Black Mesa Project
Final Environmental Impact Statement

DOI FES 08-49
OSM-EIS-33

Volume I – Report

U.S. Department of the Interior
Office of Surface Mining
Reclamation and Enforcement

November 2008

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U.S. Department of the Interior
Office of Surface Mining
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P.O. Box 46667
Denver, Colorado 80201-6667

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DEPARTMENT OF THE INTERIOR

Mission: As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people.

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Our mission is to carry out the requirements of the Surface Mining Control and Reclamation Act in cooperation with States and Tribes. Our primary objectives are to ensure that coal mines are operated in a manner that protects citizens and the environment during mining and assures that the land is restored to beneficial use following mining, and to mitigate the effects of past mining by aggressively pursuing reclamation of abandoned coal mines.

Cover photographs (from left to right):
(1) dragline removing overburden from coal at Peabody Western Coal Company's Black Mesa Complex
(2) drilling of test well for Coconino aquifer water-supply system
(3) sheepherder and flock on reclaimed land at Peabody Western Coal Company's Black Mesa Complex
(4) Black Mesa Pipeline, Incorporated's coal-slurry preparation plant
(5) Black Mesa Pipeline, Incorporated's coal-slurry pipeline Pump Station Number 2

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 16667
Denver, Colorado 80201-6667

November 3, 2008

Dear Reader:

Enclosed is the Final Environmental Impact Statement (EIS) for the Black Mesa Project. The EIS consists of two volumes. Volume I is the EIS text, revised in response to comments received on the Draft EIS distributed in November 2006. Volume II contains a record of the oral and written comments received by the Office Surface Mining Reclamation and Enforcement (OSM) on the adequacy of the Draft EIS and OSM's responses to these oral and written comments.

Following the publication of this EIS, the following decisions will occur. The Group Administrator, Renewable and Minerals Resources, Division of Resources, Arizona State Office, Bureau of Land Management, will approve, conditionally approve, or disapprove the life-of-mine mining plan. The Manager, Southwest Branch, Program Support Division, Western Region, OSM, will approve, conditionally approve, or disapprove Peabody Western Coal Company's life-of-mine permit application and in the case of an approval or conditional approval issue a Federal permit to conduct surface coal mining and reclamation operations, with conditions, as necessary, to comply with applicable Federal laws and regulations. These decisions can be made no sooner that 30 days after the U.S. Environmental Protection Agency (EPA) publishes in the Federal Register its notice of availability of the Final EIS.

The Final EIS Volumes I and II can be accessed at and downloaded from http://www.wrcc.osmre.gov/WR/BlackMesaDraftEIS.htm. For further information, contact Dennis Winterringer at the OSM address provided above or send your request to BMKEIS@osmre.gov.

Sincerely,

Richard Holbrook, Manager
Program Support Division

Enclosures

U.S. Department of the Interior
Office of Surface Mining Reclamation and Enforcement

Black Mesa Project

Final Environmental Impact Statement
DOI FES 08-49
OSM-EIS-33

Volume I – Report

November 2008

Type of Action: Administrative

Prepared by the
Office of Surface Mining Reclamation and Enforcement

In cooperation with the:

U.S. Department of the Interior
- Bureau of Indian Affairs
- Bureau of Land Management

U.S. Environmental Protection Agency

Tribes
- Hopi Tribe
- Hualapai Tribe
- Navajo Nation

County of Mohave, Arizona
City of Kingman, Arizona

Allen D. Klein
Regional Director, Western Region
Office of Surface Mining Reclamation and Enforcement

COVER SHEET

PROPOSED ACTIONS:

Approval of revisions to the life-of-mine operation and reclamation plans for surface coal mining at Peabody Western Coal Company's Black Mesa Complex.

LEAD AGENCY:

Office of Surface Mining Reclamation and Enforcement

COOPERATING AGENCIES:

Department of the Interior
- Bureau of Indian Affairs (BIA)
- Bureau of Land Management (BLM)

Environmental Protection Agency (USEPA)

Tribes
- Hopi Tribe
- Hualapai Tribe
- Navajo Nation

County and City
- Mohave County
- City of Kingman

FOR FURTHER INFORMATION:

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ABSTRACT:

This Environmental Impact Statement (EIS) has been prepared to analyze and disclose the potential impacts resulting from approval of a permit application from Peabody Western Coal Company (Peabody) proposing revisions to the life-of-mine (LOM) operation and reclamation plan for surface coal mining at the Black Mesa Complex in northern Arizona. The action proposed by Peabody is to revise the life-of-mine operation and reclamation plans for its permitted Kayenta mining operation and, as a part of this revision, incorporate into these plans the initial program area surface facilities and coal resource areas of its adjacent Black Mesa mining operation, which previously supplied coal to the Mohave Generating Station in Laughlin, Nevada.

Three alternatives were considered. Alternative A would involve the approval of the LOM revision and all components associated with supplying coal to the Mohave Generating Station (e.g., approve the permit for the coal-slurry preparation plant, reconstruct the Black Mesa coal-slurry pipeline, and construct and operate the Coconino aquifer water-supply system). Alternative B, the preferred alternative in this Final EIS, would be the approval of the LOM revision. Alternative C would be the disapproval of the LOM revision.

The following actions would occur: The BLM Arizona State Director (or designee), in consultation with the BIA, Hopi Tribe, and Navajo Nation, would approve, conditionally approve, or disapprove the LOM mining plan. The OSM Director (or designee) would approve, conditionally approve, or disapprove Peabody's permit application package and, in the case of an approval or conditional approval, issue a Federal permit to conduct surface coal mining and reclamation operations, with conditions, as necessary, to comply with applicable Federal laws and regulations.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

PURPOSE AND NEED

This environmental impact statement (EIS) is being prepared in compliance with the National Environmental Policy Act (NEPA) in order to analyze and disclose the probable effects of the Black Mesa Project in northern Arizona. The purpose of and need for the Black Mesa Project is to continue the supply of coal from Peabody Western Coal Company's (Peabody's) Kayenta mining operation to the Navajo Generating Station near Page, Arizona. The action proposed by Peabody is to revise the life-of-mine (LOM) operation and reclamation plans for its permitted Kayenta mining operation and, as a part of this revision, to incorporate into these plans the initial program area surface facilities and coal-resource areas of its adjacent Black Mesa mining operations, which previously supplied coal to the Mohave Generating Station in Laughlin, Nevada. This EIS collectively refers to the area occupied by the Kayenta mining operation and Black Mesa mining operation as the Black Mesa Complex.

The United States Department of the Interior (USDI), Office of Surface Mining Reclamation and Enforcement (OSM), is the lead agency responsible for preparing this EIS. Other Federal agencies and tribal governments cooperating with OSM in the preparation of the EIS include the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), U.S. Environmental Protection Agency (USEPA), Hopi Tribe, Hualapai Tribe, Navajo Nation, City of Kingman, and Mohave County.[1]

The following actions would occur: the BLM Arizona State Director (or designee), in consultation with the BIA, Hopi Tribe, and Navajo Nation, would approve, conditionally approve, or disapprove the LOM mining plan. The OSM Director (or designee) would approve, conditionally approve, or disapprove Peabody's permit application package and, in the case of an approval or conditional approval, issue a Federal permit to conduct surface-coal mining and reclamation operations, with conditions, as necessary, to comply with applicable Federal laws and regulations.

This EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality regulations for implementing NEPA (Title 40 Code of Federal Regulations Parts 1500-1508), and other applicable regulations including the Surface Mining Control and Reclamation Act (SMCRA) of 1977.

Changes to the Purpose and Need from the Draft EIS

Since the Draft EIS was published in November 2006, the purpose of and need for the Black Mesa Project to supply coal to the Mohave Generating Station no longer exists. With this change, Peabody amended its permit revision application, thus causing the change in the statement of purpose and need and reducing the scope of the proposed action. Some of Peabody's LOM revisions and three of the four original proposed actions are no longer proposed.

- As a part of its LOM revisions, Peabody no longer proposes to construct a new coal-haul road and new coal-washing facility, produce coal from the Black Mesa mining operation for the Mohave Generating Station, and acquire additional water for slurry transportation of coal and coal washing.

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[1] As described in the Draft EIS, Section 1.2, under Alternative A, other agencies would have authorities and actions to take regarding the coal-slurry preparation plant, coal-slurry pipeline, and/or C aquifer water-supply system.

- Black Mesa Pipeline, Inc. (BMPI) no longer proposes to continue to operate the Black Mesa coal-slurry preparation plant.
- BMPI also no longer proposes to reconstruct the 273-mile-long coal-delivery slurry pipeline from the Black Mesa mining operation to the Mohave Generating Station.
- The co-owners of the Mohave Generating Station[2] no longer propose to construct a new water-supply system, including a 108-mile-long water-supply pipeline and a well field near Leupp, Arizona, to obtain water from the Coconino aquifer (C aquifer) and to convey the water to the Black Mesa Complex for use in the coal slurry and other mine-related purposes.

The Hopi Tribe and Navajo Nation also proposed that the C aquifer water-supply system could be expanded to provide an additional 5,600 acre-feet per year (af/yr) of water for tribal domestic, municipal, industrial, and commercial uses. Both tribes indicated that upsizing the pipeline and expanding the system's well field would fulfill the needs of both tribes to significantly expand and improve tribal water supplies at a relatively modest cost. This EIS analyzes the tribes' potential withdrawals of C-aquifer water from the proposed well field, which would be interrelated with the sizing of the previously proposed water-supply pipeline and well field and the total amount of C-aquifer water ultimately withdrawn from the well field near Leupp. The construction of tribal water-distribution systems was never proposed as a part of the Black Mesa Project; therefore, it is not analyzed in this EIS.

Although these actions are no longer proposed and not part of the preferred alternative, they still could occur under certain circumstances. Alternative A addresses supplying coal to the Mohave Generating Station, which remains permitted for operation. Although operation of the Mohave Generating Station was suspended in December 2005, it has not been decommissioned. Although it appears that implementing Alternative A is unlikely, Peabody wishes to proceed in revising its permit to incorporate the surface facilities and coal-resource areas in the initial program area of its adjacent Black Mesa mining operation; that is, Alternative B. Because Alternative A is still possible, albeit unlikely, this EIS continues to analyze its effects.

BACKGROUND

The Black Mesa Complex has operated as two separate surface-mining operations (Kayenta mining operation and Black Mesa mining operation) since the early 1970s and is an area composed of three

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[2] Operation of the Mohave Generating Station—owned jointly by Southern California Edison Company (SCE), Salt River Project (SRP), Los Angeles Water and Power, and Nevada Power Company—was suspended on December 31, 2005. After a comprehensive reassessment of efforts required to return the power plant to operation, SCE, the operator and majority owner of the Mohave Generating Station, announced on June 19, 2006, that it would not continue to pursue resumed operation of the power plant. Two other owners, Nevada Power Company and Los Angeles Department of Water and Power, made similar announcements. The fourth owner, SRP, announced that it was continuing to assess the situation and might pursue resumed operation of the power plant with new partners, but not as sole owner. In September 2006, SRP announced that it was accelerating efforts to return the plant to service, and requested that the environmental impact statement process resume while it attempted to form a new ownership group. With SCE's concurrence, SRP committed to replace SCE as the principal applicant for those aspects of the Black Mesa Project that SCE had initiated. On February 6, 2007, SRP announced that it would no longer pursue resumption of the coal operations at the Mohave Generating Station and no longer continue as the project proponent for completion of the Black Mesa Project EIS. On February 7, 2007, SCE resumed responsibility for completion of the EIS and, on May 18, 2007, SCE announced that work on the Black Mesa Project EIS was suspended. In letters dated February 25 and April 30, 2008, Peabody Western Coal Company notified the Office of Surface Mining Reclamation and Enforcement of its intention to amend the pending life-of-mine permit-revision application for the Black Mesa Complex to remove proposed plans and activities that supported supplying coal to the Mohave Generating Station because it believed that reopening the Mohave Generating Station for operation is unlikely.

contiguous leases and several surface rights-of-way and easements granted to Peabody from the Hopi Tribe and Navajo Nation. The Black Mesa Complex comprises approximately 24,858 acres of land where the surface and mineral interests are held exclusively by the Navajo Nation (Navajo Exclusive Lease Area, Lease 14-20-0603-8580), and approximately 40,000 acres of land are located in the former Hopi and Navajo Joint Minerals Ownership Lease Area (Joint Lease Area, Leases 14-20-0603-9910 and 14-20-0450-5743). The tribes have joint and equal interest in the minerals that underlie the Joint Lease Area; however, the surface has been partitioned and is within the exclusive jurisdiction of the tribe to which the surface is partitioned (6,137 acres partitioned to the Hopi Tribe and 33,863 acres partitioned to the Navajo Nation). The coal-mining leases with the Hopi Tribe and Navajo Nation provide Peabody the right to produce up to 290 million tons of coal from the Navajo Exclusive Lease Area and up to 380 million tons of coal from the Hopi and Navajo Joint Lease Area for a combined total of 670 million tons.

The coal-mining leases, approved by the Hopi Tribe and Navajo Nation, provide Peabody with the rights to prospect, mine, and strip leased lands to produce coal and kindred products, including other minerals that may be found, except for oil and gas. Peabody also is given the right to construct support facilities such as buildings, pipelines, tanks, plants, and other structures; make excavations, stockpiles, ditches, drains, roads, spur tracks, electric power lines, and other improvements; and to place machinery and other equipment and fixtures and do all other things on the leased lands necessary to carry on mining operations, including rights of ingress and egress, and to develop and use water for the mining operations, including the transportation by slurry pipeline of coal mined from the leases.

The Kayenta mining operation produces 8.5 million tons of coal per year and, since 1973, has been supplying coal from the Black Mesa Complex exclusively to the Navajo Generating Station by way of the Black Mesa and Lake Powell Railroad, a distance of 83 miles. The Kayenta mining operation is permitted by OSM to mine coal reserves into 2026 at current production rates. The intent of the LOM revision is to improve or enhance the efficiency and cost-effectiveness of the mine plan for the Kayenta mining operation. However, no changes to this coal-delivery system or to the generating station are needed.

The Black Mesa mining operation supplied coal to the Mohave Generating Station from 1970 until December 2005, when the Black Mesa mining operation ceased delivering coal due to suspension of Mohave Generating Station operations.

On February 17, 2004, Peabody filed an LOM permit revision application with OSM proposing several revisions to the LOM plans of the Kayenta and Black Mesa mining operations. On July 2, 2008, Peabody amended the pending mine permit revision application for the Black Mesa Complex to remove proposed plans and activities that supported supplying coal to the Mohave Generating Station because Peabody believed that reopening the Mohave Generating Station for operation as a coal-fired power plant is unlikely. Peabody submitted an amended application on July 2, 2008, which is consistent with its letters omitting components to supply coal to the Mohave Generating Station and the haul road.

ALTERNATIVES

Under the SMCRA, OSM must make decisions on the LOM revision for the Black Mesa Complex. The primary decision options available to OSM are (A) approval of the LOM revision and all components associated with coal supply to the Mohave Generating Station, (B) approval of the LOM revisions without all components associated with coal supply to the Mohave Generating Station, and (C) disapproval of the LOM revision (no action). In making the decisions, OSM will consider issues associated with the use of water from the N aquifer, as required by the Secretary of the Interior, prior to issuance of the permanent LOM permit. The three alternatives addressed in the EIS are as follows:

- Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to the Mohave Generating Station
- Alternative B – Approval of the LOM Revision (Preferred Alternative)
- Alternative C – Disapproval of the LOM Revision (No Action)

Table ES-1 shows the differences in acreages of the permanent program permit area, amounts of coal for delivery, and amounts of water usage for each of the three alternatives. Description of the three alternative decisions addressed in the EIS follow the table.

Table ES-1 Summary of Alternatives

	Alternative A	Alternative B	Alternative C
Acres permitted	63,057	62,930	44,073
Acres for coal-haul road	127	0	0
Acres disturbed by mining	12,409	6,942	6,942
Coal produced into 2026 (million tons per year)			
• Black Mesa mining operation	6.35	0	0
• Kayenta mining operation	8.5	8.5	8.5
Water use (af/yr)			
• C aquifer			
o Coal washing	500	0	0
o Coal slurry	3,700	0	0
o Mine-related and domestic	1,600	0	0
o Contingency	200	0	0
o Tribal			
▪ Hopi Tribe	2,000	0	0
▪ Navajo Nation	3,600	0	0
Total	11,600	0	0
• N aquifer (average annual use in acre-feet)			
o 2008 through 2025[1]	2,000[1]	Average of 1,236	Average of 1,236
o 2026 through 2028	Up to 505	505	505
o 2029 through 2038	Up to 444	444	444
Coal-slurry pipeline[2]			
• Construction right-of-way acres	2,319	0	0
• Permanent right-of-way acres	1,821	0	0
Water-supply system[3]			
• Construction right-of-way acres	1,261	0	0
• Permanent right-of-way acres	722	0	0

NOTES: [1] As a worst case, under Alternative A, an estimated average of 2,000 acre-feet of Navajo-aquifer water would be used for (1) public consumption, (2) withdrawal from the N-aquifer wells to maintain their function, (3) emergencies, and (4) the Kayenta mining operation.
[2] Alternative A only; reflects acreage for the existing pipeline alignment with realignments in Moenkopi Wash and Kingman area.
[3] Alternative A only; reflects acreage for the scenario of 11,600 acre-feet of water per year and Eastern Route (including the four pump stations, substation, and power line).
af/yr = acre feet per year

Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to the Mohave Generating Station

If Alternative A were selected, Peabody's February 2004 application for the LOM permit revision and mine plan changes would be approved as would all the components associated with supplying coal to the Mohave Generating Station. Alternative A was the proposed project and the agencies' preferred alternative in the Draft EIS.

LOM Revision and Mine Plan Changes

Under Alternative A, Peabody's February 2004 application for the LOM permit revision would be approved and a Federal permit would be issued to continue surface-coal-mining and reclamation operations at the Black Mesa Complex. OSM's existing permanent Indian Lands Program permit area (the 44,073 acres within the current permit area for the Kayenta mining operation) would be expanded to incorporate the initial program parts of the existing lease area (the 18,984 acres) associated with the Black Mesa mining operation and existing and proposed rights-of-way (including 127 acres for a new coal-haul road described below). The Black Mesa Complex would continue operations through 2026.

Peabody would obtain a separate and additional off-lease right-of-way from the Hopi Tribe to construct the new coal-haul road, between the southern portions of Peabody's leases, as a support facility for continued Kayenta and Black Mesa mining operations. The road would be 500 feet wide and approximately 1.6 miles long; approximately 127 acres would be required.

Until its suspension in December 2005, the Black Mesa mining operation produced about 4.8 million tons of coal annually, all of which were delivered to the Mohave Generating Station. Approval of the 2004 LOM permit revision would allow the Black Mesa mining operation to continue through 2026 under a permanent Indian Lands Program permit. The LOM revision did not propose to change the Black Mesa mining methods, but would increase the average annual production rate of the Black Mesa mining operation from 4.8 million tons to about 6.35 million tons.

Under Alternative A, a new coal-washing facility would be constructed adjacent to the existing Black Mesa coal-preparation facilities to meet the anticipated future coal-quality requirements of the Mohave Generating Station. The purpose of the coal-washing facility would be to remove out-of-seam rock and mineral impurities (earth materials), commonly referred to as refuse, from the coal, which results in less ash when the coal is burned. The coal-washing facility would use about 500 af/yr of C-aquifer water and would remove about 0.95 million tons per year of coal-processing refuse, resulting in about 5.4 million tons per year of washed coal being crushed and mixed with water at the coal-slurry preparation plant and transported as slurry to the Mohave Generating Station through a pipeline. The estimated 0.95 million tons per year of coal-processing refuse would be returned by end-dump trucks to designated mine pits (N-06 and J-23) for disposal. Peabody would develop (and submit for regulatory approval) a refuse sampling and disposal plan that would be incorporated in the mining permit. No refuse piles or coal-mine-waste impoundments are proposed. The coal-washing process, preparation process and facilities, potential fugitive dust emissions, and refuse disposal are described in Appendix A-1.

Peabody's February 2004 application for the LOM revision proposed actions to replace a portion of the N-aquifer water with C-aquifer water for the Black Mesa mining operation, the use of which resulted in the administrative delay in permitting the Black Mesa mining operation and the Black Mesa coal-slurry preparation plant. Under Alternative A, about 672 af/yr of water from the C aquifer water-supply system would be used to replace much of the N-aquifer water used by the Black Mesa mining operation; 500 af/yr of C-aquifer water also would be used for washing coal. From 2026 through 20028, 505 af/yr of

N-aquifer water would continue to be pumped for mine reclamation, public use, and to maintain operation of the N-aquifer wells, and 444 af/yr would be used from 2029 through 2038.

Components Associated with Coal Supply to the Mohave Generating Station

In addition to approval of the 2004 LOM permit application, the components associated with supplying coal to the Mohave Generating Station would be approved; that is, the coal-slurry preparation plant permit, reconstruction of the coal-slurry pipeline, and construction of a new water-supply system.

Coal-Slurry Preparation Plant

Until December 2005, the coal from the Black Mesa mining operation was prepared (i.e., crushed and mixed with water) at the coal-slurry preparation plant for transportation through the coal-slurry pipeline to the Mohave Generating Station. BMPI submitted a permanent Indian Lands Program permit application (preparation-plant permit application) to OSM in 1988 for operation of the plant. Like the Black Mesa mining operation, OSM's decision on the preparation-plant permit application was delayed due to issues associated with the use of N-aquifer water. On January 3, 2005, BMPI submitted a revised permit application to OSM, which was determined to be administratively complete. Only minor modifications to the existing plant would need to occur; no ground-disturbing activities would result.

Coal-Slurry Pipeline

Until 2005, coal from the Black Mesa mining operation was transported by BMPI via the coal-slurry pipeline from the Black Mesa Complex to the Mohave Generating Station, a distance of approximately 273 miles. The existing pipeline crosses the Hopi and Navajo Reservations, as well as Federal, State, local government, and private lands. The pipeline, constructed in the late 1960s and operated since the early 1970s, reached its 35-year design life. Reconstruction of the pipeline would involve burying a new pipeline adjacent and parallel to the existing pipeline for most of its length. A temporary right-of-way width of about 15 feet would be needed, in addition to the existing 50-foot-wide permanent right-of-way, for construction activities.

BMPI is proposing localized realignments along the existing alignment. In the Moenkopi Wash, the pipeline would be shifted about 200 feet on one side or the other of the existing pipeline to move it out of the active wash channel (this realignment may or may not require new right-of-way). In the vicinity of Kingman, Arizona, approximately 28.5 miles of the pipeline would be rerouted to the south of Kingman to avoid areas in major residential or commercial developments. The reroute would require new right-of-way; however, the reroute would parallel other linear utilities and/or roads for the majority of the reroute.

Existing booster-pump stations (one at the coal-slurry preparation plant and three along the coal-slurry pipeline) would require only minor modification, if any; no ground-disturbing activities would result.

Water Supply

Until December 2005, approximately 4,400 af/yr of water were drawn from the N aquifer within Peabody's lease. Under Alternative A, use of C-aquifer water would replace the majority of N-aquifer water use. Proposed future use of C-aquifer water for the Black Mesa Complex and coal slurry would total an average of 6,000 af/yr (Table ES-2).

Table ES-2 Alternative A Water Use

Use	Acre-Feet per Year
Coal washing	500
Coal slurry	3,700
Mine-related and domestic purposes	1,600
Contingency	200
Total	**6,000**

The water from the C aquifer would be supplied from a well field to be located near Leupp, Arizona, and conveyed via pipeline to the Black Mesa Complex. The N aquifer would be a contingency standby source that would be used in case of interruptions or curtailments of the C-aquifer water supply.

The components of the C aquifer water-supply system, as proposed for the Black Mesa Project, are described below.

- A well field in the southwestern part of the Navajo Reservation and on the Hopi Hart Ranch (south of Leupp, Arizona) including 12 to 21 wells and associated facilities (e.g., well yards, collector pipelines, access roads, electrical power lines).
- An approximately 108-mile-long pipeline with a capacity of 6,000 af/yr from the well field north-northeast to the Black Mesa Complex following, to the extent practicable, existing roads.
- An estimated two pump stations and associated facilities (e.g., access roads, electrical transmission lines)

Water for the project would come primarily from the C aquifer with some supplemental use of water from the N aquifer. Additionally, the development of a water-supply system from the C aquifer provides an opportunity to enhance water availability to the Hopi Tribe and Navajo Nation for municipal, industrial, and commercial uses by expanding the system capacity. Two water-withdrawal scenarios and pipeline capacities were considered.

C-Aquifer Water Withdrawal and Supply: 6,000 af/yr. Under this alternative, up to 6,000 af/yr would be withdrawn from the C aquifer and delivered to the Black Mesa Complex for the life of the project (i.e., 2010 through mid 2026). This is the amount of water that would be needed annually for the coal slurry, coal-washing facility, other mine-related and domestic uses, and a contingency. After 2026, the water would no longer be needed for the project and pumping from the C aquifer would cease. Water for reclamation would be provided from the existing N-aquifer wells.

C-Aquifer Water Withdrawal and Supply: 11,600 af/yr. Under this alternative, the Hopi Tribe and Navajo Nation would have an option to pay the incremental costs of increasing the water production from the C aquifer and increasing the size of the water-supply pipeline in anticipation of potential future use of the system for tribal purposes. The total maximum amount of water that could be delivered would be 11,600 af/yr—6,000 af/yr for project-related purposes and an additional 5,600 af/yr for tribal use. Under this alternative, 2,000 af/yr and 3,600 af/yr would be available for use by the Hopi Tribe and Navajo Nation, respectively. In addition, after 2026 when the 6,000 af/yr of water would be no longer needed for project-related purposes, the Navajo Nation would use up to 6,000 af/yr in addition to the 3,600 af/yr, and pumping C-aquifer water up to 11,600 af/yr would continue for the estimated 50-year life of the pipeline. In order to deliver the system's additional capacity to Hopi and Navajo communities, lateral pipelines would have to be constructed; however, the details of the delivery spur pipelines, timing of construction, and ultimate use of the water are not known at this time.

The proposed well field is near Leupp, Arizona. To produce 6,000 af/yr of water, a minimum of 12 wells would be developed; to produce 11,600 af/yr of water 21 wells would be developed. For the 11,600 af/yr alternative, the section of the well field proposed to produce the 6,000 af/yr for the Black Mesa Complex (12 wells) and 3,600 af/yr for the Navajo Nation (5 wells) would be located on the Navajo Reservation in a triangular area bounded by State Route 99, Canyon Diablo, and the Burlington Northern Santa Fe (BNSF) Railroad just north of Red Gap and Interstate 40 (I-40). To provide 2,000 af/yr of water to the Hopi Tribe, four wells would be developed in the section of the well field that is within the Hart Ranch (owned in fee by the Hopi Tribe), a triangular area bounded by the BNSF Railroad, Canyon Diablo, and I-40. Proposed use of C-aquifer water under Alternative A is shown in Table ES-2. When the 6,000 af/yr of C-aquifer water is no longer needed for the project (in 2026), the use of the 6,000 af/yr and associated wells would be transferred to the Navajo Nation.

The Kayenta and Black Mesa mining operations would cease in 2026, and the mines would be reclaimed. From 2026 through 2028, 505 af/yr of N-aquifer water would be used for reclamation and public use and 444 af/yr of N-aquifer water would be used from 2029 through 2038. Under this alternative, pumping the N aquifer for project-related uses would cease when the water is no longer needed for project-related uses. The leases between the Hopi Tribe, Navajo Nation, and Peabody require N-aquifer wells to be transferred to the tribes in operating condition. The wells would be transferred to the tribes once Peabody completes reclamation and relinquishes the leases.

N-Aquifer Water Supply. Until December of 2005, approximately 4,400 af/yr of water were withdrawn from the N aquifer within Peabody's lease area—3,100 af/yr of water for slurry of 4.8 million tons of coal and 1,300 af/yr of water for mine-related and domestic purposes. Both mining operations and local residences together accounted for the 1,300 af/yr of water. Under Alternative A, use of N-aquifer water would continue at a reduced rate. Peabody's N-aquifer well field would be conserved to provide potable water for the public and as an emergency backup supply should the primary C-aquifer source supply be interrupted for any reason. It is the applicants' intent to no longer use water from the N aquifer for mine-related or slurry use except as noted below.

Under Alternative A, if the C aquifer water-supply system were developed, the wells must be pumped periodically for extended periods of time to maintain the N-aquifer well field in an operationally ready state in case of emergencies and to supply the public. As a worst case, an estimated average of 2,000 af/yr of N-aquifer water would be used for (1) public consumption, (2) withdrawal from the N-aquifer wells to maintain their function, (3) emergencies, and (4) the Kayenta mining operation.

If the N aquifer were to be used as the sole water supply (i.e., the C aquifer water-supply system was not developed); up to 6,000 af/yr of water would be withdrawn from the N aquifer within Peabody's lease area for the life of the project (i.e., 2010 through mid 2026). If the N aquifer were to be used as the sole water supply, concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for coal slurry leading to the administrative delay of OSM's permanent Indian Lands Program permitting decision for the Black Mesa mining operation would not be resolved.

C Aquifer Water-Supply Pipeline

Under Alternative A, the C aquifer water-supply pipeline would convey the water from the proposed well field near Leupp, Arizona, along one of two major alternative routes to the Black Mesa Complex. The Eastern Route, would be about 108 miles long, need two pump stations, and cross both Hopi and Navajo Reservations. Along this Eastern Route pipeline alternative, there are two areas where localized routing subalternatives are considered. At the Little Colorado River, the pipeline would cross either (1) under the river using horizontal boring as the method of construction (which would be the preferred method) or (2) over the river on an abandoned historic road bridge. In the Kykotsmovi area, the pipeline would be buried under a road that bypasses the community or in a road that passes through the community. The Western Route pipeline alternative would be approximately 137 miles long, need four pump stations, and cross only the Navajo Reservation.

Alternative B – Approval of the LOM Revision

If Alternative B were selected, Peabody's February 2004 LOM application, as revised by the July 2008 amendment of the application (together the "2008 LOM Revision") would be approved.

The Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume operation. The coal-washing facility, the 127-acre coal-haul road, and the C aquifer water-supply system, in any configuration, would not be constructed. The preferred alternative includes the use of N-aquifer water to supply amounts averaging 1,236 af/yr for mine-related uses through 2025.

If OSM approves the LOM revision for the Black Mesa Complex, the area previously associated with the Black Mesa operation (18,857 acres), including associated surface facilities, would be added to the 44,073 acres of the existing OSM permanent permit area for the Black Mesa Complex, bringing the total acres to 62,930, which would be considered as one operation for the purpose of regulation by OSM. This entire area is within Peabody's existing coal leases.

Areas mined out by the Black Mesa operation by the end of 2005 have already been or are being reclaimed. One coal-resource area that was not completely mined out by the end of 2005 (N-06) is currently producing coal for the Navajo Generating Station. Several coal-resource areas, totaling 5,950 acres, which were never mined by the Black Mesa mining operation, would be incorporated into the permanent permit area for the Black Mesa Complex. If the LOM revision were approved, Peabody would not be authorized to mine these coal-resource areas. However, the unmined coal-resource areas could be mined in the future if applications were submitted to, and approved by, OSM. Under the existing permit, Peabody has approval to produce coal from the N-09, N-10, N-99, J-19, and J-21 mining areas to supply the Navajo Generating Station through 2026. It is anticipated that Peabody would continue to request that OSM renew its permit every five years until the coal is mined out. Impacts of an extended mining scenario beyond 2026, which could include mining of some or all of the aforementioned eight coal-resource areas, are addressed in the cumulative effects section of the EIS. Through 2026, the Black Mesa operational infrastructure would be used as necessary to facilitate mining and reclamation by the Kayenta mining operation.

From 2026 through 2028, 505 af/yr of N-aquifer water would be used for reclamation and public use and 444 af/yr of N-aquifer water would be used from 2029 through 2038. The wells would be transferred to the tribes once Peabody successfully completes reclamation and relinquishes the leases.

Alternative C – Disapproval of the LOM Revision (No Action)

OSM's decision under Alternative C to disapprove the LOM revision would have the same effect as OSM taking no action on the LOM revision.

The Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume operation. The coal-washing facility, 127-acre coal-haul road, and the C aquifer water-supply system, in any configuration, would not be constructed. The leased area previously associated with the Black Mesa operation (18,857 acres) would not be incorporated into the permanent program permit area for the Black Mesa Complex. The remaining unmined coal-resource areas, totaling 5,950 acres that were within the area of the Black Mesa operation would not be incorporated into the permit area for the Black Mesa Complex if the LOM revision were not approved. If no action were taken on the LOM revision, those unmined coal-resource areas could not be mined under OSM's administrative delay rules because Peabody never received a prior authorization to mine those resource areas. However, the unmined coal-resource areas could be mined in the future if a future application were submitted to, and approved by, OSM.

If the LOM revision is disapproved or no action is taken on it, the facilities and structures located in the initial program area that historically were shared by the Kayenta and Black Mesa mining operations would continue to be used by the Kayenta mining operations, but they would have to be permitted separately under a future revision. The 1990 permit issued by OSM "authorizes those surface coal mining and reclamation operations described in the application for this permit approved by the Office of Surface Mining Reclamation and Enforcement (OSM) on July 6, 1990, as it applies to the Kayenta Mine." If the LOM revision is disapproved, the permit area would need to be revised to include the facilities and structures that were approved for use under the 1990 permit.

Under the current permanent Indian Lands Program permit, the Black Mesa Complex's Kayenta mining operation already has OSM-approved mining, operation, and reclamation plans that allow it to produce all of the coal needed by the Navajo Generating Station through 2026. The Kayenta mining operation would continue to use N-aquifer water in amounts averaging 1,236 af/yr through 2025. Whether no action is taken on the LOM revision or the LOM revision is disapproved, the Kayenta mining operation would continue to operate through 2026, at which time the mine would be reclaimed, similar to Alternative B. From 2026 through 2028, 505 af/yr of N-aquifer water would be used for reclamation and public use and 444 af/yr of N-aquifer water would be used from 2029 through 2038. The wells would be transferred to the tribes once Peabody successfully completed reclamation and relinquished the leases.

AFFECTED ENVIRONMENT

Chapter 3 addresses the existing conditions of the human and natural environment that potentially could be affected by any of the alternatives. The existing conditions of the environment are described based on the most recent data available—primarily literature, published and unpublished reports, and agency databases. Field reconnaissance and interviews were conducted as necessary to verify specific information (such as land use or traditional cultural resources). The affected environment is characterized in the EIS for the following general resource concerns.

- Landforms and Topography
- Geology and Mineral Resources
- Soils
- Water Resources (surface and groundwater hydrology)
- Climate
- Air Quality
- Vegetation
- Fish and Wildlife (including threatened and endangered species)
- Land Use
- Cultural Environment
- Social and Economic Conditions
- Environmental Justice
- Indian Trust Assets
- Noise and Vibration
- Visual Resources
- Transportation
- Recreation
- Health and Safety

ENVIRONMENTAL CONSEQUENCES

The information regarding the existing condition of the environment (Chapter 3.0 Affected Environment) was used as a baseline by which to measure and identify the potential impacts that could result from implementing the Black Mesa Project. The EIS team considered and incorporated best management practices, conservation measures, and mitigation (which the applicants commit to implement), where appropriate, before arriving at the impacts described in the EIS.

An impact, or effect, is defined as the modification to the environment brought about by an outside action. Impacts vary from no change, or only slightly discernible change, to a full modification or elimination of the environmental condition. Impacts can be *beneficial* (positive) or *adverse* (negative).

Impacts can be *short-term*, or those changes to the environment during and following ground-disturbing activities that generally revert to predisturbance conditions at or within a few years after the ground disturbance has taken place. *Long-term* impacts are defined as those that substantially would remain beyond short-term ground-disturbing activities.

For the mining operations, the local short-term impacts are those that would occur from the beginning of mining of a unit through reclamation of that unit when vegetation is reestablished (i.e., through regrading, replacement of topsoil, reseeding, and initial revegetation). The mining operation continually advances with contemporaneous reclamation. That is, earth material excavated from a coal-producing unit is deposited to backfill the adjacent previously mined unit. When the unit has been backfilled, the area is reclaimed. This sequence continues until all of the coal has been removed from a given coal-resource area. Mining and reclamation of a given coal-resource area generally spans between 20 and 25 years. Long-term impacts are defined as those occurring during the period when vegetation is established and controlled livestock grazing is permitted, through and beyond release of the property by Peabody.

For the coal-slurry pipeline and water-supply system, local short-term impacts of the project are those that would occur during construction of the pipelines (and water-supply well field) plus a reasonable period for reclamation (i.e., a total of about five years). Long-term impacts are those that would persist beyond or occur after the five-year construction and reclamation period.

An action can have direct or indirect effects, and it can contribute to cumulative effects. *Direct effects* generally occur at the same time and place. *Indirect effects* are later in time or farther in distance, but still reasonably foreseeable. *Cumulative effects* result from the proposed action’s incremental impacts when these impacts are added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them (Federal or non-Federal).

Also in identifying impacts, the vulnerability of resources is considered. The status of a resource, resource use, or related issue in this regard is evaluated against the following:

- Resource significance—a measure of formal concern for a resource through legal protection or by designation of special status
- Resource sensitivity—the probable response of a particular resource to project-related activities
- Resource quality—a measure of rarity, intrinsic worth, or distinctiveness, including the local value and importance of a resource
- Resource quantity—a measure of resource abundance and the amount of the resource potentially affected

Several resources are more conducive to quantification than others. For example, impacts on vegetation can be characterized partly using acreage, and air quality can be measured against air quality standards. Evaluations of some resources are inherently difficult to quantify with exactitude. In these cases, levels of impact are based on best available information and professional judgment.

For purposes of discussion and to enable use of a common scale for all resources, resource specialists considered the following impact levels in qualitative terms. The terms *major, moderate, minor, negligible, or none* that follow, consider the anticipated magnitude, or importance, of impacts, including those on the human environment.

- Major—impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; stress within the social, cultural, and economic realm; degradation of a resource defined by laws, regulations, and/or policy
- Moderate—impacts that potentially could cause some change or stress (ranging between significant and insignificant) to an environmental resource or use; readily apparent effects
- Minor—impacts that potentially could be detectable but slight
- Negligible—impacts in the lower limit of detection that potentially could cause an insignificant change or stress to an environmental resource or use
- None—no discernible or measurable impacts

Impacts are described for the four main project components under Alternative A. Under Alternatives B and C, the coal-washing facility would not be constructed, the coal-slurry preparation plant would not be permitted for operation, the coal-slurry pipeline would not be reconstructed nor operate in the future, the C aquifer water-supply system would not be constructed, and, consequently, coal would not be delivered to the Mohave Generating Station.

Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to the Mohave Generating Station

Black Mesa Complex

For the resumption and expansion of Black Mesa mining operation and continued Kayenta mining operations, the primary impacts at the Black Mesa Complex from the mining and reclamation process include the following.

The upper 250 feet of surface material would be removed from more than 12,409 acres. This would include a loss of about 7,500 acres of piñon/juniper woodland vegetation and about 3,850 acres of sagebrush. The existing vegetation on these 12,409 acres would be permanently removed during mining operations.

Before coal is removed, vegetation is cleared and topsoil is removed and saved. After topsoil is replaced, it is seeded and planted. Places where there are steep-sided slopes and sharp angled rocky hills would be replaced with gently rolling hills with smoother contours. The water drainage patterns would be restored to pre-mining conditions to the extent practicable through backfilling and grading of the mined areas. The areas would be reseeded with a mix of shrubs, forbs, and grasses. The regulatory requirement is to restore the land affected to a condition capable of supporting the uses which it was capable of supporting prior to any mining (in the case of the Black Mesa Complex, livestock grazing and wildlife) and to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected and capable of self-regeneration and plant succession at least equal in extent of cover to the natural vegetation of the area. The replacement of piñon/juniper woodland with grassland results in 10 times the productivity for grazing. Plants that are important to and used by the Hopi and Navajo people for medicinal or ceremonial purposes also would be planted.

Once vegetation has been established on these reseeded areas, limited (or controlled) livestock grazing would be allowed, to facilitate the revegetation process. Controlled livestock grazing would continue for about 10 more years before an area is released from Peabody's management and transferred to the tribes. The total amount of time from when an area begins to be mined to when the land is returned to the tribes is about 20 to 25 years.

Peabody's LOM application indicates 163 surface-water impoundments to exist in 2008 under SMCRA to control sediment transport from mined areas into the washes. A total of 51 impoundments are proposed to be permanent (left as part of the post-mining landscape).

All the operations related to mining and handling the coal would result in about 145 tons per year of particulate matter (primarily PM_{10}) (very small particles of soil or dust, liquid droplets, or/or chemicals) being emitted into the air over current conditions (prior to suspension of the Black Mesa mining operations) by the end of the project.

There would be a very small decrease in the amount of surface-water flow traveling down the major washes within the Black Mesa Complex resulting from development and use of temporary and permanent impoundments, as well as reclamation actions to reduce erosion from surface water runoff. The change in flow would be so small, it would not be detected by the gauges that measure stream flow.

There could be some decrease in groundwater quantity as a result of the mining exposing pockets of porous rock that are saturated with water. Some local water wells and springs could go dry. Once mining has ceased and the land has been reclaimed and returned to its previous use (which could take up to 20 years), the groundwater system would reach a new balance. Some springs could return, but some would not. There also could be a decrease in groundwater quality, both from increased total dissolved solids and formation of acidic water pockets.

Where a water supply (e.g., a well or developed spring) has been affected by contamination, diminution, or interruption resulting from mining operations, Peabody would be required by OSM's permit to provide alternate water supplies as close to the original water supply as practicable.

Refuse from washing the coal, composed of earth materials, would be reburied in mined pits. It is anticipated that impacts from this refuse would be similar to that already experienced by disposal of regraded spoil material (which are temporary and immeasurable). Peabody would use a sampling and testing plan to analyze the chemical constituents of the refuse verifying the results are consistent with the original leachate test study. If they are significantly different and indicate a potential for greater adverse impact, special disposal procedures would be implemented so the refuse cannot mix with existing soil or water.

The primary impacts on the people and lands located adjacent to the Black Mesa Complex from the mining and reclamation operations within the Black Mea Complex include relocation of households and nuisance dust and noise.

Seventeen Navajo households, currently located on land that would be permitted for mining under the proposed project, would have to be resettled out of the area to be mined through 2026. Peabody, in coordination with the Navajo Nation, would attempt to resettle these families within the residents' customary use areas (e.g., where ranching activities take place or where socio-cultural ties exist). This resettlement would include providing new houses, areas for family garden plots, and livestock grazing areas. These families would be able to return to their original home sites after reclamation is considered completed and the land is returned to tribal control, after about 20 to 25 years. The mined area would be reclaimed with the goal of increasing its grazing productivity.

Mining-related activities would continue to generate particulate matter (primarily PM_{10})that can exacerbate breathing and health problems. Residents living next to the mining operations would have a greater exposure to this particulate matter for the duration of the mining operations.

Local residents would be allowed to continue to get free firewood, coal, and potable water at two water stands within the Black Mesa Complex for the duration of the proposed project.

The primary impacts on the region as a whole, from the mining and reclamation operations at the Black Mesa Complex, would include economic benefits from employment and coal and water royalties, which would benefit both tribal governments and the general economy. This would include restoration of about 400 mining jobs that were lost when the operation of the Mohave Generating Station was suspended, as well as about 80 additional mining jobs resulting from the increased production included under the proposed Black Mesa Project. There would be about a 10.5 percent increase in revenues historically paid to the Hopi Tribe and Navajo Nation from royalties related to increased coal production. This would result in the payment of royalties of about $15.5 million and $37.9 million annually to the Hopi Tribe and Navajo Nation, respectively. Other taxes, payments, and grants to the tribes resulting from resumption of coal mining activities would be restored and increased as a result of increased coal production. Retail revenues in the local economy also would be restored after mining operations resume. There also would be an increase of $18.1 million annually to the State of Arizona in sales taxes paid by Peabody.

Payment of water royalties to the Navajo Nation would resume due to either continued use of the N aquifer, or as a result of development and use of the C aquifer water-supply system. There would be an increase in the amount of water used over past years due to the increase in coal production for the Mohave Generating Station under the LOM revision.

A permanent access road would be built from water-supply pipeline Milepost 71 to 76. This would provide an incidental opportunity to have the road extended north from Arizona Route 264 (adjacent to the pipeline) to the mining operations. Developing the route would improve the transportation network for Hopi and Navajo residents, especially the Hopi villages and the Navajo chapters of Forest Lake and Hardrock.

Reconstruction and Operation of the Coal-Slurry Pipeline

Construction-related impacts along the existing coal-slurry pipeline alignment would include ground disturbance, disturbance of land uses and natural and cultural resources, and construction employment.

Construction would disturb about 2,100 acres of land. Depending upon the final route selected, between 24 and 38 percent of the impacted area has not been disturbed previously. Except for a permanent operations and maintenance road, the remainder of the pipeline right-of-way would be revegetated. There could be impacts from construction activities on several sensitive species that are protected by Federal, tribal, and/or State laws, including the destruction of some individual plants; however, no permanent impacts on or threat to the population as a whole are expected. Timing of construction activities and preconstruction surveys would reduce impacts on those species of special concern.

Twenty-three cultural resources were identified as being located within the existing coal-slurry pipeline right-of-way that are significant and eligible for listing on the National Register of Historic Places because of their potential to yield important information about the prehistory and history of the region. The alternate route would affect nine more sites, all of which also are National Register-eligible properties. The Hopi also consider all Anasazi/Ancestral Puebloan sites to be significant because of their association with important events in Hopi history, and sites with remnants of architecture to be eligible for listing on the National Register because they represent distinctive types. Efforts would be made during preparation of final designs to avoid or reduce impacts on the National Register-eligible properties. For sites that cannot be avoided, there is good potential to satisfactorily mitigate the impacts through data recovery studies.

In some areas, farming, grazing, out-structures, and/or development occur on top of or adjacent to the existing coal-slurry pipeline right-of-way. These uses of the pipeline right-of-way would be temporarily impacted during reconstruction of the pipeline. Structures that have been placed on top of the pipeline right-of-way would be relocated off the right-of-way. Nonpermanent uses of the right-of-way could be restored once construction has been completed.

Reconstruction of the pipeline using the existing route would affect about 70 residences in the Kingman and Laughlin areas, either by temporarily limiting access or disturbance to residential property during construction. If the alternate route is chosen, three low- to moderate-density residential areas adjacent to the right-of-way would be affected as access to residential and industrial properties may be limited temporarily during construction.

Construction-related employment would provide a temporary benefit to the local economy.

Long-term impacts from operation and maintenance of the coal-slurry pipeline include the following.

When mining resumes in mid 2009, 15 to 20 operational employees would be hired to staff the pipeline's booster-pump station locations and BMPI's office in Flagstaff. The jobs would continue through 2026.

Though unlikely, pipeline failure (with release of coal slurry) could occur, but it is not possible to estimate where it would occur or the amount of slurry that could be discharged. The impact would be short term and repairable. An emergency response plan that addresses clean-up and management of impacts, including the length of time required for cleanup, would be developed and followed for the coal-slurry pipeline operation.

Construction and Operation of the C-aquifer Water-Supply System

Impacts in the immediate area of the proposed well field and water-supply pipeline route from construction and operation of the system would include the following.

There would be temporary interruption of livestock grazing and traffic; and presence of noise and dust from construction of the well field, water-storage tank, road network, water-supply pipeline, pump stations, and power lines. The eastern route would follow existing roads for the majority of its length. There would be a greater temporary impact on traffic from construction of the eastern route, where it proceeds near and through Kykotsmovi. With the western route, there would be greater impact (loss of grazing habitat) on grazing from construction and creation of a permanent access road for operation and maintenance. If blasting is needed, there would be temporary noise from blasting along the pipeline route.

There are residences (about 55) and corrals, windmill wells, and water tanks associated with grazing dispersed in the area identified for the well field. Construction of access roads temporarily would limit access to and from residences, grazing, and other use areas. Pump stations along the water-supply pipeline would be located near highly traveled roads where grazing would less likely to be concentrated, and would be located at least 0.25 mile from any permanent residence. Each pump station would displace approximately 4 acres during construction and 1.2 acres for the life of the water-supply system.

There would be a permanent loss of about 160 acres (total over a large area) of grazing land due to the construction of permanent structures (i.e., pump houses, water-storage tank, pump stations, power lines, substations). Visual impacts would result from the permanent intrusion of these new structures on the landscape, but would be minimized by painting the structures to blend with the surroundings. Noise from the operating pumps at the pump stations would be audible; however, the pump stations would not be located near residences or public facilities.

There potentially could be impacts on numerous archaeological, historical, and traditional cultural resources. However, there is great flexibility in locating the individual wells and access roads, and, to a lesser degree, the power lines and pump stations related to the pipeline alignments. These resources would be avoided to the maximum extent practicable. If they cannot be avoided, treatment of the resources would be undertaken in compliance with Federal and tribal policies. Areas affected by the western water-supply pipeline route have some of the highest densities of archaeological sites in the region, and use of this route would require substantial time and money to mitigate impacts on these resources.

Temporary jobs for community members as construction workers would be available during construction.

Impacts in the region from long-term operation and use of the C aquifer water supply system include the following.

There could be a potential lowering of water levels in shallow livestock wells in the vicinity of the C aquifer well field; however, the project proponent would provide an alternate water source for livestock grazing should the groundwater levels drop such that these shallow wells become inoperable.

There could be a potential minor reduction of about 1.3 to 1.5 percent in base flow in three perennial stream reaches that receive discharge from the C aquifer—lower Clear Creek, lower Chevelon Creek, and the Little Colorado River from Holbrook to Winslow. These reaches are important to several native fish species including bluehead sucker, Little Colorado sucker, and roundtail chub. Lower Chevelon Creek is an important reach for the Little Colorado spinedace. Little Colorado spinedace is a federally threatened species, and the affected reach of the lower Chevelon Creek is designated as its critical habitat. Although these reductions in base flow that could result from the proposed project would be very small and likely may not even be measurable, they may affect the availability of suitable stream habitat and reduce the ability of fish populations to survive the dry seasons. The project proponents would implement conservation measures to offset the potential adverse effects of stream base flow depletion attributable to the proposed project. Funds would be provided to implement activities to aid in the survival, conservation, and recovery of the federally threatened Little Colorado spinedace, and the roundtail chub.

Construction and operation of the C aquifer water-supply system would provide the opportunity to develop a permanent water-supply system that could deliver water to numerous tribal communities along and off the main water-supply pipeline alignment. Also, with the construction of the power lines to serve the well field and pump stations, there is a potential opportunity to provide electricity to local residents.

Impacts resulting from use of the N aquifer water-supply system include the following:

If the N aquifer water-supply system is used solely as a supplemental supply, as proposed, estimated reductions in base flow would average about 1.3 percent as compared to 1955 pre-mining base flow estimates, with the largest reduction occurring in Begashibito Wash, which would be about 1.48 percent, or 32 af/yr as compared to 1955 base flow estimates.

If the N aquifer water-supply system continues to provide all the water needed for the Black Mesa Complex, the amount of groundwater pumped would increase from about 4,400 af/yr to 6,000 af/yr. There would be reductions in groundwater discharges to streams. Based upon 1955 pre-mining estimates, the largest reductions from Peabody's pumping through 2038 are anticipated to occur in Begashibito Wash, where there would be an estimated 1.66 percent, or about 36 af/yr, reduction, and in Moenkopi Wash, where there would be an estimated 0.56 percent, or about 23 af/yr, reduction, as compared to 1955 base flow estimates.

Alternative B –Approval of the LOM Revision

It is anticipated that, under Alternative B, approximately 6,942 acres would be disturbed by mining from 2010 through 2026. The impacts are characterized similarly to those of Alternative A, for an area reduced in size (i.e., about 6,942 acres would be mined [5,467 acres fewer than Alternative A]. Water from the N aquifer, averaging 1,236 af/yr, would be used for mine-related uses through 2025. From 2026 through 2028, 505 af/yr of N-aquifer water would be used for reclamation and public use, and 444 af/yr of N-aquifer water would be used from 2029 through 2038. The areas in which vegetation would be disturbed would be reduced, but the relative proportions of the vegetation types impacted would be similar to those of Alternative A (i.e., 65 percent piñon/juniper, 30 percent sagebrush, and a few percent in other vegetation types). Five Navajo households, currently located on land that would be permitted for mining under the proposed project, would have to be resettled out of the area to be mined through 2026. Fewer cultural resource and traditional cultural resources would be affected. The opportunity for improved livestock grazing would be foregone, because the unmined area would be less productive for grazing. With the reduction in mining, there would be fewer coal-haul roads constructed.

No mining in 5,467 acres would preserve coal resources for future use. Although the unmined coal-resource areas would be incorporated into the permanent program permit area, mining of these resources would not be authorized until Peabody proposes that these resources be mined and submits to OSM a permit application, and OSM and BLM approve this mining. Without knowing a new customer's purpose and need for purchasing and using the coal, the amount and quality of the coal needed per year, and a plan for mining and transporting the coal, impacts associated with the potential transaction cannot be predicted. If and when there is such a proposal, impacts associated with the mining plan revision, development and construction of a means for transportation of the coal to its destination) would need to be reviewed under NEPA.

Alternative C – Disapproval of the LOM Revision (No-Action)

Under Alternative C, most of the impacts are characterized the same as Alternative B. Because the mined areas and mining facilities and infrastructure for the Black Mesa mining operation would be promptly reclaimed and the possibility of mining in the Black Mesa mining operation area would disappear, residents in or near the Black Mesa mining operation who live a traditional lifestyle would experience the benefit of the end of nearby mining-related activities more rapidly than in Alternative B.

Cumulative and Indirect Effects

The most notable cumulative effects (i.e., the incremental impact of an action when added to past, present, and reasonably foreseeable actions) addressed are related to air quality, water resources (hydrology), vegetation and wildlife habitat, and social and economic conditions, particularly for Alternative A.

Air Quality. The effects of particulates and gaseous air pollutants were assessed within a regional context. During construction of the pipelines increased particulate matter (primarily PM_{10}) emissions would be 206 tons per year. That temporary 3.6 percent increase in total regional PM emissions would not be anticipated to cause an exceedance of the National Ambient Air Quality Standards (NAAQS), especially since the Black Mesa mining operations would not occur during that time period. Consequently, the air quality impacts during construction of the pipelines are considered minor.

Under Alternative A, upon completion of construction, the ongoing Kayenta and resumed Black Mesa mining operations would be the only project component contributing to regional PM_{10} and the resumption of Black Mesa mining operations would increase total regional PM_{10} emissions by 145 tons per year, an increase of 12 percent in total regional emissions. Peabody has demonstrated that the increased PM_{10} emissions from the ongoing Kayenta and resumed Black Mesa mining operations would not cause exceedance of the NAAQS. Consequently, the air quality impacts are considered minor locally during construction and negligible during normal operation; thus, there would be negligible to no impact regionally.

The effects of gaseous air pollutants also were assessed. Those pollutants, associated with vehicle and equipment exhaust emissions currently have minor, localized impacts within the immediate vicinity of the complex, but have negligible impacts on air quality in the region. During the time of construction of the pipelines, total regional gaseous pollutant effects would be negligible.

Although continued operation of Navajo Generating Stations and resumption of operations at the Mohave Generating Station are not included in the preferred or alternate actions, in 2008, and in response to comments on the Draft EIS by agencies and others, additional text pertaining to emissions of mercury, selenium, and greenhouse gases from these facilities, along with a discussion of the current scientific community consensus on climate change, was added to the appropriate sections in Chapters 3 and 4.

Under Alternatives B and C, there would b no increase in emissions over that currently emitted from the Kayenta mining operation.

Water Resources (Hydrology). According to groundwater modeling completed for the project, under Alternative A, continued and increasing regional pumping of groundwater from the C aquifer (municipal, irrigation, and industrial, mostly unrelated to the Black Mesa Project) is expected to cause declines in groundwater elevations, especially near major pumping centers. In 2026, declines of 20 feet or more are predicted in areas of Silver Creek along the Little Colorado River from Holbrook to Joseph City, and the upper Little Colorado River above St. Johns, while declines of between 5 and 15 feet would occur at lower Chevelon and Clear Creek. This compares with less than 1 foot decline at lower Chevelon and Clear Creek due to maximum project pumping.

Cumulative regional pumping of groundwater from the N aquifer would reduce groundwater discharge to various streams on Black Mesa. The greatest change is expected to occur at Pasture Canyon near Tuba City. Diminution in groundwater discharge is predicted to be 58.9 af/yr in 2025, all of which is attributable to nonproject pumping. This reduction in discharge is 15 percent of the total 2005 estimated Pasture Canyon discharge. At Cow Springs, which is closer to the mine well field, the reduction due to community pumping is 2.0 af/yr versus 14.9 af/yr due to the project.

Water withdrawn from the N aquifer for Alternatives B or C (average of 1,236 af/yr) would be much less than the amount that has been withdrawn in the past and would result in negligible impact. No water would be withdrawn from the C aquifer.

Vegetation and Wildlife Habitat. Historic and continuing grazing has caused reductions in perennial grasses and forbs in all ecosystems in northern Arizona, and increases in species that are not palatable to livestock, including some shrubs and weedy species. Natural fire regimes have been altered by removal of grasses through grazing and by fire suppression. This has led to encroachment of trees into former grass-land areas and increases in tree density in both grasslands and wooded habitats. Large-scale piñon and juniper removal projects have been conducted east and northeast of the permit area within the past 30 to 50 years for range improvement, resulting in short- or long-term conversion of woodlands to grasslands. Although reclamation of mined areas at the Black Mesa Complex results largely in grassland, the herbaceous forage established in the reclaimed areas has been shown to be beneficial to wildlife. In addition, rock features are established to restore wildlife protection and cover, and islands of shrubs or trees are planted for more diversified habitat.

Activities that have affected and will continue to affect the distribution and abundance of wildlife in northern Arizona include grazing, fire suppression, rural residential development, spread of invasive species, increasing populations of brown-headed cowbirds (a nest parasite), fragmentation of large habitat blocks by new roads and utility corridors, and increasing human population. Increased attention by governmental and nongovernmental agencies to the management and protection of biodiversity is countering some of these activities.

Special Status Species. Depending on the hydraulic connection between the river alluvium and the C aquifer, projected drawdowns in excess of 20 feet effectively could preclude or reduce the development and persistence of large tracts of salt cedar in this area. Under Alternative A, cumulative impacts from pumping also would reduce groundwater levels 5 feet along lower Chevelon Creek and 15 feet along lower Clear Creek, but pumping for the Black Mesa project would contribute only to an additional reduction in groundwater levels from 0.1 foot along lower Chevelon Creek and 1.0 foot along lower Clear Creek. Due to these factors and the low likelihood that southwestern willow flycatchers are present and use riparian habitats along this portion of the Little Colorado River, cumulative impacts as a result of the proposed project are anticipated to be unlikely.

The decline and eventual elimination of base flow in lower Chevelon Creek from regional groundwater pumping would have significant adverse effects on Little Colorado spinedace and its habitat, including reductions in the length of flowing stream in the dry season, elimination of riffles and shallow runs during the dry season, and a marked reduction in the size and depth of pools. The effects would likely be most significant in the drier months of June and July, but impacts would be expected throughout other portions of the year as well. However, project-related groundwater pumping is not expected to contribute to long-term cumulative impacts on lower Chevelon Creek, because the cumulative effects from regional pumping essentially would eliminate all flow by 2060, even if the project were not constructed. Project-related pumping would contribute a reduction of 0.1 cubic feet per second (cfs) for lower Clear Creek out of an estimated 2006 base flow of 2.7 cfs. Regional water use combined with potential effects of climate change could decrease available habitat for Navajo sedge, known to occur in Tsegi Canyon, near Inscription, and in Ho No Geh Canyon.

Economic Conditions. Due to the existence of the Black Mesa Complex, mining drives the economy of the local area and makes the largest private-industry contribution to the revenue of the Hopi Tribe and Navajo Nation. The affected region includes the entire Hopi and Navajo Reservations, Page, and Flagstaff. Mining employees earn the highest wages in the local area, with many contributing to the support of extended families. Mining-related multiplier effects accrue to the local area, providing jobs and income in sectors such as wholesale and retail trade. When both mining operations are active, the local unemployment rate is about half that of both reservations, overall. However, significant economic impacts have resulted from the suspension of the Black Mesa mining operation in December 2005.

Final closure of the Black Mesa Complex would cause major economic impacts on the Kayenta area and major revenue impacts on both reservations. High rates of poverty—often three times the rate of the nation overall—have persisted on the Hopi and Navajo Reservations throughout modern history. With the loss of the mining operations, the historical (premining) level of poverty would return throughout the reservations absent other economic development, and would eliminate the island of relative prosperity in the Kayenta area.

PREFERRED ALTERNATIVE

The lead and cooperating agencies' preferred alternative is Alternative B, which is approval of Peabody's July 2, 2008, amended application for the LOM revision, which includes adding 18,857 acres to the permanent program permit area, revising the operation and reclamation plan, approving changes to the mining plan for the Hopi and Navajo coal leases, and using an average 1,236 af/yr of N-aquifer water. Coal would no longer be supplied to the Mohave Generating Station from the Black Mesa Complex.

CONSULTATION AND COORDINATION

The analyses for this EIS were completed in consultation with other agencies and the public. OSM sent letters inviting 11 agencies to participate in the preparation of the Black Mesa Project EIS; nine decided to accept the invitation to be cooperating agencies: BIA, BLM, Reclamation, USEPA, Forest Service, Hopi Tribe, Navajo Nation, Mohave County, and the City of Kingman. The Arizona State Land Department and U.S Army Corps of Engineers, Los Angeles District, both responded to OSM that they would participate as reviewers of the EIS rather than as cooperating agencies in the preparation of the EIS. Later, at its request, the Hualapai Tribe became a cooperator. OSM has worked closely with the cooperating agencies throughout the EIS process. Many of the Federal cooperating agencies are participants in the multi-agency consultations for Section 7 under the Endangered Species Act and Section 106 under the National Historic Preservation Act. Several other Federal and State agencies and local governments were involved during the preparation of the EIS, but to a lesser extent than the cooperating agencies. Also, OSM consulted government-to-government with the Hopi Tribe, Hualapai Tribe, and Navajo Nation.

Public scoping meetings were held during January and February 2005 in Saint Michaels, Forest Lake, Kayenta, Kykotsmovi, Leupp, Kingman, and Flagstaff in Arizona, and in Laughlin, Nevada. More than 700 people attended the 10 scoping meetings, and 351 written submissions and 237 oral statements were made by the public and other governmental agencies to OSM during the scoping period. A detailed report of comments and issues heard from the public was developed and placed on the OSM project web site at www.wrcc.osmre.gov/WR/BlackMesaEIS.htm and an informational newsletter detailing the results of the scoping period were distributed in September 2005.

More than 700 copies of the Draft EIS were distributed in late November 2006 to Federal agencies; tribal, State, and local governments; organizations; and individuals. OSM published the notice of availability of the Draft EIS for public review and comment in the Federal Register on November 22, 2006. The USEPA published a notice of availability in the Federal Register on December 1, 2006. The availability of the Draft EIS, deadline for public comments, and locations, dates, and times of public meetings on the Draft EIS were announced in media releases, paid newspaper legal notices, and radio announcements. Radio broadcasts were in English, Hopi, and Navajo. Copies of the Draft EIS also were mailed to those who contacted OSM after the November 22, 2006, Federal Register notice. Copies of the document also were made available for public review at the Gallup Public Library, Hopi Public Library, Tuba City Public Library, Page Public Library, Winslow Public Library, Holbrook Public Library, Flagstaff City-Coconino County Public Library, Kingman Library, Laughlin Library, and Bullhead City Library.

The USEPA Federal Register notice on December 1, 2006, initiated a 45-day public comment period that was to end 45 days later on January 22, 2007. News and information about the Draft EIS—regarding its availability, comment deadlines, and the dates, times, and locations of public meetings—was publicized through media releases, and by paid newspaper legal notices and radio. In a Federal Register Notice published on December 20, 2006, OSM announced that the comment period would be extended to February 6, 2007, and that a second public meeting would be held in Leupp.

OSM held 12 public meetings—Window Rock, Moenkopi, Forest Lake, Kykotsmovi, Kayenta, Leupp (2), Peach Springs, Kingman, Winslow, and Flagstaff in Arizona, and Laughlin, Nevada.

The comment period ended on February 6, 2007; however, OSM received and accepted comments beyond that date. OSM received 18,148 submittals containing comments from Federal agencies, tribal, State, and or local governments; public and private organizations; and individuals. At the request of the project proponents, work on the Final EIS was suspended in May 2007.

After a one-year suspension of work on the EIS, OSM in May 2008 resumed work on the EIS. In a Federal Register published on May 23, 2008, OSM announced that the comment period on the Draft EIS was being reopened for 45 days until July 7, 2008. It did so to allow persons the opportunity to comment on the proposed project and preferred alternative, which is now Alternative B instead of Alternative A.

The comments in each submittal were identified, recorded, and analyzed. Responses were prepared for all substantive comments. A description of the comment analysis, the comments received, and the responses to those comments are provided in this Final EIS (Volume II, Appendix M).

PREFACE

PREFACE

This environmental impact statement (EIS) is being prepared in compliance with the National Environmental Policy Act (NEPA) in order to analyze and disclose the probable effects of the Black Mesa Project in northern Arizona. The purpose of and need for the Black Mesa Project is to continue the supply of coal from Peabody Western Coal Company's (Peabody's) Kayenta mining operation to the Navajo Generating Station near Page, Arizona. The action proposed by Peabody is to revise the life-of-mine (LOM) operation and reclamation plans for its permitted Kayenta mining operation and, as a part of this revision, to incorporate into these plans the initial program area surface facilities and coal resource areas of its adjacent Black Mesa mining operations, which previously supplied coal to the Mohave Generating Station in Laughlin, Nevada. This EIS collectively refers to the area occupied by the Kayenta mining operation and Black Mesa mining operation as the Black Mesa Complex.

The Office of Surface Mining Reclamation and Enforcement (OSM) is the lead agency responsible for preparing this EIS. Other Federal agencies and tribal and local governments cooperating with OSM in the preparation of this EIS include the Bureau of Indian Affairs; Bureau of Land Management; U.S. Environmental Protection Agency; Hopi Tribe; Hualapai Tribe; Navajo Nation; Mohave County, Arizona; and City of Kingman, Arizona.

This EIS consists of 7 chapters and 13 appendices. Chapter 1 provides a description of the proposed Federal actions and the need for these proposed actions; the action proposed by Peabody; scope of the analysis; relation of the proposal to other development; and scoping issues and concerns.

Chapter 2 provides a description and comparison of the range of alternative decisions available to OSM and BLM regarding the proposed life-of-mine revision for the Black Mesa Complex. Also described are the alternatives that were considered but eliminated from detailed study in this EIS.

Chapter 3 provides a description of the existing environment that would be affected by the proposed action. Chapter 4 provides a description and analysis of the probable effects on the environment that could result from each of the three alternatives. A comparison of the alternatives is found both in the Summary and in Section 2.5 in Chapter 2 of this EIS.

Chapter 5 provides a description of the consultation and coordination that occurred with the public, American Indian tribes, government agencies, and private organizations during the preparation of the EIS and lists those from whom comments were solicited. Chapter 6 contains a list of the individuals, with their qualifications, who prepared this document and/or the environmental analyses contained herein. Chapter 7 is a list of the selected references used in the preparation of this document.

Appendices have been included to provide supplemental information on mining and reclamation procedures and typical well field and pipeline construction, operation, and maintenance; legal authorities and mandates; estimated project costs; truck and rail alternatives to transporting coal via slurry; biological resources; land use; water resource impact assessment methodology; visual resources, and comments on the Draft EIS and responses to those comments.

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF MAPS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

°C	degrees Centigrade
°F	degrees Fahrenheit
2-D	two dimensional
3-D	three dimensional
μg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
μS/cm	microSiemens per centimeter
A&Wc	Aquatic and Wildlife – Cold Water Fishery
A&We	Aquatic and Wildlife – Ephemeral
ACEC	areas of critical environmental concern
af/yr	acre-feet per year (1 acre-foot is equal to 325,851 gallons)
ADEQ	Arizona Department of Environmental Quality
ADOR	Arizona Department of Revenue
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
af/yr	acre-feet per year
AGFD	Arizona Game and Fish Department
AgI	agricultural irrigation
AgL	agricultural livestock watering
AIRFA	American Indian Religious Freedom Act
Alk	alkalinity
AMA	Aquifer Management Area
AML	Abandoned Mine Land
ANSI/AWS	American National Standards Institute/American Welding Society
API	American Petroleum Institute
APP	Aquifer Protection Program
APS	Arizona Public Service Company
ARPA	Archaeological Resources Protection Act
ARS	Arizona Revised Statutes
As	Arsenic
ASLD	Arizona State Land Department
ASME	American Society of Mechanical Engineers
ASU	Arizona State University
AUM	animal unit month
AWQS	Aquifer Water Quality Standards
AWWA	American Water Works Association
AZPDES	Arizona Pollutant Discharge Elimination System
BACT	best achievable control technology
bgs	below ground surface
BIA	Bureau of Indian Affairs
BIOME	BIOME Ecological and Wildlife Research
BLM	Bureau of Land Management
BMPI	Black Mesa Pipeline, Inc.
BNSF	Burlington Northern Santa Fe

BOR	U.S. Bureau of Reclamation
BTCA	best technology currently available
Btu	British thermal unit
C aquifer	Coconino aquifer
Ca	calcium
CAA	Clean Air Act
CAP	Central Arizona Project
$CaSO_4$	gypsum (calcium sulfate)
CAWCD	Central Arizona Water Conservation District
CBM	coal bed methane
CCDAQEM	Clark County Department of Air Quality and Environmental Management
CDP	Census Designated Places
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHIA	Comprehensive Hydrologic Impact Assessment
Cl	chloride
CML	cement-mortar lined
CO	carbon monoxide
CO_2	carbon dioxide
CPO	Cultural Preservation Office
CRPA	Cultural Resource Protection Act
CSP	coal-slurry pipeline
CWA	Clean Water Act
D aquifer	Dakota aquifer
dB	decibel
dBA	A-weighted decibels
DWS	domestic water source
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPC	engineering, procurement, and construction
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FBC	full-body contact
FC	fish consumption
FHWA	Federal Highway Administration
FIRE	Finance, Insurance, and Real Estate
Fl	fluorine
FLPMA	Federal Land Policy and Management Act
FOIA	Freedom of Information Act
Forest Service	U.S. Department of Agriculture Forest Service
ft/bgs	feet below ground surface
ft/day	feet per day
ft^2/day	square feet per day
FWS	U.S. Fish and Wildlife Service

gpd/ft	gallons per day per foot
g/VMT	Grams emitted per vehicle mile traveled
GMU	Game Management Units
gpm	gallons per minute
HCO_3	bicarbonate
HCPO	Hopi Cultural Preservation Office
HIS	Indian Health Services
HTHA	Hopi Tribal Housing Authority
HUD	Housing and Urban Development
Hz	hertz
I-40	Interstate 40
ICP	inductively coupled plasma spectrometry
IMPROVE	Integrated Monitoring of Protected Visual Environments
km	kilometer
kV	kilovolt
kVA	kilovolt amperes
L_{dn}	day-night average sound level
L_{eq}	equivalent noise level
LOM	life-of-mine
m/s	meters per second
Mg	magnesium
mg/L	milligrams per liter
ml	milliliter
MSHA	Mine Health and Safety Administration
MSL	mean sea level
N aquifer	Navajo aquifer
N41	Navajo Route 41
Na	sodium
NAAQS	National Ambient Air Quality Standards
NACE	National Association of Corrosion Engineers
NAGPRA	Native American Graves Protection and Repatriation Act
National Register	National Register of Historic Places
NDEP	Nevada Department of Environmental Protection
NDOH	Navajo Division of Health
NEPA	National Environmental Policy Act
NHA	Navajo Housing Authority
NHPA	National Historic Preservation Act
NNC	Navajo Nation Council or Navajo Nation Code
NNEPA	Navajo Nation Environmental Protection Agency
NNHSD	Navajo Nation Housing Services Department
NO_2	nitrogen dioxide
NO_3	nitrate
NO_X	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission

NRCS	Natural Resource Conservation Service
NSR	New Source Review
NTU	Nephelometric turbidity unit
NTUA	Navajo Tribal Utility Authority
O_3	ozone
OHV	off-highway vehicle
OSM	Office of Surface Mining Reclamation and Enforcement
Pb	lead
PBC	partial body contact
Peabody	Peabody Western Coal Company
pH	measure of acidity
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppm	parts per million
PSD	Prevention of Significant Deterioration
R aquifer	Redwall aquifer
RAWS	remote automatic weather station
RCRA	Resource Conservation and Recovery Act
Reclamation	Bureau of Reclamation
RFRA	Religious Freedom Restoration Act of 1993
RUSLE	Revised Universal Soil Loss Equation
SAIPE	Small Area Income and Poverty Estimates
SAR	sodium adsorption ratio
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison Company
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SLUD	Strategic Land Use and Development Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
SO_4	sulfate
SPCC	Spill Prevention Control and Countermeasure
SPLP	Synthetic Precipitation Leaching Procedure
SRP	Salt River Project
SSPA	S.S. Papadopulos and Associates
STATSGO	State Soil Geographic
SWPPP	Stormwater Pollution Prevention Plan
TDS	total dissolved solids
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
tons/acre/yr	tons per acre per year
U.S. 160	U.S. Highway 160
U.S. 89	U.S. Highway 89
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978

URS	URS Corporation
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
U.S. 89	U.S. Highway 89
U.S. 160	U.S. Highway 160
VRM	Visual Resource Management
WQARF	Water Quality Assurance Revolving Fund
WQMP	Water Quality Management Plan
WRCC	Western Regional Climate Center
WSP	water-supply pipeline
WWTP	Waste Water Treatment Plant

INTRODUCTION

CHAPTER 1

1.0 INTRODUCTION

1.1 PURPOSE AND NEED FOR ACTION

This environmental impact statement (EIS) is being prepared in compliance with the National Environmental Policy Act (NEPA) in order to analyze and disclose the probable effects of the Black Mesa Project in northern Arizona. The purpose of and need for the Black Mesa Project is to continue the supply of coal from Peabody Western Coal Company's (Peabody's) Kayenta mining operation to the Navajo Generating Station near Page, Arizona (Map 1-1). The action proposed by Peabody is to revise the life-of-mine (LOM) operation and reclamation plans for its permitted Kayenta mining operation and, as a part of this revision, to incorporate into these plans the initial program area surface facilities and coal-resource areas of its adjacent Black Mesa mining operations, which previously supplied coal to the Mohave Generating Station in Laughlin, Nevada. This EIS collectively refers to the area occupied by the Kayenta mining operation and Black Mesa mining operation as the Black Mesa Complex.

1.1.1 <u>Changes to the Purpose and Need from the Draft EIS</u>

Since the Draft EIS was published in November 2006, the purpose of and need for the Black Mesa Project to supply coal to the Mohave Generating Station no longer exists. With this change, Peabody amended its permit revision application, thus causing the change in the statement of purpose and need and reducing the scope of the proposed action. Some of Peabody's LOM revisions and three of the four original proposed actions are no longer proposed.

- As a part of its LOM revisions, Peabody no longer proposes a new coal-haul road, construction of a new coal-washing facility, coal production from the Black Mesa mining operation for the Mohave Generating Station, and water for slurry transportation of coal and coal washing.
- Black Mesa Pipeline, Inc. (BMPI) no longer proposes to continue to operate the Black Mesa coal-slurry preparation plant.
- BMPI also no longer proposes to reconstruct the 273-mile-long coal-delivery slurry pipeline from the Black Mesa mining operation to the Mohave Generating Station.
- The co-owners of the Mohave Generating Station[1] no longer propose to construct a new water-supply system, including a 108-mile-long water-supply pipeline and a well field near Leupp,

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[1] Operation of the Mohave Generating Station—owned jointly by Southern California Edison Company (SCE), Salt River Project (SRP), Los Angeles Department of Water and Power, and Nevada Power Company—was suspended on December 31, 2005. After a comprehensive reassessment of efforts required to return the power plant to operation, SCE, the operator and majority owner of the Mohave Generating Station, announced on June 19, 2006, that it would not continue to pursue resumed operation of the power plant. Two other owners, Nevada Power Company and Los Angeles Department of Water and Power, made similar announcements. The fourth owner, SRP, announced that it was continuing to assess the situation and might pursue resumed operation of the power plant with new partners, but not as sole owner. In September 2006, SRP announced that it was accelerating efforts to return the plant to service, and requested that the environmental impact statement process resume while it attempted to form a new ownership group. With SCE's concurrence, SRP committed to replace SCE as the principal applicant for those aspects of the Black Mesa Project that SCE had initiated. On February 6, 2007, SRP announced that it would no longer pursue resumption of the coal operations at the Mohave Generating Station and no longer continue as the project proponent for completion of the Black Mesa Project EIS. On February 7, 2007, SCE resumed responsibility for completion of the EIS and, on May 18, 2007, SCE announced that work on the Black Mesa Project EIS was suspended. In letters dated February 25 and April 30, 2008, Peabody Western Coal Company notified the Office of Surface Mining Reclamation and Enforcement of its intention to amend the pending life-of-mine permit-revision application for the Black Mesa Complex to remove proposed plans and activities that supported supplying coal to the Mohave Generating Station because it believed that reopening the Mohave Generating Station for operation is unlikely.

Arizona, to obtain water from the Coconino aquifer (C aquifer) and to convey the water to the Black Mesa Complex for use in the coal slurry and other mine-related purposes.

Although these actions are no longer proposed and not part of the preferred alternative, they still could occur under certain circumstances. Alternative A addresses supplying coal to the Mohave Generating Station, which remains permitted for operation. Even though operation was suspended in December 2005, it has not been decommissioned. Although it appears that implementing Alternative A is unlikely, Peabody wishes to proceed in revising its permit to incorporate the surface facilities in the initial program area and coal-resource areas of its adjacent Black Mesa mining operation; that is, Alternative B. Because Alternative A is still possible, albeit unlikely, this EIS continues to analyze its effects[2].

The Hopi Tribe and Navajo Nation also proposed that the C aquifer water-supply system could be expanded to provide an additional 5,600 acre-feet per year (af/yr) of water for tribal domestic, municipal, industrial, and commercial uses. Both tribes indicated that upsizing the pipeline and expanding the system's well field would fulfill the needs of both tribes to significantly expand and improve tribal water supplies at a relatively modest cost. This EIS analyzes the tribes' potential withdrawals of C-aquifer water from the proposed well field, which would be interrelated with the sizing of the currently proposed water-supply pipeline and well field and the total amount of C-aquifer water ultimately withdrawn from the well field. The construction of tribal water-distribution systems was never proposed as a part of the Black Mesa Project; therefore, it is not analyzed in this EIS.

The Kayenta mining operation delivers 8.5 million tons of coal per year from the Black Mesa Complex to the Navajo Generating Station, a distance of 83 miles, by the Black Mesa and Lake Powell Railroad. The LOM revisions would improve or enhance the efficiency and cost-effectiveness of the mine plan for the Kayenta mining operation. However, no changes to this coal-delivery system or to the generating station are proposed.

The United States Department of the Interior (USDI), Office of Surface Mining Reclamation and Enforcement (OSM), is the lead agency responsible for preparing this EIS. Other Federal agencies and tribal governments cooperating with OSM in the preparation of the EIS include the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), U.S. Environmental Protection Agency (USEPA), Hopi Tribe, Navajo Nation, and City of Kingman, Arizona.

1.2 BACKGROUND

The Black Mesa Complex has operated as two separate surface-mining operations (Kayenta mining operation and Black Mesa mining operation) since the early 1970s and is an area composed of three contiguous leases and several surface rights-of-way and easements granted to Peabody from the Hopi Tribe and Navajo Nation. The Black Mesa Complex comprises approximately 24,858 acres of land where the surface and mineral interests are held exclusively by the Navajo Nation (Navajo Exclusive Lease Area, Lease 14-20-0603-8580), and approximately 40,000 acres of land are located in the former Hopi and Navajo Joint Minerals Ownership Lease Area (Joint Lease Area, Leases 14-20-0603-9910 and 14-20-0450-5743) (Map 1-2). The tribes have joint and equal interest in the minerals that underlie the Joint Lease Area; however, the surface has been partitioned and is within the exclusive jurisdiction of the tribes to which the surface is partitioned (6,137 acres partitioned to the Hopi Tribe and 33,863 acres

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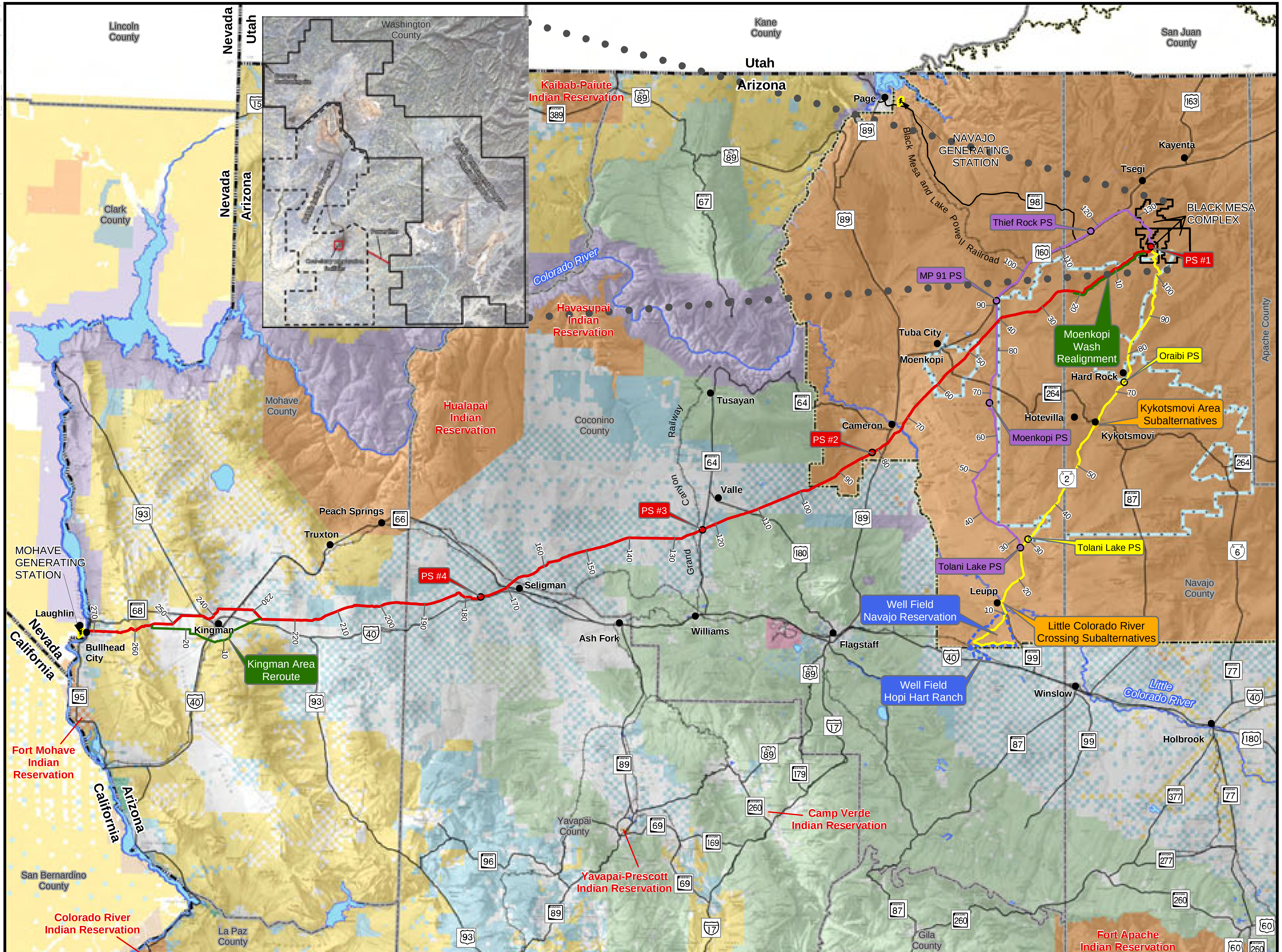
[2] As described in the Draft Environmental Impact Statement, Section 1.2, under Alternative A, other agencies would have authorities and actions to take regarding the coal-slurry preparation plant, coal-slurry pipeline, and/or C aquifer water-supply system.



Map 1-1
Project Area

Black Mesa Project EIS

LEGEND

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

Surface Management

- Bureau of Land Management
- U.S. Forest Service
- National Park Service
- U.S. Fish and Wildlife Service National Wildlife Refuge
- Bureau of Reclamation
- American Indian Reservation
- Military Reservation
- State Trust
- County, Park and Outdoor Recreation Area
- Private

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

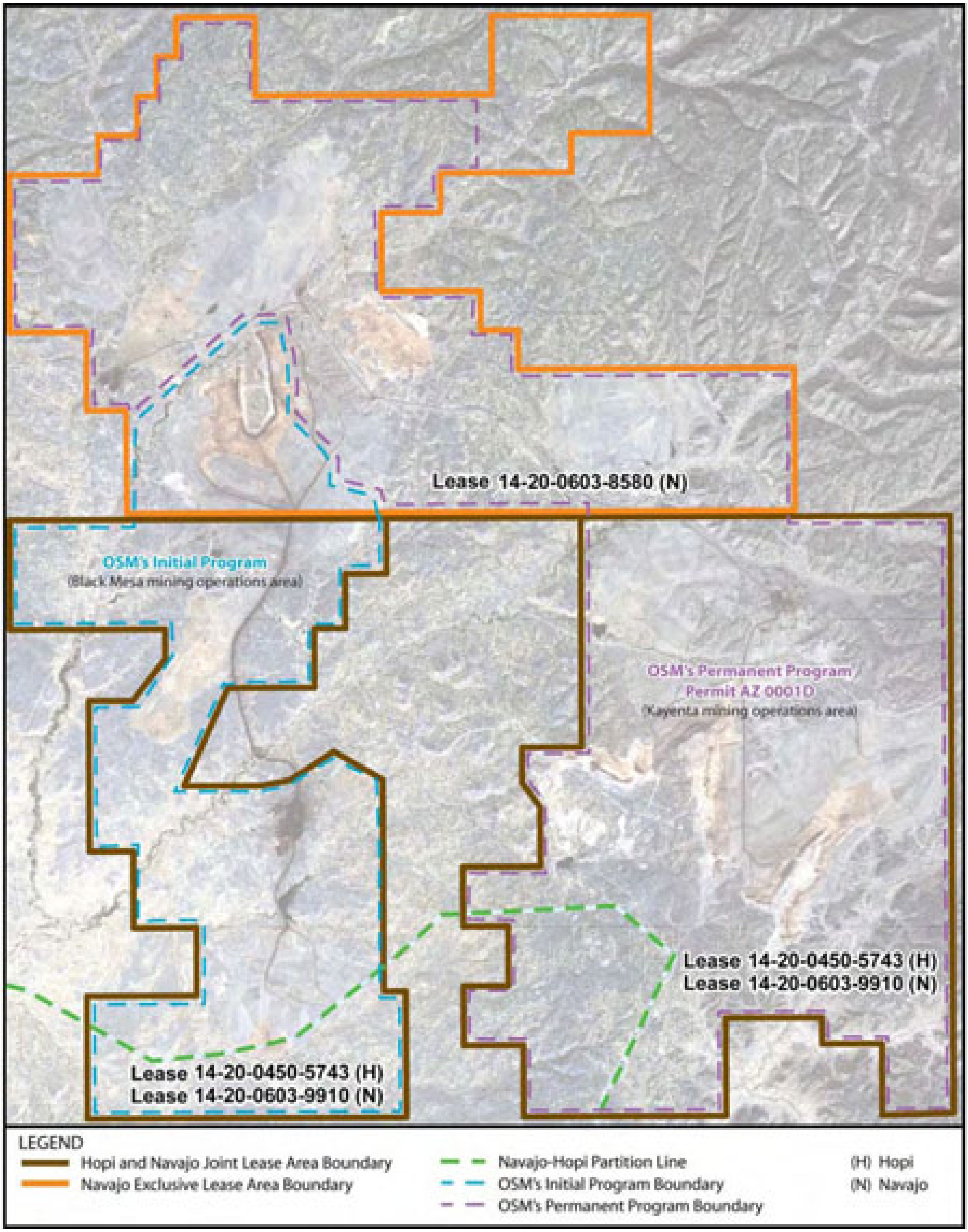
SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
Teal Data Center 2000

N

November 2008

0 20 40
Miles

Prepared By:
URS



Map 1-2 Lease Area

partitioned to the Navajo Nation). The coal-mining leases with the Hopi Tribe and Navajo Nation provide Peabody the right to produce up to 290 million tons of coal from the Navajo Exclusive Lease Area and up to 380 million tons of coal from the Hopi and Navajo Joint Lease Area for a combined total of 670 million tons. The coal-mining leases approved by the Hopi Tribe and Navajo Nation provide Peabody with the rights to prospect, mine, and strip leased lands to produce coal and kindred products, including other minerals that may be found, except for oil and gas. Peabody also is given the right to construct support facilities such as buildings, pipelines, tanks, plants, and other structures; make excavations, stockpiles, ditches, drains, roads, spur tracks, electric power lines, and other improvements; and to place machinery and other equipment and fixtures and do all other things on the leased lands necessary to carry on mining operations, including rights of ingress and egress, and to develop and use water for the mining operations, including the transportation by slurry pipeline of coal mined from the leases.

A complete coal-removal, -preparation, and -transportation system is in place and, though separate operations, the Kayenta and Black Mesa mining operations have historically shared some facilities and structures (e.g., offices, shops, coal-handling facilities, roads, etc.).

Several grants of rights-of-way and easements on Hopi and Navajo Nation land allow Peabody access to and use of land outside the existing coal-lease areas. These rights-of-way and easements include an overland conveyor; a coal-loading site; two parcels of land providing access for utilities, haul roads, maintenance roads, sediment-control ponds, and a rock-borrow area; and an electrical transmission line. A more detailed description of the mine facilities is provided in Appendix A-1.

Peabody has been supplying coal from the Kayenta mining operation to the Navajo Generating Station since 1973. The Kayenta mining operation, the northernmost and eastern portion of the lease area, currently produces coal and reclaims land under OSM Permit AZ-0001D, originally issued in 1990 under OSM's permanent Indian lands program. The Kayenta mining operation is permitted to mine coal reserves that would last through 2026 at current production rates. The Kayenta mining operation is the sole coal supplier for the Navajo Generating Station, and the Navajo Generating Station is its sole customer.

The Black Mesa mining operation, the southwestern portion of the lease area, supplied coal to the Mohave Generating Station from 1970 to December 2005. Until the latter date, the Black Mesa mining operation was the sole supplier of coal to the Mohave Generating Station, and the Mohave Generating Station was its sole customer. After the effective date (December 13, 1977) of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), Title 30, United States Code, Section 1201 et seq. (30 U.S.C. 1201 et seq.), the operation produced coal and reclaimed land under OSM's initial regulatory program.[3] Although Peabody is authorized to mine coal from the Black Mesa mining operation until such time that OSM makes a decision on the LOM revision, Peabody has not produced coal at the Black Mesa mining operation for the Mohave Generation Station since suspension of operations at the power plant in December 2005.

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[3] Between 1990 and 2005, the Black Mesa operation mined coal under the Office of Surface Mining Reclamation and Enforcement (OSM) initial regulatory program. Since 2005, Peabody Western Coal Company (Peabody) has continued to use surface facilities at the Black Mesa mining operation under the initial regulatory program for both its reclamation activities at the Black Mesa mining operation and in conjunction with its Kayenta mining operation. Prior to 1990, Peabody had submitted a permanent program permit application to OSM for both the Kayenta and Black Mesa mining operations. In 1990, OSM approved and issued a permit for the Kayenta operation. Under the direction of the Secretary of the Interior, OSM administratively delayed its decision on the Black Mesa operation owing to concerns of the Hopi Tribe and Navajo Nation regarding use of Navajo-aquifer water for coal slurry and mine-related purposes. Under this administrative delay, Peabody conducted the Black Mesa operation until December 2005, when mining operations ceased due to suspension of operations at the Mohave Generating Station.

On February 17, 2004, Peabody filed an LOM permit revision application with OSM proposing several revisions to the LOM plans of the Kayenta and Black Mesa mining operations. OSM reviewed the application and found it administratively complete. However, in letters dated February 25, 2008, and April 3, 2008, Peabody notified OSM of its intention to amend the pending mine permit revision application for the Black Mesa Complex to remove proposed plans and activities that supported supplying coal to the Mohave Generating Station because Peabody believed that reopening the Mohave Generating Station for operation as a coal-fired power plant is unlikely. Peabody submitted an amended application on July 2, 2008, which is consistent with its letters omitting components to supply coal to the Mohave Generating Station and the haul road.

At this time, Peabody has not indicated that new customers are being considered for the coal from the Black Mesa mining operation. Although, under Alternative B, the unmined coal-resource areas would be incorporated into the permanent program permit area, mining of these resources would not be authorized until Peabody proposed that these resources be mined and BLM and OSM approved this mining. Without knowing a new customer's purpose and need for purchasing and using the coal, the amount and quality of coal needed per year, and a plan for mining and transporting the coal, impacts associated with the potential transaction cannot be projected. If and when there is such a proposal, associated actions (e.g., mining plan revision, development and construction of a means of transportation of the coal to its destination) will need to be reviewed under NEPA.

Under the SMCRA, OSM may approve, disapprove, or approve with conditions the LOM revision application for the Black Mesa Complex. If requirements of SMCRA are met, OSM must approve the application. In making its decision, OSM will consider the concerns of the Hopi Tribe and Navajo Nation associated with use of water from the Navajo aquifer (N aquifer); However, OSM has no authority under SMCRA to adjudicate water rights or to conditionally permit to prohibit or limit the use of N-aquifer water allowed by the leases, Other Federal agencies (i.e., BLM, U.S. Army Corps of Engineers [USACE], USEPA, and U.S. Fish and Wildlife Service [FWS]) have authorities and/or actions (decisions) to perform for the various proposals related to the mining operation. These authorities and actions are summarized below and are described in more detail in Section 2.3, Table 2-6.

- OSM approval, conditional approval, or disapproval of Peabody's LOM revision;
- BLM approval of changes to Peabody's mining plan;
- USACE approval of modification of Peabody's Clean Water Act (CWA) Section 404 permit and USEPA (Hopi lands) and Navajo Nation Environmental Protection Agency (NNEPA) (Navajo lands) issuance of CWA Section 401 water-quality certification;
- USEPA and NNEPA approval of modifications of Peabody's National Pollutant Discharge Elimination System (NPDES) permit;
- USEPA approval of Peabody's notice of intent for coverage under the 2006 Multi-Sector General NPDES Permit for Storm Water; and
- FWS review of OSM's biological assessment and, if OSM and FWS enter into formal consultation, issuance of a biological opinion related to Section 7 of the Endangered Species Act (ESA).

Also, through the conditions of the existing mine permit, OSM will require Peabody's continued compliance with the National Historic Preservation Act of 1966 (NHPA), Section 106, (16 U.S.C. 470

et seq.), Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001-3013), and laws, regulations, and policies of the Hopi Tribe and Navajo Nation.

1.3 PROJECT LOCATION

The Black Mesa Complex (which includes the areas of the Kayenta mining operation and Black Mesa mining operation) is located on about 64,585 acres of land leased within the boundaries of the Hopi and Navajo Indian Reservations near Kayenta in Navajo County in northern Arizona (about 125 miles northeast of Flagstaff, Arizona) (refer to Map 1-1). Coal from the Kayenta mining operation is delivered by electric railroad 83 miles northwest to the Navajo Generating Station near Page in northern Coconino County in northern Arizona.

The components associated with Alternative A (coal-slurry preparation plant, coal-slurry pipeline, and C aquifer water-supply system) are or would be located in Navajo, Coconino, Yavapai, and Mohave Counties in northern Arizona, and a small part in the extreme southern tip of Nevada in Clark County (refer to Map 1-1). Until December 2005, coal from the Black Mesa mining operation was delivered via the 273-mile-long coal-slurry pipeline southwest to the Mohave Generating Station in Laughlin, Nevada.

Under Alternative A, the well field for the proposed new C aquifer water-supply system would be located in the area of Canyon Diablo, south of Leupp in Coconino County, Arizona, on both the Navajo Indian Reservation and land owned by the Hopi Tribe. The C aquifer is a large aquifer system that encompasses more than 27,000 square miles in northern Arizona and extends into northwestern New Mexico, Utah, and Colorado. A proposed new 108-mile-long pipeline would convey water from the well field northeast from the Diablo Canyon through Coconino and Navajo Counties and the Hopi and Navajo Indian Reservations to the Black Mesa Complex. The part of the N aquifer that historically has supplied the water for the coal slurry and continues to supply water for mine-related and domestic purposes is part of a larger area that encompasses an approximately 12,000-square-mile area and three hydrologic sub-basins.

1.4 RELATION TO OTHER DEVELOPMENT

1.4.1 Navajo Generating Station

The Navajo Generating Station is a coal-fired, steam electric-generating power plant with a generating capacity of 2,250 megawatts from three 750-megawatt units. The first unit began producing electricity in 1974, and commercial operation of the other units began in 1975 and 1976. The power plant consumes 8.5 million tons of coal annually. The Black Mesa and Lake Powell Railroad, a 50,000-volt electric railroad, is a rail line dedicated to transporting the coal 83 miles from the Black Mesa Complex to the Navajo Generating Station.

The co-owners of the Navajo Generating Station are Salt River Project (SRP) (21.7 percent share and plant operator), Bureau of Reclamation (Reclamation) (24.3 percent share), Los Angeles Department of Water and Power (21.2 percent share), Arizona Public Service Company (APS) (14.0 percent share), Nevada Power Company (11.3 percent share), and Tucson Electric Power (7.5 percent share). The electrical power produced by the Navajo Generating Station is used to serve residential, commercial, and industrial customers in Arizona, Nevada, and California. The power supply from the Navajo Generating Station also is used to pump water through the Central Arizona Project, a 336-mile-long system that conveys water from the Colorado River to central Arizona for agricultural, commercial, and residential uses. The generating station has been important to the co-owners of the facility because of its dependability as a base source of power to the region and because it is fueled with coal, which is less expensive than natural gas.

There are no proposals to modify the facilities or operation of either the Navajo Generating Station or the Black Mesa and Lake Powell Railroad that would require Federal approval. Moreover, any proposals to modify the Navajo Generating Station are beyond OSM's decision-making authority. Therefore, potential modifications to facilities or operation of the Navajo Generating Station are not part of the Black Mesa Project considered in this EIS. However, because approval by OSM of the LOM revision would enable the Navajo Generating Station potentially to use coal from additional coal-resource areas within the Black Mesa Complex, a summary description of the cumulative impacts that would occur with the continued operation of the Navajo Generating Station is included in this EIS.

1.4.2 Mohave Generating Station

The Mohave Generating Station is a coal-fired, steam electric-generating power plant that produced electricity from 1970 until December 2005, when operation of the power plant was suspended. This facility, which has a generating capacity of 1,580 megawatts, was operated by Southern California Edison (SCE) and is jointly owned by SCE (56 percent share), SRP (20 percent share), Los Angeles Department of Water and Power (10 percent share), and Nevada Power Company (14 percent share). The generating station has been important to the co-owners of the facility because of its dependability as a baseload source of power to the region and because it is fueled with coal, which is less expensive than natural gas.

In response to a lawsuit concerning air quality, the co-owners entered into a consent decree in 1999 with the environmental organizations that filed the lawsuit. Under the consent decree, for the Mohave Generating Station to operate on coal beyond 2005, the co-owners would need to install new air-pollution-control technology on the plant (sulfur dioxide scrubbers, baghouses, and low nitrogen oxide burners). Under the terms of the consent decree, operation of the power plant was suspended on December 31, 2005, because the air-pollution-control technology had not been installed. Installation costs of the new pollution-control technology would have exceeded $1 billion. This cost included the purchase and installation of the new pollution-control and related equipment; reconstruction of the coal-slurry pipeline; and the development of an alternative water supply to replace the use of N-aquifer water for the slurry prepared at the coal-slurry preparation plant, for mine-related uses, and for the new coal-washing facility.

Construction activities at the Mohave Generating Station associated with the emission-control improvements would not require any Federal approvals. Environmental regulatory and statutory requirements affecting the Mohave Generating Station would result in no requirement for Federal environmental review under NEPA.

The decision on whether or not the Mohave Generating Station should resume operations and continue to operate is beyond the scope of OSM's and the cooperating agencies' decision-making authority and therefore is not considered in this EIS. Any resumed operations prior to 2010 using the current coal-supply system under existing permits also is beyond the scope of OSM's and the cooperating agencies' decision-making authority and therefore was not considered in this EIS. However, since the Mohave Generating Station would operate as a coal-fired facility in the future only if OSM were to approve the LOM revision and the other agencies were to approve the other components as described under Alternative A, Section 4.23 includes, where appropriate, summary information about the impacts associated with resumed operation of the Mohave Generating Station in January 2010. Information on such impacts also is included in the Preliminary Environmental Assessment for the Mohave Generating Station Continued Operation Potential Project, prepared as directed by the California Public Utilities Commission Administrative Law Judge (Commission Proceedings A.02-05-046).

1.5 ISSUES IDENTIFIED THROUGH SCOPING

1.5.1 Scoping

OSM has a regulatory responsibility to solicit comments from the public regarding the proposed project and to consult with relevant Federal and State agencies, local governments, and affected federally recognized American Indian tribes. Scoping is a process that invites public input on the proposed project early in the NEPA process to help determine the scope of issues to be addressed and identify the significant issues related to the proposed action. OSM concurrently carried out the NEPA scoping process and administrative public participation process for Peabody's LOM revision pursuant to the SMCRA. For the convenience of the public, which has an interest in both processes, OSM held public meetings with the dual purposes of obtaining comments that would help define the scope of the EIS and holding informal conferences on Peabody's revision application. Accordingly, OSM considered the comments made by members of the public during the meetings and in writing to be relevant to both the EIS and the permit application processes.

OSM's notice of intent to prepare an EIS was published in the Federal Register on December 1, 2004. This marked the beginning of the scoping period for the Black Mesa Project EIS. The notice of intent indicated that the scoping period, required to be a minimum of 30 days, would end on January 21, 2005. OSM solicited comments from relevant agencies and the public and held eight scoping meetings in January 2005. At the request of the public, OSM extended the scoping period and held two additional scoping meetings in February 2005. A second notice was published in the Federal Register on February 4, 2005, announcing the additional meetings and the extension of the scoping period to March 4, 2005. Comments received during the scoping period were analyzed and documented in the Black Mesa Project Scoping Summary Report issued in April 2005. By the end of the scoping comment period, OSM had received 237 statements made by speakers at public meetings and 351 written or electronically mailed submissions. In addition to these, more than 2,000 form letters regarding the LOM revision were received.

1.5.2 Summary of Issues

The comments received during scoping (December 2004 to March 2005) from agencies and the public generally were related to one of three major topics—actions and alternatives, environmental impacts, and process concerns. A summary of the comments received during scoping, organized by the three major topics and subsidiary issue categories, is provided below. The summary is followed by Table 1-1, which is a list of issues derived from the scoping comments and that indicates where each issue is addressed in the EIS.

1.5.2.1 Actions and Alternatives

Concerns about a potentially diminishing water supply were expressed in many of the comments received from the public regarding the Black Mesa Project, and reflected a broader concern that the project may cause irreparable injury to "Mother Earth." The project's perceived effects on the natural balance of the area is seen by some as a challenge to traditional American Indian culture, and viewed by some as further evidence of the perceived insensitivity of the dominant culture towards traditional lifeways. The scarcity of water in a desert environment, coupled with this concern, generated public interest in investigating alternatives to the current method of transporting coal from the Black Mesa mining operation to the Mohave Generating Station. Operation of the coal-slurry pipeline is viewed by some as an unnecessary use of water resources and as having potential repercussions for other water users and future generations. This concern was raised by some local community members who claim—by tradition and belief—attachment to the land and the ecosystem and feel the need to exercise vigilance regarding local water resources that have supported Hopi and Navajo communities for generations. Suggested alternatives regarding water use fell into two major categories: (1) discontinue use of the coal-slurry pipeline and use alternate methods, such as railway or trucks for coal transportation; and (2) use an alternative medium to water for coal slurry or a source of water other than the N aquifer. The C aquifer had been identified as a possible alternative water source. Some commenters raised similar questions about use of the C aquifer, including a concern about potential impacts on local wells drawing from the C aquifer. In a letter from the Hopi Tribe, preference was expressed to use C-aquifer water if this alternative source proved to be viable. As a solution to the impacts (undetermined at the time of scoping) on the area's groundwater sources, the use of energy sources other than coal at Mohave Generating Station also was suggested. Alternative energy was a solution encouraged by those who were concerned about the prospect of a changing environment.

Many believe that use of the C aquifer and/or the N aquifer would turn out to be unsustainable, and promoted use of alternative methods of coal delivery. In consideration that rail or truck transport may be found preferable, other issues were raised, such as potential impacts on property rights and public safety associated with overland truck and rail routes. Potential impacts on land uses were also a concern regarding both reconstruction of the coal-slurry pipeline and the water-supply pipeline route (from the C-aquifer well field to the Black Mesa Complex). Others voiced concern about the potential loss of the local community water supply currently provided by the N aquifer wells within Peabody's lease area, should use of N aquifer water be discontinued. Potential installation of a new C aquifer water-supply system raises the potential for use of that system to expand the current use of C-aquifer water to local tribal communities for municipal and industrial purposes. Some recommended upsizing the pipeline and installing lateral pipelines for that purpose.

1.5.2.2 Environmental Issues

The environment and the human community within that natural environment were of particular concern to the Hopi and Navajo communities, where traditional lifestyles, for many in the community, are closely linked to the natural world. The issue of water—especially the use of groundwater for the coal-slurry pipeline and the proposed coal-washing facility—dominated public discussion about the natural environment. Water-quantity concerns in part derive from decreasing water levels in wells in recent years and from the belief of some commenters that sinkholes are being caused by decreasing groundwater levels. Water-quality concerns derive from fears regarding potential pollution from mining. Commenters also expressed concerns about the competing user demands on the N and C aquifers and whether the aquifers can support domestic, agricultural, municipal, and industrial uses, as well as Black Mesa coal-mining and -delivery operations. Drought adds to these concerns. Several commenters were concerned about the design and implementation of hydrologic studies to be conducted on the C aquifer. Another concern was raised about the adequacy of previous assumptions and groundwater modeling of the area, especially with the prospect of long-term drought. Surface water was also a concern. Some believe that the flow in the Moenkopi Wash has fallen from historically higher levels, and some suggest the impoundments created by Peabody to control sediment were the cause. Additional hydrologic study on impoundment effects was recommended. Potential interference in all water sources was a concern regarding impacts on local endangered species and riparian habitats.

Comments reflected deep respect for water as a source of life and a corresponding apprehension that the project would cause profound, hidden damage to local water sources, and thus to local culture. Water is essential to the culture of the Hopi and Navajo people. Traditional occupations such as farming and livestock raising depend on water. Free-flowing springs play a prominent role in various religious practices by both tribes and support the habitat of certain native plants used for medicinal and ceremonial purposes. Commenters expressed concern that interference with a traditional way of life would not be well tolerated by some people in the local communities and would cause distress to those people. The perception of industrial facilities as “a blight” on the landscape and incompatible with the indigenous culture is a view shared by some community members. At the same time, however, others, including government entities, welcome the economic benefits the mine operations bring to the community and expressed concern about the prolonged or permanent loss of jobs and other basic benefits such as heating and potable water supply should the mining operations be interrupted or not resume. The skill involved in difficult and often dangerous mining jobs is also a source of pride for some and therefore a component of local culture. The prospect of the separation of family members as the potentially unemployed mine workers seek employment elsewhere is a worry for some, and the potential permanent closure of the mining operations is viewed as a danger to community cohesion. The effect of a loss of coal royalties on area schools and other educational programs is a related concern. Opinions are divided about traditional lifestyles versus acceptance of “mainstream” lifestyles and economic pursuits—the mining operations seem to be at the center of this debate.

A few residents living within the mine lease area who have chosen not to relocate or are living close to the Black Mesa mining operation say they have poor health as a result of asthma and black lung disease, and consider it to be the result of air pollution from coal mining. Some urged that health care studies be a part of the EIS, and others promoted the use of alternative energy sources that would have less potential of affecting health. Concern about air quality extends to the project’s potential effects on global warming. Skepticism about the cost/benefit ratio of the Black Mesa Project for the local community grew out of a perception of past injustices. Health issues, issues of environmental justice, and issues of violated trust are concerns of some members of the community who expressed wariness about information offered in this EIS. There is a corresponding call to keep elders in the discussion and to make every effort to address issues important to local Hopi and Navajo communities adequately.

1.5.2.3 Process Concerns

The issue of fairness was frequently at the center of process concerns. Many felt that, to accomplish equitable decisions about the proposed project, the local community should be more involved in the decision-making process. Suggestions included the extension of the scoping period (which was subsequently extended to March 4, 2005), a repeat of a scoping meeting at the Forest Lake Chapter that had limited attendance due to bad weather (which was done), larger meeting facilities for the Flagstaff meetings, broader notification of meetings, expansion of both the quality and quantity of available information, and translations of project materials and reports into the Hopi and Navajo languages. Effective collaboration and communication among stakeholders was also a theme—the desire to find common ground among stakeholders with different objectives.

Navajo members of the Leupp Chapter expressed frustration that the Chapter’s resolution against use of the C aquifer had not been accepted by the Navajo Nation Tribal Council. This frustration, for some, extends to other positions taken by its tribal council. A number of residents of the Black Mesa area object to the practice of depositing the coal royalty and lease payments into the tribal general fund without due consideration of the disproportionate impact burden they bear as direct neighbors of the mine. They feel they should receive more compensation.

Table 1-1 Issues Raised by the Public and by Government Agencies During Scoping

Issues	Section(s) of the EIS Where Addressed[1]
Actions and Alternatives	
Consider use of trucks to transport coal from the Black Mesa Complex to the Mohave Generating Station.	2.4.4.1, Appendix D
Consider use of rail to transport coal from the Black Mesa Complex to the Mohave Generating Station.	2.4.4.2, Appendix E
Consider use of the Coconino aquifer (C aquifer) instead of the Navajo aquifer (N aquifer) for water supply.	2.2.1.2.3
Consider a medium other than water as a coal-slurry medium.	2.4.4.3
Consider an alternative coal-slurry pipeline alignment to the south of Kingman, instead of building in the existing right-of-way.	2.2.1.2.2.1.2, 3.0, 4.0
Consider a C aquifer water-supply pipeline alignment that traverses only Navajo lands.	2.2.1.2.3.1.2, 3.0, 4.0
Consider a C aquifer water-supply pipeline alignment that avoids the developed Kykotsmovi area.	2.2.1.2.3.1.2, 3.0, 4.0
Use alternative fuel sources, such as solar energy, instead of continuing operation of Mohave Generating Station.	2.4.6
Conduct comprehensive hydrologic studies of aquifers relative to the proposed use.	3.4, 4.4, 4.4.1.3, Appendix H
Water Resources	
Impacts of groundwater withdrawals on springs, in the context of biological resources.	4.7.1.3
Impacts of groundwater withdrawals on springs, as related to ceremonial, sacred, and religious resources.	3.10, 4.10, 4.10.1.3
Impacts of groundwater withdrawals on land subsidence and sinkhole creation.	4.4.1.3, Appendix H
Impacts of groundwater withdrawals on wells.	4.4.1.1.2, 4.4.1.3, 4.4.1.4
Impacts of groundwater withdrawals on availability of water for agriculture and grazing.	4.4.1.1.2, 4.4.1.3
Impacts of C-aquifer groundwater withdrawals on water supplies for future northern Arizona municipal and industrial use.	4.4.1.3
Impacts of surface-water impoundments on availability of water for agriculture and grazing.	4.4.1.1.1
Impacts of surface-water impoundments on downstream flows.	4.4.1.1.1
Impacts of the project on water rights.	4.4
Impacts on water quality, as it relates to human consumption of groundwater supplies.	4.4
Impacts of surface-water impoundments on water quality.	4.4.1.1.1
Cumulative impacts of the project on groundwater and surface-water supplies, including the effects of the current drought.	4.24
Biological Resources	
Impacts on threatened and endangered species.	3.7, 3.8, 4.7, 4.8
Impacts on native plants used for ceremonial reasons.	3.7.1.4, 3.7.2.1.5, 4.7, 4.8
Impacts of the project, and of reclamation plans, on livestock grazing.	3.9, 4.9
Air Quality	
Impacts of mining on air quality.	3.6, 4.6
Impacts of Mohave Generating Station on air quality.	4.23
Impacts of Mohave Generating Station on global climate change (cumulative air-quality effects).	4.23.3, 4.24.1.1
Land Use	
Impacts of mining on local land uses.	3.9.1, 4.9
Impacts of existing coal-slurry pipeline alignment on land development opportunities in the Kingman area.	3.9.2, 4.9.1.2
Impacts of C-aquifer water pipeline on land uses along the alignment.	2.2.1.2.3.1.2, 3.9.3.2, 4.9.1.3.2
Impacts of mined land reclamation on future land uses.	3.9.1, 4.9.1
Aesthetics	
Impacts of mining on the visual (and spiritual) landscape.	3.15, 4.15
Public Health and Safety	
Impacts of mining on health of local residents.	3.11,4.6.6
Impacts of operations on mine worker health and safety.	3.11.2.7, 4.6.6, 4.11.1.1
Impacts of mining on soil selenium levels.	3.3.1

Table 1-1 Issues Raised by the Public and by Government Agencies During Scoping

Issues	Section(s) of the EIS Where Addressed[1]
Social and Economic Conditions	
Impacts of continuing or discontinuing mining on tribal income.	3.11, 3.12, 4.11, 4.12
Impacts of continuing or discontinuing mining, pipeline, and power plant operations on jobs and employment.	3.11, 3.12, 4.11, 4.12
Impacts of discontinuing mining on local benefits and support provided by Peabody Western Coal Company (Peabody).	3.11, 3.12, 4.11, 4.12
Impacts of discontinuing mining on tribal scholarships and educational programs currently supported by Peabody and mining income.	3.11, 3.12, 4.11
Impacts of relocations of local residents to accommodate mining operations in expanded mine area.	3.9.1, 4.9.1.1, 4.9.2, 4.9.3 , 4.11.1.1, 4.11.2.1, 4.11.3, 4.12.1.1, 4.12.2, 4.12.3
Environmental Justice	
Impacts of the project on American Indian lands and people.	3.11, 3.12, 4.11, 4.12
Concern about proper and fair compensation for resources used.	3.11, 4.11
Concern about fairness of using tribal resources for convenience of nontribal communities.	3.11, 3.12, 3.13, 4.11, 4.12, 4.13
Community Values and Traditional Knowledge, Cultural Resources	
Impacts of the project on natural resources (Mother Earth).	4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.10
Concern about the inherent value of water to human existence.	3.4, 4.4
Impacts on religious, sacred, and ceremonial resources such as water and native plants.	1.5.2.2, 3.10, 3.10.4, 4.10
Impacts on the American Indian traditional way of life, including agriculture (Hopi) and grazing (Navajo).	3.9, 3.10, 4.9, 4.10
Impacts on the availability of jobs, which provide dignity, a future for one's children, and a means of remaining near one's family.	3.11, 3.12, 4.11, 4.12
Impacts on archaeological and historical resources.	3.10, 4.10
Impacts on traditional cultural properties.	3.10, 4.10
EIS Process Concerns	
Should hold meetings in many locations.	1.4, 5.4, 5.5
Should provide project-related materials in American Indian languages.	5.4,5.5
Should undertake and continue government-to-government relations with tribes.	5.0
Should make sure that the effort is collaborative, bringing everyone together for discussions and decisions.	5.0
Should consult with tribal elders in conducting data collection and impact assessments.	5.0

NOTES: [1] Sections that provide background information that assist in understanding the issues, concerns, and/or impacts are listed.
EIS = environmental impact statement

ALTERNATIVES

2.0 ALTERNATIVES

This chapter presents the alternatives to the proposed project that are considered in this EIS, the process by which these alternatives were developed, and the alternatives that were considered initially but have been eliminated from detailed study in this EIS. Section 2.1 provides a description of the Black Mesa Project as proposed by Peabody. Section 2.2 provides a description of the alternatives that are being considered and evaluated in this EIS. Section 2.3 provides a summary of potential decisions or actions that are required by various Federal agencies before the proposed project can be implemented. Section 2.4 provides a description of the alternatives that were considered initially but eliminated from detailed study in this EIS.

2.1 PROPOSED BLACK MESA PROJECT

Peabody proposes to revise the LOM operation and reclamation plans for its Kayenta mining operation and to incorporate plans for the initial Indian Lands Program area of its adjacent Black Mesa mining operation (surface facilities and coal resource areas within existing coal leases). This EIS refers to the area collectively occupied by the Kayenta mining operation and the Black Mesa mining operation as the Black Mesa Complex.

The Kayenta mining operation is authorized under a permanent Indian Lands Program permit originally issued by OSM in 1990 (OSM Permanent Program Permit AZ-0001D). The Permanent Program Permit AZ-0001D is an LOM permit renewable at five-year intervals and has been renewed on three occasions: 1995, 2000, and 2005. The current Kayenta permit area is 44,073 acres (Map 2-1). The Kayenta mining operation produces about 8.5 million tons of coal per year, all of which are delivered to the Navajo Generating Station.

Until December 2005, the Black Mesa mining operation was conducted in accordance with OSM's Initial Program[1] under an administrative delay of OSM's permanent Indian Lands Program permitting decision instituted in 1990 by the Secretary of the Interior (refer to Chapter 1 footnote 3). If OSM approves the LOM revision for the Black Mesa Complex, the 18,857-acre initial program area for the Black Mesa mining operation, including surface facilities and coal reserves, would be added to the 44,073 acres in the existing OSM permanent permit area, bringing the total acres of the permanent permit area to 62,930. If approved, the permanent permit area would not distinguish between the Kayenta mining operation and Black Mesa mining operation; they would be considered one operation for the purpose of regulation by OSM. The current rate of coal production, 8.5 million tons per year, would not change. The LOM permit would continue to be renewable at five-year intervals. Approval of the LOM revision application would not authorize mining of unmined reserves in the Black Mesa mining operations area; however, those areas could be mined in the future upon submission of a new LOM revision application.

The LOM revision would not change currently-approved mining and reclamation plans for the Kayenta mining operation. From 1970 until December 2005, the Black Mesa and Kayenta mining operations used N-aquifer water at a rate of about 4,400 acre-feet per year for mine-related and domestic uses and coal

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[1] SMCRA provides for a two-phase program to regulate surface coal mining operations on Indian lands: an initial regulatory program and a permanent regulatory program. The permanent regulatory program contains a more comprehensive set of performance and reclamation standards than the initial regulatory program. Both the Black Mesa and Kayenta mining operations at first operated under the initial regulatory program. The Kayenta mining operation operated under the initial program until it was permitted under the permanent program in 1990. The Black Mesa mining operation continues to operate under the initial regulatory program owing to the administrative delay of OSM's permanent program permitting decision. Incorporating the Black Mesa mining operation into the permanent program permit area would extend the more comprehensive standards of the permanent program to this operation.

slurry use during the operation of the Mohave Generating Station. Starting in 2006 after the Mohave Generating Station suspended operations, the Black Mesa Complex has used about 1,200 af/yr of N-aquifer water for domestic and mine-related purposes. The Complex would continue to withdraw N-aquifer water, on average 1,236 af/yr, through mid-2026. The LOM revision would not change the existing mining methods or the average annual production rate of the Kayenta mining operation. Mine plan areas are shown on Map 2-2. Table 2-1 is a list of coal resource areas and their status as it pertains to mining and reclamation. Coal-mining techniques and mine reclamation are described in Appendix A-1.

Table 2-1 Coal Resource Areas and Mining Status[1]

Coal Resource Area	Total Acres[2]	Mining and Reclamation Status
N-01	350	Mined and reclaimed[3]
N-02	650	Mined and reclaimed[3]
N-06	2,890	Active mining and reclamation in 780 acres, 2,060 acres reclaimed, 50 acres proposed to be mined and reclaimed in the future[3]
N-7/8	940	Mined and reclaimed[3]
N-09	2,170	Active mining and reclamation on 375 acres, no acres reclaimed, 1,795 acres to be mined and reclaimed in the future[4]
N-10	1,790	Active mining and reclamation in temporary cessation; 55 acres disturbed, 130 acres reclaimed, 1,605 acres to be mined and reclaimed in the future[4]
N-11	800	Mined and being reclaimed, 295 acres reclaimed, 505 acres in reclamation, no additional areas to be mined in the future[3]
N-14	1,650	Mined and reclaimed[5]
N-99	3,880	Undisturbed, to be mined and reclaimed in the future[6]
J-01	480	Mined and reclaimed
J-02	900	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-03	100	Mined and reclaimed
J-04	520	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-06	1,220	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-07	1,040	Mined and reclaimed
J-08	730	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-09	470	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-10	430	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-14	950	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-15	730	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-16	1,350	Mined and reclaimed
J-19	3,910	Active mining and reclamation in 2,080 acres, 1,060 acres reclaimed, 770 acres to be mined and reclaimed in the future[4]
J-21	5,280	Active mining and reclamation in 980 acres, 2,630 acres reclaimed, 1,670 acres to be mined and reclaimed in the future[4]
J-23	2,500	Undisturbed, proposed to be mined and reclaimed in the future[6]
J-27	70	Mined and reclaimed
J-28	1,440	Undisturbed, proposed to be mined and reclaimed in the future

SOURCE: Peabody Western Coal Company 2008

NOTES: [1] In addition to the coal resource areas, about 3,270 acres are disturbed by actively used long-term support facilities including haul roads, other primary roads, coal-handling areas, conveyors, railroad-loading facilities, storage areas, shops, offices, and other structures and facilities.

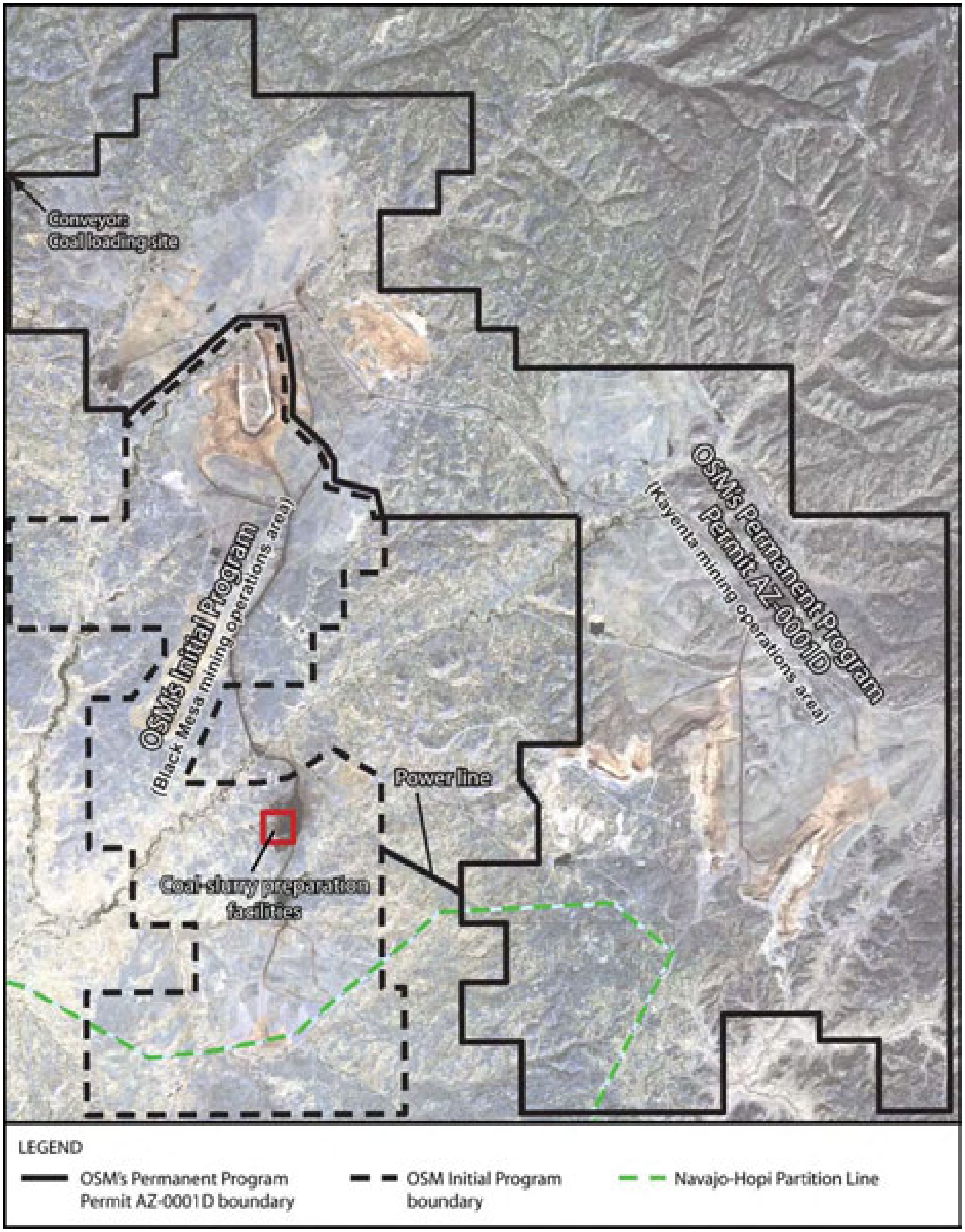
[2] Approximate acres subject to Office of Surface Mining (OSM) regulation—areas mined before the effective date of the Surface Mining Control and Reclamation Act (December 13, 1977), totaling approximately 2,760 acres, are not included.

[3] OSM has terminated its jurisdiction over this area under the initial program.

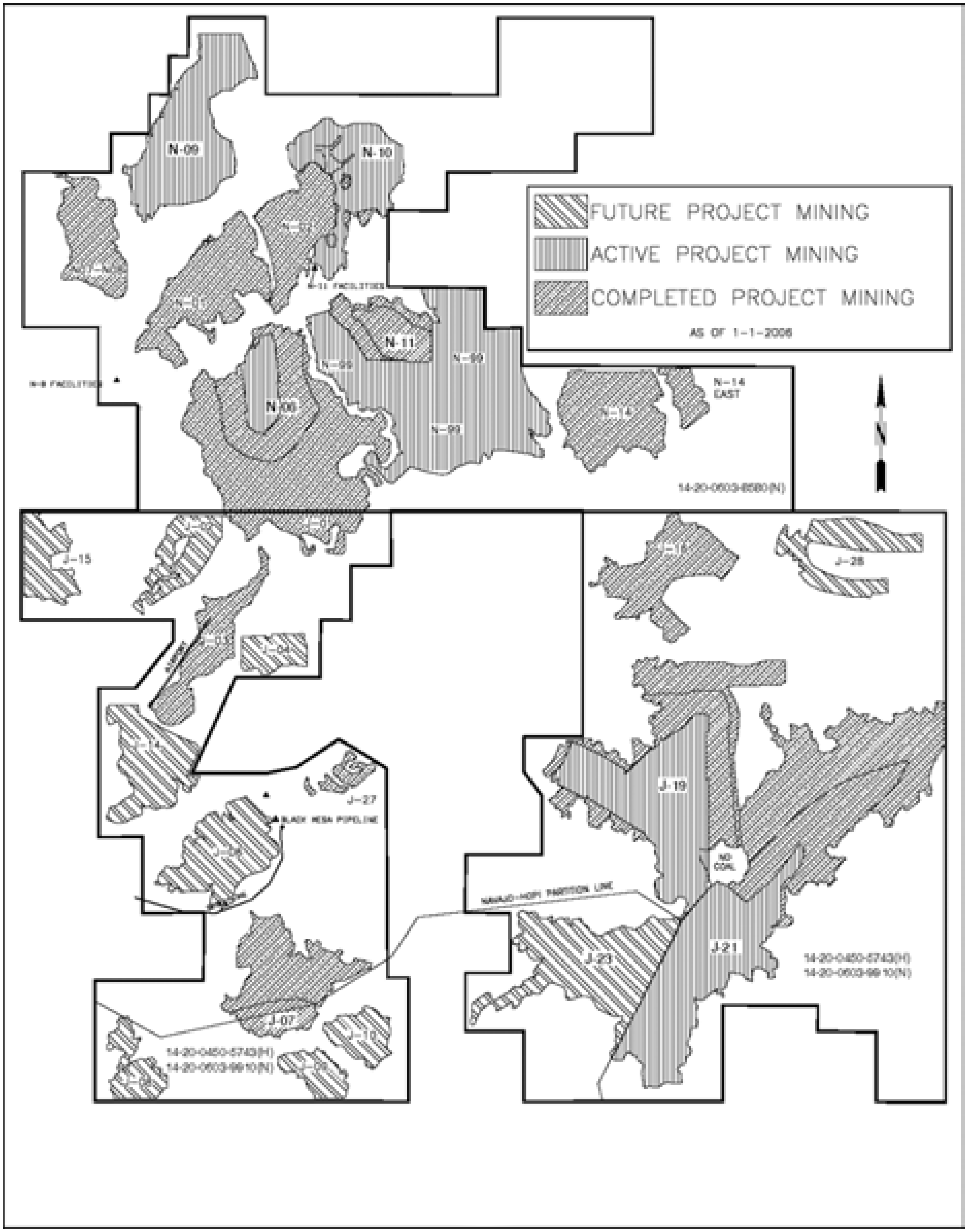
[4] Approximate acres as of January 1, 2008.

[5] Phase I bond release approved by OSM.

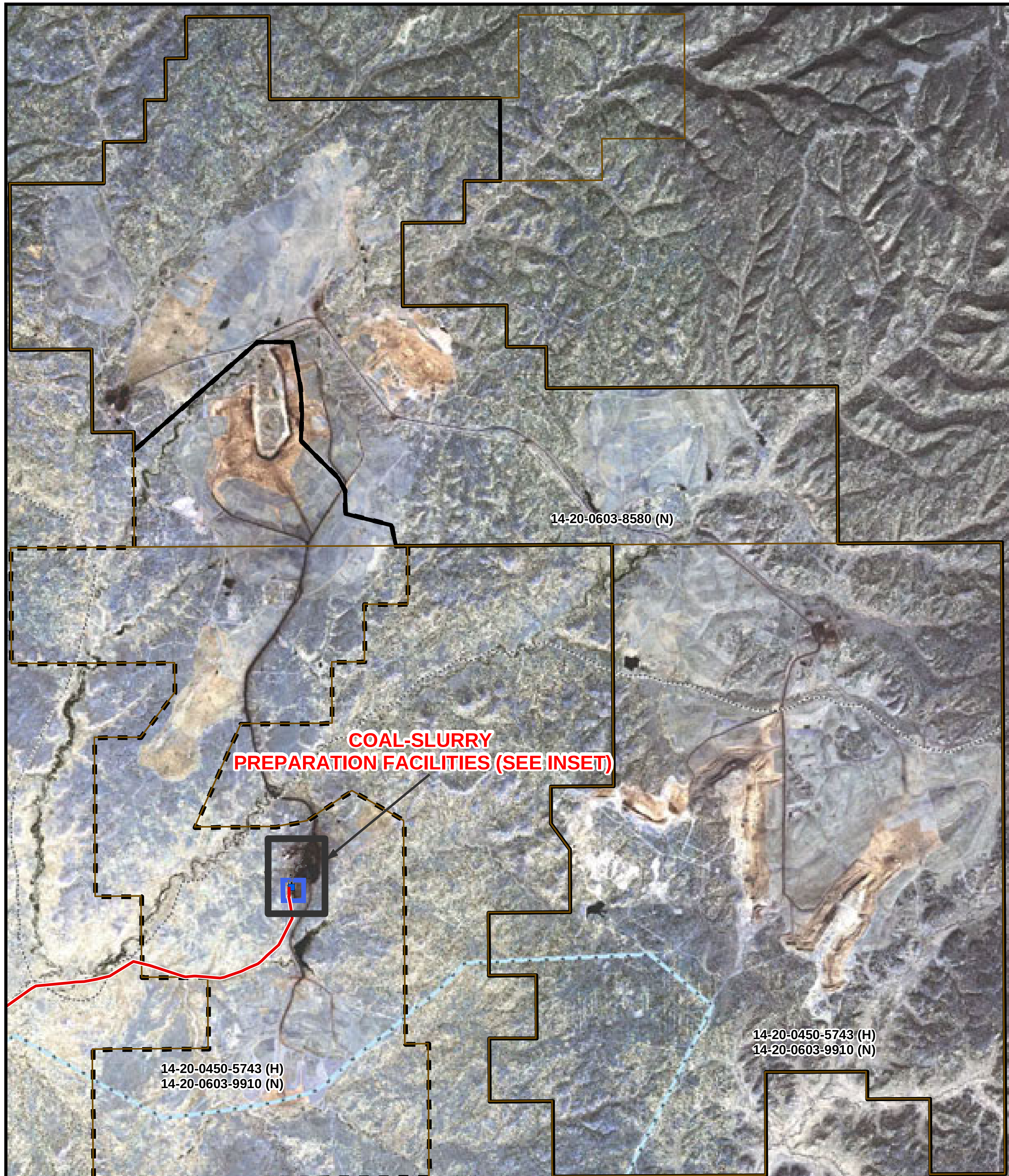
[6] Mining in this coal-resource area would not be authorized if the life-of-mine revision is approved.

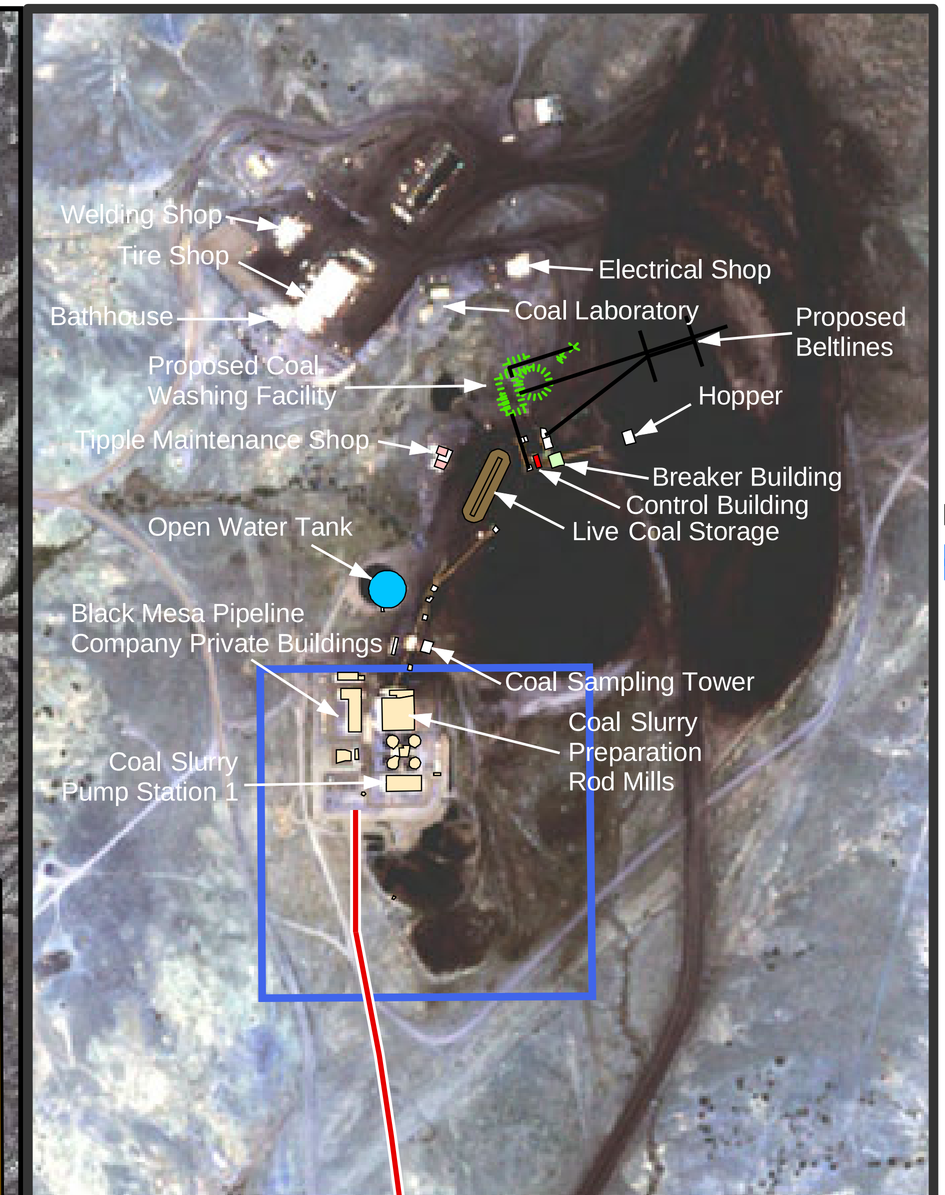


Map 2-1 Black Mesa Complex: OSM's Initial and Permanent Programs



Map 2-2 Mine Plan Areas





COAL-SLURRY
PREPARATION FACILITIES

Map 2-3

Black Mesa Mine Complex and Facilities

Black Mesa Project EIS

LEGEND

- 14-20 Peabody Lease Area and Number
- Kayenta Mining Operation Area (permanent permit)
- Black Mesa Mining Operation Area (currently unpermited)
- Black Mesa Pipeline, Inc. Lease Area

Coal-Slurry Pipeline

- Existing Route

General Features

- Hopi Reservation Boundary
- Navajo Reservation, Chapter Boundary

SOURCES:
URS Corporation 2005, 2006
Peabody Energy 2006
DigitalGlobe Incorporated 2003

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November 2008

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Miles

Prepared By:
URS

2.2 ALTERNATIVES

Based on the description of the project proposed in December 2004 by Peabody, the co-owners of the Mohave Generating Station, BMPI, and the tribes, and the issues derived from public comments received during the scoping process in early 2005, a list of alternatives to the applicants' proposals was developed. All the alternatives were screened to determine whether they would meet the purpose of and need for the Black Mesa Project and were reasonable and feasible. Factors considered in evaluating whether alternatives were technically or economically feasible or practical, and whether they would meet the purpose and need for any of the actions of the Black Mesa Project included legal issues; environmental issues; design and/or engineering issues; economics of the tribes and others: and capital cost, operating cost, and funding.

Those alternatives that satisfy the criteria and achieve the purpose of and need for the Black Mesa Project have been studied and analyzed and are described in Sections 2.2.1, 2.2.2, and 2.2.3. Other alternatives that did not satisfy the criteria and/or did not achieve the purpose of and need for the Black Mesa Project were eliminated from detailed study. These are described in Section 2.4.

The three alternatives addressed in this EIS are as follows:

- Alternative A – approval of the LOM revision and all components associated with coal supply to the Mohave Generating Station
- Alternative B (preferred alternative) – approval of the LOM revision
- Alternative C – disapproval of the LOM revision

Figure 2-1 provides illustrations and summaries of the alternatives. Each of these action alternatives is described in more detail below.

2.2.1 Alternative A – Approval of the 2004 LOM Revision and All Components Associated with Coal Supply to the Mohave Generating Station

If Alternative A were selected, Peabody's February 2004 application for the LOM permit revision and mine plan changes would be approved as would all the components associated with supplying coal to the Mohave Generating Station. Alternative A was identified as the agencies' preferred alternative in the Draft EIS.

Although the components associated with supplying coal to the Mohave Generating Station are no longer proposed, they still could occur. Mohave Generating Station remains permitted for operation, although operation was suspended in December 2005; it has not been decommissioned. Although implementing Alternative A appears unlikely, Alternative A is still viable and this EIS continues to analyze its effects.

2.2.1.1 LOM Revision and Mine Plan Changes

Under Alternative A, Peabody's February 2004 application for the LOM permit revision would be approved and a Federal permit would be issued to continue surface-coal-mining and reclamation operations at the Black Mesa Complex. OSM's existing permanent Indian Lands Program permit area (the 44,073 acres within the current permit area for the Kayenta mining operation) would be expanded to incorporate the initial Indian Lands Program parts of the existing lease area (the 18,984 acres associated with the Black Mesa mining operation; refer to Figure 2-1) and existing and proposed rights-of-way (including 127 acres for a new coal-haul road described below). The Black Mesa Complex would continue operations through 2026.

Peabody would obtain a separate and additional off-lease right-of-way from the Hopi Tribe to construct a new coal-haul road, between the southern portions of Peabody's Joint Lease Area, as a support facility for continued Kayenta and Black Mesa mining operations. The road would be 500 feet wide and approximately 1.6 miles long; approximately 127 acres would be required.

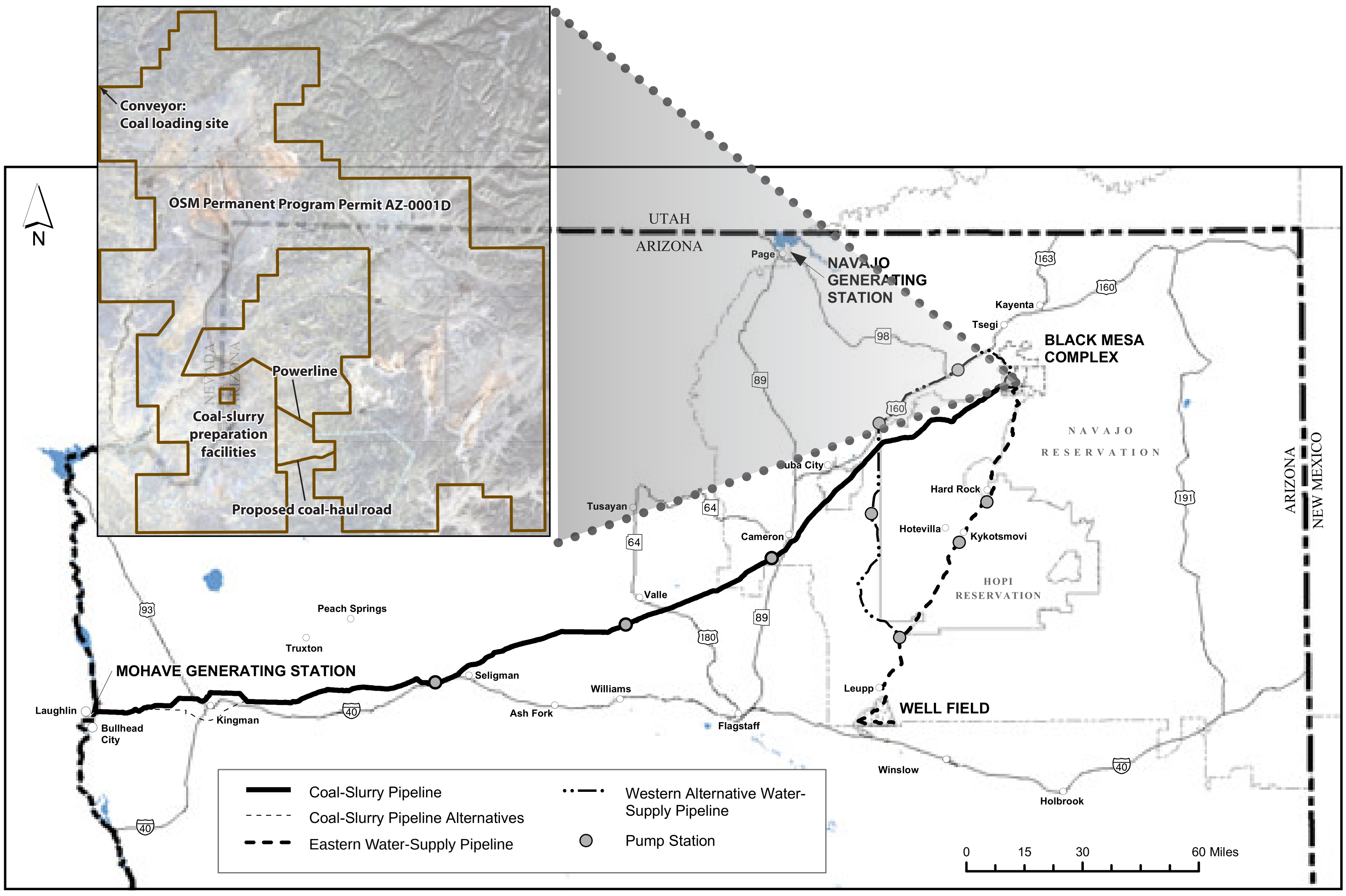
Until its suspension in December 2005, the Black Mesa mining operation produced about 4.8 million tons of coal annually, all of which were delivered to the Mohave Generating Station. Approval of the 2004 LOM permit revision would allow the Black Mesa mining operation to continue to supply coal to the Mohave Generating Station through 2026 under a permanent Indian Lands Program permit. The LOM revision did not propose to change the Black Mesa mining methods, but would increase the average annual production rate of the Black Mesa mining operation from 4.8 million tons to about 6.35 million tons if the Mohave Generating Station continued operations.

Under Alternative A, a new coal-washing facility (refer to Map 2-3) would be constructed adjacent to the existing Black Mesa coal-preparation facilities to meet the anticipated future coal-quality requirements of the Mohave Generating Station. The purpose of the coal-washing facility would be to remove out-of-seam rock and mineral impurities, commonly referred to as refuse, from the coal, which results in less ash production when the coal is burned. The coal-washing facility would use about 500 af/yr of C-aquifer water and would remove about 0.95 million tons per year of coal-processing refuse (earth material), resulting in about 5.4 million tons per year of washed coal being crushed and mixed with water at the coal-slurry preparation plant and transported to the Mohave Generating Station through the coal-slurry pipeline. The estimated 0.95 million tons per year of coal-processing refuse would be returned by end-dump trucks to designated mine pits (N-06 and J-23) for disposal. Peabody would develop (and would be required to submit for regulatory approval) a refuse sampling and disposal plan that would be incorporated in the mining permit. No refuse piles or coal-mine-waste impoundments are proposed. The coal-washing process, preparation process and facilities, potential fugitive dust emissions, and refuse disposal are described in Appendix A-1.

Peabody's February 2004 application for the LOM revision proposed actions to minimize the use of N-aquifer water, the use of which resulted in the administrative delay in issuing a permanent Indian lands program permit for the Black Mesa mining operation and the Black Mesa coal-slurry preparation plant. Under Alternative A, water for the coal-slurry pipeline would be supplied by the C aquifer About 672 af/yr of water from the C aquifer water-supply system would be used to replace much of the N-aquifer water used by the Black Mesa (nonslurry) mining operation, and 500 af/yr of C-aquifer water also would be used for washing coal. The proposed C aquifer water-supply system is described in more detail in Section 2.2.1.2.3.1. Up to 500 af/yr of water from the N aquifer would continue to be pumped to maintain operation of the N-aquifer wells. This water also would be used in mining operations, principally dust suppression as required by Federal regulations, and to provide water to local residents.

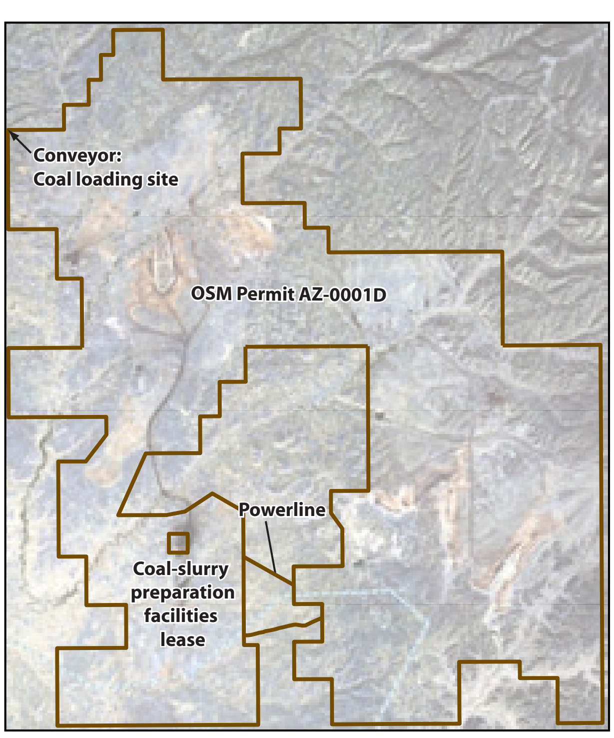
2.2.1.2 Components Associated with Coal Supply to the Mohave Generating Station

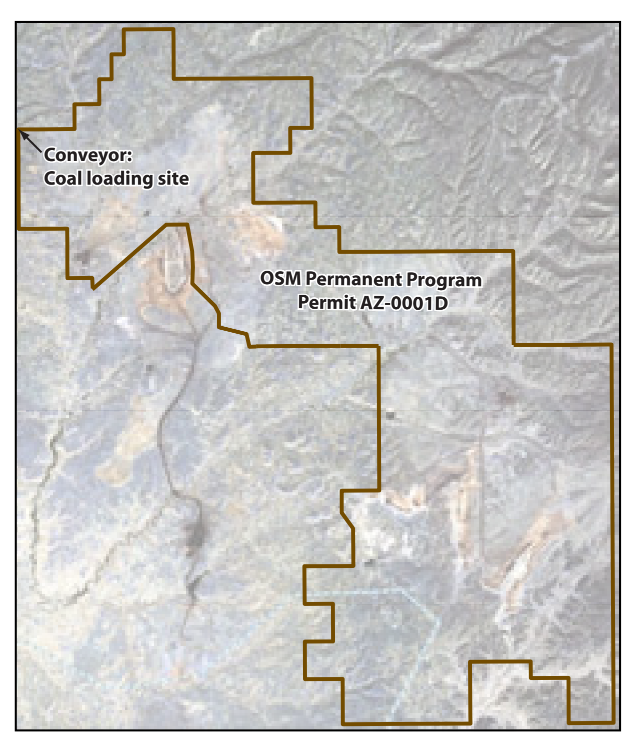
In addition to approval of the 2004 LOM permit application, the components associated with supplying coal to the Mohave Generating Station would be approved; that is, the coal-slurry preparation plant permit, reconstruction of the coal-slurry pipeline, and construction of a new water-supply system. Alternatives (or subalternatives) for each of these are described in the following sections and illustrated in Figure 2-2.



Alternative A – Approval of the Life-of-Mine Revision and All Components Associated with Coal Supply to Mohave Generating Station:

- Approval of Peabody's life-of-mine permit revision for the Black Mesa Mine Complex (Black Mesa and Kayenta mining operations), including mining of coal to supply the Mohave Generating Station, a new coal-wash plant and associated coal-waste disposal; and construction, use, and maintenance of a new haul road between mine areas on the southern ends of Peabody's coal leases;
- Approval of BMPI's existing coal-slurry preparation plant and rebuilding the 273-mile-long coal-slurry pipeline to the Mohave Generating Station; and
- Approval of a new aquifer water-supply system, including a 108-mile-long pipeline to convey the water to the mine complex.





Alternative B – Approval of the LOM Revision (Preferred Alternative):

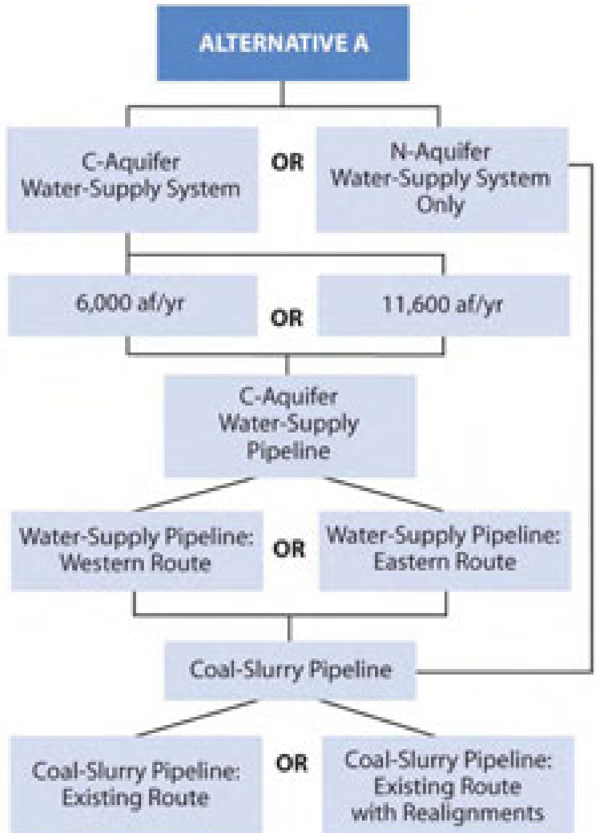
- Approval of Peabody's life-of-mine permit revision, including incorporation of the Black Mesa mining operation surface facilities and coal deposits into the Kayenta mining operation permit area;
- No coal mining at the Black Mesa mining operation to supply the Mohave Generating Station;
- No construction, use, and maintenance of a new haul road between mine areas on the southern ends of Peabody's coal leases;
- No proposed reconstruction of the coal-slurry pipeline; and
- No proposed construction of the C aquifer water-supply system.

Alternative C – Disapproval of the LOM Revision (No Action):

- Disapproval of Peabody's life-of-mine permit revision.
  - No proposed coal mining at the Black Mesa mining operation to supply the Mohave Generating Station but continued coal mining at the Kayenta mining operation to supply coal to the Navajo Generating Station, because Peabody already has an approved permit for this mine and has the right of successive permit renewals;
  - No incorporation of Black Mesa mining operation surface facilities and coal deposits into the Kayenta mining operation permit area;
- No proposed reconstruction of the coal-slurry pipeline; and
- No proposed construction of the C aquifer water-supply system.

Figure 2-1
Alternatives Evaluated

Figure 2-2 Alternative A Subalternatives



2.2.1.2.1 Coal-Slurry Preparation-Plant Permit

Until December 2005, the coal from the Black Mesa mining operation was prepared (i.e., crushed and mixed with water) at the coal-slurry preparation plant for transportation through the coal-slurry pipeline to the Mohave Generating Station (refer to Map 2-3). The slurry was a mix of 50 percent coal fines and 50 percent water. Under Alternative A, approximately 3,700 af/yr of C-aquifer water would be used to transport about 5.4 million tons of coal to the Mohave Generating Station. BMPI, owner and operator of the coal-slurry preparation plant and coal-slurry pipeline, leases a 40-acre parcel of land within the initial Indian Lands Program area from both the Hopi Tribe and Navajo Nation (two leases) upon which the coal-slurry preparation plant was constructed in 1969. The land is located in Section 15, Township 32 North, Range 18 East and is about 6,470 feet in elevation (U.S. Geological Survey [USGS] 7.5-minute quadrangle, Great Springs, Arizona 1972, photorevised 1982). The preparation plant and associated facilities are located at the coal-slurry pipeline portal, directly southwest of Peabody's Black Mesa coal stockpiles and coal-handling facilities. BMPI's facilities consist of several small buildings and shops, a power substation, a sewage-treatment plant, and the main coal-slurry facilities and pumps. Directly south of the aboveground structures are several constructed ponds and catchments for waste water.

BMPI submitted a permanent Indian Lands Program permit application (preparation-plant permit application) to OSM in 1988 for operation of the plant. Like the Black Mesa mining operation, OSM's decision on the preparation-plant permit application was delayed due to issues associated with the use of N-aquifer water. On January 3, 2005, BMPI submitted a revised permit application to OSM, which was determined to be administratively complete. Only minor modifications, if any, to the current configuration of the coal-slurry preparation plant would be needed to handle the increase from 4.8 to 5.4 million tons of coal per year.

2.2.1.2.2 Reconstruction of the Coal-Slurry Pipeline

Coal from the Black Mesa mining operation was transported by BMPI via a coal-slurry pipeline from the Black Mesa Complex to the Mohave Generating Station, a distance of approximately 273 miles (refer to Map 1-1). The pipeline passes through five Arizona counties—Navajo (approximately 25 miles), Coconino (approximately 145 miles), Yavapai (approximately 26 miles), and Mohave (approximately 76 miles)—crosses under the Colorado River, and terminates at the Mohave Generating Station in Clark County, Nevada (approximately 1.5 miles). The pipeline crosses the Hopi and Navajo Reservations, as well as Federal, State, local government, and private lands (Table 2-2).

Table 2-2 Approximate Miles Crossed by the Existing Coal-Slurry Pipeline, by Surface Manager or Owner

Surface Management or Ownership	Miles
Hopi	35
Navajo	61
Bureau of Land Management	14
U.S. Forest Service – Kaibab National Forest	5
Arizona State Trust	66
Private (including county and municipal lands)	92

SOURCES: Arizona Land Resource Information System 2002; Black Mesa Pipeline, Inc. 2005

The coal-slurry pipeline is buried. The pipeline, constructed in the late 1960s and operated since the early 1970s, has reached its 35-year design life. Pipeline reconstruction would involve burying a new pipeline adjacent to the existing pipeline. A temporary right-of-way width of about 15 feet would be needed, in addition to the existing 50-foot-wide permanent right-of-way, for construction activities. Appendix A-2 provides a description of typical construction techniques and reclamation.

The reconstructed pipeline would pass under the Little Colorado River east of Cameron, Arizona, and under the Colorado River at Laughlin, Nevada. At the crossing of the Little Colorado River the existing pipeline is underground. During the reconstruction, the Little Colorado River would be crossed by directionally drilling under the river. It is anticipated that the Colorado River would be crossed by horizontally boring under the river. All other water bodies, where crossed, are dry during much of the year and would be crossed using conventional open-trench cutting during the dry season. The pipe would be buried deep enough in the water channels and banks to avoid potential future scouring and/or erosion.

The current alignment crosses the City of Kingman in areas that were undeveloped when the pipeline was constructed originally. Because these areas now contain major residential and commercial developments, this segment would be abandoned and a new segment would be constructed around the city.

Existing booster-pump stations (one at the coal-slurry preparation plant and three along the coal-slurry pipeline (CSP) at Mileposts 81.5, 123.5, and 176.5) would require only minor modification, if any. Each station is on 10 to 20 acres of land; the principal structures at each site include a main pump building of steel-sided construction, residential trailers for employees, an aboveground earthen water-storage reservoir, a slurry settling and retention pond, pipeline fixtures including valves and piping, and an electrical substation. Reconstruction work at the pump stations would include equipment modifications, building modifications, and replacement of above- and belowground pipe and conduits. The layout of the facilities would not change and no acreage would be added.

2.2.1.2.2.1 Coal-Slurry-Pipeline Route Subalternatives

For the coal-slurry pipeline, two alternative routes are addressed: (1) the existing route and (2) the existing route with realignments along the Moenkopi Wash and around the Kingman area. Estimated costs for construction, operation, and maintenance of the coal-slurry pipeline are shown in Appendix B.

2.2.1.2.2.1.1 <u>Coal-Slurry Pipeline: Existing Route</u>

The 273-mile-long coal-slurry pipeline would be reconstructed by burying a new pipeline adjacent and parallel to (about 5 feet from) the centerline of the existing pipeline in the existing right-of-way. In a very limited number of narrow areas (e.g., rugged terrain, rocky areas) that could not accommodate the two parallel pipelines, the segment of existing pipeline would be removed and replaced with the new segment. The locations of these segments of pipeline would be identified during final engineering and design. A permanent access road exists along the majority of the pipeline route within the right-of-way. The existing pipeline would be abandoned and, for the most part, left in place underground.

2.2.1.2.2.1.2 <u>Coal-Slurry Pipeline: Existing Route with Realignments</u>

The alternative to the above is to reconstruct the coal-slurry pipeline along most of the existing route. Two realignments are being considered—a realignment along Moenkopi Wash and a Kingman area reroute.

Along the Moenkopi Wash, segments of the pipeline would be realigned between CSP Mileposts 2 and 22. The existing alignment is beneath and parallel to the Moenkopi Wash in proximity to the active channel in the wash. BMPI would realign the pipeline where needed, up to 200 feet on either side of the existing pipeline. The pipeline still would be located within the outer boundaries of the wash, but out of the active water-flow channel (Map 2-4a). The specific segments of pipeline that would be realigned have not yet been identified. However, along the 20 miles identified on Map 2-4a, it is anticipated that the segments to be realigned would cumulatively add to approximately 1 mile.

The Kingman area reroute would be south of Kingman, Arizona. The existing pipeline route crosses through Kingman in areas that were undeveloped when the pipeline originally was constructed. BMPI proposes to reroute the pipeline to the south of Kingman, from CSP Mileposts 228 to 255 (27 miles along the existing route and 28.5 miles of new Kingman reroute), to avoid construction in these areas that are now residential and commercial developments (refer to Map 1-1; Map 2-4b). The Kingman reroute would cross approximately 9 miles of land administered by the BLM, 3 miles of Arizona State Trust Land, and 16.5 miles of privately owned land.

2.2.1.2.3 Water Supply

Under Alternative A, water for the project would come primarily from the C aquifer with supplemental use of the N aquiferThe C aquifer water-supply system would provide up to 6,000 af/yr of water for coal-slurry transportation and mine-related use (see Section 2.2.1.2.3.1). The existing N aquifer water-supply system would continue to supply up to 500 af/yr of water for mine-related and domestic uses, and also would be a contingency standby source to be used in case of interruptions or curtailments of the C-aquifer water supply for an extended period of time (see Section 2.2.1.2.3.2.1).

Use of the existing N aquifer water-supply system as the sole water supply for the proposed project also is an alternative analyzed under Alternative A (i.e., the C aquifer water-supply system would not be constructed). Under this alternative, the existing N aquifer water-supply system would provide up to 6,000 af/yr of water for coal-slurry transportation and mine-related use (see Section 2.2.1.2.3.2.2).

2.2.1.2.3.1 C Aquifer Water-Supply System

Under Alternative A, water use for the Black Mesa Complex and coal slurry would total an average of 6,000 af/yr (Table 2-3). The water from the C aquifer would be supplied from a well field that would be located near Leupp, Arizona, and conveyed via pipeline to the Black Mesa Complex.

Table 2-3 Alternative A Water Use

Use	Acre-Feet per Year
Coal washing	500
Coal slurry	3,700
Mine-related and domestic purposes	1,600
Contingency	200
Total	6,000

The components of the C aquifer water-supply system are described below. Appendix A-3 provides a description of typical construction techniques for the well field, water-supply pipeline, and associated facilities.

- A well field in the southwestern part of the Navajo Reservation (located south of Leupp, Arizona) including 12 wells and associated facilities (e.g., well yards, collector pipelines, access roads, power lines)
- An approximately 108-mile-long main pipeline with a capacity of 6,000 af/yr from the well field north-northeast to the Black Mesa Complex following, to the extent practicable, existing roads
- An estimated two pump stations and associated facilities (e.g., access roads, electrical transmission lines)

Under Alternative A, the C aquifer water-supply system would replace the N-aquifer water supply as the primary water source for mine operations, although some use of N-aquifer water would continue (see Section 2.2.1.2.3.2). Additionally, the development of a water-supply system from the C aquifer provides an opportunity to enhance water availability to the Hopi Tribe and Navajo Nation for municipal, industrial, and commercial uses by expanding the system capacity. Ownership of the system had not been determined at the time the Draft EIS was published.

Two different water-withdrawal scenarios and two water-supply pipeline alternative routes are considered in this EIS (Section 2.2.1.2.3.1.1). Estimated costs for construction and operation and maintenance of the water-supply system are given in Appendix B.

2.2.1.2.3.1.1 Water Withdrawal and Supply

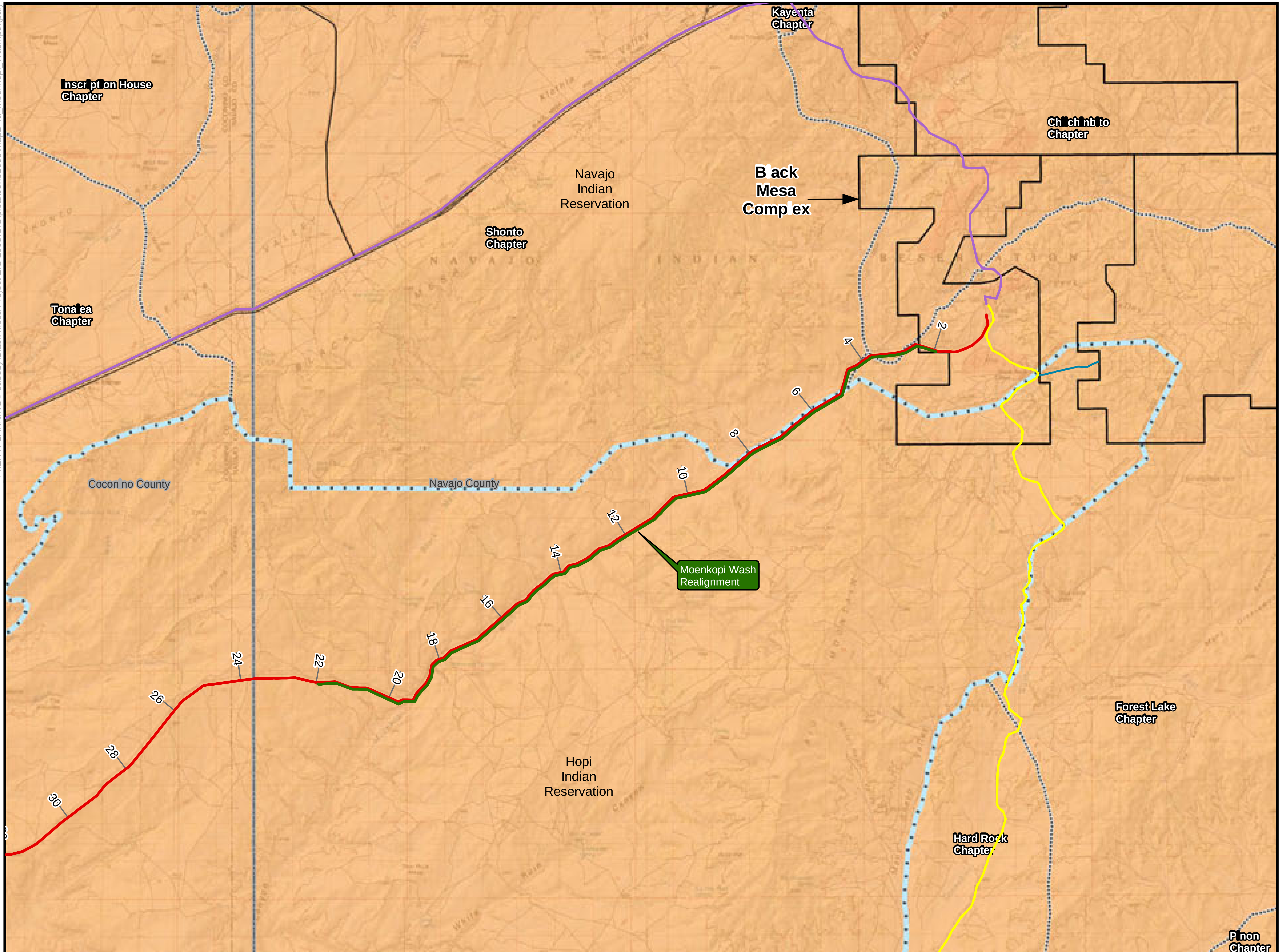
Two water-withdrawal scenarios and pipeline capacities were considered as described below.

C-Aquifer Water Withdrawal and Supply: 6,000 af/yr

Under this water-withdrawal scenario, up to 6,000 af/yr would be withdrawn from the C aquifer and delivered to the Black Mesa Complex for the life of the project (i.e., 2010 through mid-2026). This is the amount of water that would be needed annually for the coal-delivery system (coal-washing facility [500 af/yr], coal slurry [3,700 af/yr]), other mine-related and domestic uses (1,600 af/yr), and a contingency (200 af/yr). After 2026, the water would no longer be needed for the project and pumping from the C aquifer would cease. Water for reclamation at the Black Mesa Complex would be supplied from the existing N-aquifer wells (see Section 2.2.1.2.3.2).

Map 2-4a

Pipeline Realignment in Moenkopi Wash



Black Mesa Project EIS

LEGEND

Project Features

Black Mesa Complex

Peabody Lease Area

Alternative A Coal-Slurry Pipeline

Existing Route

Realignment

Alternative A Water-Supply Pipeline

Eastern Pipeline Route

Western Pipeline Route

Alternative A Coal-Haul Road

Surface Management

American Indian Reservation

General Features

Hopi Reservation Boundary

Navajo Reservation, Chapter Boundary

County Boundary

Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005
Arizona State Land Department 2005

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November 2008

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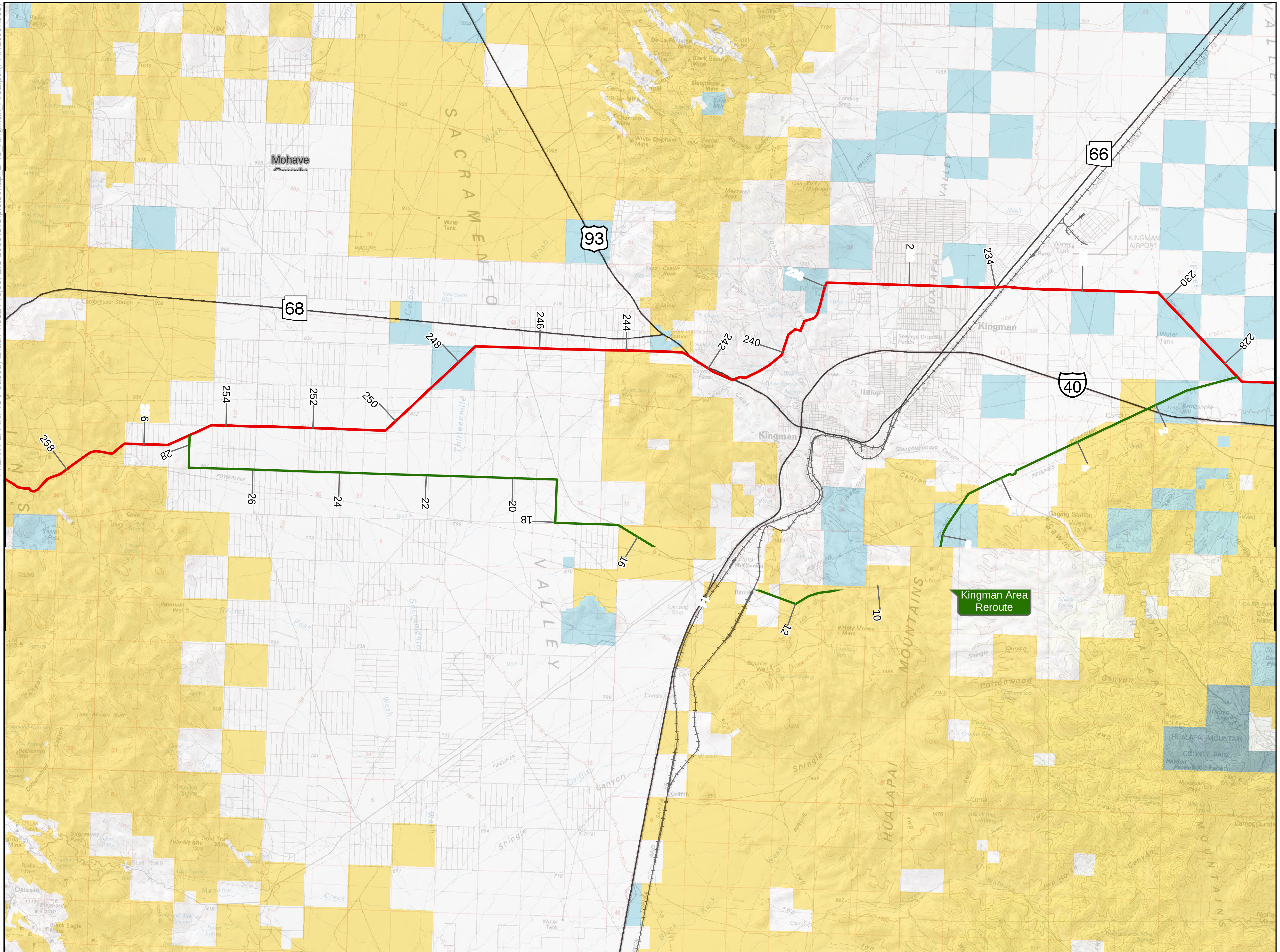
Miles

Prepared By:
URS



Map 2-4b
Kingman Area Reroute
(Alternative A)

Black Mesa Project EIS

LEGEND

Alternative A Coal-Slurry Pipeline

- Existing Route
- Reroute

Surface Management

- Bureau of Land Management
- State Trust
- County, Park and Outdoor Recreation Area
- Private

General Features

- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005
Arizona State Land Department 2005

N

November 2008

0 2 4
Miles

Prepared By: URS

C-Aquifer Water Withdrawal and Supply: 11,600 af/yr

Under this water-withdrawal scenario, the Hopi Tribe and Navajo Nation would have an option to pay the incremental costs of increasing water production from the C aquifer and increasing the size of the water-supply pipeline in anticipation of the potential use of the system for tribal purposes (e.g., municipal, industrial, and commercial uses). The maximum amount of water that could be delivered would be 11,600 af/yr—6,000 af/yr for project-related purposes and an additional 5,600 af/yr for tribal use (2,000 af/yr for the Hopi Tribe and 3,600 af/yr for the Navajo Nation). Under this scenario, after 2026 when the 6,000 af/yr of water is no longer needed for project-related purposes, the Navajo Nation would use up to 6,000 af/yr of C-aquifer water in addition to the 3,600 af/yr. Pumping up to 11,600 af/yr of C-aquifer water would continue for the estimated 50-year life of the pipeline. Water for reclamation at the Black Mesa Complex would be supplied from the existing N-aquifer wells (see Section 2.2.1.2.3.2).

To deliver water from the system to Hopi and Navajo communities, spur lines would need to be constructed; however, the details of the locations and design of the delivery-spur pipelines, timing of construction, and ultimate use of the water are not known at this time. While the consequences of increased and sustained production are considered in the impact section of this EIS, the impacts of developing spur pipelines to tribal villages and use by these communities are not considered in this EIS. Any future Federal actions concerning such spur pipelines would be subject to NEPA analysis at the time of plan development.

2.2.1.2.3.1.2 Infrastructure

Well Field

The C-aquifer well field would consist of production wells, access roads, an electric-power-distribution system, water-storage tank, and associated piping.

Test wells used to quantify well yields ranged from 400 to 745 gallons per minute (Hoffman et al 2005). To produce 6,000 af/yr of water, 12 wells would be developed, and to produce 11,600 af/yr of water, 21 wells would be developed (Reclamation 2006). However, the final well-field design would be determined by pump testing completed project wells that may produce higher yields, potentially reducing the number of wells needed to produce water for the project.

To produce the 11,600 af/yr of water, the section of the well field proposed to produce the 6,000 af/yr for the Black Mesa Complex (12 wells) and 3,600 af/yr for the Navajo Nation (5 wells) would be located on the Navajo Reservation in a triangular area bounded approximately by State Route 99, Canyon Diablo, and the Burlington Northern Santa Fe (BNSF) Railway just north of Red Gap Ranch and Interstate 40 (I-40). To provide 2,000 af/yr of water to the Hopi Tribe, four wells would be developed in the section of the well field that is within the Hopi Hart Ranch (owned in fee by the Hopi Tribe) in a triangular area bounded approximately by the BNSF Railway, Canyon Diablo, and I-40 (refer to Map 1-1; Map 2-5).

Proposed use of the C-aquifer water is shown in Table 2-4.

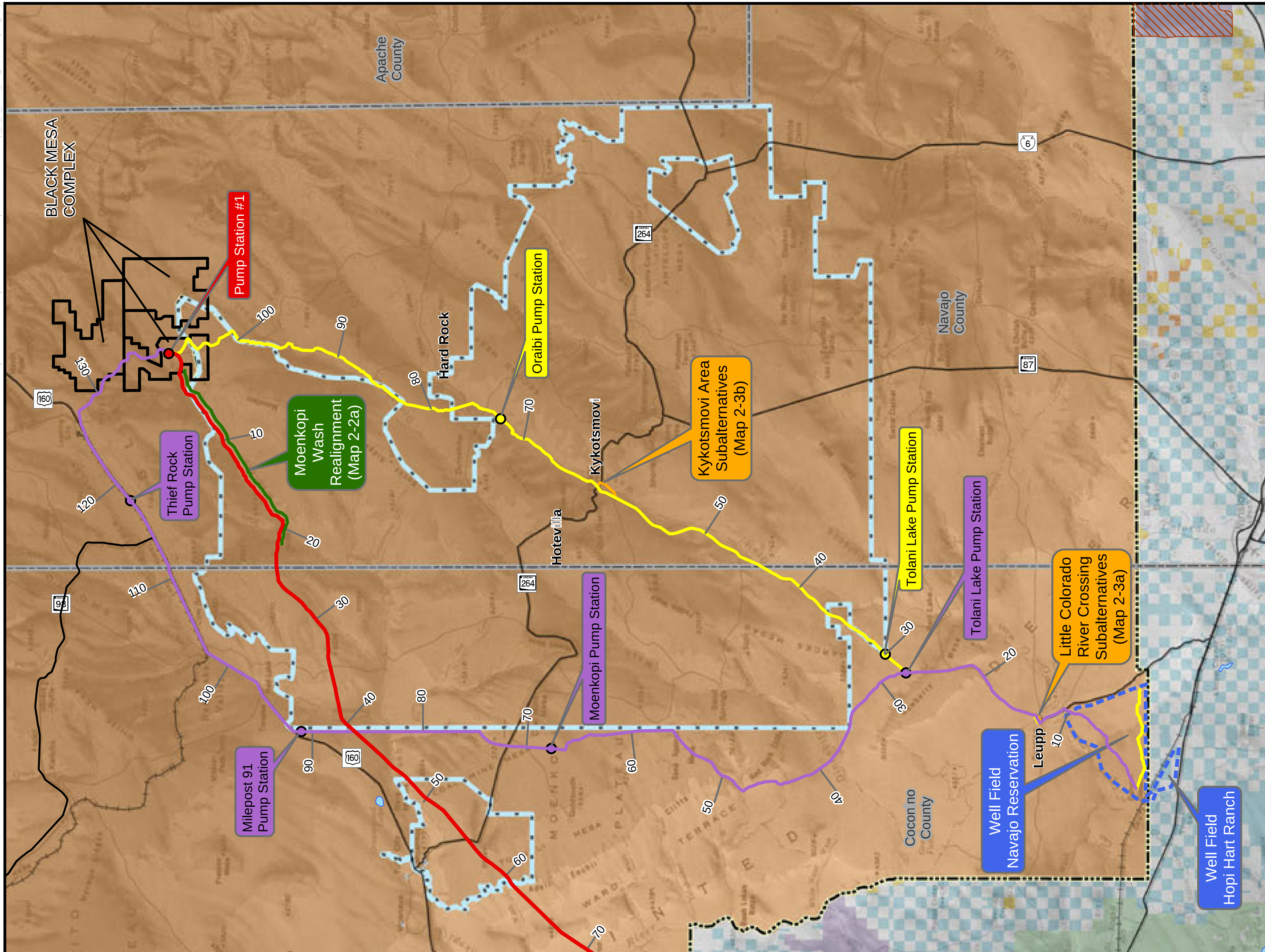
Table 2-4 Proposed Use of C-Aquifer Water

Use	Acre-Feet per Year into 2026	Acre-Feet per Year after 2026
Black Mesa Complex		
Coal washing	500	0
Coal slurry	3,700	0
Mine-related and domestic uses	1,600	0
Contingency	200	0
Subtotal	*6,000*	*0*
Tribal		
Hopi Tribe	2,000	2,000
Navajo Nation	3,600	9,600
Subtotal	*5,600*	*11,600*
Grand total	**11,600**	**11,600**

The locations of the wells had not been determined at the time of the Draft EIS; however, the wells would be spaced so there is a minimum separation of 1.2 to 1.5 miles between each site. Each well site would require a temporary right-of-way of 200 feet by 200 feet for construction and a permanent right-of-way of approximately 50 feet by 50 feet, which would be surrounded by a security fence. The well yard would be gravel paved and the only aboveground equipment at each well site would be the security fencing, lighting, and electrical-power and control cubicle. The preliminary design of each well is a 1,100-foot-deep, 24-inch-diameter pilot borehole (with a 1,000-foot-deep, 18-inch-diameter standard casing). Single-lane, unpaved access roads, with turnouts for passing, would be constructed to each site from the existing roads in the area. The travel surface of the roads would be about 10 to 15 feet within a 40-foot-wide temporary right-of-way (25-foot-wide permanent right-of-way). Electric power would be supplied to the well field by a new power-distribution system. Each well site would receive power via a 24.9 kilovolt (kV) line on wood-pole structures. The power lines would be constructed parallel to the access roads within the road right-of-way where possible.

One power line is anticipated to bisect the Navajo well field to provide the Navajo Tribal Utility Authority (NTUA) better access for providing power to local residents. The power supply for the new distribution system would be supplied from either a new substation that would be constructed along an existing 230kV transmission line or a new local substation that would be constructed at approximately Milepost 6 along the route of the water-supply pipeline. It is expected that APS would supply power to the Hopi well field from either an existing substation near Sunrise, Arizona, or from an existing 69kV transmission line in the area. In the latter case, APS would install a new 69/24.9kV tap on the transmission line. APS then would use a steel-pole line and pole-top transformers to provide power to each well site. The details would not be known until Hopi conducts engineering design for its well field and enters into electrical method-of-service discussions with APS.

A main collector pipeline would be constructed underground, within a 65-foot-wide temporary right-of-way (50-foot-wide permanent right-of-way), to convey pumped groundwater to the water-storage tank. The storage tank would require a permanent right-of-way or easement of approximately 215 feet by 215 feet, and would be fenced and lighted for security.



Map 2-5
Water-Supply Pipeline Route Alternatives

Black Mesa Project EIS

LEGEND

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

Surface Management

- Bureau of Land Management
- U.S. Forest Service
- National Park Service
- American Indian Reservation
- State Trust
- Private

General Features

- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005

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November 2008

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Miles

Prepared By:
URS

C Aquifer Water-Supply-Pipeline Route Alternatives

Two major alternative routes for the water-supply pipeline were identified—an eastern route that would cross the Hopi and Navajo Reservations and a western route that would cross the Navajo Reservation only (refer to Map 2-5).

A permanent access road would be needed to maintain and repair the pipeline. In areas where the pipeline is adjacent to public roads, the public road would serve as the access road. In areas where there is no existing access road, a permanent road approximately 25 feet wide would be maintained within the pipeline's permanent right-of-way.

C Aquifer Water-Supply Pipeline: Eastern Route. The eastern route for the C aquifer water-supply pipeline would be approximately 108 miles long. The route would cross approximately 54 miles of the Hopi Reservation and approximately 54 miles of the Navajo Reservation.

An estimated two pump stations with four pumps each (one pump would be a spare) would be located along the pipeline alignment to lift and move the water to the Black Mesa Complex. The summit elevation along this route is 6,774 feet (the well field is 5,050 feet in elevation). The Tolani Lake Pump Station, located at water-supply pipeline (WSP) Milepost 30, would be approximately 31,350 square feet (0.7 acre) and the Oraibi Pump Station, located at WSP Milepost 73, would be approximately 25,500 square feet (0.6 acre). Permanent rights-of-way or easements to accommodate the two pump stations and access roads to each site would be required. Each site would be enclosed by a security fence, and the pump and other equipment would be enclosed in a building to provide weather protection and security. Electric power to the pump stations would be provided by a 69kV transmission line on steel-pole structures, which would be located along the roadway on the opposite side of the road from the pipeline (east side).

Along this route, minor routing alternatives have been identified in two areas—at the crossing of the Little Colorado River and in the Kykotsmovi area.

Little Colorado River Crossing Subalternatives. The water-supply pipeline's Eastern Route would cross the Little Colorado River between approximately WSP Mileposts 13 and 14. Two alternative crossings were considered (Map 2-5a):

- Crossing under the river by drilling a horizontal tunnel approximately 50 to 200 feet beneath the river and pulling the pipeline through the tunnel.
- Crossing over the river on an existing but abandoned bridge.

Kykotsmovi Area Subalternatives. The water-supply pipeline's Eastern Route would pass through or in the vicinity of the village of Kykotsmovi. Two minor routing alternatives were considered in the Kykotsmovi area (Map 2-5b):

- Along the western subalternative, the water-supply pipeline would be buried beneath the main roadway through the village of Kykotsmovi.
- Along the eastern subalternative, the water-supply pipeline would be buried in the right-of-way of the road that bypasses Kykotsmovi on its eastern edge.

C Aquifer Water-Supply Pipeline: Western Route. This alternative water-supply pipeline route would be approximately 137 miles long and would cross the Navajo Reservation only (refer to Map 1-1 and Map 2-5). It is estimated that four pump stations would be located along the pipeline route to lift and move the water to the Black Mesa Complex. These pump stations would have the same configuration as those described for the Eastern Route. The summit elevation along this route is higher (7,320 feet in elevation) than the Eastern Route. The four pump stations would be located at the following pump stations and mileposts: Tolani Lake Pump Station at approximately WSP Milepost 27.5; Moenkopi Pump Station at WSP Milepost 67.8; Milepost 91 Pump Station at WSP Milepost 91.0; and Thief Rock Pump Station at WSP Milepost 118.0.

2.2.1.2.3.2 N-Aquifer Water Supply

Until December 2005, approximately 4,400 af/yr of water were drawn from the N aquifer within Peabody's lease area—3,100 af/yr of water for slurry for 4.8 million tons of coal and 1,300 af/yr of water for mine-related and domestic purposes. Both mining operations and local residences accounted for the 1,300 af/yr of water.

2.2.1.2.3.2.1 Supplemental Use of N-Aquifer Water

Under Alternative A, 6,000 af/yr of water from the C aquifer would provide the majority of the water needed for the mining operations; use of the N aquifer would continue, but at a reduced rate. The reliability of the C aquifer is difficult to quantify, but reliability would be very high.[2] The C-aquifer wells would be capable of supplying water at some level at all times and at least one spare well would be installed initially. Peabody's N-aquifer well field would be conserved to provide potable water for the public and an emergency back-up supply should the primary C-aquifer supply be interrupted. Under Alternative A, the intent would be to no longer use water from the N aquifer for mine-related or slurry purposes except as noted below.

Peabody's existing leases with the tribes require N-aquifer wells to be transferred to the tribes in operating condition for their use once Peabody successfully completes reclamation and relinquishes the leases. To maintain the N-aquifer well field in an operationally ready state to supply the public and to provide water in case of emergency, the wells must be pumped periodically for extended periods. As a worst case under Alternative A, an estimated average of 2,000 af/yr of N-aquifer water would be used for (1) public consumption, (2) withdrawal from the N-aquifer wells to maintain their function, (3) emergencies, and (4) the Kayenta mining operation.

A conservative approach was used to estimate the average amount of water needed for emergencies because uncertainty exists in the source, supply infrastructure, and operating functions of the water-supply system. The estimate assumed that the C-aquifer water supply would be interrupted for one month or for six month, on alternating basis, at three-year intervals throughout the life of the project. Full use of N-aquifer water was assumed for each interruption.

The Kayenta and Black Mesa mining operations would cease in 2026, and the mines would be reclaimed. From 2026 to 2028, up to 505 af/yr of N-aquifer water would be used for reclamation and public use and, from 2029 to 2038, up to 444 af/yr of N-aquifer water would be used for post reclamation maintenance and public uses. Under this alternative, pumping the N aquifer for project-related uses would cease when the water is no longer needed for those uses (i.e., mine operations, coal delivery, and reclamation). The wells would be transferred to the tribes once Peabody successfully completed reclamation and relinquished the leases.

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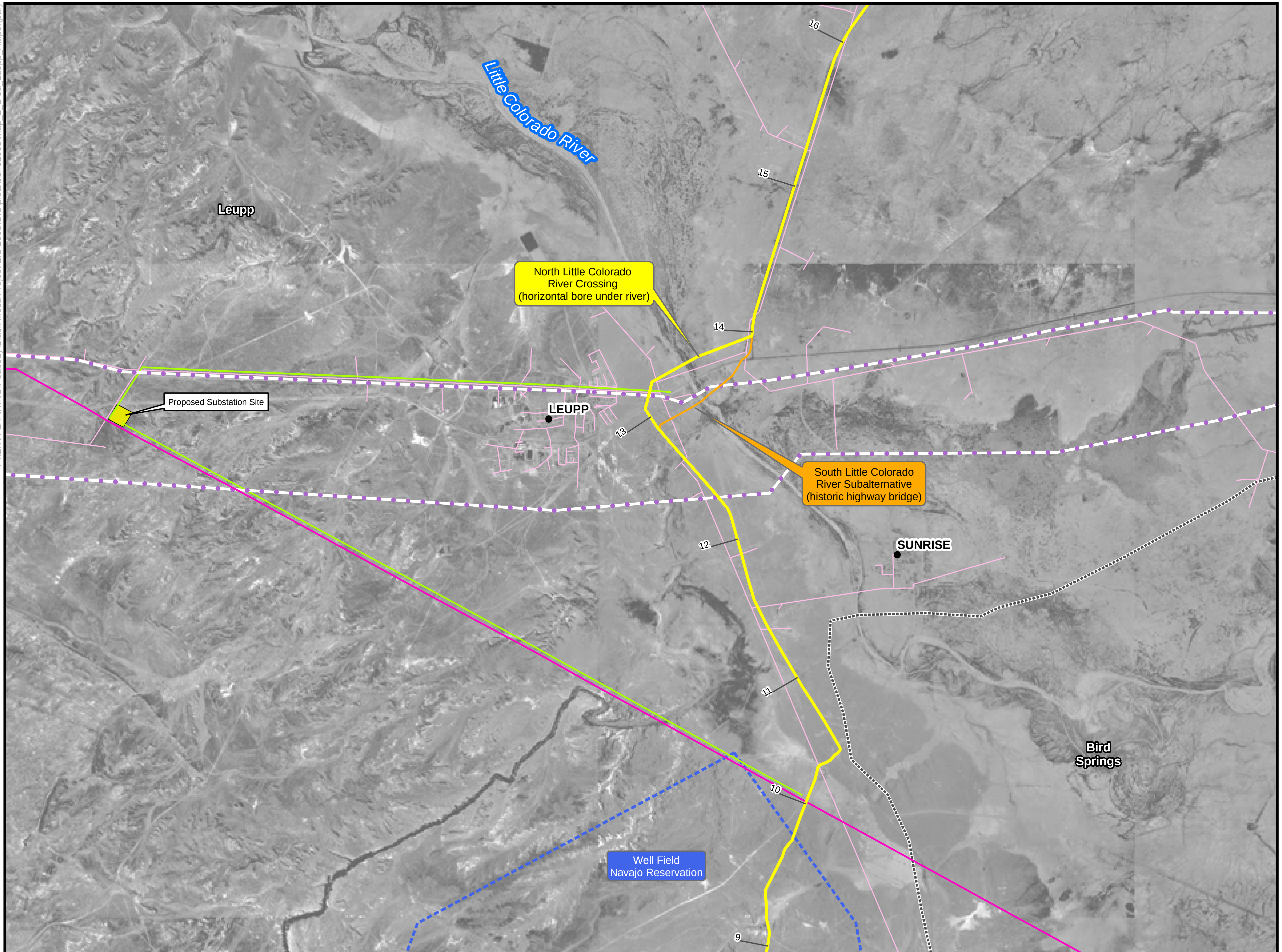
[2] The reliability of the C aquifer to supply coal shipments from Black Mesa to the Mohave Generating Station is expected to be high because aquifer tests indicate the capacity of the aquifer is more than capable of supplying the required water and because water-distribution-system failure rates are typically low. In addition, the existing water-storage capacity (e.g., 6-million-gallon water tank) at Black Mesa would be increased to provide back-up water in case of unexpected C-aquifer pipeline outages. The C aquifer would supply water for coal-slurry shipments using a similar system of wells, storage tanks, and pipes as exists for Peabody's N-aquifer well field, which is known to be reliable.

Map 2-5a

Water-Supply Pipeline: Little Colorado River Crossing Subalternatives

Black Mesa Project EIS



LEGEND

Project Features

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Existing 230kV Power Line
- Existing 69/12kV Power Line
- New 69kV Distribution Line
- New Substation Site

Other Features

- Gas Pipeline

General Features

- Leupp — Leupp Chapter Boundary

SOURCES:
URS Corporation 2005
USGS DOQQ 1992-1996
Navajo Tribal Utility Authority 2005

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November 2008

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Prepared By:
URS

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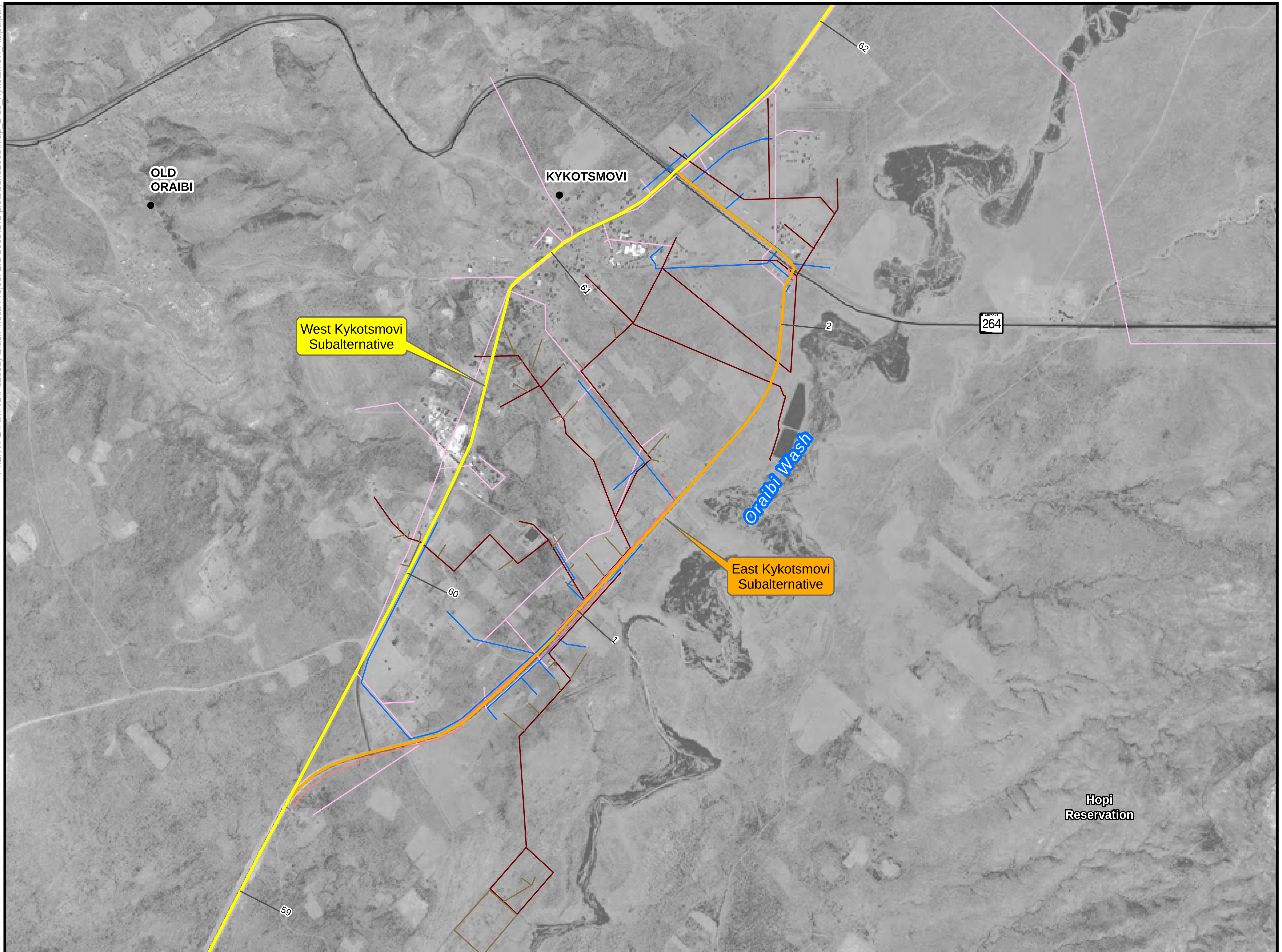

Map 2-5b
Water-Supply Pipeline:
Kykotsmovi Area Subalternatives

Black Mesa Project EIS

LEGEND

Project Features

Alternative A Water-Supply System

- West Kykotsmovi Subalternative
- East Kykotsmovi Subalternative

Other Features

- Phone Line
- 69/12kV Power Line
- Water Line
- Waste Water Tap
- Waste Water Line

General Features

- Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005
USGS DOQQ 1992-1996
Hopi Tribe 2005

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November 2008

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Miles

Prepared By:
URS

2.2.1.2.3.2.2 N Aquifer as the Sole Water Supply

Under this scenario (see the N aquifer water-supply system alternative in Figure 2-1), up to 6,000 af/yr would be drawn from the N aquifer within Peabody's lease area for the expected life of the project (i.e., 2010 through mid-2026). This would be the amount of water needed annually for the coal-delivery system (coal-washing facility [500 af/yr], coal slurry [3,700 af/yr]), other mine-related and domestic purposes (1,600 af/yr), and a contingency (200 af/yr).

From 2026 through 2028, 505 af/yr of water would be needed for mine reclamation and public (domestic) uses, and 444 af/yr of N-aquifer water would be needed from 2029 to 2038. After 2038, the water would no longer be needed for the project, and pumping from the N aquifer for project purposes would cease. The wells would be transferred to the tribes once Peabody successfully completed reclamation and relinquished the leases.

Under this scenario, the concern leading to the administrative delay of OSM's permanent Indian Lands Program permitting decision described in Section 2.1 would not be resolved. The delay of permitting decisions for the Black Mesa mining operation and Black Mesa coal-slurry preparation plant stemmed from the concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for coal-slurry purposes.

2.2.1.3 Costs

Total cost by alternative is shown in Table 2-5. More detailed costs are shown in Appendix B.

Table 2-5 Total Costs for Water-Supply Pipeline Eastern and Western Route Alternatives

	Agencies' Preferred Alternative 11,600 af/yr ($ million)		Applicants' Proposed Alternative 6,000 af/yr ($ million)	
	Capital Cost[1]	Annual Operation and Maintenance[1]	Capital Cost[1]	Annual Operation and Maintenance[1]
Eastern Route				
C-aquifer well field and pump stations	42	3.9[2]	34	3.2[2]
Eastern water-supply pipeline[3]	155	0	145	0
Construction costs	**197**	**0**	**179**	**0**
Water costs for Black Mesa Complex[4]	0	5.4		5.4
Annual operation and maintenance costs	**0**	**9.3**	**0**	**8.6**
Coal-slurry pipeline[5]	200	24	200	24
Total estimated costs for coal-delivery system[6]	**397**	**33.3**	**379**	**32.6**
Western Route				
C aquifer well field and pump stations	53	6.7[2]	45	6[2]
Western water-supply pipeline[3]	179	0	169	0
Construction costs	**232**		**214**	
Water costs for Black Mesa Complex[4]		5.4		5.4
Annual operation and maintenance costs[4]		**12.1**		**11.4**
Coal-slurry pipeline[5]	200	24	200	24
Total Estimated Costs for Coal-Delivery System[7]	**432**	**36.1**	**414**	**35.4**

SOURCES: Black Mesa Pipeline, Inc. 2005; Peabody Western Coal Company 2005; Southern California Edison Company 2006

NOTES: [1] 2006 dollars.
[2] Includes operation and maintenance for pipeline
[3] Does not include costs for right-of-way.
[4] Annual water royalties to Hopi Tribe and Navajo Nation.
[5] The capital costs do not include right-of-way costs.
[6] Includes costs for well field, 108 miles of pipeline (includes West Kykotsmovi and north crossing of the Little Colorado River subalternatives), and two pump stations.
[7] Includes costs for well field, 137 miles of pipeline, and four pump stations.

2.2.2 Alternative B – Approval of the 2008 LOM Revision (Preferred Alternative)

If Alternative B were selected, Peabody's February 2004 LOM application, as revised by the July 2008 amendment of the application, (together the "2008 LOM Revision") would be approved.

The Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume operation. The coal-washing facility, the 127-acre coal-haul road, and the C aquifer water-supply system, in any configuration, would not be constructed. The preferred alternative includes the use of N-aquifer water to supply amounts averaging 1,236 af/yr for mine-related uses through 2025.

If OSM approves the 2008 LOM revision for the Black Mesa Complex, the area previously associated with the Black Mesa operation (18,857 acres), including associated surface facilities, would be added to the 44,073 acres of the existing OSM permanent permit area for the Black Mesa Complex (refer to Figure 2-1), bringing the total acres to 62,930, which would be considered as one operation for the purpose of regulation by OSM. This entire area is within Peabody's existing coal leases.

Areas mined out by the Black Mesa operation by the end of 2005 have already been or are being reclaimed (areas J-01, J-03, J-07, and J-27) (refer to Map 2-2). One coal-resource area that was not completely mined out by the end of 2005 (N-06) is currently producing coal for the Navajo Generating Station. Several coal-resource areas, totaling 5,950 acres, that were never mined by the Black Mesa mining operation (J-02, J-04, J-06, J-08, J-09, J-10, J-14, and J-15) would be incorporated into the permanent permit area for the Black Mesa Complex. If the LOM revision were approved, Peabody would not be authorized to mine these coal-resource areas. However, the unmined coal-resource areas could be mined in the future if applications were submitted to, and approved by, BLM and OSM. Under the existing permit, Peabody has approval to produce coal from the N-09, N-10, N-99, J-19, and J-21, mining areas to supply the Navajo Generating Station through 2026. It is anticipated that Peabody would continue to request that OSM renew its permit every five years until the coal is mined out. Impacts of an extended mining scenario beyond 2026, which could include mining of some or all of the aforementioned eight coal-resource areas, are addressed in the cumulative effects section of the EIS. Through 2026, the Black Mesa operational infrastructure would be used as necessary to facilitate mining and reclamation by the Kayenta mining operation.

From 2026 through 2028, 505 af/yr of N-aquifer water would be used for reclamation and public use, and about 444 af/yr of N-aquifer water would be used from 2029 through 2038. The wells would be transferred to the tribes once Peabody successfully completes reclamation and relinquishes the leases.

2.2.3 Alternative C – Disapproval of the LOM Revision (No-Action Alternative)

OSM's decision under Alternative C to disapprove the LOM revision would have the same effect as OSM's taking no action on the LOM revision.

The Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume operation. The coal-washing facility, 127-acre coal-haul road, and the C aquifer water-supply system, in any configuration, would not be constructed. The leased area previously associated with the Black Mesa operation (18,857 acres) would not be incorporated into the permanent program permit area for the Black Mesa Complex (refer to Figure 2-1). The remaining unmined coal-resource areas, totaling 5,950 acres that were within the area of the Black Mesa operation (areas J-02, J-04, J-06, J-08, J-09, J-10, J-14, and J-15) would not be incorporated into the permit area for the Black Mesa Complex if the LOM revision is not approved. If no action were taken on the LOM revision, those unmined coal-resource areas could not be mined under OSM's administrative delay rules because Peabody never received a prior authorization to mine those resource areas. However, the unmined coal-resource areas could be mined in the future if a future application were submitted to, and approved by, OSM.

If the LOM revision is disapproved or no action is taken on it, the facilities and structures located in the initial program area that historically were shared by the Kayenta and Black Mesa mining operations would continue to be used by the Kayenta mining operation, but they would have to be permitted separately under a future revision. The 1990 permit issued by OSM "authorizes those surface coal mining and reclamation operations described in the application for this permit approved by the Office of Surface Mining Reclamation and Enforcement (OSM) on July 6, 1990, as it applies to the Kayenta Mine." If the LOM revision is disapproved, the permit area would need to be revised to include the facilities and structures that were approved for use under the 1990 permit.

Under the current permanent Indian Lands Program permit, the Black Mesa Complex's Kayenta mining operation already has OSM-approved mining, operation, and reclamation plans that allow it to produce all of the coal needed by the Navajo Generating Station through 2026. The Kayenta mining operation would continue to use N-aquifer water in amounts averaging 1,236 af/yr through 2025. Whether no action is taken on the LOM revision or the LOM revision is disapproved, the Kayenta mining operation would continue to operate through 2026, at which time the mine would be reclaimed, similar to Alternative B. From 2026 through 2028, up to 505 af/yr of N-aquifer water would be used for reclamation and public use. From 2029 through 2038, up to 444 af/yr of N-aquifer water would be used for postreclamation maintenance and public use. The wells would be transferred to the tribes once Peabody successfully completed reclamation and relinquished the leases.

Although it is reasonably foreseeable under Alternative C that Peabody would request future permit revisions to mine all remaining leased coal reserves within the lease area, the cumulative impacts of such foreseeable future permitting already are addressed under Alternative B; thus, for the purpose of evaluating impacts, Alternative C assumes that none of the initial program area coal reserves within the leases would be mined after 2026 (other than those which are currently approved in the existing permit).

2.3 AGENCY AUTHORITY AND ACTIONS

Implementation of any of the alternatives would require certain Federal, State, tribal, and/or local actions or approvals, which are listed in Table 2-6. Brief descriptions of Federal legal authorities and mandates are provided in Appendix C.

Table 2-6 Summary of Potential Major Agency Authorities and Actions

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
FEDERAL			
Life-of-Mine Revision (Alternatives A, B, and/or C; all alternatives unless otherwise noted)			
Life-of-mine (LOM) plan revision	Office of Surface Mining Reclamation and Enforcement (OSM)	LOM revision permit approval	Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 United States Code [U.S.C.] 1201 et seq.)
		Environmental Impact Statement (EIS) and Record of Decision	National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.); Council on Environmental Quality NEPA implementing regulations (40 Code of Federal Regulations [CFR] 1500-1508); OSM Handbook on Procedures for Implementing the National Environmental Policy Act
Right-of-way for transportation corridor (Alternative A only)	Bureau of Indian Affairs (BIA)[1, 2] Western Regional Office and Hopi Agency	Grant of easement for a right-of-way across American Indian lands	25 CFR Part 169, Stipulations for Rights-of-way over Indian Land
Modification of a Section 404 permit	U.S. Army Corps of Engineers (USACE)	Modify permit for discharge of dredged or fill material to waters of the United States	33 U.S.C. 1344(a); 33 CFR Parts 320, 323, 325
Effects on species listed or critical habitat designated under the Endangered Species Act (ESA)	Action agency (agencies) in consultation with U.S. Fish and Wildlife Service (FWS)	Compliance with the ESA	ESA of 1973 as amended (16 U.S.C. 1531 et seq.); 50 CFR 402; ESA
Modification of the National Pollution Discharge Elimination System (NPDES) permit	U.S. Environmental Protection Agency (USEPA)	EIS and Record of Decision	Clean Water Act (33 U.S.C. 1342); 40 CFR 124.9
Changes to the mining plan	Bureau of Land Management (BLM)	Approval	25 CFR 216; 43 CFR 3480

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Effects on historic properties	All Federal action agencies, Arizona and Nevada State Historic Preservation Offices (SHPOs), Navajo Tribal Historic Preservation Office (THPO), Hopi Cultural Preservation Office (HCPO), and Advisory Council on Historic Preservation (if it chooses to participate)	Consultations with all interested parties to determine whether there will be adverse effects on historic properties, and if so how to take those effects into account; usually means development of a Section 106 Memorandum of Agreement	National Historic Preservation Act (NHPA) Section 106, 16 U.S.C. 470f; 36 CFR 800
Coal-Slurry Preparation Plant (Alternative A only)			
Surface coal-mining operations (coal-slurry preparation plant) conducted on American Indian reservations	OSM	Coal-slurry preparation plant permit	SMCRA (30 U.S.C. 1201 et seq.); 30 CFR 750, 785.21
C-Aquifer Water-Supply System (Alternative A only)			
Grant of rights-of way for well field, pipeline-gathering system, water-conveyance pipeline, and other associated facilities	BIA[1, 3, 4] Western Regional Office Navajo Regional Office	Rights-of-way grant across American Indian reservations, permit or lease for the water-conveyance pipeline and associated facilities	25 CFR 169
Approval of lease or permits for water supply and related facilities	BIA[1,3,4] Western Regional Office Navajo Regional Office	Lease or permits for water supply and related facilities	25 CFR 162
Construction, operation, maintenance, and abandonment of pipeline across or within highway right-of-way	Federal Highway Administration (FHWA)	Permits to cross Federal-Aid Highway	Federal-Aid Highway Act, 23 U.S.C. 101, et seq. 23 CFR 1.23 23 CFR 645 23 CFR 771
Construction sites with greater than 5 acres of land disturbed	USEPA (on American Indian reservations)	Section 402 NPDES Permit for Storm Water Discharges from Construction Sites	Clean Water Act (33 U.S.C. 1342); 40 CFR 122
Construction across water resources	USACE	Section 10 and/or Section 404 permits, for construction of obstructions to navigable capacity of navigable waters or for discharge of dredged or fill material to waters of the United States, respectively	33 U.S.C. 403, 1344(a); 33 CFR 320, 322, 323, 325

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Construction in or modification of floodplains	All Federal action agencies	Consider alternatives to avoid adverse effects and incompatible development in the floodplains	Executive Order 11988; 33 CFR 320.4(l) (USACE)
Potential discharge of dredged or fill material to waters of the United States (including wetlands and washes)	USACE	Section 404 Permit to discharge dredged or fill material to waters of the United States	Clean Water Act [33 U.S.C. 1344(a)]; 33 CFR 320, 323, 325
Discharge of dredged or fill material to waters of the United States (including wetlands and washes)	USEPA (Navajo Nation EPA [NNEPA] on Navajo Reservation)	USEPA authority to "veto" a USACE permit issued under 33 U.S.C. 1344(a) [Clean Water Act Section 404(a)]	Clean Water Act Section 404(c) [33 U.S.C. 1344(c)]; 40 CFR 231
Placement of structures and construction work in navigable waters of the United States	USACE	Section 10 permit for construction of obstructions to navigable capacity of navigable waters	Rivers and Harbors Act of 1899 (33 U.S.C. 403); 33 CFR 320, 322, 325
Potential pollution discharge during construction, operation, and maintenance	USEPA	Spill Prevention Control and Countermeasure (SPCC) plan	Oil Pollution Act of 1990; 33 U.S.C. 2701 et seq.; 40 CFR 112
Effects on species listed or critical habitat designated under the ESA	Action agencies in consultation with FWS	Compliance with the ESA	ESA of 1973 as amended (16 U.S.C. 1531 et seq.); 50 CFR 402
Effects on historic properties	Lead Federal agency, BIA, Navajo THPO, HCPO, and Advisory Council on Historic Preservation (if it chooses to participate)	Consultations with all interested parties to determine whether there will be adverse effects to historic properties, and if so how to take those effects into account; usually involves development of a Section 106 Memorandum of Agreement	NHPA of 1966 (16 U.S.C. 470f); 36 CFR 800
Excavation of archaeological sites on tribal lands	BIA[1], tribal consents	Permits to excavate	Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 470aa to 470mm); 25 CFR 262; 43 CFR 7
Potential conflicts with freedom to practice American Indian religions	Lead Federal agency and BIA[1]	Consultation with affected American Indians	American Indian Religious Freedom Act (AIRFA) (42 U.S.C. 1996); Executive Order 13007 (61 Federal Register 26771); Religious Freedom Restoration Act of 1993 (RFRA) (42 U.S.C. 2000bb et seq.)
Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	BIA[1], Tribal consents	Consultation with American Indian group regarding treatment of remains and objects	Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. 3001); 43 CFR 10

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Investigation of cultural and paleontological resources	BIA[1]	Permit for study of historical, archaeological, and paleontological resources	Antiquities Act of 1906 (16 U.S.C. 432-433); 36 CFR 296; 43 CFR 3, 7 and 2300; ARPA; 25 CFR 262; 43 CFR 7
Coal-Slurry Pipeline (Alternative A only)			
Rights-of-way for coal-slurry pipeline and other associated facilities	BIA[1, 3, 4]	Grant of easement for rights-of-way	25 CFR 169
Right-of-way grants for coal-slurry pipeline	U.S. Forest Service (Forest Service)	Special use authorization permit or easement	Federal Land Policy and Management Act of 1976 (FLPMA), Title V (43 U.S.C. 1761-1771); 36 CFR 251
Preconstruction surveys; reconstruction, operation, maintenance, and abandonment of coal-slurry pipeline on public land; right-of-way extension	BLM	Right-of-way grant across public land; temporary use permit; land use plan maintenance	FLPMA, Title V (43 U.S.C. 1761-1771) 43 CFR 2800
	Forest Service	Special use authorization permit or easement	36 CFR 251
Construction, operation, maintenance, and abandonment of pipeline across or within highway right-of-way	FHWA	Permits to cross Federal-Aid Highway	Federal-Aid Highway Act, 23 U.S.C. 101, et seq.; 23 CFR 1.23; 23 CFR 645; 23 CFR 771
Construction sites with greater than 5 acres of land disturbed	USEPA (on Indian land)	Section 402 NPDES permits for Storm Water Discharges from Construction Sites	Clean Water Act (33 U.S.C. 1342); 40 CFR 122
Construction across water resources	USACE	Section 10 and/or Section 404 Permit, for construction of obstructions to navigable capacity of navigable waters or for discharge of dredged or fill material to waters of the United States, respectively	33 U.S.C. 403, 1344(a); 33 CFR 320, 322, 323, 325
Construction in or modification of floodplains	All Federal action agencies	Consideration of alternatives to avoid adverse effects and incompatible development in the floodplains	Executive Order 11988; 33 CFR 320.4(l) (USACE)
Potential discharge of dredged or fill material to waters of the United States (including wetlands and washes)	USACE	Section 404 permit to discharge dredged or fill material to waters of the United States	Clean Water Act [33 U.S.C. 1344(a)]; 33 CFR 320, 323, 325

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Placement of structures and construction work in navigable waters of the United States	USACE	Section 10 permit for construction of obstructions to navigable capacity of navigable waters	Rivers and Harbors Act of 1899 (33 U.S.C. 403); 33 CFR 320, 322, 325
Potential pollution discharge during construction, operation, and maintenance	USEPA	SPCC plans for pump stations	Oil Pollution Act of 1990, 33 U.S.C. 2701 et seq.; 40 CFR 112
Effects on species listed or critical habitat designated under the ESA	Action agencies in consultation with FWS	Compliance with the ESA	ESA of 1973 as amended (16 U.S.C. 1531 et seq.); 50 CFR 402
Effects on historic property	Federal lead agency, SHPOs, Navajo Nation THPO, HCPO, and Advisory Council on Historic Preservation (if it chooses to participate)	Consultations with all interested parties to determine whether there will be adverse effects to historic properties, and if so how to take those effects into account	NHPA (16 U.S.C. 470, et seq.); 36 CFR 800
Excavation of archaeological sites	Federal land-managing agency and tribes	Permits to excavate	ARPA (16 U.S.C. 470aa to 470ee)
Potential conflicts with freedom to practice American Indian religions	Federal lead agency, Federal land-managing agency	Consultation with affected American Indians	AIRFA (42 U.S.C. 1996); Executive Order 13007 (61 Federal Register 26771); RFRA (42 U.S.C. 2000bb et seq.)
Disturbance of graves, associated funerary objects, sacred objects, and items of cultural patrimony	Federal land-managing agency	Consultation with American Indian group regarding treatment of remains and objects	NAGPRA (25 U.S.C. 3001); 43 CFR 10
Investigation of cultural and paleontological resources	Affected land-managing agency	Permit for study of historical, archaeological, and paleontological resources	Antiquities Act of 1906 (16 U.S.C. 432-433); 36 CFR 296; 43 CFR 3, 7 and 2300; ARPA; 25 CFR 262; 43 CFR 7
Investigation of cultural resources	Affected land-managing agency	Permits to excavate and remove archaeological resources on Federal lands; consultation with American Indian tribes with interest in resources must be consulted prior to issuance of permits	ARPA (16 U.S.C. 470aa to 470mm); 43 CFR 7
Ground disturbance on Federal land or Federal Aid project	BLM, Forest Service	Compliance with BLM mitigation and planning standards for paleontological resources on public lands	FLPMA (43 U.S.C. 1701-1771) Antiquities Act of 1906 (16 U.S.C. 431-433); 7 CFR 3100 (Department of Agriculture, including Forest Service); BLM Manual Section 8270

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
TRIBAL			
Hopi Tribe (Alternative A only)			
Use of Hopi lands and resources	Hopi Tribal Planning	Hopi Tribe's input in planning for reservation development; procedural review and approval of community development plans; approval of well leases, drilling permits, and use of water	Hopi Indian Tribe Ordinance 55
Realty action	Hopi Tribal Planning	Protocol for realty	Hopi Resolution H-55-2000
Engagement in the business of investigating, conducting tests, and collecting scientific information/data concerning the natural resources of the Hopi Reservation	Hopi Office of Revenue Commission Hopi Department of Natural Resources	Business license; procedures, terms, and conditions of permits and penalties for violation	Hopi Indian Tribe Ordinance 14
Engagement in business on the Hopi Reservation	Hopi Office of Revenue Commission; Hopi Tribal Council	Revenue Commissioner to administer tribal licensing ordinances	Hopi Indian Tribe Ordinance 31
Engagement in business on the Hopi Reservation	Hopi Tribal Council	Nonmember business license; ordinance exemption for sales to tribe; license fees on the privilege of doing business on the reservation; compliance with rules about reservation business and protection of consumers; bonding requirement for nonresidents	Hopi Indian Tribe Ordinance 17
Possession or use of Hopi land without permission	Civil Trespass	Compliance with provisions on prohibitions about the possession or use of Hopi land without permission	Hopi Indian Tribe Ordinance 52
Indian preference provisions for employment	Tribal Employment Rights Office	Provisions for American Indian employment	Hopi Indian Tribe Ordinance 37
Construction of improvements within District 6 of Hopi Reservation	Hopi Tribal Council	Control of new construction on the 1882 reservation outside District 6	Hopi Indian Tribe Ordinance 23
Effects on water	Hopi Water Resources Program	Establishment of water quality standards applicable to all water resources; provision of wellhead protection; permits for well drilling and adherence to defined well specifications	Hopi Tribal Resolution H-107-97

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Construction debris	Hopi Environmental Protection Office	Removal of construction debris via Environmental Protection Plan	Office of Solid Waste, Solid Waste Ordinance No. 44
Preconstruction activities: 1) Historical or scientific research 2) Archaeological surveys and excavations	Hopi Cultural Preservation Office	License authority; tribal approval	Hopi Indian Tribe Ordinance No. 26
Preconstruction activities – site visit	Hopi Tribal Council	Written permission from Hopi Tribal Council chairman to visit archaeological or historical site	Hopi Indian Tribe Executive Order 78-1
Construction in or removal of range improvements	Hopi Office of Range Management	Written authorization from Hopi Department of Range Management	Hopi Indian Tribe Ordinance No. 43
Construction in or removal of woodlands	Hopi Department of Natural Resources	Permit to harvest woodland products	Hopi Indian Tribe Ordinance No. 47
Navajo Nation			
Modification of Title V air quality permit (Alternatives A, B, and C)	NNEPA	Title V permit	Clean Air Act (42 U.S.C. 7661a); 40 CFR 71
On-ground investigations for tribal or federally protected species (Alternative A)	Navajo Nation Fish and Wildlife Department	Biological investigation permit	Government Services Committee Resolution SFCF-3-94
Preconstruction activities, construction, operation, and maintenance (Alternative A)	Resources Committee of the Navajo Nation Council	Formal written approval (e.g., well leases, drilling permits, use of water)	2 Navajo Nation Code (NNC) 164
Wetlands (Alternatives A, B, and C)	USEPA Region IX, NNEPA	NPDES permit; Section 401 water quality certification	NNC CJA-16-96
Permission to survey on Navajo Tribal Trust land for surveying, map legal description, environmental assessment, ethnographic and archaeological studies (Alternative A)	Navajo Nation reviewing departments (*) *Project Review Office	Navajo Nation Council consent letter or permit per Resource Committee	2 NNC 695; 25 CFR 169
Discharge of dredged or fill material to waters of the United States (including wetlands and washes) (Alternatives A, B, And C)	NNEPA	Section 404 permit	Clean Water Act [33 U.S.C. 1344(a)]; 33 CFR 320, 323, 325

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Construction disturbance in areas of sensitive animal and plant species (Alternative A)	Navajo Nation Fish and Wildlife Department, *Natural Heritage Program	Review and approval by Navajo Nation	25 CFR 169.4 to 169.5
Construction disturbance in areas of cultural resources (Alternatives A, B, and C)	*Historic Preservation Department	Review and approval by Navajo Nation	25 CFR 169.5
Encroachment on all existing rights-of-way (Alternative A)	Navajo Nation reviewing departments	Navajo Nation consent letter	25 CFR 169.3
Construction, operation, and maintenance of right-of-way (Alternative A)	Resource Committee of Navajo Nation Council; BIA agencies or area office	Resource Committee resolution and Navajo Nation consent letter	2 NNC 695(B)(6)
Restoration of right-of-way (Alternative A)	NNEPA	Review and approval	25 CFR 169.5
Cultural resource investigations on Navajo Nation lands (Alternative A)	Navajo Nation Historic Preservation Department; BIA, Navajo Regional Office	Class B inventory permits, Class C excavation permits, ARPA permits for disturbance of archaeological resources	Navajo Nation Cultural Resource Protection Act (CRPA-19-88); ARPA; 43 CFR 47
Clearing, transporting, selling, trading, or bartering of any Navajo forest product (Alternative A)	Navajo Nation Forestry Department	Commercial permit	Resource Resolution RCJN-69-88; 23 NNC 902 (c); 17 NNC 525; 18 U.S.C. 1850; 18 U.S.C. 1853; 18 U.S.C. 1855
Potential effects on the water of Navajo Nation lands (Alternative A)	Navajo Nation Department of Water Resources	Water use permit	Chapter 7, NNC 254 22 ; NNC 1101 et seq.
Survey activities for geologic or paleontological resources (Alternative A)	Navajo Nation Minerals Department	Reconnaissance permit	Government Services Committee Resolution GSCAP-20-94
Removal of fossil resources for study (Alternative A)	Navajo Nation Minerals Department	Collection permit	Government Services Committee Resolution GSCAP-20-94
STATE			
Arizona (Alternative A only)			
Storm-water management from potential discharges associated with industrial activity or construction of sites greater than 5 acres (cumulative)	Arizona Department of Environmental Quality (ADEQ)	Arizona Pollutant Discharge Elimination System (AZPDES) permit	Arizona Revised Statute (A.R.S.) 49-255 and Arizona Administrative Code (A.A.C.) R18-9-1, 2; A.A.C. R18-11-1
Construction across water resources	ADEQ	State Water Quality Certification (State review required for all Section 404 permits)	Clean Water Act (33 CFR 320, 322, 323, 325)

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
NPDES permit	ADEQ	Consistency Review Form to ensure that a proposed facility or use will be consistent with the existing Certified Regional Water Quality Management Plan (WQMP)	Clean Water Act (Section 303, et al.); Federal Water Pollution Control Act Section 208
Construction and operation of sedimentation pond	ADEQ	Aquifer Protection Permit	A.R.S. 49-241 through 49-252; A.A.C. R18-9-101 through R18-9-403
Fugitive dust as a result of project construction	ADEQ	Compliance with dust control measures and standards	A.A.C: R-18-2-604, R-18-2-605, R-18-2-606, R-18-2-607, R-18-2-612
Construction, operation, maintenance, and abandonment of pipeline across or within state highway right-of-way	Arizona Department of Transportation	Crossing permit, permit for use of right-of-way	A.R.S. 28-7053; A.A.C. R17-3-501 through 509
Encroachment onto State Trust Land	Arizona State Land Department	Right-of-way permit	A.R.S. 37-461
Loss of special status plant species	Arizona Department of Agriculture	Permit to remove plants	Native Plant Law (A.R.S. 3-901 through 916)
Disturbance to or loss of habitat of special status animal species	Arizona Department of Game and Fish	Coordination with the FWS/BLM/USACE	U.S. Fish and Wildlife Coordination Act
Potential disturbance to cultural resources on State Trust Land	Arizona State Museum	Permit to investigate	A.R.S. 41-841 through 847
	SHPO	Review and approval of use of any State Trust Lands	A.R.S. 41-861 through 864
Potential disturbance to human remains or funerary objects	Arizona State Museum	Grant for permission to disturb	A.R.S. 41-865
Nevada (Alternative A only)			
Storm-water management from potential discharges associated with industrial activity or construction of sites greater than 5 acres (cumulative)	Nevada Department of Environmental Protection (NDEP), Bureau of Water Pollution Control	General Permit for Stormwater Discharges Associated with Construction Activity (NVR100000)	NRS 445A.300 through 445A.730
Construction across water resources	NDEP, Bureau of Water Quality Planning	State Water Quality Certification (State review required for all Federal Section 404 permits)	Clean Water Act (33 CFR Parts 320, 322, 323, 325); NRS 445A.010 through 445A.730
Potential for fugitive dust from project construction	NDEP, Bureau of Air Pollution Control	Surface Area Disturbance Permit Authority overridden by Clark County	NAC 445B.22037

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Disturbance or modification of special status plant species or habitat	Division of Forestry	Compliance survey for identification of plant species; permit for lawful take of protected plant	NRS 527.050, 527.270, 527.250
Disturbance to or loss of special status animal species	Division of Wildlife	Special permit	NAC 503.093
Potential disturbance to human remains or funerary objects	Office of Historic Preservation	Notification of discoveries, consultation with affiliated groups	NRS 383.150 to 383.190
LOCAL			
Navajo County, Arizona (Alternative A only)			
Construction of pipeline	Department of Public Works, Planning and Zoning	Special use permit	Zoning ordinance
Potential encroachment onto county rights-of-way	Department of Public Works	Right-of-way use permit	A.R.S. 11-562
Coconino County, Arizona (Alternative A only)			
Construction of pipeline	Public Works Department	Blanket permit	County ordinance
Construction activities	Public Works Department	Grading and excavation permit	County ordinance
Potential encroachment onto county rights-of-way	Public Works Department	Encroachment permit	County ordinance 94-01; A.R.S. 11-562
Yavapai County, Arizona (Alternative A only)			
Construction of pipeline	Department of Public Works	Special use permit	County ordinance
Potential encroachment onto county rights-of-way	Development Services Department	Right-of-way permit	County ordinance 2001-1; A.R.S. 11-562
Mohave County, Arizona (Alternative A only)			
Potential encroachment onto county rights-of-way	Public Works Department	Right-of-way use permit	A.R.S. 11-562; Mohave County ordinance
Construction of pipeline	Planning and Zoning Office	Special use permit	Zoning ordinance
City of Bullhead City, Arizona (Alternative A only)			
Construction of pipeline	Community Development Department	Conditional use permit	Municipal Code 17.08
Construction of pipeline	Community Development Department	Grading permit	Municipal Code 15.40
Potential encroachment onto city rights-of-way	Engineering Department	Notification 24 hours in advance of work	Municipal Code 12.04.030
City of Kingman, Arizona (Alternative A only)			
Construction of pipeline	Planning and Zoning Division	Conditional use permit	Municipal Code 29.000
Construction of pipeline	Building Department	Grading permit	Municipal Code 3310

Table 2-6 Summary of Potential Major Agency Authorities and Actions (continued)

Proposal Requiring Action	Agency	Permit, License, Approval, Compliance, or Review	Relevant Law and/or Regulation
Potential encroachment onto city rights-of-way	Public Works Department	Right-of-way permit	Streets and Sidewalks Development Rules and Regulations, Division 3, 6
Clark County, Nevada (Alternative A only)			
Potential for fugitive dust from project construction	Air Quality and Environmental Management	Dust control permit	Clark County Air Quality Regulations, Section 94
Clearing vegetation, rough grading, stockpiling, altering natural ground surface or its elevation	Comprehensive Planning	Grading permit; Land disturbance permit	County Ordinance 30.32.040
Disturbance to or loss of habitat of special status animal species	Comprehensive Planning	Incidental take permit	County Ordinance 30.32.050
Potential encroachment onto county rights-of-way	Department of Development Services	Encroachment permit; Improvement plans	County Ordinance 30.32.070 County Ordinance 30.32.080
Construction of pipeline	Comprehensive Planning	Conditional use permit	County Ordinance 30.44.010

NOTES:

[1] Life-of-mine approval implicates other Federal laws that Peabody will be required to comply with.

[2] All Bureau of Indian Affairs (BIA) permits and/or leases require prior Hopi Tribe and/or Navajo Nation concurrences that typically require completed environmental assessment document.

[3] The J-23 coal resource area is in a portion of the mine that contains both Navajo and Hopi Trust land. The corridor location would need to be clearly identified to establish which BIA Regional Office is responsible for addressing this request (BIA March 11, 2005).

[4] The proposed C-aquifer pipeline would require a BIA right-of-way approved by the Navajo Regional Director. These right-of-way permits are administered and processed by the Navajo Regional Office Branch of Real Estate Services (BIA, March 11, 2005).

[5] Grazing permit holders should, at a minimum, be consulted if the proposed C-aquifer pipeline crosses their customary use area and if compensation is necessary. At a minimum, provisions should be made for rehabilitation of areas impacted by construction activities and compensation for areas removed from forage production for facilities such as pumping stations, transmission lines, and access roads (BIA, March 11, 2005). At this time, it is not certain whether a permit or lease would be the best means of addressing the proposed C-aquifer well sites (BIA, March 11, 2005).

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY IN THE EIS

The alternatives described in this section were considered but eliminated from detailed analysis in the EIS as not being reasonable alternatives; i.e., not being technically or economically feasible or practical, and/or not meeting the purpose of and need for the project.

2.4.1 Approval of the Black Mesa Portion of the 2004 LOM Revision and Disapproval of the Kayenta Portion of the 2004 LOM Revision

During scoping, an alternative was proposed that would result in the approval of the Black Mesa portion of the 2004 LOM revision and disapproval of the Kayenta portion of the 2004 LOM revision. Under this alternative, the Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline would resume operations as described in Alternative A (refer to Section 2.2.1). The Kayenta mining operation would continue to operate through 2026 (under OSM's existing permanent Indian Lands Program permit). After 2026, Kayenta mining operation would cease and the mine would be reclaimed. This alternative is not substantively different from the approval alternative (Alternative A). The 2008 LOM revision proposes only the Kayenta mining operation; thus, this alternative is no different from Alternative C. Therefore, this alternative is not considered further.

2.4.2 Other Water Sources

Many scoping comments suggested the use of an alternative to water as a medium for the coal slurry, or that a source of water other than the N aquifer be considered. While the latter has been considered and the C aquifer has been analyzed in this EIS, a number of other alternative sources of water have been investigated over several years. The following summaries briefly describe investigations of water-supply options from the Colorado River, groundwater basins near the coal-slurry pipeline, groundwater sources near the Black Mesa Complex, and gray water from the City of Flagstaff.

2.4.2.1 Colorado River Water-Supply Options

Between 1990 and 2003, the United States, Hopi Tribe, Navajo Nation, SCE, Peabody, and SRP evaluated various Colorado River water-supply options to see if they could meet the demands for mining operations, the coal slurry, and the Hopi Tribe and Navajo Nation. The evaluations were part of discussions to resolve tribal water-rights claims to the Little Colorado River watershed and to resolve issues related to the Black Mesa mining operation. The process involved detailed studies between 1990 and 2003 of numerous pipeline alignments, a range of water quantities, the law of the Colorado River, and related issues. Representatives of the Federal Government, Hopi Tribe, Navajo Nation, SCE, Peabody, and SRP participated in the process. The representatives concluded that all the Colorado River options were technically infeasible, at least within the time available to develop an assured water supply for the Black Mesa Project. Though considered, the Colorado River water-supply options were eliminated from further study in this EIS (Sommers 2005).

One of the most important considerations in any proposal to divert water from the Colorado River is the "Law of the River," a complex set of laws and regulations governing the use of water from the Colorado River and its tributaries. Moreover, an important component of the Law of the River is the Colorado River Compact of 1922, which divided the Colorado River Basin into an Upper Basin and Lower Basin, with a dividing point at Lees Ferry, just downstream from Lake Powell (Reclamation 2004).

Each basin has an annual allocation of water from the Colorado River. The Upper Basin states have an obligation to deliver 7.5 million acre-feet of water to the Lower Basin. The water in each basin is apportioned, by percentage, among the states that use the water. Arizona receives only a small allocation from the Upper Basin (50,000 af/yr), which is largely consumed by existing uses on the Navajo

Reservation, the City of Page, and the Navajo Generating Station. Moreover, because the Black Mesa Complex is located in the Lower Basin, new diversions for mining, slurry, and tribal demands would likely have to come from Arizona's allocation from the Lower Basin (Reclamation 2006; SRP 2002).

Several potential sources of Lower Basin water were identified for possible use by the Black Mesa Project; however, changing the point of diversion and location of use of any Colorado River water source would require the approval of the Arizona Department of Water Resources (ADWR). In addition, most sources likely would require consent of the Central Arizona Water Conservation District (CAWCD) because supplies from the Central Arizona Project likely would be affected. ADWR and CAWCD were reluctant to consent to any use of Colorado River Lower Basin water supplies for use in northern Arizona, outside the three-county Central Arizona Project area, unless there was also some direct benefit to the rest of the state. Thus, progress in identifying a specific source of Colorado River water for the Black Mesa Project was slow (SRP 2002).

Lake Powell is the closest point of diversion from the Colorado River for use in the Black Mesa Project and for nearby tribal demands. During the 1990s, a number of Lake Powell diversion alternatives were extensively studied, involving a range of water quantities and different pipeline alignments. The primary diversion point from the lake that was evaluated was a location near the existing pump station for the Navajo Generating Station using a similar pumping scheme. Locating the pump station near the Navajo Generating Station pump station would take advantage of existing infrastructure and minimize environmental impacts. The various evaluated pipeline alignments followed the railroad alignment that transports coal from the Kayenta mining operation to the Navajo Generating Station and/or existing highways and roads, again to minimize environmental impacts. Additional alignments also were evaluated to provide water to nearby Navajo towns and villages. The major stumbling block for the use of water from Lake Powell is the potential legal issue associated with the diversion of water from the Upper Basin for use in the Lower Basin, where the mine complex is located. Such a diversion is not explicitly authorized by the Colorado River Compact of 1922. It is possible that Lake Powell diversion of water for use in the Lower Basin would require, either legally or politically, the consent of the seven Colorado River Basin states, which would likely take a number of years to negotiate and would have an uncertain outcome. Also, the high cost of an extensive network of pipelines to distribute the water was a consideration (Sommers 2005; SRP 2002)**.**

To avoid delays associated with resolution of the trans-basin diversion and use issues, a Lower Basin diversion location just downstream of Lees Ferry was investigated—a Marble Canyon diversion at the mouth of Jackass Canyon was evaluated in 2002. The diversion alternative was strongly opposed by environmental groups, especially because of its location at the upper end of the Grand Canyon in or immediately adjacent to Grand Canyon National Park. The diversion location and pipeline alignment also presented engineering challenges and were expected to result in substantial environmental impact within the Grand Canyon and elsewhere. This Lower Basin diversion location was deemed to be technically and economically unacceptable.

Another Lower Basin diversion location was evaluated at Bullhead City, where the existing coal-slurry pipeline crosses the Colorado River. The concept was to use the existing coal-slurry pipeline, which was to be retired and replaced as part of the Black Mesa Project, to convey water upstream to the mine using a series of pump stations. Although costs, including pumping costs, were a very serious concern with this option, which would involve pumping the water approximately 273 miles generally uphill over an elevation gain of more than 5,000 feet, the option was never fully evaluated because of increased opposition to using Arizona's allocation from the Lower Basin for a Nevada-related project.

Increased opposition to diversion and use of Lower Basin water for mining, coal slurry, and tribal use followed the Navajo Nation's filing of a lawsuit against USDI in March 2003. The lawsuit alleged that USDI was not adequately asserting and protecting the rights of the Navajo Nation to water from the main stem of the Colorado River in the Lower Basin. In response to the lawsuit, the State of Arizona and central Arizona water users took the position that the claims of the Navajo Nation to water from the Lower Colorado River in the Lower Basin must be resolved before a supply of Colorado River water could be allocated for the Black Mesa Project. Preliminary discussions to resolve the Navajo Nation's Lower Basin claims revealed that it would likely take many years to settle those claims. As a result, the United States, tribes, and companies concluded that the Colorado River was not a viable source for the immediate future, and turned to the C aquifer as an alternative.

2.4.2.2 Groundwater Basins Near the Coal-Slurry Pipeline

Peabody investigated potential water sources along the coal-slurry pipeline. Again, the concept was to use the existing coal-slurry pipeline, which was to be retired and replaced, to convey water upstream to the mine. At the same time, Peabody evaluated the potential to purchase gray water from the City of Flagstaff. The City of Flagstaff had indicated that a portion of its potential capacity would be available, and with augmentation from groundwater, might supply enough water for the needs of the mines (a discussion of the gray water alternative is provided below). Peabody conducted a preliminary evaluation of the potential areas of groundwater production along the coal-slurry pipeline route for use in (1) augmenting Flagstaff gray water and (2) providing a stand-alone water supply that could be delivered using the existing coal-slurry pipeline after its replacement (URS Corporation 2003a).

As part of the investigation, the areas underlying the coal-slurry pipeline were partitioned into six zones. These zones generally, and in many cases specifically, were identified based on known hydrogeologic basins. None of the basins entirely underlie either the Hopi or Navajo Reservations. Certain areas in some of the groundwater basins that were studied exhibited good potential for groundwater development. However, with the exception of one zone, (Zone D), the Little Colorado River Plateau Hydrologic Basin, further investigations were deemed to be unjustified because of Arizona's present groundwater management code. Article 8, Title 45, of Arizona Revised Statutes (A.R.S.) governing the transportation of groundwater precludes transportation of groundwater between basins in the State of Arizona, unless approval is granted by the State legislature. There are certain exceptions to this rule, but none apply to the basins included in this evaluation.

Although there are provisions to allow other exceptions to the statute, further investigations were abandoned due to the uncertainty associated with a positive outcome in the legislature and the length of time it might take to get the exception.

Though considered, a water supply from groundwater basins along the coal-slurry pipeline was determined to be technically infeasible and eliminated from further study. Further investigation of the potential for a well field in Zone D was discontinued for the following reasons: (1) concerns voiced by ADWR about potential surface-water impact from significant additional groundwater development that could interfere with adjudication claims in the Little Colorado River water rights case; (2) questionable water quality and yield in the northern portion of the basin (total dissolved solids [TDS] of about 3,000 parts per million [ppm]); (3) proximity to sensitive springs (Blue Springs) if a well field were to be sited in the northern portion of the basin; (4) interference with existing users if a well field were to be sited in the southern portion of the basin; and (5) relatively high costs per acre-foot for well construction.

Peabody also investigated the potential for purchasing water from a source in the vicinity of Drake, Arizona, near enough to the coal-slurry pipeline that Peabody determined further investigations might be warranted. This source is believed to tap the Martin Limestone, an aquifer system known to produce large volumes of water of superior quality. However, this alternative was rejected for the same reasons previously discussed (trans-basin diversion and use issues), and because potential impacts on flow in the Verde River system were indicated.

2.4.2.3 Groundwater Sources Near the Black Mesa Complex

Peabody reevaluated the feasibility of supplementing water supplies at the Black Mesa Complex using the Dakota aquifer (D aquifer) (GeoTrans, Inc. 2001). Though considered, groundwater sources near the mines were eliminated from further study in this EIS based on the information summarized below.

Peabody investigated whether 500 af/yr could be pumped from the D aquifer from five wells. The D aquifer overlies the N aquifer and comprises four geologic formations—Morrison, Cow Springs, Entrada, and Dakota. For purposes of the investigation, all four formations were modeled as one hydrostratigraphic unit. Hydraulic properties were determined from previous studies conducted by Peabody (1999) and Stetson Civil & Consulting Engineers (1966). Pumping was assumed to be continuous at 500 af/yr (62 gallons per minute [gpm] for each of the five wells). The target pumping rate produced about 414 feet of drawdown at the well bore after 30 years of simulation. According to the model, after only two to three years, the wells would begin to interfere with each other. The results indicated that the feasibility of pumping the target volumes is low, due to the large drawdown relative to the available head in the D aquifer. In addition, the quality of D-aquifer water in the Black Mesa area makes it unsuitable for potable and coal-slurry uses due to elevated TDS. It could only be used for certain dust-suppression applications and would require a separate distribution system from the N-aquifer distribution system. Thus, previous conclusions were affirmed that the D aquifer in the vicinity of the Black Mesa Complex could not provide water of sufficient quantity and quality on a sustained basis to replace a significant portion of the current water supply. Nor could it provide the additional water needed for Alternative A (2,000 af/yr) or Alternative B (averaging 1,236 af/yr).

Peabody evaluated use of the N aquifer in areas outside of the Black Mesa Basin, under the premise that the aquifer might be used in areas where issues sensitive to the Hopi Tribe could be avoided regarding potential impact on springs and streams located in the Black Mesa Basin. Also, groundwater use by the Navajo Nation is less from the Black Mesa Basin than from other basins. The areas evaluated were the so-called "Northwest N aquifer" and the "Northeast N aquifer."

The Northwest N aquifer is the principal aquifer beneath the Kaibito Plateau. A northeast-trending groundwater divide occurs within the N aquifer along the southeastern margins of the Kaibito Plateau, roughly parallel to U.S. Highway 160 and passing close to Shonto, Arizona. Groundwater entering the N aquifer in this area flows either to the northwest, beneath the Kaibito Plateau and toward Lake Powell, or to the south and east toward the Black Mesa Basin. It is believed that this basin stores about 80 million acre-feet of very good quality water (URS Corporation 2001).

The Northeast N aquifer is located north and east of the Black Mesa Complex in the Blanding Hydrologic Basin. A 500-square-mile area of interest located west of Chinle Wash was evaluated. Surface drainage in this area is to the northeast in this area toward Chinle Wash, which ultimately drains to the San Juan River above Lake Powell. The area of interest was on the northeast side of the groundwater divide, north and east of the Black Mesa. Groundwater recharged along the divide flows either northeast toward the Blanding Basin and toward the San Juan River, or southeast toward the Black Mesa Basin. It is estimated that about 25 million acre-feet of very good quality water is stored in the area of interest (URS Corporation 2001).

Preliminary evaluations of water supplies from these two sources were performed, including estimating costs to develop delivery systems to the mines (URS Corporation 2001). The Northwest N- and Northeast N-aquifer alternatives were rejected primarily because preliminary feedback from the tribes indicated that they were uncomfortable using these portions of the N aquifer for mining uses at any location, regardless of the potential impact on tribal water supplies, springs, and streams. Furthermore, a review of potential conflicts associated with Colorado River water rights indicated potential issues that could preclude development of a well field in either the Northwest N or the Northeast N aquifers.

Both of these potential water sources are located in the Upper Colorado River Basin (URS Corporation 2002). Well fields developed in the Upper Basin that could be hydraulically connected to surface water could not be constructed unless the user demonstrated that the well field would not interfere with the existing appropriation of surface water for Arizona. Given the proximity of the Northwest N-aquifer study area to Lake Powell and the perennial reaches of Navajo and Kaibito Creeks, it is very possible that technical information would show that operation of a well field would consume groundwater that is tributary to the Colorado River, and the groundwater would have to be considered part of Arizona's 50,000 acre-foot allocation from the Upper Colorado River Basin. It is known that Lake Powell's waters recharge the N aquifer in the area in question, so hydraulic communication is documented. Arizona's allocation of Upper Colorado River Basin water is already consumed, so the portion of a new well field that removes surface water could not be authorized. The same situation applies, although to a lesser extent and probability, to the Northeast N aquifer via connectivity to perennial reaches of Chinle Wash.

2.4.2.4 Gray-Water Alternatives

Peabody evaluated the use of reclaimed sanitary wastewater from Flagstaff, Arizona, to supply at least a portion of the supply needed by the Kayenta and Black Mesa mining operations. Conceptual engineering and capital-cost analyses for this alternative were performed (URS Corporation 2003b). This alternative consisted of a new pipeline to deliver gray water from Flagstaff's Wildcat Hill Treatment Plant to the existing coal-slurry pipeline near Gray Mountain, Arizona, following U.S. Highway 89N.

Reclaimed water used for the coal-slurry system must meet "A+ Reclaimed Water" requirements as specified by the Arizona Administrative Code Title 18, Chapter 11, Article 3 (A.A.C. R 18-11-309). At the time this alternative was evaluated, Flagstaff was in the process of designing improvements to one of its wastewater treatment plants to bring the plant's effluent to this standard, and to another of its treatment plants to improve efficiency. The scope and cost of the improvements were not included in the report. However, Flagstaff had indicated that to obtain the water, the user would have to commit to financing the upgrades, including a pipeline between two of the treatment plants to accumulate the desired volume of water needed. The cost of the treatment plant upgrades was estimated to exceed $20 million. The pipeline that would have linked the city's two major treatment plants was estimated at another $2 to $3 million.

Initially, Flagstaff indicated that 4,388 acre-feet of gray water that was being discharged into the Rio del Flag would be available for use. By the time the report was prepared, the city revised its estimate of available water to 3,095 af/yr. This amount was based on treatment plant average monthly output in 2002, adjusted for existing and future use commitments the city had made (primarily for irrigation at local golf courses, schools, and parks). This amount assumed increases in future flow from the Flagstaff treatment systems attributable to growth. Removal of the future flow increase from the estimate resulted in approximately 2,552 af/yr available, based on 2002 output from the plants. Thus, the Flagstaff gray-water alternative had the potential to provide about 64 percent of Peabody's existing water requirement (4,000 af/yr) and about 43 percent of the future water requirement (6,000 af/yr) for Alternative A. In either case, it was insufficient to replace all of the water needed for coal transportation. Ultimately, Flagstaff committed a significant portion of the remaining available water to other users, rendering this alternative not viable. Gray water from Tuba City and Kayenta also was examined briefly as a supplement to Flagstaff water; however, the available quantities were small, and the total water available was insufficient to meet the water needs for the Black Mesa Project.

Gray water was not considered as an alternative water source for the Black Mesa Project under Alternative B or C. Of the total volume of water needed for Alternatives B and C (average of 1,236 af/yr), up to 731 af/yr of water would be needed for mine-related purposes and supplemented with up to 500 af/yr of water from the N aquifer (maintenance of well field). Considering the relatively small volume of water that would be needed under Alternative B or C (731 af/yr) compared to Alternative C (6,000 af/yr) and the high cost of and environmental impacts associated with constructing the water-conveyance system, the construction of such a system is unwarranted.

2.4.3 Water-Return Pipeline

Construction of a pipeline to return the slurry water to the mine once the water is separated from the coal at the Mohave Generating Station also was suggested as an option during scoping. However, about half the water in the coal slurry can be reclaimed and used for cooling and other purposes at the power plant, which reduces the plant's requirements for Colorado River water. Construction of a return pipeline would be very costly, and it still would be necessary to obtain additional water from another source, greatly increasing the cost of this option. For this reason, implementing the use of a water-return pipeline was determined to be economically infeasible and eliminated from further study in this EIS.

2.4.4 Alternative Coal Delivery Methods

In response to public comments, OSM evaluated alternative means of transporting the coal from the Black Mesa Mine to the Mohave Generating Station, including truck and rail delivery, and alternatives to water as a medium for the slurry.

2.4.4.1 Truck Transportation

As an alternative to transporting coal from the Black Mesa mining operation via slurry pipeline, OSM examined the feasibility of trucking the coal over existing roads and highways. Based on the analysis of a conceptual operations plan, trucking as an option was determined to be economically and technically impractical, as summarized below.

Costs for this alternative were estimated based on an examination of the year-round over-the-road operations that would be necessary to haul 5.4 million tons of coal from the Black Mesa mining operation to the Mohave Generating Station; the route considered included U.S. Highway 89, I-40, and State Highway 68. It was determined that the operations would require 592 truckloads of coal to be transported to the generating station (including 592 return trips) over those roads per day. This would be the equivalent of adding about one truck almost every minute for 24 hours a day, 7 days a week, in addition to the traffic that currently travels that route. Although the examination did not exhaustively investigate all conceivable costs involved, it did consider the potential impacts on communities along the route.

The truck volume that would be added to existing highways by the coal-haul operation was added to existing truck volumes to determine impacts on traffic (available from the 2003 Arizona Department of Transportation (ADOT) Highway Performance Monitoring System). A comparison of the percentage of existing traffic volumes to the percentage of traffic volumes with the trucking operation is presented in Map 2-6.

Map 2-6
Percentages of Existing Traffic Volumes, and Traffic Volumes with Trucking Operation

The comparison reveals that volumes would increase dramatically, especially on the two-lane highways at both ends of the route where percentages would increase by 25 percent to more than 100 percent. These increases would significantly alter the operational patterns of these highways, impacting public safety, road maintenance, and overall congestion.

Capital costs for the truck alternative, including upgrades to existing infrastructure and the acquisition of new equipment, would be approximately $2,737.2 million. Annual operating costs were estimated at approximately $271 million, and the annualized cost per ton of coal was estimated to be $103.86 (URS Corporation 2005a).

A comparison of the estimated costs of trucking with the estimated costs for reconstruction of the coal-slurry pipeline reveals that the capital costs and the annual operation and maintenance costs for trucking would be significantly greater, as shown in Table 2-7. The estimated costs of the trucking alternative include those associated with making substantial changes to the Mohave Generating Station in order to accept, handle, and burn dry coal rather than wet coal. However, use of dry coal at the Mohave Generating Station would require the facility to undergo a Prevention of Significant Deterioration (PSD) applicability determination that could result in the facility undergoing New Source Review under the Clean Air Act (CAA). This could result in a change of operations or the installation of additional air-pollution-control equipment to meet best available control technology (BACT) emission standards. The costs of any such additional air-pollution-control equipment or changes in operations required by air-permitting activities have not been included in the cost estimates cited above. Financing costs also were not included.

Table 2-7 Comparison of Estimated Costs for Transporting Coal by Truck and by Coal Slurry

Type of Cost	Trucking	Coal Slurry[1]
Capital cost ($ millions)	2,737.2	379.0 to 414.0
Power plant facilities conversion[2] ($ millions)	216.5	NA
Annual operation and maintenance ($ millions)	271.0	27.18 to 30.0[3]
Annualized cost per ton of coal[4]	103.86	13.47 to 14.67[3]

SOURCES: Black Mesa Pipeline, Inc. 2005; Southern California Edison Company 2005; URS Corporation 2005a

NOTES:
[1] Includes reconstruction of the coal-slurry pipeline and development of the C-aquifer well field and water-supply pipeline. The range of costs represents the 108-mile-long eastern route (and two pump stations) and 137-mile-long western route (and four pump stations) for the water-supply pipeline, and the 6,000 af/yr and 11,600 af/yr alternatives.
[2] Conversion of the Mohave Generating Station facilities to accept and burn dry coal.
[3] Includes cost of the coal-slurry pipeline ($24 million), annual water royalties to the Hopi Tribe and Navajo Nation ($5.4 million in 2006 dollars), and water-supply pipeline $3.18 to $6 million, based on the pipeline size and alternative route selected.
[4] The annualized cost per ton of coal is calculated from the annualized capital and operation and maintenance costs divided by the annual coal tonnage.
NA = not applicable

Finally, it should be recognized that, although not analyzed in detail, implementation of this alternative would entail serious adverse impacts such as disruption of local traffic patterns, traffic congestion particularly in commercial areas along the two-lane highways (U.S. Highways 160 and 89) and in the Laughlin area, public safety issues, noise from diesel engines and engine braking systems, and emissions from diesel engines and fugitive coal dust that would affect local air quality near roadways.

2.4.4.2 Rail Transportation

Over more than a decade, a number of studies have addressed the feasibility of using rail to transport coal from the Black Mesa Complex to the Mohave Generating Station (OSM 1990; USDI 1992, 1993; SCE 1994; Peabody 1997, 2003). The feasibility of delivering 5.4 million tons of coal from the Black Mesa mining operation to the Mohave Generating Station by a common-carrier railroad system—the BNSF Railway, the nearest major east-west rail line in the United States—was examined further for this EIS (Appendix E, URS Corporation 2005b). This potential option was found to be economically and technically impractical and was eliminated from further consideration as discussed below.

To reach the BNSF main line from the Black Mesa mining operations, a 164-mile-long rail spur would have to be constructed south to Winslow, Arizona. The spur would run southwest along U.S. Highway 160, pass south of Tuba City, then follow the Little Colorado River southeast to Winslow. To reach the Mohave Generating Station from the BNSF main line also would require the construction of a rail spur north from the main line. Two options were analyzed: (1) an eastern approach of 35 miles from Franconia, Arizona, and (2) a western approach of 23 miles from west of Needles, California. The study identified and developed conceptual railroad-spur alignments based on previous studies with revisions as needed (Map 2-7).

Capital costs for the railroad alternative include rail improvements, rail construction, rolling stock (i.e., locomotives, coal cars, etc.), and loading/unloading facilities at both ends of the rail line. Needed improvements to the BNSF's 267-mile-long main line from Winslow to the eastern approach at Franconia would include 30 miles of new third main line track, side tracks, control points, interlockings, bridges, grade crossings, culverts, land for rights-of-way, etc., which were estimated to cost $141.0 million. For the western approach (from the main line west of Needles), an additional cost of $9.7 million would be added to the main line improvement costs.

Map 2-7
Conceptual Railroad Spur Alignments

Capital construction costs for new spurs are estimated to be $821.1 million for the new spur from the Black Mesa to Winslow, $230.1 million for the eastern-approach spur from Franconia to the Mohave Generating Station, and $156.6 million for the western-approach spur from west of Needles to the Mohave Generating Station.

New facilities needed at Black Mesa would include a new conveyor system from the mine to a new load-out facility that would include a new coal-storage silo, new loop track, and a new unit train loading facility. New facilities at the Mohave Generating Station would include new unloading facilities, train-servicing facilities, and the Mohave Generating Station would need to be converted to enable burning of dry coal. The new cost of Black Mesa and Mohave Generating Station facilities would total $397.3 million, including the plant conversion.

The alternative would require substantial changes to the Mohave Generating Station in order to accept, handle, and burn dry coal rather than wet coal. As a result, use of dry coal at the Mohave Generating Station would require the facility to undergo a PSD applicability determination that could result in the facility undergoing New Source Review under the CAA. This could result in a change of operations or the installation of additional air-pollution-control equipment to meet BACT emission standards. The cost of any such additional air-pollution-control equipment or changes in operations required by air-permitting activities have not been included in the cost estimates cited above. Other capital start-up costs would include $67.5 million for four train sets (based on volume of coal transported, current train technology, and terrain encountered) plus spares consisting of 19 diesel locomotives and 550 gondola coal cars. The total capital cost would be $1,636.5 million and for the eastern approach to the Mohave Generating Station is $1,636.5 million and $1,572.7 million for the western approach.

Estimates of the annual operating and maintenance cost for each of the alternative approaches were based on (1) an annual operating expense of $0.015 per revenue ton-mile, (2) annual operating revenue to BNSF of $0.0032 per revenue ton-mile (operating revenue of $0.0185 per ton-mile minus operating expense of $0.0153 per ton-mile) (based on cost data from the Association of American Railroads Railroad Facts, 2004 Edition). The total cost for operation and maintenance of the alternative from the Black Mesa Complex to Mohave Generating Station from the east via Franconia is estimated at $43.1 million, and for the alternative approach from the west is estimated at $45.0 million.

The annualized cost per ton of coal, calculated from the annualized capital and operation and maintenance costs divided by the annual coal tonnage of 5.4 million tons, is estimated at $40.07 for the Black Mesa Complex to Mohave Generating Station approach from the east via Franconia and $39.18 for the alternative approach from the west.

A comparison of the estimated costs of delivering coal by rail with the estimated costs for reconstruction of the coal-slurry pipeline reveals that the costs for the rail option (without consideration of financing costs) are significantly greater, as shown in Table 2-8.

Table 2-8 Comparison of Estimated Costs for Transporting Coal by Rail and by Coal Slurry

Type of Cost ($ millions)	Western Approach Railroad	Eastern Approach Railroad	Coal Slurry
Capital cost			
Slurry pipeline reconstruction[1]	NA	NA	200.0
Water-supply system construction[2]	NA	NA	179.0 to 214.0
BNSF mainline improvements	150.7	141.0	NA
New spur from Black Mesa to Winslow	821.1	821.1	NA
New spur to Mohave Generating Station	156.6	230.1	NA
Unit train equipment (four train sets and spares)	67.5	67.5	NA
New facilities at load out and power plant including dry coal conversion	397.3	397.3	NA
Total capital cost	1,572.7	1,636.5	379.0 to 414.0
Annual operation and maintenance	45.0	43.1	27.18 to 30.02
Annualized cost per ton of coal[3]	40.07	39.18	13.47 to 14.672

SOURCE: URS Corporation 2005b

NOTES: [1] Includes coal-slurry pipeline ($24 million), annual water royalties to the Hopi Tribe and Navajo Nation ($5.4 million), and water-supply system $3.18 to $6 million, based on the pipeline size and alternative route selected.

[2] Includes well field, and the range represents the 108-mile-long eastern route (and two pump stations) and 137-mile-long western route alternative (and four pump stations) water-supply pipeline routes, and the 6,000 af/yr and 11,600 af/yr alternatives.

[3] The annualized cost per ton of coal was calculated from the annualized capital and operation and maintenance costs divided by the annual coal tonnage.

BNSF -= BNSF Railway

NA = not applicable

The examination of the railroad option also revealed technical challenges. For example, in several locations, the maximum railroad gradient would exceed the 1.5 percent maximum specified in the design criteria. This would present challenges that might or might not be resolved with engineering. Population growth around Laughlin and Bullhead City has resulted in substantial residential and commercial development, and more development is planned. This would present challenges in acquiring rights-of-way for the rail spur to the power plant. With these unknowns, this option was deemed to be technically infeasible as well.

Although not analyzed in detail, implementation of this alternative also would entail serious adverse impacts including impacts on safety, residential and commercial developments in the Laughlin and Bullhead City area, and nearby recreation areas, as well as impacts from noise and increased diesel-engine emissions and fugitive coal dust. Other issues associated with construction and operation of the rail spurs would include potential impacts on cultural resources, including traditional cultural properties, wetlands, special status species, big game, and visual resources.

2.4.4.3 Other Media for Slurry

The use of methanol as a medium to transport coal to the Mohave Generating Station was suggested as an alternative to using water in the slurry. In a previous study, methanol, methane (CH_4), and carbon dioxide (CO_2) were considered for this purpose (USDI 1992). Transporting coal mixed with any one of these has not been studied in detail, and the technology remains unproven. For this reason, the use of methanol, CH_4, or carbon dioxide was determined to be technically infeasible at this time and was eliminated from further study in this EIS.

No commercial pipelines employ these technologies, nor have tests of these technologies been conducted. A test project would have to be constructed and operated before any of these media could be considered as a replacement for the coal-slurry. Tests would be required to provide the operating and cost data needed to design these commercial facilities and estimate their costs with an accuracy acceptable to an investor.

Even without the benefit of tests, several issues make methanol, CH_4, and CO_2 operationally difficult and costly alternatives to water. Methanol could be produced at the mine by combining coal and water; however, making methanol would require more water than the coal-slurry pipeline would use (USDI 1992). Particulate pollution and the potential for explosion are other drawbacks to this option. Transporting the coal using CH_4 or CO_2 would require that coal be ground into even finer particles than it would be for the slurry. Methane and CO_2 both would require special handling—coal preparation might have to be completed in an inert atmosphere, and similar handling could be required at the Mohave Generating Station. Also, the coal combined with CH_4 could potentially cause combustion or explosion. The use of water eliminates the potential for particulates, combustion, or explosion.

In addition, these three alternatives to water would require substantial modifications in coal preparation, pumping, pipeline design, dewatering, and power plant facilities. They would require construction and operation of production and storage facilities at the mine. The pipeline would have to be designed to contain the pressure required for CO_2. Provisions would have to be made for venting or selling CO_2, a greenhouse gas, once that gas was separated from the coal at the power plant. Finally, Mohave Generating Station's fuel-handling equipment and boilers, at a minimum, would require substantial modification to burn coal conveyed by methanol, CH_4, or carbon dioxide.

Transporting coal with any type of gas would require substantially higher velocities than it does with water. As a result, the erosiveness of the coal-and-gas mixture could present a potential risk of pipeline failure. The high velocities in the pipeline also could "grind" the coal into finer particles making the ash after combustion more difficult to capture. Thus, there could be greater potential emissions of particulate matter equal to or less than 10 microns in diameter (PM_{10}).

2.4.5 No Coal-Washing Facility

Comments received during scoping suggested that washing the coal before it is mixed into slurry is a waste of water and the coal-washing facility therefore should not be constructed.

Under Alternative A, Peabody would build a coal-washing facility to clean the coal mined from the Black Mesa mining operation to remove rock and mineral matter in order to meet coal-quality requirements for the Mohave Generating Station. Originally, the boilers at the Mohave Generating Station were designed to accept coal with 8.9 percent ash content. As the ash content increases, plant downtime and maintenance increase, resulting in decreased plant efficiency. For the past 19 years, the power plant has burned coal with an ash content averaging 10.1 percent (an annual high of 10.43 percent and an annual low of 9.79 percent). The average ash content for the first 16 years of the LOM revision is projected to increase to 11.75 percent. For the power plant to operate in a manner that is efficient and economically feasible, the coal must be washed to maintain a 9 percent or less ash to conform to the plant's boiler specifications (Lehn 2005). Replacing the boilers to enable them to burn efficiently also would entail replacing all the associated equipment such as pulverizers, air preheaters, etc. Also, the ash handling, ash disposal, foundations, etc., would have to be changed or modified to handle the high ash content. Thus, the cost for this alternative probably would be in the range of $800 million to $1 billion.

The water recovered after washing the coal would be reused. Since the coal-ash content would be reduced by the coal-washing process, the quantity of water required for delivering 9-percent-ash coal to the Mohave Generating Station would be less than the volume needed to deliver an equivalent quality of 11.75 percent ash coal in terms of British thermal units (BTUs). Moving the equivalent in a decreased usage of water estimated at about 100 to 150 af/yr of water.

After washing, the water remaining on the recovered coal and refuse must be removed to reduce handling problems and recover the water for conservation and reuse in the preparation plant. Initial start-up of the preparation plant would require approximately 330 acre-feet. Thereafter, on an annual basis, water entering the plant as surface moisture on the 6.35 million tons of run-of-mine coal would be approximately 47 acre-feet. Water leaving the plant as surface moisture on the product coal (5.4 million tons) would amount to approximately 140 af/yr as surface moisture at 3.5 percent. Water leaving the plant as surface moisture on the coarse refuse (7.0 percent) and fine refuse (40.0 percent) would amount to approximately 226 af/yr. Due to more water leaving the preparation plant (processed coal and refuse) than entering (run-of-mine coal), this would result in a deficit of about 319 acre-feet of water. Therefore, make-up water demand on an annual basis for the preparation plant would be about 319 acre-feet plus an additional 5 acre-feet to offset losses due to evaporation, totaling 324 af/yr. In summary, some of this water would be lost to the atmosphere due to evaporation. However, the water not lost to evaporation would mean less water would be needed for the slurry. An annual water use of 500 af/yr for the coal-washing facility was estimated for the purpose of developing conservative water-use scenarios associated with groundwater modeling and impact projections.

2.4.6 Alternative Energy Sources and Energy Efficiency

Some participants in the Black Mesa Project scoping process pressed for consideration of energy conservation and development of alternative energy sources. Because this EIS is a response to Peabody's application to revise the mining plans for the Black Mesa Complex to develop its coal leases, these concerns are outside the scope of OSM's and the cooperating agencies' authority and the scope of this EIS. However, the concerns have been addressed in a separate study conducted in accordance with California Public Utilities Commission Decision 04-12-016, issued on December 2, 2004. The study evaluates potential alternatives to, or complementary energy resources for, the Mohave Generating Station.

The Final Study Report, issued by SCE in February 2006, considered the following generation resources: (1) integrated coal gasification/combined cycle (with CO_2 capture and storage), (2) reflective solar dish, (3) wind, (4) natural-gas-fired combined cycle, and (5) other renewable resources (e.g., biomass or photovoltaics). Energy efficiency also was considered as an option. The report is available from SCE.

2.4.7 Construction of the C Aquifer Water-Supply System

Construction and operation of the C aquifer water-supply system was considered for Alternatives B and C. The C aquifer water-supply system would be constructed and up to 6,331 af/yr of C-aquifer water would be withdrawn: up to 731 af/yr of water for mine-related purposes and up to 5,600 af/yr for tribal use (2,000 af/yr for the Hopi Tribe and 3,600 af/yr for the Navajo Nation). As in Alternative A, a minimum of 12 wells would be developed in the well field near Leupp, Arizona, to produce the 6,331 af/yr of C-aquifer water. The N aquifer would continue to supply up to 500 af/yr of water for mine-related and public uses and also would serve as an emergency standby source in case of interruptions or curtailments of the C-aquifer water supply for an extended period of time. When no longer needed for mine-related purposes, the 731 af/yr of water would be used by the Navajo Nation. Pumping the C aquifer by the tribes would continue for an estimated 50-year life of the pipeline (until 2060).

The cost to construct, operate, and maintain a C aquifer water-supply system to supply 731 af/yr of water to the Black Mesa Complex would be very expensive. As discussed in Section 2.2.1.3, the cost of a C aquifer water-supply system under Alternative A to supply 6,000 af/yr of water to the Black Mesa Complex would range from $187.6 to $225.4 million. Although the cost of constructing a 731-af/yr water-supply system would be somewhat lower that the cost of constructing a 6,000 af/yr water-supply system, the cost would still be very high. Considering the relatively small amount of C-aquifer water that would be needed under Alternatives B and C (731 af/yr) and the expense of the system, the construction, operation, and maintenance of a C aquifer water-supply system under Alternatives B and C would be economically infeasible.

2.4.8 Reduced-Mining Alternative

Comments on the Draft EIS requested that OSM analyze a Reduced-Mining Alternative under which coal production would be reduced, and the water needed for the project would be obtained from alternative water sources other than the N aquifer, such as the Colorado River, groundwater basins near the coal-slurry pipeline, and gray water from Flagstaff and Phoenix.

The amount of coal produced under Alternatives B and C (8.5 million tons per year) would be less than what would be produced under Alternative A (a total of 14.85 tons per year) and therefore would require less water. Production of 8.5 million tons per year cannot be reduced, as this is the amount that is needed for the Navajo Generating Station to operate efficiently. Producing less than 8.5 million tons of coal per year would not meet the purpose and need of the project to supply coal to the Navajo Generating Station. The Kayenta mining operation is the sole supplier for the Navajo Generating Station, and the Navajo Generating Station is its sole customer.

2.4.9 Hybrid Water Alternative

Comments on the Draft EIS requested that OSM analyze a Hybrid-Water Alternative that would combine portions of various water sources, such as gray water from Tuba City, Flagstaff, or Phoenix supplemented by D-aquifer water. This alternative would overcome the shortfall of gray water from Flagstaff and water from the D aquifer alone, instead of combining the two to sufficiently provided water for coal-slurrying purposes. In addition, the commenters noted that OSM did not consider alternatives that adopt reclamation technologies to reduce the total amount of water needed, regardless of the source.

The construction of a multisource gray and nongray water system would be prohibitively expensive. For reclaiming areas disturbed by mining activities, Peabody uses arid-land revegetation techniques and native vegetation species for revegetation because they are adapted to the semidesert environment at the Black Mesa Complex. Peabody takes advantage of natural precipitation by executing seeding and mulching operations immediately prior to the monsoon rain season; no supplemental irrigation or additional water is required or used during the seeding, planting, and mulching operations.

2.4.10 <u>No Mining Alternative</u>

Comments on the Draft EIS indicated that OSM did not address an alternative that disallows mining at the Black Mesa Complex.

Ending mining at the Black Mesa Complex is not an option at this time. As stated under Alternative C, the disapproval alternative, the Kayenta mining operation has OSM-approved mining, operation, and reclamation plans that allow it to produce all of the coal needed by the Navajo Generating Station through 2026. Contractually, the Kayenta mining operation is the sole supplier of coal for the Navajo Generating Station, and the Navajo Generating Station is its sole customer.

2.4.11 <u>New Customer for Black Mesa Coal Alternative</u>

Comments on the Draft EIS requested that OSM assess the impact of supplying the coal (6.35 million tons per year), planned for delivery to the Mohave Generating Station under Alternative A, to an alternative customer.

At this time, Peabody has not indicated that new customers are being considered for the coal from the Black Mesa mining operation. Although, under Alternative B, the unmined coal resources would be incorporated into the permanent program permit area, mining of these coal resources would not be authorized until Peabody proposed that these resources be mined and BLM and OSM approved this mining. Without knowing a new customer's purpose and need for purchasing and using the coal, the amount and quality of coal needed per year, and a plan for mining and transporting the coal, impacts associated with the potential transaction cannot be projected. If and when there is such a proposal, associated actions (e.g., BLM and OSM review of mining plan and mine operation and reclamation plan revisions, development and construction of a means of transportation of the coal to its destination) will require review under NEPA.

2.4.12 <u>No-Sacred-Springs-or-Sites Alternative</u>

Comments on the Draft EIS recommended that OSM consider an alternative that permits mining only in areas that do not destroy or deface springs and sites that are sacred to tribal communities.

The 20-year Black Mesa Archaeological Project, conducted between 1967 and 1986, fulfilled OSM's obligations under Section 106 of the NHPA for the Black Mesa Project. Pursuant to terms and conditions of the current LOM Permit AZ-0001D that OSM renewed on July 6, 2005, Peabody continues to take into account any sacred and ceremonial sites brought to the attention of Peabody by local residents, clans, or tribal government representatives of the Hopi Tribe and Navajo Nation (Special Condition 1). Because impacts on any sacred springs and seeps are being addressed pursuant to that permit condition, development of another alternative is unwarranted.

2.4.13 <u>Lower-Emissions Coal Power Generation Alternative</u>

Comments on the Draft EIS suggested that there is lack of analysis of an alternative requiring that Black Mesa coal be burned in a "clean coal plant," "which the Navajo Generating Station clearly is not."

Contractually, the Kayenta mining operation is the sole supplier of coal for the Navajo Generating Station, and the Navajo Generating Station is its sole customer. The Kayenta mining operation has OSM-approved mining, operation, and maintenance plans that allow it to produce all of the coal needed by the Navajo Generating Station through 2026. There are no decisions to be made regarding the Navajo Generating Station. Therefore, an alternative to address lower-emissions coal power generation is outside the scope of this EIS.

2.4.14 No-Relocation Alternative

Comments on the Draft EIS suggested that OSM consider an alternative that would allow mining in areas that would not require relocation of Navajo households.

Under Alternative A, 17 residences (households) on the Navajo partitioned land and/or exclusive Navajo surface land would need to be resettled through 2026. Under Alternative B, 5 residences would be relocated through 2026 and, if mining continues beyond 2026, an 11 additional residences would be relocated through approximately 2040 when Peabody would reach the 670-million-ton total specified in the lease agreement. These residences are all within the leased area. The lease agreement is between the Navajo Nation and Peabody and, when the need to resettle residences due to mining activities becomes necessary, Peabody coordinates with the Navajo Nation. These households have three choices: (1) move to a place of their choice on or near their customary use area with which the tribe and Peabody concur (i.e., where future mining would not require another move); (2) move elsewhere on the reservation outside of Black Mesa; or (3) accept cash and move on their own. Peabody would pay for the move (or pay cash) one time.

OSM has no authority over the coal-mining leases and, therefore, has no decision authority over resettling residences.

2.5 COMPARISON OF ALTERNATIVES

Table 2-9, at the end of this chapter, is a summary of selected issues and concerns identified through the scoping process for the EIS and the magnitude of impacts that would occur under the three alternative actions. Given an understanding of the project actions proposed (see description of the project in Sections 2.1 and 2.2 and Appendix A) and the inventoried resource information reflecting the existing environment (Chapter 3), each resource was assessed to determine the impacts that could result from the project (Chapter 4). The levels of impacts summarized in Table 2-9 (and in Chapter 4) reflect the incorporation of measures that render the impacts less intense or severe. These measures include best management practices, conservation measures, and other mitigating measures the applicants commit to employ; are part of the project description and are described in Chapter 4 (see Section 4.18) and Appendix A.

2.6 AGENCIES' PREFERRED ALTERNATIVE

The lead and cooperating agencies' preferred alternative is Alternative B, approval of Peabody's 2008 LOM revision, which includes adding 18,857 acres to the permanent permit area, revising the operation and reclamation plan, approving changes to the mining plan for the Hopi and Navajo coal leases, and using an average of 1,236 af/yr of N-aquifer water. Coal would no longer be supplied to the Mohave Generating Station from the Black Mesa Complex. Approval of the LOM revision would incorporate the unmined coal-resource areas from the initial Indian Lands Program area into the permanent permit area; however, approval of the LOM revision would not authorize mining of those coal-resource areas.

Table 2-9 Summary of Impacts by Alternative

Issue or Concern		Alternative A	Alternative B	Alternative C
Landforms and Topography				
Impact on landforms and topographic diversity	Black Mesa Complex	Permanent impact for 12,409 acres, but the disturbance is mitigated by site restoration because of the new landscape constructed; minor long-term impact.	Permanent impact for 6,942 acres, but the disturbance is mitigated by site restoration because of the new landscape constructed; minor long-term impact.	Same as Alternative B.
	Coal-slurry pipeline	No short- or long-term impact anticipated where reconstruction would be in existing right-of-way; negligible to no short- or long-term impact along the Moenkopi Wash realignments and Kingman reroute.	NA	NA
	Water-supply system	Negligible to no short- or long-term impact anticipated along the eastern route; minor short- and long-term impact along the western route where more topographic relief would be crossed (e.g., Red Rock Cliffs, Ward Terrace, Coal Mine Canyon).	NA	NA
Geology and Minerals				
Impacts on geological resources	Black Mesa Complex	Existing geology in upper 250 feet of mined areas (12,409 acres) would be disturbed permanently, but the disturbance is mitigated by site restoration because of the new landscape constructed; minor long-term impact.	Permanent impact for 6,942 acres in the upper 250 feet of mined area; minor long-term impact.	Same as Alternative B.
	Coal-slurry pipeline	No impact on geological resources anticipated (either route).	NA	NA
	Water-supply system (infrastructure)	No impact on geological resources anticipated (either route).	NA	NA
Impacts on mineral resources of economic value (coal, uranium and vanadium, oil and gas)	Black Mesa Complex	*Coal:* Coal resources in the Wepo Formation would be produced for economic purposes; no impact on coal resources below 250 feet (Toreva and Dakota Sandstone formations). *Other minerals:* No impact on other mineral of economic value anticipated.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
	Coal-slurry pipeline	No impact anticipated (either route).	NA	NA
	Water-supply system (infrastructure)	No impact anticipated (either route).	NA	NA
Impacts on paleontological resources	Black Mesa Complex	No impact on unique and important fossil specimens anticipated.	No impact on unique and important fossil specimens anticipated.	No impact on unique and important fossil specimens anticipated.
	Coal-slurry pipeline	No impact on unique and important fossil specimens anticipated (either route).	NA	NA
	Water-supply system (infrastructure)	No impact on unique and important fossil specimens anticipated (either route).	NA	NA
Soils				
Impacts on soil productivity	Black Mesa Complex	Permanent for 13,529 acres, improved productivity long term.	Permanent for 8,062 acres, improved productivity long term.	Same as Alternative B.
	Coal-slurry pipeline	Minor impact anticipated in the short and long term (either route).	NA	NA
	Water-supply system (infrastructure)	Minor impact anticipated in the short and long term (either route).	NA	NA
Water Resources (Hydrology)				
Degradation of surface water quality from discharges and sediment contribution	Black Mesa Complex	Negligible; impacts would be infrequent and small magnitude.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Negligible to no impact anticipated in the short term; no impact in the long term (either route).	NA	NA
	Water-supply system (infrastructure)	Negligible to no impact anticipated in the short term; no impact in the long term (either route).	NA	NA
Changes in stream-channel morphology	Black Mesa Complex	Negligible; impacts of the mine drainage system on the natural stream patterns would be mostly temporary and confined to the Black Mesa Complex.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Negligible impact anticipated in the short term; no impact in the long term.	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
	Water-supply system (infrastructure)	Negligible impact anticipated in the short term; no impact long term.	NA	NA
Impacts on volume of stream flow	Black Mesa Complex	The change in stream flow is so small that it would be difficult to measure, leading to the conclusion that there would be negligible impact from surface-water diversion, impoundments, and sediment ponds on the Black Mesa Complex.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	No impact anticipated in the short and long term.	NA	NA
	Water-supply system (infrastructure)	No impact anticipated in the short and long term.	NA	NA
Impacts on the Wepo and alluvial aquifer levels and water quality	Black Mesa Complex	• Some minor impact on local groundwater levels in coal seam and shallow alluvial aquifers anticipated during mining; however, the impact would lessen after reclamation is complete. • Impact on shallow groundwater due to mine dewatering would be negligible. • Reduction in recharge would be immeasurable; therefore, negligible to no impact anticipated on the quantity of recharge on alluvial aquifers. • Chemical reaction of groundwater with spoil material could result in moderate to minor water-quality impacts on local wells, increasing levels of salinity and trace elements to a level that decrease usability. Peabody would be required to provide alternative water supplies to any wells rendered unusable. • Any poor-quality water discharges into streams would be diluted to negligible levels since streams generally flow only	Similar to Alternative A, but for a smaller area.	Same as Alternative B.

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
		after precipitation events. • Negligible to no impact from infiltration of surface-water runoff; runoff from mine facilities using petroleum products and hazardous materials treated with stormwater pollution prevention structures (and SPCC plan in place) are not allowed to infiltrate groundwater.		
	Coal-slurry pipeline	Negligible to no impact anticipated in the short and long term.	NA	NA
	Water-supply system (infrastructure)	Negligible to no impact anticipated in the short and long term.	NA	NA
Impacts of groundwater pumping	C aquifer	*Pumping costs (6,000 af/yr):* Negligible impact anticipated in the short and long term. *Pumping costs (11,600 af/yr):* Negligible impact anticipated in the short and long term.	NA	NA
		Reduction in aquifer thickness (6,000 af/yr): Negligible impact anticipated during mining; no impact after mining. *Reduction in aquifer thickness (11,600 af/yr):* Negligible impact anticipated during and after mining.	NA	NA
		Streams and springs (6,000 af/yr): Negligible impact anticipated during mining; no impact after mining. *Streams and springs (11,600 af/yr):* Negligible impact anticipated during mining; negligible after mining.	NA	NA
		Water quality (6,000 af/yr): No impact anticipated during or after mining. *Water quality (11,600 af/yr):* No impact anticipated during mining; negligible after mining.	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
	N aquifer	*Pumping costs:* Negligible impact anticipated during mining; no impact after mining for 505-af/yr and 2,000-af/yr pumping scenarios. Minor impact anticipated during mining, no impact anticipated after mining for 6,000-af/yr pumping scenario.	Negligible impact anticipated in the short term; no impact in the long term.	Same as Alternative B.
		Streams and springs: Negligible impact anticipated during mining; no impact after mining.	Negligible impact anticipated in the short term, no impact in the long term.	Same as Alternative B.
		Water quality: No impact anticipated during mining for 505 af/yr and 2,000-af/yr pumping scenarios. Minor impact anticipated during mining; no impact in the long term for 6,000-af/yr pumping scenario.	No impact anticipated in the short and long term.	Same as Alternative B.
Climate				
Impacts on macroclimate and microclimate	Region	Negligible impact anticipated in the short term.	Same as Alternative A.	Same as Alternative A.
Air				
Impacts of particulate matter (PM_{10}) from mining activity; PM_{10}, criteria and hazardous air pollutants, and greenhouse-gas emissions from vehicle and equipment exhaust	Black Mesa Complex	Minor impact anticipated locally; negligible regionally.	No increase in emissions.	No increase in emissions.
Impacts of particulate matter from mining activity; PM_{10}, criteria and hazardous air pollutants, and greenhouse-gas emissions from vehicle and equipment exhaust	Coal-slurry pipeline and water-supply system	Minor impact anticipated locally and negligible regionally during construction (two years); negligible to no impact in the long term.	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
Vegetation				
Impacts on vegetation structure and composition	Black Mesa Complex	Major impact anticipated in the short and long term; generally beneficial impacts result from reclamation.	Similar to Alternative A, but for asmaller area.	Same as Alternative B.
	Coal-slurry pipeline	Major impact anticipated in the short term; minor in the long term; moderate in the long term for piñon/juniper woodland (either route).	NA	NA
	Water-supply system	*C-aquifer well field:* Moderate to minor impact anticipated in the short term; minor in the long term. *Other C aquifer water-supply system infrastructure:* Major impact in the short term; minor in the long term (either route).	NA	NA
Impacts on species diversity	Black Mesa Complex	Minor impact anticipated in the short and long term.	Similar to Alternative A, but for smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Minor to negligible impact anticipated in the short and long term.	NA	NA
	Water-supply system (infrastructure)	Minor to negligible impact anticipated in the short and long term.	NA	NA
Impacts on culturally important species	Black Mesa Complex	Moderate impact anticipated during operations; minor to moderate impact anticipated (depending on how easily species reestablish) following reclamation.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Minor impact anticipated in the short and long term.	NA	NA
	Water-supply system (infrastructure)	Minor impact anticipated in the short and long term.	NA	NA
Impacts on riparian vegetation	Black Mesa Complex	Minor impact anticipated in the short term; negligible in the long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Negligible short and long term (either route).	NA	NA
	Water supply	*C-aquifer pumping (6,000 af/yr):* No impact. *C-aquifer pumping (11,600 af/yr):* No	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
		impact anticipated in the short term; minor in the long term		
		N-aquifer pumping: Minor impact anticipated in the short and long term.	Same as Alternative A.	Same as Alternative A.
		C-aquifer water-supply system infrastructure (either route): Negligible impact anticipated in the short and long term.	NA	NA
Impacts of noxious weeds and invasive species	Black Mesa Complex	Minor impact anticipated in the short and long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Minor impact anticipated in the short and long term (either route).	NA	NA
	Water-supply system (infrastructure)	Moderate to minor impact anticipated in the short and long term (either route).	NA	NA
Impacts on threatened, endangered, and special status species	Black Mesa Complex	No impact.	No impact.	No impact.
	Coal-slurry pipeline	Minor to negligible short and long term (either route).	NA	NA
	Water-supply	*C aquifer water-supply system infrastructure (either route);* Minor to no impact short and long term (either route).	NA	NA
		N-aquifer pumping: Minor to negligible impact on Navajo sedge	Same as Alternative A.	Same as Alternative A.
Fish and Wildlife				
Impacts on terrestrial habitats and wildlife	Black Mesa Complex	*Woodland:* Major during operations, moderate following reclamation. *Nonwoodland:* Major short term, moderate and beneficial long term. *Rock outcrop:* Major short term, moderate to minor long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Major impact anticipated in the short term; moderate impact anticipated in the long term (either route).	NA	NA
	Water-supply system (infrastructure)	Major impact anticipated in the short term, moderate long term (either route).	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts on game species and burros	Black Mesa Complex	No impact.	NA	NA
	Coal-slurry pipeline	Moderate to minor impact anticipated in the short term; negligible in the long term (either route).	NA	NA
	Water-supply system (infrastructure)	No impact.	NA	NA
Impacts on bighorn sheep	Black Mesa Complex	NA	NA	NA
	Coal-slurry pipeline	Major to moderate impact anticipated in the short term; minor to negligible in the long term (either route).	NA	NA
	Water-supply system (infrastructure)	NA	NA	NA
Impacts on raptors	Black Mesa Complex	*Woodland:* Minor impact anticipated in the short term; moderate to minor impact in the long term. *Open country:* Minor impact anticipated in the short term; moderate and beneficial in the long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Minor impact anticipated in the short and long term (either route).	NA	NA
	Water-supply system (infrastructure)	Minor impact anticipated in the short term and negligible in the long term (either route).	NA	NA
Impacts on riparian habitats and species	Black Mesa Complex	Minor to negligible impact anticipated in the short term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Negligible to no impact anticipated in the short and long term (either route).	NA	NA
	Water-supply system (infrastructure)	Negligible to no impact anticipated in the short and long term (either route).	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts on aquatic habitats and species (including impoundments on Black Mesa Complex)	Black Mesa Complex	Beneficial short and long term due to development of impoundments and planting vegetation at impoundments..	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Minor to negligible short term, no impact long term (either route).	NA	NA
	Water-supply System (infrastructure)	Minor short term, negligible long term (either pipeline route)	NA	NA
Impacts on threatened and endangered	Black Mesa Complex	Minor to no impact short and long term; Minor to negligible impact on Mexican spotted owl.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Minor to no impact short and long term (either route).	NA	NA
	Water supply	*C-aquifer pumping (6,000 af/yr):* No impact. *C-aquifer pumping (11,600 af/yr):* No impacts anticipated in the short term; minor to moderate in the long term on Little Colorado River spinedace and roundtail chub; minor to negligible impact anticipated on Southwest willow flycatcher. *N-aquifer pumping:* No impact anticipated in the short term; minor in the long term. *C-aquifer water-supply system infrastructure (either route):* No impact.	NA	NA
Impacts on other special status species	Black Mesa Complex	Minor to negligible impact anticipated in the short and long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Moderate to no impact anticipated in the short term; negligible to no impact anticipated in the long term (either route).	NA	NA
	Water-supply system (infrastructure)	Moderate to no impact anticipated in the short term; negligible to no impact anticipated in the long term (either route).	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
Land Use				
Impacts on residential uses	Black Mesa Complex	Impacts from relocation of 17 residences (households) have potential to be major.	Impacts from relocation of five residences (households) have potential to be major.	Same as Alternative B.
	Coal-slurry pipeline	*Existing route:* Level of impact varies depending on population density. During construction, structures (residences or outbuildings) would be avoided, but temporarily impeded access and ground disturbance of properties could result in minor to no impacts. Route passes through dense land uses in Kingman and Laughlin areas. Negligible to no impact anticipated in the long term. *Existing route with realignments:* Impacts would be similar to the existing route except the Kingman reroute would avoid higher-density residential areas. The reroute would pass adjacent to three low- to moderate-density residential areas. Minor to no impacts anticipated in the short term. Negligible to no impact anticipated in the long term.	NA	NA
	Water-supply system (infrastructure)	*Eastern route:* Minor to negligible impact anticipated in the short term; no impact in the long term. The subalternative that passes through Kykotsmovi would affect an area of greater density than the subalternative that bypasses Kykotsmovi. *Western route:* Generally the same as the eastern route.	NA	NA
Impacts on livestock grazing and agriculture	Black Mesa Complex	Moderate impacts anticipated due torelocation of 17 residences (households) during mining activities and reclamation. Livestock grazing improved after reclamation.	Similar to Alternative A, but relocation of five residences (households) and less land would be mined and reclaimed (loss of opportunity for improved livestock grazing).	Same as Alternative B.

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
	Coal-slurry pipeline	Minor to negligible impacts would result from impeded access and property disturbance during construction. Negligible to no impact in the long term (either route).	NA	NA
	Water-supply system (infrastructure)	*Eastern route:* Minor impact anticipated in the short term. Negligible to no impact in the long term. *Western route:* Impacts would be similar to eastern route, but because the route is longer, more forage would be removed during construction. Minor impact anticipated in the short term; no impacts in the long term.	NA	NA
Impacts on commercial and industrial uses	Black Mesa Complex	No impact.	Same as Alternative A.	Same as Alternative A.
	Coal-slurry pipeline	*Existing route:* Minor to negligible impact would result from impeded access and property disturbance during construction; negligible to no impact in the long term. *Existing route with realignments:* Short-term impacts would be similar to existing route; negligible to no impacts in the long term.	NA	NA
	Water-supply system (infrastructure)	No impact.	NA	NA
Impacts on archaeological and historical resources	Black Mesa Complex	Minor impact anticipated.	No impact.	No impact.
	Coal-slurry pipeline	Moderate impact anticipated (either route).	NA	.NA
	Water-supply system	*Continued use of N aquifer (any volume):* No impact. *C-aquifer well field:* Minor impact anticipated. *Other C aquifer water-supply system infrastructure (either route):* Moderate impact anticipated.	*Continued use of N aquifer (any volume):* No impact. *C-aquifer well field:* No impact. *Other C aquifer water-supply system infrastructure (either route):* Moderate impact anticipated. No impact.	Same as Alternative B.

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts on traditional cultural resources (including human burials)	Black Mesa Complex	*Coal mining:* Moderate impact anticipated. *Coal-haul road:* No impact.	Same as Alternative A.	Same as Alternative A.
	Coal-slurry pipeline	Moderate impact anticipated (either alternative route).	NA	NA
	Water-supply system	*Continued use of N aquifer (any volume):* No impact. *C-aquifer well field:* Minor impact anticipated. *Other C aquifer water-supply system infrastructure (either alternative route):* Moderate impact anticipated.	*Continued use of N aquifer (any volume):* No impact. *C-aquifer well field:* No impact. *Other C aquifer water-supply system infrastructure (either alternative route):* No impact.	Same as Alternative B.
Social and Economic Conditions				
Impacts on employment and income	Black Mesa Complex	• Major beneficial short term (resumption of Black Mesa mining operation). • Major adverse long term (upon cessation of all mining, which would occur regardless of the proposed action). • Both short term and long term, other jobs and income that result from multiplier effects would be affected. • Minor beneficial, temporary (2 years), during the coal-washing facility construction phase. • Minor beneficial income effect from improved grazing forage yields on reclaimed land.	• Major adverse, long-term impact anticipated (upon cessation of mining – Kayenta mining operation only, which would occur regardless of the proposed action). • Both short- and long-term impact anticipated, other jobs and income that result from multiplier effects would be affected. • Minor beneficial (less than Alternative A) income effect from improved grazing forage yields on reclaimed land.	Same as Alternative B.
	Coal-slurry pipeline	Beneficial, short-term (two years) impact anticipated during construction. Major impact anticipated in the local area; moderate in the region.	NA	NA
	Water-supply system (infrastructure)	If C aquifer water-supply system constructed, beneficial, short-term (two years) impact anticipated during construction. Major impact anticipated in the local area (either route); moderate in the region.	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
		If C aquifer water-supply system constructed, minor short-term impact anticipated during operations.		
Impacts on revenue to governmental entities	Black Mesa Complex	• Major beneficial impact anticipated in the short term (resumption of Black Mesa mining operation). • Major adverse impact anticipated in the long term (upon cessation of mining, which would occur regardless of the proposed action), especially to Hopi Tribe and Navajo Nation.	Major adverse impact anticipated in the long term (upon cessation of mining – Kayenta operation only, which would occur regardless of the proposed action).	Same as Alternative B.
	Coal-slurry pipeline	Beneficial, short-term (two years) impact anticipated during construction. Major impact, especially sales tax receipts.	NA	NA
	Water-supply system (infrastructure)	If C aquifer water-supply system is constructed, minor impact anticipated in the short term; right-of-way tax revenue during operations.	NA	NA
Impacts on economic development	Black Mesa Complex	In the short term, the mining revenues and other jobs and income in local support services would have a minor beneficial effect on economic development. In the long term, those services might support industries other than mining; a potential minor beneficial effect.	NA	NA
	Coal-slurry pipeline	No impact.	NA	NA
	Water-supply system	If C aquifer water-supply system is constructed, major beneficial impact anticipated; such as less concern that N-aquifer water withdrawals for mining-related purposes would interfere with water use for tribal economic development. Minor benefit anticipated from associated road improvements. If maximum N-aquifer water supply used, major adverse impact anticipated;	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
		continuation of concern that water withdrawals for mining-related purposes interfere with water use for tribal economic development.		
Environmental Justice				
	Black Mesa Complex	Moderate adverse impact on residents in or near mining complex who live a traditional lifestyle; continued mining (including Black Mesa operation) now permitted continues adverse effects.	Minor benefit to residents in or near the Black Mesa Complex who live a traditional lifestyle; mining of coal-resource areas in the initial Indian Lands Program area (Black Mesa mining operation area) would not occur under the LOM revision; surface facilities would continue to be used.	Moderate benefit to residents in or near Black Mesa Complex who live a traditional lifestyle; shutdown of mining within the initial Indian Lands Program area Black Mesa operation ends its adverse effects.
	Coal-slurry pipeline	Negligible adverse short-term effect of construction on traditional economy and plants and animals important to Hopi and Navajo culture.	NA	NA
	Water-supply system	Minor beneficial effect of associated road improvements.	NA	NA
Noise and Vibration				
Impacts from noise	Black Mesa Complex	Moderate to minor impact anticipated; depending on distance to mining operations.	Moderate to minor impact anticipated; depending on distance to mining operations. Fewer persons affected than for Alternative A.	Same as Alternative B.
	Coal-slurry pipeline	Moderate impact anticipated, but very short term for a small number of residences (during construction).	NA	NA
	Water-supply system	*C-aquifer well field:* Negligible to minor impact anticipated during construction; negligible for life of the mining operations. *Other C aquifer water-supply system infrastructure (either route):* Negligible to minor impact anticipated during construction; negligible for life of the mining operations.	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
Impacts from vibration	Black Mesa Complex	Moderate to minor temporary impact anticipated, for a small number of residences.	Moderate to minor temporary impact anticipated for a smaller number of residences than in Alternative A.	Moderate to minor temporary impact anticipated for a smaller number of residences than in Alternative A or B.
	Coal-slurry pipeline	Negligible to no impact anticipated during construction; residences far enough away to prevent greater impacts.	NA	NA
	Water-supply system	*C-aquifer well field:* Negligible to no impact anticipated in the short and long term. *Other C-aquifer water-supply system infrastructure (either route):* Major temporary impact if blasting is required during construction.	NA	NA
Visual Resources				
Impacts on scenic quality	Black Mesa Complex	Moderate to minor short term, negligible to no impact long term.	Similar to Alternative A, but for a smaller area.	Same as Alternative B.
	Coal-slurry pipeline	Moderate to negligible for residential views during construction and reclamation. Negligible (except minor in small amount of Class A landscape area) long term.	NA	NA
	Water-supply system	*C-aquifer well field:* Minor to negligible impact anticipated except moderate where view of water-storage tank detracts. *Other C aquifer water-supply system infrastructure (either route):* Moderate long-term impact where views of pump stations detract. Minor to no impact anticipated elsewhere.	NA	NA
Transportation				
Impacts on traffic and transportation	Black Mesa Complex	Negligible impact anticipated in the short and long term.	Same as Alternative A.	Same as Alternative A.
	Coal-slurry pipeline	Minor to no impact anticipated during construction.	NA	NA

Table 2-9 Summary of Impacts by Alternative (continued)

Issue or Concern		Alternative A	Alternative B	Alternative C
	Water-supply system	Minor to no impact anticipated during construction. Minor to negligible beneficial effects from new roads.	NA	NA
Recreation				
Impacts on recreation	Black Mesa Complex	Negligible impact anticipated in the short and long term.	Negligible impact anticipated in the short and long term.	Negligible impact anticipated in the short and long term.
	Coal-slurry pipeline	Negligible impact anticipated in the short and long term.	NA	NA
	Water-supply system	Negligible impact anticipated in the short and long term.	NA	NA

NOTES: NA = not applicable.

In Alternatives B and C, the Black Mesa mining operation, coal-slurry preparation plant, and coal-slurry pipeline that supplied coal to the Mohave Generating Station until the end of 2005 would not resume. The coal-washing facility, the 127-acre coal-haul road, and water-supply system, in any configuration, would not be constructed.

Levels of impact intensity are negligible (at lower levels of detection), minor (detectable, but slight), moderate (readily apparent environmental effects), and major (severe adverse or exceptional beneficial environmental effects. Unless otherwise stated as a "beneficial" impact, the impacts described would be adverse.

af/yr = acre-feet per year

Short term = For the Black Mesa Complex, the local short-term impacts are those that would occur from the beginning of mining through reclamation when vegetation is re-established; for the coal-slurry pipeline and C aquifer water-supply system, 5 years (construction and reclamation).

Long term = For the Black Mesa Complex, impacts that would persist beyond or occur after reclamation; for the coal-slurry pipeline and C aquifer water-supply system, beyond 5 years.

The terms *major, moderate, minor, negligible, or none* that follow, consider the anticipated magnitude, or importance, of impacts, including those on the human environment.

Major: Impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; or stress within the social, cultural, and economic realm. Degradation of a resource defined by laws, regulations, and/or policy.

Moderate: Impacts that potentially could cause some change or stress (ranging between significant and insignificant) to an environmental resource or use; readily apparent effects.

Minor: Impacts that potentially could be detectable but slight.

Negligible: Impacts in the lower limit of detection that potentially could cause an insignificant change or stress to an environmental resource or use.

None: No discernible or measurable impacts.

Chapter 3

Affected Environment

3.0 AFFECTED ENVIRONMENT

In accordance with NEPA regulations codified at 40 CFR 1502.15, this chapter presents a summary of the existing conditions of the human and natural environments in the areas that potentially could be affected. This information serves as the baseline to assess the impacts that are anticipated to result from implementing the proposed Black Mesa Project or alternatives. The affected environment is characterized for the following resources, land uses, and social and economic conditions:

- 3.1 Landforms and Topography
- 3.2 Geology and Mineral Resources
- 3.3 Soil Resources
- 3.4 Water Resources (Hydrology)
- 3.5 Climate
- 3.6 Air Quality
- 3.7 Vegetation
- 3.8 Fish and Wildlife
- 3.9 Land Use
- 3.10 Cultural Resources
- 3.11 Social and Economic Conditions
- 3.12 Environmental Justice
- 3.13 Indian Trust Assets
- 3.14 Noise and Vibration
- 3.15 Visual Resources
- 3.16 Transportation
- 3.17 Recreation
- 3.18 Health and Safety

These topics were selected based on Federal regulatory requirements and policies, concerns of the lead and cooperating agencies, and/or issues expressed by agencies and the public during scoping.

The existing conditions of the environment are described based on recent available data—primarily literature, published and unpublished reports, and agency databases. Field reconnaissance verified data gathered for land use, visual resources, vegetation, and fish and wildlife. Intensive field surveys were conducted to inventory cultural resources along the coal-slurry and water-supply pipeline routes. Field visits and interviews were conducted to identify traditional Hopi, Hualapai, and Navajo lifeways and traditional cultural resources.

The areas where different project components are or would be located were examined with varying degrees of scrutiny and at different scales for each resource. For example, air quality or socioeconomic conditions are analyzed over broad areas, while other analyses focus on more specific resource areas, such as a stream, a view, or an archaeological site. In areas of broader focus, specific project components are not necessarily addressed, or are addressed as a group.

3.1 LANDFORMS AND TOPOGRAPHY

The project study area is located within two areas having distinct topographic and geological characteristics—the Colorado Plateau and the Basin and Range physiographic provinces. The provinces are separated by a transition zone that has some of the characteristics of both provinces (Map 3-1). The Colorado Plateau is defined by an abrupt change in elevation, coincident with uplifted and gently folded sedimentary layers internal to the plateau, and steep-sided valleys that incise the plateau's perimeter. The Colorado Plateau province is higher in elevation than surrounding provinces, with elevations generally between 5,000 and 7,000 feet above mean sea level (MSL). The Arizona part of the province is drained by the Little Colorado River.

West and southwest of the study area the Colorado Plateau descends to the Basin and Range province, an area characterized by lower elevations and steeper relief. The steep mountains are formed by fault-blocked and tilted basement rocks and sedimentary formations. The intermontane valleys are deep sedimentary basins filled with alluvial deposits. Mountain elevations range from 4,000 to 5,000 feet above MSL, while the valleys range from 3,000 to a low of 500 feet above MSL at Davis Dam on the Colorado River.

The Colorado Plateau and the Basin and Range provinces are separated by a transition zone that has intermediate physiographic and geologic properties. The transition zone is not a formal province, but an area where the steep drop-off in elevation is concentrated. In the study area, the transition zone first becomes obvious at the Aubrey Cliffs near Seligman, Arizona. The western boundary of the transition zone might be defined by the Grand Wash Cliffs and the adjacent Hualapai Valley, northeast of Kingman. This is reflected in the change of elevation between Seligman (at 5,250 feet above MSL) and Kingman (at 3,336 feet above MSL).

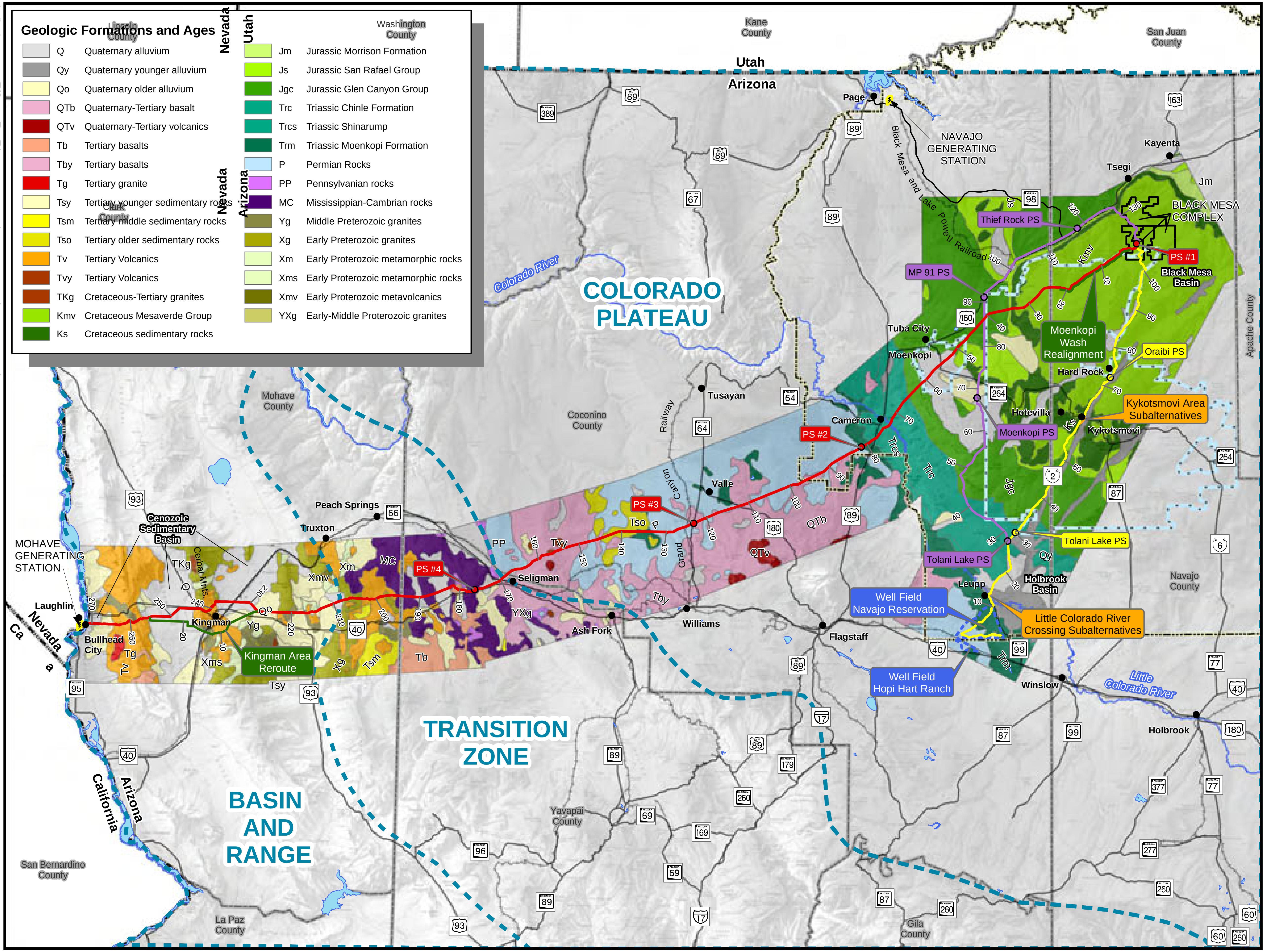
3.1.1 Black Mesa Complex

Black Mesa is a massive highland in northeastern Arizona within the Colorado Plateau that covers approximately 2.1 million acres. It rises abruptly in a 1,200- to 2,000-foot-high uneven wall along its northern boundary, then slopes southwestward through gently rolling hills toward the Little Colorado River. The maximum elevation at the northern rim of the mesa is approximately 8,200 feet above MSL.

The Black Mesa Complex is located on the northern portion of Black Mesa, south of Kayenta. Elevations of the Black Mesa Complex range from about 7,200 feet above MSL on the northeast to 6,100 feet above MSL on the southwest. The topography is characterized by gently rolling hills on a relatively flat mesa that slopes to the southwest at a gradient of about 70 feet per mile. Four major steep-sided, deep washes cut the Black Mesa Complex from the northeast to the southwest and direct surface drainage to the southwest: Yellow Water Canyon and Coal Mine Wash on the north, Moenkopi Wash in the center, and Dinnebito Wash to the south. The steep canyons cut by the washes are narrow, with several small terraces developed only in the wider portions of the washes in the southwestern part of the Black Mesa Complex. There is generally minor accumulation of alluvial material in those washes. Coal exposed on the steep sides of those washes in several locations has burned in place to form outcrops of massive baked shale and sandstone that is called clinker or scoria and is resistant to erosion. Weathering of the less resistant surrounding rock has formed steep rounded buttes of hard shale and sandstone outcrops and clinker material in the area of the Black Mesa Complex.

In the coal-mining areas within the Black Mesa Complex, surface mining of overburden and subsurface coal resources has removed up to 250 feet of rock and effectively destroyed the structure and sedimentary layers, to near the base of the Wepo Formation. Mining also has altered topographic features, such as slope gradient and surface-drainage patterns. Through 2007, approximately 16,741 acres had been disturbed by the Kayenta mining operation and 7,067 acres had been disturbed by the Black Mesa mining operation. Restoration of mining sites to the approximate original contour is required by SMCRA. Mined areas are backfilled and graded to approximate the original topographic relief. The approximate original contour restoration is designed to reestablish the drainage pattern to approximate original conditions and to blend in with the surrounding unmined areas. Restored areas generally have smoother contours with less topographic relief than the original topography, and no pronounced landforms (e.g., no cliffs, steep buttes, or narrow canyons).

Map 3-1
Geology



Black Mesa Project EIS

LEGEND

Geology

Physiographic Province

Project Features

Black Mesa Complex

Peabody Lease Area

Alternative A Coal-Slurry Pipeline

Existing Route

Realignment

Alternative A Water-Supply System

C-Aquifer Well Field

Eastern Pipeline Route

Subalternative along Eastern Route

Western Pipeline Route

PS = Pump Station

General Features

River

Lake

Hopi Reservation Boundary

Navajo Reservation Boundary

State Boundary

County Boundary

Interstate/U.S. Highway/State Route

Railroad

SOURCES:
URS Corporation 2005
Arizona Geologic Survey 2003

N

November 2008

0 20 40

Miles

Prepared By:

URS

3.1.2 Coal-Slurry Pipeline

3.1.2.1 Coal-Slurry Pipeline: Existing Route

The existing pipeline route traverses the widely diverse topography of the Colorado Plateau and Basin and Range provinces, as described above. Beginning in the Black Mesa Complex, the existing pipeline route passes through the gently rolling hills of Black Mesa. At about CSP Milepost 4, it enters the steep-sided, 250-foot-deep Moenkopi Wash—the wash cuts through the mesa in a northeast to southwest direction, directing surface drainage to the southwest. Small terraces appear in the wider portions of the wash. There is generally minor development of alluvial material in the wash, and the massive shale outcroppings described above discourage erosion at several wash locations. The pipeline exits Moenkopi Wash at Black Mesa Wash near CSP Milepost 19 and traverses the mesa downslope to the west. Elevations range from about 6,900 feet above MSL at the Black Mesa Complex to 5,700 feet above MSL at the southwestern edge of the mesa.

Leaving Black Mesa south of Tonalea, the pipeline route turns southwest and crosses Moenkopi Plateau. The topography of the Moenkopi Plateau region consists of low mesas up to 300 feet high, incised by dry washes and separated by relatively flat alluvial plains with localized sand dunes. Near Cameron, the pipeline route crosses the flat plain of the Painted Desert and the Little Colorado River drainage at about 4,100 feet above MSL, then climbs westward onto the Coconino Plateau. Along the route, the Colorado Plateau is at about 6,000 feet above MSL in elevation and characterized by generally flat terrain covered with lava flows and abundant volcanic cinder cones.

Near CSP Milepost 169 and Seligman, the existing route drops off the Colorado Plateau into the transition zone, an elevation change of about 1,000 feet. Elevations in the transition zone range from about 6,000 feet above MSL in the Juniper and Cottonwood Mountains to about 4,000 feet above MSL at the base of the Cottonwood Cliffs near CSP Milepost 208. In the transition zone, the existing route traverses rolling hills separated by nearly flat alluvial plains at lower elevations.

The route crosses the Basin and Range province from about CSP Milepost 208 to the Colorado River. Elevations range from highs of about 6,900 feet above MSL in the Cerbat Mountains near Kingman and the Black Mountains east of Bullhead City to lows of 2,600 feet in the Sacramento Valley and 300 feet above MSL at the river. In the mountains, the pipeline is buried in rugged mountainous topography separated by nearly level alluvial plains in the valleys.

3.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

The pipeline realignments in Moenkopi Wash would be within the wash but outside the active channel, generally within 200 feet of the existing pipeline route.

The Kingman reroute would depart the existing pipeline route near CSP Milepost 228 in the Hualapai Valley and continue southwest across a gently northward sloping alluvial plain. It then would cross the Hualapai Mountains, and then turn west to traverse the flat Sacramento Valley alluvial plain before meeting the existing pipeline route near CSP Milepost 255. The elevation range is almost the same as for the existing route. This reroute would traverse rugged mountains and nearly level alluvial plains of the Basin and Range province.

3.1.3 <u>Water Supply</u>

3.1.3.1 C Aquifer Water-Supply System

3.1.3.1.1 Well Field

The site for the proposed C-aquifer well field is located in a flat area within the Colorado Plateau province and Little Colorado River drainage. Few landform features are found in this area that gently slopes to the northeast and the Little Colorado River. Elevations range from about 5,300 feet above MSL at the west end to 4,800 feet above MSL at the east end.

3.1.3.1.2 C Aquifer Water-Supply Pipeline

Both the Eastern and Western routes of the C aquifer water-supply pipeline would cross the Little Colorado River and continue northeast through the western Painted Desert. The western Painted Desert is an area of multicolored hills and escarpments that should not be confused with the eastern Painted Desert located in and around Petrified Forest National Park 60 miles east of Leupp, Arizona. Elevations range from about 4,700 feet above MSL at the Little Colorado River up to 5,100 feet above MSL on Newberry Mesa. This area slopes southwest toward the Little Colorado River and generally has low relief until it reaches the low escarpment of Newberry Mesa. The Eastern and Western routes separate near WSP Milepost 27.

3.1.3.1.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

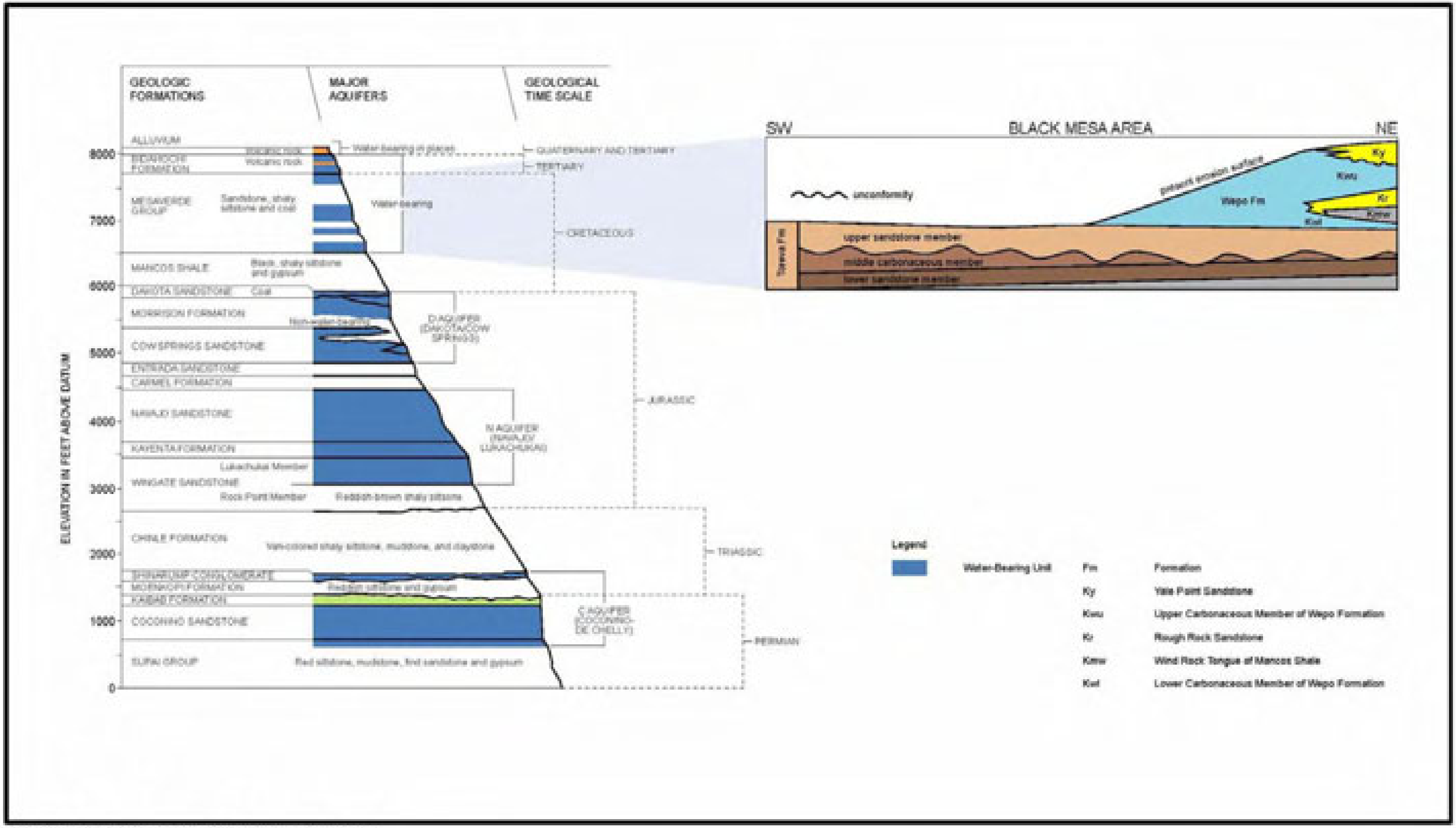
The Eastern Route would trend northeast from WSP Milepost 27, roughly paralleling Oraibi Wash, and pass through the community of Kykotsmovi. The area is characterized by low mesas with approximately 100-foot-high escarpments and flat, featureless plains that gently slope to the south and southwest. Oraibi Wash has cut a channel into the plain about 60 feet deep. Elevations range from about 5,100 feet above MSL on Newberry Mesa up to about 5,700 feet above MSL at WSP Milepost 76 in Oraibi Wash. The route then would turn north and continue past a 200-foot-high sandstone escarpment onto Third Mesa, then continue up the gently sloping Black Mesa and cross a 6,800-foot-high ridge to the coal-slurry preparation plant, located at an elevation of about 6,400 feet above MSL. The route would follow the trend of Dinnebito Wash but for the most part would be outside that drainage. The canyon cut by the wash is narrow and steep sided, with small terraces developed only in the wider portions of the wash.

3.1.3.1.2.2 C Aquifer Water-Supply Pipeline: Western Route

The Western Route would turn northwest from WSP Milepost 27 and then north along the top of Newberry Mesa and Ward Terrace at an elevation of about 5,000 feet above MSL. It would continue over the Adeii Eechii (Red Rock) Cliffs and across the low mesas, dry washes, and flat alluvial plains with localized sand dunes of the Moenkopi Plateau at an elevation of about 5,800 feet above MSL. South of Tonalea the route would meet and parallel U.S. Highway 160 northeast through the flat Red Lake and Klethla Valleys. Near WSP Milepost 127, it would turn southeast and continue over Black Mesa and cross a 7,300-foot-high ridge to the coal-slurry preparation plant. Two additional pump stations would be required along the Western Route to accommodate the longer distance and higher elevation encountered.

3.2 GEOLOGY AND MINERAL RESOURCES

The Colorado Plateau physiographic province is characterized by relatively flat-lying and laterally continuous Paleozoic and Mesozoic sedimentary formations, highlighted by coal-bearing rocks deposited in the Black Mesa Basin that supply the Black Mesa mining operation (Figure 3-1). The Basin and Range physiographic province is characterized by folded and block-faulted mountains of Tertiary volcanic and sedimentary deposits, often with a central core of Precambrian metamorphic and/or granitic rocks, separated by thick alluvium-filled sedimentary basins. The transition zone has geologic characteristics of both provinces (refer to Map 3-1).



SOURCE: Modified from ADWR, 1989; Nations et. al., 2000

Figure 3-1 Stratigraphic Column of Black Mesa Area

The topography of the Colorado Plateau province in northern Arizona is the result of relatively gentle structural folding caused by northerly trending uplifts. The Black Mesa Basin is a broad synformal structure trending northwest to southeast. It is bounded on the southeast and east by the Defiance Uplift, on the north by the Monument and Paiute Uplifts, and on the west by the Echo Cliffs and Kaibab Uplifts. The Preston Mesa-Mount Beautiful Anticline and the Tuba City-Howell Mesa Syncline extend along the southwestern side of the basin. The Defiance Anticline bounds the basin to the northeast and east. These folds have very gentle dips even though their axial traces extend for miles. The north and northwest basin boundary is formed by the Comb Ridge Monocline and Organ Rock Monocline, which dip down to the southeast. These monoclinal folds compose the northwestern hydrologic barrier of the N aquifer in the Black Mesa Basin.

Faulting is less extensive than folding in the study area. Normal faulting associated with fold axes is the most common type found. None of these faults are considered significantly active, and there is no indication that any recent volcanism, such as occurred in the San Francisco Peaks, ever extended to the Black Mesa Basin. Although the Colorado Plateau experienced only minor Holocene seismic activity, the margins of the plateau, including the western Grand Canyon, do exhibit some minor level of earthquake hazard. Several recorded earthquakes have measured between 5 and 6 magnitude on the Richter scale. Farther south, within the study area, the seismicity drops off, but occasional earthquakes in the Flagstaff area have been in the 4 to 5 magnitude range. The region between Flagstaff and the Colorado River experienced very little Holocene seismic activity. In general, the earthquake hazards in the study area are minor.

3.2.1 Black Mesa Complex

3.2.1.1 Geologic Environment

The geology of the Black Mesa Complex area is dominated by relatively flat-lying sedimentary rocks with minor structural deformation by local folding and faulting. The rock units of Black Mesa are primarily undeformed and oriented in roughly horizontal beds. The Oljeto Syncline is a prominent fold that cuts north-south across the area, and lesser folds, such as the Maloney Syncline, are roughly parallel to it. Most faults are oriented east-west and are displaced less than 40 feet.

Coal rank, quality, and thickness vary among Peabody’s designated coal-reserve areas in the Black Mesa Complex. Geological data from the individual coal-reserve areas were collected as part of Peabody’s various permit application packages, including the LOM revision. In 1977, exploration drill holes revealed specific aspects of the Black Mesa geology that contributed to the original and subsequent mine plans. Coal seams were found to be thicker in the synclinal folds and thinned by erosion on the anticlines. In the southeast part of the Black Mesa Complex area, all seven of the coal horizons are present at varied depths. These depths are controlled by northwest-southeast trending fold belts and small-displacement, high-angle normal faults. In the southern part of the Black Mesa Complex (Coal-Resource Area J-07), the Oljeto Syncline controls the depth and location of the four minable coal horizons. The Oljeto Syncline also is present along the Joint Use Boundary (Coal-Resource Areas J-01, N-06 [refer to Map 2-1 and Map A-1]). In the northern part of the Black Mesa Complex (Coal-Resource Areas N-14, N-10, N-11), structural disturbance is less pronounced and only two of the coal horizons are minable. Outcrops of coal typically have been burned to form resistant clinker material.

The Yale Point Sandstone is a medium- to coarse-grained quartz sandstone. It is interbedded with the underlying Wepo Formation and can exceed 200 feet of thickness in the outcrop on the northeastern edge of Black Mesa. The Yale Point Sandstone contains only a minor coal seam or two and is not considered economic to mine.

3.2.1.2 Geologic Natural Areas

There are no existing or proposed geologic natural areas in the Black Mesa Complex designated to preserve and protect unique or valuable geologic resources.

3.2.1.3 Mineral Resources

The Black Mesa Basin has proven coal reserves that have been mined for use by local communities as well as commercial enterprises. Economically viable coal reserves occur in the Toreva Formation, Wepo Formation, and Dakota Sandstone.

Coal beds in the Dakota Sandstone are present throughout the region, mostly in the carbonaceous shale middle member. The USGS estimates 9.6 billon tons of inferred coal resources in the Dakota Formation at Black Mesa. Historically, the Dakota coal beds have been mined at three locations on Black Mesa outside the Black Mesa Complex for local use as fuel. Coal beds in other sedimentary basins produce economically viable quantities of coal-bed methane (CBM) gas from the Dakota Formation. The Dakota Sandstone is stratigraphically below the Wepo Formation and not affected by mining activities.

The carbonaceous middle member of the Toreva Formation contains several coal beds up to 7 feet thick. The USGS estimates 6 billion tons of inferred coal resources in the Toreva Formation. The Toreva Formation has been mined near Keams Canyon, which is outside the Black Mesa Complex. The Toreva Formation is stratigraphically below the Wepo Formation.

Economically viable reserves of coal are found in the Wepo Formation. In 2005, more than 13 million tons of coal were extracted by the Kayenta and Black Mesa mining operations. Through 2007, 345 million tons of coal had been mined under existing OSM permits. Prior to the existing OSM permits, approximately 52 million tons of coal had been mined, a total of approximately 297 million tons from the two mining operations (as of 2007). The USGS' inferred total coal resource in the Wepo Formation exceeds 4.8 billion tons.

No other mineral resources of economic value (either metallic nor nonmetallic) are present in abundance. Minor quantities of the mineral material scoria are present; it is often used for road maintenance and in reclamation.

3.2.1.4 Paleontological Resources

The Cretaceous coal-bearing strata being mined in the Black Mesa Basin contain abundant plant and animal fossils and have high potential for yielding paleontological resources. The strata are laterally extensive and outcrop at many localities that have allowed collection and examination of the fossil assemblages that occur at the Black Mesa Complex. The paleontological resources contained in these rocks are common throughout Black Mesa.

3.2.2 Coal-Slurry Pipeline

3.2.2.1 Coal-Slurry Pipeline: Existing Route

More than half of the existing coal-slurry pipeline (which currently is not in operation), from the Black Mesa Mine to about Seligman (including the pipeline realignments in Moenkopi Wash), is within the Colorado Plateau physiographic province. The existing pipeline route traverses the transition zone from about Seligman to Kingman and the Basin and Range province from Kingman (including the Kingman reroute) to the terminus.

3.2.2.1.1 Geologic Environment

The existing pipeline route begins at Black Mesa and extends southwest to the Little Colorado River near Cameron. The geology of this area includes surface exposures of the Upper Cretaceous Toreva Formation, Wepo Formation, and Yale Point Sandstone (all part of the Cretaceous Mesa Verde Group) as well as Mancos Shale. The Toreva Formation and Mancos Shale are exposed in several washes that cut through the Wepo Formation. The more established washes (Wepo, Oraibi, and Dinnebito) contain Quaternary alluvium. Several geologic structures with subtle folding and faulting characterize the Black Mesa area. These structures include the Oraibi Monocline, Wepo Syncline, Cow Springs Anticline, and Black Mesa Syncline.

Continuing west to Cameron and on to Seligman, the existing route traverses surface exposures of relatively flat-lying Jurassic, Triassic, and Permian sedimentary rocks. Between CSP Mileposts 65 and 79, the pipeline route crosses the Chinle Formation, which contains swelling clays and expansive soil that potentially can affect pipeline structural stability. Uranium, and localized waste piles from historical uranium mining having potentially high levels of radiation, could be present in that area of the Chinle Formation. The pipeline route crosses the inactive Mesa Butte Fault about 23 miles southwest of Cameron between CSP Mileposts 99 and 100. Between Cameron and Seligman, the surface geology consists primarily of Permian sedimentary rocks and Quaternary volcanic rocks and basalt flows.

From Seligman westward, the existing route traverses surface exposures of transition zone rocks that include Precambrian granites, Paleozoic limestones, Tertiary volcanic and basaltic rocks, and Quaternary alluvium in streambeds. Several inactive faults are present in this area, including the Grand Wash-Cottonwood Fault at about CSP Milepost 210, which defines the boundary between the transition zone and Basin and Range province.

West of the Cottonwood Fault, the route traverses mountain ranges and valleys of the Basin and Range province and encounters surface exposures of Precambrian granitic and metamorphic rocks, Tertiary volcanics, and Quaternary alluvium. Several inactive faults are crossed at the fault-block boundaries of mountain ranges east and west of Kingman and west of the Sacramento Valley.

3.2.2.1.2 Geologic Natural Areas

There are no existing or proposed geologic natural areas along the existing route designated to preserve and protect unique or valuable geologic resources.

3.2.2.1.3 Mineral Resources

The existing pipeline begins on Black Mesa where it is buried within coal-bearing sedimentary rocks at a width and depth that has not affected near-surface coal resources.

There are no known noncoal mines or mineral deposits of economic value in the segment of the existing pipeline route corridor that traverses the Colorado Plateau. The pipeline route crosses the Cameron mineral district that historically has been mined for uranium and vanadium; however, the Navajo Nation has banned uranium mining on tribal land.

The segment of pipeline route from Kingman to Laughlin crosses several mining districts with numerous mines and mining claims. These include the Wallapai silver-gold-lead-zinc district in the Cerbat Mountains north of Kingman, the Union Pass gold-silver-beryllium district in the Black Mountains, and the San Francisco gold-silver-fluoride district and Oatman gold-silver-lead district, both in the Black Mountains southeast of Bullhead City.

The existing route encounters no active or inactive mineral material pits as it traverses the Colorado Plateau or transition zone. Southeast of Kingman, it traverses an existing mineral material pit in the foothills of the Hualapai Mountains.

3.2.2.1.4 Paleontological Resources

Surface exposures of Paleozoic and Mesozoic rocks occur along the Colorado Plateau and transition zone segments of the existing route. Cretaceous coal-bearing strata that contain abundant plant and animal fossils are found on Black Mesa. The paleontological resources contained in these rocks are common throughout Black Mesa.

Paleozoic sedimentary rocks, including limestones equivalent to the Mississippian-age Redwall Limestone and the Devonian-age Temple Butte Limestone, outcrop in the western Colorado Plateau and transition zone. These limestones have high potential for yielding paleontological resources; however, the paleontological resources contained in these rocks are common throughout the Colorado Plateau.

From the Kingman area west, the existing pipeline crosses Precambrian granitic rocks and Tertiary volcanic rocks in the Hualapai Mountains, and Quaternary alluvium in the Hualapai and Sacramento Valleys. None of these rock types are considered fossil-bearing.

3.2.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

3.2.2.2.1 Geologic Environment

The pipeline realignments in Moenkopi Wash would be entirely within the Colorado Plateau province and traverse surface exposures of the Upper Cretaceous Wepo and Toreva Formations and the Mancos Shale on Black Mesa. Portions of Moenkopi Wash contain Quaternary alluvium.

The Kingman reroute would traverse mountain ranges and valleys of the Basin and Range province and encounter surface exposures of Precambrian granitic and metamorphic rocks, Tertiary volcanics, and Quaternary alluvium. Inactive faults are present at the fault-block boundaries of mountain ranges east and west of Kingman.

3.2.2.2.2 Geologic Natural Areas

There are no existing or proposed geologic natural areas along the realignments that are designated to preserve and protect unique or valuable geologic resources.

3.2.2.2.3 Mineral Resources

The pipeline realignments in Moenkopi Wash would traverse coal-bearing sedimentary rocks on Black Mesa. There are no known mineral deposits or mineral districts along this realignment. No active or inactive mineral material pits are in this area, and the realignments would be outside any mineral district.

There are no known mineral deposits of economic value reported along the Kingman reroute. The reroute would pass through one mining district south of the town of McConnico. The mines of the McConnico district—past producers of gold and silver—were discovered in the early 1900s and did not produce beyond 1950. The reroute also would pass through an existing mineral materials pit southeast of Kingman.

3.2.2.2.4 Paleontological Resources

The pipeline realignments in Moenkopi Wash would traverse a geologic area comparable to that of the existing route. Cretaceous coal-bearing strata that contain abundant plant and animal fossils are found on

Black Mesa. The paleontological resources contained in these rocks are common throughout the Black Mesa Basin. The Kingman reroute would traverse outcrops of Precambrian granitic rocks and Tertiary volcanic rocks in the Cerbat Mountains.

3.2.3 Water Supply

3.2.3.1 C Aquifer Water-Supply System

3.2.3.1.1 Well Field

The proposed C-aquifer well field is located within the Colorado Plateau province and the Little Colorado River drainage. Other than small areas of stream alluvium in creeks and washes, rocks exposed at the surface include the Permian Kaibab Formation and Triassic Moenkopi Formation. The surface geology and structural geology are shown on Map 3-2.

No subsurface economic mineral resources are known to exist in the well field area. There are no existing or proposed geologic natural areas in the well field area. There are no known mineral deposits of economic value in the well field area. No active or inactive mineral material pits are located in the well field area. The paleontological resources contained in the fossil-bearing Kaibab Formation and Moenkopi Formation are common throughout the Colorado Plateau.

3.2.3.1.2 C Aquifer Water-Supply Pipeline

At the well field, the pipeline route is underlain by the Kaibab Formation. As the route progresses toward the coal-slurry preparation plant, it crosses successively younger geologic units. Heading north from the well field, it would traverse surface exposures of relatively flat-lying Permian, Triassic, and then Jurassic sedimentary rocks. At the Little Colorado River crossing, the two subalternatives would be on Quaternary alluvium. Between CSP Mileposts 24 and 34, the pipeline would cross the Chinle Formation, which contains swelling clays and expansive soil that can affect pipeline structural stability. Deposits of uranium and localized waste piles from historical mining of uranium, with potentially high levels of radiation, could be present in that area of the Chinle Formation. The two alternative routes separate near CSP Milepost 27. Both the eastern and western pipeline routes would cross the major geologic units present in the Black Mesa Basin.

3.2.3.1.2.1 C Aquifer Water-Supply Pipeline: Eastern Route (Agencies' Preferred Alternative)

The Eastern Route would begin traversing Cretaceous sedimentary rocks near Kykotsmovi. The two subalternative routes through the Kykotsmovi area would be on Dakota Sandstone. The remainder of the Eastern Route would be on alluvium or surface exposures of the Wepo and Toreva Formations. On Black Mesa, the route would traverse coal-bearing sedimentary rocks. Cretaceous coal-bearing strata on Black Mesa contain abundant plant and animal fossils. The paleontological resources contained in these rocks are common throughout the Black Mesa Basin.

There are no existing or proposed geologic natural areas along the Eastern Route. There are no known noncoal mines or mineral deposits of economic value along the eastern pipeline route, nor are there any mineral material pits.

3.2.3.1.2.2 C Aquifer Water-Supply Pipeline: Western Route

The Western Route would traverse surface exposures of Triassic, Jurassic, and Cretaceous sedimentary rocks, and alluvium in washes and on the Moenkopi Plateau. The remaining 10 miles of the Western Route would be on surface exposures of the Wepo and Toreva Formations on Black Mesa. The route also would traverse coal-bearing sedimentary rocks on Black Mesa. Cretaceous coal-bearing strata on Black

Mesa contain abundant plant and animal fossils. The paleontological resources contained in these rocks are common throughout Black Mesa Basin.

There are no known existing or proposed geologic natural areas along the alternative route. There are no known noncoal mines or mineral deposits of economic value along the Western Route. There are no mineral material pits along the Western Route.

3.3 SOIL RESOURCES

3.3.1 Black Mesa Complex

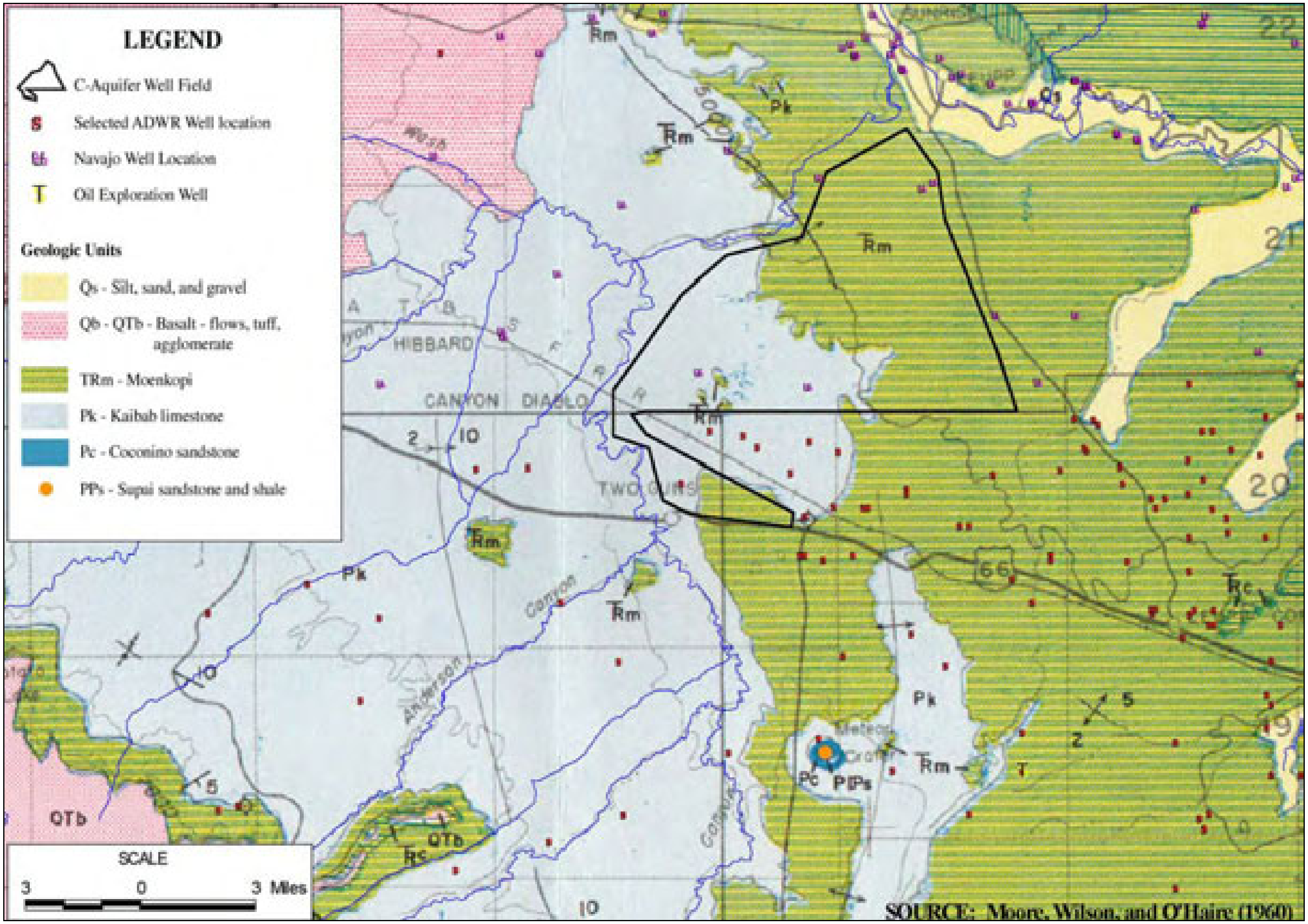
The soils on the plateaus, mesas, hillsides, and fan terraces of the Colorado Plateau range from very shallow (a few inches) to deep (5 feet) and generally are well drained. Many have formed in basalt and pyroclastics and are very cindery. The water-erosion potential is usually slight to moderate, but may be high in areas with steeper slopes. Wind-erosion potential is often moderate to severe. Many portions of the Colorado Plateau are subject to high wind and water erosion due to sparse vegetation cover and soil type.

Soils within the Black Mesa Complex are derived primarily from the Cretaceous Mesaverde Group, a series of sedimentary sandstones, siltstones, and mudstones. In 1979, 1983, 1985, 2000, and 2003, site-specific soil surveys, required by SMCRA, were conducted by private contractors in the Black Mesa Complex area, along with the surrounding areas, to provide detailed soil taxonomy. The surveys identified 14 soils in and surrounding the area. These soils were predominantly very fine- to fine-grained sandy loams with minor smectitic clayey soils. The smectite clays, also referred to as “swelling clays,” can undergo as much as a 30 percent volume change due to wetting and drying. Soils in the area can be characterized generally as well drained with moderate shrink-swell potential (with the exception of the smectitic clayey soils) and as slightly susceptible to wind erosion.

On reclaimed surface mines, topsoil is essential for reestablishing native vegetation and forage. Subsoil and weathered rock overburden beneath the topsoil supply additional nutrients and moisture for plant growth. The removal and replacement of all topsoil is required by SMCRA unless it is demonstrated that selected subsoil or spoil is better suited for growing plants. Topsoil is removed as a separate layer before mining and is either spread on nearby regraded areas or, if necessary, temporarily stockpiled. Topsoil is spread to the appropriate depths for the approved postmining land use.

By definition, topsoil means the A and E soil horizon layers of the four master soil horizons (30 CFR 701.5). The soils of the Black Mesa Complex have A horizons that range in thickness between 0 to 1 inch and 0 to 4 inches, depending on the soil. The topsoil is of insufficient quantity to salvage as a separate layer and must be salvaged together with suitable subsoil and suitable unconsolidated material below the subsoil to provide a topsoil mixture suitable for reclamation. When topsoil material requirements to support the reclamation plan so demand, Peabody salvages the residual soils unless their depth makes salvage impractical. The soil surveys assessed residual soils’ unsuitability for restoration based on four conditions: selenium concentration, sodic zones, pH, rock fragment percentage, and acid-forming spoils.

Soils developed from the coal-bearing parent rock of the Mesaverde Group have the potential for higher than normal selenium concentrations. Native vegetation that bioaccumulates selenium on these soils can create a level of toxicity in the forage high enough to affect cattle. For this reason, Peabody has conducted geobotanical studies (submitted as part of Peabody’s permit application) on the disturbed areas in support of the suitability assessments of topsoil material.



Map 3-2 Surface Geology and Structure Proposed C-Aquifer Well Field

The geobotanical studies demonstrated that selenium-accumulating plant populations are common locally in certain subhabitats in the area. The selenium accumulators occurred on the shallow soils associated with wooded ridges and disturbed areas, and were absent from the broad sagebrush valleys and wash terraces where the deeper soils occur. Based upon the results of selenium analysis in plants and soils at a representative cross section of sites where accumulator plants were found, the soils in which they were growing are not seleniferous. No selenium poisoning of livestock has been reported in or surrounding the Black Mesa Complex.

Overburden material, which could be used to provide soil, also was evaluated for this problem. Initial results indicated the probability of suspect concentrations of plant-available selenium occurring in regraded spoils. The assessment of overburden for 13 mining areas concluded that selenium has the potential to occur in seven of those areas. Most values that exceeded the suspect level of 0.26 ppm approved by OSM were less than 0.30 ppm. More recent analysis of selenium levels of regraded spoil in comparison to selenium blood levels in cattle grazing on reclaimed areas indicate that the selenium levels present in the regraded spoil do not pose a threat to livestock. No selenium monitoring in the regraded spoil is currently required.

Sodium adsorption ratios (SAR) greater than 18 or 22, depending on soil texture, are indicative of elevated sodium in soil. The overburden assessment for 11 mining areas concluded that there was potential for sodic zones to occur in 10 areas at or near the surface of regraded soils.

Alkaline and acidic soils are typical in coal seams and in deeper subsurface soils. Overburden materials having elevated SAR also may have unsuitable pH values: either alkaline pH values greater than 8.8, or acidic pH values less than 5.5. However, acidic soils may not be a significant issue because of excess alkalinity measured in many core samples.

Negative acid-base account potential values indicate a potential for acid-forming zones that make spoil unsuitable for use as replacement soil in reclamation areas. Negative acid-base accounting has been detected at unsuitable levels in about 10 percent of the total samples of spoil collected and analyzed. Acidic or acid-forming spoils are not anticipated in most areas.

Seventeen years of sampling show that about 10 percent of near-surface spoil is unsuitable to reestablish native vegetation and forage after mining, overburden mixing, and final grading. These areas are mitigated by placing 4 feet of suitable plant growth material (suitable spoil on topsoil) on the unsuitable material.

3.3.1.1 Prime Farmland Determination

The soils that occur are predominantly in the Natural Resource Conservation Service (NRCS) land capability Classes VI and VII. Soils in Classes VI and VII have severe to very severe limitations that make them unsuitable for cultivation and limit or restrict their use largely to pasture, range, woodland, or wildlife habitat. Soils in these groupings are used primarily for livestock grazing. The land in the Black Mesa Complex area has received a negative determination as prime farmland from the NRCS (Peabody 1985, 1986).

3.3.2 Coal-Slurry Pipeline

As stated previously, the existing coal-slurry pipeline (which currently is not in operation) crosses two physiographic provinces—the Colorado Plateau and the Basin and Range, with a transition zone between the two. In the Basin and Range province and the transition zone, the soils in the valleys generally have formed from mixed alluvium. The soil depths range from very shallow to deep and are typically gravelly, sandy, or loamy with caliche in the subsurface. The erosion potential is slight to moderate, typically increasing with greater slope. In the floodplains, terraces, and alluvial fans of the Colorado River area, the soils have formed in alluvium derived from igneous and sedimentary rocks. They are deep soils and are sandy, loamy, or gravelly on the surface. Caliche is typical in the subsurface of soils developed on the terraces and alluvial fans. The erosion potentials are slight to moderate, increasing with greater slope.

Between CSP Mileposts 65 and 79, the existing route crosses soil derived from the Chinle Formation, which contains swelling clays and expansive soil that can affect pipeline structural stability. Deposits of uranium and localized waste piles from historical mining of uranium, with potentially high levels of radiation, could be present in that area of the Chinle formation.

Both the pipeline realignments in Moenkopi Wash and the Kingman reroute are located within the same general areas as the existing route and would cross the same soil types.

Although there is no prime and unique farmland along the existing route, the American Farmland Trust identified high-quality farmland on private and State Trust Land near Seligman, Arizona (between CSP Mileposts 170 and 180).

3.3.3 Water Supply

3.3.3.1 C Aquifer Water-Supply System

3.3.3.1.1 Well Field

Soils in the area of the well field are considered to be well drained, with a clay content of less than 20 percent and a low shrink-swell potential. The wind erodibility for soils in this area is high due to sparse vegetation. Susceptibility for soil-induced corrosion of concrete is low. Susceptibility for corrosion of uncoated steel is high throughout most of the well-field area, with the exception of a small area in the southwestern corner of the well field characterized as holding moderate potential.

3.3.3.1.2 C Aquifer Water-Supply Pipeline

Soils along the Eastern Route can be described generally as either well drained or somewhat excessively drained. The shrink-swell potential is generally low; however, minor areas along the middle and approximately the last 10 miles of the Eastern Route have moderate shrink-swell potential. The majority of soils along the Western Route are characterized as excessively drained. Two small transects in the middle of the Western Route and approximately the last 20 miles to the coal-slurry preparation plant are well drained. The shrink-swell potential of the soils along the route is generally low, with the exception of two small transects in the middle of the route, where soils have high shrink-swell potential.

As discussed in Section 3.3.1.1, soils that occur in the project area are predominantly unsuitable for cultivation. There is, however, limited agriculture along the proposed C aquifer water-supply pipeline's Eastern Route. Small farm plots on the order of 1 acre typically may be located within the major washes on the relatively flat terraces where more soil has accumulated. Although the farm plots are sited adjacent to drainage channels, there are no flood irrigation features such as dikes, diversions, or canals to water the crops. The availability and quality of surface water is uncertain and unreliable. Instead, moisture for the crops is provided by infrequent rainfall events. These farm plots are established on an opportunistic and intermittent basis because they depend on sufficient rainfall for a successful crop. For these reasons, Peabody considers the farm plots as "kitchen gardens" used to augment the household food supply and does not include them as an established land use requiring reclamation.

3.4 WATER RESOURCES (HYDROLOGY)

Surface drainage of northern Arizona is a consequence of the topography of the Colorado Plateau physiographic province in the east and the Basin and Range physiographic province in the west. The Black Mesa Complex and the C aquifer water-supply system are entirely within the Colorado Plateau, while the coal-slurry pipeline is within both the Colorado Plateau province and the Basin and Range province.

The Colorado Plateau is a region of low relief, punctuated by erosional plateaus; steep-sided, river-cut canyons; and isolated volcanic landforms. The area stands high in elevation relative to surrounding parts of Arizona. Drainage is controlled by the perennial Colorado River flowing from the northeast to the west, and by the Little Colorado River running from the south near the White Mountains to its junction with the Colorado River downstream from Page, Arizona. The Little Colorado River is intermittent (flowing certain times of the year) from Holbrook, Arizona, to the Colorado River. To the west and southwest, the Colorado Plateau gives way to the Basin and Range province, characterized by lower elevations and steeper relief. The Basin and Range comprises north- to northwest-trending, discontinuous, steep-sided mountain ranges interspersed with deep alluvial valleys. Major watersheds are shown on Map 3-3.

Black Mesa is a major physiographic feature of the Colorado Plateau. Washes, including Moenkopi, Dinnebito, Oraibi, Polacca, and Jeddito, drain Black Mesa to the southwest and join the Little Colorado River, as shown on Map 3-4. Laguna Creek and Chinle Wash drain to the north and join the San Juan River. All of the washes draining Black Mesa are intermittent. None of the tributaries or washes is a reliable source of water for irrigation or potable use.

Tributaries that are fed by springs, potentially affected by N-aquifer groundwater pumping or by mining operations, include Moenkopi, Dinnebito, Oraibi, Coal Mine, and Yellow Water Canyon washes and Laguna Creek on Black Mesa (refer to Map 3-4). Streams potentially impacted by C-aquifer pumping are shown on Map 3-5 and include lower Clear Creek, lower Chevelon Creek, and the Little Colorado River near Winslow.

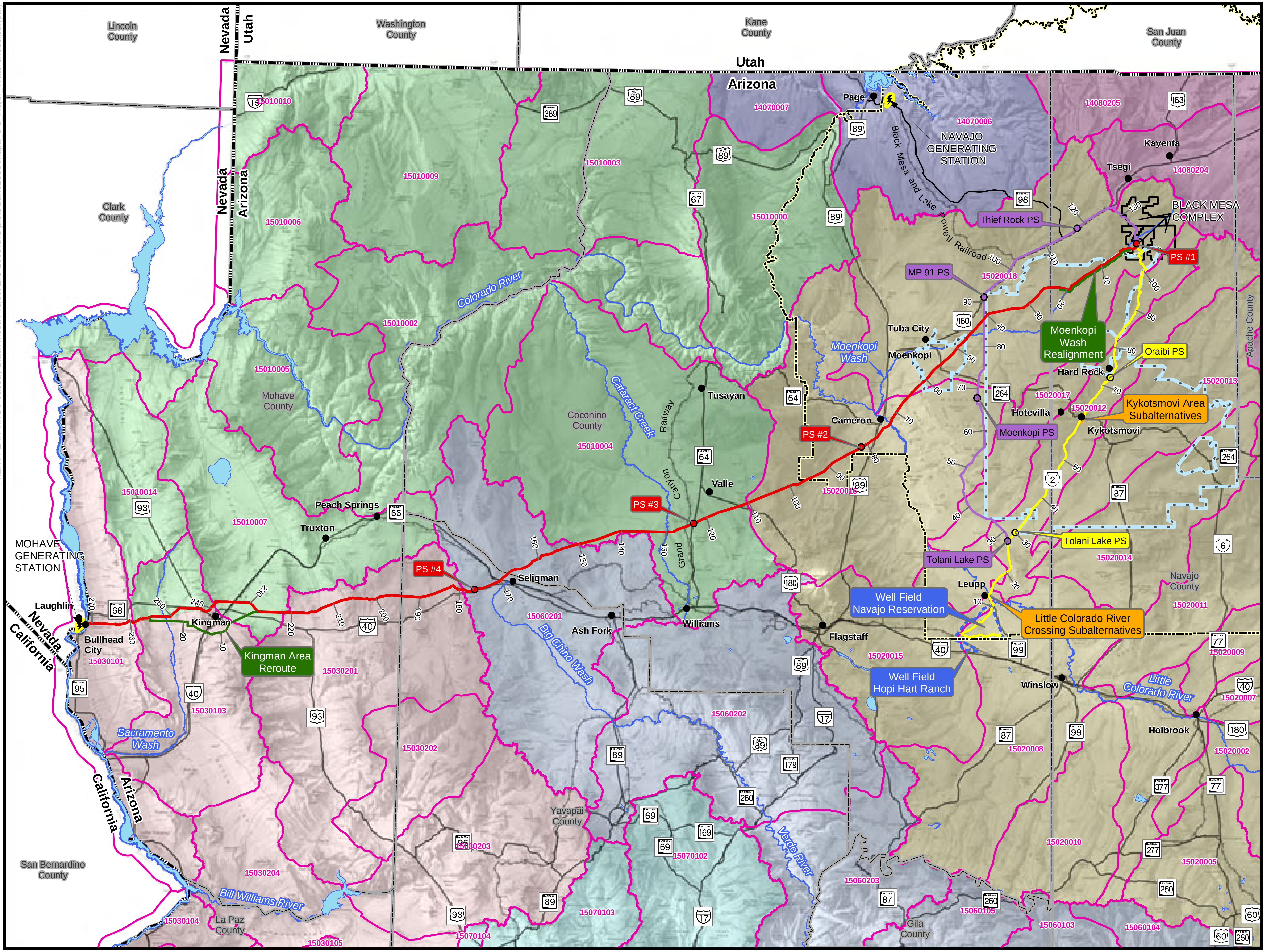
Numerous springs are found across and adjacent to the Hopi and Navajo Reservations, some of which have important cultural value to either or both tribes. Lower Moenkopi Village, on the Hopi Reservation, obtains water from a spring near Moenkopi Wash. There are more than 200 other springs on the Hopi Reservation with cultural or water-supply value to the community. Many of these springs are local and not associated with the major regional aquifers. Four of the larger and/or consistent springs have been monitored by the USGS since at least 1995. These include Moenkopi School (19 af/yr in 2005), Pasture Canyon (54 af/yr in 2005), Burro Springs (0.3 af/yr in 2005), and Unnamed Spring near Dinnehotso (35 af/yr in 2005) in the unconfined portion (upper surface is open to the atmosphere through permeable overlying material) of the N aquifer (Truini 2006). These springs have shown fluctuations but no long-term trends are apparent (USGS 1985-2005). Since these springs occur where the N aquifer is at or near the ground surface, a portion of the spring flow may be due to the infiltration of rain water. Fluctuation in spring flow may be due, in part, to variations in precipitation.

Blue Springs (long-term average 164,000 af/yr) is the discharge point for most C-aquifer water flowing north from the Mogollon Rim. Blue Springs is a series of springs located in the Little Colorado River gorge upstream from the river's confluence with the Colorado River mainstem.

There are several groundwater sources within the project area, each of varying water quality, water-yielding capability, and accessibility. Figure 3-1 (refer to Section 3.2) identifies the significant water-bearing units in the study area. Significant water-bearing formations and associated aquifers include the following, in descending order:

- The alluvial system, composed of gravel, sand and silt, associated with stream channels that occur in the vicinity of the Black Mesa area (OSM 2006). This system is local and varies greatly in size and extent depending on the nature of the stream channels.
- Water-bearing formations of the Mesa Verde Group, specifically the Wepo Formation containing siltstone, mudstone, sandstone, and coal beds. There are no developed Wepo water-use locations on the leasehold (Peabody 1986, revised 2003). The Wepo aquifer is discontinuous across the leasehold and does not constitute a regional aquifer.
- The D aquifer, which includes the Dakota Sandstone, portions of the Morrison Formation, and the Cow Springs Sandstone (ADWR 1989); the D aquifer is confined (groundwater in the aquifer is under pressure and will rise above the level at which it is encountered by a well) by the overlying Mancos Shale.
- The N aquifer includes the Navajo Sandstone, the Kayenta Formation, and the Lukachukai member of the Wingate Sandstone; the N aquifer is confined by the overlying Carmel Formation.
- The C aquifer includes the Kaibab Formation, the Coconino Sandstone, and the upper part of the Supai Group; in some areas the C aquifer is confined by the overlying Moenkopi and Chinle Formations.
- The Redwall-Muav aquifer (R aquifer) is composed of the Redwall-Muav limestones that underlie the C aquifer. Over most of the study area, the Redwall-Muav limestones are separated from the overlying C aquifer by the relatively impermeable silts and clays of the lower Supai Group. However, in the area west of Cameron, water from the C aquifer is thought to move downward through faults and fractures in the Supai Group into the R aquifer before discharging at Blue Springs.

The relationships among these units in the project area are shown on Figure 3-2. The extent of the regional aquifers is shown on Maps 3-4, 3-5, and 3-6 (the R aquifer does not outcrop in the study area and is not shown on the surface maps). The regional aquifers (D, N, C, and R) extend over large areas and are controlled by the regional northern dip of the rocks and the basin structure beneath Black Mesa. The R aquifer is deeply buried throughout the study area. Water from Blue Springs is nonpotable (3,000 milligrams per liter [mg/L] of TDS), and no wells in the study area produce water from the R aquifer. The C aquifer is at the surface south of the Little Colorado River but is buried beneath more than 5,000 feet of sedimentary rock under the area of the Kayenta and Black Mesa mines. With the exception of the southeast portions of the D and N aquifers and the C and R aquifers west of Cameron, there is little interconnection among the major water-bearing units. It should be noted that, for convenience of presentation, the vertical exaggeration on Figure 3-2 is large (26 times), giving the impression of much greater structural relief than actually exists.



Map 3-3

Major Watersheds

Black Mesa Project EIS

LEGEND

Watersheds

- Bill Williams River
- Lower Colorado River - Lake Mead
- Upper Colorado River - Dirty Devil
- Little Colorado River
- Lower Gila River
- Lower San Juan River
- Verde River
- Sub-watershed Boundary and Hydrologic Unit Number

Other Water Features

- River
- Lake

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005
Arizona State Land Department 2005
Arizona Department of Water Resources 2004
- Modified by URS 2005

N

November 2008

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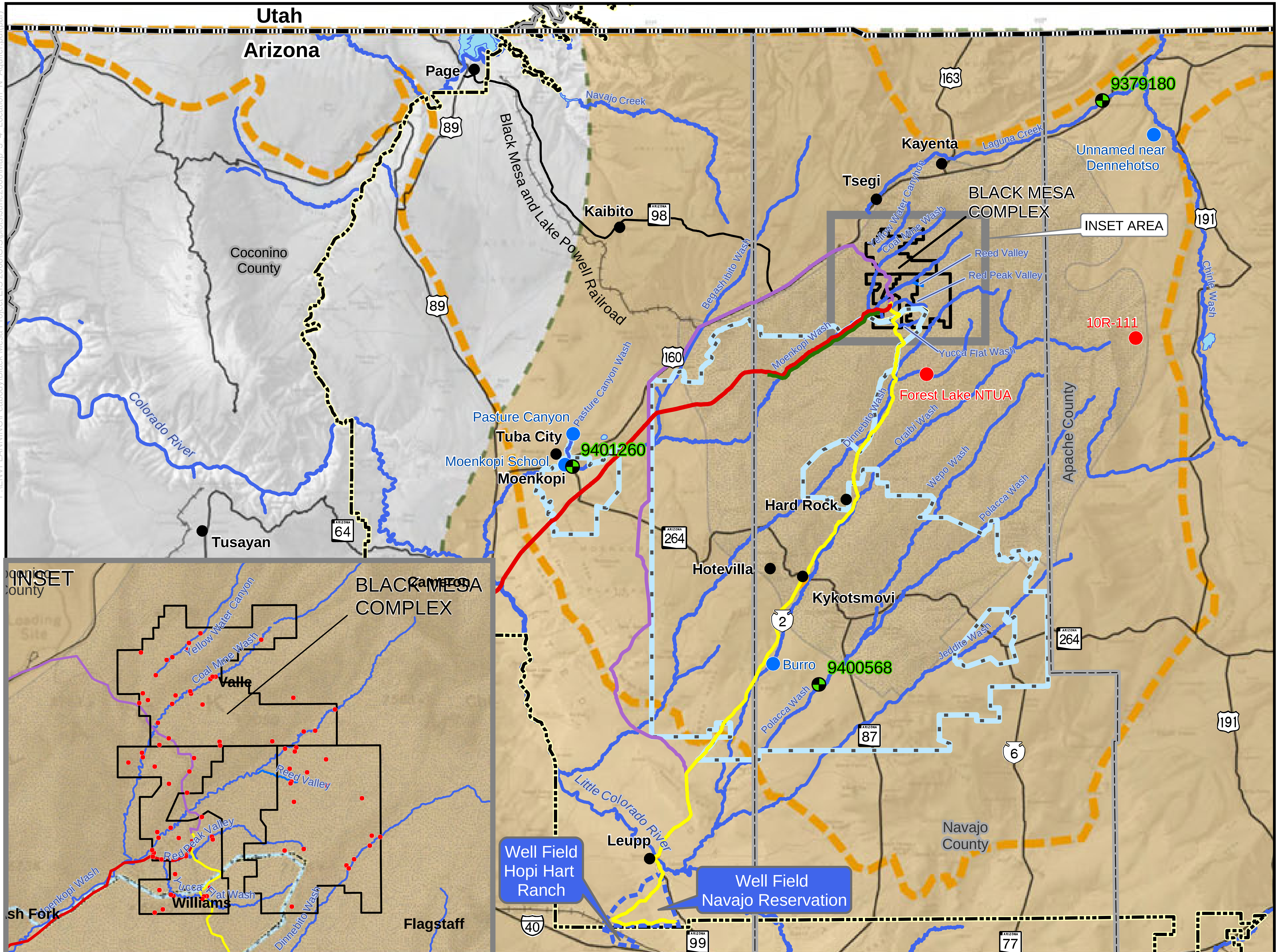
Miles

Prepared By:
URS



Map 3-4
Location of Surface Drainages on Black Mesa and Key N-Aquifer Features

Black Mesa Project EIS

LEGEND

Surface Drainage Features
- Streams
- Well
- Spring
- Stream Gage Station
- Lake

Aquifers
- C-Aquifer
- N-Aquifer
- Confined Area of N-Aquifer (Southeast edge is limit of the model)

Project Features

Black Mesa Complex
- Peabody Lease Area

Alternative A Coal-Slurry Pipeline
- Existing Route
- Realignment

Alternative A Water-Supply System
- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

General Features
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005
USGS 2005
USGS Water Resources 2006
Bureau of Reclamation 2005

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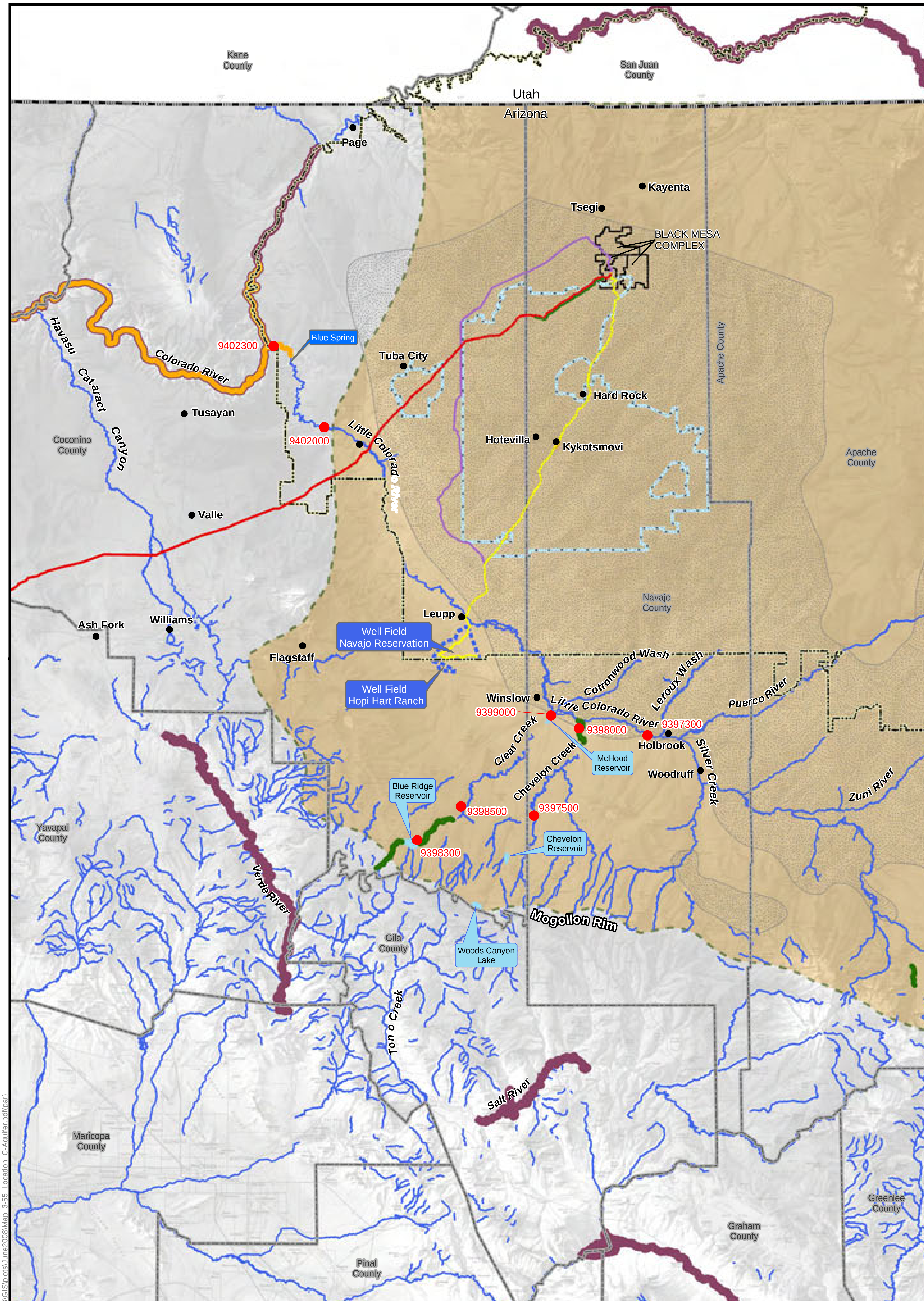
Prepared By:
URS



Prepared By:

URS

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0 10 20

Miles

SOURCES:
URS Corporation 2005
USGS 2005
USGS Water Resources 2006
Bureau of Reclamation 2005
U.S. FWS Critical Habitat Portal 2005

LEGEND

Surface Drainage Features

- Stream Reach
- 9399000 Steam Gage Station

Aqifers

- C-Aquifer
- Confined Area of N-Aquifer (Southeast edge is limit of the model)

Critical Habitat

- Humpback Chub
- Little Colorado Spinedace
- Razorback Sucker

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

General Features

- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary

Map 3-5
Location of Surface Drainages South of Black Mesa and Key C-Aquifer Features

November 2008

Black Mesa Project EIS

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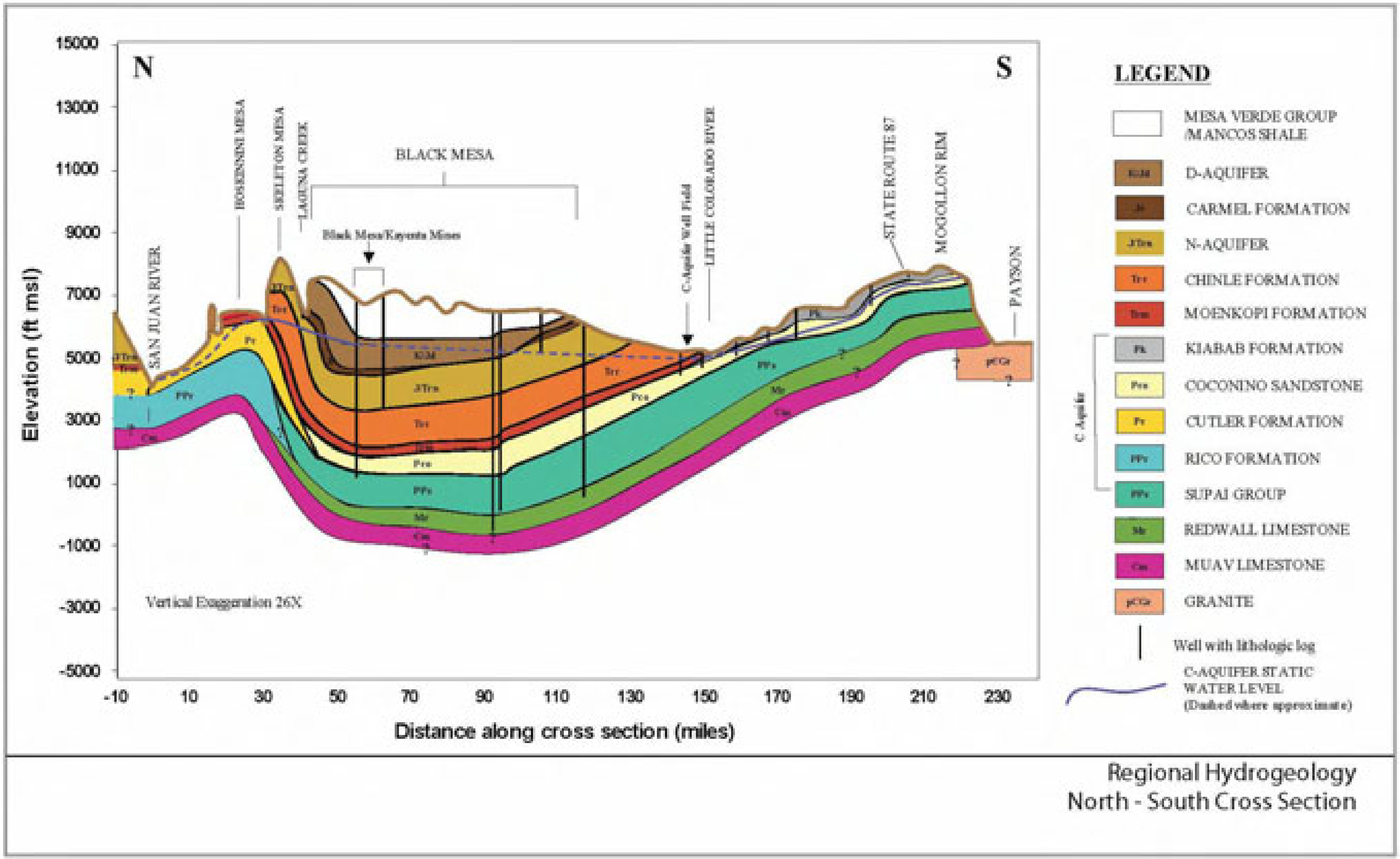
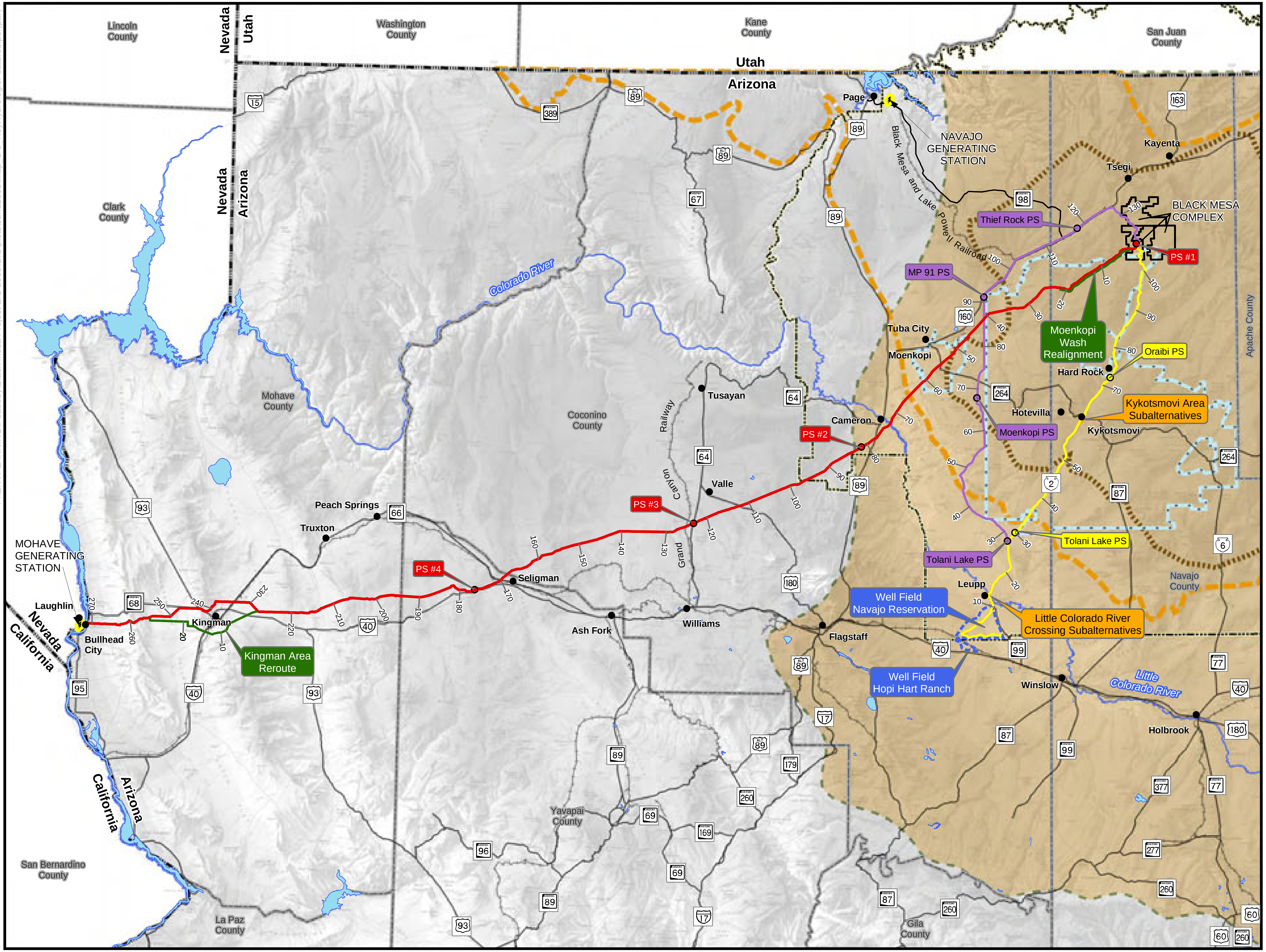


Figure 3-2 Regional Hydrology



Map 3-6

Extent of Regional Aquifers

Black Mesa Project EIS

LEGEND

Aquifers

- C Aquifer
- D Aquifer
- N Aquifer

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005, 2006
Bureau of Reclamation 2005

N

November 2008

0 20 40
Miles

Prepared By:
URS

Of principal interest to this project is the N aquifer, which is the current and proposed source of water supply for mining operations. The N and C aquifers are the major sources of potable water for municipal use. Until December 2005 when mining at the Black Mesa operation ceased, the N aquifer was the primary source of water supply for the coal-slurry pipeline. The N aquifer can be characterized as a sandstone aquifer with low transmissivity that is confined beneath the leasehold, the central portion of the Navajo Reservation, and the northeast portion of the Hopi Reservation. The Peabody well field is in the confined area of the N aquifer, which is shown on Map 3-4. The aquifer is unconfined in the areas of Moenkopi and Tuba City where significant springs occur. The C aquifer is characterized as a moderately transmissive sandstone aquifer and generally is unconfined south of the Little Colorado River and in the southwestern corner of the Navajo Reservation. It is deep and confined under Black Mesa and beneath the Hopi Reservation. The aquifer in the area of the proposed C-aquifer well field is unconfined.

The N and C aquifers are large aquifer systems; water in storage is estimated to be 166 and 413 million acre-feet, respectively (ADWR 1989; Eychaner 1983). Recharge is from precipitation and is estimated to range from 2,600 to 20,248 af/yr (Brown and Eychaner 1988; Eychaner 1983; GeoTrans 1987; Lopes and Hoffman 1997, and Zhu 2000), with a median of 13,000 af/yr for the N aquifer, and 319,000 af/yr for the C aquifer, or approximately 0.008 and 0.08 percent of the water in storage (Eychaner 1983; Hart et al. 2002). Because the annual recharge is small compared to the volume of water in storage, aquifer water levels do not fluctuate significantly in response to typical wet and dry cycles of precipitation.

3.4.1 Black Mesa Complex

Water resources in the Black Mesa region, particularly the eastern portion of the area where the existing and planned water production facilities are located, have been studied for many years. Peabody has conducted extensive surface water and groundwater studies in support of its permit applications and associated regulatory requirements.

These studies include sedimentation and streamflow measurements, as well as detailed groundwater modeling of the N and D aquifers, and are referenced throughout this section of the EIS. OSM prepared a Cumulative Hydrologic Impact Analysis (CHIA) of the coal lease area in 1989 (USDI 1989). The purpose of the CHIA is to evaluate the potential for damage to the hydrologic balance outside the Black Mesa Complex. The hydrologic balance is the relationship between the quality and quantity of water inflow to, and water outflow from, a hydrologic unit such as a drainage basin or aquifer. The CHIA currently is being updated to include information from additional water resource studies available since the first CHIA report and to determine potential mining-related hydrologic impact on the existing and foreseeable water uses. Existing hydrologic conditions, including the ongoing mining operations, are described in the following subsections.

3.4.1.1 Surface Water

Two major drainages convey runoff and spring discharge from the Black Mesa Complex including Moenkopi Wash and Dinnebito Wash (refer to Map 3-4). The two washes are intermittent and discharge to the Little Colorado River system. Additionally, five relatively large washes feed Moenkopi Wash on the mine leasehold—Yucca Flat, Red Peak Valley, Reed Valley, Coal Mine, and Yellow Water Canyon.

Flows are highly variable and primarily consist of storm runoff. As is typical of the area, runoff from storm events can range from a few cubic feet per second (cfs) to more than 10,000 cfs, depending on the location, intensity, and duration of a storm. Perennial reaches (flowing continuously at that point) are the result of saturated rock units at the surface and the discharge of alluvial aquifers holding stormwater bank storage. This flow is referred to as base flow and is generally synonymous with the low flow of the stream. When base flow occurs, Peabody measures flows in each of the washes within the Black Mesa Complex. Base flow is generally low and ranges from 0.020 to 0.29 cfs for Coal Mine Wash, 0.09 to

Complex. Base flow is generally low and ranges from 0.020 to 0.29 cfs for Coal Mine Wash, 0.09 to 0.17 cfs for Moenkopi Wash, 0.002 cfs for Dinnebito Wash, 0.08 cfs for Reed Valley Wash, 0.071 cfs for Red Peak Valley Wash, and 0.027 cfs for Yellow Water Canyon Wash. Not all stream reaches within the permit area have periods of base flow.

The USGS monitored streamflow on Coal Mine Wash (three locations) and Moenkopi Wash (two locations) sporadically throughout the 1970s within the permit and adjacent area. After 1980, all on-site streamflow monitoring was performed by Peabody. Peabody surface-water monitoring has occurred at 14 locations within the permit area, and includes all major drainages and tributary drainages.

Monitoring of surface water is a routine permit requirement for Peabody. Peabody categorizes surface-water quality data based on three sources of surface water monitored—rainfall (stormwater), snow melt, or base flow. Water-quality analyses indicate a variety of water types, mostly calcium/magnesium sulfate and calcium/magnesium bicarbonate waters. Stormwater generally has less contact time with salt-containing materials that results in less concentration after evaporation. Therefore, TDS concentrations tend to decrease as runoff increases. Mean concentration of stormwater is given in Table 3-1.

Table 3-1 Mean Concentrations of Chemical Parameters in Stormwater, Stream Monitoring Sites by Site Number (1986 to 2002)

	Dinnebito Wash		Reed Valley Wash	Yellow Water Wash		Yazzie Wash	Coal Mine Wash			Red Peak Valley Wash		Moenkopi Wash	
	34	**78**	**37***	**50**	**15**	**157**	**16**	**18****	**25**	**14**	**155**	**35**	**26**
pH	8.1	8.0	8.0	8.0	8.0	8.2	8.1	8.0	8.0	8.3	8.3	8.1	8.0
TDS	1,170	1,489	1,485	755	686	231	471	1,335	1,538	268	316	292	1,109
Alk	91	87	121	86	85	111	80	123	119	92	88	68	107
SO_4	740	937	694	437	398	122	242	810	977	109	128	118	660
Ca	166	194	162	125	127	50	87	165	168	46	43	52	152
Mg	70	98	105	44	34	8	19	80	97	12	12	11	66
Na	75	98	100	19	16	4	13	104	141	15	31	5	83
C1	17	22	213	17	10	3	8	26	20	10	11	4	38

SOURCE: Peabody Western Coal Company 1986

NOTES: *Excludes chemical data for two samples that were influenced by magnesium chloride spills upgradient of this monitoring site.

**Includes chemical data from subsites FLUM18 and CG18.

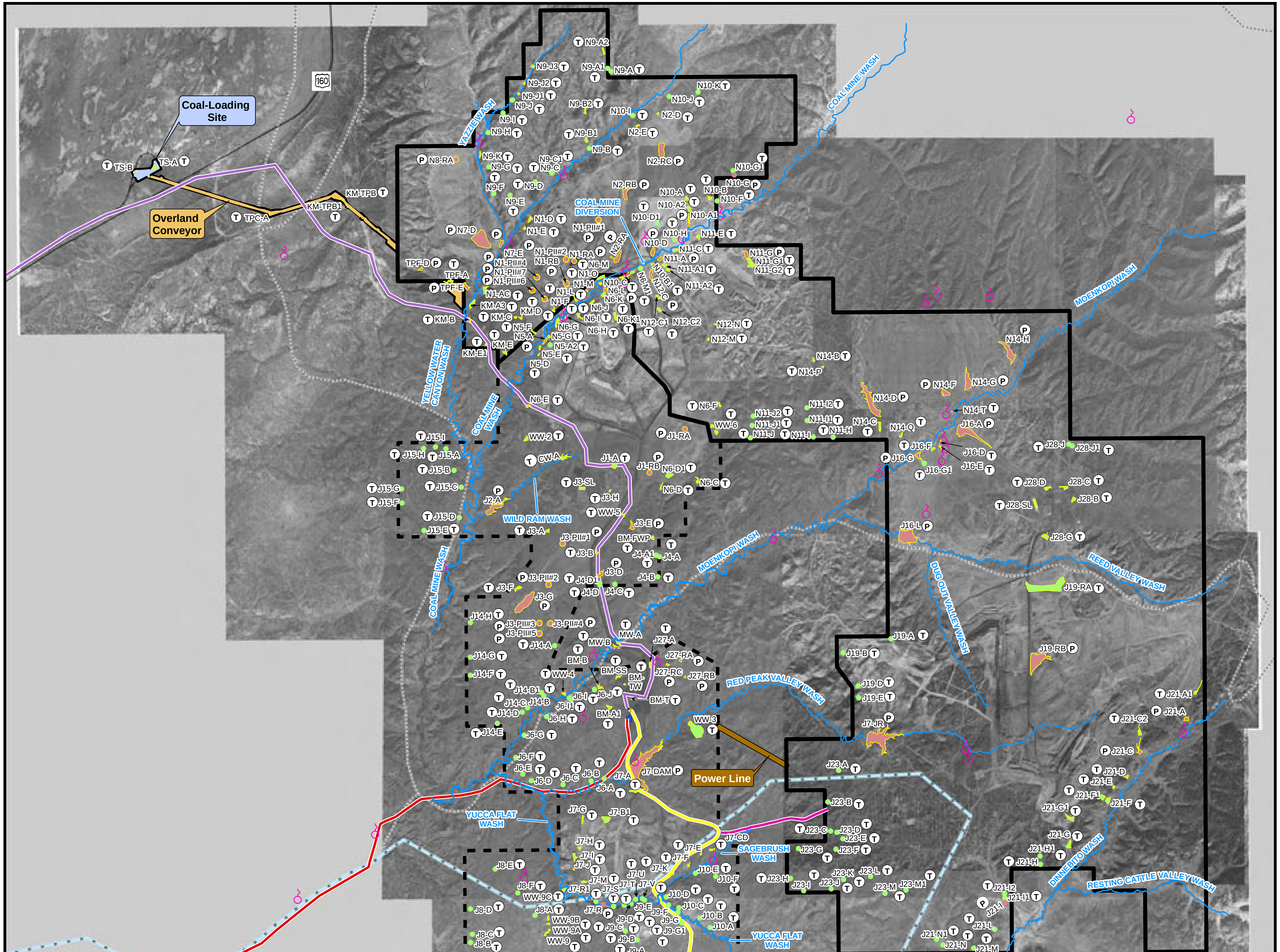
pH = acidity, TDS = total dissolved solids, Alk = alkalinity, SO_4 = sulfate, Ca = calcium, Mg = magnesium, Na = sodium, Cl = chloride

Peabody's LOM applicaton indicates 163 impoundments to exist in 2008 under SMCRA to control sediment transport from mined areas into the washes. A total of 51 impoundments are proposed to be permanent (left as part of the postmining landscape). Location of these impoundments, along with other water features on the permit area, are shown on Map 3-7 (as of 2007).

Map 3-7

Temporary and Permanent Impoundments

Black Mesa Project EIS



LEGEND

Impoundments and Other Water Features

- Existing Permanent Impoundment (P)
- Existing Temporary Impoundment (T)
- Proposed Permanent Impoundment (P)
- Proposed Temporary Impoundment (T)
- Stream
- Spring

Project Features

Black Mesa Complex

- Kayenta Mining Operation Area, including Coal-Loading Site, Overland Conveyor, and Power Line (permanent permit area)
- Black Mesa Mining Operation Area (currently unpermitted area)
- Alternative A New Coal-Haul Road

Alternative A Coal-Slurry Pipeline

- Existing Route

Alternative A Water-Supply System

- Eastern Pipeline Route
- Western Pipeline Route

General Features

- Hopi Reservation Boundary
- Navajo Reservation Chapter Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005, 2006
Peabody Energy 2006
DigitalGlobe Incorporated 2003

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November 2008

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Miles

Prepared By:
URS

Permanent internal impoundments on the mining operation areas also have been monitored for water quality (Table 3-2). Most, but not all, values fall within the draft livestock-watering standards established by the USEPA (1995), Hopi Tribe (1998), and Navajo Nation (1999). With the exception of Impoundment Site No. N2-RA, the quality of water in these impoundments is similar in range to natural stormwater flow, with TDS, sulfate (SO_4), calcium (Ca), magnesium (Mg), sodium, and chloride (Cl) lower than natural drainages. Reclaimed areas have generated runoff that is similar in water-quality composition.

Table 3-2 Mean Concentrations of Chemical Parameters, Permanent Internal Impoundments by Site Number (1986 to 2002)

	116	124	118[a]	N1-RA	122[a]	123[a]	112[a]	113[a]	119[a]	N7-D	N2-RA	N2-RB	N2-RC	N8-RA
pH	8.2	7.8	8.6	9.5	8.0	7.5	7.8	7.9	7.9	8.1	8.5	8.1	8.6	8.0
TDS	459	205	144	424	143	177	281	603	165	939	11,944	566	227	133
Alk	84	100	105	145	96	102	109	205	116	74	301	113	97	56
SO_4	225	68	16	180	15	21	98	252	25	595	8,280	297	79	34
Ca	63	44	24	34	25	26	24	46	28	155	451	108	44	26
Mg	25	13	11	23	9	9	12	21	12	56	549	34	12	4
Na	29	4	5	69	4	7	44	117	9	41	2414	12	6	2
C1	10	3	5	7	5	6	4	8	2	20	54	6	4	4

SOURCE: Peabody Western Coal Company 1986
NOTES: [a]Pre-law area ponds.
pH = acidity, TDS = total dissolved solids, Alk = alkalinity, SO_4 = sulfate, Ca = calcium, Mg = magnesium, Na = sodium, Cl = chlorine

In compliance with NPDES Permit No. NN0022179, Peabody conducts regularly scheduled inspections of impoundments to monitor and assess conditions including seepage from impoundments and potential effects on livestock drinking water. Several of the seeps found during the 2005 inspections downstream of impoundments with outfalls permitted under the NPDES permit (NPDES impoundments) have the potential to be accessed and used by livestock as a source of drinking water.

The Hopi Tribe (1998) and Navajo Nation (1999) have proposed, but have not formally adopted, water-quality standards for livestock. The Arizona Department of Environmental Quality (ADEQ) has established standards for agricultural livestock watering for the Little Colorado River below Lyman Lake, which is upstream of the Navajo Indian Reservation. Constituents for which livestock standards have been established include arsenic (As), cadmium, chromium, copper, lead (Pb), mercury, selenium, zinc, and pH. The National Academy of Sciences has recommended livestock standards for other constituents including aluminum, boron, fluoride, nitrate (NO_3), nitrite, TDS, and vanadium.

Sediment structures are earthen embankments constructed by digging key-ways into the sides and bottoms of drainages, and building dams on top of the key-ways from earthen materials excavated locally using standard engineering and construction methods. At some locations, water impounded by the dams may persist in large enough amounts and for sufficient durations to cause seepage through the bottom of the dam or through more permeable geologic formations near the embankment, eventually emanating downstream of the structure. Peabody terms these downstream emanations “seeps.” The seeps range from damp areas at the embankment toe to water flowing at low rates in the channel for limited distances below the structure. Most of the seeps are ephemeral, and those that do flow more persistently do so at rates no greater than several gpm.

The water impounded by the dams usually carries low dissolved chemical loads, but commonly features high concentrations of suspended solids due to the natural process of sediment entrainment during rainfall runoff. After the suspended solids settle out of the water impounded above the dam, seepage through the embankment or surrounding geology (e.g., thin coal seams) can react with constituents that naturally occur in the materials used to build the embankments or the more permeable geologic formations in the vicinity. These reactions between water from the impoundment and surrounding materials can result in elevated concentrations of select water-quality parameters such as pH, NO_3, aluminum, selenium, iron, and other trace elements. On occasion, these parameters have exceeded water-quality standards. However, the seepages and chemical reactions are not prevalent at the sediment-control structures built by Peabody.

Seeps below NPDES impoundments were identified as features of concern by the USEPA during the late 1980s and early 1990s. As a result, Peabody monitored the seeps, and conducted a comprehensive study during 1995. The study (Brogan-Johnson 1996) concluded the following:

> The evaluation of major ion chemistry, deuterium and oxygen isotope data, relationships between water levels and seep discharges, and geology, indicate that the chemistries of the impoundments are variable, and the geochemical relationships between impoundments and their seeps are complex. All exceedences of the effluent limitations appear to be attributable to natural processes, and/or the geologic material within the study area. The chemistry of the seeps and natural springs in the Wepo Formation appear to be controlled by similar geochemical processes.

Nevertheless, the presence of the impoundments creates a source of water that feeds the seeps and, in some cases, results in discharges that exceed water quality standards for some parameters.

Based on the study results, Peabody developed a Seepage Management Plan to manage seeps below NPDES-permitted sediment-control structures. The plan was approved by USEPA and subsequently incorporated in the Kayenta and Black Mesa Mine NPDES permit in March 1999, and remains a NPDES permit requirement today. Peabody routinely inspects select NPDES sediment ponds that have seeps, conducts monitoring at the seeps for flow and water quality at least annually and in some cases more frequently, and assesses the data with respect to livestock water-quality standards and potential impacts on the hydrologic balance. Peabody submits an annual Seepage Monitoring and Management Report to USEPA and other agencies (Hopi Tribe, Navajo Nation, and OSM) that incorporates seep-inspection summaries, flow and water-quality data, assessments of the data with respect to livestock water-quality standards and impacts on the hydrologic balance, and summaries of management activities that have been conducted during the year. To date, Peabody has submitted seven annual Seepage Monitoring and Management Reports.

Peabody samples seeps that have pooled or have sufficient flowing water to allow sampling on an annual basis. Water-quality parameters measured in the field in 2005 included electrical conductivity, pH, temperature, and salinity. A total of 41 water samples were collected from NPDES and non-NPDES seeps. Thirty-eight samples were analyzed for iron (total and dissolved), selenium (total and recoverable), and nitrogen (NO_3 and nitrite), while three samples were further analyzed for the full suite of chemical parameters (Peabody 2006).

Analysis indicated that livestock drinking-water standards were exceeded in samples collected in 2005 from 6 of 28 seep-sampling sites (Seeps BM-A1-S1, BM-A1-S2, N6-F-S1, J21-A1-S1, N14-D-S1, andN14-P-S1) (Table 3-3). These six sites are below five separate ponds. Two of the ponds, J21-A1 and N14-D, are not NPDES ponds. The measurements are similar to previous years, with the exception of the high value for total recoverable selenium measured at a seep below Pond J3-D. No results outside the acceptable range for livestock drinking water were measured at the remaining 22 sites that were sampled.

Table 3-3 Seep-Water Samples not Meeting Livestock Drinking-Water Standards*

Seep Monitoring Site	Water-Quality Parameters	Livestock Drinking-Water Standards	Measured Values	Impacts on Livestock Drinking Water and Prevailing Hydrologic Balance
BM-A1-S1	Field pH	6.5 to 9.0 S.U.	4.86 to 5.18 S.U.	Measurements outside of pH range recommended for livestock, indicating seep water is unsuitable for livestock. Proposed (pending USEPA approval) passive treatment system and rock placed along limited reaches to prevent livestock accessing seep water.
BM-A1-S2	Field pH	6.5 to 9.0 S.U.	3.42 to 4.25 S.U.	Measurements outside of pH range recommended for livestock, indicating seep water is unsuitable for livestock. Proposed (pending USEPA approval) passive treatment system and rock placed along limited reaches to prevent livestock accessing seep water.
N6-F-S1	Field pH	6.5 to 9.0 S.U.	3.89 to 4.18 S.U.	Measurements outside of pH range recommended for livestock, indicating water is unsuitable for livestock. Additional fencing added in 2005 to prevent access by livestock.
J21-A1-S1	TDS	6,999 mg/L	8,610 mg/L	New seep, only sampled once. May be laboratory error, but likely to be near the standard.
N14-D-S1	Field pH	6.5 to 9.0 S.U.	3.60 S.U.	Seep unsuitable for livestock use. Fenced to prevent livestock access.
N14-P-S1	Field pH	6.5 to 9.0 S.U.	5.57 S.U.	New seep. Downstream impact small due to buffering by alkaline soils and concurrent snowmelt.
	Total recoverable aluminum	5 mg/L	6.80 mg/L	

SOURCE: Peabody Western Coal Company 2006

NOTES: * Livestock drinking-water standards established by Navajo Nation (1999).
pH = acidity or alkalinity of a solution, S.U. = standard units, USEPA = U.S. Environmental Protection Agency, TDS = total dissolved solids, mg/L = milligrams per liter, µg/l = micrograms per liter

Evaluation of water-quality data collected in 2005 indicates that the impact of these seeps is localized. The pH of the water controls the solubility and transport of metals. Other than at the immediate area of the seeps, the pH of surrounding groundwater and surface water is alkaline. When dissolved in low-pH water, most metals are rapidly lost to a solid (precipitation) as the seep water flows a short distance downgradient. Some of the values of the constituents of concern are already as high or higher in the natural system. In addition, seep-flow rates and total chemical loads are relatively small in comparison to the flow rates and chemical loads typically measured in downgradient shallow groundwater (alluvial aquifer) and streamflow (Peabody 2004).

The results of the analyses of seeps on surface-water quality indicate that increases in chemical concentration would be minimal or immeasurable if seep water with high levels of NO_3, SO_4, TDS, selenium, or aluminum mixed directly with conservatively low rates of stormwater runoff in receiving streams. Thus, impacts of seeps on surface water are limited to the immediate areas of the seeps below the NPDES ponds. Information regarding the results of seep inspections and analyses conducted in 2005 are presented in the 2005 Seepage Monitoring and Management Report prepared by Peabody (2006).

3.4.1.2 Groundwater

Within Black Mesa, groundwater in the region can be found in the alluvium, Mesa Verde Group, D-aquifer system, N-aquifer system, and C-aquifer system. The alluvial and Mesa Verde Group aquifer systems are discussed below. The D-, N-, and C-aquifer systems are discussed in Section 3.4.3.

The alluvial-aquifer system represents alluvium (stream deposits) and colluvium (original rocks and debris) that occur as a substantial volume within and along principal washes in the study area. These washes include Dinnebito, Reed Valley, lower Coal Mine, and lower Moenkopi. The saturated portions of these washes range from 900 to 40,000 square feet in area (OSM 2006). Transmissivity values are reported to range from 21 gallons per day per foot (gpd/ft) to 5,100 gpd/ft (Peabody 2006). The alluvial aquifer is recharged from infiltration of surface-water runoff, and from the intersection of the alluvial channels with saturated portions of the Mesa Verde Group, including the Toreva and Wepo Formations (OSM 2004b).

Alluvial-aquifer water quality is highly variable and dependent upon the water quality and quantity of the contributing source. TDS range from 628 mg/L (Coal Mine Wash) to 62,000 mg/L (Moenkopi Wash). Nitrate is a concern in the alluvium, ranging up to 540 mg/L in some samples. Water quality in alluvial wells upgradient of all mining activities (groundwater flow before reaching the mine area) has a median TDS ranging from 540 mg/L (Coal Mine Wash) to 4,276 mg/L (Dinnebito Wash). Sulfate concentrations in upgradient background alluvial-monitoring wells have a median concentration ranging from 220 mg/L (Coal Mine Wash) to 2,774 mg/L (Dinnebito Wash). Therefore, background alluvial water is marginally suitable for livestock watering based on Hopi Tribe and Navajo Nation proposed livestock watering limits of 1,000 mg/L for SO_4. Of the 32 alluvial wells sampled in 2005, 6 wells potentially were suitable for livestock use (Peabody 2005).

The Mesa Verde Group yields small amounts of water to wells and springs on Black Mesa. This group is a source of water for springs located on the Hopi Reservation and is of local significance as a shallow source of water supply. The Mesa Verde Group includes the Wepo Formation that is mined for coal at the Black Mesa Complex. This Formation is separated from the underlying D aquifer by the relatively impermeable Mancos Shale.

Water levels in the Wepo aquifer range from 0 to 212 feet below ground surface (bgs) across the permit area (Peabody 1986, revised 2004). The aquifer is confined in some areas and is not present continuously across the project area. Recharge occurs in the unconfined and exposed surface areas of broken and burned coal-clinker material. The direction of groundwater flow is generally west to southwest across the Black Mesa Complex. Tests on wells drilled into the Wepo aquifer indicate transmissivity values of between 0.07 and 1,990 gpd/ft. Reported storage coefficients for the Wepo aquifer are between 1.9×10^{-5} and 1.45×10^{-4}, indicating confined or delayed yield conditions in the area of the test wells.

The LOM revision application evaluated the hydrogeology of water flow to the open pits from the Wepo aquifer. Aquifer testing indicated that some flow in the Wepo aquifers was confined and that coal beds acted as confining layers in some sequences. In general, however, groundwater modeling assumed that the alluvial and Wepo aquifers were connected and, upon excavation, groundwater flow would be in the direction of the face of the mine pits. Maximum inflow (Pit N-14) was estimated to be about 23 gpm. The computer-predicted impact on Wepo aquifer water levels was as much as 65 feet. However, actual observation of both pit-water inflow and water-level change in Wepo wells suggests that groundwater modeling overestimates both these numbers (Peabody 1986, revised 2004).

To date, two Wepo windmill wells have been removed by mining, and one additional windmill well will be removed in the future. Peabody has committed to replacing all three wells. Peabody has installed two water stands that provide free potable (N-aquifer) water to the public on a 24-hour, 7-day-a-week basis.

Groundwater from the Wepo aquifer is highly variable in chemical quality. Water from sandstone units generally contains calcium bicarbonate. Coal water contains calcium/magnesium sulfate, and water from shale units contains sodium/potassium sulfate. Wepo-aquifer water from background wells located a significant distance from the area disturbed by mining indicates median SO_4 concentrations may be as high as 1,100 mg/L. Therefore, Wepo-aquifer water is marginally suitable for livestock watering based on Hopi Tribe and Navajo Nation proposed surface-water-quality standards for livestock (SO_4 limit of 1,000 mg/L).

3.4.2 Coal-Slurry Pipeline

3.4.2.1 Surface Water

A number of watercourses are traversed by the existing coal-slurry pipeline. The pipeline crosses the following:

- Coal Mine Wash
- Moenkopi Wash
- Black Mesa Wash
- Little Colorado River
- Cedar Wash
- Miller Wash
- Spring Valley Wash
- Red Lake Wash
- Cataract Creek
- Martin Dam Draw
- Big Chino Wash
- Muddy Creek
- Knight Creek
- Tuckayou Wash
- Sacramento Wash
- Colorado River

In addition to these larger named washes and water bodies, the existing pipeline route crosses many smaller, unnamed washes. Of these watercourses, only the Colorado River is perennial; the rest are intermittent or, most commonly, ephemeral (flowing in direct response to precipitation). There are, however, portions of some drainages that are perennial. None are unique waters, as defined by the NNEPA. The Colorado River is one of the most regulated streams in the West. Where the existing coal-slurry pipeline crosses the Colorado River, the river's flow is controlled by the Davis Dam. The rest of these washes or streams are largely unregulated.

The major nonperennial streams include Moenkopi Wash, Little Colorado River, Cataract Creek, Big Chino Wash, and Sacramento Wash. Median annual peak surface-water flows recorded at USGS stream-gauging stations vary widely and are reflective of local rainfall, the period of record for the stream-gauging station, and how much of the watershed is upstream of the location. From these data, it is likely that Moenkopi Wash, the Little Colorado River, and Sacramento Wash would provide the largest potential flood flows.

Designated uses of the streams not on tribal land have been defined only for Cataract Creek, Sacramento Wash, the Little Colorado River, and the Colorado River (Table 3-4). The remaining nontribal streams are all designated for aquatic-and-wildlife ecological and partial-body-contact recreational uses. On the Navajo Reservation, surface-water quality is the responsibility of the NNEPA and USEPA. On the Navajo Reservation, Begashibito Wash and the Little Colorado River are designated for secondary human contact, ephemeral warm-water habitat, and livestock and wildlife watering. Moenkopi Wash has the same designations plus agricultural water supply (Navajo Nation 1999).

Table 3-4 State-Designated Use, as declared by AZ Rule R18-11, Appendix B

Listed streams							
Stream	**Stream Segment**	**State-Designated Uses**					
Cataract Creek	Below 1 km downstream of Williams Wastewater Treatment Plant outfall to confluence of Red Lake Wash	A&Wc	FBC	FC			AgL
Sacramento Wash	Tributary to Topock Marsh at 34°43’48"/114°29’13"	A&We	PBC				
Little Colorado River	Below confluence with Puerco River	A&Ww	FBC	DWS	FC	AgL	
Colorado River	Lake Powell to Topock	A&Wc	FBC	DWS	FC	AgI	AgL
Tributary rule streams							
Stream		**State-Designated Uses**					
Miller Wash	Ephemeral tributary to Cataract Creek	A&We	PBC				
Spring Valley Wash	Ephemeral tributary to Cataract Creek	A&We	PBC				
Red Lake Wash	Ephemeral tributary to Cataract Creek	A&We	PBC				
Martin Dam Draw	Ephemeral tributary to Partridge Creek	A&We	PBC				
Big Chino Wash	Ephemeral tributary to the Verde River	A&We	PBC				
Muddy Creek	Ephemeral tributary to Big Chino Wash	A&We	PBC				
Tuckayou Wash	Ephemeral tributary to Knight Creek	A&We	PBC				
Knight Creek	Ephemeral tributary to the Big Sandy River	A&We	PBC				

SOURCE: Arizona Department of Environmental Quality 2003a

NOTES: Latitude/longitude: ° = degree, ‘ = minute, " = second; A&Wc = aquatic and wildlife (cold water), A&We = aquatic and wildlife (ephemeral), AgI = agricultural irrigation, AgL = agricultural livestock watering, DWS = domestic water source, FBC = full-body contact, FC = fish consumption, km = kilometer, PBC = partial-body contact

3.4.2.2 Groundwater

Map 3-6 shows the pipeline route and major groundwater aquifers. In the western portions of the route (west of Cameron) the pipeline crosses primarily shallow alluvial aquifers. These aquifers are composed of unconsolidated and semiconsolidated clay, silt, sand and gravel. Groundwater depths range from a few feet to several hundred feet bgs. In most areas, however, the water table is below the excavation depth of the pipeline trench. East of Cameron, the coal-slurry pipeline crosses the outcrops of the N aquifer, D aquifer, and Wepo and alluvial aquifers. These aquifers are described in other sections of this chapter.

3.4.3 Water Supply

3.4.3.1 C Aquifer Water-Supply System

3.4.3.1.1 Surface Water

With the exception of the Colorado River, most streams in the study area are intermittent or ephemeral. There are, however, portions of some drainages that are perennial. These reaches exist where groundwater discharges to the stream channel. These stream reaches may be affected by groundwater pumping from the C aquifer. The two streams of most concern for possible impacts due to pumping at the C-aquifer well field are lower Clear and Chevelon Creeks. Location of the proposed C-aquifer well field, Clear Creek, Chevelon Creek, and other C-aquifer features are shown on Map 3-5.

The Clear Creek watershed (subwatershed of the Little Colorado River watershed) drains approximately 600 square miles above and to the south of the City of Winslow before the confluence with the Little Colorado River. Clear Creek is composed of both perennial reaches, fed by baseflow, and ephemeral sections, supplied by flood-flow periods during snowmelt and runoff events. ADWR estimated an average depleted flow (streamflow after diversions and evaporation) of 61,860 af/yr for Clear Creek (ADWR 1994).

The headwaters of Clear Creek are on the Mogollon Rim, at about 7,500 feet above MSL (refer to Map 3-5). The stream flows 25 miles in a generally northeasterly direction to its junction with the Little Colorado River at about 4,900 feet above MSL. Blue Ridge Reservoir, located on one of the Clear Creek headwater tributaries, has a storage capacity of 19,500 acre-feet. About 0.5 mile south of the confluence with the Little Colorado River, Clear Creek is impounded to form McHood Reservoir. McHood Reservoir currently stores between 200 and 500 acre-feet.

June is traditionally the period of lowest rainfall and surface flow runoff in the region, and it offers the monthly average most indicative of base flow conditions and flow minima. There are two USGS stream-gauging stations in the Clear Creek watershed: USGS Station 09398500 below Willow Creek with a period of record from 1947 to 1991, and farther downstream, USGS Station 09399000 near Winslow, with a period of record from 1906 to 1982. These data, while not necessarily reflective of current conditions, show the climate variations that include high streamflow pulses early in the calendar year followed by a summer dry period and increase over the monsoonal months of August and September. Fall/winter frontal storms also are reflected in the streamflow data. As of the summer of 2005, the Winslow station was reactivated and now serves as a real-time stream gauge.

A field investigation was conducted between June 30 and July 5, 2005, and consisted of visual inspection of the perennial reaches of lower Chevelon Creek and lower Clear Creek, along with measurement of flow, salinity (specific conductance), and retrieval of water samples for laboratory analysis. The work was performed by staff from the USGS Arizona Water Science Center in Flagstaff, Arizona.

Perennial flow in Clear Creek begins about 10 miles upstream from the Little Colorado River. Flow in Clear Creek was about 2.5 cfs 0.5 mile above McHood Reservoir (approximately 2 miles upstream from the confluence with the Little Colorado River). At the entrance to the reservoir, the flow increased to 3.2 cfs. Seeps from the Coconino Sandstone were observed in the canyon walls at the reservoir. Immediately below the dam, the creekbed was dry. However, springs began appearing directly below this section of the creek. Flow increased to about 5.4 cfs over this interval. Flow in the Little Colorado River above Clear Creek was about 0.06 cfs and increased to 3.2 cfs below the confluence of Clear Creek and the Little Colorado River.

Chevelon Creek is located to the southeast of Clear Creek and is broadly similar in surface-water hydrology (refer to Map 3-5). The Chevelon Creek watershed drains approximately 800 square miles south of the City of Winslow and empties into the Little Colorado River. Chevelon Creek is characterized by streamflow patterns similar to Clear Creek, with distinct perennial reaches sustained by springs and seeps. ADWR estimated an average depleted (after all diversions) flow of 40,680 af/yr (ADWR 1994).

Streamflow patterns in Chevelon Creek are similar to those in Clear Creek. There are two USGS stream-gauging stations: Station 09397500 below Wildcat Canyon, with a period of record from 1947 to present, and Station 09398000 near Winslow, with a period of record from 1906 to 1972. The period of record is the period when daily values of approved, quality-assured data were collected. Seasonality of runoff is similar to that of Clear Creek, although of slightly higher discharge on Chevelon Creek. Median flows from the periods of record on Chevelon Creek for June are 0.063 cfs at Wildcat Canyon and 5.02 cfs at Winslow.

Perennial flow in Chevelon Creek starts about 12 miles upstream from its confluence with the Little Colorado River. During the field investigation, observed flow in Chevelon Creek ranged from 0.36 to 0.50 cfs in the reaches above Chevelon Reservoir (about 5 miles above the confluence with the Little Colorado River). Seeps from the Coconino Sandstone were observed in this same section. Along the shores of the reservoir, a spring discharges about 0.1 cfs. Flow over the Chevelon Reservoir Dam was 2.2 cfs, which increased to 2.7 cfs downstream of the dam. One-half mile upstream of the confluence with the Little Colorado River, the flow measured 2.6 cfs, and at the confluence, 1.6 cfs. Thus, it appears that the stream was gaining at the reservoir and immediately downstream began losing to the streambed and evaporation.

The USGS has taken several samples for standard water-quality analysis on both Chevelon and Clear Creeks. These data indicate generally good-quality water with low values for typical problem constituents in southwestern streams (i.e., boron, fluoride, NO_3, pH, etc.). TDS range from about 500 to 3,600 mg/L.

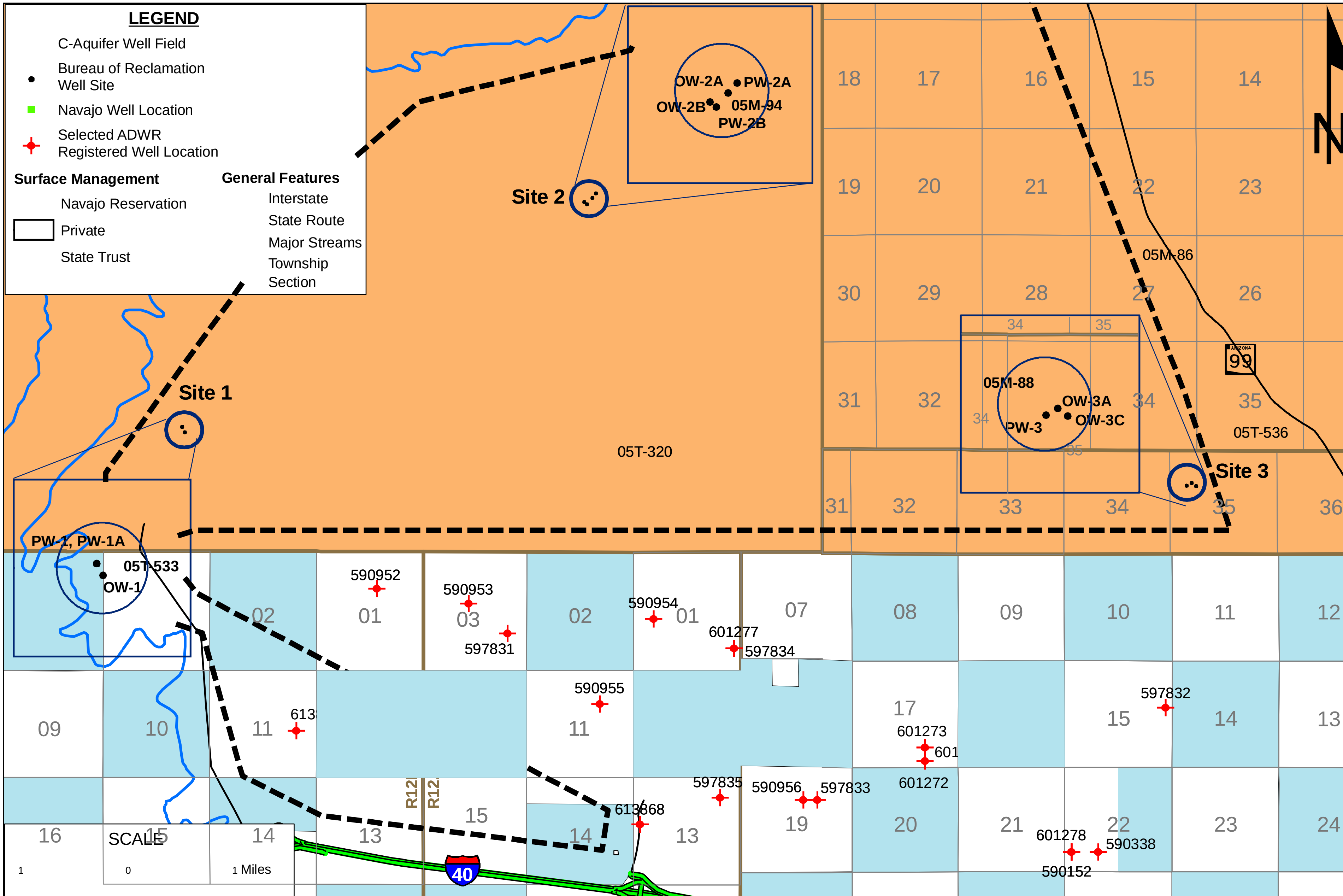
3.4.3.1.2 Groundwater

The C aquifer underlies most of the eastern half of northern Arizona and includes an area of approximately 27,000 square miles (refer to Map 3-6). Most recharge to the C aquifer occurs along the Mogollon Rim and in the San Francisco Peaks where precipitation is high. Additionally, recharge occurs on the slopes of the Defiance Uplift (near Ganado) where precipitation also is elevated. C-aquifer recharge is estimated to be 319,000 af/yr. Of this amount, 173,280 af/yr flow north into the study area. Most of this water (164,000 af/yr) eventually discharges at Blue Springs in the Little Colorado River gorge. Recharge that does not flow north into the Little Colorado River basin flows south into the Verde and Salt River basins (Hart et al. 2002). The total volume of groundwater in storage in the C aquifer within the Little Colorado River watershed has been estimated at 413 million acre-feet (ADWR 1989). Groundwater usage in the Little Colorado River Basin portion of the C aquifer in 2000 is estimated at about 100,000 af/yr (Reclamation 2005)

Approximately 1,500 square miles of the C aquifer along the western edge of the Navajo Reservation is considered to be dry (water level is below the bottom of the C aquifer). In this area, groundwater is thought to move downward through faults and fractures in the Supai Group into the limestone of the R aquifer (Hart et al. 2002). Over much of the rest of the study area, the C aquifer generally is separated from the underlying R aquifer by the low-permeability units of the middle and lower Supai Group. The saturated thickness of the C aquifer varies from 0 to more than 900 feet and averages 400 feet within the watershed.

The C aquifer is unconfined south of the Little Colorado River (refer to Map 3-5). North of the river, beneath the Hopi and Navajo Reservations, the aquifer generally is confined by the overlying Moenkopi and Chinle Formations (Leake et al. 2005).

As requested by Reclamation, USGS drilled three test wells and six observations wells at three sites within the proposed well field for the project water supply. Location of the test wells and other wells in the area of the well field are shown on Map 3-8. Depths of the test wells range from 1,096 to 1,134 feet. These wells were pumped and tested to investigate lithologic, structural, and water-quality conditions and to estimate aquifer parameters. The results of these tests are presented in Table 3-5 and Table 3-6.



SOURCES:
Arizona Department of Water Resources 2005
Navajo Nation Department of Water Resources 2005
Bureau of Reclamation 2006

Map 3-8

C-Aquifer Test Wells and Other Nearby Wells

Table 3-5 Aquifer Parameters for C-Aquifer Well Field

Parameter	Site 1	Site 2	Site 3
Specific capacity (gpm/ft)	2.0	7.5	2.4
Transmissivity (gpd/ft)	52,400	134,700	40,400
Hydraulic conductivity (ft/day) – Coconino (Ss)	28	42	11
Hydraulic conductivity (ft/day) – Schnebly Hill Formation	NA	0.5	0.2
Hydraulic conductivity (ft/day) – Upper Supai Group	0.1	NA	0.2
Specific yield (dimensionless)	0.06	0.08	0.05
Specific storage (1/ft)	2×10^{-6}	2×10^{-6}	2×10^{-6}
Vertical anisotropy (dimensionless)	0.5	0.2	0.2

SOURCE: Hoffmann et al. 2005
NOTE: ft/day = feet per day, ft = foot (feet), gpm/ft = gallons per minute per foot, gpd/ft = gallons per day per foot,

Table 3-6 Test Well Selected Inorganic Water-Quality Parameters, in mg/L except Arsenic (µg/L)

Site	Well Number	TDS	Na	Ca	Mg	NO_3	SO_4	Cl	F	As	Formation	Depth Interval (feet)
1	PW-1A	837	54.9	121	567	0.4	383	64.7	0.2	0.3	C/S-H	837 to 1,077
	OW-1	838	58.2	121	58.4	0.4	386	65.2	0.2	0.4	C/S-H	686 to 1,086
2	PW-2B	592	27.6	96.1	41.7	0.3	257	20.9	0.3	0.7	C C/S-H	577 to 715 715 to 977
	OW-2B	594	27.6	99.2	43.1	0.2	255	21.7	0.3	0.2	C C/S-H	698 to 740 740 to 998
3	PW-3	770	85.1	100	52.1	0.2	253	121	0.8	0.7	C S-H	696 to 740 740 to 1,000
	OW-3C	773	80.1	107	50.7	0.2	253	129	0.2	1.0	C Upper Supai	1,000 to 1,076 1,150 to 1,170
	Sunshine Well	606	26.1	107	45.5	0.2	265	21.7	0.2	0.5	—	—

SOURCE: Hoffmann et al. 2005
NOTES: As = arsenic, Ca = calcium, Cl = chlorine, F = fluoride, Mg = magnesium, Na = sodium, NO_3 = nitrate, SO_4 = sulfate, TDS = total dissolved solids, C = Coconino Sandstone, S-H = Schnebly Hill Formation

There are 166 known wells located within 10 miles of the proposed C-aquifer well field. Average well depth is 669 feet bgs and average depth to water is 310 feet bgs. Well yields in the vicinity of the proposed well field are reported to be between 5 and 1,700 gpm. Most of the wells in the area are small-diameter stock wells and are not designed to produce large volumes of water. Five wells produce more than 200 gpm; these are larger-diameter irrigation wells and indicate that properly designed wells can produce significant volumes of water. Reclamation pumped the test wells between 450 and 795 gpm. The ability to install moderate- to large-capacity wells in the C aquifer is further supported by reported well yields at large industrial facilities that use C-aquifer water. The closest of these facilities is the APS Cholla Power Plant, located approximately 30 miles to the east (Figure 3-3). This facility has been in operation since the late 1960s and has 21 production wells in the C aquifer. The average pumping rate of these wells is 500 gpm (HDR 2003).

Water quality in the C aquifer is generally good south of the Little Colorado River, but degrades north of the river. South of the Little Colorado River, TDS are generally less than 500 mg/L. North of the river the TDS content ranges from 3,000 to greater than 10,000 mg/L (ADWR 1989).

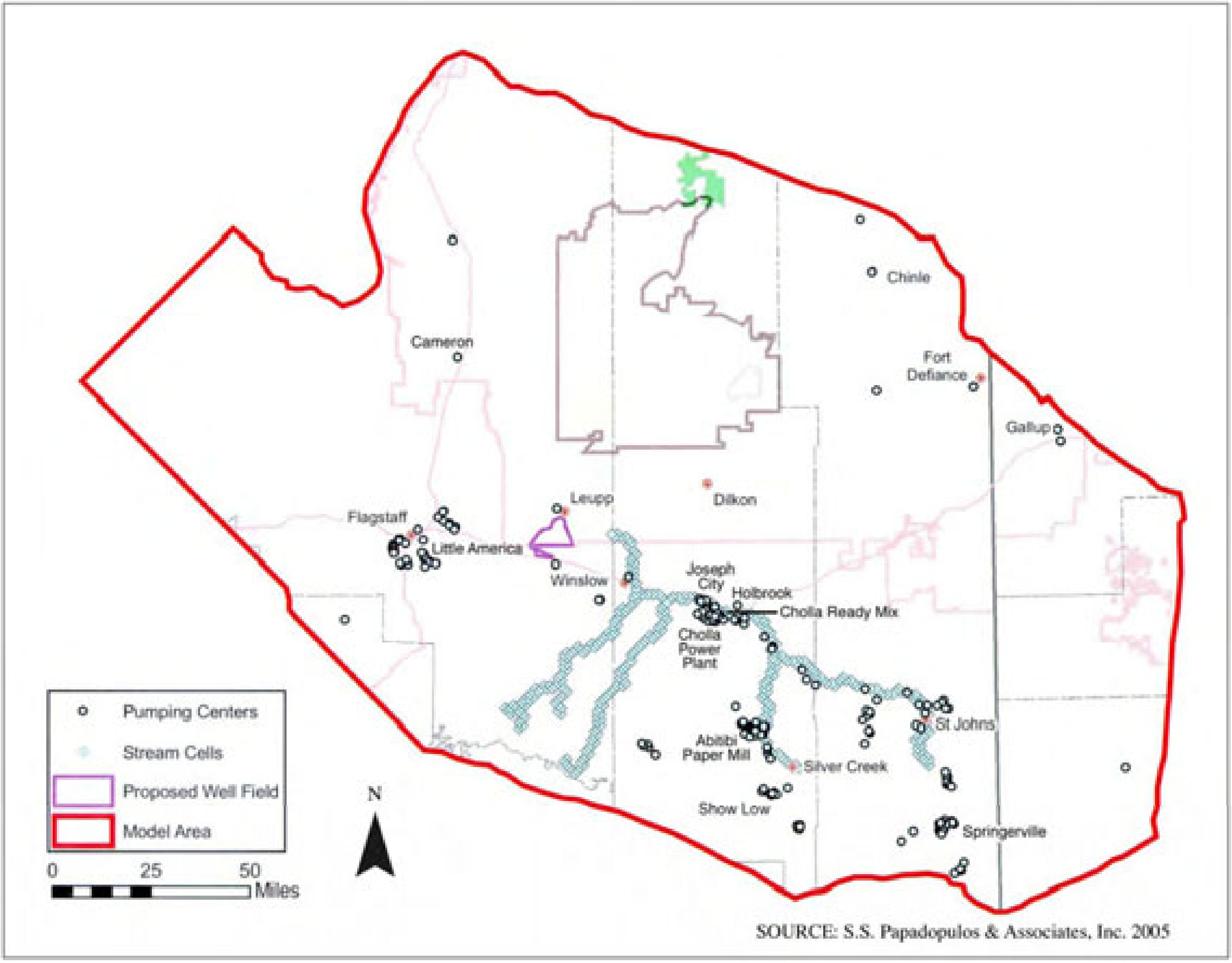


Figure 3-3 Historic and Proposed C-Aquifer Pumping Centers

Selected inorganic water-quality parameters for the test wells in the C-aquifer well field are given in Table 3-6. The water is moderately hard and has a pH of about 7.6. TDS range from 592 to 838 mg/L, which is above the secondary, nonmandatory drinking water standard of 500 mg/L. Nitrate, As, and fluoride are well below the drinking-water standards for these parameters; however, SO_4 is slightly above the secondary, nonmandatory drinking water limit of 250 mg/L.

3.4.3.1.3 Infrastructure

3.4.3.1.3.1 Well Field

The three test well sites are individually located 10 miles south of Leupp, 8 miles southwest of Leupp, and 10 miles southwest of Leupp. The proposed well-field area is within the 1,200-square-mile watershed of Canyon Diablo. Canyon Diablo is an ephemeral stream with few uses or sources of potential pollution.

The test wells and proposed well field are underlain entirely by the C aquifer. Depths of the test wells range from 1,096 to 1,134 feet bgs. Depth to water ranges from 226 to 615 feet bgs. The proposed well field is estimated to have 12 production wells drilled to approximately 1,100 feet bgs. Well spacing would be approximately 1 mile.

3.4.3.1.3.2 C Aquifer Water-Supply Pipeline Routes

In the hydrologic environment, there are some differences between the Eastern Route and the Western Route of the water-supply pipeline. The routes are both entirely within the Little Colorado River watershed. The Eastern Route would cross Dinnebito Wash, Oraibi Wash, Little Colorado River, and Yucca Flat Wash. In addition to these larger washes, many smaller unnamed washes that also may qualify as waters of the United States under the Clean Water Act may be involved. All these stream courses are intermittent or ephemeral. None supply a reliable source of drinking or irrigation water.

The Western Route would avoid the integrated channels of Oraibi and Dinnebito Washes but would cross Moenkopi Wash near Blue Canyon. This reach of Moenkopi Wash has a number of springs and seeps that are fed by the N aquifer. The Western Route also would follow Begashibito Wash, which is not encountered by the Eastern Route. Defined uses for streams crossed by the water pipeline are given in Table 3-7.

Table 3-7 Navajo Nation Water Pipeline Stream Crossings, Designated Uses

Surface-Water Body	Designated Use				
Begashibito Wash	—	—	ScHC	EphWwHbt	L&W
Dinnebito Wash	—	—	ScHC	EphWwHbt	L&W
Moenkopi Wash	—	AgWS	ScHC	EphWwHbt	L&W
Little Colorado River	Dom	PrHC	ScHC	EphWwHbt	L&W

SOURCE: Navajo Nation Water Quality Standards 1999
NOTES: AgWS = agricultural water supply, Dom = domestic water supply, EphWwHbt = ephemeral warm-water habitat, L&W = livestock and wildlife watering, PrHC = primary human contact, ScHC = secondary human contact,

Because the pipeline would be constructed near land surface, construction and operation would not affect existing groundwater in the D, N, or C aquifers. On the leasehold, the pipeline would cross the Wepo and alluvial aquifers.

3.4.3.1.4 Water Withdrawal

Current groundwater use in the C aquifer is estimated to be 100,000 af/yr. Of this, about 60,000 af/yr are pumped by the four major industrial users in the study area, 16,000 af/yr are pumped by irrigators, and the remaining 24,000 af/yr are pumped mostly by municipalities (Reclamation 2005).

Most communities in the eastern portion of the study area use the C aquifer for both municipal and irrigation uses. Communities within the area of the proposed C-aquifer well field include Leupp-Dilkon and Cameron on the Navajo Reservation, and Joseph City, Holbrook, and Winslow off the reservation. Three large regional power plants use water from the C aquifer; however, only one (Cholla, operated by APS) is located near the well-field area. In addition, the Catalyst Paper (Snowflake), Inc. paper mill near Snowflake, Cholla Ready Mix in Holbrook, and several agricultural users all extract groundwater from the C aquifer within the study area. Estimated 2010 groundwater use for these entities is given Table 3-8 (Reclamation 2005). Location of these users are shown on Figure 3-3.

Table 3-8 Estimated 2010 Groundwater Uses

User	Annual Use (af/yr)
Leupp-Dilkon	456
Cameron	25
Holbrook	948
Winslow	2,195
Holbrook Agriculture	1,500
Joseph City Agriculture	1,600
Winslow Agriculture	300
Cholla Power Plant	15,000
Cholla Ready Mix	100
Catalyst Paper Mill	18,000

SOURCE: S.S. Papadopulos and Associates, Inc. 2005

While the C aquifer is experiencing water-level declines in areas of intensive development, the USGS concluded that "the cones of depression have not reached the boundaries of the aquifer or caused a decline in springs or base flow along the periphery of the C aquifer" (Hart et al. 2002).

3.4.3.2 N and D Aquifer Water-Supply Systems

The N aquifer includes the Navajo Sandstone, sandstones of the Kayenta Formation, and the Lukachukai member of the Wingate Formation. The N aquifer consists of 4 million acres within the Little Colorado River system. The aquifer is composed of fine-grained sandstone alternating with siltstone and ranges in thickness from a few feet to 1,300 feet thick (Farrar 1979). The average thickness of the aquifer is approximately 400 feet (Eychaner 1983), and the storage coefficient is estimated to range from 0.00022 to 0.008 for the confined areas and 0.10 to 0.15 for the unconfined areas. The total water in storage has been estimated at 166 million acre-feet for this aquifer (Eychaner 1983). Transmissivity values range from 560 to 2,600 gpd/ft (Peabody 2004).

Recharge of this system generally occurs in the north-central part of the aquifer, north and west of Kayenta, where aquifer units are exposed at the land surface and precipitation is relatively high. Some N-aquifer groundwater flows to the northeast, where it discharges into Laguna Creek; to the northwest where it discharges into Navajo Creek; and to the southwest where it discharges into Moenkopi Wash. All three of these streams have perennial reaches of varying lengths supported by discharge from the N aquifer. The N aquifer also discharges to springs along the aquifer boundary (ADWR 1989) (refer to Map 3-4). These perennial stream reaches and springs may potentially be affected by groundwater pumping from the N aquifer. Areas of groundwater discharge that have been modeled to assess potential impacts due to pumping include:

- Chinle Wash
- Laguna Creek
- Pasture Canyon
- Moenkopi Wash
- Dinnebito Wash
- Oraibi Wash
- Polacca Wash
- Jaidito Wash
- Begashibito Wash/Cow Springs

There is little or no downward leakage of groundwater from the N aquifer into the underlying C aquifer because they are separated by approximately 1,000 feet of the relatively impermeable Chinle and Moenkopi Formations (ADWR 1989).

Groundwater from the N aquifer is considered to be of good to excellent quality and is suitable for most uses. Generally the groundwater contains less than 500 mg/L of TDS and rarely exceeds 1,000 mg/L. Fluoride concentrations are generally less than the recommended average concentration for drinking water.

The USGS has been monitoring N-aquifer water levels since 1981 and currently uses a groundwater-monitoring network of 34 wells to track annual water-level changes. Specifically, six nonpumping observation wells, identified as BM1 through BM6, are used to evaluate the regional hydrologic condition of the N aquifer. BM1 through BM6 have been monitored since the 1970s and are currently equipped with continuous recording devices, collecting a water-level measurement every 15 minutes. BM6 had the largest measured regional drawdown since 1965 with a water-level decline of 155 feet by 2004 (USGS 1985-2005). The USGS groundwater monitoring also indicated that although drawdown has occurred in the N aquifer, measured water levels have not dropped below the top of the N aquifer within the confined basin. Since the aquifer remains confined, groundwater in wells has continued to be above the top of the aquifer. Therefore, the saturated thickness (thickness of aquifer containing groundwater) of the confined N aquifer is unchanged at the monitored locations.

The potential for induced leakage from the D aquifer due to groundwater pumping in the N aquifer is less in the area where the N aquifer is confined by the Carmel Formation than in areas where the Carmel Formation is thin or sandy (refer to Figure 3-2). The thickness and lithology of the Carmel Formation are factors influencing groundwater leakage between the aquifers. Areas where the Carmel Formation is less than 120 feet thick coincide with areas where water from the overlying D aquifer has historically (over thousands of years) mixed with underlying N-aquifer water (Truini 2005).

The D aquifer includes the Dakota Sandstone, the water-bearing portions of the Morrison Formation, and the Cow Springs Sandstone (refer to Figure 3-1). The D aquifer is overlain by the Mancos Shale and is confined over most of the area (ADWR 1989).

Recharge generally occurs from precipitation along the eastern boundary of the D aquifer. Groundwater flows south, west, and north and discharges into springs on the eastern and northern edges of the aquifer and into the alluvium of Polacca, Oraibi, and Dinnebito Washes along the southwest aquifer boundary, and Moenkopi Wash to the west. This discharge is consumed by plants or lost to evaporation and is not seen as surface flow.

The estimated saturated thickness of the D aquifer is roughly 500 feet; however, this also may include some unsaturated units within the Dakota and Morrison Formations. The storage coefficient was estimated to be 0.015 based upon core samples adjusted to compensate for the nonwater-bearing units included in the thickness (Cooley 1969). The total amount of water in storage is estimated to be 15 million acre-feet (ADWR 1989).

Groundwater quality in the D aquifer is marginal to unsuitable for domestic use, although it may be acceptable for other uses. TDS concentrations range from 190 to 4,410 mg/L, generally exceeding the recommended limit of 500 mg/L for drinking water. Fluoride concentrations range from 0.2 to 9.0 mg/L and often exceed the maximum contaminated levels of concentration of 4 mg/L. Water quality improves slightly in the southern portion of the aquifer (ADWR 1989).

3.4.3.2.1 Infrastructure

3.4.3.2.1.1 Peabody Well Field

The N aquifer currently supplies the water for the mining operations at the Black Mesa Complex. The Peabody well field consists of eight wells used for mining operations and the coal-slurry pipeline, which currently is not in operation. Wells are located on the leasehold (refer to Map 3-4) and range in depth from 3,417 feet bgs to 3,733 feet bgs. Static (nonpumping) water levels in 2005 ranged from 945 to 1,374 ft bgs.

3.4.3.2.1.2 Community Well Fields

The BIA, Navajo Tribal Utility Authority (NTUA), and Hopi Tribe operate about 70 N-aquifer wells that are combined into 28 well systems to supply several communities on Black Mesa. The closest communities to the Peabody well field are Forest Lake, Kitsillie, Chilchinbito, and Kayenta. The largest water users are Tuba City, Kayenta, and Shonto (Truini 2005). Well depths range from 475 feet bgs (Tuba City) in the unconfined area to 2,600 feet bgs (Forest Lakes and Kitsillie) in the confined area. Depth to water in 2004 was between 30 feet bgs (Tuba City) and 1,316 feet bgs (Kitsillie) (USGS 1985-2005).

3.4.3.2.2 Water Withdrawal

The N aquifer currently supplies the majority of the water for the mining operations at the Black Mesa Complex. It also is used extensively by the Hopi and Navajo tribes as a public drinking supply. Total withdrawals from the N aquifer increased from about 70 to 8,000 af/yr from 1965 to 2002, with the major increase due to industrial use by the eight wells used for mining operations and the coal-slurry pipeline, which currently is not in operation. About 270 windmills produce N-aquifer water, primarily for stock watering. In total these windmill wells produce about 65 af/yr. In 2003, 5,800 acre-feet were withdrawn from the confined N aquifer, of which 4,450 acre-feet were attributed to operations at the Black Mesa Complex (USGS 1985-2005). The remaining water withdrawn is used by the communities.

Groundwater pumping has occurred historically in the D aquifer. While approximately 124 D-aquifer wells are located within the study area and provide a reliable source of water for local residents, most of the pumping is outside the study area. Until the Black Mesa mining operation shut down in late 2005, Peabody withdrew approximately 130 af/yr of groundwater from this aquifer through its production wells, which are screened in both the N aquifer and D aquifer. Community pumping of the confined D aquifer accounts for an annual withdrawal of approximately 100 af/yr.

3.5 CLIMATE

3.5.1 Region

The study area lies within two separate climatic regions—the eastern region and the western region. The eastern region includes the plateau and mountainous areas that are predominant from the Grand Canyon National Park and Sycamore Canyon eastward. The western region includes the valley and low mountainous regions located in portions of northwestern Arizona, southern Nevada (Clark County), and eastern California (San Bernardino County) (Map 3-9). Meteorological conditions recorded at sites within the eastern and western regions of the study area are summarized in Table 3-9.

Table 3-9 Meteorological Conditions of the Study Area

Monitor	Winter Average	Spring Average	Summer Average	Fall Average	Annual Average
Eastern Region					
Mean monthly temperature average (°F)[1]					
Betakin	31.5	47.5	69.6	51.3	50.0
Tuba City	35.3	54.4	75.0	55.9	55.1
Winslow Airport	35.4	53.9	75.1	56.0	55.1
Flagstaff	30.3	43.1	63.2	47.1	45.9
Mean monthly precipitation average (inches)[1]					
Betakin	3.08	2.19	3.32	3.32	11.91
Tuba City	1.50	1.20	1.83	2.02	6.54
Winslow Airport	1.55	1.19	3.00	2.09	7.84
Flagstaff	6.13	4.20	5.85	5.32	21.50
Mean monthly snowfall average (inches)[1]					
Betakin	31.5	12.4	0.0	7.7	51.6
Tuba City	4.2	0.8	0.0	1.5	6.5
Winslow Airport	8.0	2.2	0.0	1.2	11.4
Flagstaff	54.1	33.6	0.0	12.6	100.3
Average wind speed (miles per hour)[2]					
Winslow Airport	6.7	9.5	8.6	6.7	7.9
Flagstaff	6.1	7.0	5.6	5.2	6.0
Western Region					
Mean monthly temperature average (°F)[3]					
Bullhead City	55.7	72.6	93.5	74.8	74.2
Yucca	49.9	64.7	86.7	68.7	67.5
Mean monthly precipitation average (inches)[3]					
Bullhead City	2.70	1.22	1.07	1.29	6.29
Yucca	2.64	1.52	1.73	1.76	7.66
Average wind speed (miles per hour)[2]					
Kingman Airport	7.8	10.2	10.6	8.1	9.2

SOURCES: Western Regional Climate Center 2005a, 2005b

NOTES: [1] For mean monthly temperature, mean monthly precipitation, and mean monthly snowfall, the period used for Betakin is 1948 to 2005, for Tuba City it is 1900 to 2005, for the Winslow Airport it is 1898 to 2005, and for Flagstaff it is 1950 to 2005.

[2] For average wind-speed values, averages are based on data collected between 1992 and 2002.

[3] For mean monthly temperature and mean monthly precipitation averages, the period used for Bullhead City is 1977 to 2005 and for Yucca it is 1950 to 2005.

Three remote automatic weather-station (RAWS) monitors provide data that best represent the prevalent wind patterns within the study area (Western Regional Climate Center [WRCC 2005c]). These data were evaluated to determine wind patterns in the Black Mesa, Flagstaff, and Union Pass areas. Based on wind patterns recorded at the Betakin RAWS monitor (near the Black Mesa Complex), the Flagstaff RAWS monitor, and the Union Pass RAWS monitor (near Bullhead City), winds are predominantly from the southwest for approximately 30 to 40 percent of the year, with the remaining winds being somewhat evenly distributed.

3.5.2 Black Mesa Complex

Peabody operates a meteorological network consisting of four meteorological tower systems and five rain-gauge sites (Figure 3-4). Conditions recorded at these meteorological towers for the period of July 7, 1985, through December 31, 2004, are summarized in Table 3-10.

Table 3-10 Meteorological Conditions at the Black Mesa Complex, July 7, 1985, through December 31, 2004

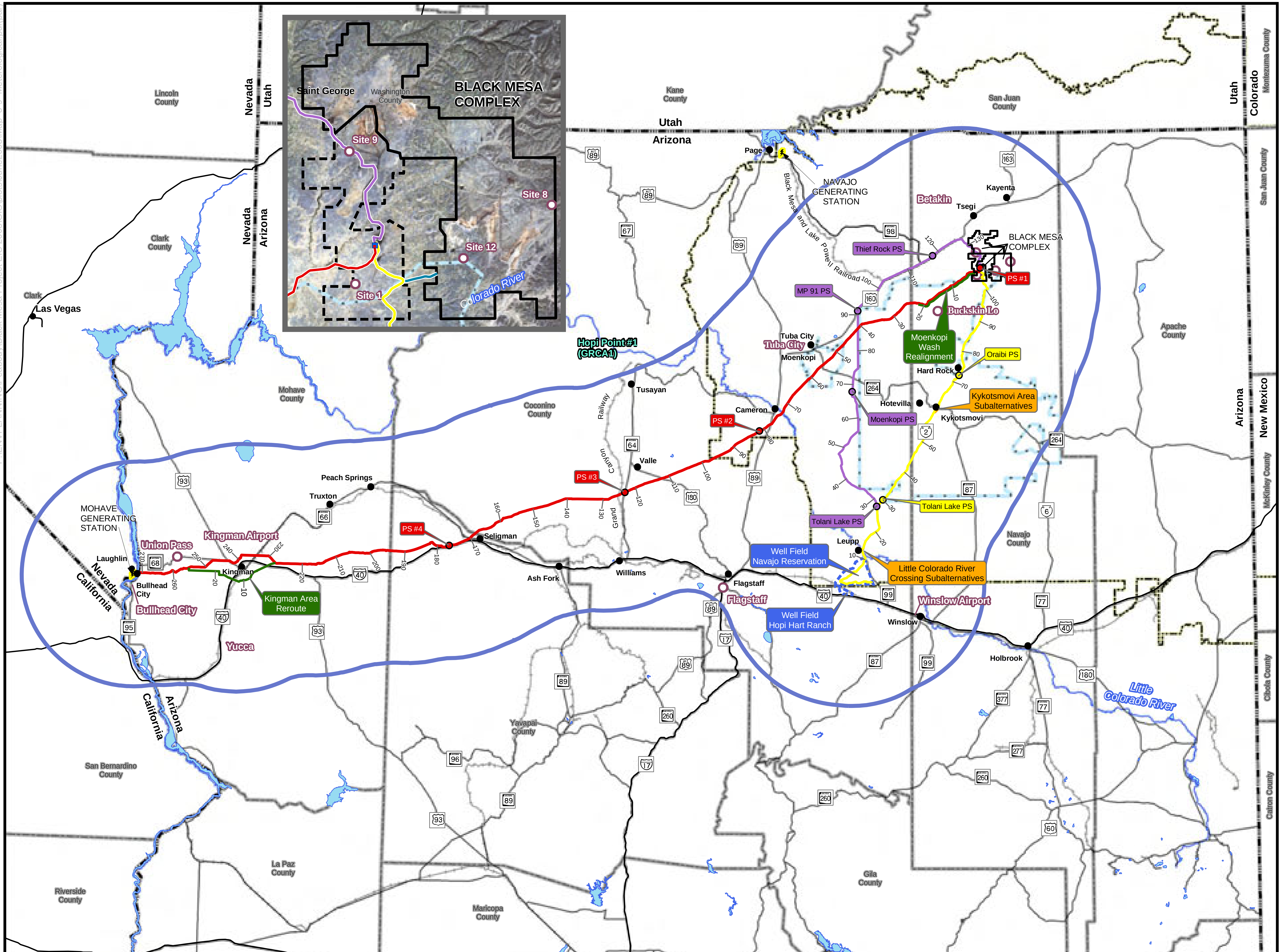
Parameter	Site 1	Site 8R	Site 9	Site 12
Temperature conditions				
Mean temperature (°F)	49.7	49.6	49.5	50.4
Maximum temperature (°F)	89.5	86.0	88.3	87.5
Minimum temperature (°F)	0.7	9.2	6.0	8.4
Precipitation				
Total annual precipitation (inches)	8.18	N/A	8.27	5.77
Wind speed				
Mean wind speed (meters per second)	3.7	4.1	3.3	4.0
Maximum wind speed (meters per second)	20.0	16.7	15.4	16.5
Minimum wind speed (meters per second)	0.2	0.4	0.2	0.2

SOURCE: TRC Environmental Corporation 2005
°F = degrees Fahrenheit, N/A = not available

The Black Mesa region in northeastern Arizona has a semiarid climate, characterized by wide variations in diurnal and annual temperature. Black Mesa receives much of its precipitation during the summer months, when afternoon showers form as a result of moist air from the Gulf of Mexico moving over the area. Rainfall as high as 0.90 inch for 1 hour and 1.98 inches for 24 hours have been recorded. The total amount of precipitation received at various locations on the Black Mesa Complex may be related to topographic features and changes in altitude. Nearly 50 percent of the annual precipitation is received in the months of July, August, and September, and 64 percent is received from April through September. Most snowfall is light and evaporates within a few days. Mean annual lake evaporation monitored at Sites 1, 8, 9, and 12 from May through October is 45 inches, with the greatest monthly evaporation occurring during June and July.

Peabody has been collecting storm hydrographs from events over the Black Mesa Complex as part of the Hydrologic Monitoring Plan. The storm characteristics are reflective of the Colorado Plateau in general. Mean summer single-peak discharges range from 54.1 to 313.5 cfs, while fall values range between 2.2 and 23.8 cfs.

Due to moderately high elevation (ranging from 6,000 to 8,200 feet above MSL), Black Mesa experiences mild summer and cold winter temperatures. The average annual temperature is about 49.8 degrees Fahrenheit (°F). Summer temperatures generally range from the mid-50s to the low 80s. Temperatures in excess of 100°F are rare.



Map 3-9
Meteorological Monitoring Stations

Black Mesa Project EIS

LEGEND

Climatic Data Locations

- Climate Study Area
- Meteorological Monitoring Station

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
Peabody Energy 2006
URS Corporation 2005, 2006
Arizona State Land Department 2005

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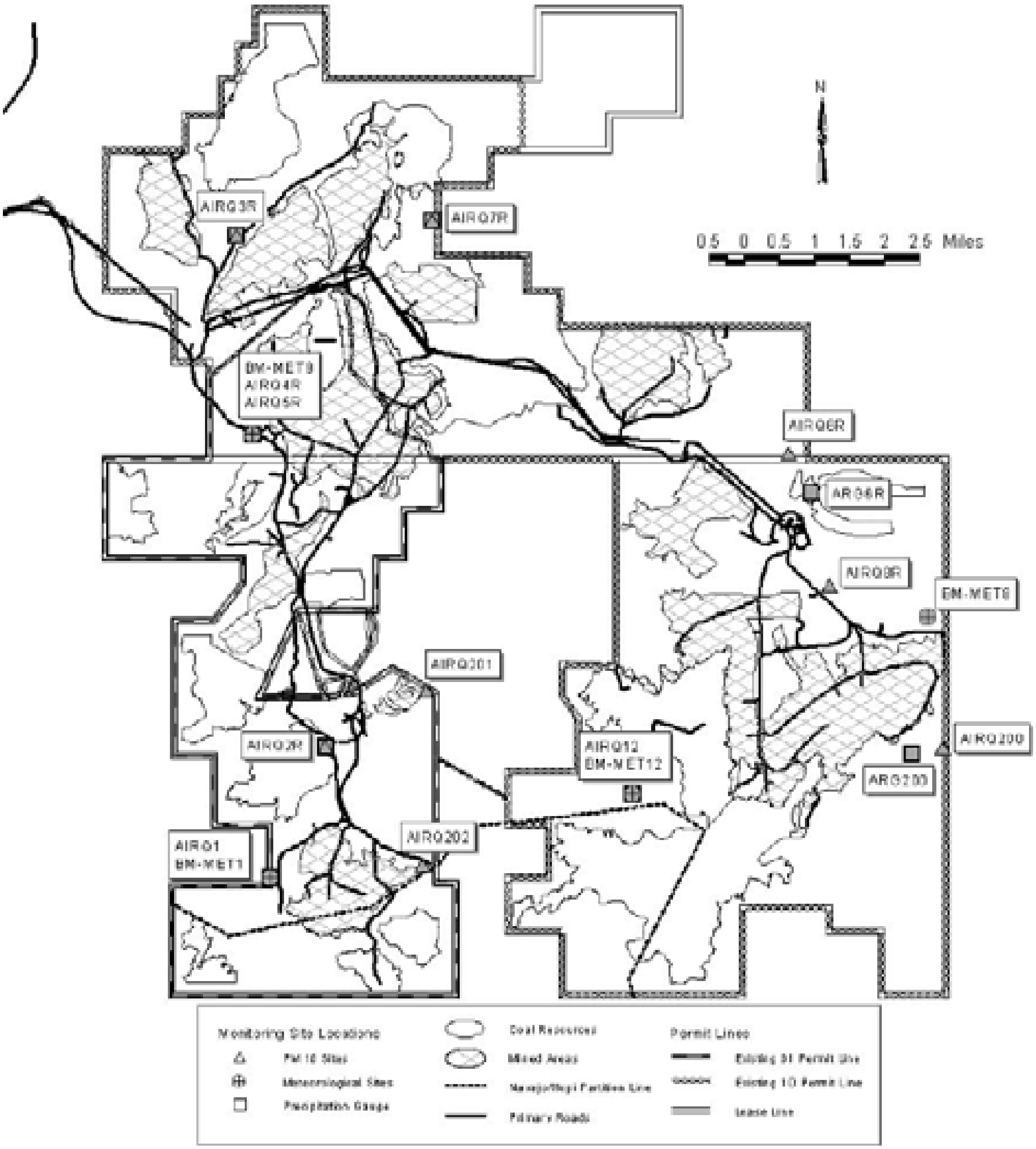


SOURCE: TRC Environmental Corporation 2005

Figure 3-4 Monitoring Site Locations at the Black Mesa Complex

In winter, early morning temperatures normally drop to the high teens or low 20s; however, the air usually warms rapidly and reaches the upper 30s or low 40s by early afternoon. The coldest month is January, with an average temperature of 31ºF. July is the warmest month, with an average temperature of 69ºF (U.S. Department of Commerce, National Oceanic and Atmospheric Administration 1974).

For the period of July 7, 1985, through December 31, 2004, average temperature and wind characteristics recorded at sites 1, 9, and 12 are available by month, and are summarized by season in Table 3-11.

Table 3-11 Seasonal Meteorological Conditions at the Black Mesa Complex

Parameter	Winter Average	Spring Average	Summer Average	Fall Average	Annual Average
Temperature conditions					
Mean temperature (°F)	32.3	47.7	68.7	50.3	49.8
Maximum temperature (°F)	43.3	60.3	82.3	62.3	62.1
Minimum temperature (°F)	21.7	35.0	54.3	37.7	37.2
Wind speed					
Average wind speed (meters per second)	3.1	4.1	3.4	3.3	3.5
Hourly maximum wind speed (meters per second)	18.2	20.2	16.4	19.6	18.6

SOURCE: Peabody Western Coal Company 2000

3.5.3 Climate Change

Based on current scientific research, there is growing concern about changes that may occur to the global climate. Through many complex interactions on a regional and global scale, the lower layers of the atmosphere experience a net warming effect. The Earth's surface average temperature rose by about 1°F during the twentieth century, and the warming process has accelerated during the past two decades (USEPA 2000; U.S. Nuclear Regulatory Commission [NRC] 2001).

There is an ongoing scientific debate about the cause of these trends. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends. Current understanding of many other aspects of climate change ranges from "likely" to "uncertain." Scientists know with virtual certainty the following:

- Human activities are changing the composition of the Earth's atmosphere. Increasing levels of greenhouse gases like CO_2 in the atmosphere since preindustrial times are well documented and understood.
- The atmospheric buildup of CO_2 and other greenhouse gases is largely the result of human activities such as the burning of fossil fuels.
- A warming trend of about 0.7 to 1.5°F occurred during the twentieth century. Warming occurred in both the northern and southern hemispheres, and over the oceans (NRC 2001).
- The major greenhouse gases emitted by human activities remain in the atmosphere for periods ranging from decades to centuries. It is therefore virtually certain that atmospheric concentrations of greenhouse gases will continue to rise over the next few decades.
- Increasing greenhouse gas concentrations tend to warm the planet (USEPA 2006a).

Greenhouse gases are gases that trap heat in the atmosphere. Some greenhouse gases such as CO_2 occur naturally and are emitted into the atmosphere through natural processes and human activities. Other greenhouse gases (e.g., fluorinated gases) are created and emitted solely through human activities. The principal greenhouse gases that enter the atmosphere because of human activities are the following:

- Carbon dioxide—Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees, and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide also is removed from the atmosphere (or sequestered) when it is absorbed by plants as part of the biological carbon cycle or sequestered by soil and water as part of the chemical carbon cycle.
- Methane—Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and from the decay of organic waste in municipal solid-waste landfills.
- Nitrous oxide—Nitrous oxide is emitted during agricultural and industrial activities. Note that N_2O is not included in the grouping of regulated air pollutants known as NOx.
- Fluorinated gases—Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are powerful synthetic greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are often used as substitutes for ozone [O_3]-depleting substances (i.e., chloroflourocarbons and halons). These gases typically are emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as high-global warming-potential gases (USEPA 2006b).

The greenhouse gas that garners the most attention in the scientific community and the media is CO_2. Since this naturally occurring chemical also is generated by the continued burning of fossil fuels. It can last in the atmosphere for centuries and "force" more climate change than any other greenhouse gas (NRC 2001). In 2004, CO_2 accounted for 85 percent of the greenhouse gas emissions produced in the United States, and electrical generation accounted for 40 percent of those CO_2 emissions. In 2004, 2,525 million short tons (2,290.6 million metric tons or teragrams) of CO_2 were produced in the United States from electrical generation (USEPA 2006c). According to USEPA's Acid Rain Program database, the Mohave Generating Station (which currently is not operating) produced 10.7 million short tons of CO_2 in 2004 or about 0.4 percent of the United States electrical-generation total. According to a USEPA website called eGRID, the Navajo Generating Station produced 20.2 million short tons of CO_2 in 2004, or about 0.8 percent of the electrical-generation total for the United States (USEPA 2008).

The Intergovernmental Panel on Climate Change (IPCC) has stated "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities" (IPCC 2007). In short, a number of scientific analyses indicate, but cannot prove, that rising levels of greenhouse gases in the atmosphere are contributing to climate change (as theory predicts). In the coming decades, scientists anticipate that as atmospheric concentrations of greenhouse gases continue to rise, average global temperatures and sea levels will continue to rise and precipitation patterns will change.

Important scientific questions remain about how much warming will occur, how fast it will occur, and how the warming will affect the rest of the climate system, including precipitation patterns and storms (USEPA 2006a). Climate science is a relatively new field of study, and additional research is being conducted to better understand the mechanisms with the potential to affect climate change. Two examples of this research involve the role of aerosol particles in the atmosphere and the impacts of variations in the Earth's solar-energy balance.

Aerosol particles influence radiative forcing directly through reflection and absorption of solar and infrared radiation in the atmosphere. Some aerosols cause a positive forcing, while others cause a negative forcing. Radiative forcing is the difference between the amount of incoming radiation energy (from the sun) and outgoing radiation energy (back from the Earth) in a specific climate system. Positive forcing warms the climate system, and negative forcing cools it. The direct radiative forcing summed for all aerosol types is believed to be negative. Volcanic eruptions are an important example of episodic, natural aerosol emissions. Explosive volcanic eruptions can create a short-lived negative forcing of two to three years on the climate system through the temporary increases that occur in SO_4 aerosol in the stratosphere. Sources of anthropogenic aerosols include industry, transportation, and agriculture.

Aerosols are also believed to cause a negative forcing indirectly through the changes they cause in cloud properties (IPCC 2007). These indirect effects on clouds include the radiative properties, the amount, and lifetime of the clouds. The IPCC denotes the indirect aerosol effects as “cloud albedo effect” and “cloud lifetime effect,” as these terms are more descriptive of the microphysical processes that occur (IPCC 2007).

The sun is the Earth’s primary source of incoming energy; thus, solar activity is the most significant contributor to the Earth’s energy balance. To maintain the Earth’s energy balance at steady-state conditions (constant temperature), all the incoming solar energy must be radiated back into space. (There is no heat transfer from the Earth to space by conduction or convection.) Changes in solar-energy output result in a forcing on the Earth’s energy balance and climate system. The energy balance for the Earth is dictated by the amount of radiation received from the sun; thus, small variations in solar output can result in significant radiative forcings on the climate system. For example, Scafetta and West (2006) have recently shown that observed feedback associated with past changes in solar activity have resulted in radiative forcings greater than those predicted by climate models and that “most of the sun-climate coupling mechanisms are probably still unknown.” Their findings suggest the presence of a solar cycle driving the climate of the last millennium, with maximum solar irradiance occurring during the medieval period and at present day (Scafetta and West 2006). Scafetta and West further estimate that the sun has contributed as much as 45 to 50 percent of the warming observed from 1900 to 2000 (Scafetta and West 2006). Thus, variations in solar activity are an important factor in the Earth’s climate (including recent climate change) and continue to be the subject of ongoing climate research.

Although the occurrence of global warming and climate change are acknowledged by climate scientists, it remains difficult to model and attribute observed temperature changes on a smaller scale (IPCC 2007). Natural changes in a local climate are difficult to relate to external forces. Consequently, estimation of the impacts of climate change on natural conditions within a particular geographic area would necessarily involve some degree of speculation. Similarly, estimation of the relative contribution of a proposed project on climate change, either within the region or globally, are miniscule, and not possible to quantify with certainty (IPCC 2007).

Review of Science and Methods for Incorporating Climate Change Information into Reclamation’s Colorado River Basin Planning Studies, published in 2007 by Reclamation’s Climate Technical Work Group, was reviewed to identify predicted regional impacts from climate change. The report discloses that existing climate models are not capable of adequately resolving expected impacts on precipitation in mountainous areas. The Colorado River Basin is categorized as a midlatitude region in which there is a high level of confidence in the prediction of future temperature change, but less confidence in the projection of changes to precipitation. The models used today do not provide sufficient resolution about the ways ocean circulation patterns may change in the future, and this is a key element in predicting precipitation changes (Reclamation 2007).

The models also experience difficulty in resolving topography. This is important because the precipitation occurs when moist air rises over mountainous areas and condenses to form clouds. The report states that the most recent global climate model's results for precipitation in the Colorado River Basin show somewhat consistent results across models and predict very little change in the average annual precipitation when compared to historical conditions. However, the models suggest that more of the annual precipitation in low- to midelevation areas that falls during winter may be in the form of rain, potentially decreasing runoff from snowpack (Reclamation 2007).

The National Research Council (2001) of the National Academy of Sciences noted that:

> The warming trend is spatially widespread and is consistent with the global retreat of mountain glaciers, reduction in snow-cover extent, the earlier spring melting of ice on rivers and lakes, the accelerated rate of rise of sea level during the 20th century relative to the past few thousand years, and the increase in upper-air water vapor and rainfall rates over most regions. A lengthening of the growing season also has been documented in many areas, along with an earlier plant flowerng season and earlier arrival and breeding of migratory birds. Some species of plants, insects, birds, and fish have shifted towards higher latitudes and higher elevations. The ocean, which represents the largest reservoir of heat in the climate system, has warmed by about 0.05°C (0.09°F) averaged over the layer extending from the surface down to 10,000 feet, since the 1950s.

Among the predicted changes in the United States are "potentially severe droughts, increased risk of flood, mass migrations of species, substantial shifts in agriculture and widespread erosion of coastal zones" (National Assessment Synthesis Team 2000).

3.6 AIR QUALITY

The CAA and subsequent amendments provide the authority and framework for USEPA regulation of air-emission sources. The USEPA regulations serve to establish requirements for the permitting, monitoring, control, and documentation of activities that affect ambient concentrations of certain pollutants that may endanger public health or welfare.

The criteria used to assess the existing conditions within the air-quality study area include the following quantifiable indicators:

- National Ambient Air Quality Standards (NAAQS), as identified in the CAA and regulated by the USEPA (Table 3-12)
- Observed levels of visibility in Class I areas

Assessment data were available from Federal, State, and local air-quality-permitting authorities, including the USEPA, Arizona, California, and Nevada authorities. Project activity occurs in Arizona and Nevada, but not in California. The applicable Arizona and Nevada regulations pertain to control of fugitive dust. Section 4.19 addresses mitigation measures to be used to control fugitive dust.

3.6.1 National Ambient Air Quality Standards

Under the CAA, USEPA has established NAAQS, which have historically applied to six criteria pollutants—sulfur dioxide (SO_2), total suspended particulate (TSP), carbon monoxide (CO), nitrogen dioxide (NO_2), Pb, and O_3. These standards are defined in terms of threshold concentration (e.g., micrograms per cubic meter [$\mu g/m^3$]) measured as an average for specified periods (averaging times). Short-term standards (i.e., 1-hour, 8-hour, or 24-hour averaging times) were established for pollutants with acute health effects, while long-term standards (i.e., annual averaging times) were established for pollutants with chronic health effects. More recently, additional standards for 8-hour average O_3

concentrations, PM_{10}, and particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$) were added. The NAAQS for TSP is no longer enforced. Table 3-12 summarizes the current NAAQS.

Table 3-12 National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS[1]	
		Primary	Secondary
Sulfur dioxide (SO_2)	3-hour	—	1,300 μg/m^3
	24-hour	365 μg/m^3	—
	Annual	80 μg/m^3	—
Particulate matter equal to or less than 10 microns in diameter (PM_{10})	24-hour	150 μg/m^3	150 μg/m^3
	Annual	50 μg/m^3	50 μg/m^3
Particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$)	24-hour	65 μg/m^3	65 μg/m^3
	Annual	15 μg/m^3	15 μg/m^3
Carbon monoxide (CO)	1-hour	40,000 μg/m^3	—
	8-hour	10,000 μg/m^3	—
Nitrogen dioxide (NO_2)	Annual	100 μg/m^3	100 μg/m^3
Lead (Pb)	Quarterly	1.5 μg/m^3	1.5 μg/m^3
Ozone (O_3)	1-hour	235 μg/m^3	235 μg/m^3
	8-hour	157 μg/m^3	157 μg/m^3

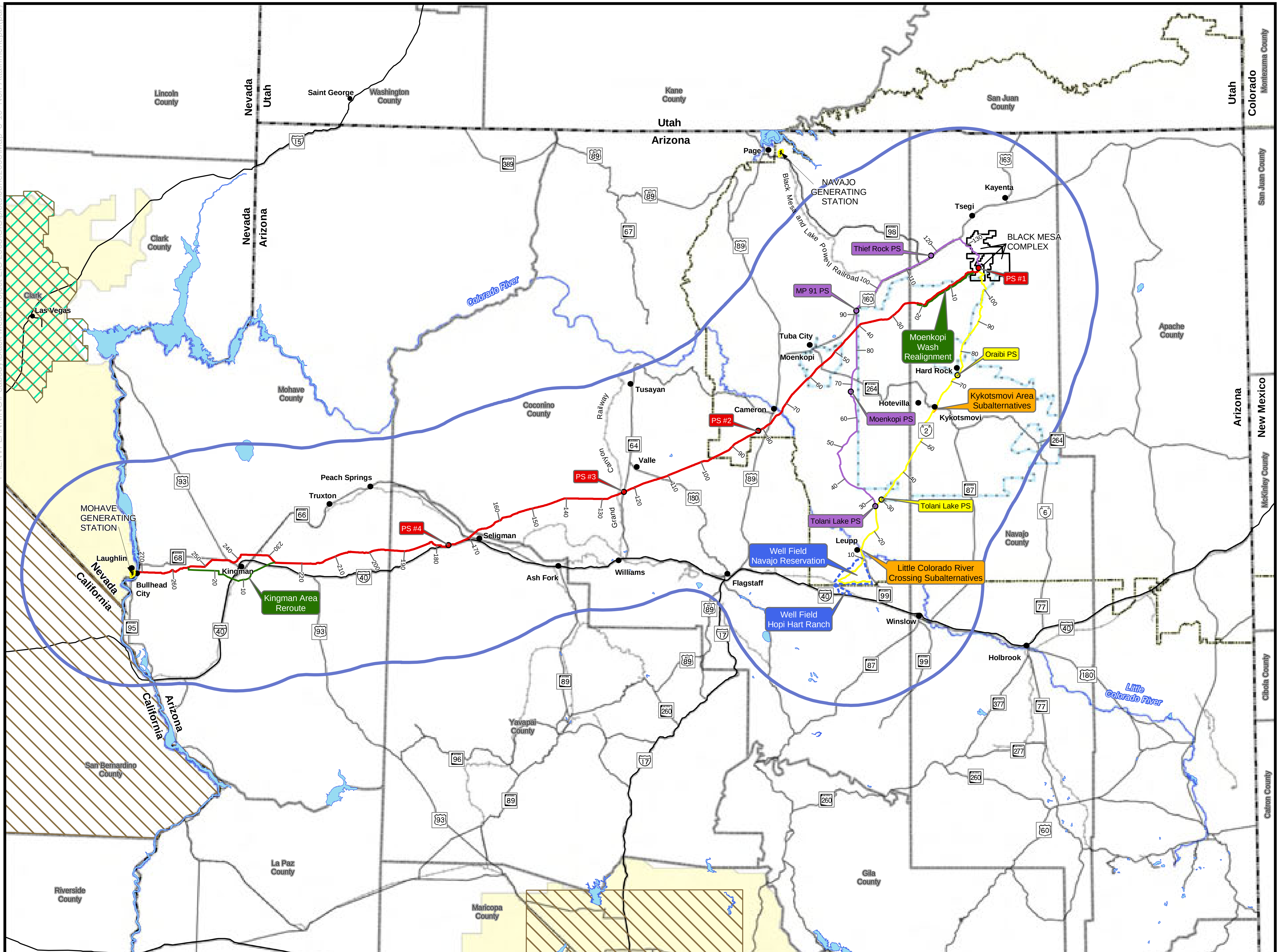
SOURCES: U.S. Environmental Protection Agency 2005b, 2005c, 2005d, 2005e, 2005f, 2005g, 2005h, 2005i
NOTES: [1] New NAAQS approved in 2008, but existing NAAQS will apply until the new regulation is issued.
μg/m^3 = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standards

Geographic areas are designated as "attainment," "nonattainment," or "unclassified" for each of the six criteria pollutants with respect to the NAAQS. If sufficient monitoring data are available and air quality is shown to meet the NAAQS, the USEPA may designate an area as an attainment area. Areas in which air-pollutant concentrations exceed the NAAQS are designated as "nonattainment" for specific pollutants and averaging times. Typically, nonattainment areas are urban regions and/or areas with higher-density industrial development. Because an area's status is designated separately for each criteria pollutant, one geographic area may have all three classifications.

Two areas within the air-quality study area are designated as nonattainment with respect to the NAAQS—the Clark County, Nevada, 8-hour O_3 and San Bernardino County, California, PM_{10} nonattainment areas (Map 3-10). These areas are located more than 200 miles from the Black Mesa Complex. They are only mentioned here because earth-moving activity associated with construction of the western terminus of the coal-slurry pipeline may occur within or near these areas. The remaining portions of the air-quality study area, including all portions within Arizona, are designated as attainment or unclassified. An unclassified designation indicates that attainment status has not been verified through data collection. When permitting new sources, an unclassified area is treated as an attainment area.

3.6.2 Federal Prevention of Significant Deterioration Program

Under the CAA, the USEPA established the PSD program. The PSD program was established to prevent unlimited increases in air pollution in areas that are already in compliance with the NAAQS (i.e., attainment areas). Certain Federal lands where the air quality is and should remain very good, such as national parks, national monuments, wilderness areas and other lands with special designations, are identified as Class I areas. Class I areas are afforded a higher degree of protection than other areas within the United States. The PSD program allows only minimal increases in air pollution in Class I areas. Class I areas that overlap the air-quality study area include the Grand Canyon National Park and the Lake Mead National Recreation Area to the north and the Sycamore Canyon Wilderness Area to the south (Map 3-11). Other nearby Class I areas include the Pine Mountain and Mazatzal Wilderness Areas to the south, and the Petrified Forest National Park to the southeast. All areas not designated as Class I are, by



Map 3-10

Attainment Classification

National Ambient Air Quality Standards Attainment Classifications

Black Mesa Project EIS

LEGEND

Air Quality Data Locations

Air Quality Study Area

Attainment Areas

Unclassifiable/Attainment

Nonattainment Areas

Particulate Matter (PM_{10})

Carbon Monoxide

Ozone (8-Hour)

Project Features

Black Mesa Complex

Peabody Lease Area

Alternative A Coal-Slurry Pipeline

Existing Route

Realignment

Alternative A Water-Supply System

C-Aquifer Well Field

Eastern Pipeline Route

Subalternative along Eastern Route

Western Pipeline Route

PS = Pump Station

General Features

River

Lake

Hopi Reservation Boundary

Navajo Reservation Boundary

State Boundary

County Boundary

Interstate/U.S. Highway/State Route

Railroad

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
Environmental Protection Agency 2005

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November 2008

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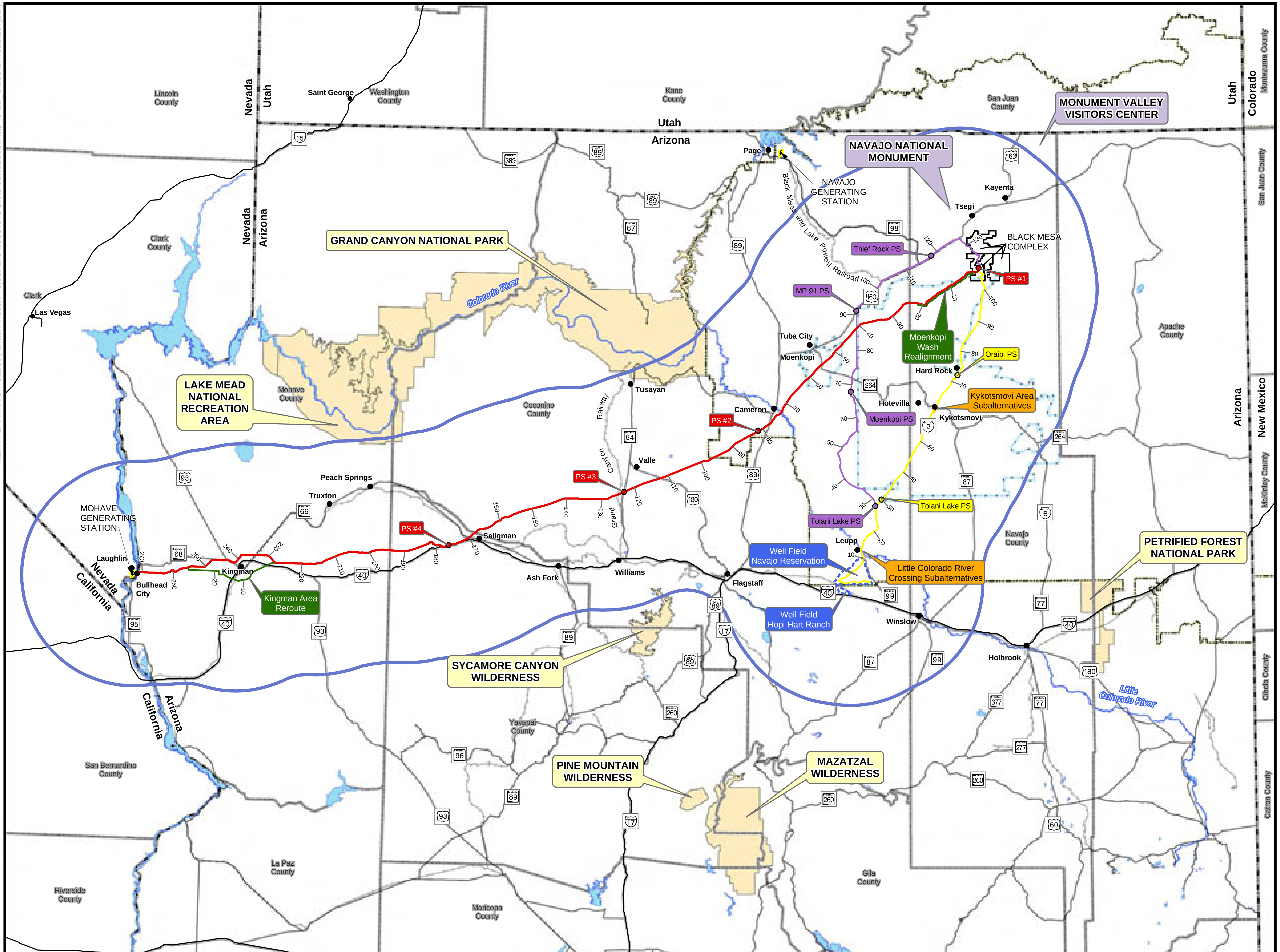
Miles

Prepared By:
URS



Map 3-11
Class I and Sensitive Class II Areas

Black Mesa Project EIS

LEGEND

Air Quality Data Locations

- Air Quality Study Area
- Federal Class I Area
- Sensitive Class II Area

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
Environmental Protection Agency 2005
Navajo Nation Parks and Recreation 2005

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November 2008

0 25 50
Miles

Prepared By:
URS

default, designated as Class II areas. The PSD program specifies limited air-pollution increases in Class II areas that are designed to allow economic development while still maintaining good levels of air quality in those areas. Two sensitive Class II areas, the Monument Valley Visitor Center and the Navajo National Monument (both located on Navajo tribal land), are shown on Map 3-11. All Class I and sensitive Class II areas in the vicinity of the proposed project are listed in Peabody's Air Quality Technical Support Document for the Black Mesa EIS (McVehil-Monnett Associates, Inc. 2006).

While the designation of areas and the attendant limitations under the PSD program are based on air pollution levels, the program also established air-quality-related values (AQRVs). One such AQRV is visibility. Permit applicants under the PSD program also must demonstrate that their project will not cause visibility degradation in excess of specified limits. See Section 3.6.8 for a discussion of regional visibility conditions.

3.6.3 Designation of Air Quality Study Area for Proposed Project

For the purposes of evaluating air quality within the vicinity of the Black Mesa Project, the air-quality study area encompasses a 31-mile (50-kilometer [km]) buffer from the locations where the elements of the Black Mesa Project would be sited. This study area is located primarily in Arizona with some small portions extending into Utah, Nevada and California. A 31-mile (50-km) buffer was chosen to be consistent with air-quality analyses required for major-source air-quality permitting (ADEQ 2003b). However, relative to actual or anticipated impacts of the Black Mesa Project within this study area, the following statements should be considered:

- Any air-quality permitting likely to be required for the project will not involve major-source permitting because the magnitude of emissions increases associated with any air permitting will likely be less than significant, as defined in the PSD program regulations. Therefore, the selection of a 31-mile (50-km) buffer to establish a study area should not be construed as an implication that major-source permitting requirements apply to the project.
- For major-source permitting, such a buffer is established around a proposed new source or major modification of an existing source to encompass the geographic area of impact typically resulting from air pollutants being discharged from elevated point sources, such as chimneys. In contrast, air-pollutant emissions from the Black Mesa Project consist of fugitive-process emissions along with fugitive dust. Such ground-level releases consisting of coarse particulate matter (PM) remain close to the ground and do not disperse significantly over large distances. Some of these emissions are associated with construction activity, are temporary, and are not subject to major source permitting requirements.
- Selection of the 31-mile (50-km) buffer to establish the study area should not be construed as an implication that air-pollutant emissions from the project will overlap and intermingle with emissions from other major stationary air-pollutant sources within the study area.

3.6.4 Black Mesa Complex Ambient-Air Monitoring

The air pollutant (resulting from Black Mesa Complex operations) of primary concern is PM. Emission sources for PM include blasting, overburden removal, coal extraction/handling/storage, fugitive road dust, and operation of vehicles and equipment. Operation of vehicles and equipment also causes emissions of other criteria pollutants, including CO, SO_2, NOx, and volatile organic compounds (VOC). NOx and VOC are precursors to the formation of O_3 in the atmosphere.

Pursuant to 30 CFR 816.95, OSM requires Peabody to develop and implement a plan to control fugitive dust effectively. In addition, pursuant to 30 CFR 780.15(a)(1), OSM requires Peabody to conduct air-quality monitoring to evaluate the effectiveness of the fugitive-dust-control program. Air-quality data collected from the Black Mesa Complex monitoring network during active mining operations are presented herein. Map 3-10 shows the locations of the Peabody air quality monitoring stations. These data should not be considered as representative of air quality throughout the study area or indicative of air quality impacts from the mining operations alone, as explained below.

The monitoring network includes 12 PM_{10} samplers at 11 locations throughout the mining complex (Map 3-12). Although this PM_{10} monitoring network is operated in accordance with relevant USEPA requirements, including a quality assurance program, it was designed to monitor air-quality conditions on a microscale within the Black Mesa Complex to evaluate the effectiveness of the fugitive-dust-control program and is not required to satisfy rigorous USEPA siting requirements. Specifically, some monitors are located close to residences and unpaved roads used by local residents and consequently do not measure PM_{10} concentrations truly representative of local or regional air quality. Peabody has not proposed to revise the monitoring system.

Quarterly monitoring reports are submitted to OSM and NNEPA. The record from these monitoring sites is very reliable for 2003 to 2005, in that 98 percent data completeness was achieved. Additional information regarding this monitoring program is provided in Peabody's Air Quality Technical Support Document for the Black Mesa EIS.

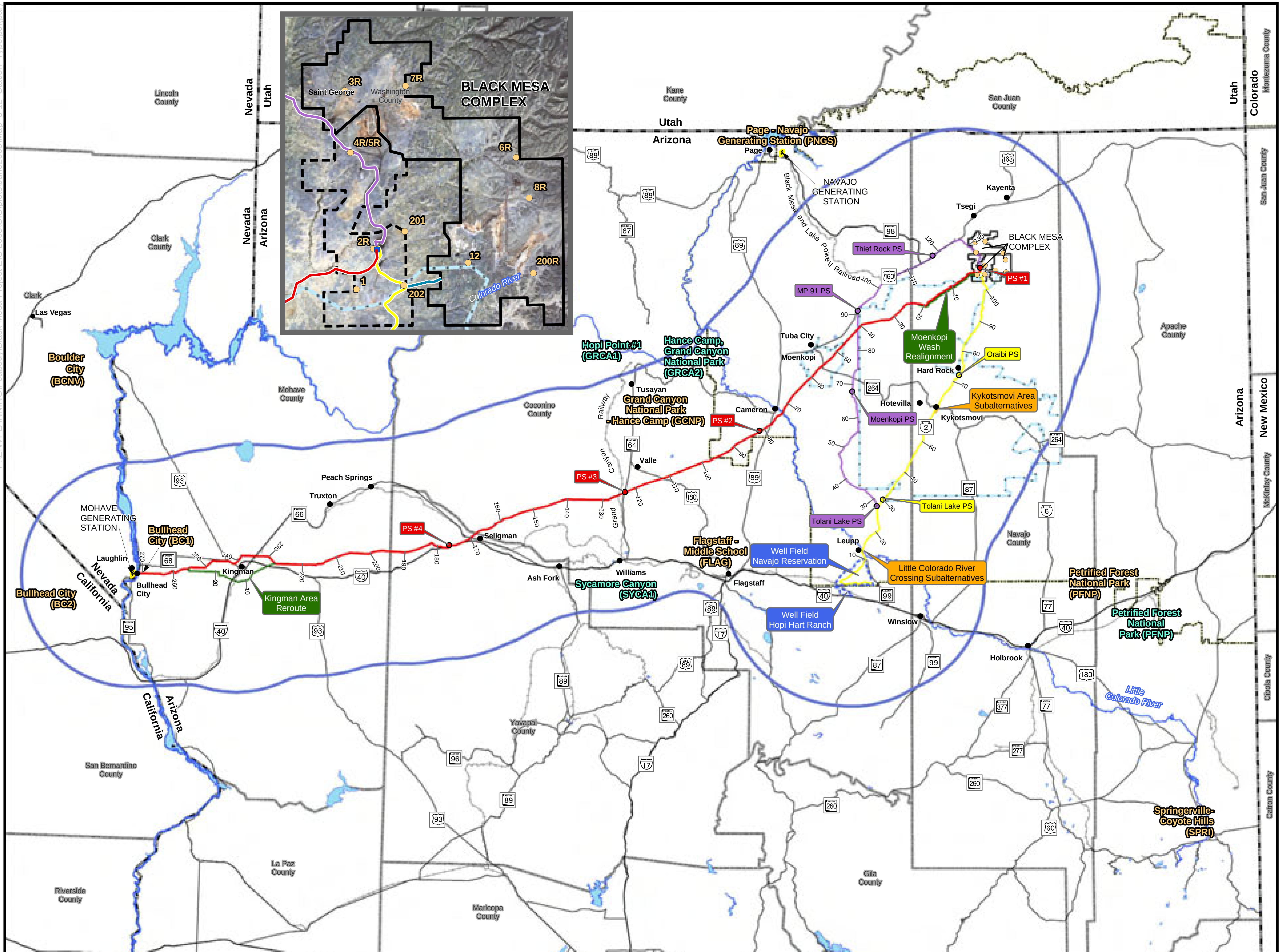
3.6.4.1 Average Annual Ambient Air Concentrations

From 2003 to 2005, the ambient-air monitoring network at the Black Mesa Complex did not record any exceedances of the annual PM_{10} NAAQS of 50 $\mu g/m^3$.
Table 3-13 presents the annual monitoring results for each site for this three-year period. Several monitors on the northern and eastern sides of the Black Mesa Complex (3R, 6R, 7R, and 200R) show consistently lower ambient PM_{10} concentrations than the other sites. This is attributed to the location of these sites being generally upwind of and distant from any mining activities. Consequently, these can be viewed as the best representation of background conditions outside the influence of mining activities.

Table 3-13 Annual Average Ambient PM_{10} Monitoring Data (in $\mu g/m^3$) at Black Mesa Complex (2003 to 2005)

Monitor ID[1]	Relative Position Within Mine Complex[1]	Monitored Annual Average PM_{10} Concentration ($\mu g/m^3$)		
		2003	2004	2005
1	Southwest	33.6	31.4	22.5
2R	Southwest	37.7	28.8	35.3
3R	Northwest	13.1	9.3	11.9
4R	West	37.2	28.2	33.4
5R	West (co-located with 4R)	36.4	28.8	34.4
6R	Northeast	15.8	12.0	13.2
7R	North	19.1	11.8	13.7
8R	East	30.6	20.4	27.8
12	South	23.6	23.7	23.4
200	Southeast	16.6	11.0	12.6
201	South	21.5	19.3	26.7
202	Southwest	19.7	15.7	16.8

SOURCE: McVehil-Monnett Associates, Inc. 2006
NOTE: [1] Refer to Map 3-10 for location of PM_{10} ambient monitors at the Black Mesa Complex.
PM_{10} = particulate matter equal to or less than 10 microns in diameter
$\mu g/m^3$ = micrograms per cubic meter
ID = identification



Map 3-12
Air Monitoring Stations

Black Mesa Project EIS

LEGEND

Air Quality Data Locations

Air Quality Study Area

Air Quality Monitoring Stations

Air Quality Monitoring Station

Project Location

Black Mesa Complex

Peabody Lease Area

Alternative A Coal-Slurry Pipeline

Existing Route

Realignment

Alternative A Water-Supply System

C-Aquifer Well Field

Eastern Pipeline Route

Subalternative along Eastern Route

Western Pipeline Route

PS = Pump Station

General Features

River

Lake

Hopi Reservation Boundary

Navajo Reservation Boundary

State Boundary

County Boundary

Interstate/U.S. Highway/State Route

Railroad

SOURCES:
Peabody Energy 2006
URS Corporation 2005, 2006
Arizona State Land Department 2005
Environmental Protection Agency 2005

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November 2008

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Miles

Prepared By:
URS

The co-located samplers 4R/5R, and site 12 are located in the vicinity of mining activities and are probably more impacted by mining activities than any of the other samplers. However, they also are subject to impacts from tribal residential activities inside the mine permit area, activities such as travel on roads used solely for nonmining purposes and other off-site activities.

3.6.4.2 Short-Term (24-Hour) Ambient-Air Concentrations

Table 3-14 lists the highest and second-highest measured PM_{10} concentrations at each of the 12 samplers surrounding the Black Mesa Complex for the three-year period from 2003 to 2005. Of the highest measurements, 14 samples exceeded the PM_{10} 24-hour standard of 150 $\mu g/m^3$ during the three-year period. These 14 elevated measurements account for 0.6 percent of 2,297 valid measurements taken during this period and occurred on six separate days, two in each year. The dates and circumstances related to the exceedances are indicated in the footnotes to Table 3-14. Additional information regarding this monitoring program is provided in Peabody's Air Quality Technical Support Document for the Black Mesa EIS.

Evaluation of meteorological conditions during the six days when values above the 24-hour average PM_{10} NAAQS were recorded suggests that mining activities are not the primary cause of these exceedances. Nonmining activities such as vehicular traffic on local unpaved roads both within and outside of the mine property can cause fugitive dust that contributes to elevated short-term PM_{10} concentrations at nearby monitors. More significantly, long-term dryness in the region tends to counteract the effects of mitigation, including extensive application of dust suppressants on roads and other dust-control measures that are practiced within the Black Mesa Complex.

Table 3-14 24-Hour Average Ambient PM_{10} Monitoring Data (in $\mu g/m^3$) at Black Mesa Complex (2003 to 2005)

Monitor ID	2003		2004		2005	
	First High	Second High	First High	Second High	First High	Second High
1	144	140	258[a]	141	150	138
2R	231[b]	85	160[c]	130	125	112
3R	106	47	33	27	41	28
4R	267[d]	137	123	89	358[e]	168[f]
5R	228[d]	125	170[c]	99	335[e]	175[f]
6R	175[b]	36	51	30	40	39
7R	215[b]	62	41	39	47	46
8R	352[b]	73	57	54	63	60
12	119	79	121	77	150	138
200	175[b]	46	50	34	36	36
201	142	55	67	56	130	78
202	104	65	74	36	81	37

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTES: [a] August 8, 2004: Cause was long-term dryness; particulate originated off site to the west.
[b] October 30, 2003: Causes were extreme winds and long-term dryness.
[c] June 2, 2004: Cause was long-term dryness throughout the area.
[d] September 24, 2003: Causes appeared to be drought, and mining activities may have contributed.
[e] August 26, 2005: Causes were high winds and long-term dryness.
[f] August 20, 2005: Causes were high winds and long-term dryness.
PM_{10} = particulate matter equal to or less than 10 microns in diameter
$\mu g/m^3$ = micrograms per cubic meter
ID = identification

3.6.5 Coal-Slurry Pipeline

Other than insignificant air-pollutant emissions due to periodic coal-slurry pipeline maintenance, there are no air-quality emissions associated with the existing coal-slurry pipeline.

3.6.6 C Aquifer Water-Supply System

The C aquifer water-supply system has not yet been constructed, so there are no historic air-pollutant emissions. The area proposed for the C aquifer water-supply system is within the air-quality study area described above.

3.6.7 Other Emission Sources in the Region

A number of diverse major point sources are located within and near the air-quality study area, including industrial, commercial, and local government facilities such as gas- and coal-fired power plants, natural-gas-pipeline compressor stations, various manufacturers, and landfills. Table 3-15 provides a summary of these sources.

Table 3-15 Major Sources Located within and near the Air-Quality Study Area (Northern Arizona Region)

Owner	Facility Type	Location[1]	Permitting Authority
American Woodmark	Cabinet manufacturer	Kingman	ADEQ
Arizona Public Service Company (Cholla Power Plant)	Coal-fired power plant	Joseph City	ADEQ
BFI Waste Systems (La Paz County Regional Landfill)	Landfill	Parker	ADEQ
Calpine-South Point Energy Center	Gas-fired power plant	Bullhead City	USEPA Region 9
Cerbat Landfill	Landfill	Kingman	ADEQ
Chemical Lime Company	Lime plant	Peach Springs	ADEQ
Citizen's Utilities Company	Gas-fired power plant	Lake Havasu City	ADEQ
City of Flagstaff (Cinder Lake Landfill)	Landfill	Flagstaff	ADEQ
El Paso Natural Gas Company (Dilkon Compressor Station)	Natural-gas compressor station	Dilkon	USEPA Region 9
El Paso Natural Gas Company (Dutch Flats)	Natural-gas compressor station	Lake Havasu City	ADEQ
El Paso Natural Gas Company (Flagstaff)	Natural-gas compressor station	Flagstaff	ADEQ
El Paso Natural Gas Company (Hackberry)	Natural-gas compressor station	Hackberry	ADEQ
El Paso Natural Gas Company (Leupp Compressor Station)	Natural-gas compressor station	Leupp	USEPA Region 9
El Paso Natural Gas Company (Seligman)	Natural-gas compressor station	Seligman	ADEQ
El Paso Natural Gas Company (Topock)	Natural-gas compressor station	Topock	ADEQ
El Paso Natural Gas Company (Williams)	Natural-gas compressor station	Williams	ADEQ
Griffith Energy, LLC	Gas-fired power plant	Griffith	ADEQ
Mohave Pipeline Operating Company (Topock)	Natural-gas compressor station	Topock	ADEQ
Mohave Valley Landfill	Landfill	Mohave	ADEQ
Navajo Generating Station	Coal-fired power plant	Page	USEPA Region 9
Norcraft Companies, LLC	Cabinet manufacturer	Mohave	ADEQ
North Star Steel Company	Steel manufacturer	McConnico	ADEQ

Owner	Facility Type	Location[1]	Permitting Authority
Peabody Western Coal Company	Coal mine	Kayenta	USEPA Region 9
Phoenix Cement Company	Cement plant	Clarkdale	ADEQ
Printpack, Inc.	Packaging-material manufacturer	Prescott Valley	ADEQ
Snowflake Recycled Paper Mill (Catalyst)	Paper mill	Snowflake	ADEQ
Southern California Edison (Mohave Generating Station)	Coal-fired power plant	Laughlin (Nevada)	NDEP
Transwestern Pipeline Company (Flagstaff)	Natural-gas compressor station	Flagstaff	ADEQ
Transwestern Pipeline Company (Kingman)	Natural-gas compressor station	Kingman	ADEQ
Transwestern Pipeline Company (Leupp)	Natural-gas compressor station	Leupp	USEPA Region 9
USA Waste (Pen-Rob Landfill)	Landfill	Joseph City	ADEQ
Waste Management of Arizona (Gray Wolf Regional Landfill)	Landfill	Dewey	ADEQ

SOURCE: U.S. Environmental Protection Agency 2005a
NOTE: [1] All locations are in Arizona.
ADEQ = Arizona Department of Environmental Quality
USEPA = U.S. Environmental Protection Agency

Minor point sources within and near the study area include industrial and commercial operations of many kinds. Prevalent types of portable sources include rock- and construction-product industries (e.g., portable crushing and screening plants), hot-mix asphalt plants, and concrete batch plants. Stationary industrial sources in this category include a broad range of consumer-goods manufacturing facilities, mortuaries, and dry cleaners. Several significant area sources exist within the study area, as well. Prevalent types of area sources include sand-, gravel-, and cinder-mining operations, unpaved roads, concentrated livestock operations, and controlled range/forest burns.

Vehicle emissions consist of NO_2, CO, and PM_{10}, which may warrant consideration in an assessment of ambient-air quality in the study area.

Monitoring data in and around the study area indicate that air quality is, for the most part, in compliance with the NAAQS.

3.6.8 Visibility Conditions

The Cooperative Institute for Research in the Atmosphere operates a network of visibility-monitoring stations in or near mandatory Class I areas (Map 3-12), and publishes Integrated Monitoring of Protected Visual Environments (IMPROVE) data. Map 3-10 shows the locations of the IMPROVE visibility-monitoring stations. The purpose is to identify and evaluate patterns and trends in regional visibility. Data from four IMPROVE monitors in and near the study area show that fine and coarse particulates were the largest contributors to the impairment of visibility (including both primary PM emissions and particulates formed from SO_2, NOx, and VOC). These particulates impact the standard visual range—the distance that can be seen on a given day—from each monitor location. Standard visual ranges for each of the four monitors on their best (highest visibility), worst (lowest visibility), and intermediate (average visibility) visibility days are provided in Table 3-16.

Table 3-16 Standard Visual Ranges from IMPROVE Monitors in and near the Air-Quality Study Area

Monitor[1,2]	Best Visibility Days (miles [km])	Intermediate Visibility Days (miles [km])	Worst Visibility Days (miles [km])
Petrified Forest National Park	127 (212)	92 (153)	61 (102)
Sycamore Canyon	122 (204)	79 (132)	49 (82)
Hance Camp, Grand Canyon National Park	162 (270)	106 (177)	70 (116)
Hopi Point No. 1	144 (240)	102 (170)	73 (121)

SOURCE: Interagency Monitoring of Protected Visual Environments 2005
NOTES: [1] Refer to Map 3-12 for locations.
[2] The period used for the Petrified Forest National Park is 1999 to 2003, for Sycamore Canyon it is 2001 to 2003, for Hance Camp at the Grand Canyon National Park it is 1999 to 2003, and for Hopi Point No. 1 it is 1993 to 1997.
IMPROVE = Interagency Monitoring of Protected Visual Environments, km = kilometers

As shown in Table 3-16, the standard visual range from Sycamore Canyon, located on the south-central edge of the study area, is consistently the lowest in each category. The two monitors that recorded the best standard visual range, Hance Camp and Hopi Point No. 1, are located on the north-central edge of the study area.

3.6.9 Air-Quality Monitor Data

Numerous monitors are located in several areas in and surrounding the air-quality study area for different criteria pollutants that are representative of conditions in the vicinity (refer to Map 3-10). Table 3-17 summarizes the data from these monitors, as reported in annual Air-Quality Reports published by the ADEQ (ADEQ 2002, 2003a, 2004) and in the Clark County Network Review (Clark County Department of Air Quality Management 2002).

As shown in Table 3-17, average NO_2, SO_2, and $PM_{2.5}$ concentrations were all below the NAAQS. However, the Boulder City, Nevada, monitor recorded exceedances of the 8-hour average O_3 concentration (0.084 ppm as compared to NAAQS of 0.08 ppm) and the 24-hour average PM_{10} concentration (371 $\mu g/m^3$ as compared to NAAQS of 150 $\mu g/m^3$). This monitor is located northwest of the air-quality study area, in proximity to Las Vegas, Nevada, and these concentrations most likely are attributed to the metropolitan Las Vegas area.

Table 3-17 Measured Air-Quality Concentrations from Monitors in and near the Air-Quality Study Area (Highest Recorded from 2003 to 2005)

Identifier	NO_2 (µg/m³)			SO_2 (µg/m³)			O_3 (µg/m³)		PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	1-Hour Average[a]	24-Hour Average[a]	Annual Average	3-Hour Average	24-Hour Average	Annual Average	1-Hour Average	8-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
NAAQS	**NA**	**NA**	**100**	**1,300[b]**	**365**	**80**	**235**	**157**	**150**	**50**	**65**	**15**
FLAG[c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	60	20	16.9	5.7
GCNP[c]	N/A	N/A	N/A	N/A	N/A	N/A	0.161	0.153	N/A	N/A	N/A	N/A
PFNP[c]	N/A	N/A	N/A	N/A	N/A	N/A	0.165	0.151	N/A	N/A	N/A	N/A
PNGS[d]	0.082	0.036	0.004	15	8	3	0.147	0.128	27	9.8	N/A	N/A
SPRI[d]	0.048	0.012	0.002	73	13	0.4	N/A	N/A	N/A	N/A	N/A	N/A
BC1[c]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	121	20	N/A	N/A
BC2[d]	0.116	0.052	0.022	170	54	7	N/A	N/A	114	23[f]	N/A	N/A
BCNV[e]	0.213	0.066	0.018	N/A	N/A	N/A	0.177	0.165	371	21	27.0	6.0

SOURCES: Arizona Department of Environmental Quality 2002, 2003a, 2004; Clark County Department of Air Quality Management 2002

NOTES: [a] These values may have been reported for purposes of compliance with State ambient standards; there are no 1-hour or 24-hour National Ambient Air Quality Standards for nitrogen dioxide.

[b] Secondary National Ambient Air Quality Standards

[c] Data are from the Arizona Department of Environmental Quality 2004 Air-Quality Report.

Data are from the Arizona Department of Environmental Quality 2002 Air-Quality Report or 2003 Air-Quality Report.

Data are from the Clark County Department of Air Quality Management 2002 Air-Monitoring Network Review.

[f] These data do not satisfy the U.S. Environmental Protection Agency's summary criteria, usually meaning that less than 75 percent of valid data recovery was available in one or more calendar quarters.

[d]

[e] New NAAQS approved in 2008, but existing NAAQS will apply until the new regulation is issued.

NA = not applicable
N/A = not available
NO_2 = nitrogen dioxide
SO_2 = sulfur dioxide
O_3 = ozone
PM_{10} = particulate matter equal to or less than 10 microns in diameter
$PM_{2.5}$ = particulate matter equal to or less than 2.5 microns in diameter
NAAQS = National Ambient Air Quality Standards
µg/m3 = micrograms per cubic meter
FLAG = Flagstaff Middle School
GCNP = Grand Canyon National Park-Hance Camp
PFNP = Petrified Forest National Park
PNGS = Page-Navajo Generating Station
SPRI = Springerville-Coyote Hills
BC1 = Bullhead City
BC2 = Bullhead City
BCNV = Boulder City

3.7 VEGETATION

3.7.1 <u>Black Mesa Complex</u>

3.7.1.1 Vegetation Types

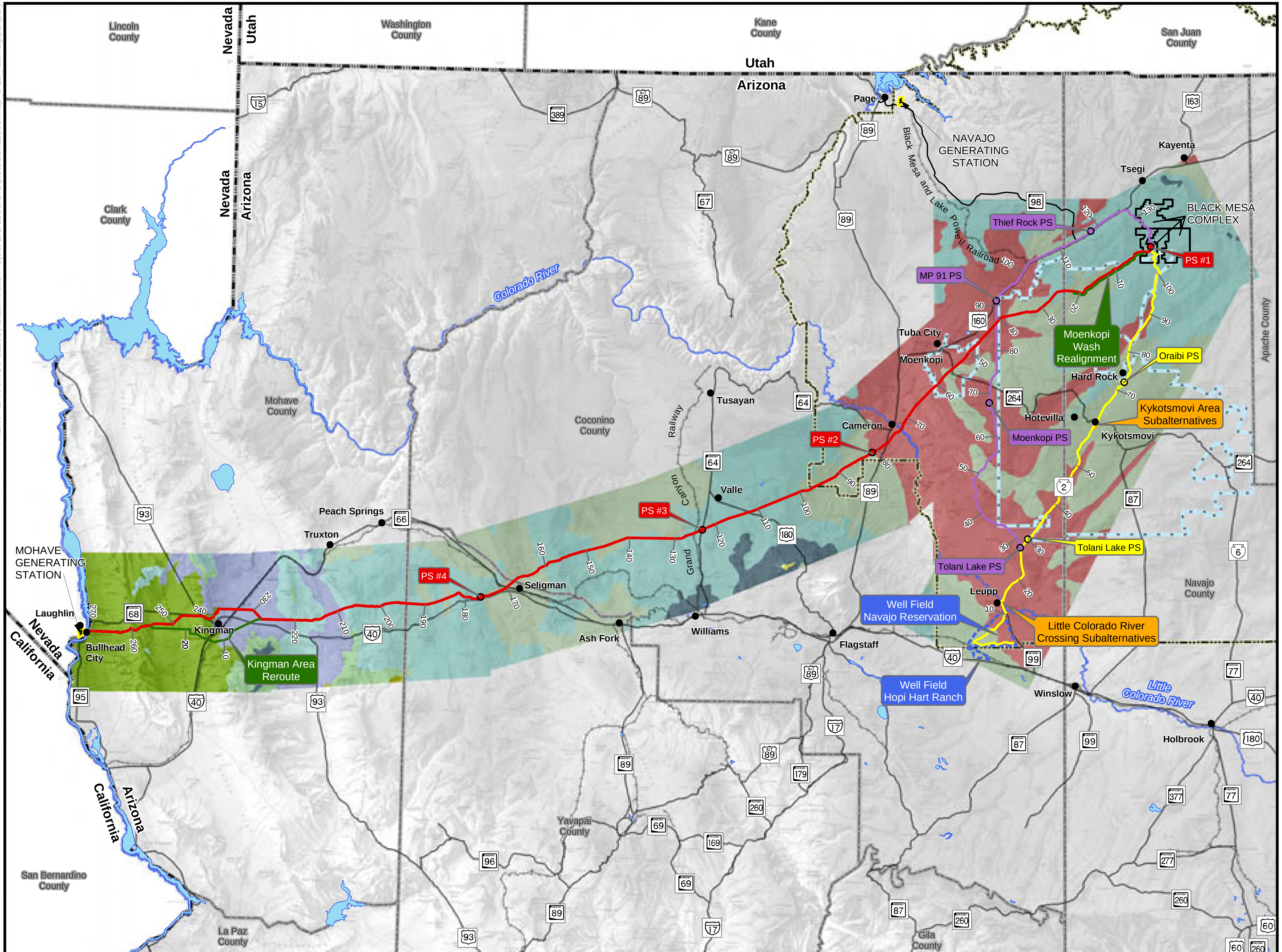
The Black Mesa Complex is located within the Great Basin conifer woodland biotic community (Map 3-13) (Brown 1982; Brown and Lowe 1980). Detailed vegetation data have been collected at various times for coal-mine permitting (Peabody 2004), and baseline vegetation sampling of the coal-resource areas was conducted in 2003 (ESCO Associates 2000a, 2000b, 2003). The Black Mesa Complex mining-operation areas generally are located within four native plant communities: piñon/juniper woodland, sagebrush shrub, saltbush shrubland, and greasewood shrubland, which are described below. A reclaimed-lands plant community is created where mine lands have been revegetated, which also is described below.

Piñon/juniper woodland is the dominant plant community within the Black Mesa Complex and occupies approximately 65 to 70 percent of the undisturbed land area. Piñon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) are dominant, with tree canopy cover ranging from 14 to 18 percent. Common shrubs include big sagebrush (*Artemisia tridentata*), fourwing saltbush (*Atriplex canescens*), cliffrose (*Cowania mexicana*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), and shadscale (*Atriplex confertifolia*). Grasses and forbs provide a small amount of cover, with the most common grasses being bottlebrush squirreltail (*Sitanion hystrix*), Indian ricegrass (*Oryzopsis hymenoides*), and muttongrass (*Poa fendleriana*). Some piñon/juniper stands appear to have very little understory vegetation, while others have a moderate presence of shrubs. Total vegetation cover in the various stands sampled by ESCO Associates (2003) ranged from 11 to 22 percent. Species density ranged from 12 to 20 species per 1,076 square feet (100 square meters). Piñon/juniper woodland has extensive areas of bare soil, rock, and litter below trees. It occurs at an elevation range of 6,300 to more than 7,200 feet above MSL in the area of the mines. Piñon tends to be dominant over juniper at higher elevations, and juniper is dominant at lower elevations.

Sagebrush shrub is the second most dominant vegetation type at the Black Mesa Complex, covering 30 to 35 percent of undisturbed land areas. This community occurs on flatter areas and in valley bottoms within the matrix of piñon/juniper woodland. It is dominated by big sagebrush and blue grama (*Bouteloua gracilis*). There is varying and sometimes substantial presence of other shrubs and subshrubs, especially fourwing saltbush, Douglas rabbitbrush, Greene rabbitbrush (*Chrysothamnus greenei*), and rubber rabbitbrush (C. *nauseosus*). Along with blue grama, galleta (*Hilaria jamesii*) is a common warm-season grass. Cool-season grasses are less common and include big squirreltail (*Sitanion jubatum*), bottlebrush squirreltail, needle and thread (*Stipa comata*), Indian ricegrass, and western wheatgrass (*Agropyron smithii*). Total vegetation cover ranges from about 8 to 17 percent, with the highest cover associated with dominance by big sagebrush (ESCO Associates 2005). Bare ground occupies 47 to 75 percent of the ground, with 2 to 15 percent rock cover. Species density ranges from 12 to 19 species per 1,076 square feet (100 square meters). Sagebrush extends to 7,000 feet above MSL within the Black Mesa Complex.

Saltbush and greasewood shrublands are two additional upland shrub communities that occupy relatively small areas. Saltbush and greasewood shrublands occupy the margins of terraces associated with the primary, secondary, and occasional tertiary drainages. The terraces are mostly 5 to 20 feet above the drainage channel floodplains where alluvial soil materials may be as much as 30 feet deep. Fourwing saltbush and greasewood (*Sarcobatus vermiculatus*) are dominant in these communities, with sparse to dense understories of annual forbs and grasses.

Map 3-13
Vegetation



Black Mesa Project EIS

LEGEND

Vegetation

- Great Basin Conifer Woodland
- Great Basin Desertscrub
- Mohave Desertscrub
- Petran Montane Conifer Forest
- Petran Subalpine Conifer Forest
- Plains and Great Basin Grassland
- Semidesert Grassland

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005, 2006
Brown, Lowe, and Pace 1979

N

November 2008

0 20 40
Miles

Prepared By:
URS

Reclaimed-land areas occupy thousands of acres of mined land in the Black Mesa Complex (10,275 acres of the Kayenta mining operation and 5,075 acres of the Black Mesa operation through 2007). This community is dominated by native and introduced grasses and shrubs. Cool-season native grass species include western wheatgrass, thickspike wheatgrass (*Agropyron dasystachyum*), Indian ricegrass, needle and thread, big squirreltail, and bottlebrush squirreltail. Common warm-season native grass species are blue grama, galleta, and alkali sacaton (*Sporobolus airoides*). The most abundant introduced perennial grass species is Russian wildrye (*Elymus junceus*), and crested wheatgrass (*Agropyon desertorum*) and intermediate wheatgrass (*Agropyron intermedium*) also are present. Fourwing saltbush is the dominant shrub species, but several other species are common. Several weedy annuals occur primarily in newer reclamation areas, including kochia (*Kochia scoparia*), Russian thistle (*Salsola iberica*), and cheatgrass (*Bromus tectorum*). Total vegetation cover ranges from about 10 to 45 percent, with average cover about 23 percent in 2004 (ESCO Associates 2005). Bare ground typically occupies 30 to 70 percent of the ground surface, with 1 to 10 percent rock cover in most areas. Species density ranges from 10 to 30 species per 1,076 square feet. Biomass production averaged 539 to 816 pounds/acre in 2004, and woody stem density averaged 3,260 to 7,178 stems per acre.

Elevations of the Black Mesa Complex generally decrease from northeast (7,200 feet above MSL) to southwest (6,100 feet above MSL); therefore, the western and southern areas of the Black Mesa Complex have lower cover of piñon/juniper woodland and a higher cover of sagebrush shrub in unmined areas. In addition, the greasewood and tamarisk (salt cedar, Chinese tamarisk [*Tamarix pentandra*]) communities are more common because these communities occur where drainages are larger and more developed.

The 40-acre coal-slurry preparation plant site is occupied by approximately 20 acres of shrubland dominated by big sagebrush and broom snakeweed (*Gutierrezia sarothrae*), 19 acres of disturbed land, and about 1 acre of reclaimed land (BMPI 2005). The sagebrush/snakeweed shrubland is typical of sagebrush shrubland in the Black Mesa Complex. The disturbed land has very little vegetation, and the reclaimed land is a former airstrip that has been seeded with the revegetation seed mix used for the Black Mesa Complex.

The proposed coal-washing facility would be located near the existing coal-slurry preparation plant and coal-storage piles. Based on an aerial photograph, the vegetation consists primarily of sagebrush shrub and/or reclaimed land.

Riparian habitat occurs along two major drainageways in linear stringers of vegetation. The stringers range from 10 to 20 feet in width, and extend from a few yards to more than 0.5 mile in length. This community occurs on the bottoms of the washes, typically occupying agrading portions such as sandbars. The dominant species is tamarisk. Small amounts of greasewood, fourwing saltbush, and coyote willow (*Salix exigua*) are associated with the tamarisk on stable sites. The herbaceous vegetation is composed of cheatgrass, European alkali grass (*Puccinellia distans*), stickseed (*Lappula occidentalis*), and desert seepweed (*Suaeda torreyana*). This community is the same as the Chinese-tamarisk community type in a general classification of riparian forest and scrubland types of Arizona (Szaro 1989). The largest areas mapped by ESCO Associates (2003) are on the Black Mesa mining operation area, in Moenkopi Wash and in Red Peak Valley. Similar riparian habitat occurs downstream from the mine area in Moenkopi Wash and Coal Mine Wash.

Wetland and aquatic plants occur at some of the many impoundments, including freshwater ponds, sediment ponds, and internally draining ponds in reclaimed areas. Some larger ponds have wetland plants along the margin, including tamarisk, coyote willow, bulrush (*Scirpus acutus*) and cattail (*Typha latifolia*). Aquatic plants include common poolmat (*Zanichellia palustris*), pondweeds (*Potamogeton filiformis* and *P. pectinata*), and holly-leafed water nymph (*Najas marina*). The only aquatic macrophyte in most ponds is a blue-green alga (*Chara* sp.).

3.7.1.2 Noxious Weeds and Invasive Species

The Noxious Weed Act of 1974 (7 U.S.C. 2801 et seq.) established a nationwide definition of noxious weeds. The State of Arizona designates weeds or invasive species as noxious under A.R.S. 3-201. Weeds that are not indigenous to Arizona, likely to be detrimental, destructive, and difficult to control or eradicate may be listed as noxious weeds by the State. Noxious weeds can out-compete native vegetation in areas of disturbance and can spread quickly in a short time span.

Table F-1 in Appendix F provides a summary of noxious weeds associated with disturbed land at various project facilities. A number of noxious and invasive plant species are known or expected to occur in the Black Mesa Complex, including bull thistle (*Cirsium vulgare*), common purslane (*Portulaca oleracea*), diffuse knapweed (*Centaurea diffusa*), field bindweed (*Convolvulus arvensis*), musk thistle (*Carduus nutans*), puncture vine (*Tribulus terrestris*), Russian knapweed (*Acroptilon repens*), Scotch thistle (*Onopordum acanthium*), and tamarisk (California Information Node 2005; ESCO Associates 2003; USGS 2004). Common purslane, bull thistle, and tamarisk are reported to be present in the mine permit area (Peabody 2004). The other species are mostly mapped along U.S. Highway 160 and Indian Route 41 in the mine vicinity (California Information Node 2005; USGS 2004).

3.7.1.3 Threatened, Endangered, and Special Status Species

The analysis of threatened, endangered, and special status species included review of FWS county lists (FWS 2005), the Navajo endangered species list (Navajo Nation Fish and Wildlife Department [NNFWD] 2005b) and Arizona Natural Heritage Program lists (Arizona Game and Fish Department [AGFD] 2006a), and evaluation of habitats and ranges. There are no federally listed, proposed, or candidate plant species known or expected to occur within the Black Mesa Complex.

No naturally occurring unique or ecologically sensitive areas have been identified on the Black Mesa Complex. The vegetation resources are well represented throughout the Great Basin and Colorado Plateau regions (Peabody 2004).

3.7.1.4 Culturally Important Plant Species

Numerous species of native plants have cultural significance to the Hopi and Navajo people for uses as food and medicine, in rituals, and for other uses such as for tools, construction, and baskets. Table F-2 in Appendix F presents a list of native plant species used for these purposes, based on published information about such uses (Begay 1979; Lomaomvaya et al. 2001; Mayes and Lacy 1989). No specific collection areas have been identified, and many of the species are widely distributed within their habitats, including the Black Mesa Complex. Cultural plants also are present in reclaimed areas as a result of an intensive reestablishment program and natural recolonization.

3.7.2 Coal-Slurry Pipeline

3.7.2.1 Coal-Slurry Pipeline: Existing Route

3.7.2.1.1 Vegetation Types

As mapped by Brown and Lowe (1980), the existing coal-slurry pipeline route crosses five major biotic communities: Great Basin conifer woodland, Plains and Great Basin grassland, Great Basin desertscrub, semidesert grassland, and Mohave desertscrub. The vegetation types intergrade, and there are few abrupt changes in vegetation type because elevational changes tend to be gradual. The distribution of vegetation types is largely related to elevation, which ranges from about 6,100 to 7,200 feet above MSL at the Black Mesa Complex to about 4,200 feet above MSL at the Little Colorado River near Cameron, and then increases to 6,050 feet above MSL at the southwestern edge of the Navajo Reservation near Mesa Butte. The elevation is constant at about 6,000 feet above MSL until CSP Milepost 159, generally ranges between about 5,200 to 5,800 feet above MSL from CSP Milepost 159 to the Cottonwood Cliffs, and then drops across several basins and ranges to about 550 feet above MSL at Bullhead City.

Great Basin conifer woodland occurs along the pipeline route at Black Mesa, the area north of the San Francisco Peaks, Juniper Mountains, Cottonwood Mountains, and Peacock Mountains. Great Basin conifer woodland has been described previously for the Black Mesa Complex. The piñon/juniper woodland association located in the central and western portions of the route is generally similar, with the addition of oneseed juniper (*Juniperus monosperma*). Much of the area mapped as Great Basin conifer woodland is dominated by or is exclusively juniper. The trees are relatively short and have a varying density from savanna to woodland to nearly closed-canopy forest. The understory in savanna and woodland areas is primarily composed of species present in adjacent scrub or grassland, such as blue grama, sideoats grama (*Bouteloua curtipendula*), broom snakeweed, and big sagebrush.

Along the Moenkopi Wash terrace, the vegetation is mostly greasewood and fourwing saltbush, with narrow strips of tamarisk that vary in abundance and density. Adjoining hills and ridges are dominated by open stands of juniper or a combination of piñon and juniper.

Plains and Great Basin grassland occurs on the Hopi Reservation, in the central portions of the route from Cameron to west of Seligman, and in portions of the Chino Valley and Seventyfour Plains. Plains and Great Basin grassland is dominated by short or mid-grasses. Dominant native perennial grasses include blue grama, wheatgrasses (*Agropyron* spp.), needlegrasses (*Stipa* spp.), Indian ricegrass, galleta, junegrass (*Koeleria macrantha*), sand dropseed (*Sporobolus cryptandrus*), and squirreltail. Cheatgrass, an introduced annual grass, may be abundant. Common shrubs include fourwing saltbush, winterfat, Whipple cholla (*Opuntia whipplei*), rabbitbrush, broom snakeweed, several species of prickly pear (*Opuntia* spp.), and soapweed yucca (*Yucca glauca*). Numerous species of forbs are present, including goldeneye (*Viguiera* spp.), groundsel (*Senecio* spp.), thistles (*Cirsium* spp.), prickly poppy (*Argemone* spp.), and sunflower (*Helianthus* spp.). Much of the Plains and Great Basin grassland in Arizona has been modified by grazing and other land uses, with resulting increases in shrub cover and decreases in grasses. Much of the degraded grassland has transitioned into Great Basin desertscrub. Grassland farther to the west has been invaded by junipers, sagebrush, and other shrubs.

Great Basin desertscrub occurs from Red Lake to Cameron on the Hopi and Navajo Reservations. These areas include the Moenkopi Plateau, Echo Cliffs, and Painted Desert to near Gray Mountain. Great Basin desertscrub as mapped by Brown and Lowe (1980) occurs primarily in the lower elevations and more arid zones of the Hopi and Navajo Reservations. Dominant species include sagebrushes (*Artemisia* spp.), saltbushes (*Atriplex* spp.), and winterfat (*Ceratorides lanata*). Other common shrub species include rabbitbrush (*Chrysothamnus* spp.), blackbrush (*Coleogyne ramosissima*), spiny hopsage (*Grayia spinosa*), Mormon tea (*Ephedra* spp.), and horsebrush (*Tetradymia* spp.). Three species of sagebrush are common—big sagebrush, Bigelow sagebrush (*Artemisia bigelovii*), and black sagebrush (*Artemisia nova*). Perennial grasses may be common or rare. Introduced annuals are common and include cheatgrass, Russian thistle, filaree (*Erodium* spp.), and tumble mustard (*Sisymbrium altissimum*). Shadscale is dominant in areas where precipitation is lower than in the sagebrush zone. Shale badlands are present in some areas and have little or no vegetation.

Semidesert grassland occurs in two areas east of Kingman, including 4 miles between the Cottonwood and Peacock Mountains, and in the Hualapai Valley. About 6 miles of the alignment in the Hualapai Valley pass through urban areas. This vegetation type originally was dominated by perennial bunch grasses, but is now often dominated by shrubs, half-shrubs, cacti, and forbs (Brown 1982). Common species include black grama (*Bouteloua eriopoda*), other grama species, three-awns (*Aristida* spp.), and other grasses; seasonally abundant forbs such as filaree (*Erodium cicutarium*), lupines (*Lupinus* spp.), buckwheats (*Eriogonum* spp.) and globemallows (*Sphaeralcea* spp.); leaf succulents such as yuccas

(*Yucca* spp.); mesquite (*Prosopis velutina*), oneseed juniper, crucifixion thorn (*Canotia holocantha*), Mormon tea, false mesquite (*Calliandra eriophylla*), catclaw acacia (*Acacia greggii*), and other shrubs. Mesquite, one-seed juniper, creosotebush (*Larrea tridentata*), and snakeweed are common invaders. Other common species observed during field reconnaissance included desert marigold (*Baileya multiradiata*), golden paperflower (*Psilostrophe cooperi*), thistle, and beavertail cactus (*Opuntia basilaris*).

Mojave desertscrub occurs from Kingman west to the Colorado River and the Mojave Generating Station. This area includes the Cerbat Mountains west of Kingman, Sacramento Valley, Black Mountains, and Mohave Valley to the Colorado River. About 1 mile in the Sacramento Valley and about 2 miles near Bullhead City are urbanized. The dominant species are creosotebush and white bursage (*Ambrosia dumosa*). In valley areas, the creosotebushes are widely spaced, and most of the openings between shrubs are bare ground most of the year or occupied by a variety of ephemeral herbaceous species following adequate rainfall. Other shrubs and perennial herbs are more common and diverse in rocky areas, along washes, and at higher elevations. Other common species include Anderson thornbush (*Lycium andersonii*), spiny hopsage (*Grayia spinosa*), paper bag bush (*Salazaria mexicana*), flat-top buckwheat (*Eriogonum fasciculatum*), ratany (*Krameria parvifolia*), and brittlebush (*Encelia farinosa*). Joshua tree (*Yucca brevifolia*), visually dominant in some parts of the Mojave Desert, was not reported to be present along the existing alignment (Entrix 2002). A number of cacti are present, including hedgehog (*Echinocereus* spp.), silver cholla (*Opuntia echniocarpa*), Mojave prickly pear (*Opuntia erinacea*), beavertail cactus, and many-head barrel cactus (*Echinocactus polycephalus*). The Black Mountains are relatively undisturbed, while the Sacramento Valley and Cerbat Mountain areas are somewhat developed, with patches of undisturbed habitat. African mustard (*Brassica tournefortii*), an invasive species, is very common along roads in the Sacramento Valley.

3.7.2.1.2 Wetlands and Riparian Habitats

A number of xeroriparian[1] shrub species are present in areas receiving intermittent water supplies, including sandy arroyos, washes, and subirrigated bajadas[2]. These species include desert willow (*Chilopsis linearis*), Mormon tea, New Mexican forestiera (*Forestiera neomexicana*), red barberry (*Berberis haematocarpa*), and smoke tree (*Dalea spinosa*) (Entrix 2002).

No wetlands are known to be present along the alignment, but small wetlands may occur in seepage areas along some washes. Narrow strips of riparian vegetation dominated by tamarisk are present along the banks of Moenkopi Wash, Begashibito Wash (with Russian olive [*Elaegnus augustifolia*]), Little Colorado River, and some minor washes east of Cameron (Entrix 2002). There are no wetlands or riparian habitat at the Colorado River crossing.

3.7.2.1.3 Noxious Weeds and Invasive Plant Species

Noxious weeds and invasive plant species known or likely to occur along the coal-slurry pipeline include African mustard, camelthorn (*Alhagi camelorum*), Dalmatian toadflax (*Linaria dalmatica*), diffuse knapweed, field bindweed, Russian knapweed, Russian olive, Scotch thistle, and tamarisk (California Information Node 2005; U.S. Forest Service [Forest Service] 2003; USGS 2004). The known distributions of these species near the coal-slurry pipeline are as follows:

- African mustard occurs near Kingman and in the Sacramento Valley.
- Camelthorn occurs in the area from Tuba City to Cameron.

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[1] Species prevalent in dense vegetation along dry washes.
[2] Broad sloping depositional surface at the base of a mountain range formed of coalesced alluvial fans.

- Dalmatian toadflax occurs along U.S. Highway 89 near Cameron.
- Diffuse knapweed occurs near Cameron.
- Field bindweed occurs in the vicinity of the existing route west of Valle.
- Russian knapweed and diffuse knapweed have been reported near Cameron.
- Russian olive was observed along Begashibito Wash during the field reconnaissance.
- Scotch thistle occurs near Tuba City, Cameron, and Valle, and has been observed along the route.
- Tamarisk occurs near the Colorado River and Little Colorado River at Cameron, and was observed in Moenkopi and Begashibito Washes during the field reconnaissance.

3.7.2.1.4 Endangered, Threatened, and Special Status Species

The analysis of endangered, threatened, and special status species included review of FWS county lists (FWS 2005), the Navajo endangered species list (NNFWD 2005b), Arizona Natural Heritage Program lists (AGFD 2006a), and Arizona BLM sensitive species list (BLM 2005a), and evaluation of habitats and ranges. Endangered, threatened, and other special status plant species known or expected to occur in the vicinity of the coal-slurry pipeline are listed in Table F-3 in Appendix F. Designations by several agencies are included. Two federally listed plant species are known to occur in the vicinity of the coal-slurry pipeline as follows:

- Fickeisen plains cactus (*Pediocactus peeblesianus* var. *fickeiseniae*) is a Federal candidate species known to occur within 1 mile of the pipeline route near Cameron and westward (Hutchins 2005; NNFWD 2005b). This is a small globose cactus that occurs on gravelly soils in Great Basin desertscrub communities at elevations of 4,000 to 6,000 feet above MSL. It retracts into the soil during drought.
- Welsh's milkweed (*Asclepias welshii*) is a federally listed endangered species with potential to occur in the area near Tuba City (NNFWD 2005b). It occurs on active sand dunes derived from Navajo Sandstone. The nearest known location is north of Tuba City and about 0.2 mile of potentially suitable habitat is present along the route. Critical habitat is designated for about 4,000 acres of sand dune habitat on the Coral Pink Sand Dunes and Sand Hills area of Kane County, Utah (FWS 1987a).

A number of other special status species occur or have the potential to occur along the route. Seven are known to or may occur on portions of the existing route that cross the Navajo Reservation. They include four species in Group 4 of the Navajo Endangered Species List, and one Forest Service sensitive species as follows:

- Peeble's blue star (*Amsonia peeblesii*), a robust perennial herb in the dogbane family, is known to occur within 1 mile of the route. It occurs in grassland and Great Basin desertscrub communities at elevations of 4,000 to 5,600 feet.
- Round dunebroom (*Errazurizia rotundata*) has the potential to occur along the alignment, in sandy pockets between outcroppings of Moenave Sandstone at elevations of about 4,800 to 5,200 feet above MSL.
- Parish's alkali grass (*Puccinelia parishii*) has the potential to occur if wetlands are present with white alkali crusts.
- Beath milkvetch (*Astragalus beathii*) occurs from Lees Ferry to south of Cameron, on roadsides and washes on seleniferous soils of the Moenkopi Formation (Arizona Rare Plant Committee 1994). This species is reported to occur within 3 miles of the route (Hutchins 2005).

- Cameron water-parsley (*Cymopterus megacephalus*) is reported to occur within 3 miles of the alignment. This species is a stemless perennial forb in the *Apiaceae* family that occurs on sandy, gravelly, or shaley soil in Great Basin desertscrub and desert grassland. It is known to occur near Cameron. This is a Forest Service sensitive species, but the route does not cross land administered by the Forest Service within the potential range of the species. It is not included on the Navajo list.

Additional special status plant species west of the Navajo Reservation include the following:

- Tusayan rabbitbrush (*Chrysothamnus molestus*) is a Forest Service sensitive species known to occur along the alignment within Kaibab National Forest south and east of Valle. It occurs on limestone-derived soils in piñon/juniper woodland and associated grassland at 5,500 feet above MSL and higher.
- Two-color beardtongue (*Penstemon bicolor* spp. *roseus*) occurs in the Black Mountains and is a BLM sensitive species. Although there are no known occurrences near the pipeline alignment, suitable habitat is present and the species may occur. It occurs in dry washes in volcanic hills.
- Chalk liveforever (*Dudleya pulverulenta* spp. *arizonica*) is considered vulnerable by the Nevada Natural Heritage Program (Miskow 2005) but has no status in Arizona. It occurs on rock outcrops and desert slopes.

- The Arizona Native Plant Law provides protection for many species of native plants by requiring authorization for removal, sale, and possession. It is prohibited to remove native plants for sale or other use, and the Arizona Department of Agriculture must be notified in advance of any land-clearing activities that would destroy native plants.

3.7.2.1.5 Culturally Important Plant Species

Culturally important native plant species that may occur along the portions of the existing route on the Hopi and Navajo Reservations are provided in Table F-2 in Appendix F.

3.7.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

The vegetation of the pipeline realignments is generally the same as along the existing pipeline route. The pipeline realignments in Moenkopi Wash involve moving segments of the pipeline out of the active channel, and these segments are likely to be located primarily in saltbush and greasewood shrublands on the alluvial terraces above the wash, in proximity to the existing route. Small areas of tamarisk are present along the edge of the channel. The Kingman reroute would cross about 10 miles of semidesert grassland southeast of Kingman and 18 miles of Mohave desertscrub in the Sacramento Valley. Portions of the desert grassland habitat have been invaded by juniper on the lower slopes of the Hualapai Mountains.

The noxious and invasive species; endangered threatened, and special status plant species; and culturally important plant species are the same as described for the existing route.

3.7.3 <u>Water Supply</u>

3.7.3.1 C Aquifer Water-Supply System

3.7.3.1.1 Water Withdrawal

Within the modeled drawdown area, riparian vegetation associated with the C aquifer occurs primarily along portions of lower Clear Creek, lower Chevelon Creek, and Little Colorado River. Riparian vegetation typically is dominated by tamarisk. Other species that occur include grasses, sedges, common reed (*Phragmites australis*), cattail, tule (*Scirpus acutus*), coyote willow, Goodding willow (*Salix gooddingii*), velvet ash (*Fraxinus velutina*), and Fremont cottonwood (*Populus fremontii*).

About 285 acres of riparian vegetation that occur along the lower 1.7 miles of Chevelon Creek are dominated by tamarisk and Russian thistle (Lopez, Dreyer, and Gonzales 1998). Above this is about 7 miles of narrow canyon with very limited riparian vegetation. The upper part of the perennial reach has a diverse riparian community consisting of grasses, sedges, poison ivy (*Toxicodendron rydbergii*), walnut (*Juglans major*), and willow.

The lower part of Clear Creek has dense tamarisk. Most of the perennial reach is in a canyon. Velvet ash is tall but has relatively low densities. Tamarisk, common reed, cattail, and bulrush are common in some areas (Clarkson and Marsh 2005a).

One Group 4 species on the Navajo Endangered Species List, Parish's alkali grass, potentially could occur at streams or seeps within the well-field drawdown zone, although it is not known to be present. Parish's alkali grass is a geographically widespread but rare annual grass whose populations vary greatly in time and space (Arizona Rare Plant Committee 1994).

Information about the potential presence of endangered, threatened, and other special status species at all components of the C aquifer water-supply system is summarized in Tables F-12 and F-13 in Appendix F. Culturally important native plant species that may occur are listed in Table F-2 in Appendix F.

3.7.3.1.2 Infrastructure

3.7.3.1.2.1 Well Field

The well field is located within two vegetation communities—Great Basin desertscrub on the northeast half and Plains and Great Basin grassland on the southwest half. These communities have been described previously in the discussion of vegetation along the coal-slurry pipeline. The well field does not contain any major drainages. There are no wetlands mapped by the National Wetland Inventory or known areas of riparian habitat within the well field.

Noxious weeds and invasive species known or likely to occur within the well field area include camelthorn, halogeton (*Halogeton glomeratus*), musk thistle, puncture vine, Russian knapweed, Russian olive, and tamarisk (California Information Node 2005; USGS 2004). The first five species are primarily problems in rangeland and therefore more likely to occur. The last two species invade washes and riparian areas and are unlikely to be common because of lack of suitable habitat. All these species have been reported in the well field or immediately adjacent areas along I-40 or near Leupp. No endangered, threatened, or other special status species are known or expected to occur in the well field area.

3.7.3.1.2.2 C Aquifer Water-Supply Pipeline

3.7.3.1.2.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

The distribution of vegetation types along the Eastern Route is associated with elevation, which ranges from about 6,700 feet above MSL near the Black Mesa Complex to 4,700 feet above MSL at the Little Colorado River, and about 5,400 feet above MSL at Canyon Diablo. The Eastern Route would cross three biotic communities—Plains and Great Basin grassland, Great Basin desertscrub, and Great Basin conifer woodland.

As mapped by Brown and Lowe (1980), grassland occurs along approximately 38 miles of the Eastern Route, including the southern 6 miles, and from WSP Milepost 52 to 84. This vegetation type is described above in the discussion of vegetation along the coal-slurry pipeline. Much of the grassland along the eastern pipeline route is transitional to Great Basin desertscrub. Areas with shallow soils and rocky outcrops have open stands of Great Basin conifer woodland. Alluvial valleys and terraces close to a wash (within about 10 feet vertically of the wash bottom) are dominated by species such as greasewood and fourwing saltbush.

Great Basin desertscrub occurs along a total of 55 miles. Most occurs near the Little Colorado River, the Painted Desert, and upland areas near Oraibi Wash, and the remaining along Dinnebito Wash. This community also is described above for the coal-slurry pipeline. Shale badlands within this community have little or no vegetation. Great Basin conifer woodland occurs for 19 miles at the Eastern Route's northern end on Black Mesa. This community is the same as described for the Black Mesa Complex.

No wetlands are known to be present along the Eastern Route, but small wetlands may occur in seepage areas along some washes. Narrow strips of riparian vegetation dominated by tamarisk are present along the banks at the Little Colorado River crossing and other drainages.

Noxious and invasive plant species known to be present in the vicinity of the Eastern Route include camelthorn, halogeton, musk thistle, puncture vine, Russian knapweed, Russian olive, and tamarisk (California Information Node 2005; USGS 2004). The first five species occupy rangeland and the last two species are trees that occur primarily along washes and in riparian areas, including the Little Colorado River near Leupp. The available information on the distribution of these species is provided below, based primarily on USGS (2004) and California Information Node (2005):

- Camelthorn is widespread in Great Basin desertscrub on the southern 40 miles of the Eastern Route.
- Halogeton is known from a number of sites near the Little Colorado River and lower Oraibi Wash.
- Musk thistle occurs in the Kayenta and Black Mesa mining areas and along Dinnebito Wash.
- Puncture vine has been reported to occur at Dinnebito Wash.
- Russian knapweed is known from a number of locations, including Dinnebito Wash, Kykotsmovi, and Leupp.
- Russian olive occurs along the Little Colorado River near Leupp and in Oraibi Wash.
- Tamarisk occurs along the Little Colorado River and in washes.

No federally listed, proposed, candidate, threatened, or endangered plant species are known or expected to occur. Two Group 4 plant species from the Navajo Endangered Species List are known to be present within 3 miles of the alignment:

- Round dunebroom is a low aromatic shrub in the pea family that occurs on exposed sites in desertscrub in the Little Colorado River Valley at elevations of 4,800 to 5,200 feet above MSL. The plants grow in sandy and gravelly soils associated with sandstone and calcareous outcrops (AGFD 2005b; Arizona Rare Plant Committee 1994).
- Parish's alkali grass could potentially occur between WSP Mileposts 92 and 96 if there are wetlands present that contain white alkali crusts (NNFWD 2005b).

Culturally important native plant species that may occur are listed in Table F-2 in Appendix F.

3.7.3.1.2.2.2 C Aquifer Water-Supply Pipeline: Western Route

The Western Route would follow the same route as the Eastern Route for about the first 27 miles, and then diverge. It would cross about 6 miles of Plains and Great Basin grassland and 21.5 miles of Great Basin desertscrub. Although it would follow a different route for the remaining distance, it would cross the same vegetation types as the Eastern Route. Plains and Great Basin grassland occurs along the Moenkopi Plateau, and a section in the Klethla Valley along U.S. Highway 160. Great Basin desertscrub occurs for a total of 68 miles, along Painted Desert and Ward Terrace, Moenkopi Plateau, and from Coal Mine Canyon to near Cow Springs.

Great Basin conifer woodland occurs along 21 miles of the Western Route, along U.S. Highway 160 and Indian Route 41 on Black Mesa. Several miles are within or adjacent to mined areas in the Black Mesa mining operations.

No wetlands are known to be present along the Western Route, but small wetlands may occur in seepage areas along some washes. Narrow strips of riparian vegetation dominated by tamarisk are present along the banks at the Little Colorado River crossing, Moenkopi Wash, Begashibito Wash, and several other locations.

Noxious weeds and invasive plant species known or likely to occur along the Western Route include bull thistle, camelthorn, diffuse knapweed, field bindweed, halogeton, musk thistle, puncture vine, Russian knapweed, Russian olive, spotted knapweed, and Scotch thistle. The known distributions of some of these species are as follows, based primarily on USGS (2004) and California Information Node (2005):

- Bull thistle occurs along U.S. Highway 160.
- Camelthorn has been reported at many locations along the southern two-thirds of the route.
- Diffuse knapweed has been reported at a number of locations, including along U.S. Highway 160 and near Leupp.
- Puncture vine occurs along the portion of U.S. Highway 160 paralleled by the pipeline.
- Field bindweed is reported for a number of locations along U.S. Highway 160 and Indian Route 41.
- Halogeton has been reported only for the southern portion that the Western Route shares with the Eastern Route.
- Musk thistle occurs along U.S. Highway 160 and in the mining operations area.
- Russian olive occurs along U.S. Highway 160, and near Leupp and Oraibi Wash.
- Scotch thistle has been reported at several locations where the Western Route would parallel U.S. Highway 160.
- Spotted knapweed occurs along U.S. Highway 160.
- Tamarisk is reported for the Leupp area and washes in the Black Mesa Complex area.

Table F-4 in Appendix F provides a summary of endangered, threatened, and other special status species that may occur along the Western Route. One federally listed threatened plant species, Welsh’s milkweed, has a potential to occur if there are sand dunes derived from the Navajo Formation (NNFWD 2005b).

Two special status plant species also may occur:

- Round dunebroom is considered to have a potential for occurrence from WSP Milepost 43 to 62 (NNFWD 2005b).
- Parish's alkali grass is known to occur within 3 miles of the Western Route from about WSP Milepost 119 to 127 (NNFWD 2005b).

Culturally important native plant species that may occur are listed in Table F-2 in Appendix F.

3.7.3.2 N Aquifer Water-Supply System

Drainages receiving groundwater discharge from the N aquifer include Chinle and Laguna Wash on the northeast side of Black Mesa, and Pasture Canyon, Moenkopi Wash, Dinnebito Wash, Oraibi Wash, Polacca Wash, and Jeddito Wash on the west and south sides of Black Mesa (GeoTrans 2005). Riparian vegetation along these washes is supported by baseflow and runoff, and includes tamarisk, coyote willow, occasional cottonwoods, and Russian olive. Both tamarisk and Russian olive are considered to be invasive species. Groundwater discharge occurs only in the unconfined portions of the aquifer and is constant throughout the year, but is typically only present as surface flow in the winter when evapotranspiration is at a minimum.

One federally listed threatened species—Navajo sedge (*Carex specuicola*)—is known to occur within the study area. This is a grasslike species restricted to seeps and hanging gardens on vertical cliffs and alcoves of the Navajo Formation (Arizona Rare Plant Committee 1994), and it occurs at a number of locations north of U.S. Highway 160 near Tsegi as well as on the Hopi Reservation near where Moenkopi Wash, Begashibito Wash, and Ha Ho No Geh Canyon overlap the unconfined portion of the N aquifer. This species has not been affected to date by pumping from the N aquifer (Peabody 2004). In addition, Parish's alkali grass has been reported from near Tuba City and Shonto but could potentially occur at any alkaline seep, spring, or seasonally wet area within the region.

3.8 FISH AND WILDLIFE

3.8.1 <u>Black Mesa Complex</u>

3.8.1.1 Summary of Habitats

The vegetation types of the Black Mesa Complex are described in Section 3.7. The major types are piñon/juniper woodland, which occupies about 65 to 70 percent of the coal-resource areas, sagebrush shrub, which occupies 30 to 35 percent of the areas, and reclaimed areas that are grasslands and shrub grasslands. Saltbush and greasewood shrub communities and riparian communities dominated by tamarisk occupy relatively small areas along drainages. Mixed conifer woodland occurs in very limited areas within the Black Mesa Complex at elevations between 6,800 and 8,200 feet above MSL. Other habitats include sandstone bluffs and aquatic and wetland habitat in some impoundments. All the major drainages in the Black Mesa Complex are intermittent. However, about 2 miles of Moenkopi Wash that are downstream from the confluence of Coal Mine Wash intersect the groundwater table and have extended periods of stream flow each year. Common wildlife species associated with each habitat type are listed in Table F-11 in Appendix F.

3.8.1.2 Wildlife

Twenty-six mammal species were recorded in the Black Mesa Complex during baseline wildlife studies conducted in 1979 through 1983 (Peabody 2004). Updated information on wildlife distribution and habitat was collected during a 2003 field reconnaissance (BIOME Ecological and Wildlife Research [BIOME] 2003). A 1979-1980 census for ungulates recorded two observations of mule deer (*Odocoileus* *hemionus*), both north of the Black Mesa Complex. In 2003, 10 mule deer and numerous pellet groups of mule deer and elk (*Cervus elaphus*) were observed during biological surveys for birds and threatened and endangered species (BIOME 2003). Mule deer may be present throughout the year, but they are not common or abundant. The elk population has steadily increased at the Black Mesa Complex since the early 1980s, and it is not uncommon to see groups of 5 to 10 elk on reclaimed areas in the Black Mesa Complex; this is based upon personal observations of Peabody environmental staff stationed at the Black Mesa Complex.

The sagebrush shrubland and piñon/juniper woodland support the largest populations of small mammals. Deer mice (*Peromyscus maniculatus*) are the most common species trapped in the Black Mesa Complex. Piñon/juniper woodland supports piñon-mice (*Peromyscus truei*), brush mice (*Peromyscus boylii*), Ord's kangaroo rat (*Dipodomys ordii*), Stephen's woodrat (*Neotoma stephensi*), and Colorado chipmunk (*Tamias quadrivittatus*). Gunnison's prairie dogs (*Cynomys gunnisonii*) occur in grassland habitats. Similar small-mammal populations including the Navajo Mountain Mexican vole (*Microtus mexicanus navaho*) occur on reclaimed lands at the Black Mesa Complex. Black-tailed jackrabbits (*Lepus californicus*) and desert cottontails (*Sylvilagus audubonii*) occur in all habitats at Black Mesa as do coyotes (*Canis latrans*), red foxes (*Vulpes fulva*) and grey foxes (*Urocyon cinereoargenteus*).

Bat studies were conducted in reclaimed areas and piñon/juniper habitat on Black Mesa in the summer of 1999. Nine bat species were identified through mist netting and the use of an Anabat II detection unit to gather acoustic records of bats. The documented species included the big brown bat (*Eptesicus fuscus*), long-legged myotis (*Myotis volans*), silver-haired bat (*Lasionyctris noctivagans*), pallid bat (*Antrozous pallidas*), fringed myotis (*Myotis thysanodes*), Mexican free-tailed bat (*Tadarida brasiliensis*), big free-tailed bat (*Nyctinomops macrotis*), western pipistrelle (*Pipistrellus hesperus*), and an unknown myotis species (SWCA Environmental Consultants 2000). Only the first six species listed above were found in piñon/juniper habitat, while all nine detected species were found in reclaimed areas. The silver-haired bat is listed as a sensitive species by the Navajo Nation.

Extensive bird surveys on Black Mesa have recorded a total of 235 species with 6 additional species identified from archaeological records. LaRue (1994) summarized comprehensive bird-censusing studies conducted in the northern Black Mesa region from the late 1970s to 1993. A number of these species were the first recorded for the region and represent a diverse variety of species from the greater roadrunner (*Geococcyx californianus*) to osprey (*Pandion haliaetus*). The highest number of birds and the greatest diversity of species are observed in summer, partly due to fledged offspring (Peabody 2004). The more common species and their habitats are presented in Table F-5 in Appendix F.

Raptor studies in the 1980s recorded 22 raptor species with 9 of those likely to nest in the Black Mesa Complex. Red-tailed hawks (*Buteo jamaicensis*) were the most abundant raptor species; Cooper's hawks (*Accipiter cooperii*) and sharp-shinned hawks (*Accipiter striatus*) were relatively common in coniferous woodland habitats. Raptor surveys in 2003 recorded American kestrel (*Falco sparverius*) and Cooper's hawk. A historic red-tailed hawk nest remained inactive in 2003 (BIOME 2003). Other less common species that may breed in the area include northern goshawk (*Accipiter gentilis*), prairie falcon (*Falco mexicanus*), western screech owl (*Otus kennicottii*), great horned owl (*Bubo virginianus*), northern pygmy-owl (*Glaucidium gnoma*), and long-eared owl (*Asio otus*). Comprehensive raptor studies have been conducted on and adjacent to the Black Mesa Complex for red-tailed hawk, peregrine falcon (*Falco peregrinus*), and Mexican spotted owl (*Strix occidentalis lucida*). The results have been reported to OSM.

A high diversity of migratory waterfowl and shorebirds utilize the larger impoundment ponds. Mallards (*Anas platyrhynchos*) are likely the only nesting species, though redheads (*Aythya americana*), ruddy ducks (*Oxyura jamaicensis*), and American coots (*Fulica americana*) also may nest in the vicinity (Corman and Wise-Gervais 2005). Many other species may utilize the ponds during migration, such as eared grebe (*Podiceps nigricollis*), great blue heron (*Ardea herodias*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), cinnamon teal (*Anas cyanoptera*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), and lesser scaup (*Aythya affinis*) (Corman and Wise-Gervais 2005). Killdeer (*Charadrius vociferous*) are the only shorebirds that may nest in the Black Mesa Complex (Corman and Wise-Gervais 2005). Both osprey and bald eagles have been observed at the ponds during migration.

Reptile species observed during 2003 field reconnaissance include whiptail lizard (*Cnemidophorus* spp.), collared lizard (*Aspidocelis collaris*), sagebrush lizard (*Sceloporus graciosus*), fence lizard (*Sceloporus undulates*), and side-blotched lizard (*Uta stansburiana*) (BIOME 2003). Other common reptiles and amphibians that may occur are listed in Table F-11 in Appendix F.

The 40-acre coal-slurry preparation-plant site is dominated by Great Basin desertscrub consisting of sagebrush/snakeweed shrubland, disturbed land with little vegetation, and a small portion of reclaimed land (BMPI 2005). Operational ponds present on the site are used by deer, small mammals, shorebirds, and other avian species (BMPI 2005). Bats may be present during foraging episodes over water tanks or small ponds, but the area is not considered significant habitat for bats. Mule deer are the only big-game species identified in the coal-slurry preparation-plant area, but they occur in low numbers (BMPI 2005). The other principal game species in the area are waterfowl, mourning doves (*Zenaida macroura*), jackrabbits, and rabbits. Others include coyote, bobcat, red fox, and gray fox (BMPI 2005). Other wildlife are similar to those described for the Black Mesa Complex, but occurrence is limited due to disturbed habitats and human activity.

The proposed coal-washing facility would be located near the coal-slurry preparation plant, coal-storage piles, and other buildings supporting the Black Mesa mining operation. Based on an aerial photograph, the vegetation consists primarily of sagebrush shrub and/or vegetation on reclaimed land. Due to the disturbed nature of the area in and immediately adjacent to the facility, though some species of wildlife may occur on the site, such as desert cottontails, rodents, or occasional coyotes or foxes, the area is not likely a significant source of habitat for wildlife in general.

The proposed new coal-haul road corridor would be located in piñon/juniper woodland, and the site has wildlife typical of this habitat.

3.8.1.3 Fisheries and Aquatic Habitats

No natural fisheries or aquatic habitats are present at the Black Mesa Complex. Sedimentation ponds, internally draining ponds in reclaimed areas, and permanent impoundments currently provide some aquatic habitat. There are currently 158 sedimentation ponds to support the Kayenta and Black Mesa mining operations, and Peabody proposes 117 additional ponds as part of the LOM revision. Of these 267 impoundments, Peabody proposes to retain 51 as permanent impoundments in the postmining reclaimed landscape.

3.8.1.4 Federally Listed Threatened, Endangered, Proposed, Candidate, and Other Special Status Animal Species

Seventeen special status wildlife species are known to occur or have the potential to occur in the area of the Black Mesa Complex, either as residents or as migrants/transients (Tables F-6 and F-7 in Appendix F). Three of these species—the Mexican spotted owl, black-footed ferret (*Mustela nigripes*), and southwestern willow flycatcher (*Empidonax trailii extimus*)—are federally listed as threatened or endangered under the ESA.

The California condor (*Gymnogyps californianus*) may occur occasionally, especially as the reintroduced population grows and expands its range. Condors are naturally curious and may be attracted to human activity.

Designated critical habitat for the Mexican spotted owl includes 3,983,042 acres statewide, most of which is on Forest Service lands. No designated critical habitat occurs on tribal, state, or private lands. Mexican spotted owls are known to occur on Black Mesa and have been intensively studied and monitored from 1994 to 2001. The nearest Protected Activity Center occurs about 0.7 mile from the active N-10 mine area, and there are no records of nesting within the permit boundary. The owls occur in mixed conifer forest, a habitat that is not present within the mine-permit area. There is also no evidence that the owls use mine reclamation or adjacent undisturbed habitat in the permit area. The closest records are in Yellow Water Canyon and in side canyons of Coal Mine Wash and Moenkopi Wash.

Suitable habitat (prairie dog towns) is present for black-footed ferret, but the species is not expected to occur and there are no known naturally occurring populations in Arizona. Peabody conducts censusing and reporting of prairie dog towns on and adjacent to the Black Mesa Complex annually.

Critical habitat was designated formally for the southwestern willow flycatcher on October 19, 2005, and included 15 management units totaling 737 miles of river corridor in Arizona, California, Nevada, Utah, and New Mexico (70 Federal Register [FR] 60886). In Arizona, critical habitat was designated in portions of Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pinal, Pima, and Yavapai counties (FWS 2005a). No critical habitat occurs within 30 miles of any Black Mesa Project feature. At least three subspecies of willow flycatcher may be present in the area during migration (including the endangered southwestern subspecies), but none have been documented to breed in the region (AGFD 2002a; Corman and Wise-Gervais 2005). All drainages that support dense stands of *Tamarix* sp. with surface water or saturated soil may be considered suitable habitat for the migrating birds. Potentially suitable habitat exists on the extreme western and northwestern portions of the Black Mesa Complex (BIOME 2003).

The bald eagle (*Haliateetus leucophalus*) has been delisted and is no longer protected by the ESA. Primary bald eagle conservation laws are the Bald and Golden Eagle Protection Act and Migratory Bird Act. Bald eagles have been observed occasionally. Two adults were observed in the southern portion of the Black Mesa Complex at an impoundment pond in 1985, and an individual was observed in the northern portion during the 1999 field season (BIOME 2003). Additional sightings occurred in 1982, 1984, 1988, and 1993 (LaRue 1994). The Black Mesa Complex does not contain suitable nesting habitat for bald eagles, but does provide occasional foraging habitat for migratory or wintering birds at impoundments in the form of carrion, fish, or small mammals.

3.8.2 <u>Coal-Slurry Pipeline</u>

3.8.2.1 Coal-Slurry Pipeline: Existing Route

Most of the vegetation types that occur in the study area are crossed by the existing coal-slurry pipeline route. A more detailed description of vegetation types can be found in Section 3.7. Wildlife habitats include the vegetation types crossed by the pipeline and urban areas:

- Great Basin conifer woodland
- Mohave desertscrub
- Semidesert grassland
- Great Basin desertscrub
- Plains and Great Basin grassland
- Urban (Kingman and Bullhead City)

Typical wildlife associated with these habitats is listed in Table F-11 in Appendix F.

The desert bighorn sheep (*Ovis canadensis*) and wild burro (*Equus asinus*) herds in the Black Mountains are considered important resources of national significance (BLM 1995b). The Hualapai Mountains (6 or more miles south of the existing alignment) provide crucial habitat for the federally listed endangered Hualapai Mexican vole (*Microtus mexicanus hualpaiensis*), which primarily occupies dry grass/forb habitats in ponderosa pine forest and moist grass/sedge habitat along streams (BLM 1995b).

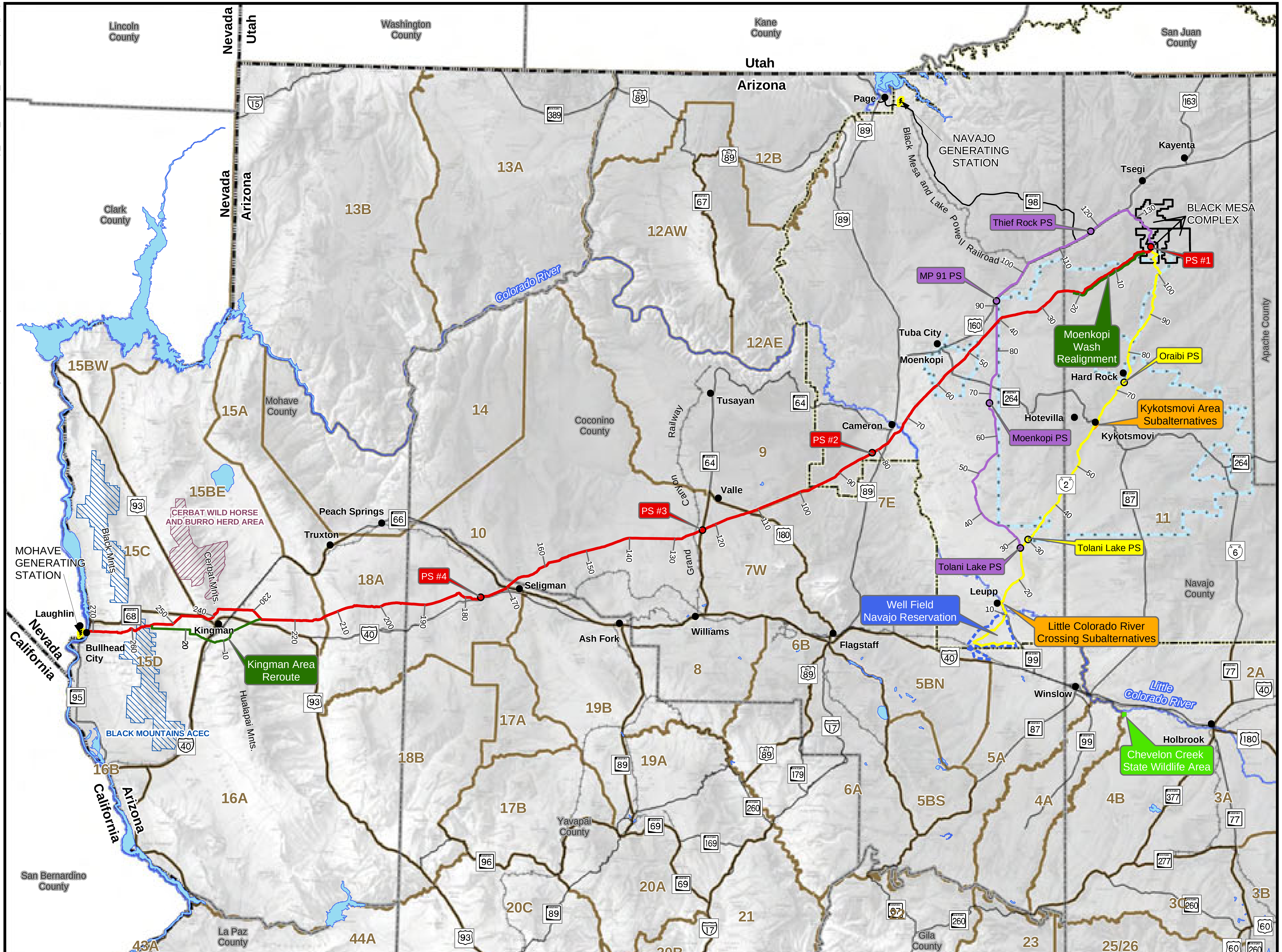
The coal-slurry pipeline crosses six AGFD game management units (GMUs) from the Navajo Reservation to the Colorado River (AGFD 2005a) (Map 3-14). From east to west, the GMUs are 7, 8, 10, 15B, 15D, and 18A. The primary game species hunted within GMUs crossed by the pipeline include mule deer, elk, pronghorn antelope (*Antilocarpa americana*), javelina (*Tayassu tajacu*), bighorn sheep, mountain lion (*Felis concolor*), mourning dove, and Gamble's quail (*Callipepla gambelli*). Arizona GMU descriptions provide the following information (AGFD 2005a). Mule deer occur throughout, although populations are low from the Cerbat Mountains west to the Colorado River. Elk and pronghorn antelope hunting occurs from the Navajo Reservation to Kingman (GMUs 8 to 18A). Elk winter in piñon/juniper habitat within this area and pronghorn occur in open grassland. Javelinas are considered common in GMU 18A, which stretches from west of Seligman to the Cottonwood Mountains. Bighorn sheep occur in the Black Mountains. Mountain lions are hunted mostly in GMUs 18A and 15B from Seligman to Kingman. Mourning dove hunting occurs mostly in GMUs 15B and 15D in the Sacramento, Hualapai, and Mohave Valleys. Gamble's quail occur mostly in the Peacock Mountains and the desert west of Kingman. On BLM-administered land, big game is managed cooperatively by AGFD and BLM's Kingman Field Office (BLM 1995b).

Wildlife movement corridors occur west of Kingman in the Cerbat and Black Mountains (Union Pass). The entire area west of Kingman is within BLM's Cerbat Wild Horse and Burro Management Area.

The Black Mountains (BLM's Black Mountains Herd Management Area) have been identified as the largest block of contiguous desert bighorn sheep habitat in Arizona and are therefore critical to the continued existence of that species. The existing pipeline alignment bisects about 7 miles of medium- and high-quality desert bighorn sheep habitat (BLM 1995b). The species are highly sensitive to human disturbance, communicable disease, and inter- and intraspecific competition for food, water, and habitat (BLM 1995b). Desert bighorn sheep compete for habitat with mule deer and wild burros in the Black Mountains (BLM 1995b).

The existing coal-slurry pipeline crosses five areas identified as conservation priorities by the Nature Conservancy: the Moenkopi Plateau east of Cameron, Aubrey Valley northeast of Seligman, Peacock/Cottonwood Mountains, Sacramento Wash, and Black Mountains South (Colorado Plateau Ecoregional Planning Team 2002; Marshall et al. 2004; Nature Conservancy 2001). These areas were identified for conservation-planning purposes based on occurrence of natural communities and rare species, and have no official status. The Nature Conservancy's conservation priority areas are identified in Arizona's Comprehensive Wildlife Conservation Strategy 2005-2015 (AGFD 2005a) as a source to be used in place of a comprehensive statewide landscape analysis, until AGFD completes its own analysis.

Golden eagles (*Aquila chrysaetos*) are known to nest near the existing coal-slurry pipeline route. Other potential nesting raptors include red-tailed hawk, Swainson's hawk (*Buteo swainsoni*), American kestrel, prairie falcon, great horned owl, western screech owl, and Cooper's hawk. Other common raptors likely to occur during wintering or foraging include turkey vulture (*Cathartes aura*), northern harrier (*Circus cyanus*), ferruginous hawk (*Buteo regalis*), and rough-legged hawk (*Buteo lagopus*).



Map 3-14
Arizona Game and Fish Department Game Management Units

Black Mesa Project EIS

LEGEND

Management Areas

- 14 AGFD Game Management Unit and Number
- BLM Area of Critical Environmental Concern
- BLM Wild Horse and Burro Herd Area

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation
- Navajo Reservation
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005
Bureau of Land Management 2005
Arizona Game and Fish Department 2004

N

November 2008

0 20 40
Miles

Prepared By:
URS

3.8.2.1.1 Fisheries and Aquatic Habitats

The only perennial water crossed by the coal-slurry pipeline is the Colorado River, near Bullhead City. Game fish present in this section of the Colorado River include rainbow trout (*Oncorhynchus mykiss*), largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), crappie (*Pomoxis nigromaculatus*), green sunfish (*Lepomis cyanellus*), and channel catfish (*Ictalurus punctatus*) (AGFD 2005c).

3.8.2.1.2 Threatened, Endangered, and Special Status Animal Species

The potential for occurrence, habitat, and status of federally listed and other special status species are summarized in Tables F-8 and F-9 in Appendix F. Federally listed threatened or endangered species potentially present where the coal-slurry pipeline would cross under the Colorado River near Bullhead City include razorback sucker (*Xyrauchen texanus*) and bonytail chub (*Gila elegans*) (AGFD 2005c; Miskow 2005). Critical habitat for the razorback sucker was designated by the FWS on March 21, 1994 (59 FR 13374) and included 15 reaches covering some 1,724 miles of river within the Colorado River Basin. These reaches occur in the Green, Yampa, Duschesne, Colorado, Whie, Gunnison, and San Jaun rivers in the Upper Colorado River Basin and portions of the Colorado, Gila, Salt, and Verde rivers in the Lower Colorado River Basin.

Critical habitat for the razorback suckeroccurs upstream of Davis Dam north of the coal-slurry pipeline location on the Colorado River. Critical habitat designated for bonytail chub by the FWS on March 21, 1994 (59 FR 13374) included seven reaches of the Colorado River system, totaling 312 miles of river in Colorado, Utah, Nevada, California, and Arizona. In Arizona, critical habitat was designated along the Colorado River from Hoover Dam to Parker Dam, including the area near Bullhead City and downriver from the Havasu National Wildlife Refuge to Parker Dam. Possible bonytail chub individuals are present between Davis Dam and Parker Dam (AGFD 2001e). Designated critical habitat is found north of the coal-slurry pipeline crossing of the Colorado River. The bonytail chub is listed as a species of speciala concern by the State of Arizona.

The Mohave population of desert tortoise (*Gopherus agassizii*) is not likely to occur on the short section of pipeline route in Nevada, as the habitat is mostly disturbed and unsuitable. Willow flycatchers could occur occasionally during migration in riparian habitat in Moenkopi Wash and at the crossing of the Little Colorado River, but the subspecies of migrating willow flycatcher has not been documented. Bald eagles may migrate along the Little Colorado River, and California condors may occur occasionally, but no key habitat features are present.

Black-footed ferrets have been reintroduced into the Aubrey Valley. The Aubrey Valley Experimental Population Area extends along U.S. Highway 66 to Chino Point, just north of the existing coal-slurry pipeline (Van Pelt and Winstead 2003). A prairie dog colony providing potential habitat for black-footed ferrets occurs approximately 6 miles north of Seligman (Van Pelt and Winstead 2003). Prairie dog towns of sufficient size to support black-footed ferrets are not present along the pipeline route.

Other special status species known or likely to be present include ferruginous hawk, golden eagle, and western burrowing owl (*Athene cunicularia hypugaea*); several species of bats near Kingman; banded Gila monster (*Heloderma suspectum*); Sonoran desert tortoise; northern leopard frog (*Rana pipiens*); and flannelmouth sucker (*Catostomus latipinnis*) (Table F-9 in Appendix F). The flannelmouth sucker was extirpated from the Colorado River below Lake Mead, but was reintroduced in the mid-1970s below Davis Dam, where populations persist until today (AGFD 2001a). Other special status species that occur include pronghorn antelope (Navajo Nation threatened species), Wupatki Arizona pocket mouse (*Perognathus amplus cineris*), milk snake (*Lampropeltis triangulum*), Maricopa tier beetle (*Cinindela oregona maricopa*), and Navajo Jerusalem cricket (*Stenopelmatus navajo*).

Forest Service management indicator species within Ecosystem Management Area 3 are listed in Table F-10 in Appendix F, based on information provided by Kaibab National Forest. The only indicators applicable to this project are juniper titmouse (*Baoelophus ridgwayi*), mule deer, and pronghorn antelope. The Forest Service management indicator species are only applicable on the approximately 5 miles of Kaibab National Forest traversed by the pipeline.

3.8.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

3.8.2.2.1 Habitat and Wildlife

The habitat and wildlife of the realignments are mostly the same as those described in Section 3.8.2.1 above. No fisheries or perennial aquatic habitat would occur along either of the pipeline realignments in Moenkopi Wash or Kingman area reroute.

The pipeline realignments in Moenkopi Wash would be in proximity to the existing pipeline route and would move segments of the pipeline out of the active channel. Habitat and wildlife species are mostly the same as along the existing route. The major habitats present along the pipeline realignments in Moenkopi Wash are Plains and Great Basin grassland and Great Basin conifer woodland. Typical wildlife associated with these habitats is presented in Table F-11 in Appendix F.

The Kingman reroute would cross about 10 miles of semidesert grassland southeast of Kingman and 18 miles of Mohave desertscrub in the Sacramento Valley. Typical wildlife of these habitats is presented in Table F-11 in Appendix F. Game species in areas along the Kingman reroute include mule deer, mourning dove, Gamble’s quail, and perhaps elk. Major habitats present along the Kingman reroute are Mohave desertscrub, semidesert grassland, and Great Basin conifer woodland. Typical wildlife of these habitats is presented in Table F-11 in Appendix F.

The threatened, endangered, and special status animal species are the same as described for the existing route (Table F-9 in Appendix F). Several BLM sensitive species of bat may occur on BLM land along the Kingman reroute south and southeast of Kingman. In addition, desert tortoise and banded Gila monster would have several additional miles of suitable habitat along the Kingman reroute.

3.8.3 Water Supply

3.8.3.1 C Aquifer Water-Supply System

3.8.3.1.1 Water Withdrawal

Groundwater levels in the C aquifer primarily reflect the topography and the locations of recharge and discharge areas. Discharge areas for the C aquifer include portions of the Little Colorado River from Lyman Lake downstream to Hunt Valley and from Woodruff to Joseph City, as well as Silver, Chevelon, Clear, and East Clear Creeks. The nearest perennial streams where the C aquifer discharges to the stream channel are upper East Clear, lower Clear, and lower Chevelon Creeks, located approximately 41, 26, and 33 miles, respectively, south and southwest of the proposed well field. East Clear Creek is located in the same watershed above Clear Creek and becomes Clear Creek at its confluence with Willow Creek. Based on USGS water-quality studies from June 30 to July 5, 2005, perennial flow in lower Clear Creek begins about 10 miles above the confluence with the Little Colorado River, and perennial flow in Chevelon Creek begins about 12 miles above the confluence. The winter of 2003-2004 was wetter than usual, and those baseflow conditions may not be typical of average years. Some, but not all, of East Clear Creek and its tributaries are perennial (Brown 1982). Groundwater levels near the areas with perennial flow are nearly equal to the stream elevation, indicating a marginal connection between the C aquifer and East Clear Creek (S.S. Papadopulos & Associates, Inc. [SSPA] 2005). The Little Colorado River is both a gaining and losing reach between the mouth of Chevelon Creek and Clear Creek. The gains in flow appear to be the result of upwelling of C-aquifer water to the river where outcrops of fractured Moenkopi

Formation are located at land surface in the channel. The losses are a result of evapotranspiration by phreatophytes and reinfiltration of some of the water to the stream-channel alluvium, based on USGS baseflow evaluation of Clear Creek, Chevelon Creek, and the Little Colorado River during June and July 2005 and 2006 (written communication, D.J. Bills, USGS, 2006).

East Clear, Clear, and Chevelon Creeks have their headwaters on the Mogollon Rim and flow north and northeast to join the Little Colorado River near Winslow (Map 3-15). The lower portions of both Clear and Chevelon Creeks are perennial because groundwater discharge from the C aquifer maintains baseflow during the dry season (early summer). Their primary source of water is snowmelt and runoff from precipitation, and flows are much higher than at other times of the year. The middle portions of the streams are interrupted perennial and mostly dry during the summer, but contain permanent or semipermanent pools.

Channel substrates within the perennial reaches of lower Clear Creek and Chevelon Creek are primarily bedrock-dominated but include boulders, gravels, sands and organic detritus. Native fish species recorded within the Clear Creek watershed in 2004 and 2005 (Clarkson and Marsh 2005a, 2005b) include Little Colorado River sucker (*Catostomus* sp.) and roundtail chub (*Gila robusta*). Nonnative fish include green sunfish, fathead minnow (*Pieapheles promelas*), rock bass (*Ambloplites rupestris*), plains killifish (*Fundulus zebrinus*), and common carp (*Cyprinus carpio*). Other fish recorded within these streams include native speckled dace (*Rhinichthys osculus*) and nonnative golden shiner (*Notemigonus crysoleucus*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*) (Young, Lopez, and Dorum 2001). Species recorded in lower Chevelon Creek are similar but also include native Little Colorado spinedace (*Lepidomeda vittata*), bluehead sucker (*Pantosteus discobolus*), nonnative black bullhead (*Ameiurus melas*), yellow bullhead (*Ameiurus natalis*), red shiner (*Cyprinella lutrensis*), and channel catfish.

Riparian vegetation potentially related to discharge from the C aquifer occurs in the lower portions of Clear and Chevelon Creeks, and along much of the Little Colorado River. These areas are used by migrating songbirds and some breeding birds, as well as reptiles, amphibians, and mammals.

Federally listed threatened or endangered species that may occur within upper East Clear, and lower Clear and lower Chevelon Creeks are listed in Table F-12 in Appendix F.

The only federally listed fish species known to occur or to be potentially present in these streams is the Little Colorado spinedace. Critical habitat was designated for the Little Colorado spinedace in 1987 (FWS 1987b). The reaches that were designated as critical habitat include 18 miles of East Clear Creek in Coconino County, 8 miles of Chevelon Creek in Navajo County, and 5 miles of Nutrioso Creek in Apache County (FWS 2005b). Habitat degradation and destruction—including degradation of water quality, depletion of water quantity from water impoundments and groundwater withdrawals, and the introduction of nonnative aquatic species—have resulted in declines in populations of Little Colorado spinedace. The lower 8 miles of Chevelon Creek are designated as critical habitat (25 miles southeast of the C aquifer well field), and Little Colorado spinedace are known to occur both within the critical habitat and in adjacent areas upstream. Little Colorado spinedace have not been found in lower Clear Creek since 1960, but are considered potentially present because this stream reach is its historical habitat and is downstream from known occupied habitat, and because this species is notorious for extreme population fluctuations when it seemingly disappears from an area for years or decades and then is found in abundance at a later date. Spinedace may be present in lower Clear Creek after high flows, but are unlikely to persist because of abundant predatory nonnative fish and other limiting factors. East Clear Creek is generally outside of the C-aquifer groundwater-discharge area, but is known to have populations of this species and contains designated critical habitat. Critical habitat for spinedace within the Clear Creek watershed occurs along approximately 18 miles of stream extending from its confluence with Clear

Creek at Leonard Canyon, upstream to the Blue Ridge (recently renamed C.C. Gragin) Reservoir Dam, and approximately 13 miles of stream extending from the upper end of Blue Ridge Reservoir upstream to Potato Lake.

Several other federally listed aquatic species occur within waters that receive discharge from the C aquifer. Humpback chub (*Gila cypha*) and razorback sucker occur in the lower Little Colorado River below Blue Springs. Razorback sucker, Gila chub, and Page springsnail (*Pyrgulopsis morrisoni*) occur in streams or springs within the watersheds of the Salt, Gila, and Verde Rivers.

Willow flycatcher could occur in riparian habitat along lower Clear Creek, lower Chevelon Creek, and the Little Colorado River during migration, but the subspecies of migrating birds is not known, and breeding southwestern willow flycatchers were not documented in recent surveys at the Chevelon Creek Wildlife Area (personal communication, S. Blackman, AGFD, 2006). Bald eagle also may occur in riparian habitat during migration and winter.

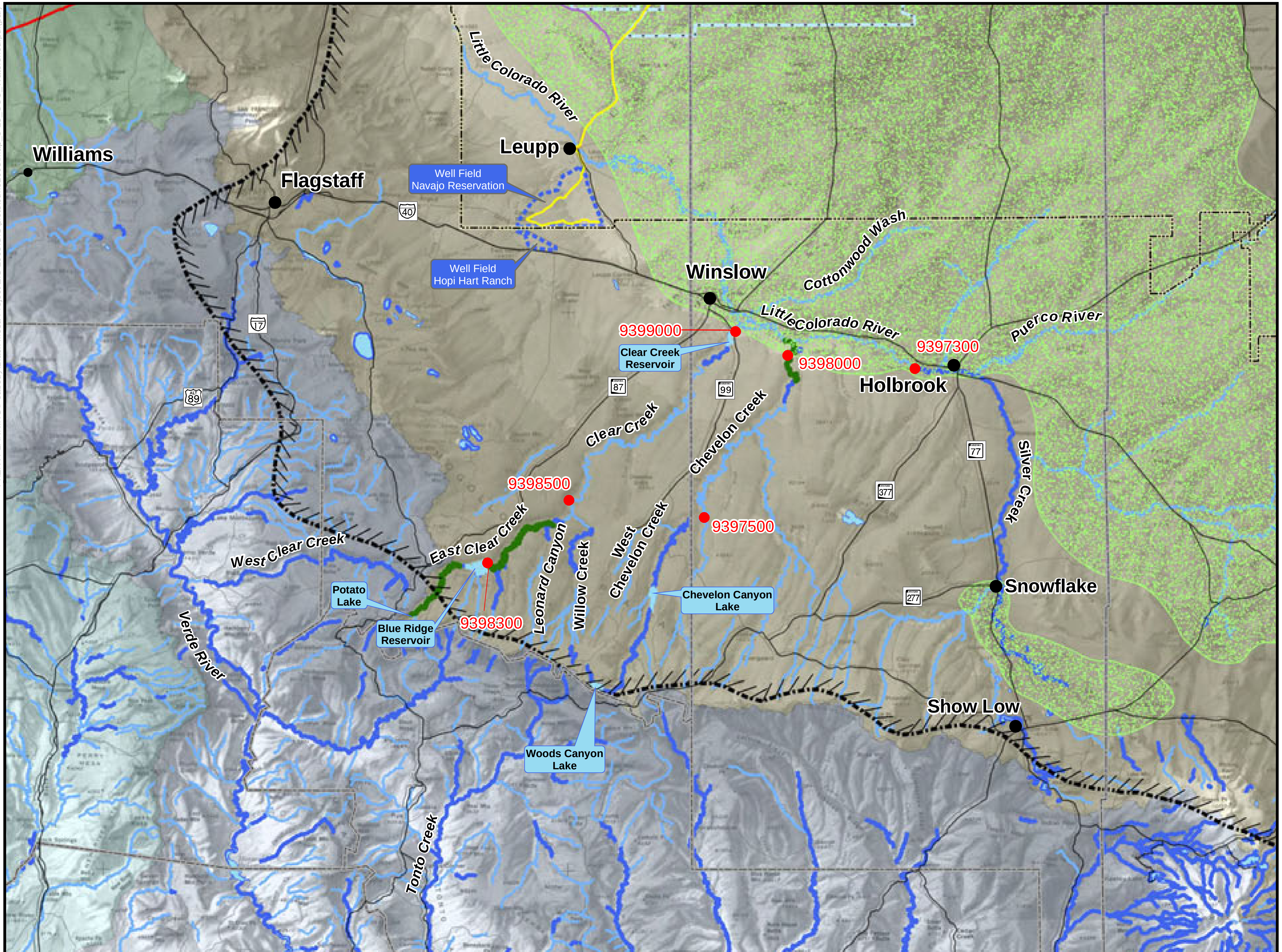
Several special status aquatic species occur within the general region surrounding the project area. They include the following:

- Bluehead sucker occurs in Clear Creek, Chevelon Creek, and the Little Colorado River (Young et al. 2001), but was very uncommon in Chevelon Creek during sampling in 1995 and 1996 (Lopez et al. 1998). Bluehead sucker occupy a variety of habitats from headwater streams to large rivers, and from cold, clear streams to warm, very turbid rivers (AGFD 2003a).
- Roundtail chub had been petitioned for Federal listing as threatened or endangered, but the FWS determined on May 3, 2005, that listing of that distinct population segment in the lower Colorado River Basin was not warranted. It is known to occur in Clear Creek and in Chevelon Creek (Voeltz 2002). Populations of roundtail chub in Chevelon Creek are considered to be “unstable-threatened” because they are uncommon and have an extremely limited range within the creek (Voeltz 2002). In addition, at least 18 nonnative fish species have been recorded. All areas below Chevelon Lake are considered unsuitable for sustainable populations because of lack of perennial flow and pool habitat and the presence of predatory nonnative fish. Populations in East Clear Creek are considered to be “stable-threatened” (Voeltz 2002). Roundtail chub were found to be common during sampling in 1999 and 2000, but were mostly found in intermittent reaches of the creek. Most individuals were found above Clear Creek Reservoir. One individual was found in lower Clear Creek during sampling in the fall of 2004 (Clarkson and Marsh 2005a), and a large population was found in a permanent pool just above the perennial portion of lower Clear Creek (Clarkson and Marsh 2005b). Roundtail chub occur in cool to warm waters of midelevation rivers and streams, and often occupy the deepest pools and eddies of large streams.
- Little Colorado River sucker is known to occur in Clear Creek, Chevelon Creek including lower reaches, and Little Colorado River (AGFD 2001b; Young et al. 2001). This species is found in creeks and small- to medium-sized rivers, mostly in pools with abundant cover.
- The northern leopard frog may occur along Clear Creek, Chevelon Creek, and the Little Colorado River, all of which are within its historic habitat.

The Chiricahua leopard frog historically was found in Clear Creek, Chevelon Creek, and the Little Colorado River, although it appears to be extirpated from this portion of its historic range (FWS 2002).

Map 3-15
Clear and Chevelon Creek Watershed Features

Black Mesa Project EIS



LEGEND

Watersheds
- Lower Colorado River - Lake Mead
- Little Colorado River
- Lower Gila River
- Verde River

Watershed Features
- Little Colorado Spinedace Critical Habitat
- Stream Gage Station
- Perennial Streams
- Ephemeral Streams
- C-Aquifer Boundary
- Confined Area of C-Aquifer

Project Features

Alternative A Coal-Slurry Pipeline
- Existing Route

Alternative A Water-Supply System
- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

General Features
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- County Boundary
- Interstate/U.S. Highway/State Route

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
U.S. FWS Critical Habitat Portal 2005
Arizona Department of Water Resources 2004
- Modified by URS 2005

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November 2008

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Miles

Prepared By:
URS

3.8.3.1.2 Infrastructure

3.8.3.1.2.1 Well Field

Two vegetation types are present in the well field—Great Basin desertscrub on the northeast half and Plains and Great Basin grassland on the southwest half. The well field does not contain any major drainages. Wildlife species associated with these habitats are listed in Table F-11 in Appendix F.

Golden eagles are known to nest within or near the well field. Other potential nesting raptors include red-tailed hawk, Swainson's hawk, American kestrel, prairie falcon, and great horned owl. Other common raptors likely to occur during wintering or foraging include turkey vulture, northern harrier, red-tailed hawk, ferruginous hawk, and rough-legged hawk.

No aquatic habitat is present in the well field area. The nearest drainage is Canyon Diablo, which is intermittent, and there is no information on fish populations (Young et al. 2001).

The potential for occurrence of other special status species is presented in Table F-13 in Appendix F. The golden eagle, a Navajo-listed species, is known to nest within 1 mile of the proposed well field. The western burrowing owl, pale Townsend's big-eared bat (*Corynorhinus townsendii pllescens*), pronghorn antelope, kit fox (*Vulpes velox*), and milk snake may occur. Some other species have potential to occur occasionally, including the ferruginous hawk.

3.8.3.1.2.2 C Aquifer Water-Supply Pipeline

3.8.3.1.2.2.1 <u>C Aquifer Water-Supply Pipeline: Eastern Route</u>

Habitats present along the Eastern Route include Plains and Great Basin grassland, Great Basin desertscrub, and Great Basin conifer woodland at the higher elevations. Typical wildlife associated with these habitats is listed in Table F-11 in Appendix F. Big-game species occurring along the Eastern Route include mule deer, but no information on herd numbers is available.

Raptors include golden eagle, ferruginous hawk, and western burrowing owl, which are discussed as special status species in Table F-13 in Appendix F. Other potential nesting species include red-tailed hawk, American kestrel, prairie falcon, great horned owl, western screech owl, and Cooper's hawk. Other common raptors likely to occur during wintering or foraging include turkey vulture, northern harrier, red-tailed hawk, ferruginous hawk, and rough-legged hawk.

No fisheries or perennial stream habitats would be crossed by the Eastern Route. The Little Colorado River is intermittent in the study area.

Threatened, endangered, and other special status animal species potentially present in the study area are presented in Tables F-12 and F-13 in Appendix F. Migrating bald eagle and willow flycatcher (unknown subspecies) may occur occasionally along Oraibi and Dinnebito washes. The bald eagle also may migrate along the Little Colorado River. The most important raptor species is the golden eagle, due both to its cultural significance to the Hopi people and in terms of known occurrence. Western burrowing owl also is likely to occur. There are historic records of black-footed ferret within 3 miles of the route. Other species that may occur include ferruginous hawk, mountain plover (*Charadrius montanus*), peregrine falcon, pale Townsend's big-eared bat, pronghorn antelope, kit fox, and milk snake.

3.8.3.1.2.2.2 C Aquifer Water-Supply Pipeline: Western Route

From its beginning on the south end to about WSP Milepost 27, the Western Route would follow the same alignment as the Eastern Route and would cross Plains and Great Basin grassland and Great Basin desertscrub. It would follow a different path for the remainder of the route, but it would cross the same vegetation types as the Eastern Route; therefore, wildlife would be similar to those described for the Eastern Route. The species of raptors likely to occur along the Western Route are the same as those likely to occur along the Eastern Route.

The potential for occurrence of threatened or endangered species would be the same as for the Eastern Route, except that Mexican spotted owl is known to occur within 3 miles of the northern portion of the proposed route. Migrating willow flycatchers (unknown subspecies) may occur occasionally in riparian habitat along streams that would be crossed by the Western Route, including Dinnebito Wash, Moenkopi Wash, and Begashibito Wash. Two special-status raptor species also occur along the Western Route, including golden eagle nests located within 1 mile of the route in both the southern and northern sections, and northern goshawk nests within 1 mile in the northern part of the route.

3.8.3.2 N Aquifer Water-Supply System

Several major washes have riparian vegetation and seasonal stream flow resulting from discharge of groundwater from the N aquifer, including Moenkopi Wash, Pasture Canyon, Dinnebito Wash, Oraibi Wash, Polacca Wash, Jeddito Wash, Begashibito Wash, Chinle Wash, and Laguna Creek (Map 3-16). All of these streams are intermittent and are not habitat for threatened, endangered, or special status fish species. The riparian habitats in these washes provide habitat for migrating songbirds. Southwestern willow flycatcher, a federally listed endangered species, occurs during migration but is not known to breed in the area. Bald eagles could occur occasionally. Northern leopard frogs are potentially present.

3.9 LAND USE

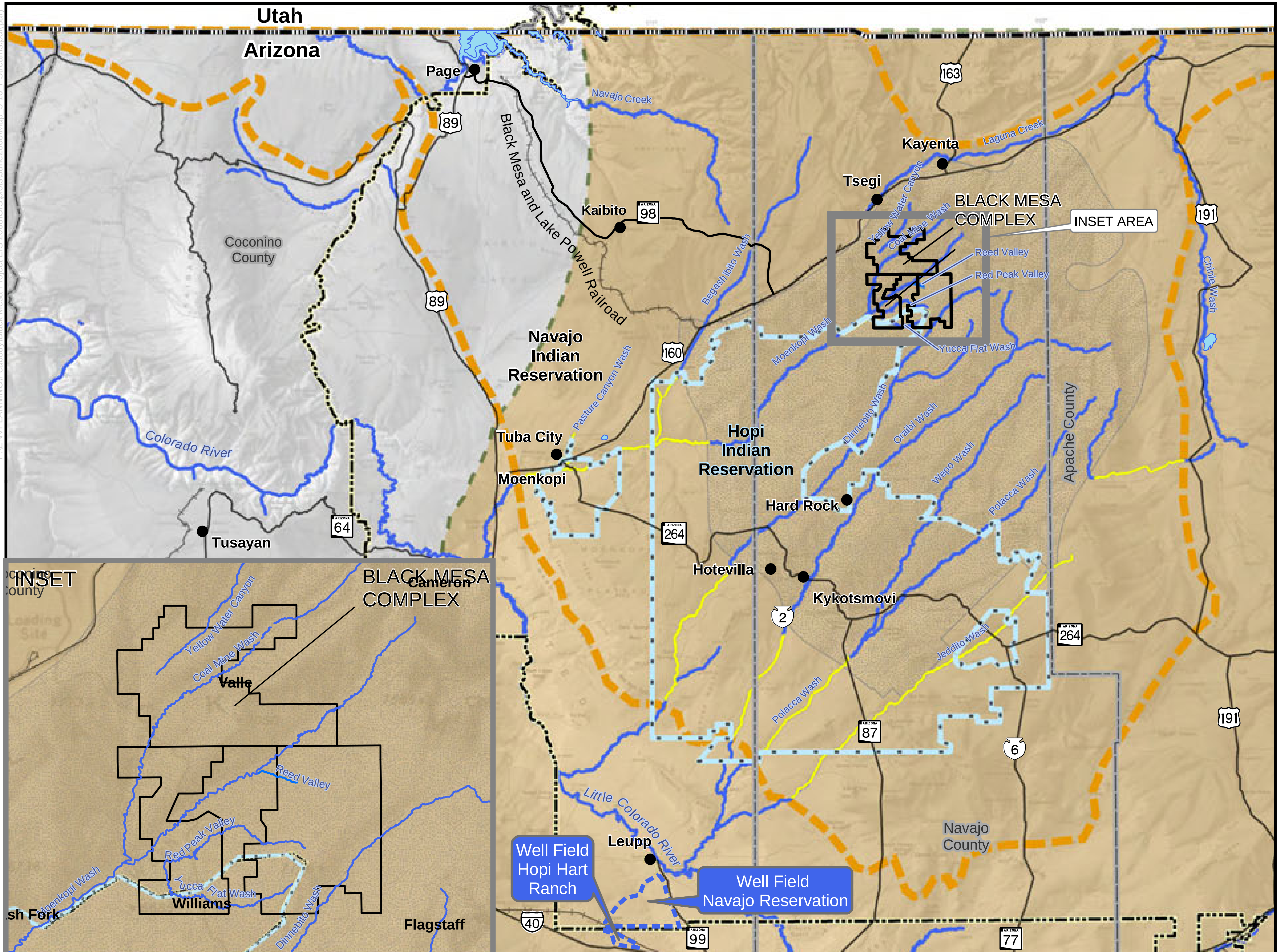
The study area examined for land use spans northern Arizona between Kayenta, Arizona, and Laughlin, Nevada, and includes five counties—Navajo, Coconino, Yavapai, and Mohave Counties in Arizona, and Clark County in Nevada (Map 3-17). Land use patterns have been influenced by a variety of factors, most notably by surface management and major transportation corridors. Land includes Federal land administered by the Forest Service (Kaibab National Forest) and BLM (Kingman Field Office, Lake Havasu Field Office, and Phoenix Field Office), State Trust land administered by the Arizona State Land Department (ASLD), privately owned land, and American Indian reservations held in trust by the Federal Government for the Hopi Tribe and Navajo Nation. Both tribes own land outside the boundaries of their respective reservations—for example, the Hopi Tribe owns Hart Ranch near Winslow, Arizona, and the Navajo Nation owns Big Boquillas Ranch near Seligman, Arizona.

Most Federal land, State Trust land, and tribal land in the study area, as well as much of the private land, is used for ranching and livestock grazing. The BIA and tribal grazing committees, ASLD, Forest Service, and BLM all manage grazing within the study area. The BIA issues grazing permits for large portions of land on the Hopi and Navajo Reservations. Descriptions of the range units and their respective carrying capacities are provided in Tables G-1 through G-5 in Appendix G.

Map 3-16

Riparian Areas Potentially Associated with N-Aquifer Discharge

Black Mesa Project EIS



LEGEND

- Potential Riparian Areas
- Stream

Aquifers

- C-Aquifer (Saturated)
- N-Aquifer
- Confined Area of N-Aquifer

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Water-Supply System

- C-Aquifer Well Field

General Features

- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005.
USGS 2005
USGS Water Resources 2006
Bureau of Reclamation 2005

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November 2008

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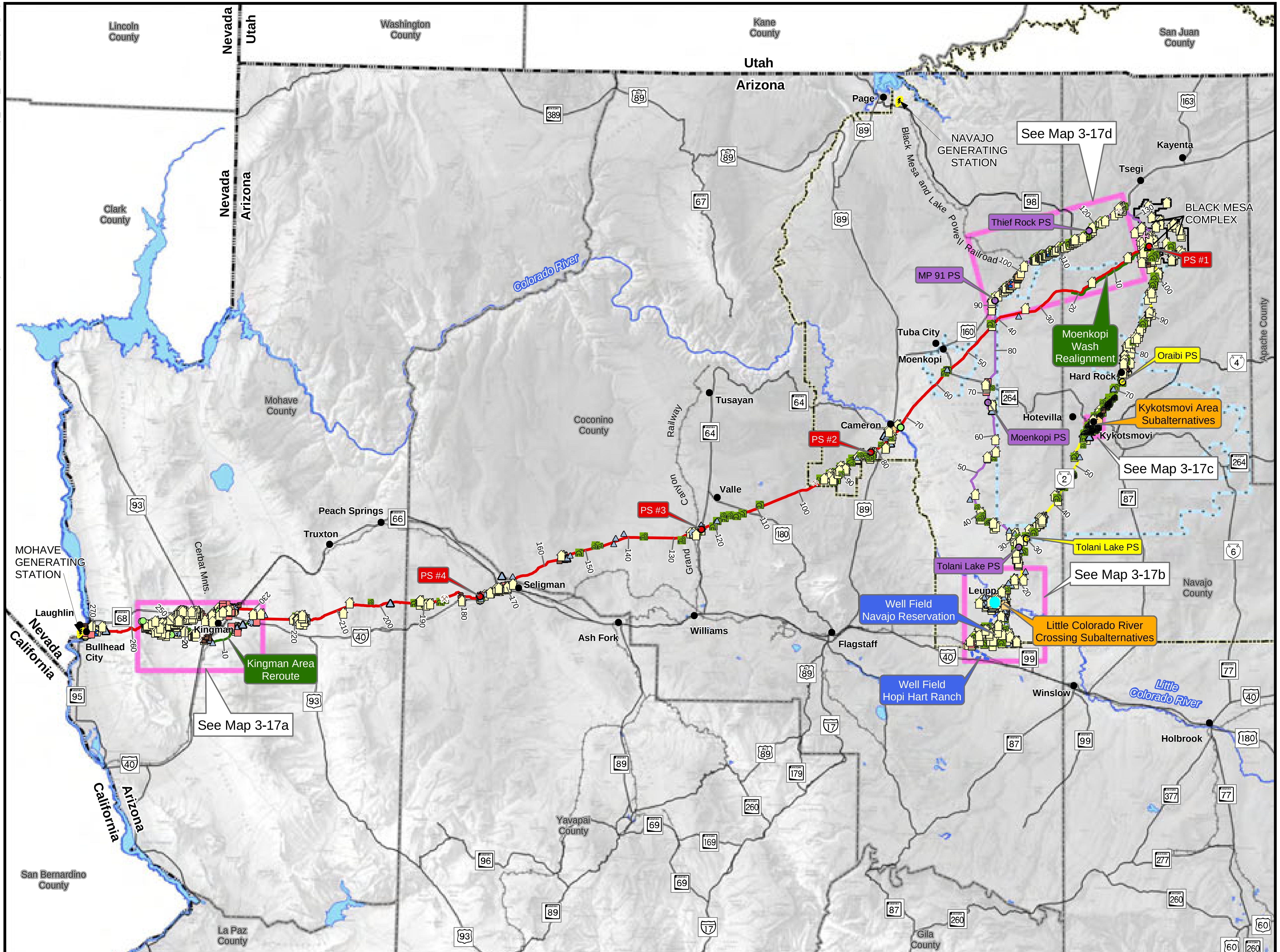
Prepared By:
URS



Map 3-17
Existing Land Use

Black Mesa Project EIS

LEGEND

Existing Land Use*

- Residential
- Commercial/Mixed Use
- Industrial
- Extraction - Mining
- Public/Quasi-Public
- School/Educational
- Air Facilities
- Agricultural (Includes livestock corral, and water tanks)
- Parks/Recreation/Preservation
- Pipeline
- Pipeline Pump Station (Natural gas or coal-slurry)
- Utilities (Includes power substations and water tanks)

*Note: Land uses are shown for areas within 2 miles of an alignment.

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005

N

November 2008

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Miles

Prepared By:
URS

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With grazing the predominant land use, most of the land within and near the entire study area is unoccupied, or is occupied by either dispersed residents or by those living remotely in small- to medium-sized communities. The majority of the Hopi population lives within mixed-use community areas that include residential, commercial, industrial, and public facilities—such as in Kykotsmovi, Moenkopi, and Hotevilla. Public facilities such as schools and health care centers are not well integrated into the communities, but are located on the peripheries (Hopi Office of Community Planning & Economic Development 2001). The Navajo people have traditionally lived in dispersed, remote locations surrounded by ample land, but today many Navajo people live in large, mixed-use communities such as Leupp, Hard Rock, Kayenta, Cameron, and Tuba City. The notable exceptions to the pattern of dispersed residential use on the Hopi and Navajo Reservations occur mostly off the reservations in western Arizona, and in areas along major transportation routes. In these areas, residential uses appear to be more clustered and associated with the communities of Kingman and nearby Sacramento/Golden Valley, Bullhead City, and South Mohave Valley, Arizona; and Laughlin, Nevada.

Commercial land uses, such as gas stations and small convenience stores, are dispersed throughout the study area along major transportation corridors (U.S. Highway 160, U.S. Highway 89, U.S. Highway 180, Arizona Highway 66, and I-40) and in association with residential uses. Commercial uses are greater in the western portion of the study area and are largely associated with the communities of Kingman and nearby Sacramento/Golden Valley, Bullhead City, South Mohave Valley, and Laughlin.

The most prominent industrial land uses in the study area are the mining operations at the Black Mesa Complex, the coal-slurry pipeline (which currently is not in operation), and the Mohave Generating Station (which currently is not in operation). In addition, there are airports and other industrial uses in Kingman and Bullhead City.

Most of the agriculture in the study area is associated with residences (i.e., small family gardens) and with small fields on the Hopi Reservation. Most Hopi farmers use a cultivation method known as “dry farming,” typically growing corn, beans, squash, and melons. There are several small fields in different locations, such as at the base of mesas, on sand slopes, in small canyons, along alluvial plains in washes, or in the valleys between mesas.

3.9.1 Black Mesa Complex

The Black Mesa Complex is located on approximately 101 square miles of land leased from the Hopi Tribe and Navajo Nation (Peabody 1986). The lease area covers 64,858 acres on the northern part of the Black Mesa just south of Kayenta, with additional grants-of-easement for approximately 361 acres (Peabody 1986). Approximately 1,860 acres in the northeast corner of the lease area are neither in the permanent program permit area nor the proposed permit area.

The Hopi and Navajo Reservation land within the complex includes approximately 40,000 acres of the former Navajo Hopi Joint Use Area, where the tribes have joint and equal interests in the underlying minerals but where the surface land has been partitioned—approximately 6,130 acres to the Hopi Tribe and 33,860 acres to the Navajo Nation. The remaining acreage within the lease area (approximately 24,850 acres) is on the Navajo Reservation, where the Navajo Nation holds exclusive rights to surface and mineral interests. Table 3-18 shows the number of acres of Hopi and Navajo Reservation land in the Black Mesa Complex divided by chapter, within the permanent program permit area and the currently initial program area.

Table 3-18 Acres of Hopi and Navajo Reservation Land in the Black Mesa Complex

Navajo Chapter/Hopi Reservation	Permanent Program Permit Area (acres)	Initial Program Area (acres)
Chilchinbito Chapter	25,700	9,500
Forest Lake Chapter	15,400	5,750
Shonto Chapter	—	800
Hopi Reservation	3,000	2,850
Total[1]	44,100	18,900

NOTE: [1] Reported acres are approximate.

The permanent program permit area of the Black Mesa Complex comprises approximately 3,000 acres of the Hopi Reservation and 41,100 acres of the Navajo Reservation. The lease area contains 68 residences (SWCA Environmental Consultants 2005). A map of residence locations (SWCA Environmental Consultants 2005) indicates that about 50 residences are located within the permanent program permit area. Coal facilities at the mine include three coal preparation areas. Peabody obtained a grant-of-easement in August 1996 for two parcels on the permanently permitted area, totaling about 78 acres for an overland conveyor, overland conveyor maintenance roads and transfer facilities, 69kV transmission line, and seven sedimentation ponds, including access roads (OSM 1990).

The initial program area of the Black Mesa Complex is located on approximately 2,850 acres of the Hopi Reservation and 16,050 acres on the Navajo Reservation. According to the map of residence locations (SWCA Environmental Consultants 2005), approximately 18 residences are located within the initial program area. Peabody obtained a grant-of-easement in August 1996 for two parcels (about 284 acres) on the initial program area, where a haul road (Indian Route 41), a 69kV transmission line, water and telephone lines, utility access roads, two sedimentation ponds, a rock-borrow area, and an access road to the Navajo water well are located.

The site for the proposed coal-washing facility is located adjacent to industrial structures associated with the coal-slurry preparation plant. The closest residence is approximately 1,500 feet to the north of the site, just outside the complex (Peabody 1986). Within the complex, the closest residence is approximately 4,500 feet south of the site (Peabody 1986). Grazing and perhaps plant collection for construction, heating, medicine, ceremonial items, and food occur in the vicinity.

The coal-slurry preparation plant occupies 40 acres of land leased by BMPI from both the Hopi Tribe and Navajo Nation.

The proposed coal-haul road would pass through land used year-round for livestock grazing. The sole exception to this land use is one residence, located approximately 250 feet north of the proposed road alignment.

The Black Mesa Complex is surrounded by land used for the same purposes—primarily grazing, with intermittent residences (OSM 1990).

There are two rights-of-way held by Peabody outside the Black Mesa Complex that are associated with the mining operation. The first is designated for an overland conveyor and rail-loading site, located north of the mining complex. The site occupies a total area of approximately 88 acres. The second accommodates a 69kV power line, located generally between two coal-resource areas, extending southeast and off the Black Mesa Complex, and then to the west. The approximate area is 9 acres (OSM 1990).

Residences on the Black Mesa Complex consist of individual family dwellings or extended family camps with several dwellings—there are no concentrated population centers (Peabody 1986). Land within the Black Mesa Complex is currently home to approximately 68 individual households (SWCA Environmental Consultants 2005). Households are relocated at Peabody's expense as areas become affected by surface-mining activities (Peabody 1986). Thirty residences have been relocated since mining within the Black Mesa Complex began (Wendt 2005). In a few cases, families have been relocated more than once.

Grazing within the complex continues year-round. There are four range units (Hopi and Navajo) on or adjacent to the Black Mesa Complex, with a combined total of 50,852 sheep units (refer to Tables G-1 and G-2 in Appendix G). All classes of livestock are grazed.

The presence of wildlife habitat and associated species on the Black Mesa Complex encourages recreational activities such as hunting.

There is little commercial development on or within 5 miles of the Black Mesa Complex. A gas station with a convenience store is located north of the complex at the intersection of U.S. Highway 160 and Indian Route 41. The closest commercial area with food and lodging is at Tsegi on U.S. Highway 160 north of the Black Mesa Complex. The next closest commercial area is Kayenta, approximately 15 miles northeast of the complex.

Peabody's mining operations, including transportation and support facilities, are the sole industrial uses currently in operation within the Black Mesa Complex (Peabody 1986).

Family gardens associated with residences occur frequently within the Black Mesa Complex, and there are 31 small fields within the complex that are or have been used for the production of adapted crops, particularly corn for domestic use (Peabody 1986). The total area of all plots equals 138 acres, with individual plots averaging approximately 5 acres (Peabody 1986). The land on the Black Mesa Complex has received a negative determination as prime farmland from the NRCS (Peabody 1986).

The Hopi and Navajo people use the plants in the area of the Black Mesa Complex for construction, heating, medicine, ceremonial items, and food (OSM 1990). Unknown quantities of the piñon pine, Utah juniper, and one-seed juniper trees that dominate the Black Mesa Complex are harvested for firewood, fence posts, and construction materials.

3.9.2 Coal-Slurry Pipeline

3.9.2.1 Coal-Slurry Pipeline: Existing Route

The existing pipeline route crosses land under Federal, State, and tribal jurisdictions. It crosses the Navajo Nation's Big Boquillas Ranch between CSP Mileposts 158 and 170. The ranch, which is owned in fee by the Navajo Nation, is located near Seligman in Chino Valley beyond the Navajo Reservation boundary. Land along most of the route is used for livestock grazing.

The pipeline passes within 1 mile of dispersed residences (including hogans) along some portions of the route, and crosses some moderately dense residential areas outside urban areas and along major transportation routes (i.e., outlying areas of Seligman, Kingman, Golden Valley, Bullhead City, and Laughlin) (refer to Maps 3-17a and 3-17b). Residential developments within 250 feet (or a 500-foot corridor) of the existing route are dispersed along the route.

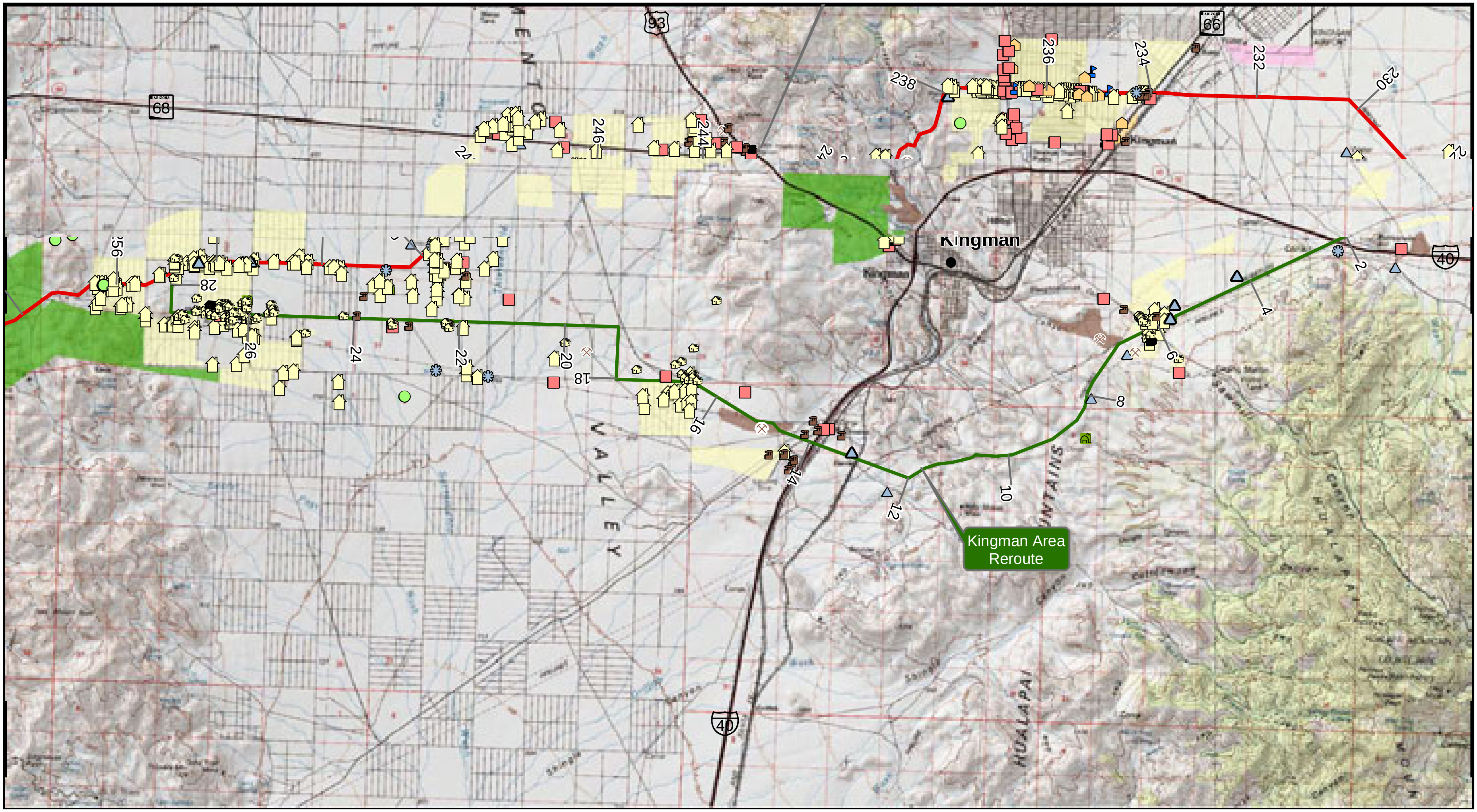
Permitted livestock grazing is prevalent along the existing pipeline route, except in more developed areas, and corrals and water tanks associated with grazing are dispersed throughout the study corridor. Tribal land crossed by the existing route is used primarily for livestock grazing. The existing pipeline route crosses grazing allotments on the Kaibab National Forest, used by two permit holders that collectively use approximately 46,550 acres (with approximately 2,500 animal unit months [AUMs]). All State Trust Land in the study area—in Coconino, Yavapai, and Mohave Counties—is used for grazing (with the exception of a small area near Bullhead City). The existing route crosses 20 grazing allotments on State Trust land (with a total of 105,373 AUMs), and approximately 6 allotments on BLM-administered land (4,713 AUMs) (refer to Tables G-1 through G-5 in Appendix G). A large area of BLM land, just east and south of Bullhead City, is closed to grazing due to special designations, and most of the land west of Kingman is closed to domestic sheep and goat grazing.

The more densely populated areas along the route—Seligman, Kingman, Golden Valley, and Bullhead City—have the typical development associated with urbanization, including commercial and public buildings (e.g., office buildings, post offices). The pipeline passes within 500 feet of a hotel isolated from the denser urban area near CSP Milepost 81 along U.S. Highway 89, and within 500 feet of schools in denser urban areas such as Kingman. Industrial land uses occur within the Black Mesa Complex where the existing route begins at the coal-slurry preparation plant (currently dormant) and at the pump stations along the coal-slurry pipeline. General industrial areas are located within the more developed areas such as Kingman and Bullhead City.

No agricultural fields were identified within 250 feet of the existing route, with the exception of family gardens associated with residences on the Navajo Reservation. American Farmland Trust identified high-quality farmland on private and State Trust land within a low-density development area near Seligman in Yavapai County, Arizona, crossed by the pipeline for approximately 10 miles (between CSP Mileposts 170 and 180). However, consultation with NRCS resulted in a negative determination of prime and unique farmland occurring at any of the project components, including that segment of the pipeline.

Multiple high-voltage power lines ranging from 69kV to 500kV cross and parallel the existing pipeline route between CSP Mileposts 75 and 80, CSP Mileposts 174 and 179 and the pipeline's approach to the Mohave Generating Station (near CSP Mileposts 202, 217, and 227, and sporadically between CSP Mileposts 240 and 271). A 230kV power line crosses the existing route near CSP Milepost 257 within BLM's Black Mountain Area of Critical Environmental Concern (ACEC). The pipeline crosses through the Kaibab National Forest within a utility corridor designated by the Forest Service between CSP Mileposts 113 and 117 (Forest Service 1996). It follows a utility corridor designated by the BLM within the Black Mountain and abuts the Mount Nutt Wilderness Area (BLM 1993). The pipeline crosses the Blue Canyon Special Management Area (between CSP Mileposts 30 and 32), an area dedicated by the Hopi Tribe to serve outdoor recreation and conservation purposes. However, the area remains undeveloped for outdoor recreation uses at this time.

Most of the land within the Hopi Reservation is planned for agriculture and range use, with the exception of the major washes that cross the reservation, which are identified as conservation areas with recreational opportunities (Hopi Office of Community Planning & Economic Development 2001). The planned land use places development constraints on these areas. On the Navajo Reservation, the draft Forest Lake Chapter Land Use Plan did not identify future uses for the area crossed by the pipeline (Navajo Nation Division of Community Development 2003). The area crossed by the pipeline within the Shonto Chapter (0.9 mile) has been identified for open space used for grazing. The Chilchinbito, Tuba City, Coal Mine Mesa, and Cameron Chapters have not developed land use plans as of July 2005.



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LEGEND

Existing Land Use*

- Residential
- Commercial/Mixed Use
- Public/Quasi-Public
- School/Educational
- Agricultural (Includes livestock corral and water tanks)
- Parks/Recreation/Preservation
- Industrial
- Extraction - Mining
- Pipeline Pump Station (Natural gas or coal-slurry)
- Utilities (Includes power substations and water tanks)
- Residential
- Air Facility
- Parks/Recreation/Preservation
- Industrial

*Note: Land uses are shown for areas within 2 miles of an alignment.

Project Features

Alternative A Coal-Slurry Pipeline

- Existing Route
- Reroute

General Features

- Interstate/U.S. Highway/ State Route
- Railroad

Existing Land Use: Kingman Area (Alternative A)

Black Mesa Project EIS

November 2008

Map 3-17a

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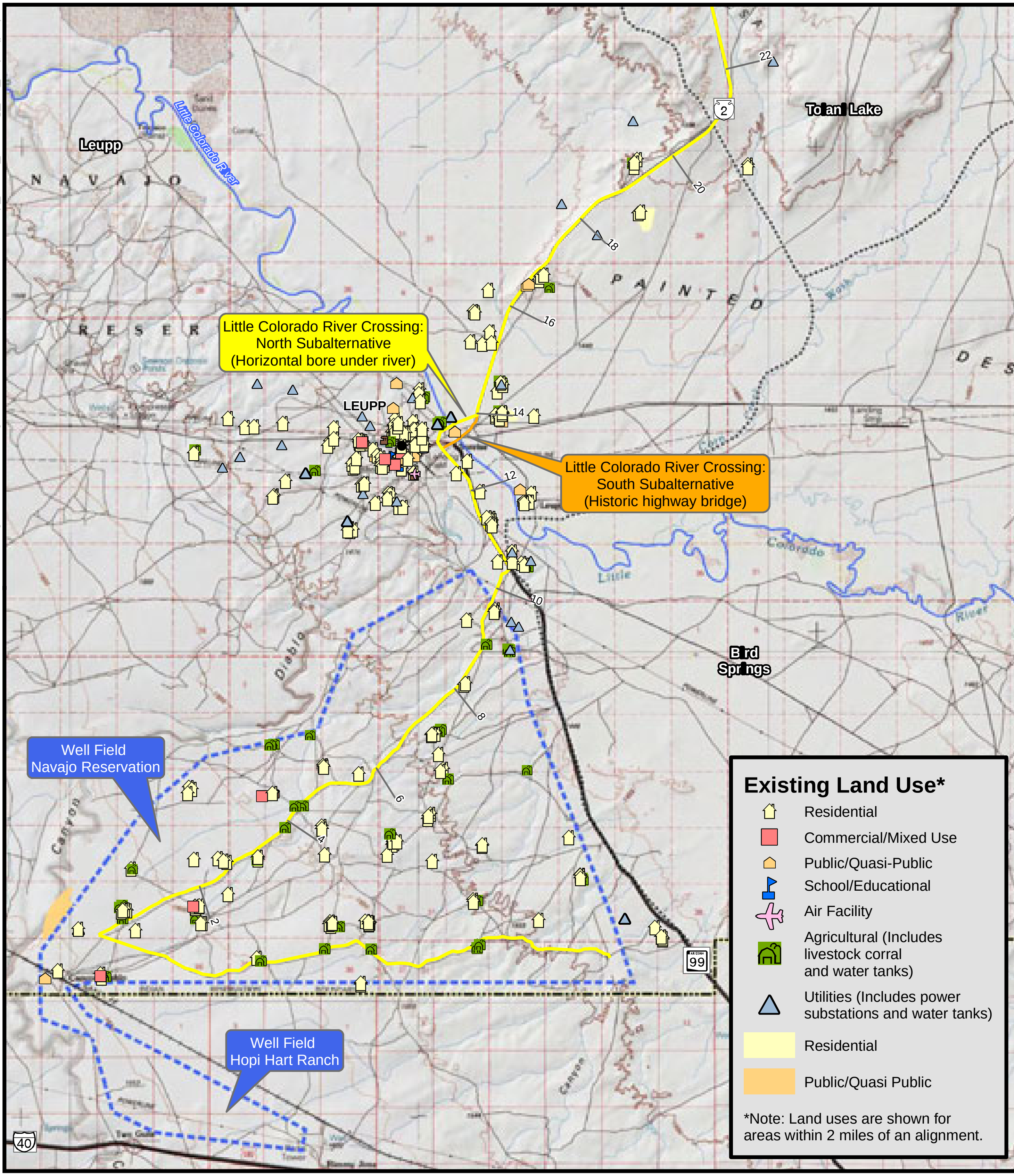

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LEGEND

Project Features

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route

General Features

- River
- Navajo Reservation Boundary
- Leupp — Navajo Reservation Chapter Boundary and Name
- Interstate/U.S. Highway/State Route
- Railroad

Existing Land Use: Well Field and Leupp Area

Black Mesa Project EIS

November 2008

Map 3-17b

In Coconino County, the existing pipeline passes through land zoned for residential development with associated agricultural uses (CSP Mileposts 96 to 170). In Yavapai County, it passes through unincorporated land zoned for rural residential development (CSP Mileposts 170 and 194) (Yavapai County 2003). It passes through unincorporated land in Mohave County (intermittently between CSP Mileposts 194 and 272) that has been identified for rural, industrial, and commercial development (Mohave County 2005). The land uses identified by the Mohave County General Plan are land use categories that are more general than zoning districts.

According to the Kingman General Plan, industrial development is planned near the airport industrial park (north of the existing route), and residential development is planned south of the existing route near CSP Mileposts 231 to 234. The plan designates land for development of new commercial and medical facilities, parks, and residential areas, including higher-end infill housing and multiple-family developments, to be interspersed within areas of older, affordable housing. The largest concentration of residential growth is expected on the east side of Kingman.

The Cerbat Foothills Recreation Area has been identified for open-space preservation and includes land owned by the City of Kingman and land managed by BLM. The existing route crosses this open space land between CSP Mileposts 240 and 244 (City of Kingman 2005).

According to the Bullhead City General Plan, future residential uses are planned (CSP Mileposts 268 to 269), as are future industrial/commercial uses (CSP Mileposts 269 to 273). The proposed Colorado River Heritage Trail passes through the pipeline right-of-way within Bullhead City (near CSP Milepost 275) (Bullhead City 2002). Land within the existing pipeline route is planned for future public/industrial/commercial development (CSP Mileposts 270 to 272).

BLM has identified non-Federal land along the existing route for acquisition, near I-40 between Kingman and Bullhead City (between CSP Mileposts 239 and 243) (BLM 1993). This land is located within and near the Cerbat Mountains in Sections 11, 10, 16, and 17 of Township 21 North, Range 17 West.

ASLD has developed conceptual land use plans that have been incorporated into the City of Kingman and the Bullhead City general plans. Two planning classifications have been identified by ASLD for particular parcels of State Trust land—conceptual plans and development plans. Within the Kingman area, the existing pipeline parallels, within 500 feet, land of both classifications (between CSP Mileposts 232 and 238). Near Bullhead City the pipeline parallels conceptually planned residential parcels and public/quasipublic parcels (near CSP Mileposts 267, 269, and 270).

3.9.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

The pipeline realignments in Moenkopi Wash could cross Federal land, State Trust land, and tribal land, where land is used primarily for livestock grazing. The Navajo Nation Shonto Chapter Comprehensive Land Use Plan identifies Shonto Chapter land along the route of the realignments as open space for future grazing.

The Kingman reroute would pass within 500 feet of developed areas in the following locations: residential (near reroute Mileposts 6 and 17 and between reroute Mileposts 22 and 28); commercial (reroute Milepost 17, near reroute Milepost 23, and between reroute Mileposts 26 and 27); and industrial (reroute Mileposts 6, 7, 23, and 24, between reroute Mileposts 13 and 16).

Between reroute Mileposts 0 and 11, it would pass areas zoned for parks and open space and residential development. Between reroute Mileposts 11 and 16, Mohave County has identified land for industrial and commercial development. Between reroute Mileposts 16 and 17, land is zoned for various levels of rural/urban and suburban development (City of Kingman 2003).

Golden Valley Ranch, a large development approved in December 2005, will be located south of the reroute (from reroute Milepost 17 to 21, in Sections 2, 3, 4, 8, 9, 10, 11, 16, and part of 14 of Township 20 North, Range 18 West) and will include residential, commercial, and educational facilities, and parks and recreation areas. Parks and commercial and residential developments are planned adjacent to the reroute (with one park located north of Shinarump Road near Township 21 North, Range 18 West). As of March 2006, land located southwest of reroute Milepost 18 is being cleared for this development.

BLM has identified several areas along the Kingman reroute for land tenure adjustments: land for acquisition near reroute Mileposts 11 and 12 (in Sections 2 and 3 of Township 20 North, Range 17 West); land for disposal near reroute Milepost 2 and between reroute Mileposts 13 and 16 (in Section 13 of Township 21 North, Range 16 West, and in Sections 6, 8, and 9 of Township 20 North, Range 17 West); and land for recreation and public purposes near reroute Milepost 15 (in Section 6 of Township 20 North, Range 17 West).

3.9.3 C Aquifer Water-Supply System

3.9.3.1 Well Field

Most of the well field area is within the Navajo Reservation, except for approximately 2,750 acres that extend south of the BNSF rail line into the Hart Ranch, which is owned in fee by the Hopi Tribe (Map 3-17b). (Portions of the ranch are managed by ASLD.) Of the 2,750 acres, approximately 1,500 acres of the Hopi Hart Ranch are owned by the Hopi Tribe, and 1,250 acres are managed by the State. Hart Ranch and State Trust land within the well field are under the jurisdiction of Coconino County ordinances and are zoned for rural residential development (Coconino County 2003).

Dispersed housing, corrals, windmill wells, and water tanks associated with livestock grazing are located within the well field area. This is consistent with the Leupp Chapter Land Use Plan. The Canyon Diablo Railroad ghost town is located within the well field just north of the BNSF rail line. This has been designated by the Leupp Chapter as a historical site that is open to visitors.

As part of the C aquifer water-supply study, carried out by Reclamation and USGS, wells were drilled within the well field area in 2005. These wells, which are located within the immediate vicinity of existing windmill wells, were used to estimate the effects of long-term pumping from the C aquifer for the proposed project. Currently these wells are not in use.

3.9.3.2 C Aquifer Water-Supply Pipeline

3.9.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route)

The Eastern Route would cross the Hopi and Navajo Reservations. Residences (including hogans) are dispersed throughout the pipeline study corridor, most along primary transportation routes. Dispersed residences outside of a populated community within approximately 250 feet of the alignment are located at WSP Mileposts 2, 8, 10, 15, 35, 59-62, 68, 69, 92, 97, and 100. The route would skirt residential areas by at least 500 feet as it passes through the community of Leupp (refer to Map 3-17b). It would continue through the populated Kykotsmovi area within a road right-of-way where residential, commercial, and quasipublic facilities exist within 250 to 500 feet of the route. On its way through the Hopi's planned community of Tawaovi, the route would avoid all existing residences by at least 500 feet.

Most of the land along the Eastern Route is permitted for livestock grazing, with water tanks and corrals dispersed throughout. Refer to Table G-2 in Appendix G for grazing districts crossed by the Eastern Route.

Leupp schools, churches, several small commercial sites (such as convenience stores), and public/quasi-public facilities (including a youth center) are located at least 500 feet from the Eastern Route, with the exception of a church and cemetery located just outside of Leupp within 250 feet of the alignment. The west Kykotsmovi subalternative (the Hopi's preferred alternative) would parallel Indian Route 2 (the pipeline buried in the road right-of-way) through the community of Kykotsmovi between WSP Mileposts 59 and 62. Residential, commercial, and quasipublic facilities (e.g., a hospital, two schools, and government offices) exist within 250 to 500 feet of the route. High-voltage power lines traverse the area, crossing the subalternative multiple times.

The study area contains multiple agricultural plots within 250 feet of the Eastern Route, including a large field, along both sides of Indian Routes 2 and 22 (with dry farms on the Hopi Reservation and small family gardens on the Navajo Reservation).

A 12/69kV power line parallels State Route 99 and Indian Route 2, with a slight departure approximately 1 mile to the west before rejoining the roadway for a final 2 miles. Another 12/69kV power line parallels and crosses the Eastern Route several times before it ends in the Black Mesa Complex. The route would cross two gas pipelines near the community of Leupp, and a 230kV high-voltage power line within Leupp. Near the community of Hard Rock, it would cross under a 500kV high-voltage power line.

The Hopi Strategic Land Use and Development Plan (2001) has identified a majority of Hopi land for continued agricultural and grazing use. The major washes, such as the Dinnebito Wash, are planned for conservation throughout the Hopi Reservation. These conservation areas have been identified within the land use plan as areas with development constraints. One area along the Eastern Route planned for future residential growth is in the Kykotsmovi community. A planned community development district is located between WSP Mileposts 74 and 79. The district is a planning area designed to integrate new community development with the existing development in accordance with the management practices for the Hopi Partitioned Land (as implemented by various offices in the U.S. Department of Natural Resources).

On the Navajo Reservation, the Leupp Chapter identified a wildlife area that traverses the Little Colorado River for future open space. The Eastern Route would cross the wildlife area near WSP Milepost 13. The Hard Rock Chapter did not identify any planned land uses within the studied corridor.

3.9.3.2.1.1 Little Colorado River Crossing Subalternatives

The area where the Eastern Route would cross the Little Colorado River is used for grazing. No residences, schools, or other public facilities exist within 500 feet of the alternative alignments. A major gas pipeline crosses the Little Colorado River near the locations where the pipeline would cross.

3.9.3.2.1.2 Kykotsmovi Area Subalternatives

The east Kykotsmovi subalternative would parallel Indian Route 503 and State Route 264 (the pipeline buried in the road's right-of-way) as the roads bypass Kykotsmovi on its eastern edge. While there are no adjacent residences, there are residences within 250 feet of the east Kykotsmovi subalternative between subalternative Mileposts 0 and 1 (Map 3-17c). Adjacent commercial land uses (such as art and cellular retail services) are located within 500 feet of subalternative Milepost 2 through 2.5. A public safety building where police and fire personnel are staffed is located less than 250 feet from the route near Milepost 1. Two schools near Milepost 2.5 are located approximately 650 feet from the alignment, to the north and south of State Route 264.

3.9.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

The Western Route passes entirely through the Navajo Reservation. Residences (including hogans) are dispersed along the Western Route, with the majority next to transportation corridors. Residential development occurs within 250 feet of the route in 13 locations (WSP Mileposts 2, 8, 10, 15, 40, 56, 59, 94-96, 99, 104-108, 110, 114, and 126). The route skirts residential areas and associated development by at least 500 feet as it passes through Leupp. As it travels along U.S. Highway 160, it would pass areas of dense residential development (Map 3-17d). Approximately five moderately dense residential areas occur between WSP Mileposts 94 and 100, and approximately seven moderately dense residential areas occur between WSP Mileposts 104 and 119.

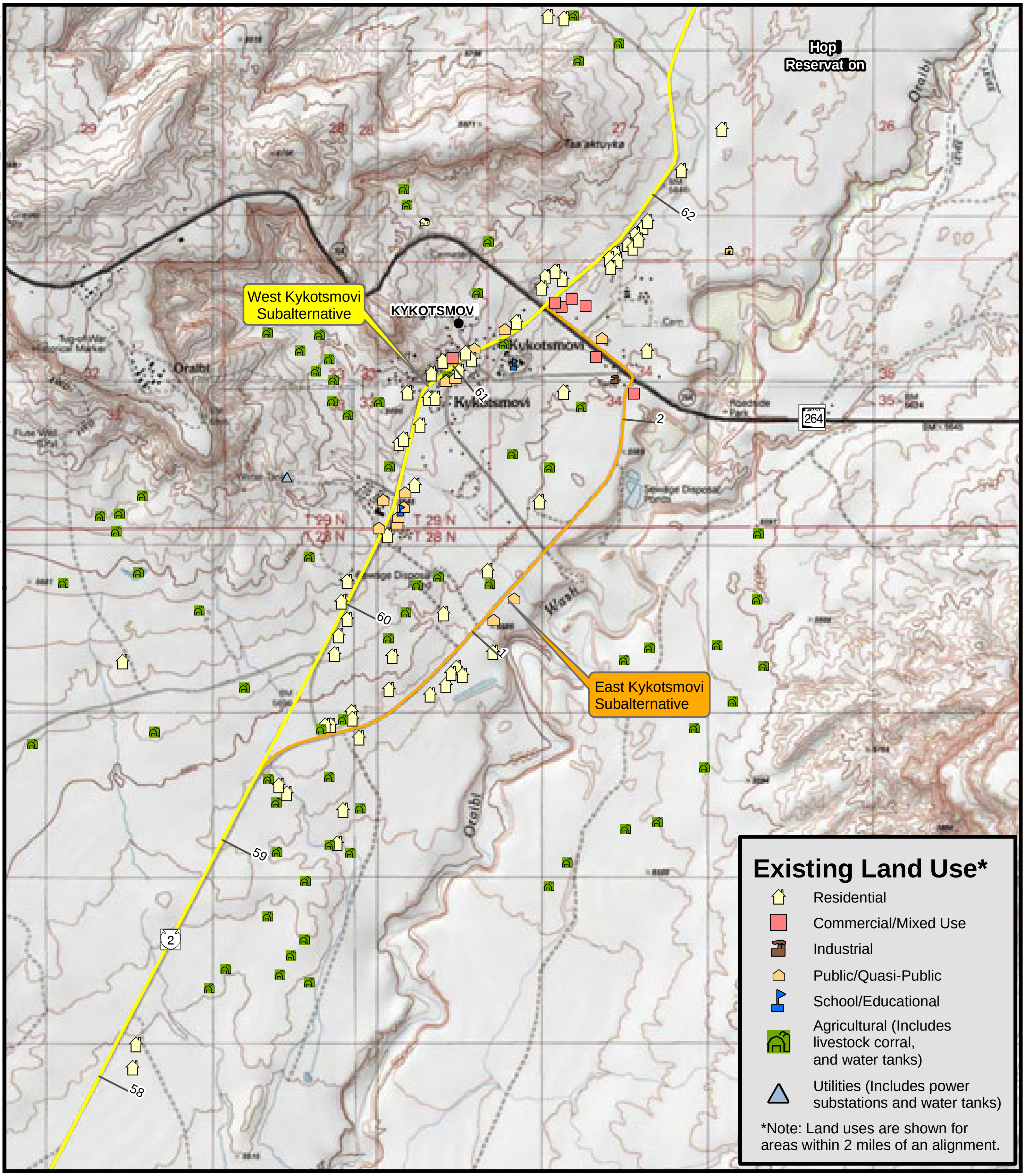
Most of the land along the alignment is permitted for livestock grazing with water tanks and corrals dispersed throughout. Refer to Tables G-1 and G-2 in Appendix G for grazing districts/range units that would be crossed by the water-supply pipeline.

The communities of Leupp and Red Lake have schools, small commercial sites, and public/quasipublic facilities (such as churches and youth centers). All are beyond 500 feet of the Western Route, with the exception of a church and cemetery located just outside Leupp within 250 feet of the route. The route would parallel U.S. Highway 160 as it enters the community of Red Lake; commercial uses such as convenience stores and gas stations occur along the highway near WSP Mileposts 96, 106, and 126. Schools are located along U.S. Highway 160 near WSP Mileposts 96, 108, and 117.

The majority of agricultural uses within the study corridor are smaller plots associated with residential areas. Agricultural plots occur within 250 feet of the alignment in several areas.

Electrical distribution lines would cross the route near WSP Milepost 86 and between WSP Mileposts 130 and 139, and two gas pipelines cross the route near Leupp. High-voltage power lines (500kV) would parallel and cross the Western Route at four points (near WSP Mileposts 67, 87, 121, and 130) and would parallel it until it terminates at the Black Mesa Complex.

The Western Route would cross the Leupp Chapter’s designated wildlife area along the Little Colorado River near WSP Milepost 13. According to the Shonto Chapter Comprehensive Land Use Plan, the Western Route would cross three designated growth areas: (1) Blue Lake Center near the western boundary of the chapter (WSP Milepost 110); (2) Mesa View, located near the intersection of U.S. Highway 160 and Arizona Route 98 (WSP Milepost 114); and (3) Black Mesa, located near the intersection of Arizona Highway 564 and U.S. Highway 160 (WSP Milepost 126). New, clustered residential subdivisions are planned at the growth centers of these areas. The Blue Lake Center (WSP Milepost 110) is planned for mixed use.



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LEGEND
Project Features

Alternative A Water-Supply System
- Eastern Pipeline Route
- Subalternative along Eastern Route

General Features
- Interstate/U.S. Highway/State Route

Existing Land Use: Kykotsmovi Area

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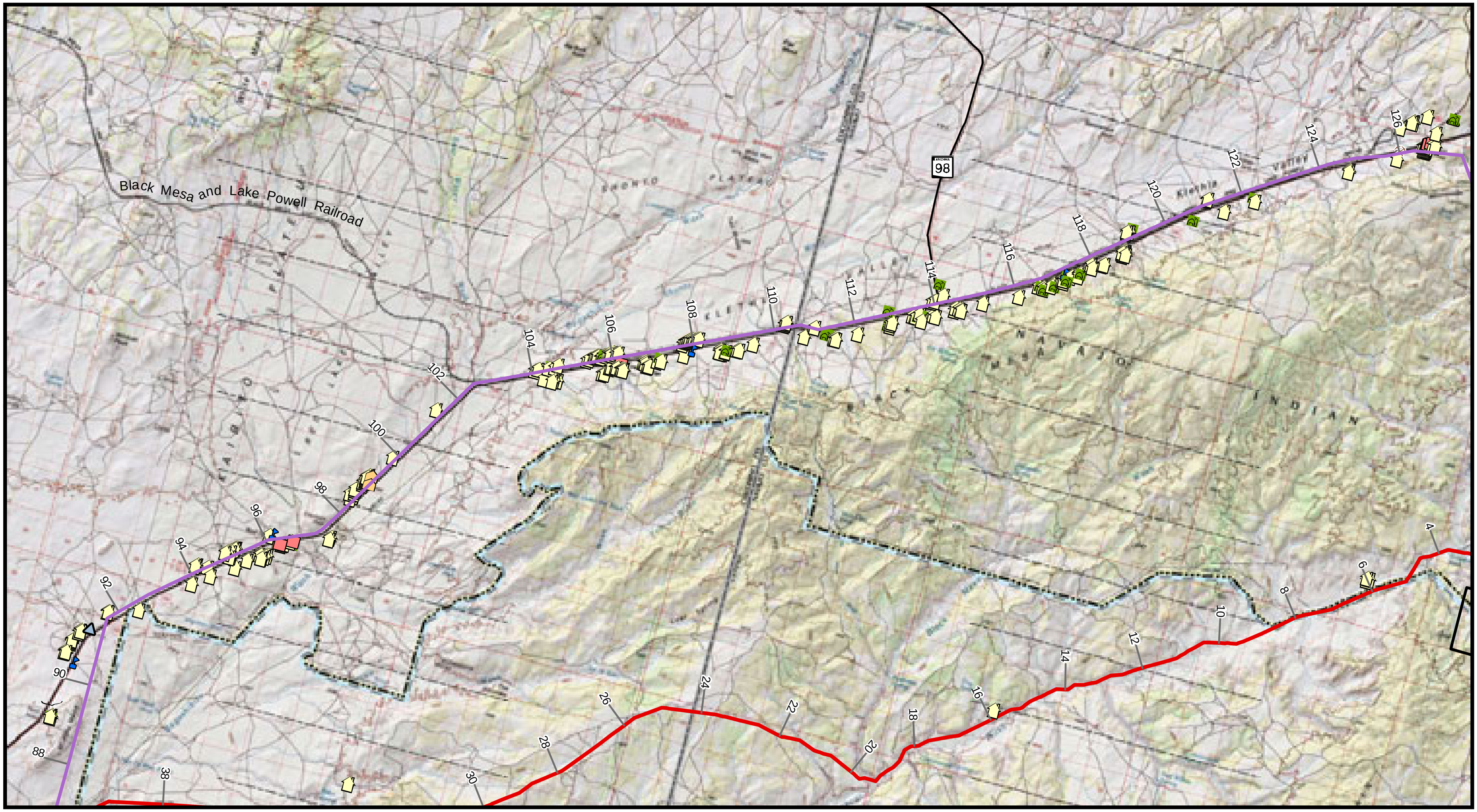
November 2008

Map 3-17c



LEGEND

Existing Land Use*

- Residential
- Commercial/Mixed Use
- Public/Quasi-Public
- School/Educational
- Agricultural (Includes livestock corral, and water tanks)
- Utilities (Includes power substations and water tanks)

*Note: Land uses are shown for areas within 2 miles of an alignment.

Project Features

Alternative A Coal-Slurry Pipeline

- Existing Route

Alternative A Water-Supply System

- Western Pipeline Route

General Features

- Hopi Indian Reservation
- Navajo Reservation Boundary
- County Boundary
- Interstate/U.S. Highway/ State Route
- Railroad

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Existing Land Use: Water-Supply Pipeline: Western Alternative

Black Mesa Project EIS

November 2008

Map 3-17d

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3.10 CULTURAL RESOURCES

The cultural environment includes those aspects of the physical environment that relate to human culture and society, along with the social institutions that form and maintain communities and link them to their surroundings (King and Rafuse 1994). Public and agency scoping identified issues related to potential impacts on two aspects of the cultural environment: archaeological and historical resources, and traditional cultural lifeways and resources. These issues were addressed pursuant to Federal, tribal, State, and local government laws and regulations protecting cultural resources. Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on properties eligible for the National Register of Historic Places (National Register).

To be eligible for the National Register, properties must be at least 50 years old (unless they have special significance) and have national, State, or local significance in American history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of four criteria:

- Criterion A — are associated with events that have made significant contributions to the broad pattern of our history
- Criterion B — are associated with the lives of persons significant is our past
- Criterion C — embody the distinctive characteristics of a type, a master, or that possess high artistic values,or that represent a significant and distinguishable entity whose components may lack individual distinction
- Criterion D — have yielded, or may be likely to yield, information important in prehistory or history (36 CFR 60.4)

To address the identified issues, studies were undertaken to inventory, evaluate, and assess impacts on the following elements of the cultural environment:

- Archaeological and historical resources that are tangible links to the cultural heritage of the region.
- Traditional cultural lifeways and resources significant to the Hopi Tribe, Navajo Nation, and Hualapai Tribe, as well as other tribal groups with traditional cultural affiliations with land in the project vicinity, including the Chemehuevi Indian Tribe, Colorado River Indian Tribes, Havasupai Tribe, Fort Mojave Tribe, Pahrump Paiute Tribe, San Juan Southern Paiute Tribe, and Pueblo of Zuni.

The area of potential effects (or region of influence) is the geographic area within which a project may cause effects on resources. The area of potential effects varies for each type of potential impact on the cultural environment. For direct disturbance due to mining and construction activities, the area of potential effects was defined to include:

- The LOM revision area for the Kayenta and Black Mesa mining operations (approximately 100 square miles), which includes about 5 acres where a coal-washing facility would be constructed just north of the existing coal-slurry preparation plant.
- About 127 additional acres for a right-of-way for a new coal-haul road to be built between the Kayenta and Black Mesa mining operations.
- The 40 acres leased by BMPI within the Black Mesa Mine for the existing coal-slurry preparation plant (all previously disturbed).

- The corridor that could have been disturbed by reconstruction of the coal-slurry pipeline (which currently is not in operation), which is about 65 feet wide and 273 miles long (approximately 2,319 acres).
- The construction zones for development of the C aquifer water-supply system (including the wells, collector lines, delivery pipeline, pumping stations, storage tanks, power lines, substation, and access roads) (approximately 900 acres).
- Areas of C and N aquifers where water levels may be lowered by groundwater pumping.

There is limited potential for less direct impacts on cultural resources due to visual intrusions and increased noise. Such impacts stemming from mining or the construction of a coal-washing plant would be confined largely within the established Black Mesa Complex. The new coal-haul road corridor is an exception, but it is almost surrounded by the coal-mining lease areas.

The area of potential effects for visual and noise effects for all linear features of the project was defined as extending 0.5 mile from the centerline of the alignments. (Although some of the features might be visible at greater distances, they are expected to result in only minor changes to views from 0.5 mile or farther away.) The area of potential effects where the C-aquifer well field would be developed was defined as approximately 70 square miles within which a maximum of approximately 21 wells would be drilled.

Biological resources that could have traditional cultural significance include plants collected for food, medicine, ceremonies, crafts, and other traditional uses, as well as raptors (eagles and hawks) captured for ceremonial uses. Other natural resources that could have traditional cultural significance include minerals or clay deposits and sources of surface water or shallow groundwater used for traditional purposes. The area of potential effects for impacts on plants, minerals, and clays would be the same as for construction impacts. Impacts on animal species are likely to result from increased noise or visual intrusions, and the area of potential effects was defined as extending 0.5 mile from the various project components.

Hydrogeological modeling indicated that pumping groundwater from the C aquifer could have potential impacts on surface water in two locations—the perennial reaches of lower Clear Creek and possibly lower Chevelon Creek. Continued pumping from the N aquifer could have potential impacts on Laguna Creek, Moenkopi Wash, Dinnebito Wash, Oraibi Wash, Polacca Wash, Jaidito Wash, Begashibito Wash, and Pasture Canyon Spring (GeoTrans 2005). These areas were defined as being the area of potential effects for potential impacts on traditional cultural values associated with surface water or shallow groundwater.

Potential impacts on traditional lifeways and knowledge could affect entire traditional cultures. Therefore the area of potential effects for those types of impacts encompasses traditional tribal territories. The Hopi heartland (*Tutsqwa*) encompasses much of northeastern Arizona, and the traditional land of the Navajo (*Dine Bikeyah*) covers parts of northeastern Arizona, northwestern New Mexico, southeastern Utah, and southwestern Colorado bounded by four sacred mountains (Mount Hesperus, Blanca Peak, Mount Taylor, and the San Francisco Peaks). In northwestern Arizona, the coal-slurry pipeline primarily crosses the traditional territories of 7 of the 14 bands of the Hualapai and Havasupai.

Archaeologists have documented that human occupation of the region began at least 11,500 years ago, and they divide the pre-Columbian era into the Paleoindian, Archaic, Early Agricultural, Formative, and Late Prehistoric periods (Bungart et al. 1998:2-6 to 2-32). These are followed by the temporally overlapping aboriginal Ethnohistoric period and the Historic period of Euro-American settlement. Anasazi/Ancestral Puebloan archaeological sites that were occupied between approximately A.D. 500 and 1300 are particularly common, as are sites that represent Navajo occupation during the late 1800s and 1900s. Sites in the western parts of the project area reflect the prehistoric Cohonina, Cerbat, and Patayan traditions, and historic-era occupation by upland Pai groups, including the Havasupai and Hualapai, and farther to the south, the Yavapai. During the historic period, the Mojave lived along the valley of the lower Colorado River. Various bands of Southern Paiutes lived primarily north and west of the Navajo and Pai groups. The San Juan Southern Paiute lived among the Navajo primarily near Willow Springs and Navajo Mountain, and a Paiute band known as the Chemehuevi moved from the deserts of southeastern California to live among the Mojave along the Colorado River. The technical reports prepared to support the EIS provide additional information about the cultural history of the project area.

To characterize the existing condition of the cultural environment, four study teams conducted cultural resource studies. The Hopi Cultural Preservation Office (HCPO) organized a team to study the project components on the Hopi Reservation, and the Navajo Nation Archaeology Department studied the project components on the Navajo Reservation. The Hualapai Tribe Department of Cultural Resources studied traditional Hualapai cultural resources (including those of the closely related Havasupai Tribe) along the coal-slurry pipeline. A URS Corporation team studied archaeological and historical resources along the portion of the coal-slurry pipeline located outside the Hopi and Navajo Reservations, and assisted OSM in consulting with other tribes.

The study teams reviewed records and reports to compile information from prior studies, and undertook intensive pedestrian field surveys to inventory cultural resources within the area of potential effects. The Black Mesa and Kayenta mining operations had been surveyed for cultural resources in conjunction with prior SMCRA permits, and they were not resurveyed. The area of potential effects for construction impacts cannot be precisely defined for other components of the proposed project until final designs are prepared, but construction zones were estimated on the basis of conceptual and preliminary designs for the (1) construction of the C aquifer water-supply system, (2) reconstruction of the coal-slurry pipeline, and (3) building of a new coal-haul road between the Kayenta and Black Mesa mining operations. If the Record of Decision approves the construction of these facilities, supplemental surveys would be conducted if needed during preparation of final designs pursuant to a Section 106 programmatic agreement. The agreement is being prepared to stipulate agency responsibilities and procedures for continuing to consider measures to assess and avoid, reduce, or mitigate any adverse effects on cultural resources if project implementation proceeds after the EIS process is completed.

The studies of traditional cultural lifeways and resources addressed the area of potential effects for construction impacts as well as the broader regions of influence defined for potential impacts on traditional lifeways and cultural resources that are significant for retention and transmission of traditional cultures. The Hopi, Navajo, and Hualapai study teams conducted records and literature reviews; undertook field reviews; and interviewed local tribal officials, local residents, elders, and other individuals knowledgeable about cultural traditions. OSM contacted 10 other tribes to solicit information and concerns about potential impacts on traditional cultural resources that might be significant to them, and invited interested tribes to participate in the Section 106 consultations. The results of the cultural resource studies are documented in a technical report prepared to support the EIS.

3.10.1 Black Mesa Complex

From 1967 to 1986, the 20-year Black Mesa Archaeological Project conducted research within the Black Mesa Complex to identify and study archaeological and historical sites and mitigate the impacts on those resources of mining coal. The Black Mesa Archaeological Project recorded 2,710 archaeological sites (1,671 preceramic and Puebloan and 1,039 historical Navajo), excavated 215 of those sites, and archaeologically tested, mapped, collected artifacts at 887 other sites (Powell et al. 2002). Through that program of research conducted under the initial regulatory program, OSM completed Section 106 requirements for the currently proposed LOM revision area for the Kayenta and Black Mesa mining operations. The proposed LOM revision would not require any additional Section 106 consultations regarding impacts of coal mining on properties eligible for the National Register.

Pursuant to terms and conditions of the LOM Permit AZ-0001C issued on July 6, 1990, and incorporated into Permit AZ-0001D that was recently renewed on July 6, 2005, Peabody continues to:

- Report the discovery of any previously unrecorded cultural resources to OSM and to cease work near discoveries until OSM determines appropriate disposition (Standard Permit Term 9).
- Identify and respectfully treat any human remains associated with archaeological sites pursuant to the 1990 NAGPRA (Special Conditions 3 and 4).
- Take into account any sacred and ceremonial sites brought to the attention of Peabody by local residents, clans, or tribal government representatives of the Hopi Tribe and Navajo Nation (Special Condition 1).

Since 1990, when the permit terms and conditions were stipulated, Peabody has made three cultural resource discoveries in the Kayenta mining operation area; eight prehistoric human burials found at those discoveries were treated in accordance with the permit terms. In 1997, Peabody reported two additional finds within the Kayenta mining operation area to OSM, but archaeological evaluation determined there were no cultural remains at those locations. No discoveries have been made in the Black Mesa mining operation area.

Although the Black Mesa Archaeological Project excavated many burials, only a sample of the archaeological sites was excavated and additional burials could be present at unexcavated sites within the mining area. Since 1990, Peabody sponsored archaeological testing of 54 unexcavated sites identified as having potential associated human burials. The testing identified 74 burials within 25 of those sites, and they were documented and moved pursuant to the permit conditions before mining was initiated at those locations. Peabody’s effort to locate burials is an ongoing commitment.

Traditional Hopis and Navajos consider all of Black Mesa (known as *Nayavuwaltsa* to the Hopi and *Dziłíjiin* to the Navajo) to be a significant traditional cultural resource because of its role in traditional stories and ceremonial and clan traditions. Because it is an area where traditional resources are obtained, they feel that development of the mines has adversely affected their traditional lifeways. Although Hopis and Navajos living anywhere might regard continued mining as an impact on their cultural traditions, the lifeways of the approximately 60 Navajo households that continue to reside within the Black Mesa Complex would be most directly affected by continued mining. Pursuant to permit conditions, Peabody also has addressed concerns about 18 sacred and ceremonial sites within the Kayenta and Black Mesa mining operation areas.

Survey of the corridor for the new coal-haul road identified two archaeological sites evaluated as eligible for the National Register—a scatter of Anasazi/Ancestral Puebloan artifacts and remnants of a historical Navajo sweat lodge.

3.10.2 Coal-Slurry Pipeline

3.10.2.1 Coal-Slurry Pipeline: Existing Route

Cultural resource studies conducted in conjunction with the original construction of the coal-slurry pipeline in 1970 identified 58 archaeological and historical sites (although 11 of those were described as actually being of recent origin). Twenty-five of the sites were on the Hopi Reservation, 19 on the Navajo Reservation, and 14 west of the reservations. Excavations were conducted at 6 of the Anasazi/Ancestral

Puebloan sites (5 on the Hopi Reservation and 1 on the Navajo Reservation) to mitigate the impacts of the construction of the coal-slurry pipeline (Ward 1976).

Replacement of the coal-slurry pipeline would involve construction activity within the 50-foot-wide right-of-way for the existing line and an extra temporary workspace 15 feet wide along the northern side of the existing right-of-way. Intensive survey of this corridor identified 50 archaeological and historical resources (Table 3-19). Eight of those are on the Hopi Reservation, one on the Navajo Reservation, and 41 are west of the reservations in Arizona. None were identified in the 1.5-mile-long segment of the route that extends into the southern tip of Nevada.

Fourteen of the 50 resources were evaluated as lacking significant historical values that would make them eligible for the National Register. Those are primarily scatters of prehistoric flaked stone artifacts with no chronological or cultural diagnostics, or scatters of historic-period trash of unknown origin. Twenty-three of the other 36 National Register-eligible sites reflect prehistoric occupation of the region, 12 historic-era uses, and 1 has both prehistoric and historical components.

Table 3-19 Archaeological and Historical Sites Along the Coal-Slurry Pipeline[1]

Site Type	Prehistoric	Anasazi/ Ancestral Puebloan	Navajo	Cohonina or Cerbat	Cohonina or Cerbat/Euro-American	Euro-American	Prehistoric/ Euro-American	Totals
Coal-slurry pipeline existing route								
Habitation		1	1			1		3
National Register eligible		1	1			1		3
Camp		1						1
National Register eligible		1						1
Field house				3	1			4
National Register eligible				3	1			4
Artifact scatter	14	5		4		6	1	30
National Register eligible	8	4		4		0	0	16
Artifact scatter and features		1						1
National Register eligible		1						1
Transportation related						9		9
National Register eligible						9		9
Mining related						1		1
National Register eligible						1		1
Military related						1		1
National Register eligible						1		1
Totals	14	8	1	7	1	18	1	50
National Register eligible	8	7	1	7	1	12	0	36
Pipeline realignments in Moenkopi Wash								
Habitation		3						3
National Register eligible		3						3
Camp		3						3
National Register eligible		2						2
Artifact scatter and petroglyphs		3						3
National Register eligible		3						3
Totals	0	9	0	0	0	0	0	9
National Register eligible	0	8	0	0	0	0	0	8
Kingman reroute								
Artifact scatter						8		8
National Register eligible						0		0
Transportation related						1		1
National Register eligible						1		1
Mining related						1		1
National Register eligible						0		0

Site Type	Prehistoric	Anasazi/ Ancestral Puebloan	Navajo	Cohonina or Cerbat	Cohonina or Cerbat/Euro-American	Euro-American	Prehistoric/ Euro-American	Totals
Transmission Line						1		1
National Register eligible						0		0
Totals	0	0	0	0	0	11	0	11
National Register eligible	0	0	0	0	0	1	0	1

NOTES: [1] Recommendations regarding eligibility are indicated; agency review is ongoing.
National Register = National Register of Historic Places

The inventory of eligible prehistoric resources includes 7 Anasazi/Ancestral Puebloan sites, including 1 identified as a habitation and 1 as a temporary camp. The other sites are artifact scatters, sometimes with features. Farther to the west, 7 sites were identified as affiliated with the Cohonina or Cerbat cultures, and 8 other scatters of flaked stone may be related to those cultures or the earlier Archaic era. Features interpreted as remnants of field houses were found at 4 of the Cohonina or Cerbat sites, and were the only evidence of architecture. Eight of the sites are primarily scatters of flaked stone generated by knapping obsidian nodules within the Mount Floyd volcanic field. Exploitation of that tool stone source might have begun during the Archaic period.

The inventory of eligible sites also includes 12 historic-period Euro-American resources. Nine of those are transportation-related and include the Grand Canyon Railway, which is listed in the National Register, and U.S. Route 66. Seven segments of Route 66 in Arizona are listed in the National Register, but those are not in the vicinity of the pipeline. The other sites are remnants of a mine and a homestead, both dating from around the 1910s to 1920s, and the World War II Kingman Army Air Forces Flexible Gunnery School Airfield.

Records reviews, field surveys, and interviews inventoried 56 traditional cultural resources along a 1-mile-wide corridor centered along the route of the proposed coal-slurry pipeline reconstruction (Table 3-20). Seventeen of the resources are significant to the Hopi Tribe, 12 to the Navajo Nation, and 26 to the Hualapai Tribe. The resources include landscape features identified in traditional histories, water sources, petroglyph sites, trails, ceremonial places and shrines, areas where eagles are collected for ceremonial uses, burials, and ancestral archaeological sites as habitations. The tribes consider these resources to be eligible for the National Register.

Table 3-20 Traditional Cultural Resources Along the Coal-Slurry Pipeline

Type	Cultural Affiliation			Totals
	Hopi[1]	Navajo[2]	Hualapai[3]	
Landscape features	1	5	6	12
Water sources	2	4	11	17
Petroglyph sites	3			3
Trails	2	1	2	5
Ceremonial places, shrines	3			3
Eagle (and other raptor) gathering areas	5			5
Ancestral sites, habitations	1	1	7	9
Burials/cemeteries		1	1	1
Totals	17	12	27	56

NOTES: [1] The Hopi consider these resources to be eligible for the National Register of Historic Places (National Register) under Criterion A or Criteria A and D.
[2] The Navajo consider these resources, except for the burial, to be eligible for the National Register under Criterion A or D. The burial is protected by the Native American Graves Protection and Repatriation Act and the Navajo Nation Jishchaá policy.
[3] The Hualapai consider one spring to be eligible for the National Register under Criterion A. The other resources may be eligible, but they require further evaluation. Agency review of eligibility is ongoing.

3.10.3 Coal-Slurry Pipeline: Existing Route with Realignments

The proposed reconstruction in the Moenkopi Wash would deviate up to 200 feet from the existing route along selected segments of the pipeline between CSP Mileposts 2 and 20 to move the pipeline away from the active channel of Moenkopi Wash. Because the specific alignment shifts to address erosion problems have not been designed at this time, a corridor 400 feet wide was surveyed along this segment of the route. Nine archaeological sites are located within this expanded corridor. They are all Anasazi/Ancestral Puebloan sites and include 3 habitations, 3 camps, and 3 artifact scatters with petroglyphs. Eight of the 9 sites are evaluated as eligible for the National Register. No additional traditional cultural resources were identified along the expanded Moenkopi Wash corridor.

The only substantial proposed realignment is designed to remove the pipeline from the northern part of Kingman, which has been developed since the original pipeline was installed. The 28-mile-long reroute would follow other pipelines, transmission lines, and roads through less developed areas south of Kingman. This realignment would cross the historical Atchison, Topeka & Santa Fe Railroad (originally the Atlantic & Pacific Railroad, and currently the BNSF Railway) and U.S. Route 66, as does the original route. Intensive survey identified 11 addition archaeological sites along the reroute, including a mining prospect pit, 8 scatters of historical trash, remnants of the Harris Station, and the Davis-Coolidge 230kV transmission line (refer to Table 3-19). Only the railroad station is evaluated as eligible for the National Register.

One traditional Hualapai cultural resource was identified along the Kingman reroute. It is a historical cemetery located about 1 mile from the proposed reroute.

3.10.4 C Aquifer Water-Supply System

3.10.4.1 Well Field

The potential well field encompasses about 70 square miles, but only a small fraction of that area would be disturbed by the proposed drilling of wells and construction of collector lines, power lines, and access roads. Because the number and layout of the wells has not been determined, the specific construction impact zones have not been defined or intensively surveyed for cultural resources. About 5 square miles within the well field were intensively surveyed for cultural resources prior to drilling three test wells and five observation wells (Jolly and Aguila 2004). That survey discovered 14 archaeological and historical sites. A records review documented that the test well survey was by far the most extensive cultural resource survey within the well field area, and only four additional archaeological and historical sites had been recorded by other surveys (Table 3-21).

The 18 sites recorded in the well field include a variety of prehistoric and historic sites. Seven were evaluated as eligible for the National Register, and archaeological testing was recommended to complete evaluation of the eligibility of four other sites. The seven other sites were evaluated as lacking significant historical values that would make them eligible for the National Register. Many other similar sites are undoubtedly present within unsurveyed portions of the well field.

3.10.4.2 C Aquifer Water-Supply Pipeline: Eastern Route

A total of 31 archaeological and historical sites were identified by intensive survey of areas that could be affected by construction of the proposed water-supply pipeline and associated pumping plants, access roads, and storage tanks (refer to Table 3-21). Most of the sites reflect Anasazi/Ancestral Puebloan or earlier prehistoric occupation of the region. Seven of the sites are classified as habitation sites, and the others reflect a variety of more limited activities. Twenty-three of the 31 sites were evaluated as having significant values that make them eligible for the National Register.

One option for crossing the Little Colorado River involves horizontal boring beneath the river. One site is located along the route of that subalternative. The site is a twentieth-century Navajo habitation that is evaluated as ineligible for the National Register. The other subalternative crossing would use an abandoned, historical bridge that is evaluated as eligible for the National Register under Criterion C.

Three Anasazi/Ancestral Puebloan artifact scatters were found along the west Kykotsmovi area subalternative, and two of these were evaluated as eligible for the National Register. No archaeological or historical sites were found along the east Kykotsmovi area subalternative.

Ten additional archaeological sites were recorded within the subalternative routes and substation sites being considered for the electrical system needed to operate the water-supply system. One of these represents the remnants of a mid-twentieth-century Navajo habitation site, another site has remnants of Navajo corrals less than 45 years old, and the eight other sites are scatters of prehistoric flaked stone with no temporally or culturally diagnostic artifacts. None of those sites are evaluated as eligible for the National Register (refer to Table 3-21).

Table 3-21 Archaeological and Historical Sites within the Area of Potential Effects for Construction Impacts of the Proposed C Aquifer Water-Supply System[1]

Site Type	Prehistoric	Archaic	Archaic/ Anasazi/Ancestral Pueblo	Ancestral Pueblo	Navajo	Euro-American	Totals
Well field							
Habitation				1			1
National Register eligible				1			1
Camp						1	1
National Register eligible						0	0
Artifact scatter	6		1		1	1	9
National Register eligible[1]	5[2]				0	0	6
Livestock related					2	1	3
National Register eligible					2	1	3
Artifact scatter, petroglyphs			1				1
National Register eligible			1				1
Road					1	1	2
National Register eligible					0	0	0
Teepee ring					1		1
National Register eligible					0		0
Subtotals	6	0	2	1	5	4	18
National Register eligible	5[2]	0	2	1	2	1	11
C aquifer water-supply pipeline: Eastern Route							
Habitation				5	2		7
National Register eligible				5	0		5
Field house				3			3
National Register eligible				3			3
Artifact scatter	2	2		16			20
National Register eligible	0	1		13			14
Bridge						1	1
National Register eligible						1	1
Subtotals	2	2	0	24	2	1	31
National Register eligible	0	1	0	21	0	1	23
Substation and power line for water-supply system (outside water pipeline corridor)							
Habitation					1		1
National Register eligible					0		0

Site Type	Prehistoric	Archaic	Archaic/ Anasazi/Ancestral Pueblo	Ancestral Pueblo	Navajo	Euro-American	Totals
Livestock related					1		1
National Register eligible					0		0
Flaked stone (Tolchaco gravels)	7						7
National Register eligible	0						0
Flaked stone, petroglyph	1						1
National Register eligible	0						0
Subtotals	8	0	0	0	2	0	10
National Register eligible	0	0	0	0	0	0	0
Totals	16	2	2	25	9	5	59
National Register eligible	5	1	2	22	2	2	34

NOTES: [1] The inventory is based on conceptual designs and does not include the locations of components such as the wells and collector lines. The survey did include options for locating the pipeline on either side of existing roads in some locations and alternative locations for the electrical substation and power line, so all of the sites probably would not be affected. Supplemental surveys would be conducted as needed pursuant to a Section 106 programmatic agreement during the post-Environmental Impact Statement preparation of final designs. Recommendations regarding eligibility are indicated; agency review is ongoing.
[2] Testing is recommended at four of these sites to further evaluate their eligibility.

Record reviews, field surveys, and interviews inventoried 87 traditional cultural resources within the well field and a 1-mile-wide corridor along the proposed water-supply pipeline and associated facilities (Table 3-22). Thirty-nine of the resources are significant to the Hopi Tribe and 48 to the Navajo Nation. The tribes consider these resources to be eligible for the National Register, or protected by the NAGPRA and the Navajo Nation Jishchaá policy.

Table 3-22 Traditional Cultural Resources within Area of Potential Effects for C Aquifer Water-Supply System[1]

Type	Cultural Affiliation: Hopi[2]	Cultural Affiliation: Navajo[3]	Totals
Well field			
Ceremonial places, shrines	2		2
Eagle (and other raptor) collecting areas	1		1
Landscape features		1	1
Subtotal	3	1	4
Surface water (potentially affected by groundwater pumping from the C aquifer)			
Water sources	2		2
Subtotal	2		2
Surface water (potentially affected by continued groundwater pumping from the N aquifer)			
Water sources	2		2
Subtotal	2		2
Water-supply pipeline: Eastern Route			
Ancestral sites, habitations	5	3	8
Ceremonial places, shrines	7	13	20
Eagle (and other raptor) gathering areas	9		9
Landscape features	1	6	7
Trails	3		3
Water sources	5	1	6
Hunting and gathering localities	1	8	9
Traditional fields (numerous fields near Kykotsmovi)	1		1
Abandoned trading post		1	1
Burials		13	13
Subtotal	32	45	77

Type	Cultural Affiliation		Totals
	Hopi[2]	Navajo[3]	
Power line for water-supply pipeline (outside pipeline corridor)			
Ceremonial places, shrines		1	1
Burials		1	1
Subtotal	0	2	2
Totals	39	48	87

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 programmatic agreement during the post-Environmental Impact Statement preparation of final designs.
[2] The Hopi consider these resources to be eligible for the National Register of Historic Places (National Register) under Criterion A or Criteria A and D.
[3] The Navajo consider these resources, except for burials, to be eligible for the National Register under Criterion A or D. Burials are protected by the Native American Graves Protection and Repatriation Act and the Navajo Nation Jishchaá policy.

The resources significant to the Hopi Tribe include ceremonial areas and shrines, areas where eagles and other raptors are collected for ceremonial uses, trails or clan migration routes, and Anasazi/Ancestral Puebloan village sites. In addition, the Hopi categorically consider all ancestral archaeological sites to be traditional cultural resources that represent the “footprints” of the Hopi across the landscape through time.

In addition, 33 species of plants that the Hopi use for a variety of traditional purposes grow along the proposed water-supply pipeline. There also are a number of traditional fields located along the proposed water-supply pipeline in the vicinity of Kykotsmovi. Many other traditionally named places within the viewshed of the well field and water pipeline are important elements of the traditional Hopi cultural landscape, but they are not threatened by the proposed project.

In addition to the impact of constructing the proposed C aquifer water-supply system, other traditionally important sources of surface water could be affected by the impacts of pumping groundwater. Hydrogeological modeling evaluated whether drawdown of groundwater around the proposed well field could affect baseflows that create perennial reaches at the lower ends of Clear Creek and Chevelon Creek. The Hopi consider all sources of surface water, whether in springs, or ephemeral or permanent streams, to have traditional cultural significance. A Hopi shrine is located at Clear Creek where water is collected for ritual use. The Hopi consider both creeks and the wildlife they support to have significant traditional values. The traditional cultural resources significant to the Navajo include locations where traditional ceremonies were conducted, remnants of corrals used in hunting game, abandoned house sites, an abandoned trading post, and geographic features named in traditional stories, including Black Mesa, the Little Colorado River, and Canyon Diablo (refer to Table 3-22). All of those resources are evaluated as eligible for the National Register. In addition, 14 burial locations were identified, and would need to be addressed pursuant to NAGPRA and the Navajo Nation Jishchaá policy if they were to be affected.

3.10.4.3 C Aquifer Water-Supply Pipeline: Western Route

Because the Western Route for the water-supply pipeline is only conceptually defined at this phase of planning, the area of potential effects for construction impacts could not be defined with any accuracy, and no field survey was conducted along this alternative. A records and literature review identified more than 340 prior studies that had recorded almost 400 archaeological and historical sites within a 1-mile-wide corridor along the Western Route. All but one of the sites are on the Navajo Reservation. The extent of prior survey within the corridor has not been quantified, but it covers only a small percentage of the area and many more unrecorded archaeological and historical sites certainly are present in the corridor. The Klethla Valley and Long House Valley crossed by the northern end of the Western Route are known to have some of the highest densities of archaeological sites in the region, and the types of sites tend to be larger and more complex than those along the Eastern Route.

Record reviews and interviews inventoried 37 traditional cultural resources along a 1-mile-wide corridor centered along the Western Route (Table 3-23). Twenty-two resources are significant to the Hopi Tribe and 15 to the Navajo Nation. The tribes consider these resources to be eligible for the National Register or to be protected by the NAGPRA and the Navajo Nation Jishchaá policy.

The resources significant to the Hopi Tribe include areas related to ceremonial capture of eagles and other raptors, ceremonial places or shrines, landscape features named in traditional histories, trails, and water sources. One of the eagle-capturing areas also is a location where plants are collected for traditional uses. In addition, the Hopi categorically consider all ancestral archaeological sites to be traditional cultural resources that represent the “footprints” of the Hopi across the landscape through time.

The traditional Navajo cultural resources include landscape features named in traditional histories, ceremonial places, and burials. More intensive interviewing of local residents and traditional land users along the route would probably identify many more specific traditional Navajo cultural resources, such as locations where traditional ceremonies were conducted, remnants of corrals used in hunting game, abandoned house sites, and burial locations.

Table 3-23 Traditional Cultural Resources within Area of Potential Effects for Water-Supply Pipeline: Western Route[1]

Type	Cultural Affiliation		Totals
	Hopi[2]	**Navajo[3]**	
Well field			
Ceremonial places, shrines	2		2
Eagle (and other raptor) collecting areas	1		1
Landscape features		1	1
Subtotals	3	1	4
Surface water (potentially affected by groundwater pumping from the C aquifer)			
Water sources	2		2
Alternative water-supply pipeline (Western Route)			
Ceremonial places, shrines, petroglyphs	4		4
Eagle (and other raptor) collecting areas	8		8
Landscape features	3	6	9
Trails	1		1
Water sources	1	3	4
Burials		3	3
Subtotals	17	12	29
Power line for water-supply pipeline (outside pipeline corridor)			
Ceremonial places, shrines		1	1
Burials		1	1
Subtotals	0	2	2
Totals	22	15	37

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 programmatic agreement during the post-Environmental Impact Statement preparation of final designs.

[2] The Hopi consider these resources to be eligible for the National Register of Historic Places (National Register) under Criterion A or Criteria A and D.

[3] The Navajo consider these resources, except for burials, to be eligible for the National Register under Criterion A or D. Burials are protected by the Native American Graves Protection and Repatriation Act and the Navajo Nation Jishchaá policy.

3.10.5 N Aquifer Water-Supply System

In the event the C aquifer water-supply system is developed, the N aquifer would be used as a temporary back-up supply in case the primary C-aquifer water supply failed for some reason. It is estimated pumping would be reduced by half. An option to the proposed development of a new water supply from the C aquifer is to continue to use existing wells within the Black Mesa Complex to pump groundwater from the N aquifer. The rate of pumping would increase to accommodate the proposed increased rate of mining. Hydrogeological review indicates that the N aquifer is connected to the baseflow in Laguna Creek, Moenkopi Wash, Dinnebito Wash, Oraibi Wash, Polacca Wash, Jaidito Wash, Begashibito Wash, and Pasture Canyon Spring. The Hopi and Navajo consider these water resources to be significant traditional cultural resources.

3.10.6 Summary

The inventory identified 127 archaeological and historical resources within the area of potential effects for the applicants' proposed project (Table 3-24). Approximately two-thirds of the resources are prehistoric sites, and most of those are Anasazi/Ancestral Puebloan. About 9 percent of the inventory is historical Navajo sites, and the remainder are Euro-American, mostly dating to the first half of the twentieth century. Eighty-two of the resources are evaluated as eligible for the National Register. A total of 129 traditional cultural resources plus 15 individual Navajo burials and a Hualapai cemetery also were identified. These resources are considered eligible for the National Register or protected by NAGPRA or the Navajo Nation Jishchaá policy.

Table 3-24 Summary of the Cultural Resources Inventory

Type	Mine/ Coal-Haul Road	Coal-Slurry Pipeline	C Aquifer Water-Supply System	Totals
Archaeological and historical resources				
Prehistoric		14	16	30
National Register eligible		8	5	13
Archaic			2	2
National Register eligible			1	1
Archaic//Anasazi/Ancestral Pueblo			2	2
National Register eligible			2	2
Anasazi/Ancestral Pueblo	1	17	25	43
National Register eligible	1	15	22	38
Cohonina/Cerbat		7		7
National Register eligible		7		7
Cohonina/Cerbat/ Euro-American		1		1
National Register eligible		1		1
Navajo	1	1	9	11
National Register eligible	1	1	2	4
Euro-American		25	5	30
National Register eligible		13	2	15
Prehistoric/ Euro-American		1		1
National Register eligible		1		1
Totals	2	66	59	127
National Register eligible	2	46	34	82
Traditional cultural resources[1]				
Hopi	1	17	39	57
Navajo	1	11 + 1 burial	34 + 14 burials	46 + 15 burials
Hualapai		26 + 1 cemetery		26 + 1 cemetery
Totals	2	54 + 1 burial + 1 cemetery	73 + 14 burials	129 + 15 burials + 1 cemetery

NOTES: [1]All considered eligible for the National Register of Historic Places or protected by Native American Graves Protection and Repatriation Act and the Navajo Nation Jishchaá policy.

3.11 SOCIAL AND ECONOMIC CONDITIONS

In accordance with NEPA, the analysis of social and economic conditions addresses the relationships between the proposed project and the communities it may affect. The following characterization of current social and economic conditions describes demographics, employment, income, fiscal and budgetary information, and community facilities in the region that could potentially be affected by the proposed project.

The study area includes areas that may be affected economically and socially by the proposed project due to their proximity to project facilities. For the regional analysis, data were collected for the Hopi and Navajo Reservations, and for up to six counties (depending on the project component), including Navajo, Coconino, Apache, Yavapai, and Mohave in Arizona, and Clark County in Nevada. Data also were collected to depict socioeconomic conditions at the local level.

The local area for the Kayenta and Black Mesa mining operations comprises the Hopi village of Moenkopi and 14 Navajo chapters (see Section 3.11.2.1). A village is the Hopi unit of local government. A chapter is the Navajo unit of local government, and nearly all Navajo land is assigned to chapters. Much 1990 and 2000 census information appears for chapters and for Moenkopi. Portions of some chapters are unincorporated, yet densely populated communities, and are defined by the U.S. Census Bureau as census-designated places. Certain information, such as the unemployment rate, is shown for census-designated places.

The populated local areas for the coal-slurry pipeline and the proposed C aquifer water-supply system include portions of the Hopi and Navajo Reservations, and the City of Kingman, Arizona. (Other than those areas, the pipeline routes traverse areas that are largely unpopulated.) Census information for 1990 and 2000 is available for the affected Navajo chapters. The rural Hopi land crossed by the coal-slurry pipeline is outside the villages and is administered at the tribal level. Information appears for tribal census tract geographic units in that area, where Hopi village information does not exist. Census tract information is available for the Kingman local areas.

Tribal and county-level data used in this analysis overlap somewhat (i.e., where tribal and county boundaries overlap in Navajo, Coconino, and Apache Counties). The proportion of each county's population in each of the two reservations as of the 2000 Census is shown in Table 3-25 to indicate the extent to which these data sources may be duplicated.

Table 3-25 Population in Arizona Counties Residing on Hopi Reservation, Navajo Reservation, or Off Reservation

	Total County	County, within Hopi Reservation	County, within Navajo Nation	County Remainder (Off Reservation)
Apache County	69,423	NA	54,521 (78.5%)	14,902 (21.5%)
Navajo County	97,470	5,812 (6.0%)	26,881 (27.6%)	64,777 (66.5%)
Coconino County	116,320	1,024 (0.9%)	23,350 (20.1%)	91,946 (79.0%)

SOURCE: U.S. Census Bureau 2000, SF 1, Table P1

NOTES: County totals and portions of the Hopi Reservation and off-reservation State Trust land, Arizona, New Mexico, Utah (part); Arizona and Navajo Reservation and off-reservation State Trust land, Arizona, New Mexico, Utah (part); Arizona.
NA = not applicable

3.11.1 Regional Overview of Demographics and Economics

Table 3-26 presents an overview of demographic characteristics for the two reservations, six counties, and the states of Arizona and Nevada. Arizona and Nevada were two of the fastest growing states in the nation in the 1990s. Mojave County, Arizona, and Clark County, Nevada, were the only counties within the region of influence whose growth rates exceeded those of their respective states. Rapid growth continued between 2000 and 2004 at the State, county, and tribal levels.

Table 3-26 Key Population Characteristics – Regional

	Counties (Arizona and Nevada)						Tribal Areas		State	
	Apache	**Coconino**	**Mojave**	**Navajo**	**Yavapai**	**Clark**	**Hopi Reservation[1]**	**Navajo Reservation[2]**	**Arizona**	**Nevada**
Total population										
Census 1990	61,591	96,591	93,497	77,658	107,714	741,459	7,360	148,451	3,665,228	1,201,833
Census 2000	69,423	116,320	155,032	97,470	167,517	1,375,765	6,946	180,462	5,130,632	1,998,257
Percent change, 1990-2000	12.7	20.4	65.8	25.5	55.5	85.5	-5.6	21.6	40.0	66.3
2004 estimate	71,320	129,570	180,210	107,420	196,760	1,375,765	11,668	187,152	5,833,685	2,410,768
Median age, 2000	27	29.6	42.9	30.2	44.5	34.4	29.1	24.0	34.2	35
Dependency ratio, 2000	67.1	44.2	66.0	64.6	64.5	48.2	68.9	69.7	54.9	48.6
Persons per household, 2000	3.41	2.8	2.45	3.17	2.33	2.65	3.49	3.77	2.64	2.62

SOURCES: U.S. Census Bureau 1990, 2000, 2004; Hopi Tribe, Navajo Nation 2006

NOTES: [1] Surveys completed for the Hopi Strategic Land Use and Development Plan indicated a year 2000 population of 10,571, rather than the 6,946 reported in Census 2000. The Hopi Strategic Land Use and Development Plan also reported the population estimate shown for 2004.

[2] The Navajo Nation reported the population estimate shown for 2004.

The median age of the population in the region is generally similar to that of the Nation. However, the Hopi and Navajo Reservations and those counties that compose portions of the reservations have lower median ages than the remainder of the region. The Hopi and Navajo Reservations, and Apache, Coconino, and Navajo Counties have relatively large numbers of persons per household.

The dependency ratio is a statistic that compares the size of the economically dependent population age groups to the size of the working-age population. The sum of the under 15 and over 65 population is divided by the population aged 15 through 64. Areas with dependency ratios over 60 tend to have a proportionately small number of employed persons supporting the remainder of the residents. While both Arizona and Nevada have dependency ratios of less than 60, all but Coconino and Clark Counties have dependency ratios over 60, and both tribes' dependency ratios are higher than any of the counties (refer to Table 3-26).

Recently, unemployment rates in the study area generally have been higher than those for Arizona as a whole (Table 3-27). In 2004, while Arizona's statewide unemployment rate was 4.8 percent, Mohave County had a rate slightly lower than the State (3.8 percent), and Coconino County had a rate slightly higher than the State (6.1 percent). Navajo County, which contains the bulk of the Kayenta and Black Mesa mining operations labor force, had a rate of 10.6 percent, and Apache County, farther from the mining operations, had a rate of 13.3 percent.

Table 3-27 Regional and Local Area Labor Force Characteristics

Year	Labor Force	Employment	Unemployment	Percent (%) Unemployment Rate
Apache County, Arizona				
2004	22,577	19,577	3,000	13.3
2003	21874	18,794	3,079	14.1
Coconino County, Arizona				
2004	68,846	64,655	4,191	6.1
2003	66,940	62,642	4,298	6.4
Mohave County, Arizona				
2004	79,741	76,698	3,043	3.8
2003	75,806	72,126	3,680	4.9
Navajo County, Arizona				
2004	37399	33,432	3,967	10.6
2003	35,938	32,055	3,883	10.8
Hopi Reservation				
2004	3,457	2,828	629	18.2
2003	3,451	2,730	721	20.9
Navajo Reservation (Arizona portion)				
2004	35,799	28,439	7,360	20.6
2003	35,890	27,449	8,441	23.5
Tuba City census-designated place				
2004	3,734	3,130	604	16.2
2003	3,652	3,033	619	16.9
Kayenta census-designated place				
2004	2,267	2,050	217	9.6
2003	2,179	1,966	213	9.8
Arizona				
2004	2,762,612	2,630,998	131,614	4.8
2003	2,690,294	2,539,359	150,935	5.6

SOURCE: Arizona Department of Economic Security 2005

The unemployment rates of the Hopi Reservation (18.2 percent) and the Navajo Reservation (20.6 percent, Arizona portion) were highest, according to the Arizona Department of Economic Security. Arizona Department of Economic Security data consider neither the unemployed whose unemployment benefits have run out nor those who are a part of the informal economy. The informal reservation economy focuses on non-business-related social, traditional, and avocational activity and reflects the production of traditional goods required to reciprocate in clan and family social obligations. A 1999 survey for the Hopi Strategic Land Use and Development Plan documented an unemployment rate of about 64 percent for the reservation. The Navajo Nation Department of Economic Development conducted surveys that indicated an unemployment rate of about 47.6 percent for 2003 (SWCA Environmental Consultants 2005).

The distribution of employment by industry sector in the study area appears in Table 3-28. In the year 2000, the services and information sector dominated employment, to a similar extent, in each of the counties, both of the reservations, and Arizona and Nevada at the statewide level. Retail and wholesale trade and manufacturing were the next largest sectors of Arizona's economy, while they were generally smaller proportions of the economy in each part of the study area. The most marked differences between a sector's share of employment in a state and in a part of the study area involved the reservations. Mining employs a much higher proportion of workers on the Navajo Reservation than statewide. Public administration employs a higher proportion of workers on both reservations than statewide.

Table 3-28 Regional Employment, Percent Share by Industry Sector, 2000

			Industry as Percent (%) of Total Employment								
		Total Employment	Agriculture, Forestry, Fishing, and Hunting	Mining	Construction	Manufacturing	Retail and Wholesale Trade	Transportation, Warehousing, and Utilities	Services and Information	FIRE and Rental/Leasing	Public Administration
Counties	Apache	16,469	1.9	1.2	10.9	2.6	9.1	7.2	51.7	2.8	12.6
	Coconino	55,510	1.3	0.4	7.7	5.2	14.8	5.4	54.5	3.9	6.8
	Mohave	60,517	0.8	0.2	9.7	7.0	15.9	5.7	51.5	4.6	4.5
	Navajo	29,575	2.3	1.4	11.1	5.4	14.7	7.0	45.1	3.8	9.2
	Yavapai	68,098	1.6	1.6	11.7	7.0	16.1	4.1	47.8	5.7	4.6
	Clark	637,339	0.1	0.2	9.7	3.7	13.5	5.1	57.2	6.8	3.6
Tribal areas	Hopi Reservation	1,869	0.3	0.7	10.5	5.5	8.6	1.4	45.2	1.8	26.0
	Navajo Reservation (Arizona portion)	21,907	1.0	2.7	12.9	3.3	8.4	6.0	52.7	2.2	10.8
State	Arizona	2,233,004	1.0	0.5	8.7	10.2	15.6	5.0	45.8	7.9	5.4
	Nevada	933,280	0.5	1.1	9.2	4.9	14.0	5.2	54.2	6.5	4.5

SOURCE: U.S. Census Bureau 2000
NOTE: FIRE = Finance, Insurance, and Real Estate

3.11.2 Black Mesa Complex

The Black Mesa Complex is within the jurisdiction of the Hopi and Navajo Reservations and Navajo County. The local area of influence is defined as the areas where the socioeconomic effects of mining operations at the Black Mesa Complex are most keenly felt. The population of the local area includes the residents of the Hopi Village of Moenkopi and 14 Navajo chapters. The area is large due to the long commuting distances—some mining workers return to their family households on weekends only. The Coconino County communities of Page and Flagstaff also are potentially affected by activities at the Black Mesa Complex, as they provide some mine-support services, trade activities, and some mine-related employment.

The Hopi villages other than Moenkopi are not considered part of the local area because they have almost no mining employment, due partly to the lack of a direct paved road to the mines. The southern portion of the Hopi road project "Turquoise Trail" is under way, with a goal to extend Indian Route 4 from Second Mesa/Shongopovi north through the Black Mesa Complex, connecting with U.S. Highway 160 just northwest of the mines.

3.11.2.1 Population in the Local Area

Table 3-29 identifies population since 1990 within the local area. The two largest communities within the local area are Kayenta Township (within Kayenta Chapter) and Tuba City (a census-designated place within Tuba City Chapter), both designated by the Navajo Nation as "primary growth centers" for economic development. Kayenta Township is the closest urban community to the Kayenta mining operation; the township is the only government structured as a municipality on the Navajo Reservation, with taxing authority and a sales tax of 5 percent.

Table 3-29 Population and Households in the Local Area of Influence

	Navajo Agency	Population (1990)	Population (2000)	Population (est. 2004)	Households (2000)[1]
Hopi Reservation area[2]					
Moenkopi administration area	NA	924	901	1,150[5]	242
Navajo Nation Chapters[3,4,5]					
Black Mesa	Chinle	455	398	410	126
Chilchinbito	Western	1,177	1,325	1,378	333
Dennehotso	Western	1,548	1,626	1,660	414
Forest Lake	Chinle	444	573	606	174
Hard Rock	Chinle	1,263	1,256	1,282	331
Inscription House	Western	1,010	1,214	1,265	351
Kaibito	Western	1,529	1,970	2,132	431
Kayenta	Western	4,902	6,315	6,651	1,618
Oljato	Western	1,913	2,292	2,395	563
Piñon	Chinle	2,050	3,066	3,247	741
Rough Rock	Chinle	1,009	919	949	217
Shonto	Western	2,330	2,419	2,515	644
Tonalea	Western	2,073	2,537	2,692	619
Tuba City	Western	7,305	8,736	9,216	2,170
Total		29,932	35,547	37,548	8,974

NOTES: [1] A household includes all the people who occupy a housing unit as their usual place of residence.
[2] Hopi Office of Community Planning & Economic Development 2004; U.S. Census Bureau 1990, 2000
[3] 1990 chapter populations are for the American Indian population only.
[4] 2000 and 2004 chapter populations include all races.
[5] Navajo Nation Division of Community Development 2004; U.S. Census Bureau 1990, 2000
est. = estimated, NA = not applicable

The Navajo Nation and BIA each distribute a wide variety of services through the agency system, and residents tend to identify with their agency. Tuba City is the headquarters of the Western Navajo Agency. While most of the chapters in the local area of influence belong to the Western Navajo Agency, a few belong to the Chinle Agency (refer to Table 3-29).

On the Navajo portion of the lease areas, there are 70 households with about 175 residents (SWCA Environmental Consultants 2005). Some of the residents are ranchers whose livestock graze on both undisturbed and reclaimed land. (Refer to Section 3.9.1 for more information about grazing on the Black Mesa Complex.)

3.11.2.2 Unemployment in the Local Area

Unemployment is a persistent problem in communities within the study area, particularly on the reservations. The overall unemployment rates for the Hopi and Navajo Reservations appear in Section 3.11.1, as reported by the Arizona Department of Economic Security and the tribes. The rates are much higher than the unemployment rates for the State of Arizona or for the entire counties in the study area. The Kayenta and Tuba City areas of the reservation have unemployment rates that are lower than those in the other parts of the reservation (refer to Table 3-27). Of the two areas, the Kayenta area's 2004 unemployment rate was lowest, at 9.6 percent, less than half the overall Navajo Reservation rate.

3.11.2.3 Employment and Income in the Local Area

The major employment sectors on the Hopi Reservation according to Census 2000 appear on Table 3-28. Information from the Hopi Tribe (Hopi Office of Community Planning & Economic Development 2001) indicates that manufacturing employment is at 40 percent of the labor force, compared with the U.S. Census Bureau's figure of 5.5 percent. The difference is partly explained by some differences in the definition of employment. The Hopi Tribe counts as manufacturing employees many persons who produced crafts—some for market and some for ceremonial purposes and exchange within extended families. The Hopi Tribe's information indicates that services employ 37 percent of the labor force. The Hopi definition includes all jobs that the U.S. Census Bureau defines as public administration, plus a small number of the jobs that the U.S. Census Bureau defines as services jobs, so the figures from the Hopi Tribe and Census 2000 are consistent. The most numerous public administration jobs are with the Hopi tribal government (554 jobs), schools, and the Indian Health Services.

The five largest employers on the Navajo Reservation in 2002 were government entities, comprising the Navajo Nation, the State of Arizona (including school districts), the Indian Health Services, the BIA's Office of Indian Education Program, and the State of New Mexico (SWCA Environmental Consultants 2005). That ranking of largest employers was consistent, in general, with Census 2000 figures which indicated that public administration and the services and information sectors accounted for over 60 percent of employment on the Arizona portion of the Navajo Reservation. Private industries, including mining, manufacturing, agriculture, and tourism, are few in comparison. After the five government entities listed above, Peabody was the sixth largest employer.

The median family income for residents within the local area of influence was $27,435, above that for the Hopi Tribe and Navajo Nation, but below the median family income for Navajo County and the State of Arizona.

The mining sector provides many jobs in the local area of influence. About 90 percent of all employees of the Kayenta and Black Mesa mining operations live on the Navajo Reservation, and less than 1 percent on the Hopi Reservation. The remaining 10 percent reside primarily in Flagstaff or Page. Figures regarding the place of residence of contractual staff are not available (SWCA Environmental Consultants 2005). Figures were not available for the distribution of employees between the two mines. However, prior to the suspension of the Black Mesa mining operation, if the mining employment was assumed to be roughly proportionate to the coal produced, approximately 621 employees and 135 contract employees worked at the mining operations, with 64 percent of the employment at Kayenta mining operation (or 374 mine employees and 86 contract workers) (SWCA Environmental Consultants 2005).

Mining's share of local employment is higher than its share of regional employment. While mining employed more than 5 percent of workers in the local communities in the year 2000, mining employed less than 3 percent of workers in the Arizona portion of the Navajo Reservation. In Chilchinbito and Kayenta, the employment in the mining sector is second to the services and information sector (Table 3-30).

Some communities within the local area have relatively few residents who work at the mines, yet the income earned by those employees has a large influence on the communities. Just a few miners live in the Black Mesa, Forest Lake, and Hard Rock Chapters, where residents are hindered in seeking employment outside their home chapters by the limited paved roads and limited telephone service.

Many young and elderly persons are supported by mine employees. The ratio of the dependent aged population to the working age population is 72.3 for the entire local area—higher than that for either reservation overall, and much higher than the Arizona ratio (54.9) (refer to Table 3-26).

Table 3-30 Local Area Employment: Total and Percent Share by Industry Sector (Census 2000)

	Total Employment	Industry as Percent (%) of Total Employment								
		Agriculture, Forestry, Fishing, and Hunting	Mining[1]	Construction	Manufacturing	Retail and Wholesale Trade	Transportation, Warehousing, and Utilities	Services and Information	FIRE and Rental/ Leasing	Public Administration
Hopi										
Moenkopi	207	0.0	6.3	20.8	0.0	5.8	0.0	41.1	0.0	26.1
Navajo Nation Chapter										
Black Mesa	60	0.0	0.0	21.7	0.0	0.0	0.0	78.3	0.0	0.0
Chilchinbito	147	0.0	18.4	0.0	0.0	15.6	12.2	38.1	0.0	15.6
Dennehotso	269	0.0	13.0	9.7	0.0	9.7	1.9	50.9	1.5	13.4
Forest Lake	27	0.0	0.0	29.6	0.0	0.0	33.3	37.0	0.0	0.0
Hard Rock	187	2.1	0.0	21.9	0.0	1.6	10.2	48.1	0.0	16.0
Inscription House	257	0.0	11.7	30.7	5.1	17.1	3.5	30.4	0.0	1.6
Kaibito	400	0.0	0.8	18.5	6.8	14.0	6.5	44.3	1.3	8.0
Kayenta	1,524	0.9	12.3	8.9	1.2	10.0	4.0	57.9	0.0	4.7
Oljato	515	0.0	5.0	13.8	4.7	12.0	8.3	52.0	0.0	4.1
Piñon	615	0.8	3.7	4.4	2.6	12.4	12.4	57.7	1.3	4.7
Rough Rock	135	0.0	3.7	15.6	0.0	0.0	0.0	70.4	0.0	10.4
Shonto	511	1.2	12.5	16.2	5.7	2.7	5.3	51.5	1.6	3.3
Tonalea	434	0.0	0.0	24.0	2.3	6.0	10.1	47.2	3.9	6.5
Tuba City	2,908	0.5	1.6	8.8	2.1	8.6	4.3	61.1	2.7	10.4

SOURCE: U.S. Census Bureau 2000

NOTES: [1] While Tonalea, Forest Lake, and Hard Rock Chapters reported no mining employment in the Census 2000; Peabody has supplied employee residence location figures for 2004 that indicate there are currently miners from the three communities.

FIRE = Finance, Insurance, and Real Estate.

Residents of the area around the Black Mesa Complex generally enjoy greater prosperity than residents of the Hopi and Navajo Reservations. Incomes are highest for mining workers and for those employed in tourism or government. Typically, wages are low in other sectors, and those seeking work exceed the number of jobs available.

A 2004 study of the area including the communities of Kayenta, Chilchinbito, and Oljato identified the mining operations as the driving force behind the local economy (Arizona State University [ASU] Center for Business Research 2004b) because coal sales to Navajo and Mohave Generating Stations bring money into the local economy. Jobs that exist due to a mine worker’s household spending, or the spending of a business that supplies the mines, would represent indirect jobs attributable to current mining operations. Similarly, income and spending that support the increase in household spending and supplier spending attributable to the two mining operations and the coal-slurry pipeline represent indirect economic impacts.

The indirect effects on regional employment and income were estimated in a separate economic study using IMPLAN regional economic modeling software (URS Corporation 2005). IMPLAN is a computerized method to develop regional input-output models. Multipliers were derived from IMPLAN to assess the relationship between the Black Mesa Complex and the regional economy. Employment, income, and output multipliers for industries related to the mines and coal-slurry pipeline in the four-county study area range from 1.3 to 2.1 (Table 3-31). The direct industry effects are expressed as a multiplier of 1.0 in each of the three categories (output, income, and employment). Multipliers above 1.0 represent indirect effects of the industry. For example, at the Black Mesa Complex, as of 2005:

- One job supported 1.1 jobs elsewhere in the economy.
- Each dollar paid for produced coal supported 0.4 dollars of production elsewhere in the economy.
- One dollar of income earned by mine workers supported 0.4 dollars of income elsewhere in the economy.

Table 3-31 Industry Multipliers

Industry	Output	Income	Employment
Coal mining	1.4	1.4	2.1
Power generation and supply	1.3	1.5	2.1
Manufacturing and industrial buildings	1.5	1.4	1.5
Highway, street, bridge, and tunnel construction	1.6	1.5	1.5
Water, sewer, and pipeline construction	1.5	1.5	1.6
Other new construction	1.6	1.5	1.6

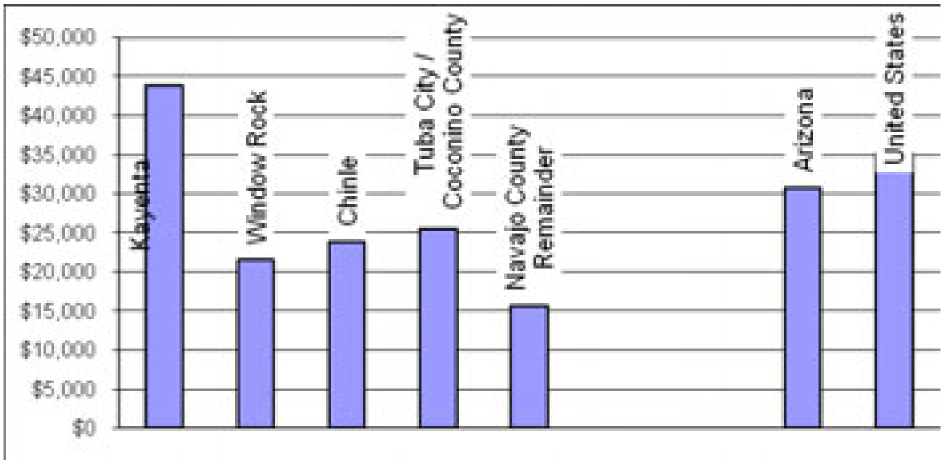
SOURCE: IMPLAN 2005
NOTES: The study area is the combined four-county area of Navajo, Mohave, Coconino, and Apache counties in Arizona.
These industries were chosen because they most closely represent the industries in which direct jobs associated with existing conditions, project construction, and project operation are categorized.

The Kayenta area has the highest per capita employment overall in the Hopi and Navajo areas, and among all the unincorporated areas in Arizona, Kayenta's per capita employment overall and in the nonagriculture private sector was higher than average. Average nonfarm private-sector payroll per employee in the Kayenta area in 2001 was $43,800, which was approximately 40 percent more than the state average. This was the highest figure among Arizona unincorporated areas (Figure 3-5). High wages paid in the mining sector are largely responsible for the high average (ASU Center for Business Research 2004b).

3.11.2.4 Fiscal Conditions

Peabody is responsible for many types of government payments, including taxes, fees, royalties, and others collected by Federal, State, and tribal agencies. OSM is responsible for collecting fees related to the Surface Mining Law, which provides for the restoration of land mined and abandoned or left inadequately restored before August 3, 1977. Under this program, production fees are collected from coal producers at all active coal mining operations. The fees are deposited in the Abandoned Mine Land (AML) Reclamation Fund, which is used to pay the reclamation costs of abandoned mine land projects. The Hopi Tribe and Navajo Nation receive grants on an annual basis funded by AML reclamation proceeds to fund reclamation of eligible mines (SWCA Environmental Consultants 2005). A variety of projects have been funded by AML grants, including abandoned coal and uranium mine reclamation and assorted community development projects. Another Federal tax paid by Peabody is the Black Lung Excise Tax, the proceeds of which are provided to the United Mine Workers of America Combined Benefit Fund. Peabody's payments for both the AML and Black Lung Excise Tax, from both the Kayenta and Black Mesa mining operations, totaled almost $12 million in 2004.

Figure 3-5 Payroll per Employee, Private-Sector, 2001 Hopi and Navajo Areas



SOURCES: Arizona Department of Commerce/Arizona State University Center for Business Research, 2004a (estimated from U.S. Department of Commerce, Census Bureau, *Zip Business Patterns 2001*).

NOTE: Apache County area data suppressed to avoid disclosure. Kayenta defined as all of ZIP Code 86033.

Peabody pays property and sales taxes to the State of Arizona (Table 3-32). The property taxes for the mines are paid to the State and redistributed through the county. It is estimated that about 85 percent of the property tax paid by Peabody is distributed back to Kayenta Unified School District. State sales tax is paid on coal sales, outside services, and materials and supplies. The revenue from the State sales tax is retained by the State and distributed through a number of funds based upon the approved State budget. Over the past few years, Peabody's sales taxes have averaged nine times the amount of the property taxes (refer to Table 3-32). Various State services are provided to residents within the study area influence, most notably through distributions back to local school districts.

Table 3-32 State of Arizona Taxes Paid by Peabody Western Coal Company

Year	Property Tax ($ million)	Sales Tax ($ million)	Total ($ million)
2001	1.7	12.0	13.7
2002	1.5	18.4	19.9
2003	1.7	14.3	15.9
2004	1.7	16.4	18.1
2005	2.0	18.7	20.6

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

The expected property tax amount for 2006 for the Kayenta mining operation would be $1.3 million, and the expected sales tax amount would be $10.5 million. This estimate assumes that the Black Mesa mining operation has closed, there would be no changes in the rates of any of the payments, and the payments would be 64 percent of the 2005 total Peabody payments (i.e., proportional to the amount of coal provided by Kayenta over the past several years).

Peabody has been responsible for paying Navajo Nation taxes levied on the Black Mesa mining operation; however, Peabody has not paid taxes to the Navajo Nation for the Kayenta mining operation. This is because Peabody, as fuel supplier to the Navajo Generating Station, has taxes waived for the Kayenta mining operation under the Navajo Generating Station Indenture of Lease. This waiver is in full force through April 30, 2011, at which time there is a partial expiration.

The Office of Navajo Tax Commission administers the taxes that Peabody has paid for the Black Mesa mining operation (Table 3-33). The Possessory Interest Tax is a tax on the taxable value of a possessory interest granted by the Navajo Nation, which provides a right to be on Navajo land performing a particular activity. The most common types of uses are oil and gas leases, coal leases, rights-of-way, and business site leases. The Business Activity Tax is a tax on the net source gains (gross receipts minus deductions) from the sale of Navajo goods and services. The tax applies to goods that are produced, processed, or extracted within the Navajo Reservation, and on all services performed within the reservation. The Fuel Excise Tax went into effect in 1999, generating $0.18 per gallon. The Navajo Sales Tax became effective on April 1, 2002, with a rate of 3 percent of gross receipts. The tax is imposed on all goods or services purchased within the reservation.

Table 3-33 Navajo Tribal Taxes Paid by Peabody Western Coal Company 1986 to 2005 (Black Mesa Mining Operation)[1,2]

Year	Possessory Interest Tax ($ million)	Business Activity Tax ($ million)	Navajo Sales Tax ($ million)	Navajo Fuel Excise Tax ($ million)	Total ($ million)
1986 to 1990	9.1	8.8	NA	NA	17.8
1991 to 1995	10.8	14.8	NA	NA	25.6
1996 to 2000	9.8	11.8	NA	NA	21.5
2001	2.6	2.0	NA	0.5	5.0
2002	2.2	3.2	0.1	0.5	6.1
2003	0.7	1.8	0.2	0.5	3.2
2004	0.7	2.0	0.3	0.5	3.5
2005	0.7	2.9	0.3	0.6	4.5
Total	36.6	47.3	0.9	2.6	87.3
Average per year	1.8	2.4	0.22	0.13	4.4

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

NOTE: [1] No Navajo Nation taxes have been paid for the Kayenta mining operation (see text).

[2] Figures may not add to totals due to rounding.

Because Peabody's taxes are waived for the Kayenta mining operation, no Navajo Nation tax revenue is expected from Peabody in 2006.

The coal produced from the mining operations also is subject to three coal-mining leases approved by the Hopi Tribe, Navajo Nation, and Secretary of the Interior. The lease agreements provide for payment of royalties and bonuses to the tribes. The royalty rates were adjusted in 1987 and were again adjusted for the Hopi lease in 1997. The bonuses were established and were first paid to each tribe in 1998. Table 3-34 identifies historical revenues to the tribes for royalties and bonuses related to coal extraction.

Table 3-34 Coal Royalties and Bonuses Paid by Peabody Western Coal Company (1986 to 2005)[1]

Year	Coal Royalties				Coal Bonuses[2]		
	Hopi Lease 5743 ($ million)	Navajo Lease 8580 ($ million)	Navajo Lease 9910 ($ million)	Overall Total ($ million)	Hopi ($ million)	Navajo ($ million)	Total ($ million)
1986 (least)	3.7	1.9	3.7	9.3	NA	NA	NA
1987 (most)	4.3	43.1[3]	4.3	51.7	NA	NA	NA
2005 (most recent)	14.7	28.9		43.6	1.8	3.5	5.3
Total	191.9	485.1		677.0	10.1	27.3	37.4
Average per year	9.6	24.3		33.9	1.3	3.4	4.7

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

NOTES: [1] Figures may not add to totals due to rounding.

[2] Bonuses began in 1998.

[3] The $43.1 million coal-royalty payment included an adjustment for royalty rates back to 1984.

The expected amounts of royalties for 2006 for the Kayenta mining operation would be $9.4 million to the Hopi Tribe and $18.5 million to the Navajo Nation (both leases). The expected amounts of bonuses for 2006 would be $1.2 million to the Hopi Tribe and $2.2 million to the Navajo Nation.

The lease agreements with the tribes provide for royalty payments for use of the N-aquifer water. The fees paid are based on the amount of water withdrawn from the aquifer. Table 3-35 summarizes the historical annual payments for water-use royalties to both tribes, which have averaged more than $1.7 million per year for each tribe. Payments in recent years have been about $2.3 million annually per tribe.

Table 3-35 Water Royalties Paid by Peabody Western Coal Company (1986 to 2004)[1]

	Hopi ($ million)	Navajo ($ million)	Total ($ million)
1986	0.02	0.02	.045
1987 (least)	0.02	0.02	.037
2003 (most)	2.3	2.3	4.5
2005 (most recent)	2.3	2.3	4.5
TOTAL	33.5	33.5	67.0
Average per year	1.7	1.7	3.4

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005
NOTE: [1] Figures may not add to totals due to rounding.

While the Kayenta mining operation has yielded 64 percent of the coal, the Black Mesa mining operation has accounted for the majority of the water use, due to the coal-slurry plant and pipeline. In 2006, the Kayenta mining operation and the water necessary to keep the Black Mesa system in operating condition are expected to use about 26 percent of the amount of water used by the Black Mesa Complex in 2005, which would result in water royalties of $0.6 million for each tribe.

The grand total of all the payments described above to the tribes from 1986 to 2005 is shown in Table 3-36.

Table 3-36 Total Annual Payments to Hopi and Navajo Tribes (1986 to 2005)[1,2,3]

Year	Hopi Reservation ($ million)	Navajo Nation ($ million)
1986	3.7	9.8
1987	4.5	51.4
1988	9.8	26.3
1989	10.3	26.3
1990	9.4	26.1
1991	11.0	29.8
1992	10.5	30.0
1993	10.6	35.8
1994	12.5	28.2
1995	13.8	27.2
1996	12.1	26.7
1997	11.9	29.1
1998	14.5	33.5
1999	12.8	34.4
2000	13.7	35.5
2001	15.1	37.1
2002	13.9	38.6

Year	Hopi Reservation ($ million)	Navajo Nation ($ million)
2003	13.6	35.0
2004	16.2	36.5
2005	18.7	39.2
Total	238.3	636.4
Average per year	11.9	31.8

SOURCES: Peabody Western Coal Company 2006; SWCA Environmental Consultants 2005

NOTES: [1] Figures may not add to totals due to rounding.
[2] Total of the annual payments detailed in Tables 3-29 through 3-31.
[3] Total does not include student scholarships nor grant payments made to the tribes by the Federal government from the Abandoned Mine Land Reclamation Fund.

In some recent years, Peabody's mining operations have been the single largest source of revenue in the Hopi and Navajo tribal budgets. Funds received by the tribes are distributed broadly to a number of tribal agencies, Hopi villages, and Navajo chapters. Coal revenues fund the bulk of the Hopi Government's annual operating budget and the bulk of more than 500 jobs provided by the Hopi Tribe. On the Hopi Reservation, the Kayenta and Black Mesa mining operations historically have accounted for approximately 50 percent of tribal government revenues. In the 2003 preliminary budget, the figure is estimated to be about 54 percent of the total Hopi tribal revenues.

Kayenta and Black Mesa mining revenues represented 26 percent of the total Navajo Nation nongrant budget in 2003; all mines on the Navajo Reservation taken together accounted for 40 percent of the 2003 budget.

3.11.2.5 Public Utilities

The NTUA is the primary provider of water and electric utilities in most of the local area of influence. NTUA is an enterprise of the Navajo Nation, providing electricity, natural gas, water, wastewater treatment, and solar energy to residents and businesses of the Navajo Reservation and limited areas of service to the Hopi Reservation. Generally, NTUA is the original developer and owner of its electric systems. Indian Health Services funds and constructs community water systems, then dedicates them to NTUA, while commercial enterprises are responsible for construction of their own water connections. Community water systems exist in population centers such as Kayenta, Moenkopi, and Tuba City.

NTUA is exploring the feasibility of establishing improved power and water distribution systems in the immediate area of the Black Mesa Complex, beyond the systems developed for the operation of the mines. Consideration would need to be given to the availability of rights-of-way and accessibility to the many dispersed home sites in the area (SWCA Environmental Consultants 2005). Many of the homes in the Black Mesa area do not have running water. Peabody makes available potable water at two water stands on the Black Mesa Complex to area residents who must haul water.

NTUA operates some centralized wastewater systems with lagoon treatment in the area, primarily for Navajo Housing Authority subdivisions, but the majority of homes on dispersed sites use individual septic systems. Kayenta, Tuba City, and Moenkopi are all served by community wastewater systems.

NTUA purchases electrical power from outside the Navajo Reservation and transmits that power to homes across most of the reservation. APS provides electrical service to Tuba City and Moenkopi, where a high proportion of households have electric service.

The Kayenta and Black Mesa mining operations are a major user of power provided by NTUA. From 1986 through 2004, the mines were the source of 22 percent of NTUA's electric-service revenue. As the overall NTUA system has grown, the mines' annual share of NTUA revenue has declined from 25 percent or more to less than 20 percent.

3.11.2.6 Education

The educational institutions at the kindergarten through high-school levels in the local area (Table 3-37) comprise four categories of schools: Arizona unified school districts, BIA schools, BIA contract schools (funded by BIA but managed by the tribes), and Arizona charter schools. Shonto Preparatory School is both a BIA contract school and an Arizona charter school.

Table 3-37 Schools (Grades K-12) in the Local Area

Name of District or School	Category	Grade Levels
Kayenta School District	Arizona unified district	K-12
Tuba City School District	Arizona unified district	K-12
Piñon School District	Arizona unified district	K-12
Shonto Preparatory School	BIA contract and Arizona charter	K-12
Kayenta Community School	BIA	K-8
Chilchinbito Community School.	BIA contract	K-8
Greyhills Academy (Tuba City)	BIA contract	9-12
Moenkopi Day School	BIA	K-8
Dennehotso Boarding School	BIA	K-8
Kaibito Boarding School	BIA	K-8
Tonalea Day School	BIA	K-8
Tuba City Boarding School	BIA	K-8
Rough Rock Community School	BIA Contract	K-12

SOURCES: Arizona Department of Education 2005; SWCA Environmental Consultants 2005
NOTES: K = kindergarten, K-12 = kindergarten through the twelfth grade

Arizona schools' five-year graduation rate in 2003 averaged 73 percent, compared to rates ranging from 51 percent to 87 percent for the schools in the mines' local area for which the rate was available (Arizona Department of Education 2005).

Tuba City, Kayenta, and Moenkopi have a higher proportion of high-school graduates among residents aged 25 and over than the overall rates for the Hopi (67.0 percent) or Navajo (57.0 percent). The State of Arizona's rate is 80.9 percent. The proportion of college graduates in Tuba City and Kayenta exceeds the 8.0 percent college graduation rate for the Navajo Nation. The other local communities have lower educational attainment among adults than is the case for the Hopi Tribe or Navajo Nation overall.

Peabody provides scholarship funds on an annual basis in the amounts of $173,000 to the Hopi Tribe and $186,000 to the Navajo Nation. The Hopi Tribe also has used $750,000 of its coal-bonus revenue for additional educational funding.

3.11.2.7 Health Care

Indian Health Services provides support for health services on the Hopi Reservation, with a new facility, Hopi Health Care Facility, at First Mesa in Polacca. The facility brings health care nearer to Hopi communities than it was previously. The facility is partially dependent upon funding by the Hopi Tribe.

The Navajo Area Indian Health Services Office, located in Window Rock, administers clinics, health centers, and hospitals, providing health care to members of the Navajo Nation. Comprehensive health care is provided to the Navajo people through hospitals, health centers, and health stations. School clinics and Navajo tribal health programs also serve the community. A major portion of the Navajo Nation health-care delivery system is sponsored by the Navajo Nation itself, which operates the Navajo Division of Health in Window Rock. Facilities within the local area of influence include the Tuba City Indian Medical Center and the Kayenta Service Unit, both operated by Indian Health Services.

At the mine complex, Peabody maintains a 24-hour emergency medical clinic that is designed primarily to service mine personnel, but also is available for emergencies of local residents. The clinic’s ambulance and the Peabody airstrip are used for medical-evacuation situations when the Kayenta airstrip may not be available due to inclement weather.

3.11.2.8 Public Safety: Law Enforcement and Fire Protection

The BIA and the Hopi Tribe (the Rangers) provide police services on the entire Hopi Reservation. The Navajo Department of Law Enforcement provides services throughout the reservation. The Navajo Department of Fire and Rescue Services and the local Kayenta Volunteer Fire Department provide fire and rescue services to residents of the Navajo Nation. The county sheriffs and Arizona Department of Public Safety also provide some service to the main reservation highways. BIA provides fire-response service, which is primarily responsible for fire services to Federal buildings. Peabody responds to fire emergencies using its pumper truck, which is located at the mine complex medical clinic. The Hopi Fire Department and the Hopi Rangers also serve the residents of the Hopi Reservation.

Wildland fire management on the Hopi and Navajo Reservations is primarily the responsibility of fire-management officers at the BIA regional agency offices that serve the two reservations. Both offices have agreements with the other participants in national interagency fire-program management and wildland firefighting. In the Hopi and Navajo areas, the BIA works frequently with BLM and the Forest Service, since BLM and the Forest Service manage much of the nearby public land.

3.11.3 Coal-Slurry Preparation Plant

The information describing existing social and economic conditions of the affected environment for the mines is applicable to the coal-slurry preparation plant (which currently is not in operation). The distribution of workers’ residences was very similar to that for the mining operations. The 34 employees at the coal-slurry preparation plant received wages averaging $28 per hour.

BMPI pays various taxes and fees, levied upon the coal-slurry preparation plant, to a number of governmental entities in the States of Arizona and Nevada and to the Navajo Nation. The information for the plant and pipeline is presented in Table 3-38. More complete descriptions of the taxation system for those taxes paid by industry are discussed in Section 3.11.2.4. BMPI has not yet been advised by any of the State or local taxing authorities as to the effect of its shutdown upon its future taxes.

Table 3-38 States of Arizona and Nevada Taxes Paid by Black Mesa Pipeline, Inc., in 2004

State	County	Property Tax (rounded to nearest $1,000)	Sales Tax (rounded to nearest $1,000)
Arizona			37,000
	Coconino	187,000	NA
	Mohave	59,9000	NA
	Navajo	150,000	NA
	Yavapai	61,000	NA
Nevada	Clark	2,000	NA

SOURCE: Sauser 2005

3.11.4 Coal-Slurry Pipeline

The existing coal-slurry pipeline and proposed alignments cross portions of Navajo County (where the pipeline is entirely on the Hopi or Navajo Reservation), Coconino County (where the pipeline is partly on the Navajo Reservation), Yavapai, and Mohave Counties in Arizona; and Clark County in Nevada. The pipeline is now dormant until such time as the Black Mesa mining operation resumes.

The coal-slurry pipeline (which currently is not in operation) is almost entirely underground, and ordinary operations require few work trips or deliveries of supplies to maintain it. Therefore, there is typically little interaction between the pipeline operation and the region. However, there would be noticeable economic and social activity during reconstruction.

Seventeen staff members supported the pipeline operation while in operation, 10 with an office in Flagstaff. The employees of the pump station at the coal-slurry preparation plant are counted with the plant personnel. The other seven staff members operated the other three pump stations.

The Kingman reroute would relocate the pipeline away from areas where future major developments are planned, to areas with less potential for growth. The social and economic characteristics of the local areas along the pipeline realignments in Moenkopi Wash and the Kingman reroute are the same as those in areas along the corresponding portions of the existing pipeline (Table 3-39), with the exception of Census Tract 9507.02 along the Kingman reroute, which has a higher proportion of persons in poverty than the remaining area.

Table 3-39 Local Area Population and Households (Pipelines and Well Field)

	Local Area	Project Component(s)[1]	Total Population (2000)	Households (2000)
Navajo Chapters	Coal Mine Mesa	Coal-slurry pipeline; water-supply pipeline (western alternative)	374	121
	Cameron	Coal-slurry pipeline	1,231	311
	Leupp	Well field and water-supply pipeline	1,605	419
	Bird Springs	Well field and water-supply pipeline	829	200
	Tolani Lake	Well field and water-supply pipeline	755	196
Hopi land	Tribal Census Tract 9411, BG2	Coal-slurry pipeline	1,556	410
	Tribal Census Tract 9410, BG4	Coal-slurry pipeline	400	119
Kingman areas	Census Tract 9509	Coal-slurry pipeline	7,618	3,187
	Census Tract 9507.02	Coal-slurry pipeline	7,332	2,856
	Census Tract 9508	Coal-slurry pipeline	3,685	1,652
	Census Tract 9506	Coal-slurry pipeline	6,513	2,658
	Census Tract 9511	Coal-slurry pipeline	3,605	1,475
	Census Tract 9510	Coal-slurry pipeline	10,376	3,783

SOURCE: U.S. Census Bureau 2000

NOTE: [1]The project component(s) column indicates which facilities associated with the component(s) would be in the area.

3.11.5 <u>Water Supply</u>

3.11.5.1 C Aquifer Water-Supply System

3.11.5.1.1 Well Field

The local area of influence for the well field (refer to Table 3-39) includes the Navajo Nation chapters of Leupp, Tolani Lake, and Bird Springs. The chapters share a community water system centered on Leupp.

The ratio of the dependent-aged population to the working-age population is 71.3 for the three-chapter area overall, higher than for either reservation, and much higher than the ratio for Arizona statewide (54.9). The American Indian population is 98.3 percent of the total population of the three-chapter area. More information about the racial and ethnic makeup of the area is presented in Section 3.12.

As indicated in Table 3-40, services and information are the dominant sectors in the local area for the proposed well field. Construction and manufacturing also are well represented. Tooh Dineh Industries in Leupp, which assembles printed circuit boards, is the leading manufacturing business. The local area was a part of the "Tuba City/Coconino County" Hopi and Navajo area that was the subject of an economic base study (ASU Center for Business Research 2004a). According to that study, the employment per 1,000 residents and the payroll per employee in private-sector jobs in the area lagged behind the Kayenta area, the state, and the nation.

3.11.5.1.2 C Aquifer Water-Supply Pipeline: Eastern and Western Routes

The Eastern and Western routes would pass through areas with similar economic profiles. Both routes would cross the three chapters in the well field's local area. The Eastern Route would cross Kykotsmovi and sparsely populated areas of the Hopi Reservation, and the Hard Rock and Forest Lake Chapters. The Western Route would cross Coal Mine Mesa, Tuba City, Tonalea, Shonto, Kayenta, and Forest Lake Chapters (refer to Tables 3-24, 3-26, 3-35).

Health-care and public-safety services are reservationwide for the Hopi Tribe, so they are the same for the local area of the water-supply pipeline as they are for the local area for the mines, and are described in Section 3.11.2. There are some additional BIA schools in the local area of the water-supply pipeline. They include the following schools serving kindergarten through the eighth grade: Leupp School in Leupp, Hopi Day School and Rocky Ridge Boarding School in Kykotsmovi, Hotevilla Bacavi Community School in Hotevilla, First Mesa Elementary School in Polacca, and Second Mesa Day School in Second Mesa. Hopi High School serves the entire local area and is in Keams Canyon.

Table 3-40 Local Area Employment: Percent Share by Industry Sector (Coal-Slurry Pipeline and Project Water Supply)[1]

		Agriculture, Forestry, Fishing, and Hunting	Mining	Construction	Manufacturing	Retail and Wholesale Trade	Transportation, Ware-housing, and Utilities	Services and Information	FIRE and Rental/ Leasing	Public Administration
Navajo Chapters	Coal Mine Mesa	0	0	22.8	12.3	8.8	0	56.1	0	0
	Cameron	7.2	0	27.6	0	22.2	0	33.8	3.4	5.8
	Leupp	0	0	27.2	14.1	0	4.3	46.1	0	8.3
	Bird Springs	11.4	0	11.4	10.3	0	3.3	41.3	4.9	17.4
	Tolani Lake	0	0	17.6	3.9	4.6	13.1	49	2.6	9.2
Hopi land	Tribal Census Tract 9411, BG2	1.6	0	13.7	3.5	8	0	52.8	0	20.4
	Tribal Census Tract 9410, BG4	0	0	17.8	14.4	8.9	7.8	51.1	0	0
Kingman areas	Census Tract 9509	1.1	0.3	9.6	11.6	16.1	7.4	45.2	2.1	6.6
	Census Tract 9507.02	0.2	0.3	13.7	12.9	14.9	4.9	46.9	3.2	3
	Census Tract 9508	5.2	2.6	10.8	8	19.4	8.1	34.9	4.4	6.5
	Census Tract 9506	1.3	0	7.2	6.5	13.4	8.5	56.4	2.9	3.7
	Census Tract 9511	0	0.3	10.9	6.5	16.2	5.5	51.4	2.1	7
	Census Tract 9510	0	0.2	7.4	14.1	15.6	8.5	42.9	3.4	8

SOURCE: U.S. Census Bureau 2000
NOTES: [1]Pertinent project components are identified in Table 3-35.
FIRE = Finance, Insurance, and Real Estate

3.12 ENVIRONMENTAL JUSTICE

In accordance with Executive Order 12898, it is the responsibility of Federal agencies to identify and address “disproportionately high and adverse human health or environmental effects of its activities on minority populations and low-income populations.” The general purposes of the Executive Order are to (1) focus attention of Federal agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental health; (2) foster nondiscrimination in Federal programs that substantially affect human health or the environment; and (3) give minority communities and low-income communities greater opportunities for public participation in, and access to public information on, matters relating to human health and the environment. One of the tasks in such an endeavor is to identify minority and low-income populations groups at geographic levels of analysis appropriate to the project under study.

An environmental justice population can be defined by one of two criteria: (1) the number of minority and/or low-income persons within a defined area exceed 50 percent of the population, or (2) the number of minority and/or low-income persons within a defined area exceed the number of minority and low-income persons in a larger community of which it is a part (e.g., a State, county, or other division) (Council on Environmental Quality [CEQ] 1997). The study areas for this analysis are the same as those considered in the analysis of social and economic conditions (Section 3.11).

Both the Hopi Tribe and Navajo Nation are minority communities. On the Hopi and Navajo Reservations, the share of population that is low income greatly exceeds the share of population that is low income in other communities, on the average, in the state or nation.

The most recent available census data on race and ethnicity were analyzed to identify minority populations that might be disproportionately larger than the general population in the county or the state. The Hopi and Navajo Reservations are predominantly American Indian (95 percent and 96 percent respectively) (Table 3-41). The smaller communities that comprise the portions of the reservation in the vicinity of the Black Mesa Project are also overwhelmingly minority populations, with a population that is 95.5 percent American Indian overall (Table 3-42).

An analysis of county-level data, some of which overlap with the reservations, affirms the presence of large minority populations. The percentage of American Indian residents in Apache County (77 percent), Coconino County (29 percent), and Navajo County (48 percent) exceeds the overall proportion of American Indians in the Arizona population (5 percent) (refer to Table 3-41). Although Clark County includes a slightly larger percentage of residents that are Black or African-American, Asian, some other race, or two or more races, the minority community is not concentrated in Laughlin, in the project vicinity. An analysis of census tracts in the vicinity of the project facilities near Kingman, Arizona, does not identify any concentrated minority populations in that area (refer to Table 3-42).

Hispanic populations also are considered to be minorities, and the census data tabulate Hispanic ancestry as an ethnicity. Therefore, Hispanic people may be of any race. As illustrated in Table 3-41, Clark County has a larger percentage of Hispanic residents (22 percent) than the State of Nevada overall (19.7 percent), but the Laughlin area does not have a large Hispanic population. The share of Hispanic residents in the project's various local areas is much smaller than the state-level comparison populations (refer to Table 3-42).

Census data also were used to identify low-income populations, using thresholds for poverty as defined by the CEQ guidance. Census data were compared to other reliable estimates of poverty to assess poverty trends regionally and locally. According to the Census 2000 data, the Hopi and Navajo Reservations have disproportionately low-income populations (39 percent and 42 percent persons below the poverty line, respectively, compared to nearly 14 percent for Arizona overall) (Table 3-43). Each of the individual counties in the region—with the exception of Yavapai County—exceeds the statewide proportion of persons below the poverty level (refer to Table 3-43).

It is likely that those living below the poverty line are undercounted for both the Hopi and Navajo, as is the case with the unemployed. For example, the 2000 Hopi Strategic Land Use and Development Plan indicated that nearly 61 percent of Hopi households have incomes below poverty level. The prevalence of poverty is consistent with the high unemployment rate found in the area (discussed in Section 3.11).

Poverty data also were analyzed for smaller geographic units. Nearly all the Navajo Chapters have a higher percentage of individuals below the poverty level than the statewide percentage (13.6 percent) or the percentages in the overlapping counties (refer to Table 3-43 and Table 3-44). The Moenkopi District of the Hopi Reservation has a similar proportion of persons below the poverty line (13.7 percent) to that of the State. Outside of the reservations, four census tracts in the Kingman area have higher percentages of persons below the poverty line than Mohave County (13.9 percent).

The small-area income and poverty estimates of the U.S. Census Bureau (U.S. Census Bureau 2002) is a consistent series of data that permits the estimates of the population in poverty to be compared from one year to the next. That series indicates the following trends in poverty population in the region from 1999 to 2002 (Table 3-45).

Other data series of poverty estimates yield slightly different results. Taken together, however, they all show persistent poverty in Apache and Navajo Counties, Arizona.

The Economic Research Service of the U.S. Department of Agriculture prepared a longitudinal study of poverty by county that yielded a map of persistent poverty counties, where 20 percent or more of persons were in poverty in each of the past four decennial censuses (1970 to 2000). Apache and Navajo Counties, Arizona, were designated as persistent poverty counties, while none of the other counties in the region were so designated.

Table 3-41 Race and Ethnicity – Regional Level[1,2,3]

	Counties						Tribal Areas		States	
		Coconino	Mohave	Navajo	Yavapai	Clark	Hopi Reservation	Navajo Reservation	Arizona	Nevada
Total population	**69,423**	**116,320**	**155,032**	**97,470**	**167,517**	**1,375,765**	**6,946**	**180,462**	**5,130,632**	**1,998,257**
Race (alone)										
White	13,536	73,381	139,616	44,752	153,933	984,796	269	4,316	3,873,611	1,501,886
Percent of total population	*19.5*	*63.1*	*90.1*	*45.9*	*91.9*	*71.6*	*3.9*	*2.4*	*75.5*	*75.2*
Black or African American	173	1,215	833	857	655	124,885	14	138	158,873	135,477
Percent of total population	*0.2*	*1.0*	*0.5*	*0.9*	*0.4*	*9.1*[c]	*0.2*	*0.1*	*3.1*	*6.8*
Apache American Indian and Alaska Native	53,375	33,161	3,733	46,532	2,686	10,895	6,573	173,987	255,879	26,420
Percent of total population	*76.9*	*28.5*	*2.4*	*47.7*	*1.6*	*0.8*	*94.6*	*96.4*	*5.0*	*1.3*
Asian	93	910	1,186	322	851	72,547	4	113	92,236	90,266
Percent of total population	*0.1*	*0.8*	*0.8*	*0.3*	*0.5*	*5.3*[c]	*0.1*	*0.1*	*1.8*	*4.5*
Native Hawaiian/ Other Pacific Islander	39	108	168	46	138	6,412	1	35	6,733	8,426
Percent of total population	*0.1*	*0.1*	*0.1*	*0.0*	*0.1*	*0.5*	*0.0*	*0.0*	*0.1*	*0.4*
Some other race	1,217	4,801	6,200	3,067	5,990	118,465	16	461	596,774	159,354
Percent of total population	*1.8*	*4.1*	*4.0*	*3.1*	*3.6*	*8.6*[c]	*0.2*	*0.3*	*11.6*	*8.0*
Two or more races	990	2,744	3,296	1,894	3,264	57,765	69	1,412	146,526	76,428
Percent of total population	*1.4*	*2.4*	*2.1*	*1.9*	*1.9*	*4.2*	*1.0*	*0.8*	*2.9*	*3.8*
Ethnicity										
Hispanic or Latino origin	3,119	12,727	17,182	8,011	16,376	302,143	133	2,296	1,295,617	393,970
Percent of total population	*4.5*	*10.9*	*11.1*	*8.2*	*9.8*	*22.0*[c]	*1.9*	*1.3*	*25.3*	*19.7*

SOURCE: U.S. Census Bureau 2000

NOTES: [1] Includes population on Hopi Reservation and off-reservation land in Arizona.
[2] Includes population on Navajo Reservation and off-reservation land in Arizona, New Mexico, and Utah.
[3] Probably not conclusive for study area.

Table 3-42 Race and Ethnicity – Local Level[1,2]

	Hopi	Navajo Chapters													
	Moenkopi District	**Black Mesa**	**Chilchinbito**	**Dennehotso**	**Forest Lake**	**Hard Rock**	**Inscription House**	**Kaibito**	**Kayenta**	**Oljato**	**Piñon**	**Rough Rock**	**Shonto**	**Tonalea**	**Tuba City**
Total population	**901**	**398**	**1,325**	**1,626**	**573**	**1,256**	**1,214**	**1,970**	**6,315**	**2,292**	**3,066**	**919**	**2,419**	**2,537**	**8,736**
Race (alone)															
White	13	2	13	12	1	25	36	11	327	61	114	13	37	19	421
Percent of total population	*1.4*	*0.5*	*1.0*	*0.7*	*0.1*	*2.0*	*3.0*	*0.6*	*5.2*	*2.7*	*3.7*	*1.4*	*1.5*	*0.7*	*4.8*
Black or African American	0	0	0	0	0	0	5	1	9	2	0	1	1	0	13
Percent of total population							*0.4*	*0*	*0.1*	*0*		*0.1*	*0*		*0.1*
American Indian or Alaska Native	871	393	1,296	1,586	566	1,214	1,154	1,949	5,856	2,204	2,910	899	2,339	2,492	7,990
Percent of total population	*96.7*	*98.7*	*97.8*	*97.4*	*98.8*	*96.7*	*95.1*	*99.0*	*92.7*	*96.2*	*94.9*	*97.8*	*92.6*	*98.2*	*91.5*
Asian	0	0	0	0	0	0	0	0	6	0	2	3	1	1	18
Percent of total population									*0.1*		*0*	*0.32*	*0*	*0*	*0.2*
Native Hawaiian/other Pacific Islander	0	0	0	0	0	0	1	0	1	1	0	0	0	0	3
Percent of total population							0		0	0					*0*
Other	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent of total population	*0.2*														
Two or more races	15	2	0	12	2	3	12	6	63	11	5	1	24	6	94
Percent of total population	*1.7*	*0.5*		*0.7*	*0.3*	*0.2*	*1.0*	*0.3*	*1.0*	*0.5*	*0.2*	*0.1*	*1.0*	*0.2*	*1.1*
Ethnicity															
Hispanic or Latino origin	0	1	16	16	4	14	6	3	53	13	35	2	17	19	197
Percent of total population		*0.3*	*1.2*	*1.0*	*0.7*	*1.1*	*0.5*	*0.2*	*0.8*	*5.7*	*1.1*	*0.2*	*0.7*	*0.7*	*2.3*

Table 3-42 Race and Ethnicity – Local Level[1,2] (continued)

	Hopi		Navajo Chapters					Kingman Area						
	Tribal Census Tract 9411, BG2	Tribal Census Tract 9410, BG4	Coal Mine Mesa	Cameron	Leupp	Bird Springs	Tolani Lake	Census Tract 9509	Census Tract 9507.02	Census Tract 9508	Census Tract 9506	Census Tract 9511	Census Tract 9510	City of Kingman
Total population	**1,556**	**400**	**374**	**1,231**	**1,605**	**829**	**755**	**7,618**	**7,332**	**3,685**	**6,513**	**3,605**	**10,376**	**20,069**
Race (alone)														
White	33	6	8	20	15	3	3	6,534	6,272	3,238	5,767	2,904	8,977	17,119
Percent of total population	*2.1*	*1.5*	*2.1*	*1.6*		*0.4*	*0.4*	*85.8*	*85.5*	*87.9*	*88.5*	*80.6*	*86.5*	*85.3*
Black or African American	0	0	0	1	0	1	0	64	31	9	27	15	38	109
Percent of total population						*0.1*		*0.8*	*0.4*	*0.2*	*0.4*	*0.4*	*0.4*	*0.5*
American Indian or Alaska Native	1,475	383	364	1,139	1,548	817	740	113	78	92	61	101	146	329
Percent of total population	*94.8*	*95.8*	*97.3*	*92.5*	*96.4*	*98.6*	*98.0*	*1.5*	*1.1*	*2.5*	*0.9*	*2.8*	*1.4*	*1.6*
Asian	1	0	0	1	0	0	0	101	31	15	40	71	109	284
Percent of total population								*1.3*	*0.4*	*0.4*	0.6	*2.0*	*1.1*	*1.4*
Native Hawaiian/other Pacific Islander	0	0	0	0	0	0	0	8	8	7	7	7	12	27
Percent of total population								*0.1*	*0.1*	*0.2*	*0.1*	*0.2*	*0.1*	*0.1*
Other	1	0	0	0	0	0	0	7	5	19	7	1	9	17
Percent of total population								*0.1*	*0*	*0.5*	*0.1*	0		
Two or more races	0	0	0	26	15	3	1	97	162	74	97	84	164	328
Percent of total population				*2.1*	*0.9*	*0.4*	*0.1*	*1.3*	*2.2*	*2.1*	1.5	*2.3*	*1.6*	*1.6*
Ethnicity														
Hispanic or Latino origin	35	11	2	44	27	5	11	694	745	231	507	422	921	1856
Percent of total population	*2.2*	*2.8*	*0.5*	*3.6*	*1.7*	*0.6*	*1.5*	*9.1*	*10.2*	*6.3*	*7.8*	*11.7*	*8.9*	*9.2*

SOURCE: U.S. Census Bureau 2000

NOTE: [1]Kayenta and Black Mesa mining operations, places of residence of 90 percent of the employees.
[2]Additional areas crossed by proposed linear facilities.

Table 3-43 Regional Income Characteristics

	County						Tribal Areas		State	
	Apache	**Coconino**	**Mohave**	**Navajo**	**Yavapai**	**Clark**	**Hopi Reservation**	**Navajo Reservation**	**Arizona**	**Nevada**
Per capita income	$8,986	$17,139	$16,788	$11,609	$19,727	$21,785	$8,637	$7,486	$20,275	$21,989
Median family income	$26,315	$45,873	$36,311	$32,409	$32,409	$50,485	$15,875	$23,209	$46,723	$50,849
Persons below poverty level	25,798	20,609	21,252	28,054	19,552	145,855	2,702	65,001	698,669	205,685
Percentage of persons below poverty level	37.8	18.2	13.9	28.8	11.9	10.8	38.9	41.9	13.6	10.5

SOURCE: U.S. Census Bureau 2000

Table 3-44 Local Income Characteristics

	Per Capita Income (in $)	Median Family Income (in $)	Persons Below Poverty Level	Percent of Persons Below Poverty Level
Kayenta and Black Mesa Mines				
Hopi area				
Moenkopi	11,432	38,266	113	13.7
Navajo Chapters				
Black Mesa	4,622	15,000	187	40.2
Chilchinbito	5,745	26,029	647	47.3
Dennehotso	5,270	20,583	730	46.6
Forest Lake	3,638	9,479	264	62.3
Hard Rock	4,732	20,556	746	58.8
Inscription House	7,216	14,750	640	49.9
Kaibito	8,117	29,896	548	27.1
Kayenta	8,698	27,689	2,459	38.8
Oljato	7,468	21,094	822	38.0
Piñon	5,478	18,007	1,606	49.5
Rough Rock	5,237	18,482	491	50.7
Shonto	8,573	31,214	828	34.4
Tonalea	6,163	24,750	1,027	40.9
Tuba City	10,331	37,455	2,420	28.4
Additional Areas Crossed by Linear Facilities				
Navajo Chapters				
Coal Mine Mesa	6,075	20,875	123	38.7
Cameron	6,055	20,278	597	43.4
Leupp	7,421	21,250	697	44.5
Bird Springs	7,844	23,981	265	35.1
Tolani Lake	6,749	28,606	269	33.8
Hopi areas				
Tribal Census tract 9411, BG2	7,298	19,211	834	52.8
Tribal Census tract 9410, BG4	9,181	35,313	169	42.4
Kingman area				
Census Tract 9509	16,989	38,852	717	9.5
Census Tract 9507.02	13,834	30,433	1,613	22.1
Census Tract 9508	20,598	39,773	651	17.7
Census Tract 9506	14,264	30,942	1,026	15.9
Census Tract 9511	15,484	36,214	624	19.2
Census Tract 9510	17,203	44,098	1,173	11.7
City of Kingman	17,181	41,327	2,207	11.6

SOURCE: U.S. Census Bureau 2000

Table 3-45 Trends in Percentage of People in Poverty by State and County, 1999 to 2002

State or County	1999	2002
Arizona	12.8	13.6
Apache County	30.5	28.3
Coconino County	15.9	15.4
Mohave County	15.1	15.7
Navajo County	23.6	24.3
Yavapai County	11.6	12.6
Nevada	10.2	10.1
Clark County	10.4	10.6

SOURCE: U.S. Census Bureau 2004

3.13 INDIAN TRUST ASSETS

The United States has a responsibility to protect and maintain rights reserved by or granted to American Indian tribes by treaty, statutes, and executive orders. This responsibility requires Federal agencies to take actions necessary to protect Indian trust assets.

The Secretary of the Interior's Order Number 3215, dated April 28, 2000, addresses "Principles for the Discharge of the Secretary's Trust Responsibility." That Secretarial Order cited the American Indian Trust Fund Management Reform Act of 1994 (Reform Act), Public Law 103-412, October 25, 1994, 108 Stat. 4239, as the most comprehensive and informative legislative statement of Secretarial duties in regard to the trust responsibility of the United States. A key section of that law indicates that the Secretary's proper discharge of the trust responsibilities of the United States shall include, but are not limited to, appropriately managing the natural resources located within the boundaries of Indian reservations and trust lands (25 U.S.C. 162a(d), cited in Babbitt 2000).

3.13.1 Indian Trust Assets Definition and Characteristics

Indian trust assets are defined as legal interests in assets that are held in trust or restricted status by the Federal Government for federally recognized American Indian tribes or individual Indian. Assets have monetary value in which a tribe has a property interest. Examples of things that could be Indian trust assets include minerals, water rights, lands, hunting and gathering rights, other natural resources, or money. Examples of property interests, other than exclusive ownership, are leases or rights to use something. Indian trust assets can be real property, physical assets, or intangible property rights.

Indian trust assets do not include things in which a tribe has no legal interest. For example, off-reservation sacred sites in which a tribe has no legal property interest generally are not considered Indian trust assets.

Other important characteristics of the trust relationship between American Indian tribes and the United States are as follows:

- A trust has three components—the trustee, the beneficiary, and the trust asset(s). In the case of Indian trust assets, title to Indian trust assets is held by the United States (trustee) for the benefit of a tribe or individual American Indian.
- Legal interest means there is a property interest for which a legal remedy may be obtained.
- Indian trust assets cannot be sold, leased, or otherwise alienated without the United States' approval. While most Indian trust assets are located on Indian reservations, they also can be located off reservation.

Indian trust assets within the Black Mesa Project area include those that are held by the United States for the Hopi Tribe and the Navajo Nation. Indian trust assets to be considered for possible effects by the proposed Federal actions are minerals, water rights, lands, hunting and gathering rights, and other natural resources.

Primary statutes governing the leasing of Indian coal assets for the benefit of an Indian tribe or nation are the Indian Mineral Leasing Act of 1938 and the Indian Mineral Development Act of 1982. An American Indian Coal Lease is obtained by direct negotiation with Indian tribal authorities, but is subject to approval and administration by the USDI. The leasing authority by which coal reserves that are Indian trust assets may be leased is at 25 U.S.C. 396a and concerns leases of unallotted lands for mining purposes. It states the following:

> On and after May 11, 1938, unallotted lands within any Indian reservation or lands owned by any tribe, group, or band of Indians under Federal jurisdiction, except those specifically excepted from the provisions of sections 396a to 396g of this title, may, with the approval of the Secretary of the Interior, be leased for mining purposes, by authority of the tribal council or other authorized spokesmen for such Indians, for terms not to exceed ten years and as long thereafter as minerals are produced in paying quantities.

The BIA performs a limited role in assisting tribes to litigate or seek to settle their water rights claims. In some cases, the BIA has been given a role in assisting tribes to implement a water rights settlement.

The source of American Indian water rights is found in the 1908 Supreme Court decision of *Winters v. United States* (207 U.S. 564 [1908]), which held that the creation of the Fort Belknap Indian Reservation in Montana under a treaty entered into in 1888 by necessity implied the reservation of sufficient water rights to fulfill the purposes of the reservation.

A water right granted to a tribe under the Winters Doctrine is given a priority date no later than the time when the reservation was established and, unlike water rights permitted, licensed or adjudicated under State statutes, such rights under the Winters Doctrine cannot be lost through nonuse (Reclamation 2006b). According to McCarthy (2004):

> The Arizona Supreme Court has concluded that Federal reserved rights apply to both surface and subsurface sources of water, and that Federal reserved rights enjoy greater protection from groundwater pumping than do state water rights. (195 Ariz. 411, 422, 989 P.2d 750 (1999). The Wyoming Supreme Court had earlier declined to apply Winters rights to groundwater (753 P.2d 76, 99-100 [Wyoming 1988]). It is likely that the Supreme Court will ultimately decide this question.

The BIA's trust responsibilities include the approval of right-of-way grants across American Indian lands (25 CFR Part 169, "Rights-of-way over Indian Land").

3.13.2 Indian Trust Assets Within the Affected Environment

3.13.2.1 Minerals

The Kayenta and Black Mesa mining operations are located on leased land within the boundaries of the Hopi and Navajo Reservations near Kayenta in Navajo County (refer to Map 1-2). All of the coal produced from these mining operations is an Indian trust asset and is produced subject to one of three coal-mining leases, which set forth such items as land rental rates, royalty rates for the coal, other fees, and additional terms. The leases, which have been amended many times over the years, are not a part of the LOM revision permit application.

One lease covers the 24,858 acres of the northern portion of the Kayenta and Black Mesa mining operations, where the Navajo Nation holds both surface and mineral land ownership. In 1964, that lease, No. 14-20-0603-8580, was approved by the Navajo Nation Tribal Council, executed by the Navajo Nation, and approved by the Secretary of the Interior.

The other two leases, approved by the Hopi Tribe and Navajo Nation in 1966, cover the southern portion of the Kayenta and Black Mesa mining operations, where the tribes have joint and equal interests in the minerals that underlie the former Joint Use Area. Lease No. 14-20-0603-9910 was approved by the Navajo Nation Tribal Council and executed by the Navajo Nation and approved by the Secretary of the Interior. Lease No.14-20-0450-5743 was executed by the Hopi Tribe and approved by the BIA**.**

The surface of the southern portion of the leasehold has been partitioned. Approximately 33,863 surface acres are in Navajo Nation ownership, while 6,137 surface acres are in Hopi Tribe ownership (Peabody 2002b).

3.13.2.2 Land

Infrastructure of the existing Black Mesa Complex occupies land that is an Indian tribal asset. BMPI holds two leases, one with the Hopi Tribe and the other with the Navajo Nation, for the 40-acre parcel occupied by its coal-slurry preparation plant. Other rights-of-way and easements contain the overland conveyor, Black Mesa and Lake Powell Railroad loading site, railroad, and power lines, for a total of 362 acres. BMPI holds two leases, one with the Hopi Tribe and the other with the Navajo Nation, for the 40-acre parcel occupied by BMPI's coal-slurry preparation plant.

A substantial portion of the rights-of-way connected to the existing components of the Black Mesa Project are on the Hopi and Navajo Reservations. The existing coal-slurry pipeline, with a 50-foot-wide permanent right-of-way, crosses approximately 35 miles of the Hopi Reservation (occupying 212 acres) and 61 miles of the Navajo Reservation (occupying 370 acres).

3.13.2.3 Water

Rights to the surface water and groundwater associated with the Hopi and Navajo Reservations are Indian trust assets of the Hopi Tribe and Navajo Nation. Section 3.4 provides a description of the water resources related to the Black Mesa Project and the current patterns of use of those water resources.

The Little Colorado River watershed comprises all of the existing Black Mesa Project components. The Hopi Tribe and the Navajo Nation claim water Indian trust assets as parties to the Little Colorado River water rights litigation entitled, "In re: The General Adjudication of all Right to use of water in the Little Colorado River System and Source (Nos. 6417-033-9055 and 6417-033-9066, Consolidated)." In the status hearing held May 12, 2006, on the Little Colorado River water rights litigation case, representatives of the Hopi Tribe and the Navajo Nation indicated ongoing negotiations concerning both groundwater and surface water rights (Superior Court of the State of Arizona 2006).

3.13.2.4 Hunting and Gathering and Other Natural Resources

The Hopi Tribe and the Navajo Nation have rights to carry on hunting and gathering, grazing, and traditional uses on the reservations. Ongoing activities of hunting and gathering, grazing, and traditional uses are described other sections (e.g., Sections 3.9 and 3.10).

3.14 NOISE AND VIBRATION

Sound is created when an object vibrates and radiates part of its energy as acoustic pressure or waves through air, water, or a solid object. Noise is defined as unwanted or undesirable sound. Sound pressure levels are expressed in units called decibels (dB). Since the human ear does not respond equally to all sound frequencies (or pitches), sound levels may be adjusted, or weighted, to correspond to the frequency-response range of human hearing and the human perception of loudness. Frequencies to which the human ear does not respond are filtered out when measuring and modeling noise levels. The A-weighted decibel (dBA) is the basic unit of sound used to describe the human response to noise from industrial and transportation sources. Decibels are measured using a logarithmic scale. Because of this, sound levels cannot be added or subtracted directly. An increase (or decrease) in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the loudness. Sound levels of typical noise sources and noise environments are presented in Table 3-46.

Table 3-46 Sound Levels of Typical Noise Sources and Noise Environments

Noise Source or Environment	A-Weighted Sound Level (decibels)	Human Judgment of Noise Loudness
Shotgun blast in close range Jackhammer in close range	130	
Thunderclap Commercial jet take-off (200 feet away)	120	Threshold of pain
Motorcycle (25 feet) Propeller plane fly-over (1,000 feet) Diesel truck, 40 miles per hour (50 feet)	90	Loud
Passenger car, 65 miles per hour (25 feet) Vacuum cleaner (3 feet)	70	Moderately loud
Normal conversation (5 feet)	60	Comfortable
Bird calls (distant)	40	Quiet
Soft whisper (5 feet) Quiet bedroom	30	Audible
Normal breathing (0 feet) Rustle of leaves in the wind	10	Very faint
Normal breathing (5 feet)	0	Threshold of human hearing

SOURCE: URS Corporation 2003

Although the A-weighted sound level may indicate adequately the level of environmental noise at any instant in time, community noise levels vary continuously and include a mixture of noise from various sources. To account for this variation, a single descriptor called the equivalent sound level (L_{eq}) is used. L_{eq} is the average A-weighted sound level during a specific time interval. One of the most common intervals is a 24-hour day. This noise descriptor is called the day-night average equivalent noise level, or L_{dn}. L_{dn} includes a 10 dBA penalty applied to sound levels in the nighttime hours (10:00 p.m. to 7:00 a.m.) to compensate for people's increased sensitivity to noise during this period. The L_{dn} is used by agencies such as the U.S. Department of Housing and Urban Development, Federal Aviation Administration, and Federal Transit Administration. The U.S. Department of Housing and Urban Development considers exterior noise levels of 65 L_{dn} or less acceptable for new housing construction. This study will use applicable noise-impact criteria established by regulatory agencies to estimate project impacts.

Low-frequency vibrations are normally felt rather than heard. Vibrations may occur as heavy equipment or trucks travel through an area or, more importantly for this project, from blasting. Blasting is used as part of the mining operations to fragment material for excavation and transport. The three major adverse effects of blasting are flyrock, air blast, and ground motion. Each of these effects is described below.

Other energy liberated from the blast is converted into vibrations as either ground motion or air overpressure (air blast). Ground motion is the principal vibration that will result from blasting, though air blast may be more noticeable because of the accompanying noise effects. Like other noises, air blast is measured in decibels; however, because the overpressure is normally at low frequencies and may be felt more than heard, measurements are not A-weighted like other noises. Instead, a flat or linear weighting is used. Ground motion is a wave motion spreading outwards from the blast, like ripples spreading outwards after a stone is dropped into water. This ground motion is measured as peak particle velocity and is used as an indicator of possible blast damage. No noise measurements or detailed field reconnaissance were conducted to measure existing noise sources or noise levels in sensitive areas. Precise data on existing noise sources (type, number, locations, operating times, etc.) were not generally available at the time of this study. Therefore, assumed sound levels were based on sound levels typically associated with identified noise sources and types of land use settings. Typical source noise levels used for estimating existing noise conditions in the study area are given in Table 3-47.

Table 3-47 Source Noise Used for Estimating Existing Noise Levels[1]

	Noise Source	Source-to-Receiver Distance (feet)	Noise Exposure Estimates[1]
Mining and excavation-related noise sources	Bucket loader	50	89
	Haul trucks (100 tons)	50	88
	Ore trucks (tractor-trailer)	50	88
	Water truck	50	91
	Front end loader	50	80
		300	70
	Fork lift	50	73
	Dozer	50	92
		300	77
	Rock drill	50	95
	Dragline crane	50	88
		300	73
	Scraper	50	92
		300	77
	Pumps	50	71
	Generators	50	83
	Compressors	50	86
Traffic-related noise sources	Interstate highway[2]	50	75
		200	65
		800 and up	50
	Roadways[3]	50	70
		200	60
		400 and up	50
	Electric railroad[4]	50	70
	Railroad lines[5]	30	75
		240	60
		800 and up	45

SOURCES: Mining sources – Minor, Michael & Associates 2000
Transportation sources – Harris, Miller, Miller & Hanson Inc. 1995

NOTES: [1]All noise exposure estimates are based upon typical highway or vehicle operation. Railroad noise levels are described in day-night average sound level; all others are in equivalent noise level daytime.
[2]Highways with four or more lanes that permit trucks, with traffic at 60 miles per hour.
[3]Roads with traffic at 55 miles per hour, but without trucks.
[4]Typical for Black Mesa and Lake Powell electric-railroad operations.
[5]Main-line railroad corridors typically carrying 5 to 10 trains per day at speeds of 30 to 40 miles per hour.

The region of influence is the geographic area that could potentially be affected by changes in noise or vibration levels due to this project; it varies for different project components. For example, the region of influence where new or increased blasting at the mines is proposed may extend up to several miles from the source. However, the region of influence for less intensive noise and vibration sources, such as coal-slurry pipeline booster pumps or traffic, would be a few hundred feet or less. Noise impacts occur only where there are people or animals (noise-sensitive receptors) to hear it. Therefore, the region of influence for any noise impacts is directly related to the location of the receptors.

Existing ambient or environmental noise is generally a composite of noise from a wide variety of natural and manmade sources (including natural sounds, local and distant transportation and industrial sounds, and sounds from local residential sources). Some land uses are considered sensitive to noise. Noise-sensitive receptors are land uses associated with indoor and outdoor activities that may be subject to stress or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, schools, churches, and libraries. Sensitive receptors in the study area were identified as part of the land use studies.

In general, the study area is very rural, sparsely populated, or uninhabited. However, dispersed noise receptors—people or animals—or sensitive areas such as individual or clustered homes, mobile homes, or other noise-sensitive land uses are present in some areas. Due to the absence of significant noise sources in the region, the ambient noise level throughout much of the study area is probably less than 50 dBA during daytime hours and 30 dBA at night. OSM's 1990 EIS estimated baseline background sound levels within the Black Mesa lease area as 33 to 43 L_{dn}. Typical noise sources would be jet planes overhead, off-road vehicles, barking dogs, and wind, and this environment generally would be considered comfortable to quiet.

Structures may be subject to damage by vibrations from blasting, or equipment and heavy truck operations. Of particular interest would be structures determined to be of historical importance or those with unique construction that might make them particularly susceptible to damage from vibrations. According to the cultural resources investigations conducted for this project, no such structures have been identified within the area of impact.

The discussions that follow:

- Describe the location, operation, and other important features of project components
- Determine noise sources not associated with the project
- Identify noise-sensitive receptors and describe their distance and direction from project components and other noise sources
- Estimate existing sound levels based on identified noise sources and proximity to sensitive receptors
- Describe the existing noise environment

For locations of sensitive receptors (e.g., residences, community areas, recreational areas), refer to Section 3.9.

3.14.1 Black Mesa Complex

Noise-sensitive receptors include residences within and outside the Black Mesa Complex. As mining progresses over time, all residences within the mining operations area would be relocated. Currently, there are approximately 68 residences dispersed throughout the lease boundary. Of the 50 residences closest to the Kayenta mining operation, there are two main clusters: one located in the southern region, and one located in the east-central region, approximately 1 to 1.5 miles from the mining operations. This cluster is near the Black Mesa mining operation and consists of 18 homes that are dispersed throughout the area. More residences are located along the route of the proposed water-supply pipeline (the segment on the Black Mesa Complex). Residences outside the Black Mesa Complex consist of two clusters: one northwest of the lease area and one southwest. Receptors to the southwest are located near Indian Route 8034.

The existing noise environment in the vicinity of the mining operation and sensitive receptors is dominated by noise associated with mining operation, including coal processing, blasting, and hauling. Surface blasting is conducted on an average of twice daily during weekdays, from sunrise to sunset and is conducted at 0.5 mile from any residence or occupied dwelling. Blasting must abide by the standards set forth in 30 CFR 816.67, which states that overpeak sound-pressure levels cannot exceed 133 dB. Warning and all-clear signals audible for at least 0.5 mile are sounded before and after blasting. Except for emergency situations, blasting occurs according to a schedule that is published annually in a newspaper with general circulation in the mining area. Additionally, blasting schedules are delivered to all individuals living within the permit area and within 0.5 mile outside the permit area. After the coal has been blasted, the pieces are loaded into trucks using excavation equipment. Two types of coal hauling are performed: on-site coal hauling and site-to-site coal hauling. Trucks perform on-site hauling and are a large source of traffic noise. The electric railroad performs site-to-site transportation from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona. The coal bound for the Navajo Generating Station is loaded at this point just west of the intersection of Indian Route 41 and U.S. Highway 160. From about 50 feet away, typical electric-railroad noise levels are approximately 70 dBA and truck noise levels are 88 dBA.

Flyrock is rock that is ejected into the air or along the ground from a blast. Flyrock is controlled by the blasting design and by limiting access in the vicinity of the blast. The Federal regulation at 30 CFR 816.67(c) prohibits flyrock from being cast more than one-half the distance to the nearest dwelling, beyond the area of control [required under 30 CFR 816.66(c)], or beyond the permit boundary.

Air blast is regulated to a maximum level in dB at a particular frequency of sound. The limit established at any residence near the Kayenta and Black Mesa mining operations is 133 dB at 2 hertz or lower frequency. Ground motion is measured normally at residences near the Kayenta and Black Mesa mining operations, where seismographs record levels of particle velocities of 0.5 inches per second or higher.

The coal-haul roads associated with the Black Mesa mining operation converge upon the coal-slurry preparation plant site, which includes a pump station. This plant is 0.75 mile away from the closest sensitive receptor and has a projected noise level of 88 dBA at 50 feet due to haul-truck noise during operation, resulting in daytime noise levels at receptors of approximately 45 to 55 dBA, punctuated with occasional audible noise from blasting activity.

Noise sources not associated with the mining operation that contribute to the overall noise environment include the following:

- An aircraft facility within the Black Mesa Complex, north of the Peabody office facilities, that is 1 mile away from the closest noise-sensitive receptor
- Indian Route 41
- Indian Route 8034

Typical operations and resulting noise-level contributions of the aircraft facilities are not known at this time. Indian Route 41 has two homes directly adjacent to it (within 0.1 mile) with a presumed noise level at these sensitive receptors of 50 dBA during daytime hours. Indian Route 8034 is approximately 2.5 miles away from the closest identified sensitive receptor and likely is not making a significant contribution to noise levels perceived by that receptor.

Based on the noise sources described, existing sound levels at sensitive receptors are expected to range from 45 dBA to 50 dBA for typical daytime noise levels, punctuated with occasional audible sounds from blasting activity. Noise levels due to aircraft-facility operations are unknown at this time. Peabody has regular flights scheduled in the morning and evening unless there is inclement weather.

OSM Permanent Regulatory Program Sections 816.61-68 and 817.61-68, as published in the Federal Register on March 8, 1983, were designed to protect the general public from adverse effects of surface mining, including blasting. These OSM regulations were designed to fulfill the intent of Congress in the

Surface Mining Act to prevent (1) injury to persons; (2) damage to public and private property outside the permit area; (3) adverse impacts on any underground mine; and (4) change in the course, channel or availability of ground or surface water outside the permit area. OSM developed the Blasting Guidance Manual to assist in compliance with the Act. All permitted mining activity must comply with these OSM regulations.

Peabody has conducted a continuous ground-vibration and air-overpressure monitoring program since 1994. Peabody submitted monthly blasting reports to OSM that contain seismographic data including all ground-motion and air-overpressure records. Monitoring levels for ground movement and air overpressure have complied with OSM regulatory requirements since monitoring began; therefore, air blast and vibration impacts from the mining operation have not exceeded established OSM limits.

3.14.2 Coal-Slurry Pipeline

3.14.2.1 Coal-Slurry Pipeline: Existing Route

The majority of the land traversed by the existing pipeline (which currently is not operational) is rural or undeveloped. However, there are dispersed residences located within 250 feet of the pipeline at 19 locations throughout the route, which also traverses the Kingman area through a rapidly developing suburban area of Kingman. Urban land uses also are near Seligman, Golden Valley, Bullhead City, and Laughlin.

The pipeline structures in the study area are typically located underground except for pump stations, which are housed inside buildings. Existing noise sources include the coal-slurry-pipeline pump stations, I-40, other local roads, the BNSF rail line, and commercial and industrial facilities.

Noise environments along the existing pipeline route likely include the following:

- Quiet, rural settings with sound levels of 45 to 50 dBA where noise sources such as roads are 1 mile or more away
- 55 dBA areas where roads are less than 1 mile away
- 65 dBA areas due to a combination of noises such as traffic and industrial uses for receptors less than 0.5 mile away, possibly ranging up to 75 dBA at the closest receptors, depending on the nature of industrial activities
- 70 to 75 dBA areas where receptors are within about 0.5 mile of the railroad, and where there are both roads and railroad
- Areas at more than 75 dBA, where for receptors are in proximity to both I-40 and the railroad

Vibration would be an issue only near transportation sources. According to the Federal Transit Administration (Harris et al. 1995), roadway vibrations are normally not an issue for residences 50 feet or more from roadway rights-of-way; therefore, residences near the study area roadways would notice noise much more than vibration effects. According to Federal Transit Administration's screening criteria (Harris et al.1995), only residences within 200 feet of the right-of-way of a railroad carrying diesel locomotives may be potentially impacted by vibration.

3.14.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

Along the Kingman reroute, there is a community near the reroute between CSP Mileposts 4 and 7 that is mainly commercial with some residential uses. Sensitive receptors include three residences north of this section. Noise sources at this location include a power substation, the Kingman Airport, and an industrial park to the north. Noise levels are 55 to 65 dBA L_{dn}. Four residences occur between reroute CSP Mileposts 14 and 16. Noise sources here include the BNSF rail line, the parallel I-40, and industrial land uses. The closest sensitive receptor is approximately 0.25 mile away from the industrial area and 0.5 mile away from I-40 and the railroad. The L_{dn} at the closest sensitive receptors is estimated at 45 to 60 dBA depending on the nature of the industrial activity.

Vibration issues are the same as discussed above in Section 3.14.2.1.

3.14.3 Water Supply

3.14.3.1 C Aquifer Water-Supply System

3.14.3.1.1 Well Field

The well field study area includes the C-aquifer well field and the first 14 miles of the water-supply pipeline. The well field site area is primarily rural in character. There are approximately 90 residences inside the well field study area and surrounding vicinity. Approximately 30 of these residences are within the study area, with an additional 10 residences on the periphery of the boundary (within 0.5 mile). The community of Leupp, with approximately 50 residences, is situated 2.5 miles north of the study area. In addition, the Canyon Diablo Railroad ghost town is of historical significance and may be considered a sensitive receptor.

Several transportation noise sources are present within the area, including the BNSF rail line that passes the study area to the south, I-40, State Route 99, and several connecting roads. Additionally, there may be transformer noise associated with a power substation to the south adjacent to I-40 and a utility approximately 0.25 mile west of WSP Milepost 11.

Noise levels at the residences in the well field study area located along State Route 99 are, at most, 70 dBA. Sensitive receptors in the general area of the well field probably experience an L_{dn} of about 50 dBA. Residences in Leupp are exposed to an approximate L_{dn} of 70 dBA. Residences next to the railroad tracks would have an approximate L_{dn} of 75 dBA.

Vibration would be an issue only near transportation sources. According to the Federal Transit Authority's screening criteria (Harris et al. 1995), only residences within 200 feet of the BNSF tracks may be potentially affected by vibration.

3.14.3.1.2 C Aquifer Water-Supply Pipeline

3.14.3.1.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

The water-supply pipeline would originate in the well field, and the existing noise environment up to WSP Milepost 14 would be as discussed in the previous section.

Though the entire area is rural in character, with active agricultural land uses in some portions, there are noise-sensitive receptors in the vicinity of most of the pipeline route. With few exceptions these are residences, some dispersed and some clustered. The pipeline would pass within 250 feet of residences in 11 locations. There is also a church and cemetery in Leupp that would be within 250 feet of the route. Schools in Leupp would be located at least 500 feet from the route. Existing noise sources in the area are limited to roads and an industrial facility near Tonalea.

The west Kykotsmovi subalternative would traverse the more populated area of Kykotsmovi. The route would pass within 500 feet of residential, commercial, and institutional facilities (e.g., school, hospital), multiple times. This setting was not inventoried for a specific number of receptors. Existing sound levels, accounting for commercial operations and local roads and street traffic, are estimated at 45 to 50 dBA.

The east Kykotsmovi subalternative would pass within 500 feet of some residences (fewer than the west Kykotsmovi subalternative) and commercial facilities, but beyond 500 feet of the school and the hospital. The pipeline also would cross under high-voltage power lines multiple times.

No noise measurements were taken as part of this study, but based on data from similar settings as well as professional judgment, existing sound levels along the pipeline alternative routes were estimated by identifying the locations of noise sources and the proximity of sensitive receptors. Noise environments likely include the following:

- Quiet, rural settings with sound levels of 45 to 50 dBA where noise sources such as roads are 1 mile or more away
- 55 dBA areas where roads are less than 1 mile away
- 65 dBA areas due to a combination of noises such as traffic and industrial uses for receptors less than 0.5 mile away, possibly ranging up to 75 dBA for the closest receptors, depending on the nature of industrial activities

Vibration would be an issue only near transportation sources, and only to residences within 50 feet of a roadway.

3.14.3.1.2.2 C Aquifer Water-Supply Pipeline Alignment: Western Route

The Western Route is the same as the Eastern Route until WSP Milepost 27, where it would deviate to the west. Only about half of the route is in proximity to noise-sensitive receptors. The other half would pass residential development in 13 locations.

The route would pass schools at Leupp and Tonalea and the church at Leupp (mentioned above in Section 3.14.3.2.1) at a distance beyond 500 feet. Existing noise sources include limited commercial uses and roads. The entire area is rural in character.

Background noise levels along the northern portion of the Western Route are estimated to be higher than those along the Eastern Route. Residences in the northern portion of the Western Route are located primarily adjacent to U.S. Highway 160 and the Black Mesa and Lake Powell Railroad; therefore, noise levels in this area could be expected to reach the 70 to 75 dBA level.

Noise environments likely include the following:

- Quiet, rural settings with sound levels of 45 to 50 dBA where noise sources such as roads are 1 mile or more away
- 55 dBA areas where roads are less than 1 mile away
- 45 to 60 dBA areas where residences are about 1 mile from apparent mining/extraction operations north of Leupp
- 70 to 75 dBA areas where receptors are within about 0.5 mile of the railroad, and where there are both roads and the railroad
- 60 to 70 dBA areas near the Kayenta mining operation conveyor and railroad

Vibration would be an issue only to residences within 50 feet of a roadway.

3.15 VISUAL RESOURCES

The visual resource inventory describes current visual conditions and includes an evaluation of existing visual conditions such as landscape character, scenic quality, and visual sensitivity. The BLM and Forest Service—as land-management agencies typically concerned with visual resources—have developed objective methodologies to assess the scenic quality of landscapes to help determine a project's visual impact on the surrounding environment. These methodologies were used for Federal land, and were borrowed for use in assessing landscapes outside areas where formal guidelines apply. Visual classes derived from the BLM's Visual Resource Management Inventory and Contrast Rating system (VRM) (BLM 1986) and Forest Service Scenery Management System (Forest Service 1995) were used to develop a consistent description of the scenic quality of the natural landscapes within the study area and a class was created for developed land (summarized in Appendix I and Map 3-18). The following description is a composite of separate components of visual resources:

- Scenic Quality Class A—Unique land of outstanding or distinctive diversity or interest, such as high relief mountains, escarpments, highly dissected canyons, monumental landforms, and scenic riverways
- Scenic Quality Class B—Land of common or average diversity of interest, consisting of rolling vegetated hills and valleys, mesas, and buttes
- Scenic Quality Class C—Highly common land and/or land of minimal diversity or interest, such as high desert plateaus or desert basin areas
- Scenic Quality Class D—Landscapes that have a modified appearance and that exhibit manmade modifications as a result of development, including residential, commercial, and industrial land uses

Viewpoints and project visibility were also an important part of the analysis, as well as a determination of the sensitivity of the viewers. Viewer sensitivity is a measure of the degree of concern about change in the visual character of a landscape. By assessing the types of viewers (e.g., recreational hikers in remote areas or residents that see the project from their houses—both viewers of high sensitivity), the land uses on land facing a project (e.g., natural recreation areas or residences), the volume (or numbers) of viewers, the duration of time spent looking at a view, and finally, the influence of adjacent land use on the view (e.g., the presence of an existing industrial facility within the viewshed) were determined.

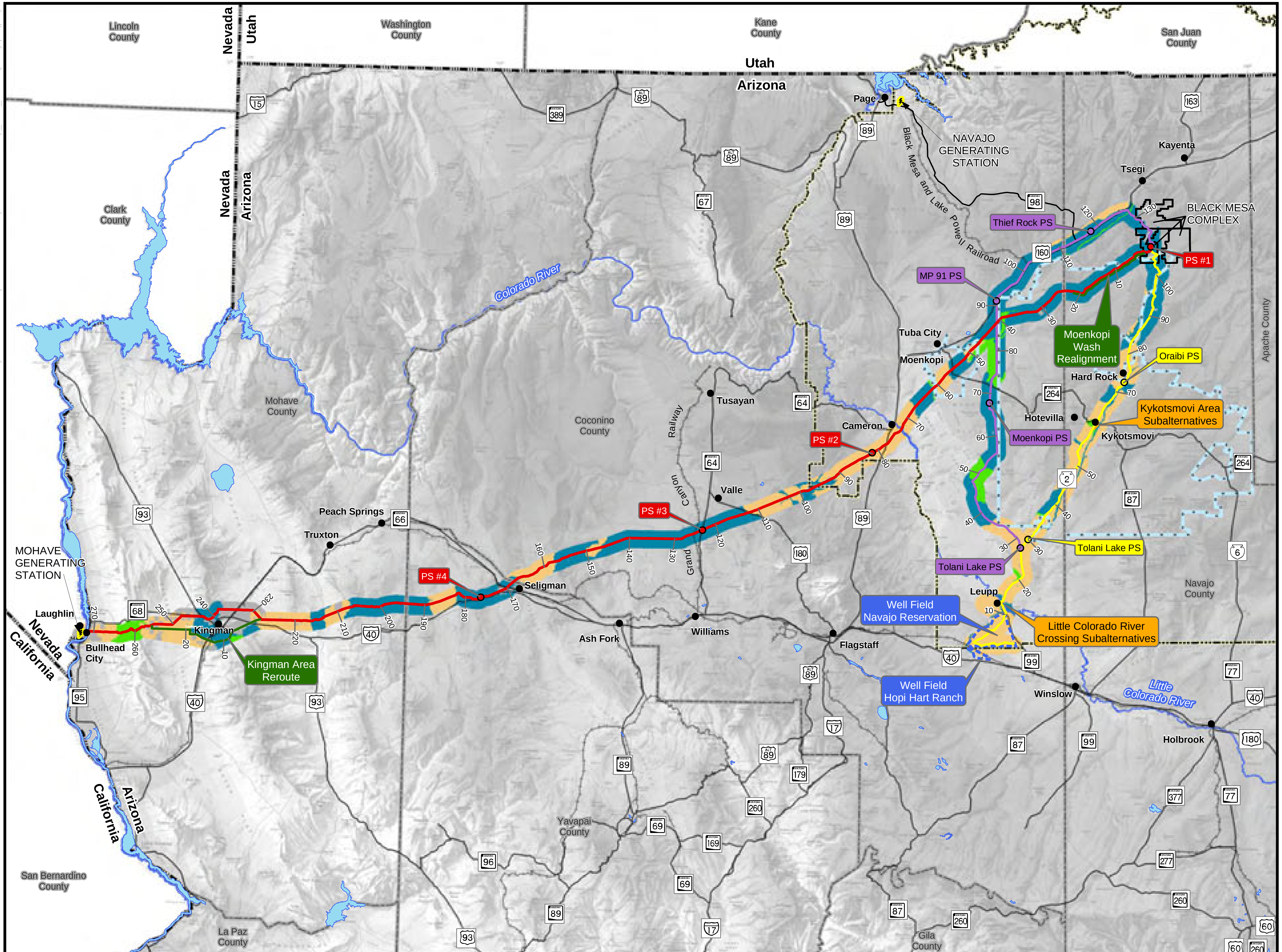
Viewing distances also were considered. The following distance zones, derived from BLM methodology, are based on visual perception thresholds of the basic design elements: form, line, texture, and color. For example, as distance increases, details become less apparent and the elements of form and line become more dominant than color or texture. These distance zones or thresholds are defined based on relative visibility from travel routes or observation points within the study area as noted in Table 3-48.

Table 3-48 Distance Zone Definitions

Distance Zone	Distance (in miles)	Description
Immediate foreground	0 to 0.25	Details are obvious. Texture and other aesthetic qualities of vegetation are normally perceived within this zone.
Foreground	0.25 to 0.50	Landform details are still perceptible but to a lesser degree.
Middleground	0.5 to 1	Foliage and fine textures cease to be perceptible. Vegetation begins to appear as outlines or patterns.
Background	1 to 2	Texture and color are weak, and landform becomes the most dominant element.
Seldom seen	Beyond 2	Topographic relief or vegetative screening obstructs views, or distances are beyond 2 miles.

Map 3-18
Scenic Quality

Black Mesa Project EIS



LEGEND

Scenic Quality
- Class A
- Class B
- Class C
- Developed

Project Features
Black Mesa Complex
- Peabody Lease Area

Alternative A Coal-Slurry System
- Existing Route
- Realignment

Alternative A Water-Supply System
- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features
- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCE:
URS Corporation 1996, 2004, 2005

N

November 2008

0 20 40
Miles

Prepared By:
URS

For the purpose of describing existing conditions as a baseline for assessing potential effects from project actions, the visual region of influence is defined as the area wherein potential undesirable visual effects from construction, operation, and maintenance of the proposed project may be discerned. A 4-mile-wide study corridor, 2 miles on each side of the reference centerline, was used to inventory visual resources as it represents an approximate threshold for moderate to high visual impacts. In special locations identified by cooperating agencies, resources were studied beyond 2 miles. The visual region of influence includes a diverse range of largely undeveloped, natural landscapes. These landscapes are generally vast and expansive, permitting extensive views of undisturbed land. Developed areas include small villages, towns, and communities, and a few areas of major development such as Kingman, Seligman, and Bullhead City, Arizona.

Developed areas include communities, rural residences, agricultural land and ranches, mines and coal mining facilities, and other utility facilities. Communities ranging in size from modest-sized towns to small rural establishments and suburban environments were identified within the study corridors. Communities close to the study area corridor include Leupp, Kykotsmovi, Seligman, Kingman, and Bullhead City, Arizona; and Laughlin, Nevada. The eastern end of the study area crosses the Hopi and Navajo Reservations. Dispersed agricultural activity occurs throughout the Hopi Reservation in washes and along the smaller drainages.

The study area was characterized using physiographic provinces, or geomorphic regions that are broad-scale subdivisions based on terrain texture, rock type, and geologic structure and history. The Black Mesa study area is contained within two major physiographic provinces, Basin and Range and Colorado Plateau (and a transition zone between the two), which exhibit several unique landscape settings and viewing conditions. The Basin and Range province is distinguished by isolated, roughly parallel, north-south trending mountain ranges separated by closed (undrained) desert basins. The Colorado Plateau's major distinguishing features are landforms cut by wind and water erosion from the largely horizontal strata and the relatively high elevations of this province (Fenneman 1931).

Several different and unique landscape character types are evident throughout the two primary physiographic provinces (as described in the Forest Service's manual, Landscape Character Types of the National Forests of Arizona and New Mexico: the Visual Management System). These were used to define five basic landscape character types within the study area: Navajo, Flagstaff, Grand Canyon, Tonto, and Mohave.

The Navajo landscape type, described as an area of young plateaus with broad open valleys, composes a large portion of the study area, including landscapes near Leupp and Cameron. Horizontal sandstone beds, eroded tablelands, cuestas, rock terraces, receding escarpments, shallow canyons, rolling desert plains, and dry washes are all characteristic of this landscape. Vegetation within this landscape is typically sparse and consists of piñon/juniper woodlands, plains grassland, salt brush, and sagebrush; bare soil and rock are common.

The Flagstaff landscape type is characterized as an undissected plateau containing extensive lava flows and volcanic cones. This type is evident in landscapes roughly west of Cameron to Seligman, Arizona. Vegetation is predominantly coniferous forest (montane conifer), mountain meadow grassland, plains grassland, and piñon/juniper woodland. Dry washes, riparian deciduous forests, and woodlands are common along watercourses.

The Grand Canyon landscape type is described as an area of high plateaus trenched by the Colorado River to form the Grand Canyon. This type is divided into two subtypes, plateaus and canyons, because of their physiographic differences. Plateaus are characterized as desert or forested plateaus, bisected by washes. The Hualapai and Coconino plateaus west of Seligman belong to the plateau subtype.

The Tonto landscape type encompasses the area between the Mogollon Escarpment and the Gila River. Generally, the landscape varies from desert plains and hills to forested plateaus and mountains. This type has two general subtypes, Sonoran Arizona Uplands and Upper Tonto, because of differences in physiography and vegetation. A section of the study area corridor west of Seligman is located within the Upper Tonto landscape and is characterized by some tilted fault block and dissected mountains. The area consists of primarily tablelands that have been carved from an extensive plateau. At higher elevations the dominant vegetation is coniferous forest. At lower elevations there is a prevalence of the piñon/juniper woodlands and isolated occurrences of oak woodlands, plains grassland, and desert grassland.

The Mohave landscape type, described as flat plains broken up by the Colorado River Valley and small ranges of tilted fault-block mountains, is found in western Arizona and southern Nevada. This type can be jagged, with steeply sloped escarpments, bare rock with sharp ridges, and V-shaped ravines, or conversely, gentle dipping slopes. The vegetation is typically open with bare soil, or desert pavement (caliche) and bare rock with creosotebush. Piñon/juniper woodlands are prevalent near foothills and mountains. Most land of the Mohave landscape character type has dry washes that drain to basins. The Colorado River, however, is a swiftly flowing river in a canyon varying in depth and remains the only perennial watercourse in the Mohave region. The study area corridor traverses the Mohave region at the western end of the coal-slurry corridor from Kingman, Arizona, to Laughlin, Nevada.

3.15.1 Black Mesa Complex

The Black Mesa Complex is located in the northern portion of the Navajo landscape type in an area characterized by rolling piñon/juniper woodlands, rock outcroppings, reclaimed mining land, and operational open pit mines (Table I-2 in Appendix I). The complex is located atop the Black Mesa, a major geographic feature of the Colorado Plateau. This extensive plateau rises to about 8,200 feet above MSL at its highest point. Reclamation from mining activities has transformed a large portion of the mesa from piñon/juniper to grassland. Several residences are located within the Black Mesa Complex. Depending on orientation, screening, and distance, the residents view active mine operations, swaths of reclaimed land, and/or natural landscapes. Ongoing mining operations are visible from some residences. New mining areas and facilities would be adjacent to existing mining areas and facilities and disturbed areas (e.g., mine pits, buildings, and roads).

The coal-slurry preparation plant, which currently is not operating, is located in the western part of the Black Mesa Complex, and the proposed coal-washing facility would be located nearby. The proposed coal-haul road would pass between the western and eastern legs of Black Mesa Complex. The viewing conditions and the potential viewers of the proposed facilities would be the same as those described for Black Mesa Complex.

3.15.2 Coal-Slurry Pipeline

3.15.2.1 Coal-Slurry Pipeline: Existing Route

The existing pipeline route passes east to west through all five of the major landscape types, including areas of Navajo, Flagstaff, Grand Canyon Plateaus, Upper Tonto, and Mohave. Each possesses different characteristics of landform, vegetation, and water (Table I-3 in Appendix I).

Beginning at the Black Mesa mining operation and heading southwest, the existing pipeline route passes through the characteristic piñon/juniper woodlands of Black Mesa and crosses several washes, the most distinguished of which is the Moenkopi Wash. It traverses dissected, high desert plains, and significant landscape features such as Coal Mine Mesa, Tohnali Mesa, Adeii Eechii Cliffs, and Ward Terrace. After crossing the Little Colorado River, it continues southwest, along the southern end of Gray Mountain and the Little Colorado River Basin.

The Flagstaff and Grand Canyon Plateau landscapes were combined for analysis purposes because the pipeline crosses a relatively small portion of each. Within the Flagstaff landscape, the pipeline crosses piñon/juniper woodlands and grasslands with lava outcrops. As the existing route crosses Cataract Canyon and enters the Grand Canyon Plateau landscape, the landscape becomes a dense concentration of piñon/juniper woodlands and grassland. The pipeline passes just north of the town of Seligman where the Aubrey Cliffs are a distinctive landmark in the general vicinity of the pipeline corridor.

The route parallels I-40 for approximately 7 miles along Upper Tonto landscape, and then veers northwest through the foothills of the Juniper Mountains. The existing route passes through dissected plains and enters a landscape of rolling piñon/juniper woodlands, as well as traversing the Cottonwood Mountains. The landscape is characterized by extensive plateaus, tablelands including mesas and buttes, and canyons of moderate depth. Mountains are jagged, with sharp angular peaks, upturned edges, and tilted fault blocks.

The bajadas and foothills of the Cottonwood and Peacock Mountains, and the Hualapai Valley—all characteristic of the Mohave landscape—precede the corridor into the City of Kingman, Arizona. Near Kingman, the pipeline route crosses the Cerbat Mountains, and development ranges from urban to rural from Kingman through the Sacramento Valley to the Black Mountains. The route then drops to a lower elevation and traverses desert basin landscape with scattered desertscrub as it enters the developed areas of Bullhead City, Arizona, and Laughlin, Nevada, to terminate at the Mohave Generating Station.

Dispersed residential viewers are within viewing distance of the existing pipeline route at varying locations along the corridor. The pipeline alignment is characterized by exposed soil, cleared vegetation, and intermittent signage/pipeline markers.

Low-density residential pockets within the foreground distance occur along the pipeline outside the more densely populated areas. In developed areas such as Kingman, many residences are located close to the existing pipeline route, but have some to full visual screening of the route. In the rural, low-density residential areas southwest of Cameron, the pipeline maintenance road is in full view of residents within the immediate-foreground or foreground distance zone.

Designated scenic routes and routes providing access to scenic areas are in proximity to the coal-slurry pipeline. From Williams, Arizona, heading north to the Grand Canyon, State Route 64 and the Grand Canyon Scenic Railroad both cross the pipeline route several miles due south of Valle, Arizona. Just west of Seligman, the existing route runs parallel to I-40 for approximately 7 miles, as it heads west to Kingman, Arizona. Viewers expecting scenic landscapes often travel these routes. The existing pipeline route crosses historic Route 66.

Recreational viewing opportunities occur along the existing pipeline route in several areas where viewers may engage in motorized and nonmotorized recreational activities. The sensitivity of viewers towards the scenic quality of an area depends on the area as well as the type of activity. Hikers, for example, would perhaps have higher expectations for scenery than off-highway vehicle (OHV) recreationists where the vehicle, rather than the scene, is the focus. Cerbat Mountain recreation areas accommodate several different types of recreation, and have views of the existing route depending on the orientation and location of the viewer.

The existing pipeline route crosses approximately 5 miles of Forest Service land in the northwestern corner of Kaibab National Forest in the Williams Ranger District. The Forest Service manages this land to accommodate a moderate level of modification, given the existing natural setting has been modified, the scenic quality is defined as Class B, and there is a lack of sensitive viewers.

The existing route also crosses several areas of BLM-managed land. The Mount Nutt Wilderness and Black Mountains ACEC near the Black Mountains east of Laughlin, Nevada, are designated by BLM as VRM Class I and II landscapes, respectively, which receive the highest amount of protection against changes that would impact a landscape's scenic quality (BLM 1993). BLM-managed land in the Cerbat Foothills Recreation Area is also designated as VRM Class IV (refer to Map 3-18) (BLM 1986).

3.15.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

The Kingman reroute within the Mohave landscape would cross the foothills north of the Hualapai Mountains for approximately 12 miles and begin to enter the Sacramento Valley area as it runs west. Development is situated within mountains and foothills in this landscape in the eastern segment of the reroute. As the reroute continues west through the Sacramento Valley, desert basin grassland is host to scattered development (Table I-4 in Appendix I). The route would reconnect with the existing pipeline, as it enters the foothills of the Black Mountains. The Kingman reroute would pass through or adjacent to several residential areas within immediate-foreground-to-middleground distance zone from the following mileposts: Kingman reroute CSP Milepost 4 to 6, east of the Hualapai Mountains (within immediate-foreground-to-middleground viewing distances); Kingman reroute CSP Milepost 14 to 15, west of the Hualapai Mountains (0.5-mile south of the reroute); Kingman reroute SCP Milepost 15.5 to 16.5, a residential development (immediate-foreground views); and CSP Milepost 22 to 27 (immediate-foreground-to-middleground views) (refer to Map 3-18).

The Kingman reroute would pass through BLM land with the following VRM classifications: VRM Class IV landscapes (which allow high modification); VRM Class III landscapes (which allow nondominant modifications to the existing landscape); and two small segments of VRM Class II landscapes (which allows for low modification of the existing natural landscape). The Mount Nutt Wilderness and Black Mountains ACEC near the Black Mountains east of Laughlin, Nevada, are designated as VRM Class I and II landscapes, respectively, which receives the highest amount of protection against changes that would impact a landscape's scenic quality (BLM 1993).

3.15.3 C Aquifer Water-Supply System

3.15.3.1 Well Field

The well field area would be located within the Navajo landscape type. The immediate landscape is barren, with an exposed reddish-brown soil. Vegetation is minimal with occasional occurrence of desertscrub brush during seasons of high rainfall. Occasional outcroppings of rock offer some visual diversity (Table I-5 in Appendix I).

Several rural residences are dispersed within the well field area. The lack of vegetation and topographic relief within the well field area provides vast, unobstructed views with very little screening. Residential viewers at WSP Milepost 3, just east of WSP Mileposts 4 and 7, and at WSP Milepost 10 would have foreground-to-background views of the proposed project facilities. Existing visual disturbances such as windmills, existing wells, and water storage tanks are present within the landscape as part of previous modifications to the landscape.

3.15.3.2 C Aquifer Water-Supply Pipeline

3.15.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

The Eastern Route would be located entirely within a Navajo-type landscape (Table I-6 in Appendix I). The route would traverse washes, desert plateaus, mesas, and piñon/juniper woodlands typical of Navajo landscapes. The route would begin at the well field area and cross the Little Colorado River near the community of Leupp. The Little Colorado River creates a distinctive path of eroded edges, vegetative patterns, and sandy beds, and can be identified from long distances because of color and texture contrasts of vegetation, water, and sand. The Eastern Route also would parallel and cross some distinctive washes such as the Dinnebito and Oraibi Washes; these washes are typically dry drainages that run during high rainfall and provide stringers of vegetation and varying degrees of cut banks adding texture, color, and line elements to the landscape. To the east is the Painted Desert, characterized by its relatively colorful flat topography and subtle land changes such as small washes, sandy areas, and randomly occurring rugged terrain. Several mesas appear on the route as it runs north to the Black Mesa Complex. The Newberry, Garces, Second, Third, and Padilla Mesas feature varying degrees of mesa grassland, vegetation, and eroded cliffs and edges, providing contrasting colors and textures to the landscape.

The Eastern Route would pass residences located along the fringes of several communities, including Leupp, Kykotsmovi, and just east of Hard Rock. Dispersed rural residences in the area of the well field, along Indian Route 2, northeast of Newberry Mesa, east of the Many Bobcat Hills area, and within the Black Mesa Complex, also would be close to the route, and there are a few residences along the Oraibi and Dinnebito Washes and adjacent to Indian Routes 22 and 8029. Most of those residences would have views ranging from open to partially screened with immediate-foreground or foreground views of the proposed project facilities. The project would potentially be in view of several residences dispersed along the alignment within the middleground and background distance zones.

For the project, two potential 69kV power line corridors (north and south alternatives) and two substation locations have been identified west of the community of Leupp. The substations and power lines would draw power from a larger high-voltage power line and deliver it to the pump stations located along the pipeline. Once reaching the proposed pipeline, the 69kV line would travel south (to supply power to the well sites) and north (to possibly as far as WSP Milepost 73). The primary proposed pump stations would be located along the pipeline at approximately WSP Mileposts 30 and 73.

The Eastern Route would cross State Route 264 north of Kykotsomovi. The Navajo Transportation Plan (Navajo Nation Department of Transportation 2003) identifies this route as a high-sensitivity travel route; views from this route are typically panoramic of open desert plains and mesas. The Eastern Route also would be adjacent to existing moderate-sensitivity travel routes such as U.S. Highway 99 and Indian Routes 2, 22, 41, and 8029 for a large segment of the alignment. Scattered occurrences of distribution power lines are common along the transportation corridors and along secondary roads serving rural residences (Navajo Nation Department of Transportation 2003).

3.15.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

The Western Route is identical to the Eastern Route until it diverges to turn northwest across the Navajo Reservation at WSP Milepost 27. Continuing from there northwest along the top of Newberry Mesa, it then would descend into Dinnebito Wash and travel toward the distinctive natural landmarks of Ward Terrace, Red Rock Cliffs, Adeii Eechii Cliffs, Tohnali Mesa, and Coal Mine Mesa. Continuing north, it would cross an eroding terrace and several miles within three canyons (Begashibito, Coal Mine, and Ha Ho No Gey Canyon). The northern end of the Western Route would pass through desert plains and several valleys (Red Lake and Kletha Valley), and would traverse the Black Mesa escarpment across rolling piñon/juniper woodlands at the top of the mesa as it enters the Black Mesa Complex (Table I-7 in Appendix I).

The Western Route has potential to be viewed by a number of residential viewers. From the point of deviation from the Eastern Route at WSP Milepost 27, the Western Route would, for the next 18 miles, pass multiple rural and/or dispersed residences within immediate-foreground and foreground distance zones, with very little screening of the proposed project facilities. Additionally, dispersed residences along this segment are within foreground and middleground distance zones.

Some residences on the Moenkopi Plateau would be within the immediate-foreground distance zone of the route. As it continues north, the route would pass residences within the middleground to background distance zones, and farther north, heavy concentrations of residential development along U.S. Highway 160 (between WSP Mileposts 91.5 and 127) would be within the immediate-foreground-to-background distance zones. Turning southeast and entering the Black Mesa Complex, it would pass residences within the complex with partially screened middleground to background views, before terminating at the Black Mesa mining operation.

The Western Route would be in proximity to two designated high-sensitivity travel routes—State Route 264 and U.S. Highway 160. It would cross State Route 264 at approximately the western WSP Milepost 71.5 and parallel U.S. Highway 160 for nearly 40 miles to connect with the Black Mesa Complex. Views from these travel routes are generally open and panoramic (Navajo Nation Department of Transportation 2003).

3.16 TRANSPORTATION

The study area for transportation includes the Black Mesa Complex, proposed well field, and a 2-mile-wide study corridor (1 mile on each side of the reference centerline) along proposed linear facilities (the coal-slurry pipeline, water-supply pipeline routes).

Roads, railroads, airports, and airstrips serve the transportation needs of visitors and area residents, businesses, and industries. A broad regional surface transportation network stretches from the Hopi and Navajo Reservations and extends through northern Arizona to Laughlin. The two major transportation corridors intersected by the project are U.S. Highway 89 from Flagstaff to Page (two lanes with passing lanes) and the transcontinental east-west I-40 from Kingman to Winslow (four lanes, divided).

U.S. Highway 89 serves as a major road traveled by visitors to the popular Grand Canyon National Park. Primary transportation corridors in the study area, mainly two-lane roads, are presented in Table 3-49. Local community and access needs throughout the study area are met by American Indian reservation routes, BIA routes, State and county roads (i.e., secondary roads), and unimproved roads.

Table 3-49 Primary Transportation Corridors

Project Region	Transportation Corridor	Communities/Cities Connected by Transportation Corridor	Notes
Eastern	U.S. Highway 160	Tuba City to Kayenta	2 lanes
	Arizona Highway 264	Window Rock to Tuba City-Moenkopi	2 lanes
	Indian Reservation Route 2	Leupp to Kykotsmovi	2 lanes
	Arizona Highway 99	Leupp to Winslow	2 lanes
	Indian Route 4 “Turquoise Trail”	The northern terminus of Arizona Highway 87 at Second Mesa with the southern terminus of U.S. Highway 163 at Kayenta	2 lanes – only partially complete
	BIA 41	U.S. Highway 160 to Piñon, Arizona	2 lanes, partially unpaved
	Indian Route 6930	Canyon Diablo Historic Highway 99	2 lanes, unpaved
	Indian Route 4	State Route 264 at Second Mesa to Piñon, Arizona	2 lanes, does not cross proposed water-supply line
Eastern to western	Interstate 40	Holbrook to Needles	4 lanes
Central	U.S. Highway 89	Flagstaff to Page	2 lanes
	Arizona Highway 64	Williams to Tusayan to Cameron	2 lanes
	U.S. Highway 180	Flagstaff to Valle	2 lanes, designated scenic

Central and western	Historic Route 66	Ash Fork to Golden Shores	2 lanes, designated a historic route and a national backcountry byway
Western	U.S. Highway 93	Kingman to Hoover (Boulder) Dam	2 lanes
	Arizona Highway 68	Kingman to Laughlin	2 lanes
	Arizona Highway 95	Laughlin to Needles	2 lanes

NOTE: The table represents primary transportation corridors within northern Arizona regions. The Black Mesa Project does not cross all identified transportation corridors.
BIA = Bureau of Indian Affairs

The study area can be divided into three distinct regions: (1) the eastern region (the Hopi and Navajo Reservations and the land north of I-40 near Winslow), (2) the central region (including the towns of Seligman and Valle), and (3) the western region (including the incorporated cities of Kingman, Bullhead City, and Laughlin).

The partially completed “Turquoise Trail” (also called Indian Route 4) is located in the eastern region of the project area within northeastern Arizona on the Hopi and Navajo Reservations. This important roadway is intended to connect the existing northern terminus of Arizona Highway 87 at Second Mesa with the existing southern terminus of U.S. Highway 163 at Kayenta. When completed, the road will provide direct access to the Black Mesa Complex from the Hopi Reservation communities, allowing Hopi people direct access to the Peabody mining operation at the complex for employment (refer to Section 3.11). The trail also will serve as an access corridor for proposed rights-of-way, facilitate north-south travel on the eastern side of the reservation, and enhance the regional travel network (Hopi Office of Community Planning & Economic Development 2001). Funds were authorized in 2006 by the Federal Highway Administration to be distributed to ADOT to continue construction of the Turquoise Trail.

Railroads within the study area include the BNSF rail line (a major U.S. common carrier from Chicago to Los Angeles), the Grand Canyon excursion train, and the Black Mesa and Lake Powell Railroad that hauls coal to the Navajo Generating Station from the Kayenta mining operation.

Two airports near the study area are located in the Cities of Kingman and Bullhead City. The Kingman Airport is located in northeast Kingman and is classified as a commercial airport. Laughlin/Bullhead City International Airport is a full-service regional airport with daily flights across the country (Bullhead City 2002). It is located within northern Bullhead City and is classified as a non-hub primary commercial service airport (Bullhead City 2002). One active airstrip, Bedard Field, is located within Black Mesa Complex. There are also airfields and airstrips located near the study area in Cameron, Kingman, Kayenta, Tuba City, Leupp, Chinle, Shonto, Rocky Ridge, Piñon, Polacca, and Seligman. Heliports are located near medical facilities within the Cities of Kingman and Bullhead City.

3.16.1 Black Mesa Complex

Indian Route 41 provides access to the Black Mesa Complex. The route extends from the junction of Arizona Highway 564 and U.S. Highway 160, approximately 21 miles southwest of Kayenta, and enters the Black Mesa Complex from the west. It acts as the main transportation artery within the mine area, with connecting side roads granting access to all Black Mesa Complex facilities. Continuing southeastward, Indian Route 41 exits the Black Mesa Complex approximately 30 miles north of Piñon, Arizona (Peabody 1986). Other roads on the Black Mesa Complex serve as access for local residents (and for school buses). In winter months, Peabody plows snow from these roads as needed.

Peabody has constructed or upgraded both primary and ancillary roads within the Black Mesa Complex. The primary roads include coal-haul and mine-vehicle roads a minimum of 50 feet wide, and coal-haul, mine-vehicle, and dragline deadheading roads approximately 150 feet wide (OSM 1990). To gain access to mine facilities in remote sites, on-highway vehicles most frequently use ancillary roads. There are two types: two-lane roads a minimum of 24 feet wide, and single-lane roads with a minimum width of a bulldozer blade or a motor-grader blade. The single-lane roads usually follow the natural topography and were established by area residents prior to mining activities (OSM 1990). Transportation within the Black Mesa Complex also includes a conveyor-belt system and airstrip.

Approximately 592 acres on the Black Mesa Complex have been disturbed to accommodate coal-haul roads (OSM 1990). The coal-haul road, proposed as part of Alternative A, would be land outside the Black Mesa Complex to connect the J-23 coal-resource area with the initial program area of the Black Mesa Complex. The route would be within the Hopi Reservation.

The haul-road network within the Black Mesa Complex is broken into numerous segments; the present haul road network in the permanent program permit area of the Black Mesa Complex is 10 miles long, and the present haul road network in the initial program area of the Black Mesa Complex is about 8 miles long.

The Black Mesa and Lake Powell Railroad that hauls coal from the Kayenta mining operation to the Navajo Generating Station near Page, Arizona, is located west of the Black Mesa Complex and north of U.S. Highway 160.

The original airstrip facilities located on the Black Mesa Complex are abandoned (the Black Mesa Pipeline, Inc., airstrip). The existing airstrip on the Black Mesa Complex, Bedard Field, was constructed on reclaimed spoil in the J-3 area; this is the only active airstrip within the Black Mesa Complex. Facilities include a paved access road, a paved runway that extends approximately 7,500 feet long and 80 feet wide, a paved tie-down area, a parking area with storage buildings, and various other structures related to the airstrip. Access is provided to the proposed coal-washing facility site and the coal-slurry preparation plant (which currently is not in operation) through the road network on the Black Mesa Complex, as well as by Indian Route 8434 (south of the Black Mesa Complex).

3.16.2 Coal-Slurry Pipeline

3.16.2.1 Coal-Slurry Pipeline: Existing Route

The existing coal-slurry pipeline route crosses and parallels primary and secondary roads along its route from the Black Mesa Complex to Laughlin. A network of dispersed, unimproved roads provides access to remote houses and areas on the Hopi and Navajo Reservations. Larger cities, such as Kingman, Bullhead City, and Golden Valley, contain many highly traveled or local access roads that are crossed or paralleled by the route.

In the eastern region, within the Black Mesa Complex, the existing route crosses Indian Route 41 and, as the coal-slurry pipeline leaves the Black Mesa Complex, it crosses and parallels unimproved roads for several miles past the Black Mesa Complex. Indian routes paralleled and/or crossed by the existing route between CSP Mileposts 4 and 97 include Indian Route 6, Indian Route 6250, and Indian Route 6730, among many other unimproved roads.

In the central region, the existing pipeline route continues west from the Navajo Reservation and crosses U.S. Highway 180 as the highway leaves the Kaibab National Forest. The Kaibab National Forest portion of U.S. Highway 180 is considered scenic. After crossing U.S. Highway 180, the route parallels an unimproved access road through the forest for approximately 5 miles before leaving the forest. The existing pipeline route crosses Arizona Highway 64 near CSP Milepost 123. Continuing southwest, near Seligman in Yavapai County, Arizona (CSP Milepost 171), the existing pipeline route parallels the north side of I-40, a major east-west travel corridor. At CSP Milepost 178, the pipeline route departs the I-40 corridor, crossing and/or paralleling unimproved roads until it enters the City of Kingman, where it is buried beneath Gordon Drive (CSP Mileposts 234 to 237).

In the western region, the existing pipeline route passes through the City of Kingman, Sacramento/Golden Valley, and Bullhead City. It crosses Arizona Highway Route 66 near the City of Kingman. U.S. Highway 93 parallels and then crosses the existing pipeline route near CSP Milepost 242.

As it enters Bullhead City from the east, the pipeline route crosses Arizona Highway 95 (a primary road) and Bullhead Parkway (a four-lane road). Silver Creek Road, located south of the pipeline right-of-way, is the only connection between these two roads. The pipeline then crosses under the Colorado River and enters Laughlin, Nevada, where it crosses Casino Drive, between CSP Mileposts 270 and 271.

The existing pipeline crosses under a runway of the Laughlin/Bullhead City International Airport near CSP Milepost 270.

The BNSF rail line crosses the pipeline route at CSP Mileposts 170 and 234. The Grand Canyon Railway crosses the pipeline route at CSP Milepost 125.

The existing route crosses two roadways identified for improvement by ADOT: U.S. Highway 89 and Arizona Highway 64 (ADOT 2004).

ADOT plans to widen U.S. Highway 89 to four lanes (from highway Milepost 442 to Milepost 482), raise the median, and add three new interchanges with intermittent turn lanes. U.S. Highway 89 crosses the existing pipeline near CSP Milepost 78, within the area of improvements. Arizona Highway 64 (highway Milepost 185 to Milepost 235) is planned for additional paved shoulders, widening of some segments to four lanes, additional turn lanes, and construction of several passing lanes (ADOT 2004). Arizona Highway 64 crosses the existing pipeline near CSP Milepost 123, an area identified for improvements.

In addition, ADOT is currently in the process of deciding on a corridor for the realignment of Arizona Highway 95. The alternative corridors are generally located east of Bullhead City and west of the Mount Nutt and Warm Springs Wilderness Areas from Arizona Highway 68 to I-40. The existing coal-slurry pipeline route would cross ADOT's current preferred corridor for the Arizona Highway 95 reroute near CSP Milepost 265.

The City of Kingman has approved a project to add a third lane to Gordon Drive. In addition, the existing pipeline may cross (near CSP Milepost 230) the proposed north-south road associated with interchange improvements at I-40 and Rattlesnake Wash.

3.16.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

The pipeline realignments in Moenkopi Wash would cross only unimproved roads. The Kingman reroute would cross and parallel typical city roads leading to residential areas and it would cross U.S. Highway 93. I-40 would be crossed by the Kingman reroute (and paralleled by the BNSF rail line).

The City of Kingman has indicated that there is a plan for a new traffic interchange on I-40 at Rattlesnake Wash (located in proximity to Milepost 2 of the Kingman reroute). The north-south connecting road would also intersect the reroute at Milepost 2.

3.16.3 C Aquifer Water-Supply System

3.16.3.1 Well Field

The transportation network that extends through the well field includes secondary Indian Routes, including Indian Route 6930 and Arizona Highway 99. I-40 is located approximately 1 mile south of the well field. The BNSF rail line passes through the southwestern corner of the Navajo portion and just north of the Hopi Hart Ranch portion of the well field.

3.16.3.2 C Aquifer Water-Supply Pipeline

3.16.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

The Eastern Route would begin at the well field and parallel Indian Route 6930, Arizona Highway 99, and Indian Route 2 for portions of its route. For approximately 4 miles, the Eastern Route would travel approximately 1 mile west of Indian Route 2 just south of the community of Kykotsmovi. The western subalternative would be located beneath the main roadway through the community of Kykotsmovi, and would cross Arizona Highway 264 as it exits the community. The eastern subalternative would be located beneath Indian Route 2, bypassing Kykotsmovi on its eastern edge, and also would be located beneath Arizona Highway 264 for less than 0.5 mile before it exits the community. Exiting the community of Kykotsmovi, it would continue north along Indian Route 2. There would be approximately 3 miles of the Eastern Route that would not follow an existing transportation corridor.

The Eastern Route would parallel the Turquoise Trail, a transportation corridor and potential utility corridor. (This portion of the Turquoise Trail would be paved.) It would next parallel an unimproved route, and then Indian Route 41, within a disturbed transportation corridor.

3.16.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

The Western Route would be identical to the Eastern Route to WSP Milepost 27, where the Western Route diverges. The route would then parallel dispersed, unimproved roads for approximately 65 miles before joining with U.S. Highway 160.

Approximately 20 percent of the route would not parallel an existing transportation corridor, though it would occasionally cross transportation corridors in these segments. The Western Route also would parallel the Black Mesa and Lake Powell Railroad along the U.S. Highway 160 portion of its route.

3.17 RECREATION

Northern Arizona offers mountains, lakes, deserts, canyons, and forests with a wide variety of recreational opportunities. Major tourist attractions are the Grand Canyon National Park, Colorado River, Lake Mead National Recreation Area, Lake Powell/Glen Canyon Recreation Area, Navajo National Monument, and Monument Valley. Developed and semideveloped campgrounds, day-use picnic areas, and trailheads are available for recreation in the region.

Recreation in the study area is managed by American Indian tribes (Hopi and Navajo), the Forest Service, BLM, AGFD, counties, and cities. OHV use, hiking, wildlife viewing, camping, hunting, mountain biking, and horseback riding are popular recreational activities in the study area. The Colorado River is a center of much recreational activity, including boating (a primary activity).

The study area for recreation includes the Black Mesa Complex and a 0.125-mile buffer on either side of the reference centerline (although areas outside of this were mapped) along proposed linear facilities (the coal-slurry pipeline and water-supply pipeline). Recreational areas were identified from community, city, and county land use plans in addition to BLM and Forest Service resource management plans and guidelines. Field review confirmed recreational uses in many areas.

According to the National Wild and Scenic Rivers System, no component of the Black Mesa Project would cross a designated wild and scenic river within Arizona (National Park Service 2005b); however, components of the project would cross several major transportation corridors that lead to visited recreation areas.

3.17.1 Black Mesa Complex

The location of Kayenta, Arizona, along the Colorado Plateau (approximately 15 miles northeast from the center of the Black Mesa Complex), places it amid geological and archaeological features that stimulate tourism throughout northeastern Arizona. Two of these attractions nearest Kayenta are Navajo National Monument (approximately 15 miles west of Kayenta) and Monument Valley Navajo Tribal Park (22 miles north of Kayenta) (Map 3-19).

No specific data are available on the use of the Black Mesa Complex for recreation. Residents report that the area is sparsely used for sightseeing (OSM 1990). Possible recreational activities may include hiking and game or bird hunting.

The Moenkopi Wash area may be the more prominent location for game hunting, commercial trapping, bird watching, and photography. Hiking may occur to a limited extent north of the Black Mesa Complex near the rim of Black Mesa. The area of Black Mesa near the Black Mesa Complex is closed to all big-game hunting (Peabody 1986).

There are no recreational resources in the immediate vicinity of the coal-slurry preparation plant or the proposed coal-washing facility located on the Black Mesa Complex, or the proposed coal-haul road.

3.17.2 Coal-Slurry Pipeline

3.17.2.1 Coal-Slurry Pipeline: Existing Route

Recreational opportunities along the existing pipeline route are generally located in designated areas (i.e., special management areas); however, trails (including historical trails) and other nondeveloped areas are located throughout northern Arizona. Virtually all of the land along the existing route provides open space for dispersed recreational activities.

The Hopi Tribe, Forest Service, City of Kingman, Mohave County, BLM, Bullhead City, and AGFD manage recreational uses along the existing alignment. No developed or designated recreational areas are located along the existing route on the Navajo Reservation.

The existing route crosses through Blue Canyon Special Management Area, located in the northwestern part of the Hopi Reservation. The area, managed by the Hopi Tribe, totals approximately 36,860 acres and was dedicated to conservation and outdoor recreation purposes, as described in the Hopi land use and development plan. However, the area has not yet been developed. Residents of Third Mesa currently use the land within the special management area for traditional gatherings (Hopi Office of Community Planning & Economic Development 2001). The existing route crosses through the special management area for approximately 1 mile. The Hopi Tribe also has identified environmental reserve areas. These areas constitute woodland areas, the Blue Canyon Special Management Area, riparian areas, and washes.

The Kaibab National Forest is composed of three separate land areas located in north-central Arizona. Most of the area is piñon/juniper woodland, and is valuable wildlife habitat for mule deer, elk, pronghorn antelope, and turkey. The existing pipeline route crosses the Williams Ranger District, which lies in a designated utility corridor within Coconino County near CSP Mileposts 113 to 117. The 5-mile-long pipeline segment that passes through the Kaibab National Forest is mostly classified by the Forest Service as "roaded modified"[3] with a small portion of the route located in the "roaded natural area."

The existing route parallels one public park in the City of Kingman near CSP Milepost 237. A second public park is located 0.5 mile away from the pipeline, also near CSP Milepost 237. The section of BLM land located just outside of Kingman (between CSP Mileposts 237 and 238) is designated for open space preservation (City of Kingman 2003). There are some areas within the City of Kingman that are open to OHV use.

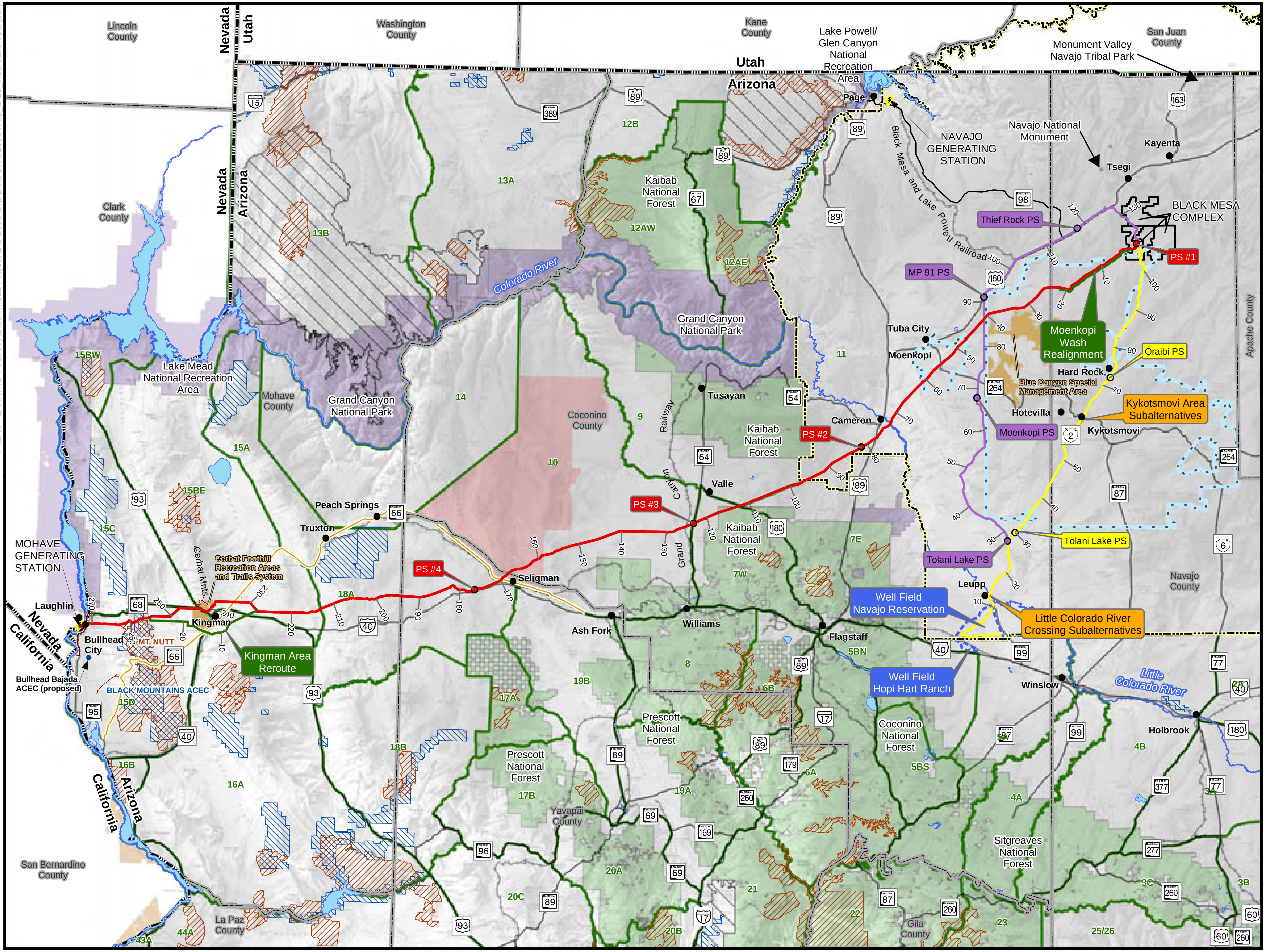
The Cerbat Foothills Recreation Area is located between Kingman and Sacramento Valley along the existing route between CSP Mileposts 240 and 242. The recreation area is comanaged by the City of Kingman and the BLM Kingman Field Office, with funding from the Trails Heritage Fund (which is managed by Arizona State Parks), and includes a trail system. The trails system consists of the Camp Beale Loop Trail, Castle Rock Trail, Badger Trail, Monolith Garden Loop Trails (construction complete in 2005), and the Camp Beale Spring Historic Site. The trail system accommodates recreational uses such as equestrian, hiking, and bicycling. Motorized vehicle use is limited to designated roads and trails within the Cerbat Foothills Recreation Area.

The community of Golden Valley shares its border with the Cerbat Foothills Recreation Area. The large amount of undeveloped land in the community have served as de facto open space for the local residents for hiking, horseback riding, and off-road driving, as well as for undesignated uses such as trash dumping (Mohave County 2002).

The Mount Nutt Wilderness, just west of Kingman and managed by the BLM Kingman Field Office, is paralleled intermittently by the existing route between CSP Mileposts 257 and 262. The wilderness lies within the Black Mountains, and is home to bighorn sheep. Recreational activities supported by the area include camping, climbing, hiking and backpacking, horseback riding, hunting, and wildlife viewing. The Mount Nutt Wilderness Area is closed to OHV use. The pipeline parallels, but is not within, the wilderness area boundary.

The Black Mountain Ecosystem Management ACEC also is managed by BLM. The Black Mountains provide a complex mix of resource values for wildlife, livestock, wild burros, and people. The presence of wilderness, rich mineral deposits, important wildlife habitat, a wild burro area, and abundant recreation opportunities can lead to conflicting uses in key areas of the Black Mountains. The Black Mountains Ecosystem Management ACEC was proposed to focus management attention on resolving these conflicts. OHV use, hunting, rockhounding, and wilderness hiking are a few of the recreational activities that take place within the ACEC (BLM 1993). The existing route is within a designated utility corridor in the ACEC between CSP Mileposts 256 and 259. The Colorado River Heritage Greenway Trail is a 30-mile-long multiple-use trail that extends from Lake Mead to the Colorado River Nature Center in Bullhead

[3] These terms are from the Recreation Opportunity Spectrum: A Framework for Planning, Management, and Research, a U.S. Forest Service guide that allows U.S. Forest Service managers to describe and provide a range of recreation opportunities from highly developed areas (urban, rural, roaded natural, roaded modified) to areas with little or no development (semiprimitive motorized and nonmotorized primitive) (Forest Service 1979).



Map 3-19
Recreation/Special Designations

Black Mesa Project EIS

LEGEND

Recreation

- AGFD Game Management Unit and Number
- Wilderness Area
- BLM Area of Critical Environmental Concern
- BLM National Monument
- National Forest
- National Park
- Big Boquillas Ranch
- Historic Route 66
- Trail

Project Features

Black Mesa Complex

- Peabody Lease Area

Alternative A Coal-Slurry Pipeline

- Existing Route
- Realignment

Alternative A Water-Supply System

- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

PS = Pump Station

General Features

- River
- Lake
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- State Boundary
- County Boundary
- Interstate/U.S. Highway/State Route
- Railroad

SOURCES:
URS Corporation 2005, 2006
Arizona State Land Department 2005
Mohave County 2005
Bureau of Land Management 2005

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November 2008

0 20 40
Miles

Prepared By:
URS

City. The trail, which will link five parks within Bullhead City, represents an important north-south link through the community. The purpose of the trail project is to treat the Colorado River within the boundaries of Bullhead City as an urban greenway that will provide residents and visitors with educational, recreational, and scenic experiences on a network of paths and trails (Bullhead City 2002). The Colorado River Heritage Greenway Trail passes over the existing pipeline at CSP Milepost 270.

Bullhead City, Arizona, and Laughlin, Nevada, lie on either side of the Colorado River. The river provides numerous recreation opportunities, including boating, jet skiing, swimming, day use/picnic facilities, and beaches. Laughlin has several large casinos located adjacent to the river, which provide walking trails for casual enjoyment and views of the river's activities. There are areas within Bullhead City that are open to OHV use.

The AGFD manages hunting within Arizona by dividing the state into GMUs. GMUs crossed by the existing route include 7, 9, 10, 15B, 15D, and 18A. GMUs 7, 9, and 10 are located along the existing route between Cameron and Seligman. GMUs 15B, 15D, and 18A are located along the existing route between Seligman and Bullhead City (refer to Map 3-14). Primary game species hunted within these GMUs include mule deer, elk, turkey, antelope, bighorn sheep, quail, and javelina. Other species hunted within the GMUs are dove, waterfowl, black bear, mountain lion, and tree squirrel. Table 3-50 lists the average annual number of permits issued by AGFD since 2000 in areas crossed by the existing route.

Table 3-50 Average Annual Number of Permits Issued by Arizona Game and Fish Department Between 2000 and 2005

GMU	Antelope	Bighorn Sheep	Elk	Javelina	Merriam's Turkey	Mule/White Tailed Deer
7(W)	60	—	1,515	—	175	2,130
9	31	—	996	—	40	970
10	20[a]	—	1,675	—	—	850
18A	100	—	10	200	—	800
15B	7[b]	13	—	—	—	390[2]
15D	—	6	—	—	—	—
Total	318	19	4,196	200	215	5,140

SOURCE: Arizona Game and Fish Department 2005d
NOTES: [a] One hundred permits for archery combined with Game Management Units 18A and 18B.
[b] Combined with 15A.
GMU = game management unit
— = Data not available for the average number of permits issued

The Great Western Trail, a 2000 Millenium Trail, is a 3,000-mile-long north-south backcountry route extending from Canada to Mexico that provides recreational opportunities. The trail is immediately south of the existing pipeline right-of-way.

Big Boquillas Ranch, owned by the Navajo Nation in fee, is open for sports use, which includes big-game hunting (deer, elk, turkey, antelope, and bighorn sheep), small-game hunting (predators and prairie dogs), camping, bird watching, photographing wildlife, and sightseeing (Arizona Elk Society 2005). Hunting within the ranch is managed by AGFD (Begay 2005). The existing route crosses through the Big Boquillas Ranch between CSP Mileposts 159 and 170 (refer to Map 3-17).

San Francisco Peaks Scenic Road is a 31-mile-long portion of U.S. Highway 180 (highway Milepost 224 to Milepost 255) that stretches from Flagstaff to a few miles before the junction with State Highway 64. This segment of scenic road was designated by ADOT on January 12, 1990 (Federal Highway Administration 2005). Also located in Kaibab National Forest, the road is a highly traveled route to the Grand Canyon. The officially designated scenic portion of the road ends soon after Red Mountain, which is located in Coconino National Forest. U.S. Highway 180 crosses the pipeline corridor on State Trust land. Highway 64 crosses the pipeline corridor on State Trust land.

The Grand Canyon Railway travels from Williams to the South Rim of the Grand Canyon and crosses the existing route near CSP Milepost 125. The Grand Canyon Railway owns a significant portion of the 65 miles of track and operates on a right-of-way through land administered by the Forest Service and National Park Service (Grand Canyon Railway 2005). The railway offers wildlife viewing and sightseeing aboard a vintage train (Grand Canyon Railway 2005).

3.17.2.1.1 Coal-Slurry Pipeline: Existing Route with Realignments

The pipeline realignments in Moenkopi Wash would not cross any designated recreational areas. The portion of the reroute from CSP Milepost 2 to 3 is located within the Black Mesa Complex where recreational activities are not designated. Residents report that the area is sparsely used for sightseeing (OSM 1990). Possible recreational activities may include game or bird hunting.

The Kingman reroute would cross Historic Route 66 at reroute CSP Milepost 13, and one park/open space area is located within Golden Valley about 0.5 mile from the pipeline alignment near reroute CSP Milepost 21. A major development approved both north and south of the reroute, Golden Valley Ranch, will include parks and open space areas adjacent to the alignment.

3.17.3 C Aquifer Water-Supply System

3.17.3.1 Well Field

According to the Leupp Chapter Land Use Plan, Old Leupp and Sunrise are historically significant scenic areas located just north of the proposed well field. These areas offer undeveloped options for recreation, tourism (sightseeing), and academic research. The historically significant Canyon Diablo site is located in the southwestern corner of the Navajo portion of the proposed well field just north of the BNSF rail line and Indian Route 6930. Currently, visitors are allowed to tour the ruins at these locations on their own (Navajo Nation Division of Community Development 2005).

The Painted Desert, known for its scenic vistas and badlands, is a large geographic area that extends from the Grand Canyon to the Petrified Forest National Park. It is located on the Navajo Reservation, private land, and national parks. A portion of the Painted Desert that is located on the Navajo Reservation lies within the well field area and offers dispersed recreation opportunities such as undeveloped areas for hiking and sightseeing.

3.17.3.2 C Aquifer Water-Supply Pipeline

3.17.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

Land on the Navajo Reservation that would be crossed by the Eastern Route is not designated for recreational opportunities; however, the alternative crosses through the Painted Desert, where dispersed recreation activities may occur (e.g., hiking, sightseeing). The Hopi Tribe designated the primary washes (e.g., Oraibi, Moenkopi, Dinnebito) for conservation and specific recreational opportunities. The Eastern Route would parallel and cross these washes that run through the reservation.

The Little Colorado River flows northwest across the planning area, and would cross the Eastern Route just east of the Community of Leupp. The river has no developed recreation areas inside the study area; however, its deep gorges may provide dispersed recreation opportunities for localized hiking (during dry months), wildlife viewing, and sightseeing.

3.17.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

There are no developed recreation opportunities located along the Western Route. U.S. Highway 160 (which is parallel to the Western Route from WSP Mileposts 92 to 126) is a highly traveled access route to Navajo National Monument and Monument Valley. The Western Route also would cross through the Painted Desert, where dispersed recreation activities may occur (e.g., hiking, sightseeing).

3.18 HEALTH AND SAFETY

Activities conducted at an industrial facility carry an inherent risk. Typical risks encountered include exposure to dust, noise, heat stress, and chemicals, as well as the opportunity for accidents due to working directly with or in proximity to large equipment. However, the establishment of appropriate policies and procedures and the monitoring of those procedures to verify that they are properly observed help to reduce the risk involved.

Numerous laws and regulations govern the policies and procedures implemented to ensure the health and safety of the mine and power-plant workers, protect persons living in the surrounding vicinity, and regulate the use and disposal of hazardous materials and wastes. These include, but are not limited to, the following:

- The Federal Mine Safety and Health Act of 1977, 30 U.S.C. 801 et seq. as amended by Public Law 91-164, as amended by Public Law 95-164. Enforced by the Mine Health and Safety Administration (MSHA), and administered by the U.S. Department of Labor
- The Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201 et seq.)
- The Clean Water Act, (Federal Water Pollution Control Act [33 U.S.C. 1251 to 1387])
- The Clean Air Act of 1970, 42 U.S.C. 7401 et seq.,as amended 1990
- The Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601 et seq. also known as “Superfund”
- The Superfund Amendments and Reauthorization Act of 1986, Title III, embodying the Emergency Planning and Community Right-to-Know Act, Public Law 99-499
- Resource Conservation and Recovery Act, as amended (42 U.S.C. 6901 et seq.)

3.18.1 Black Mesa Complex

Safety practices observed at the Black Mesa Complex and all associated facilities were identified by review of the policies and procedures established by the MSHA. All mining operations’ safety plans and procedures are based on guidance developed by MSHA. The agency develops and enforces safety and health rules applying to all mines in the United States; helps mine operators who have special compliance problems; and makes available technical, educational, and other types of assistance. MSHA works cooperatively with industry, labor, and other Federal and State agencies toward improving safety and health conditions for all miners.

3.18.1.1 Safety Policies, Procedures, and Enforcement

Safety policies and procedures established at the Black Mesa Complex are directly based upon guidance provided by the U.S. Department of Labor through MSHA (Holgate 2005). The Mine Safety and Health Act of 1977 implementing regulations, 30 CFR 1-199, that outline the policy and procedures for safety at mining operations. Part 77, “Mandatory Safety Standards, Surface Coal Mines and Surface Work Areas of Underground Coal Mines,” establishes mandatory safety standards, including requirements for equipment-safety specifications and maintenance, handling and safety procedures, fire protection, and use of explosives and blasting. Part 77 forms the basis for the various safety plans developed and maintained at the Black Mesa Complex (MSHA 2005a). Based on the criteria identified in Part 77, a series of safety plans has been prepared to address each aspect of work performed at the mines (Holgate 2005). Other key CFR sections on the safety policies that are mandatory and used extensively by the Safety Department at the Black Mesa Complex to establish safety policies and procedures include the following:

- Notification, Investigation, Reports and Records of Accidents, Injuries, Illnesses, Employment, and Coal Production in Mines (30 CFR 50)
- Occupational Noise Exposure (30 CFR 62)
- Mandatory Health Standards—Surface Coal Mines and Surface Work Areas of Underground Coal Mines (30 CFR 71)
- Criteria and Procedures for Proposed Assessment of Civil Penalties (30 CFR 100) (MSHA 2005a)

Continual training is a key component in ensuring safety at the mines. Introductory and ongoing training classes are held regularly for new and current employees in accordance with the Mine Safety and Health Act guidance (Holgate 2005).

Despite every effort to establish and enforce detailed safety procedures, accidents and injuries can sometimes occur. A first aid station is located at the site to address any immediate injuries that can be remedied locally. In the event of a more serious accident, a medical-evacuation helicopter and paramedics are available 7 days a week, 24 hours a day to airlift an injured person to the nearest hospital (Holgate 2005).

The requirements of the Mine Safety and Health Act dictate that MSHA make at least two safety inspections each year at every surface mine. These visits can occur without notification, and at any time of the day or on any day of the week. While the Safety Department at the Black Mesa Complex is ultimately responsible for compliance with safety requirements, the department managers of each group are responsible for seeing that all safety regulations are followed.

3.18.1.2 Hazards and Contaminants

3.18.1.2.1 Blasting

Hazards associated with blasting include handling of explosives by workers and proximity to the blast site. Blasting operations at the Black Mesa Complex are conducted according to Federal law, applicable regulations, and the approved permit application. No blasting is conducted within 0.5 mile of an occupied dwelling. Since Federal law and regulation both allow mining to within 300 feet of such a structure, the permit requirements are more stringent than Federal law and regulations. Blasts are monitored for air blast and ground vibration by five permanent seismographs located throughout the permit area. Blasting records are submitted and reviewed monthly by OSM. In the event of a violation, Federal enforcement action is taken (OSM 2005a).

To prevent injury to people and damage to property both within and outside of the permit area, notices of the blasting schedule are distributed to all citizens within the permit area and within 0.5 mile outside the permit area. Prior to the detonation of each blast, a warning signal is sounded that must be audible within a range of 0.5 mile of the point of the blast, as required by the regulations at 30 CFR Part 816.66(b). This is to alert residents and workers where a blast is to be detonated. After the blast, an all-clear signal is sounded when the area is clear. All blasting operations are restricted to the daytime hours between sunrise and sunset (OSM 2005a).

3.18.1.2.2 Air Quality

Mining involves drilling and shearing of large quantities of minerals. If the appropriate precautions are not taken, the clouds of dust raised in displacing these materials can damage the lungs, particularly after years of exposure (refer to Section 3.6). In accordance with requirements of the Mine Safety and Health Act, all applicable precautions are observed at the Black Mesa Complex to ensure worker health and safety (Holgate 2005).

Persons living in the vicinity of the mining operations also are subject to the air quality effects of mining operations. Peabody has operated an air-quality-monitoring program since 1980 in accordance with Federal regulations. Airborne particulates and dust are monitored at 12 different sites located throughout the leased area, based on wind patterns, mining activity, and location of residences. Quarterly and annual air quality monitoring reports are prepared by Peabody to ensure compliance with air-quality requirements (OSM 2005b).

3.18.1.2.3 Transportation

Traffic accidents can occur on pit ramps or routes of travel that are within the mining and spoil grading areas. The safe operation and maintenance of haul trucks, water trucks, rubber-tired end loaders, and other surface-mining machinery is emphasized in the regulations in the Mine Safety and Health Act of 1977. Weather can be a factor in traffic accidents at the mine; frequent freezing and thawing can loosen formerly solid rock on the high walls, road cuts, and portal faceups. Appropriate signage and traffic control are monitored as part of the safety procedures at the Black Mesa Complex in accordance with the MSHA regulations.

A private airport for the use of Peabody personnel is located in the reclaimed J-03 area. The airport facilities include an approximately 7,500-foot-wide paved runway and a small airplane tie-down, taxiway, and storage building area. The facilities were designed, constructed, and are maintained to comply with all applicable local and Federal regulations.

3.18.1.2.4 Natural Hazards

Environmental conditions at and near mining operations that could present serious hazards include seasonally extreme temperatures and potential flash flooding, rugged terrain, and remoteness. The project area is found in a generally arid to semiarid climate with a dry season in May and June. The monsoon season generally begins in July, producing potentially heavy rains and flash flooding. Winter snowfall occurs over most of the project area beginning in October and November, sometimes creating hazardous conditions.

Along with weather extremes, the presence of venomous or otherwise dangerous wildlife can be a hazard to workers, residents, and visitors. Several species of venomous reptiles (such as rattlesnakes) and anthropods (such as various species of scorpions, spiders, and bees) are in the area. Common sense and care around locations where these animals may be found generally avoids unfortunate encounters between these species and humans.

3.18.1.2.5 Solid Waste

A solid-waste landfill was operated by Peabody at the J-03 area until its closure in 1997. A closure plan was prepared, approved, and implemented; the landfill was revegetated in 1999. No active solid-waste facilities are located in the lease area. All solid waste is removed from the site by regulated contractors and transported to off-site municipal landfills.

3.18.1.2.6 Hazardous Materials and Wastes

A hazardous material is any material (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment. A hazardous material is defined as any substance or chemical that is a health hazard or physical hazard, including chemicals that are carcinogens, toxic agents, irritants, corrosive agents, or sensitizers; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, flammable, or are oxidizers; and chemicals that, in the course of normal handling, use, or storage, may produce toxic dusts, gases, fumes, vapors, mists, or smoke (National Institute for Occupational Safety and Health 2005).

No hazardous materials are used for mining and processing of coal at the Black Mesa Complex. Some routine cleaning products and water-soluble solvents are maintained in the support structures in limited quantities (Chischillie 2005).

Mining operations require maintenance activities for equipment and machinery used in the processes. Safety-Kleen™ parts washers containing cleaning solvents are located at the Black Mesa mining operation area in the preparation plant, shops, at a contractor’s on-site location, and in the human resource area. Parts washers are located at the Kayenta mining operation area in the preparation plant, truck shop (two units), and welding shop. Bays containing an aqueous solution of soap and water are located at the Black Mesa truck shop and at the Kayenta truck shop and preparation plant. All of the parts washers are serviced and the wastes are removed by the contractor, Safety-Kleen™, every 8 weeks, with the exception of the Black Mesa aqueous-solution washer, which is serviced every 16 weeks. Parts washers are located on the drag line at the Kayenta mining operation, and waste is placed in drums for removal. Approximately 90 to 125 drums are removed every 90 days (Chischillie 2005).

The main waste streams found at the Black Mesa mining operation are grease, grease and debris, grease/oil/solvent, greasy rags, and used solvent. These wastes are collected and removed every 8 weeks. As a result of fire training that has been conducted, a waste stream consisting of fire retardant with diesel gas was removed in 2003. Other waste streams occurring less often at the Black Mesa mining operation are used paint and analysis material from the laboratory consisting of Mg and perchlorate. A waste stream of Nyloband adhesive used for beltline splicings at the Kayenta mining operation occurs occasionally (Chischillie 2005).

Two 10,000-gallon used-oil tanks are located at the Black Mesa mining operation. One is used to accumulate used oil while the other filled tank is out of service for testing and removal of the contents. Two other tanks, approximately 5,000 gallons each, serve the same function for used antifreeze. Both products are serviced by ThermoFluids located in Phoenix, Arizona (Chischillie 2005).

Several products are recycled at the Black Mesa mining operation area, including scrap metal, tires, computer equipment, fluorescent lamps (4-foot and 8-foot lengths), high-pressure sodium light bulbs, and mercury-vapor light bulbs. These are removed from the site yearly. Used batteries also are recycled at Black Mesa, and are removed on an as-needed basis by Napa Service located near Shiprock, Arizona (Chischillie 2005). When not reserved for analysis, used oil, parts washer fluid, spent solvent, grease, and antifreeze also are recycled.

A 5,000-gallon aboveground Jet A fuel tank is located at the new airport facility in the J-03 area to service the aircraft. The tank is constructed of steel and is housed in a spill-proof concrete containment area. The tank was constructed in 1986, and no violations or spills have occurred since its installation (Armstrong 2005).

3.18.2 <u>Coal-Slurry Pipeline</u>

The existing coal-slurry pipeline (which currently is not in operation) extends 273 miles from the Black Mesa Complex to the Mohave Generating Station in Laughlin, Nevada. Four pump stations are located in undeveloped areas at intervals along the pipeline. With the exception of the Kingman and Laughlin areas, the pipeline route passes through areas that are rural and undeveloped. The coal-slurry pipeline route crosses a number of major thoroughfares carrying a substantial volume of traffic, including county roadways, U.S. highways, State routes, Indian routes (Hopi, Navajo), and a number of private roadways.

The coal-slurry pipeline, which operated from 1970 through 2005, was operated and maintained in accordance with American Society of Mechanical Engineers Code B31.11, Slurry Transportation Piping System, and standard procedures established by the pipeline owners to ensure safe operation and integrity of the pipeline. The existing pipeline is protected from corrosion with external coating and a cathodic protection system designed in accordance with the National Association of Corrosion Engineers Standard RP-01-69-92. The operation and maintenance of the pipeline was and would continue to be performed by qualified and trained employees. Personnel were and would be capable of monitoring the pipeline's operating conditions as well as controlling flows and pressures through the pipeline. Field operations personnel inspect and conduct routine maintenance of the pipeline facilities regularly. The pipeline also is inspected by aerial surveillance regularly.

There have been 31 pipeline failures of varying types and sizes during the 35 years the coal-slurry pipeline was in operation; however, only one event occurred in the first 20 years of operation that was not the result of human error (e.g., third-party backhoe excavation accidents, operator error with a control valve). Some of these failures appeared to be the result of corrosion acting on poor-quality pipe. Extensive wall thickness losses have been observed in random joints of the pipe. Adjacent joints, produced by the same mill and with the same specifications and wall thickness, exhibited widely different corrosion rates. Remote pressure-monitoring devices were installed after the pipeline had operated for some time that would prevent many of the leaks that occurred initially and would prevent many potential leaks in the reconstructed system.

The existing pipeline has reached its design life of 35 years. For that reason, the new pipeline is proposed. However, the potential for rupture along the route is possible. In the event of rupture, the rupture is detected by control personnel, the flow is stopped to minimize the amount of coal slurry spilled, and the location of the rupture is identified and that segment of pipeline is isolated. If needed, the slurry in that segment of pipeline is pumped into a pond, designed and constructed for that purpose, at the closest pump station along the pipeline. Erosion, subsidence, and flooding issues could occur as a result of a rupture and there could be the possibility of personal injury. Safety procedures have been established to respond immediately to a rupture event once it is detected.

Facilities at the pump stations include pump houses, a water well, a cooling tower, a water pond, and coal-slurry pond. Chemicals used at the facility include ethylene glycol (for pump temperature control), a liquid-oxygen scavenger (to prevent rust in the pipeline), oil, paint, and various greases and lubricants. Chemical wastes at the pump station are collected and hauled off site by a licensed contractor for disposal (Solberg 2005).

3.18.3 C Aquifer Water-Supply System

The proposed C aquifer water-supply system well field is situated near the community of Leupp, Arizona, which is a rural community on the Navajo Reservation. A small community of approximately 50 residences is located to the north of the well field. From the well field, the proposed water supply would convey the water to the Black Mesa Complex through areas that are rural and undeveloped with the exception of the community of Kykotsmovi. No large commercial or industrial facilities are located in or near the proposed well field or along the proposed pipeline route.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter provides a description of the effects on the environment that potentially could occur under each alternative group of actions as described in Chapter 2. This chapter begins with a summary of the terms used for the impact assessment and then, for each resource, describes the impacts that could result from each alternative.

The information about the existing condition of the environment from Chapter 3 was used as a baseline by which to measure and identify potential impacts from the project. The EIS team then considered and incorporated, where appropriate, mitigation measures to avoid or minimize the magnitude of an impact, or conservation measures to compensate or offset an impact, before arriving at the impacts described here.

An impact, or effect, is defined as a modification of the environment brought about by an outside action. Impacts vary in significance from no change, or only slightly discernible change, to a full modification or elimination of the environmental condition. Impacts can be *beneficial* (positive) or *adverse* (negative). Impacts can be *short-term*, or those changes to the environment during and following ground-disturbing activities that generally revert to predisturbance conditions at or within a few years after the ground disturbance has taken place. *Long-term* impacts are defined as those that would remain substantially beyond short-term ground-disturbing activities.

For the mining operations, short-term impacts are those that would occur from the time mining begins in a coal-producing unit through reclamation when vegetation has been reestablished. The mining operation continually advances with contemporaneous reclamation activities. That is, earth material excavated from a coal-producing unit is deposited to backfill the adjacent, previously mined unit. When the unit has been backfilled, the area is regraded and revegetated. When vegetation has been reestablished, limited use of the land may be allowed. This sequence continues until all the coal has been removed from a given coal-resource area (Appendix A-1). Long-term impacts are those that would persist beyond or occur after reclamation.

For the coal-slurry pipeline and water-supply system, local short-term impacts of the project are those that would occur during construction of the pipelines (and water-supply well field) plus a reasonable period for reclamation (i.e., a total of about five years). Long-term impacts are those that would persist beyond or occur after the five-year construction and reclamation period.

An action can have direct or indirect effects, and it can contribute to cumulative effects. *Direct effects* occur at the same time and place. *Indirect effects* are later in time or farther in distance, but still reasonably foreseeable. *Cumulative effects* result from the proposed action's incremental impacts when these impacts are added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them (Federal or non-Federal).

Also in identifying impacts, the vulnerability of resources also is considered. The status of a resource, resource use, or related issue in this regard is evaluated against the following:

- Resource significance—a measure of formal concern for a resource through legal protection or by designation of special status
- Resource sensitivity—the probable response of a particular resource to project-related activities
- Resource quality—a measure of rarity, intrinsic worth, or distinctiveness, including the local value and importance of a resource

- Resource quantity—a measure of resource abundance and the amount of the resource potentially affected

Several resources are more conducive to quantification than others. For example, impacts on vegetation can be characterized partly using acreage, and air quality can be measured against air quality standards. Evaluations of some resources are inherently difficult to quantify with exactitude. In these cases, levels of impact are based on best available information and professional judgment.

For purposes of discussion and to enable use of a common scale for all resources, resource specialists considered the following impact levels in qualitative terms. The terms *major, moderate, minor, negligible, or none* that follow, consider the anticipated magnitude, or importance, of impacts, including those on the human environment.

- Major—impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; or stress within the social, cultural, and economic realm. Degradation of a resource defined by laws, regulations, and/or policy
- Moderate—impacts that potentially could cause some change or stress (ranging between significant and insignificant) to an environmental resource or use; readily apparent effects
- Minor—impacts that potentially could be detectable but slight
- Negligible—impacts in the lower limit of detection that potentially could cause an insignificant change or stress to an environmental resource or use
- None—no discernible or measurable impacts

Impacts are described for the major components under Alternative A (Black Mesa Complex, coal-slurry pipeline, and C aquifer water-supply system). Under Alternatives B and C, the coal-slurry pipeline would not be reconstructed nor operate in the future; thus, no adverse or beneficial impacts associated with the coal-slurry pipeline would occur under Alternatives B and C. Under Alternatives B and C, the C aquifer water-supply system would not be built; thus, no adverse or beneficial impacts associated with the C aquifer water-supply system would occur under Alternatives B and C.

Tables 4-1, 4-2, 4-3, and 4-4 are summaries of the areas affected by the three Black Mesa Project alternatives. Table 4-1 presents the acres associated with rights-of-entry. Table 4-2 presents the acres associated with the OSM permit for the Black Mesa Complex and the acres that have been disturbed by mining through 2007, the acres proposed for mining from 2008 through 2026, and the acres that could be mined after 2026. Table 4-3 is a summary of the existing and proposed right-of-way acreages associated with the coal-slurry pipeline. Table 4-4 is a summary of the proposed right-of-way acreages associated with the C aquifer water-supply system.

Table 4-1 Black Mesa Complex Right-of-Entry Acreages

Right-of-Entry Documents	Acres
Joint Hopi/Navajo coal leases Numbers 14-20-0603-9910 and 14-20-0450-5743	40,000
Navajo-only coal lease Number 14-20-0603-8580	24,858
Conveyor, railroad, power line rights-of-way and easements	362
Coal-slurry preparation-plant lease	40
Existing right-of-entry area total	**65,260**
Proposed new coal-haul road right-of-way[1]	**127**
Existing and proposed right-of-entry area total	**65,387[2]**

NOTES:
[1] Area shown on Drawing 85360, SW Sheet in the life-of-mine application.
[2] The total existing and proposed right-of-entry area is larger than the 63,057 acres proposed for the permit area under the life-of-mine revision. The difference is the 2,330-acre area in the northeast corner of Navajo Lease No. 14-20-0603-8580, which is not proposed to be within the permit area because it contains no mineable coal.

Table 4-2 Black Mesa Complex Permit and Disturbance Acreages

Area	Permit Area	Area Disturbed Through 2007	Proposed 2008-2026 Disturbance	Foreseeable Post-2026 Disturbance[1]
Existing OSM permit area	44,073	15,266	7,736	6,518[2]
OSM Permit Area Alternative A[3, 4]	**63,057**	**20,990**	**12,409**	**8,313**
OSM Permit Area Alternative B[5]	**62,930**	**20,990**	**6,942**	**13,780**
OSM Permit Area Alternative C[6]	**44,073**	**20,990**	**6,942**	**0[7]**

NOTES:
[1] This is the area where mining is reasonably foreseeable, although not specifically proposed in the life-of-mine (LOM) revision, and which is evaluated in the cumulative impacts assessment. Under Alternatives A and B, mining all remaining reserves within the existing leases to supply the Navajo Generating Station is reasonably foreseeable beyond 2026; however, under Alternative A, the continued operation of Mohave Generating Station is not reasonably foreseeable due to the lack of foreseeable source of cooling water after 2026. Under Alternative B, the Black Mesa mining operation would not be approved (i.e., would not be resumed), but it is reasonably foreseeable that all coal reserves within the leases would be mined after 2026 to supply the Navajo Generating Station. Under Alternative C, the Black Mesa mining operation would not be approved (i.e., would not be resumed), and the Kayenta mining operation would cease after the currently permitted coal reserves are depleted (i.e., the Kayenta mining operation would not continue past 2026).
[2] The LOM revision proposes mining coal-resource areas within the existing OSM permit area that are not currently approved for mining (e.g., J-23 and J-28), and the acreages of those coal-resource areas are included in both the (1) additional area proposed in LOM revision proposed 2008-2026 disturbance for Alternative A and (2) existing OSM permit area foreseeable post-2026 disturbance.
[3] Includes 127 acres for the proposed new coal-haul road right-of-way.
[4] This would be the OSM permit area and disturbance acreages if the LOM revision is approved.
[5] This would be the OSM permit area and disturbance acreages if the LOM revision is approved.
[6] This would be the OSM permit area if the LOM revision is disapproved.
[7] Although it is reasonably foreseeable under Alternative C (disapproval of the LOM revision) that Peabody Western Coal Company would request future permit revisions to mine all remaining coal reserves within the lease area, the cumulative impacts of such foreseeable future permitting would be addressed under Alternative B; thus, Alternative C assumes that none of the initial program area coal reserves within the leases would be mined after 2026 (for the purpose of evaluating cumulative impacts under a disapproval of all future mining, other than that which is currently approved in the existing permit).

Table 4-3 Black Mesa Coal-Slurry Pipeline Existing and Proposed Rights-of-way Acreages

Affected Area	Existing Permanent Right-of-way[1]	New Permanent Right-of-way[1]	Total Permanent Right-of-way	New Temporary Right-of-way[2]	Total Right-of-way
Existing route (273 miles)	1,655	0	1,655	496	2,151
Existing route with realignments					
• Existing route (245 miles)	1,485[3]	0	1,485	445	1,930
• Moenkopi Wash realignments (1 mile)		6	6	2	8
• Kingman reroute (28 mile)		170	170	51	221
Pump stations[4]	160	0	160	0	160
Total Coal-Slurry Pipeline: Existing	**1,815**	**0**	**1,815**	**496**	**2,311**
Total Coal-Slurry Pipeline: Realigned	**1,645**	**176**	**1,821**	**498**	**2,319**

SOURCE: Black Mesa Pipeline, Inc. 2006

NOTES:

1 Permanent right-of-way would be 50 feet wide for length of the pipeline.

2 An additional 15-foot-wide temporary right-of-way (adjoining the permanent right-of-way for the length of the pipeline) would be required for construction, with a few exceptions along short stretches of rough terrain where up to 100 feet would be needed.

3 Existing right-of-way for sections of pipeline that would be abandoned due to realignment would be relinquished in accordance with right-of-way conditions for relinquishment.

4 The existing right-of-way for the pump stations would not change nor would additional temporary construction right-of-way be needed to accommodate pump-station upgrades that may be implemented (e.g., pump replacements).

Table 4-4 C Aquifer Water-Supply System Proposed Rights-of-way Acreages

Affected Area	Permanent Right-of-way	Additional Temporary Right-of-way	Total Right-of-way
Well Field: 6,000 af/yr			
12 wells[1]	-7	-4	-11
Access roads, collector pipelines, power lines for 12 wells[2]	60	36	96
Additional distribution power lines for 12 wells[2]	0	47	47
Water-storage tank[3]	1	2	3
Electrical substation[4]	1	2	3
Total	**69**	**91**	**160**
Well Field: 11,600 af/y			
21 wells[1]	13	6	19
Access roads, collector pipelines, power lines for 21 wells[2]	80	48	128
Additional distribution power lines for 21 wells[2]	0	67	67
Water-storage tank[3]	1	2	3
Electrical substation[4]	1	2	3
Total	**95**	**125**	**220**
Water-Supply Pipeline: Eastern Route			
Pipeline, power line, access road corridor (108 miles)[5]	264	397	661
Pump stations (2)[6]	1	4	5
69kV transmission line[7]	370	0	370
Additional right-of-way for access roads[8]	4	0	4

Affected Area	Permanent Right-of-way	Additional Temporary Right-of-way	Total Right-of-way
Water-Supply Pipeline: Western Route			
Pipeline, power line, access road corridor (137 miles)[5]	337	505	842
Pump stations (4)[9]	2	8	10
69kV transmission line[7]	655	0	655
Additional right-of-way for access roads[10]	38	0	38
Total 6,000 af/yr Eastern Route	**702**	**499**	**1,201**
Total 11,600 af/yr Eastern Route	**722**	**539**	**1,261**
Total 6,000 af/yr Western Route	**1,095**	**611**	**1,706**
Total 11,600 af/yr Western Route	**1,115**	**651**	**1,766**

SOURCE: Southern California Edison Company 2006
NOTES:
1 Each well site would require temporary construction right-of-way of 200 feet by 200 feet (0.9 acre) and permanent right-of-way of 50 feet by 50 feet (0.06 acre).
2 The collector pipelines and well-field distribution power lines would share the same right-of-way as the access roads where possible (40 feet wide for temporary construction right-of-way and 25 feet wide for permanent right-of-way). Some spans of distribution power lines would be outside of the access road right-of-way. The distribution power line would be owned by Navajo Tribal Utility Authority and have a 30-foot tribal right-of-way centered on the line; thus, only temporary right-of-way acreages are shown.
3 The water-storage tank would require temporary right-of-way of 300 feet by 300 feet for construction (2.1 acres) and permanent right-of-way of 215 feet by 215 feet (1.1 acres).
4 The electrical substation would require temporary right-of-way of 295 feet by 295 feet for construction (2.0 acre) and permanent right-of-way of 200 feet by 200 feet (0.9 acre).
5 The temporary right-of-way for pipeline construction would be 30 feet wide and the permanent right-of-way would be 20 feet wide. The pipeline right-of-way would be contiguous with rights-of-way for existing roads to the extent possible and the pipeline's access roads and power lines would share the pipeline right-of-way.
6 Each pump station would require temporary right-of-way of about 295 feet by 295 feet for construction (2.0 acres). Tolani Lake pump station would require a permanent right-of-way of about 170 feet by 150 feet (0.6 acre), and Oraibi pump station would require a permanent right-of-way of about 165 feet by 190 feet (0.7 acre).
7 The 69kV transmission line serving the pump stations would have a 50-foot-wide right-of-way.
8 Additional 5 feet of pipeline right-of-way would be needed between water-supply pipeline (WSP) Mileposts 72 and 77 and for about 2 miles at Dinnebito Wash (where the pipeline is not next to a road) to accommodate the access road.
9 Each pump station would require temporary right-of-way of about 295 feet by 295 feet for construction (2.0 acres) and permanent right-of-way of about 170 feet by 150 feet (0.6 acre).
10 Additional 5 feet of pipeline right-of-way would be needed between WSP Mileposts 33 and 59, 71 and 91, 126 and 139; and 4 miles total would be needed at wash crossings (where the pipeline is not next to a road) to accommodate the access road.
af/yr = acre feet per year
kV = kilovolt

Also considered, and described at the end of the chapter, are (1) the conservation measures, (2) summary of mitigation measures (including best management practices), (3) short-term uses versus long-term productivity, (4) irreversible and irretrievable commitment of resources, (5) indirect effects associated with resuming operation at Mohave Generating Station (dependent in part on implementation of the coal-supply components of Alternative A), and (6) cumulative effects.

4.1 LANDFORMS AND TOPOGRAPHY

4.1.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.1.1.1 Black Mesa Complex

The impact on landforms and topography resulting from mining activities in the permit area is extensive and permanent, and would continue under Alternative A through the proposed life of the mine. Removal of the coal would drastically alter topographic features such as slope gradient and surface-drainage patterns. Surface mining of overburden and subsurface coal resources would continue to remove up to 250 feet of rock and drastically modify topographic and landform features, such as hills, slopes, and surface drainage patterns, while forming highwalls in the mining pits and temporary spoil stockpiles of crushed overburden rock. The narrow, deep washes would not be altered because coal on the steep sides of many washes has been burned in place as a result of natural processes.

Site reclamation is an important part of the mining process. Reclamation of the approximate original contour is required and includes backfilling pits and grading highwalls and spoil to approximate the original shape, topographic relief, and major drainage patterns. Reclamation operations are required to be contemporaneous with mining operations. Backfilling and grading of mined areas generally would begin when four spoil ridges have accumulated and would continue as mining progressed until the final pit is backfilled and the entire mined area is regraded. Restoration of the approximate original contour would reestablish the drainage pattern of the mined area to approximate original conditions and conform to drainage in the surrounding unmined areas, to minimize the impact on topography and landforms. Generally, regraded mined land will have the same general landform as the land had before mining but without any steep slopes (i.e., no steeper than 3 horizontal to 1 vertical [3h:1v]).

To promote slope stability where necessary, highwall slope steepness would be reduced to 3h:1v or less. Embankments for sediment-control dams and ponds, and for existing and future roads, would range from 1.5h:1v or less in cuts in unmined areas to 4h:1v or less in fill areas. These features would be stable with regard to landslides and slumping resulting from slope failure.

There would be long-term impacts on landforms and topography resulting from coal mining. The impact on landforms and topography is permanent, but the disturbance is mitigated by site reclamation. The reclaimed area generally would have gently rolling hills with smoother contours and less topographic relief than the original topography, and no pronounced landforms (e.g., no cliffs, steep buttes, or narrow canyons). The flatter topography would make the reclaimed area more suitable for multiple land uses.

Disturbance from construction of the coal-washing facility would occur within approximately 2 acres surficially and is not expected to affect landforms and topography.

Construction of the coal-haul road would result in disturbance within approximately 127 acres along a 2-mile-long corridor. Embankments for the road would range from 1.5h:1v in cuts in unmined areas to 4h:1v for fill areas. These features would be stable with regard to landslides and slumping. By using approved construction methods to maintain the slope stability, there would be no significant impacts on landforms and topography.

4.1.1.2 Coal-Slurry Pipeline

Alternative A would result in no impact on landforms and topography where reconstruction of the coal-slurry pipeline would follow the existing coal-slurry pipeline route. Along the coal-slurry pipeline Moenkopi Wash realignment and Kingman reroute, construction would be restricted to a 65-foot-wide right-of-way, and the trench would be backfilled and regraded to conform to the original topography.

During construction, alterations of the topography or cutting into landforms would be avoided to the extent practicable. Thus, there would be negligible to no impact on landforms and topography along the Moenkopi Wash realignments and Kingman reroute.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of coal slurry would stop. The volume of slurry released would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal-slurry release would cover approximately 0.7 acre with 6 inches of nontoxic coal fines, while the fresh water in which the coal was entrained would soak into the ground (see Appendix A-2). Minor localized erosion of the land would result if the release occurred on a slope.

4.1.1.3 C Aquifer Water-Supply System

Construction of the well field would not require alteration of the topography. Construction of the water-supply pipeline and associated access roads, where needed, whether the eastern or western alternative is selected, would be restricted to a 65-foot-wide right-of-way, and the trench would be backfilled and regraded to conform to the original topography. Alterations of the topography or cutting into the landforms would be avoided to the extent practicable. There would be negligible to no impact on landforms and topography along the preferred pipeline alternative route. There would be impacts on landforms and topography along the alternative pipeline route right-of-way because there is more topographic relief, which would require more cut and fill where the pipeline route would crosses the Adeii Eechii Cliffs, Ward Terrace, and Coal Mine Canyon. Construction of the two pump stations would result in surface disturbance, but no impact on landforms or topography is anticipated.

It is unlikely that the water-supply pipeline would fail. The pipeline would be made of steel pipe, lined with concrete mortar, and wrapped in tape, or coated with epoxy or polyurethane for corrosion protection. In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. In the event of a failure, some flooding would occur in topographic lows and drainage channels. If failure were to occur on a steep slope, there would be a minor impact from localized erosion and the possibility of damage to a cliff face or slope.

4.1.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

4.1.2.1 Black Mesa Complex

Under Alternative B, the overall impact on landforms and topography would be the same as those under Alternative A, except that the area disturbed would be much less; that is, 6,942 acres disturbed by mining between 2008 and 2026 rather than the 12,409 acres under Alternative A. Also, 127 acres would not be disturbed by construction of the coal-haul road. The Black Mesa mining operation would cease. Reclamation of the mined portion of the Black Mesa mining operation area would conform to the reclamation methods described above and result in a postmining land surface with approximately the original shape, topographic relief, and drainage patterns as the premining topography. Because approved construction methods would be used, the reconstructed slopes and drainage patterns would have no significant impact on landforms and topography. Although, under Alternative B, the unmined coal resources would be incorporated into the permanent program permit area, mining of those resources would not be authorized. However, the unmined coal resources could be mined in the future if an application were submitted to, and approved by, BLM and OSM.

4.1.3 <u>Alternative C – Disapproval of the LOM Revision (No Action)</u>

4.1.3.1 Black Mesa Complex

Under Alternative C, the overall impact on landforms and topography would be the same as those under Alternative B, except no additional acreage would become a part of the permitted area. The coal-haul road would not be constructed.

4.2 GEOLOGY AND MINERAL RESOURCES

4.2.1 <u>Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station</u>

4.2.1.1 Black Mesa Complex

4.2.1.1.1 Surface Mining

4.2.1.1.1.1 Geology Resources

Under Alternative A, mining would remove about 250 feet of overburden (non-coal-bearing rocks above the coal seams) and interburden (non-coal-bearing rocks between the coal seams) on approximately 12,409 acres in the Black Mesa Complex. The existing geology in the upper 250 feet of the mined areas, consisting of sedimentary rock lithology and a gently sloping structure, would be disturbed permanently.

Under Alternative A, the surface and shallow subsurface geology would be modified substantively by mining activities. The open pits would be backfilled with unconsolidated, crushed rock from the strata overlying the coal seams that have been mined. This material would have grain sizes ranging from fine-grained sand and clayey shales to boulders. It would be graded to approximate the original topographic contours. The unconsolidated backfill material would not be placed on steep slopes where geologic hazards such as landslides can develop. The unconsolidated fill would impact the lateral continuity of water-bearing sedimentary rocks to depths of 250 feet and severely reduce or eliminate groundwater flow in the saturated zones of the Wepo Formation.

4.2.1.1.1.2 Mineral Resources

Coal. By law and regulation, coal-mining activities must be conducted in a manner that maximizes recovery of the coal resources and protects coal resources remaining after mining (Appendix A-1). Mining activity at the Black Mesa Complex removes coal seams in the Wepo Formation. The USGS estimates that 4.8 billion tons of coal are present in the Wepo Formation in the Black Mesa area. An average thickness of 20 feet of coal would be extracted from multiple coal seams in the Wepo Formation. Peabody estimates that approximately 11.6 percent of the coal reserves would be lost during mining activities due to normal overburden stripping. The impact of this permanent loss of coal resources is considered normal given current mining technology and stratigraphic nature of the coal being mined. Coal resources in the Wepo Formation would be produced. There would be no impact on coal resources in the Toreva Formation and Dakota Sandstone because they are below 250 feet and cannot be mined by surface-mining methods.

Uranium and Vanadium. Uranium and vanadium deposits, found in the Salt Wash Member of the Jurassic Morrison Formation, the Triassic Chinle Formation, and the Toreva Formation, would not be impacted by the proposed coal mining because they underlie the Wepo Formation. These deposits would remain available for future development. However, exploitation of these resources is not likely in the reasonably foreseeable future because the Navajo Nation Tribal Council passed legislation to prohibit uranium-mining activities on the Navajo Reservation.

Oil and Gas. Oil and gas resources are produced primarily from Paleozoic sedimentary formations in the Paradox Basin northeast of Black Mesa. Although inadequately tested, correlative formations may contain economic deposits of oil and gas in deep sedimentary rocks underlying the Black Mesa Complex. Exploration for those resources would be restricted during the life of the mine; however, there are no oil and gas or coalbed natural gas exploration activities anticipated for the area. Oil and gas resources would not be impacted by the proposed coal mining because, if present, they would occur in formations below the mineable coal seams. These resources are not likely to be exploited in the reasonable foreseeable future, and would remain available for future exploration on Black Mesa.

4.2.1.1.1.3 Paleontological Resources

There are abundant plant and animal fossils in the Cretaceous-age coal-bearing strata that outcrop on Black Mesa. Paleontological resources in those strata have been studied and are well documented. Outcrops of trace fossils, such as footprints, also have been recorded. No unique fossil-collection areas have been identified in the proposed mining area; therefore, impact on unique and important fossil specimens in the proposed mining area is not anticipated.

4.2.1.1.2 Coal-Washing Facility

Construction of the coal-washing facility would disturb approximately 2 acres and is not expected to affect geologic or mineral resources because, other than coal, none are known to exist in the area.

4.2.1.1.3 Coal-Haul Road

Construction of the coal-haul road is not expected to affect geologic or mineral resources because, other than coal, none are known to exist in the area.

4.2.1.2 Coal-Slurry Pipeline

No known geological or paleontological resources are expected to be impacted by reconstruction of the pipeline. Because of the pipeline’s narrow temporary or permanent rights-of-way, none of these resources would be excluded from use or made permanently inaccessible during the life of the pipeline.

Although moderate-to-high potential for the presence of oil and gas resources exists along several portions of the coal-slurry pipeline alignment, exploitation of these resources is not likely in the reasonably foreseeable future because of the lack of information about oil and gas resources in this area creates a significant risk for exploration. Exploration and development would not be inhibited by the presence of the pipeline, which is in a narrow corridor.

There is high potential for coal resources in the Black Mesa Basin along the coal-slurry pipeline alignment. Based on Peabody’s proposed LOM revision, exploitation of these coal resources is not likely in the reasonably foreseeable future. High potential for uranium and vanadium mineral resources exists in the Cameron district. However, exploitation of these resources is not likely in the reasonably foreseeable future because the Navajo Nation Tribal Council voted on legislation to prohibit uranium mining activities on the Navajo Reservation.

The coal-slurry pipeline could be affected by swelling clays that are commonly encountered in volcanic-ash deposits of the Chinle Formation. These swelling clays could cause soil shifting and cracking that could damage the pipeline. However, this potential for pipeline damage would be minimized or eliminated through appropriate design, engineering, and construction of the pipeline.

4.2.1.3 C Aquifer Water-Supply System

As discussed in Chapter 3, there are no known geological resources or economic mineral resources in the area of the proposed well field; therefore, it is anticipated that implementation of Alternative A would result in no impact on known mineral and geological resources within the C-aquifer well field or along either the eastern or western alternative routes of the water-supply pipeline because those resources would remain accessible from outside the narrow pipeline corridor. Thus, none of these resources would be excluded from use or made permanently inaccessible.

In the unlikely event of a pipeline failure, some flooding would result in topographic lows and drainage channels. If failure were to occur on a steep slope, there could be minor impact by localized erosion.

There is high potential for the presence of oil and gas resources beneath the C-aquifer well field and in some areas along either alternative route of the water-supply pipeline. However, exploitation of these resources is not likely in the reasonably foreseeable future because the lack of information on oil and gas resources in this area results in a significant risk for exploration. Exploration and development would not be inhibited by the presence of the pipeline due to the narrow width of the corridor.

There is high potential for coal in the Black Mesa Basin along either alternative route of the water-supply pipeline. However, based on Peabody's proposed LOM revision, exploitation of these resources is not likely in the reasonably foreseeable future and would not be inhibited by the presence of the pipeline. There is no known interest in exploitation of the coal resources along the pipeline.

The water-supply pipeline could be impacted by swelling clays that are commonly encountered in volcanic-ash deposits of the Chinle Formation. These clays could cause soil shifting and cracking that could damage the pipeline. However, this potential for pipeline damage would be minimized or eliminated through appropriate design, engineering, and construction of the pipeline.

There are no known geological or unique paleontological resources within the areas to be disturbed; therefore, no impact on these resources is expected by construction or operation of the pipeline.

4.2.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, the types of impacts on geologic and mineral resources would be similar to those described under Alternative A, but the coal-haul road would not be constructed. Although, under Alternative B, the unmined coal resources would not be authorized, mining of these resources (approximately 72 million tons) would not be authorized. However, the unmined coal-resource areas could be mined in the future if an application were submitted to, and approved by, BLM and OSM.

4.2.3 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the overall impact on geologic and mineral resources would be the similar to those under Alternative B, but coal resources at the Black Mesa mining operation area would remain unmined (but available for future mining, if pursued) and the coal-haul road would not be constructed.

4.3 SOILS

4.3.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.3.1.1 Black Mesa Complex

4.3.1.1.1 Surface Mining

Surface-mining activities blend and homogenize soil resources. The topsoil and suitable subsoil would be removed and stockpiled for reclamation following backfilling and regrading of the mined areas.

Approximately 12,409 acres would be disturbed by surface-mining activities. The permit to conduct surface coal-mining operations includes requirements to conduct surface reclamation and soil restoration operations on the disturbed land as part of the mine closure. OSM guidelines for reclamation programs and projects identify soil and slope conditions that must be considered during reclamation including soil pH and acid-forming spoils, sodic zones, toxic substance occurrence in soil, percent and length of slope, and slope stability. Slope reclamation operations generally include regrading, smoothing, and slope contouring to approximate the original topographic contours. Peabody prepared an approved Surface Stability and Drainage System Development Plan to reestablish a more stable and controlled drainage pattern. Reestablishing of the drainage pattern would be followed by replacing soil, topsoil, and vegetation.

4.3.1.1.1.1 Soil Loss

Conserving, protecting, and replacing the soil resource is important because it reclaims the ground surface, promotes revegetation that stabilizes slopes in the area, retains water on slopes, mitigates runoff and erosion, and restores the productivity and capability of the reclaimed lands. Erosion and soil loss from regraded and revegetated slopes were predicted using both the Revised Universal Soil Loss Equation and SEDIMOT II. In accordance with SMCRA, Peabody prepared an approved Minesoil Reconstruction Plan to minimize erosion by using the best technology currently available (BTCA). The BTCA practices used to reduce soil loss would vary depending on topography, soil chemical and physical properties, and revegetation success. BTCA practices include reclaiming slopes with material having low erosion potential; then terracing, ripping, and contour furrowing; followed by seeding and mulching.

Following mining operations, the potential for erosion of redistributed soil would be minimized by regrading slopes to approximate original contours. Mechanical manipulation of the surface topography to stabilize the surface and control erosion would be accomplished by terracing, ripping, contour furrowing, and other methods. By implementing the approved Surface Stability and Drainage System Development Plan and BTCA practices, the impact of soil loss by erosion on newly reclaimed and terraced slopes would range from 1 to 3 tons per acre per year (tons/acre/yr) depending on the slope length and gradient, compared to 5 to 125 tons/acre/yr on slopes where no terraces or BTCA practices other than contour seeding are implemented (2002 LOM Plan). The soil loss on restored land would be approximately 3 to 9 tons/acre/yr after 10 years, which is less than the 7 to 22 tons/acre/yr that can be expected on undisturbed slopes.

4.3.1.1.1.2 Soil Suitability

The LOM revision identifies that 12,409 acres would be disturbed. By salvaging topsoil and suitable subsoil from areas to be disturbed prior to mining, Peabody estimates approximately 1.9 feet of soil material is available to uniformly cover all reclaimed areas (2003 LOM Plan). The Minesoil Reconstruction Plan proposes to salvage the topsoil (as defined in 30 CFR Part 701.5i) together with suitable subsoil and underlying unconsolidated material to provide a topsoil mixture suitable for reclamation. Salvaged material is either redistributed immediately or stockpiled for use as topsoil on future regraded areas. Topsoil stockpiles are protected from wind and water erosion by seeding the stockpiles and placing berms around the perimeter of the stockpile.

As summarized in Section 3.3, during the past 15 years Peabody has collected and evaluated soil-resources data to examine the suitability of soil and overburden to be used in reclamation. Graded spoil is sampled and inventoried to determine how much topsoil and/or supplemental plant growth material is needed to create a 4-foot-deep nontoxic, non-acid-forming root zone. Spoil suitability for use in the root zone is based on several soil parameters including: sodic zones that have elevated SARs, salinity, pH, and acid-forming potential (2004 LOM Plan).

Implementation of the Minesoil Reconstruction Plan would identify and characterize the location and depth of spoils unsuitable for restoration. Those areas containing unsuitable graded spoil would be covered with suitable topsoil or spoils material to a thickness based upon the depth at which unsuitable materials were encountered. Graded suitable overburden material would be covered with up to 12 inches of soil. Implementation of the Minesoil Reconstruction Plan would result in the creation of a 4-foot nontoxic, non-acid-forming root zone capable of restoring or exceeding the predisturbance productivity of the disturbed areas.

4.3.1.1.1.3 Soil Productivity

In the long term, soil erosional stability would be maintained by an effective and permanent vegetative cover. The original soil profile would be lost permanently. Although the reclaimed (postmining) land cannot be restored to premining productive use immediately due to the long timeframe required for plant succession in the arid climate, productivity would be maximized by reclamation procedures that create a suitable 4-foot-deep plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover. The LOM plan reports that historical overgrazing on Black Mesa has degraded the productivity of the soil. Soil reconstruction and revegetation would be undertaken to restore the land to productive use and, in the long term, soil productivity should exceed premining capability (2000 LOM Plan).

Construction of the coal-washing facility would result in disturbance of soils within an approximately 2-acre area. The facility would be isolated by stormwater-control structures and procedures from discharging any sediment load to adjacent receiving waters. Any incidental erosion would be corrected as part of routine maintenance. Soil reconstruction and revegetation would occur following mine closure would allow for resumption of the premining grazing use. In the long term, soil productivity would exceed premining capability (2000 LOM Plan).

Construction and operation of the coal-haul road would result in disturbance of soils within an approximately 127-acre area. The proposed road would cross Red Peak Wash and adjacent tributaries. It would be constructed to comply with OSM and tribal standards for surface-mine-site transportation facilities, including proper drainage for the road itself and crossings over existing streams, diversions, and drainage structures. Any incidental erosion caused by the road would be corrected as part of routine maintenance. Dust suppression, using tanked and sprayed nonpotable water, would be a normal maintenance procedure. Soil restoration and revegetation following mine closure would restore the road corridor to productive use and, in the long term, soil productivity should exceed premining use (2000 LOM Plan).

4.3.1.2 Coal-Slurry Pipeline

A 65-foot-wide swath of soils was disturbed during construction of the pipeline in the 1960s. Under Alternative A, soil within the 65-foot-wide temporary construction right-of-way (approximately 2,319 acres) for the coal-slurry pipeline would be disturbed during reconstruction. The topsoil and subsoil would be segregated during excavation and stockpiled. Disturbed land would be reclaimed following construction of the pipeline in accordance with approved procedures (Section 4.19 and Appendix A-2). Soil reconstruction and revegetation would be implemented to restore the pipeline right-of-way to productive use. Unsuitable material that would affect soil productivity would be backfilled beneath a 4-foot-deep root zone of suitable material. Therefore, the impact of disturbing the soils would be mitigated.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of coal slurry would stop (Appendix A-2). The volume of coal slurry released to the surface would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on Black Mesa coal-slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal-slurry release would cover approximately 0.7 acre with 6 inches of nontoxic fines, while the fresh water in which the coal was entrained would soak into the ground. Typically, the slurry would leak to the surface and flow in a narrow meandering path, the direction and length of which would depend on the terrain. The release generally would be confined to a local area, and minor localized soil erosion would result if the release occurred on a slope. If the volume of the release was sufficient to warrant mechanical removal of the coal, the potential damage to the soil or ground surface caused by the removal of the deposit might outweigh the benefit of removing the coal. This would have to be determined by the appropriate agency and/or landowner and BMPI on a site-specific basis.

4.3.1.3 C Aquifer Water-Supply System

Construction of the well-field facilities (i.e., wells, access roads, collector pipelines, power lines, substation, water-storage tank) would disturb soils of up to approximately 160 acres for the 6,000 af/yr alternative (for 12 wells) and up to approximately 220 acres for the 11,600 af/yr alternative (for 21 wells). Construction of the water-supply pipeline and associated facilities (i.e., pipeline, power line, access roads, pump stations) would disturb up to approximately 1,040 acres for the eastern pipeline alternative and up to approximately 1,545 acres for the western pipeline alternative. Construction areas would be cleared of vegetation, the topsoil would be removed and segregated for use in reclamation, and, for the pipelines, the subsoil would be excavated for the trench. Following placement of the pipeline in the trench, the trench would be backfilled with the subsoil (a minimum of about 36 inches of cover). The site and corridor contours would be restored to conform to adjacent areas. The topsoil would be replaced and the disturbed area would be reseeded. The primary short-term impact on soils, the potential for accelerated soil erosion, would be minimized using best management practices and mitigation (described in Section 4.19 and Appendix A-3).

The aboveground facilities would occupy their locations long term while the pipeline rights-of-way could be returned for appropriate land uses.

Along the water-supply-pipeline routes, susceptibility to soil-induced corrosion of concrete is low. Corrosion is not anticipated since the steel pipe is concrete-mortar lined and tape wrapped, or epoxy or polyurethane coated, for corrosion protection. In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. Some flooding would occur in topographic lows and drainage channels. If failure were to occur on a steep slope, there would be minor impacts from localized erosion and possible of damage to a cliff face or slope. Damage would be repaired by a maintenance and/or response crew.

4.3.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, the overall impacts on soil resources would be similar to those described under Alternative A, except that the Black Mesa mining operation would not resume and, consequently, fewer acres would be disturbed by mining (i.e., 6,942 acres between 2008 and 2026 instead of 12,409 acres under Alternative A). The coal-haul road would not be constructed. The mined areas of the Black Mesa mining operation would be reclaimed. Although the reclaimed (postmining) land cannot be restored to premining productive use immediately due to the long time required for plant succession in the arid climate, long-term productivity would be maximized by reclamation procedures that create a suitable 4-foot-deep plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover. Peabody would undertake soil reconstruction and revegetation to restore the land to productive use and, in the long term, it is anticipated that soil productivity would exceed premining capability (2008 LOM Plan).

4.3.3 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the types of impacts on soil resources would be similar to those described under Alternative B. Approximately 6,942 acres would be disturbed by mining between 2008 and 2026 instead of 12,409 acres under Alternative A; however, the coal-haul road would not be constructed. Approximately 5,467 acres that were projected to be mined on the Black Mesa mining operation area under Alternative A would not be impacted under this alternative. Reclamation would begin on approximately 2,500 disturbed acres on the Black Mesa mining operation area. Although the reclaimed (postmining) land cannot be restored to premining productive use immediately due to the long time required for plant succession in the arid climate, productivity would be maximized by reclamation procedures that create a suitable 4-foot-deep plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover. The soil reconstruction and revegetation activities would restore the land to productive use, and it is anticipated that soil productivity would exceed premining use.

4.4 WATER RESOURCES (HYDROLOGY)

Impacts on surface-water and groundwater quantity and quality can occur as a result of coal mining and the construction of pipelines and other surface facilities. These activities have the potential to impact the flow and quality of surface water and the shallow groundwater system. Impacts are measured by changes in water flows and water quality and are generally limited to an area within a few miles of the mining operations or construction site.

Impacts on surface water and groundwater due to pumping of the C and/or N aquifers for mining-related and coal-slurry pipeline water supplies are the result of changes in the water levels in the aquifers. These changes can occur over relatively large areas, especially in the confined portions of the aquifer systems.

Data and measurements used to assign degrees of impact are discussed in Appendix H. Potential impacts on surface water and groundwater for each alternative are described below.

Federal Water Resources Permits Applicable to All Alternatives. The proposed project actions and the alternative actions are subject to Federal permitting requirements for protecting the nation's surface-water resources. The primary regulatory authorities and responsibilities of the appropriate Federal, tribal, and State agencies are discussed in this section. Applications for appropriate permits would be made during the project design phase when site-specific details are available. Coordination with the USACE and other regulatory agencies would continue through project design in order to assure that the assumptions made in this document would be met.

Section 404 of the CWA (33 U.S.C. 1344) prohibits the discharge of dredged or fill materials into waters of the United States without a permit from the USACE. The USACE may issue individual permits or nationwide permits, depending on the type and magnitude of project impacts. Because the Black Mesa Project is being evaluated in this EIS, the USACE has advised that project activities would be covered under Nationwide Permits 12 (utility-line activities), 21 (surface-coal-mining activities) and, possibly, 14 (linear transportation projects) (USACE 2004a, 2004b, and 2005). This determination assumes that no wetlands would be affected by the project, all crossings of jurisdictional waters would be perpendicular and involve only temporary impacts, and that a preconstruction notice would be provided to the USACE. These permits would cover activities associated with construction of the water-supply system and coal-slurry pipeline, and any necessary access roads, as well as modifications at the Kayenta and Black Mesa mining operations. Nationwide permits carry specific conditions that must be met in order to assure water-quality standards (USACE 2002), and these conditions would be included in project design specifications.

Section 401 of the CWA (33 U.S.C. 1341) requires the applicant for a Federal license or permit to conduct any activity, which may result in any discharge to navigable waters, to provide the permitting agency with certification that any such discharge will comply with applicable water-quality standards. Authority for water-quality certification under Section 401 in Arizona is delegated to the NNEPA for waters of the U.S. occurring on tribal lands and to the ADEQ for other locations. Work conducted under Nationwide Permits 12, 14, and 21 requires water-quality certification by the appropriate agencies.

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) prohibits obstruction or alteration of navigable waters of the United States without permission of the USACE. For this project, a Section 10 permit, if needed, would apply to the coal-slurry-pipeline crossing of the Colorado River. The USACE would evaluate the need for a Section 10 permit based on project design and construction requirements. Preliminary discussions conducted as part of the EIS studies indicate that the pipeline should be installed using horizontal boring under the Colorado River, with at least 50 feet between the bed of the river and the boring entry point, and that contingency plans must be in place (USACE 2004a and 2005).

4.4.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.4.1.1 Black Mesa Complex

4.4.1.1.1 Surface Water

Kayenta and Black Mesa mining operations must comply with SMCRA and CWA regulations, which require that surface-water runoff from constructed surfaces be controlled to "prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow, or runoff outside the permit area." The CWA requires that discharges to streams meet all applicable water-quality standards. OSM-approved procedures for controlling sediment transport include berms, terraces, sediment ponds, and other energy-dissipative channel structures that allow water to pond and sediment to accumulate. To support the Kayenta and Black Mesa mining operations, Peabody's LOM application proposes 158 impoundments to exist in 2005 and an additional 104 future ponds as part of the LOM revision. Of these 262 impoundments, Peabody proposes to retain 51 as permanent impoundments in the postmining reclaimed landscape, which would be transferred with other mine facilities to the tribes when Peabody relinquishes the leases (refer to Map 3-7). In addition, there would be numerous water-control berms.

Surface-water management activities related to mining operations can cause three potential impairments to water use on and off of the leasehold:

- Degradation of surface-water quality by adding suspended sediment, dissolved pollutants, or otherwise poor-quality water to existing streamflows
- Changes in channel geometry, morphology, or location due to changes in flow hydraulics or hydrology
- General diminution of flow due to increased channel- or pond-bottom area contact and resultant infiltration, or through evaporation from the surface of ponds or channels

These potential impacts are discussed below.

4.4.1.1.1.1 Degradation of Surface-Water Quality

Surface-water quality must be protected by handling earth materials and runoff in a manner that minimizes the formation of acidic or toxic drainage, prevents additional contribution of suspended solids to streamflow outside the permit area to the extent possible using the BTCA, and otherwise prevents water pollution (30 CFR 816.41(d)(1)). To comply with this requirement, sedimentation structures are built near the disturbed area to impound surface-water runoff and sediment. Peabody is authorized to discharge the retained surface water subject to compliance with NPDES permit NN0022179. Discharge of the impounded surface water may be necessary to maintain the appropriate design storage capacity after the storm event, or surface-water discharge may result when the surface-water runoff exceeds the design storm-flow event.

Some sedimentation-control structures are designed not to discharge, and are proposed to be retained for livestock watering as part of the approved postmining landscape. The 2004 and 2005 Annual Hydrology Reports (Peabody 2004, 2005c) contain comparisons of water quality collected at ponds during each reporting period with recommended livestock drinking-water standards. Although both reports show that some water-quality samples from the ponds have constituents that are higher than one or more recommended standards, most can be explained by contributions from groundwater sources or high suspended solids from recent runoff that will lessen over a relatively short time due to settling. A few are anomalous compared with the historical water-quality record for each pond and with respect to the entire water-quality data set collected from all ponds. As of the end of 2005, there have been 488 water-quality samples collected since 1986 from 84 proposed permanent impoundments and temporary sediment ponds. During this period, a few of the impoundments proposed in the LOM plan revision application have shown water quality in excess of recommended water-quality parameters. Permanent impoundments must meet specific performance standards as outlined in 30 CFR 816.49(b), including having water quality suitable for the intended land use (livestock grazing). Peabody will be required to submit information to OSM to demonstrate that each of the permanent impoundments meets the performance standards. If any of the impoundments do not meet the performance standards, OSM will not approve them to be retained in the landscape.

As discussed in Section 3.4.1.1, seeps have developed downstream from some sedimentation ponds. Since the onset of mining, some 220 sediment ponds have been constructed, and seeps have been observed below 33 sediment ponds since the onset of sediment-pond construction in 1972. Seeps occur intermittently at the sediment ponds depending on the amount and duration of water impounded in each pond. As of 2005, 70 sediment ponds had been reclaimed, and of those 70 reclaimed structures, seeps had been observed historically below three.

An assessment of the hydrologic implications of seeps was presented to USEPA in the 1999 Seepage Monitoring and Management Report. This was the first of seven annual reports submitted to USEPA in accordance with the Seepage Management Plan, and the report presented detailed hydrologic impact assessments including comparisons of 1999 seep-monitoring results with historical data, statistical trend analyses, and mixing calculations. The assessments indicated that no significant impacts had occurred on the prevailing hydrologic balance, although some seeps monitored in 1999 exceeded some of the livestock water-quality standards. Peabody concluded the seeps had little potential to impact the prevailing hydrologic balance for three principal reasons. (1) The pH of the water controls the solubility and transport of most trace elements. Other than at the immediate area of the seeps, the pH of surrounding ground and surface water is alkaline. Most metals that become soluble in low-pH seep water are rapidly lost to a solid phase (precipitation) over a short distance down gradient. (2) Some of the constituents of concern are already as high or higher in the natural groundwater and surface water systems. (3) Seep flow rates and associated total chemical loads are relatively small in comparison to the flow rates and chemical loads typically measured in alluvial groundwater and surface water runoff below the seeps.

During 2005, seeps were observed at 20 of the sediment ponds that were inspected, 17 of which also have NPDES-permitted outfalls. Of those 17 sediment ponds, five exhibited seep-water quality that had at least one exceedence of a livestock standard. Five of the six sampled seeps (two seeps below one pond were sampled) exceeded the livestock standard for pH. The livestock standard for selenium was exceeded at one seep, the standard for aluminum was exceeded at one seep, and the livestock standard for TDS may have been exceeded at one seep (refer to Table 3-3). At the remaining 12 sediment ponds, which also have NPDES-permitted outfalls, seeps met livestock water-quality standards. Flow rates of the seeps monitored in 2005 were well within the historical range of seep flows (less than 0.0003 gpm up to 15.6 gpm). Likewise, the number of ponds exhibiting poor seep-water quality during 2005 and the values of those constituents that exceeded water-quality standards were well within the historical ranges.

Under the current Seepage Management Plan, Peabody dewaters sediment ponds at the earliest practicable opportunity to prevent seeps, and constructs fences around the areas below dams to prevent livestock from accessing those seeps that have not met livestock water-quality standards. In addition, Peabody has planted willows and cattails in the area below a dam to reduce downstream flow from several seeps. These activities have proved to be effective to some degree. However, fencing provides only a limited measure of protection for livestock access, and does not completely protect the beneficial use of seep water for livestock and wildlife. The USEPA has recommended other measures to protect water-quality standards and beneficial uses, such as treating the water, eliminating the sediment pond, sealing the pond, capturing the water and infiltrating it upstream of the pond, or intercepting the seep water and pumping it back into the pond. Peabody recently applied to USEPA to renew its NPDES permit, and USEPA is currently reviewing the renewal application. USEPA and Peabody are negotiating new and modified seep-management measures to improve the effectiveness of the Seepage Management Plan and to ensure compliance with the CWA. The improved management measures would be applied at all NPDES sediment ponds with poor seep-water quality, including proposed permanent impoundments. If approved by USEPA, Peabody would install passive-treatment systems to treat seep water below two existing impoundments, and remove several existing temporary sediment ponds with seeps exhibiting poor water quality, which is expected to eliminate the seeps associated with those temporary ponds. The renewed NPDES permit is expected to require continued implementation of the modified Seepage Management Plan, including using existing seep-management measures, performing pond inspections, and reporting the monitoring results.

Peabody also would use design and construction methods that would minimize seeps for new sediment ponds by identifying geochemically inert materials for constructing the embankments, compacting the embankments to meet engineering design standards, and siting embankments at locations with low permeable geologic units to the extent practicable. Future ponds to be built during the life of mining that would serve as NPDES outfalls would be subject to the requirements of the modified Seepage Management Plan in the renewed NPDES permit. Future ponds where seeps develop would be evaluated in accordance with the Seepage Management Plan. Therefore, the impacts of the existing seeps associated with existing sediment ponds and future seeps that may occur below new sediment structures are considered to be minor.

Changes in Channel Morphology. Design and operation of the sedimentation ponds would result in a sediment load below equilibrium with the natural hydraulic regime of many washes and channels on the Black Mesa Complex. Erosion of the sides and substrate of the wash would be expected for a short distance downstream of any discharge point, as the stream regained geomorphic equilibrium. Pond-discharge structures are designed in anticipation of this behavior, and allow the water (using grade-control structures, gabion aprons, and bank stabilizers) to attain equilibrium in a gradual and nondestructive fashion. In all cases, erosional scouring of sediment would reach equilibrium before the washes exit the Black Mesa Complex. In addition, failures to meet performance standards are monitored and corrected by Peabody staff as they are observed, confirmed by regular OSM and tribal inspection, and monitored by BIA to ensure compliance with lease terms and conditions.

Diversions of natural streamflow also are designed to preserve geomorphic stability and prevent uncontrolled or destructive erosion and sedimentation. All diversions on the Black Mesa Complex are developed using quantitative hydraulic modeling programs (e.g., SEDIMOT II) that simulate the geometry required to maintain geomorphic equilibrium in a natural channel. Where this is not possible, short, specific structures (such as grade-control structures) are designed and constructed in the channel to correct the problem. Similar to the pond discharges, these channels and structures are regularly inspected and maintained by Peabody staff and reviewed by OSM and tribal inspectors.

Peabody would ensure, under permit conditions, any impacts of the mine's drainage system on the natural stream patterns in the affected environment would be confined to the Black Mesa Complex. Because these variations would be far less than the natural variability of these washes and would include a small proportion of the affected washes within the permit area, the impact of the mine on the geometry, morphology, or location of the natural stream patterns is expected to be negligible outside the permit area.

Diminution of Flow. Sediment ponds are designed to detain water long enough to allow settling of suspended sediment to settle before the water is released into the local drainage, where surface-water impoundments retain water permanently. Further, contour furrows and terraces on reclaimed slopes are placed in the path of runoff to decrease the amount of or slow down water that would have entered the surface-drainage system. Use of sediment ponds results in some amount of surface water being lost, either through infiltration into the ground or evaporation from the surface of the ponded water. This lost potential surface flow represents a diminution of surface-water quantity at the permit boundary, relative to the reaches of the local drainage system that are not under a sediment-management system. Loss of runoff also occurs where many originally existing streams in the permit area are diverted from their channels to allow surface-mine excavations and reclamation to proceed. The effect of this volumetric loss on downstream water quantities (principally Coal Mine, Moenkopi, and Dinnebito Washes) was examined as part of the Chapter 18, Probable Hydrologic Consequences of the permit application package (Peabody 1986, amended 2008).

The examination concluded that the volume of water retained or detained by the drainage-control structures is a very small proportion of the total runoff in the affected watersheds. At the end of the next five-year mining plan (December 2013), approximately 0.7 percent of the Dennebito drainage area and 2.7 percent of the Moenkopi drainage area would be impounded. After mining, about 0.5 percent of the Dinnebito Wash and 2.2 percent of the Moenkopi Wash watershed areas would be impounded permanently. The permanent impoundments are estimated to result in a diminution of flow at the lower end of Dinnebito and Moenkopi Washes of about 1 and 5 percent, respectively, of the average annual runoff (Peabody 1986, amended 2008). Assuming a similar ratio of impoundment area to flow loss, the maximum diminution of flow at the lower end of the basins is estimated to be 1.4 percent for Dennebito

Wash and 6.4 percent for Moenkopi Wash, volumes that would be difficult to detect using available streamflow measurement technology.

The analysis described above assumes no transmission loss of flow between the Black Mesa Complex and the downstream USGS streamflow gage near Moenkopi. In fact, measurements indicate that loss through infiltration is very high in Moenkopi Wash, with rates of about 1 inch per hour (Peabody 1986, amended 2008). Using a 644 acre-foot volume (equal to the total impounded volume for 1998 to 1999), the analysis indicated that the flow could travel about 45 miles downstream before it was completely absorbed by the bed material. This is short of the 70 miles to the first downgradient use location at the town of Moenkopi, where most irrigation operations are located. This estimate is supported by measurements from a storm event on July 27, 1998, where 206.7 acre-feet of water were gauged at the permit boundary of Moenkopi Wash, and 14 acre-feet were measured at the USGS gage near Moenkopi from July 27 to 29, 1998.

Given these observations, it appears that the amount of surface-water flow lost by the mining operations would be small when compared to the amount naturally lost through infiltration in the wash. The change in streamflow would be difficult to measure, leading to the conclusion that there would be negligible to no surface-water quantity impacts from surface-water diversion, impoundments, and sediment ponds on the mining operations areas.

4.4.1.1.2 Groundwater

4.4.1.1.2.1 Impacts on the Wepo and Alluvial Aquifers

On the Black Mesa Complex, groundwater occurs in the more permeable beds within the Wepo Formation and within the alluvium associated with the stream channels. Mining can have potential impacts on these aquifers as follows:

- Dewatering of the coal seam and shallow aquifers by exposure of the pit walls
- Diversion of shallow groundwater movement by structures such as dams and pit walls
- Impairment of the water quality through infiltration of poor-quality surface water
- Impairment of water quality by leaching spoils and migration to adjacent groundwater aquifers

As of 2005, there were 25 Wepo Formation and 32 active alluvial-aquifer sites being monitored for water level and water quality (Peabody 2005c).

Mining of coal seams and interbedded porous rock frequently results in the exposure of saturated zones and discharge of groundwater to the pit face or sides (Peabody 1986, amended 2004). Several of the Wepo Formation coal seams are saturated. Peabody has monitored the quality and quantity of the Wepo Formation's aquifer water since the initiation of mining. Peabody modeled the potential impact of mine dewatering on the alluvial and Wepo aquifer wells. Water-level drawdowns of up to 65 feet by 2013 were predicted. However, actual water-level drawdowns in 2004 were typically an order of magnitude less than predicted, suggesting that the modeling is conservative, even given the additional nine years in the modeling period. In 2004, measured drawdown had exceeded historic fluctuations by more than 5 feet in five of the alluvial wells and two of the Wepo aquifer wells (Peabody 1986, amended 2004).

Some local wells or springs would be mined out. However, under these circumstances, Peabody would be required to provide alternative water supplies as near to the original supply as practicable. Upon completion of backfilling, regrading, and revegetation, the replaced spoil would resaturate and a new, different hydrogeologic regime would be established on the reclaimed land. Some springs would return to availability and some would not, in an individually unpredictable fashion. Based on estimates of the hydrogeologic behavior of similarly reclaimed land, porosities and hydraulic conductivity should increase. However, this does not mean that water levels would return to original levels. It is likely that there would be some minimal impact on local groundwater levels in the coal seam and shallow and alluvial aquifers on the reclaimed and adjacent lands during mining. After reclamation is complete, the hydrologic regime would reach a new equilibrium.

The Wepo and alluvial aquifers do not provide water of suitable quality for domestic use. The quality for stockwatering is marginal. Where shallow groundwater wells have been impacted by mining, Peabody has provided alternative supplies. Two windmill wells have been removed by mining and one additional windmill well will be removed in the future. Peabody has committed to replacing all three wells. Peabody has installed two water stands that provide free potable (N-aquifer) water to the public on a 24-hour, 7-days-a-week. Overall the impact on the use of the shallow groundwater system due to mine dewatering is considered negligible.

Surface-water flow events recharge the alluvial aquifers associated with the stream channels. Reduced flows in washes might be expected to decrease the amount of recharge; however, the impoundment of water and subsequent seepage of pond water into the banks and substrate of the ponds locally enhance recharge. Although it is difficult to quantify, only a small proportion of the premining runoff would actually evaporate or be consumed by mine activities. Therefore, it is expected that reduction in recharge, if any, would be immeasurable and there would be negligible impact on the quantity of recharge to the alluvial aquifers from mining activity.

Chemical reaction of groundwater with spoil material (i.e., broken and crushed rock) has the potential to create groundwater of a lower quality than would occur in an unmined subsurface environment. This is because the reactions common in these settings are enhanced by the greater surface area and oxygen flux afforded by the broken rock and enhanced porosity of the spoil. Dissolution of salts on the surfaces of shales and clays could raise the specific conductivity of the spoil groundwater. Several studies suggest a 50 to 130 percent increase in dissolved solids in similar spoil aquifers in the western United States (Peabody 1986, amended 2008).

Acid reactions in the spoil water also are likely. However, there are sufficient carbonate materials and alkaline salts available in the overburden materials to neutralize most acid production from the oxidation of sulfides. All but one of the overburden core samples taken on the leasehold had excess neutralization potential. These cores also indicate that there are no high concentrations of metals in the overburden. As acid water comes in contact with the alkaline overburden, the pH rises and metals that are present tend to precipitate. This is supported by the analysis of ground water in the Wepo and alluvial aquifer-monitoring wells; metals in these wells generally do not exceed livestock watering standards (Peabody 1989, revised 2003).

Although there are specific procedures in the mine plan to reduce acid-forming materials, and the presence of carbonate material in the Wepo overburden and inter-burden is sufficient to achieve neutrality, some local pockets of acidic water could be formed. This could result in the release of trace elements associated with SO_4 and sulfide as these reactions proceed toward equilibrium. These chemical reactions could result in some minor-to-moderate water-quality impacts on local wells, increasing the levels of salinity and trace elements to a level that decreases their usability. Peabody would be required to provide alternative water supplies to any wells rendered unusable due to violation of water-quality standards.

Similarly, the spoil water also could discharge to the surface water as springs or seeps. Some degradation of surface-water quality could result, particularly in the vicinity of the springs. However, the impact on the surface-water flows would be minor in volume compared to stormwater runoff. As noted above, discharges from springs with low pH water are neutralized by the alkaline soils. Since streams are intermittent and generally flow only after precipitation events, any poor-quality spring-water discharges tend to be diluted by the much larger streamflows. Streamflow events tend to carry high sediment loads and are generally not suitable for use by livestock, resulting in little potential exposure of livestock to poor-quality spoil water.

Finally, the opposite condition, degradation of groundwater by infiltration of surface water, also is a possible impact from surface-mining activities. Controlled surface water would be allowed to infiltrate to the shallow subsurface in impoundments, sediment ponds, or diversions. Increases in some soluble ions (Ca, Mg, Na, SO_4 and bicarbonate) and TDS would occur. The potential for formation of acid and trace-metal migration is minimal due to the high carbonate content of the soil materials. The magnitude of the impact on groundwater quality should be limited to the immediate pit areas due to low transmissivity and groundwater gradients in the shallow aquifers (Peabody 1986, revised 2003).

Runoff from shops or other facilities using petroleum products and hazardous materials is controlled under Peabody’s Spill Control and Countermeasure plan. This plan specifies measures for handling and controlling these materials as well as cleanup procedures in the event of a spill.

The coal-washing facility would use water from the C or N aquifer, depending on the final selection between these options. In either case, the volumes of water used would be consistent with the production of high-quality coal required by the Mojave Generating Station. The facility would use various water-saving and recycling technologies. Initially, the plant would require approximately 330 acre-feet of water. A moisture balance on the entering coal, exiting clean coal, and waste would result in an annual deficit of 324 acre-feet, to be supplied by either aquifer. In the LOM plan revision, an estimate of 500 af/yr (from the C aquifer or the N aquifer) has been evaluated. The coal-washing facility would be constructed near the existing coal-processing facilities. Runoff from the facility would be contained in the existing NPDES-permitted sediment ponds. The coal-washing facility is designed to recycle water, with essentially no process-water discharge. A small, nondischarging surge pond would be constructed adjacent to the plant to contain water that could be drained periodically from plant tanks during repairs. The Spill Prevention Control and Countermeasure plan would be modified to address this pond. Coal waste initially would be disposed in the N-06 pit for approximately 3 years, and then new waste would be disposed in the J-23 pit for the remaining 14 years. A study commissioned by Peabody to evaluate the short- and long-term effects of this plan on the hydrologic balance of the affected environment concluded that the coal-wash refuse (earth material) is no more likely to interact with groundwater or produce poor-quality leachate than regraded spoil material, and that any adverse effects would be temporary and immeasurable (Western Water & Land, Inc. 2003). The study concluded that there would be a negligible impact from disposal of the coal-wash refuse, as proposed.

The study relied on surrogate core samples and leachate tests to provide chemical data to assess impacts, because actual wash-plant refuse from the coal-washing facility would not be available until operations resume at the Black Mesa mining operation in 2010. A degree of uncertainty was introduced to the study results because the core samples were not expected to have the same physical characteristics as the refuse material and were not subjected to a washing process.

As a result, Peabody would develop and submit for regulatory approval a Refuse Sampling and Disposal Plan that would be incorporated into the mining permit. The plan would be implemented when the coal-washing facility begins operating. The plan would consist of periodic sampling of refuse based upon the source (pit and seam) of run-of-mine coal being processed to ensure a representative cross section of the refuse material is sampled. Samples would be analyzed for the same chemical constituents (including trace elements) employing the same analytical techniques used to analyze the core samples as described in the study. The analytical data results would be compared to the chemical data assessed in the study. If the analytical data results from coal-wash-refuse samples exceed concentrations from the initial core samples, new model simulations would be conducted using the new data and the same models used to predict impacts in the study. If the coal-washing-refuse sample data and model results do not deviate from the study data and model results, the refuse would be disposed in the pits (N-06 and J-23) using standard practices currently outlined in the permit application. If the data and model results deviate significantly from the study and indicate the potential for greater impacts, Peabody would implement special refuse-disposal procedures such as placing the refuse in pit areas over preconstructed liners consisting of compacted clay spoil and capping the refuse with compacted clay spoils, or mixing the refuse with greater volumes of specially handled spoil having chemical characteristics suitable for diluting or neutralizing the refuse. Locations where special disposal procedures are implemented would be surveyed and recorded. Following final grading and reseeding, a downgradient spoil-monitoring well would be installed, and monitoring of water levels and chemistry would be conducted at frequencies and for parameters as described in the plan and approved by OSM to confirm the special disposal procedures are effective.

The coal-haul road, shown on Figure 2-1, would be constructed and maintained in full compliance with Peabody's OSM and tribal standards for surface-mine-site transportation facilities, including proper drainage for the road itself and for crossings over existing streams, diversions, and drainage structures. Dust suppression, using tanked and sprayed nonpotable water, would be a normal maintenance procedure.

Impacts on groundwater quantity and quality from construction and maintenance of the road would be similar to those from existing roads, and are expected to be negligible. The impact on surface-water quantity would be to increase, slightly, the amount of runoff over that from undisturbed land. Stormwater runoff from the coal-haul road would be treated by implementing best management practices as described in Peabody's Storm Water Pollution Prevention Plan (SWPPP). The SWPPP is required by Peabody's coverage under the Multi-Sector General NPDES Permit for Storm Water, and the existing SWPPP would be modified to include the new coal-haul road. Implementing best management practices along the new coal-haul road as part of the SWPPP would result in negligible impacts on downstream surface water.

4.4.1.2 Coal-Slurry Pipeline

Short-term disturbances of surface-water drainages and, in rare instances, the shallow groundwater system would result along the coal-slurry pipeline right-of-way during construction. The primary impact would be a short-term increase in sedimentation resulting from excavation of the trench and vehicular construction traffic. Impacts would be confined largely to the pipeline right-of-way and would be negligible.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of coal slurry would stop (Appendix A-2). The volume of coal slurry released to the surface would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on Black Mesa coal-slurry-pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal-slurry release would cover approximately 0.7 acre with 6 inches of nontoxic fines, while the fresh water in which the coal is entrained would soak into the ground. Typically, the slurry would leak to the surface and flow in a narrow, meandering path, the direction and length of which would depend on the terrain. The release generally would be confined to a local area and the impact would be short term and, in the majority of instances, negligible on surface-water resources. If the volume of the release was sufficient to warrant mechanical removal of the coal, the potential damage to soil or drainage caused by the removal of the deposit might outweigh the benefit of removing the coal. This would have to be determined by the appropriate agency and/or landowner and BMPI on a site-specific basis.

One of the potential risks associated with horizontal boring under a watercourse, such as the Colorado River, is the escape of drilling mud into the environment as a result of release, tunnel collapse, or rupture (from excessive drilling pressure) of mud to the surface. If the rupture occurs in the watercourse, the fine clay particles would disperse and settle on the bottom of the watercourse. Ruptures are difficult to detect underwater, but the potential for a rupture would be minimized through proper geotechnical practices, adequate drill planning and execution, careful monitoring, and use of appropriate equipment and response plans in the unlikely event that a rupture were to occur. During operation, it is unlikely that the pipeline would fail and release slurry into the watercourse. Based on historical performance of the existing pipeline (Appendix A-2), no failures and consequent leaks occurred in or near the river during the 35 years of operation. Considering this and the proposed conceptual design of the reinforced pipeline, failures are not anticipated. In the unlikely event of a release, the extent of the impact is uncertain, as such a determination would depend on the amount of slurry released and the conditions of the watercourse (e.g., flow rate). Generally, the nontoxic fines released would be suspended in the water, carried an uncertain distance by the current, and disperse over the bottom of the watercourse. This impact on water would be temporary and negligible.

There would be no impacts on the deep groundwater aquifers during construction or operation.

4.4.1.3 Water Supply

Water demands for the mining operations, coal-slurry pipeline, and coal-washing facility would be supplied by groundwater from either a combination of the C and N aquifers or the N aquifer. As described in Chapter 3, these aquifers are regional in extent, underlying much of the northwestern corner of Arizona. The N aquifer underlies Black Mesa and is the current source of water to the Black Mesa Complex and many of the communities on the Hopi and Navajo Reservations. While the C aquifer exists under Black Mesa, it is deep (greater than 5,000 feet under the Black Mesa Complex) and of poor quality. In areas where the C aquifer is at or near the ground surface, including in the area of the proposed C aquifer well field, the water quality is suitable for most uses.

The N and C aquifers are separated by approximately 1,000 feet of low-permeability semi-consolidated silts and clays of the Chinle and Moenkopi Formations. There is essentially no hydraulic connection between the N and C aquifers. Impacts due to pumping of these aquifers to supply the Black Mesa Complex are, therefore, discussed separately.

The impact of groundwater pumping is commonly assessed by a measured or projected lowering of the water level in the pumping wells and in wells located within the cone of depression created by the pumping well(s). The lowering of the water level has the potential to result in five primary effects as follows:

- Increase in the cost of pumping due to increased lift to get the water to the land surface.
- Reduction in saturated thickness and consequently a decrease in the transmissivity (ability of the aquifer to transmit water to the well) in unconfined aquifers. In severe cases, a well can cease to produce water or "go dry."
- Diminution of stream baseflow and spring flow (groundwater discharge to the surface-water system) due to a lowering of aquifer water levels in the area of perennial streams and springs.
- Migration of man-caused or natural poor-quality groundwater toward the well field.
- Potential for subsidence in unconsolidated aquifer systems due to compression of fine-grained layers. Also, the removal of cavity filling material and dissolution of limestone in some limestone aquifers can foster sinkhole development. These effects are not a concern in this study, however,

due to the fact that the primary water-bearing units of the N and C aquifers are not composed of unconsolidated material or limestone (refer to Appendix H).

In large, complicated aquifers and stream systems with multiple pumping centers, it is necessary to use numerical models to assess the relationship between groundwater pumping and streamflow diminution. Three separate models have been developed over the past several years that have assessed the potential stream diminution from C-aquifer pumping in the area of Clear and Chevelon Creeks. These models are briefly described below:

- Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study—In 2003, under Reclamation's Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study, HDR developed a three-dimensional (3-D) numerical flow model of the Clear and Chevelon Creek area. The numerical model (MODFLOW) covered only a portion of the C aquifer and did not include all pumping centers. The area outside the numerical model was simulated with an analytical model (HDR 2003).
- USGS Superposition Model—The USGS developed a numerical model of the entire C aquifer for Reclamation. Given the schedule constraints of the Black Mesa EIS, the USGS developed a simplified model of the C aquifer that addressed only pumpage from the proposed well field and its impact on Clear and Chevelon Creek streamflow. This "superposition model" is a two-dimensional (2-D) MODFLOW numerical model designed to be conservative in that the efficiency of the connection between the groundwater and surface water in the creeks was assumed to be high. In addition, the model does not include any natural recharge or regional groundwater flow. It assumes all water pumped from the proposed well field comes from aquifer storage or Clear and Chevelon Creeks. This model was not calibrated to reflect historic flow in Clear and Chevelon Creeks (Leake et al. 2005).
- SSPA Model—SSPA developed a three-dimensional (3-D) MODFLOW model of the entire C aquifer that includes considerations of recharge, regional flow, and all known pumping centers. The model was calibrated to measured flows in lower Clear and lower Chevelon Creeks and water-level changes in wells (SSPA 2005).

The three C-aquifer groundwater models were developed independently. However, the USGS and SSPA models predict essentially the same streamflow depletion in lower Clear and Chevelon Creeks. These models predict greater depletion than the HDR model, due in part to the lower project pumpage assumed in the HDR model. However, all three models predict small streamflow depletion values resulting from project pumping over the planning period (refer to Appendix H).

The N aquifer has been modeled by the USGS and two consultants retained by Peabody. These models are described below:

- USGS Black Mesa Model—The USGS developed a finite-difference model of the N aquifer in 1983 that was upgraded in 1988 and 2000. The model was designed to evaluate the impacts of current and future groundwater withdrawals for the Black Mesa Complex, as well as municipal withdrawals from surrounding Indian communities. The model is 2-D and comprised of one layer that represents the N aquifer. A general head boundary was used to simulate vertical flow between the D aquifer and N aquifer (Brown and Eychaner 1988; Eychaner 1983).
- HSI GeoTrans and Waterstone D and N Aquifer Model—HSI GeoTrans and Waterstone (GeoTrans) developed a finite-difference model of the D and N aquifers using the MODFLOW numerical code. This is a regional 3-D groundwater-flow model developed to estimate the effects of pumping by Peabody and several American Indian communities on the aquifers and on surface-water flows. The GeoTrans model covers a slightly larger area than the USGS model.

> Additional hydrogeologic field data were collected and compiled as a part of the studies to develop the model. The model has undergone extensive sensitivity testing and validation. Evaluation of the model indicates that it successfully simulates historic water-level response to pumping in the N aquifer. It also produces N-aquifer drawdowns that are essentially the same as the USGS model (Peabody 1999, GeoTrans 2005, 2006). This model has been accepted by OSM for use in evaluating impacts due to mine-related pumpage.

In this EIS, the USGS superposition, SSPA and GeoTrans numerical models are used to assess the impacts of pumping from the C and N aquifers, respectively, as these models are the most representative of the complexities of these aquifer systems (refer to Appendix H).

4.4.1.4 C Aquifer Water-Supply System

As described in Chapter 2, there are two possible C-aquifer pumping subalternatives. These are summarized in Table 4-5.

Table 4-5 Pumping Rate Subalternatives

Subalternative Pumping Rate (af/yr)	Comment
6,000	Project only (including coal slurry and coal washing through 2026)
11,600	Project (6,000 af/yr) plus 5,600 af/yr for tribal domestic, municipal, industrial, and commercial use (2010 to 2060)

NOTE: af/yr = acre feet per year

Impacts of these pumping subalternatives on surface-water and groundwater resources in the study area are described below.

4.4.1.4.1 Well Field

4.4.1.4.1.1 Increased Cost of Pumping

Since the siting of individual wells in the C-aquifer well field has not yet been determined, location of the nearest existing stock well is unknown. However, drawdown in any nearby well would not be more than the drawdown in the center of the well field. Static water level in the well-field area is approximately 240 feet bgs. The estimated annual energy cost of pumping for a stock-watering well from this depth is $130 (refer to Appendix H). Under the maximum well-field pumping (up to 11,600 af/yr), drawdown of the water level in the center of the C-aquifer well field is projected to be 58 feet (SSPA 2005). Thus, the maximum pumping lift would be 298 feet (240 feet plus 58 feet) after 50 years of well-field operation. This would result in an annual pumping cost of $150, an increase of 15 percent, or a negligible impact. The impact on pumping cost for 6,000 af/yr would result in less than half the pumping cost increase, or about 7 percent, also a negligible impact (refer to Appendix H).

As noted in Appendix H, many C-aquifer stock-watering wells have windmills rather than electric pumps. For these wells, costs do not increase when the water level declines, as long as the decline does not require the pump to be set deeper. The pump-setting depth in wells in the area is generally unknown. Assessing the impact of project pumping on these wells relies on available data concerning the height of the water column in the well (depth of the well minus the static water level) and is evaluated in the same manner as the potential reduction in aquifer saturated thickness, as described in the subsequent subsection

4.4.1.4.1.2 *Reduction in Aquifer Saturated Thickness*

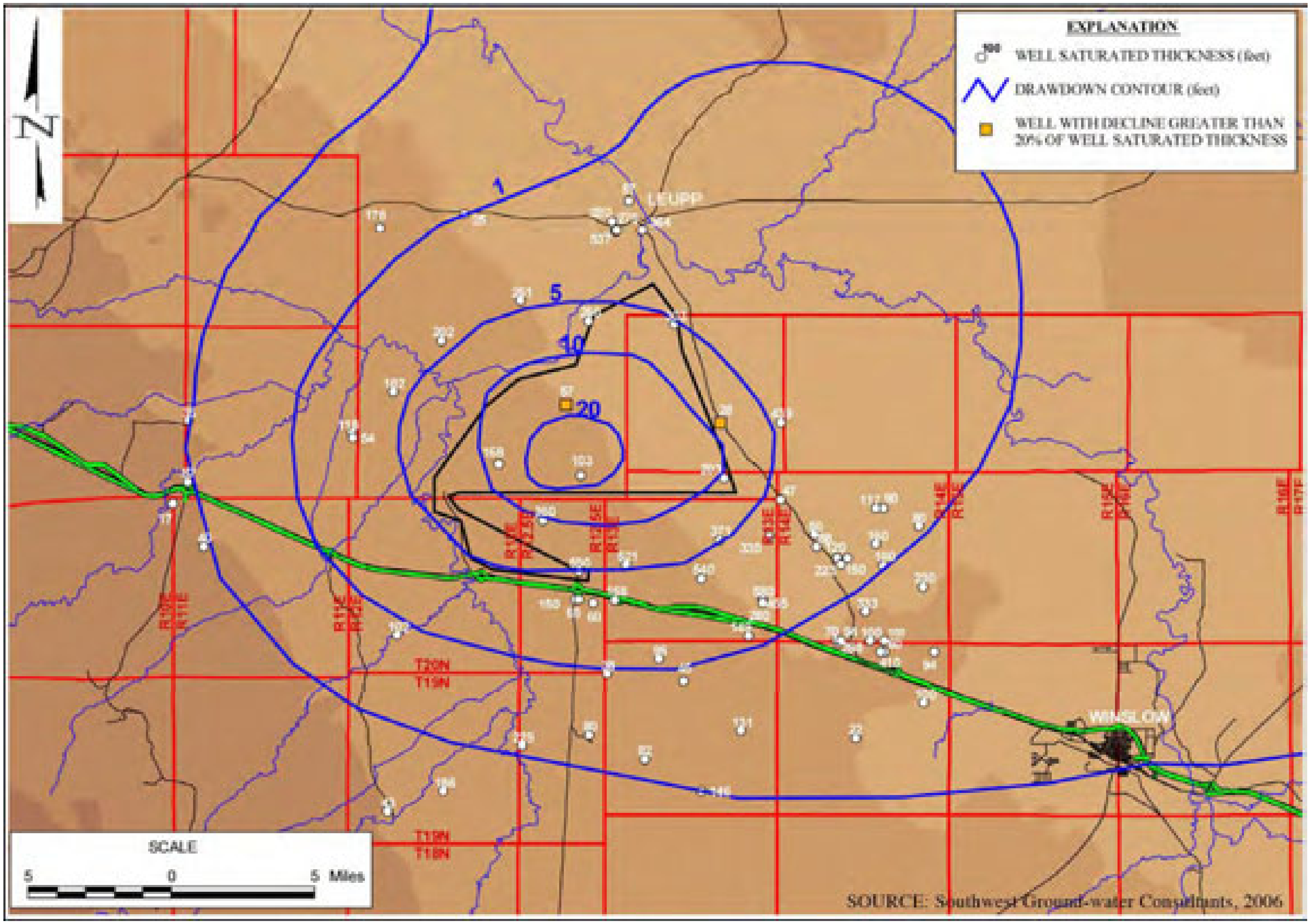
The C aquifer in the area of the well field is unconfined; average saturated thickness of the C aquifer in the well-field area is about 700 feet (Reclamation 2005). As noted above, under maximum well-field pumping (up to 11,600 af/yr), maximum drawdown of the water level in the center of the C-aquifer well field is projected to be 58 feet in 2060 (SSPA 2005), or about 8 percent of the aquifer thickness after 50 years of pumping. This level of drawdown would have a negligible impact on the aquifer (refer to Appendix H). The impact on the pumping cost for 6,000 af/yr, which would pump less than one-half the groundwater, would be an increase of less than 4 percent.

While the overall reduction in aquifer saturated thickness is small, some local wells would be impacted. Maps 4-1 and 4-2 show the anticipated 2060 drawdown due to pumping for the 6,000 and 11,600 af/yr subalternatives, respectively. The saturated thickness in wells with known depths and water levels also is shown. The number shown is the height of the water table above the bottom of the well, in feet. Under the 6,000 af/yr subalternative, two wells would experience a reduction of saturated thickness of between 29 and 32 percent, resulting in a minor to moderate impact (refer to Appendix H). At the 11,600 af/yr withdrawal rate, 11 wells would have a reduction in saturated thickness of between 21 and 70 percent, with corresponding impacts of minor to major. While the impact on individual wells is significant, the number of wells affected is relatively small, two and 11 out of a total of 71 known wells for each subalternative, respectively. Some additional wells may not have been identified or their saturated thickness data may not be available. Depending on the specific design of the C-aquifer well field and distribution facilities, some affected well owners could receive replacement water from the proposed well field. Other impacted owners could require that wells be deepened or new wells drilled. Specific actions would be taken to address impacts on existing water users in coordination with the tribes.

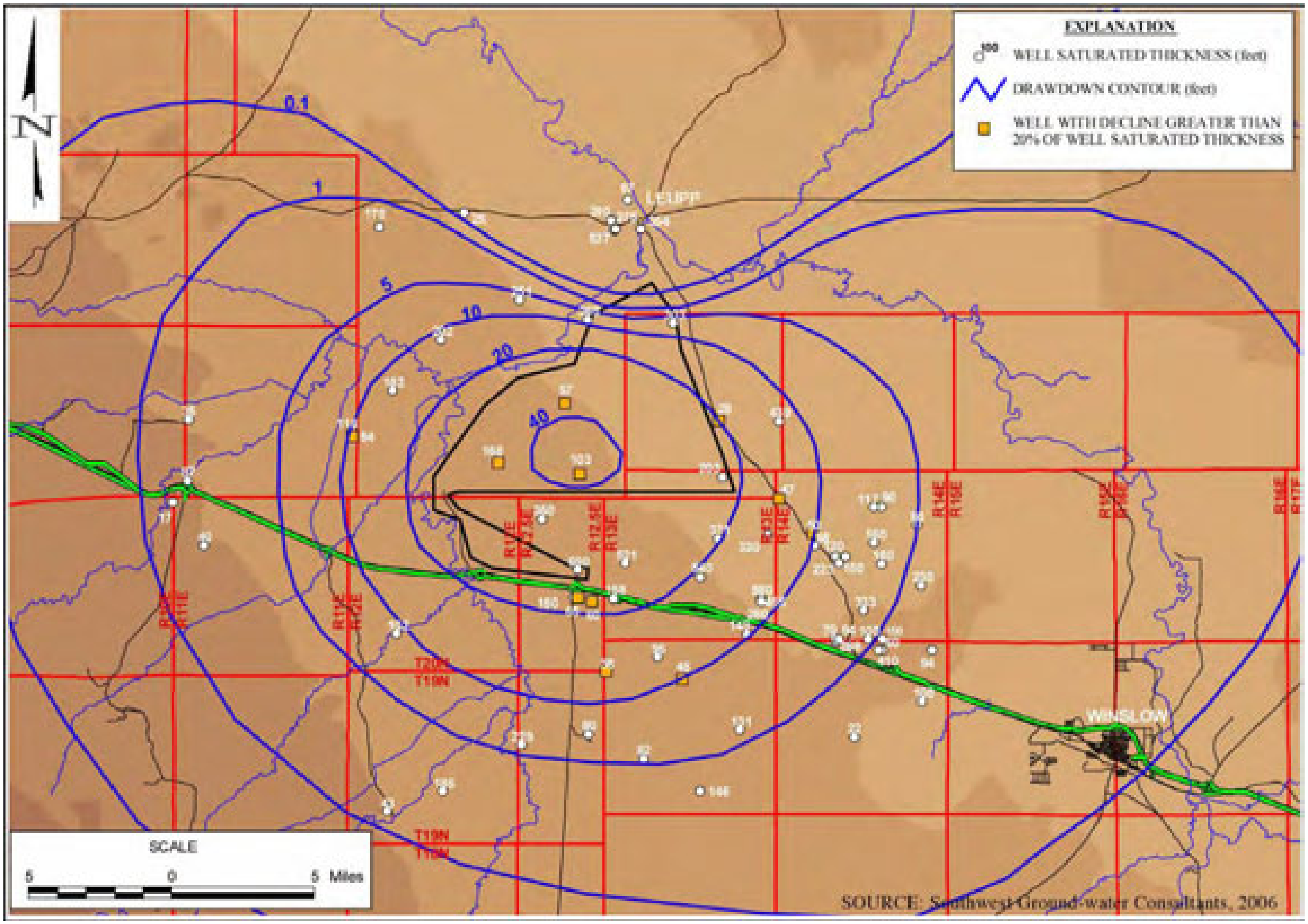
Under the 11,600 af/yr subalternative, local water levels in the Leupp area are projected to rise, since some of existing current demand would be supplied from the C-aquifer well field with concurrent reductions in local well use. This water-level rise creates the difference in the pattern of drawdown south of Leupp between the 6,000 af/yr (Map 4-1) and 11,600 af/yr (Map 4-2) scenarios.

4.4.1.4.1.3 *Diminution of Stream and Spring Flow*

Stream baseflow diminution in lower Clear Creek and lower Chevelon Creek was estimated using the USGS and SSPA groundwater models (Leake et al. 2005; SSPA 2005). At the end of the planning period (2060), the maximum diminution would occur at the confluence of the creeks with the Little Colorado River (Table 4-6).



Map 4-1 Drawdown vs. Saturated Thickness, C Aquifer 6,000 af/yr Subalternative



Map 4-2 Drawdown vs. Saturated Thickness, C Aquifer
11,600 af/yr

Table 4-6 Projected Baseflow Diminution in Upper East Clear Creek, Lower Clear Creek, and Lower Chevelon Creek

Subalternative	Upper East Clear Creek (cfs)[1]	Lower Clear Creek (cfs)[2]	Lower Chevelon Creek (cfs)[2]
6,000 af/yr	less than 0.001	0.05	0.03
11,600 af/yr	less than 0.001	0.06	0.04

SOURCES: [1]Leake et al. 2005; [2] S.S. Papadopoulos and Associates 2005

NOTES: af/yr = acre feet per year, cfs = cubic feet per second

Model-predicted diminution of stream baseflow in upper East Clear Creek is essentially zero. Maximum predicted baseflow reduction in lower Clear Creek is 0.06 cfs for the 11,600 af/yr subalternative or 1.1 percent of the average baseflow and 0.05 cfs or 1.0 percent for the 6,000 af/yr subalternative, a negligible impact in both cases. For lower Chevelon Creek, the diminutions for the 11,600 and 6,000 af/yr subalternative are respectively 1.5 and 1.1 percent of the 2005 baseflow (2.7 cfs), also a negligible impact for both scenarios (refer to Appendix H).

As discussed in Chapter 3, while baseflow constitutes essentially all of the streamflow in some days during the summer months, the baseflow is a relatively small percentage of the average annual streamflow of 83 cfs in lower Clear Creek and 54 cfs in lower Chevelon Creek. Maximum diminution of average annual flow by maximum project groundwater pumping (11,600 af/yr) is 0.1 percent, resulting in a negligible impact on human uses.

Blue Springs is the major discharge point for the C aquifer, releasing more than 164,000 af/yr into the Little Colorado River, upstream from its confluence with the Colorado River. Water from the springs is not potable (salinity is 3,000 ppm), but is of cultural significance to the Hopi and Navajo people and supports critical habitat for the Little Colorado River humpback chub. Blue Springs is approximately 77 miles north-northwest of the C-aquifer well field (refer to Map 3-4). Model-predicted changes in flow at Blue Springs due to project pumping are essentially zero (SSPA 2005), resulting in no effects from this project. The only other known C-aquifer springs within the project area are those that support baseflow in Clear and Chevelon Creeks. Effects on these springs are identified in the discussion of impact on streamflow and Table 4-6 above.

4.4.1.4.1.4 Migration of Poor-Quality Groundwater

As noted in Chapter 3, groundwater quality in the C-aquifer well field is suitable for most drinking water and industrial uses. However, the quality of the groundwater declines to the northeast, with TDS levels reaching 2,000 mg/L approximately 10 miles from the center of the proposed well field. The potential for this water to migrate into the well field was evaluated using particle-tracking methods. The capture area of the well-field pumping at the maximum rate (11,600 af/yr) does not reach the 2,000 mg/L isopleth, although it does reach the 1,500 mg/L isopleth. Based on the modeling, it was concluded that water quality would remain suitable for drinking-water purposes over the modeled period (SSPA 2005). Under the 6,000 af/yr subalternative, pumping would be confined to a 16-year period (mid-2009 through 2025). It is highly unlikely that any change in water quality would occur over this period. Some change in water quality over the longer planning period (until 2060) and higher pumping rate of up to 11,600 af/yr cannot be ruled out, but is unlikely to make the water unsuitable for domestic use as any poor-quality water migrating from the northeast would be blended with good quality water moving from the southwest into the well field. Any increase in salinity, if it occurs, would take place gradually over years, and would be detectable through simple routine monitoring so that engineering and/or management solutions could be implemented before the users of the water are affected.

4.4.1.4.2 C Aquifer Water-Supply Pipeline

Because the pipeline would be constructed near land surface, construction and operation would not affect existing groundwater in the regional D, N, or C aquifers, which generally have water levels below the level of excavation for the pipeline trench. The pipeline would cross numerous washes where, locally, groundwater could be near the surface. On the Black Mesa Complex, the pipeline would cross the Wepo and shallow alluvial aquifers. In areas with shallow groundwater, some temporary discharge of groundwater to the excavation may occur during construction. The impact on other users, if any, is expected to be limited in both time and distance from the excavation.

Based on the conceptual design, engineering, and construction of the pipeline (Appendix A-3), it is unlikely that the water-supply pipeline would fail. However, if a failure were to occur, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. In the event of a failure, some flooding would occur in topographic lows and drainage channels and some erosion and sediment transport might occur at the point of failure. The area affected would be limited. Releases resulting from pipeline failure would not be expected to have an adverse impact on local water quality.

Overall, construction and operation of the C aquifer water-supply pipeline is expected to have a negligible impact on the existing surface-water and groundwater resources.

4.4.1.5 D and N Aquifer Water-Supply System

Two potential options for mining-related and coal-slurry pipeline water supply have been identified. As indicated in Section 2.2.1.2.2.1, there are two potential subalternatives for using the existing N-aquifer water supply. Under one subalternative, N aquifer water-supply system would not be relied on for mining or industrial use, while the proposed new C aquifer water-supply system would provide the majority of the water needed for the mining operations. The N-aquifer wells would need to be pumped periodically to keep them in operating condition until being returned to the Navajo Nation, and they also would be used as a temporary back-up supply in case the primary C-aquifer water supply failed for any reason. Under a second subalternative, the N aquifer water-supply system would continue to be used as the sole water supply for mining-related purposes and coal slurry.

As discussed in Appendix H, the analysis of impacts due to pumping from the D and N aquifers relies on the 3-D groundwater flow model developed for Peabody by GeoTrans. The effects of N-aquifer pumping associated with each option is discussed in the following subsections.

4.4.1.5.1 Alternative A, Supplemental Use of N-Aquifer Water

Under Alternative A, recent past average annual use (2000 through 2004) of the N aquifer (4,400 af/yr) would be reduced to an average rate of about 480 af/yr over the life of the mining operations. Therefore, even though pumping of the N aquifer may continue, water levels in the area of the well field may rise due to a decrease in the pumping compared to previous years. Pumping would consist of up to 500 af/yr from mid-2009 through 2025 for mine-related and public use; 505 af/yr for mine reclamation and domestic use from 2026 through 2028; and 444 af/yr would be used from 2029 through 2038. These pumping rates assume that no N-aquifer water is needed as a back-up supply and the C-aquifer water supply does not fail for any reason. Since water-supply systems historically have been highly reliable, it is expected that the actual pumping during the LOM permit period would be similar to the projected amounts.

4.4.1.5.1.1 Cost of Pumping

Peabody modeled the effects on nearby N-aquifer community wells under various mine-pumping scenarios (Geotrans 2006). Predicted water-level change is given in
Table 4-7.

Table 4-7 N-Aquifer Well Drawdown, Alternative A, Supplemental Use of N-Aquifer Water, 2005 to 2025

		Water Level, 2005 (feet msl)		Water Level, 2025 (feet msl)		Drawdown (feet)[1]		
Community	Well	All but Peabody	All	All but Peabody	All	All but Peabody	All	Peabody
Chilchinbeto	PM3	5,533.4	5,465.2	5,516.0	5,481.2	17.4	-16.1	-33.5
Forest Lake NTUA 1	4T-523	5,667.6	5,469.1	5,653.2	5,563.9	14.4	-94.8	-109.3
Kayenta West	8T-541	5,488.5	5,454.7	5,438.3	5,418.6	50.2	36.1	-14.1
Keams Canyon	PM2	5,799.2	5,790.6	5,781.8	5,770.3	17.4	20.3	3.0
Kykotsmovi	PM1	5,461.6	5,438.6	5,413.3	5,383.8	48.2	55.1	6.6
Pinion	PM6	5,712.9	5,640.7	5,680.1	5,620.4	32.8	20.3	-12.5
Rocky Ridge	PM2	5,609.2	5,516.0	5,594.1	5,523.2	15.1	-7.5	-22.3
Rough Rock	10R-111	5,719.4	5,717.8	5,717.8	5,715.8	1.6	2.0	0.3

SOURCE: Geotrans 2006
NOTE: [1] Negative sign (-) indicates rise in water level.
Msl = mean sea level, NTUA = Navajo Tribal Utility Authority

Five of the eight wells modeled show a rise in water level due to a reduction in N-aquifer pumping under this alternative. As would be expected, wells closest to the mine's well field have the greatest predicted response. The well with the greatest total drawdown is at Kykotsmovi (55.1 feet); however, the drawdown due to the project (6.6 feet) is 3 percent of the 2004 depth to water (229 feet bgs), resulting in a negligible impact (refer to Appendix H).

Some of the Peabody production wells pump from both the D and N aquifers, with about 3 percent of the water coming from the D aquifer (Peabody 1986, revised 2005). The communities of Chilchinbito, Kitsillie, Kykotsmovi, and Polacca also use D-aquifer water but are located far enough from the mine that drawdown due to maximum project pumping is limited to about 1 foot (OSM 2006). This level of drawdown would have no measurable impact on pumping cost.

D-aquifer uses near the leasehold are primarily for stock watering using windmill-driven pumps. While these wells are not subject to increased pumping costs, they can be adversely impacted if water levels decline in the wells to a point where pumps must be lowered and/or the wells deepened to remain productive.

Two windmill wells in the D aquifer are within 15 miles of the Peabody pumping center, identified as 4T-402 and 4K-387. Windmill Well 4K-387 is screened in both the Cow Springs and Dakota Formations, and is approximately 15 miles from the Peabody pumping center. Windmill Well 4T-402 withdraws water from the Dakota Sandstone Formation and is approximately 1 mile from the Peabody pumping center. Due to the reduction in pumpage associated with this alternative, the water level in Windmill Well 4T-402 is projected to rise over the 2005 to 2025 period, resulting in no adverse impact (OSM 2006).

4.4.1.5.1.2 Reduction in Aquifer Saturated Thickness

All the N-aquifer and D-aquifer wells that are predicted to experience water-level declines are located in the confined portion of the aquifer and are not predicted to have their water levels lowered below the top of the aquifer. In other words, no reduction in saturated thickness is predicted for N- and D-aquifer wells within the confined area of the aquifer. There would be no impact.

Near the boundary between the confined and unconfined areas of the aquifer, a small water-level draw-down in the unconfined aquifer is predicted. This occurs primarily to the north of the leasehold in the area of Kayenta and Shonto. The effects of mine-related pumpage are small compared to community pumping.

4.4.1.5.1.3 Diminution of Stream and Spring Flow

As discussed in Chapter 3, The USGS has been monitoring N-aquifer spring flow from four springs (Moenkopi School, Pasture Canyon Spring, Burro Spring, and an unnamed spring near Dinnehotso) for a minimum of 10 years (some springs have been monitored for much longer but not always at the same location). The closest USGS-monitored spring (the unnamed spring near Dinnehotso) is more than 35 miles from the Black Mesa Complex. The USGS concludes that “for the consistent periods of record at all four springs, the discharges have fluctuated but long-term trends are not apparent” (USGS 2005a). It appears that pumping to date has not measurably reduced the monitored N-aquifer spring flow. However, modeling of N-aquifer groundwater discharge suggests that as future nonmining-related groundwater pumping near some of these springs increases, flows from springs could be impacted (GeoTrans 2006).

There are other N-aquifer springs that are not monitored, and past changes to these springs, if any, are unknown. As discussed in Appendix H, numerical models of the N aquifer are not designed to simulate discharge from individual springs (Brown and Eychaner 1988; GeoTrans 1999). However, the GeoTrans model does simulate groundwater discharge to Begashibito Wash approximately 25 miles west of the leasehold. Cow Springs, located at the southwestern extent of Begashibito Wash, is an area of groundwater discharge as expressed by seeps and small springs. Cow Springs is the closest modeled area of seeps and springs to the mine and would therefore experience the greatest impact due to project pumping. The model predicts changes in groundwater discharge into Begashibito Wash and Cow Springs combined.

Model-predicted groundwater discharge diminution due to Peabody pumping is given in Table 4-8. Under the scenario for minimum pumpage, the 2025 diminution in Begashibito Wash/Cow Springs is predicted to be 13.6 af/yr. This is 0.63 percent of the estimated 2005 discharge of 2,169 af/yr, or a negligible impact.

4.4.1.5.1.4 Migration of Poor Quality Groundwater

Throughout the Black Mesa region, water levels in the D aquifer are typically higher than in the N aquifer. Therefore, there is a downward component of groundwater flow and the potential for poorer-quality D-aquifer water to migrate into better-quality N-aquifer water. Flow and water-quality conditions between the N and D aquifers are documented in recent USGS publications (Truini 2003, 2005). These studies conclude that leakage through the Carmel Formation from the overlying D aquifer to the underlying N aquifer has occurred for thousands of years, and that the historical and continued leakage is greatest in the southern half of the Black Mesa region due to lithologic conditions in confining Carmel Formation.

Table 4-8 Projected Groundwater Discharge Diminution of Black Mesa (N-Aquifer) Streams, in af/yr, Alternative A, Supplemental N-Aquifer Use, 2005 to 2025

Pumping	2005		2025		Change Due to Pumping			Percent Peabody
	All	Non-Peabody	All	Non-Peabody	All	Non-Peabody	Peabody	
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,381.7	2,390.4	52.8	52.8	-0.1	0.00
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.00
Moenkopi Wash	4,283.3	4,302.7	4,275.5	4,299.5	7.8	3.2	4.6	0.11
Dinnebito Wash	515.0	515.3	514.2	514.9	0.8	0.4	0.5	0.09
Oraibi Wash	455.5	455.9	452.3	453.6	3.1	2.3	0.8	0.17
Polacca Wash	431.1	432.1	422.3	424.2	8.8	7.9	0.9	0.22
Jaidito Wash	2,015.1	2,018.2	1,999.3	2,007.8	15.8	10.3	5.5	0.27
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,153.5	2,175.3	15.6	2.0	13.6	0.63

SOURCE: Geotrans 2006

The USGS indicated that an increase in downward leakage from the D aquifer to the N aquifer would first appear as increased TDS or electrical conductivity (Eychaner 1983). The USGS also identified increased Cl and SO_4 concentrations as important indicators of downward leakage. The USGS monitors water quality in the confined N aquifer throughout the Black Mesa region as part of a 1991 Cooperators Agreement among BIA, USGS, ADWR, and Peabody. The USGS monitoring program collects samples at some of the Peabody's pumping wells to validate Peabody's N aquifer water-quality-monitoring program, which began in 1980. To date, USGS' and Peabody's N aquifer water-quality data indicate that no increasing or decreasing trends are apparent in TDS, Cl, or SO_4 concentrations, although small year-to-year variations in concentrations do occur (USGS 2005a).

Most of Peabody's production wells are partially screened in the water-bearing units composing the D aquifer, as well as being screened in the N aquifer. Hydraulic heads in the D aquifer are about 250 feet higher than in the N aquifer in the area of the well field. When the production wells are not pumping, D-aquifer water has the hydraulic potential to flow downward from the D aquifer screened interval to the N aquifer. Reduction in pumping since December 2005 has resulted in some of Peabody's production wells being turned off for extended periods (weeks), with the potential for D-aquifer water to mix with N-aquifer water in the immediate vicinity of those wells. However, Peabody's water-quality-monitoring data for the first quarter of 2006 indicate that degradation of the N aquifer in the vicinity of Peabody's production wells is not occurring. Water-quality samples collected in February and March 2006 from the production wells that had been idle since December 2005 showed no increases in electrical conductivity, TDS, Cl, or SO_4 concentrations compared to the historical data (OSM 2006) A shutdown of the mine well field also occurred in the fall of 1985. In the USGS 1987 report on the Black Mesa monitoring program, no degradation of water quality in the well field was noted (Hill and Sottilare 1987).

Peabody conducted an analysis of potential leakage from the D aquifer to the N aquifer using the GeoTrans model and standard mixing calculations. Pumping from the N aquifer was similar to that proposed under the 11,600-af/yr scenario with the exception of some additional pumpage that was simulated for well-field maintenance (Scenario K). Results of this analysis indicated a maximum increase in N-aquifer SO_4 concentration of 1 percent by 2039 (Peabody 1986, revised 2003). The 1 percent increase by 2039, if it occurred, would be confined to the immediate areas of the individual pumping wells and would not change the drinking-water use designation of the N aquifer. The impact, if any, is judged to be negligible.

Peabody is required to continue monitoring the water quality of the N-aquifer production wells and report the data to OSM each quarter. If any degradation in N-aquifer water quality occurs that could affect existing water use, Peabody would be required to take corrective action.

Although the applicants propose that no additional N-aquifer water be used for mining or slurry operations, to span the range of impacts that might occur if one or more C-aquifer supply failures were to occur, a worst-case scenario for N-aquifer water use was developed and modeled. If the C aquifer water-supply system were to fail, back-up water use from the N aquifer could range from a few af/yr to 6,000 af/yr, depending on the severity and length of the system failure. Because it is not possible to predict the timing or severity of breakdowns that may occur, a "flat" water use over the LOM permit period was assumed. Since aquifer impacts are cumulative, this methodology was assumed to produce the same or greater impacts than would be expected from a scenario in which a breakdown would occur in a particular year. Since the C-aquifer water supply would not be expected to fail over the entire LOM permit period, a conservative estimate of 2,000 af/yr was assumed (one-third of the total) to be pumped to evaluate impacts.

Under the worst-case scenario, the average annual use of the N aquifer would be reduced from 4,400 af/yr (the average use from 2000 to 2004) to 2,000 af/yr over the life of the mining operation (through 2025). (It should be noted that modeling performed to evaluate this scenario used 2,500 af/yr; thus it is somewhat more conservative in its prediction of streamflow depletion and water-level drawdown.) In addition, 505 af/yr would be pumped from 2026 through 2028 for Black Mesa Complex reclamation and 444 af/yr from 2029 through 2038.

4.4.1.5.1.5 Cost of Pumping

Drawdowns due to project pumping under this scenario are given in Table 4-9.

Table 4-9 N-Aquifer Well Drawdown, Alternative A, Use of N-Aquifer Water During Outages of C-Aquifer Well Field (2,000 af/yr), 2005 to 2025

		Water Level, 2005 (feet msl)		Water Level, 2025 (feet msl)		Drawdown (feet)[1]		
Community	**Well**	**All but Peabody**	**All**	**All but Peabody**	**All**	**All but Peabody**	**All**	**Peabody**
Chilchinbeto	PM3	5,533.4	5,465.2	5,516.0	5,459.3	17.4	5.9	-11.5
Forest Lake NTUA 1	4T-523	5,667.6	5,469.1	5,653.2	5,494.0	14.4	-24.9	-39.4
Kayenta West	8T-541	5,488.5	5,454.7	5,438.3	5,411.7	50.2	43.0	-7.2
Keams Canyon	PM2	5,799.2	5,790.6	5,781.8	5,769.3	17.4	21.3	3.9
Kykotsmovi	PM1	5,461.6	5,438.6	5,413.3	5,380.5	48.2	58.1	9.5
Pinon	PM6	5,712.9	5,640.7	5,680.1	5,603.3	32.8	37.7	4.6
Rocky Ridge	PM2	5,609.2	5,516.0	5,594.1	5,499.0	15.1	17.1	2.3
Rough Rock	10R-111	5,719.4	5,717.8	5,717.8	5,715.5	1.6	2.0	0.7

SOURCE: Geotrans 2006
NOTES [1] Negative sign (-) indicates rise in water level.
msl = above mean sea level, NTUA = Navajo Tribal Utility Authority

This scenario results in rises in post-2025 water levels attributable to project pumping in wells closest to the Peabody well field (due to the fact that the proposed average annual pumpage is less than 2000-2004 the average annual pumpage for 2000 through 2004). The maximum increase in drawdown due to project pumping (9.5 feet) occurs at Kykotsmovi. The 2004 depth to water at Kykotsmovi is approximately 229 feet bgs (Truini et al. 2005). The increase in lift and power cost would be about 4 percent, resulting in negligible impact on pumping cost (refer to Appendix H).

Local D-aquifer windmill wells are within the area of influence of well-field pumping (see Section 4.4.1.5.2). The estimated 2025 water level under this pumping scenario (2,000 af/yr) at the closest well (4T-402) shows a rise of about 11 feet, resulting in no adverse impact (Geotrans 2006).

4.4.1.5.1.6 Reduction in Aquifer Saturated Thickness

The N and D aquifers remain confined (fully saturated) under all potential alternatives and thus would experience no reductions in saturated thickness (Geotrans 2006). In other words, no reduction in saturated thickness is predicted for N- and D-aquifer wells within the confined area of the aquifer. There would be no impact.

Near the boundary between the confined and unconfined areas of the aquifer, a small water-level drawdown in the unconfined aquifer is predicted. This occurs primarily to the north of the leasehold in the area of Kayenta and Shonto. The effects of mine-related pumpage are small compared to community pumping.

4.4.1.5.1.7 Diminution of Stream and Spring Flow

Modeled changes in groundwater discharge to streams and springs are given in Table 4-10.

Table 4-10 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative A, 2,000 af/yr N-Aquifer Use, 2005 to 2025

Pumping[1]	2005		2025		Change Due to Pumping			Percent Peabody
	All	Non-Peabody	All	Non-Peabody	All	Non-Peabody	Peabody	
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,380.4	2,390.4	54.1	52.8	1.2	0.05
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.000
Moenkopi Wash	4,283.3	4,302.7	4,272.2	4,299.5	11.1	3.2	7.9	0.18
Dinnebito Wash	515.0	515.3	514.1	514.9	0.9	0.4	0.5	0.09
Oraibi Wash	455.5	455.9	452.3	453.6	3.1	2.3	0.8	0.18
Polacca Wash	431.1	432.1	422.2	424.2	8.9	7.9	1.0	0.23
Jaidito Wash	2,015.1	2,018.2	1,999.2	2,007.8	15.9	10.3	5.6	0.28
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,153.0	2,175.3	16.1	2.0	14.1	0.65

SOURCE: Geotrans 2006
NOTE: [1] Modeled pumpage for mine operations is 2,500 acre-feet per year, slightly higher than proposed. Streamflow change is therefore slightly conservative.

Predicted diminution in groundwater discharge is greatest at Begashibito Wash/Cow Springs where the decrease due to project pumpage is 14.1 af/yr. This would result in a decrease of 0.65 percent, or a negligible impact.

4.4.1.5.1.8 Migration of Poor Quality Groundwater

This option results in less pumpage in the future. Therefore, a negligible impact is anticipated.

4.4.1.5.2 Alternative A, N Aquifer as the Sole Water Supply

This alternative assumes that the C-aquifer well field would not be constructed. Average annual N-aquifer pumping under this option is estimated to be 6,000 af/yr from mid-2009 through 2025, an increase of about 33 percent over the recent past annual pumpage. The increase would result from the additional 0.6 million tons per year of coal that would be transported to the Mohave Generating Station. In addition, 505 af/yr would be pumped for Black Mesa reclamation (from 2026 through 2028) and 444 af/yr from 2029 through 2038.

4.4.1.5.2.1 Cost of Pumping

Increasing project pumpage would increase the drawdown in nearby wells (Table 4-11).

Table 4-11 N-Aquifer Well Drawdown, Alternative A, Maximum Use of N-Aquifer Well Field (6,000 af/yr), 2005 to 2025

Community	Well	Water Level, 2005 (feet msl)		Water Level, 2025 (feet msl)		Drawdown (feet)		
		All but Peabody	All	All but Peabody	All	All but Peabody	All	Peabody
Chilchinbeto	PM3	5533.4	5465.2	5516.0	5421.2	17.4	44.0	26.6
Forest Lake NTUA 1	4T-523	5667.6	5469.1	5653.2	5379.2	14.4	90.2	75.8
Kayenta West	8T-541	5488.5	5454.7	5438.3	5399.9	50.2	54.8	4.6
Keams Canyon	PM2	5799.2	5790.6	5781.8	5768.0	17.4	22.6	5.6
Kykotsmovi	PM1	5461.6	5438.6	5413.3	5375.9	48.2	62.7	14.4
Pinon	PM6	5712.9	5640.7	5680.1	5575.1	32.8	65.6	32.8
Rocky Ridge	PM2	5609.2	5516.0	5594.1	5458.6	15.1	57.4	42.3
Rough Rock	10R-111	5719.4	5717.8	5717.8	5715.2	1.6	2.6	1.0

SOURCE: Geotrans 2006
NOTES: msl = above mean sea level, NTUA = Navajo Tribal Utility Authority

Drawdown due to project pumping at the Forest Lake NTUA No. 1 well of 75.8 feet is predicted at the end of 2025 (Geotrans 2006). This would result in a 6.5 percent increase in pumping lift and cost, a negligible impact (refer to Appendix H).

As discussed in Section 4.4.1.5.1, some of the Peabody production wells pump from both the D and N aquifers. The communities of Chilchinbito, Kitsillie, Kykotsmovi, and Polacca also use D-aquifer water but they are located far enough from the mine that drawdown due to maximum project pumping is limited to about 1 foot (OSM 2006). This level of drawdown would have no measurable impact on pumping cost.

Two D-aquifer windmill wells are within the area of influence of well-field pumping. Estimated 2025 drawdown for the Peabody N-aquifer well-field pumping scenario of 6,000 af/yr at the closest well (4T-402) is approximately 2.2 feet (Geotrans 2006). The water column (height of the water level above the bottom of the well) is approximately 340 feet. The estimated drawdown is 0.6 percent of the water column, which would have a negligible impact on the yield of the well.

4.4.1.5.2.2 Reduction in Aquifer Saturated Thickness

The N and D aquifers remain confined (fully saturated) under this maximum pumping alternative and thus would experience no reduction in saturated thickness. In other words, no reduction in saturated thickness is predicted for N- and D-aquifer wells within the confined area of the aquifer. There would be no impact.

4.4.1.5.2.3 Diminution of Stream and Spring Flow

Model-predicted streamflow reduction under 6,000 af/yr pumpage is given in Table 4-12.

Model-predicted diminution in groundwater discharge is greatest at Begashibito Wash/Cow Springs, where flow reduction in 2025 due to project pumping is 14.9 af/yr, or 0.69 percent of the total 2005 discharge. Even at the maximum potential project pumpage, the reduction in groundwater discharge is considered to be negligible (refer to Appendix H).

Table 4-12 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative A, 6,000 af/yr N-Aquifer Use, 2005 to 2025

	2005		2025		Change Due to Pumping			
Pumping	**All**	**Non-Peabody**	**All**	**Non-Peabody**	**All**	**Non-Peabody**	**Peabody**	**Percent Peabody**
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,378.1	2,390.4	56.4	52.8	3.6	0.15
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.000
Moenkopi Wash	4,283.3	4,302.7	4,266.8	4,299.5	16.5	3.2	13.3	0.31
Dinnebito Wash	515.0	515.3	514.1	514.9	0.9	0.4	0.5	0.10
Oraibi Wash	455.5	455.9	452.3	453.6	3.2	2.3	0.8	0.18
Polacca Wash	431.1	432.1	422.2	424.2	8.9	7.9	1.0	0.24
Jaidito Wash	2,015.1	2,018.2	1,999.0	2,007.8	16.1	10.3	5.7	0.28
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,152.2	2,175.3	16.9	2.0	14.9	0.69

SOURCE: Geotrans 2006

4.4.1.5.2.4 Migration of Poor-Quality Groundwater

Over the more than 20 years that N-aquifer water quality has been monitored, there has been no notable long-term trend or change in quality (Peabody 2005; USGS 2005a). The maximum pumping scenario would result in A 33 percent increase over recent (2004-2005) pumping for the life of the mining operations. While there is no reason to suspect that water quality would deteriorate over the life of the mining operations, there is a level of uncertainty not associated with the other options. Nevertheless, any impact likely would not be sufficient to cause a loss of the resource for industrial or domestic use. Due to the level of uncertainty, a minor impact is conservatively assigned.

4.4.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Surface-water and groundwater impacts due to mining under this alternative would be similar, but reduced in area, from those described in Alternative A. Effects on the hydrologic regime are controlled by the regulatory requirements of SMCRA and oversight by OSM. Hydrologic impacts are limited in scope and are largely confined to the Black Mesa Complex.

Under Alternative B, an average 1,236 af/yr would be pumped from the N aquifer for the Kayenta mining operation from 2008 through 2026, along with 505 af/yr for Black Mesa mining operation reclamation (from 2025 through 2028) and 444 af/yr from 2029 through 2038.

4.4.2.1.1.1 Cost of Pumping

Drawdown at selected wells due to Alternative B pumping is given in Table 4-13.

Table 4-13 N-Aquifer Well Drawdown, Alternative B, Use of N-Aquifer Water for Kayenta Mine and Reclamation of Black Mesa Mine, 2005-2025

Community	Well	Water Level, 2005 (feet msl)		Water Level, 2025 (feet msl)		Drawdown (feet)[1]		
		All but Peabody	All	All but Peabody	All	All but Peabody	All	Peabody
Chilchinbeto	PM3	5,533.4	5,465.2	5,516.0	5,473.0	17.4	-7.9	-25.6
Forest Lake NTUA 1	4T-523	5,667.6	5,469.1	5,653.2	5,546.2	14.4	-77.1	-91.5
Kayenta West	8T-541	5,488.5	5,454.7	5,438.3	5,415.3	50.2	39.4	-10.8
Keams Canyon	PM2	5,799.2	5,790.6	5,781.8	5,770.0	17.4	20.3	3.3
Kykotsmovi	PM1	5,461.6	5,438.6	5,413.3	5,382.8	48.2	55.8	7.2
Piñon	PM6	5,712.9	5,640.7	5,680.1	5,616.4	32.8	24.6	-8.5
Rocky Ridge	PM2	5,609.2	5,516.0	5,594.1	5,517.3	15.1	-1.3	-16.4
Rough Rock	10R-111	5,719.4	5,717.8	5,717.8	5,715.8	1.6	2.0	0.3

SOURCE: Geotrans 2006
NOTES: [1] Negative sign (-) indicates rise in water level.
msl = above mean sea level, NTUA = Navajo Tribal Utility Authority

N-aquifer pumpage under this alternative is significantly less than past pumpage, resulting in a water level rise in wells closest to the Peabody well field. Figure 4-1 shows the anticipated 2025 drawdown due to pumping for the proposed project (Peabody 2008). Greatest increased drawdown due to project pumpage occurs at Kykotsmovi and is 7.2 feet. Depth to water at Kykotsmovi in 2004 was approximately 229 feet (Truini et al. 2005). Increased cost of pumping in 2025 due to project drawdown is approximately 3 percent. The impact is considered negligible (refer to Appendix H).

As with the other N-aquifer pumping alternatives, impacts on D-aquifer wells would be negligible.

4.4.2.1.2 Reduction Saturated Thickness

The N and D aquifers remain confined (fully saturated) under all potential alternatives and thus will experience no reduction in saturated thickness. In other words, no reduction in saturated thickness is predicted for N- and D-aquifer wells within the confined area of the aquifer. There would be no impact.

4.4.2.1.3 Diminution of Stream and Spring Flow

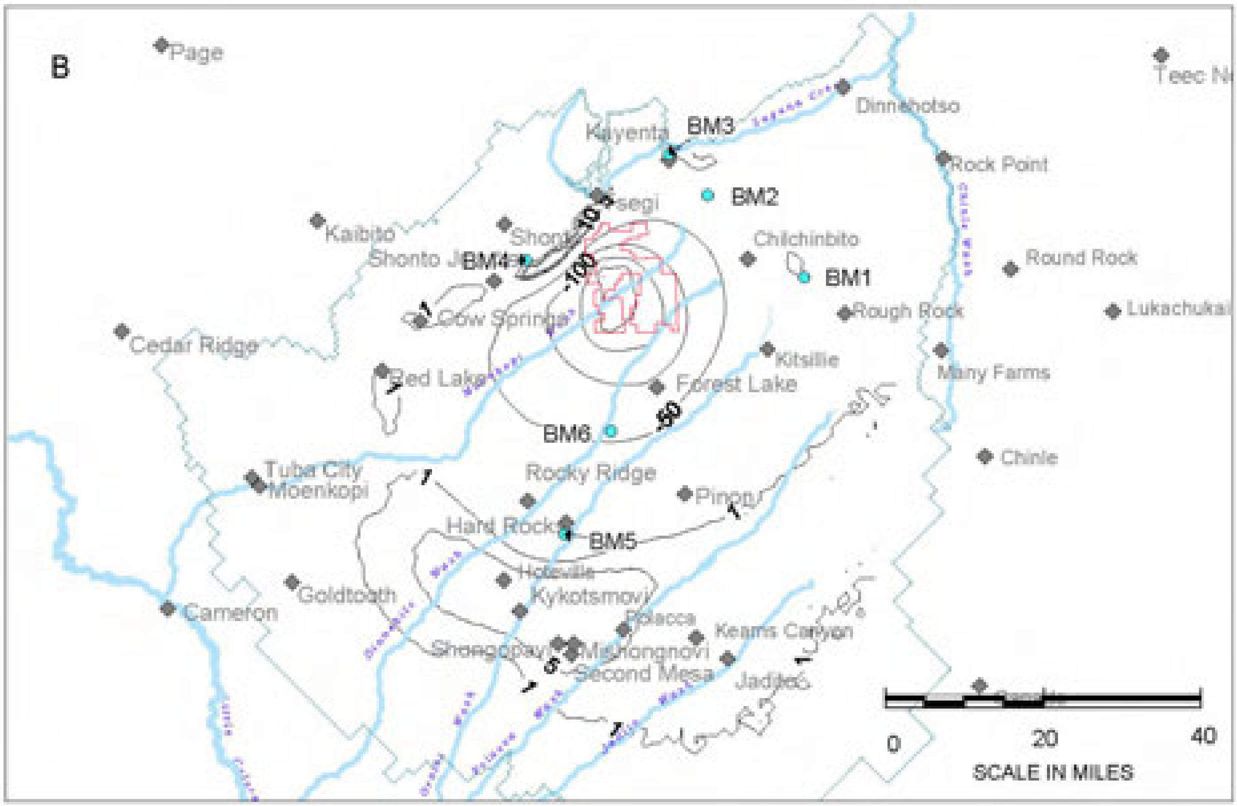
Projected groundwater discharge diminution is given in Table 4-14.

Under proposed Alternative B project pumpage, the greatest change in discharge, 13.7 af/yr, occurs at Begashibito Wash/Cow Springs. This change is 0.63 percent of the 2005 discharge and is considered negligible.

4.4.2.1.4 Migration of Poor-Quality Groundwater

Over the more than 20 years that N-aquifer water quality has been monitored, there has been no notable long-term trend or change in quality (Peabody 2005c; USGS 2005a). Since the Alternative B pumping scenario would result in less N-aquifer pumpage in the future, there is no reason to suspect that water quality would change for the worse.

Figure 4-1 Simulated Drawdown in the N Aquifer in 2025 Due to Peabody Pumping Only, Relative to 2005



SOURCE: Peabody Western Coal Company 2008.
NOTES: The contour interval is 50 feet, with supplemental contours for 1, 5, 10, 20, and 30 feet.

Table 4-14 Projected Groundwater Discharge Diminution to Black Mesa (N Aquifer) Streams, in af/yr, Alternative B, Approval of LOM without Black Mesa, Coal Slurry or C-Aquifer Water Supply, 2005 to 2025

	2005		2025		Change Due to Pumping			
Pumping	**All**	**Non-Peabody**	**All**	**Non-Peabody**	**All**	**Non-Peabody**	**Peabody**	**Percent Peabody**
Streams/Springs								
Chinle Wash	498.8	498.8	498.8	498.8	0.1	0.1	0.0	0.00
Laguna Creek	2,434.5	2,443.2	2,381.1	2,390.4	53.4	52.8	0.6	0.02
Pasture Canyon	389.4	389.4	330.5	330.5	58.9	58.9	0.0	0.000
Moenkopi Wash	4,283.3	4,302.7	4,274.7	4,299.5	8.6	3.2	5.4	0.13
Dinnebito Wash	515.0	515.3	514.1	514.9	0.9	0.4	0.5	0.09
Oraibi Wash	455.5	455.9	452.3	453.6	3.1	2.3	0.8	0.17
Polacca Wash	431.1	432.1	422.3	424.2	8.8	7.9	0.9	0.22
Jaidito Wash	2,015.1	2,018.2	1,999.2	2,007.8	15.8	10.3	5.5	0.27
Begashibito Wash/ Cow Springs	2,169.1	2,177.3	2,153.4	2,175.3	15.7	2.0	13.7	0.63

SOURCE: Geotrans 2006

4.4.3 Alternative C – Disapproval of the LOM Revision (No Action)

Surface-water and groundwater impacts due to mining under this alternative would be the same as under Alternative B. Effects on the hydrologic regime are controlled by the regulatory requirements of SMCRA and oversight by OSM. Hydrologic impacts are limited in scope and are largely confined to the Black Mesa Complex.

4.4.3.1 Project Water Supply

4.4.3.1.1 C Aquifer Water-Supply System

The C aquifer water-supply system would not be constructed under this alternative.

4.4.3.1.2 N Aquifer Water-Supply System

N-aquifer water use under this alternative is the same as under Alternative B and would have identical impacts.

4.5 CLIMATE

4.5.1 Traditional Climate Issues

The following statements, from the 1990 Final EIS for the Black Mesa – Kayenta Mine Project, would apply to the construction of the coal-slurry and water-supply pipelines and to continued operation of the mines:

> Proposed mining activities at the Black Mesa–Kayenta mine would affect the life zone near the ground (microclimate), which would be modified on a local basis until revegetation is successful. The climate of the western United States (macroclimate) would not be affected by the proposed operations at the Black Mesa–Kayenta mine, inasmuch as the particles needed to generate cloud condensation nuclei would be restricted to areas generally within a few hundred feet of their source and would probably be emitted at ground level. The particles would have very little buoyancy and would settle quickly near their source. Furthermore, no constant source of moisture is available to transform any cloud condensation nuclei into potential precipitation-producing clouds.
>
> Soil temperatures and near ground [air] temperatures would be higher in areas of bare soil than in areas of vegetated land, and moisture availability in the soil would be reduced. Wind speed directly adjacent to the surface would be slightly higher, causing an increase in erosion and mechanical abrasion of exposed soil be moving particles. Local mine site wind patterns may be changed by mining topography.
>
> OSM concludes that that the impacts of Alternative 1 on the microclimate and macroclimate would be negligible over the short and long term.

OSM expects that approval of any of the alternatives studied in the EIS is expected to have a negligible impact.

4.5.2 Global Climate Issues

Observed global temperature increases have been widely attributed to anthropogenic emissions of greenhouse gases, including CO_2, methane (CH_4), nitrous oxide (N_2O), and other chemicals. The global warming potential (GWP) of each of these compounds varies and, therefore, is expressed in this EIS in terms of “CO_2 equivalent” or “CO_2e.”As further discussed herein, the geographic scope and predicted air pollutant emissions of the proposed actions are too small to allow calculation of any measurable impacts of the project on global climate. The assessment of the impacts of global climate change is in its formative phase, and it is not yet possible to know with confidence the net impact of such change. The potential effects of global climate change could alter water supplies, agriculture, sea levels, ultraviolet radiation levels, and natural variances in the ecosystem. Climate change must be viewed from a global perspective; therefore, the magnitude of the emissions potentially contributed by the Black Mesa Project needs to be viewed in that context. Activities associated with mining of coal resources, reconstruction and operation of the coal-slurry pipeline, and construction and operation of the C aquifer water-supply system would produce some of the listed greenhouse gases, primarily as a result of the combustion of fossil fuels, activities that produce greenhouse gases.

The incremental contribution of greenhouse gases from the Black Mesa Project and alternatives would be negligible when compared to total greenhouse gases produced in the United States.

The following subsections present general discussions regarding greenhouse gas emissions associated with operation of the Black Mesa Complex and the scientific community consensus on observed and predicted global climate changes. Estimation of greenhouse gas emissions associated with construction of the coal-slurry and water-supply pipelines and with operation of the Black Mesa Complex is presented in Section 4.6. Estimation of greenhouse gas emissions from operation of the Mohave Generating Station (which currently is not in operation) and Navajo Generating Station, which are not part of the proposed action or alternatives, is presented in Section 4.24.

4.5.2.1 Greenhouse Gas Emissions Associated with the Black Mesa Complex

4.5.2.1.1 Methane

Although methane releases often are associated with underground mining of deeper coal seams, the actively mined coal seam at the Black Mesa Complex is generally above the prevailing water table and relatively shallow (less than 300 feet of overburden). This setting is not conducive to the retention of methane; methane associated with the seam (if any) likely was vented long ago. However, estimation of CH_4 emissions associated with operation of the Black Mesa Complex in 2004, 2005, and 2006 is presented in Section 4.6.

4.5.2.1.2 Carbon Dioxide

Emissions of carbon dioxide will result from the combustion of fossil fuels during construction of the coal-slurry and water-supply pipelines and during operation at the Black Mesa Complex. Transport of coal to the Navajo Generating Station is conducted using electric trains, powered by electric generated at the Navajo Generating Station. Estimation of CO_2 emissions occurring during these phases, including those associated with electric power consumption, is presented in Section 4.6.

4.5.2.1.3 Nitrous Oxide and Other Greenhouse Gas Chemicals

Emissions of N_2O and other greenhouse gas chemical associated with construction of the coal-slurry and water-supply pipelines and operation of the Black Mesa Complex are expected to be miniscule or nonexistent, as they are not associated with combustion of fossil fuels or mining activity.

4.5.2.2 Current Scientific Consensus on Climate Change

4.5.2.2.1 Greenhouse Gases

Combustion of all fossil fuels (coal, coke, petroleum, and natural gas) and lime-based flue-gas desulfurization (FGD) processes result in emissions of CO_2. Carbon dioxide is widely considered to be a greenhouse gas. Greenhouse gases, which also include water vapor, methane, NOx, chlorofluorocarbons and other chemicals, play a natural role in maintaining the temperature of the earth's atmosphere by allowing some sunlight to pass through and heat the surface of the earth and then absorbing a portion of the infrared heat reflected or transmitted from the ground. Water vapor is the most abundant, variable, and perhaps the most important greenhouse gas. Water vapor is not considered a pollutant and is necessary for life. Without the natural heat trapping effect of greenhouse gases, the surface of the earth is estimated to be about 34 degrees Centigrade (°C) cooler (California Environmental Protection Agency 2006). Natural sources of greenhouse gases include volcanic eruptions, animal respiration, and decomposition of organic matter.

The following text is excerpted from the USEPA website on climate change:

- According to the National Academy of Sciences, the Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities. Human activities have altered the chemical composition of the atmosphere through the buildup of greenhouse gases—primarily CO_2, methane, and nitrous oxide. The heat-trapping property of these gases is undisputed although uncertainties exist about exactly how earth's climate responds to them.
- Since the beginning of the industrial revolution, atmospheric concentrations of CO_2 have increased nearly 30 percent, methane concentrations have more than doubled, and nitrous oxide concentrations have risen by about 15 percent. These increases have enhanced the heat-trapping capability of the earth's atmosphere. Sulfate aerosols, a common air pollutant, cool the atmosphere by reflecting light back into space; however, sulfates are short-lived in the atmosphere and vary regionally.
- Scientists generally believe that the combustion of fossil fuels and other human activities are the primary reason for the increased concentration of carbon dioxide. Plant respiration and the decomposition of organic matter release more than 10 times the CO_2 released by human activities; but these releases generally have been in balance during the centuries leading up to the industrial revolution with CO_2 absorbed by terrestrial vegetation and the oceans.

Several factors have been identified that have the potential to affect the earth's climate. According to the IPCC, most of the observed increase in global average temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic or human-caused greenhouse gas concentrations (IPCC 2007). Reports prepared by the IPCC indicate that the global pool of anthropogenic greenhouse-gas-emission sources is contributing cumulatively to climate change and will continue to do so in the future.

Climate science is a relatively new field of study, and additional research is being conducted to better understand current scientific views on mechanisms with the potential to affect climate change. Two examples of this research involve the role of aerosol particles in the atmosphere and the impacts of variations in the Earth's solar-energy balance.

4.5.2.2.2 Aerosols

Aerosol particles influence radiative forcing directly through reflection and absorption of solar and infrared radiation in the atmosphere. Some aerosols cause a positive forcing, while others cause a negative forcing. Radiative forcing is the change in the difference between incoming radiation energy (from the sun) and outgoing radiation energy (back from the Earth) in a specific climate system. A positive forcing warms the climate system and a negative forcing cools it. The direct radiative forcing summed over all aerosol types is believed to be negative. Volcanic eruptions are an important example of episodic natural aerosol emissions. Explosive volcanic eruptions can create a short-lived cooling forcing of two to three years on the climate system through the temporary increases that occur in sulfate aerosol in the stratosphere. Examples of sources of anthropogenic aerosols include industry, transportation, and agriculture.

Additionally, aerosols also are believed to cause a negative radiative forcing indirectly through the changes they cause in cloud properties (IPCC 2007). These indirect effects on clouds include the radiative properties, the amount, and lifetime of the clouds. The IPCC denotes the indirect aerosol effects as “cloud albedo effect” and “cloud lifetime effect” as these terms are more descriptive of the microphysical processes that occur (IPCC 2007).

4.5.2.2.3 Solar Activity

The sun is the Earth’s primary source of incoming energy; thus, solar activity is the most significant contributor to the Earth’s energy balance. To maintain the Earth’s energy balance at steady-state conditions (constant temperature), all the incoming solar energy must be radiated back into space (there is no heat transfer from the Earth to space by conduction or convection). Changes in solar-energy output result in a forcing on the Earth’s energy balance and climate system. As discussed above, the energy balance for the Earth is dictated by the amount of radiation received from the sun; thus, small variations in solar output can result in significant radiative forcings on the climate system. For example, Scafetta and West (2006) have recently shown that observed feedbacks associated with past changes in solar activity have resulted in radiative forcings greater than those predicted by climate models and that “most of the sun-climate coupling mechanisms are probably still unknown.” Their findings suggest the presence of a solar cycle driving the climate of the last millennium, with maximum solar irradiance occurring during the medieval period and at present day (Scafetta and West 2006). Scafetta and West (2006) further estimate that the sun has contributed as much as 45 to 50 percent of the warming observed from 1900 to 2000 (Scafetta and West 2006). Thus, variations in solar activity are an important factor in the Earth’s climate (including recent climate change) and continue to be the subject of ongoing climate research.

4.5.2.3 Trends in Greenhouse Gas Emissions

The global atmospheric CO_2 concentration has increased from approximately 280 ppm in 1750, to 379 ppm in 2005 (IPCC 2007). The annual growth rate of the concentration of CO_2 from 1995 to 2005 was larger than in any period since scientist began continually measuring it. The primary source of this increase is from burning fossil fuels, with land use changes providing a small but significant contribution. The main fossil-fuel combustion CO_2 emission-source categories include electric-power generation (35 percent of total anthropogenic CO_2 emissions [International Energy Agency 2005]), transportation (20 percent), other industry (20 percent), and residential (20 percent). Methane concentrations are also increasing, but the rate of increase has been slowing since the 1990s. Methane is emitted from agricultural operations and fossil fuel use. Nitrous oxide concentrations have been increasing at a constant rate since 1980 and are primarily attributed to agriculture and natural sources.

Global emissions related to the combustion of fossil fuels are currently increasing, and are expected to do so for at least several decades; however, longer-term future trends in global CO_2 emissions are uncertain.

Commercial, industrial, and population growth result in increased CO_2 emissions; therefore, CO_2 emissions from developing nations such as China and India are increasing rapidly. For example, China is currently constructing the equivalent of two 500-megawatt coal-fired power plants per week (Katzer et al. 2005). In developed countries, growth in population and industry, along with a significant number of aging power plants, drive the need to provide new electric-generating capacity. In the United States, more than 70 coal-fired power-plant projects are currently proposed at various stages of development (USEPA 2007).

The trend in future anthropogenic CO_2 emissions likely will be driven by a mix of technological, economic, and policy developments. Technology at newer power plant reduces “carbon intensity” (the amount of CO_2 emitted per unit of economic output), resulting in a decrease in the CO_2 emissions per unit of electricity generated. Research and development activities are under way in the field of carbon capture and sequestration technology. This technology is expected to become available within the next two decades and would allow the power-generation industry to capture CO_2 and store it underground, drastically reducing emissions to the atmosphere (U.S. Department of Energy 2007). Advances in renewable-energy technologies also are likely to contribute to efforts to decrease CO_2 emissions attributable to power generation. Policy developments worldwide will likely accelerate the process of CO_2 emissions reduction. The United States is expected to enact legislation that will require mandatory caps on CO_2 emissions or create a carbon tax. These types of policy initiatives would be even more effective in reducing global CO_2 emissions with the participation of developing nations such as China and India. Efforts to improve vehicle fuel economy will further serve to reduce CO_2 emissions worldwide. Ultimately, the levels of global CO_2 emissions in the future will be determined by a mix of these technological, economic, and policy developments; thus, future increases and decreases in CO_2 emission rates are uncertain today.

4.5.2.4 Summary of IPCC-Reported Predictions for Future Climate Change

The IPCC has predicted climate-change-related impacts on surface-air temperature, sea-surface temperature, precipitation, sea level, and ocean acidity for various modeled scenarios in Chapter 10 of its Fourth Assessment Report, The Physical Science Basis (IPCC 2007). Note that the following climate-change-impact discussions are not intended to address every conceivable environmental impact of climate change; rather, the following climate-change predictions are presented to summarize the primary climate change impacts noted by the IPCC in the Fourth Assessment Report.

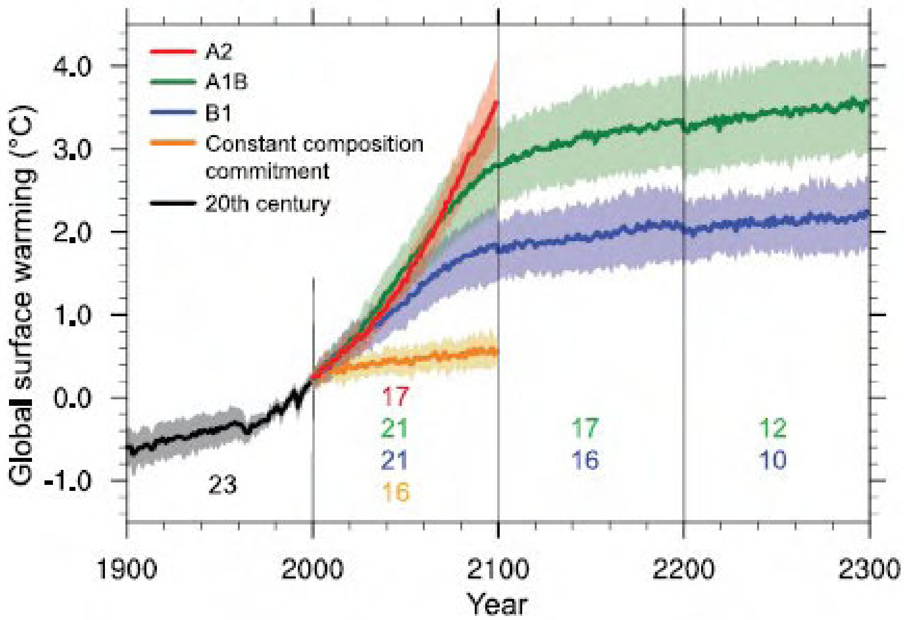
4.5.2.4.1 Surface Air Temperature

Surface-air temperatures are predicted to increase by 1.8 to 4.0°C, with the greatest temperature increases to take place over land with high northern latitudes and less warming over the southern oceans and the North Atlantic (IPCC 2007). The model projections of temperature changes are illustrated graphically in Figure 4-2. The various lines represent separate IPCC emission scenarios. A2 represents the rapid-population-growth scenario; A1B represents the balanced-energy scenario; and B1 represents the low-emissions-intensity scenario.

The IPCC also predicts that heat waves may increase in intensity, frequency, and duration. The number of frost days may decrease, while the length of the growing season may increase in the middle and high latitudes (IPCC 2007, p. 750).

In terms of sea-surface temperature, the IPCC predicts that the tropical Pacific will have a weak shift toward “El Nino-like” conditions, with increased warming of the sea-surface temperature in the central and east equatorial Pacific oceans compared to the oceans in the west, with weakened tropical circulations, and a shift in mean precipitation toward the east (IPCC 2007).

Figure 4-2 Summary of Predicted Temperatures



SOURCE: Intergovernmental Panel on Climate Change 2007

4.5.2.4.2 Precipitation

The IPCC-modeled climate-change impacts for precipitation and predicts that precipitation generally will increase within areas of regional tropical precipitation and over the tropical Pacific, but generally will decrease in the subtropics. Precipitation will increase at high latitudes, as will the global average mean water vapor, evaporation, and precipitation. Precipitation-event intensity is projected to increase, particularly in tropical and higher latitude areas. In the subtropics, where precipitation is predicted to decrease, intensity is expected to increase, but with longer periods between precipitation events. During the summer, midcontinental areas are predicted to have a tendency toward drying, which would indicate a greater chance of droughts (IPCC 2007). The prediction of changes in precipitation patterns continues to carry great uncertainty, and there remains a lack of consensus for many regions.

4.5.2.4.3 Climate Variability and Extreme Events

Increased variability in future climate and extreme events are predicted as a result of future climate change. The IPCC reports that temperature extremes, heat waves, and heavy precipitation events are “very likely” to become more frequent, and that future tropical cyclones are “likely” to become more intense (IPCC 2007). In its assessment of North American regional climate projections (Christensen et al. 2007) the IPCC reports similar findings of increased, prolonged hot spells and increased diurnal temperature range, particularly in summer.

4.5.2.4.4 Projected Future Impacts on Resources

Projected changes in precipitation, temperature, sea level, and concentrations of atmospheric CO_2 are likely to impact natural resources. The magnitude and timing of impacts will vary with the amount and timing of climate change and, in some cases, the capacity of natural systems to adapt.

The mean sea level is predicted to rise 0.59 to 1.94 feet (0.18 to 0.59 meters) over the twenty-first century. The largest component of the modeled sea-level rise is due to thermal expansion of the sea water. The melting of glaciers, ice caps, and the Greenland ice sheet are also projected to contribute to the rise in mean sea level. However, the models have also predicted that the Antarctic Ice Sheet will receive increased precipitation, without substantial surface melting which will reduce the mean sea level (IPCC 2007).

The IPCC estimates that the ocean pH will be reduced between 0.14 and 0.35 pH units in the twenty-first century (IPCC 2007). The reduction in pH is attributable to the increased CO_2 concentration in the Earth's atmosphere. An increase in CO_2 concentrations would correlate to an increase in the CO_2 that dissolves in water. When CO_2 is dissolved in water it can form carbonic acid, lowering the pH of the body of water.

The IPCC has documented regional climate effects in its Working Group I Report *Summary for Policymakers* (IPCC 2007). The following are examples of current regional climate effects that are occurring due to climate change from the IPCC document:

- Increased number and size of glacial lakes due to temperature increase
- Increased surface instability in permafrost regions
- Earlier signs of spring (leaf unfolding, bird migration and egg-laying, and fish migration)
- Shift in the ranges of certain plants, land animals, and aquatic species
- Longer growing seasons

The IPCC also has predicted future climate-related impacts on resources. Note that the magnitude and timing of these impacts will vary with the degree of climate change and the ability of ecosystems to adapt. Examples of predicted future impacts include the following:

- By 2050, annual average river runoff at high latitudes and in some wet tropical areas is projected to increase by 10 to 40 percent, and decrease by 10 to 30 percent over some of the dryer middle-latitude regions and in the dry tropical areas.
- Areas affected by drought are predicted to have little relief. However, heavy precipitation events are predicted to increase and may cause increased flood risks.
- Glaciers and snow cover are projected to decrease, which will reduce water availability in regions dependant on melt water from mountain ranges.
- Crop productivity is predicted to increase slightly in middle and high latitudes areas with local mean temperature increases of 1 to 3°C, and decreasing in other lower latitude areas, especially seasonally dry and tropical regions, depending on the crop.
- Sea-level rise is projected to increase the risk of coastal erosion.
- Salt marshes and mangroves are projected to be affected negatively by sea-level rise.
- Human health impacts both positive and negative will vary by location as temperatures increase. Critically important will be factors that directly shape the health of populations such as education, health care, disease prevention and infrastructure and economic development.

4.5.2.4.5 Projected Climate Change in the Western United States

In the next century, the West is projected to warm between 3.6°F and 9°F (2°C and 5°C) (Cubashi et al. 2001). The degree of change may correspond to the increase in CO_2 in the atmosphere by 2100 and will vary across the western United States because of the large differences in topography. Projected levels of precipitation in the West are inconsistent, with average values near zero (Cubashi et al. 2001). Decreases in snowpack have been observed and are projected to continue and even accelerate, especially in milder climates. Slower losses are anticipated in high elevation areas (Mote et al. 2005). The impacts of climate change on resources in the Great Basin in the western United States has been studied and reported on by the Forest Service (2008). That report includes an overview along with individual issues papers detailing critical research and management issues facing the Great Basin. Discussions of climate change impacts on water resources, agriculture, native ecosystems, and biodiversity and species at risk presented by the Forest Service (2008) are summarized below.

4.5.2.4.5.1 Water Resources

Predictions related to western streamflows are as follows:

- Increased winter flow
- Reduced and earlier spring peaks
- Reduced summer and fall flows

The overall change in streamflows will depend on the degree of warming that occurs, actual changes in precipitation, and the effects on evapotranspiration. Evapotranspiration is the total of evaporation and plant transpiration from the Earth's land surface to the atmosphere. There may be increases in variability in unregulated streamflow in most watersheds in the Great Basin. In summer, water uses like hydropower, irrigation, fishing, recreation, etc. may be affected negatively by lower flows and increased variability. In winter, there may be increases in hydropower production due to increased winter streamflow.

4.5.2.4.5.2 Agriculture

As long as water availability remains sufficient, higher CO_2 levels may result in better crop growth and a longer growing season. This is likely to change when temperatures increase substantially. These conditions also may benefit species of weeds and pests, while low-value crops requiring irrigation may have difficulty competing for available water. Infectious diseases and insect outbreaks also could increase with regional warming.

4.5.2.4.5.3 Native Ecosystems

Assuming a reliable water supply, native plant species are likely to experience increased growth. Increased levels of CO_2 will result in native grasses using water more efficiently. It follows that cheatgrass and other annual grasses may invade new areas and experience increased growth. This may also be true for other invasive species, including perennial forbs and woody varieties.

Climate change is likely to result in longer fire seasons, with more fires occurring earlier and later than is currently typical. More severe fires impacting larger number of acres may result. In drier parts of the Great Basin, the frequency of fires is likely to increase in years with greater precipitation during fall, winter, and spring because of the increased growth of fire fuels. Also, fuel accumulation during the previous growing season will add to the fire frequency. If cheatgrass becomes more invasive, its greater flammability is likely to contribute to increased fire frequency and extent.

4.5.2.4.5.4 Biodiversity and Species at Risk

As temperatures increase, certain species are likely to relocate due to effects on their habitats. Habitats in higher elevations may decrease. Animal, bird, and butterfly species may become extinct in local areas. Some native species may be displaced if invasive varieties benefit from climate change. In the event that fire severity and burn area increases, shifts in the distribution and abundance of dominant plant species may occur and affect the habitat of some sensitive plant and animal species.

4.5.2.4.6 Contributions of a Single Source to a Cumulative Climate Impact

Based on the small incremental contribution of CO_2 emissions from the Mohave Generating Station (when in operation) and Navajo Generating Stations relative to the total greenhouse gas emissions in the global carbon cycle, and the uncertainty in the global estimates of the relevant parameters, any attempt to predict climate impacts that would be expected from the incremental contribution of the project would be speculative. The IPCC Fourth Assessment Report concluded that current climate models are less precise when used to predict the global impact of individual greenhouse-gas-emitting facilities, or to predict localized climate changes attributable to global temperature changes. This uncertainty is increased by an inability to predict the effects of the technological, political, regulatory, and business responses to climate change over the coming decades. Developments are occurring more rapidly in response to the findings of the IPCC and other evidence of changing climate.

Nonetheless, greenhouse-gas emissions may be appropriately considered a cumulative-effects issue, and the construction and operation of any new CO_2 source would result in an incremental increase (albeit very small) to cumulative greenhouse gas emissions, unless the increase were offset by reductions from other sources, such as the retirement of older, less efficient plants. If the trend of an increased number of fossil-fuel-fired power plants in the United States. and around the globe continues over the next several decades, these plants would continue to be major contributors to the cumulative anthropogenic-emissions pool, absent policy changes, carbon offsets, technological advances, etc. This anthropogenic CO_2 emissions pool would contribute to the total global emissions pool (which also includes natural sources), potentially resulting in a net positive radiative forcing on climate, which could contribute to the current observed and predicted climate-change impacts discussed in the previous text.

One technology being advanced to reduce atmospheric emissions of CO_2 is carbon capture and sequestration. This is accomplished by compressing the CO_2 gas so that it may be transported in pipelines and injected into geologic formations for storage deep underground. However, this technology, and the means to concentrate CO_2 in a gasification process, is still being developed. Pilot projects are being initiated in several countries. Carbon capture and sequestration requires additional energy, water, and chemical usage and would result in increased emissions of NOx. Regulatory authorities and legal professionals are examining the associated safety and liability issues associated with these projects.

4.5.3 <u>Summary</u>

The mechanisms involved in land-atmosphere interactions are not well understood (National Research Council 2005). The precise timing, nature, and magnitude of climate-change impacts at a specific location are not certain. A general model to evaluate global climate change from a single CO_2 emission source has not been developed. Currently, circulation models take into account the global carbon cycle, the oceans, atmospheric circulation patterns, cloud cover, and other parameters to evaluate the global climate. Due to the uncertainties in Earth's carbon cycle and the uncertainties in the range of climate predictions in terms of future control technologies, political policies, new regulations, and business markets, quantifying impacts on a regional or global basis based on the addition of a few CO_2 emission sources would be highly speculative.

4.6 AIR QUALITY

The assessment of air-quality impacts is based on compilation of regulated pollutant emissions for the Black Mesa Complex and background sources, and calculation of predicted emissions and gaseous-pollutant emissions associated with the proposed replacement of the existing coal-slurry pipeline and construction of the proposed new water-supply system.

4.6.1 LOM Revision Air-Pollutant Emissions

4.6.1.1 Particulate-Matter Emissions from Mining Activity

Fugitive PM_{10} emissions data for the Black Mesa Complex operations for the LOM were obtained from Peabody (Peabody 2005a). These data include annual PM_{10} emission rates for overburden and coal removal; operation of vehicles, heavy equipment, the draglines, and overland conveyor systems; the coal preparation facilities; and wind erosion of disturbed surfaces resulting from mining activity. Vehicle-exhaust emissions are excluded from these data; see the following paragraph for vehicle- and equipment-exhaust emissions. This information was developed by Peabody, using USEPA-approved emissions estimation models, based on a variety of input information pertaining to current and planned mining operations. Annual PM_{10} emissions for most of the background sources within the study area (and within Arizona) were obtained from ADEQ (2005). Annual PM_{10} emissions information for the Navajo Generating Station was obtained from SRP (2005). Annual PM_{10} emissions information for the Mohave Generating Station was obtained from SCE (2005).

4.6.1.2 Particulate-Matter and Gaseous-Air-Pollutant Emissions from Vehicle and Equipment Exhaust

Predicted emissions of PM_{10}, CO, unburned hydrocarbons, NOx and SO_2 and greenhouse gases (expresses herein as CO_2e) resulting from the combustion of fuels (predominantly diesel) in various vehicles and equipment at the Black Mesa Complex were estimated based on a vehicle and equipment inventory supplied by Peabody. For purposes of this EIS, unburned hydrocarbons are assumed to be VOCs. Emission factors for diesel-fueled heavy-duty vehicles and off-highway equipment were calculated following the method outlined in the USEPA report “Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition,” (USEPA 2004). Emission factors for gasoline-fueled light-duty trucks were obtained from a MOBILE5 model run based on national averaged fleet conditions, at a speed of 10 miles per hour and an ambient temperature of 60^{o}F. Vehicle and equipment exhaust will contain $PM_{2.5}$. As a conservative estimate, it can be assumed that all of the PM_{10} emissions from internal-combustion engines are composed of $PM_{2.5}$ material. Calculated estimates of greenhouse gas emissions associated with operation at the Black Mesa Complex were provided by Peabody. Peabody calculated greenhouse gas emission in accordance with the standard protocol issued by the U.S. Department of Energy Voluntary Reporting of Greenhouse Gas Program, administered by the Energy Information Administration (EIA) created under the Energy Policy Act of 1992.

4.6.2 Pipeline Construction Emissions

4.6.2.1 Particulate Emissions from Earthmoving Activity

Predicted PM_{10} emissions associated with construction of the coal-slurry and water-supply pipelines were calculated using published USEPA emissions factors for heavy construction operations. Specifically, Section 13.2.3, “Heavy Construction Operations,” of the USEPA document, “Compilation of Air Pollutant Emissions Factors,” provides a total uncontrolled PM emission factor of 1.2 tons/acre/month for heavy earthmoving operations similar to the anticipated pipeline construction activities (e.g., clearing, grading, digging trenches, creating temporary storage piles, backfilling trenches, compacting, etc.) (USEPA 1995). This emission factor includes generation of fugitive dust due to vehicular traffic associated with the construction activity. Therefore, estimation of vehicle-caused fugitive dust during construction of the pipelines was not determined separately.

According to the USEPA document Particulate Emissions From Controlled Construction Activities (EPA-600/R-01-031), uncontrolled PM_{10} emissions from major cut and fill operations in desert soils are 33 percent of total PM. According to the Midwest Research Institute document Estimating Particulate Matter Emissions from Construction Operations, the application of water or dust suppressants on exposed areas would reduce emissions by another 61 percent (Midwest Research Institute 1999). Therefore, a controlled

PM_{10} emission factor of 0.154 tons per acre per month was used to calculate PM_{10} emissions from earthmoving activity.

Table 4-3 provides a breakdown of total acreage affected by reconstruction of the coal-slurry pipeline. The total right-of-way area corresponding to the realignment alternatives is 2,319 acres, which provides the highest number of affected acres, and which is used here to estimate worst-case particulate emissions. Table 4-4 provides a breakdown of total acreage affected by construction of the well field, water-supply pipeline and associated facilities (electric transmission and distribution lines, substation and access roads). The total right-of-way area for the Western Route of the 11,600 af/yr alternative is 1,766 acres, which represents the highest number of acres affected, and which is used here to estimate worst-case particulate emissions.

According to the pipeline construction plan in Appendix A-2, it is unlikely that a particular location along the pipeline route would undergo active earthmoving activity for more than a week. For purposes of this impact analysis, it was conservatively assumed that, on average, the entire area affected by pipeline construction would be affected by heavy construction operations for approximately a half of a month. In actuality, since the total duration of the coal-slurry pipeline construction is anticipated to be 18 months, and the total area that may be disturbed is 2,319 acres, the average amount of time a single acre would be impacted would likely be substantially less than one-half of a month. This same assumption applies to the water-supply pipeline alternatives, as well. An emission factor of 1.2 tons per acre was multiplied against the total project acreage, and then the result was halved, to derive uncontrolled PM emissions for the total project for each proposed segment of the coal-slurry and water-supply pipeline projects.

4.6.2.2 Particulate and Gaseous-Pollutant Emissions from Construction Equipment

Construction vehicles and equipment usually are powered by gasoline- or diesel-fired internal combustion engines. Operation of such equipment results in emissions of PM_{10}, NOx, SO_2, CO, and VOC. Vehicle and equipment exhaust would contain $PM_{2.5}$. As a very conservative estimate, it can be assumed that all of the PM_{10} emissions from internal-combustion engines are composed of $PM_{2.5}$ material.

The type and number of on-road and off-road vehicles and equipment to be used during construction of the coal-slurry pipeline have not been specified by the project applicants. Therefore, gaseous-air-pollutant emissions from the pipeline construction were estimated based on a typical array of equipment and vehicles for similar projects. A roster of on-road and off-road vehicles and equipment to be used during construction of the well field and water-supply pipeline were provided by SCE. Table 4-15 shows the roster of equipment and vehicles anticipated for construction of the coal-slurry pipeline, well field, pump stations, and water-supply pipeline.

Table 4-15 Equipment List for Typical Construction of Coal-Slurry Pipeline and Water-Supply Pipeline

	Quantity			
		Water-Supply Pipeline		
Equipment	Coal-Slurry Pipeline	Well Field	Water Pipeline and Pump Stations	Average Engine Horsepower (hp)
Pickup and crew cab trucks	30	30	30	200
Truck (2 to 5 tons)	1	12	21	250
Truck (5 to 15 tons)	17	1	2	250
Bulldozer (rubber tire)	15	5	7	300
Backhoe/loader/trencher	17	5	13	150

	Quantity			
		Water-Supply Pipeline		
Equipment	Coal-Slurry Pipeline	Well Field	Water Pipeline and Pump Stations	Average Engine Horsepower (hp)
Crane (10 to 20 tons)	—	3	10	300
Crane (75 ton)	—	—	1	400
Drill rig	—	1	5	300
Generator/welder	10	1	2	200
Grader	1	2	2	125
Roller/compactor	—	1	—	150
Semitractor/trailer	—	5	9	350
Portable rock—crushing plant	—	4	13	—
Rock—crushing generator		—	1	200
Portable concrete batch plant	—	—	1	—
Concrete batch plant generator	—	—	1	200
Office trailer	1	—	1	—

SOURCE: Black Mesa Pipeline, Inc. 2005; Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance 2005; Southern California Edison Company Roster of Equipment and Vehicles for the Water-Supply System 2006

4.6.2.3 Emissions from Pipeline Operations

Air pollutant emissions from operation of the coal-slurry and water-supply pipelines, if any, would be negligible. All pumping equipment on both pipelines would be electric. Therefore, air-pollutant emission estimates were not calculated.

4.6.3 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.6.3.1 Black Mesa Complex

Table 4-16 is a summary of the PM_{10} emissions associated with the Kayenta and Black Mesa mining operations. This information represents projected worst-case emission levels for the LOM. For both mines, the emissions shown are from projected mining activities for the three “worst-case years” for the LOM (2006, 2022, and 2023). The basis for selecting the worst-case years were high mine production levels and proximity to property boundaries. At Black Mesa, projected production for 2006 according to LOM plans was 4.6 million tons. During the previous three years (baseline years), prior to temporary suspension of activities at the mine at the end of 2005, Black Mesa produced an average of 4.49 million tons of coal. Emission calculations for 2006 are, therefore, considered a “worst-case” representation of baseline emissions.

Table 4-16 Annual Fugitive PM_{10} Emissions from Black Mesa Complex Operations

Operation	PM_{10} Emissions (tons per year)		
	Baseline[1]	2022	2023
Kayenta mining operation (fugitives)			
Overburden removal	56.47	67.33	59.34
Coal removal	6.43	6.43	6.43
Draglines/heavy equipment	411.58	423.25	429.48
Coal-truck travel	13.68	19.55	19.94
Coal-preparation facilities	157.81	158.26	158.26

Operation	PM_{10} Emissions (tons per year)		
	Baseline[1]	2022	2023
Wind erosion	379.26	379.26	379.26
Black Mesa mining operation (fugitives)			
Overburden removal	12.92	13.78	14.56
Coal removal	3.01	4.15	4.15
Draglines/heavy equipment	252.82	311.91	323.78
Coal-truck travel	18.65	20.89	22.10
Coal-preparation facilities	68.04	42.43	42.43
Wind erosion	171.63	236.88	236.88
Overland conveyor system	0.01	0.01	0.01
Vehicle and equipment exhaust[2]	147.00	147.00	147.00
Total	1,699.31	1,831.13	1,843.62

SOURCE: Peabody Western Coal Company 2005a, 2005b
NOTES: [1] Baseline emissions are the life-of-mine projections for 2006 for the Black Mesa Complex, including the Kayenta and Black Mesa mining operations
[2] Usage levels of vehicles and equipment are assumed to remain the same through 2026.
PM_{10} = particulate matter equal to or less than 10 microns in diameter

Table 4-18 is a summary of the estimated annual PM_{10} and gaseous-air-pollutant emissions associated with the exhausts from vehicles and equipment used within the Black Mesa Complex. The PM_{10} emissions from vehicles are included in the total PM_{10} emissions for the Black Mesa Complex in Table 4-16. The gaseous air pollutants associated with vehicle- and equipment-exhaust emissions currently have minor, localized impacts within the immediate vicinity of the complex, but have negligible impacts on air quality in the region.

Table 4-17 is a summary of estimated greenhouse gas emissions, expressed as CO2e, associated with the operation at the Black Mesa Complex in 2004, 2005, and 2006. Data for calendar year 2007 was not available. Note that total facility greenhouse gas emissions reduced in 2005 and cessation of Black Mesa mining operations in 2005. The greenhouse gas emissions associated with operation of the Black Mesa Complex during 2004 through 2006 (ranging from 277,636 tons per year to 417,743 tons per year) are only a fraction of the greenhouse gas emissions from a typical coal-fired power plant (tens of millions of tons per year).

Table 4-17 Estimated Greenhouse Gas Emissions Resulting from Operations at the Black Mesa Complex Expressed as CO_2 Equivalent (tons per year)

Parameter	Kayenta Mining Operation			Black Mesa Mining Operation		
	2004	2005	2006	2004	2005	2006
Energy consumption						
Electricity	114,230	111,296	76,923	0	0	0
Gasoline	3,276	3,237	3,916	1,275	1,206	0
Diesel	52,213	56,725	61,812	33,169	30,730	0
Propane	5	3	13	5	4	0
Subtotal	169,724	171,262	142,664	34,449	31,939	0
Process methane emissions	134,393	134,590	134,973	79,177	63,716	0
Total greenhouse gas emissions (CO_2e)	304,117	305,852	277,636	113,626	95,655	0
Tons of coal produced	8,180,941	8,192,967	8,216,257	4,81,777	3,878,609	0
Greenhouse gas intensity (pounds CO_2e/ton coal)	82.0	82.3	74.5	52.0	54.4	0

Table 4-18 Air-Pollutant Emissions from Vehicle and Equipment Exhaust at Black Mesa Complex [1]

Vehicle/Equipment	Quantity	Fuel	Average Engine Power (hp)	Unit of Emission Factors	Emission Factors [1, 2]					Maximum Annual Emissions (tons/year) [3, 4]				
					VOC	CO	NOx	PM_{10}	SO_2	VOC	CO	NOx	PM_{10}	SO_2
Diesel mining equipment														
Tractor/backhoe/trencher	36	Diesel	100	g/hp-hr	0.5572	3.8020	5.3827	0.6371	0.1822	3	18	26	3	1
Crane/large forklift	23	Diesel	400	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	1	6	18	1	0
Welder/compressor	24	Diesel	300	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	3	30	83	3	2
Dozer /loader	54	Diesel	850	g/hp-hr	0.3058	1.2283	5.9150	0.2201	0.1641	93	373	1,796	67	50
Large coal-haul trucks (150 to 250 tons)	25	Diesel	1,500	g/hp-hr	0.3058	1.2283	5.9150	0.2201	0.1641	53	213	1,027	38	28
Semitractor/trailer	22	Diesel	350	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	1	5	15	1	0
Drill	11	Diesel	300	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	4	16	70	4	2
Grader /scraper	19	Diesel	600	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	5	47	131	5	4
Vehicles														
Pickup truck	2	Diesel	200	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	1	2	9	0	0
2-ton trucks	32	Diesel	250	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	5	19	85	5	3
2- to 5-ton trucks	22	Diesel	300	g/hp-hr	0.3298	1.2014	5.3619	0.3094	0.1640	14	52	234	14	7
5- to 15-ton trucks	27	Diesel	400	g/hp-hr	0.2165	2.0991	5.7831	0.2313	0.1641	5	52	145	6	4
Pickup/crewcab/suburban	70	Gasoline	200	gpm	4.72	46.06	2.41	0.093	0.113	13	128	7	0.3	0.3
Total emissions										**201**	**963**	**3,643**	**147**	**103**

SOURCE: Peabody Western Coal Company 2005a, 2005b; U.S. Environmental Protection Agency 2004

NOTES: [1] Emission rates are estimated for both Kayenta and Black Mesa mining operations for all years.

[2] Emission factors for off-highway diesel-fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition" (USEPA 420-P-04-009, April 2004). For all vehicles and equipment, Tier 1 emission factors were used.

[3] Emission factors for gasoline-driven pickup trucks and crew cab were obtained from a MOBILE5 run based on national averaged fleet conditions, at a speed of 10 miles per hour and an ambient temperature of 60^{o} Fahrenheit.

[4] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment and their operating schedule.

[5] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 120 miles/day and an operating schedule of 300 days a year.

VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 microns
SO_2 = sulfur dioxide
g/hp-hr = grams per horse-power hour
gpm = gallons per mile

PM

Table 4-19 Particulate-Matter Emissions Associated with Earthmoving Activity During Construction of Coal-Slurry and Water-Supply Pipelines (Alternative A only)

Pipeline	Work Area (acre)	Maximum Annual [1] Uncontrolled PM_{10} Emissions (tons) [2]	Maximum Annual [1] Controlled PM_{10} Emissions (tons) [3]	Project [4] Total Uncontrolled PM_{10} Emissions (tons) [2]	Project [4] Total Controlled PM_{10} Emissions (tons) [2]
Coal-slurry pipeline, existing route with realignments	2,319 [5]	335	131	503	196
Water-supply pipeline: western alternative, 11,600 af/yr	1,766 [6]	192	75	352	138
Total work area/emissions	4,085	527	206	855	334

SOURCE: Calculations using Alternative A description and U.S. Environmental Protection Agency emissions factors (USEPA Document AP-42)

NOTES: [1] Maximum emissions in a 12-month period.
[2] Total PM (1.2 tons/acre/month) * 33 percent PM_{10} factor.
[3] Reduction of uncontrolled PM_{10} by 61 percent due to watering.
[4] Total duration of coal-slurry pipeline construction is 18 months; total duration of water-supply pipeline construction is 22 months.
[5] From Table 4-4; alternative with highest amount of affected acreage.
[6] From Table 4-3; alternative with highest amount of affected acreage.
PM_{10} = particulate matter equal to or less than 10 microns in diameter, af/yr = acre-feet per year

Table 4-20 is a summary of the PM_{10} and gaseous-pollutant emissions associated with the use of construction vehicles and equipment during construction of the coal-slurry pipeline. Included are both total project (24-month) emissions and maximum annual emissions. Table 4-21 is a summary of the PM_{10} and gaseous-pollutant emissions associated with the use of construction vehicles and equipment during construction of the C aquifer water-supply pipeline. Included are both total project (22-month) emissions and maximum annual emissions.

The number of equipment and vehicles used during construction is substantially fewer than typically associated with measurable air-pollutant impacts, such as congested urban areas. In addition, vehicles would be mobile, rarely in one location for more than a few minutes, and the equipment would be transient, moving to new locations along the pipeline routes every few days. Therefore, the gaseous air pollutants associated with vehicle- and equipment-exhaust emissions would have minor, localized impacts within the immediate vicinity of ongoing construction activity, but negligible impacts on air quality in the region.

Greenhouse gas emissions for gasoline-fueled crew cab and pickups and off-highway diesel-fueled vehicles and/or equipment were calculated following the method outlined in the American Petroleum Institute (API) report “Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry” (February 2004). For all such vehicles and equipment, emission factors in units of tons per million British thermal units were used to calculate CO_2 emissions and tons per 1,000 gallons were used to estimate emissions of CH_4 and N_2O. Annual emissions for all diesel-fueled vehicles and equipment were calculated based on the amount of diesel fuel combusted on an annual and total project basis. The gallons of diesel fuel combusted was calculated using the average engine horsepower for each type of vehicles and equipment, an operating schedule of 3,000 hours per year, the adjusted brake specific fuel consumption factor, a higher heating value of diesel fuel of 5.75×10^6 British thermal units per barrel (1 barrel equals 42 gallons), and a density of diesel fuel of 7.1 pound per gallon. Annual emissions for gasoline-fueled pickup trucks and crew cabs were calculated based on a traveling distance of 150 miles/day during construction, all with an operating schedule of 6 days/week, and 52 weeks/year. Total duration of coal-slurry pipeline construction was estimated at 18 months and total duration of water-supply pipeline construction was estimated at 22 months. Table 4-20 includes a typical roster of equipment to be used during construction of the proposed project. This same roster of equipment was used in estimate the CO_2e. Note that CO_2e values were calculated assuming a global warming potential factor ("CO_2e) of 1 for CO_2, 21 for CH_4, and 310 for N_2O. One pound of CH_4 has 21 times the global warming potential of one pound of CO_2, and one pound of N_2O has 310 times the global warming potential of one pound of CO_2.

Table 4-22 summarizes how PM_{10} emissions were calculated for the rock-crushing plant used to make the gravel that would underlie the pipeline. summarizes how PM_{10} emissions were calculated for the portable concrete batch plant used to produce concrete for a variety of uses at the well field, pipeline crossings under roads and streams, and pump stations. Table 4-24 summarizes the maximum particulate and gaseous-pollutant emissions, from earthmoving activity and operation of equipment and vehicles, resulting from the construction of the well field and water-supply pipeline.

Table 4-20 Air Pollutant Emissions from Construction Vehicles and Equipment - Coal-Slurry Pipeline (Alternative A)

Vehicle/Equipment	Quantity	Fuel	Average Engine Power (hp)	Load Factor [1]	Unit of Emission Factors	Emission Factors [2, 3]					Maximum Annual Emissions (tons/year) [4, 5,7]						Total Construction Emissions (tons/year) [6,7]					
						VOC	CO	NOx	PM_{10}	SO_2	VOC	CO	NOx	PM_{10}	SO_2	CO_2e	VOC	CO	NOx	PM_{10}	SO_2	CO_2e
Trucks (2-ton)	1	Diesel	250	0.59	g/hp-hr	0.33	1.20	5.36	0.35	0.66	0.16	0.59	2.61	0.17	0.32	449.17	0.24	0.88	3.92	0.26	0.48	673.75
Trucks (5- to 15-ton)	17	Diesel	250	0.59	g/hp-hr	0.33	1.20	5.36	0.35	0.66	2.73	9.96	44.45	2.89	5.44	7,635.86	4.10	14.94	66.67	4.34	8.16	11,453.79
Sideboom	10	Diesel	500	0.43	g/hp-hr	0.21	1.37	6.09	0.21	0.65	1.47	9.75	43.27	1.52	4.62	5,005.84	2.20	14.63	64.90	2.28	6.93	7,508.77
Dozer	15	Diesel	300	0.59	g/hp-hr	0.22	2.10	5.78	0.27	0.66	1.90	18.42	50.76	2.38	5.76	6,891.77	2.85	27.64	76.14	3.57	8.64	10,337.66
Grader	1	Diesel	125	0.59	g/hp-hr	0.36	1.39	5.43	0.39	0.66	0.09	0.34	1.32	0.10	0.16	423.46	0.13	0.51	1.99	0.14	0.24	635.19
Tractor/backhoe/ loader	17	Diesel	150	0.21	g/hp-hr	0.79	2.34	6.29	0.64	0.76	1.40	4.14	11.14	1.14	1.35	7,374.51	2.09	6.21	16.71	1.70	2.03	11,061.76
Air compressor/ generator	5	Diesel	200	0.43	g/hp-hr	0.28	0.79	5.64	0.28	0.65	0.40	1.12	8.02	0.39	0.92	2,192.39	0.61	1.67	12.04	0.59	1.39	3,288.58
Welder	5	Diesel	200	0.21	g/hp-hr	0.65	2.02	6.21	0.57	0.77	0.45	1.40	4.31	0.40	0.53	2,192.39	0.68	2.10	6.47	0.60	0.80	3,288.58
Pickup trucks and crew cab	30	Gasoline	200	-	g/mile	3.150	30.210	2.200	0.098	0.113	4.88	46.75	3.40	0.15	0.17	11,449.94	7.31	70.13	5.11	0.23	0.26	17,174.90
Total emissions											**13**	**92**	**169**	**9**	**19**	**43,615**	**20**	**139**	**254**	**14**	**29**	**65,423**

SOURCE: URS Corporation 2006

NOTES: [1] Load-factor values were obtained from the U.S. Environmental Protection Agency 's Newest Draft Nonroad Emission Inventory Model, which can be found at www.epa.gov/otaq/models/nonrdmdl/nr-eiip4.wpd.

[2] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition" (USEPA 420-P-04-009, April 2004). For all vehicles and equipment, Tier 1 emission factors were used.

[3] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60^{o} Fahrenheit.

[4] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 3,000 hours per year.

[5] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 150 miles a day and an operating schedule of 6 days per week and 52 weeks per year.

[6] Total emissions from pipeline construction are based on 18 months of construction.

[7] CO_2e emission for gasoline fueled crew cabs and pickups and off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the American Petroleum Institute (API) report "Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry" (February 2004).

VOC = volatile organic compounds
hp = horsepower
CO = carbon monoxide
CO_2e = carbon dioxide equivalents
NOx = nitrogen oxides
PM_{10} = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
SO_2 = sulfur dioxide
g/hp-hr = grain per horsepower-hour

Table 4-21 Air-Pollutant Emissions from Construction Vehicles and Equipment – Water-Supply Pipeline (Eastern and Western Routes)

Vehicle / Equipment	Fuel	Average Engine Power (hp)	Load Factor [1]	Well Field Construction Phases and Duration in Months					Main Transmission Pipeline and Pump Station Construction Phases and Duration in Months						Equivalent Vehicle Usage (Machine-hours)	Unit of Emission Factors	Emission Factors [2,3]					Maximum Annual Emissions (tons/year) [4,5]						Total Construction Emissions (tons/year) [6]					
				Access Roads	Well Sites	Collector Pipe	Storage Tank	Electrical Supply	Main Transmission Pipeline	Directional Boring	Pump Station	Electrical Substation	Electrical Supply Line	Road Improvements																			
Construction Phase Duration in Months				1	22	22	3	22	22	2	14	12	14	1			VOC	CO	NOx	PM_{10}	SO_2	VOC	CO	NOx	PM_{10}	SO_2	CO_2e	VOC	CO	NOx	PM_{10}	SO_2	CO_2e
				Quantity of Diesel Powered Construction Vehicles/Equipment																													
Truck (2- to 5-ton)	Diesel	250	0.59	3	1	5	-	3	6	-	3	6	3	3	123,000	g/hp-hr	0.33	1.20	5.36	0.35	0.66	3.60	13.10	58	3.81	7.16	12,352.13	6.59	24.02	107.20	6.98	13.12	18,415.90
Truck (5- to 15-ton)	Diesel	250	0.59	-	-	-	-	1	-	-	-	-	1	1	9,250	g/hp-hr	0.33	1.20	5.36	0.35	0.66	0.27	0.99	4.40	0.29	0.54	935.77	0.50	1.81	8.06	0.52	0.99	1,384.94
Bulldozer (rubber tire)	Diesel	300	0.59	3	-	2	-	-	2	-	1	1	-	3	30,000	g/hp-hr	0.22	2.10	5.78	0.27	0.66	0.69	6.70	18.46	0.87	2.10	3,503.51	1.27	12.28	33.84	1.59	3.84	5,390.02
Backhoe/loader/trencher	Diesel	150	0.21	1	-	4	-	-	8	-	2	2	-	1	79,500	g/hp-hr	0.79	2.34	6.29	0.64	0.76	1.19	3.52	9.47	0.97	1.15	5,090.28	2.18	6.46	17.36	1.77	2.11	8,343.36
Crane (10- to 20-ton)	Diesel	300	0.21	-	-	2	1	-	4	1	2	2	1	-	50,750	g/hp-hr	0.21	1.37	6.09	0.21	0.65	0.40	2.64	11.70	0.41	1.25	6,092.68	0.73	4.83	21.45	0.75	2.29	9,027.84
Crane (75-ton)	Diesel	400	0.21	-	-	-	-	-	-	-	1	-	-	-	3,500	g/hp-hr	0.21	1.37	6.09	0.21	0.65	0.04	0.24	1.08	0.04	0.11	711.55	0.07	0.44	1.97	0.07	0.21	830.15
Drill rig	Diesel	300	0.59	-	1	-	-	-	-	1	4	-	-	-	20,000	g/hp-hr	0.21	1.37	6.09	0.21	0.65	0.44	2.92	12.95	0.46	1.38	2,757.27	0.80	5.35	23.75	0.84	2.54	3,557.77
Generator	Diesel	200	0.43	-	-	-	1	-	-	-	1	1	-	-	7,250	g/hp-hr	0.28	0.79	5.64	0.28	0.65	0.11	0.29	2.12	0.10	0.24	800.50	0.20	0.54	3.88	0.19	0.45	859.79
Grader	Diesel	125	0.59	1	-	1	-	-	1	-	-	-	-	1	11,500	g/hp-hr	0.36	1.39	5.43	0.39	0.66	0.18	0.71	2.77	0.20	0.33	486.60	0.34	1.30	5.08	0.37	0.61	860.91
Roller/compactor	Diesel	150	0.59	1	-	-	-	-	-	-	-	-	-	-	250	g/hp-hr	0.36	1.39	5.43	0.39	0.66	0.00	0.02	0.07	0.01	0.01	22.46	0.01	0.03	0.13	0.01	0.02	22.46
Semitractor/trailer	Diesel	350	0.59	-	-	2	2	1	4	-	2	2	1	-	56,500	g/hp-hr	0.22	2.10	5.78	0.27	0.66	1.52	14.72	40.56	1.90	4.60	7,860.45	2.78	26.99	74.36	3.48	8.44	11,843.07
Welding machine	Diesel	200	0.21	-	-	-	4	-	4	2	6	1	-	-	50,000	g/hp-hr	0.65	2.02	6.21	0.57	0.77	0.82	2.55	7.84	0.72	0.97	4,387.92	1.50	4.67	14.37	1.33	1.77	5,929.62
Portable rock-crushing plant generator	Diesel	200	0.43	-	-	-	-	-	1	-	-	-	-	-	5,500	g/hp-hr	0.28	0.79	5.64	0.28	0.65	0.94	2.51	11.63	0.83	0.79	355.78	0.18	0.51	3.68	0.18	0.42	652.26
Portable concrete batch plant generator	Diesel	200	0.43			-	-	-	-	-	1	-	-	-	3,500	g/hp-hr	0.28	0.79	5.64	0.28	0.65	0.06	0.18	1.28	0.06	0.15	355.78	0.12	0.33	2.34	0.12	0.27	415.07
Vehicle / Equipment	**Fuel**	**Avg. Engine Power (hp)**	**-**	**Quantity of Gasoline-Powered Vehicles**											**Miles/Yr (5)**	**Unit of Emission Factors**	**VOC**	**CO**	**NOx**	**PM_{10}**	**SO_2**	**VOC**	**CO**	**NOx**	**PM_{10}**	**SO_2**	**CO_2e**	**VOC**	**CO**	**NOx**	**PM_{10}**	**SO_2**	**CO_2e**
Pickup/crewcab truck	Gasoline	200	-	30											46,800	g/mile	3.15	30.21	2.2	0.098	0.113	4.87	46.74	3.40	0.15	0.17	910.77	8.94	85.69	6.24	0.28	0.32	1,669.74
Total emissions																						**15**	**98**	**186**	**11**	**21**	**46,623**	**26**	**175**	**324**	**18**	**37**	**69,203**

SOURCE: Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance; URS Corporation 2006

NOTES:

[1] Load-factor values were obtained from U.S. Environmental Protection Agency's Newest Draft Nonroad Emission Inventory Model, which can be found at www.epa.gov/otaq/models/nonrdmdl/nr-eiip4.wpd.

[2] Emission factors for off-highway diesel-fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition," USEPA 420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.

[3] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60^o Fahrenheit.

[4] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 3,000 hours/year.

[5] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 150 miles a day and an operating schedule of 6 days per week and 52 weeks per year.

[6] Total emissions from pipeline construction are based on worst-case scenario of the 11,600 acre-feet per year alternative.

[7] CO_2e emission for gasoline fueled crew cabs and pickups and off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the American Petroleum Institute (API) report "Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry" (February 2004).

VOC = volatile organic compounds
hp = horsepower
CO = carbon monoxide
CO_2e = carbon dioxide equivalents
NOx = nitrogen oxides
PM_{10} = particulate matter with aerodynamic diameter less than or equal to 10 microns
SO_2 = sulfur dioxide
g/hp-hr = grain per horsepower-hour

Table 4-22 PM_{10} Emissions from Portable Rock-Crushing Plant [1]

Source [2]	Quantity	Amount Processed [3] (tph)	Hours Operated (hr/yr)	Emission Factor (lb/ton/unit)	Maximum Annual Emissions (tpy)	Total Construction Emissions (tons)
Batch drop operations	1	20	3,000	0.00017	0.005	0.009
Loading feed hopper	1	20	3,000	0.00017	0.005	0.009
Pneumatic loading of lime silo	0	20	3,000	0.0049	0.0	0.0
Lime transfer onto conveyor belts	0	20	3,000	0.000046	0.0	0.0
Primary crushing	1	20	3,000	0.00054	0.016	0.030
Secondary crushing	1	20	3,000	0.00054	0.016	0.030
Tertiary crushing	0	20	3,000	0.00054	0.0	0.0
Fine crushing	0	20	3,000	0.0022	0.0	0.0
Screening	1	20	3,000	0.00074	0.022	0.041
Fine screening	0	20	3,000	0.0022	0.0	0.0
Stackers	1	20	3,000	0.00017	0.005	0.009
Conveyor transfer points	1	20	3,000	0.000046	0.001	0.003
Totals					**0.07**	**0.13**

SOURCE: Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance; URS Corporation 2006

NOTES: [1] PM_{10} emissions from portable rock crushing plant are based on Arizona Department of Environmental Quality's "Annual Air Emissions Inventory Questionnaire For Facilities Permitted to Operate a Crushing and Screening Plant."

[2] Fugitive Emissions from haul roads and storage piles as well as truck unloading emissions have already been accounted for in Table 4-18).

[3] Amount processed was estimated based on a calculated volume of 2,136,673 cubic feet of crushed rock (a density of 100 pounds per cubic foot) needed to complete the project over the span of 22 months.

PM_{10} = particulate matter with aerodynamic diameter less than or equal to 10 microns
hr/yr = hours per year
lb/ton/unit = pound per ton per unit
tph = ton per hour
tpy = ton per year

Table 4-23 PM_{10} Emissions from Portable Concrete Batch Plant [1]

Source [2]	Throughput Rate [3] (tph)	Hours Operated (hr/yr)	Emission Factor (lb/ton/unit)	Maximum Annual Emissions (tpy)	Total Construction Emissions (tons)
Batch drop operations – aggregate	1,499	3,000	0.00016	0.360	0.660
Batch drop operations – sand	1,499	3,000	0.00004	0.090	0.165
Aggregate transfer to feed hopper	1,499	3,000	0.00016	0.360	0.660
Sand transfer to feed hopper	1,499	3,000	0.00004	0.090	0.165
Aggregate transfer to elevated bins	1,499	3,000	0.00016	0.0360	0.660
Sand transfer to elevated bins	1,499	3,000	0.00004	0.090	0.165
Aggregate transfer to weigh hoppers	1,499	3,000	0.00016	0.360	0.660
Sand transfer to weigh hoppers	1,499	3,000	0.00004	0.090	0.165
Cement transfer to silo	1,499	3,000	0.00005	0.112	0.206
Cement transfer to weigh hopper	1,499	3,000	0.001	2.248	4.122
Mixer loading – truck mix	1,499	3,000	0.0073	16.413	30.091
Mixer loading – central mix	1,499	3,000	0.00061	1.372	2.514
Conveyor transfer points (aggregate)	1,499	3,000	0.000022	0.049	0.091
Conveyor transfer points (sand)	1,499	3,000	0.000017	0.038	0.070
Screening	1,499	3,000	0.00035	0.787	1.443
Fine screening	1,499	3,000	0.001	2.248	4.122
Totals				**25.07**	**45.96**

SOURCE: Appendix A-2 Typical Well Field and Pipeline Construction, Operation, and Maintenance 2006; URS Corporation 2006

NOTES: [1] PM_{10} emissions from portable concrete batch plant are based on the Arizona Department of Environmental Quality's Annual Air Emissions Inventory Questionnaire for Facilities Permitted to Operate a Concrete Batch Plant

[2] Fugitive emissions from haul roads and storage piles as well as truck unloading emissions have already been accounted for in Table 4-1.

[3] Concrete throughput rate was estimated based on 1,278 cubic yards of concrete (density 150 pounds per cubic foot) needed to complete the project over the span of 14 months.

PM_{10} = particulate matter with aerodynamic diameter less than or equal to 10 microns.

hr/yr = hours per year

lb/ton/unit = pound per ton per unit

TPH = ton per hour

TPY = ton per year

Table 4-24 Annual Emissions From Construction of Water-Supply Pipeline (Alternative A)

Emissions	PM_{10} (tons)	VOC (tons)	CO (tons)	NOx (tons)	SO_2 (tons)
Equipment/vehicle combustion [1]	11	15	98	186	21
Portable rock-crushing plant [2]	0.07	—	—	—	—
Portable concrete batch plant [3]	25	—	—	—	—
Earthmoving [4]	75	—	—	—	—
Totals	**111**	**15**	**98**	**186**	**21**

SOURCE: URS Corporation 2006

NOTES: [1] Equipment/vehicle combustion emissions includes water-supply pipeline's total construction emissions from Table 4-21.

[2] Portable rock crushing plant emissions are from Table 4-22.

[3] Portable concrete batch plant emissions are from Table 4-23.

[4] Earthmoving emissions are project total controlled PM_{10} emissions from Table 4-18.

VOC = volatile organic compounds

CO = carbon monoxide

NOx = nitrogen oxides

PM_{10} = particulate matter with aerodynamic diameter less than or equal to 10 micrometers

SO_2 = sulfur dioxide

4.6.3.2 Total Air-Quality Impacts of Alternative A

Table 4-25 provides a summary for Alternative A of the maximum annual PM_{10} emissions for the mining operations and construction of the coal-slurry and water-supply system. Estimates for several years that reflect annual project emissions before, during, and after construction of the pipelines are included in this table. The timelines in Table 4-25 show that the Kayenta mining operation would continue through 2026; water-supply pipeline construction was planned to occur from January 2008 through late 2009 (22 months); coal-slurry-pipeline construction would occur from January 2008 through July 2009 (19 months); and Black Mesa, with the coal-washing plant, would operate 2010 through 2026.

Table 4-25 Maximum Annual Controlled PM_{10} Emissions During and After Pipeline Construction (Alternative A)

Source	Maximum Annual Emissions (tons per year)				
	2006[1]	2007[1]	2008[1]	2009[1]	2010 to 2026[2]
Black Mesa and Kayenta mining operations[3]	1,699	1,699	1,699	1,699	1,843
Coal-slurry pipeline	0	0	140	70	0
C aquifer water-supply system[4]	0	0	111	63	0
Increase over existing conditions	0	0	251	133	144

SOURCE: Calculated from Table 4-20and Table 4-21data, and Peabody Western Coal Company 2005

NOTES: [1] Assumes baseline emissions for Black Mesa Mine.

[2] Assumes Black Mesa mining operation production is 6.35 million tons per year with wash plant after 2009.

[3] The projected worst-case emissions for 2006 were used for years 2006 through 2009; the 2010 to 2026 emissions were projected for the worst-case year during that period, which was 2023.

[4] The water-supply pipeline Western Route alternative has the highest predicted emissions.

PM_{10} = particulate matter with aerodynamic diameters less than or equal to 10 microns

The worst-case increase in PM_{10} emission rates from the project is 251 tons per year and occurs during construction, when both the water-supply and coal-slurry pipelines are under construction. This increase represents approximately 4.4 percent of total regional point source PM_{10} emissions (projected Black Mesa Complex baseline emissions and other background sources). As described in Chapter 3, the highest annual average ambient concentration of PM_{10} recorded between 2003 and 2005 by the monitors at the Black Mesa Complex was 37.7 µg/m^3 (refer to Table 3-11), which is 75.4 percent of the NAAQS value of 50 µg/m^3. Therefore, a temporary 4.4 percent increase in regional emissions would not be anticipated to cause an exceedance of the NAAQS. Consequently, the air-quality impacts associated with Alternative A are considered minor.

New Source Review of new and modified facilities in areas with acceptable air quality evaluates the facilities' ability to comply with the NAAQS and the PSD increments. As described in Section 3.6, an "attainment" area is a geographic area in which existing levels of air quality have been designated by USEPA as meeting the NAAQS. An area is designated as "unclassified" if the USEPA lacks sufficient air-monitoring data to assign either an "attainment" or "nonattainment" designation to that area. The areas surrounding the Black Mesa Complex and the pipeline routes are designated as either attainment or unclassified.

4.6.3.3.1 Assessment of NAAQS Conformance

Excavation activities during pipeline construction have the potential to create transient concentrations that may exceed the NAAQS in a limited area. However, the ambient impacts of such transient emissions are difficult to model with accuracy. Mitigation measures for Alternative A would include application of water to vehicle-traffic routes and excavation zones, avoidance of excavation during adverse wind conditions, use of gravel on heavier-use roadways, and limitations on vehicle speed on unpaved areas. Combinations of these measures would be used to fit local conditions. Even with such measures, it is possible that the PM_{10} standard for 24-hour averaging periods may be exceeded close to excavation areas during periods of construction activity. These localized exceedances would not continue once the activity in a specific area is completed for that day.

The estimated emissions of PM_{10} and other pollutants for the entire scope of pipeline construction activities are tabulated in Section 4.6.3.2. Only a small fraction of these emissions would affect any given location along the pipeline route during a single day. It is the daily emissions that more realistically reflect the PM_{10} emission level that could affect NAAQS compliance on a localized basis.

A refined dispersion-modeling analysis was performed to characterize the effects of operation of the Black Mesa Complex with the proposed coal-washing plant (McVehil-Monnett Associates, Inc. 2006). This analysis used the Industrial Source Complex 3 (ISC3) refined model, and one complete year of representative, on-site meteorological data. Emissions inventories for PM_{10} and NOx were developed using emission factors endorsed by the Wyoming Department of Environmental Quality (WDEQ). Three worst-case years were identified based on total Black Mesa Complex emissions and proximity to mine boundaries. Receptor points were positioned along the permit boundary of the Black Mesa Complex, at key cultural resource locations, and at residences that are assumed to remain occupied during the LOM operations. Details on the emissions inventory development and modeling methodology are provided in the Air Quality Technical Support Document for the Black Mesa Project Draft EIS (McVehil-Monnett Associates, Inc. 2006).

Background concentrations, combined with predicted mining-activity contributions, were based on several years of ambient PM_{10} data from two monitors at locations that are relatively unaffected by man-made emissions (monitors 3R and 12, from Tables 3-11 and 3-12). Based on the ambient-air-monitoring data described in Section 3.6.1, a background PM_{10} concentration of 13.0 µg/m^3 was determined for both

24-hour and annual averaging times. Based on accepted guidance from ADEQ for rural areas of the state, a background NO_2 concentration of 2.1 μg/m^3 was used for the annual NO_2 assessment.

The ISC3 model uses a conservative methodology to estimate particulate depositions. The model is not sophisticated enough to accurately simulate deposition of particulate emissions or to determine the true wind direction. Therefore, results are expected to overestimate the impacts that would be calculated by more sophisticated methods.

The results of the refined model assessment of NAAQS conformance for Black Mesa Complex activities are summarized in Table 4-26. The maximum predicted ambient concentrations at any location along the Black Mesa Complex boundary are equal to the sum of the predicted contribution from mine sources, plus the conservative background concentrations for the area. The highest predicted boundary-receptor concentrations for any modeled day at all receptors are below the NAAQS. Mining activities are ground-level emission sources, and the particulate emissions are not transported far from the source. Consequently, the predicted particulate concentrations have been shown to decrease substantially at relatively short distances outside the Black Mesa Complex boundary. Since the maximum predicted boundary concentrations are below the NAAQS, the concentrations at locations outside the boundary also would be less than the NAAQS.

Table 4-26 Assessment of NAAQS Conformance for Black Mesa Complex

Pollutant and Averaging Time	Predicted Maximum Black Mesa Complex Contribution for Analyzed Years (μg/m^3)			Predicted Total Concentration for Analyzed Years Including Estimated Background (μg/m^3)			NAAQS (μg/m^3)
	2006[a]	2022	2023	2006[a]	2022	2023	
PM_{10}, 24-hour	85.7	84.0	101.9	98.7	97.0	114.9	150
PM_{10}, annual	28.2	33.7	35.9	41.2	46.7	48.9	50
NO_2, annual	10.6	18.2	18.9	12.7	20.3	21.0	100

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTE: [a] Based on the worst-case projection for the Black Mesa Complex.

μg/m^3 = micrograms per cubic meter, NAAQS = National Ambient Air Quality Standards,
PM_{10} = particulate matter equal to or less than 10 microns in diameter, NO_2 = nitrogen dioxide

Table 4-27 shows that predicted concentrations of PM_{10} and NO_2 from the NAAQS modeling assessment are below significant impact levels at Navajo National Monument (10 miles northwest of the Black Mesa Complex) and the Monument Valley Visitor Center (31 miles north-northeast of the Black Mesa Complex), which are the nearest sensitive Class II areas. Moreover, this dispersion analysis showed that ambient concentration contributions at or above significance levels from mining activities would not occur at any sensitive receptors or existing, major stationary sources.

Table 4-27 Assessment of Impacts From Black Mesa Complex on Local Sensitive Receptors

Receptor	PM_{10} Annual Impact (μg/m^3) Significance Level = 1 μg/m^3			NO_2 Annual Impact (μg/m^3) Significance Level = 1 μg/m^3		
	2006[a]	2022	2023	2006[a]	2022	2023
Navajo National Monument	0.41	0.40	0.39	0.13	0.13	0.15
Monument Valley Visitor Center	0.29	0.29	0.29	0.08	0.12	0.12

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTE: [a] Based on the worst-case projection for the Black Mesa Complex.

μg/m^3 = micrograms per cubic meter, NAAQS = National Ambient Air Quality Standards,
PM_{10} = particulate matter equal to or less than 10 microns in diameter, NO_2 = nitrogen dioxide

The results in Table 4-26 and Table 4-27 should be interpreted while recognizing the tendency of the ISC3 model to predict significantly greater PM_{10} concentrations than normally observed. To better represent certain ground-level sources, USEPA revised and reevaluated the ISC3 model only to find that "[i]n spite of the improved performance of the ISC3 model, the model significantly over predicts (as defined by the protocol) for PM_{10} but not for TSP" (see USEPA, December 1995. Modeling Fugitive Dust Impacts from Surface Mining Operations – Phase III, "Evaluating Model Performance," U.S. Environmental Protection Agency (EPA)454/R-96-002,33). Conclusions based on the predicted PM_{10} concentrations shown in Table 4-20 and Table 4-21 should account for this documented tendency of the ISC3 model to significantly overpredict PM_{10} impacts from surface coal mines.

4.6.3.3.2 Assessment of PSD Increment Consumption

The PSD increments are maximum allowable increases in ambient pollutant concentrations above a baseline level (set as the minor source baseline date) for specified averaging times. As each new source is permitted within a defined region, the amount of available increment is reduced, or "consumed," because of the predicted changes in ambient concentrations due to the new source(s). Consumption of increment for a given pollutant and averaging time, at a given locale, is equal to the predicted ambient concentrations from operation of currently permitted sources, less the concentrations that would have occurred due to operation of the roster of emission sources present at the minor source baseline date. The PSD increments for Class I and Class II areas are provided in Table 4-28.

Table 4-28 Class I and Class II Increments and Significance Thresholds Applicable to PSD Permitting Projects

Pollutant	PSD Significance Thresholds ($\mu g/m^3$)		PSD Increment ($\mu g/m^3$)	
	24-Hour Average	Annual Average	24-Hour Average	Annual Average
PM_{10} Class II	5	1	30	17
PM_{10} Class I	5	1	8	4
NO_2 Class II	NA	1	NA	25
NO_2 Class I	NA	1	NA	2.5

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTES: PSD = Prevention of Significant Deterioration, $\mu g/m^3$ = micrograms per cubic meter, PM_{10} = particulate matter equal to or less than 10 microns in diameter, NO_2 = nitrogen dioxide, NA = not applicable

The proposed physical and operational changes at the Black Mesa Complex would not result in net increases of air-pollutant emissions of sufficient magnitude to trigger a PSD permitting requirement. Furthermore, with respect to permitted point-source emissions only (excluding area and mobile sources) at the Black Mesa mining operations, the changes would result in a net decrease in emissions. Nevertheless, an assessment of PSD increment consumption in Class I areas resulting from these changes was carried out, based on the refined dispersion modeling performed for the LOM (McVehil-Monnett Associates, Inc. 2006; Peabody 2005a, 2005b). For purposes of this EIS, comparison of the PSD significance thresholds with the predicted off-property concentrations of NO_2 and PM_{10} resulting from the continued operation of the Black Mesa Complex was employed as an indicator of the consumption of increment in regional Class I areas.

The predicted distances to annual concentrations (due to mining activities) less than or equal to the PSD significance levels were quantified. This simulation was used to identify the maximum distance from the Black Mesa Complex boundary that increases in PM_{10} and NO_2 concentration were predicted to be above the PSD significance levels. The assessment was based on estimated emissions of PM_{10} and NOx at a level corresponding to the three worst-case years used in the dispersion modeling conducted by McVehil-

Monnett Associates. Receptor points in the model were positioned in an array extending outward from the Black Mesa Complex.

The footprint, or “isopleth,” of the area where concentrations were predicted above the PSD significance levels for annual averaging times are illustrated in Map 4-3 and Map 4-4, which are extracted from the Air Quality Technical Support Document for the Black Mesa Project Draft EIS (McVehil-Monnett Associates, Inc. 2006). The predicted extent of significant concentrations appears to extend farther to the south of the Black Mesa Complex, compared to other directions due to modeled wind patterns. In the case of PM_{10}, concentrations above 1 μg/m^3 can be predicted to occur as far as approximately 60 miles to the south. For NO_2, Map 4-4 shows that the maximum distance for the predicted occurrence of concentrations above 1 μg/m^3 is approximately 24 miles to the south. In other directions, the significance thresholds barely are exceeded outside the Black Mesa Complex boundaries.

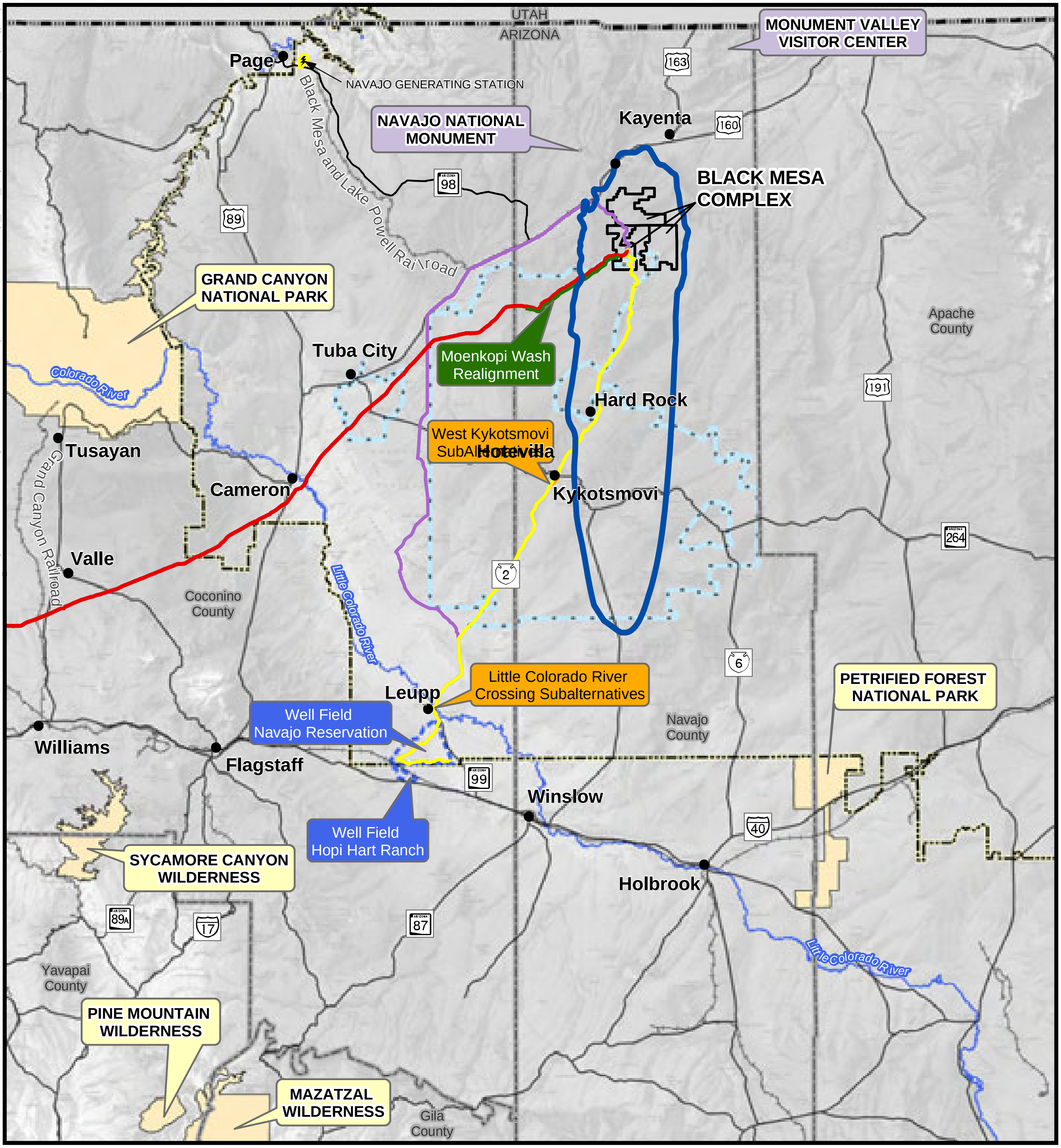
The modeling results predict that air-quality impacts would not extend toward the closest sensitive areas. The Navajo National Monument and the Monument Valley areas are sensitive Class II areas located to the northwest and north-northeast, respectively, from the Black Mesa Complex. In these directions, even the very low significance-threshold concentrations are predicted not to be exceeded beyond the boundary of the Black Mesa Complex.

Even in the southern direction, the maximum distances to significant concentration levels under the worst-case conditions are small in comparison with the distances from the Black Mesa Complex to other sources in the region and to Class I areas. The closest Class I area in a southerly direction from the Black Mesa Complex is the Petrified Forest National Park, which is 87 miles distant. This analysis predicts that the concentrations of PM_{10} and NO_2 emissions from operations at the Black Mesa Complex would be insignificant within the boundaries of any Class I Areas or Class II sensitive areas, and the annual PM_{10} and NO_2 increments would be protected within the boundaries of those Class I Areas and sensitive Class II Areas.

With respect to Class II increment consumption around the Black Mesa Complex, a different method of analysis was employed. Emissions of PM_{10} and NO_2 from mining operations were separated into reasonable estimates of baseline emissions (those that were occurring just prior to the minor source baseline dates), and those that consume increment by virtue of occurring after the minor source baseline dates. The PM minor source baseline date was established in this area on October 31, 1977, while the NO_2 minor source baseline date was established on August 15, 1990.

Production levels and mine plans at the Black Mesa Complex have changed very little over the LOM to date. It is reasonable to assume that current emissions are a good estimate of the emissions that were occurring just prior to the minor source baseline date. However, a conservative evaluation would be based on the assumption that only 75 percent of current emissions existed on the minor source baseline dates. It follows that 75 percent of the predicted concentrations from the dispersion model are representative of the concentrations that would have existed at the property boundary just prior to the minor source baseline dates. These baseline emissions do not consume the increment.

According to Table 4-26, the highest predicted annual PM_{10} concentration at the Black Mesa Complex property boundary, without background concentrations, would be 35.9 μg/m^3 in 2023. This concentration represents emissions from both the Black Mesa and Kayenta operations. Based on the assumptions above, 75 percent of this concentration would be considered in the baseline and would not be increment-consuming. Therefore, 25 percent, or 9 ug/m^3, would count toward the increment. This value falls well below the annual PM_{10} increment for Class II areas (17 μg/m^3).



SOURCES:
URS Corporation 2005
McVehil-Monnett Associates, Inc. 2006
Arizona State Land Department 2005
Navajo Nation Parks and Recreation 2005

Prepared By:
URS

LEGEND

Air Quality Features
- PM_{10} 1 $\mu g/m^3$ Impact Contour
- Federal Class I Area
- Sensitive Class II Area

Alternative A Water-Supply System
- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

Black Mesa Complex
- Peabody Lease Area

Alternative A Coal-Slurry Pipeline
- Existing Route
- Realignment

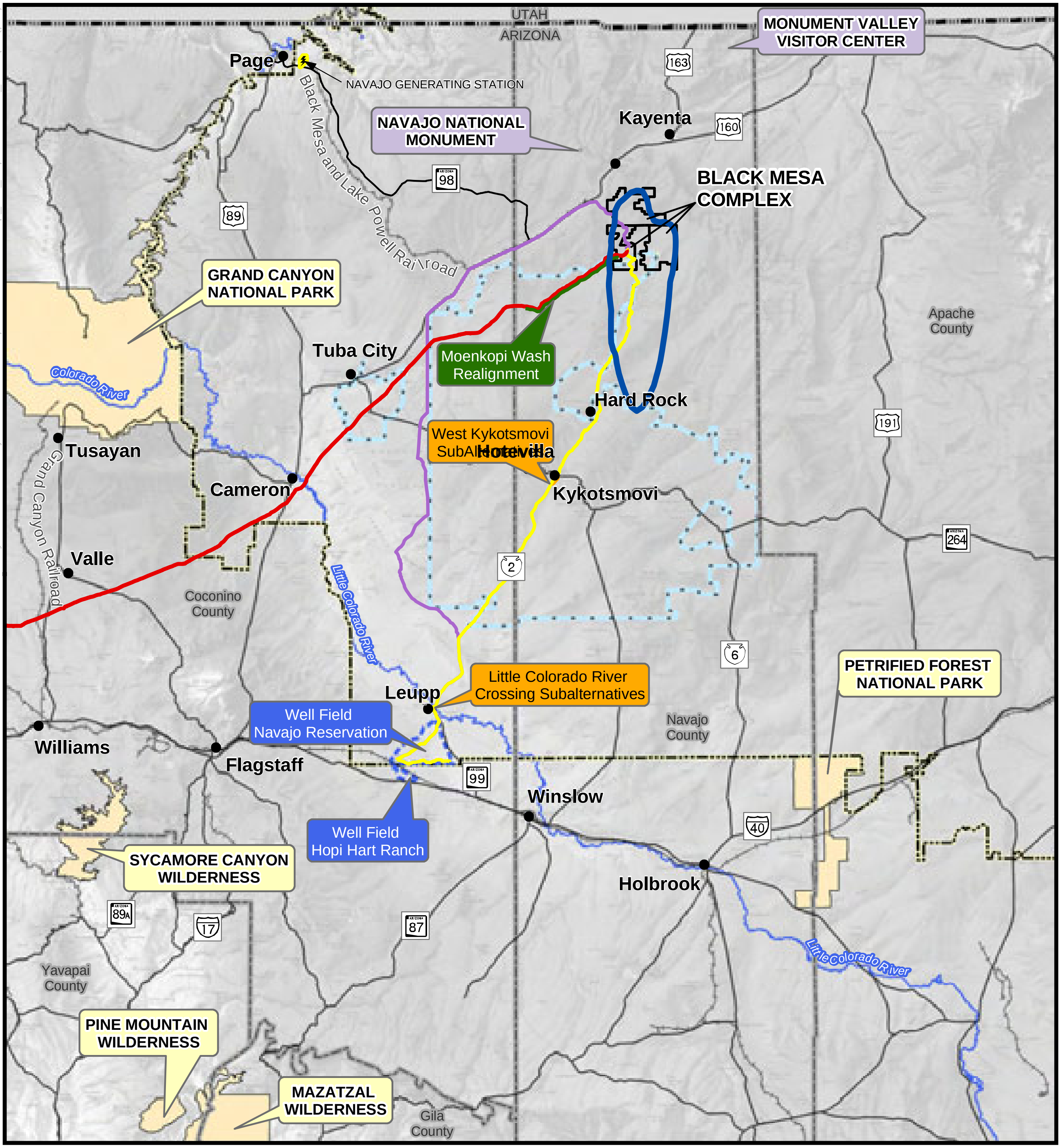
General Features
- River
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- Interstate/U.S. Highway/ State Route
- Railroad

Particulate Matter (PM_{10}) Significant Impact Area

Black Mesa Project EIS

November 2008

Map 4-3



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SOURCES:
URS Corporation 2005
McVehil-Monnett Associates, Inc. 2006
Arizona State Land Department 2005
Navajo Nation Parks and Recreation 2005

Prepared By:
URS

LEGEND

Air Quality Features
- NO_2 1 µg/m^3 Impact Contour
- Federal Class I Area
- Sensitive Class II Area

Alternative A Water-Supply System
- C-Aquifer Well Field
- Eastern Pipeline Route
- Subalternative along Eastern Route
- Western Pipeline Route

Black Mesa Complex
- Peabody Lease Area

Alternative A Coal-Slurry Pipeline
- Existing Route
- Realignment

General Features
- River
- Hopi Reservation Boundary
- Navajo Reservation Boundary
- Interstate/U.S. Highway/ State Route
- Railroad

Nitrogen Dioxide (NO_2) Significant Impact Area

Black Mesa Project EIS

November 2008

Map 4-4

Using this conservative approach, it also can be seen that the 24-hour Class II PM_{10} increment and the Class II annual NO_2 increment would be protected. Therefore, it can be concluded that Class II PSD increments will be protected in the vicinity of the Black Mesa Complex.

4.6.3.3.3 Assessment of Visibility Impacts in Class I and Sensitive Class II Areas

Class I areas are defined as those areas of the nation that are of special natural, scenic, recreational, or historic interest to the public. The quality of scenic vistas is protected by PSD regulations that require applicants to assess the potential for visibility impairment in "mandatory" Class I areas identified within the regulations. Section 3.6.8 provides a summary of the existing visibility conditions, quantified as the standard visual range, from monitoring data at mandatory Class I areas near the study area. There are no mandatory Class I areas closer than 60 miles from the Black Mesa Complex; the closest is the eastern boundary of Grand Canyon National Park, which is approximately 74 miles distant to the west-southwest. Two nearby tribal areas, Navajo National Monument, which is generally northwest and about 10 miles distant, and the Monument Valley Visitor Center, which is approximately 31 miles to the north-northeast, were determined to be areas where visibility also would be considered an important AQRV. Therefore, visibility impacts on these two areas also were assessed.

Assessment of visibility impacts is required for PSD permitting when mandatory Class I areas are within 60 miles of the project area. In addition, similar assessments usually are required by land managers for sensitive tribal lands and Class II wilderness areas. The project alternatives do not trigger PSD permitting. However, for purposes of this EIS, this section provides a qualitative evaluation of the potential for visible-plume impacts provided for four Class I areas (Grand Canyon, Mesa Verde, Bryce Canyon, and Petrified Forest National Parks)[1] and the two sensitive tribal Class II areas closest to the Black Mesa Complex.

Pipeline construction activities have the potential to create transient, relatively high concentrations of some pollutants within a limited area in the immediate vicinity of the construction site. The distances from the pipeline routes to mandatory Class I areas and sensitive tribal lands suggest that transport of these short-term construction emissions and the ability of a viewer to see a visible plume would be negligible. Mitigation measures for the Black Mesa Complex and the two pipelines are discussed in Section 4.19; these would reduce further the potential for visible plumes at mandatory Class I or sensitive areas from either pipeline construction or continuing mine activities. The estimated emissions of PM and PM_{10} and other pollutants for pipeline construction activities are tabulated in Section 4.6.3.2.

For purposes of this EIS, the potential for air-quality effects in the form of visible plumes at mandatory Class I areas was assessed for the continued operation of the Black Mesa Complex and proposed coal-washing facility. Emissions considered as potential sources of visible plumes from the Black Mesa

[1] These four Class I areas do not represent the four closest to the Black Mesa Complex or to the air-quality study area for this environmental impact statement; rather, they are the closest mandatory Class I areas for which visibility data from Integrated Monitoring of Protected Visual Environments (IMPROVE) monitoring stations are available. Peabody Energy's consultant, McVehil-Monnett & Associates, chose these four areas for analysis, pursuant to their work on the Air Quality Technical Support Document (McVehil-Monnett 2006). The Capitol Reef National Park is located approximately 38 miles north-northwest of the study area (where the study area boundary crosses the Arizona-Utah state line near the boundaries between Coconino and Navajo Counties in Arizona), and approximately 75 miles north-northwest of the Black Mesa Complex. Canyonlands National Park is approximately 68 miles north-northeast of the study area (where the study area boundary crosses U.S. Highway163 at Arizona-Utah state line) and approximately 100 miles north-northeast of the Black Mesa Complex. IMPROVE visibility data were unavailable for the Capitol Reef and Canyonlands National Parks.

Complex are low-level releases of fugitive dust and gaseous (e.g., NOx) emissions from vehicle tailpipes and blasting. These emissions do not emanate from a single location; rather, emissions from the Black Mesa Complex are distributed nonhomogeneously throughout eight mine areas and four preparation areas covering approximately 2 to 5 square miles (depending on the year) across a mine site encompassing nearly 100 square miles.

The assessment of visible plumes from ground-level-area emission sources, such as mining activities, is not suitably addressed by conventional dispersion-modeling tools. The USEPA has developed a simplified and conservative screening tool (VISCREEN) for plume-visibility assessments. However, this tool was designed to evaluate impacts from single, elevated point sources. As a result, no appropriate screening-level assessment approach exists for the type and distribution of sources found at the Black Mesa Complex. Mining activities tend to release larger-sized particles that are deposited to the ground a short distance from the source.

Consequently, it is more meaningful to review the meteorological and topographic influences that could affect the visibility of plumes from the Black Mesa Complex. These considerations are evaluated as follows for each of the areas of interest.

4.6.3.2.1.1 Grand Canyon, Mesa Verde and Bryce Canyon National Parks

For these distant mandatory Class I areas, the prevailing local wind pattern near the Black Mesa Complex and elevation differences indicate that plumes would not be visible. As described in Peabody's Air Quality Technical Support Document, the winds near the Black Mesa Complex are predominantly from the north, which would tend to prevent transport of a visible plume toward the east, north, or west (McVehil-Monnett Associates, Inc. 2006). The elevations of intervening plateaus to the west and southwest of the Black Mesa Complex generally 6,000 feet above MSL, but the terrain slopes down to 4,000 feet above MSL or less closely to the eastern boundary of the Grand Canyon National Park (46 miles west of the Black Mesa Complex). The more-distant Bryce Canyon National Park, (150 miles northwest of the Black Mesa Complex), is on the gradual plateau upslope on the opposite side of the Colorado River Valley, at an elevation of nearly 7,500 feet above MSL. Near Mesa Verde (120 miles northeast of the Black Mesa Complex), the elevation increases dramatically just to the west of the park, creating a topographic barrier.

4.6.3.2.1.2 Petrified Forest National Park

This mandatory Class I area is 87 miles south-southeast of the Black Mesa Complex. Although the local winds would tend to transport a plume in this direction, the distance to the park and the elevations of intervening plateaus indicate that a visible plume would be unlikely. Several plateaus to the south of the Black Mesa Complex are above 6,000 feet above MSL, compared to the prevailing park elevations of about 5,500 feet above MSL or below.

4.6.3.2.1.3 Navajo National Monument and Monument Valley

These two sensitive Class II areas are 10 miles northwest and 31 miles north-northeast of the Black Mesa Complex. The prevailing local winds would tend to prevent transport of a visible plume in the direction of these sensitive areas.

4.6.4 Alternative B: Approval of the 2008 LOM Revision (Preferred Alternative)

There would be no emission increases associated with preferred Alternative B. Coal production at the Black Mesa Complex is reduced from 14.4 million tons of coal per year (under Alternative A) to 8.5 million tons of coal per year.

4.6.5 Alternative C: Disapproval of the LOM Revision (No-Action Alternative)

There would be no emission increases associated with Alternative C. Coal production at the Black Mesa Complex is reduced from 14.4 million tons of coal per year (under Alternative A) to 8.5 million tons of coal per year.

4.6.6 Fugitive Dust and Health-Related Issue

Concerns were raised during scoping about the potential for lung disease, particularly asthma and black lung, in mine workers and local residents potentially resulting from mining activities. This section provides a discussion of exposure to PM, asthma and black lung, and the measures Peabody takes to reduce amounts of PM resulting from mining activities.

For purpose of this discussion, it is important to note that only two size fractions of particulate are regulated under the Federal clean Air Act. Specifically, the NAAQS include a 24-hour standard for PM_{10} (150 µg/m^3), and a 24-hour standard (35 µg/m^3) and an annual standard (15 µg/m^3) for $PM_{2.5}$. As stated previously, PM_{10} refer to PM that has an aerodynamic diameter of 10 microns or less. In general, particles larger than 10 microns are trapped in a person's mouth, nose, and throat, and do not reach a person's lungs. $PM_{2.5}$ refers to the subset of PM_{10} that has an aerodynamic diameter of 2.5 microns or less. $PM_{2.5}$ tends to reach the deepest areas of a person's lungs, where many illnesses originate.

PM emissions from mining and material handling operations tend to be course, in the PM_{10} range and larger; a very small percentage of these emissions consist of particles that are 2.5 microns or smaller. Conversely, emissions from fuel-burning equipment (including natural gas, oil, and gasoline) tend to be smaller, predominantly in the $PM_{2.5}$ fraction. (Most coal-fired power plants in the region are equipped with fabric filter technology (baghouses) that removes well over 90 percent of PM larger than 2.5 microns.)

A broad range of health effects have been associated with ambient PM. As stated in a USEPA Staff Paper (USEPA 2005), "the epidemiologic evidence for PM-related effects was found to be strong, suggesting a 'likely causal role' of ambient PM in contributing to health effects." However, there are active areas of research regarding whether differing compositions of PM from different sources affect health differently and whether air pollutants other than particulate matter also might be contributing to the health effects seen with particulate matter exposures. Particulate matter air pollution is composed of two major components: primary particles emitted directly into the atmosphere by pollution sources and secondary particles formed in the atmosphere from gaseous pollutants such as SO_2 and NO_X. Coal extraction activity (mining) does not usually result in the direct emission of gaseous pollutants.

In addition to unanswered questions regarding whether the composition of particulate matter has a bearing on health effects, issues also remain regarding the confounding of health effects due to particulates with the health effects due to other air pollutants. While much progress has been made in sorting out contributions of ambient particulate matter and its components to observed health effects relative to other co-pollutants, including gaseous criteria pollutants (e.g., O_3, NO_2, SO_2, and CO), no plausible toxicological mechanism has been identified relating the increased mortality due to co-pollutants versus primary particulate matter. Thus, the PM effects that most likely reflect overall effects are exerted by $PM_{2.5}$ either acting alone and/or in combination with other ambient air pollutants.

One important issue that USEPA focused on in its latest review of health effects is whether there is a threshold concentration below which adverse health effects are not seen. The detection of a threshold level for the effects of PM on mortality has proven to be very difficult. The available evidence does not either support or refute the existence of thresholds for the effects of PM on mortality across the range of concentrations in the available studies. Since individual thresholds vary from person to person due to individual differences in susceptibility and preexisting disease conditions (e.g., asthma) that make them unusually sensitive, even at low concentrations. Due to the uncertainties associated with determination of a health impact's threshold for the general population, as-yet-undetermined health effects associated with $PM_{2.5}$ may exist for sensitive individuals even though ambient $PM_{2.5}$ levels meet the NAAQS.

Refer to Section 3.6.4.2 for a discussion on monitored ambient PM_{10} concentrations at the Black Mesa Complex. Although a few exceedances of the 24-hour NAAQS have been recorded, these were attributed primarily to dry conditions, high winds, and vehicular traffic on local roads, rather than on mine operations.

The following paragraphs present further information on specific diseases and the causative relationship, if any, to PM exposures.

4.6.6.1 Asthma

Asthma is a disease that affects the breathing passages (bronchi) of the lungs. Asthma is caused by chronic inflammation of these passages. Consequently, bronchioles of persons with asthma are highly sensitive to various internal and external "triggers." An asthma attack is a reaction to a trigger, much like an allergic reaction. When an asthma attack is triggered, the bronchioles swell and fill with mucus, narrowing the airway. Sometimes, muscles within the breathing passages contract, further narrowing the airway. This narrowing makes it difficult for air to be breathed out (exhaled) from the lungs.

The exact causes of asthma are not known. What all people with asthma have in common is chronic airway inflammation and excessive airway sensitivity to various triggers. Some people are born with the tendency to have asthma; others are not. Scientists are trying to identify the genes that cause this tendency. Each person with asthma has his or her own unique set of triggers. Common triggers among sensitive persons include exposure to tobacco and wood smoke, inhaling airway irritants such as perfumes and cleaning products, exposure to allergens such as molds and animal dander, exposure to cold, dry weather, an upper respiratory infection such as a cold, emotional stress, stomach acid reflux disease, and sulfites (an additive to some foods and wine) (Merck Research Laboratories 2005a).

Based on the foregoing, it is difficult to establish, scientifically, a direct link between air-pollution sources and elevated incidence of asthma in a local population. The best indicator available to assess air-pollutant concentrations is the NAAQS established by the USEPA to protect human health and welfare. The ambient PM_{10} concentrations monitored in the area surrounding the Black Mesa Complex (refer to Section 3.6.1) comply with the long-term (chronic exposure) NAAQS.

A number of studies have been published that demonstrate a positive relationship between PM and increased symptoms of asthma for those people who already have the condition. However, the role of outdoor air pollution, in particular O_3 and PM, has not been associated with an increase in asthma. A recent study found that the risk of developing asthma (incidence) was not greater, overall, in children living with high levels of O_3 or particulate air pollution (American Academy of Pediatrics 2004). Therefore, the proposed project would not affect the existing incidence rates of asthma currently present in the region.

4.6.6.2 Black Lung

Black lung is the disease caused by prolonged inhaling of coal-mine dust in proximity to the source. Only the smallest dust particles make it past the nose, mouth, and throat to the alveoli, or air sacs, deep in the lungs. The alveoli, located at the ends of the bronchioli, are responsible for exchanging gases with the blood. Macrophages, a type of blood cell, collect foreign particles and carry them to where they can be expelled (coughed out or swallowed). If too much fine dust is inhaled over an extended period, some particles and dust-laden macrophages collect permanently in the lungs. The alveoli walls become weakened and less elastic after years of cleaning out dust deposits, which leads to emphysema. Lung tissue and blood vessels on the lungs may become scarred by the dust particles, which reduces the amount of oxygen that the lungs can transfer into the blood stream, obstructing airflow, and causing chronic bronchitis (Merck Research Laboratories 2005b; U.S. Department of Labor, Mine Safety and Health Administration [MSHA] 2005b; The Courier-Journal 2005).

Black lung is prevented by adequately suppressing coal dust at the work site. Enforcement of maximum permitted dust levels in occupational settings is a preventive measure used to minimize exposure to coal dust. In 1969, standards for coal dust and other safety measures were first set when Congress passed the Federal Coal Mine Safety and Health Act, which set dust levels per meter of air and established the MSHA within the Department of Labor to monitor safety and health levels of mines. MSHA mandates a program to ensure worker safety. This includes proper safety gear, use of respirators where warranted, maintaining a dust-suppression system, and conducting ongoing worker training, including a mandatory 8-hour annual refresher course. MSHA also conducts a periodic dust-sampling program where workers are provided with a monitor to wear during their shifts. The samples are analyzed to ensure that workers are being protected.

At the Black Mesa Complex, respirators are mandatory for workers in certain areas, which include drillers, mobile equipment operators, welders, and workers at the coal-preparation facilities. Protective mechanisms include pressurized cabs on vehicles and heavy equipment that have air-conditioning systems that filter the air and keep dust from coming into the cab. Cabs are sealed around the doors and windows. Drills have dust skirts and dust-controlling devices (Dunfee 2006).

Considering local residents as well as workers, Peabody has implemented an extensive dust-control plan for the Black Mesa Complex. As explained in Section3.6.4, pursuant to 30 CFR 816.95, OSM requires Peabody to develop and implement a plan to effectively control fugitive dust from its coal-mining operations. In addition, pursuant to 30 CFR 780.15(a)(1), OSM requires Peabody to conduct air-quality monitoring to evaluate effectiveness of Peabody's fugitive-dust-control program. Air-quality data collected from the Black Mesa Complex's monitoring network during active mining operations are presented in Chapter 3. Map 3-10 shows the locations of the Peabody air-quality-monitoring stations.

The monitoring network includes 12 particulate matter (PM_{10}) samplers at 11 locations throughout the mining complex (refer to Map 3-12). The PM_{10}-monitoring network is operated in accordance with relevant USEPA requirements, including a quality assurance program, and was designed to monitor air-quality conditions on a microscale at the Black Mesa Complex to evaluate the effectiveness of the fugitive-dust-control program (it is not required to satisfy rigorous USEPA siting requirements). Specifically, some monitors are located close to residences and unpaved roads used by local residents.

Quarterly monitoring reports are submitted to OSM and NNEPA. The ambient PM_{10} concentrations monitored in the area of the Black Mesa Complex indicate that the public is not exposed to short-term (24-hour) or chronic (annual) concentrations at levels that present a risk of black lung. Should monitoring data indicate that ambient PM_{10} standards are being threatened by impacts from mining operations, Peabody can adjust the nature, extent, and frequency of its various available dust-control measures (Section 4.19.2.2.1) as necessary to reduce impacts to maintain compliance with the applicable NAAQS.

4.6.7 Acid-Deposition Effects Due to Mining Activities

A potential issue that was identified during the scoping comment phase of this EIS was the possibility that emissions from diesel-engine-driven vehicles and mining equipment at the Black Mesa Complex, or along the pipeline route during construction, could cause acid-deposition impacts. Engine tailpipe emissions do contain relatively small concentrations, (on the order of 10 to 100 ppm) of NOx and SO_2, which are precursors of acid deposition. However, consideration of the physical and chemical processes for acid deposition support the conclusion that this phenomenon would not result from engine emissions.

Two processes must occur to form "acid rain." First, concentrations of NOx and SO_2 from an emission source are converted in the atmosphere to soluble chemical forms. Second, the acidic reaction products must be transported to a sufficiently high elevation to be absorbed in rain droplets. The dispersion of engine-exhaust plumes, in contrast, does not create the conditions that can result in acid deposition. Tailpipe-exhaust streams are expelled at high velocity, which promotes rapid dispersion close to the ground. Both the effects of surface wind currents and the movement of the vehicles promote rapid dispersal of the exhaust within relatively few meters of the exhaust point. Consequently, the conversion of NOx and SO_2 to a soluble form is impaired. Even if the reactions could occur, vehicle exhausts cannot be transported to sufficiently high elevation to be absorbed in rain droplets.

A quantitative, screening-level assessment of acid deposition due to Black Mesa mining operations at the closest mandatory Class I areas resulting from the Black Mesa Complex was performed for purposes of the EIS. The nitrogen deposition rate was estimated from annual average concentrations based on a technique presented in the Interagency Working Group on Air Quality Models (USEPA 1998).

Table 4-29 presents the calculated dry deposition of nitric acid,, which serves as an indicator of the potential for deposition effects at each of the closest Class I areas. Significance criteria recommended by the Forest Service for terrestrial sulfur and nitrogen atmospheric deposition consist of an acceptable range of 3 to 5 kilogram per hectare per year (kg/ha-yr) for total nitrogen. Since the Black Mesa Complex is located in semiarid region, the dry deposition estimates shown in Table 4-29 are appropriately compared to the 3 to 5 kg/ha-yr range for total nitrogen. The maximum estimated dry deposition of nitrogen for three modeled years (2006, 2022, and 2023) ranges from 0.21 (2022 and 2023) kg/ha-yr at Bryce Canyon National Park to 3.74 kg/ha-yr (2022 and 2023) at the Petrified Forest National Park. Therefore, maximum nitrogen deposition at each of the four Class I areas are within or below the range of acceptable deposition rates.

Table 4-29 Nitric Acid (HNO_3) Deposition Contributions From Black Mesa Complex

		2006		2022		2023	
Class I Areas	**Approx. Distance to Class I Areas (km)**	**Maximum NO_2 Annual Concentration ($\mu g/m^3$)**	**Calculated Dry Deposition of HNO_3 (kg/ha-year)**	**Maximum NO_2 Annual Concentration ($\mu g/m^3$)**	**Calculated Dry Deposition of HNO_3 (kg/ha-year)**	**Maximum NO_2 Annual Concentration ($\mu g/m^3$)**	**Calculated Dry Deposition of HNO_3 (kg/ha-year)**
Petrified Forest National Park	145	0.052	1.13	0.173	3.74	0.173	3.74
Mesa Verde National Park	155	0.014	0.30	0.072	1.55	0.072	1.56
Grand Canyon National Park	120	0.050	1.08	0.013	0.28	0.013	0.28
Bryce Canyon National Park	190	0.032	0.70	0.010	0.21	0.010	0.21

SOURCE: McVehil-Monnett Associates, Inc. 2006

NOTES: HNO_3 = nitric acid, approx. = approximate, km = kilometer(s), NO_2 = nitrogen dioxide, $\mu g/m^3$ = micrograms per cubic meter, kg/ha-year = kilograms per hectare per year

4.6.8 Federal Implementation Plan Conformity (Navajo Nation)

A typical consideration for projects that would have total emissions above major source thresholds is conformity with applicable implementation plans for the locale. In general, the conformity assessment consists of determining whether the proposed project would cause or contribute to nonattainment of

NAAQS, and verifying that emissions from the project have been considered in establishing the emission inventory in the implementation plan.

In general, a conformity analysis is usually only performed if the proposed project occurs within a designated nonattainment area. Furthermore, a conformity determination is usually not required unless the proposed project will emit more than a *de minimis* (negligible) threshold amount per year established for each of the criteria pollutant for which the area has been designated AS nonattainment. All portions of the project location and the air-quality study area located within Arizona, including the Navajo Nation, are classified as attainment AREAS, with respect to the NAAQS (see discussion in Section 4.6.9).

A portion of the study area is encompassed within the Navajo Nation, for which a Federal implementation plan exists for certain criteria pollutants. The emissions of the project alternatives have been considered in the development of the Federal implementation plan. The operation of the Black Mesa Complex predates the development of the Federal implementation plan, and emissions related to this operation would not increase by a significant amount for the continued operation of the mines and proposed coal-washing facility. Consequently, a complete Federal implementation plan conformity analysis is not warranted for the project alternatives.

4.6.9 State Implementation Plan Conformity (Arizona, California, and Nevada)

A small portion of the proposed project (the terminus of the coal-slurry pipeline at Mohave Generating Station) is located within Clark County, Nevada, which is classified as a nonattainment area for the 8-hour O_3 NAAQS. Emissions of O_3 precursor compounds (NOx and VOC) would only occur as a result of temporary vehicle and equipment operations in a relatively small area and are not anticipated to exceed the *de minimis* threshold of 100 tons per year. Therefore, there is no requirement to conduct a conformity analysis for the Clark County O_3 nonattainment area.

Although the proposed project activity does not extend into California, a small portion of the 31-mile study area extends into the San Bernardino PM_{10} nonattainment area. As discussed previously, fugitive dust emissions from earthmoving activity are emitted at ground level, tend to consist of coarser particles, and do not migrate a significant distance from the source. Therefore, no particulate emissions would be expected to occur within this nonattainment area and no conformity analysis is required.

As stated previously, none of the portions of the study area in Arizona are classified as nonattainment for any NAAQS pollutant. Therefore, there is no requirement to conduct a conformity analysis for the portion of the study area within Arizona.

4.7 VEGETATION

The analysis includes a description of effects on plant community structure and composition to provide a context for discussing the impacts on vegetation, and also addresses potential impacts on riparian and wetland vegetation. The study area for upland vegetation includes areas that would be affected directly by ground disturbance, plus a 0.5-mile buffer to address noxious weeds. The region of influence for riparian, wetland, and aquatic vegetation includes drainages that may be affected by changes in flow or release of sediment, and vegetation that may be affected by localized groundwater withdrawal.

4.7.1 Types of Common Impacts

The primary impact on vegetation would be physical removal of plants in construction and mining areas. All areas where vegetation is removed by mining or construction would be revegetated. The Black Mesa Complex has a detailed revegetation plan, summarized in Appendix A-1. Monitoring of revegetation success is conducted twice a year, and an annual monitoring report is produced, such as ESCO Associates and Peabody (2008) for 2007 vegetation monitoring. Revegetation plans for the pipelines and well-field facilities have not been developed at this time but would be developed in coordination with the appropriate land-managing agencies at the time that the construction, operation, and maintenance plans are prepared prior to construction. Revegetation generally would consist of establishing grasses and shrubs in impacted areas. In the Black Mesa Complex, most of the revegetation species are native, but several nonnative grass and forb species are used. Small portions of the mine would be planted with piñon, juniper, and other trees. Since one of the goals of mine revegetation is improved grazing, much of the Black Mesa Complex revegetation area is likely to be maintained in grassland and shrubland over the long term, while smaller areas would develop by natural succession into woodland and shrubland to support wildlife and to provide culturally important plant species.

Natural succession is likely to be quicker along the pipeline rights-of-way because it is narrow and has a relatively large edge-to-area ratio. The revegetated surface initially would be dominated by the seeded species, other species that become established from seed banks, and weedy opportunistic species, but in time generally would have a composition similar to native communities through the process of natural succession and dispersal of plants from undisturbed areas. Plants that are adapted to shallow bedrock and steep topography are unlikely to reestablish because the construction and ground-surface preparation process generally would result in more uniform soils and gentler topography than native conditions. Differences between predisturbance and reclamation plant community composition may persist indefinitely where the substrate is substantially different than the predisturbance conditions.

The consequences of vegetation removal and subsequent revegetation may be short or long term, depending on the extent of impact, nature of the affected plant community, and relative success of revegetation. Plant communities that are dominated by trees would take longer to reach predisturbance conditions than other communities; piñon and juniper trees would take 50 or more years to reach mature size, even where they reestablish early in the revegetation period. Loss of mature trees would affect the ecological functions and uses of native plant communities. For example, removal of dense woodland would be beneficial for livestock forage production and open-country birds, but detrimental to wildlife species adapted to woodland or those that use trees for cover, foraging, or nesting. Shrublands typically would take less time to reestablish, 10 to 20 years, and grasslands would take the least time, 3 to 5 years under good conditions.

Revegetation and natural succession would likely take longer and be less successful in areas that have limitations such as extreme aridity, soil salinity, poorly developed soils, and highly erosive soils. At the Black Mesa Complex, suitability sampling ensures that 4 feet of suitable plant growth media is present on reclaimed areas. While all the affected areas have relatively low precipitation, reestablishment of vegetation is expected to be most successful at higher elevation areas now covered by plains and Great Basin grassland or piñon/juniper woodland. The most difficult areas to reclaim would be the Mohave desertscrub west of the Black Mountains on the coal-slurry pipeline, and Great Basin desertscrub at lower elevations on the Hopi and Navajo Reservations on the coal-slurry and water-supply pipelines. Special reclamation techniques (e.g., soil manipulation, hand seeding) may be needed in these areas.

Various construction activities have the potential to increase the abundance of existing noxious weeds or to introduce new noxious weeds into the project area. These activities include mobilizing and movement of construction vehicles, excavation and movement of topsoil, land clearing, and reclamation. Removing existing vegetation and disturbing soils would encourage germination of seed already present and allow spread of weeds from airborne seeds. Weeds that are currently established may spread through disturbed areas, or new weeds may be introduced and become problematic. After construction, noxious weeds can persist or spread. Noxious weeds that establish in construction areas and along rights-of-way may spread into adjacent lands, resulting in degradation of habitat quality, decreased productivity, and increased management costs for agricultural activities, including livestock grazing. At the Black Mesa Complex, seed and mulch are specified to be free of noxious weeds.

Additional indirect construction-related impacts could include soil compaction, disruption of microphytic crusts, and an increased potential for wind and water erosion of disturbed surfaces. Soil erosion and compaction can impede the establishment of new vegetation, reduce vegetative cover and productivity, and have long-term effects on vegetation structure and composition in affected areas. The Black Mesa Complex has an extensive program of sediment ponds and other practices to control erosion. Erosion- and sediment-control practices are described in the soils section.

There are no known wetlands in the footprint of any of the facilities, and impacts on this resource are not discussed further.

4.7.2 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.7.2.1 Black Mesa Complex

4.7.2.1.1 Upland Vegetation

Mining operations, from January 1, 2008, to 2026, would result in disturbance of 12,409 acres of vegetation. The acres of vegetation types that potentially would be affected by mining are presented in Table 4-30.

Table 4-30 Approximate Acres of Vegetation Types Potentially Affected by 2008 to 2026 Mining Operations

Vegetation Type	Total Acres	Percent of Total Acres
Piñon/juniper woodland	7,931	63.3
Sagebrush	3,804	31.2
Saltbush	67	0.5
Greasewood	5	0.2
Revegetated land	349	2.0
Previously disturbed land	251	2.8
Tamarisk (riparian shrub)	2	0.0
Total	12,409	100.0

The short-term effects of mining would be major, due to the amount of native vegetation that would be affected. Large areas of piñon/juniper woodlands would be removed and, during reclamation, these areas would be converted to a mixture of grasses and shrubs. The vegetation plan includes establishment of general-purpose rangeland for grazing, key shrubland and woodland habitat areas for wildlife, and cultural plant sites (Table F-2 in Appendix F). The standard rangeland seed mix includes some 21 species, consisting of cool-season and warm season grasses, forbs, and shrubs. Fifteen of the species are native and six are introduced, including two cool-season grass species, one shrub, and three forb species. Shrubland and woodland planting areas would be established on selected sites including ponds, ridgelines, drainage bottoms, hill slopes, and as islands within reclaimed areas. Vegetation would be established in these areas using both planting and seeding and would be designed to favor the establishment of trees and shrubs by including grasses and forbs that are compatible with shrubs. Development of cultural plant sites would be similar to establishment of key habitat areas, and is intended to develop sites on more mesic aspects and coarse-textured soils similar to native areas supporting piñon/juniper and many cultural species.

With the inclusion of the key habitat areas and cultural plant sites, long-term effects on plant species diversity are expected to be minor. The postmining uses of the reclaimed areas would be similar to premining uses, including production of forage for grazing, wildlife habitat, and collection of culturally important plants.

4.7.2.1.2 Culturally Important Species

Peabody, in consultation with the Hopi Tribe and Navajo Nation, has developed a list of more than 120 culturally important plants at Black Mesa, based on published ethnobotanical studies and contacts with medicine men, herbalists, and residents of Black Mesa (refer to Table F-2 in Appendix F). Establishment of culturally important plants would focus on about 60 of these species that are more common in use, have broad application for a variety of uses, or which were identified as particularly important. Peabody has developed an intensive nursery program to produce seedlings of these species for planting. Ten of the species in the standard rangeland mix are culturally important, and all of the tree and shrub species in the planting program are culturally important. A specific cultural plant mix of 10 to 15 species would be seeded in the cultural plant sites, and seedlings from the nursery project would be planted in selected sites.

With the implementation of the proposed mitigation program, impacts on culturally important plant species would be moderate in the short term and minor to moderate in the long term. Long-term impacts on common species would be considered minor for species that are successfully reestablished and moderate for those that are difficult to reestablish. No impacts on uncommon or rare culturally important species have been identified. It should be noted that the availability of many perennial forbs is limited in premining native plant communities due to intensive grazing. Perennial forb cover is no more than 0.8 percent in the premining sagebrush type and 0.1 percent in piñon/juniper woodland (ESCO Associates 2003).

4.7.2.1.3 Riparian Vegetation

Riparian vegetation occurs on major drainages within the permit area and downstream, and consists mostly of tamarisk (salt cedar). Although tamarisk is an invasive species and has a lower habitat value than native species, it can be important for migrating birds (Yong and Finch 2002). Riparian vegetation is supported primarily by water stored in alluvial aquifers and intermittent streamflows that recharge the aquifers. A number of past and present activities have the potential to affect riparian habitats within and downstream of the mine permit area, including the construction of roads, dams, and sediment ponds. Dams and sediment ponds may affect downstream habitat by reductions in surface flow, interception of recharge to alluvial aquifers, and truncation of alluvial aquifers (for dams built to bedrock). These in turn may affect stream baseflow, channel characteristics, and spring discharge downstream.

Direct impacts from mining could affect about 2 acres of riparian shrub (tamarisk). Planting of willows and cottonwoods at some ponds would replace and improve the lost habitat. Short-term impacts would be minor, and long-term impacts would be negligible.

As of January 2002, the total watershed draining to dams and impoundments in the permitted area was 4.2 square miles in the Dinnebito Watershed and 62.8 square miles in the Moenkopi Watershed (Peabody 2004). These represent 0.5 and 2.4 percent, respectively, of the total watershed area. The areas affected would be increased during the LOM mining to 0.7 and 2.8 percent, respectively, and reduced to 0.47 and 2.2 percent after final reclamation. Because the mine area is high in the watershed and receives more precipitation than lower-elevation areas, the amount of runoff intercepted is estimated to be about 1.7 percent of the average annual runoff of Dinnebito Wash basin and 6.1 percent of Moenkopi Wash basin, for the LOM, and 1.0 and 4.8 percent after final reclamation. For the portions of the watersheds within the mine permit area, a higher proportion of runoff would be intercepted at the mine permit boundary—12 percent of Dinnebito Wash and 29 percent of Moenkopi Wash. These reductions in water availability could affect several miles of stream channel from the boundary until the next major downstream tributary, and could result in local reductions in riparian vegetation. However, monitoring of alluvial aquifer levels at the mine has shown negligible effects of impoundments on alluvial water levels. Overall effects on riparian vegetation would be negligible.

4.7.2.1.4 Noxious Weeds and Invasive Species

Peabody does not have a written noxious weed management plan, but does undertake weed control in revegetation areas and around other facilities. At the Black Mesa Complex, seed and mulch are specified to be weed free. Maintenance and management of revegetated areas includes weed management when needed (Peabody 2004a). Weed infestations have not been a significant problem to date, and no weed infestations have developed that interfered with rangeland revegetation. Weedy plants (that are not listed as noxious weeds) are common in the early stages of revegetation, but typically decrease to become a minor component of a revegetated area after about five years. Proper timing of tillage during seedbed preparation and use of native-grass hay for mulch have a significant role in reducing establishment of weeds. If nonlisted weeds compose more than 40 percent of vegetation cover in a rangeland revegetation area for two consecutive years, weeds would be controlled by mowing. If problems persist, the area would be tilled and reseeded, and herbicides might be used prior to reseeding. Listed noxious weeds would be controlled in compliance with Federal and tribal noxious weed requirements. Peabody controls weeds around shops and other facilities, and sprays roadsides to control diffuse knapweed and prevent its spread into revegetation areas (Pfannenstiel 2005). Based on use of these preventative and control measures, impacts from noxious weeds are assessed as minor.

4.7.2.1.5 Threatened, Endangered, and Special Status Species

Mining would have no effect on any threatened, endangered, or special status plant species, as no special status species are known to occur on the Black Mesa Complex.

4.7.2.1.5.1 Coal-Washing Facility

The facility would occupy about 2 acres of sagebrush or reclaimed land. It would be dismantled and the land would be reclaimed and revegetated upon cessation of mining, using the same methods as previously described for the mining operations. Only a small area would be affected, with minor impacts on vegetation. Weeds would be controlled around the facility, and impacts of noxious weeds would be minor. Construction and operation of the facility would have no effect on any threatened, endangered, or special status plant species.

4.7.2.1.5.2 Coal-Slurry Preparation Plant

This facility already exists and there would be no construction impacts. The plant would be dismantled and the land would be reclaimed and revegetated upon cessation of mining, using the same methods and success criteria as described for the Kayenta mining operation in the revegetation plan (Peabody 2004). Weeds would be controlled around the facility, and impacts of noxious weeds would be minor. Operation of the plant is not likely to have an effect on any threatened, endangered, or special status plant species.

4.7.2.1.5.3 Coal-Haul Road

Construction of the coal-haul road would disturb about 127 acres of piñon/juniper woodland. Impacts would be the same as described for other areas of piñon/juniper woodland, and the haul road would be revegetated when the road is no longer needed using procedures described for the mining operations above. Disturbances from construction of the coal-haul road would increase the potential for the limited invasion and establishment of noxious weed species. Preventative and control measures are the same as described for the mining operations, and impacts are expected to be minor. Construction and use of the coal-haul road would have no effect on any threatened, endangered, or special status plant species.

4.7.2.2 Coal-Slurry Pipeline

4.7.2.2.1 Coal-Slurry Pipeline: Existing Route

4.7.2.2.1.1 Upland Vegetation

Most of the 65-foot-wide construction right-of-way would include the right-of-way previously disturbed for construction of the original coal-slurry pipeline, which was typically 50 feet wide, but ranged up to 100 feet or more in difficult terrain. Most of the new disturbance would occur within previously disturbed areas. Since 35 years have elapsed since the original construction, the vegetation in much of the operational right-of-way is similar to that of adjacent undisturbed areas, except for a mostly two-track access road within the right-of-way. The exception is in areas occupied by piñon/juniper woodland, where most of the operational right-of-way is dominated by grassland species. Piñon, juniper, and some shrub species are common in portions of the right-of-way, but typically have lower density and much lower canopy cover than in adjacent undisturbed areas.

During construction, woody vegetation would be cut to ground level in all of the right-of-way, and portions of the right-of-way would be graded to create a suitable work surface for construction. Most of the existing aboveground vegetation likely would be destroyed or damaged by construction. Plant root systems and soil seed banks would mostly remain intact except in the trench, where soil seed banks would be replaced by topsoil salvage.

The acres of vegetation types that potentially would be impacted from construction are presented below in Table 4-31.

Table 4-31 Acres of Vegetation Types Potentially Affected — Coal-Slurry Pipeline: Existing Route

Vegetation Type	Area Affected (acres)		
	Existing 50-Foot-Wide Operational Right-of-Way	New 15-Foot-Wide Construction Right-of-way Adjacent to Existing Right-of-Way	Total
Piñon/juniper woodland		190	190
Grassland vegetation in existing right-of-way within mapped piñon/juniper	634		634
Plains/Great Basin grassland	448	134	582
Great Basin desertscrub	234	70	304
Desert grassland	92	28	120
Mohave desertscrub	192	58	250
Urban/industrial	52	16	68
Tamarisk	2	1	3
Total	1,654	497	2,151

Construction would affect more than 2,100 acres, including about 500 acres of land not disturbed previously by some ground-disturbing activity. This would be a major short-term impact. The proposed pipeline is adjacent to an existing Questar pipeline for about 27 miles west of the Navajo Reservation, and the “new” disturbance would likely be in the previously disturbed Questar pipeline right-of-way. Therefore, the area of disturbance of piñon/juniper woodland could be about 50 acres less than indicated, and would be considered a moderate long-term impact from construction. There would be no impacts on vegetation associated with work at the four existing pump stations.

BMPI would revegetate the construction area as part of construction activities, and specific information on proposed revegetation would be incorporated into the construction, operations, and maintenance plan once design and engineering for the pipeline have been completed. Impacts on vegetation from construction would be major, but long-term impacts would be minor, except for long-term loss of piñon/juniper woodlands, which is considered moderate. Impacts on vegetation diversity would be negligible to minor in all areas, over both the short and long term. Most of the noxious weed species currently present in undisturbed habitats could be expected to reoccupy the right-of-way, either through regrowth, revegetation seeding, or dispersal of seeds from adjacent areas along the relatively narrow right-of-way. The integrated noxious weed management plan, which would be prepared prior to construction, would include measures to prevent the spread of noxious weeds during construction and reclamation, and as part of right-of-way maintenance.

In the unlikely event of a pipeline failure, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would automatically close, and the flow of coal slurry would stop (Appendix A-2). The volume of coal slurry released to the surface would depend on the location of the leak on the pipeline (top of the pipe versus bottom of the pipe), and the terrain where the leak occurs (a flat location versus on a slope). Using historical data on Black Mesa coal-slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of about 565 cubic yards. The maximum coal-slurry release would cover approximately 0.7 acre with 6 inches of nontoxic fines, while the fresh water in which the coal is entrained would soak into the ground. Typically, the slurry would leak to the surface and flow in a narrow, meandering path, the direction and length of which would depend on the terrain. The release could result in some erosion, but generally would be confined to a local area. The impact would be short term and negligible to minor. If the volume of the release was sufficient to warrant mechanical removal of the coal, the potential damage to vegetation and soil caused by the removal of the deposit might outweigh the benefit of removing the coal. This would have to be determined by the appropriate agency and/or landowner and BMPI on a site-specific basis.

4.7.2.2.1.2 Culturally Important Species

Impacts on culturally important species are likely to be minor. The pipeline alignment is relatively narrow and crosses through typical habitats of the Colorado Plateau. It is unlikely that construction would adversely affect culturally important species that are rare and/or uncommon. More common species would be affected, but reductions in population size and availability generally would be minor.

4.7.2.2.1.3 Riparian Vegetation

About 3.2 acres of tamarisk would be variously affected along portions of Moenkopi Wash, Begashibito Wash, and the Little Colorado River. These areas are expected to recover relatively quickly after construction, and impacts would be negligible.

4.7.2.2.1.4 Noxious Weeds and Invasive Species

Construction of the coal-slurry pipeline has the potential to introduce or spread noxious weeds across a wide area of northern Arizona. BMPI currently has no weed management plan, and observations of the right-of-way suggest that recent construction may have introduced or spread noxious weeds in one portion of the pipeline route. BMPI would be required to prevent and control impacts from noxious weeds on Federal lands, and is required under State law to prevent the spread of State-listed restricted pests. An Integrated Noxious Weed Management Plan would be developed and implemented, and impacts would be minor.

4.7.2.2.1.5 Threatened, Endangered, and Special Status Species

Several special status species may occur along the coal-slurry pipeline route and realignments, based on known distributions and presence of suitable habitat. Individuals of these species could be present within or adjacent to the construction area and could be destroyed or damaged during construction. There have been no recent field surveys for these species along the pipeline route or realignments. However, surveys would be conducted prior to construction to identify specific areas and site-specific mitigation.

Four Navajo-listed species (Peeble's blue star, Parish's alkali grass, round dunebroom, and Beath milkvetch), one federally listed species (Welsh's milkweed), and one Federal candidate species (Fickeisen plains cactus) have the potential to occur along the route on the Navajo Reservation. These plants could be destroyed or damaged by construction activities. Impacts could vary from minor to major, depending on the number of plants affected and the status of the species. Although most of the area that would be disturbed by construction would be within the existing pipeline right-of-way, it is possible that at least some of these plants could have become reestablished in the 35 years since the previous disturbance. The Navajo Nation requires clearance surveys prior to construction for Navajo Nation endangered species list Group 2 and 3 species, including Welsh's milkweed and Fickeisen plains cactus. If Welsh's milkweed is found during preconstruction surveys, conservation and mitigation measures would be instituted; thus the impacts would be negligible or minor. If other Navajo-listed endangered species are found, appropriate mitigation would be developed in consultation with the Navajo Nation. Mitigation may include avoidance of individuals on the edges of the right-of-way, use of temporary fencing to protect plants adjacent to the construction area, transplanting, and salvage of soil seed banks. With application of these mitigation measures, impacts would likely be negligible to minor.

One Forest Service sensitive species is known to occur along the alignment within Kaibab National Forest. Tusayan rabbitbrush was observed to occur both within and adjacent to the right-of-way during a field reconnaissance in October 2005, and may occur at additional locations along the alignment. This species is adapted to light-to-moderate disturbance (Johnson 2006). Construction of the new pipeline could destroy plants within the construction area if present, but lightly to moderately damaged plants may resprout. In addition, new plants are likely to become reestablished in the disturbed area. Thus, construction and operation of the pipeline is not expected to have adverse long-term impacts on this species. Impacts on local populations would be moderate in the short term, and minor to negligible in the long term. The Forest Service would require an evaluation of areas of occurrence in the right-of-way by a botanist approved by the Forest Service, but not detailed surveys (Johnson 2006). Mitigation may include seed collection and reseeding of the right-of-way after construction.

One BLM sensitive species—two-color beardtongue—may occur along the alignment in the Black Mountains and Sacramento Valley. The BLM would require preconstruction clearance surveys for sensitive species. If sensitive species are found, appropriate mitigation would be developed, such as those given above for Navajo-listed endangered species. Impacts would be negligible to minor.

Only two special status species have the potential to occur on private and State Trust land because of the elevation and suitability of habitats where these lands occur: Tusayan rabbitbrush (in areas adjacent to Kaibab National Forest) and chalk live forever (in desert areas along the Nevada portion of the route). Impacts on these species would be minor, if present.

Under the Arizona Native Plant Law, BMPI would be required to notify the ADOA prior to construction activities that would affect protected native plants on non-Indian lands. Protected native plants are uncommon to rare along much of the pipeline alignment, except in the Mohave desertscrub and desert grassland vegetation types. The BLM, Kingman Field Office, would require the salvage of such plants—for example, cacti, yuccas, and agaves—prior to construction, and subsequent transplantation back into the right-of-way during revegetation. This mitigation would occur on about 17 miles of BLM land crossed by the alignment, including areas south and east of Kingman in desert grassland, as well as Mohave desertscrub in the Black Mountains and west to the Colorado River.

4.7.2.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

Impacts on vegetation would be similar to those described for the existing alignment, but there are some differences in the acreage of affected plant communities (Table 4-32). The preferred alignment would affect about 50 acres more piñon/juniper woodland and desert grassland, about 45 acres less grassland in the existing right-of-way, and 50 acres less urban/industrial land. The amount of impact on riparian vegetation in Moenkopi Wash is not known, but probably would be similar to the existing route. The existing route with realignments is slightly longer and would affect about 2,159 acres, 8 more than the existing route. Most of the affected area was disturbed during the construction of the original pipeline, but about 790 acres would be newly disturbed adjacent to the existing route or realignments, about 300 acres more than with the existing route. The BLM requirement for salvage of protected native plants would be applied on land administered by the BLM along the Kingman reroute.

Table 4-32 Acres of Vegetation Types Potentially Affected – Coal-Slurry Pipeline: Existing Route with Realignments

	Area Affected (acres)			
Vegetation Type	**Existing 50-Foot-Wide Permanent Operational Right-of-Way**	**New Temporary 15-Foot-Wide Construction Right-of-Way**	**New 50-Foot-Wide Permanent Right-of-Way on Realignments**	**Total**
Piñon/juniper woodland	0	190	3	193
Grassland vegetation in existing right-of-way within mapped areas of piñon/juniper	632	0	0	632
Plains/Great Basin grassland	446	135	3	583
Great Basin desertscrub	235	70	0	305
Desert grassland	65	40	67	172
Mohave desertscrub	93	59	103	255
Urban/industrial	12	4	0	16
Tamarisk	2	1	0	3
Total	1,485	499	176	2,159

4.7.2.3 Water Supply

4.7.2.3.1 C Aquifer Water-Supply System

4.7.2.3.1.1 Water Withdrawal

Under the 6,000-af/yr and 11,600-af/yr pumping alternatives, the area of groundwater drawdown of 0.1 foot or more would include the Little Colorado River from about Winslow downstream to below Leupp. Effects on vegetation from the 6,000-af/yr pumping alternative would be similar in nature to those described below for the 11,600-af/yr pumping. However, the magnitude of effects would be slightly less under the 6,000-af/yr pumping alternative.

Riparian vegetation (mostly tamarisk) is present along the Little Colorado River from Winslow downstream to Leupp. However, except for a relatively small area around Winslow, the Little Colorado River is separated from the C aquifer by the relatively impermeable Moenkopi Formation. Pumping would have negligible impact on riparian vegetation along the Little Colorado River in this area.

The C aquifer is at or near the ground surface and riparian vegetation is present in lower Clear Creek, lower Chevelon Creek, and portions of the Little Colorado River from Woodruff to Joseph City. Groundwater drawdowns in these areas are projected to range from 0.1 to 1 foot by 2060, under the 11,600 af/yr alternative. Depth to groundwater is a prime determinant of the composition and abundance of riparian vegetation. The types of vegetation most at risk from groundwater decreases are obligate phreatophytes such as cottonwoods and willows, which use relatively shallow groundwater (typically within 10 feet of the ground surface), while tamarisk can occur in dense stands where the water table is as deep as 30 feet below the surface. The affected areas are dominated by tamarisk with relatively little cottonwood and willow. Gradual decreases in the elevation of the water table of 0.1 to 1 foot over an extended period of time would likely have minimal effects on riparian vegetation. Impacts may include thinning or loss of riparian vegetation in areas of deeper water table, and possible increases of tamarisk at the expense of cottonwoods and willows.

One special status species, Parish's alkali grass, could potentially be affected by groundwater drawdown associated with operation of the well field, but it has not been recorded in the area of potential impact.

4.7.2.3.1.2 Infrastructure

4.7.2.3.1.2.1 <u>Well Field</u>

The 6,000 af/yr volume alternative would have 12 wells, and the 11,600 af/yr volume alternative would have 21 wells. Other facilities would include access roads, power lines, a water-storage tank, two electrical substations, and piping. All impacts would occur in the Plains and Great Basin grassland or Great Basin desertscrub vegetation communities. The estimated areas of impact are shown in Table 4-33.

Table 4-33 Estimated Acres of Potential Impact on Plains and Great Basin Grassland or Great Basin Desertscrub from C-Aquifer Pumping

	6,000 af/yr Well Field	11,600 af/yr Well Field
Permanent impacts		
Great Basin desertscrub	32.5	42.5
Plains and Great Basin grassland	30.5	40.5
Subtotal	*63*	*83*
Temporary impacts		
Great Basin desertscrub	51	71
Plains and Great Basin grassland	47	67
Subtotal	*98*	*138*
Totals	**161**	**221**

NOTE: af/yr = acre-feet per year

Impacts of vegetation removal would be minor to moderate for the short term, and minor for the long term, assuming that adequate revegetation is completed. Impacts on culturally important plants are expected to be minor. No impacts on riparian vegetation in the well field have been identified. Construction of the well field and associated facilities has the potential to introduce or spread noxious weeds, similar to construction of other project facilities. The Integrated Noxious Weed Management Plan would prescribe measures to prevent spread of noxious weeks. No threatened, endangered, or special status plant species would be affected by construction of the wells and related facilities, under either alternative.

4.7.2.3.1.2.2 <u>C Aquifer Water-Supply Pipeline</u>

C Aquifer Water-Supply Pipeline: Eastern Route

Upland Vegetation. Vegetation would be removed or disturbed during construction of the pipeline, power line and access road corridor, two pump stations, and 69kV transmission lines to the pump stations. The construction right-of-way for the pipeline would be 65 feet wide, all of it new disturbance but mostly located along existing roads. Woody vegetation would be cut to ground level across the entire right-of-way, and portions of the right-of-way would be graded. Most of the existing vegetation would be destroyed or damaged by construction, but plant root systems and soil seed banks would mostly remain intact or would likely be replaced through topsoil salvage. The only permanent aboveground facilities would be the pump stations, which would occupy about 1 acre.

The areas of impact from construction are presented below in Table 4-34 for the various vegetation types along the pipeline. Since the pipeline would be mostly in the road right-of-way, there would be few, if any, trees affected. In addition, much of the impact would occur along roads or in disturbed rights-of-way. The locations of the 69kV transmission line routes have not been determined, and information on affected vegetation communities is not available. The rights-of-way would be revegetated as part of reclamation activities, and specific information would be incorporated into the construction, operations, and maintenance plan once design and engineering for the pipeline have been completed.

Table 4-34 Estimated Acres of Vegetation Types Potentially Affected – Water-Supply Pipeline: Eastern Route

Vegetation Type	Area Affected (acres)
Piñon/juniper woodland	89
Plains/Great Basin grassland	59
Great Basin desertscrub	522
Unidentified (transmission line)	370
Total	**1,040**

Impacts from construction on native vegetation would be major, and long-term impacts generally would be minor except for possible major impacts where the alignment crosses large areas of Great Basin desertscrub that can be difficult to revegetate. Impacts on vegetation diversity would be negligible to minor in all areas, both in the short and long term, unless there was an invasion of noxious weeds or other invasive species. Most of the species currently present in undisturbed habitats can be expected to reoccupy the right-of-way, either through regrowth, revegetation seeding, or dispersal of seeds from adjacent areas along the relatively narrow right-of-way.

Based on the conceptual design, engineering, and construction of the pipeline (Appendix A-3), it is unlikely that the water-supply pipeline would fail. However, if a failure were to occur, the decreased pressure and flow rate in the pipeline would be detected, remotely operated block valves would close, and the flow of water would stop. Some erosion might occur at the point of the failure and flooding would occur in topographic lows and drainage channels. The area affected would be limited. Impacts on vegetation would be short term and negligible to none.

Culturally Important Species. Impacts on culturally important species are likely to be minor. The pipeline route crosses through typical habitats of the Colorado Plateau, and construction is unlikely to adversely affect uncommon or rare culturally important species. More common species would be affected, but reductions in population size and availability generally would be minor.

Riparian Vegetation. Narrow strips of riparian shrub, dominated by tamarisk, are present along the banks of the Little Colorado River and other drainages. Impacts on riparian vegetation would be avoided at the crossing of the Little Colorado River because the pipeline would be installed either by using directional drilling under the river or on an abandoned, historic road bridge. After construction, these affected areas are expected to recover relatively quickly because of resprouting or reseeding, and impacts would be negligible.

Noxious Weeds and Invasive Species. Construction of the well field and associated facilities has the potential to introduce or spread noxious weeds across a large area of the Hopi and Navajo Reservations. Impacts would be minor to moderate, considering that an Integrated Noxious Weed Management Plan would be developed and implemented during the construction and revegetation periods.

Threatened, Endangered, and Special Status Species. Two special status plant species—round dunebroom and Parish's alkali grass—have the potential to occur along the Eastern Route, based on known distributions and general habitats. If present within the construction area, the plants would be destroyed or damaged by construction activities including trenching, right-of-way clearing, and vehicle traffic. These species are listed in Group 4 of the Navajo Nation endangered species list, and the Navajo Nation would not require species-specific clearance surveys. If populations are identified, mitigation would include avoidance of individuals on the edges of the right-of-way, use of temporary fencing to protect plants adjacent to the construction area, transplanting, and/or salvage of soil seed banks. Impacts would be negligible to minor.

Little Colorado River Crossing and Kykotsmovi Area Subalternatives. Impacts on vegetation from construction at the crossing of the Little Colorado River mostly would be avoided, since either directional drilling or use of the historic bridge would avoid disturbing the active channel of the Little Colorado River and adjacent tamarisk riparian vegetation. Impacts on vegetation from construction of either of the subalternative routes in the Kykotsmovi area would be avoided because the pipeline would be buried under a road in either case, and no sensitive resources would be affected.

C Aquifer Water-Supply Pipeline: Western Route Impacts on vegetation would be the similar to those described for the Eastern Route, but the Western Route is about 30 miles longer and would impact a proportionally larger area of native vegetation, as shown in Table 4-35. It also would affect a larger area of piñon/juniper woodland. Tamarisk and other riparian vegetation would be affected at the crossings of Dinnebito Wash, Moenkopi Wash, Coal Mine Canyon, and Begashibito Wash. The locations of the 69kV transmission line routes have not been determined, and information on affected vegetation communities is not available. The only permanent aboveground facilities would be the pump stations, which would occupy about 2 acres.

Table 4-35 Acres of Vegetation Types Potentially Affected – Water-Supply Pipeline: Western Route

Vegetation Type	Area Affected (acres)
Piñon/juniper woodland	137
Plains/Great basin grassland	199
Great Basin desertscrub	553
Tamarisk	1
Unidentified (69kV transmission line)	655
Total	**1,545**

The same two special status plant species that could occur along the Eastern Route (Parish's alkali grass and round dunebroom) also could occur along the Western Route. Potential impacts on and mitigation for these species would be the same. The Western Route may affect Welsh's milkweed, a federally listed threatened species. A field evaluation of habitats has not been conducted.

4.7.2.3.2 N Aquifer Water-Supply System

Under the proposed action, the existing N-aquifer wells would be pumped periodically to maintain them, to provide water when the C aquifer water-supply system is down, and to furnish a public water supply after the end of mining. The groundwater modeling conducted by GeoTrans (2006) assessed the potential depletions in groundwater discharges to streams. Reductions in baseflow were simulated in nine streams that receive discharge from the N aquifer. The largest of these is Moenkopi Wash, which had an estimated 1955 (prepumping) N-aquifer discharge of about 4,300 af/yr. Laguna Creek, Jeddito Wash, and Begashibito Wash had 1955 N-aquifer discharges of 2,000 to 2,500 af/yr, and the other five drainages (Chinle Wash, Pasture Canyon, Dinnebito Wash, Oraibi Wash, and Polacca Wash) had N-aquifer discharges of around 400 to 500 af/yr. These numbers only represent baseflow, and most flow is intermittent and provided by surface runoff from snowmelt and storms. Simulated changes in baseflow due to Peabody's pumping through 2038 were 1.3 percent compared to 1955, with the largest simulated reduction occurring in Begashibito Wash (1.48 percent). A large but unquantified portion of the N-aquifer discharge supports tamarisk and smaller amounts of other riparian vegetation. Although tamarisk is considered an invasive species and generally provides poor-quality habitat compared to native riparian vegetation, this habitat is important for migrating birds and could be used by the migrating southwestern willow flycatcher (refer to Section 4.8, Fish and Wildlife).

Tamarisk and other riparian vegetation that uses water from groundwater discharge may be affected by this reduction, through reductions in area of the stands, reduced growth rates, thinning of stands, or changes in composition in favor of upland species. Effects would be negligible and not measurable because of the small amount of simulated reduction, dispersed effects, and because intermittent runoff flows provide much of the water used by riparian vegetation.

If use of the C-aquifer facilities is not approved, the Black Mesa Complex would pump water from the N aquifer at a rate of 6,000 af/yr during mine operations, with reduced pumping afterward for reclamation and public water supply. The simulated reductions in N-aquifer discharge to streams would be larger than for the proposed project. The largest reduction would be in Begashibito Wash in 2038, 1.7 percent (36.1 af/yr), and Moenkopi Wash would lose 0.89 percent of its flow (38.2 acre-feet), as compared to 1955. The combined simulated reduction in baseflow would be 106 af/yr, or about 0.74 percent of N-aquifer discharge to these streams. Tamarisk and other riparian vegetation may be affected by this reduction, but impacts would be minor.

Navajo sedge is a federally listed endangered plant species that occurs on the Hopi Reservation near where Moenkopi Wash, Begashibito Wash, and Ha Ho No Geh Canyon overlap the unconfined portion of the N aquifer and on the Navajo Reservation north of U.S. Highway 160 near Tsegi. The species is found in seepage areas on cliffs (hanging gardens) receiving discharge from the N aquifer. Based on the groundwater modeling, the Hopi Reservation sedge population has not been affected to date by Peabody's pumping from the N aquifer. The Hopi Reservation sedge population is located in the unconfined portion of the aquifer beyond the boundary between the confined and unconfined area and the model predicts no drawdown would occur at this location as a result of Peabody's pumping. Considering the minimal change in spring flows associated with N-aquifer pumping, it is unlikely that the Hopi Reservation sedge population would be affected in the future. The Navajo Reservation sedge population occurs approximately 6 miles north-northwest of the northern end of Peabody's N-aquifer well field on the Black Mesa Complex. Peabody's well-field pumping should have no measurable impact on the water source that supplies this population. Even though the Navajo Reservation sedge population is geographically much closer to Peabody's well field than the Hopi Reservation sedge population, the Navajo Reservation sedge population is hydrologically even more isolated from the impacts of Peabody's well-field pumping. The N-aquifer well at Tsegi (8T-522) indicated a drop of only 2.9 feet from the baseline period through 2005 (Truini and Macy 2006), and GeoTrans (2005) predicted drawdown in the N aquifer at Tsegi to be approximately 1 foot assuming a pumping rate of 6,000 af/yr over the period between 2005 and 2025, and approximately 0.4 foot assuming an average 1,236 af/yr.

4.7.3 Alternative B – Approval of the LOM Revision (Preferred Alternative)

4.7.3.1 Black Mesa Complex

Impacts generally would be the same as those described for Alternative A for the Black Mesa Complex, except that the 2008 through 2026 mining disturbance area would be 6,942 acres. The acres of impact on the various vegetation types may differ depending on whether the Kayenta mining operation uses some of the areas currently included in the Black Mesa mining operation. However, the relative proportion of the vegetation types would be similar to Alternative A, approximately 65 percent piñon/juniper, 30 percent sagebrush, and a few percent of other vegetation types.

The mining operations would use an average 1,236 af/yr of N-aquifer water through 2026, 505 af/yr for mine reclamation and domestic use from 2026 through 2028, and 444 af/yr from 2029 through 2038. Based on this scenario, the groundwater discharge to seven streams in 2038 would be reduced by an average of 0.6 percent (a total of approximately 79 acre-feet) compared to simulated premining (1955) discharges. The maximum would be a decrease of 1.39 percent in Begashibito Wash (about 30 acre-feet), and the decrease in discharge to Moenkopi Wash would be 0.56 percent, or 23 acre-feet. These small decreases in discharge would have negligible effects on riparian vegetation, similar to those described for Alternative A.

4.7.4 Alternative C – Disapproval of the LOM Revision (No Action)

Impacts would be similar to those described for Alternative A for the Black Mesa Complex, and the Black Mesa mining operation would cease, thus, no additional vegetation in the Black Mesa mining operation area would be disturbed. The 2008 through 2026 mining disturbance area would be 6,942 acres, and would consist of approximately 65 percent piñon/juniper, 30 percent sagebrush, and a percentage of other vegetation types. The mining operations would use 1,236 af/yr of N-aquifer water through 2026, the same as under Alternative B, and impacts on riparian vegetation from drawdown of the N aquifer would be the same.

4.8 FISH AND WILDLIFE

The study area for terrestrial wildlife includes the mine permit areas and construction rights-of-way/footprints for the other facilities, plus an 0.5 mile buffer (1 mile for some threatened or endangered species). This study area provides the basis for analysis of both direct and indirect impacts on wildlife resulting from direct mortality, habitat loss, and disturbance and displacement during construction.

The region of influence for fisheries and for riparian and aquatic habitats is larger in order to provide a basis for addressing indirect effects relating to construction, and the effects of operation of the C-aquifer well field. It includes areas directly affected by construction and mining, streams affected by changes in hydrology, and the area of potential groundwater drawdown from project-related pumping of the C and N aquifers.

4.8.1 Types of Common Impacts

A short-term loss of all habitat types would result from clearing of vegetation during mining, pipeline construction, and construction of other facilities. Impacts would be partially mitigated by reconstructed topsoil and revegetation. A detailed revegetation plan has been developed for the Black Mesa Complex (Peabody 2004), where revegetation of mining operations areas has been ongoing since the 1960s. Revegetation plans have not been developed for other project facilities. There would be a long-term loss of woodland habitat. Woodlands would be replaced mostly by grassland in mining areas, and pipeline rights-of-way typically are managed to prevent reestablishment of trees. Even where they are planted or allowed to grow, establishment of trees may be difficult or episodic (during years of favorable conditions), and mature trees would take 50 or more years to replace. Species that occur primarily in woodlands would incur long-term reductions in habitat-carrying capacity and populations. Species that use trees for thermal or hiding cover, or for nest sites or hunting, also may experience long-term effects. There would be displacement of wildlife and interference with movement patterns during periods of active mining and construction. The open pipeline trench could have effects on wildlife movement during pipeline construction. Injury or death of smaller and less mobile animals such as small rodents, reptiles, and amphibians could result from crushing on the ground or in burrows, burial in spoil areas, or from being trapped in the open trench and buried. Most of the small animals within the mined areas would likely be displaced, injured, or killed. There could be disruption of breeding or loss of nests or young where construction occurs during the nesting season of raptors and migratory birds. Impacts are avoidable by restricting clearing of vegetation to the nonbreeding season, or by conducting nest surveys and protection of individual nests during the breeding period. Most native bird species are protected under the Migratory Bird Treaty Act, which prohibits direct take and destruction of occupied nests. Clearing of vegetation during the breeding season could result in loss of eggs or young in active nests, and would be a violation of the Act; therefore, clearing would not be authorized in such areas. Of the habitats in the project area, piñon/juniper woodlands have the highest diversity of breeding migratory birds. There could be degradation of wildlife habitat by invasion of noxious weeds or other invasive species.

4.8.2 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.8.2.1 Black Mesa Complex

4.8.2.1.1 Terrestrial Habitats and Wildlife

Mining operations, from January 1, 2006, to 2026, would result in the disturbance of approximately 12,409 acres of native and revegetated habitat, including 8,564 acres of piñon/juniper woodland, about 4,295 acres of sagebrush and other shrublands, and 650 acres of revegetated grassland. Through 2026, the Black Mesa mining operation would disturb approximately 5,681 acres of native or revegetated habitat, including 2,141 acres of piñon/juniper woodland, 3,450 acres of sagebrush and other shrubland, 3 acres of tamarisk, and 87 acres of revegetated grassland. Disturbed areas would be revegetated. Revegetation design features of particular relevance to wildlife and their habitats are described in the revegetation program prepared for the project (Peabody 2004a).

Short-term losses of habitat would be major, because more than 10,000 acres of native vegetation would be affected, although some of these areas are currently degraded and show signs of overgrazing. With application of the revegetation program, long-term impacts would be reduced but would be variable for different groups of species. The most important change in habitat would be conversion of about 8,000 acres of piñon/juniper woodland habitat from woodland to mostly grassland. The revegetation program would replace some woodland and shrubland habitat, but there would be a large overall loss of woodlands. However, annual revegetation monitoring shows that herbaceous productivity is much greater in revegetated areas than in natural habitats at Black Mesa, and forage is more abundant for species able to use it.

The "key habitat areas" are shrubland and woodland revegetation areas (refer to Appendix F) designed to help mule deer and other species by providing thermal and hiding cover and shrub browse. The intent is to maximize the interspersion of various habitat components, including forage, protective cover, and thermal cover. Deer are known to use the revegetation areas for feeding, and usability would be improved by providing for escape and hiding cover. The piñon/juniper plantings, shrub plantings, and rock piles are intended to allow for travel across the reclaimed surfaces, to provide structural diversity for songbirds and small mammals, to allow further development of wildlife habitat through natural succession, and to increase the usefulness of the rangeland revegetation areas for wildlife.

The usefulness of the woodland and shrub plantings initially would be low, but would increase as the trees and shrubs matured. However, substantial cover may take up to 50 years to achieve in woodland plantings and 10 or more years in shrub plantings. Once fully established, the plantings in the key habitat areas would increase the available edge habitat greatly and would help to break up the revegetation grasslands, making them more accessible to species able to use the edge habitat. The wildlife plantings as well as the plantings of culturally important plant species would encourage dispersal of these species and encourage natural succession.

Species adapted to open woodlands, edges, or grasslands would benefit from the proposed revegetation, including species such as elk, black-tailed jackrabbit, Gunnison's prairie dog, Navajo Mountain Mexican vole, silky pocket mouse, western harvest mouse (*Reinthrodontumys megalotis*), Ord's kangaroo rat, horned lark (*Ememophila alpestris*), meadowlark (*Sturnella neglecta*), and ash-throated flycatcher (*Myiarchus cinerascens*). Species that are generally restricted to thicker woodlands would have long-term losses of habitat and populations. These include species such as Colorado chipmunk, brush mouse, piñon mouse, Stephen's woodrat, porcupine (*Erethizon dorsatum*), piñon jay (*Gymnorhinus cyanocephalus*), gray flycatcher (*Empidonax wrightii*), juniper titmouse (*Baeolophus ridgwayi*), mountain chickadee (*Poecile gambeli*), and black-throated gray warbler (*Dendroica nigrescens*).

Mining and revegetation also would eliminate rock outcrops, bluffs, and talus, and would reduce topographic diversity. The revegetated areas would be more uniform in substrate, topography, and drainage patterns. Losses of rocks and rough terrain would affect species such as the bobcat (*Felis rufus*), western spotted skunk (*Spilogale gracilis*), and rock squirrel (*Spermophilus variegatus*), which use these areas for foraging and denning. It also may remove nest sites for species such as red-tailed hawk, great-horned owl, and raven. Peabody's proposed plan to create rock piles every 100 acres would help to mitigate loss of this habitat. Short-term impacts on wildlife would be major, because of the large area of habitat and the number of individuals that could be affected directly or indirectly. Long-term impacts would be reduced by the reclamation and revegetation program, and would be minor to moderate for some species, and beneficial for others. There would be a long-term loss of woodland habitat and species, but substantial blocks of undisturbed habitat would remain both within the Black Mesa Complex and in immediately adjacent areas. No species would be eliminated from the area. Piñon/juniper woodland is common on Black Mesa, and the area affected by mining would be a small part of the total area. The presence of permanent ponds would contribute to diversity of habitats and wildlife species.

4.8.2.1.2 Raptors

Raptors would be affected both by mining activities and by long-term conversion of piñon/juniper woodland to grassland and shrubland habitat. Mining would displace raptor foraging and result in short-term moderate loss of foraging habitat. Direct impacts on active nesting activity would be minor because Peabody conducts annual ahead-of-mining surveys of raptor nests. When active nests are found, Peabody is required to consult with OSM, FWS, BIA, and Navajo Nation to develop measures that would prevent effects on the active nest. Nests are removed when the season's breeding activity ends, resulting in either use of alternate nests site in future years, or long-term loss of the breeding territory. For the 1990 EIS (OSM 1990), Peabody estimated that loss of about 9,000 acres of piñon/juniper woodland and several thousand acres of other habitats may result in an estimated displacement of four to six Cooper's hawk nests, one northern goshawk nest (indirectly affected by noise and disturbance), four to six red-tailed hawk nests, and three great horned owl nests. A roughly similar level of impact may occur from this project.

Long-term loss of piñon/juniper woodland habitat would affect woodland foraging species such as Cooper's hawk, while favoring birds that use open country or that are adaptable, such as the red-tailed hawk and great horned owl. The increased herbaceous production in revegetation is likely to increase prey populations for raptors that forage in open areas, especially during initial periods of establishment when the revegetation areas are excluded from grazing, an average of about five years. Raptor perches would be reduced through reductions in the number of trees, but would be mitigated by installation of raptor hunting and resting perches throughout the reclaimed areas, at a minimum density of one per 400 acres. These perches are constructed of 1.5-inch-diameter steel pipe, with a welded steel crossbar, and are 10 feet high. These perches would not provide concealment or shelter from weather. Potential raptor nest sites would be reduced by destruction of mature trees, and replacement could take 50 or more years and would be limited to the small woodland planting sites.

Overall impacts on raptors would be minor for species that forage in open areas because of the mitigations protecting active nests, mitigation installing hunting and resting perches, the suitability of the revegetation areas for foraging, and the availability of alternate nesting habitat in proximity to mined areas. Impacts on Cooper’s hawk and other species using dense woodlands would be moderate and long term.

4.8.2.1.3 Riparian Habitats and Species

Tamarisk occurs along intermittent reaches of the major washes, with the most extensive area along Moenkopi Wash. This habitat type is used by numerous migrating bird species in spring and fall (Yong and Finch 2002, Carpenter 1998). One of the concerns identified during scoping was effects on downstream riparian habitats and wildlife. There may be localized areas in Moenkopi Wash near the permit area boundary that show reductions in tamarisk habitat due to interception of runoff on the mining areas, but monitoring of alluvial groundwater on the Black Mesa Complex has shown negligible effects from impoundments. Impacts on riparian vegetation from pumping of the N aquifer are addressed below under Section 4.8.2.3.

4.8.2.1.4 Aquatic Habitats and Species

A total of 267 impoundments would be constructed and used during mining, and more than 51 ponds would be left in place after mine closure. Planting of riparian vegetation would occur at some of them. These ponds would continue to provide habitat for amphibians, waterfowl, and shorebirds, and impacts of the project are considered to be beneficial.

4.8.2.1.5 Threatened, Endangered, and Special Status Species

Mining operation would have minor to no effect on any listed endangered or threatened species. Species that occur in or near the Black Mesa Complex are as follows:

- Mexican spotted owls are known to occur on Black Mesa and have been studied and monitored for a number of years. The nearest nesting area occurs about 2.2 miles from existing mine areas, the nearest activity area occurs 0.7 mile from the N-10 mine area; there are no records of nesting within the permit boundary. The owls occur in mixed conifer forest, typically nesting in sandstone cavities in the steep, shaded canyons. This habitat is distinctly different than the piñon/juniper woodlands present in the mine permit area. However, a protected activity center overlaps the permit area, and two other protected activity centers are close enough possibly to be affected indirectly by the mining operation. The closest records of Mexican spotted owls are in Yellow Water Canyon and in side canyons of Coal Mine Wash and Moenkopi Wash. The N-10 coal-resource area is about 1 mile from mixed conifer forest. Monitoring would take place to determine if owls occur at the N-10 area and within 2 miles, starting two years before mining begins. Minor impacts could occur.
- Bald eagles have been observed occasionally in major washes and near ponds. The mine provides potential foraging opportunities for migrating eagles, including carrion, terrestrial mammals such

as prairie dogs, and fish in some ponds. Mining operations would not disturb or affect use of the area by migrating bald eagles, and creation of permanent ponds may provide opportunities for migrating eagles. Impacts would be negligible to minor.

- Migrating willow flycatchers, of which some could be the southwestern subspecies, may use dense stands of tamarisk in the Black Mesa area during migration. Suitable stopover habitat is present in a wash adjacent to areas J-02 and J-15, and portions of Yellow Water Wash bordering N-9. Mining activities would remove an estimated 3 acres of tamarisk. This is considered a minor impact because breeding would not be affected and there are relatively large areas of tamarisk habitat downstream from the mining areas. Planting of willows around some ponds would provide additional habitat for use during migration. Minor impacts could occur.
- Mountain plovers have suitable breeding habitat (large prairie dog colonies with low vegetation cover) in Coal Areas J-05, J-06, J-08, and J-14, but there is no record of occurrence of this species. Mining and revegetation are therefore expected to have no impacts on mountain plover.
- Kit foxes have the potential to occur in greasewood, sagebrush, and saltbush habitat within some of the southern coal areas, but the species has not been documented at Black Mesa; therefore, no impacts are expected.
- Northern goshawks are unlikely to be affected due to the lack of suitable habitat within the permit area. Historical monitoring shows that they are rarely present in the permit area.

A number of other special status species are known to occur, and impacts on those species would be negligible or minor.

- Several special status raptor species are known to occur or may occur at the Black Mesa Complex, including the golden eagle, ferruginous hawk, northern goshawk, and peregrine falcon. Peabody conducts annual raptor-monitoring surveys and is required to conduct raptor surveys prior to mining any area; if nests are found, Peabody would consult with the FWS, OSM, BIA, Hopi Tribe, and Navajo Nation to avoid or minimize impacts. With this mitigation, impacts on nesting would be negligible. Changes in habitat from mining and revegetation could increase the availability of prey in these areas and at ponds which may provide opportunities for the golden eagle, ferruginous hawk, and peregrine falcon, while loss of piñon/juniper habitat may adversely affect the northern goshawk. Impacts would be minor.
- The pale Townsend’s big-eared bat is on the Navajo Nation endangered species list. This species uses a wide range of habitats, and it is not clear whether conversion of piñon/juniper woodland would have adverse effects. Mining of cliffs and other rock formations that contain crevices or caves would remove actual or potential day and night roosting habitat. Similar and more suitable habitat occurs on northern Black Mesa outside the permit area, and impacts are expected to be minor.
- Navajo Mountain Mexican voles are known to occur at both the Kayenta and Black Mesa mining operations, in continuous stands of sagebrush, near permanent impoundments on mine reclamation areas, and along drainage bottoms (BIOME 2003). This species is on the Navajo Nation endangered species list and is listed as a wildlife species of special concern by the State of Arizona. During 1999, live trapping was conducted in closed basins within mine reclamation areas and on reclaimed grassland. A total of 28 Mexican voles were found in closed, reclaimed basins, and none were found in revegetated grassland. Mexican voles represented 28 percent of the small rodents captured. Suitable habitat occupies about 70 acres and is present in the N-10, N-99 North, and J-02/J-15 coal areas. The species appears to be attracted to mesic areas near water impoundments that have taller and denser vegetation cover. Mining of suitable habitat would result in short-term loss of habitat and mortality of voles, but other areas of suitable habitat

along drainages would not be affected. The reclaimed mine surface would provide suitable habitat in the long term. The overall impacts would be minor in the short and long terms.

- Impacts are expected to be negligible or minor for species that may occur but whose presence has not been documented. They include western burrowing owl, spotted bat, and milk snake.

The coal-washing facility would occupy a small site in proximity to the coal-slurry preparation plant. Impacts from construction and operation would be minor or negligible.

The coal-slurry preparation plant already exists, and no additional ground-disturbing activities would take place.

The types of impacts from construction and operation of the coal-haul road would be similar to those described above for the mining operations areas. Construction of the road would remove about 127 acres of piñon/juniper habitat. Larger wildlife would be displaced during construction, and smaller or less mobile animals could be injured or killed. The loss of wildlife habitat would continue for the life of the facility. In addition, the road could be a barrier to wildlife movement because of its width and berms, particularly for less mobile animals. Impacts from construction and operation would last the life of the road and would be moderate. The coal-haul road would be reclaimed using the methods described above for the mining operations areas. Impacts on endangered and special status species generally would be the same as described above for the mining operations areas.

4.8.2.2 Coal-Slurry Pipeline

4.8.2.2.1 Coal-Slurry Pipeline: Existing Route

4.8.2.2.1.1 Terrestrial Habitats and Wildlife

Reconstruction of the coal-slurry pipeline would affect more than 2,100 acres of wildlife habitat. Because construction would occur mostly within the previously disturbed right-of-way, only about 190 acres of piñon/juniper woodland would be removed, and the remainder would be grassland or shrubland habitats, much of it developed on previously disturbed right-of-way. Short-term impacts on wildlife habitat would be major, and long-term impacts would be moderate. Where the right-of-way crosses through piñon/juniper woodland, the strip of nonwoodland vegetation would be widened from 50 feet to 65 feet. Construction is not likely to affect cliffs or rock outcrops on the existing route since many were already altered or removed during construction of the original pipeline. Since the right-of-way is already present, the increased width may increase habitat fragmentation slightly. In addition, widening of the right-of-way for construction would have negligible effects on increasing cowbird access to dense piñon/juniper woodlands, since the right-of-way already is present.

The open pipeline trench may trap small animals and may cause injury to larger animals attempting to cross it. Animals are most at risk of being trapped or injured at night, and especially during the summer and wet weather.

Restoration of habitat would be difficult and may be unsuccessful in the more arid portions of the pipeline route, including the Great Basin desertscrub near the Little Colorado River, and the lower elevation areas of Mohave desertscrub. Unsuccessful reclamation would result in long-term loss of habitat.

4.8.2.2.1.2 Game Animals and Wild Burros

The coal-slurry pipeline would cross habitats used by pronghorn antelope, mule deer, elk, javelina, mountain lion, and bighorn sheep. No specific sensitive areas have been identified for these species, with the exception of the bighorn sheep. The others would be displaced from the construction area during periods of human activity, and would have short- or long-term losses of foraging habitat during the revegetation period. Impacts would be moderate short-term and negligible long-term.

Bighorn sheep habitat in the Black Mountains that is crossed by the pipeline includes about 3 miles of areas rated as high quality habitat and 3 miles of medium-value habitat (BLM 1993). The herd south of U.S. Highway 68 represents the largest surviving population in the Black Mountains after recent population declines in the area (Pebworth personal communication 2007). The alignment would not affect watering sources used by bighorn sheep. The Black Mountains are a movement corridor, and construction of the pipeline across the mountains would disrupt movements during construction. Bighorn sheep are highly sensitive to human disturbance. AGFD recommends avoidance of construction during the lambing season (February 1 to May 31) and during the hunting season (December) (Pebworth personal communication 2007). The applicant would coordinate with AGFD and the land-managing agency to comply with this recommendation to the extent practicable and identify appropriate site-specific mitigation. Impacts from displacement and disruption of movement could be moderate to major, depending on the time of year and the length of the construction period.

The entire area from Kingman west to Bullhead City is part of the Black Mountain burro herd management unit. Any wild burros that occur in the area at the time of construction would disperse and be displaced temporarily, due to human activity, from the construction area and would have short- or long-term losses of foraging habitat during revegetation. Impacts would be minor.

4.8.2.2.1.3 Raptors

Nesting raptors could be affected by construction, when construction occurred near active nests. Impacts would be avoided by use of preconstruction nest surveys and avoidance of construction near nests during their active period, similar to methods currently used by Peabody at Black Mesa. Loss of nesting and foraging habitat would be minor because of the narrow area of impact and the large amount of available and relatively undisturbed habitat adjacent to the right-of-way.

4.8.2.2.1.4 Aquatic Habitats and Wildlife

The only perennial aquatic habitat crossed by the pipeline is at the Colorado River. The crossing would be bored under the river, and impacts on the river or its banks are not anticipated. The crossing method for the Little Colorado River would be a horizontal bore under the river. This is a major intermittent stream. One of the potential risks associated with horizontal boring is the escape of drilling mud into the environment as a result of release, tunnel collapse, or rupture (from excessive drilling pressure) of mud to the surface. If the rupture occurs in the watercourse, the fine clay particles can settle on the bottom of the watercourse, covering benthic invertebrates, aquatic plants, and fish and their eggs; however, specific impacts on species cannot be predicted. Ruptures may be difficult to detect when they occur underwater, but the potential for a rupture would be minimized through proper geotechnical practices, adequate drill planning and execution, careful monitoring, and use of appropriate equipment and response plans in the unlikely event that one occurs. During operation, it is unlikely that the pipeline would fail and release slurry into the watercourse. Based on historical performance of the existing pipeline, no failures and consequent leaks in or near the river occurred during the 35 years of operation. Considering this and the proposed reinforced conceptual design of the pipeline, failures are not anticipated. In the unlikely event of a release, the extent of the impact is uncertain, as such a determination would depend on the amount of slurry released and the aquatic ecology at the location and time of the release. Generally, the nontoxic coal fines released would be suspended in the water, carried by the current, and dispersed over the bottom of the watercourse. Some fish and benthic organisms may be impacted adversely by the coal fines being released into the river, but the effects would be very temporary and minor to negligible.

4.8.2.2.1.5 Threatened, Endangered, and Special Status Species

Federally listed threatened or endangered species known or likely to occur in or near the project area include bald eagle, California condor, southwestern willow flycatcher, desert tortoise (Mohave population), bonytail chub, and razorback sucker. Impacts on each species are described below and would be negligible or minor:

- Construction and operation is unlikely to affect bald eagle and California condor. These species may occur sporadically in the project area, but key habitat features are not present.
- Construction may result in disturbance or removal of an estimated 3.2 acres of tamarisk along portions of Moenkopi Wash, Begashibito Wash, and the Little Colorado River. While tamarisk in these areas would not likely be suitable for nesting, it could provide foraging and resting habitat for migrating flycatchers. Migrating willow flycatchers have been observed at both Moenkopi Wash and the Little Colorado River, but the subspecies is not known (whether the listed southwestern willow flycatcher or other unlisted subspecies). Surveys, in which only one migrant willow flycatcher was detected during the initial survey effort, were conducted along the Little Colorado River approximately 0.5 mile upstream to 0.5 mile downstream of the proposed coal-slurry pipeline alignment during the 2005 breeding season. No nesting was observed in 2005, and there are no records of southwestern willow flycatcher nesting. Removal of tamarisk is therefore not likely to affect southwestern willow flycatchers, though there would be a temporary reduction of approximately 3.2 acres of available migratory stopover and foraging habitat.
- Construction and operation of the coal-slurry pipeline would have no effect on the Mohave desert tortoise in Nevada because the pipeline would be installed by horizontally boring under the Colorado River into the fenced yard of the Mohave Generating Station.
- Bonytail chub and razorback sucker both occur in the Colorado River at the proposed crossing. It is unlikely that construction and operation would affect these species. The new pipeline would be installed by boring under the river. The potential for a rupture of drilling mud would be minimized through proper geotechnical practices, adequate drill planning and execution, careful monitoring, and use of appropriate equipment and response plans in the unlikely event that one occurs. During operation, considering the historical performance of the existing coal-slurry pipeline and the proposed reinforced conceptual design of the pipeline, failures are not anticipated. In the unlikely event of a release, as described previously, fish may be impacted adversely by the coal fines being released into the river, but the effects would be very temporary and minor to negligible.
- Adverse effects from a potential rupture are likely to be negligible due to the implementation of an emergency rupture response plan and contingency crossing plan that outlines the protocol to monitor the construction, to stop work in the event of a rupture or spill, and to contain and clean up drilling fluids and other deleterious substances. A large number of other special status species also are known to occur along the route. Impacts on these species would be minor.
- There is suitable habitat for nesting by special status raptor species including ferruginous hawks, golden eagle, and western burrowing owl. Construction could cause disruption of breeding activities and nest abandonment or loss of eggs or young if present. To comply with the Migratory Bird Treaty Act and Bald Eagle Protection Act, construction would be avoided during the breeding season in the vicinity of active nests. Locations of active nests would be identified based on preconstruction aerial and/or ground surveys. The project would have negligible effects on wintering, migrating, or foraging special status raptors such as peregrine falcon.
- Several bat species are known or likely to occur along the pipeline route. The project would not involve destruction or modification of caves, mines, buildings, or cliff habitat where nocturnal or

wintering roosts may be located. Construction could displace some bats from day roosts in piñon or juniper trees, and clearing of vegetation from the right-of-way would have a minor effect on availability of foraging habitat.

- Pronghorn antelope and kit fox are listed on the Navajo Nation endangered species list. Construction of the pipeline would have a negligible to minor effects on these species. Impacts could include temporary displacement from the construction area, and loss of pronghorn forage and kit fox prey from the right-of-way during construction and revegetation.
- The Wupatki Arizona pocket mouse is on the Navajo Nation endangered species list (Group 4). Impacts would be similar to those for other small mammals, and might include death from construction equipment, crushing, and loss of habitat. Impacts on populations are expected to be minor in the short term and negligible in the long term.
- Gila monster and milk snake are likely to occur along portions of the route. As with other small animals, they may be killed by construction equipment or crushing in their burrows and by being trapped in the trench. The right-of-way have reduce habitat suitability until revegetation is accomplished. Mitigation to reduce impacts would include preconstruction clearance surveys (within 48 hours of clearing habitat), fencing of the construction area to exclude Gila monster, and/or checking of the trench and other excavations prior to filling. Impacts would be minor.
- The Sonoran population of the desert tortoise is known to occur around Kingman and westward through the Black Mountains to the Colorado River. Impacts and mitigation would be similar to those on the Mohave population of the desert tortoise.
- The northern leopard frog is not likely to be affected by construction of the pipeline because there is little or no suitable habitat. Although documented at the Little Colorado River, the river is normally dry, and the species is not likely to be encountered.
- The flannelmouth sucker is present at the proposed crossing of the Colorado River, but is not likely to be impacted because the crossing would be directionally drilled under the river. Adverse effects from a potential rupture are likely to be negligible due to implementation of an emergency rupture response plan and contingency crossing plan that would outline the protocol to monitor the construction, to stop work in the event of a rupture or spill, and to contain and clean up drilling fluids and other deleterious substances.
- Maricopa tiger beetle and Navajo Jerusalem cricket may occur along the route. Like other small animals, they could be killed by construction equipment or crushing in their burrows and by being trapped in the trench. The right-of-way may have reduced habitat suitability until revegetation is accomplished. Impacts on populations are expected to be minor because of the small size of the construction area relative to available habitat.

4.8.2.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

Impacts would be the same as described for the existing route, except for differences in the amount of affected habitat (refer to Section 4.7). The existing route with realignments would affect about 50 acres more piñon/juniper woodland and desert grassland, about 45 acres less grassland in the existing right-of-way, and 50 acres less urban/industrial land. The existing route with realignments also would affect about 300 acres more previously undisturbed habitats than the existing alignment.

Impacts on threatened, endangered, and special status species generally would be the same. The amount of impact on tamarisk (potential southwestern willow flycatcher migration/stopover habitat) in Moenkopi Wash is not known, but would probably be similar to the existing route. There are several more miles of habitat of the Sonoran population desert tortoise and banded Gila monster where preconstruction clearance surveys would be needed to identify habitat and means to prevent death or injury during construction.

4.8.2.3 Water Supply

4.8.2.3.1 C Aquifer Water-Supply System

4.8.2.3.1.1 Water Withdrawal

Under the 6,000-af/yr pumping alternative, the area of groundwater drawdown of 0.1 foot or more would include the Little Colorado River from near Winslow downstream to below Leupp (Appendix H). The 11,600-af/yr pumping alternative would involve a higher rate of pumping for a longer time. The area of groundwater withdrawal would be much larger and would extend from near Holbrook to Cameron along the Little Colorado River, and would include lower Clear Creek and lower Chevelon Creek (refer to Maps 4-1 and 4-2).

Effects on wildlife and special status species from the 6,000-af/yr pumping alternative would be similar to those described below for the 11,600-af/yr pumping. However, the magnitude of effects would be slightly less under the 6,000-af/yr alternative.

Several mathematical models were developed to assess the extent and magnitude of groundwater drawdown associated with the Black Mesa Project. The results provided below are summarized primarily from the SSPA study (SSPA 2005). The USGS and SSPA models used the same project well-field pumping sets. While there are similarities in methods and results between the USGS and SSPA models, there are some significant differences:

- The USGS model is a superposition model. It simulates only groundwater-level declines, not actual water levels or streamflows. Aquifer recharge and discharges are not directly considered.
- The USGS model does not simulate historical and future regional pumping, and thus does not take into account impacts caused by that pumping.
- The USGS model is not calibrated to water levels, stream baseflows, or spring discharges. As a result, its usefulness in predicting future water-level changes or streamflow depletions has not been as well established.

In the vicinity of the proposed well field, and between the well field and Clear and Chevelon Creeks, SSPA and the USGS used similar values for the parameters of transmissivity and storage coefficient. These two parameters are key controls on the rate of groundwater movement and the observed drawdown in response to groundwater pumping. Another important parameter is streambed conductance, which determines how much groundwater flows into or out of a stream, depending upon groundwater levels. (Physically, this parameter simulates processes that extend beyond the streambed itself, but the term “streambed conductance” is used for consistency with common usage.) The values of streambed conductance applied in the SSPA and USGS models differ by several orders of magnitude. Because a key goal of the C-aquifer model is to evaluate impacts on Clear and Chevelon Creeks, using appropriate streambed conductance values is essential to developing useful predictions of future stream depletion; therefore, the SSPA model was selected. More information about the groundwater models is provided in Sections 3.4 and 4.4.

According to the SSPA model, the area of simulated maximum withdrawal in 2060, with groundwater declines of 5 to 40 feet, would occur over a 293-square-mile area extending southward from the proposed well field near Canyon Diablo to about 8 miles south of I-40 near Chilson. The groundwater drawdown in this area would have no effects on riparian habitat, because C-aquifer water levels are generally greater than 200 feet below the land surface, and there is no direct hydrologic connection between the C aquifer and riparian vegetation on the land surface. Simulated groundwater drawdown of 0.1 to 1.0 feet by 2060 would occur over a larger area, including three perennial stream reaches that receive discharge from the C aquifer—lower Clear Creek, lower Chevelon Creek, and the Little Colorado River from Woodruff downstream to Holbrook. Lower Chevelon Creek is designated as critical habitat for the Little Colorado spinedace, a federally threatened species, and lower Clear Creek also may have this species although it has not been observed since 1960. It may be present because it is known to occur higher in the watershed, has suitable habitat in lower Clear Creek, recent sampling was not intensive enough to be conclusive, the species exhibits wide fluctuations in populations, and lower Clear Creek is within the historic range of this species. However, the presence of large numbers of nonnative fish may preclude persistence of spinedace. There are no records of detections of Little Colorado spinedace from the Little Colorado River in the area between Woodruff and Holbrook that would be affected by project-related pumping. Several other special status species also occur, including bluehead sucker and Little Colorado sucker in all three streams, and roundtail chub in Clear Creek and Chevelon Creek.

Only a portion of the total flow in the perennial stream reaches in lower Clear and Chevelon Creeks is from groundwater discharge. Most of the flow is from snowmelt and precipitation, which are seasonal. The month of June historically has the lowest streamflow, and during this summer dry period essentially all of the flow in perennial sections of these creeks is from groundwater discharge, which is referred to as the streams' baseflow. Without baseflow, the seasonal nature of precipitation and runoff would result in these streams being intermittent, with fish confined to permanent or semipermanent pools during the dry season. Pumping under this alternative would affect approximately 12 miles of habitat within lower Chevelon Creek, 8 miles of which is designated critical habitat for the Little Colorado spinedace as well as 10 miles of lower Clear Creek. Proposed conservation measures (Section 4.18) would benefit and improve habitat within 38 to 48 miles of streams, including 31 miles of designated critical habitat for the Little Colorado spinedace. Stream miles affected was used as a surrogate for direct effects on spinedace and other special status fish, as current distributions and numbers of fish are difficult to determine and populations have a tendency to appear and disappear from sampling sites from one year to the next and may disappear for several years (FWS 2001).

Based on results from the SSPA model (SSPA 2005), baseflow discharge would be reduced by 0.06 cfs in lower Clear Creek and 0.04 cfs in lower Chevelon Creek by 2060, from pumping of the C aquifer in the Canyon Diablo well field under the 11,600 af/yr alternative. Reductions in groundwater discharge would begin about 2020, and would increase to 0.1 cfs by the end of the simulation period in 2060. For lower Clear Creek, the modeled streamflow depletion of 0.06 cfs in 2060 represents about 1.5 percent of the estimated June baseflow of 4.2 cfs, and the upper bound depletion of 0.25 cfs represents about 6 percent of baseflow. The modeled streamflow depletion of 0.04 cfs for lower Chevelon Creek in 2060 represents about 1.3 percent of the estimated 3 cfs baseflow in lower Chevelon Creek. Baseflow depletions in the Little Colorado River near Holbrook have not been simulated, and would be lower than in Clear and Chevelon Creeks because it is farther away from the pumping area.

While baseflow depletion of the Little Colorado River in the Chevelon to Clear Creek segment was not in the focus of the numerical models, it is now understood that there are data to indicate there is a baseflow component in this reach of the river that could be impacted by withdrawals, and future studies or evaluations will take this into account. Groundwater discharge from the C aquifer to the Little Colorado River from Woodruff already is heavily impacted by non-project-related pumping to support industrial, municipal, and irrigation uses. The perennial reach of the Little Colorado River from the mouth of the Puerco River to Joseph City has been intermittent to ephemeral for years. A number of C-aquifer flowing wells in the Holbrook to Joseph City area no longer flow at land surface. Two wetlands, Obed Meadows and McDonald Springs, have completely dried up. In light of these continuing impacts from non-project-related pumping, it seems unlikely that the project pumping would have a detectable impact in these areas. However, there are still springs and perennial areas on or adjacent to the Little Colorado River that may be impacted; these include the reach from the confluence with Chevelon Creek to the confluence with Clear Creek, as well as Hugo Meadows.

Although these are only a minor portion of the current mean baseflows for the month of June, there may be reductions in the availability of stream habitat during the dry season. The percentage reduction in flow during other times of the year would be much smaller and would be unlikely to affect availability of habitat measurably. Effects from the project combined with other ongoing and expected pumping are addressed in Section 4.24.

These changes, while small, may affect availability of suitable stream habitat and reduce the ability of fish populations to survive the dry season. Little Colorado spinedace typically occupy midwater portions of flowing pools and runs and avoid the deepest pools and relatively shallow areas. During periods of baseflow, the deepest pools may be the only available habitat for spinedace. Streamflow depletions from project-related groundwater pumping of the C aquifer are projected to reduce baseflow in lower Clear and Chevelon Creeks by approximately 0.06 cfs and 0.04 cfs, respectively. These values represent only a fraction of the mean June baseflows for both Clear and Chevelon Creeks and would be expected to have negligible to minor effects on streamflow or the quality and quantity of available habitat during "normal" to "above normal" water years.

However, during "below normal" or "dry" water years, additional streamflow depletion from project-related groundwater pumping of the C aquifer might affect availability of stream habitat and populations of Little Colorado spinedace. In a system that already has been stressed due to past drought and reduced flows, any further reduction in flows could result in the reduction in flow at riffles, and decrease in water depth and width in shallow pools and runs. Flow-over riffles could be eliminated, particularly in the upper, more intermittent, portion of lower Clear and Chevelon Creeks, and in isolated pools during the dry season. Reductions in flow may isolate spinedace in nonflowing pools where they may be subject to more predation and competition for food and space. Streamflow depletions also may affect spinedace spawning and recruitment, which occur in shallow water, and could affect spinedace through changes in water temperatures and a reduction in food production. Effects on larval and juvenile spinedace are likely to be greater than on adults during this period, since they generally have lower food reserves, higher metabolism, lower mobility, and are more vulnerable to predation. Young of the year are most abundant on uniformly turbulent riffles. Project-related effects on the spinedace are likely to be negligible to minor during years of average or above average precipitation; however, effects may be minor to moderate during years of below average precipitation.

Other special status fish species also may be affected by depletion of baseflow. Adult roundtail chub typically prefer deeper pools, while young juveniles occupy backwater habitat and older juveniles tend to occupy shallow, swifter habitats. Bluehead sucker and Little Colorado sucker occupy a variety of habitats. Reductions in pool depth would slightly decrease the amount of habitat available for adult fish and could reduce populations through competition. Younger fish would be more affected by loss of shallower habitats, including backwaters and runs, and might be forced into less suitable habitat where they would be subject to increased predation and competition. Effects on juvenile fish are likely to be greater than effects on adult fish. Section 4.18 provides a description of the conservation measures developed to offset the potential adverse effects of stream baseflow depletion. Changes to baseflow would be expected to have negligible to minor effects on streamflow or the quality and quantity of available habitat for roundtail chub, bluehead sucker, and Little Colorado sucker.

The humpback chub does not occur in the vicinity of any of the project facilities. The only known extant wild populations of humpback chub in Arizona occur along the mainstem Colorado River in Marble and Grand Canyons and the Little Colorado River. Blue Springs, which is located approximately 77 miles north-northwest of the C-aquifer well field, is the major discharge point for the C aquifer, releasing more than 164,000 af/yr into the Little Colorado River between River Miles 3 and 15, upstream from its confluence with the main stem of the Colorado River in Grand Canyon. Based on results of groundwater models developed for the C aquifer, the effects of pumping from the well field have shown no impact on Blue Springs or flows into the Little Colorado River. Therefore, the proposed C-aquifer pumping would not affect the humpback chub.

Groundwater drawdown also may affect availability of habitat for wildlife and special status species that utilize riparian vegetation, including the southwestern willow flycatcher. A review of the AGFD southwestern willow flycatcher habitat model completed for Arizona (Paradzick and Hatten 2004) indicated that there were five areas totaling 46 acres of potentially suitable nesting habitat (Habitat Classes 4 and 5) along portions of the Little Colorado River from Woodruff to Joseph City and near the confluence with lower Chevelon and lower East Clear Creeks. As recommended by Dockens and Paradzick (2004), these areas were evaluated by helicopter on November 3, 2006, to determine if suitable vegetation (composition and structure) was present in the field. Native obligate riparian vegetation (e.g., cottonwood and willow) was extremely limited, and vegetation within this general area was mainly composed of open/shrubby stands of nonnative salt cedar or barren floodplain (no riparian plants) with no apparent surface water present. The flight confirmed that the model was accurate—the only potentially suitable habitat in the project area had been identified by the model. No other potential habitat was observed. Of the five areas predicted to be potential breeding habitat, one site was an irrigated agricultural field (4.9 acres); a second site (7.8 acres) was a grass field supported by runoff from a wastewater treatment plant, which the model "confused" for dense riparian vegetation; a third site (5.8 acres), a marsh within the Little Colorado River floodplain dominated by cattails and other emergent vegetation with low shrubby tamarisk in the surrounding area, was unsuitable as flycatcher breeding habitat; the fourth site (9.8 acres) was tamarisk growing within or surrounding Clear Creek Reservoir; and the fifth site was tamarisk along lower Chevelon Creek. The habitat at Clear Creek Reservoir was marginally suitable for breeding southwestern willow flycatchers based on its extent and structure (thin patches of shrubby tamarisk) and is likely supported by local surface groundwater due to reservoir storage and operation. The tamarisk patches along lower Chevelon Creek appeared to be potentially suitable as breeding willow flycatcher habitat (dense tall tamarisk with high canopy cover and near water). However, the site is unoccupied based on AGFD flycatcher surveys conducted in the Chevelon Creek Wildlife Area between 2005 and 2006, which detected no resident (territorial) southwestern willow flycatchers during the 2005 or 2006 breeding seasons (Blackman 2006). The nearest occupied southwestern willow flycatcher breeding habitat in the Little Colorado River watershed occurs at River Reservoir approximately 30 miles from Chevelon Creek. Gradual decreases in the elevation of the water table of 0.1 to 1 foot over an extended period would likely have minimal or no effect on riparian vegetation and habitat. Impacts may include reduced foliage density and crown dieback or mortality of riparian plants in areas of deeper depth to the water table. Tamarisk, the primary species in this area, would be less affected than obligate riparian species such as cottonwood and willow. Impacts on wildlife and southwestern willow flycatcher habitat would not be measurable and would likely be negligible.

Bald eagle and peregrine falcon may occur occasionally in riparian habitats in the region, but are not likely to be affected by groundwater drawdown.

4.8.2.3.1.2 Infrastructure

4.8.2.3.1.2.1 Well Field

Construction of the wells and associated facilities would affect a small portion of the well-field area during construction, resulting in temporary loss of habitat, displacement of some species of wildlife, and mortality of less mobile species. Operation of the well field would require a limited amount of human activity and therefore would have negligible to no impact on wildlife. There would be no loss of woodland habitat, as all the affected vegetation consists of Plains and Great Basin grassland or Great Basin desertscrub.

Golden eagle nests are known to occur within 1 mile of the well field and may be affected by construction and operation activities. Impacts would be minimized or avoided by siting facilities away from nests and by seasonal restrictions on major activities near the nest when the nests are in use. Presence of burrowing owls would be determined through preconstruction surveys, and activities would be avoided during the nesting season where present. Construction and operation activities would result in minor temporary impacts from displacement and loss of some individuals that may occur in the vicinity, including wintering ferruginous hawks, occasional peregrine falcon, pronghorn antelope, pale Townsend's big-eared bat, and milk snake.

Kit foxes may occur in the well-field area, especially in Great Basin desertscrub habitat. Clearing and ground-disturbing activities associated with well-field development could result in the loss of habitat for the kit fox and could increase the potential for the direct mortality and/or displacement of some individuals (if present). These impacts are expected to be minor.

4.8.2.3.1.2.2 C Aquifer Water-Supply Pipeline

C Aquifer Water-Supply Pipeline: Eastern Route

Construction of the pipeline would affect about 860 acres of habitat, much of which would be within areas disturbed previously by road construction. Impacts on the 116 acres of piñon/juniper woodland would be long term because trees would not be replanted in the right-of-way, and the right-of-way would be converted from woodland to grassland. However, since the pipeline would be mostly in road rights-of-way, there would be few, if any, trees affected. Impacts on plains and Great Basin grassland and on Great Basin desertscrub generally would be temporary during the revegetation period. However, reclamation of the desertscrub areas could be difficult, and there could be long-term losses of vegetation cover and productivity in the right-of-way.

Additional impacts would result from construction of two pump stations, new 69kV power lines along the pipeline, and access roads to the pump stations. The new power lines have the potential to cause raptor electrocutions and would be designed to prevent impacts.

The open pipeline trench may trap small animals and may cause injury to larger animals attempting to cross it. Animals are most at risk of being trapped or injured at night, and especially during the summer and wet weather.

There may be disturbance or loss of small areas of tamarisk at the Little Colorado River and some other drainages. No impacts would occur in aquatic habitats.

A number of other special status species are known to occur. Impacts from construction would be minor with recommended mitigation, and impacts from operation and maintenance would be negligible.

- Both the golden eagle and western burrowing owl are known to nest in the vicinity of the existing pipeline route. Construction could cause disruption of breeding and loss of nests, eggs, or young. To comply with the Migratory Bird Treaty Act and Bald Eagle Protection Act, construction should be avoided during the breeding season near active nests. Preconstruction surveys would be used to identify locations of active nests and establish seasonal protective buffer zones. The project would have negligible effects on migrating or wintering peregrine falcons and ferruginous hawks.

- One special status bat species, the pale Townsend's big-eared bat, is known to occur in the area. Construction is unlikely to involve destruction of cliffs or bluffs in the right-of-way, where this species roosts in rock crevices. The project would have negligible effects on the species.
- Pronghorn antelope may be temporarily displaced during construction of the pipeline and associated facilities. Also, forage in the right-of-way would be lost temporarily.
- Kit foxes may occur along the pipeline route, especially in Great Basin desertscrub habitat. Impacts may include direct disturbance of kit foxes and disturbance or destruction of potentially suitable foraging and denning habitat.
- Impacts are expected to be negligible or minor for species that may occur but whose presence has not been documented, including mountain plover and milk snake, and may include temporary displacement of mountain plover and mortality of milk snake in the construction zone.
- There would be minor impacts on potential southwestern willow flycatcher migration and/or stopover habitats where tamarisk is found at the crossing of the Little Colorado River, Begashibito Wash, and possibly in other drainages.

Little Colorado River Crossing and Kykotsmovi Subalternatives

Impacts on habitat and wildlife from construction at the crossing of Little Colorado River mostly would be avoided, since either directional drilling under the Little Colorado River and use of the historic bridge would avoid disturbing the active channel and adjacent tamarisk. Impacts on habitat and wildlife from construction of either of the subalternative routes in the Kykotsmovi area would be avoided because the pipeline would be buried under a road in either case.

C Aquifer Water-Supply Pipeline: Western Route

Impacts on wildlife habitat would be similar to the Eastern Route, but a larger area of habitat would be affected, including approximately 136 acres of piñon/juniper woodland and 1,545 acres of all habitats. The new power lines have the potential to cause raptor electrocutions and would be designed to prevent such impacts.

There would be minor impacts on tamarisk riparian shrub at the Little Colorado River, Begashibito Wash, and possibly in other drainages.

Impacts on threatened, endangered, and special status species would be the same as the Eastern Route, except for the following:

- The Mexican spotted owl may occur along several miles of the route on the northern part of Black Mesa. It is not known whether suitable habitat would be directly affected. They also are known to occur within several miles of the route where it parallels portions of U.S. Highway 160, but the pipeline would not affect suitable habitat in this area. If the Western Route is selected, surveys would be conducted to identify suitable habitat and activity areas on or near the right-of-way, and seasonal limitations on construction would be coordinated with AGFD and the land-managing agency to identify means to protect activity areas near the construction zone.
- The Western Route would affect approximately 1 acre of tamarisk habitat that may be used by migrating southwestern willow flycatchers. Nesting has not been observed, and impacts on habitat would be short term because tamarisk recovers quickly after disturbance.
- The northern goshawk is known to nest within 1 mile of the Western Route on Black Mesa. As with other raptors, construction could cause abandonment of an active nest and loss of eggs or

young, depending on the season of construction, proximity of the nest, and visibility. Impacts would be prevented by avoidance of construction near active nests during the nesting season.

- Construction is likely to involve destruction of cliffs or bluffs that may be used as roost sites by Townsend's big-eared bats. Small numbers of bats could be displaced, but impacts on populations would be minor because of the relatively small area.

4.8.2.3.2 N Aquifer Water-Supply System

Groundwater modeling of N-aquifer pumping (Geotrans 2006) identifies seven streams that would have reduced baseflow from aquifer discharge under both the 11,600-af/yr and the 6,000-af/yr pumping alternatives. Simulated reductions in N-aquifer discharge through 2038 would be about 0.57 percent (76.6 acre-feet) of total N-aquifer discharge for the 6,000-af/yr pumping alternative, and 0.79 percent (106 acre-feet) for the 11,600-af/yr pumping alternative. Impacts would be largest at Begashibito Wash, at more than 1 percent in 2038 for both alternatives.

Drawdown would not affect perennial stream habitat, but might affect tamarisk and other riparian vegetation that use water from groundwater discharge, through reductions in area of the stands, reduced growth rates, thinning of stands, or changes in composition in favor of upland species. Although tamarisk is considered an invasive species and generally provides poor-quality habitat compared to native riparian vegetation, this habitat type is important for migrating birds and could be used by migrating endangered southwestern willow flycatcher. Modeling indicates that the effect from reductions of groundwater discharge would be minor or negligible (not measurable) because of the slight simulated reduction and dispersed effects, and because intermittent runoff flows provide much of the water used by riparian vegetation. Impacts on the southwestern willow flycatcher and its habitat would be negligible.

4.8.3 Alternative B – Approval of the LOM Revision (Preferred Alternative)

The Kayenta mining operation would continue through 2026. Impacts generally would be the same as described for Alternative A, except that the 2008 through 2026 mining disturbance area would be 6,942 acres. The acres of impact on the various types of wildlife habitat may differ depending on whether the Kayenta mining operation produces coal from some of the areas currently included in the Black Mesa mining operation. However, the relative proportion of habitats would be similar to Alternative A for the Black Mesa Complex. The coal-slurry pipeline and C aquifer water-supply system would not be constructed and, therefore, would have no effects on wildlife.

The mining operations would use an average 1,236 af/yr of N-aquifer water through 2026, 505 af/yr for mine reclamation and domestic use from 2026 through 2028, and 444 af/yr from 2029 through 2038. The groundwater modeling of the N aquifer predicts that the groundwater discharge to seven drainages in 2038 would be reduced by an average of 0.6 percent (total of 79.9 acre-feet) compared to simulated premining discharges. The maximum would be a decrease of 1.39 percent in Begashibito Wash (about 30.3 acre-feet), and the decrease in discharge to Moenkopi Wash would be 0.56 percent, or 23 acre-feet. These small decreases in discharge would have negligible effects on riparian habitat (refer to Section 4.7.2.1), and thus the effects on riparian-dependent wildlife species also would be negligible.

4.8.4 Alternative C – Disapproval of the LOM Revision (No Action)

The Kayenta mining operation would continue through 2026, and impacts would be the same as described for Alternative B. The Black Mesa mining operation would cease and would not disturb any additional wildlife habitat. The 2008 through 2026 mining disturbance area would be 6,942 acres, and the proportion of habitat types affected would be to the same as Alternative B.

4.9 LAND USE

4.9.1 <u>Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station</u>

4.9.1.1 Black Mesa Complex

As stated previously in the chapter, short-term impacts are those that would occur from the time when mining begins in a unit through reclamation when vegetation has been reestablished. Reclamation efforts at the mine are directed toward restoring the land to be used for livestock grazing, wildlife habitat, and cultural plant use. When vegetation has been reestablished, limited use of the land may be allowed. Long-term impacts are those that would persist beyond or occur after reclamation.

4.9.1.1.1 Residential

A total of 17 Navajo residences on the Navajo Partitioned Land and/or exclusive Navajo surface in the Black Mesa Complex would be displaced between 2005 and 2026 (Wendt 2005). Although relocation would be at Peabody's expense and new locations would most likely be within the residents' customary use areas (e.g., where ranching activities take place or where sociocultural ties exist), this would create hardships on the households and potentially could be a major impact.

4.9.1.1.2 Livestock Grazing

The maximum disturbance under Alternative A would exclude the use of 470.8 AUMs by 138 sheep, or 32 cattle or horses, from grazing within the disturbed and reclaimed areas for up to the life of the mining (OSM 1990). As under all alternatives, reclamation would focus on returning postmining surfaces to livestock grazing lands, the primary historical land use in the area. Reclamation would take place on lands immediately after mining activities in an area have been completed (refer to Appendix A-1). Premining grazing land would be restored, with changes in vegetation communities from piñon/juniper woodland and shrubland to grassland resulting in more forage available for livestock (OSM 1990). Based on the revegetation success standards that Peabody must achieve pursuant to the SMCRA permit, forage production would increase as much as 10 times over the premining productivity (OSM 1990) (refer to Appendix A-1).

The coal-haul road is located on Hopi land and would remove approximately 20 acres from grazing in Hopi Range Unit 263 until mining operations cease and reclamation is complete. After operations cease in 2026, the road would be revegetated and the area would be available for grazing.

4.9.1.1.3 Agriculture

Family garden plots would be relocated along with residences that are relocated to accommodate mining activity. Reclaimed land would support the reestablishment of family garden plots.

Relocations of residences, livestock grazing, and agriculture are disruptive to the households involved and therefore have the potential to become major impacts. Still, because the relocations would be nearby and because many of the land uses could return to their former locations once mined land is reclaimed, the long-term impact of relocation would be moderate.

4.9.1.1.4 Commercial/Industrial

No commercial or industrial land uses—apart from those affiliated with Peabody—are located within the Black Mesa Complex. At the initial program area of the Black Mesa Complex, the coal-slurry preparation plant and proposed coal-washing facility site are within a previously disturbed fenced area dedicated to coal preparation. Therefore, construction of the coal-washing facility and operation of both facilities would have no impact on land uses.

4.9.1.2 Coal-Slurry Pipeline

In the unlikely event of a pipeline failure, the amount of slurry released would depend on the location of the leak on the pipeline (top of the pipeline versus bottom of the pipeline), and the terrain where the leak occurs (a flat location versus a slope). Using historical data on slurry pipeline releases, BMPI estimates that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of 565 cubic yards. The maximum coal-slurry release would cover approximately 0.7 acre with 6 inches of nontoxic coal fines, while the fresh water in which the coal was entrained would soak into the ground. The impact on land use would be short term and would range from negligible to minor depending on the location and circumstances of failure. If the extent of the release warrants, BMPI would clean up the release immediately; therefore, the impact would be short term. An emergency response plan that addresses cleanup and management of impacts, including the length of time required for cleanup, would be in place for the coal-slurry pipeline.

4.9.1.2.1 Coal-Slurry Pipeline: Existing Route

4.9.1.2.1.1 Residential

Impacts would vary, depending on proximity and population density. Residences would be avoided whenever possible; however, during construction, access to property in both rural and suburban residential areas along the route would be disrupted. Approximately 70 residences could be affected along the existing route, either by restricted access or disturbance to residential property during construction.

Construction would restrict access temporarily to property in the Kingman and Laughlin areas, and would disturb residential properties (though not necessarily residential structures) in, or immediately adjacent to, the existing pipeline right-of-way in 12 low- to moderate-density residential areas.

4.9.1.2.1.2 Livestock Grazing

Construction activity would reduce available forage temporarily until reclamation is successful. Livestock grazing also could be impacted as a result of hazards to livestock from equipment and or construction activities (e.g., trenches). Such impacts would be reduced by notifying ranchers of upcoming construction activities in active grazing areas to move livestock to graze in other areas to avoid construction activities.

4.9.1.2.1.3 Agricultural

Family plots, generally in rural areas adjacent to or beyond the pipeline right-of-way, would not be directly impacted. Most farming occurs in rural areas where disturbance of related outstructures could be mitigated by moving or reconstructing them beyond the right-of-way.

Impacts on all of the above land uses would be brief. The impact levels would vary from minor to none. Minor impacts would usually result from access restrictions or property disturbance of longer duration, while negligible impacts would usually result from access restrictions that are slightly more disruptive than ordinary traffic disturbances.

4.9.1.2.1.4 Commercial/Industrial

The coal-slurry pipeline crosses under parking lots of Laughlin casinos and the Laughlin/Bullhead City Airport. However, in 1990, the original coal-slurry pipeline was replaced with two pipelines (one operating pipeline and one spare). These pipelines would be sufficient for the life of the reconstructed pipeline. There would be no construction in the parking lots or on airport property.

4.9.1.2.1.5 Rights-of-Way/Utility Corridors

The project would have no effect on rights-of-way and utility corridors.

4.9.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

Along the pipeline realignments in Moenkopi Wash, temporary disturbance of livestock grazing during construction would be the only impact in this area. Generally, land use impacts would be similar to those along the existing route. New right-of-way for this realignment would be required.

Along the Kingman reroute, construction activity (refer to Appendix A-2) would disturb three low- to moderate-density residential areas adjacent to the right-of-way. In addition, the reroute could disrupt access during construction; however, structures would not be affected. Construction and operation of the pipeline would not affect the existing high-voltage power line and gas pipeline that the Kingman reroute would partially parallel. Where other residential structures are located farther from the right-of-way and access road, impacts on landscaped property or outstructures would be fewer. Access to residential and industrial properties may be impeded temporarily during construction. This reroute would avoid highly dense residential areas crossed by the existing alignment. Impact levels would be minor to none for the reasons described for the existing route.

4.9.1.3 C Aquifer Water-Supply System

4.9.1.3.1 Well Field

Wells would be dispersed within the well field, spaced about 1.2 to 1.5 miles apart, and each well would require approximately 0.06 acre of permanent right-of-way for a well pad and associated equipment (e.g., wellhead, pump, communication, housing). If 12 wells were developed, approximately 160 acres (dispersed over the area of the well field) would be disturbed by construction of the wells, access roads, pipelines, and power lines. Permanent right-of-way for the wells and associated facilities would require about 69 acres for the life of the project. If 21 wells were developed, approximately 220 acres would be disturbed by construction activities and approximately 95 acres would be required for permanent right-of-way. A spur road to access each well would be needed and the pipeline from each well (that carries the water to the long-distance water-supply pipeline) would be buried in the access road. Also, an overhead power line would be constructed to each well to provide electricity to each pump.

Approximately 55 residences are located within the well field. Although residences would be avoided during the development of the well field, access to residences or associated use areas may be disrupted during short-term construction activities. Much of the well field is used for grazing.

The impact from construction would vary from minor to none. Minor impacts usually would result from temporary shifts in the areas used for grazing, or access limitations or property disturbance of longer duration, while negligible impacts usually would result from access restrictions that are slightly more disruptive than ordinary traffic disturbances. Long-term impacts would be negligible.

4.9.1.3.2 C Aquifer Water-Supply Pipeline

In the unlikely event of a pipeline failure, some flooding would occur in topographic lows and drainage channels, there could be some amount of erosion, and much of the fresh water would soak into the ground. The amount of water released is not possible to predict. If the extent of the release warrants, the area affected (e.g., by erosion) would be repaired as soon as practicable; therefore, the impact would be short term. The impact on land use would be short term and negligible.

4.9.1.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

4.9.1.3.2.1.1 <u>Residential</u>

The majority of the land crossed by the pipeline is rural. The Eastern Route generally parallels or is located within existing roadways or road rights-of-way; however, access to residences or commercial areas would be disrupted temporarily during construction at locations where the alignment crosses a sole access road. Survey of residential and commercial uses prior to construction would help avoid such areas and minimize impacts. Where the route is located away from a road, no residences would be affected.

Minor impacts would usually result from access restrictions or property disturbance of longer duration, while negligible impacts would usually result from access restrictions that are slightly more disruptive than ordinary traffic disturbances.

4.9.1.3.2.1.2 Livestock Grazing

The majority of the Eastern Route is located within a roadway. During construction, grazing would continue in areas adjacent to the right-of-way. In areas with no roads and trails, such as south of the Black Mesa Complex, grazing within the pipeline right-of-way would be displaced as a result of the forage removal from pipeline and access-road construction activities. Construction and operation of the pump stations would displace up to 4 acres during construction and 1.2 acres permanently of grazing land. Pump stations would be near highly traveled roads, where grazing is less likely to be concentrated. Short-term impacts would be minor; long-term impacts would be negligible to none.

4.9.1.3.2.1.3 Agricultural

Of approximately 74 acres of agricultural fields crossed by the eastern pipeline route, approximately 3 acres would be disturbed by construction, which would result in displacement of uses from about 4 percent of the agricultural areas along the route. Short- term impacts would be minor; long-term impacts would be negligible to none.

4.9.1.3.2.1.4 69kV Power Line

Construction and operation of an overhead 69kV power line would temporarily impact residential, agricultural, commercial, and public/quasi-public land uses in or near the community of Kykotsmovi during construction by possibly limiting access. The line would be built adjacent and parallel to an existing road. Impacts would be moderate during construction, and negligible in the long term.

4.9.1.3.2.1.5 Kykotsmovi Area Subalternatives

Construction would temporarily disrupt access to residential, commercial, and public/quasi-public properties in the Kykotsmovi area. Both of the alternative routes are within roadways; thus, there would be no direct impact on structures. The Western Route would pass through areas of greater density than the eastern alternative, but location within the roadway would minimize direct impacts. Access to about seven residences along the Western Route would be affected during construction, which would be a minor impact. There would be no long-term impacts.

4.9.1.3.2.1.6 Little Colorado River Crossing Subalternatives

Both subalternative routes crossing the Little Colorado River would pass through an area largely devoid of development, and construction impacts would be negligible or none. The historic bridge over the Little Colorado River is abandoned and serves no transportation purpose.

4.9.1.3.2.2 C Aquifer Water-Supply Pipeline: Western Route

Land use impacts along the western pipeline route would be similar to those described for the Eastern Route, but because this alternative is longer, more ground would be disturbed.

Unlike the Eastern Route, this route parallels fewer existing roads or trails, and more forage would be removed for pipeline installation, displacing more grazing. Minor impacts would usually result from shifts in the areas used for grazing during construction or from access restrictions or property disturbance of longer duration, while negligible impacts usually would result from access restrictions that are slightly more disruptive than ordinary traffic disturbances. Construction of an access road under this alternative would increase access to area residences and rangelands, of negligible benefit.

4.9.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

The Kayenta mining operation would continue through 2026, and the types of impacts would be similar to those discussed under Alternative A for the Black Mesa Complex. The initial program parts of the Black Mesa Complex would be incorporated into the permit. Existing disturbed areas of the mine would be reclaimed. The opportunity for improved livestock grazing would be foregone because the unmined land would be less productive for grazing. The unmined land is 10 times less productive over the long term than the land that is mined and reclaimed (OSM 1990). On reclaimed areas, final bond release could occur 10 years after the last augmented seeding, and livestock grazing could resume. Under Alternative B, five Navajo residences (households) on the Navajo Partitioned Land and/or exclusive Navajo surface would be relocated through 2026. Although the relocation would be at Peabody's expense and new locations would most likely be within the residents' customary use area (e.g., where ranching activities take place or where sociocultural ties exist), this would create hardships on the households and potentially could be a major impact.

4.9.3 Alternative C – Disapproval of the LOM Revision (No Action)

The Kayenta mining operations would continue through 2026, and impacts would be similar to those discussed under Alternative A. The Black Mesa mining operation would not resume, and the disturbed area of the mine would be reclaimed. On reclaimed areas, final bond release could occur 10 years after the last augmented seeding, and livestock grazing could resume. The opportunity for improved livestock grazing would be forgone because the unmined land would be less productive for grazing, 10 times less productive than the land that is mined and reclaimed (OSM 1990). Under Alternative C, five Navajo residences (households) on the Navajo Partitioned Land and/or exclusive Navajo surface would be relocated through 2026. Although the relocation would be at Peabody's expense and new locations would most likely be within the residents' customary use area (e.g., where ranching activities take place or where sociocultural ties exist), this would create hardships on the households and potentially could be a major impact.

4.10 CULTURAL ENVIRONMENT

Assessment of the potential effects on the cultural environment was based primarily on criteria defined by regulations for Protection of Historic Properties at 36 CFR 800, which implement the National Historic Preservation Act. Those regulations define an effect as a direct or indirect alteration to the characteristics of a historic property that qualify it for inclusion in the National Register. Effects are adverse when the alterations diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association. Examples of adverse effects include the following:

- Physical destruction, damage, or alteration of all or part of the property
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR 68) and applicable guidelines
- Removal of the property from its historic location
- Change of the character of the property's use or of physical features in the property's setting that contribute to its historic significance

- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features
- Neglect of a property, which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization
- Transfer, lease, or sale of the property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance [36 CFR 800.5(a)(2)]

The criteria of adverse effect were applied to each cultural resource identified within the area of potential effects and listed in or evaluated as eligible for the National Register or otherwise determined to have traditional cultural significance. For the NEPA analysis, the criterion for a significant impact on cultural resources was defined as an unavoidable adverse effect that appeared to have little potential for acceptable mitigation through consultation with parties participating in the review of the project in compliance with Section 106 of the NHPA.

Many of the resources that would be adversely affected are archaeological sites, and disturbance of those sites would be long-term permanent impacts. As final designs are prepared, project modifications would be considered to avoid or reduce impacts on those sites, and studies could be conducted to recover and preserve information to mitigate impacts on significant sites that cannot be avoided. A variety of measures might be implemented to mitigate short-term and long-term impacts on other types of cultural resources, particularly on various types of traditional cultural resources. For example, disturbed areas might be planted with native species that are collected for traditional uses to mitigate the short-term impacts of construction disturbance, and construction activities might be restricted to designated seasons to avoid short-term disturbance of eagles and other raptors that are collected for ceremonial uses. Traditional ceremonies might be arranged to address what could be perceived as long-term impacts on ceremonial areas or named places related to traditional histories. Some of the most sensitive impacts relate to disturbance of human remains in historical graves or archaeological sites. Project modifications would be considered to avoid disturbance of burials, but if all human remains cannot be avoided, they would be excavated and repatriated in consultation with related and affiliated groups pursuant to regulations and policies applicable to the ownership of the land on which they are located. Specific measures to reduce or mitigate adverse effects on each traditional cultural resource that cannot be avoided would be developed in consultation with the tribes who value those resources. Measures to avoid, reduce, or mitigate adverse effects on cultural resources would be implemented in consultation with the Navajo Nation Tribal Historic Preservation Officer and Arizona and Nevada State Historic Preservation Officers and other interested parties pursuant to a Section 106 Programmatic Agreement.

4.10.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.10.1.1 Black Mesa Complex

4.10.1.1.1 Archaeological and Historical Resources

As discussed in Chapter 3.10, the 20-year Black Mesa Archaeological Project, conducted from 1967 through 1986, completed Section 106 mitigation requirements for coal-mining operations within the Black Mesa Mine Complex (including the permitting of the coal-slurry preparation plant and construction of a coal-washing facility). Pursuant to terms and conditions of the current LOM Permit AZ-0001D, Peabody continues to report to OSM and address the discovery of any unrecorded archaeological and historical resources.

Alternative A would incorporate 18,984 acres of the Black Mesa operation initial program area into the area currently permitted for mining through 2026. By definition, it is not possible to predict unexpected discoveries, but experience in fulfilling the LOM permit conditions since 1990 suggests that incorporation of the Black Mesa operation initial program area into the permit and mining coal through 2026 might result in approximately three to five additional unanticipated discoveries of archaeological or historical resources. Because of the extensive prior mitigation, the relatively few sites that would be affected, and the procedures for addressing discoveries, this level of impact is rated as minor.

4.10.1.1.2 Traditional Cultural Resources

Traditional Hopis and Navajos consider all of Black Mesa to be a significant traditional cultural resource because of its role in traditional stories and ceremonial and clan traditions, and because it is an area where traditional resources are obtained. They feel that development of the Black Mesa Complex has adversely affected their traditional life ways. Alternative A would authorize continued mining within the Black Mesa operation initial program area through 2026. Although Hopis and Navajos living anywhere might regard that continued mining as an impact on their cultural traditions, the life ways of the approximately 60 Navajo households that continue to reside within the Black Mesa Complex would be most directly affected by extension of the LOM permit.

Special Condition No. 1 of the existing LOM permit requires Peabody to take into account any sacred and ceremonial sites brought to the attention of Peabody by local residents, clans, or representatives of the Hopi Tribe or Navajo Nation tribal governments. Based on prior experience, it is estimated that perhaps 10 to 15 additional sacred or ceremonial sites might be reported through 2026 within the Black Mesa operation initial program area.

The Hopi and Navajo have traditional cultural affiliations with human remains associated with archaeological sites within the Black Mesa Complex. Although the Black Mesa Archaeological Project excavated many burials, only a sample of the archaeological sites was excavated and there could be burials at the unexcavated sites. The passage of NAGPRA in 1990 stipulated that Federal agencies inventory and repatriate excavated human remains. Special Condition No. 4 of Permit AZ-0001C, issued July 6, 1990, required Peabody to comply with NAGPRA by identifying and respectfully treating any human remains associated with unexcavated archaeological sites in areas to be disturbed by mining activities. That condition is included in the current Permit AZ-0001D, and if Alternative A were approved, the condition would apply to the additional 18,984 acres of the Black Mesa operation initial program area that would be incorporated into the permit area.

Assuming that experience in fulfilling the permit conditions is a reasonable indication of what to expect in the future, it is estimated that mining within the Black Mesa operation initial program area through 2026 would require testing of approximately 20 to 25 archaeological sites for burials, and perhaps 25 to 30 more human remains might be found and need to be moved. Because policies and procedures are in place for treating burials and sacred or ceremonial sites, the projected level of impact is rated as moderate.

Construction activities related to development of a new coal-haul road on the Hopi Indian Reservation from the J-23 coal-resource area in the Kayenta mining operation area to the coal-preparation facilities in the Black Mesa mining operation area would be confined to a corridor about 500 feet wide and 2 miles long. An intensive field survey of the corridor identified two archaeological and historical sites that are evaluated as eligible for the National Register (Table 4-36). Construction of the road is unlikely to disturb the entire width of the corridor, but because a final design for the road has not been prepared, it is not known whether the sites would be disturbed or not. Regardless, the projected potential impacts on two sites are rated as minor.

Table 4-36 Potential Adverse Effects on Archaeological and Historical Sites within the Coal-Haul Road Corridor[1]

No.	Site Name/ Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
1	045-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, C, D	Potential adverse effect, data recovery if avoidance not feasible
2	046-2005(Hopi)	Hopi	Navajo	Sweat lodge	Eligible, Criteria A, D	Potential adverse effect, consult with former users and treat if avoidance not feasible

NOTES: [1]The inventory is based on conceptual designs. Effects would be reassessed pursuant to a Section 106 Programmatic Agreement during the preparation of final designs after the environmental impact statement.
[2] Recommendations regarding eligibility, effect, and treatment are indicated; agency consultations are ongoing. Refer to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions. National Register = National Register of Historic Places

The Hopi and Navajo consider all of Black Mesa to be a significant traditional cultural property. A Hopi study team and a Navajo study team concluded that the proposed construction of the coal-haul road would not adversely affect the significant traditional cultural values of Black Mesa. Therefore, the coal-haul road is projected to have no impacts on traditional cultural resources.

4.10.1.2 Coal-Slurry Pipeline

4.10.1.2.1 Coal-Slurry Pipeline: Existing Route

4.10.1.2.1.1 Archaeological and Historical Resources

Thirty-six archaeological and historical resources listed in or eligible for the National Register have been inventoried along the existing route of the coal-slurry pipeline. Most pipeline reconstruction activities would be confined to a previously disturbed 50-foot-wide right-of-way across many of those resources, but conceptual designs indicated that construction activities within temporary construction easements are likely to adversely affect parts of 23 of those resources Table 4-37). Two of these sites may have been excavated to mitigate the impacts of the original pipeline construction, and if so, any remaining significant values at those sites might not be adversely affected.

Table 4-37 Potential Adverse Effects on Archaeological and Historical Sites along the Existing Coal-Slurry Pipeline Route[1]

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
Existing Alignment						
1	026-2005(Hopi)	Hopi	Ancestral Pueblo (Anastasia)	Feature and artifact scatter	Eligible, Criteria A, D	Adverse effect, avoid or test and recover data
2	031-2005(Hopi)	Hopi	Navajo	Habitation	Eligible, Criteria A, C, D	Adverse effect, avoid or recover data (ethnographic/archival research)
3	032-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Adverse effect, avoid or test and recover data
4	034-2005(Hopi), possibly Dot Knish Village, Airs D:10:1(PC)[3]	Hopi	Ancestral Pueblo	Habitation	Eligible, Criteria A, C, D	No adverse effect if determined that the affected area was previously excavated; if not, adverse effect, avoid or test and recover data
5	038-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Adverse effect, avoid or test and recover data

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
6	042-2005(Hopi)	Hopi	Ancestral Pueblo	Temporary camp	Eligible, Criteria A, C, D	Adverse effect, avoid or test and recover data
7	043-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Adverse effect, avoid or test and recover data
8	044-2005(Hopi), possibly Airs D:9:1(PC)[3]	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, C, D	No adverse effect if determined that the affected area was previously excavated; if not, adverse effect, avoid or test and recover data
9	AZ H:9:41(ASM)	ASLD	Cohonino	Artifact scatter	Eligible, Criterion D	Adverse effect, avoid or test and recover data
10	AZ H:9:42(ASM)	ASLD	Cohonino	Artifact scatter	Eligible, Criterion D	Adverse effect, avoid or test and recover data
11	AZ H:9:43(ASM)	ASLD	Cohonina	Field house, artifact scatter	Eligible, Criterion D	Adverse effect, avoid or test and recover data
12	AZ H:10:120(ASM)	ASLD, private	Cohonina	Field house with associated artifacts	Eligible, Criterion D	Adverse effect, avoid or test and recover data
13	AZ H:10:130(ASM)	ASLD	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
14	AZ H:10:131(ASM)	Private	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
15	AZ H:10:132(ASM)	ASLD, private	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
16	AZ H:10:133(ASM)	ASLD	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
17	AZ H:10:134(ASM)	ASLD, private	Cohonina/ Cerbat	Artifact scatter (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
18	AZ H:10:135(ASM)	ASLD	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
19	AZ H:10:136(ASM)	Private	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
20	AZ H:10:137(ASM)	Private	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
21	AZ H:10:138(ASM)	Private	Prehistoric	Scatter of flaked stone (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
22	AZ H:10:139(ASM)	Private	Cohonina/ Cerbat	Artifact scatter (Mount Floyd volcanic field)	Eligible, Criterion D	Adverse effect, avoid or test and recover data
23	AZ H:11:41(ASM)	Private	Cohonina	Field house	Eligible, Criterion D	Adverse effect, avoid or test and recover data

NOTES: [1] The inventory is based on conceptual designs. Supplemental surveys would be conducted as needed pursuant to a Section 106 Programmatic Agreement during the preparation of final designs after the environmental impact statement.

[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing.

[3] Site may have been excavated to mitigate the impacts of the original pipeline construction.

ASLD = State Trust land managed by the Arizona State Land Department

National Register = National Register of Historic Places, No. = number

Of these 23 sites, 8 are on the Hopi Reservation, and 15 are west of the Hopi and Navajo Reservations. One of the sites is an Ancestral Pueblo habitation site, and six others also reflect Ancestral Pueblo occupation of the region, including one temporary camp, and five artifact scatters. One site is a historical Navajo habitation. Seven sites reflect prehistoric Cohonina or Cerbat occupation of northwestern Arizona—three sites with field houses, and four artifact scatters without features. The eight other sites are scatters of flaked stone in the Mount Floyd volcanic field. Although culturally or temporally diagnostic artifacts have not been found on these sites, they probably were used by the Cohonina and Cerbat cultures, and perhaps during the earlier Archaic era as well.

All of the resources that might be adversely affected are significant and eligible for the National Register because of their potential to yield important information about the prehistory and history of the region (Criterion D). The Hopi also consider all Ancestral Pueblo sites to be significant under Criterion A because of their association with important events in Hopi history, and sites with remnants of architecture to be eligible under Criterion C because they represent distinctive types. Efforts would be made during preparation of final designs to avoid or reduce impacts on the National Register-eligible properties. For sites that cannot be avoided, there is good potential to mitigate the impacts satisfactorily through data recovery studies. Because of this potential and the prior disturbance of the affected sites, the projected impacts are rated as moderate.

4.10.1.2.1.2 Traditional Cultural Resources

Reconstruction of the coal-slurry pipeline along the existing route has potential to adversely affect 11 traditional Hopi cultural resources and 1 traditional Hualapai cultural resource (Table 4-38). These include areas where eagles and other raptors are collected for ceremonial uses, ceremonial areas and shrines, trails, landscape features, trails, ancestral sites, and water sources. The pipeline reconstruction mostly would be limited to a previously disturbed corridor, but the effects are potentially adverse. Those effects and measures to avoid, reduce, or mitigate adverse effects would be discussed pursuant to a Section 106 Programmatic Agreement if Alternative A is approved. Because of the prior disturbance and potential to reduce or mitigate adverse effects, the impacts are rated as moderate.

Table 4-38 Potential Impacts on Traditional Cultural Resources along the Existing Coal-Slurry Pipeline[1]

No.	Resource	Cultural Affiliation	National Register Status[2]	Effects, Recommended Treatment[2]
1	Hotvela Young Corn Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
2	Kiikiqö, petroglyphs, and pictographs, site 032-2005	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
3	Hotvela Sun Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
4	Hotvela Fire Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
5	Salt pilgrimage trail	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
6	Owaqöl ritual race track	Hopi	Eligible, Criterion A	Crossed, adverse effect, avoidance recommended
7	Tuutuskya (offering place)	Hopi	Eligible, Criterion A	Crossed, adverse effect, avoidance recommended
8	Orayvi Greasewood Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
9	Songòopavi Bear Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
10	Palavayu (Little Colorado River), sacred watercourse	Hopi	Eligible, Criterion A	Crossed, adverse effect, avoidance recommended

No.	Resource	Cultural Affiliation	National Register Status[2]	Effects, Recommended Treatment[2]
11	Koohonina trail	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoidance recommended
12	Tuckayou Spring	Hualapai	eligible, Criterion A	Possible blockage of downstream flow, adverse effect, reconstruct pipeline to allow flow over the pipeline

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the preparation of final designs after the environmental impact statement..
[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions. It is recognized that avoidance of some resources, such as linear trails, is impossible, and measures to reduce or mitigate impacts would be implemented in consultation with the appropriate tribe.
National Register = National Register of Historic Places, No. = number

4.10.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

4.10.1.2.2.1 Archaeological and Historical Resources

The agencies' preferred route with realignments could affect nine more archaeological and historical sites eligible for the National Register than reconstruction of the pipeline along the existing right-of-way. Eight of these resources are Ancestral Pueblo archaeological sites located within a 400-foot-wide corridor along Moenkopi Wash (Table 4-39). Three of these sites are habitation sites, two appear to be temporary camps, and three are artifact scatters and/or petroglyphs (rock art). Impacts cannot be determined until final designs are prepared, but it is anticipated that a total of no more than 1 mile of the pipeline would be realigned in this segment, and there is good potential to avoid impacts on all of these sites. The Kingman realignment is likely to adversely affect one additional National Register-eligible site, which is the archaeological remnants of the razed Harris Station along the Atchison, Topeka & Santa Fe Railway.

Table 4-39 Potential Impacts on Archaeological and Historical Sites along the Coal-Slurry Pipeline Realignments[1]

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
Moenkopi Wash Realignments						
1	033-2005(Hopi)	Hopi	Ancestral Pueblo	Possible habitation, possible pit house, artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
2	035-2005(Hopi)	Hopi	Ancestral Pueblo	Petroglyphs and artifact scatter	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
3	036-2005(Hopi)	Hopi	Ancestral Pueblo	Petroglyphs	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
4	037-2005(Hopi)	Hopi	Ancestral Pueblo	Petroglyphs and artifact scatter	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
5	039-2005(Hopi)	Hopi	Ancestral Pueblo	Temporary camp, 1-room structure, artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
6	040-2005(Hopi)	Hopi	Ancestral Pueblo	Temporary camp	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
7	041-2005(Hopi)	Hopi	Ancestral Pueblo	Habitation	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
8	AZ J-37-05(NNHPD)	Navajo	Ancestral Pueblo	Habitation	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
Kingman Reroute						
1	Harris Station, AZ F:16:61(ASM)	BLM, private	Euro-American	Remnants of 1890s to 1940s railroad station	Eligible, Criteria D	Potential adverse effect, avoid or test and recover data

NOTES: [1] The inventory is based on conceptual design. Supplemental surveys would be conducted as needed pursuant to a Section 106 Programmatic Agreement during the preparation of final designs after the environmental impact statement.
[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions.
National Register = National Register of Historic Places, No. - number

All nine of the additional sites that might be affected by the realignments are eligible for the National Register because of their potential to yield important information about the prehistory and history of the region (Criterion D). The Hopi also consider the Ancestral Pueblo sites to be significant under Criterion A because of their association with important events in Hopi history, and sites with petroglyphs to be eligible under Criterion C because they are representative of a style of rock art. Efforts would be made during preparation of final designs to avoid or reduce impacts on these sites, but if they cannot be avoided, there is good potential to satisfactorily mitigate the impacts through data recovery studies. Because of this potential and the prior disturbance, the projected impacts are rated as moderate.

4.10.1.2.2.2 Traditional Cultural Resources

Reconstruction of the coal-slurry pipeline with the Moenkopi Wash realignments would not adversely affect any more traditional cultural resources than would reconstruction along the existing right-of-way. The level of impacts is rated as moderate.

One traditional Hualapai cultural resource, a historical cemetery, is located about 1 mile from the proposed Kingman reroute. Reconstruction of the coal-slurry pipeline along that reroute is not expected to affect the cemetery.

4.10.1.3 C Aquifer Water-Supply System

4.10.1.3.1 Well Field

4.10.1.3.1.1 Archaeological and Historical Resources.

A records review of the proposed well field identified 11 archaeological and historical sites evaluated as eligible for the National Register or as requiring archaeological testing to complete their evaluation (Table 4-40). Five of these sites are scatters of prehistoric flaked stone that may date to the Archaic or Ancestral Pueblo periods. Two other sites reflect Ancestral Pueblo occupation, and include a habitation site and an artifact scatter with petroglyphs. The three other sites are related to livestock grazing by Navajos or Euro-Americans. The well field has not been designed, but there is considerable flexibility in selecting the specific location of wells (as many as 21) and associated power lines, access roads, and collector pipelines. Consequently, there is considerable potential for avoiding adverse effects on archaeological and historical sites as the well field is designed, and potential impacts are rated as minor.

Table 4-40 Potential Impacts on Archaeological and Historical Sites within the C-Aquifer Well Field[1]

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
1	011-2004(Hopi)	Hopi	Archaic, possible Ancestral Pueblo	Scatter of flaked stone	Eligible, Criterion D	Potential adverse effect, avoid or test and recover data
2	013-2004(Hopi)	Hopi	Euro-American	Post-1900 livestock pens, windmill, water tanks	Eligible, Criterion D, possibly A	Potential adverse effect, avoid or test and recover data

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
3	AZ-N-56-3(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo III habitation site	Eligible, Criterion D	Potential adverse effect, avoid or test and recover data
4	AZ-N-56-4(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Petroglyph and artifact scatter	Eligible, Criterion D	Potential adverse effect, avoid or test and recover data
5	AZ-N-56-6(NNHPD)	Navajo	Prehistoric	Scatter of flaked stone	Eligibility testing recommended, Criterion D	Potential adverse effect, avoid or test and recover data
6	AZ-N-56-7(NNHPD)	Navajo	Prehistoric	Scatter of flaked stone	Eligibility testing recommended, Criterion D	Potential adverse effect, avoid or test and recover data
7	AZ-N-56-8(NNHPD)	Navajo	Prehistoric	Scatter of flaked stone	Eligibility testing recommended, Criterion D	Potential adverse effect, avoid or test and recover data
8	AZ-N-56-9(NNHPD)	Navajo	Navajo	1930s to 1960s sheep dipping station	Eligible, Criterion D, possibly A	Potential adverse effect, avoid or test and recover data
9	AZ-N-41-10(NNHPD)	Navajo	Prehistoric	Scatter of flaked stone	Eligibility testing recommended, Criterion D	Potential adverse effect, avoid or test and recover data
10	AZ-N-56-11(NNHPD)	Navajo	Navajo	1890s to 950s rocks alignments and scatter of artifacts (possible herding camp)	Eligible, Criterion D	Potential adverse effect, avoid or test and recover data
11	AZ-O-49-1(NNHPD)	Navajo	Prehistoric, Navajo	Scatter of flaked stone (Tolchaco gravels), 1930s cistern and inscribed concrete marker	Prehistoric component eligible, Criterion D; historic-period component not eligible	Potential adverse effect, avoid or test and recover data

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the preparation of final designs after the environmental impact statement.
[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions.
National Register = National Register of Historic Places, No. = number

4.10.1.3.1.2 Traditional Cultural Resources

Four traditional cultural resources have been inventoried within areas that could be affected by development of the C-aquifer well field, but only one of these—an area where the Hopi collect eagles for ceremonial uses—is likely to be adversely affected (Table 4-41). Consultations would be conducted with the Hopi Cultural Preservation Office pursuant to a Section 106 Programmatic Agreement to seek ways to avoid, reduce, or mitigate those impacts.

The Hopi consider all sources of surface water, whether in springs, or ephemeral or permanent streams, to have traditional cultural significance. Clear Creek and Chevelon Creek were identified as two specific traditional Hopi cultural resources within areas that might be affected by pumping of groundwater from the C aquifer. Hydrogeological modeling of the impacts of the proposed pumping of groundwater, even at the highest rate being considered, indicated the reduction in baseflow within those creeks, which are about 26 to 33 miles east of the well field, would be negligible (refer to Section 4.4.1.4), and no adverse effects are anticipated.

Table 4-41 Potential Impacts on Traditional Cultural Resources within the C-Aquifer Well Field and Related Surface Water[1]

	Resource	Cultural Affiliation	National Register Status[2]	Effects, Recommended Treatment[2]
1	Songòopavi Bearstrap Clan eagle-collecting area	Hopi	Eligible, Criterion A	Within 1 mile, adverse effect, recommend avoidance
Surface Water				
1	Sakwavayu/ Lemovayu (Clear Creek) shrine	Hopi	Eligible, Criterion A	No measurable decrease in streamflows
2	Sakwavayu (Chevelon Creek)	Hopi	Eligible, Criterion A	No measurable decrease in streamflows
Shallow Groundwater Used for Traditional Livestock Grazing				
1	Wells in the Leupp vicinity	Navajo	No historic properties	Dropping water table may dry up wells; alternative water supply would be provided for traditional livestock grazing

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the preparation of final designs after the environmental impact statement..

[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions.

National Register = National Register of Historic Places, No. = number

Springs and other water resources also are important to traditional Navajo culture. Some Navajo continue traditional grazing of livestock in the well-field area and rely on shallow wells to provide water for their herds. Development of the C-aquifer water supply could cause those wells to go dry. Although the wells are not historic properties, this could result in adverse impacts on traditional lifeways. The project proponents would provide an alternative water source for livestock grazing to mitigate the impacts of groundwater drawdown.

One traditional Hopi cultural resource and an aspect of traditional Navajo lifeways could be affected. Because of the potential to mitigate the effects, the impacts are rated as minor.

4.10.1.3.2 C Aquifer Water-Supply Pipeline: Eastern Route

4.10.1.3.2.1 Archaeological and Historical Resources

Twenty-three archaeological and historical resources evaluated as eligible for the National Register have been identified within areas that could be affected by construction of the eastern alignment of the C aquifer water-supply pipeline and associated access roads, substation, and power line (Table 4-42). The surveyed area included options for installing the pipeline on either side of the roads that are followed along much of the Eastern Route, as well as alternative locations for a substation and power line routes. Therefore, it is unlikely that all 23 of the identified resources would be affected. However, additional archaeological and historical sites might be subject to potential effects because the area of construction disturbance might be expanded as final designs are prepared for facilities such as the pump stations.

Table 4-42 Potential Impacts on Archaeological and Historical Sites along the C Aquifer Water-Supply Pipeline and Related Facilities: Eastern Route[1]

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
Proposed Water Pipeline						
1	013-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
2	014-2005(Hopi), NA14487(?)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
3	015-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter and possible shrine	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data

No.	Site Number	Jurisdiction	Cultural Affiliation	Site Type	National Register Status[2]	Effects, Recommended Treatment[2]
4	016-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
5	017-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
6	019-2005(Hopi)[3]	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
7	020-2005(Hopi)[3]	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
8	021-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
9	022-2005(Hopi)	Hopi	Ancestral Pueblo	Rock alignment (possible field house)	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
10	023-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
11	024-2005(Hopi)	Hopi	Ancestral Pueblo	Habitation	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
12	025-2005(Hopi)	Hopi	Ancestral Pueblo	Habitation	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
13	027-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
14	028-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
15	029-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
16	030-2005(Hopi)	Hopi	Ancestral Pueblo	Artifact scatter	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
17	048-2005(Hopi), JUA 80-07	Hopi	Ancestral Pueblo	Habitation	Eligible, Criteria A, C, D	Potential adverse effect, avoid or test and recover data
18	AZ-J-43-40(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo I and/or II field house	eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
19	AZ-J-44-19(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo II field house	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
20	AZ-O-31-3(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo I habitation	Eligible, Criteria A, D	Potential adverse effect, avoid or test and recover data
21	AZ-O-48-1(NNHPD)	Navajo	Ancestral Pueblo (Anasazi)	Pueblo II habitation	Eligible, Criteria A, D, partially excavated	Potential adverse effect, avoid or test and recover data
22	AZ-O-48-19(NNHPD)	Navajo	Archaic	Scatter of flaked stone	Eligible, Criterion D	Potential adverse effect, avoid or test and recover data
23	AZ-O-48-40(NNHPD)	Navajo	Euro-American	Circa 1920 steel, through-truss bridge	Eligible, Criterion C	Potential adverse effect, design reuse to preserve historic features

NOTES: [1] The inventory is based on conceptual designs and does not include the locations of two pumping stations, and other facilities such as holding tanks. The survey included options for locating the pipeline on either side of existing roads in some locations, so all the sites probably would not be affected. Supplemental surveys would be conducted pursuant to a Section 106 Programmatic Agreement during the post–environmental impact statement preparation of final designs and additional sites might be identified.

[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions.

[3] Located along the west Kykotsmovi area subalternative.

National Register = National Register of Historic Places, No. = number

Twenty-one of the 23 sites are related to Ancestral Pueblo (Anasazi) occupation of the region, and include 5 habitation sites, 3 field houses, and 13 artifact scatters. Another scatter of flaked stone dates to the Archaic era.

The other recorded resource—an abandoned steel truss bridge—is being considered as one of two subalternatives for crossing the Little Colorado River. If the bridge were used to support the pipeline over the river, there is potential to adversely affect the historic integrity of the bridge if the addition of the pipeline did not comply with the Secretary of the Interior's Standards for Historic Preservation. On the other hand, adaptive reuse of the bridge might enhance the potential for preservation of the bridge in place. There are no National Register-eligible resources along the other subalternative crossing, which would involve boring beneath the river.

The other subalternative for the Eastern Route of the water-supply pipeline is in the Kykotsmovi area. Two of the Ancestral Pueblo artifact scatters are located along the west Kykotsmovi subalternative. Use of the east Kykotsmovi subalternative alignments would avoid potential impacts on those sites.

Construction of a water-supply pipeline along the eastern alternative alignment could affect numerous archaeological sites and a historical bridge. The projected impacts are rated as moderate.

4.10.1.3.2.2 Traditional Cultural Resources

Seventy-nine traditional cultural resources have been inventoried within areas that could be affected by development of the Eastern Route for the C aquifer water-supply pipeline and associated facilities, and current preliminary designs indicate 21 of those could be adversely affected (Table 4-43). Nineteen of those are significant to the Hopi, and include trails, plant collection areas, fields in the Kykotsmovi vicinity, eagle-collecting areas, ceremonial areas, water resources, and an ancestral village. Potential effects and measures to avoid, reduce, or mitigate adverse effects would be considered pursuant to a Section 106 Programmatic Agreement if the Eastern Route is approved. Two resources of significance to Navajos are burials that may be close enough to the proposed route that they might be disturbed. If those burials could not be avoided, they would be treated pursuant to the NAGPRA and the Navajo Nation Jishchaá policy. Because of the potential to reduce or mitigate adverse effects, the potential impacts are rated as moderate.

4.10.1.3.3 C Aquifer Water-Supply Pipeline: Western Route

4.10.1.3.3.1 Archaeological and Historical Resources

Because the Western Route for the water pipeline is only conceptually defined, the area of potential effects for construction impacts could not be delineated with sufficient detail to warrant intensive field survey to identify archaeological and historical resources along this alternative. A records and literature review identified more than 340 prior studies that had recorded almost 400 archaeological and historical sites within a 1-mile-wide corridor along the Western Route. The review indicated that the Klethla Valley, Long House Valley, and northern Black Mesa, which are crossed by the Western Route, have some of the highest densities of archaeological sites in the region, and have a higher percentage of larger and more complex habitation sites than along the Eastern Route. The Western Route also is more than 30 percent longer than the Eastern Route. Therefore, it is very likely that use of the Western Route would adversely affect considerably more archaeological and historical sites and require substantially more time and funds to mitigate impacts than would use of the proposed route. Because there is good potential for satisfactory mitigation through data recovery, the impacts are rated as moderate.

Table 4-43 Potential Adverse Effects on Traditional Cultural Resources along the C Aquifer Water-Supply Pipeline and Related Facilities: Eastern Route[1]

No.	Resource	Cultural Affiliation	National Register Status[2]	Effects, Recommended Treatment[2]
1	Songòopavi Bearstrap Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
2	Palavayu (Little Colorado River), sacred watercourse	Hopi	Eligible, Criterion A	Crossed, adverse effect, avoid
3	Songòopavi Bear Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
4	Traditional plant collection areas	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
5	Masqötö, spiritual area	Hopi	Eligible, Criterion A	Within 1 mile, adverse effect, avoid
6	Hotvela Sand Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
7	Uyvatuyqa, Kwan Society eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
8	Trail to San Francisco Peaks	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
9	Kiiqö along highway south of Kiqötsmovi	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
10	Farm fields along Oraibi Wash	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
11	Tep'va (Greasewood Spring)	Hopi	Eligible, Criterion A	Crossed, adverse effect, avoid
12	Rabbit Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
13	Traditional trail and wagon road (Route 22)	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
14	Masituyqa	Hopi	Eligible, criteria A, D	Within 1 mile, adverse effect, avoid
15	Na'uyva (Hidden Springs)	Hopi	Eligible, Criterion A	Within 1 mile, potential adverse effect, avoid
16	Tsongongöyakni, smoking circle	Hopi	Eligible, Criteria A, D	Within 1 mile, potential adverse effect, avoid
17	Tuutuskya (offering place) associated with Kiisiwu pilgrimage	Hopi	Eligible, Criteria A, D	Within 1 mile, potential adverse effect, avoid
18	Tuutuskya (offering place) on pilgrimage trail to Kiisiwu	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
19	Young Corn Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
20	Hotvela (Sun Clan) eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, potential adverse effect, avoid
21	Jishchaá, Burial 1	Navajo	Protected by NAGPRA	Possible disturbance, treat pursuant to Navajo Nation Jishchaá policy
22	Jishchaá, Burial 8	Navajo	Protected by NAGPRA	Possible disturbance, treat pursuant to Navajo Nation Jishchaá policy

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post–environmental impact statement preparation of final designs.
[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions. It is recognized that avoidance of some resources, such as linear trails, is impossible, and measures to reduce or mitigate impacts would be implemented in consultation with the appropriate tribe.
NAGPRA = Native America Graves and Repatriation Act, National Register = National Register of Historic Places, No. = number

4.10.1.3.3.2 Traditional Cultural Resources

Records reviews and limited interviewing identified 17 traditional Hopi cultural resources and 12 traditional Navajo cultural resources that could be affected by the Western Route for the C aquifer water-supply pipeline. Twelve of those could be adversely affected (Table 4-44). Eleven of these are significant to the Hopi and include eagle-collecting areas, a trail, and a water source. One historical Navajo burial also might be disturbed. Interviewing local Navajo residents along the route probably would identify numerous other, more specific traditional Navajo cultural resources, such as locations where traditional ceremonies have been conducted, abandoned house sites, remnants of corrals used in hunting game, and other burial locations. Although incomplete, the inventory indicates the impacts are likely to be moderate.

Table 4-44 Potential Adverse Effects on Traditional Cultural Resources along the C Aquifer Water-Supply Pipeline and Related Facilities: Western Route[1]

No.	Resource	Cultural Affiliation	National Register Status[2]	Effects, Recommended Treatment[2]
1	Songòopavi Bearstrap Clan eagle-gathering area[1]	Hopi	Eligible, Criteria A, D	More than 1 mile away, adverse effect, avoid
2	Palavayu (Little Colorado River), sacred watercourse[1]	Hopi	Eligible, Criterion A	Crossed, adverse effect, avoid
3	Songòopavi Bear Clan eagle-gathering area[1]	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
4	Hotvela Sand Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	More than 1 mile away, adverse effect, avoid
5	Orayvi Greasewood Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
6	Salt pilgrimage trail	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
7	Naptsiwtaqa - Hotvela Fire Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Within 1 mile, adverse effect, avoid
8	Hotvela Sun Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
9	Mariiya (Middle Mesa) eagle- and plant-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
10	Kwatupatsa - Hotvela Eagle Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
11	Hotvela Young Corn Clan eagle-gathering area	Hopi	Eligible, Criteria A, D	Crossed, adverse effect, avoid
12	Jishchaá, Burial 1[1]	Navajo	Protected by NAGPRA	Possible disturbance, treat pursuant to Navajo Nation Jishchaá policy

NOTES: [1] The inventory is based on conceptual designs and would be supplemented as needed pursuant to a Section 106 Programmatic Agreement during the post–environmental impact statement preparation of final designs.
[2] Recommendations regarding eligibility, effects, and treatment are indicated; agency consultations are ongoing. Refer to the introduction to Section 3.10 for summary of eligibility criteria or Title 36 Code of Federal Regulations Part 60 for detailed definitions. It is recognized that avoidance of some resources, such as linear trails, is impossible, and measures to reduce or mitigate impacts would be implemented in consultation with the appropriate tribe.
NAGPRA = Native America Graves and Repatriation Act, National Register = National Register of Historic Places, No. = number

4.10.1.4 Continued Use of the N Aquifer

Pumping of groundwater from the N aquifer would continue for well maintenance, and as a backup supply if there were outages in the C-aquifer supply. The expected maximum rate of pumping is no more than about half the current rate. An option for continued complete reliance on the N aquifer also is being considered as an alternative to building a new C aquifer water-supply system. The Hopi consider streams and springs within the area that could be affected by continued pumping of groundwater from the N aquifer to be traditional cultural resources. Hydrogeological modeling indicates that any of these options would result in no measurable reductions in baseflow within those streams and springs, and no adverse effects are anticipated under any N-aquifer pumping scenario.

4.10.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, the 18,857 acres of the Black Mesa operation initial program area would be incorporated into the area permitted for mining. Further mining would not be authorized within the 18,857 acres of the initial program area unless a future permit application is submitted to, and approved by, OSM. However, the coal-slurry pipeline would not be reconstructed and operations would not resume, and the C aquifer water-supply system would not be developed. Impacts of those activities on cultural resources would be avoided. Impacts on cultural resources would be confined to the mining operations areas, and as discussed in Section 3.10, mitigation studies have been completed and requirements of Section 106 of the NHPA have been fulfilled for the entire coal-lease area. In accordance with LOM permit conditions, Peabody would continue to address any cultural resources discoveries, identify and treat human remains, and take into account any sacred and ceremonial sites brought to their attention by local residents, clans, or representatives of the Hopi Tribe or Navajo Nation tribal governments.

4.10.3 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the Kayenta mining operation would continue through 2026 as currently permitted. The impacts on cultural resources would be similar to those of Alternative B, except that further mining would not be authorized within the 18,857 acres of the Black Mesa operation initial program area unless a future permit application is submitted to, and approved by, OSM. That might result in avoiding impacts on approximately 5 unanticipated discoveries of cultural resources, 10 to 15 sacred sites or ceremonial areas, and 25 to 30 burials that may be within 20 to 25 archaeological sites.

4.11 SOCIAL AND ECONOMIC CONDITIONS

This section addresses the social and economic impacts of the Kayenta and Black Mesa mining operations (including ancillary facilities), the coal-slurry pipeline, and the C aquifer water-supply system upon the communities within the region of influence. Many types of historic and current data (presented in Chapter 3) were applied and projected, as appropriate, to quantify the economic impacts on the affected environment.

To estimate impacts of the alternatives on revenue, fluctuations in revenue that occurred in the past were reviewed. The future abilities of the various governmental entities to generate revenue were considered (including various revenue sources and rate-setting opportunities). Judgments about project consequences were made based on those considerations.

4.11.1 Assumptions

Several assumptions were made for the purposes of the impact assessment. These are described below.

There would be no substantial change in mining, construction, or reclamation technology over the LOM operations.

The government legislation and regulations controlling taxation, royalty payments, employment wage rates, and hiring practices generally would remain in effect. There would be neither major changes in the various rates nor changes in the manner in which government agencies receive the revenue. The revenue from water use, however (historically received as water royalties, see Table 3-35), is considered a special case. It is assumed that the revenue from mining-related water use would increase in Alternative A, at least as a result of the increase in water use to 6,000 af/yr. No assumption is made concerning any increase in water revenue that is a result of any other changes in royalties (such as the water royalty rates) or any other water-revenue sources.

For most of the revenue sources, it is assumed the increased revenue to the Navajo Nation and to the Hopi Tribe that is attributable to each mine would be closely related to the increased amount of coal extracted from the mine in any given year. Coal royalties and bonuses paid to the Hopi Tribe and the Navajo Nation are provided in Section 3.11, Table 3-35. Examples are the possessory interest tax, business activity tax, Navajo sales tax, Navajo fuel excise tax, coal royalties, and coal bonuses. It is assumed that the increased water-related revenue in Alternative A would come largely from the Black Mesa mining operation because of the high volume of water use by the coal-slurry pipeline.

The industry multipliers (Section 3.11, Table 3-31) are assumed to remain the same. Those industry multipliers express the relationship between the components of the Black Mesa Project and the regional economy.

Key dates that are part of the LOM permit revision application partly determined the assumed durations of project phases for socioeconomic analysis purposes. The activities that would occur under Alternative A were assumed to be as follows:

- The existing-conditions phase is based on conditions present on January 1, 2006, the first day that Mohave Generating Station was not operating. During the existing-conditions phase, the Kayenta mining operation would continue (with 8.5 million tons of coal production annually), but the Black Mesa mining operation (with 4.8 million tons of coal production annually through 2005) would not. While design, right-of-way acquisition, and other preparations would occur with regard to the coal-slurry pipeline and C aquifer water-supply system, no pipeline construction would occur.
- The construction phase was planned to begin on January 1, 2008, and last for two years (2008 through 2009). Reconstruction of the coal-slurry pipeline and construction of the C aquifer water-supply system would occur. During that phase, the Kayenta mining operation would continue.
- The operations phase would have a duration of 16 years (2010 through mid-2026). Under Alternative A, the Black Mesa mining operation would resume, and both the C aquifer water-supply system and the coal-slurry pipeline would operate. Coal production for the complex would be 14.7 million tons annually (with Black Mesa at an increased production level of 6.2 million tons annually and Kayenta continuing at the 8.5 million ton level). That production level, an increase of 10.5 percent from the 2005 level, would continue through 2026. The Black Mesa Complex would cease mining operations in 2026.
- The reclamation phase for the permitted area would begin in 2026 and continue through 2028.

For Alternative B or C, it is assumed that a steady rate of mining activity would occur at the Kayenta mining operation. Since the production of coal by the Kayenta mining operation would be the same under Alternative A, B, or C, most socioeconomic effects of the Kayenta mining operation alone would be the same under any of the alternatives. Under Alternative B, the Black Mesa operation initial program parts of the mine lease area would be incorporated into the permit area. The Black Mesa mining operation infrastructure (offices, roads, etc.) would be used as necessary by the Kayenta mining operation. Under Alternative C, the initial program area would not be permitted at all, and its reclamation phase, including the Black Mesa mining operation infrastructure, could begin as early as 2007.

4.11.2 Impacts Common to All Alternatives

Peabody provides free wood (a byproduct of grubbing that is often used as firewood), coal, and potable water to residents at two water stands within the lease area. Peabody would continue to provide these items under all alternatives, and there would be no change in these incidental benefits.

4.11.3 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.11.3.1 Black Mesa Complex

Continued operation of the Kayenta mining operation, restoration of the Black Mesa mining operation, increased coal production at the Black Mesa mining operation, and construction and operation of the remaining components of this alternative would result in the following:

- Direct economic effects from employment at the Black Mesa Complex
- Indirect multiplier economic effects on jobs, production, and income
- Direct economic effects from Black Mesa Complex revenue collected by the tribes and state agencies
- Social effects from the changes in the types and intensity of activities in the area, and relocation of households

These effects are discussed below.

4.11.3.1.1 Direct Economic Effects from Employment

If the Black Mesa operations resume, about 350 employees would be required for the Black Mesa mining operation during the operation phase, for a total of about 835 employees at the Black Mesa Complex. This would be an increase of 79 employees over the 2005 levels, to staff the increased coal production. The restored and additional jobs would be at year 2010 wages equivalent to the $40,000 to $62,000 range for mining jobs in 2001. These would be the highest paid private-sector jobs in the Hopi Reservation and the Arizona portion of the Navajo Reservation. This is considered to be a major beneficial effect.

4.11.3.1.2 Indirect Multiplier Economic Effects

Using the mining industry's multiplier effects on the regional economy, there would be beneficial effects of employment and income resulting from the resumed Black Mesa mining operation as follows:

- For the 350 Black Mesa mining operation jobs, about 385 jobs would be created elsewhere in the local or regional economy
- For every dollar paid for the coal, there would be 40 cents paid for goods or services elsewhere in the local or regional economy
- For every dollar of income earned by mine workers, 0.4 dollar of income would be earned by others elsewhere in the local or regional economy

4.11.3.1.3 Direct Economic Revenue Effects

The coal revenue from the Black Mesa Complex to the Hopi Tribe and the Navajo Nation, not including water royalties, would increase about 10.5 percent because of the increase in the amount of coal produced. The annual revenue to the two tribes from coal production would be about $15.5 million for the Hopi Tribe and about $37.9 million for the Navajo Nation. With construction and operation of the C aquifer water-supply system, water royalties would be paid to the Navajo Nation associated with the use of 6,000 af/yr of water from the C aquifer. If the N aquifer would continue to be used, water royalties would increase for the tribes due to increased mining-related water use, from 4,400 af/yr to 6,000 af/yr.

It is anticipated the local area of influence of the Black Mesa Complex, which includes the Hopi village of Moenkopi and 14 Navajo chapters, would continue to be the home of 90 percent of the Black Mesa Complex employees. Beyond the jobs at the Black Mesa Complex, the local area would experience the majority of the additional multiplier effects of the mining industry. Fees associated with Peabody's CAA Title V permit would be a new Navajo Nation revenue source. Authority for the Title V permit program shifted from USEPA to NNEPA in 2004. The NNEPA will carry out the authority for the next renewal of Peabody's five-year permit, with any required revisions. The fee amounts cannot be anticipated at this time.

If the Black Mesa mining operation resumes, the sales tax payments from Peabody to the State of Arizona would likely be restored from the $10.5 million figure expected in 2006 (see Section 3.11.2.4) to amounts at or above the 2005 total ($18.1 million). Peabody does not yet have a projection of its likely property tax amounts for the periods covering the shutdown or the resumption of the Black Mesa mining operation.

There would be short-term economic impacts when mining removes grazing lands. There are 68 homes dispersed throughout the lease area, and some residents are ranchers whose livestock graze on both undisturbed and reclaimed land. The total acreage of grazing lands that are impacted in the Black Mesa Complex is approximately 138 acres, which is approximately 0.2 percent of the lease area (SWCA Environmental Consultants 2005). It is anticipated that ranchers would continue having access to grazing areas, thus yielding negligible economic impacts. Landowners of grazing areas that would be closed due to the project would be fairly compensated for any revenue lost.

4.11.3.1.4 Social Effects

Increasing coal production at the Black Mesa mining operation would result in an increase in disturbances to the nearby residences that could cause increased intrusions to the rural setting and lifestyle within the local area of influence; however, it is expected this increase would not be detectable given the amount of disturbance already ongoing or that occurred on a regular basis prior to 2006.

As noted earlier, 17 residences (households) would need to be relocated out of areas to be mined. The households would have three relocation choices: (1) relocate to a place of their choice on or near their customary use area with which the tribe and Peabody concur (i.e., where future mining would not require another relocation), (2) relocate elsewhere on the reservation away from Black Mesa, or (3) accept cash and relocate on their own. Peabody would pay for relocation (or pay cash) one time.

4.11.3.1.5 Long-Term Effects

Once all mining operations have ceased and all the disturbed areas have been reclaimed, Peabody would release these lands back to the tribes' control. Land reclamation would result in a long-term beneficial economic effect by improving the quality and the quantity of the forage. Research conducted by Peabody for the Kayenta mine in 1997 indicated that revegetated areas, as compared to undisturbed lands, had 4 to 6.5 times as much useable forage in the spring and 3.7 to 25.4 times as much useable forage in the fall (OSM 2005c). Peabody reported that by 2004, 18 families were grazing livestock on 3,700 acres of reclaimed pasture (OSM 2005c).

There would be a permanent loss of mining-related employment, the indirect multiplier economic effects, and coal production-related revenues to the Hopi Tribe, Navajo Nation, applicable counties, and the State of Arizona after mining and reclamation activities have been completed.

4.11.3.1.6 Coal-Washing Facility

Construction of the coal-washing facility would provide several temporary jobs, constituting an employment and income effect upon the local area. Davis-Bacon wages would apply to the project. For equipment operators in heavy construction, the most recent Davis-Bacon wages ranged from $17.00 to $22.00. Median wages for construction laborers in Navajo County in 2003 were about $10.00 for a laborer and $22.00 for a first-line supervisor.

4.11.3.1.7 Coal-Slurry Preparation Plant

Resumption of the Black Mesa mining operation would cause the plant to reopen with approximately the same number of employees (34) as in 2005, which would have a direct beneficial effect.

4.11.3.1.8 Coal-Haul Road

The temporary addition of construction jobs related to the new coal-haul road would provide a direct beneficial effect on the local area over the temporary construction phase. There would be no employment associated with the coal-haul road over the operational phase.

4.11.3.2 Coal-Slurry Pipeline

The socioeconomic effects of the coal-slurry pipeline reconstruction and resumption of operation would be the same regardless of the route selected. That is because the routes are similar enough that the small differences between them would not change the labor pool, taxing authorities, or other population groups or geographic areas that would be affected by the project.

Reconstruction of the coal-slurry pipeline would provide a temporary employment opportunity during the construction phase for individuals throughout the region (primarily those living on the Hopi and Navajo Reservations, and in Flagstaff, Bullhead City, and Laughlin), and especially within the coal-slurry pipeline's local area of influence. This comprises the Navajo Nation chapters of Forest Lake, Coalmine Mesa, and Cameron; two Hopi areas defined by the boundaries of two tribal block groups (areas within census tracts); and the Kingman area, defined by the boundaries of six census tracts. Reconstruction of the pipeline would provide substantial revenue during the construction phase. Sales tax receipts for construction materials, lodging, and fuel would be the largest construction revenue sources. BMPI has not yet been advised by any of the State or local taxing authorities as to the effect of its reconstruction on its future taxes. These impacts are temporary and significant, with economic multipliers for construction wages and local direct spending as discussed above.

Under Alternative A, mining would resume in mid-2009, and 15 to 20 operational employees would be hired to staff the pipeline's booster-pump station locations and BMPI's office in Flagstaff. The jobs would continue through 2026. These impacts are permanent and significant, with economic multipliers for wages and local direct spending as discussed above.

4.11.3.3 Water Supply

4.11.3.3.1 C Aquifer Water-Supply System

4.11.3.3.1.1 Water Withdrawal

The reduction of the use of the N-aquifer wells in the area of the mines would lessen the concern that mining withdrawals would interfere with water use for other purposes. The users include those Hopi and Navajo communities that rely on the public water supply from about 70 municipal wells that tap the N aquifer. The users also include those who use N-aquifer water for grazing and agriculture.

Under the 11,600 af/yr subalternative, 5,600 af/yr of C-aquifer water would be available in 2010 for use by the Hopi Tribe (2,000 af/yr) and the Navajo Nation (3,600 af/yr) to support tribal potential uses such as domestic, municipal, industrial, and commercial uses. The development of the 5,600 af/yr would not be funded by the Black Mesa Project applicants. In addition, under this subalternative, the 6,000 af/yr used for mining and coal slurry would become available for Navajo uses as Kayenta and Black Mesa mining and reclamation operation phases are completed and the water is no longer needed for those purposes. The spur pipeline construction necessary to deliver the water to tribal communities is not considered in this EIS. The communities that would receive the water have not been identified, and the dates when these projects would be undertaken are not known at this time.

It is possible to project how the additional supply of 5,600 af/yr of water could accommodate economic development. The Hopi Tribe has designated the N-aquifer water for nonindustrial use, so the Hopi Tribe looks to the C-aquifer water for industrial and other economic development use. The following are two examples of the employment that could be supported by the 2,000 af/yr supply of C-aquifer water:

- Low water-use businesses (150 gallons of water per employee per day), almost 8,700 employees; or
- High water-use businesses (800 gallons of water per employee per day), more than 1,600 employees

The C-aquifer water supply (2,000 af/yr) could have a major short-term beneficial effect upon economic development efforts for the Hopi Tribe. That beneficial effect would depend on the development of a spur pipeline, which is not analyzed in this EIS.

The Navajo Nation has indicated that the C-aquifer water would be employed for a variety of uses. The employment that could be supported by the 3,600 af/yr supply of C-aquifer water, calculated as for the Hopi Tribe, would be as follows:

- Low water-use businesses (150 gallons of water per employee per day), more than 15,000 employees; or
- High water-use businesses (800 gallons of water per employee per day), nearly 3,000 employees

The C-aquifer water supply (3,600 af/yr) could have a major beneficial effect on economic development and the Navajo Nation's efforts to expand its potable water supply system to outlying communities. That beneficial effect would depend on the development of the spur pipeline, which is not a part of this EIS.

As noted above, under the 11,600 af/yr subalternative, the 6,000 af/yr of water used for mining and coal slurry would become available for Navajo uses as Kayenta and Black Mesa mining and reclamation operation phases are completed and the water is no longer needed for those purposes. The use of this additional 6,000 af/yr could have a major long-term beneficial effect on economic development and household water supply for the Navajo Nation. The advance knowledge that the 6,000 af/yr water supply would later become available would be an additional economic benefit. Proprietors of businesses could first choose to locate where they would be served by the 5,600 af/yr water supply. Once established, they could plan for the availability of the 6,000 af/yr water supply over the long term. Proprietors could, for example, plan for later expansion or for the location of branch operations.

Under the 6,000 af/yr subalternative, it is likely that many of the communities near the water-supply pipeline would not become connected to a central water system, and the C aquifer water-supply system would cease operation at the end of the mining operation and land reclamation of the Black Mesa Project. There are currently no other water-supply plans of nearly the size of the C aquifer water-supply system for the Hopi Reservation or the western Navajo Reservation.

4.11.3.3.1.2 Infrastructure

Construction of the well field, pipeline, and associated facilities would provide temporary employment opportunities in the local area of influence, which would include the Navajo Nation chapters of Leupp, Bird Springs, Tolani Lake (either route), and Coalmine Mesa (Western Route only). Also, construction would provide substantial revenue during the construction phase. Sales tax receipts for construction materials, lodging, and fuel would be the largest construction revenue source.

Operation and maintenance of these facilities would result in long-term employment opportunities. The lease agreements associated with the water-supply system infrastructure would provide for annual payments to the Hopi Tribe and Navajo Nation. The Eastern Route of the C aquifer water-supply pipeline would occupy 54 miles of right-of-way on the Hopi Reservation and 54 miles of right-of-way on the Navajo Reservation. If, instead, the water-supply pipeline were constructed on the Western Route, all 137 miles of right-of-way would be on the Navajo Reservation. The amount of right-of-way related revenue to each tribe would depend upon which route would be selected. Property tax revenue would be distributed to the Coconino County school districts that serve the local area.

An access road related to the pipeline would be constructed between WSP Mileposts 71 and 76, in the Hardrock area. While a paved road within that area would be beneficial, it probably would not be of measurable economic benefit unless it became part of a continuous connection north to U.S. Highway 160. If such a connection were in place, workers could commute to the mining operations and beyond.

The additional electrical infrastructure for the water pipeline also could provide the opportunity to install residential connections along the pipeline in the well-field area. Connections in Kykotsmovi could support the existing electrical system and lessen the potential for outages. A 69kV transmission line with available capacity could be extended into the planned Tawaovi community.

The incidental opportunity by which the project water supply would be available to tribal communities is discussed in Section 4.11.3.3.1.1. Spur pipelines would need to be developed to serve Hopi and Navajo communities. The impact of developing the spur pipelines is not part of the project and, thus, is not considered in this EIS.

4.11.3.3.2 N Aquifer Water-Supply System

Though not preferred or proposed, if the N aquifer water-supply system were used exclusively to supply the mining operations and coal-slurry pipeline, there would be no change in employment associated with operation and maintenance of the water supply. There would be no temporary construction employment and no extended-operations employment effect. There would be concerns about the perceived effects of increased water withdrawals on local water availability for domestic use, grazing, and agriculture.

4.11.4 Alternative B –Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, the 18,857 acres of the initial permit area would be incorporated into the area permitted for mining; however, the unmined coal-resource areas would not be authorized unless a an application is submitted in the future and approved by OSM. The permitted area would continue to supply coal to the Navajo Generating Station at the rate of 8.5 million tons of coal production annually from the present time to 2026. No construction would occur during the years from 2008 to 2009, and no increase in mining would occur from 2010 to 2026. There would be no changes and, therefore, no impacts in the following during the period from 2006 to 2026 for the Kayenta mining operation:

- Employment at the Kayenta mining operation
- Mining industry-related regional multiplier effects upon jobs, production, or income
- Revenue to governmental agencies (other than water use revenue)
- Revenue to the Hopi Tribe and Navajo Nation

Peabody would continue to provide free wood, coal, and potable water to residents, at two water stands within the lease area. Fewer acres would be disturbed at the Black Mesa Complex, so less land would be affected that is important to grazing or to traditional economic activities such as materials gathering for food, clothing, shelter, or crafts. With fewer acres disturbed and then reclaimed, grazing activities would not be interrupted. On the other hand, there would be fewer acres where reclamation would improve forage yields.

As noted earlier, five residences (households) would need to be relocated out of areas to be mined. The households would have three relocation choices: (1) relocate to a place of their choice on or near their customary use area with which the tribe and Peabody concur (i.e., where future mining would not require another relocation), (2) relocate elsewhere on the reservation off of Black Mesa, or (3) accept cash and relocate on their own. Peabody would pay for relocation (or pay cash) one time.

4.11.5 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the Kayenta mining operation would continue through 2026 as currently permitted. The impacts on social and economic conditions would be similar to those of Alternative B, except that further mining would not be authorized within the 18,857 acres of the initial program area of the Black Mesa Complex. In addition to a reduction in the total number of acres disturbed, as in Alternative B, no acres in the initial program area, specifically, would be disturbed and there would be no project-related impact on any lands important to the traditional economy.

As noted earlier, five residences (households) would need to be relocated out of areas to be mined. The households would have three relocation choices: (1) relocate to a place of their choice on or near their customary use area with which the tribe and Peabody concur (i.e., where future mining would not require another relocation), (2) relocate elsewhere on the reservation off of Black Mesa, or (3) accept cash and relocate on their own. Peabody would pay for relocation (or pay cash) one time.

4.12 ENVIRONMENTAL JUSTICE

The reservations in the project area are both minority and low-income areas. The counties most affected by the project—Navajo, Coconino, and Apache—have higher proportions of poverty populations than does the State of Arizona. Four Kingman-area census tracts within the project area also have a higher proportion of those living in poverty than in Mohave County overall.

The economies of minority and low-income communities are often less resilient than the economies of other communities. These populations generally are dependent upon their surrounding environment (e.g., subsistence living), more susceptible to pollution and environmental degradation (e.g., reduced access to health care), and often less mobile or transient than other populations (e.g., unable to relocate to avoid potential impacts). Adverse social and economic effects within these populations are often more intense.

4.12.1 Assumptions

American Indian environmental justice populations on or near reservations are the majority population because the reservations are tribal homelands. No specific assumptions are made about long-term regional income levels, but a high proportion of the population is in poverty now, and historically, very few areas have emerged rapidly from poverty. Poverty has persisted for decades on the reservations and in Apache and Navajo counties overall. It is assumed that for at least two decades much of the region would have a higher proportion of persons in poverty than would Arizona, Nevada, or the United States.

The poverty level was defined in 2003 Census Series P-60, Income and Poverty, as a money income threshold of $9,573 for a one-person household (under 65 years of age) through a figure of $18,660 for a four-person family with two related children under 18 years of age, to a figure of $35,572 for a family of nine or more persons with eight related children under 18 years of age. The report's geographic breakdown of proportions of persons in poverty goes only to a statewide level. The total percentage of people in poverty in Arizona is listed in the report as 13.9 percent for Arizona and 9.0 percent for Nevada. Meanwhile, the percent of persons in poverty in the year 2000 (latest available figures) for the Hopi reservation was 38.9 percent, and for the Navajo reservation was 41.9 percent.

In implementing the project, all applicable Hopi Tribe and/or Navajo Nation requirements, as applicable, would be met with regard to hiring preferences and with regard to business entities' procurements of materials or services.

All economic effects (including employment, revenue, and economic development) addressed in the social and economic conditions section, also apply to the environmental justice population. Two additional types of effects are discussed in this section—additional economic effects on low-income and minority areas and cultural effects upon the American Indian population. In every case, the bulk of both the beneficial effects and the adverse effects would apply to the environmental justice population.

4.12.2 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.12.2.1 Economy (Employment, Incomes, and Fiscal Conditions)

A great majority of the jobs at and related to the mines are held by American Indians. In addition, the Kayenta community, which has an economy driven by the mines, and the entire local area of 14 Navajo chapters and the Hopi village of Moenkopi are American Indian communities. Directly or indirectly, the mines provide the bulk of the higher-paid jobs in this low-income local area. The temporary construction jobs for facilities at the mines also would represent highly paid jobs in the area.

The governments that are recipients of many of the revenues from the mines are American Indian tribal governments. The communities that might have access to a new water supply that could support economic development efforts are American Indian communities. While the Kayenta school district that most benefits from mining tax revenue is an Arizona public school district, a majority of the students and employees of the district are American Indian.

The hiring of labor for the construction of the project would comply with Navajo Employment Preference and Federal equal employment opportunity requirements. The Navajo Employment Preference is applied to registered individuals in the Navajo Nation, some of whom live in their home chapters. If an individual is a registered member and has the educational background and necessary experience that match the job requirements, he/she will receive preference for that particular job.

The Navajo Business Preference Act, which recommends selecting suppliers from the Certified Navajo Businesses list (Navajo Nation 2006) would be followed for the hiring of businesses to support the project. To fulfill any particular construction need, the Certified Navajo Businesses list would be considered first. Local qualified disadvantaged business enterprises (DBE), minority business enterprises (MBE) and women-owned business enterprises (WBE) also would be sought to meet appropriate project support needs. Various government agencies keep registries of qualified MBE/DBE/WBE program(s). Those who seek to hire a business may consult a number of published registries.

Some local businesses employ union labor, so some of the construction workforce could be union labor. Some of the Certified Navajo Businesses employ union labor. The Navajo Employment Preference in hiring would be applied to job applicants who are Navajo chapter members, whether living on the Navajo Reservation or outside the Navajo Reservation. Minority persons, whether American Indian or Hispanic or of another race, also would be affirmatively recruited.

The workforce that would construct the coal-washing facility and coal-haul road would include mostly American Indians. The wages would be as indicated in Section 4.11.3 and would be higher than the wages typical for the area. The coal-washing facility would be operated by mine employees; therefore, the employment effects from operation of the facility would be similar to or the same as for the mines.

It is assumed that approximately 50 percent of the coal-slurry pipeline reconstruction workforce would be members of the Hopi Tribe and Navajo Nation. Though temporary, such employment opportunities provide wages that would be higher than typical for the area. American Indians also would experience the bulk of the other employment and revenue effects of the coal-slurry pipeline.

For the infrastructure at the C aquifer water-supply system, it is assumed that approximately 50 percent of the construction workforce would be a member of the Hopi Tribe or Navajo Nation. Though temporary, such employment opportunities provide wages that would be higher than typical for the area. A permanent access road would be built from WSP Mileposts 71 to 76. If, with other nonproject road construction, it were extended north from Arizona State Route 264 (adjacent to the pipeline) to the mines, developing the route would improve the transportation network for Hopi and Navajo residents, especially the Hopi villages and the Navajo chapters of Forest Lake and Hard Rock. Such a road would provide improved access to jobs, health care, schools, and other facilities.

There would be 15 jobs to maintain the pipeline and operate the pumping stations. The new electrical transmission infrastructure and any water-distribution system built from the water-supply pipeline could bring power and water to some of the lowest-income Hopi and Navajo areas.

4.12.2.1.1 Land Use

Under Alternative A, 17 Navajo households currently located on land that is permitted for mining would be relocated. Peabody would attempt to relocate these families within the residents' customary use areas (i.e., where ranching activities take place or where sociocultural ties exist). This relocation would include providing new houses, areas for family garden plots, and livestock grazing areas. These families would be able to return to their original home sites after reclamation is considered completed and the land is returned to tribal control after 20 to 25 years. The mined area would be reclaimed with the goal of increasing its grazing productivity.

4.12.2.1.2 Human Health

Generally, air quality is in compliance with the NAAQS. However, PM (e.g., fugitive dust from the mining operations) is the air pollutant that remains a concern of residents in the immediate vicinity of the Black Mesa Complex. This alternative would meet all NAAQS standards. Impacts on air quality in the local area are described in Section 4.6 and impacts on human health are described in Section 4.6.6. Communities near the Black Mesa Complex do not appear to have greater susceptibility to asthma than the greater population. It is also important to note that while there are health concerns related to respiratory diseases in the local population, data that are specific to tribal populations are unavailable and potential impacts cannot be quantified.

To mitigate potential impacts, the Black Mesa Complex has an extensive dust-control program (Section 4.6.5).

The households that would experience the effects of mining on grazing lands are American Indian households. Health and safety effects of continued mining operations would affect largely minority and low-income populations. The required adherence to various occupational health and safety regulations would include the continuation of onsite occupational health-treatment facilities.

4.12.2.1.3 Water Resources

The population directly affected by and concerned about the effects of water withdrawals upon the continuing availability of local water for grazing and agriculture is almost entirely an American Indian population.

The 11,600 af/yr pumping subalternative of the C aquifer water-supply system represents a capacity of 6,000 af/yr of water for project-related purposes (mining and coal slurry) and an opportunity to realize an additional 5,600 af/yr for tribal use. Under this subalternative, at the end of the LOM, the 6,000 af/yr also would become available for Navajo tribal use. Long-term community and economic development for the Hopi and Navajo environmental justice populations would be enhanced by the availability of the water. Under the 6,000 af/yr subalternative, the C aquifer water-supply system would cease operation when it is no longer needed for mine-related purposes. The reduction in use of the N-aquifer wells by the Black Mesa Complex would lessen the concern that N-aquifer mining-related withdrawals would interfere with water use for grazing, agriculture, and domestic wells, and would address the stated concerns of traditional tribal members with the use of the N aquifer.

Though not preferred or proposed, if the N aquifer were used as the sole water supply, the continuing and increased use of the N-aquifer wells by the Black Mesa Complex would result in continued concern that withdrawing water from the N aquifer for mine-related purposes would interfere with water use for grazing, agriculture, and domestic wells. Almost all the use of the N aquifer other than by the Black Mesa Complex is by the American Indian population.

4.12.3 Alternative B – Approval of the LOM Revision (Preferred Alternative)

4.12.3.1 Economy (Employment, Incomes, and Fiscal Conditions)

The 18,857 additional acres would be incorporated into the area permitted for mining. Section 4.11.4.1 indicates the lack of several short-term social and economic benefits under Alternative B, compared to Alternative A. The local area that would experience the lack of benefits would be the American Indian community.

If Alternative B were chosen, there would be no reconstruction and operation of the coal-slurry pipeline and no new water-supply system, so short-term construction-related economic benefits would not be realized by the American Indian communities. Similarly, the long-term benefits associated with restarting and increasing coal production also would not be realized. Furthermore, the incidental opportunity to deliver water for domestic, municipal, industrial, and commercial uses to American Indian communities along the pipeline also would not be realized as a result of this project.

4.12.3.1.1 Land Use

The types of effects of Alternative B would be the same as those described for the Black Mesa Complex under Alternative A. However, under Alternative B, five households would need to be relocated out of the areas to be mined (12 fewer households than under Alternative A).

4.12.3.1.2 Human Health

There are no emission increases associated with Alternative B; thus, concentrations of criteria pollutants would be below the NAAQS standards.

4.12.3.1.3 Water Resources

Surface-water and groundwater impacts due to mining under Alternative B would be similar, but reduced in area from those described in Alternative A for the Black Mesa Complex. Effects on the hydrologic regime are controlled by the regulatory requirements of SMCRA and OSM's application of them. There would be no impacts on the C aquifer water-supply system under the preferred alternative, as it would not be constructed under this alternative. Impacts on the N aquifer are considered negligible, as there would be less N-aquifer pumpage than in the past. Impacts on water resources are described in Section 4.4.2.

4.12.4 Alternative C – Disapproval of the LOM Revision (No Action)

Impacts from Alternative C would be similar to those of Alternative B. The Black Mesa mining operation would not resume, and the mined areas of the Black Mesa mining operation would be reclaimed. Mine reclamation would occur sooner in the Black Mesa mining operation area than would be the case under Alternative A. With the absence of mining activities on the lands of the initial program area, the tribal people would cease to be affected by such things as mining traffic and noise from that area of the Black Mesa Complex. Mining would cease to interfere with the availability of plants used for medicinal, ceremonial, and household needs, and the reliance on firewood from the piñon/juniper woodland would be reduced. Over the long term, since fewer lands would be mined and reclaimed, less land would ultimately have improved productivity for grazing. Revenues related to coal production paid to both tribes would cease earlier than under either of the other two alternatives, eliminating substantial resources and programs that assist environmental justice populations in the regional and local area of influence.

For water resources, there would be no impacts associated with the C aquifer water-supply system, as it would not be constructed under this alternative. Impacts on N-aquifer water use would be the same as those under Alternative B.

4.13 INDIAN TRUST ASSETS

This section discusses the Indian trust assets that would be affected or consumed as a result of the proposed actions under each of the alternatives.

All the coal that would be mined at the Black Mesa Complex is an Indian trust asset. The affected lands that are Indian trust assets comprise land on the Hopi and Navajo reservations that would be a part of the project, including the land surface where coal mining would occur, the lands occupied by rights-of-way and easements related to mining, the coal-slurry pipeline, the C-aquifer well field, and the water-supply pipeline (Alternative A only). The water that would be affected includes the water that would continue to be withdrawn from the N aquifer and, in Alternative A, the water that would be withdrawn from the C aquifer. The amounts of Indian trust assets affected by the project would vary by alternative.

The trust responsibilities of the United States that are pertinent to the project, as described in Section 3.13, would be carried out throughout the life of the project. While Peabody's coal leases described in Section 3.13 are not components of the Black Mesa Project, any renegotiation of the leases that would occur over the duration of the project would be subject to the approval of BIA.

4.13.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

Several of the agreements that commit Indian trust assets to the project are continuing agreements. The Navajo Nation Council has supported the use of Indian trust assets for the Black Mesa Project when it has approved the coal-mining leases, coal-slurry preparation plant lease, and right-of-way permits for the project. The Hopi Tribe has supported the use of Indian trust assets for the Black Mesa Project when it has approved the coal-mining lease and rights-of-way for the project.

The amount of coal to be mined by the Black Mesa mining operation under Alternative A would increase from 4.8 million tons per year to 6.2 million tons per year. The approval of that increase would be a part of the approval of the LOM revision by OSM. Annual coal production at the Kayenta mining operation would not change from the current 8.5 million tons per year.

The land surface in the lease area would be disturbed by the mining operations and then would be reclaimed for grazing and other uses, restoring the land and vegetative asset to higher forage productivity than existed prior to mining.

Black Mesa Project facilities would occupy land subject to the following new agreements under the agencies' preferred routing alternatives and any subalternatives:

- A right-of-way permit for the 127 acres of the coal-haul road corridor, between Peabody and the Hopi Tribe, subject to approval by BIA and the tribe
- Permits (permanent right-of-way) and easements for the coal-slurry pipeline, including portions of the existing route and some additional acreage, between the BMPI and the Hopi Tribe and the Navajo Nation, subject to approval by BIA and the tribes
- Permits (permanent right-of-way) and easements for the water-supply system components, between the system's owner and the tribes, and also subject to approval by BIA. Under the 11,600 af/yr subalternative, the Navajo Nation would issue right-of-way permits for approximately 83 total acres for the well field. Hart Ranch, which is owned by the Hopi Tribe, but which is not tribal trust land, would be the location of four wells. All the 639 acres of permanent right-of-way for the water-supply pipeline, roads, power lines, and pump stations would be on tribal trust land, much of it on the Hopi and Navajo reservations. There is not yet enough information on the locations of all the facilities to estimate the proportion of right-of-way that would be on each reservation. Under the 6,000 af/yr subalternative, less acreage would be needed for the well field, and no wells would be located on the Hart Ranch.

The western water-supply pipeline route subalternative would be entirely on the Navajo Nation and the water-supply system right-of-way agreements would be between the system's owner and the Navajo Nation only. Acres of temporary and permanent right-of-way are summarized for each reservation in Table 4-45.

Table 4-45 Acres of Right-of-Way per Reservation

	Hopi Reservation		Navajo Reservation	
Right-of Way	**Length (miles)**	**Acres**	**Length (miles)**	**Acres**
Coal-Slurry Pipeline				
Temporary right-of-way[1]	35	275.8	61	480.6
Permanent right-of-way[2]		212.1		369.7
C Aquifer Water-Supply Pipeline – Eastern Route				
Temporary right-of-way[1]	54	425.5	54	425.5
Permanent right-of-way[2]		327.3		327.3
C Aquifer Water-Supply Pipeline – Western Route				
Temporary right-of-way[1]	0	0	137	1,079.4
Permanent right-of-way[2]		0		830.3
Totals				
Temporary right-of-way[1]		701.3[3]		906.1[4] 1,560.0[5]
Permanent right-of-way[2]		539.4[3]		697.0[4] 1,100.0[5]

NOTES: [1] Temporary right-of-way is 65 feet wide.
[2] Permanent right-of-way is 50 feet wide.
[3] Only the C aquifer water-supply pipeline Eastern Route would cross the Hopi Reservation.
[4] Total acres coal-slurry pipeline plus C aquifer water-supply pipeline's Eastern Route
[5] Total acres coal-slurry pipeline plus C aquifer water-supply pipeline's Western Route

The C-aquifer water withdrawal would be up to 6,000 af/yr for project-related use and 11,600 af/yr for project-related use and tribal use. The Navajo Nation would receive royalties from the system's owner for the use of 6,000 af/yr of project-related water during the LOM.

Under the 11,600 af/yr subalternative, the Hopi Tribe and Navajo Nation would have an option to pay the incremental costs of increasing water production from the C aquifer and increasing the size of the water-supply pipeline in anticipation of the potential future use of the system for tribal purposes. During the life of the project, the 5,600 af/yr increment above the water needed for project-related purposes would be available for Hopi (2,000 af/yr) and Navajo (3,600 af/yr) tribal use. When the 6,000 af/yr is no longer needed for the project, it would be used by the Navajo Nation, if the appropriate infrastructure is constructed.

This study assumes that pumping the C aquifer water up to 11,600 af/yr would continue for the estimated 50-year life of the pipeline (until 2060). The impacts on the water resource of a C aquifer water-supply system are stated in this EIS.

Spur pipelines would need to be constructed to deliver any of this water to Hopi and Navajo communities; the impact of developing spur pipelines is not considered in this EIS. Any future Federal actions on such spur pipelines would be subject to NEPA analysis at the time of plan development.

Under any of the C aquifer water-supply system options, there would also be project-related supplemental use of N aquifer water. The amount of N aquifer water pumped would be reduced from the current (prior to 2006) rates.

There is also an alternative whereby the C aquifer water-supply system would not be built and the N aquifer would supply up to 6,000 af/yr for the project. The impacts on the water resource of increasing N aquifer use are stated in this EIS. Under this alternative, the reason for the administrative delay of OSM's permanent Indian Lands Program permitting decision would not be resolved. The delay of permitting decisions for the Black Mesa mining operation and Black Mesa coal-slurry preparation plant stemmed from the concerns of the Hopi Tribe and Navajo Nation regarding use of N-aquifer water for the coal slurry and mine-related purposes.

4.13.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Mining would not resume at the Black Mesa mining operation and annual coal production at the Kayenta mining operation would not change from the current 8.5 million tons per year.

Areas previously disturbed by the Black Mesa mining operation and unmined coal-resource areas would be incorporated into the permanent program permit area for the Black Mesa Complex. However, Peabody would not be authorized to mine these areas unless a future application is submitted to, and approved by, BLM and OSM. If no new resource areas were approved for mining, the only land surface disturbances in the part of the lease area occupied by the Black Mesa mining operation would be in those particular coal-resource areas that have been previously disturbed in part. Surface facilities in the Black Mesa operation initial program area that had previously been shared by the Black Mesa and Kayenta mine operations would continue to be used as needed for the Kayenta mining operation.

Neither the coal-slurry pipeline nor the C aquifer water-supply system would be constructed under Alternative B, so their impacts on the Indian trust assets of land and water would not occur.

Therefore, compared to Alternative A, a smaller portion of the coal resources Indian trust assets would be consumed through the LOM operations (after 2026), and there would be less disruption of grazing and traditional uses on the land. N-aquifer water in amounts averaging 1,236 af/yr would be used from 2008 to 2025.

4.13.3 Alternative C – Disapproval of the LOM Revision (No Action)

Mining would not resume at the Black Mesa mining operation and annual coal production at the Kayenta mining operation would not change from the current 8.5 million tons per year.

No areas previously disturbed by the Black Mesa mining operation would be incorporated into the expanded permit area for the Black Mesa Complex.

Neither the coal-slurry pipeline nor the C aquifer water-supply system would be constructed under Alternative B, so their impacts on the Indian trust assets of land and water would not occur.

Therefore, compared to Alternative A, a smaller portion of the coal resources Indian trust assets would be consumed through the LOM operations (by 2026). There would be less disruption of grazing and traditional uses on the land, and less land surface would be used for project purposes in general than under Alternative A or B. N-aquifer water in amounts averaging 1,236 af/yr would be used from 2008 to 2025.

4.14 NOISE AND VIBRATION

The study area is generally very rural and sparsely populated or uninhabited; however, homes are present in areas, some located within 250 feet of project facilities. Homes, schools, churches, and medical facilities are considered sensitive receptors for noise and vibration. Ambient noise levels throughout much of the rural study area are estimated to be less than 50 dBA during daytime hours and 30 dBA during the nighttime hours. This is consistent with OSM's 1990 EIS, which predicted sound levels ranging from 15 to 52 dBA for the evening hours, from 13 to 56 dBA for morning hours, and an L_{dn} ranging from 33 to 43 dBA. This noise environment would be characterized as "comfortable" to "quiet" (refer to Table 3-46).

The region of influence is the geographic area that could potentially be affected by changes in noise or vibration levels due to this project. The region of influence varies for different project components. For example, the region of influence for blasting at the mines would extend up to several miles from the source. The region of influence for less intensive noise and vibration sources, such as coal-slurry-pipeline and water-supply-pipeline booster pumps or truck traffic, would be a few hundred feet or less. Noise impacts occur only where there are people or, in some cases, animals (noise-sensitive receptors); therefore, the region of influence for noise impacts is directly related to the location of the receptors.

4.14.1 Noise

The main issue regarding noise is the extent to which a change in environmental noise over existing conditions would be perceived by sensitive receptors. No noise monitoring or modeling was conducted for this study. The level of noise impacts was determined by considering the baseline noise levels within an area (whether the area was generally quiet or noisy) and then what increase (or decrease) the proposed action would be expected to produce to these baseline noise levels.

Most noise impacts would last only through the LOM and subsequent reclamation periods (through 2029). The exceptions are noise impacts associated with the life of the water-supply pipeline. The 11,600 af/yr pumping alternative would last for at least 50 years for Hopi and Navajo use—beyond the duration of mining.

4.14.2 Vibration

Vibration impacts were determined by using the Blasting Guidance Manual, which was developed by OSM to prevent injury and damage to public and private property outside the mine permit area. To verify compliance with the Blasting Guidance Manual and the vibration standards within the manual, a continuous ground-vibration- and air-overpressure-monitoring program is required. OSM requires that airblast levels be limited to a maximum of 134 dB (peak); therefore, airblast levels exceeding this would be considered major impacts. Ground vibrations cannot exceed peak particle velocity of 1.25 inches per second at a distance of 300 feet or 0.75 inches per second at 5,000 feet (Rosenthal and Morlock 1987). Measurements in excess of these limits would be major impacts. Vibration and airblast levels below the listed values are not considered capable of producing injury or property damage, but may cause annoyance and would, therefore, be considered moderate to minor impacts depending on distance to the receptor.

4.14.3 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.14.3.1 Black Mesa Complex

4.14.3.1.1 Noise

Under Alternative A, mining operations would extend through 2026. When the Black Mesa mining operation resumes in mid-2009, coal production at the Black Mesa Complex would be at a level of 14.7 million tons annually, an increase of 10.5 percent from the 2005 level. The increased production would cause an associated increase in blasting and in truck transport of the mined materials within the Black Mesa Complex.

Noise sources include blasting and associated noise, and coal transport by trucks and by the Black Mesa and Lake Powell Railroad. Postmining reclamation activities would require vehicular and equipment use for earthmoving and planting, producing minor to moderate noise impacts.

As mining operations expand, more residences become exposed to the noise and vibration of blasting operations. To comply with 30 CFR 816.61(d), Peabody relocates persons living within 3,000 feet of blasting operations as a mitigation measure. According to the mining plan under this alternative, an additional 17 relocations are planned through 2026 to move residents impacted by blasting yet within their customary use areas inside the Black Mesa Complex boundary (Wendt 2005).

Some residents within the Black Mesa Complex who live near transportation routes and within range of blasting warning signals would experience slight increases in noise. The increase in coal production would engender a corresponding increase in transport-truck activity, but effects would be minor—a 10.5 percent increase in truck activity would cause less than a 3 dBA change. The combined increase in blasting signals, blasting, and truck activity is estimated to increase noise levels by about 1 to 2 dBA in locations that are considered quiet, a minor to negligible impact, since a change of 3 dBA is considered the limit of detection for the average human ear. The number of warning and all-clear signals produced at blasting sites by a audible-speaker warning device of 100 watts or greater —audible at 0.5 mile—also would increase.

Construction of the coal-washing facility would have a short-term effect on the closest sensitive receptors (within the Black Mesa Complex). Operation of the facility would contribute only negligible noise increases because the operations would be enclosed in buildings.

Resumed operation of the coal-slurry preparation plant would return daytime noise levels at receptors to approximately 45 to 55 dBA. Increasing coal production and shipment by 30 percent would negligibly increase noise above these levels because most of the increased machinery noise would be contained within enclosed buildings.

The coal-haul road would pass within approximately 250 feet of one residence. Haul trucks may produce a sound level in excess of 80 dBA at this distance from the receptor (see Section 3.14.1).

In 2026, transport truck traffic would decline to only that necessary for reclamation and the coal-slurry preparation plant would cease operation, as would the Black Mesa and Lake Powell Railroad. Residents near the railroad would experience a cessation in noise from railroad operations. With the elimination of coal-transport trucks and the railroad, noise levels at many residences would decrease by 10 to 15 dBA in some areas—a long-term reduction in noise levels.

4.14.3.1.2 Vibration

Blasting must abide by limits for overpeak sound-pressure levels set forth in 30 CFR 816.67. Peabody has conducted a continuous airblast-monitoring program since 1994, using six permanent recording locations and portable instrumentation. The locations and monitoring thresholds of these monitoring stations were determined in consultation with OSM. Since monitoring began, air overpressure levels have remained below the 134 dB standard. Monitoring for vibration impacts would continue under this alternative. Vibration impacts over the LOM are expected to be similar to those experienced today (within regulatory requirements) and would be short term.

Blasting would cease with the end of mining operations, resulting in long-term beneficial effects to the nearest receptors.

4.14.3.2 Coal-Slurry Pipeline

4.14.3.2.1 Coal-Slurry Pipeline: Existing Route

The primary noise sources associated with the coal-slurry pipeline are the booster-pump stations. The sound of the pumps is muffled by the surrounding steel-sided building. Pump-station operations would not change upon the resumption of pipeline operation. Alternative A would neither require larger capacity pumps at the existing booster-pump stations nor an increase in the number of pump stations. Therefore, there would be no noise impacts on residences along the pipeline route. Temporary noise impacts from reconstruction and installation of the pipeline may be moderate but would be very short term. Residences are located at a distance where impacts from vibration would be negligible to none.

4.14.3.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

The coal-slurry pipeline realignments would require no change in pump-station operation; consequently, there would be no long-term noise impacts in the vicinities of the alternative realignments. During reconstruction of the pipeline, residential noise and vibration impacts would be of the same magnitude as for the existing alignment alternative.

4.14.3.3 Water-Supply

4.14.3.3.1 C Aquifer Water-Supply System

4.14.3.3.1.1 Infrastructure

4.14.3.3.1.1.1 <u>Well Field</u>

Residences within the well-field area near the community of Leupp and the BNSF are the noise receptors of most concern regarding exposure to additional noise sources from the proposed project, as they are already exposed to relatively high levels of traffic noise (approximately 70 dBA L_{dn} and 75 dBA L_{dn}, respectively). Even with this contextual consideration, all noise impacts from the well field would be negligible to minor under Alternative A.

During the construction phase, drilling and installation of the wells and construction of the associated pipelines, transmission lines, and other structures would produce short-term noise impacts. These impacts would be similar to, and within levels considered acceptable for, new housing construction (refer to Section 3.14). During the operational phase, the well pumps would be submerged and would generate barely audible noise to nearby residences. (Precise locations for wells are unknown at this time.) Under Alternative A, this negligible increase in noise would exist throughout the LOM operations. Under the 11,600 af/yr alternative, the wells would be in use by Hopi and Navajo communities for at least 50 years, so impacts are considered long-term.

Residences in the vicinity are far enough away from the proposed construction areas that the temporary (short-term) vibration impacts would be negligible.

4.14.3.3.1.1.2 C Aquifer Water-Supply Pipeline

The Eastern Route would require two pump stations, new 69kV power lines, and access roads. The pumps would be housed within structures, mitigating any external noise. The pump stations would be located no closer than 0.25 mile to the nearest residences and would be barely audible if at all. Occurrence of noise produced by 69kV power lines is generally limited to periods of inclement weather, and dissipates quickly beyond the right-of-way line. Access roads would be used only for inspection and maintenance activities. Sporadic maintenance traffic would generate minor impacts (less than 1 dB difference). There are residential areas along most of the alignment, and two schools and a church in the Kykotsmovi area. Some areas already experience relatively high noise levels where there are traffic and industrial uses within 0.5 mile (65 dBA). Even with these contextual considerations, all impacts of the pipeline and existing noise sources taken together would be minor.

Construction of all facilities would produce temporary, minor increases in noise levels within their respective vicinities. Blasting to remove rock could occasionally be required during construction of the pipeline. Blasting would be conducted following a plan in accordance with construction activity regulations. For some nearby receptors the blasting would be very loud and would cause vibration effects, but would be within regulatory limits used in devising the plan. Blasting would be minimized by limiting it to those situations where there is no alternative.

Noise related to operation of the Western Route of the water-supply pipeline would be the same as that for the Eastern Route. Construction effects from blasting under this alternative would be the same as those described for the western alternative. There are fewer residential locations along this route.

4.14.4 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, the Kayenta mining operation would continue at current levels. The initial program area would be incorporated into the area permitted for mining. The related noise impacts would be caused by a smaller number (but the same type) of blasting events, the smaller volume of truck and rail traffic, and the smaller volume of postmining reclamation activity as those under Alternative A for the Black Mesa Complex. Short-term reclamation activities would occur in the former Black Mesa mining operation area.

4.14.5 Alternative C – Disapproval of the LOM Revision (No Action)

Under Alternative C, the Kayenta mining operation would continue through 2026 as currently permitted. Noise impacts would be similar to those of Alternative B. Short-term reclamation activities would occur in the former Black Mesa mining operation area.

4.15 VISUAL RESOURCES

Criteria used to determine project impacts on visual resources were adapted from BLM and Forest Service methodologies (BLM Manual Handbook 8431 and the Forest Service's Scenery Management Systems Manual (Forest Service 1995) and professional judgment. Criteria used to assess the magnitude of impacts were derived from BLM Manual Sections 8400 and 8431 (Visual Resource Inventory and Visual Contrast Rating [BLM 1986], respectively), which establish the methodology to measure potential impacts on visual resources based on visual contrast. For this project, visual contrast is a measure of the degree of perceived change that would occur in the landscape due to the construction, operation, and reclamation of the project components. Contrast due to modification of landforms, destruction or disturbance of vegetation, and introduction of structures into the landscape were evaluated separately, and then together, to determine the overall visual contrast. Contrast types are described in Table 4-46.

For the purposes of this analysis, impacts would result from substantial degradation of the character or scenic quality of a landscape, where the form, line, color, and texture qualities that make it unique or identifiable, or that establish a "sense of place," are interfered with, or substantial visual changes are introduced into the landscape that would be seen from highly sensitive viewpoints (e.g., residences, recreation areas, and scenic roads). This could include partial or full blockage of scenic viewsheds (e.g., mountains, mesas, ridgelines, and riparian corridors) where views are currently unobstructed.

Two types of impacts were evaluated—impacts on general scenic quality and impacts on views as related to specific viewers. Impacts on views were determined by identifying viewer sensitivity. For example, high-sensitivity viewers include residents, recreationists, and recreational destination travelers, and moderate-sensitivity viewers included viewers in commercial settings, and travelers along roads within the project area. Impacts on high- to moderate-sensitivity viewers were determined by consideration of existing scenic quality, project-introduced visual contrast, and distance zones.

Table 4-46 Contrast Types Defined

Contrast Type	Definition
Landform contrast	Landform contrast is the change in landform patterns caused by exposure of soils, disturbance to natural contours and/or geologic formations, and other noticeable modifications uncharacteristic to the natural landscape.
Vegetation contrast	Vegetation contrast is established by examining the diversity and complexity of existing vegetation and determining to what degree vegetation would be disturbed to construct roads, maintain right-of-way, and locate new project facilities. Typically, the more diverse and dense the vegetation the higher the contrast level. The removal of vegetation in a vacant/undeveloped area can create a distinct line, which inherently draws viewer attention to the modification.
Structure contrast	Structure contrast is the change by which proposed project facilities would differ from the surrounding landscape character. The introduction of new or modified structures into the existing landscape would create visual changes; however, these changes may not be as noticeable in a previously disturbed setting with the same or similar structures (e.g., replacing the existing coal-slurry pipeline in the same corridor). The most substantial structural contrasts would result from the introduction of new facilities into an undisturbed setting. Adjacent development, including power lines, roads, pipelines, or other utility facilities, reduces the degree of structural contrast. Typically, the construction of project facilities is less noticeable in industrial settings or in areas where other features dominate the setting.

Contrast Type	Definition
Visual contrast	Visual contrast is derived from a combined analysis of landform, vegetation, and structure contrast. Visual contrast is a measure of the degree of perceived change that would occur in the landscape due to the construction and operation of the project. Visual contrast typically results from (1) landform modifications that are necessary to upgrade and construct new access roads, (2) removal of vegetation to construct roads and maintain right-of-way, and (3) introduction of new structures in the landscape.

For the analysis, it was assumed that the 69kV power lines would be sited in the same right-of-way as the collector pipelines in the well field and in the same right-of-way as the proposed water-supply pipeline (with the exception of Kykotsmovi, where the 69kV power line could be located east of the town). Also, it was assumed that no new aboveground structures (i.e., power lines, pump stations, or water-storage tanks) would be required along the coal-slurry pipeline or alternative realignments.

Within the study area, proposed aboveground facilities (e.g., water-storage tank, pump station, power lines) would be constructed in different landscapes and could be seen by several types of viewers. Six simulations of these project facilities were created from selected viewpoints in order to evaluate potential typical viewing conditions. These six simulations are listed below and discussed in Appendix J.

- Simulation 1 – well collection field – proposed water storage tank
- Simulation 2 – proposed pump station(s) Milepost 30
- Simulation 3 – proposed pump station Milepost 73
- Simulation 4 – 69kV power line along Indian Route 2
- Simulation 5 – 69kV power line near Kykotsmovi
- Simulation 6 – 220/69kV substation west of Leupp

4.15.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.15.1.1 Black Mesa Complex

Under Alternative A, the expansion of mining into areas adjacent to the Kayenta mining operation and the resumed Black Mesa mining operation would cause minor visual impacts; new mining activity in separate areas would cause visual fragmentation of the natural landscape, with a moderate short-term impact on scenic quality. Removal of earth and vegetation would create visual contrast within the environment that would be mitigated later with reclamation. Reestablishment of landform contours and vegetation would reduce visual impacts in the long term.

Impacts on scenic quality and views from residential areas within the Black Mesa Complex due to construction of the coal-washing facility would be short-term and negligible, as the mining operation is an industrial landscape with a heavily modified appearance. Future mining activities at the Black Mesa Complex could potentially be visible to high-sensitivity residential viewers, with varying impacts, depending on the viewing distance.

Construction of the coal-haul road would be considered a moderate impact due to the removal of piñon/juniper and a noticeable disturbance of landform within a Class B landscape.

Moderate short-term impacts would result when activities related to construction of the coal-washing facility and coal-haul road occur within immediate foreground-to-foreground distance zones.

4.15.1.2 Coal-Slurry Pipeline

4.15.1.2.1 Coal-Slurry Pipeline: Existing Route

Under Alternative A, the new pipeline would be buried adjacent to the existing pipeline or within the existing pipeline trench, and long-term impacts on scenic quality would be negligible. No new maintenance roads or aboveground facilities would be added. Relatively low levels of vegetation removal and landform disturbance would occur, and visible ground disturbance would be mitigated by reestablishment of vegetation.

The greatest viewer impacts along the existing route would affect to high-sensitivity viewers along the western end of the coal-slurry pipeline within the Black Mountains ACEC, but those impacts would be minor. Although the area is a Class A landscape, no overhead structures would be added, and the route is within the existing pipeline corridor, which would minimize visual contrast in the landscape. Viewers along the remainder of the route would experience very little impact—the alignment passes through Class B, C, and D landscapes where mitigation would return the landscape to existing conditions. No overhead structures would be added.

Short-term, moderate impacts on residential views due to construction activities associated with pipeline replacement would occur along the existing route. All other impacts would be no greater than minor (e.g., impacts on moderate-sensitivity viewers in commercial use areas or roadways) including minor impacts on viewers within immediate foreground-to-foreground distance zones in remote locations along the pipeline route.

The use of the existing alignment in the Moenkopi Wash and Kingman areas would cause less vegetation removal and landform disturbance than would the realignments. Visible ground disturbance would be mitigated by reestablishment of vegetation. Because there are more residences in the area west of Kingman, there would be more impacts on residential views due to construction activities associated with pipeline replacement than with the realignment.

4.15.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

Installation of the coal-slurry pipeline along the alternative alignments would have the following short-term, minor effects on scenic quality and viewers:

- Moenkopi Wash – A new pipeline corridor and maintenance road would disturb landform and vegetation in a previously undisturbed Class B landscape. However, visual contrast would be weak to moderate, with negligible to minor impact on scenic quality and viewers.
- Kingman Reroute – Impacts on scenic quality and viewers would be negligible because the route would parallel existing power lines and roads and there are fewer residences.

4.15.1.2.2.1 Agency Visual Management Compatibility

The majority of the project area is State Trust land, tribal land, or private land where no visual management objectives apply. Most BLM lands traversed by the coal-slurry pipeline and realignments are BLM Class IV lands, where only moderate visual modification or development may be introduced. (BLM landscape classifications range from Class I to Class V, with Class I the highest rating). The route also parallels the northern boundary of the Mount Nutt Wilderness Area and traverses the Black Mountain ACEC (Class I and Class II landscapes, respectively). Class I management objectives are to preserve the existing character of the landscape. The level of change to the landscape here should not attract attention. Class II management objectives restrict changes in form, line, color, and texture within the landscape—activities in the area should not be visually evident or attract attention.

The existing coal-slurry pipeline route traverses BLM-managed land between Seligman and Bullhead City, where impacts related to replacement of the existing pipeline would be compatible with BLM management objectives.

The pipeline passes through a very small segment of land managed by the Forest Service (on the northern edge of the Williams Ranger District, Kaibab National Forest), where management objectives allow moderate modification. Pipeline replacement within the existing route would be in compliance with the Forest Service's Scenery Management System, as it would not interfere with the existing character of the landscape.

The Kingman reroute would be in compliance with agency management objectives for two BLM VRM Class II areas between (approximately) CSP Mileposts 6.5 and 7.5 and CSP Mileposts 25.5 and 28 (i.e., mileposts along the reroute). Existing utilities and linear features in the first segment—power lines and existing roads that could be used for maintenance—would reduce visual contrast. In addition, scenic-quality impacts on a flat landscape of Class C scenic quality would be considered low. From CSP Mileposts 26 to 28, the alignment passes just north of a Class I area. However, since the route is not within the designated Class I area and modifications to the adjacent landscape would be minimal and would not attract attention, the route would be in compliance with management objectives.

4.15.1.3 Water Supply

4.15.1.3.1 C Aquifer Water-Supply System

4.15.1.3.1.1 Infrastructure

4.15.1.3.1.1.1 Well Field

Under Alternative A, installation of water pumps at the well locations and the electrical line required to power them would have negligible to minor impacts on scenic quality as a result of weak project contrast. These facilities would be slightly noticeable; however, they would not detract from the overall scenic-quality level of the surrounding landscape. The visual impacts associated with the creation of maintenance roads and disturbance of the vegetation and landform, if required, could potentially result in detectable but slight impacts on scenic quality.

Detectable but slight impacts potentially would be observed by high-sensitivity viewers within immediate foreground-to-foreground distance zones, depending on the final selected location of the pumps within the well-field area. The pumps and power line would be slightly noticeable to these viewers; however, these facilities would not be dominant structures within the viewsheds.

Installation of a large water-storage tank would affect scenic quality from views in two locations within the well field. The tank would be noticeable on the horizon and would detract from the area's scenic quality (Appendix J, Simulation 1).

4.15.1.3.1.1.2 C Aquifer Water-Supply Pipeline

C Aquifer Water-Supply Pipeline: Eastern Route

Two pump stations along the water-supply pipeline near the Tolani Lake area and the Hardrock area (at WSP Mileposts 30 and 73, respectively) would be dominant visual features in the landscape, and would diminish scenic quality (Appendix J, Simulations 2 and 3).

Detectable but slight impacts on scenic quality would occur along the water-supply pipeline where vegetation would be removed where a 69kV power line would be constructed and vegetation would be removed (Appendix J, Simulation 4), and where the pipeline would be adjacent to Oraibi and Dinnebito

Washes. Impacts on scenic quality along the remainder of the Eastern Route would be negligible. The route's location next to existing utilities (a high-voltage transmission line and electrical distribution lines) and existing roads and highways would reduce the visual contrast introduced into the landscape, as well as minimize the need to build new maintenance roads.

Moderate to minor viewer impacts would occur in two locations: (1) pump stations within Class C landscapes would be visible to residential viewers south of Leupp, Arizona, and (2) water-storage tanks at WSP Milepost 10 would be visually dominant in the landscape. Mitigation would help minimize visual contrast.

Some minor viewer impacts would occur along the pipeline route where high-sensitivity viewers are within immediate foreground distance zones. Minor impacts were identified within the well field, in and around Kykotsmovi, and to the north (Appendix J, Simulation 5) and just south of the mine lease area. Viewer impacts would be negligible along most of the pipeline route because facilities would be adjacent to roadways or other previously disturbed landscapes.

Minor viewer impacts also would occur on moderate-sensitivity viewers of previously undisturbed, highly vegetated areas (from approximately WSP Mileposts 37 to 52; north of Kykotsmovi from WSP Mileposts 64 to 71; and near the Black Mesa Complex boundary) along the water-supply pipeline. However, because the route would parallel existing linear features (i.e., roads and power lines), the majority of impacts (on moderate-sensitivity viewers) would be negligible.

Moderate short-term viewer impacts would occur where high-sensitivity viewers are within immediate-foreground distance zones and have unobstructed views of construction activities related to pump stations, water-storage tanks, and substations. All other impacts would be minor.

Water-Supply Pipeline: Western Route

Under Alternative A, moderate scenic-quality impacts would occur along the Western Route where pump stations would be built, and where the power line and maintenance road would be built in previously undisturbed Class A landscapes. Disturbance of landform (a new road) and introduction of an overhead structure (69kV power line) would diminish scenic quality from approximately WSP Mileposts 43 to 52 and from approximately WSP Mileposts 73 to 82.

Minor scenic-quality impacts would occur where the same facilities would be introduced into Class B landscapes (from approximately WSP Mileposts 36 to 59 and from approximately WSP Mileposts 72 to 91), and where vegetation would be removed and a new maintenance road constructed (from approximately WSP Mileposts 128 to 134).

There would be negligible scenic quality impacts in Class C and D landscapes as a result of the ability to parallel existing roads and utility corridors (in the well-collection field and along the water-supply pipeline from the well field to approximately WSP Milepost 36; from WSP Mileposts 59 to 72; WSP Mileposts 92 to 128; and within the active area of the Black Mesa mining operation).

Pump stations and other project-related facilities would be noticeable in the northern portion of the route along U.S. Highway 160, a heavily traveled access route to Navajo National Monument and Monument Valley Tribal Park—viewer impacts would be detectable. There would be no viewer impacts along the remainder of the route, as there are few high-sensitivity viewers within 0.5 mile of the facility sites, and the route would parallel existing roads and facilities.

Moderate viewer impacts would occur in one location (approximately WSP Milepost 68) where a pump station would be installed within the immediate-foreground distance zones of moderate-sensitivity viewers. Minor viewer impacts on moderate-sensitivity viewers would occur within immediate-foreground distance zones, from approximately WSP Mileposts 58 to 75 (a Class B landscape), and in scattered locations along the Kletha Valley, where facilities would parallel existing linear features.

Moderate short-term viewer impacts associated with construction activities along the Western Route would occur primarily in areas adjacent to pump station locations (i.e., WSP Mileposts 27.5, 68, 91, and 118). Minor impacts would occur in areas where power line construction and pipeline placement would be necessary within immediate foreground-to-foreground distance zones from residential viewers. The most short-term, minor impacts from construction activities would occur in the Kletha Valley area because of travelers using U.S. Highway 160 and existing development adjacent to the highway.

4.15.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

The Kayenta mining operation would operate through at least 2026 and the Black Mesa operation initial program area would be incorporated into the area permitted for mining. It is currently expected that after 2026, operations at the Kayenta mining operation would cease and the mined land would be reclaimed. Impacts would be the same as those for the Kayenta mining operation discussed in Alternative A. Visual impacts associated with the C-aquifer well field and pipeline and with the reconstruction of the coal-slurry pipeline would not occur.

4.15.3 Alternative C – Disapproval of the LOM Revision (No Action)

The Kayenta mining operation would operate through at least 2026. It is currently expected that after 2026, the Kayenta mining operation would cease and the mined land would be reclaimed. The Black Mesa mining operation would not resume operations, and the coal-washing facility and the coal-haul road would not be constructed. There would be a reduction of impacts on visual resources due to the reclamation of mining land in the former Black Mesa operation area. With reclamation of mining lands, scenic quality of the mining areas would improve. Visual impacts associated with the C-aquifer well field and pipeline and with the reconstruction of the coal-slurry pipeline would not occur.

4.16 TRANSPORTATION

4.16.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.16.1.1 Black Mesa Complex

On the Black Mesa Complex, roads are considered facilities that support the mining operation and have both short- and long-term uses. The existing road system (approximately 543 acres) on the Black Mesa Complex would continue to be used until the mining and reclamation operations would be completed. Minor access roads to exploration and development areas and pit and spoil ramps would be constructed and used for short durations of mining. Coal-haul roads, vehicle roads, mine vehicle roads, and maintenance roads would be used over a long duration. Peabody would locate, design, construct, use, maintain, and reclaim all roads needed in the permit area in a manner that minimizes impacts on the environment. About 127 acres outside the lease areas would be added to construct a new coal-haul road from the J-23 coal-resource area on the permanently permitted area of the Black Mesa Complex to the coal-preparation facilities on the Black Mesa operation initial program area. The roadway with a new surface right-of-way about 500 feet wide and 2 miles long would be constructed to improve travel efficiency. As part of the LOM revision, haul roads are proposed to be constructed in Coal-Resource Areas N-09 and J-08/J-09 as needed for mining activities. Proposed additional acreage through 2026 is 478 acres. Also, Peabody proposes to realign Indian Route 41, a public road.

All roads that were used by Peabody or built and used by Peabody on or after December 16, 1977 will be reclaimed unless they have been approved by OSM as a part of the postmining land use. Because of the areal extent and nature of Peabody's mining activities, very few of the roads would be reclaimed until the end of mining and reclamation activities on the entire Black Mesa Complex. Exceptions include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal-resource area.

Local residents have road access to most parts of the permit area. Exceptions include the immediate vicinity of active coal-mining areas and coal-handling facilities. Mining sometimes causes residential relocations (a land use impact), but has negligible effect on residents' mobility and access through the local area.

4.16.1.2 Coal-Slurry Pipeline

4.16.1.2.1 Coal-Slurry Pipeline: Existing Route

Pipeline installation would impede traffic flow temporarily along roadways in affected areas during construction. Construction in the Kingman and Laughlin areas, which experience higher traffic volumes and have more extensive road networks along the existing pipeline route, would exacerbate road delays, detours, and access disruptions. Effects on the road networks are minor to none, depending on the location. Further effects would be as follows:

- Airports – There would be no impact on any of the airports or airstrips in the project area.
- Railroads – Railroads crossed by the existing coal-slurry pipeline route would not be affected.

4.16.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

4.16.1.2.2.1 Moenkopi Wash Realignment

Few properties would be affected by disrupted access. Transportation impacts would be similar to those along the existing route; however, a new access road built as part of this alternative would have potential to increase transportation routes in the area.

4.16.1.2.2.2 Kingman Reroute

Transportation impacts would be limited to disrupted access in some areas during construction, creating delays and detours, particularly at major intersections.

4.16.1.3 C Aquifer Water-Supply System

4.16.1.3.1 Well Field

Because of the rural nature of the area, construction along Indian Route 6930 in the well-field area would have negligible impacts on traffic. Access to and travel within the well-field area would be increased by the addition of project-related access roads, including improved access to Canyon Diablo, a historically significant scenic area, a negligible beneficial effect.

4.16.1.3.2 C Aquifer Water-Supply Pipeline: Eastern Route

The Eastern Route would traverse rural areas and primary roads in densely populated areas, including the communities of Leupp and Kykotsmovi. In these areas, minor traffic impacts would occur during construction. Only a small portion of the pipeline (and none of the ancillary facilities) is located underneath a roadway, reducing construction-related interruption to traffic, so some areas would have no transportation impact. The extension of a permanent access road north from State Route 264 to the Black Mesa Complex would be a minor beneficial effect.

4.16.1.3.2.1 Kykotsmovi Area Subalternatives

Construction would temporarily disrupt access to property along the primary transportation corridor and the bypass road in the community, and could delay or detour traffic.

4.16.1.3.2.2 Little Colorado River Crossing Subalternatives

The crossing of the Little Colorado River south of Indian Route 15 (a major arterial) would either use an abandoned, historic bridge resulting in no impacts since it currently does not serve transportation purposes, or the crossing would be horizontally drilled under the river.

4.16.1.3.3 C Aquifer Water-Supply Pipeline: Western Route

Only a small portion of the pipeline, and none of the ancillary facilities, is located underneath a roadway, reducing construction-related interruption of traffic.

Where the Western Route would intersect with or parallel primary or secondary roads, through traffic would be temporarily affected during construction. Higher-density suburban areas along U.S. Highway 160 would experience impacts on traffic flow as a result of disrupted access and detours during construction activities. In rural areas, construction would impact traffic flow as a result of disrupted access and detours, though to a lesser extent than more urban and suburban areas because fewer roads are present, less traffic occurs on those roads, and through traffic might be accommodated more easily on rural roads.

The Western Route would have impacts similar to the Eastern Route at existing roadway intersections. About 50 percent of the route would parallel an existing transportation corridor, in comparison with 90 percent along the Eastern Route. New access roads would increase the transportation network in areas along the western alternative.

4.16.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, transportation impacts from mining operations associated with the Kayenta mining operation would be the same as those under Alternative A, except that the coal-haul road would not be constructed. Under Alternative B, mining associated with the Black Mesa mining operation would not resume and reclamation would be initiated. There would be no increase in access.

4.16.3 Alternative C – Disapproval of the LOM Revision (No Action)

The mining operations would continue on the permanently permitted area of the Black Mesa Complex through 2026. Mining on the Black Mesa operation initial program area of the Black Mesa Complex would not resume and reclamation would be initiated. There would be no increase in access.

4.17 RECREATION

4.17.1 Alternative A – Approval of the LOM Revision and All Components Associated with Coal Supply to Mohave Generating Station

4.17.1.1 Black Mesa Complex

While no developed recreational facilities or areas are designated, recreation on the Black Mesa Complex is passive and dispersed. Typical recreational activities include hiking, horseback riding, and mine tourism. No hunting is allowed and fishing is discouraged. Off-highway vehicles are used by local residents, but use is normally limited to existing roads. The effects of mine operations on recreation or effects of recreation on mine operations are and would continue to be negligible. New roads (e.g., the coal-haul road), if open to the public, could provide improved access to areas with potential for recreation.

Effects of the presence or operation of mining on Navajo National Monument and Monument Valley Tribal Park, two prominent recreational resources in the vicinity of the Black Mesa Complex, would continue to be negligible.

4.17.1.2 Coal-Slurry Pipeline

4.17.1.2.1 Coal-Slurry Pipeline: Existing Route

Construction along the coal-slurry pipeline would temporarily impact developed recreational trails or byways (Camp Beale Loop Trail, Western/Arizona Trail, and San Francisco Peaks Scenic Road) and recreation areas (Cerbat Foothills Recreational Area, local parks and open space, Camp Beale Springs Historic Site, and Big Boquillas Ranch). Ground disturbance and restricted access would be temporary, lasting three days per 2,500-foot-long pipeline section. All land would be reclaimed promptly and all trails returned to use.

The existing route of the coal-slurry pipeline parallels the northern boundary of the Mount Nutt Wilderness Area for approximately 5 miles within a designated utility corridor; construction activities would be restricted to the corridor and would not extend into the wilderness area. Improvement of the existing access road, which is currently unimproved, would provide vehicular access to previously inaccessible areas. Construction activity along the boundary of the Mount Nutt Wilderness could create temporary dust, noise, and visual impairments that may detract from wilderness character for visitors who may be engaged in wilderness recreation activities. The pipeline would be properly designed so as not to create some long-term impacts on wilderness naturalness from flyrock, tailings, and runoff during precipitation events or in the event of a pipeline rupture.

Horizontal drilling under the Colorado River would minimize disturbance of recreational activities along the river. Construction could temporarily restrict access to the trail adjacent to the Colorado River in Laughlin, Nevada. Based on historical performance of the existing pipeline, no failures and consequent releases of slurry have occurred under or near the Colorado River. Considering this and the proposed conceptual design of the new pipeline (Appendix A-2), a failure and release is unlikely. However, if a failure and release were to occur, the amount of slurry released cannot be determined. Using historical data on slurry pipeline releases that were not in proximity to the river, BMPI has estimated that the amount of slurry released may range from an average of 100 cubic yards (or less) to a maximum of 565 cubic yards. The impact could range from negligible to minor depending on the location and circumstances of failure. An emergency response plan that addresses cleanup and management of impacts, including the length of time required for cleanup, would be in place for the coal-slurry pipeline.

Construction impacts at each of the above-named areas would be negligible and temporary.

4.17.1.2.2 Coal-Slurry Pipeline: Existing Route with Realignments

Construction along the segments of pipeline in the Moenkopi Wash would have negligible impact on dispersed recreation by temporarily restricting access to areas with recreational opportunities.

Construction along the Kingman reroute would impact dispersed recreation by temporarily restricting access to areas with recreational opportunities. Impacts on Historic Route 66 and the Mount Nutt Wilderness Area along the existing alignment would be similar. This alignment avoids the Cerbat Recreational Area and Trails System and the Camp Beale Springs Historic Site and trail loop, and would prevent impacts on those areas. Construction across/under Hualapai Mountain Road Scenic Drive would cause delays in accessing the Hualapai Mountain Park, located southeast of Kingman. Construction impacts at each of the areas would be negligible and temporary.

4.17.1.3 C Aquifer Water-Supply System

4.17.1.3.1 Well Field

Construction of an access road to each of the wells (for construction and maintenance) could provide additional vehicular access to dispersed recreational areas such as Canyon Diablo, a historically significant scenic area, which would be a negligible impact. Dispersed recreation in Painted Desert areas within the well field would not be affected.

4.17.1.3.2 C Aquifer Water-Supply Pipeline

4.17.1.3.2.1 C Aquifer Water-Supply Pipeline: Eastern Route

Construction along the existing access roads could increase vehicular access to dispersed recreation areas in the Painted Desert and to washes designated for conservation by the Hopi Tribe. Dispersed (scenic) recreational uses within the Painted Desert geographic area would not be affected by construction and operation of the water-supply pipeline because the scenic areas are located beyond the proposed alignment. However, construction and operation of the 69kV power line and pump stations could detract from the unspoiled setting that is an element of the recreational experience within the Painted Desert geographic area, a negligible impact.

4.17.1.3.2.1.1 Kykotsmovi Area Subalternatives

Recreational opportunities within the community of Kykotsmovi— generally related to education or day care facilities—are not located within the areas of potential disturbance, but may be impacted to a negligible degree by temporary access restrictions associated with construction, regardless of the subalternative selected.

4.17.1.3.2.1.2 Little Colorado River Crossing Subalternatives

Recreational opportunities within the community of Leupp are generally related to education or youth center facilities. These facilities are not located within the area of potential disturbance, and temporary access restrictions would have negligible impact. Dispersed recreation activities in and adjacent to the Little Colorado River may be temporarily disrupted by construction, a negligible impact. Disturbance of recreational activities along the river would be minimized by employing directional drilling under the Little Colorado River, a mitigation measure to which the applicant has committed.

4.17.1.3.3 C Aquifer Water-Supply Pipeline: Western Route

Construction and operation of the western alternative for the water-supply pipeline would increase vehicular access to dispersed recreation areas in the Painted Desert. Opportunities for dispersed (scenic) recreation would not be affected. However, the recreational experience could be affected where the 69kV power line and pump stations would detract from the scenic quality of the landscape. Construction could cause negligible impacts on traffic due to potential delays estimated to occur intermittently and at different locations as construction proceeds, more than 90 days along U.S. Highway 160, a heavily traveled access route to Navajo National Monument and Monument Valley Tribal Park.

4.17.2 Alternative B – Approval of the LOM Revision (Preferred Alternative)

Under Alternative B, impacts on recreation from mining operations would be the same as those under Alternative A. Mining areas on the Black Mesa operation initial program area of the Black Mesa Complex would be reclaimed, and upon sufficient restoration of the landscape, the lands would be available for dispersed recreation. Any impacts associated with the coal-slurry pipeline or C aquifer water-supply system would not occur.

4.17.3 Alternative C – Disapproval of the LOM Revision (No Action)

Impacts on recreation from the Kayenta mining operation would be similar to those under Alternative A through 2026. At the end of 2026, mining operations would cease, and mining land would be reclaimed, allowing dispersed recreation on those areas of the lease area when the landscape is sufficiently restored. Mining areas on the initial program area of the Black Mesa Complex would be reclaimed, and upon sufficient restoration of the landscape, the lands would be available for dispersed recreation. Any impacts associated with the coal-slurry pipeline or C aquifer water-supply system would not occur.

4.18 CONSERVATION MEASURES (ALTERNATIVE A)

This section discusses a suite of conservation measures that were developed under Alternative A to compensate for or offset the potential adverse effects of stream baseflow depletion caused by predicted groundwater drawdown on Little Colorado spinedace and its designated habitat, and roundtail chub. The purpose of the conservation measures is to aid in the survival, conservation, and recovery of two fish species: the federally listed Little Colorado spinedace and the roundtail chub, which was formerly proposed for listing. The measures also would serve to improve and conserve Little Colorado spinedace designated critical habitat. (Conservation measures were not required for Alternatives B or C.)

The conservation measures were developed through a series of meetings and field trips with the Black Mesa Project Biological Resources Subcommittee composed of wildlife and fishery experts from Federal, tribal, and State agencies and from the co-owners of the Mohave Generating Station (see Section 5.2.2). The subcommittee developed an initial list of approximately 26 potential conservation measures that would benefit the covered species and their habitat. The actions were founded upon the conservation measures described in the Little Colorado Spinedace Recovery Plan (FWS 1998), East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace (Forest Service 2006), draft State Conservation Agreement for the roundtail chub (AGFD in preparation), and professional judgments of agency experts with a regulatory role in native fish conservation and management (i.e., FWS, AGFD, Forest Service). The list of conservation measures under consideration captured a variety of actions including land purchases, hatchery rearing and stocking of covered species, fish barrier construction and renovation, habitat improvements, and research. The subcommittee evaluated and ranked each action to (1) determine the relative conservation benefit to the species and their habitat; (2) area (stream reach) or lineage of Little Colorado spinedace that would benefit; (3) relationship to the Little Colorado Spinedace Recovery Plan; (4) conflicts with established state sportfish management direction; (5) other potential social, economic, or environmental conflicts (e.g., landowner concerns); and (6) the scope of the conservation measure relative to the expected impacts of the proposed action (i.e., was the measure commensurate with expected impacts).

Based on the analysis and ranking, and subsequent field visits to potential fish-barrier sites, two measures were agreed upon by the team as having the highest conservation benefit to the species and their habitats (including designated critical habitat): (1) funding to implement watershed habitat improvement actions that were previously developed by the FWS and Forest Service and covered under an existing environmental assessment (Forest Service 2006), which could benefit from additional funding for implementation; and (2) the establishment of a long-term conservation fund (endowment) to implement high-priority native fish conservation projects in the Little Colorado River watershed (with emphasis on spinedace in the Chevelon Creek and East Clear Creek watersheds). A two-phased approach to the conservation measures was chosen to provide both immediate habitat improvements for the species and to implement actions that would benefit and improve habitat and the status of the species over time (including implementation of conservation actions 50 years from the date the Black Mesa Project is initiated).

4.18.1 East Clear Creek Watershed Habitat Improvement Projects

To improve the status of the species and its habitat, the co-owners propose to provide funding to implement a number of capital conservation projects described in the Forest Service's East Clear Creek Watershed Improvement Project environmental assessment (Forest Service 2006). The East Clear Creek Watershed Improvement Project covers conservation actions over approximately 70,000 acres in the East Clear Creek drainage. The overall purpose of the East Clear Creek Watershed Improvement Project is to reduce the threat of stand-replacing fire, improve meadow and stream-course riparian function, and reduce impacts of recreation on meadows and riparian and stream habitats. The projects initially were developed during a coordinated effort among resource agencies (i.e., East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species) to proactively identify threats to spinedace and appropriate restoration and conservation actions. To accomplish this goal, the proposed action includes more than 20 projects within four main treatment types: (1) restoring understory and overstory vegetative health and diversity; (2) reducing potential for stand-replacing wildfire; (3) restoring soils, meadow systems, and riparian areas; and (4) reducing effects of roads on riparian areas and threatened, endangered, and sensitive species habitat. The Biological Resources Subcommittee reviewed the individual projects contained within the East Clear Creek Watershed Improvement Project and selected those that had the most clear and direct benefits to Little Colorado spinedace and its habitat (including designated critical habitat) and roundtail chub. Specifically, five projects were chosen that are expected to increase water yield and improve the function of wet meadows (i.e., provides for water retention during wet periods causing slower and sustained release into downstream channels) and/or directly protect and/or improve occupied spinedace habitat (Table 4-47). The direct benefits of each individual project to spinedace and its habitat are described in detail in the East Clear Creek Watershed Improvement Project; in general, the proposed projects would improve spinedace and chub habitat through reductions of sediment, provide for a more natural hydrograph, increase instream flow volume and duration, and/or improve bank storage capacity and soil conditions. Overall, 38 to 48 miles of occupied, unoccupied but potential recovery habitat, and/or critical habitat (31 miles) would benefit from the conservation projects. The upper end of the range includes implementing 10 miles of natural-channel design projects.

Because the actual cost of each project was estimated, and to allow for contingencies, the co-owners propose to fund projects in Group A (Table 4-47) up to $316,820. If funds remain after these five projects are implemented, the balance would be provided to implement natural-channel design projects (Group B). Should one or more of the capital conservation projects identified in Table 4-47 not be feasible (e.g., Forest Service decides not the implement a specific project, or a project already has been completed), the co-owners would coordinate with FWS and Forest Service to identify other projects (up to $316,820) within the East Clear Creek Watershed Improvement Project environmental assessment that provide equal conservation benefit to the covered fish species. The funding for the projects would be provided when all project permits and approvals have been obtained and are concurrent with the start of construction.

Table 4-47 Proposed Capital Conservation Projects (described in the East Clear Creek Watershed Health Improvement Environmental Assessment) to Offset Impacts on Federally Listed Fish Species

Project	Benefit	Year(s) Implemented	Estimated Cost (includes inflation)	Cost with 100% Contingency
Group A				
Create area closures at Dane Springs and Dines Tank for protection of spinedace habitat	Reduction of sediment and disturbance frequency. Protect extant population of spinedace from recreation impacts.	3, 4	$44,142	$88,264
Remove tank and rehabilitate one site at Dick Hart	Reduction of sediment into aquatic system	2	$18,200	$36,400
Stabilize stream crossings	Reduction of sediment entering system	1, 2, 3, 4, 5	$49,836	$99,672
Rehabilitate or remove any wood structures located in stream channels of Buck Springs and Houston Draw	Improve stream channel function and improve aquatic habitat	2	$22,881	$45,762
Thin trees on approximately 83 acres in upland areas above Merritt, McFarland, Limestone Tank, and Upper Buck Springs	Increase flow duration of springs	3, 5	$23,361	$46,722
Subtotal			*$158,410*	*$316,820*
Group B				
Contribute to natural-channel design projects, layback banks/hydromulch at one or more sites identified in the East Clear Creek Watershed Health Improvement environmental assessment	Reduced sediment entering system and improved bank storage capacity would increase flow duration	5, 7	Up to $158,410	
Maximum contribution of Group A and B			**$316,820**	

4.18.2 Annual Conservation Fund for Native Fish Species

The amount that the proposed conservation fund would provide on an annual basis is $40,000 for 50 years. The conservation fund concept was developed and agreed to in Biological Resources Subcommittee meetings. The benefits of the conservation fund for spinedace and roundtail chub conservation and recovery were identified as providing long-term funding that (1) would fully offset project impacts, and thus provide a net conservation benefit to the species and their habitat, (2) would augment Federal and State native fish conservation efforts, (3) could be used in an adaptive management approach—improving conservation measures as new information and priorities change over time, and (4) would be flexible and thus could be applied to a variety of actions and projects to achieve maximum benefit to the species. High-priority projects are those tiered to existing strategies or conservation documents (e.g., East Clear Creek Watershed Recovery Strategy, State Conservation Agreements, Forest Service plans, and recovery plans). It is expected that the types of projects may change over time as resource agency priorities change and new information concerning the species is incorporated into conservation efforts. While specific projects to be implemented using the conservation fund have not yet been identified, the amount of benefit over the 50-year period is expected to surpass those of the capital conservation projects because the fund would be used to address known threats and future threats and to improve spinedace and roundtail chub population status and the condition of their habitat over both the short- and long-term and over a broader area. Detailed descriptions of the endowment priorities, management, and structure follow.

4.18.2.1 Priority Species

In order of importance from highest to lowest, the priority species for conservation are the Little Colorado spinedace, roundtail chub, bluehead and Little Colorado suckers, and speckled dace.

4.18.2.2 Priority Project Locations

The locations with the highest priority for conservation are the Chevelon Creek and East Clear Creek watersheds, as well as other sub-watersheds in Little Colorado River basin that have extant populations or designated critical habitat and/or that have been identified as important for native fish conservation (e.g., Silver Creek, Nutrioso, and the mainstem Little Colorado River from Winslow to Greer).

4.18.2.3 Priority Project Types

The highest-priority projects are those that directly protect extant native fish populations or replicate populations, and project with the second-highest priority are those that may indirectly benefit/protect extant populations through methods involving riparian habitat improvements within the designated critical habitat reaches or occupied reaches (increased streamflow, improved water quality, etc.) or hatchery production. Third in priority are those projects that improve unoccupied, but potentially suitable native fish habitat, and the lowest projects in priority are those that do not provide clear “on-the-ground” benefits (e.g., native fish education and/or outreach projects).

Conservation projects could include the following:

- Construction and maintenance of fish barriers
- Stream renovations (management/control of nonnative fish and crayfish, or other harmful nonnative organisms) and repatriation of native fishes
- Watershed/stream habitat restoration projects and monitoring to assess native fish benefits
- Native fish culture, hatchery support, and supplemental stocking
- Development and maintenance of artificial refuges
- Protection and monitoring of instream flow
- Land and water purchases
- Stream habitat inventories and evaluations to assess fish habitat
- Public education and outreach

4.18.2.4 Endowment Limitations and Constraints

Limitations and constraints on the annual conservation fund (endowment) would be as follows:

- Funds *may not be used* to implement conservation actions or reasonable and prudent measures required of other entities by any agency (Federal, tribal, State) to mitigate impacts associated with any other development projects.

- Funds may be used to incrementally enhance or augment other mitigation or conservation projects, or may be used as matching funds, to provide additional benefits to native fish species.
- Funds *may not be used* for costs associated with agency overheads (e.g., oversight of the conservation fund payments, labor costs associated with participation on the technical subcommittee).
- Funds may be used for labor or other costs associated with specifically approved conservation projects (e.g., direct labor charges for stream restoration). However, agency labor charges for conservation projects should be kept to a minimum. Agencies should use base funding from other sources prior to seeking money from this endowment to pay for staff time.

4.18.2.5 Project and Endowment Decision-Making Process

The co-owners (of the Mohave Generating Station) proposed a two-tiered approach for project identification and funding allocation. This includes (1) a technical/biological subcommittee for project identification/solicitation, review, and recommendation to the executive committee; and (2) an executive committee, composed of the FWS Field Supervisor from the Arizona Ecological Services Office (AESO) and the AGFD Director, with authority to make final project selection. A technical/biological subcommittee would be established: lead (co-chaired) by FWS and AGFD and include the applicants and consulting agencies. The members of the technical/biological subcommittee may request, as appropriate and deemed necessary, input from other interested parties (e.g., Forest Service, spinedace recovery team members, and university researchers).

- The technical/biological subcommittee would identify potential projects and could develop a multiyear conservation fund implementation plan or strategy (may be tiered to the East Clear Creek Watershed Recovery Strategy conservation table developed during subcommittee discussions, Little Colorado Spinedace Recovery Plan, Integrated Fisheries Management Plan for the Little Colorado River Watershed, State Conservation Agreement for native fish species, projects developed by the Native Fish Conservation Team, Forest Service land management plans, or existing projects).
- The FWS and AGFD co-chairs would organize an annual meeting and invite interested agencies, organizations, and persons.
- The technical/biological subcommittee would recommend annually (or other appropriate time period) to FWS AESO Field Supervisor and AGFD Director, for review and approval, a proposed project summary list, and any recommended changes regarding the conservation fund allocation management and administration.
- The technical/biological subcommittee could choose to recommend no projects in any given year in order to build up the conservation fund for larger, more costly projects later.
- Recommendations for projects to be undertaken would be provided at least six months prior to the initiation of implementation-level planning for the next Federal fiscal year (October 1 to September 30). A decision about which projects to fund would occur no later than the initiation of planning for the next fiscal year.

Oversight role of FWS AESO Field Supervisor and AGFD Director would be as follows:

- FWS and AGFD have the authority to manage federally listed native fish in Arizona outside tribal land.

- AGFD also has the authority to manage nonnative fish, including sportfish and other aquatic wildlife, in Arizona outside tribal land.

- A memorandum of agreement (MOA) (or other appropriate agreement) based only on Section 2.3.2 of the biological assessment would be developed between the FWS AESO Field Supervisor and the AGFD Director within one year of signing the Record of Decision for the project to facilitate joint participation and collaboration in conservation fund allocation.

- The conservation fund MOA could be tiered to an existing MOA between the agencies entitled "State Wildlife Agency Participation in Implementing the Endangered Species Act: State of Arizona" and a Cooperative Agreement pursuant to Section 6 of the ESA (which requires the State to maintain an adequate conservation program for all species of mutual concern).

- The FWS AESO Field Supervisor and AGFD Director would review and approve conservation fund allocation for projects proposed by the conservation fund's financial manager.

- The conservation fund MOA would establish and recognize the function of the technical/biological subcommittee for project/plan identification and development, and identify the roles and responsibility of the AGFD and FWS co-chairs.

- FWS and/or the AGFD (as mutually agreed to on a project basis) would be the responsible agency(or agencies) to enter into additional cooperative agreements (e.g., Memoranda of Understanding, MOAs, collection agreements, contracts) with other agencies, organizations, or companies to implement conservation projects using the funding.

- The FWS could consider and approve, in collaboration with AGFD, the addition to the conservation fund of other sources of funding (e.g., conservation or mitigation funds associated with other Federal or non-Federal projects in the watershed that affect native fish and are consistent with Section 2.3.2 of the biological assessment.

- The FWS and/or AGFD (as mutually agreed) would track project-level conservation fund expenditures being used for fish projects and project results on an annual basis.

4.18.2.6 Conservation Fund Structure

Annual conservation fund payments would begin the same year that C-aquifer pumping by the Black Mesa Project commences and would continue for 50 years.

The co-owners would fund an annuity or other financial instrument that would provide $40,000 per year for 50 years.

The conservation fund would be funded and administered for the duration of the project (50 years). The conservation fund, if the funding mechanism allows, may be exhausted prior to its expected termination date (e.g., to complete one large conservation project) upon approval of the FWS AESO Field Supervisor, in coordination with and approval by the AGFD Director and applicants, but doing so would not obligate the project participants to additional funding commitments.

The funding instrument (annuity or other investment) would provide annual payments of $40,000 to a financial manager determined by the co-owners in coordination with and approved by FWS AESO Field Supervisor and AGFD Director. The conservation fund's financial manager would be responsible for holding, investing, and allocating the funds as directed by the FWS in coordination with AGFD.

4.19 MITIGATION

This section describes the standard practices, best management practices, and mitigation measures that would be employed in constructing, operating, and maintaining the components of the alternatives. The intent of these practices and measures is to avoid an impact or minimize the magnitude of an impact. Similar information is provided in Appendix A-1, a summary of mining and reclamation procedures; Appendix A-2, a summary of typical pipeline construction; and Appendix A-3, a summary of the water-supply system construction. As part of the design and engineering efforts prior to construction, BMPI and the Mohave Generating Station co-owners would identify more detailed, area-specific mitigation, which would be reviewed with the appropriate land-managing agencies (e.g., Hopi Tribe, Navajo Nation, BIA, Forest Service, BLM) or land owners.

4.19.1 Measures Common to All Project Components

4.19.1.1 Noxious Weeds and Invasive Species

Consistent with ADOA Rule R3-4-244, equipment used in an area infested with regulated or restricted noxious weeds would have all soil and debris removed prior to relocation to a noninfested area. In addition, areas infested with noxious weeds would be treated under an Integrated Weed Management Plan. Treatments may involve manual removal, herbicide application, or biological-control methods.

An Integrated Noxious Weed Management Plan would be developed that would include identification of noxious weeds in the project area, weed management goals and objectives, and preventative and control measures. Weed-control methods would be selected based on the management goals for the species, the nature of the surrounding environment, and methods recommended by Federal, State, and local weed management agencies. The plan would be developed and implemented in coordination with the Plant Services Division of the ADOA, Federal, and tribal agencies when their lands are involved, and local weed management associations. Measures to prevent the spread of noxious weeds could include, but are not limited to, the following:

- Contractors' vehicles and equipment would be inspected and treated as necessary to ensure that they are free of soil and debris capable of transporting the seeds or roots of noxious weeds.
- Populations of noxious weeds in or near the areas to be disturbed would be treated at the start of construction to prevent seed dispersal into land disturbed by construction. Controls could include physical removal or herbicides.
- Periodic surveys would take place during the construction period and revegetation periods to identify and treat noxious weed infestations in a timely manner.
- Potential areas of topsoil salvage would be assessed for presence and abundance of noxious weeds prior to salvage. Topsoil from heavily infested areas would be treated by spraying, or taken off site for disposal, or buried during construction.
- Disturbed areas would be revegetated as soon as feasible following construction. If permanent seeding cannot occur due to the time of year, mulch and a mulch tackifier would be used for temporary erosion control until seeding could occur.
- Fertilizer would not be used in revegetated areas (except agricultural areas) because it can enhance the growth of noxious weeds.
- Certified weed-free mulch and certified weed-free seed would be used for reclamation, and weed-free straw would be used for sediment barriers.
- Native plants and seeds would be used in reclamation efforts to the extent possible.

- On Forest Service–administered lands, best management practices and treatments for noxious and invasive weeds would be consistent with the Coconino, Kaibab, and Prescott National Forests Noxious Weed EIS (USDA 2005).

4.19.1.2 Small Mammals and Birds

Construction activities would be limited during the small-mammal breeding season, especially for prairie dogs from April through June. Crevices, caves, and other rock formations (potential day or night roosts) would be surveyed for bats prior to destruction. Snag trees would be monitored for bat activity before logging occurs. If bat maternity colonies are located, construction would be postponed until the bat's normal maternity season has ended and they have dispersed to other locations (September).

4.19.1.3 Threatened and Endangered Species and Sensitive Plant Species

Preconstruction surveys would be conducted in suitable habitat during an appropriate season for reliable observation of the target species (survey periods may vary by species). Where found, appropriate mitigation would be developed in consultation with wildlife and conservation agencies. Mitigation may include avoidance, use of temporary fencing, transplanting, and salvage of soil and seed banks.

4.19.1.4 Visual

Areas disturbed by earthmoving activities would be restored to the approximate original contour and would include backfilling and grading of the mined area using spoil stockpiles to approximate the original shape, topographic relief, and drainage patterns, thereby minimizing the impact on the landscape.

To minimize impacts from ground-disturbing activities associated with the reconstruction of the coal-slurry pipeline and construction of the water-supply system, the following would be implemented to the extent practicable. The alignments of new pipeline and any new roads would follow the landform contours in designated areas where practicable to minimize ground disturbance and/or reduce scarring (visual contrast) of the landscape, providing that such alignment does not affect other resource values substantively. In areas to be cleared, vegetation would be removed in natural patterns to the extent practicable, to minimize visual contrast. Project facilities (e.g., water-supply-pipeline pump stations, water-storage tank, substations) would be painted a color that would blend in and be compatible with the surrounding landscape.

The water-supply pipeline and associated 69kV transmission line would be sited along existing roads where possible to minimize visual impacts. Nonreflective self-weathering poles would be used to minimize the visibility of the transmission line structures. Where possible, the transmission line would be co-located with existing utilities to reduce the addition of new structures into landscapes.

4.19.1.5 Cultural Resources

If the project is approved, consideration of impacts on cultural resources would continue as final designs are prepared for the various project components during post-EIS phases of project implementation. Supplemental surveys would be conducted as necessary to complete the inventory of cultural resources within the area of potential effects. Effects on National Register-listed or -eligible cultural resources would be reassessed, and measures to avoid, reduce, or mitigate any identified adverse effects would be implemented after completion of consultations in compliance with Section 106 of the NHPA. The highest-priority goal would be to avoid adverse effects wherever feasible when preparing final designs for the various project components. Design of some facilities is relatively flexible, such as the location of wells in the C-aquifer well field, and consequently there is considerable potential to avoid construction impacts as final designs are prepared. Other components of the project are less flexible. Many of the cultural resources that might not be avoidable are important for their potential to yield important information. Satisfactory mitigation of adverse effects on those types of resources commonly is achieved through research studies that recover and preserve that information before the sites are disturbed or destroyed. Most of the archaeological resources that could be affected are relatively simple, nonhabitation sites that would require only modest research efforts to investigate and document.

Some resources, such as the bridge across the Little Colorado River, have other types of values that warrant preservation in place. If the bridge were selected as the option for supporting the C aquifer water-supply pipeline across the river, efforts would be made to design the adaptive reuse of the bridge to avoid or minimize any loss of historical integrity in accordance with the standards and guidelines of the Secretary of the Interior.

Disturbance of human remains and funerary objects that might be associated with affected cultural resource sites are among the most sensitive potential impacts. If any burials cannot be avoided, they would be treated in accordance with the appropriate regulatory requirements, which are tied to land ownership. On tribal and Federal lands, human burials would be treated in accordance with the NAGPRA and implemented through permits issued pursuant to the Archaeological Resources Protection Act. Treatment of any remains on the Navajo Nation also would be consistent with the Navajo Nation Jischáá' policy. Any human remains on Arizona State Trust land or private land within the state would be treated in accordance with the Arizona Antiquities Act (A.R.S. Sections 15-1631, 41-841 et seq.) and Arizona Burial Law (A.R.S. Section 41-865). In the unlikely event that human remains are found along the short segment of the coal-slurry pipeline in Nevada, they would be reported to Clark County law enforcement. If these are determined to be ancient Indian remains, the Nevada State Historic Preservation Office would be notified in accordance with Nevada Revised Statutes, Section 383.170 to determine appropriate treatment.

Treatment to address impacts on traditional cultural resources would be developed and implemented in consultation with tribal preservation offices, and as appropriate, with traditional residents and customary users. Treatment could involve a variety of strategies, such as minor shifts in alignments to avoid traditional fields or plant-collecting areas, timing of construction activities to avoid disturbing nesting raptors, and design of facilities to minimize changes in views of and views from traditional cultural resources.

In May 2005, OSM initiated consultations pursuant to Section 106 of the NHPA for actions under Alternative A. However, under preferred Alternative B, a Programmatic Agreement is not necessary.

4.19.2 Black Mesa Complex

As stated previously, site reclamation is an important part of the mining process and must comply with SMCRA. The mining operations and reclamation plans established for the Black Mesa Complex prevents and/or mitigates impacts from mining for all affected resources. Appendix A-1 provides a summary of reclamation procedures that would be undertaken as part of the proposed project, and the comprehensive operations required to mitigate impacts of mining at the Black Mesa Complex. The SMCRA bonding program, administered by OSM, mitigates any long-term, postmining damage by ensuring performance of the reclamation plan past the period of active mining, through continuous monitoring, inspection, and financial incentive.

4.19.2.1 Mine Facilities

4.19.2.1.1 Water-Control Facilities

Peabody is required to design, construct, and maintain appropriate sediment-control measures including, but not limited to, sediment ponds, diversions, culverts, and other sediment- and water-control structures in accordance with 30 CFR 816.45 to prevent, to the extent practicable, additional contributions of sediment to streamflow or to runoff outside the permit area due to mining activity, and to minimize erosion. Sediment-control measures include practices used within and adjacent to the areas disturbed by mining. Sediment-control measures consist of the use of proper mining and reclamation methods and sediment-control practices, singly or in combination. Sediment-control methods may include, but are not limited to, the following:

- Limiting disturbance to the smallest practicable area at any one time during the mining and construction operation
- Stabilizing graded material in a timely manner to promote a reduction in the rate and volume of runoff
- Retaining sediment within disturbed area
- Diverting runoff away from disturbance areas, including stockpiles, back slopes, and material storage
- Diverting runoff through disturbed areas using stabilized earth channels, culverts, or pipes so as to prevent, to the extent practicable, additional contributions of sediment to streamflow or to runoff outside the permit area
- Using straw dikes, silt fences, small V-shaped ditches, riprap, mulches, check dams, ripping, contour furrowing, vegetative sediment filters, small depressions, sediment traps, and other measures that would reduce overland flow velocity, reduce runoff volume, or trap sediment
- Maintaining sufficient ground moisture in trafficked areas to reduce the potential for wind and water erosion

Siltation structures or sedimentation ponds are used primarily for controlling sediment from all disturbed areas, except those permitted areas that are exempted by the requirements of these regulations. Other alternative sediment-control methods may be used in conjunction with the siltation structures or, in the case of the permitted areas that are exempt (i.e., roads), they may be used individually.

4.19.2.1.1.1 Temporary Sedimentation Ponds

Peabody would construct sedimentation ponds to control runoff and sediment from disturbed areas pursuant to 30 CFR 816.46, 816.47, 816.49, and 816.56 (refer to Map 3-7). Sediment ponds generally are recognized in the coal-mining industry as the BACT to prevent, to the extent practicable, additional contributions of suspended-solids sediment to streamflow or runoff outside the permit area due to mining disturbance. All surface drainage from the disturbed areas pass through a siltation structure before leaving the permit area, except in certain small areas that are exempt from these regulations. In the exempt areas, alternative sediment-control methods would be used to eliminate additional contributions of sediment outside the permit area. Most of the sediment ponds are designed to be temporary and would be reclaimed when they are no longer needed to treat runoff from disturbed areas. Certain temporary ponds would be proposed for permanent retention in the landscape, but would be required to be upgraded to meet permanent impoundment regulatory requirements. Sedimentation ponds and impoundments are designed to comply with the requirements of 30 CFR 780.11, 780.12, 780.25, 816.46, 816.47, 816.49, and 816.56, and other applicable regulations.

4.19.2.1.1.2 Permanent Impoundments

Fifty-one water sources consisting of three categories of impoundments determined to be needed to provide water for wildlife and livestock will be or are being proposed to remain after the mining is completed (refer to Map 3-7). Being multipurpose structures, these structures are presently used for sediment control during the LOM and reclamation operations and would be converted to permanent structures prior to final bond release.

4.19.2.1.1.3 Mine Safety and Health Administration-Size Impoundment Structures

Peabody uses 11 existing structures that meet the criteria of 30 CFR 77.216(a). Two structures would be temporary and nine structures would be permanent. The primary purpose of these structures, except for the Kayenta Mine fresh-water pond, is to control sediment from disturbed mining areas. The Kayenta Mine fresh-water pond's purpose is to hold pumped groundwater from nearby N-aquifer wells that is used for dust suppression.

4.19.2.1.2 Topsoil Stockpiles

Where prompt replacement of topsoil recovered ahead of mining disturbances is infeasible, numerous topsoil stockpiles would be developed throughout the mine areas to store topsoil pursuant to 30 CFR 780.14(b)(5) and 816.22(c) until it is needed for revegetation operations. Stockpiled topsoil typically remains in place from less than three months to more than 10 years, depending on the location with respect to revegetation operations and the revegetation schedule. Using best management practices, stockpiles would be placed on a stable site protected from wind and water erosion, and would not be disturbed until required for redistribution.

4.19.2.1.3 Transportation Facilities

Primary and ancillary roads would be located, designed, constructed, used, maintained, and reclaimed in accordance with the regulations and performance standards set forth under 30 CFR 816.150 and 816.151. Appropriate regulatory approval must be obtained for mine-related road crossings of stream buffer zones prior to construction of these crossings.

All roads used or built by Peabody on or after December 16, 1977, would be reclaimed, unless they have been approved by the regulatory authority as a part of the land use plan. Because of the size and nature of Peabody's mining activities, very few of the roads in the latter category would be reclaimed until the end of mining activities on the entire leasehold. Exceptions include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal-resource area.

4.19.2.1.4 Support Facilities

New support facilities would be approved by OSM prior to construction regardless of their location. All disturbances for construction of facilities to support mining operations would be located within a designated disturbance area. Maintenance of all facilities and reclamation of temporary facilities would be in accordance with the approved mining plan.

4.19.2.2 Coal Mining

Peabody must conduct coal-mining activities in a manner that conserves and protects the coal resource in accordance with 25 CFR Chapter 1, Subchapter I. BLM provides inspection and enforcement to ensure protection and conservation of the coal reserve, and also is responsible for independently verifying Peabody's coal production. Coal mining on Black Mesa is a complicated process involving extraction of nonconcentrated, multiple coal seams having varying overburden depths and innerburden thicknesses. The complicated nature of the coal-seam geology has resulted in the selection and application of equipment providing highly efficient and effective coal removal.

4.19.2.2.1 Mining Methods and Equipment

4.19.2.2.1.1 Clearing and Grubbing

Immediately prior to topsoil removal, the area to be mined would be cleared of large vegetation consisting primarily of piñon and juniper trees, to facilitate topsoil recovery. Trees would be removed up to 2,000 feet in advance of active mining operation (i.e., active highwall) for safety and security reasons. The vegetation debris removed would be placed at locations that will not interfere with mining operations. A majority of this material is made available to local residents as firewood and the remainder is either piled at the edges of the mining area to provide cover and nesting habitat for wildlife or buried in the pit during mining operations.

4.19.2.2.1.2 Topsoil Removal

All suitable topsoil would be removed from disturbed areas prior to initiating mining or mining-related activities. Prior to the start of removal operations, the proper salvage depth would be staked or otherwise identified under the supervision of a soil scientist or other qualified person. Salvage-depth information must be adhered to by equipment operators. Topsoil material would be removed throughout the year, weather permitting, in 1,000- to 2,000-foot-long by 300-foot-wide sections. It would be removed using scrapers or other earthmoving equipment and either hauled directly to recontoured areas for redistribution or transported to topsoil storage areas (stockpiles) located throughout the mine area for storage prior to eventual redistribution. Topsoil would be removed up to 1,500 feet in advance of the active mining operation (i.e., active pit highwall) for resource protection reasons.

Peabody routinely implements dust-control measures for topsoil stripping and redistribution operations. The cut of the topsoil removal areas and the ingress and egress routes to this area are included in watering operations. The ingress and egress routes to the topsoil lay-down area, where the final grading has occurred, also are watered. To reduce compaction, the lay-down area generally is not watered. Similarly, topsoil removal operations that place salvaged soil in stockpiles include watering as described above and often on the stockpile itself. Additional watering operations are conducted in the access routes to and from the equipment parking lot and the equipment parking and support areas.

4.19.2.2.1.3 Overburden Removal

After being drilled and blasted, overburden material covering the shallowest coal seam would be removed. The overburden would be placed in piles in the previously mined pit along the side of the current cut using draglines and auxiliary excavating equipment. This process would be repeated sequentially as the pit advances into the coal field (Appendix A-1, Figures A-1 and A-2). Overburden and spoil material that would be used as topsoil supplements would be identified and removed in much the same manner as topsoil material.

4.19.2.2.1.4 Air-Quality Control

Fugitive dust controls at the Black Mesa Complex focus on those substantive sources of PM_{10} emissions, which typically contribute the most to ambient levels of that pollutant (e.g., draglines, shovels, and haul roads). The fugitive-dust-control plan for the Black Mesa Complex currently uses the following activities, practices, and equipment to ensure that the mining operations do not result in a pattern of ambient PM_{10} impacts in excess of the applicable NAAQS:

- Exposed surface areas are protected and stabilized to control erosion and attendant fugitive dust by timely revegetation, stabilization of topsoil stockpiles, and revegetation management
- Rills and gullies, which form in regraded and topsoiled areas, are filled, regraded, or otherwise stabilized

- Exposed surface areas are minimized to the extent practicable
- Before or during loading, shot coal is watered as necessary
- The drop height from earth-excavating equipment is minimized to the extent feasible
- Haulage and ancillary mine roads are watered at frequencies dependent upon the amount and timing of use, condition of the roads, and the amount of dust observed when in use
- Frequently used haul roads and light-duty roads are chemically treated at least twice per year with a dust suppressant (35 percent magnesium chloride or equivalent at a chemical-to-water ratio of approximately 5:1)
- Magnesium chloride is stored year-round on site for use in spot treatment of roads, when necessary
- Some light-duty roads and parking lots are paved
- Water injection or rotoclones are employed on all overburden drills
- Haul-truck speeds are mechanically limited to 30 miles per hour, and all other vehicles are limited to 45 miles per hour, or as posted
- Sprays of water or water and a surfactant are installed and used at coal-handling and -conveying equipment
- Spoil and coal fires are suppressed and extinguished as soon as reasonably and safely possible
- All conveyors are covered
- Chutes, drapes, or other means are used to enclose conveyor transfer points, screens, and crushers

In addition, a comprehensive meteorological and ambient PM_{10}-monitoring program at the Black Mesa Complex is used to determine the effectiveness of those dust-control practices. Should monitoring data indicate that ambient PM_{10} standards are being threatened by impacts from mining operations, Peabody can adjust the nature, extent, and frequency of its various, available dust-control measures as necessary to reduce those impacts to maintain compliance with the applicable NAAQS. These practices and programs would continue under the LOM revision.

4.19.2.3 Reclamation

4.19.2.3.1 Surface Stabilization

Peabody, as required by statute and regulation, has included a plan in the LOM revision permit application that would be implemented to establish a reclaimed landscape that minimizes erosion and supports land uses. Under this plan, factors such as hill-slope gradient and length, soil properties, surface-soil mechanical manipulation techniques, site characteristics, and revegetation practices would be evaluated using prescribed criteria to design the surface form, soil placement, and drainage plan. The Revised Universal Soil Loss Equation is applied to evaluate the effectiveness of the surface-stabilization practices and determine the need for, and spacing of, gradient terraces on steeper slopes. Gradient terraces and down drains, in conjunction with surface protection and erosion-control techniques, may be used when necessary to maintain landscape stability. Geomorphic grading principles also are included. With this plan, soil losses are predicted to be less than soil losses in premining conditions.

4.19.2.3.2 Postmining Land Uses

The primary historical land use in the area has been livestock grazing—primarily sheep and goats. In recent years, the number of cattle and horses have increased. Other land uses include agriculture (primarily dry-land corn production), gathering of plant materials (for cultural, medicinal, and edible purposes), commercial trapping, various forms of outdoor recreation, and preservation of wildlife habitat. Reclamation efforts at the mine are directed toward restoring the land to be used for livestock grazing, wildlife habitat, and cultural plant use.

4.19.2.3.3 Postmining Topography

Backfilling and grading operations would be designed to produce a diverse topography similar to the original landform, as discussed above regarding the surface-stabilization plan.

4.19.2.3.4 Mine-Soil Reconstruction

Topsoil and topsoil-supplement redistribution operations would ensure the replacement of a minimum of 4 feet of suitable plant growth media for revegetation, of which a minimum of 9 to12 inches would be topsoil. Graded spoils determined to be suitable as a rooting medium would be covered by a minimum of 9 to 12 inches of topsoil. Graded spoils determined to be unsuitable would be covered with a minimum of 4 feet of suitable material (overburden and/or topsoil). Redistribution of plant-growth media would be accomplished whenever weather and soil moisture conditions permit, using scrapers, bulldozers, front-end loaders, backhoes, and end-dumps, and miscellaneous support equipment (road graders, water trucks, and farm tractors). This material would be obtained from topsoil storage piles or hauled directly from topsoil material removal areas and supplemental sources (highwalls and spoil banks). Scoria or red rock that is suitable for plant growth would be used in localized areas for reclamation of cultural plants, woody plants, and wildlife habitat.

Mine soil and spoils would be scarified prior to or immediately after topsoil material is distributed, to increase adhesion at the interface between the respective materials and relieve compaction. After redistribution operations are complete, contour furrows would be installed perpendicular to the slope. Revegetation treatments such as seeding, mulching, and erosion repair would be conducted on the contour to reduce the potential for downslope water flow.

4.19.2.3.5 Revegetation Plan

The revegetation plan has been developed to meet the requirements of 30 CFR 816.95, 816.97, 816.111, 816.113, 816.114, 816.116, and 816.133. Following topsoil replacement, surface mechanical manipulations, and seedbed preparation, revegetation would be completed using a combination of applied seed mixes, mulching, and seedling planting programs. The best technologically available practices would be used to accomplish all revegetation activities. The rangeland seed mix, the primary seed mix used for revegetation, is composed of a minimum of 21 species, including warm- and cool-season grasses, forbs, and shrubs. The predominantly native seed mix is designed to meet the requirements of the regulations cited above and meet nutritional requirements for livestock and wildlife. The rangeland seed mix would be split into drilled and broadcast components based on seedbed ecology needs of the seeded species and physical seed characteristics. Specialized seeding equipment would be used to seed both components at the proper depths in one pass to reduce equipment traffic on the reclaimed surface. Several additional seed mixes would be used in revegetating drainages or establishing wildlife habitat and sites for reestablishing cultural plants. The primary seeding season is from May to September, with a secondary seeding season available during spring and fall when ground conditions permit equipment operations.

Immediately following seeding of topsoiled areas, a native-grass hay mulch would be applied at 2 tons per acre and crimped. Native-grass hay is more effective than straw and does not establish volunteer crops. Sites established with suitable plant-growth substrates such as red rock or scoria are not mulched because of rough surface configuration and high coarse-fragment content. Following revegetation, the reclaimed areas would be fenced to exclude livestock and monitored for vegetation establishment.

Peabody, in consultation with the Hopi Tribe and Navajo Nation, has developed a list of more than 120 culturally important plants at Black Mesa, based on published ethnobotanical studies and contacts with medicine men, herbalists, and residents of Black Mesa (Appendix F, Table F-2). Peabody has developed and implemented a cultural plant restoration program on select reclaimed areas that also serves to reestablish woodland and wildlife habitat. Typically, sites of one to several acres are prepared on north-facing slopes using suitable plant growth substrates of red rock (scoria). These sites are developed to simulate the native site requirements of the target species. The sites contain numerous planting microsites due to roughened conditions created during substrate-replacement operations. Plant materials are developed from local native seed collections with some regional sourcing as needed to ensure that plants are adapted to environmental conditions at the site and are capable of regeneration. This ecological approach considers plant adaptations and symbiotic relationships common to plants in the arid Southwest. More than 50 cultural plant species of grasses, forbs, shrubs, and trees are commonly included in this program. This program would continue to be implemented under the LOM revision.

Piñon/juniper woodland sites would be reestablished as a part of the cultural plant restoration program. Typically, seedlings of piñon pine, Utah juniper, and to a lesser extent Gambel oak, are included in these planting efforts. Planted tree densities would be 250 to 350 stems per acre and the minimum established density is 75 trees per acre. Live piñon transplants from salvage of 3- to 5-foot-tall trees in grubbing areas ahead of mining would be transplanted annually to complement tree seedling planting.

Revegetation practices to restore wildlife habitat would include the overall rangeland seeding program, cultural plant and piñon/juniper woodland restoration, and additional woody species plantings around ponds and small depressions. The revegetation program would be designed to establish diverse vegetation capable of meeting wildlife nutritional needs and other habitat factors such as cover or nesting. High-density shrub areas (greater than 800 stems per acre) would be interspersed within the reclaimed landscape. Cultural plant/woodland/wildlife habitat sites also would be interspersed within the reclaimed landscape. These features would combine to increase edge and habitat diversity.

4.19.2.3.6 Revegetation Success

Revegetation success standards and their evaluation have been structured to meet the criteria of 30 CFR 816.111 and 816.116. Standards are based on a combination of native reference areas and approved technical standards that reflect environmental site conditions, ecological considerations, and land uses. The criteria for evaluation follow both 30 CFR 816 requirements and other Federal guidelines and address the parameters of cover, production, wood density, and diversity. Revegetated areas would be included in an annual vegetation-monitoring program to identify any needed remedial action, document trend and vegetation performance of reclaimed areas, contribute to the database for revegetation success evaluations, and provide data for implementation of land uses. The vegetation-monitoring data would be used to establish grazing levels in an approved grazing management program designed to enhance vegetation community characteristics and demonstrate achievable land uses.

4.19.2.4 Protection of Fish and Wildlife, and Related Environmental Values

Peabody's plan for protection of fish, wildlife, and related environmental values addresses the requirements of 30 CFR 816.97. The discussion in Section 4.19.2.3.5 addresses reestablishment, mitigation, and enhancement of vegetative habit features and needs. Various sections of the approved permits address operations conducted to minimize hazards to raptors from electric power lines and how to design, locate, and operate roads and facilities that avoid or minimize impacts on wildlife and permit passage. These also apply to the LOM revision.

Enhancement or replacement of nonvegetative features of wildlife habitat would include linear rock features and rock structures established at 1 acre per 100 acres with specified design criteria in the AZ-0001 and AZ-0001D permits. Raptor perches would be established at a density of 1 acre per 400 acres. The perches would be constructed based on the most appropriate and technologically sound design criteria at the time of installation.

As described above, impoundments significantly enhance habitat, establish wetland vegetation, and provide critical habitat features previously not readily available in the premine landscape.

4.19.2.4.1 Small Mammals and Birds

Construction activities would be limited during the small-mammal breeding season, especially for prairie dogs from April through June. Crevices, caves, and other rock formations (potential day or night roosts) would be surveyed for bats prior to construction. Snag trees would be monitored for bat activity before logging occurs. If bat maternity colonies are located, construction will be postponed until the normal maternity season has ended and bats have dispersed to other locations (September).

4.19.2.4.2 Threatened and Endangered Species, and Species of Special Concern

Peabody promptly notifies the regulatory authorities of any Federal-, tribal-, or State-listed species occurring in the permit area and conducts the required mitigation or monitoring following consultation. Surveys for nesting raptors in advance of active mining operations are conducted annually, and mitigation procedures are implemented as necessary after consultation with the regulatory authority if nesting raptors are located within the survey area. Prairie dog colonies are monitored annually for areal extent and sign of black-footed ferrets. If the size of a prairie dog colony exceeds the minimum acreage requirements in effect at the time, black-footed ferret surveys are conducted in accordance with guidelines specified by the regulatory authority. Mexican spotted owl surveys and monitoring were conducted over a seven-year period ending in 2000, and the surveys would be reinitiated when mining activities are within 2 miles of any known nest site or the mixed-conifer habitat type adjacent to the lease area. Surveys or monitoring would be coordinated with the regulatory authority following approved protocols.

4.19.3 Coal-Slurry Pipeline and Water-Supply System

Any new pipeline alignment would be carefully surveyed and located to avoid areas of difficult terrain and other sensitive environmental and human features. Where possible and to avoid unnecessary destruction of vegetation, the width of the construction right-of-way for the pipelines, limited to 65 feet under Alternative A, would be narrowed when practicable where construction takes place in dense woodland and riparian vegetation.

There are no agency authorities that permit and regulate the pipelines or well field. For the coal-slurry pipeline, the provisions of the American Society of Mechanical Engineers (ASME) Code B31.11, "Slurry Transportation Piping Systems," would be followed in the design, construction, operation, and maintenance of the coal-slurry pipeline. For the water-supply system (well field, collector pipelines, pump stations, and water-supply pipeline), provisions of the American Water Works Association (AWWA) would be followed in the design, construction, operation, and maintenance. The construction supervisor would ensure that pipeline-construction activities are completed in conformance with all applicable requirements and that all environmental mitigation measures are identified and implemented. All mitigation requirements would be incorporated into the project construction specifications and disseminated during preconstruction briefings so that mitigation requirements are understood by on-site construction and inspection personnel. Both the construction and maintenance activities would be performed in a manner that would minimize adverse effects on environmental and cultural resource values. The Hopi Tribe and Navajo Nation would be consulted to ensure that all clearing, grading, and construction activities where they have jurisdiction are conducted in such a manner as to minimize disturbance to traditional lifeways.

Environmental inspectors would oversee all field activities. The environmental inspectors' responsibilities would include, but not be limited to, inspecting erosion-control devices, water resources, cultural resources, vegetation, protected wildlife species, and protected areas. The environmental inspectors also would evaluate the success of revegetation and stabilization of the right-of-way following construction. All erosion-control devices are to remain in place and in a functional condition until stabilization is achieved, at which time the temporary erosion-control devices would be removed and disposed of in compliance with conditions agreed upon for the project.

4.19.3.1 Water-Quality Control

Construction activities would be performed by methods that would prevent entrance, or accidental spillage, of solid matter, contaminants, debris, and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include but are not limited to refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, liquid or semiliquid petroleum products (oil), aggregate processing tailings, mineral salts, thermal pollution, and drilling fluids other than water. All construction activities would be performed under a SWPPP. Staging areas would be set back with a sufficient buffer from waters of the United States and riparian vegetation to avoid staging impacts on these resources.

4.19.3.2 Dust Abatement

The construction work would comply with all applicable Federal, tribal, State, and local laws and regulations regarding the prevention, control, and abatement of dust pollution. The construction activities would use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including but not limited to crops, orchards, cultivated fields, livestock, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions. Methods of mixing, handling, and storing cement, concrete aggregate, and other fine PM would include means of eliminating atmospheric discharges of dust. The construction activities also would use watering trucks for dust abatement, where required.

4.19.3.3 Air-Quality Control

Construction activities would comply with applicable Federal, tribal, State, and local laws and regulations concerning the prevention and control of air pollution. The construction activities would use such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants. Equipment and vehicles that show excessive emissions of exhaust gases would not be operated until corrective repairs or adjustments have been made to reduce such emissions to acceptable levels.

4.19.3.4 Noise Abatement

Measures to reduce noise generated from construction activities when the activities are within 0.5 mile of a noise-sensitive receptor (occupied dwelling) would be implemented, when required. The need for such measures would be determined during construction after evaluating the conditions on site (e.g., prevailing wind direction, the proximity of noise-sensitive receptors, terrain, or presence of natural sound buffers that may alleviate the need for implementing noise-reduction measures). Such measures may include, but are not limited to, the use of temporary sound-baffle walls.

4.19.3.5 Light Pollution Abatement

Permanent and/or temporary artificial lighting used during construction and for permanent operations and maintenance would be directed to shine downward at an angle less than horizontal and aimed so that it is directed away from any residences and shielded so as not to include a residence in its direct beam. Any lighting would abide by Hopi Tribe and/or Navajo Nation laws governing light pollution. If there are none, the lighting would conform to State or county laws governing light pollution, whichever is more stringent.

4.19.3.6 Transportation

Construction of the pipelines under Alternative A would interfere with some transportation routes. Mitigation measures would be as follows:

- Major intersections would be bored or trenched and steel plated until the pipeline is installed.
- A traffic management plan would be established prior to construction activities.
- Owners and/or tenants of affected properties would be contacted prior to construction to explain the construction process and give them opportunity to identify any special conditions or concerns that should be incorporated into construction plans. Residents and businesses would again be notified two weeks before construction (regarding construction dates, work hours, traffic detours, and contact numbers of the proponent and the contractor). Emergency response agencies also would be notified of the work schedule.
- Access to property would be provided by placing steel plates across trenches during construction (except during trenching operations).

4.19.3.7 Preservation of Historical and Archaeological Data

During the construction activities, if evidence of a burial site or possible scientific, prehistoric, historic, or archaeological data is discovered, the work would cease immediately at that location and the appropriate land-management staff would be notified. During construction, care would be exercised so as not to disturb or damage artifacts, fossils, or grave sites uncovered during any activities such as clearing, grading, or excavation operations. Cooperation and assistance, as may be necessary, would be provided as requested to the appropriate tribal or other authorities to preserve the burial site and/or findings for removal or other disposition by the appropriate agency. All work would be conducted in accordance with the approved Historic Properties Management Plan for the project.

4.19.3.8 Raptors and Migratory Birds

Raptor surveys would be conducted prior to construction of the pipelines. The survey area should cover an area of 0.5 mile on either side of the pipeline. It would use a combination of aerial and ground surveys to cover the potential area of impact adequately. Protective buffer zones would be established around active nests during construction to avoid disturbance and loss of active nests wherever possible. Typical buffer zones include 0.25 to 0.33 mile for more tolerant species such as red-tailed hawk and up to a mile for sensitive species such as ferruginous hawk. Buffer zones would be established in consultation with FWS, AGFD, and the tribes based on site-specific factors, and would be maintained until the young have fledged.

Electrical transmission lines would be designed to prevent or minimize the risk of electrocution, using methods described in Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 (Avian Power Line Interaction Committee 1996).

To assist in compliance with the Migratory Bird Treaty Act, initial clearing of vegetation would be completed outside of the primary bird-nesting season of April 1 to July 31 to the extent practicable. Alternatively, nest surveys could be conducted ahead of construction to identify active nests and avoid harm to active nest sites.

Surveys for burrowing owls would be conducted near prairie dog towns and in round-tailed ground squirrel (*Spormophilius tereticaudus*) colonies (Mohave desertscrub and desert grassland) that would be affected by project activities, if construction occurs during the breeding season. Construction within 75 yards of an active nest would be avoided from April 1 to September 1 to the extent practicable. Active and passive relocation techniques would be used to move both parents and fledgling burrowing owls from occupied burrows in and near the construction zone during breeding season, and the burrows would be destroyed to prevent reoccupation prior to construction.

4.19.3.9 Southwestern Willow Flycatcher

Clearing of tamarisk and other riparian vegetation would be completed between November and March, outside of the breeding season to the extent practicable. Alternatively, nest surveys would be conducted ahead of construction activities to identify active nests; if no nests are present, clearing could occur during the breeding season. If future surveys indicate that this habitat is occupied by breeding southwestern willow flycatcher, then a re-initiation of consultation with FWS would be required under Section 7 of the ESA. Any staging areas would be set back with a sufficient buffer from waters of the United States and riparian vegetation to avoid impacts on these resources from staging areas.

4.19.3.10 Bighorn Sheep

Construction in bighorn sheep habitat in the Black Mountains would be avoided during the lambing season (February 1 to May 31) to the extent practicable, and in the bighorn sheep hunting season in December.

4.19.3.11 Desert Tortoise

Preconstruction tortoise surveys and handling would follow protocols developed by the FWS for Mohave population, and by AGFD for the Sonoran population. Qualified biological monitors would be used during construction to conduct preconstruction surveys and move any desert tortoise to safe locations. Burrows within the right-of-way would be inspected for presence of the species before being destroyed. Open trenches and other excavations would be fenced with temporary tortoise-proof fencing.

The Arizona BLM requires compensation for impacts on Sonoran desert tortoise habitat on public land for any disturbance that requires longer than 10 years to revegetate to preconstruction condition. Compensation is determined through a formula that includes varying rates in the three categories of desert tortoise habitat. Compensation and the formula are discussed in the Management Plan for the Sonoran Desert Population of Desert Tortoise in Arizona (Arizona Interagency Desert Tortoise Team 1996). At present, the number of acres that would be affected within the three categories is unknown, since the exact location of the pipeline has not yet been determined. Prior to construction when a more precise pipeline alignment has been designed, BMPI would coordinate with BLM to determine the amount of desert tortoise habitat affected and the amount of compensation that would be required.

4.19.3.12 Other Wildlife

To minimize the potential hazard of open trenches during construction, the following trenching guidelines would be applied during construction of the pipelines to the extent practicable:

- Keep trenching and backfilling crews close together, and minimize the length of open trench.
- Where trenches are left open and not backfilled, install short, lateral trenches or wooden planks for wildlife to escape from the trench, sloping to the surface at less than a 1:1 slope. In areas where this is not possible or practical, survey the open trench prior to beginning construction activities each day, and have trapped animals removed by a qualified biologist or trained technician.

4.19.3.13 Colorado River Fish

The horizontal drilling contractor would have a professionally prepared Emergency Rupture Response Plan and contingency Crossing Plan in place, prior to any drilling activities that would outline the protocol to monitor the construction, to stop work in the event of a rupture, and to contain and clean up drilling fluids and other deleterious substances. A geotechnical assessment would be conducted, prior to any drilling activities, to determine if this drilling technique has a high chance of success and a low risk of rupture. An SWPPP would be developed and implemented for the site in accordance with Arizona Pollution Discharge Elimination System (AZPDES) permit requirements prior to any drilling activities.

4.19.3.14 Clearing and Grading

Construction activities would exercise care to preserve the natural landscape and would be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for temporary and permanent work, approved roads, or excavation operations, all trees, native shrubbery, and other vegetation would be preserved and would be protected from damage as is practicable. Clearings and cuts through vegetation would be minimized to the greatest extent practicable, and the clearings and cuts required or otherwise authorized would be shaped irregularly to soften undesirable aesthetic impacts. On completion of the work, all work areas would be left in a condition that would facilitate revegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the construction would be repaired or otherwise corrected.

Topsoil would be stripped and segregated from subsoil in accordance with landowner or land-manager agreements. Space would be provided for temporary storage of spoil material and topsoil salvaged from the excavation. The width of the right-of-way would be restricted to avoid undue surface disturbance to adjacent resources. No disturbance would be allowed beyond the right-of-way limits.

Brush and shrubs within the right-of-way would be cut or scraped at or near the ground level. Except for the area to be excavated for the trench, the vegetative root system and subsurface soils would be left intact to the greatest extent practicable. This would assist in stabilization of the soils within the right-of-way throughout construction. Timber and other vegetative debris may be chipped for use as erosion-control mulch, cut and stacked along the construction area, or otherwise disposed of in accordance with applicable regulations and landowner or land-manager preference.

Clearing, grading, or other construction activities would not be conducted during conditions when the soil in the right-of-way of access roads is too wet to adequately support construction equipment.

Best management practices that would be used to minimize soil erosion and sedimentation during pipeline construction follow. An SWPPP would be developed as part of final engineering and construction planning and would be implemented during construction. The plan would include measures to minimize soil erosion and sedimentation during and following pipeline construction. The following general soil erosion and sedimentation minimization best management practices would be included in the plan:

- Potentially erosion-sensitive areas would be identified, and specific mitigation measures to address these areas would be included in the SWPPP.
- Weather would be considered when scheduling activities and would be monitored during construction to allow implementation of soil-stabilization and sediment-control measures prior to the onset of adverse conditions.
- Clearings and cuts through vegetation would be minimized to the extent practicable.
- Except for the areas to be excavated, the vegetative root system and subsurface soils in the construction zone would be left intact to the extent practicable.
- The quantity and duration of soil exposure would be minimized to the extent practicable.
- Dust-control measures would be implemented as needed to minimize nuisance dust. These measures could include application of water to vehicle traffic routes and excavation zones when constructing in populated or sensitive areas, avoidance of construction during adverse wind conditions, use of gravel on heavier-use roadways, and limitations on speed on unpaved areas.
- Temporary erosion controls would be installed and maintained during construction where site conditions warrant, to reduce water velocity and redirect runoff from precipitation.
- Suitable diffusers and/or energy dissipation techniques would be used when discharging project water to washes, charcos, or approved depressions.
- Original land contours would be restored to conform to adjacent areas as near as practicable.
- Rock and excess soil would be managed in one or more of the following ways:
  - Smaller rocks would be placed in the pipeline trench above the bedding material and would be used for side-hill cut restoration, water-diversion berm construction on slopes, construction of vehicle-control barriers, and would be dispersed into the 50-foot-wide right-of-way after construction.
  - Rocks dispersed on the surface would be distributed in a way that attains a natural appearance (e.g., no straight lines or windrows).
  - Rock would be hauled to off-site disposal areas approved by the Forest Service, or to other approved locations.
- Vegetation compatible with the planned land use and existing biotic community would be reestablished following final grading as agreed to by the relevant regulatory agencies, tribes, and/or private landowners.
- In agricultural areas, subsoil would be scarified, and the segregated topsoil would be returned to its original grade.
- Permanent erosion- and sediment-control measures such as diversion terraces would be installed as conditions warrant.
- Following construction, all erosion-control measures would be inspected and monitored as needed until final stabilization is achieved.

4.19.3.15 Excavation

Topsoil and subsoil would be sidecast to the same side of the trench in a two-pass excavation process. The first cut would be a shallow excavation that removes the topsoil and stockpiles it on the far edge of the nonwork side of the trench. The second cut would be the deeper excavation of 4 to 4.5 feet that removes the subsoil and also stockpiles it to the nonwork side, but adjacent to the trench.

4.19.3.16 Construction Methods in Special Areas

4.19.3.16.1 Steep Topography

Where severe side slopes are encountered, two construction techniques typically would be used. Using the cut-and-fill technique, the upslope side of the construction right-of-way would be cut during grading. The material removed from the cut then would be used to fill the downslope edge of the right-of-way to provide a safe and level surface from which to operate the heavy equipment. Alternatively, side-hill construction could use “two-toning” to provide two levels of work area. Side-hill areas could require additional temporary workspace downslope in order to effectively use these techniques. During grade restoration, the spoil would be placed back into the cut to restore approximate original contours.

Areas of steep slopes may require the use of winching techniques. In such circumstances, construction would require the use of winching tractors to hold each piece of equipment while working on the slopes to address safety concerns. The use of winch tractors in such areas would be necessary during both construction and restoration phases. The slopes would be restored to approximate original contours, and frequent trench and slope breakers would be used to reduce runoff and direct flow to vegetated areas off the right-of-way.

4.19.3.16.2 Road and Utility Crossings

Paved roads and highways would be crossed by horizontal boring at a specified depth beneath the surface. This method would be employed to avoid disruption of traffic. Heavier-walled pipe would be installed under the crossing.

Underground pipelines or utilities generally would be undercrossed. For such crossings, prior contact with the utility would establish any requirements for work performance or restoration. Before construction begins, the “one-call system” would be used for locating and marking the existing utility. At a minimum, the bore typically would allow a clearance of 12 inches between the proposed pipeline and any other pipeline or utility. On either side of the crossing, the trench typically would not be excavated any closer than 5 feet from any existing pipeline or utility encountered in the right-of-way.

4.19.3.16.3 Water-Body Crossings

There are several different construction methods that can be used to install pipelines at watercourse or water-body crossings. The pipeline installation method typically used depends on the size and sensitivity of the water body. The pipeline would cross some water bodies that are dry during much of the year. At these crossings, construction would occur during the dry season using conventional open-trench methods. The pipelines would be buried at sufficient depths, both on the banks and in the stream of the water body, to avoid future scouring that may expose or undermine the pipeline.

Typically, construction within water bodies would be completed as a distinct and independent construction operation from other work on the remainder of the right-of-way. This would allow the scheduling of crews and equipment to expedite construction activities across water bodies.

With the exception of the initial clearing equipment, only the equipment needed for excavation and backfilling would be allowed in the stream channel. All other construction equipment would cross the water body on temporary equipment or existing bridges. Any staging areas would be set back with a sufficient buffer from waters of the United States and riparian vegetation to avoid impacts on these resources from staging areas.

Horizontal directional drilling involves the use of a remotely guided drill head driven by a rotary drill rig using a drilling mud system for lubrication and cutting return and to maintain hole integrity. In certain cases, this method is preferable since the pipeline is drilled underneath the watercourse with very little disturbance of the bed or banks of the watercourse. Pipe sections somewhat longer than the length of the drilled hole are strung and welded opposite the drill rig and then pulled back through the hole using the drill rig.

Use of this technique involves drilling a pilot bore hole underneath the watercourse towards a surface target, back reaming the bore hole to the drill rig, then passing the reamer back to the opposite bank where the pipe is attached and pulled back toward the drilling rig. This process typically uses the freshwater gel-mud system composed of a mixture of clean, fresh water as the base, a biodegradable or biopolymer drilling-fluid lubricant as the viscosifier, and synthetic polymers to transport drilled spoil, reduce friction, and stabilize the bore hole. This method is less intrusive and is more favorable than an open-cut water crossing because it minimizes the potential to impact aquatic ecology.

One of the risks associated with horizontal directional drilling is the potential for drilling mud to escape into the environment as a result of a spill, tunnel collapse, or the rupture of mud to the surface. These ruptures are caused when excessive drilling pressure results in drilling mud moving vertically toward the surface. If a rupture occurs in a watercourse, the fine clay particles can settle onto the bottom of the watercourse. The risk of ruptures would be reduced through proper geotechnical assessment practices, adequate drill planning and execution, careful monitoring, and having appropriate equipment and response plans ready in the unlikely event that a rupture occurs.

Horizontal boring would be used to install the pipeline beneath the Colorado River between Laughlin, Nevada, and Bullhead City, Arizona, and under the Little Colorado River east of Cameron, Arizona. At the crossing of the Colorado River near Bullhead City, the bore would begin about 200 feet from the eastern edge of the Colorado River channel, extending under the Colorado River at a depth of approximately 50 feet below the channel bottom (90 feet bgs). The bore would continue underground for approximately 3,300 feet and would exit the ground inside the fenced yard of the Mohave Generating Station. This would virtually eliminate all surface disturbance on the Nevada side of the Colorado River. All drilling operations would be confined to a temporary workspace approximately 200 feet by 200 feet at the entry site, a 100-foot by 150-foot temporary workspace at the exit location, and right-of-way along the path of the horizontal bore that would include the staging area for pipe strings for the pull backs.

At the crossing of the Little Colorado River, east of Cameron, the existing pipeline is buried in a trench. Horizontal drilling would be used to install the new pipeline beneath the river. The pipeline would be buried deep enough below the surface of the water channel and banks to avoid future scouring and/or erosion.

Even though significantly more expensive, the directional bore beneath the Little Colorado River would be the preferred method under Alternative A, because it would allow the pipe to be buried much deeper to avoid potential adverse impacts on the pipe from flood conditions, as well as resulting in less environmental impact.

4.19.3.16.4 Blasting

If blasting is necessary, all required authorizations would be obtained and all safety precautions observed. All blasting would be conducted in compliance with Federal, tribal, State, and local laws, regulations, and policies. After blasting has been completed, backhoes would be used to clean the trench for pipe installation.

4.19.3.17 Lowering and Backfilling

After the pipeline is lowered into the trench, the trench would be backfilled with the excavated soil. In areas where topsoil was segregated during trenching, the subsoil would be replaced in the trench first, followed by placement of the topsoil. Where the previously excavated material contains large rocks or other materials that could damage the pipe or coating, clean fill or protective coating, such as rock shield, would be placed around the pipe prior to backfilling. In order to maintain soil porosity in agricultural areas, no soil tamping would be performed as part of the backfilling process. As a result, a small crown of material could be left to account for future settling.

4.19.3.18 Cleanup and Restoration

After the pipeline has been installed, backfilled, and successfully tested, the right-of-way, temporary work areas, and other disturbed areas would be finish-graded and any remaining construction debris would be disposed of properly. Original land contours would be restored to conform to adjacent areas to the degree practicable. In upland agricultural areas, subsoil would be decompacted and the segregated topsoil would be returned to its original horizon. Permanent erosion- and sediment-control measures, including diversion terraces and revegetation, would be installed at this time. In all wash crossings, the disturbed areas would be restored and revegetated. Additionally, each wash crossing would be reinspected and monitored after the restoration activities have occurred to ensure that natural flow patterns and revegetation have successfully occurred. All viable, protected plants, including cacti and yuccas, would be salvaged and used during restoration. Reseeding on public lands would be done with native species found in the area. Private and public property such as fences, gates, driveways, and roads disturbed by pipeline construction would be restored to original or better condition.

Revegetation for the coal-slurry pipeline and water-supply system would enhance and hasten natural revegetation. This would be achieved by creating a suitable soil seedbed through imprinting or other soil roughening technique, seeding of native species, and mulching. Fertilization is not likely to be needed because most native grasses and forbs are adapted to naturally low nutrient levels, and excess fertilizer is likely to favor invasive weed species at the expense of desired vegetation.

Because of the range of conditions along the pipelines, four different seed mixes would be developed. Proper seedbed preparation and mulching would vary according to area, and would be adapted to site condition. Seed mixes would include native shrubs, subshrubs, grasses, and forbs, and would have a minimum of 8 to 10 species. Mixes are needed for the following areas: Mix 1, for piñon/juniper and grassland areas; Mix 2, for Great Basin desertscrub; Mix 3, for desert grassland and for Mohave desertscrub (over about 2,000 feet in elevation); and Mix 4, for lower-elevation Mohave desertscrub. The BLM Kingman Field Office recommends also using hydromulch.

Areas of tamarisk riparian shrub disturbed during construction of the pipelines would be planted with native riparian vegetation suitable for the site’s soil and hydrologic conditions, such as coyote willow and cottonwood in mesic areas and native riparian plant species in drier areas.

Arizona protected native plants on public land administered by the BLM Kingman Field Office, would be salvaged prior to construction and would be transplanted back into the right-of-way during revegetation.

All waste materials including, but not limited to, excess spoils, waste materials, rubbish, sanitary waste, roadway pavement materials, etc., would be disposed of at the conclusion of construction in approved disposal facilities according to type. Excess rocks, not reburied in the trench, would be scattered within the right-of-way in a way that would not impede vehicle or game movement. Windrows of rock would not be allowed. Materials would be recycled whenever practical. The disposal of all materials would be in accordance with applicable Federal, tribal, State, and local laws and regulations.

Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement would apply. Records would be kept of the types and amounts of waste materials produced during construction and of the disposal of all waste materials on or off the job site.

In addition, an environmental site assessment would be performed at the following construction locations:

- All hazardous waste accumulation areas
- All hazardous material and petroleum-dispensing and storage areas where the aggregate storage of hazardous materials or petroleum at the site is 110 gallons or more

This site assessment would be performed by a qualified environmental consultant or equivalent and would document through appropriate analytical sampling and testing that all sites are free of the effects of contamination (i.e., contaminant concentrations are less than applicable Federal, tribal, State, or local action cleanup levels). Upon completion of the work, and following removal of all materials from the project area, work areas would be regraded and left in a neat manner conforming to the natural appearance of the landscape.

Hazardous materials, as defined by Federal Standard No. 313, as amended, and any other hazardous materials or substances identified by Federal, tribal, State, and local laws or regulations that are used during construction would be disposed of in accordance with the applicable laws and regulations. Only disposal facilities that are approved for disposal of hazardous wastes would be used, and records would be kept of all such disposal. Hazardous wastes would be recycled whenever possible.

All nonhazardous waste materials including, but not restricted to, refuse, garbage, sanitary waste, industrial wastes, oil and other petroleum products, and roadway pavement materials would be disposed of during construction by removal from the construction area to an approved disposal facility.

4.19.3.19 Hydrostatic Testing

Hydrostatic testing would be conducted to verify the integrity of the pipeline. Any significant loss of pressure indicates that a leak may have occurred and would require further inspection. The water required for hydrostatically testing the pipeline would be minimized by transferring the water used to test one section to the next section for testing, where possible. Where required, the test water would be discharged onto the surface of the ground within the right-of-way using energy dissipation and filtration devices (e.g., hay bales and silt fences) to reduce the velocity of the discharged water, thereby reducing potential for erosion.

4.20 MONITORING

Monitoring is the process of collecting information to measure conditions and determine if management strategies or compliance requirements are being met. Peabody conducts various types of monitoring programs at the Black Mesa Complex to meet objectives or requirements of several agencies, including OSM, USEPA, BIA, and tribal agencies. BMPI and SRP would monitor activities of the coal-slurry pipeline reconstruction and water-supply system construction as well as monitor the effectiveness of reclamation after construction. Examples of monitoring programs are described below.

4.20.1 Black Mesa Complex

A description of Peabody’s monitoring programs follows. These monitoring programs will continue regardless of the alternative selected.

4.20.1.1 Hydrology

Peabody monitors surface water, including flow and water quality, at five stream sites at the Black Mesa Complex. Several permanent impoundments proposed for the landscape are monitored semiannually for water levels and quality, and 10 springs are monitored annually for flow and water quality. These data are reported quarterly and in comprehensive annual Hydrology Reports. Discharges from sediment ponds, although infrequent, are monitored in accordance with Peabody's NPDES Permit No. NN0022179, and are reported monthly.

Groundwater at the Black Mesa Complex is monitored using several wells constructed in the Wepo Formation, alluvium, and in regraded spoil. Monitoring consists of water levels and water quality once per year in Wepo and alluvial-monitoring wells, and semiannually at a select few Wepo and alluvial wells. These data are reported quarterly and in comprehensive annual Hydrology Reports.

The N-aquifer production wells are monitored quarterly for a limited set of water-quality parameters and annually for a full suite of water-quality parameters. Water levels from the production wells are collected as conditions allow, but two N-aquifer observation wells are instrumented and record water levels continuously. These data are reported quarterly and in comprehensive annual Hydrology Reports.

Peabody also collects samples from select locations in the water-distribution system to comply with the Navajo Nation's Safe Drinking Water Act requirements, and analyzes them for bacteria and other water-quality parameters as required. Bacteria analyses are reported monthly, and supplemental water-quality analyses are reported annually.

Details of the OSM-approved hydrologic monitoring conducted by Peabody at the Black Mesa Complex are contained in Chapter 16, "Hydrologic Monitoring Program," in the AZ0001D permit documents for the Kayenta and Black Mesa mining operations.

4.20.1.2 Air Quality

Peabody maintains 12 air-quality monitors located at 11 sites at the Black Mesa Complex, where 24-hour composite samples for PM_{10} are collected every six days. In support of the air-quality monitoring efforts, Peabody has established four meteorological towers where wind speed, wind direction, and temperature are monitored continuously. Three of these sites are equipped with precipitation gauges, and five other precipitation gauges are located at several of the air-quality-monitoring sites. PM_{10} data and supporting meteorological information are reported quarterly and in comprehensive annual Air-Quality Monitoring Reports.

Details of the OSM-approved air-quality and meteorological monitoring conducted by Peabody at the Black Mesa Complex are contained in Chapter 12, "Air Quality," in the AZ0001D permit documents for the Kayenta and Black Mesa mining operations. (Also refer to Section 3.6.4 in this EIS.)

4.20.1.3 Soil and Spoil Sampling

Peabody monitors spoil quality prior to soil replacement on a 330-foot grid ensuring a suitable 3-foot-thick plant rooting zone is provided at the reclaimed surface. Topsoil replacement thickness is measured and verified by sampling a minimum of one site per 5 acres. These data are reported annually in comprehensive Reclamation Status and Monitoring Reports.

4.20.1.4 Vegetation Monitoring

Peabody has conducted annual vegetation monitoring at the Black Mesa Complex since the early 1980s. This has included monitoring in both the reclaimed and reference areas in most years. Select permanent transects and random sampling units in varying coal-resource units are sampled in either spring or fall or both seasons. Reference areas are sampled in at least one season and sometimes both. Sampling in two seasons has been the normal procedure due to two peaks of vegetation growth resulting from bimodal precipitation patterns. More than 60 permanent transects are located in revegetated areas that are representative of ongoing reclamation efforts. These permanent transects document changing revegetation requirements, vegetation establishment and development under varying climatic conditions, or results of different or improved revegetation procedures. These transects also are located in unique or high-interest reclaimed areas such as scoria planting sites. The permanent transects allow for measurement of vegetation performance over time to document trend and successional change as well as the response to drought and subsequent recovery. Furthermore, the sampling of transects and selected random sampling units measure achievement or progress towards revegetation success, confirmation of reclamation methods, stocking rate information for managed grazing, and evaluation of ongoing grazing management programs.

The approved vegetation sampling and monitoring program is contained in Chapter 9, “Vegetation Resources,” of the AZ-0001D permit. For bond-release evaluations, sampling intensities are set to meet sample adequacy requirements. All annual monitoring data are entered into a Peabody-developed vegetation database. The results of annual vegetation-monitoring efforts are provided to the OSM, Hopi Tribe, Navajo Nation, and the BIA in the annual Reclamation Status and Monitoring Report.

4.20.1.5 Wildlife Monitoring

Wildlife monitoring has been conducted at the Black Mesa Complex since the early 1980s. The core monitoring program is contained in Chapter 10, “Fish and Wildlife Resources,” of the AZ-0001D permit. The monitoring program has addressed threatened and endangered and other special-interest species, mine-front and nesting surveys for raptors, prairie dog colony and black-footed ferret surveys, red-tailed hawk monitoring, and general wildlife presence on reclaimed and native areas within and adjacent to the Peabody lease area. Documentation of the large numbers of migratory birds passing through the Black Mesa region has been a major ongoing focus. During Peabody’s historical monitoring period, several high-interest species have been monitored for consecutive periods. Peregrine falcon surveys were conducted from 1989 to 2000 to identify any possible mining impacts, including general monitoring for presence and nesting and breeding surveys. Mexican spotted owls were surveyed from 1994 to 2001 to assess any potential impacts as mining moved closer to potential habitat and the 2-mile buffer adjacent to the Peabody lease area. Monitoring during this period included surveys for Mexican spotted owls’ presence, breeding populations, and prey habits. More recent monitoring efforts have intensified efforts to identify and document wildlife use in reclaimed areas, particularly use by mule deer and elk. Annual wildlife-monitoring reports are submitted to the OSM, Hopi Tribe, Navajo Nation, and BIA as a part of the comprehensive annual Reclamation Status and Monitoring Report.

4.20.1.6 Reclamation

Monitoring of reclaimed areas has been described above in Sections 4.20.1.3. and 4.20.1.4. Additionally, disturbances ahead of mining, mining areas and associated activities, final grading, topsoil replacement, and revegetation are monitored and tracked throughout the year using a geographic information system database. The database is updated monthly and forms the basis for annual reporting of these activities. As with the other disciplines detailed above, reclamation activities are reported to the OSM, Hopi Tribe, Navajo Nation, and BIA as a part of the comprehensive annual Reclamation Status and Monitoring Report. The Reclamation Status Report follows the requirements for reporting as outlined in OSM’s reclamation status guidance document of November 15, 1998.

4.20.2 Coal-Slurry Pipeline and Water-Supply System

If Alternative A were selected, following construction, the pipeline rights-of-way and well field would be monitored for reclamation success until vegetation is reestablished as agreed upon with the applicable land-managing agencies or land owner.

The pipelines would be operated and maintained in accordance with standard procedures established by the pipeline owners to ensure safe operation and integrity of the pipeline. The operation and maintenance of the pipeline would be performed by qualified and trained employees. Personnel would be capable of monitoring the pipeline's operating conditions as well as controlling flows and pressures through the pipeline.

Field operations personnel would make regular visits to the pipeline facilities. During these visits, they would inspect these facilities and conduct routine maintenance in conformance with established procedures. Qualified operating and service personnel would, as necessary, check and repair all equipment to ensure safe and reliable operations. Emergency Response Plans would be prepared and made readily available during operations and maintenance.

Federal and State agencies have ongoing streamflow, spring, and well-monitoring programs in the area of the C-aquifer well field.

The applicants and, after 2026, the Hopi Tribe and Navajo Nation, would be committed to a comprehensive program of monitoring pumping amounts, water levels, and water quality in the vicinity of the proposed C-aquifer well field. The monitoring would occur during Black Mesa Project pumping and for a period of five years after project pumping ceases. The objective of the monitoring program would be to identify possible impacts of project pumping on existing wells and streamflows, determine if model assumptions and predictions were accurate, and determine if expected impacts on stream habitat (thus fish) were greater than predicted. USGS, in cooperation with BIA, has already begun monitoring water levels and springs to develop baseline conditions before project pumping starts. The components of the proposed groundwater-monitoring program are listed in Table 4-48.

Table 4-48 Proposed Groundwater Monitoring Program, C-Aquifer Well Field and Vicinity

Monitoring Component	Description
Pumping amounts	Measure and report monthly and annual well-field pumping amounts for mine and tribal uses.
Water-level monitoring	Measure and report spring and fall static-water levels in C-aquifer monitoring wells (in spring and fall). Monitoring wells would be located: (1) within and adjacent to the well field; (2) in a radial pattern emanating from the well field; and (3) east, west, and between lower Clear and Chevelon Creeks.
Initial water-quality data	Measure and report initial water quality from project wells using parameters for municipal water-quality standards. Measure and report initial quality from monitoring wells using parameters for the water-quality standard associated with the historical use of the well water.
Water-quality monitoring	Periodically measure and report electrical conductance in each monitoring well. If electrical conductance increases by more than 20 percent, samples would be analyzed for all parameters of the relevant water-quality standard.
Other well data	Collect and report data provided by the tribes and others for initial water quality, annual pumping amounts, and annual water levels for wells in the area.

4.21 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

4.21.1 Black Mesa Complex

For the purposes of this discussion, "short-term" impacts are those that would occur from the time when mining begins in a unit through reclamation of that unit when vegetation has been reestablished (i.e., through regrading, replacement of topsoil, reseeding, and initial revegetation). Long-term impacts are defined as the period when vegetation is established and controlled grazing is permitted, through release of the property by Peabody.

Under Alternative A, both the Kayenta and Black Mesa mining operations would be committed to coal production and reclamation through 2026 (the Kayenta mining operation would continue through 2026 under all alternatives). The Black Mesa Project would enable Peabody to continue to supply a reliable, lower cost of fuel (coal) to the Mohave Generating Station to fuel its operations (coal would continue to be supplied to the Navajo Generating Station through 2026 under all alternatives).

Mining through mid-2026 would result in the construction of additional roads, power lines, fences, and other structures in areas where mining has been conducted since 1970. Over the short term, mining would continue to change the environment and commit resources, and then the area affected by mining would be reclaimed and returned to rangeland for grazing and wildlife habitat. Over the long term, use of the land for grazing would not be affected by mining operations.

Approximately 12,409 acres of land within the Black Mesa Complex would be disturbed by construction and mining during the LOM (6,942) by the Kayenta mining operation and 5,467 by the Black Mesa mining operation). There would be long-term changes to the existing geology and topography from backfilling and grading operations; however, the modified topography would support, and in some places enhance, the proposed postmining land uses of grazing and wildlife habitat. Over the long term, soil and vegetation productivity would return to or exceed premining productivity because the reclaimed soil would be more uniform in depth, texture, and chemical and physical composition than the premining soils.

There also would be a short-term loss of vegetation and wildlife habitat. Native and introduced grasses and shrubs and islands of piñon/juniper would be planted after mining to restore vegetation in disturbed areas. Revegetation would establish mostly a grassland/shrubland mix, with islands of woodland habitat in the mined areas. The revegetation areas at the mines would have higher herbaceous productivity than existing communities, but there would be long-term loss of structural elements of the existing habitat such as woodland hiding and thermal cover, and cliffs and rock outcrops. Over the long term, the revegetated areas would support a diverse and productive wildlife community, but species adapted to woodlands would be displaced by species more adapted to grasslands and edge habitats. The retention of the large impoundments would be beneficial to a variety of wildlife over the long term.

Over the short term, mining would sustain the existing workforce through 2026—mine-related population and levels of public service would be sustained in the surrounding communities for that period. Long-term impacts potentially would be major on both the Hopi Tribe and Navajo Nation when coal and water royalties cease to be generated by mining activities. Over the short and long terms, the sociocultural influences of the mining operations would contribute to the forces of modernization prevalent on the Hopi and Navajo Reservations.

Relocating of Navajo households living within the permit area would continue over the LOM. Residents would continue to be subjected to periodic noise from blasting and daily noise from other mining activities. Long-term effects would be diminished and eventually eliminated when reclamation is completed. This process would take generations, which would exacerbate the short- and long-term effects of social disruption of families living in the area.

4.21.2 Coal-Slurry Pipeline and Water-Supply System

For the purposes of this discussion, “short term” is defined as the time required for construction of the pipelines and reclamation following construction—a period of five years. “Long term” is defined as lasting beyond five years.

Most of the impacts on the environment would result from construction activities and would be short term. Effects include the disturbance of soils, temporary increase in potential for soil erosion, use of water during construction, and disturbance of habitat until the construction rights-of-way are reclaimed. Over the long term, some habitat would be lost from construction of aboveground facilities associated with the C aquifer water-supply system (e.g., well heads, access roads, water-storage tank, power lines, pump stations, substations). Effects on air quality would be short term and localized, resulting from construction activities that create fugitive dust, and vehicle and equipment emissions.

Short-term and long-term impacts on cultural resources (Section 4.10) and paleontological resources (Section 4.2) would be similar to those of mining as discussed in their respective Chapter 4 sections. The presence of construction equipment and construction-related dust, and the visibility of disturbed areas within the landscape (until reclamation is complete) would impact scenic quality in project-related construction areas. Visible aboveground facilities would remain for the duration of their usefulness. Local and regional economies would benefit from the construction of the pipelines. Local economic benefits from operation of the coal-slurry pipeline would not be realized until the operation to supply coal to the Mohave Generating Station resumes. Local economies would benefit from new jobs and services to support the water-supply system and reinstated jobs and services to support the coal-slurry pipeline.

4.22 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This section describes irreversible and irretrievable commitments of resources associated with implementation of the alternatives. A resource commitment is considered *irreversible* when primary or secondary impacts from its use limit future use options. Irreversible commitment applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those resources that are renewable only over long time spans, such as soil productivity. A resource commitment is considered *irretrievable* when the use or consumption of the resource is neither renewable nor recoverable for use by future generations. Irretrievable commitment applies to the loss of production, harvest, or natural resources. For example, in the surface mining of coal, the removal of coal would be an irreversible and irretrievable commitment of resources. While the coal would be irreversibly committed from the geologic formations, it also would be committed irretrievably when burned for electrical generation.

Another example of irreversible loss involves soil loss or erosion. Soil losses from handling, erosion losses from topsoil stockpiles, and other unavoidable erosion losses of native soils would be irreversible. CWA and SMCRA require that soil erosion and sedimentation be minimized and otherwise controlled to mitigate these effects to the maximum extent technologically feasible.

Impacts on terrestrial resources, such as vegetation communities and wildlife may be either permanent or temporary depending on the time involved. For instance, a mine site without piñon/juniper woodlands as the land use may still revert to a woodland through natural succession—despite the problems of excess compaction, lack of native seed sources across the reclaimed area, and other site conditions that could hinder vegetation succession.

With sufficient time, although it may take hundreds of years, natural processes for mine-soil improvement and succession can overcome conditions limiting reforestation, and the resource loss is not irreversible. Conversely, intensively managed reclaimed mine sites may never regain trees due to long-term use as industrial, residential, agricultural, or other nonvegetated uses. Reclamation techniques may exist to equal or exceed natural vegetative regeneration and productivity. In the cases where these techniques are applied, the loss of vegetation resources may be no less reversible than timber harvest. Reclamation of mine sites to vegetative-community conditions may not reestablish wildlife habitat to pre-mining conditions. While no program can dictate land uses, many programs encourage and promote the tangible benefits for return of mined land to revegetated conditions to minimize and mitigate adverse effects.

Use of groundwater for mining operations is neither irreversible nor irretrievable. Project-related water use would not prevent other future uses. Once mine usage ceases, aquifer water levels would recover over time.

Both irreversible and irretrievable impacts would occur under all alternatives on geology and minerals, soils, fish and wildlife, land use, cultural resources, and visual resources. Results are summarized Table 4-49.

Table 4-49 Irreversible and Irretrievable Commitment of Resources

Resources/ Related Issues	Type of Commitment/Reason for Commitment	Alter-native	Irreversible	Irretrievable
Geology and minerals	Under all alternatives, there would be an irreversible and irretrievable commitment of coal resources. Under Alternative A, this would occur from the Kayenta and Black Mesa mining operation extracting 270 million tons of coal. Under Alternatives B and C, this would result from the Kayenta mining operation extracting 170 million tons of coal.	A	Yes	Yes
		B	Yes	Yes
		C	Yes	Yes
Soils	The structure and characteristics of the original soil profiles would be irreversibly changed when land is disturbed for mining. Commitment of the resource would be irreversible in areas where mining activities take place. However, reclamation would occur immediately and there would not be an irretrievable loss of soil productivity, as reclaimed areas would be recovered.	A	Yes	No
		B	Yes	No
		C	Yes	No
Fish and wildlife	An irretrievable commitment of wildlife habitat would occur from the construction of facilities associated with mining operations, coal-slurry pipeline, and water-supply system. This would result in a permanent minor loss of wildlife habitat unless these facilities were removed and the areas rehabilitated.	A	Yes	Yes
		B	Yes	Yes
		C	Yes	Yes
Land use	An irretrievable commitment of land use would occur from the construction of facilities associated with mining operations, coal-slurry pipeline, and the water-supply system. This would result in a permanent minor loss of forage production and cover from these areas unless these facilities were removed and the areas rehabilitated.	A	No	Yes
		B	No	No
		C	No	No
Cultural	Damage to cultural resources is an irreversible and	A	Yes	Yes

Resources/ Related Issues	Type of Commitment/Reason for Commitment	Alter-native	Irreversible	Irretrievable
		B	Yes	Yes
		C	Yes	Yes
Visual resources	There would be an irreversible and irretrievable commitment of visual resources from altering the landscape. The process of removing and replacing overburden would change the visual quality for these landscapes. Restoration reduces the impacts on visual resources, but the landscape would be permanently changed. Change in the landscape from the presence of aboveground facilities including access roads (mines, coal-slurry pipeline, and water-supply system). When the facilities are removed at the end of their useful life, the landscape could be restored; however, there would be irreversible and irretrievable loss of the original visual resources.	A	Yes	Yes
		B	Yes	Yes
		C	Yes	Yes

4.23 INDIRECT EFFECTS ASSOCIATED WITH RESUMING OPERATION AT MOHAVE GENERATING STATION

On December 31, 2005, operation of the Mohave Generation Station was suspended until new air-pollution-control equipment required by a consent decree is installed. The Mohave Generating Station owners have indicated that without a new water source for slurry-pipeline operations, they would be unable to renew their coal contract, which would prevent them from installing the controls needed to resume power plant operations. Therefore Alternative A, which approves the development and use of the C aquifer water-supply system for coal-slurry-pipeline operations, would have the indirect effect of allowing the Mohave Generating Station to resume operations. Under Alternatives B or C, the Mohave Generating Station would not resume operation, and other baseload generating stations in the region, primarily coal- or natural gas-fired facilities, would increase their electrical output to replace the lost power generation of the Mohave Generating Station. The environmental effects of these decisions are summarized below from the Preliminary Environmental Assessment for the Mohave Generating Station Continued Operation Potential Project (SCE 2004).

4.23.1 <u>Hydrology</u>

The Mohave Generating Station historically has used the Colorado River as its primary water supply, supplemented by reclaimed coal-slurry pipeline and monitoring-well water. The plant historically has had an average water requirement of 17,500 af/yr for power plant cooling, process water, and domestic water purposes of which approximately 16,000 af/yr are from the Colorado River. If the Mohave Generating Station returns to service, the power plant's overall plant-water demand would increase by approximately 2,300 af/yr due primarily to operation of the new air-pollution-control equipment, but also due to the power plant's anticipated increased capacity factor. The increased demand would not result in an increase in Colorado River water use, but would be met by in-plant water reuse and conservation controls, supplemented by reclaimed water from local businesses. The Mohave Generating Station is a "zero discharge" facility. All wastewater is evaporated on the site. Under Alternative A, the power plant would continue to withdraw and use its historic Colorado River water allocation. Under Alternatives B or C, the power plant's Colorado River water allocation would be used by another water user in Nevada. There would be no net difference in Colorado River water use among the three alternatives. Therefore, Alternative A would have no measurable effect on Colorado River water quantity or quality.

4.23.2 Air Quality

The Mohave Generating Station already has obtained the needed construction and operating permits to install the air-pollution-control equipment required by the consent decree to return the facility to service (Table 4-50). For most criteria pollutants, the future potential to emit from the station would be less than historic baseline emissions. In the case of CO and VOC, the potential to emit would be approximately 12 percent higher than historic emissions, since the future capacity factor of Mohave Generating Station is assumed to be higher than its recent historic baseline.

Table 4-50 Mohave Generating Station Criteria Pollutant Emissions

Air Pollutant	Two-Year Average (2000 to 2001) (tons per year) [1]	Potential to Emit (2010 to 2026) (tons per year) [2]
NOx	20,517	19,613
SO_2	42,024	8,701
PM_{10}	1,977	1,741
CO	1,209	1,364
VOC	145	163

NOTES: [1] Mohave Generating Station baseline emissions from Permit to Construct application.
[2] Mohave Generating Station potential to emit from Permit to Construct application.
PM_{10} = particulate matter equal to or less than 10 microns in diameter

Under Alternative A, the power plant would emit air pollutants at its permitted levels. These emissions are generally reductions from historic levels and are allowed by the Mohave Generating Station Title V operating permit as being consistent with the Nevada's state implementation plan to protect public health and welfare. CO and VOC increases are less than PSD review thresholds and are therefore not considered to be significant. The controls required by the consent decree were approved by USEPA Region IX as sufficient to address concerns related to Mohave Generating Station's contribution to impairment of visibility at the Grand Canyon National Park.

Under Alternative B or C, air pollutants from the existing facility would not be emitted at permitted levels. However, emissions from other baseload generating stations in the region, primarily coal or natural-gas facilities, would occur at higher levels to replace the lost power-generation capacity of the Mohave Generating Station. The net emissions from replacement generation may be higher or lower than from the Mohave Generating Station.

Alternative A would result in increased emissions from the Mohave Generating Station site. Alternative B or C would result in an increase in emissions from other generating stations in the region, which may be higher or lower than emissions from the Mohave Generating Station. The Mohave Generating Station's future potential to emit has been reviewed by the Nevada Division of Environmental Protection and USEPA Region IX and has been found to be consistent with State and Federal implementation plans to protect public health and welfare, including visibility in Class I areas. Therefore, Alternative A would not be expected to have a significant adverse impact on local air quality.

4.23.3 Climate

If the Mohave Generating Station returns to service, CO_2 emissions from plant operations have been estimated to be 11.9 million tons per year. CO_2 emissions were estimated using the historic emission rate reported in the USEPA's Acid Rain Electronic Data Reports multiplied by the future capacity factor in the application for the permit to construct. The Mohave Generating Station emissions would represent less than 0.05 percent of the 2004 emissions produced by electrical generation in the United States. In 2002, worldwide CO_2 emissions were estimated to exceed 27,550 million tons per year (USEPA 2006d).

Sources of replacement baseload power for the Mohave Generating Station would emit greenhouse gases to a greater or lesser extent than the Mohave Generating Station.

Under Alternative A, 11.9 million tons/year of CO_2 would be emitted from the Mohave Generating Station site. Under Alternative B or C, CO_2 emissions from the existing Mohave Generating Station site would not occur. However, CO_2 emissions may increase from other baseload generating stations in the region, the net effect of which might be higher or lower than the Mohave Generating Station.

The net impact of CO_2 emissions from Alternative A, B, or C would not cause a significant impact on global climate change.

The IPCC Fourth Assessment Report states that current climate models are not able to predict, with sufficient precision, global impacts of individual projects, nor can they predict localized climate impacts resulting from global climate changes. The implication of this is that attempting make such predictions using current techniques, could provide unreliable results. Similarly, in a memorandum dated May 14, 2008, the FWS Director stated that "the best scientific data available today do not allow us to draw a causal connection between greenhouse gas emissions from a given facility and effects posed to listed species or their habitats, nor are there sufficient data to establish that such impacts are reasonably certain to occur." See Section 4.5.2 for further discussion of global climate trends and the consensus of the scientific community regarding climate change.

4.23.4 Noise and Vibration

The Mohave Generating Station is located within an industrial district and is subject to the corresponding Clark County Unified Development Code noise requirements at the property line. The most significant noise sources at the site are located within the power block area, about 0.5 mile from the closest property line. Therefore, noise attenuates significantly before it reaches the property line. The facility's baseline noise levels historically have been in compliance with Clark County noise requirements. The new air-pollution-control equipment would be installed adjacent to the existing power block and would include noise attenuation measures to reduce equipment noise levels. The proximity of the existing and new noise sources is anticipated to result in very little additional noise above existing levels at the property line. Construction noise levels would be temporary and limited to construction hours. Due to the distance to the nearest sensitive receptor, noise levels are not expected to be significantly greater than ambient.

Under Alternative A, future operations are anticipated to have an insignificant impact on ambient noise levels. Under Alternative B or C, noise from the existing facility would not occur.

4.23.5 Social and Economic Conditions

If Alternative A is implemented and the Mohave Generating Station returns to service, the economic benefits of plant operations to Clark County and Laughlin in Nevada, and to Mohave County and Bullhead City in Arizona, would return to historic levels. In 2000, the most recent year for which information was readily available, Mohave Generating Station employed 340 workers (SCE 2004). The average salary for union-represented workers was in excess of $66,561 per year. In comparison, the average per capita income for Laughlin, Bullhead City, and Clark County was $30,624 (1997 data), $28,405 (1990 data), and $30,628 (1999 data) respectively. In 2000, Mohave Generating Station workers received more than $22 million in salary and wages that were primarily expended in the local region, and Mohave Generating Station purchased $25 million in goods and services from local vendors and contractors in the tristate area (Nevada, Arizona, and California).

The installation of the new air-pollution-control equipment would result in the creation of approximately 20 new jobs, and additional goods and services would be procured in the local region to service the new pollution-control equipment. Local construction jobs of up to 700 workers also would be created during the three-year construction period.

4.23.6 Visual Resources

The Mohave Generating Station is located within an industrial district and has been part of the visual landscape since 1970. Therefore, the baseline character of the present view is as an industrial complex. Under Alternative A, the installation of the new air-pollution-control devices would expand the existing footprint of the facility and add more, visible structures, including $S0_2$ scrubbers and silos. In addition, the existing stack would be removed and replaced with a new stack that would be slightly wider and higher. These structures would be placed adjacent to existing equipment and would blend into the existing industrial features. Therefore, Alternative A would be expected to result in an insignificant impact on the visual character of the site and its surroundings.

4.23.7 Transportation

Under Alternative A, vehicular traffic to and from the Mohave Generating Station would resume at historic levels. Historically, vehicle traffic in the area did not adversely impact traffic patterns or road maintenance. In addition, the installation of the new pollution controls is estimated to require up to an additional 190 truck trips per week and vehicle traffic for 20 additional employees. During the peak construction period, more than 700 workers would be employed at the site. Traffic congestion during construction would be alleviated by planning shifts around peak traffic times, staggering vehicle trips, and selecting alternate travel routes. Impacts on local transportation from Alternative A would be insignificant.

4.23.8 Other Impacts

The Mohave Generating Station site is an existing industrial complex that previously has been disturbed. No additional undisturbed land would be required under Alternative A if the Mohave Generating Station returns to service. Therefore, potential impacts on landforms, topography, geology, mineral resources, soil resources, vegetation, fish and wildlife, land use, cultural resources, and recreation were deemed to be insignificant.

4.24 CUMULATIVE EFFECTS

Regulations prepared by the CEQ for implementing NEPA require Federal agencies to analyze and disclose the effects that result from incremental impacts of an action "when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

4.24.1 General

4.24.1.1 Climate

Although operation of the Mohave Generating Station (which currently is not in operation) and Navajo Generating Stations is not included in the proposed or alternative actions, they collectively emitted approximately 31 million tons of greenhouse gases on an annual basis. The majority of greenhouse gas emissions is CO_2, a widely recognized greenhouse gas. Annual CH_4 and N_2O emissions from these two plants, expressed in CO_2 equivalent, total approximately 190,000 tons. Anthropogenic emissions of greenhouse gases have been linked to observed trends in increasing global temperatures. Therefore, this section presents an overview of the latest science on climate change and related impacts. The indirect effects associated with resuming operation of the Mohave Generating Station are discussed in Section 4.23.

Other existing coal-fired power plants in the region, including three in northeastern Arizona and three in northwestern New Mexico, emit varying amounts of CO_2, based on the amounts of sub-bituminous coal being burned in each. Total annual CO_2 emissions attributable to electric power generation in the United States are approximately 27,550 million tons. As described in Section 4.5.2, there is wide scientific community consensus that anthropogenic greenhouse gas emissions are contributing to increased temperatures observed in recent years. The environmental community and the media have paid particular attention to CO_2 emissions from coal-fired power plants.

The IPCC Fourth Assessment Report states that current climate models are not able to predict, with sufficient precision, global impacts of individual projects, nor can they predict localized climate impacts resulting from global climate changes. The implication of this is that attempting to make such predictions using current techniques, could provide unreliable results. Similarly, in a memorandum dated May 14, 2008, the Director of FWS stated that "the best scientific data available today do not allow us to draw a causal connection between greenhouse gas emissions from a given facility and effects posed to listed species or their habitats, nor are there sufficient data to establish that such impacts are reasonably certain to occur." (Refer to Section 4.5.2 for further discussion of global climate trends and the consensus of the scientific community regarding climate change.)

4.24.1.2 Air Quality

The primary air pollutant of concern is PM emissions resulting from ongoing and proposed mining activity at the Black Mesa Complex. As described in Section 4.6, most of the PM emissions associated with mining and material-handling operations tend to be coarser particles, such as PM_{10} and larger; a relatively small percentage of total PM emissions are in the $PM_{2.5}$ size range. Relatively minor emissions of particulate and gaseous air pollutants would also be emitted by various vehicles and equipment associated with mine operations. the alternatives do not include the combustion of coal from the Black Mesa Complex. However, comments on the Draft EIS received from cooperating agencies and other parties raised concerns regarding the potential cumulative impacts resulting from the combustion of coal originating from the Black Mesa Complex. Therefore, the following subsections include a discussion of cumulative PM impacts within the study area and a general discussion of air toxics emissions commonly associated with coal combustion.

4.24.1.2.1 Particulate Matter Emissions

Table 4-51 summarizes recent, actual (reported) annual PM_{10} emissions from several major and minor point sources located within or near the project study area. The "other sources" described in the table include the total PM_{10} emissions from all identified permitted point sources with PM_{10} emissions less than 10 tons per year. The historical background point source PM_{10} emissions total 3,736 tons/year.

Current annual PM_{10} emissions from the Kayenta mining operation were estimated at 1,154 tons per year. Adding the annual PM_{10} emissions from the background point sources within the study area (3,736 tons per year) to the annual PM_{10} emissions from the Kayenta mining operation (1,154 tons per year) results in total annual regional PM_{10} point source emissions of 4,890 tons per year. It is important to note that the background sources listed are in northeast Arizona and northwest New Mexico; therefore, total PM_{10} emissions in the broader study area are higher than the 4,890 tons per year value for this analysis.

The cumulative effects in the past included the operation of the Mohave Generating Station. According to SCE, the two-year average emissions baseline (based on emissions during 2002 and 2001) for PM_{10} emissions was 1,977 tons per year (SCE 2006). These impacts have been regulated under the jurisdiction of the Nevada Department of Environmental Protection, pursuant to applicable State regulations. Evaluation of the magnitude and extent of past or future Mohave Generating Station impacts are not the subject of this EIS. Presently, the scaled-back operations in the Black Mesa Complex and suspension of operations at the Mohave Generating Station have reduced the cumulative effects on air quality in the region, relative to past years. The criteria pollutant emissions for the Black Mesa Complex have been substantially reduced and the emissions from the Mohave Generating Station can be subtracted entirely from the inventory of emission sources. At the time of the EIS, there is no available quantitative modeling evaluation of the magnitude of these emission reductions on regional air quality.

Table 4-51 Background Point Source Annual PM_{10} Emissions [1]

Facility Name	Company Name	Location	Year	PM_{10} Emissions (tons per year)
Navajo Generating Station [2]	Salt River Project	Page, Arizona	2004	329
Mohave Generating Station [3]	Southern California Edison Company	Laughlin, Nevada	2004	1,977
Cholla Generating Station	Arizona Power Service	Joseph City, Arizona	2003	731
Nelson Lime Plant	Chemical Lime Company	Peach Spring, Arizona	2003	374
Phoenix Cement	Phoenix Cement	Phoenix, Arizona	2003	126
Snowflake Pulp Mill	Abitibi Consolidated	Snowflake, Arizona	2004	58
Griffith Energy Project	Griffith Energy LLC	Kingman, Arizona	2004	58
El Paso Natural Gas Company - Williams Compressor Station	El Paso Corporation	Williams, Arizona	2004	15
American Woodmark Corporation	American Woodmark Corporation	Kingman, Arizona	2004	12
All other sources (annual PM_{10} emissions less than 10 tons)			Most recent year	56
Total background source PM_{10} emissions (tons per year)				**3,736**

NOTES: [1] Emission data for sources are from Arizona Department of Environmental Quality unless noted otherwise.
[2] Emission data from Navajo Generating Station, personal communication with Lee Shakespear (Salt River Project) on October 27, 2005.
[3] Emission data from South California Edison Company, personal communication with Gary Dudley, October 28, 2005.
PM_{10} = particulate matter equal to or less than 10 microns in diameter

Table 4-52 summarizes total PM_{10} emissions from background point sources and the highest annual PM_{10} emissions associated with each of the project alternatives, reflecting past, current, and future impacts. It is important to note that during the 2006 to 2009 time period (current impacts), the Mohave Generating Station is not operating. Therefore, the total background point source PM_{10} emissions value has been reduced by the historical baseline amount of 1,977 tons per year attributable to this point source. Furthermore, maximum PM_{10} emissions from Mohave Generating Station will be lower than the historical baseline by 236 tons/year to 1,741 tons per year when the facility resumes operation in 2010. Consequently, the total background PM_{10} emissions value from 2010 to 2026 will include 1,741 tons/year from Mohave Generating Station.

Table 4-52 also shows the magnitude of annual emissions increases (associated with pipeline construction and expanded operations of the Black Mesa mining operation) over current regional emissions levels (which include the current Kayenta mining operation). Note that the highest increase in annual project PM_{10} emissions under Alternative A is approximately 14.8 percent of current regional emissions. Note that no PM_{10} emissions increases over current regional emission levels would occur with Alternatives B and C, since only the current Kayenta mining operation would continue.

Table 4-52 Summary of Highest Annual PM_{10} (tons per year) Increases Over Regional Point Source Emissions for All Three Alternatives

Period	Total Regional PM_{10} Emissions	Alternative A	Percent of Background Source Emissions	Alternative B	Percent of Background Source Emissions	Alternative C	Percent of Background Source Emissions
Prior to 2006 [1]	4,890	0	NA	0	NA	0	NA
2006-2009 [2]	2,913	251	8.6	0	NA	0	NA
2010-2026 (or later) [3]	4,653	690	14.8	0	NA	0	NA

NOTES: [1] Emitting activities include operation of the Kayenta and Black Mesa mining operations, regional point sources (including Mohave Generating Station).

[2] Emitting activities include operation of the Kayenta mining operation at current production levels, regional point sources (except Mohave Generating Station) and construction of coal-slurry and water-supply pipelines. Black Mesa mining operation did not operate during Mohave Generating Station outage (2006 to 2009).

[3] Alternative A emitting activities include Black Mesa mining operation at increased production level (6.2 million tons per year), operation of Kayenta mining operation at current level and regional point sources (including Mohave Generating Station). Alternatives B and C's emitting activities include operation of Kayenta mining operation at current levels through 2026 (operation of Black Mesa mining operation does not resume).

PM_{10} = particulate matter equal to or less than 10 microns in diameter, NA = not applicable

As described in Section 4.6, refined air-quality analyses performed for this EIS offer an indication of the contribution to cumulative effects from continued future operation of the Black Mesa Complex and the addition of the coal-washing plant as part of Alternative A. A key finding is that, based on highly conservative modeling (as described herein), discernable changes in air quality due to mining activities are predicted to be confined to the south of the Black Mesa Complex. This is predicted based on modeled winds. Although predicted concentrations above discernable levels (e.g., PSD significance thresholds) are predicted to occur for up to 100 km south of the Black Mesa Complex, there is little opportunity for the mining activity impacts to overlap with impacts from other sources in the region. This pattern would be largely unchanged from the level of impacts and the direction of impacts that have occurred during past operations of the Black Mesa Complex.

At this time, Peabody has not indicated that new customers are being considered for the coal from the Black Mesa mining operation and Peabody's application does not authorize mining of the unmined coal-resources in that area. However, without knowing a new customer's purpose and need for purchasing and using the coal, the amount and quality of coal needed per year, and a plan for mining and transporting the coal, impacts associated with the potential transaction cannot be projected. If and when there is such a proposal, associated actions (e.g., mining plan revision, development and construction of a means of transportation of the coal to its destination) will be required under NEPA.

4.24.1.2.2 Air Toxics Associated with Coal Combustion

Sub-bituminous coal contains trace amounts of various elements, such as mercury, selenium, and arsenic. When coal is pulverized and burned in a power plant's boiler, these elements typically are included in the flue gas exiting the boiler. Coal combustion also results in the formation of a variety of organic compounds, including dioxins and furans. The listing of hazardous air pollutants regulated under Title III of the CAA includes some of these elements and compounds. If emitted out the chimney in gaseous form, these chemicals typically disperse in the atmosphere, or they may become particulates, caused primarily by oxidation processes. Some of these same chemicals, and others, are generated in the boiler in particulate form, commonly associated with flyash; if emitted, these pollutants may eventually settle to the ground, either close to or far from the stack. The deposition of particulate forms of chemicals potentially toxic to biological species has been a concern associated with combustion processes, particularly those involving coal, municipal solid waste, and other fuels.

Deposition of PM in the atmosphere is usually caused by two primary mechanisms: “wet” deposition associated with precipitation, and “dry” deposition resulting from a combination of atmospheric dispersion and gravimetric settling. In any one location over time, “total” deposition is typically the result of a combination of wet and dry deposition. With regard to PM emitted by a particular source, wet deposition rates will be highest nearer to the stack, as precipitation events at that location encounter higher plume concentrations. Conversely, dry deposition tends to be higher at some distance from the stack, as the dispersion and settling mechanisms tend to take longer, and the plume has traveled farther.

Mercury compounds generated in a power plant’s boiler are unique, in that gaseous (elemental), oxidized. and particulate forms are created. Although the ratios of elemental and particulate forms generated in a boiler can vary, due to variations in coal composition, boiler design, temperatures, oxygen levels and combustion stoichiometry, limited data on mercury generation associated with sub-bituminous coal combustion in power plants within the Four Corners region indicates that the ratio of particulate to elemental mercury formed in the boiler is approximately 80 percent to 20 percent.

The coal-fired power plants in the region are equipped with various types and vintages of air-pollution-control equipment. If plants are equipped with selective catalytic reduction (proposed for the existing San Juan Generating Station and the proposed Desert Rock Energy Project) for NOx control, some of the elemental mercury would be converted to oxidized form, allowing it to be removed later in the SO_2 scrubber. Particulate mercury is removed with the flyash removal systems (electrostatic precipitators or baghouses); state-of-the-art fabric-filter technology (baghouses) typically remove well over 98 percent of PM in the flue gas exiting the boiler. FGD systems (SO_2 scrubbers) remove a portion of the oxidized mercury. Consequently, total mercury-removal rates range from 50 to 90 percent. The ratio of mercury forms emitted to the atmosphere tends to be around 20 percent particulate and oxidized and 80 percent elemental (gaseous form).

As part of the biological assessment for the Desert Rock Energy Project, work is currently ongoing to evaluate the cumulative impacts of mercury and selenium deposition within the San Juan Basin, particularly in areas containing critical habitat for threatened species. While this study has not been completed, preliminary information from that effort indicates that:

- Deposition rates, as calculated using sophisticated dispersion modeling, are miniscule—orders of magnitude below levels that could be measured.
- Current soil levels of mercury and selenium appear to be in equilibrium, despite the deposition of PM emitted by the Four Corners and San Juan power plants for several decades.
- Both the Four Corners and San Juan power plants are planning significant mercury emission reduction projects, to occur over the next several years; one proven method involves injection of activated carbon upstream of the baghouse, allowing elemental mercury to adsorb onto the carbon and then be removed in the baghouse.

Selenium species generated in the boiler are almost entirely in the particulate form, allowing removal in the PM-control equipment. In addition, the chemical processes associated with FGD systems have an affinity for removing residual selenium. The control of other pollutants, such as arsenic, are similar, although with varying degrees of removal efficiency.

4.24.1.2.3 Biological Resources

Historic and continuing grazing has caused reductions in perennial grasses and forbs in all ecosystems in northern Arizona, and increases in species that are not palatable to livestock, including some shrubs and weedy species. Perennial grasses would increase within the Black Mesa Complex as a result of revegetation efforts, increasing forage available to livestock and some wildlife species.

Natural fire regimes have been altered by removal of grasses through grazing and by fire suppression. This has led to encroachment of trees into former grassland areas and increases in tree density in both grasslands and wooded habitats. Grassland areas within the Black Mesa Complex would increase as a result of the proposed action and associated revegetation efforts.

Large-scale piñon- and juniper-removal projects have been conducted in the project area within the past 30 to 50 years, resulting in short- or long-term conversion of woodlands to grasslands to increase forage for livestock. Further conversion of piñon/juniper woodlands to grasslands would occur as a result of the proposed action.

Activities that have affected and will continue to affect the distribution and abundance of wildlife in northern Arizona include grazing, fire suppression, rural residential development, spread of invasive species, increasing populations of brown-headed cowbirds (a nest parasite), fragmentation of large habitat blocks by new roads and utility corridors, surface-water impoundments, groundwater pumping, and increasing human population. Increased attention by governmental and nongovernmental agencies to the management and protection of biodiversity is countering some of these activities.

4.24.1.2.4 Cultural Resources

The cumulative impacts of culture change and deterioration, weathering, and erosion of the tangible aspects of cultural resources accumulate over time. Prior, ongoing, and future developments of various types also have degraded and destroyed cultural resources in the vicinity of the project and will continue to do so. If the option of sizing the water pipeline to provide water to tribal communities as well as the Black Mesa Complex were implemented, the construction of the water-supply system and the development the water supplies might stimulate would lead to other impacts on cultural resources—perhaps as great or even greater than the proposed project. Although it is estimated that the proposed project might adversely affect approximately 100 or more cultural resources, thousands of cultural resources have been recorded within the region, and it is likely that hundreds of thousands remain to be recorded and evaluated. Regardless of the alternative selected, the impacts of the proposed project therefore are expected to represent only a minor increment to cumulative impacts on the cultural resources within the region. The exceptions where cumulative impacts are projected to be more substantial are lower Chevelon Creek and to a lesser extent lower Clear Creek, which are significant traditional Hopi cultural resources.

4.24.1.2.5 Recreation

Recreation areas exist throughout northern Arizona and provide opportunities for both developed and passive, dispersed recreational use. Although recreational use of the Black Mesa Complex is currently limited, once reclaimed, the area available for recreation could increase. Regardless of the alternative selected, current and proposed development, particularly in the western portion of the project area, would most likely increase the demand for access to recreation areas and use of access roads.

4.24.1.2.6 Transportation

ADOT plans to widen U.S. Highway 89 to four lanes (from highway Milepost 442 to Milepost 482), raise the median, and add three new interchanges with intermittent turn lanes. U.S. Highway 89 crosses the existing pipeline near CSP Milepost 78, within the area of improvements. Arizona Highway 64 (highway Milepost 185 to Milepost 235) is planned for additional paved shoulders, widening of some segments to four lanes, additional turn lanes, and construction of several passing lanes (ADOT 2004). Arizona Highway 64 crosses the existing pipeline near Milepost 123, an area identified for improvements.

In addition, ADOT is in the process of deciding on a corridor for the realignment of Arizona Highway 95. The alternative highway corridors are generally located east of Bullhead City and west of the Mount Nutt and Warm Springs Wilderness Areas from Arizona Highway 68 to I-40. The existing coal-slurry pipeline route would cross ADOT's current preferred highway corridor for the Arizona Highway 95 reroute near CSP Milepost 265.

The City of Kingman has approved a project to add a third lane to Gordon Drive. In addition, near CSP Milepost 230, the existing pipeline may cross the proposed north-south road associated with interchange improvements at I-40 and Rattlesnake Wash.

The City of Kingman has indicated that there is a plan for a new traffic interchange on I-40 at Rattlesnake Wash (located in proximity to CSP Milepost 2 of the Kingman reroute). The north-south connecting road would also intersect the reroute at Milepost 2.

As stated previously, the coal produced from the Kayenta mining operation is transported from Black Mesa to the Navajo Generating Station by the Black Mesa and Lake Powell Railroad, which is powered by electricity generated at the Navajo Generating Station.

On the Black Mesa Complex, roads are facilities that support the mining operation and used either short or long term. The existing rod system will continue to be used until the mining and reclamation operations are complete. Minor access roads to exploration and development areas and pit and spoil ramps would be constructed and used for the short duration of mining in a unit. Coal-haul roads, vehicle roads, mine-vehicle roads, and maintenance roads are used long term. All roads that have been used by Peabody or built and used by Peabody on or after December 16, 1977, will be reclaimed unless they have been approved by OSM as part of post-mining land use. More roads potentially would be built under Alternative A than under Alternatives B or C; however, at the completion of mining, the same number of permanent roads would remain regardless of the alternative selected.

4.24.1.2.7 Social and Economic Conditions

Due to the existence of the Black Mesa Complex, mining drives the economy of the local area and makes the largest private-industry contribution to the revenue of the Hopi Tribe and Navajo Nation. The Mohave Generating Station has been and (under Alternative A) would be supplied completely by the Black Mesa mining operation, and the coal for the Navajo Generating Station has been and (under all alternatives) would continue to be supplied completely by the Kayenta mining operation. OSM's approval of the LOM revision to resume the Black Mesa mining operation would enable resumed operation of Mohave Generating Station from 2010 through 2026. A brief summary of the impacts of continued or discontinued operation of the Mohave Generating Station and continuation of the Navajo Generating Station follows.

The Mohave Generating Station operated from 1970 to 2005, and in recent years employed 305 people, had a $22.2 million payroll, and made an overall contribution of about $364 million to the region's economy. The direct economic impact of the generating station employment generally affected three communities—Laughlin, Bullhead City, and Mohave County. Since the station is located in Laughlin, certain benefits accrue to the Laughlin business community and directly to Nevada governments, such as the property tax revenues to the State, Clark County, and the Clark County School District (Southeast Region). Nearly two-thirds of the Mohave Generating Station's employees resided in Mohave County other than in Bullhead City (many in the Kingman area), while about one-quarter lived in Bullhead City, and fewer than 1 in 12 lived in Laughlin. The indirect economic activity such as jobs in businesses that supported the station similarly benefited Mohave County. It is expected that resumed operations at Mohave Generating Station would result largely in a reversal of the direct and indirect effects of the shutdown, with respect to employment and governmental revenue. If and when the station resumes operations, it will be equipped with new air-pollution-control technology.

The suspension of operations at the Mohave Generating Station, Black Mesa mining operation, and associated facilities, may last only through 2009, if Alternative A is selected, or may become permanent. From 2006 through 2009, the shutdown has had a direct effect on the economy of the entire region, felt most severely in the local area on both reservations, and in Kingman and Laughlin.

Proposed construction activities at the Mohave Generating Station that are associated with the emission-control improvements do not require any Federal approvals. Many of the required activities, labor force, materials, and other components for the proposed construction project would be similar to those for the operation of the station. The construction activities could offset many of the adverse effects of the later portion of the station's shutdown period.

The Navajo Generating Station is usually considered as one element of the "Navajo Project," whose other components are the Kayenta mining operation and the Black Mesa and Lake Powell Railway. The Navajo Project's 483 employees at the mining operation are addressed elsewhere in this EIS. In total, there are about 500 full-time employees between the Navajo Generating Station and the railway who are employed by SRP, the special government district that operates the generating station. The Navajo Generating Station is a basic industry that, with tourism, drives the economy of Page, Arizona. Of the 500 employees, more than 80 percent are Hopi or Navajo. While some live in the local area of the mines, others live in Page or LeChee, Arizona, or in other areas nearer to the generating station.

Under existing conditions, the Navajo Generating Station supplies a substantial portion of the total electric power supplied to communities in Arizona, Nevada, and southern California. The jobs at the "Navajo Project" are among the most numerous, stable, high-paying jobs for residents of Page and the Hopi and Navajo Reservations. The generating station and the Kayenta mining operation together are also minor direct contributors to the Flagstaff economy.

Under Alternative A, the resumption of operation of the facilities related to operation of Mohave Generating Station in 2010 would have a direct beneficial effect upon the economy of the entire region. The completion and operation of the C aquifer water-supply system and a permanent road would have a direct beneficial effect upon economic development in the region and especially throughout the Hopi Reservation and in the western Navajo Reservation.

The long-term shutdown of the Black Mesa Complex operations and the Mohave Generating Station would have impacts on the entire region, especially Kayenta, Kingman, and Laughlin. Electric power generation planning at present (2006) takes into account the closure of the Mohave Generating Station when the Colorado River water allocation for the plant ends in 2026.

The Navajo Generating Station would continue to operate for the foreseeable future. The Navajo Generating Station would be fueled by Black Mesa Complex coal beyond 2026, provided that an additional LOM revision and associated plans, permits, and contracts were put in place. When the Black Mesa Complex and the Navajo Generating Station would eventually shut down, major economic impacts on the Kayenta area would occur because of the cessation of the mining operation, and major economic impacts on the Page area would occur because of the shutdown of the Navajo Generating Station.

4.24.1.2.8 Environmental Justice

The Navajo Generating Station is a basic industry that, with tourism, drives the economy of Page. Of the 500 employees of the generating station and the associated Black Mesa and Lake Powell Railroad, more than 80 percent are Hopi or Navajo. While some live in the local area of the mines, others live in Page, LeChee, or other areas nearer to the station. The LeChee Chapter currently has one of the lowest proportions of persons living in poverty on the Navajo Reservation. Other western Navajo chapters, beyond the local area of the mining operations, such as Bodaway, Cameron, Coalmine Mesa, and Coppermine, have high poverty rates. The local area beyond Page outside the Navajo Reservation is very rural and has elevated rates of poverty. The industries in Page are the employment base for the region. Any decline in employment at the station would carry with it income effects on those households that are at or near the top of the income range in the local area.

Laughlin, Nevada, the location of the Mohave Generating Station, has few residents with incomes under the poverty level. A majority of the employees of the station live in the Kingman, Arizona, area while some live in Bullhead City, Arizona. Generally, there are no high proportions of poverty-level residents in Kingman and Bullhead City, but there are a few census tracts in each area with high rates of poverty. The population in poverty experienced minor indirect and induced economic impacts when the station shut down. The local area surrounding the station has few minority residents.

Much of the region of influence is designated as a medically underserved area. That designation indicates that the number of primary care physicians per thousand in the population is low, while the proportion of persons in poverty, the proportion of elderly persons, and the infant mortality rate are high. According to the formula, the designation is applied to the entire counties of Apache and Navajo, the low-income population in Mohave County and Bullhead City, the Kingman Indian Health Service Area in Mohave County, and the Tuba City Indian Health Service area in Coconino County.

The mining operations and generating stations would adhere to occupational health and safety regulations, including on-site health facilities. They are located in areas, however, where the access to health care is limited. When and if any of the mining operations or stations cease operations and, therefore, a health care resource is lost, there is a minor direct influence on the former employees and a minor indirect influence on the area.

4.24.2 Specific to the Black Mesa Complex

The cumulative effects of coal-surface mining on the Black Mesa Complex under all alternatives would increase acreage reconstructed with gentler slopes, smoother rolling hills, and less dense drainage patterns. Reclamation operations implemented under the approved reclamation plan (refer to Appendix A-1) reduces the degree of impacts from mining operations. In addition, under all alternatives, surface mining would increase the amount of permanent subsurface disturbance that would impact the lateral continuity and groundwater-flow conditions of water-bearing sedimentary formations. The existing geologic sedimentary rocks and structures would be changed permanently to the mined depth of approximately 250 feet at the base of the Wepo Formation.

Since the beginning of mining operations and through 2005, Peabody’s mining operations have removed 377 million tons of coal from mining areas within the Black Mesa Complex. Under Alternative A, the mining operations would remove 170 million tons from the Kayenta mining operation and 105 million tons, from the Black Mesa mining operation, through 2026. This represents a total of 652 million tons of coal removed from the Black Mesa Complex. The Kayenta mining operation has already disturbed 12,409 acres, and the Black Mesa mining operation has disturbed 6,965 acres—acres that have been or are being reclaimed for productive use. Under Alternative A, 6,942 acres and 5,467 acres, respectively, would be progressively disturbed and subsequently reclaimed for productive use. Under Alternatives B and C, the Kayenta mining operation would disturb the same amount of acreage, while the Black Mesa mining operation would not resume and therefore would not disturb any more acreage.

The past (1996 to 2007), proposed, and reasonably foreseeable mining of coal in the Black Mesa Complex would result in disturbance of up to 42,832 acres of native vegetation and wildlife habitat under

Alternatives A and B and 28,556 acres under Alternative C. Although the areal extent of impacted acreage would be greatest under Alternative A, the intensity of impact when reclamation operations are conducted under the approved reclamation plan would be the same under all alternatives. The cumulative effects of coal-surface mining on the soil resources of Black Mesa can be characterized as beneficial to neutral. The project would result in conversion of woodlands to grassland on Black Mesa. The quality of rangeland and wildlife habitat on the mesa is expected to improve with reclamation of disturbed areas under all alternatives.

CHIA is required by OSM. The objective of the CHIA is to determine material damage to the hydrologic balance for the cumulative mining effects in the impact area. Currently, the CHIA is being updated by OSM and the 1989 CHIA concluded that there were no significant cumulative impacts on surface water at Moenkopi or Dinnebito Washes, and no significant surface-water impacts.

As described in Section 4.4, neither the mining activities and monitoring data collected at the Black Mesa Complex since 1989 nor the proposed LOM activities have resulted in change in the overall conclusion of the 1989 CHIA. There are no other coal-mining activities within the area. Given the lack of dependable year-round surface water, there are no other surface-water uses that would result in a greater cumulative impact on surface-water resources than that of the Black Mesa Complex.

4.24.3 Specific to the Water Supply

4.24.3.1 C Aquifer Water-Supply System

Under Alternative A, groundwater from the C aquifer would be pumped to supply water for the coal-slurry pipeline and for Kayenta and Black Mesa mining operations and reclamation. In addition, there is historic, present, and future projected pumpage from the C aquifer by both tribal and nontribal users.

Past and current pumpage has been estimated by various entities (ADWR 1994; Hart et al. 2002; USDA 1981). Future nonproject-related C-aquifer pumpage was estimated in the Western Navajo and Hopi Water Supply Needs, Alternatives and Impacts Study (HDR 2003). These sources were reviewed and updated by Reclamation's C-aquifer Technical Advisory Group (TAG) (Reclamation 2005). The C-aquifer groundwater demand (pumpage) estimates produced by the TAG are considered the most up-to-date estimates available and were adopted for this study.

Although there was some water use prior to 1950 it was small compared to the total water budget, and for modeling purposes was considered to be zero (SSPA 2005). Estimated total nonproject pumpage increased from 95,492 to 120,079 af/yr over the 61-year (2000 to 2060) projection period. Estimated groundwater pumpage from 1950 to 2000 (past) and 2001 to 2060 (future), by major use, is given in Table 4-53.

Table 4-53 Estimated Nonproject C-Aquifer Pumpage, 1950 to 2060, in acre-feet per year

Use	1950 to 2000	2000 to 2060
Irrigation	0 to 23,148	23,148 to 18,200
Industrial	0 to 50,382	50,382 to 63,000
Municipal	0 to 21,963	21,693 to 38,879
Total	**0 to 95,492**	**95,492 to 120,079**

SOURCE: S.S. Papadopoulos and Associates 2005

As can be seen, pumpage in the C aquifer has grown significantly since the 1950s, with the largest single use being industrial. Over 90 percent of industrial use consists of four major facilities as shown in Table 4-54.

Table 4-54 Major Industrial Users

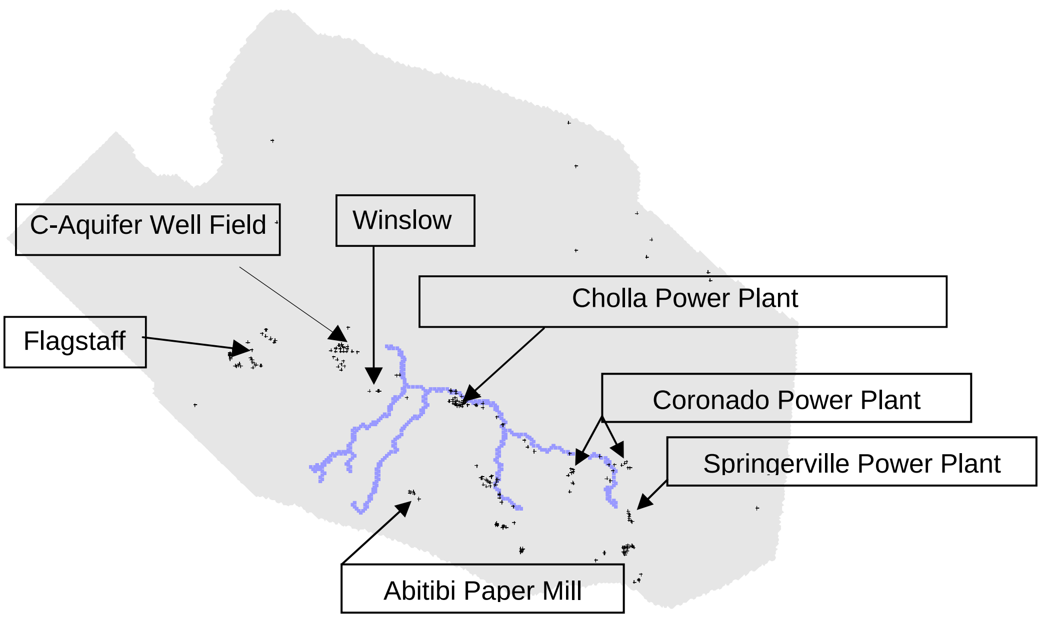
User	Estimated 2000 Pumpage (acre-feet)
Cholla Power Plant	14,882
Coronado Power Plant	10,394
Springerville Power Plant	9,252
Abitibi Paper Mill	15,553

SOURCE: S.S. Papadopoulos and Associates 2005

Two of these facilities, the Cholla Power Plant and Abitibi Paper Mill, are located closest to the C-aquifer well field.

The TAG-estimated pumping rates were assigned to each of the nonproject pumping centers within the C-aquifer groundwater-flow model to estimate the impact on aquifer water levels and streamflow depletion. As discussed in Appendix H, the SSPA and USGS models were used for assessment of impacts due to regional pumping. Location of pumping centers is shown on Figure 4-3.

Figure 4-3 Pumping Rates



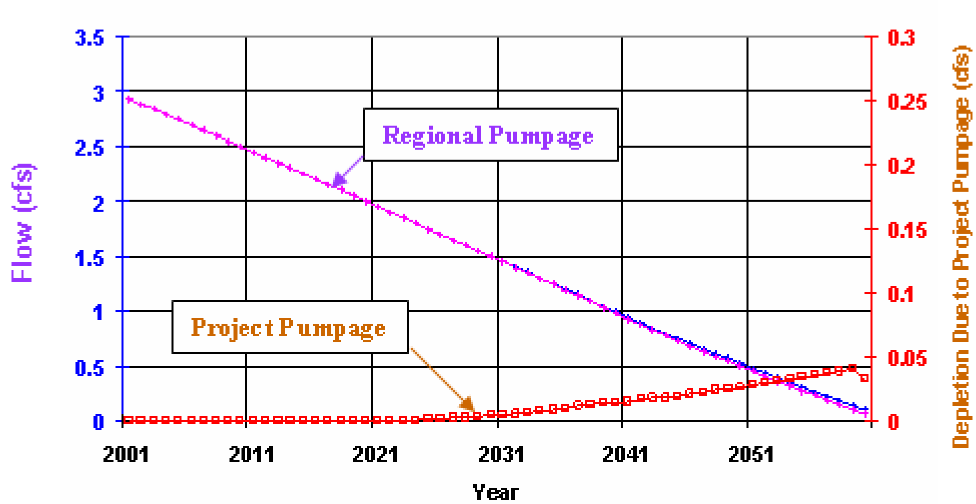
SOURCE: S.S. Papadopoulos and Associates 2005

According to groundwater modeling, continued and increasing regional pumping of groundwater from the C aquifer is expected to cause declines in groundwater elevations, especially near major pumping centers. In 2060 declines of 20 feet or more are predicted for areas near Silver Creek, along the Little Colorado River from Holbrook to Joseph City, and the upper Little Colorado River above St. Johns, while declines of 5 to 15 feet are predicted to occur in the area of lower Chevelon and Clear Creeks (SSPA 2005).

Model-predicted impact of nonproject and project pumping on stream baseflow in lower Clear and Chevelon Creeks is shown in Figure 4-4 and Figure 4-5. Baseflow in Lower Clear Creek is predicted to decline from about 4.2 cfs in 2000 to 2.7 cfs in 2060, or a decline of 1.5 cfs. The baseflow on lower Chevelon Creek declines from almost 3 cfs in 2000 to about 0.1 cfs in 2060, a reduction of more than 95 percent. The projected impact on lower Chevelon Creek baseflow is due primarily to its proximity to the Cholla Power Plant/Holbrook/Agriculture pumping center (SSPA 2005).

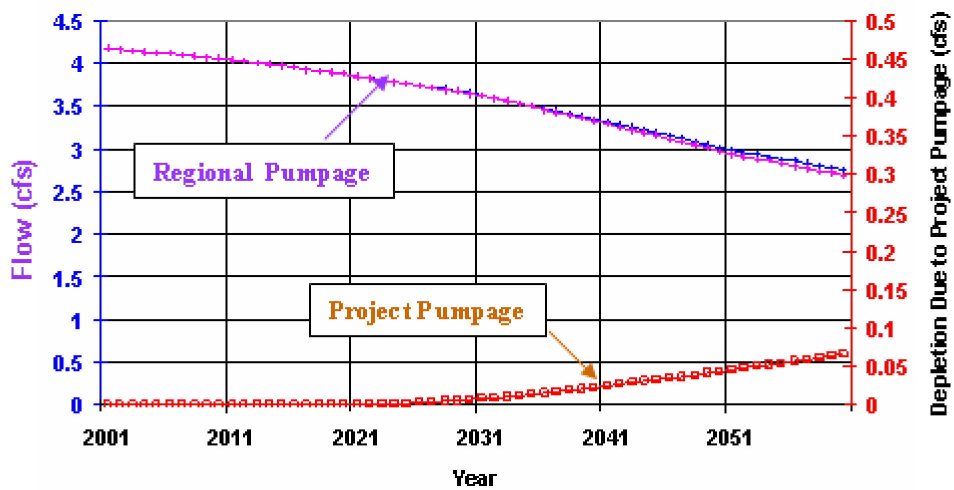
The projected maximum impact on baseflow due to project pumping is less than 3 percent of the impact due to nonproject pumpage. The impact on average annual streamflow is about 0.1 percent, as discussed in Section 4.4. Computer modeling indicates that although the proposed pumping of groundwater from the C aquifer for the project would have negligible effects on perennial reaches of lower Clear Creek and lower Chevelon Creek, cumulative impacts from other nonproject pumping will reduce baseflows considerably. Baseflow in Clear Creek is projected to decline by 20 to 25 percent between 2000 and 2060 (from 4.2 cfs to 3.2 cfs), and by about 90 percent in Chevelon Creek, from 3.0 cfs to 0.3cfs. These impacts are projected to result primarily from pumping for municipal, industrial, and agricultural uses in the vicinity of Holbrook and Joseph City (SSPA 2005).

Figure 4-4 Lower Chevelon Creek Baseflow Diminution from Regional Pumping and Project Pumpage of 11,600 (acre-feet per year)



Source: S.S. Papadopulos 2005

Figure 4-5 Lower Clear Creek Baseflow Diminution from Regional Pumping and Project Pumpage of 11,600 (acre-feet per year)



Source: S.S. Papadopulos 2005

Increases in depth to groundwater beneath perennial stream segments would reduce the availability of water for riparian vegetation, making it more dependent on seasonal runoff. This is likely to cause decreases in the extent and density of riparian vegetation, where present along these stream segments. Native cottonwood, willows, and other species are likely to be more adversely affected than tamarisk. Depending on the hydraulic connection between the river alluvium and the C aquifer, projected drawdowns in excess of 20 feet could preclude or reduce the development and persistence of large tracts of salt cedar in this area. Southwestern willow flycatchers could be affected by decrease in the extent, thinning of cover, and changes in composition in riparian vegetation, and by reductions in areas of surface water or saturated soils in breeding habitat.

Reductions of surface flow in lower Chevelon Creek due to nonproject pumping could impact those users diverting surface flows out of the creek, and these impacts would reduce water availability for wildlife species (such as waterfowl, mammals, and riparian birds) that use the lower section of the creek.

The decline and eventual elimination of baseflow in lower Chevelon Creek from regional groundwater pumping would have significant adverse effects on Little Colorado spinedace and its habitat, including reductions in the length of flowing stream in the dry season, elimination of riffles and shallow runs during the dry season, and a marked reduction in the size and depth of pools. Approximately 12 miles of habitat within lower Chevelon Creek, 8 miles of which is designated critical habitat for the Little Colorado spinedace as well as 10 miles of lower Clear Creek would be affected by the proposed action. Proposed conservation measures would benefit and improve habitat within 38 to 48 miles of streams, including 31 miles of designated critical habitat for the Little Colorado spinedace. The effects would likely be most significant in the drier months of June and July, but impacts would be expected throughout other portions of the year as well. Diminution in baseflow would reduce or eliminate habitat for fish at a critical season, and surviving spinedace may be isolated in pools where they would be subject to increased competition and predation. However, project-related groundwater pumping is not expected to contribute significantly to long-term cumulative impacts on lower Chevelon Creek, as the impact on average streamflow is about 0.1 percent, as discussed in Section 4.4.1.4 and because the cumulative effects from regional pumping essentially would eliminate all flow by 2060, even if the project were not constructed. Project-related pumping would contribute to an additional reduction of 0.1 cfs for lower Clear Creek. Several other special status fish species, including the roundtail chub, Little Colorado sucker, and bluehead sucker, are similarly affected by cumulative loss of habitat and adverse interactions with introduced species. Special status fish species could potentially be impacted if pumping of the C aquifer causes nonnative fish from the Little Colorado River to move into the Colorado River, thus increasing competition with and predation on native fishes.

The effect of nonproject pumping on water levels in the C-aquifer well field would be to increase the maximum drawdown from 58 to 68 feet, an increase of 10 feet. This increase in drawdown is due to the proximity of the nearest major pumping centers (Winslow, Cholla Power Plant, Holbrook and Joseph City agriculture) to the project well field (SSPA 2005). Modeling predicts that even with the additional drawdown from nonproject pumping, there would be a less than 10 percent reduction in aquifer thickness after 50 years.

4.24.3.2 N-Aquifer Water Supply

Alternative A assumes some continued use of N-aquifer water (average of 480 af/yr) for mine-related uses. The GeoTrans D- and N-aquifer groundwater-flow model assessed the impacts on aquifer water levels and discharge to streams and springs due to the Alternative A project uses as well as other nonproject (community) uses (Geotrans 2006).

Municipal (community) and industrial (Peabody) N-aquifer annual usage from 1965 to 2003 as reported by the USGS is given in Table 4-55.

Table 4-55 Municipal and Industrial N-Aquifer Annual Usage from 1965 to 2003

Use	1965 to 2003 (acre-feet per year)
Community	70 to 2,790
Peabody (started in 1968)	0 to 4,450
Total	**70 to 7,240**

SOURCE: U.S. Geological Survey 1985-2005

GeoTrans estimated the future community usage based on an assumed growth rate of 2.7 percent per year (GeoTrans 2005). On this basis, total community pumpage would increase from 2,790 acre-feet in 2003 to approximately 5,000 acre-feet in 2025.

As discussed in Section 4.4.1.5.1 and Table 4-8, modeling predicts that under Alternative A the water level in the closest community well (Forest Lakes NTUA No. 1) would rise by 94.8 feet in 2025. The rise due to reduced Peabody pumping is 109.3 feet; however, continued community pumping would result in a water-level decline (drawdown) between 2005 and 2025 of 14.4 feet at the Forest Lake NTUA Well No. 1. The predicted 2025 water level reflects drawdown that has occurred since mining began. Total water-level decline since 1955 (starting date in the model) through 2005 is estimated to be approximately 217 feet (Geotrans 2006). Net decline in water level through 2025 is, therefore, estimated to be about 122 feet (217 feet to 95 feet) of which about 90 percent would be due to pre-2005 mine-related pumping. As noted above, Forest Lake NTUA No. 1 is the closest community well to the Peabody well field. Wells located farther from the well field would have less project-related drawdown and a lower percentage of total drawdown due to project pumpage. For example, Kykotsmovi Well PM1 is predicted to have a total 2025 drawdown of 53 feet, of which about 12 percent, or 7 feet, would be due to Peabody pumping (Geotrans 2006; USGS 1985-2005).

Predicted 2025 reduction of groundwater discharge to streams is greatest at Begashibito Wash/Cow Springs (refer to Table 4-4), the closest point of stream/spring discharge to the Peabody well field (Geotrans 2006). The total predicted 2005 to 2025 reduction in discharge is 15.6 af/yr, of which 13.6 af/yr is due to project pumping. Past mine-related pumpage is estimated to have reduced 2005 groundwater discharge at Begashibito Wash/Cow Springs by about 9 af/yr, for a total predicted project-related reduction of approximately 23 af/yr in 2025, a 1 percent reduction in premining groundwater discharge. As with wells, the further the point of discharge the less the reduction in discharge due to project pumping and the higher the percentage due to nonproject pumpage. For example at Pasture Canyon, near Tuba City, the predicted 2025 reduction in discharge is 96 af/yr, all of which is attributed to nonproject (community) pumping (Geotrans 2006).

With the exception of Pasture Canyon, diminution in 2025 groundwater discharge from the N aquifer to streams/springs from all pumping (project and nonproject) is predicted to be less than 2 percent of the premining discharge. At Pasture Canyon the 2025 reduction is predicted to be 22 percent of the premining discharge, all of which would be attributed to community pumping. In all cases, stream/spring baseflow diminution due to project pumping is less than 2 percent of premining groundwater discharge (Geotrans 2006).

Preferred Alternative B and Alternative C assume continued use of N-aquifer water for mine-related uses. The GeoTrans D- and N-aquifer groundwater-flow model assessed the impacts on aquifer water levels and discharge to streams and springs due to the Alternative B project uses as well as other non-project (community) uses (GeoTrans 2006).

Municipal (community) and industrial (Peabody) N-aquifer usage from 1965 to 2003 as reported by USGS is given in Table 4-56.

Table 4-56 Municipal and Industrial N-Aquifer Usage from 1965-2003

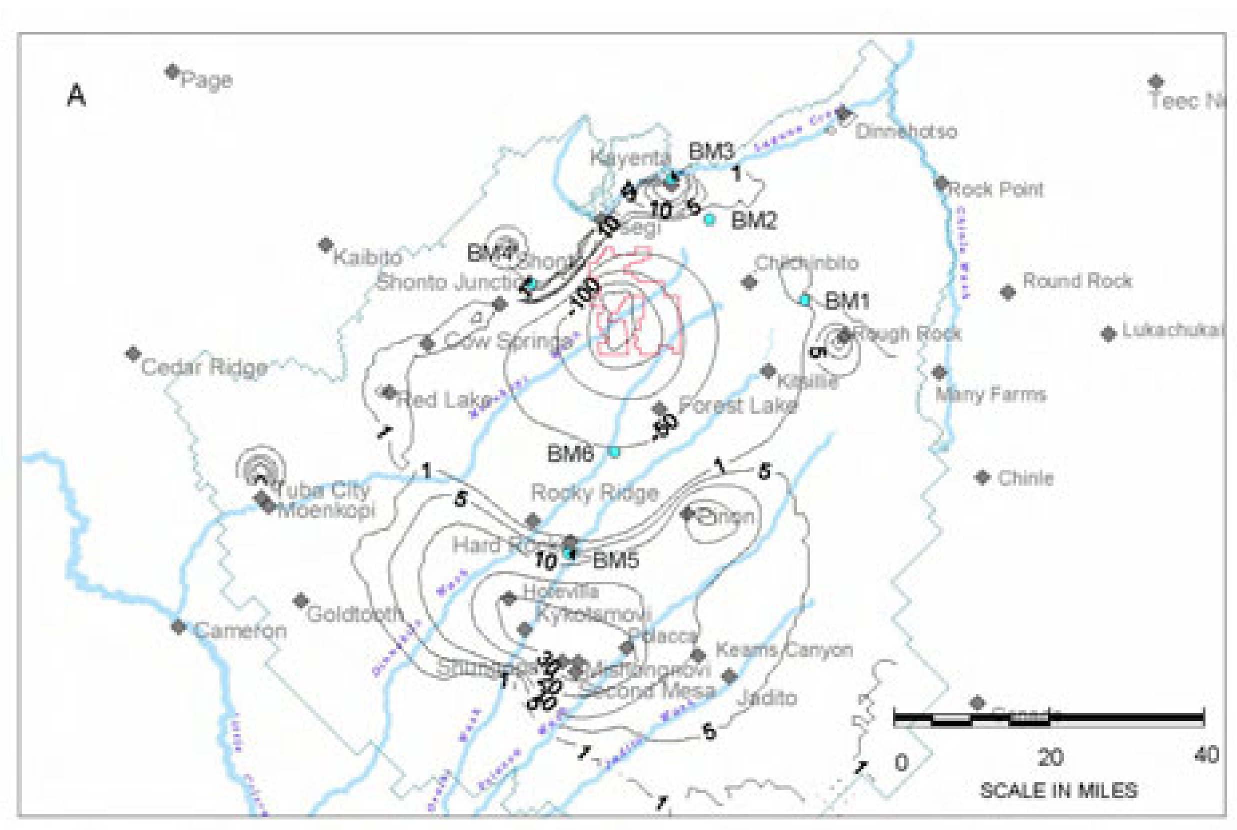
USE	1965-2003 (acre-feet)
Community	70 to 2,790
Peabody (started in 1968)	0 to 4,450
Total	**70 to 7,240**

SOURCE: U.S. Geological Survey 1985-2005

GeoTrans estimated the future community usage based on an assumed growth rate of 2.7 percent per year (GeoTrans 2005). On this basis, total community pumpage would increase from 2,790 acre-feet in 2003 to approximately 5,000 acre-feet in 2025.

Total 2005 to 2025 predicted N-aquifer piezometric level drawdown (from pre-mining levels) due to Peabody (Alternative B) and community pumpage is shown on Figure 4-6. This figure shows the development of cones of depression around the major pumping centers, including Peabody, Tuba City, Kayenta, Rough Rock, Piñon, and Kykotsmovi. Piezometric level drawdown due to Peabody alone is shown on Figure 4-1. Comparison of these figures demonstrates the relative effect of Peabody and community pumping throughout the extent of the N-Aquifer.

Figure 4-6 Simulated Drawdown in the N Aquifer in 2025 Due to Community and Peabody Pumping, Relative to 2005



SOURCE: Peabody Western Coal Company 2008

Modeling predicts that under Alternatives B and C the water level in the closest community well (Forest Lakes NTUA No. 1) would rise by 77.1 feet between 2005 and 2025. The rise due to reduced Peabody pumping is 91.5 feet; however, continued community pumping would result in a water-level decline (drawdown) between 2005 and 2025 of 14.4 feet at the Forest Lake NTUA Well No. 1. The predicted 2025 water level reflects drawdown that has occurred since mining began. Total water-level decline since 1955 (starting date in the model) through 2005 is estimated to be approximately 217 feet, 90 percent of which is due to pre-2005 mine-related pumping (GeoTrans 2006). Net decline in water level through 2025 is estimated to be about 140 feet, however, due to the reduction in pumping from 2005 to 2025 under Alternative B. As noted above, Forest Lake NTUA No. 1 is the closest community well to the Peabody well field. Wells located farther from the well field would have less project-related drawdown and a lower percentage of total drawdown due to project pumpage. For example, Kykotsmovi PM1 is predicted to have a total drawdown in 2025 of 144 feet of which about 21 percent, or 30 feet, would be due to Peabody's pumping (GeoTrans 2006; USGS 1985-2005).

The annual cost of pumping (in 2008 dollars) at Piñon at three timeframes, premining (1955), maximum mine pumping (2005) and preferred Alternative B (2025) are given below. All costs assume a constant annual average pumping rate and electric cost (see Appendix H). Relative pumping cost due to the effects of Peabody pumping and community pumping are identified.

Condition (Year)	Total ($/year)	Peabody ($/year)	Community ($/year)
Premining (1955)	21,212	0	21,212
Maximum mine pumping (2005)	24,805	2,053	22,752
Alternative B (2025)	25,489	1,825	23,664

This analysis shows that the relative cost of pumping due to drawdown caused by mine pumping is between 8 and 9 percent of the community's pumping cost. It also shows that the cost of pumping due to mine drawdown decreases over time under the preferred Alternative B due to both a decrease in annual mine pumping rate and an increase in community pumping.

Decreased flows in some seeps and springs fed by the N aquifer may occur, and this could decrease available habitat for Navajo sedge. The cumulative effects on Navajo sedge in the area include non project-related pumping of the N aquifer for human and livestock use as well as impacts from livestock grazing and trampling on the species. The non-project-related diminution of flows at Begashibito Wash/Cow Springs, where modeling shows the largest decreases in flows, from pumping of the N aquifer is predicted to be 2.0 af/yr (Geotrans 2006). This is 0.09 percent of the estimated 2005 discharge of 2,169 af/yr, or a negligible effect.

The FWS expressed a concern about the effects that climate change on water resources in the arid project environment, combined with project groundwater pumping, may have on plant species dependent on groundwater expressions at seeps and springs; particularly on Navajo sedge. The Navajo sedge is a plant that is associated with springs and seeps on or near vertical walls of the Navajo sandstone. As such, factors that affect the availability of water in the Navajo sandstone may affect the species. Reported occurrences are in Tsegi Canyon, near Inscription House, and in Ho No Geh Canyon. Both locales are in areas where the Navajo sandstone composes the nearby land surface and also is present as steep cliffs. Thus, the availability of water in these locales would be affected by changes in local recharge and potentially by lowering of the water table by pumping.

At Tsegi Canyon, changes in climate are well documented in tree-ring data collected near Betatakin. The piñon and juniper trees that provided the tree-ring data present information on short- and long-term climatic changes because they live in dry soils, rather than wet seep environments. The effects of climatic changes will be smoothed by the storage in the system and the addition of climatic signals that are not in phase. Long-term changes in climate would be expected to affect the amount of water available to support the Navajo sedge, but data do not exist to allow quantitative predictions to be developed.

Inscription House is located in a tributary channel to Tsegi Canyon, in an area with Navajo sandstone composing the cliff walls and the Kayenta Formation serving as the valley floor. The valley is verdant because of the discharge of locally recharged groundwater from the Navajo sandstone. This discharge is caused by the lower permeability of the underlying Kayenta Formation. The N-aquifer model predicts that there is essentially zero drawdown caused by Peabody's pumping in the Navajo sandstone near this locale. In the underlying Kayenta, the model also predicts no drawdown. Thus, the effect of Peabody's pumping on the Navajo sedge at this location is negligible, regardless of whether global warming has an impact.

The N-aquifer model also predicted zero drawdown near Ho No Geh Canyon near the confluence of Moenkopi Wash and Begashibito Wash. Global warming might affect this locale, as it also is in an area of Navajo sandstone outcrops.

CONSULTATION AND COORDINATION

CHAPTER 5

5.0 CONSULTATION AND COORDINATION

5.1 INTRODUCTION

During the scoping process, and consultation and coordination throughout the preparation of this EIS, formal and informal efforts were made by the OSM to involve other Federal agencies, State and local governments, tribes, and the public. Consultation and coordination with Federal and intergovernmental agencies, organizations, American Indian tribes, and interested groups and individuals are important to (1) ensure that the most appropriate data have been gathered and employed for analyses and (2) ensure that agency and public sentiment and values are considered and incorporated into decision making.

The sections of this chapter describe the consultation and coordination efforts for this EIS including the formal consultation required, public participation activities, and public review of the Draft EIS.

5.2 CONSULTATION AND COORDINATION

Coordination and collaboration on the EIS were accomplished through written and telephone communication, meetings, and other cooperative efforts between OSM and interested Federal, State, and local government agencies, tribes, organizations, other interest groups, and the public.

5.2.1 Cooperating Agencies

As part of scoping, Federal, State, and local agencies, and American Indian tribes that may have an interest in the Black Mesa Project EIS were invited to participate in the preparation of the EIS as cooperating agencies. A cooperating agency is any Federal, State, or local government agency or American Indian tribe that has either jurisdiction by law or special expertise regarding environmental impacts of a proposal or a reasonable alternative for a major Federal action affecting the quality of the human environment. The benefits of cooperating agency participation in the analyses for and preparation of this EIS include (1) disclosure of relevant information early in the analytical process; (2) application of available technical expertise and staff support; (3) avoidance of duplication of other Federal, State, local, and tribal procedures; and (4) establishment of a mechanism for addressing intergovernmental issues.

In August 2004, OSM sent formal letters inviting 11 agencies to participate as cooperating agencies in the preparation of the Black Mesa Project EIS and received 9 positive responses. The Arizona State Land Department and the USACE, Los Angeles District, both responded to OSM that they would participate as reviewers of the EIS rather than as cooperating agencies in the preparation of the EIS. On November 15, 2005, the Hualapai Tribe requested cooperating agency status from OSM. OSM sent a formal letter acknowledging the Hualapai Tribe as a cooperating agency on November 30, 2005. The cooperating agencies included the following:

- Federal: Department of the Interior—Reclamation, BIA, BLM; USEPA; and Department of Agriculture—Forest Service.
- American Indian Tribes: Hopi Tribe, Hualapai Tribe, Navajo Nation.
- Local governments: City of Kingman, Mohave County.

The initial cooperating agencies' meeting was held on March 24, 2005, to discuss the status of the project, results of the scoping process, scope of the EIS, EIS and project schedules, future coordination, agency actions and decisions, alternatives to be considered and issues to be addressed in the EIS, and the criteria to be used to evaluate alternatives. On September 14, 2005, OSM met with the BLM in the Kingman Field Office to discuss the status of the project and, in particular, the 14-mile portion of the coal-slurry pipeline that crosses public land administered by BLM. Representatives of the Hualapai Tribe attended the meeting. The cooperating agencies also held frequent (usually weekly) conference calls and met on May 17 and 18, 2006, to discuss the content of the preliminary Draft EIS.

Following the public review of the Draft EIS in February 2007 and as OSM prepared the Final EIS, work on the EIS was suspended. When, in April 2008, Peabody requested that OSM complete the Final EIS, reducing the scope of the project from approval of the LOM revision and all components associated with supplying coal to the Mohave Generating Station to approval of the LOM revision only, OSM reconvened the cooperating agencies to explain the status of the project. The Bureau of Reclamation and Forest Service informed OSM that they no longer would be cooperating agencies; however, all agencies agreed to participate to the extent needed.

5.2.2 Government-to-Government Consultation

The United States has a unique legal relationship with American Indian tribal governments as set forth in the Constitution of the United States, treaties, Executive Orders, Federal statues, Federal policy, and tribal requirements, which establish the interaction that must take place between Federal and tribal governments. The most important basis for this relationship is the trust responsibility of the United States to protect tribal sovereignty, self-determination, tribal lands, tribal assets and resources, and treaty and other federally recognized and reserved rights. Federal agencies work with tribes, government-to-government, to address issues concerning Indian tribal self-government, tribal trust resources, and Indian tribal treaty and other rights. Government-to-government consultation is the process of seeking, discussing, and considering views on environmental and cultural resource management issues. OSM's Directive REG-18, Protection of Indian Lands and Indian Trust Assets, contains consultation and coordination procedures for OSM's interaction with the tribes. In addition to status as cooperating agencies, OSM requested formal government-to-government consultation with the Hopi Tribe, Hualapai Tribe, and Navajo Nation. Meetings were held with each as shown in Table 5-1.

Table 5-1 Government-to-Government Consultation Meetings

Tribal Government	Meeting Dates
Hopi Tribe	June 23, 2006 November 7, 2006 September 4, 2008
Hualapai Tribe	May 17, 2006
Navajo Nation	November 29, 2006

5.2.3 Formal Consultation

OSM and the cooperating agencies are required to prepare EISs in coordination with any studies or analyses required by the Fish and Wildlife Coordination Act (16 U.S.C. Sec 661 et seq. [16 U.S.C. 661]), Endangered Species Act of 1973 (16 U.S.C. Sec 1531 et seq. [16 U.S.C. 1531]), and the National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec 470 et seq. [16 U.S.C. 470]).

Early in the preparation of the EIS, the cooperating agencies suggested and agreed to work collaboratively in the consultations for Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act. Doing so would effectively facilitate the consultation processes. The following sections are summaries of the activities associated with the consultation processes to date for threatened and endangered species and cultural resources.

5.2.3.1 Biological Resources

In accordance with the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., formal consultation is required when the action agency (or agencies in this case) determines that the proposed action may affect a listed species or designated critical habitat. The consultation process determines whether the proposed action is likely to jeopardize the continued existence of a species or destroy or adversely modify critical habitat. The process begins with OSM's written request and a submittal of a completed biological assessment, and concludes with the issuance of a biological opinion from FWS, which may include an incidental take statement or a letter of concurrence from FWS (if FWS agrees that the proposed project would have no effect or would not adversely affect a threatened or endangered species or their critical habitat. In May 2005, URS Corporation (URS), on behalf of OSM, sent letters requesting lists of any federally listed, sensitive, endangered, and/or threatened species that may occur in the project area to the AGFD; BLM, Kingman Field Office; Forest Service, Kaibab National Forest; Hopi Tribe; Navajo Nation; Nevada National Heritage Program; FWS, Southern Nevada Field Office; and FWS, Arizona Ecological Services (a copy of the letter and list of recipients are in Appendix K). Responses and accompanying information received are summarized in Table 5-2.

Table 5-2 Information Provided by Agency or Tribe Regarding Listed Species in the Project Area

Agency	Date of Response	Information Provided
AGFD	May 20, 2005	Special status species list
Forest Service, Kaibab National Forest	May 17, 2005	Forest Service sensitive species list
Navajo Nation	July 8, 2005	Endangered and sensitive species
Nevada National Heritage Program	July 17, 2005	Endangered, threatened, candidate and/or at risk plant and animal taxa
FWS, Southern Nevada Field Office	May 23, 2005	Federally listed species list
FWS, Arizona Ecological Services (courtesy copy to the Flagstaff field office)	July 12, 2005	Federally listed species list

Considerable efforts have been made by all participants to determine major issues and concerns and potential effects the project may have on federally listed species. At the suggestion of the cooperating agencies, a Biological Resources Subcommittee was formed soon after the cooperating agency meeting on March 24, 2005 to facilitate this process. The Biological Resources Subcommittee consists of representatives from OSM, BIA, BLM, Reclamation, USEPA, FWS, AGFD, Hopi Tribe, and Navajo Nation. The project applicants also participated in the Biological Resources Subcommittee. To date, informal consultation has been ongoing. This process has helped (1) identify which species and habitats may be in the action area, (2) determine the effects the project action may have on listed species, (3) discuss ways the effects can be eliminated or reduced through project action modification, (4) discuss the need to enter into formal consultation, and (5) discuss ways the project action can help in the conservation of selected listed species. Several meetings of varied members of the Biological Resources Subcommittee were held. Table 5-3 provides a summary of these meetings.

Table 5-3 Summary of Meetings Related to Federally Listed Species on the Black Mesa Project

Agency/Organization	Date	Topics Discussed
FWS, Reclamation, and URS (on behalf of OSM)	June 24, 2005	Initial organization of the Biological Resources Subcommittee.
OSM, FWS, Reclamation, BIA, AGFD, Hopi Tribe, Navajo Nation, Peabody, SCE, BMPI, and URS	July 26, 2005	Status of the project including biological resources studies, and coordination with the participants regarding the multi-agency Consultation Agreement.
OSM, Reclamation, BIA, Hopi Tribe, Navajo Nation, FWS, AGFD, SCE, SRP, and URS	September 21, 2005	Results of the groundwater and streamflow modeling, and potential impacts on native fish due to baseflow reductions of water as a result of pumping water from the C aquifer.
OSM, Reclamation, BIA, Hopi Tribe, Navajo Nation, AGFD, SCE, Salt River Project (SRP), and URS	September 27, 2005	Initial discussion about potential conservation opportunities for threatened and endangered species that may be affected by pumping water from the C aquifer.
OSM, Reclamation, BIA, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	September 29, 2005	Status of the species analyses, status and schedule of the Biological Assessment, and further discussion on conservation opportunities for species potentially affected by C aquifer pumping (Little Colorado River spinedace, roundtail chub, and Chiricahua leopard frog).
OSM, FWS, Reclamation, BIA, AGFD, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	December 14, 2005	Provide background on project and potential impacts, review current list of conservation measures developed, and discuss other potential conservation measures that may be implemented to offset project related impacts to special status fish species.
OSM, FWS, Reclamation, BIA, AGFD, Forest Service, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	January 18 and 19, 2006	Provide background on project and potential impacts, review potential conservation measures for special status fish species on the Apache-Sitgreaves and Coconino National Forests, and obtain Forest Service input on proposed conservation measures and Forest Service process for implementing these measures.
OSM, FWS, Reclamation, BIA, AGFD, Forest Service, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	February 8, 2006	Prioritize conservation measures that have been previously identified to assist the project proponents in identifying a proposal for consideration in the Biological Assessment and EIS.
FWS, Reclamation, BIA, AGFD, SCE, SRP, and URS	February 21, 2006	Review additional information provided by meeting participants on refining the short list of potential projects ranked at the last meeting. Add as must detail as possible to the proposed projects.
OSM, FWS, Reclamation, BIA, ADWR, USDI/PPA, Forest Service, Hopi Tribe, Navajo Nation, SCE, SRP, and URS	May 17, 2006	Review previous considerations and recommendations. Review new facts and recommendations for proposed capital conservation projects (as described in the East Clear Creek Watershed Health Improvement Environmental Assessment) to offset impacts on listed native fish species.
OSM, FWS, BIA, Navajo Nation, SRP, and URS	October 18, 2006	Review agency comments on the draft Biological Assessment.

A Consultation Agreement was developed to outline the consultation process and products, actions, and schedule for the consultation under Section 7 of the ESA. The Consultation Participants are OSM, BIA, BLM, Forest Service, USEPA, and FWS. The Hopi Tribe, Navajo Nation, SRP (the Mohave Generating Station co-owners were represented previously by SCE), Peabody, and BMPI are participating through BIA and OSM as applicants. OSM distributed the Consultation Agreement to the Consultation Participants for signature on November 3, 2005. All signatures were obtained by October 3, 2006.

All data collected from the Federal agencies, the tribes, and State and local government agencies, as described in Table 5-2, have been incorporated into this EIS and the Biological Assessment. The Biological Assessment was completed and submitted to the FWS on March 13, 2007.

In addition to the Biological Assessment, two Biological Evaluations were prepared: one for the Forest Service to address Forest Service sensitive and indicator species and migratory bird species and one for the Navajo Nation to address Navajo Nation sensitive species. When work on the Black Mesa Project was suspended in mid-May 2007, work on the Biological Evaluations also was suspended.

When, in April 2008, Peabody requested that OSM complete the Final EIS, OSM also revised the Biological Assessment to reflect Alternative B as the proposed project. Also, the Biological Evaluation for the Navajo Nation was completed (to reflect Alternative B as the proposed project). The Biological Evaluation for the Forest Service is no longer needed because rebuilding the coal-slurry pipeline is no longer a part of the proposed project.

5.2.3.2 Cultural Resources

Section 106 of the NHPA requires OSM and the cooperating Federal agencies to consider the effects of the agencies' undertakings on properties listed in or eligible for the National Register of Historic Places (which can include a diversity of archaeological, historical, and traditional cultural resources). Regulations for Protection of Historic Properties (36 CFR 800) implement Section 106 and define a process for Federal agencies to use in consulting SHPOs, THPOs, and other interested parties as they assess the effects of their undertakings. Pursuant to those regulations, OSM initiated Section 106 consultations with the Navajo THPO and the Arizona and Nevada SHPOs in May 2005 (a copy of the letter and list of recipients are in Appendix K).

OSM has coordinated closely with the Hopi Tribe and Navajo Nation about various aspects of the project, including potential impacts on cultural resources. The HCPO and the Navajo Nation Archaeology Department were retained to conduct inventories of archaeological and historical sites on their respective reservations, as well as studies of traditional cultural resources of significance to their respective communities. On May 20, 2005, OSM sent letters to 11 other tribes to provide them information about the project area and to ask if they wanted to participate in the Section 106 consultations (a copy of the letter and list of recipients are in Appendix K). The Hualapai Tribe indicated they not only wanted to participate in the Section 106 consultations, but also wanted to serve as a cooperating agency in the preparation of the EIS. Because of their concerns, the Hualapai Tribe Department of Cultural Resources was retained to inventory and assess effects on traditional Hualapai cultural resources. The Chemehuevi Tribe, Colorado River Indian Tribes, Havasupai Tribe, and Fort Mojave Tribe indicated they wanted to participate in the Section 106 consultations. The San Juan Southern Paiute Tribe did not want to participate in the consultations but indicated it wanted to continue to receive information about the project. The Zuni Tribe also indicated it wanted to continue to receive information about the project, but would defer to the Hopi Tribe and Navajo Nation regarding treatment of cultural resources and could opt to not participate in a Section 106 agreement. The Pahrump Paiute Tribe did not indicate if it wanted to participate. The Yavapai-Apache Nation, Yavapai-Prescott Indian Tribe, and Las Vegas Paiute Tribe indicated they have no concerns about the project and did not want to participate in the consultations.

Informational meetings were held on June 30, 2005 with representatives of the Navajo Nation; on July 1, 2005 with the Hopi Tribe; and on October 17, 2005 with the Hualapai Tribe to provide further information and discuss future coordination.

A Cultural Resources Subcommittee, with representatives of the lead and cooperating agencies, other involved Federal and State agencies, and project proponents was organized to coordinate compliance with Section 106, and other laws, regulations, and ordinances protecting cultural resources. The subcommittee members reviewed the cultural resources study plan and technical reports. A Cultural Resources Subcommittee meeting was held on January 10, 2006 to discuss the results of the cultural resources inventory and development of a Section 106 Programmatic Agreement.

On May 8, 2006, OSM sent a letter to the Hopi Tribe, Hualapai Tribe, and Navajo Nation requesting a government-to-government consultation meeting with each tribe. A meeting with the Hualapai Tribe was held on May 17, 2006 and with the Hopi Tribe on June 23, 2006. In addition, after the close of the reopened comment period on the Draft EIS, the Hopi Tribal Chairman asked OSM with meet with the Hopi Tribal Council. As noted in Table 5-1, the meeting was held on September 4, 2008. Also, the Chairman asked that OSM meet with the Hopi and Tewa people to clarify the status of the Black Mesa Project and answer questions. This meeting was held on September 5, 2008.

5.3 PUBLIC PARTICIPATION

The public participation process for the EIS has been ongoing throughout the development of the EIS. In addition to formal public participation activities, informal contacts occur frequently with public land users, industry, and interested persons through meetings, field trips, telephone calls, electronic mail, and/or letters.

As required, OSM, in coordination with the cooperating agencies, conducted scoping in the early stages of preparing the EIS to encourage public participation and solicit public comments on the scope and significance of the proposed action (CEQ regulations, 40 CFR 1501.7). OSM initiated the scoping process in January 2005 by requesting comments to determine the scope of issues and concerns that needed to be considered during the analyses conducted for the EIS.

5.3.1 Notice of Intent

OSM's Federal Register Notice of Intent, published on December 1, 2004 (Volume 69 Federal Register Pages 69949-69951 [69 FR 69949-69951]), marked the beginning of the scoping period for the Black Mesa Project EIS. The scoping period, required to be a minimum of 30 days, was announced as ending on January 21, 2005. OSM solicited comments from relevant agencies and the public and held eight scoping meetings in January 2005. At the request of the public, OSM extended the scoping period and held two additional scoping meetings in Forest Lake, Arizona, in February 2005. A second notice was published in the Federal Register on February 4, 2005 (70 FR 6036), announcing the additional meetings and the extension of the scoping period to March 4, 2005. Copies of the Federal Register notices are in Appendix L.

5.3.2 Newspaper and Radio Announcements

In December 2004 and February 2005, OSM issued news releases to local and regional newspapers to announce the project and to inform the public of the scoping meeting times and locations. The news releases were sent to The Navajo Times, Hopi Tutuveni, The Navajo-Hopi Observer, Arizona Daily Sun, Gallup Independent, Mohave Valley Daily News, The Laughlin Nevada Times, Bullhead City Bee, The Kingman Daily Miner, The Winslow Mail, and Holbrook Tribune.

OSM also used paid radio announcements and newspaper advertisements to introduce the project and announce the times and locations of the scoping meetings. The radio announcements were aired in December 2004 and in January and February 2005; the newspaper advertisements were published in December 2004 and February 2005.

The paid radio announcements were aired on KUYI Hopi Radio 88.1 FM and on KTNN Radio AM 660 (Navajo Nation). The announcements on KUYI were made in Hopi followed by English twice a day on December 31, 2004, and on February 12, 14, and 16, 2005. The announcements on KTNN were made in Navajo followed by English twice a day on five consecutive days, December 29, 2004, through January 2, 2005; and on February 12, 14, and 16, 2005.

Table 5-4 lists the newspapers and the date of each paid advertisement.

Table 5-4 Newspapers and Dates of Publications

Publication	Date(s)
The Navajo Times	Thursday, December 16 and 23, 2004, and February 3, 2005
Hopi Tutuveni	Thursday, December 16, 2004 and Wednesday, February 2, 2005
The Navajo-Hopi Observer	Wednesday, December 15 and 22, 2004 and Thursday, February 3, 2005
Arizona Daily Sun	Wednesday, December 15 and 22, 2004
Gallup Independent	Wednesday, December 15 and 22, 2004
Mohave Valley Daily News	Wednesday, December 22 and 29, 2004
The Laughlin Nevada Times	Wednesday, December 22 and 29, 2004
Bullhead City Bee	Friday, December 24 and 31, 2004
The Kingman Daily Miner	Wednesday, December 22 and 29, 2004

5.3.3 Additional Public Notice

OSM created bulletin-board flyers to announce the scoping meetings and sent the flyers to the Hopi Office of Mining and Mineral Resources and the Navajo Minerals Department with the request that the flyers be posted in public places such as tribal offices, chapter houses, and grocery stores.

In addition, OSM developed a project Web site (http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm]) for the Black Mesa Project. Information that was posted on the Web site at the time of scoping and shortly thereafter included public meeting announcements; descriptions of the project, EIS planning process, and the proposed project area; Black Mesa Project Scoping Summary Report; and transcripts of the public scoping meetings.

A project newsletter update was sent in September 2005 to all members of the public who chose to be on the project mailing list as well as project team members and other interested parties. The newsletter provided a summary of the project, including the steps of the EIS process and what would be happening next in the project. In addition, a summary of issues heard during scoping was included in the newsletter. Contact information for OSM was provided to allow interested parties to ask questions or request additional information.

Two more newsletters were sent in July and September 2006. The former newsletter notified the persons on the mail list that on June 19, 2006, SCE, majority owner of Mohave Generating Station, announced it would not continue to pursue resumed operation of the power plant. Due to uncertainty about the future of the Black Mesa Project, OSM stated that it had suspended activities to publish the Draft EIS. The latter newsletter notified persons on the mailing list that OSM had resumed work on the EIS because SRP, a minority owner of the power plant, had requested OSM to do so because it was still assessing the situation and might reopen the power plant if it found additional partners.

5.4 PUBLIC SCOPING MEETINGS

OSM hosted 10 public scoping meetings, with a total of more than 720 in attendance, within a period that extended from January 3, 2005, through February 19, 2005. Attendance is shown in Table 5-5.

Table 5-5 Public Scoping Meeting Dates, Locations, Attendance, and Number of Speakers (2005)

Meeting Date	Meeting Location	Attendance	Number of Speakers
January 3	St. Michaels, Arizona	41	9
January 4	Forest Lake, Arizona	55+	25
January 4	Kayenta, Arizona	106	22
January 5	Kykotsmovi, Arizona	119	34
January 6	Leupp, Arizona	120	29
January 12	Kingman, Arizona	35	14
January 12	Laughlin, Nevada	38	20
January 13	Flagstaff, Arizona	130+	53
February 18	Forest Lake, Arizona	44	13
February 19	Forest Lake, Arizona	38	18
TOTAL		726+	237

Each of the 10 meetings began with a presentation of the project by OSM, followed by oral presentations by members of the public wanting to comment on the Black Mesa Project and the EIS process. Two project maps and a flow chart of the EIS process were displayed at each of the meetings.

A project fact sheet, comment forms, speaker cards, and mailing list cards were made available to the public at each scoping meeting. A Navajo interpreter was available at the meetings in St. Michaels, Forest Lake, Kayenta, Kykotsmovi, Leupp, and Flagstaff to translate oral comments. A court reporter was present at each meeting and the meeting transcripts became part of the official record.

Comment forms were provided to enable individual members of the public and agency representatives to (1) express interest in being added to the project mailing list; (2) provide comments regarding issues or concerns that they deemed to be significant and that they felt should be addressed in the EIS, and why; (3) provide suggestions regarding reasonable changes and/or additions to the proposed project that they felt should be made to reduce the environmental impacts (including mitigation measures not in the proposal that they feel should be carried out) and why; and (4) submit any other comments or questions regarding the overall project. OSM invited participants to submit comments in formats other than the comment forms, such as letters, facsimiles, and electronic mail messages submitted to OSM.

5.4.1 Comments Received During Scoping

Comments received during the scoping period were analyzed and documented in the Black Mesa Project Scoping Summary Report issued in April 2005. By the end of the scoping comment period, OSM had received 351 written or electronically mailed submissions and 237 statements made by speakers at public meetings. In addition to these, more than 2,000 form letters regarding the LOM revision were received. The comments received during scoping also are summarized in Chapter 1 Section 1.5. Specific environmental issues and where they are addressed in this Draft EIS are listed in Table 1-1.

5.5 PUBLIC REVIEW OF THE DRAFT EIS

Prior to the release of the Draft EIS, OSM sent out a newsletter that announced the upcoming availability of the Draft EIS. The newsletter included a postage-prepaid form for requesting a paper copy, an electronic copy (CD), or a separately bound Executive Summary. More than 700 copies of the Draft EIS were distributed in late November 2006 to the entities on the project mailing list. OSM announced the availability of the Black Mesa Project Draft EIS for public review and comment in the Federal Register on November 22, 2006. The USEPA published a notice of availability in the Federal Register on December 1, 2006. Copies of the Draft EIS also were mailed to those who contacted OSM after the November 22, 2006, Federal Register notice. Shipments of the Draft EIS were sent to the Hopi Tribe and Navajo Nation for distribution to people who requested copies. Copies of the document were made available for public review at the Gallup Public Library, Hopi Public Library, Tuba City Public Library, Page Public Library, Winslow Public Library, Holbrook Public Library, Flagstaff City-Coconino County Public Library, Kingman Library, Laughlin Library, and Bullhead City Library.

The USEPA Federal Register announcement on December 1, 2006, initiated a 45-day public comment period that was to end 45 days later on January 22, 2007. The availability of the Draft EIS, deadline for public comments, and locations, dates, and times of public meetings on the Draft EIS were announced in media releases, paid newspaper legal notices, and radio announcements. Radio broadcasts were in English, Hopi, and Navajo. A summary of these efforts is presented in Table 5-6, below.

Table 5-6 Summary of Legal Notice Publications and Radio Announcements

Publication	Original Legal Notice	Revised Legal Notice[1]
Navajo Times	December 7, 14, 21, 2006	December 28, 2006
Hopi Tutuveni	December 7, 21, 2006	January 4, 2007
Navajo-Hopi Observer	December 6, 13, 20, 2006	December 27, 2006
Arizona Daily Sun	December 11-17, 2006	December 29, 2006; January 5, 2007
Gallup Independent	December 11-16, 22, 2006	December 29, 2006
Mohave Valley Daily News	December 10-15, 2006	December 22, 29, 2006
Laughlin Nevada Times	December 13, 20, 2006	December 27, 2006; January 3, 2007
Bullhead City Bee	December 8, 15, 22, 2006	December 29, 2006
Kingman Daily Miner	December 17-22, 2006	December 29, 2006; January 5, 2007
Winslow Mail	December 13, 20, 2006	December 27, 2006; January 3, 2007
Holbrook Tribune-News	December 13, 15, 20, 22, 2006	December 27, 29, 2006
KUYI Hopi Radio 88.1 FM	Twice per day (morning and evening) December 26 through 29 (in English and Hopi), 2006	Twice per day (morning and evening) December 26 through 29 (in English and Hopi), 2006
KTNN Radio AM 660 (Navajo)	Eight times on day of December 29 (in English and Navajo)[2], 2006	December 29[2], 2006

NOTES:
[1] Revised legal notice announced second Leupp meeting and extended comment period deadline.
[2] Originally scheduled to occur during the same days as the Hopi announcement; however, due to weather-related equipment failure all Navajo radio spots occurred on December 29.

In a Federal Register Notice published on December 20, 2006, OSM announced that the comment period would be extended to February 6, 2007, and that a second public meeting would be held at the Leupp Chapter on January 11, 2007 (the first meeting in Leupp on January 9, 2007, had coincided with the Navajo presidential election). In addition to the notice provided in the Federal Register, these changes were announced through paid newspaper legal notices and radio announcements in English, Hopi, and Navajo (as shown on Table 5-6).

Government agencies, tribes, and the public were invited to submit their comments by postal service, electronic mail, facsimile transmissions (faxes), and in a variety of formats at the public meetings. This information, as well as team contact information and the project Web site address, was provided in the Federal Register notice, newspaper legal notices, and at the public hearings.

OSM held 12 public meetings to provide information about the Draft EIS and opportunities to comment on its adequacy. Table 5-7 provides the dates and locations of the meetings. The meetings were conducted as informal open houses where attendees could (1) watch a video about the Black Mesa Project EIS, (2) view project display boards and discuss the proposed action and alternatives one-on-one with project team members, (3) submit written comments, and (4) submit oral comments to a court reporter. Project team members from OSM, BIA, the Hopi Tribe, the Navajo Nation, Peabody Western Coal Company, Black Mesa Pipeline, Inc., and Salt River Project were on hand to answer questions at all of the meetings. The open house format was described in the Federal Register notice and in advertisements for the meeting. In response to specific requests, some of the meetings included open question and answer sessions.

Table 5-7 Public Meeting Locations (2007)

Date	Location
Tuesday, January 2	Window Rock, Arizona
Wednesday, January 3	Moenkopi, Arizona Forest Lake, Arizona
Thursday, January 4	Kykotsmovi, Arizona Kayenta, Arizona
Tuesday, January 9	Leupp, Arizona Peach Springs, Arizona (12:00 noon to 3:00 pm) Kingman, Arizona
Wednesday, January 10	Winslow, Arizona Laughlin, Nevada
Thursday, January 11	Leupp, Arizona (12:00 noon to 4:00 pm) Flagstaff, Arizona

NOTES:
*Except where noted, all meetings occurred between 6 pm and 9 pm.

As attendees arrived at the meetings, they were asked to sign an attendance register and were offered informational materials (i.e., Draft EIS [paper copy or compact disk] and/or Executive Summary). An OSM representative opened each meeting with introductory remarks about the intent and format of the meeting, and instructed attendees about the various ways they could provide comments on the Draft EIS, including those available at the meeting.

After introductory remarks by OSM, a video presentation was shown that summarized the project and potential impacts from the project. The video presentation was shown in the Hopi language at Moenkopi and Kykotsmovi on the Hopi Reservation, in Navajo at the meeting locations on the Navajo Reservation, and in English at the meeting locations off the reservations. Copies of the presentation were mailed to attendees who requested them. Project displays included the following topics: project description and purpose; project components; proposed action and alternatives; and information on how to provide comments on the Draft EIS and where to provide them. The exhibit also provided instructions on how to submit comments on the Draft EIS.

Comment forms were available for those wishing to provide written comments, and a court reporter was available to record verbatim statements (in English) for those wishing to submit oral comments at the meeting. Translators were available for those wishing to make comments in Hopi or Navajo; these comments were tape recorded and later translated into English for the record. Comments were submitted at all of the meetings, with the exception of the public hearing held on the Hualapai Reservation (Table 5-8). Attendees also were invited to submit comments by mail, fax, or electronic mail by the end of the comment period.

Table 5-8 Public Meeting Attendance and Comments

Meeting Location	Individuals Registered	Written Comments Submitted	Oral Comments to Court Reporter	Oral Comments to Translator
Window Rock	25	4	7	0
Moenkopi	23	0	0	2
Forest Lake	48	4	1 identified speaker 7 unidentified speakers	
Kykotsmovi	56	6	10	1
Kayenta	54	5	5	0
Peach Springs	19	1	4 speakers identified, possibly 12 unidentified speakers	0
Leupp	77	9	13 speakers identified 7 unidentified speakers	60
Kingman	25	1	3	0
Winslow	73	1	6	5
Laughlin	22	7	1	
Leupp	63	2	14 speakers identified, possibly 14 unidentified speakers	0
Flagstaff	99	6	26	5
Total	584	46	90-131	73

The comment period ended on February 6, 2007; however, OSM received and accepted comments through the end of February 2007. On April 9, 2007, OSM notified the Hopi Tribe that OSM would consider additional comments on the Draft EIS, which it received from practitioners of Hopi traditional religion by May 11, 2007. On May 1 and 3, 2007, the Hopi Tribe was present at the Hopi Abandoned Mine Land Office to receive oral and written comments. OSM received 17,873 submittals containing comments from Federal agencies, tribal, State, and or local governments; public and private organizations; and individuals. As mentioned above, these comments were presented as statements recorded at the public meetings or in written documents (comment forms or letters) submitted at those meetings or sent to OSM by regular mail, e-mail, and fax. Of the 17,873 submittals, 17,142 submittals were form letters; that is, letters that are similar or identical in content resulting from a letter-writing campaign. Thirteen such form letters were identified.

After a one-year suspension of work on the EIS, OSM in May 2008 resumed work on the EIS. In a Federal Register published on May 23, 2008, OSM announced that the comment period on the Draft EIS was being reopened for 45 days until July 7, 2008. It did so to allow persons the opportunity to comment on the proposed project and preferred alternative, which is now Alternative B instead of Alternative A. In its weekly Federal Register notice for EISs, USEPA listed the Draft EIS as one for which the comment period notice was being amended. As listed in Table 5-9, OSM placed legal advertisements in eight newspapers in southeast Nevada, northern Arizona, and northwest New Mexico and had radio ads aired in English and native languages on two radio stations on the Hopi and Navajo reservations. It prepared and distributed copies of a newsletter to more than 900 persons on the EIS mailing list, the Hopi villages, and the five Navajo chapter houses near the mine complex. It sent electronic mail messages to persons that submitted electronic mail comments on the Draft EIS. Lastly, OSM posted updated information on the OSM Western Region Web site at http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm.

Table 5-9 Summary of Legal Notice Publications, Radio Announcements, and Press Releases (2008)

Publication/Radio Station	Date(s) Printed or Broadcast
Legal Advertisements[1]	
Navajo Times	May 29, June 5, 12, 19
Hopi Tutuveni	June 5, 12
Navajo-Hopi Observer	May 28, June 4, 11, 18
Arizona Daily Times	May 30, June 6, 13, 20
Gallup Independent	May 28, June 4, 11, 18
Laughlin Nevada Times	June 4, 11, 18, 25
Kingman Daily Miner	May 29, June 4, 11, 18
Holbrook Tribune-News	May 30, June 6, 13, 20
Radio Announcements[1]	
KUYI Hopi Radio 88.1 FM	Radio ads to be run two times per day, one day per week for four weeks
KTNN Radio AM 660	Radio ads to be run two times per day, one day per week for four weeks

NOTES: [1] The legal notices and radio announcements were purchased to ensure that the announcements would be published or broadcast; proof of publication or broadcast is provided.
[2] Press releases were submitted but not purchased; the media do not have an obligation to print the release; records of print dates are not provided.

The comments in each submittal were identified, recorded, and analyzed. Responses were prepared for all substantive comments. In response to some comments, the text of the EIS was modified. A description of the comment analysis, the comments received, and the responses to those comments are provided in Volume II, Appendix M of this Final EIS.

5.6 DISTRIBUTION OF THE FINAL EIS

The following agencies, organizations, and individuals were notified that the Final EIS would be available in paper copy, on compact disk (CD), and on the project web site. Some requested and will receive a copy of the Final EIS for review and comment.

FEDERAL

Department of Agriculture

Forest Service, Kaibab National Forest, Williams, Arizona
Natural Resources Conservation Service, Phoenix, Arizona

Department of the Army

U.S. Army Corps of Engineers, Los Angeles District, Regulatory Brach, Arizona Section, Tucson, Arizona

Department of the Interior

Bureau of Indian Affairs
- Hopi Agency
- Navajo Regional Office, Gallup, New Mexico
- Navajo Regional Office, Farmington, New Mexico
- Trust Services, Washington, DC
- Truxton Canon Agency Office, Valentine, Arizona
- Western Regional Office, Phoenix, Arizona

Bureau of Land Management
- Arizona State Office, Phoenix, Arizona
- Kingman Field Office, Kingman, Arizona
- Washington, DC Office

Bureau of Reclamation
- Denver, Colorado, Office
- Phoenix Regional Office, Arizona
- Glendale Regional Office, Glendale, Arizona

Minerals Management Service
National Park Service
Natural Resources Library
Office of Environmental Policy and Analysis
- Denver Region, Denver, Colorado
- Headquarters, Washington, DC
- Western Region, Oakland, California

Office of Policy Analysis, Washington, DC
Office of the Solicitor
- Rocky Mountain Region, Lakewood, Colorado

Office of Surface Mining
- Western Regional Coordinating Center, Denver, Colorado

U.S. Environmental Protection Agency
- Region 9, San Francisco, California

U.S. Fish and Wildlife Service
- Arizona Ecological Services Field Office, Phoenix, Arizona
- Division of Environmental Quality, Arlington, Virginia
- Flagstaff Sub-Office, Flagstaff, Arizona Attn: Brenda Smith
- Southwest Region 2, Albuquerque, New Mexico Attn: Stephen Robertson

U.S. Geological Survey
- Arizona Water Science Center, Flagstaff, Arizona
- Flagstaff, AZ Office
- Washington, DC Office

Federal Legislators

Senator John McCain
Senator John Kyl
Congressman Rick Renzi
Congressman Trent Franks

STATE

State of Arizona

Governor Janet Napolitano
Arizona Department of Environmental Quality
Arizona Department of Mines and Mineral
Arizona Department of Transportation
Arizona Department of Water Resources
Arizona Economic Development Division
Arizona Game and Fish Department
Arizona State Historic Preservation Office
Arizona State Land Department

State Legislators

Representative Lucy Mason, District 1
Representative Andrew M. Tobin, District 1
Representative Albert Tom, District 2
Representative Tom Chabin, District 2
Representative Trish Gore, District 3
Representative Nancy McLain, District 3
Representative Tom Boone, District 4
Representative Judy Burges District 4
Representative Jack Brown, District 5
Representative Bill Konopnicki, District 5
Senator Tom O'Halleran, District 1
Senator Albert Hale, District 2
Senator Ron Gould, District 3
Senator Jack Harper, District 4
Senator Sylvia Allen, District 5

State of Nevada

Nevada State Clearinghouse

Tribal Governments

The Hopi Tribe, Kykotsmovi, Arizona
The Navajo Nation, Window Rock, Arizona
- Navajo Department of Water Resources
- Water Rights Unit
- Navajo Chapters
  - Alamo Chapter Navajo Nation
  - Aneth Chapter
  - Baca/Prewitt Chapter
  - Becenti Chapter
  - Beclabito Chapter
  - Birdsprings Chapter
  - Black Mesa Chapter
  - Blue Gap/Tachee Chapter
  - Bodaway-Gap Chapter
  - Breadsprings Chapter

Burnham Chapter
Cameron Chapter
Casamero Lake Chapter
Chichiltah Chapter
Chilchinbeto Chapter
Chinle Chapter
Church Rock Chapter
Coalmine Canyon Chapter
Coppermine Chapter
Cornfields Chapter
Counselor Chapter
Cove Chapter
Cove Chapter
Coyote Canyon Chapter
Crownpoint Chapter
Crystal Chapter
Dennehotso Chapter
Dilkon Chapter
Forest Lake Chapter
Fort Defiance Chapter
Gadii ahi (Cudeii) Chapter
Ganado Chapter
Greasewood Springs Chapter
Hardrock Chapter
Hogback Chapter
Houck Chapter
Huerfano Chapter
Indian Wells Chapter
Inscription House Chapter
Iyanbito Chapter
Jeddito Chapter
Kaibeto Chapter
Kayenta Chapter
Kinlichee Chapter
Klagetoh Chapter
Lake Valley Chapter
LeChee Chapter
Leupp Chapter
Little Water Chapter
Low Mountain (Jeddito) Chapter
Lukachukai Chapter
Lupton Chapter
Manuelito Chapter
Many Farms
Mariano Lake Chapter
Mexican Springs Chapter
Nageezi Chapter
Nahata Dzill Chapter
Nahodishgish Chapter
Naschitti Chapter
Navajo Mountain Chapter
Nazlini Chapter
Nenahnezad Chapter
Newcomb Chapter
Oak/Pine Springs Chapter
Ojo Encino Chapter
Oljato Chapter
Pinedale Chapter
Piñon Chapter
Pueblo Pintado Chapter
Ramah Chapter
Red Lake #18 Chapter
Red Mesa Chapter
Red Rock Chapter
Red Valley Chapter
Rock Point Chapter
Rock Springs Chapter
Rough Rock Chapter
Round Rock Chapter
San Juan Chapter
Sanostee Chapter
Sawmill Chapter
Sheepsprings Chapter
Shiprock Chapter
Shonto Chapter
Smith Lake Chapter
St. Michaels Chapter
Standing Rock Chapter
Steamboat Chapter
Sweetwater (Tolikan) Chapter
Teecnospos Chapter
Teesto Chapter
Thoreau Chapter
T'iis Tsoh Sikaad Chapter
Toadlena/Two Grey Hills Chapter
Tohajiilee Chapter
Tohatchi Chapter
Tolani Lake Chapter
Tonalea Chapter
Torreon Chapter
Tsaile/Wheatfields Chapter
Tsayatoh Chapter
Tselani/Cottonwood Chapter
Tuba City/Toh Nanees Dizi Chapter
Twin Lakes Chapter
Upper Fruitland Chapter
Whippoorwill Chapter
Whitecone Chapter
Whitehorse Lake Chapter
Whiterock Chapter
Wide Ruins Chapter

Hualapai Tribe, Peach Springs, Arizona
Pahrump Paiute Tribe, Pahrump, Nevada
The Zuni Tribe, Zuni, New Mexico
Governor, Zuni Tribe

Local Governments

Apache County Development and Community Services, Arizona
Clark County, Nevada, Board of Supervisors
Coconino County, Arizona, Board of Supervisors
Mohave County, Arizona, Public Works Department
Navajo County, Arizona, Board of Supervisors
Yavapai County, Arizona, Board of Supervisors
City of Bullhead City, Arizona, City Manager Tim Ernster
City of Flagstaff, Arizona, Mayor Joseph Donaldson
City of Holbrook, Arizona, City Manager David M. Newlin
City of Holbrook, Arizona, Mayor Brian Smithson
City of Kingman, Arizona, Special Projects Administrator Rob Owen
City of Williams, Arizona, City Manager Dennis Wells

City on Winslow, Arizona, Mayor Allen Affeldt
Town of Laughlin, Town Manager Jackie Brady

Project Applicants
Peabody Western Coal Company

Private Corporations/Organizations
Arizona Public Service, Phoenix, Arizona
Black Mesa Pipeline, Inc. Flagstaff, Arizona
Brown & Brown Law Offices, Pinetop, Arizona
Californians for Renewable Energy, Soquel, California
Energy Minerals Law Center, Durango, Colorado
Eros Resources Group, Denver, Colorado
Healing Ourselves and Mother Earth, Tecopa, California
Indigenous Support Coalition of Oregon, Eugene, Oregon
Intrinsic, LLC, Flagstaff, Arizona
National Resources Defense Council, Santa Monica, California
Nevada Power Company, Las Vegas, Nevada
Peabody Watch Arizona, Flagstaff, Arizona
Salt River Project, Phoenix, Arizona
Sierra Club Partnership Program, Flagstaff, Arizona
Snell & Wilmer, Phoenix, Arizona
Tucson Electric Power, Tucson, Arizona
United Mine Workers of America, Kayenta, Arizona
University of California, Berkeley, California
Western States Constitutionalist Alliance, Green Valley, Arizona

Individuals
Aisyln Colgan, Oakland, California
AL Qoyawayma, Prescott, Arizona
Arista Larusso, Mesa, Arizona
Ashlee Chee, Winslow, Arizona
Berta Benally, Flagstaff, Arizona
C. Jason Arnold, Kingman, Arizona
Caleb Johnson, Kykotsmovi, Arizona
Calvin Johnson, Leupp, Arizona
Charlene Woodstock, Berkeley, California
Chelsea Chee, Flagstaff, Arizona
Daniel Higgins, Tucson, Arizona
Dixie Block, Oakland, California
Eliot Kalman, Athens, Ohio
Enei Begaye, Flagstaff, Arizona
Esther Honyestewa, Tuba City, Arizona
Eugenie F. Bedonie, Pinon, Arizona
F. BeDonie, Arizona
Jim Honacki, Flagstaff, Arizona
John Ford, Dolan Springs, Arizona
John Redhouse, Albuquerque, New Mexico
Josh Avey, Phoenix, Arizona
Kee Hardy, Leupp, Arizona
Ken Lamm, Flagstaff, Arizona
Kimberly Spurr, Flagstaff, Arizona
Laura Chee, Leupp, Arizona
Let Tsosie Williams, Kayenta, Arizona
Mitch Smith, Fort Mohave, Arizona
Morning Star Gali, Oakland, California
Alex Nikee, Gallup, New Mexico
Paul M. Getty, Scottsdale, Arizona
Phyllis Hogan, Flagstaff, Arizona
Resident, Peoria, Arizona
Rita Quintana, Denver, Colorado
Sara Hayes, Long Beach, California
Shonri Begay, Flagstaff, Arizona
Stephen Canning, Port Orford, Oregon
Thomas Sisk, Flagstaff, Arizona
Tom Viator, Phoenix, Arizona
Valencia Herder, Kykotsmovi, Arizona
Vincent H. Yazzie, Flagstaff, Arizona
Wahleah Johns, Flagstaff, Arizona

CHAPTER 6

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6.0 PREPARERS AND CONTRIBUTORS

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Jerry Gavette, Soil Scientist (CPSS/CPSC)	Mine Team Leader	MS, Agriculture-Soils BS, Agriculture Production and Management
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Robert Postle, Ecologist	Mine Team Leader	MS, Land Rehabilitation BA, Environmental Biology
Cooperating Agencies		
Bureau of Indian Affairs		
Amy Heuslein, Regional Environmental Protection Officer, Western Regional Office, Environmental Quality Services	Management, Oversight, NEPA, Biological Resources	BS, Wildlife Biology
Garry Cantley, Regional Archaeologist, Western Regional Office, Environmental Quality Services	Cultural Resources	MA, Archaeology BA, Anthropology
Omar Bradley, Acting Regional Director Navajo Regional Office	Management, Oversight	MBA BS, University Services
Jonathan Martin, Natural Resources Officer	Biological Resources, NEPA	MS, Forest Management BS, Forest Management
Don Simonis, Natural Resources Officer/Regional Archaeologist	Cultural Resources	MA, Anthropology BA, Anthropology
Raymond Roessel, Western Regional Office, Division of Natural Resources, Hydrologist	Water Resources	MS, Hydrology BA, Geology
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Bureau of Land Management		
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Rebecca Peck	Biological Resources	BS, Wildlife Management
Craig Johnson	Cultural Resources	MA, Anthropology BA, Psychology, Anthropology
Bruce Asbjorn	Wilderness, Visual Resources, Recreation	BS, Range Forest Management
Don McClure	Environmental Resources	MS, Range Management

Name/Title	Project Responsibility	Education
Paul Hobbs	Soils	BS, Soil Science
Jerica Richardson	Cultural Resources	BA, Anthropology
Josey Elefritz	Geographic Information Systems	Liberal Studies
Janna Paronto	Lands	Paralegal Certificate, Lands Academy
Ruben Sanchez	Management, Oversight	BS, Range Management
Wayne King	Management, Oversight	BS, Natural Resources Management
Michael Taylor	Management, Oversight	BS, Wildlife Science
Gregg Simmons	Planning, NEPA Program Lead	BS, Forest Management
Bureau of Reclamation		
Bruce Ellis	Management, Oversight	BA, Anthropology
Sandra Eto	NEPA Specialist	BA, Sociology
Kevin Black, Sr.	C Aquifer Water-Supply Study Manager	BS, Business Management
Henry Messing	Biological Resources	MS, Biology BS, Biology
Jon Czaplicki	Cultural Resources	MA, Anthropology BA, Anthropology
Rob Clarkson	Native Fish Biologist	MS, Zoology BS, Fisheries Management
City of Kingman		
Rob Owen	Special Projects Administrator	BS, Urban Planning
Hopi Tribe		
Scott Canty	Office of General Counsel	Attorney, Hopi Tribe
Harris Sherman	Outside Council	JD BA, History
Arnold Taylor	Natural Resources	BS, Agriculture
Leigh Kuwanwisiwma	Cultural Resources	BS, Accounting
Michael Yeatts	Cultural Resources	MA, Anthropology BS, Chemistry
Lanell Poseyesva	Cultural Resources	BA, Anthropology
Stewart Koyiyumptewa	Cultural Resources	BA, Anthropology
Lee Wayne Lomayestewa	Cultural Resources	Member of 7 Traditional Hopi Societies
Joelynn Roberson	Project Management	MPA, Public Administration BS, Political Science
Norman Honie	Mining and Mineral Resources	AA, Animal Husbandry Certificates of Applied Science in Range Management and Drafting Certificates in Mining and Mineral Property Management
Nat Nutongla	Water Resources	BS, Physical Geography
Sharon Lopez	Wetlands, Floodplains	MS, Environmental Science and Policy BS, Fresh Water Studies
Steven Lomadofkie	Geology, Minerals	
Robert Adams	Soils, Vegetation	BA, Mechanical Engineering
Priscilla Pavatea	Soils, Biological Resources	BS, Animal Health BS, Animal Health Science
Donna Anderson	Biological Resources	MS, Wildlife and Fisheries Science BS, Wildlife and Fisheries Science
Clayton Honyumptewa	Land Use	Courses: Land Management and Natural Resources

Name/Title	Project Responsibility	Education
Davis Pescusa	Lands and Realty	BA, Business Administration
Robert Charley	Realty and Right-of-Way	
Clay Hamilton	Real Estate Services	Training, Cultural Resources
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Gina Mullen	Geographic Information Systems	MS, Environmental Science and Policy BS, Geology
Navajo Nation		
John Stucker, Senior Mining Engineer, Minerals Department – Surface Mining Program	Project Management, Geology, Minerals, Soils	PE, BS, Mining Engineering
Arvin Trujillo, Executive Director, Navajo Nation Division of Natural Resources	Project Management	MS, Mineral Processing BS, Chemistry
Stanley Pollock, Assistant Attorney General	Legal	JD MGS
John Leeper	Water Resources	PE, PhD, Civil Engineering MS, Civil Engineering BS, Civil Engineering
Jason John	Water Resources	MS, Geohydrology BS, Geohydrology
Robert Kirk	Water Resources	BS, Geography
David Mikesic, Zoologist, Natural Heritage Program, Department Fish and Wildlife	Biological Resources	MS, Zoology BA, Biology – Terrestrial Ecology
Alan Downer, Director, Navajo Nation Historic Preservation Department	Cultural Resources	PhD, Applied Anthropology MS, Anthological Archeology BS, Geology
Ron Maldonado	Cultural Resources	BS, Anthropology
Charlene Nelson	Air Resources	MS, Environmental Engineer BS, Health Science
Rachel Misra, Air Compliance Officer, Navajo Nation Environmental Protection Agency	Air Resources	PhD, Medical Education MS, Zoology MSc, Fishery Biology BSc, Zoology
Eugenia Quintana	Air Resources	MS, Community and Regional Planning, Natural and Environmental Planning BUS, University Services
Ray Benally, Director, Navajo Nation Water Resources Department	Water Resources	PE, RLS, BS, Engineering MBA
Tom Morris, Senior Environmental Specialist	Wetlands, Floodplains	BS, Agriculture AAS, Environmental Technology
Lawrence Begay	Senior Reclamation Specialist	BS, Microbiology and Chemistry
Judy Willeto	Vegetation, Grazing	AA, Animal Science
Rita Whitehorse-Larsen, Wildlife Biologist, Senior Environmental Specialist	Biological Resources, Fish and Wildlife Department Environmental Reviewer, Navajo nation Environmental Protection Agency	BS, Environmental Resources – Range and Wildlife Management
Howard Draper	Land Use and Realty	BS, Geography Regional Development
Martin Begaye	Visual Resources	BS, Anthropology
Trib Chroudahary	Socioeconomics	MS, Economics BS, Economics

Name/Title	Project Responsibility	Education
Rachelle Silver, GIS Analyst	Geographic Information Systems	AAS, Microcomputer Operations
Ron Malecki, Wildlife Biologist, Environmental Reviewer	Biological Resources, Environmental Review	BS, Biology
Eric Rich, Senior Hydrologist	Hydrology, Water Quality	BS, Hydrology BS, Sociology/Spanish
Mohave County		
Nick Hont	Liaison	PE, BS, Civil Engineering
U.S. Environmental Protection Agency		
Jeanne Geselbracht	NEPA Specialist	MA, Geography BA, Geography
Jason Brush	Clean Water Act 404 and 401	MA, Anthropology
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USDI Fish and Wildlife Service		
Steve Spangle, Regional Supervisor	Management, Fish and Wildlife	BS, Wildlife Management
Brenda Smith, Assistant Field Supervisor	Management, Fish and Wildlife	MS, Wildlife and Fisheries Science BS, Wildlife Biology
John Nystedt	Fish and Wildlife	BS, Zoology, Wildlife Science
Shaula Hedwall	Fish and Wildlife	MS, Natural Resource Sciences, Wildlife Ecology emphasis BS, Forestry, Wildlife Ecology emphasis
USDA Forest Service – Kaibab National Forest		
Tom Mutz	Lands and Minerals	BS, Forest Watershed Management BS, Psychology
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Other Participating Agencies		
Arizona Game and Fish Department		
Rebecca Davidson, Habitat Branch	Project Evaluation Coordinator	BS, Environmental Science
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USDI Office of Policy Analysis		
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USDI Office of Environmental Policy and Compliance		
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Project Proponents		
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Name/Title	Project Responsibility	Education
Bob Goodson	Project Environmental Coordination	BA, Geography
Michelle Nuttall	C-Aquifer Project Manager, Oversight	BA, Biology
Tom Taylor	Cultural Resources	MA, Anthropology BA, Anthropology
Paul Phelan	Engineering Management Oversight	BS, Mechanical Engineering BS, Metallurgical Engineering
Larry Johnson	Project Manager, Engineering and Technical Services	PE, BS, Mechanical Engineering
Brian Watts	Project Engineering and Technical Services	PE, BS, Engineering
Steve Weaver	Project Engineering and Technical Services	PE, BS, Mechanical Engineering
Black Mesa Pipeline, Inc.		
Fred Rimington, President	Management, Oversight	MBA BS, Business Administration
Ruth Jensen, Environmental Specialist	Environmental Review	BS, Chemical Engineering
Peabody Western Coal Company		
Brian Dunfee, Director, Environmental Services	Project Oversight	MS, Range Ecology BS, Wildlife Biology
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Randy Lehn, Manager, Mine Engineering and Services	Engineering Oversight	BS, Civil Engineering
John Cochran	Hydrology, Air, and Meteorology	BS, Hydrology
Vern Pfannenstiel	Reclamation, Vegetation, and Wildlife	BS, Range Ecology
Salt River Project		
Randy Dietrich	Management, Oversight	MBA MS, Electrical Engineering BS, Electrical Engineering
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Chuck Paradzick	Biological Resources	MS, Natural Science BS, Wildlife Conservation Biology
Rick Anduze	Cultural Resources	25+ years archaeology experience
Consultants		
URS Team		
Cindy Smith, Manager, Environmental Planning	Project Manager (2004-September 2008)	BS, Liberal Arts and Sciences
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Name/Title	Project Responsibility	Education
Cary Roberts, Environmental Planner	Project Coordination	MS, Environmental Management BS, Ecology and Evolutionary Biology
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Jeffery Johnson, Senior Biologist	Biological Resources	MS, Botany BS, Botany
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Barbara Garrison, Senior Biologist	Biological Resources	BS, Wildlife and Fisheries Science
Jeff Dawson, Senior Biologist	Biological Resources	MS, Botany BS, Biology
Jaime Wood, Environmental Planner	Land Use, Recreation, Transportation	MS, Environmental Planning BS, Environmental Studies BS, Geography, Environmental Resource Management
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A.E. (Gene) Rogge, PhD, Manager, Cultural Resources	Cultural Resources	PhD, Anthropology MA, Anthropology BA, Anthropology
Debra Duerr, Senior Environmental Planner	Public Involvement	BA, Urban Planning
Lyndy Long, Public Involvement Specialist	Public Involvement	BA, English Literature
Richard Stuhan, GIS Analyst	Geographic Information Systems	BS, Applied Geography/ Geographic Information Management/Remote Sensing
Glenn Emanuel, Application Developer	Information Technology	BS, Management Information Systems
Michael Evans, Software Programmer	Information Technology	MBA, Business Administration BS, Computer Science

Name/Title	Project Responsibility	Education
Mitch Meek, Graphic Artist	Graphics	BFA, Graphic Design
John Qoyawayma, Graphic Artist	Graphics	Technical courses in CAD, graphic design
Wendy Gabriel, Writer/Editor	Editing, Document Production	MA, Environmental Planning BA, Psychology
Maggie Fulton, Writer/Editor	Editing, Document Production	BA, English
Anthropological Research LLC		
T.J. Ferguson	Cultural Resources	PhD, Anthropology MCRP, Community and Regional Planning MA, Anthropology BA, Social Science
Chip Colwell-Chanthaphonh	Cultural Resources	PhD, Anthropology MA, Anthropology BA, Anthropology
Circa Cultural Consulting		
Peter Bungart	Cultural Resources	MA, Anthropology
Anne Raney	Cultural Resources	MA, Anthropology
EPG		
Cindy Smith, Environmental Planning	Technical Specialist (September 2008-Present)	BS, Liberal Arts and Sciences
ERO Resources (Consultant to SRP)		
Craig Sommers	Water Resources	MS, Water Resource Economics BS, Soil and Water Science
Navajo Nation Archaeology Department		
Robert Begay, Manager	Cultural Resources	MA, Anthropology BS, Psychology
Davina Twobears	Cultural Resources	MA, Anthropology BA, Anthropology
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Harriett K. Sandoval	Cultural Resources	BA, Anthropology
Hualapai Tribe		
Loretta Jackson-Kelly, Tribal Historic Preservation Officer	Cultural Resources	Associate Degree in Applied Science
Jana Tschopp	Cultural Resources	MA, Anthropology
Sharon Wilder	Cultural Resources	Hualapai Tribal Member
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SWCA		
Rich Valdez	Fish Biologist	PhD, Fisheries Ecology MS, Fisheries BS, Wildlife Management

Disclaimer Statement

National Environmental Policy Act (NEPA) Disclosure Statement
Black Mesa Environmental Impact Statement

The President's Council on Environmental Quality (CEQ) regulations at 40 CFR 1506.5(c) require that consultants preparing an environmental impact statement (EIS) execute a disclaimer specifying they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for the purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 19026-18038 at Questions 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)" 46 FR 18026 at 18031.

In accordance with these requirements, URS Corporation has prepared this EIS on behalf of the Office of Surface Mining Reclamation and Enforcement and the cooperating agencies and declares no financial or other interest in the outcome of the Black Mesa Project.

Certified by:

Jennifer Frownfelt
Jennifer Frownfelter, Vice President
URS Corporation

13 October 2008
November 2008

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7.0 REFERENCES

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APPENDIX A

Appendix A

A-1 Black Mesa Complex: Mining and Reclamation Procedures

A-2 Alternative A Coal-Slurry Pipeline: Typical Pipeline Construction, Operation, and Maintenance

A-3 Alternative A C Aquifer Water-Supply System: Typical Well Field and Pipeline Construction, Operation, and Maintenance

Appendix A-1
Black Mesa Complex:
Mining and Reclamation Procedures

Appendix A-1
Black Mesa Complex:
Mining and Reclamation Procedures

GENERAL

Authorization to Mine

Since the 1970s, Peabody Western Coal Company (Peabody) has been surface mining coal on Black Mesa, within Navajo County, Arizona. Mining takes place within the Black Mesa Complex, which is located on contiguous coal leases within the boundaries of the Hopi and Navajo Indian Reservations. The Kayenta mining operation has been in operation since 1973 and operates under an Office of Surface Mining Reclamation and Enforcement (OSM) Permanent Program Permit AZ-0001D, originally issued on July 6, 1990. Permit AZ-0001D is renewable at 5-year intervals and currently authorizes mining operations in coal resource areas N-09, N-10, N-99, J-19, and J-21, which, combined, contain enough coal to sustain the Kayenta mining operation through 2026 at the current production rate of 8.5 million tons of coal per year. Permit AZ-0001D has been renewed on three occasions: July 6, 1995; July 6, 2000; and July 6, 2005. The Black Mesa mining operation, mined from 1970 to late 2005[1], was authorized to operate under an OSM initial regulatory program (30 Code of Federal Regulations [CFR] Subchapter B Part 710) while the decision on the operations' Permanent Program Permit application remains in administrative delay pursuant to 30 CFR 750.11(c) Subchapter E.

Peabody filed a major permit revision application with OSM on February 17, 2004, seeking an extension of the life of mining through at least 2026 for both the Kayenta and Black Mesa mining operations and attendant changes to various other components of Peabody's Mining and Reclamation Plans. However, in letters dated February 25 and April 30, 2008, Peabody notified OSM of its intention to amend the pending mine permit-revision application for the Black Mesa Complex to remove proposed plans and activities that supported supplying coal to the Mohave Generating Station because it believed that reopening the Mohave Generating Station for operation is unlikely, but it will continue to supply coal to the Navajo Generating Station. Peabody submitted to OSM an amended mine permit-revision application on July 2, 2008.

If Alternative B of the Black Mesa Project Environmental Impact Statement is implemented, the OSM Director (or designee), in consultation with the Bureau of Indian Affairs (BIA) and the Hopi Tribe and Navajo Nation [30 CFR 750.6(d)], would approve Peabody's permit application and issue a Federal permit to conduct surface coal mining and reclamation operations at the Black Mesa Complex with conditions necessary to meet the requirements of the Surface Mining Control and Reclamation Act (SMCRA) and all other applicable Federal laws. The Federal permit to mine coal would be renewable at 5-year intervals for the extended life of the mines. The Bureau of Land Management (BLM) Arizona State Director (or designee) would approve the proposed life-of-mine plan. Authority for OSM and BLM to take these actions is found in 30 CFR 750.6(a) and 25 CFR Chapter I, respectively. Responsibilities for consultation with BIA are defined under 30 CFR 750.6 and 25 CFR Part 216. In order for Peabody to continue surface-coal-mining and reclamation operations beyond the currently authorized timeframes, all approvals listed under the proposed action must be obtained.

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[1] The Mohave Generating Station is a coal-fired, steam electric-generating power plant that produced electricity from 1970 until year-end 2005, when operation of the power plant was suspended.

Coal Mining Leases

The Black Mesa Complex comprises approximately 24,858 acres of land where the surface and mineral interests are held exclusively by the Navajo Nation ("N" designated coal resource areas) and approximately 40,000 acres of land in the former Hopi and Navajo Joint Minerals Ownership Lease Area ("J" designated coal resource areas) (Map A-1). The tribes have joint and equal interests in the minerals that underlie the former Joint Use Area; however, the surface has been partitioned. The portion of the leasehold that lies in the former Joint Use Area consists of approximately 6,137 acres partitioned to the Hopi Tribe and 33,863 acres partitioned to the Navajo Nation. The coal-mining leases with the Hopi Tribe and Navajo Nation, shown on Map A-1, provide that Peabody may produce up to 290 million tons from the exclusive Navajo Lease Areas (Contract 14-20-0603-8580 originally executed on February 1, 1964) and up to 380 million tons from the Hopi and Navajo Joint Minerals Ownership Lease Area (Contracts 14-20-0603-9910 and 14-20-0450-5743 originally executed on June 6, 1966) for a combined total of 670 million tons. While the specified leased coal tonnages are certain, the assignment of coal parcels to a particular buyer of the coal may change, depending upon customer demand and coal-quality needs.

The coal-mining leases also provide Peabody rights to prospect, mine, and strip leased lands for coal and kindred products, including other minerals, except for oil and gas, as may be found. Peabody also is given the right to construct support facilities such as buildings, pipelines, tanks, plants, and other support structures; make excavations, openings, stockpiles, dumps, ditches, drains, roads, spur tracks, transmission lines, and other improvements; and to place machinery and other equipment and fixtures and do all other things upon the leased lands necessary for the efficient operation of mining. Peabody may occupy that portion of the leased lands as is necessary to carry on mining operations, including right of ingress and egress, and may develop and use water for the mining operations.

Rights-of-Way and Easements

There are several existing grants of rights-of-way and easements allowing Peabody access and use of lands outside the existing coal lease areas. A grant of right-of-way and easement for an overland conveyor and coal-loading site was issued to the Navajo Generating Station project participants by the Secretary of the Interior with the approval of the Navajo Nation on December 10, 1969, that was ultimately transferred to Peabody. A grant of right-of-way and easement for two parcels of land providing access for utilities, haul roads, maintenance roads, sediment-control ponds, and a rock-borrow area was approved by the Navajo Nation and BIA on August 19 and 28, 1996, respectively. A grant of right-of-way for an electrical transmission line was issued by the BIA with the consent of the Navajo Nation on September 9, 1984.

As described in Chapter 2, if Alternative A were selected, Peabody would obtain a separate and additional off-lease right-of-way to construct a coal-haul road as a support facility for continued Kayenta and Black Mesa mining operations (Chapter 2, Map 2-1). If Alternative B were selected, Peabody would not need the additional off-lease right-of-way.

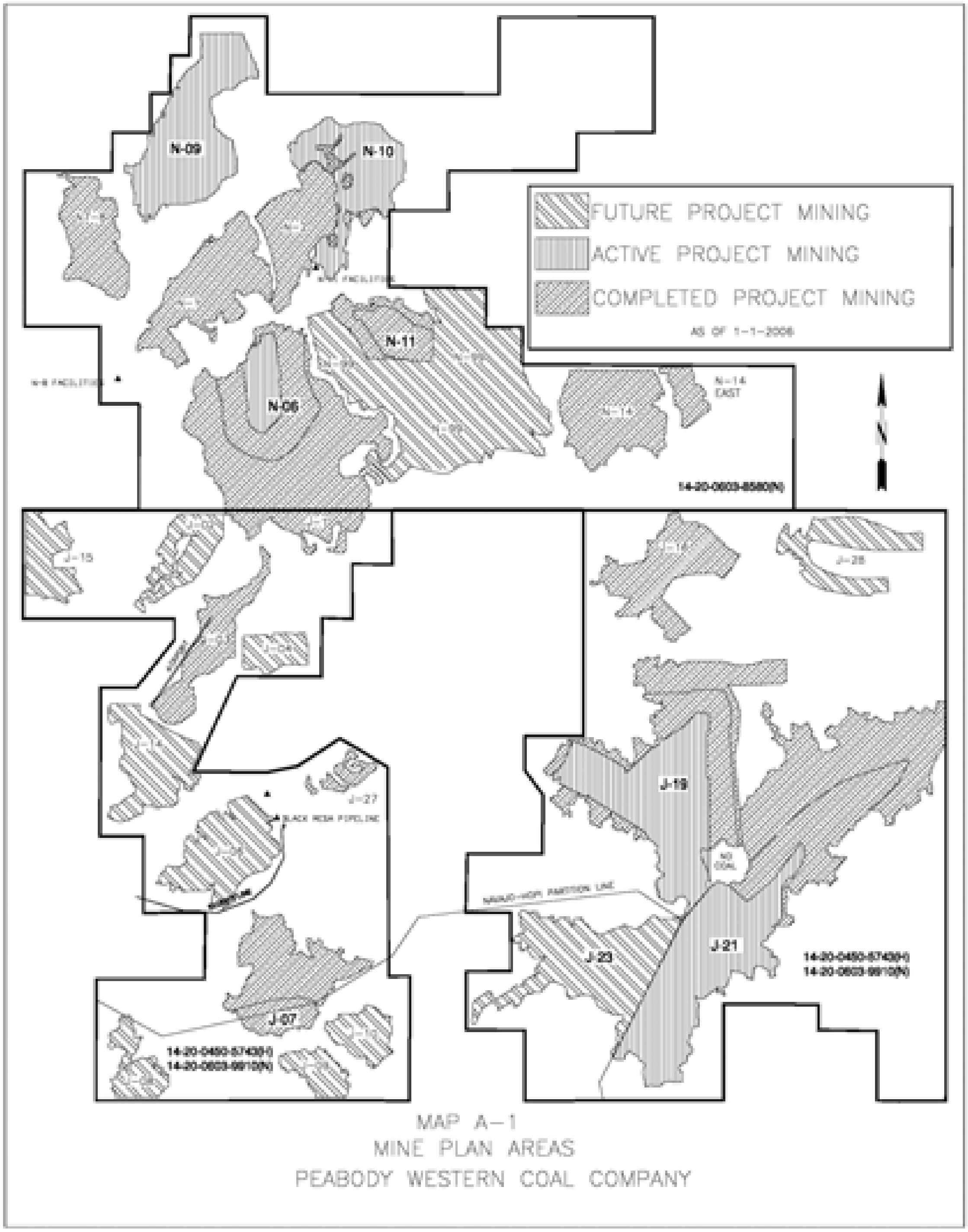
Coal-Supply Agreements

Peabody has a coal-supply agreement with the participants of the Navajo Generating Station containing a term ending in mid-2011. This coal supply agreement contemplates three potential 5-year extensions. Peabody presently is engaged in negotiations with the participants to extend the term of this coal-supply agreement. The coal-supply agreement with the participants of the Mohave Generating Station ended on December 31, 2005.

The future project mining areas within the Black Mesa Complex are shown on Map A-1. Approximately 829 million tons of potentially economical coal reserves are available within the Black Mesa Complex. On January 1, 2005, approximately 367 million of the 670 million tons currently under lease had been sold.

Coal Resource Protection

Peabody must conduct coal-mining activities in a manner that conserves and protects the coal resource in accordance with 25 CFR Subchapter I. The BLM provides inspection and enforcement to ensure protection and conservation of the coal reserve, and also is responsible for independently verifying Peabody's coal production. Coal mining on Black Mesa is a complicated process involving extraction of nonconcentrated, multiple coal seams having varying overburden depths and innerburden thicknesses. The coal seams split, change to burned coal, and pinch out in very short distances. The complicated nature of the coal-seam geology has resulted in the selection and application of equipment providing highly efficient and effective coal removal. Auxiliary equipment has been carefully matched to primary excavators and their capabilities to ensure maximum coal recovery while maintaining environmental integrity.


FUTURE PROJECT MINING
ACTIVE PROJECT MINING
COMPLETED PROJECT MINING
AS OF 1-1-2008
N-09
N-10
N-11
N-06
N-14
EAST
14-20-0603-8580(N)
J-15
J-27
BLACK MESA PIPELINE
J-28
J-19
NO COAL
NAVAJO-HOPI PARTITION LINE
J-23
J-21
J-07
14-20-0450-5743(H)
14-20-0603-9910(N)
MAP A-1
MINE PLAN AREAS
PEABODY WESTERN COAL COMPANY

MINE FACILITIES

This section contains a description of the existing and proposed facilities that do and would support the mining operation. These facilities include water-control facilities, transportation facilities, and other support facilities.

Water-Control Facilities

Sediment- and Water-Control Facility Plan

Peabody must design, construct, and maintain appropriate sediment-control measures including sediment ponds, diversions, culverts, and other sediment- and water-control structures in accordance with 30 CFR 816.45 in order to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area due to mining activity, and to minimize erosion. Sediment-control measures include practices used within and adjacent to the mining-disturbance areas. Sediment-control measures consist of the use of proper mining and reclamation methods and sediment-control practices, singly or in combination. Sediment-control methods may include, but are not limited to, the following:

- Disturbing the smallest practicable area at any one time during the mining and construction operation;
- Stabilizing graded material to promote a reduction in the rate and volume of runoff;
- Retaining sediment within disturbed area;
- Diverting runoff away from disturbance areas, including stockpiles, back slopes, and material storage;
- Diverting runoff through disturbed areas using stabilized earth channels, culverts, or pipes so as to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area;
- Using straw dikes, silt fences, small V-ditches, riprap, mulches, check dams, ripping, contour furrowing, vegetative sediment filters, small depressions, sediment traps, and other measures that would reduce overland flow velocity, reduce runoff volume, or trap sediment; and
- Treating traffic areas with water or dust suppression to reduce the potential for wind and water erosion.

Siltation structures or sedimentation ponds are used primarily for controlling sediment from all disturbed areas, except those permitted areas exempted by the requirements of these regulations. Other alternative sediment-control methods may be used in conjunction with the siltation structures or, in the case of the permitted areas that are exempt (i.e., roads), they may be used individually.

Sediment Ponds and Impoundments

Temporary Sedimentation Ponds

Peabody constructs sedimentation ponds to control runoff and sediment from disturbed areas pursuant to 30 CFR 816.46, 816.47, 816.49, and 816.56. Sediment ponds generally are recognized in the coal-mining industry as the best available control technology to prevent, to the extent possible, additional contributions of suspended solids sediment to stream flow or runoff outside the permit area due to mining disturbance. All surface drainage from the disturbed areas passes through a siltation structure before leaving the permit area, except in certain small areas that are exempt from these regulations. In the exempt areas, alternative sediment-control methods are used to eliminate additional contributions of sediment off the permit area. Most of the sediment ponds are designed to be temporary, and are reclaimed when they are no longer needed to treat runoff from disturbed areas. Certain temporary ponds may be proposed for permanent retention in the post-mining landscape, but must be upgraded to meet permanent impoundment regulatory requirements.

At the end of 2007, 156 sedimentation structures existed in the permit areas. Seventy-three temporary sedimentation structures have been removed and reclaimed or are approved for removal and reclamation by the regulatory authority. Peabody proposes to construct 11 temporary sedimentation ponds through 2013, and projects constructing an additional 92 temporary sedimentation ponds after 2013 over the life of mining. Again, many of these will be reclaimed during the life-of-mine timeframe when they are no longer needed to control runoff and sediment from the disturbed areas.

Sedimentation ponds and impoundments are designed to comply with the requirements of 30 CFR 780.11, 780.12, 780.25, 816.46, 816.47, 816.49, and 816.56, and other applicable regulations.

Permanent Impoundments

Fifty-one water sources consisting of three categories of impoundments determined to be needed to provide water for wildlife and livestock have been or are being proposed to exist permanently after mining is completed. These categories include pre-SMCRA internal impoundments, existing and proposed post-SMCRA internal impoundments, and existing and proposed water-control structures (sediment ponds). Nineteen permanent internal impoundments currently exist that are available for wildlife and livestock use as a part of the post-mining landscape. One additional internal permanent impoundment is being proposed for consideration in the permit application (J-19-RB). It would be located in the J-19 coal resource area. In addition, Peabody is proposing 31 existing or proposed temporary sediment-control structures as permanent impoundments. These include 9 existing Mine Safety and Health Administration structures, 20 existing sediment-control structures, and 2 proposed sediment-control structures. Being multi-purpose structures, these structures are used for sediment control during the life of the mine and reclamation operations and would be converted to permanent structures prior to final bond release.

Mine Safety and Health Administration-Size Impoundment Structures

Peabody uses 11 existing structures that meet the criteria of 30 CFR 77.216(a). Two structures would be temporary and 9 structures would be permanent. The primary purpose of these structures, except for the Kayenta mining operation fresh-water pond, is to control sediment from disturbed mining areas. The Kayenta mining operation fresh-water pond's purpose is to hold groundwater pumped from nearby Navajo-aquifer wells used for dust suppression.

Topsoil Stockpiles

Where prompt replacement of topsoil recovered ahead of mining disturbances is infeasible, numerous topsoil stockpiles are developed throughout the mine areas to store topsoil pursuant to 30 CFR 780.14(b)(5) and 816.22(c) until it is needed for revegetation operations. Stockpiled topsoil remains in place from less than 3 months to more than 10 years, depending on the location with respect to revegetation operations and the revegetation schedule. Stockpile dimensions, slopes, and volumes vary based on total salvage volumes, the configuration of the location site, and proximity to access roads. Using best management practices, stockpiles are placed on a stable site protected from wind and water erosion, and are not disturbed until required for redistribution.

Transportation Facilities

There are four types of roadways inside or crossing Peabody's permit area: primary roads, ancillary roads, non-mining-related roads (i.e., public roads and private roads), and pit ramps or routes of travel that are within the mining and spoil grading areas.

Primary and ancillary roads are located, designed, constructed, used, maintained, and reclaimed in accordance with the regulations and performance standards set forth under 30 CFR 816.150 and 816.151. Appropriate regulatory approval must be obtained for mine-related road crossings of stream buffer zones prior to construction of these crossings.

Within the primary and ancillary road classifications there are five sizes of roads based on use and traffic volume. There are three typical sizes of primary roads: (1) haul roads and mine-vehicle roads; (2) coal-haulage, mine-vehicle, and dragline-deadheading roads; and (3) mine-access roads. Two types of ancillary roads are used by lighter duty vehicles on a less frequent basis to access remote mine-facility sites, such as environmental monitoring sites; the first type is typically a two-lane road where an all-weather road is required to access remote sites, and the second type is usually a single-lane road that follows the natural topography (typically less frequently used than the first type).

All roads used or built by Peabody on or after December 16, 1977, will be reclaimed, unless they have been approved by the regulatory authority as a part of the post-mining land use plan. Because of the size and nature of Peabody's mining activities, very few of the roads in the latter category will be reclaimed until the end of mining activities on the entire leasehold. Exceptions include roads in the immediate vicinity of pits and ramps, which are created in the spoil and reclaimed as the general reclamation activities progress within a specific coal resource area.

Support Facilities

Support facilities include, but are not limited to, the following: mine buildings, offices and shops, bath houses, storage silos and cap magazines, coal-loading facilities, coal-crushing and -sizing facilities, coal-storage areas, equipment storage areas, water diversions and culverts, sheds constructed on permanent foundations and greater than 100 square feet in size, utilities, permanent fuel-storage and -tank farms, environmental monitoring sites, wells, and railroad and surface-conveyor systems (refer to Chapter 2, Map 2-2). New support facilities would be approved by OSM prior to construction regardless of their location. All disturbances for construction of facilities to support mining operations are contained within a designated disturbance area. Maintenance of all facilities and reclamation of temporary facilities is in accordance with the approved mining plan.

Coal-Washing Facility (Alternative A)

As described in Chapter 2, if Alternative A of the Black Mesa Project were approved and implemented, Peabody would need to construct and operate a coal-washing facility at the Black Mesa mining operation in order to meet future coal-quality requirements of the Mohave Generating Station. The purpose of the coal-washing facility is to remove out-of-seam rock and mineral impurities, commonly referred to as refuse, from the coal, which results in less ash when the coal is burned. The coal-washing facility would be integrated into the existing Black Mesa coal-preparation facilities and thus would result in changes to both the facilities and the method of operation of the facilities. This section describes the coal-washing process, the changes that would be needed to integrate the coal-washing facility into the coal-preparation process at the Black Mesa mining operation, the effect the changes would have on potential fugitive dust emissions, and refuse disposal. No changes are proposed at the Kayenta mining operation coal-preparation facilities.

Coal-Washing Process

If Alternative A were selected, a coal-cleaning process would sort the coal as mined, sorting some to refuse and some to clean coal. This cleaning process would be accomplished using water-based technologies that use differences in specific gravity, so the chemical constituents of the individual particles would not be changed.

The coal-washing facility would consist of two parallel 600-ton-per-hour modules. Each module would consist of two cleaning circuits each consisting of heavy media cyclones (for coarse coals) and spiral concentrators (for fine coals). All raw coal greater than 1 millimeter (mm) in size would be segregated via vibrating screens and processed in large diameter heavy media cyclones. A heavy media process uses a finely ground (minus 0.044 mm) magnetite that is mixed with water to produce a medium of the desired specific gravity to separate the coal from the rock. The coal is mixed with the medium and pumped into the heavy media cyclones. The magnetite then is recovered from both the clean coal and refuse streams using drain and rinse screens in combination with magnetic separators, for reuse within the coarse coal circuit. Emissions from the storage and use of magnetite, prior to its becoming mixed with water, would be controlled with a baghouse.

The minus 1 mm fine raw coal is further segregated at 0.15 mm, with the use of classifying cyclones, so that a nominal 1-mm by 0.15-mm raw coal is produced and processed in spiral concentrators. The raw coal from the classifying cyclone, already mixed with water, is fed onto the spiral concentrators. Centrifugal force from the natural flow within the unit produces a specific gravity separation so that the coal can be separated from the refuse. All raw coal smaller than 0.15 mm segregated in the classifying cyclone circuit would not be beneficiated, but instead would be recovered as refuse.

Future Preparation Process and Facilities

Also, if Alternative A were selected, the Black Mesa mining operation's preparation facilities would require changes in configuration and certain methods of operation to meet coal-quality requirements of the Mohave Generating Station, accommodate the coal-washing facility, and to reduce overall fugitive dust emissions. Primary changes from past operations would include: (1) increased hours of operation to accommodate growth in demand for coal at the Mohave Generating Station; (2) changes in the configuration and management of run-of-mine and clean coal stockpiles to achieve a more uniform product; (3) the like-kind replacement of the primary crusher; (4) removal of a pre-existing screen and secondary crusher; (5) modification of the coal-stacking and reclaiming systems; (6) addition of the coal-washing facility; (7) addition of the refuse-handling system; and (8) addition of new coal-quality sampling systems. Some relocation of conveyor belts also would be needed to accommodate the coal-washing facility. Figure A-1 provides a general flow diagram of the future coal preparation process.

As in the past operation, coal would be transported from one or more pits in off-road, bottom-dump or end-dump trucks to the coal preparation facility such that approximately 6.35 million raw tons would be produced. It would be dumped in one of three locations; the truck dump hopper, the run-of-mine stockpile, or a small off-specification oxidized coal stockpile. The run-of mine stockpile would have separate zones for high- and low-ash coal. Coal would be recovered from the off-specification coal stockpile using a loader and trucks for transport to the truck dump hopper. Coal from the run-of-mine stockpile would be pushed to the truck dump hopper using rubber-tired dozers.

All coal passing the truck dump hopper is fed to the primary crusher where it would be crushed to a 2-inch minus size. Coal would leave the primary crusher via conveyor, would be sampled for quality, and would be transferred back to the run-of-mine stockpile into separate zones of high- and low-ash crushed coal by way of two new stacker tubes installed inside the footprint of the stockpile. The previous screen and secondary crusher would be eliminated.

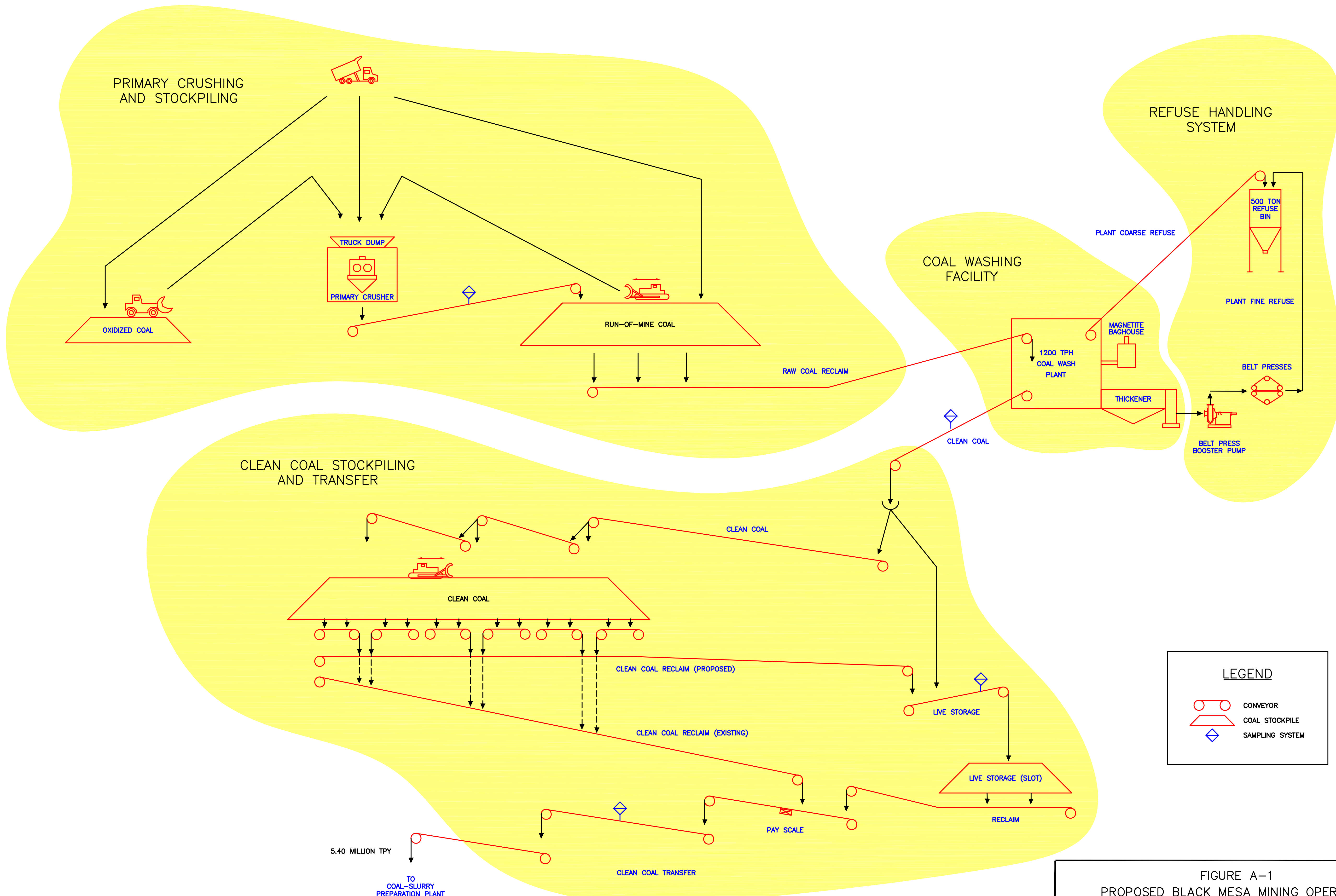


FIGURE A-1
PROPOSED BLACK MESA MINING OPERATION
COAL-PREPARATION FACILITIES LAYOUT

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From the crushed coal management zones in the run-of-mine stockpile, coal would be blended onto a new sub-grade reclaim conveyor belt for transport to the coal-washing facility. Track dozers would be employed for pile maintenance and reclamation of coal from the crushed coal zones of the run-of-mine stockpile. Total maximum feed to the coal-washing facility would be approximately 6.35 million tons annually. Approximately 950,000 tons (maximum) of refuse would be generated, conveyed to the refuse bin and loaded in trucks for disposal. This material would be wetted thoroughly as a result of the coal-cleaning process, and would not generate appreciable fugitive dust emissions.

Clean coal would be produced at an annual rate of approximately 5.4 million tons. This clean, thoroughly wetted product would be carried by conveyor to the clean-coal storage transfer point. Along the way a new two-stage sampling system would remove a small portion of the coal for quality analysis. The coal then would be conveyed either directly to the pre-existing live-storage facility or the clean-coal stockpile.

Coal conveyed to the clean-coal stockpile would be distributed based on quality among three new stacker tubes that would be installed within the existing footprint of the stockpile. A new sub-grade reclaim system would be installed and track dozers would continue to be used on the pile for maintenance and coal recovery purposes. The previously existing coal-reclaim system from the pile would be retained so the coal may be processed through the live-storage facility or delivered directly to the conveyors to the coal-slurry preparation facility.

There would be no changes to the remaining conveyor and sampling facilities that would convey clean coal from the mine to the neighboring coal-slurry preparation facility.

Potential Fugitive Dust Emission

The changes that were proposed at the Black Mesa mining operation's coal-preparation facilities had been designed to result in an overall net reduction in fugitive dust emissions from the facilities (Table A-1). The planned reduction in the number of coal stockpiles and elimination of the screening and secondary crushing processes more than offset the increase in emissions resulting from increased coal blending activities. While the emission estimates in Table A-1 are made on an uncontrolled basis for the purpose of assessing the worst case potential to emit, the facilities would be constructed and operated with emission controls. These controls include watering coal in the pit(s) during loading to reduce emissions when the coal is dumped at the stockpiles or hopper, deployment of water sprays at key process locations (e.g., the truck dump hopper, primary crusher, conveyor transfer points, stackers), partial or complete enclosure of key emission points (crusher, transfer points), and watering of coal stockpile aprons and haul roads.

Table A-1 Coal-Washing Facility Project Emission Changes

	Potential To Emit (tons/yr PM_{10})[1]		
Emission Sources	**Increases**	**Decreases**	**Net Change**
Crushers	7.66	6.19	+ 1.47
Screens	0.00	21.24	-21.24
Transfer points	0.24	0.29	- 0.05
Dozers/Loaders on coal stockpiles	17.2	1.30	+ 15.9
Unpaved haul roads	0.00	6.16	- 6.16
Wind erosion on coal stockpiles	32.37	29.51	+ 2.86
Baghouses	0.72	0.00	+ 0.75
Total	**58.22**	**64.69**	**- 6.47**

SOURCE: McVehil-Monnett Associates, Inc. 2006
NOTES: [1]Potential To Emit is calculated on an uncontrolled basis (no credit is taken for dust-control practices).

Refuse Disposal

If Alternative A were selected, the coal-washing facility would remove a maximum of about 950,000 tons per year of refuse, which would be returned to the mine pits for disposal. Prior to disposal, coarse refuse from the coarse refuse hopper would be mixed with the fine refuse (particle size less than 0.15 mm) exiting the coal-washing facility. The fine refuse would be dewatered prior to disposal using belt presses. The water would be cycled back to the coal-washing facility for reuse. No refuse piles or coal-mine-waste impoundments are proposed.

Peabody conducted a modeling study to determine the environmental consequences of disposing of refuse in the pits. The modeling study relied on leachate tests on waste material collected from coal core samples to provide chemical data, because actual coal-washing facility refuse material would not be available until operations resume at the Black Mesa mining operation. A degree of uncertainty was introduced to the study results because the coal core samples were not expected to have the same physical characteristics as the actual refuse material and were not subjected to a washing process.

As a result, Peabody would develop and submit for regulatory approval a refuse sampling and disposal plan that would be incorporated into the mining permit. The plan would be implemented when the coal-washing facility begins operating. The plan would consist of periodic sampling of refuse based upon the source (pit and seam) of run-of-mine coal being processed to ensure that a representative cross-section of the refuse material is sampled. Samples would be analyzed for an appropriate array of chemical constituents (including trace elements). The analytical data results would be compared to the chemical data assessed in the modeling study. If the analytical results from coal wash refuse samples exceed concentrations from the initial core samples, new model simulations would be conducted using the new data and the same models would be used to predict impacts in the study. If the coal-washing facility refuse sample data and model results do not deviate from the study data and model results, the refuse would be disposed of in the pits (N-06 and J-23) using standard practices currently outlined in the permit application. If the data and model results deviate significantly from the study and indicate the potential for greater impacts, Peabody would implement special refuse-disposal procedures such as placing the refuse in pit areas over preconstructed liners consisting of compacted clay spoil and capping the refuse with compacted clay spoils, or mixing the refuse with greater volumes of specially handled spoil having chemical characteristics suitable for diluting or neutralizing the refuse. Locations where special disposal procedures were implemented would be surveyed and recorded. Following final grading and reseeding, a downgradient spoil monitoring well would be installed and monitoring of water levels and chemistry would be conducted at frequencies and for parameters as described in the plan and approved by OSM to confirm that the special disposal procedures were effective.

<u>Well Fields</u>

No new well fields are proposed in the current permit application.

COAL MINING

This section contains a description of the mining methods, equipment, and coal production rates proposed by Peabody for the Kayenta and Black Mesa mining operations through the remaining life of the mines.

Peabody proposes to mine approximately 170.0 million tons of coal through the Kayenta mining operation between 2006 and 2026—approximately 8.5 million tons per year—for shipment by the Salt River Project Agriculture Improvement and Power District (SRP) to the Navajo Generating Station, using the Black Mesa and Lake Powell Railroad.

Under Alternative A, Peabody would mine approximately 105 million tons of coal through the Black Mesa mining operation between 2009 and 2026—approximately 6.2 million tons per year. This coal would be processed and transported by Black Mesa Pipeline, Inc. (BMPI) from Black Mesa to the Mohave Generating Station in Laughlin, Nevada, by way of the coal-slurry pipeline. Under Alternative B, this coal would be available to be mined and shipped to the Navajo Generating Station.

Mining Methods and Equipment

The mining operation practices a conventional form of strip mining called "area mining" wherein the overburden above the uppermost coal seam and the innerburdens or partings between the lower coal seams are removed in parallel strips across the coalfield until the area is mined. The overburden and partings are disposed of behind the active pit in previously mined pits where the bottom seam has been completely removed.

Clearing and Grubbing

Immediately prior to topsoil removal the area to be mined is cleared of large vegetation consisting primarily of piñon and juniper trees to facilitate topsoil recovery. The vegetation debris removed is placed at locations that would not interfere with mining operations. A majority of this material is made available to local residents as firewood and the remainder is either piled at the edges of the mining area to provide cover and nesting habitat for wildlife or buried in the pit during mining operations.

Topsoil Removal

All suitable topsoil is removed from disturbed areas prior to initiating mining or mining-related activities. Prior to the start of removal operations, the proper salvage depth is staked or otherwise identified under the supervision of a soil scientist or other qualified person. Salvage-depth information must be adhered to by equipment operators. Topsoil material is removed throughout the year, weather permitting in 1,000- to 2,000-foot-long by 300-foot-wide sections. It is removed using scrapers or other earth-moving equipment and either hauled directly to recontoured areas for redistribution or transported to topsoil storage areas (stockpiles) located throughout the mine area for storage prior to eventual redistribution. Topsoil materials are removed up to 1,500 to 2,000 feet in advance of the active mining operation (i.e., active pit highwall) for safety and resource protection reasons.

Peabody implements dust control measures for topsoil stripping and redistribution operations. The cut of the topsoil removal areas and the ingress and egress routes to this area are included in watering operations. The ingress and egress routes to the topsoil lay-down area, where the final grading has occurred, also are watered. To reduce compaction, the lay-down area generally is not watered. Similarly, topsoil removal operations that place salvaged soil in stockpiles include watering as described above and often on the stockpile itself. Additional watering operations are conducted in the access routes to and from the equipment parking lot and the equipment parking and support areas.

Overburden Removal

After being drilled and blasted, overburden material covering the shallowest coal seam is removed. The overburden is placed in piles in the previously mined pit along the side of the current cut using draglines and auxiliary excavating equipment. This process is repeated in sequential fashion as the pit advances into the coalfield (Figures A-2 and A-3).

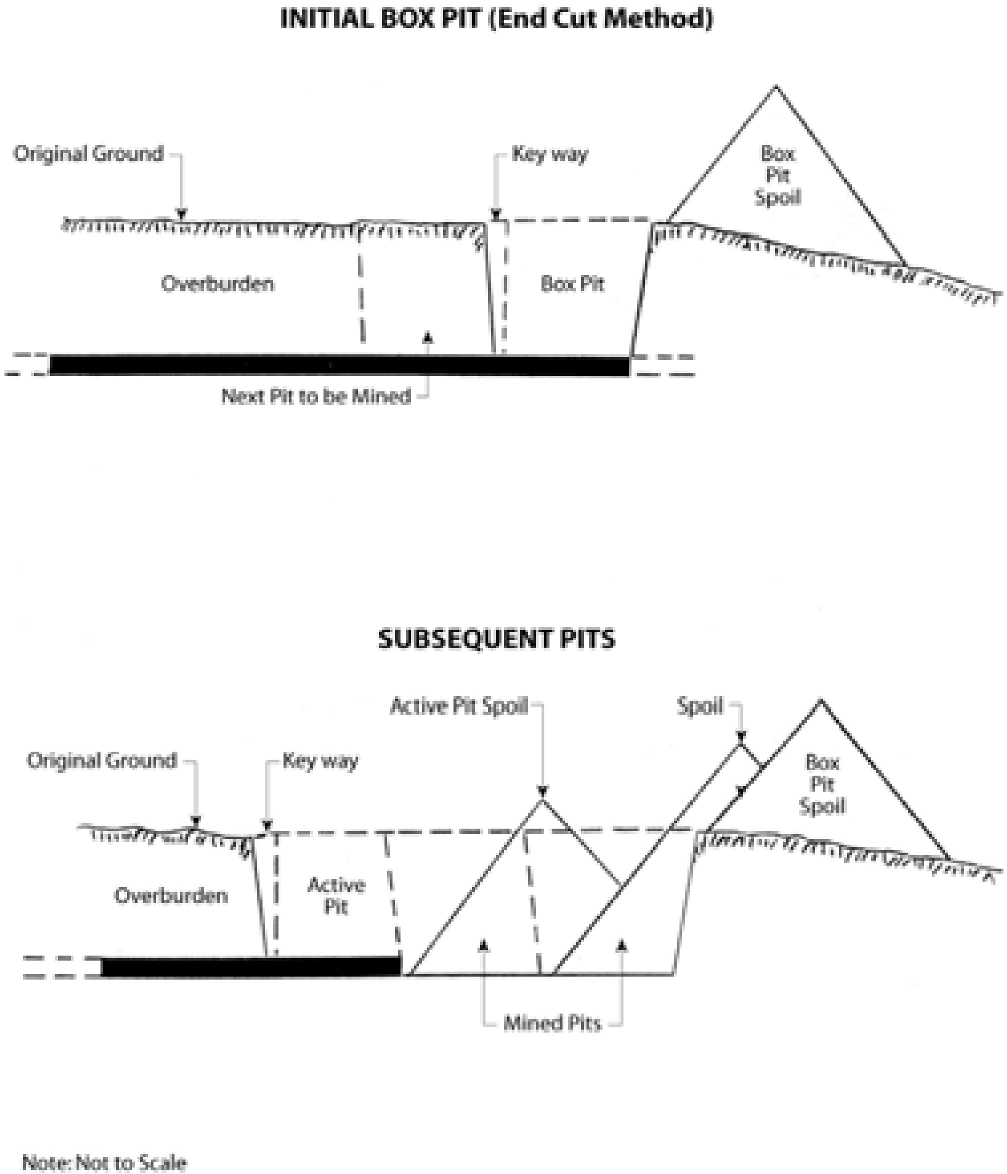


Figure A-2

Typical Pit Cross Sections

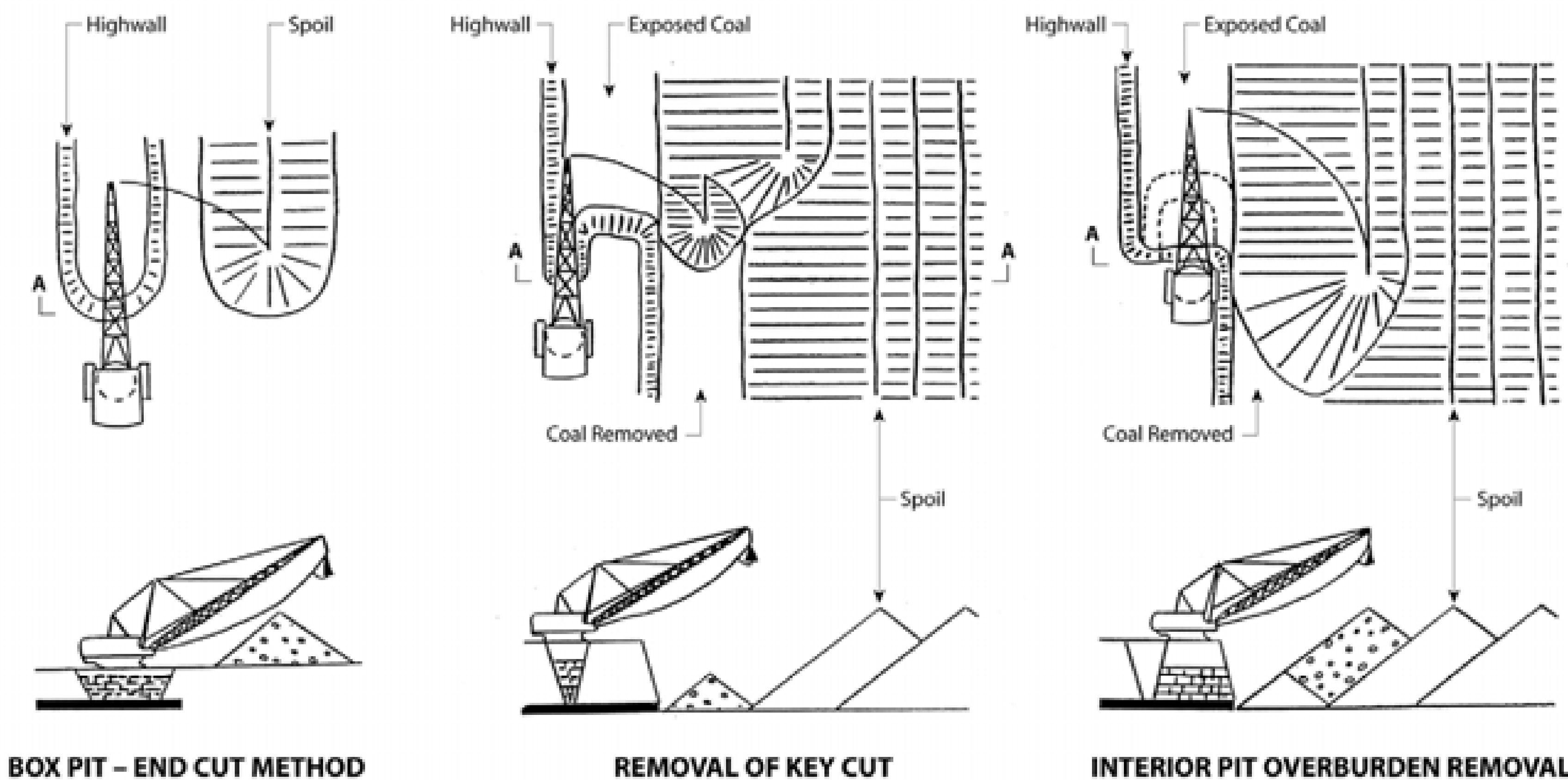


Figure A-3

Typical Pit Cross Section Showing Initial Box Pit and Subsequent Pits

Overburden and spoil material that would be used as topsoil supplements is identified and removed in much the same manner as topsoil material. Topsoil supplements may be handled throughout the year. Topsoil supplements are not stockpiled and therefore are hauled directly to recontoured areas for redistribution.

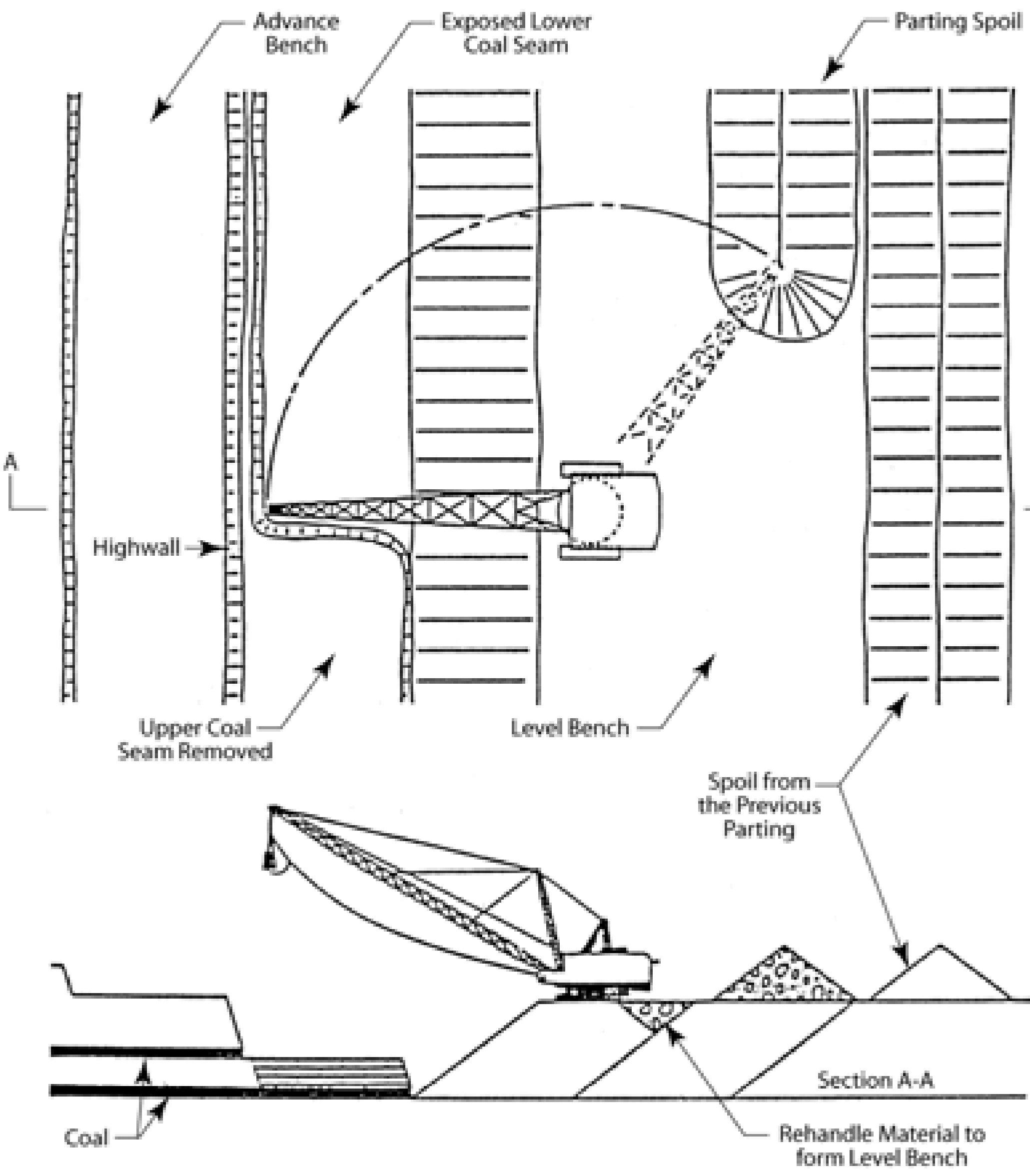
Draglines are also the primary excavators of partings or innerburdens (material between the coal seams) as thickness and field conditions indicate. Partings may vary in thickness from 6 inches to more than 50 feet in the lateral distance of one cut. After being drilled and blasted, partings are removed and placed within or along side the cut by draglines, backhoes, bulldozers, and/or truck and backhoe combinations, according to the operational requirements of each pit. Equipment such as trucks and backhoes or loaders and scrapers also may be used to assist with overburden or parting removal. When trucks and backhoes or scrapers are used, excavated material remains in the cut or pit area. A bulldozer is continually assigned to each dragline to perform bench leveling, access road preparation, trailing cable relocation, and miscellaneous duties.

The overburden excavation process begins with the digging of a narrow slot, or key cut, down to the coal seam to establish the highwall (refer to Figure A-3). The location of the key cut and the spoil establishes the width of the pit. The dragline is positioned above the area to be excavated and in line with the direction the cut is progressing. The dragline bucket is lowered to the material to be excavated, drawn toward the dragline, lifted, and swung to the side, at which point it dumps or spoils the excavated material into a previously mined cut or along the side of the cut onto unmined ground. This process is repeated until the entire area in front of the dragline has been excavated. The dragline then is repositioned and begins another key cut and starts the process again. This procedure is followed until the operational limits of the machine are achieved or pit boundaries are reached. At this point, the dragline "walks," or deadheads, to where the next cut is to begin. The entire process starts again with each successive cut being excavated parallel to the previously mined cut and continues until excavation activities are complete within the pit.

Based on geological conditions and the mix of excavation equipment on Black Mesa, Peabody has defined the maximum recovery depth to be 180 feet. In some conditions, it may be economical to extend the maximum recovery depth to approximately 220 feet; however, this is evaluated by Peabody's engineering department on a case-by-case basis.

An alternative to the highwall-side overburden excavation process is to level a bench on the spoil side and position the dragline on the spoil side to excavate the overburden and pull back the spoil over the coal seam (Figures A-4 and A-5). The main advantage of this method is to enable the dragline, which has limited operating radius to handle overburden covers of greater depth than would normally be contemplated. Other advantages of this overburden excavation process include better coal recovery in deeper overburden, reduced auxiliary equipment required for overburden excavation, increased spoil stability, reduced material rehandle, and maintaining an adequate pit width. The disadvantages include the need to prepare a spoil-side bench, sequencing the spoil-side benching operation with the pit operations, and increased dragline cycle times.

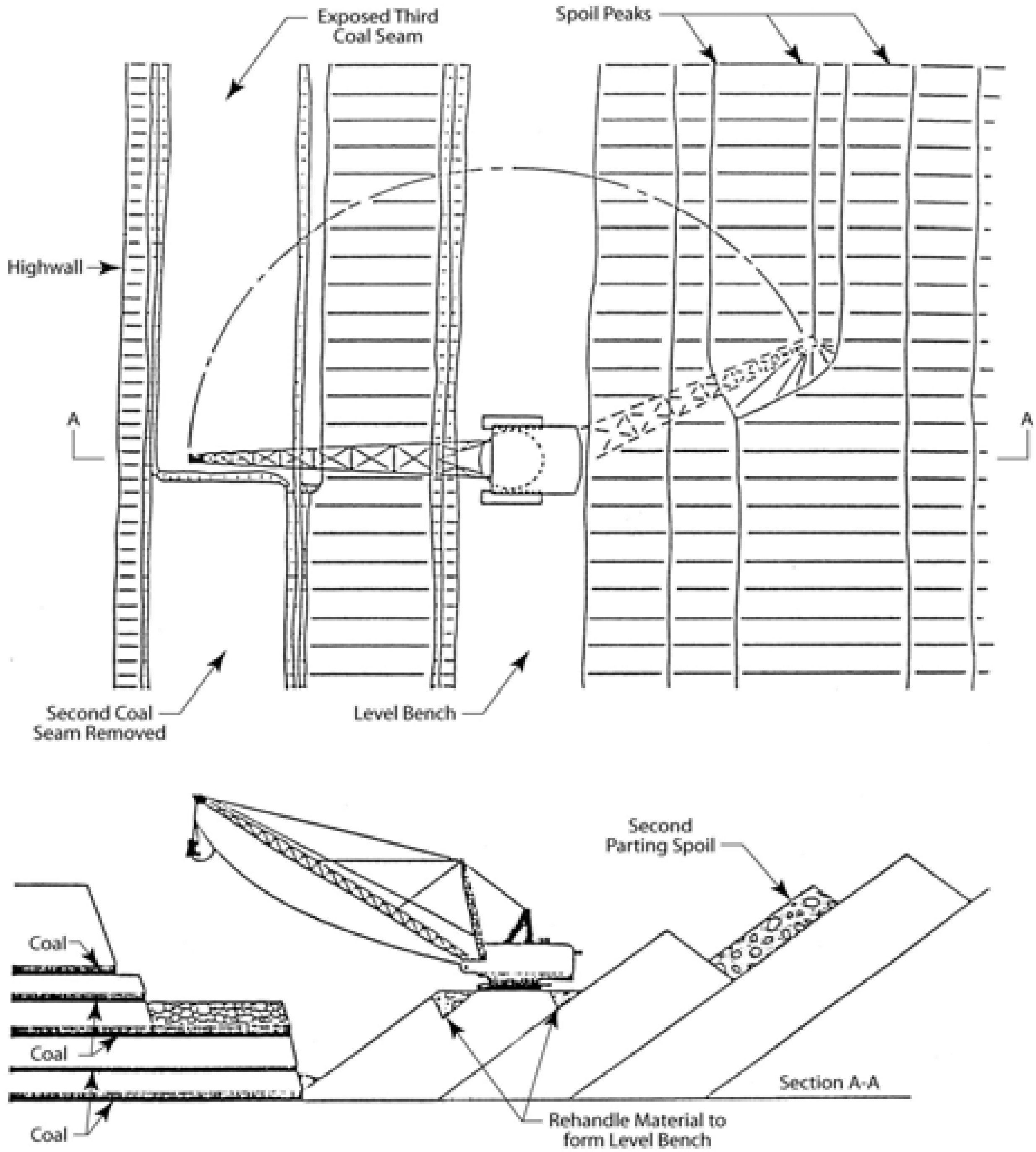
Typically, in deeper overburden, the upper coal seams may be uncovered on the highwall side and the lower seams uncovered on the spoil side. The positioning of the overburden removal equipment would be determined pit-by-pit to allow the most efficient coal recovery.



PLAN AND CROSS-SECTIONAL VIEW

Figure A-4

Spoil-Side Overburden Stripping



PLAN AND CROSS-SECTIONAL VIEW

Figure A-5

Spoil-Side Overburden Stripping

The selection of parting removal equipment is dependent upon the operational requirements within each pit. A dragline generally removes partings in excess of 15 feet; however, it may occasionally remove partings as thin as 5 feet. Backhoes and front-end loaders are used to remove partings that range in thickness from 3 to 15 feet. Occasionally, end-dump trucks are used in conjunction with a backhoe or front-end loader to remove partings within a pit. Bulldozers may remove partings that are less than 3 feet thick by first ripping the parting and afterwards pushing it off the coal seam to be removed.

Once the overburden or parting has been removed from above the coal seam, any remaining overburden material is cleared from the top of the coal seam using rubber-tired or track-type dozers.

The coal seam then is drilled and blasted using the same procedures that are followed to fragment overburden and partings. Rubber-tired front-end loaders and backhoes primarily are used to load the coal into haulage trucks for transportation to preparation areas. Backhoes are used in areas where thicker coal seams are to be loaded and mobility of the loader is not a prime consideration.

Haulage from pits to preparation areas is accomplished by bottom-dump trucks ranging in capacity from 150 to 250 tons. Occasionally, 150-ton end-dump trucks or smaller equipment also may be used. Haulage trucks are routed to pits as necessary to meet production and coal-quality requirements.

Backfilling

When all of the coal has been removed from the pit, overburden from the next parallel cut would be placed in the initial pit for backfilling. This would produce, in effect, an advancing pit that would continue until all the coal has been removed from the given coal resource area.

RECLAMATION

Surface Stabilization

Peabody has developed a plan in the permit application for establishing a reclaimed landscape that would minimize erosion and support post-mining land uses. Under this plan, factors such as hill slope gradient and length, soil properties, surface-soil mechanical manipulation techniques, site characteristics, and revegetation practices are evaluated using prescribed criteria to design the surface form, soil placement, and drainage plan. The Revised Universal Soil Loss Equation is applied to evaluate the effectiveness of the surface stabilization practices and determine the need for, and spacing of, gradient terraces on steeper slopes. Gradient terraces and down drains, in conjunction with surface protection and erosion control techniques, may be used when necessary to maintain landscape stability. With this plan, soil losses are predicted to be less than soil losses in pre-mining conditions.

Post-Mining Land Uses

The primary historical land use in the area has been livestock grazing—primarily sheep and goats. In recent years, the numbers of cattle and horses have increased. Other land uses include agriculture (primarily dry-land corn production), gathering of plant materials (for cultural, medicinal, and edible purposes), commercial trapping, various forms of outdoor recreation, and preservation of wildlife habitat. Reclamation efforts at the mine are directed toward restoring the land to be used for livestock gazing, wildlife habitat, and cultural plant use.

Post-Mining Topography

Backfilling and grading operations are designed to produce a diverse topography similar to the original landform, as discussed above regarding the surface stabilization plan. Material, including highwalls, would be graded to slopes of 3h:1v or less. Rough-grading operations would be performed by bulldozers, scrapers, and occasionally, draglines. Bulldozers and scrapers are used for final grading.

Mine-Soil Reconstruction

Topsoil and topsoil-supplement redistribution operations ensure the replacement of a minimum of 4 feet of suitable plant growth media for revegetation, of which a minimum of 9 to12 inches would be topsoil. Graded spoils determined to be suitable as a rooting medium would be covered by a minimum of 9 to 12 inches of topsoil. Graded spoils determined to be unsuitable are covered with a minimum of 4 feet of suitable material (overburden and/or topsoil). Redistribution of plant-growth media is accomplished whenever weather and soil moisture conditions permit, using scrapers, bulldozers, front-end loaders, backhoes, and end-dumps, and miscellaneous support equipment (road graders, water trucks, and farm tractors). This material is obtained from topsoil storage piles or hauled directly from topsoil material removal areas and supplemental sources (highwalls and spoil banks). Scoria or red rock that is suitable for plant growth is used in localized areas for reclamation of cultural plants, woody plants, and wildlife habitat.

Mine spoils are scarified prior to or immediately after topsoil material is distributed, to increase adhesion at the interface between the respective materials and relieve compaction. After redistribution operations are complete, contour furrows are installed perpendicular to the slope, using an offset disk unit with 36-inch disks. Revegetation treatments such as seeding, mulching, and erosion repair are all conducted on the contour to reduce the potential for downslope water flow.

Revegetation Plan

General

The revegetation plan has been developed to meet the requirements of 30 CFR 816.95, 816.97, 816.111, 816.113, 816.114, 816.116, and 816.133. Following topsoil replacement, surface mechanical manipulations, and seedbed preparation, revegetation is completed using a combination of applied seed mixes, mulching, and seedling planting programs. The best technologically available practices are used to accomplish all revegetation activities. The Rangeland Seed Mix, the primary seed mix used for revegetation, is composed of a minimum of 21 species, including warm and cool season grasses, forbs, and shrubs. The predominantly native seed mix is designed to meet the requirements of the above-cited regulations and meet nutritional requirements for livestock and wildlife. The Rangeland Seed Mix is split into drilled and broadcast components based on seedbed ecology needs of the seeded species and physical seed characteristics. Specialized seeding equipment is used to seed both components at the proper depths in one pass to reduce equipment traffic on the reclaimed surface. Several additional seed mixes are used in revegetating drainages or establishing wildlife habitat and sites for re-establishing cultural plants. The primary seeding season is from May to September, with a secondary seeding season available during spring and fall when ground conditions permit equipment operations.

Immediately following seeding of topsoiled areas, a native grass hay mulch is applied at 2 tons per acre and crimped. Native grass hay is more effective than straw and does not establish volunteer crops. Sites established with suitable plant growth substrates such as red rock or scoria are not mulched because of rough surface configuration and high coarse-fragment content. Following revegetation activities, the reclaimed areas are fenced to exclude livestock and are monitored for establishment.

Cultural Plant, Woodland, and Wildlife Habitat Revegetation

Peabody has developed and implemented a cultural plant restoration program on select reclaimed areas that also serves to reestablish woodland and wildlife habitat. Sites of one to several acres are prepared on north-facing slopes using red rock (scoria) suitable plant growth substrates. These sites are developed to simulate native site requirements of the target species. The sites contain numerous planting microsites due to roughened conditions created during substrate replacement operations. Plant materials are developed from local native seed collections with some regional sourcing as needed to ensure that plants are adapted to environmental conditions at the site and are capable of regeneration. Seedlings from these sources are grown in nurseries specializing in native plants. Specialized nursery cultural practices for the species being grown are used to develop these native plant materials. All seedlings receive mycorrhizal fungi applications for enhanced survivability and growth following planting. This ecological approach considers plant adaptations and symbiotic relationships common to plants in the arid Southwest. Seedlings are specially handled following greenhouse operations and are hand planted in a random distribution in the microsites present in the planting areas. More than 50 grass, forb, shrub, and tree cultural plant species are commonly included in this program.

Piñon/juniper woodland sites are re-established as a part of the cultural plant restoration program. Seedlings of piñon pine, Utah juniper, and to a lesser extent Gambel oak, are included in these planting efforts. Planted tree densities are 250 to 350 stems per acre and the minimum established density is 75 trees per acre. Live piñon transplants from salvage of 3- to 5-foot-tall trees in grubbing areas ahead of mining are transplanted annually to complement tree seedling planting. Approximately 200 trees are transplanted to select reclaimed sites annually during the winter dormant season.

Revegetation practices to restore wildlife habitat include the overall rangeland-seeding program, cultural plant and piñon/juniper woodland restoration, and additional woody species plantings around ponds and small depressions. The revegetation program is designed to establish diverse vegetation capable of meeting wildlife nutritional needs and other habitat factors such as cover or nesting. High-density shrub areas (greater than 800 stems per acre) are interspersed within the reclaimed landscape. Cultural plant/woodland/wildlife habitat sites also are interspersed within the reclaimed landscape. These features combine to increase edge and habitat diversity.

Revegetation Success

Revegetation success standards and their evaluation are structured to meet the criteria of 30 CFR 816.111 and 816.116. Standards are based on a combination of native reference areas and approved technical standards that reflect environmental site conditions, ecological considerations, and post-mining land uses. The criteria for evaluation follow both 30 CFR 816 requirements and other Federal guidelines and address the parameters of cover, production, woody density, and diversity.

Revegetated areas are included in an annual vegetation monitoring program to identify any needed remedial action, document trend and vegetation performance of reclaimed areas, contribute to the database for revegetation success evaluations, and provide data for implementation of post-mining land uses. The vegetation monitoring data are used to establish grazing levels in an approved grazing management program designed to enhance vegetation community characteristics and demonstrate achievable post-mining land uses.

Protection of Fish and Wildlife, and Related Environmental Values

General

Peabody's plan for protection of fish, wildlife, and related environmental values addresses the requirements of 30 CFR 816.97. The previous discussion under Revegetation Plan addresses re-establishment, mitigation, and enhancement of vegetative habit features and needs. Various sections of the approved permits address operations conducted to minimize hazards to raptors from electric power lines and how to design, locate, and operate roads and facilities that avoid or minimize impacts on wildlife and permit passage.

Nonvegetative wildlife-habitat-enhancement-or-replacement features include linear rock features and rock structures established at 1 acre per 100 acres with specified design criteria in the AZ-0001 and AZ-0001D permits. Raptor perches are established at a density of 1 acre per 400 acres. The perches are constructed based on the most appropriate technologically sound design criteria at the time of installation. Permanent impoundments and their numbers have been discussed previously in this appendix. These impoundments significantly enhance habitat, establish wetland vegetation, and provide a critical habitat feature previously not readily available in the pre-mine landscape.

Threatened and Endangered Species, and Species of Special Concern

Baseline studies and annual wildlife and vegetation monitoring address current species listed as threatened, endangered, or of special concern by Federal, tribal (Hopi or Navajo), or State agencies. Peabody promptly notifies the regulatory authorities of any Federal, tribal, or State listed species occurring on the permit area and would conduct the required mitigation or monitoring following consultation.

Surveys for nesting raptors in advance of active mining operations are conducted annually, and mitigation procedures are implemented as necessary after consultation with the regulatory authority if nesting raptors are located within the survey area. Prairie dog colonies are monitored annually for areal extent and sign of black-footed ferrets. If the size of a prairie dog colony exceeds the minimum acreage requirements in effect at the time, black-footed ferret surveys are conducted in accordance with guidelines specified by the regulatory authority. Mexican spotted owl surveys and monitoring were conducted over a 7-year period ending in 2000. Mexican spotted owl surveys will be reinitiated when mining activities are within 2 miles of any known nest site or the mixed-conifer habitat type adjacent to the lease area. Surveys or monitoring will be coordinated with the regulatory authority following approved protocols. Peregrine falcons were delisted in August 1999, and Peabody ended monitoring and breeding surveys in 2000. If listing status for the peregrine falcon changes or if the proximity of mining operations dictates, monitoring will be reinitiated after consultation with the regulatory authority. Mexican spotted owls and peregrine falcons were intensively monitored by Peabody from 1994 to 2000 and 1989 to 2000, respectively, with no apparent impacts on either species.

ABANDONMENT OF MINING FACILITIES

Abandonment activities would begin when particular facilities are no longer required to support mining operations. Facilities such as buildings, parking lots, roads, wells, and utilities that are requested to be kept by the tribes will be turned over to them. Other materials having economic value (such as structures and equipment) would be salvaged or recycled. All other materials would be disposed of using approved procedures and in accordance with the Navajo Nation Solid Waste Disposal regulations. All sites would be recontoured to conform to the natural landform, covered with topsoil, and revegetated, using the same post-mining techniques as those proposed for areas disturbed by mining.

In the event that cessation of mining operations was to occur in a coal-resource area with unmined but recoverable coal resources remaining, the following procedures would be implemented. If no further mining operations were to occur in the coal-resource area, final reclamation procedures, including backfilling and grading, topsoil replacement, and revegetation, would be carried out similar to all other areas proposed for mining disturbance as required under 25 CFR 211 and 30 CFR 59 and 132. Accurate survey information at the time of final mining operations would provide the location of final highwalls and coal-recovery limits in case mining is reinitiated at a future date resulting in a minimal loss of the coal resource. These procedures would minimize reaffecting the land in the event of future surface coal-mining operations. In cases where the abandonment is temporary (temporary cessation), the coal seam(s) would be covered, access to the pit area would be blocked, and the highwall would be bermed for safety. Any backfill or cover material that contacts the remaining coal seam(s) would be inert and contain no combustible material. Sediment control and environmental monitoring of the area would be continued. Survey information at the cessation of operations would provide accurate location of the final highwall and coal-recovery limits to facilitate reinitiation of mining operations with minimal loss of the coal resource and minimizing any reaffecting of the land as specified in 30 CFR 59 and 131. The decision to temporarily or permanently abandon operations is dependent on many factors including operational, market, contract, or customer.

Appendix A-2
Alternative A Coal-Slurry Pipeline: Typical Pipeline Construction, Operation, and Maintenance

Appendix A-2
Alternative A Coal-Slurry Pipeline:
Typical Pipeline Construction, Operation, and Maintenance

INTRODUCTION

Reconstruction of the existing coal-slurry pipeline was proposed as part of the Black Mesa Project Alternative A. This appendix provides a description of the typical construction procedures, operation and maintenance activities, and abandonment procedures associated with the pipeline. More detailed information specific to the Black Mesa Project would be prepared following engineering and design prior to construction, and would be documented in a construction, operation, and maintenance plan (or Plan of Development for the Bureau of Land Management [BLM]).

Under Alternative A, Black Mesa Pipeline, Inc. (BMPI) would reconstruct the 273-mile-long coal-slurry pipeline to transport coal from the Black Mesa mining operation to the Mohave Generating Station. The pipeline would be welded steel with an external fusion-bonded epoxy coating to prevent corrosion. The existing pipeline consists of 260 miles of 18-inch outside diameter and 13 miles of 12.75-inch outside diameter steel pipe located at the western end into the Mohave Generating Station (Mileposts 260 to 273). (The length of the pipeline could differ if rerouted; detailed engineering and construction planning have not been completed and the length of the existing pipeline is given as an example.) The pipe diameter is reduced at Milepost 260 to absorb the excess pressure associated with a 3,000-foot drop in elevation near the end of the pipeline. Pipeline slopes are limited in order to limit build-up of solids in sags, which could occur during prolonged shutdown of the pipeline, as well as improve the system restart capability. The pipeline would operate 7 days a week, 365 days a year.

There are presently four booster-pump stations located along the existing coal-slurry pipeline, and no additional pumps would be needed. The length of pipeline sections between the pump stations are, in order, 82 miles, 42 miles, 53 miles, and 96 miles. Each pump station is a 10- to 20-acre fenced facility with the following principal structures: main pump building of steel-sided construction; residential trailers for employees; above-ground earthen water-storage reservoir; slurry settling and retention pond; pipeline fixtures including valves, piping, etc.; and an electrical substation. Pump Stations 1, 3, and 4 each have three electric-motor-driven pumps, and Pump Station 2, with a high-elevation lift, has four electric-motor-driven pumps. In full operation, nine pumps are operating with a spare pump on standby at each pump station. Each pump station has a water reservoir with sufficient water to flush out the downstream section and a dump pond to accommodate slurry from the upstream section in an emergency. The pump stations are controlled remotely via microwave linkage to a central control room in offices adjacent to the coal-slurry preparation plant attached to the Black Mesa mining operation. When in operation, each pump station is staffed with two technicians to provide routine maintenance and housekeeping. One of the technicians is on call at all times to handle unanticipated emergency situations.

CONSTRUCTION PROCEDURES

Pipeline

Construction activities would be performed by construction contractors that BMPI would retain and oversee. Any new pipeline alignment would be surveyed carefully and located to avoid areas of difficult terrain and other sensitive environmental and human features. Several other preconstruction activities would be completed prior to construction of the pipeline. These activities include, but are not limited to, verification of pipeline alignment; continued coordination with the landowners, land managers, and/or other affected interests; acquisition of permits; finalization of design; and procurement of materials.

Although there are no agency authorities that permit and regulate the pipeline, the provisions of the American Society of Mechanical Engineers (ASME) Code B31.11, "Slurry Transportation Piping Systems," would be followed in the design, construction, operation, and maintenance of the coal-slurry pipeline. The construction supervisor would ensure that pipeline-construction activities are completed in conformance with all applicable requirements and that all environmental mitigation measures are identified and stipulations adhered to. All mitigation requirements would be incorporated into the project construction specifications and disseminated during preconstruction briefings so that mitigation requirements are understood by on-site construction and inspection personnel. Both the construction and maintenance activities would be performed in a manner that would minimize adverse effects on environmental cultural resource values. The Hopi Tribe and Navajo Nation would be consulted to ensure that all clearing, grading and construction activities where they have jurisdiction are conducted in such a manner as to minimize disturbance to traditional life ways. The Hopi Tribe and Navajo Nation would be consulted to ensure that all clearing, grading, and construction activities, where they have jurisdiction, are conducted in such a manner as to minimize disturbance to traditional lifeways.

Environmental inspectors would oversee all field activities. The environmental inspectors' responsibilities would include, but not be limited to, inspecting erosion control, water resources, cultural resources, vegetation, protected wildlife species, and protected areas. The environmental inspectors also would evaluate the success of revegetation and stabilization of the right-of-way following construction. If deficiencies in the establishment of vegetative cover are discovered, the environmental inspectors would report these to the construction supervisor. All erosion-control devices are to remain in place and in a functional condition until stabilization is achieved, at which time the temporary erosion-control devices would be removed and disposed of in compliance with conditions agreed upon for the project. The environmental inspectors would oversee these activities as they are performed.

One construction spread of 400 personnel would be needed to complete the reconstruction of the coal-slurry pipeline. The majority of the construction work would be completed by a qualified workforce under contract to BMPI. Local workers would be employed to the extent practicable. Construction contractors may base their operations in Flagstaff, Arizona, and the base of operations may move as construction is completed along the pipeline.

It is anticipated that construction would take place over a period of approximately 18 months and would commence as the project is authorized and all permits have been issued. Commissioning and start-up of the coal-slurry pipeline is anticipated to require approximately 6 months after construction is complete.

Water Pollution Control

Construction activities would be performed by methods that would prevent entrance, or accidental spillage, of solid matter, contaminants, debris and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include but are not restricted to refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, liquid or semi-liquid petroleum products (oil), aggregate processing tailings, mineral salts, thermal pollution, and drilling fluids other than water. All construction activities would be performed under a Storm Water Pollution Prevention Plan (SWPPP).

Dust Abatement

The construction work would comply with all applicable Federal, tribal, State, and local laws and regulations regarding the prevention, control and abatement of dust pollution. The construction activities would use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including but not limited to crops, orchards, cultivated fields, livestock, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions. Methods of mixing, handling, and storing cement, concrete aggregate, and other fine particulate matter would include means of eliminating atmospheric discharges of dust. The construction activities also would use watering trucks for dust abatement, where required.

Air Pollution Control

Construction activities would comply with applicable Federal, tribal, State and local laws and regulations concerning the prevention and control of air pollution. The construction activities would use such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants. Equipment and vehicles that show excessive emissions of exhaust gases would not be operated until corrective repairs or adjustments have been made to reduce such emissions to acceptable levels.

Preservation of Historical and Archeological Data

If untreated archaeological or historical resources were discovered during construction, the work would cease immediately at that location and measures would be implemented to protect those resources while the find is evaluated. The appropriate agencies would be notified to implement the discovery plan defined by the Section 106 Programmatic Agreement and Treatment Plan developed for the project. If the discovery includes American Indian remains, the discovery would be treated pursuant to the applicable laws and regulations, as stipulated by the Programmatic Agreement. If the discovery included paleontological resources, the appropriate land-managing agency would be notified so that the discovery could be addressed in accordance with any applicable regulations.

Noise Abatement

Measures to reduce noise generated from construction activities when the activities are within 0.5 mile of a noise sensitive receptor (occupied dwelling) would be implemented, when required. The need for such measures would be determined during construction after evaluating the conditions on site (e.g., prevailing wind direction, the proximity of noise sensitive receptors, terrain, or presence of natural sound buffers that may alleviate the need for implementing noise reduction measures). Such measures may include, but are not limited to, the use of temporary sound baffle walls.

Light Pollution Abatement

Permanent and/or temporary artificial lighting used during construction and for permanent operations and maintenance would be directed to shine downward at an angle less than horizontal and aimed so that it is directed away from any residences and shielded so as not to include a residence in its direct beam. Any lighting would abide by Hopi Tribe and/or Navajo Nation laws governing light pollution. If there are none, the lighting would conform to State or county laws governing light pollution, whichever is more stringent.

Standard pipeline construction techniques would be employed along the pipeline route and would typically involve the following sequence: surveying and flagging the right-of-way, clearing and grading, excavation, stringing, bending, welding, field joint coating, lowering in, backfilling, hydrostatic testing, cleanup, restoration, and post-construction monitoring. Figure A-6 provides an illustration of the typical pipeline construction sequence. Vehicles and equipment typically include light-, medium-, and heavy-duty trucks, dozers, front-end loaders, backhoes, motor graders, cranes, a sideboom, a bending machine, welding machines, pipe cradles, a water pump, and air compressors.

Clearing and Grading

Construction activities would exercise care to preserve the natural landscape and would be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for temporary and permanent work, approved roads, or excavation operations, all trees, native shrubbery, and other vegetation would be preserved and would be protected from damage as is practicable. Clearings and cuts through vegetation would be minimized to the greatest extent practicable, and the clearings and cuts required or otherwise authorized would be shaped irregularly to soften undesirable aesthetic impacts. On completion of the work, all work areas would be left in a condition that would facilitate revegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the construction would be repaired or otherwise corrected.

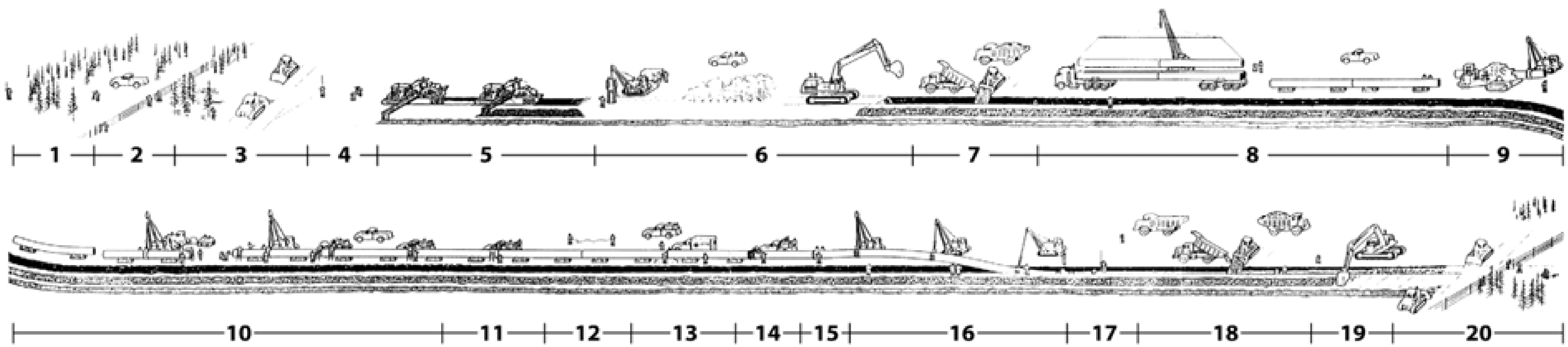
Vegetation would be cleared and the construction right-of-way would be graded to provide safe and efficient operation of construction equipment. Most of the coal-slurry pipeline would be constructed on the existing right-of-way, which was cleared during construction of the current pipeline. Topsoil would be stripped and segregated from subsoil in accordance with landowner or land-manager agreements. Space would be provided for temporary storage of spoil material and topsoil salvaged from the excavation. Figure A-7 shows a cross section of a typical construction right-of-way. The width of the right-of-way would be restricted to avoid undue surface disturbance to adjacent resources. The right-of-way boundaries are the limits of work and would be clearly staked or flagged. No disturbance would be allowed beyond the right-of-way limits.

Brush and shrubs within the right-of-way would be cut or scraped at/or near the ground level. Except for the area to be excavated for the trench, the vegetative root system and subsurface soils would be left intact to the greatest extent practicable. This would assist in stabilization of the soils within the right-of-way throughout construction. Timber and other vegetative debris may be chipped for use as erosion-control mulch, cut and stacked along the construction area, or otherwise disposed of in accordance with applicable regulations and landowner or land-manager preference.

The construction area would be graded to create a suitable work surface for construction vehicles. Grading would be performed by bulldozers, road graders, or other earth-moving equipment.

Clearing, grading, or other construction activities would not be conducted during conditions when the soil in the right-of-way of access roads is too wet to adequately support construction equipment. If construction equipment creates excessively deep ruts, support of equipment would be deemed inadequate and construction activities would be suspended until soil conditions improve.

Fences crossing the right-of-way would be braced, cut, and temporarily fitted with a gate to permit passage. During construction, the opening would be controlled as needed to prevent undesired passage. Upon completion of construction activities, existing improvements (e.g., fencing, cattleguards) would be replaced, braces left in place, and a permanent gate installed.

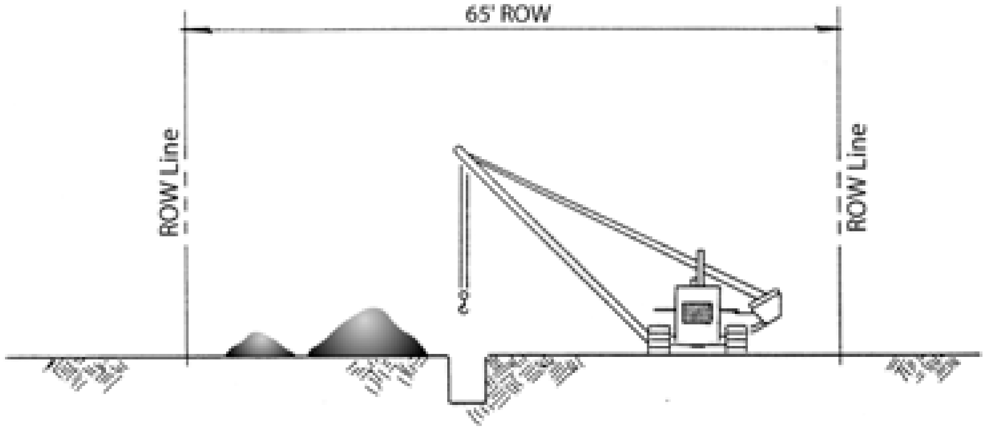


LEGEND

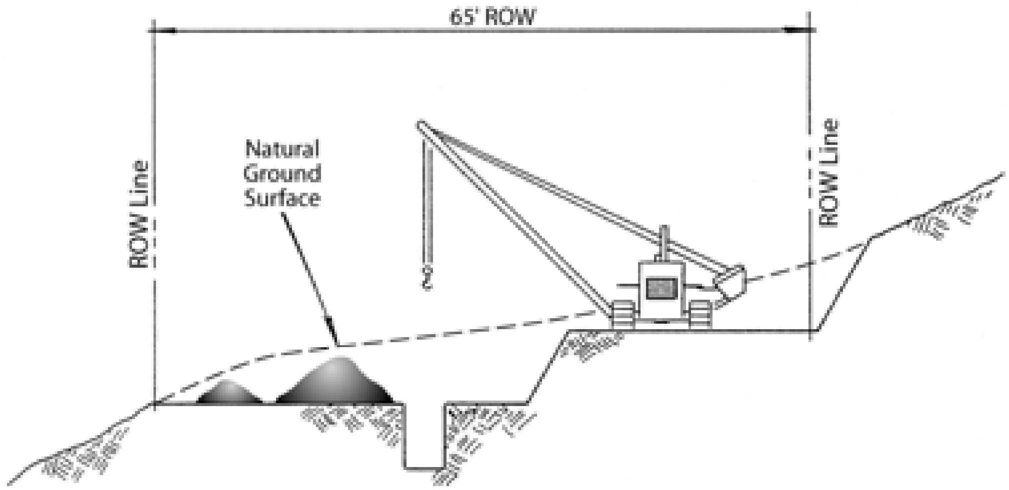
1 – Right-of-way acquisition and survey
2 – Fencing
3 – Clearing and grading
4 – Centerline survey of trench
5 – Excavation (rock-free)
6 – Excavation (rock)
7 – Padding trench bottom
8 – Stringing
9 – Bending
10 – Line up, stringer bead, and hot pass
11 – Fill and cap weld
12 – As-built footage
13 – X-ray and weld repair
14 – Coating field and factory welds
15 – Inspection and repair of coating (jeeping)
16 – Lowering in
17 – As-built profile survey
18 – Padding over pipe
19 – Backfill and final test
20 – Complete repairs, replace topsoil, cleanup, and revegetate

Figure A-6

Typical Pipeline Construction Sequence



CROSS SECTION ON EVEN TERRAIN



CROSS SECTION ON SLOPING TERRAIN

Figure A-7

Typical Cross Section on Varied Terrain

Best management practices that would be used by BMPI would minimize soil erosion and sedimentation during pipeline construction follow.

A SWPPP would be developed as part of final engineering and construction planning that would include measures to minimize soil erosion and sedimentation during and following pipeline construction. The following general soil erosion and sedimentation minimization best management practices would be included in the plan:

- Potentially erosion-sensitive areas would be identified and specific mitigation measures to address these areas included in the SWPPP.
- Weather would be considered when scheduling activities and monitored during construction to allow implementation of soil stabilization and sediment-control measures prior to the onset of adverse condition.
- Clearings and cuts through vegetation would be minimized to the extent practicable.
- Except for the areas to be excavated, the vegetative root system and subsurface soils in the construction zone would be left intact to the extent practicable.
- The quantity and duration of soil exposure would be minimized to the extent practicable.
- Dust-control measures would be implemented as needed to minimize nuisance dust.
- Temporary erosion controls would be installed and maintained during construction where site conditions warrant to reduce water velocity and redirect runoff from precipitation.
- Suitable diffusers and/or energy dissipation techniques would be used when discharging project water to washes, charcos, or approved depressions.
- All work areas would be left in a condition that would facilitate revegetation, provide for proper drainage and prevent erosion.
- Original land contours would be restored to conform to adjacent areas as near as practicable.
- Vegetation compatible with the planned land use and existing biotic community would be re-established following final grading as agreed to by the relevant regulatory agencies, tribes, and/or private landowners.
- In agricultural areas, subsoil would be scarified and the segregated topsoil returned to its original grade.
- Permanent erosion- and sediment-control measures such as diversion terraces would be installed as conditions warrant.
- Following construction, all erosion-control measures would be inspected and monitored as needed until final stabilization is achieved.

Excavation

Excavation of the pipeline trench would follow right-of-way clearing and grading. The majority of the excavation would be accomplished using machinery such as a ditch wheel that cuts a vertically sided trench approximately 36 inches wide (at the bottom) and generally to a depth sufficient to accommodate a minimum of 30 inches of cover in areas of normal excavation. Where excavation would occur in bedrock areas, the pipeline would be installed with a minimum of 18 inches of cover. In areas requiring special construction techniques (e.g., road and stream borings), the pipeline would be placed deeper. Topsoil and subsoil would be sidecast to the same side of the trench in a two-pass excavation process. The first cut would be a shallow excavation that removes the topsoil and stockpiles it to the far edge of the nonwork side of the trench. The second cut would be the deeper excavation of 4 to 4.5 feet that removes the subsoil and also stockpiles it to the nonwork side but adjacent to the trench. It is anticipated that a maximum length of trench open at any one time would be approximately 2,500 feet for about three days.

Construction Methods in Special Areas

Specialized construction procedures would be used for construction activities in rugged terrain, residential areas, agricultural areas, and at road, railroad, and water-body crossings. However, civil and environmental surveys have not yet been conducted and determination of construction methods has not been made.

Steep Topography. Where severe side slopes are encountered, two construction techniques typically would be used. Using the cut-and-fill technique, the upslope side of the construction right-of-way would be cut during grading. The material removed from the cut then would be used to fill the downslope edge of the right-of-way in order to provide a safe and level surface from which to operate the heavy equipment. Alternatively, side-hill construction could use “two-toning” to provide two levels of work area. Side-hill areas could require additional temporary workspace downslope in order to effectively use these techniques. During grade restoration, the spoil would be placed back in the cut to restore approximate original contours.

Areas of steep slopes may require the use of winching techniques. In such circumstances, construction would require the use of winching tractors to hold each piece of equipment while working on the slopes to address safety concerns. The use of winch tractors in such areas would be necessary during both construction and restoration phases. The slopes would be restored to approximate original contours, and frequent trench and slope breakers would be used to reduce runoff and direct flow to vegetated areas off the right-of-way (refer to Figure A-7).

Road and Utility Crossings. Paved roads and highways would be crossed by horizontal boring at a specified depth beneath the surface. This method would be employed to avoid disruption of traffic. Heavier-wall pipe would be installed under the crossing.

Underground pipelines or utilities generally would be undercrossed. For such crossings, prior contact with the utility would have established any requirements for work performance or restoration. Before construction begins, the “one-call system” would be used for locating and marking the existing utility. At a minimum, the bore typically would allow a clearance of 12 inches between the proposed pipeline and other pipeline or utility. On either side of the crossing, the trench typically would not be excavated any closer than 5 feet from any existing pipeline or utility encountered in the right-of-way.

Water-body Crossings. There are several different construction methods that can be used to install pipelines at watercourse or water-body crossings. The pipeline installation method typically used depends on the size and sensitivity of the water body. The pipeline would cross some water bodies that are dry during much of the year. At these crossings, construction would occur during the dry season using conventional open-trench methods. The pipelines would be buried at sufficient depths, both on the banks and in the stream of the water body, to avoid future scouring that may expose or undermine the pipeline.

Typically, construction within water bodies would be completed as a distinct and independent construction operation from other work on the remainder of the right-of-way. This would allow the scheduling of crews and equipment to expedite construction activities across water bodies.

With the exception of the initial clearing equipment, only the equipment needed for instream excavation and backfilling would be allowed in the stream channel. All other construction equipment would cross the water body on temporary equipment bridges.

Horizontal directional drilling involves the use of a remotely guided drill head driven by a rotary drill rig using a drilling mud system for lubrication, cutting return, and to maintain hole integrity. In certain cases, this method is preferable since the pipeline is drilled underneath the watercourse with very little disturbance to the bed or banks of the watercourse. Pipe sections somewhat longer than the length of the drilled hole are strung and welded opposite the drill rig and then pulled back through the hole using the drill rig.

Use of this technique involves drilling a pilot bore hole underneath the watercourse towards a surface target, and back reaming the bore hole to the drill rig, then passing the reamer back to the opposite bank where the pipe is attached and pulled back toward the drilling rig. This process typically uses the freshwater gel mud system composed of a mixture of clean, fresh water as the base, a biodegradable or biopolymer drilling fluid lubricant as the viscosifier, and synthetic polymers to transport drilled spoil, reduce friction, and stabilize the bore hole. This method is less intrusive and is more favorable than an open-cut water crossing because it minimizes the potential to impact aquatic ecology.

One of the risks associated with horizontal directional drilling is the potential for escape of drilling mud into the environment as a result of a spill, tunnel collapse, or the rupture of mud to the surface. These ruptures are caused when excessive drilling pressure results in drilling mud propagating vertically toward the surface. If a rupture occurs in a watercourse, the fine clay particles can settle onto the bottom of the watercourse. The risk of ruptures can be reduced through proper geotechnical assessment practices, good drilling planning and execution, careful monitoring, and having appropriate equipment and response plans ready in the unlikely event that one occurs.

Pipe pulled into the directionally drilled holes would have a factory-applied coating of fusion-bonded epoxy and an overcoat of epoxy-based polymer concrete if stones, boulders, or solid rock are anticipated. Instead, the pipe would have a factory-applied coating of either epoxy or urethane. After welding the seams together, the joints would have the coating repaired.

Typically, the direction drilling would be done by a specialized crew of about 11 people using a directional drill rig, weld machines, and a small crane. Any other required equipment or personnel would be taken from the pipeline-installation crew.

This method would be used to install the pipeline beneath the Colorado River between Laughlin, Nevada, and Bullhead City, Arizona, and under the Little Colorado River east of Cameron, Arizona. At the crossing of the Colorado River near Bullhead City, the bore would begin about 200 feet from the eastern edge of the Colorado River channel, extending under the Colorado River at a depth of approximately 50 feet below the channel bottom (90 feet below ground surface). The bore would continue underground for approximately 3,300 feet and would exit the ground inside the fenced yard of the Mohave Generating Station. This virtually would eliminate all surface disturbance on the Nevada side of the Colorado River. All drilling operations would be confined to an approximate 200-foot by 200-foot temporary workspace at the entry site, a 100-foot by 150-foot temporary workspace at the exit location, and right-of-way along the path of the horizontal bore that would include the staging area for pipe strings for the pull backs.

At the crossing of the Little Colorado River, east of Cameron, the existing pipeline is buried in a trench. Horizontal drilling would be used to install the new pipeline beneath the river. The pipeline would be buried deep enough below the surface of the water channel and banks to avoid future scouring and/or erosion.

Blasting. It is not anticipated that blasting would be required along the coal-slurry pipeline alignment, as most of the pipeline follows and is adjacent to the existing pipeline, which required some blasting during the original construction and which is expected to have fractured the adjacent rock. If blasting would be necessary, all required authorizations would be obtained and all safety precautions observed. All blasting would be conducted in compliance with Federal, tribal, State, and local laws, regulations, and policies. After blasting has been completed, backhoes would be used to clean the trench for pipe installation. If blasting were required, the following safety precautions, at a minimum, would be taken:

- In areas near human use, blasting would be blanketed (matted).
- Landowners or tenants in proximity to the blasting would be notified in advance so that livestock and property could be adequately protected.
- Before blasting, the affected area would be checked to ensure that construction personnel, other persons, and all equipment are out of the danger area. Where blasting occurs adjacent to public or private roads, flagmen would be stationed at safe distances to control traffic and protect the public.
- Blasting would be controlled or limited where damage to rock mass could create slope instability.
- Extreme care would be used to avoid any damage to underground structures, cables, pipelines, springs, wells, or other water supplies. In areas where blasting is not feasible due to proximity to these items, the trench would be dug by conventional techniques.
- Blasting would not be used within or near stream or river channels without prior consultation with the appropriate jurisdictional agencies to determine what protective measures, if any, would be required to minimize damage to fish and aquatic life.

Stringing and Bending

Pipe would be shipped directly from the manufacturer by rail or truck to the storage sites for the coal-slurry pipeline. Potential sites include Flagstaff, Williams, Kingman, and Seligman, Arizona. The four fenced BMPI pump stations also would be used as construction staging areas. From those locations, the pipe would be hauled by truck to the pipeline right-of-way. Each segment of pipe would be unloaded by cranes or tractors equipped with side booms and slings, and strung parallel to the trench. The stringing operation would be coordinated with trenching and installation activities to minimize the amount of construction time.

After the segments of pipe are strung along the trench, but before the joints are welded together, pipe segments would be bent to accommodate horizontal and vertical changes in direction. Such bends would be made using an approved, cold, smooth bending machine with hydraulically operated equipment that makes the bend.

Welding

After the pipe is bent, the pipe segments would be aligned end-to-end and clamped into position. The coal-slurry pipeline then would be welded in compliance with ASME Code B31.11, “Slurry Transportation Piping Systems,” and American Petroleum Institute 1104, “Standard for Welding

Pipelines and Related Facilities" (latest edition). Welds would be visually inspected by a qualified inspector and would be radiographically inspected. A contractor certified to perform radiographic inspection would be employed to perform this work. This inspection would adhere to ASME B31.11. Any defects in the welding would be repaired or removed as required by the specified regulations and standards.

Coating

As mentioned previously, the exterior would be coated with a fusion-bonded epoxy. After welding, field joints would be coated with applied fusion-bonded epoxy. Before the pipeline is lowered into the trench the coating would be inspected visually and mechanically, and any faults or scratches would be repaired.

Lowering and Backfilling

Once the coating operation has been completed, the pipeline would be lowered into the trench. Side-boom tractors would be used to simultaneously lift the pipe, position it over the trench, and lower it in place. The pipeline and trench would be inspected to verify that minimum cover is provided, the trench is free of rock or debris, external pipe coating is not damaged, and the pipe is properly fitted and installed into the trench.

After the pipeline is lowered into the trench, the trench would be backfilled with the excavated soil. Previously excavated materials would be pushed back into the trench using bladed equipment or backhoes. In areas where topsoil was segregated during trenching, the subsoil would be replaced in the trench first, followed by placement of the topsoil. Where the previously excavated material contains large rocks or other materials that could damage the pipe or coating, clean fill or protective coating, such as rock shield, would be placed around the pipe prior to backfilling. In order to maintain soil porosity in agricultural areas, no soil tamping would be performed as part of the backfilling process. As a result, a small crown of material would be left to account for future settling.

Cleanup and Restoration

After the pipeline has been installed, backfilled, and successfully tested, the right-of-way, temporary work areas, and other disturbed areas would be finish-graded and any remaining construction debris would be disposed of properly. Original land contours would be restored to conform to adjacent areas as near as practicable. In upland agricultural areas, subsoil would be decompacted and the segregated topsoil would be returned to its original horizon. Permanent erosion- and sediment-control measures, including diversion terraces and revegetation, would be installed at this time. In all wash crossings, the disturbed areas would be restored and revegetated. Additionally, each wash crossing would be re-inspected and monitored after the restoration activities have occurred to ensure that natural flow patterns and revegetation have successfully occurred. All viable, protected plants, including cacti and yucca, would be salvaged and used during restoration. Reseeding on public lands would be done with native species found in the area. Private and public property such as fences, gates, driveways, and roads disturbed by pipeline construction would be restored to original or better condition.

All waste materials including, but not limited to, excess spoils, waste materials, rubbish, sanitary waste, roadway pavement materials, etc., would be disposed of at the conclusion of construction in approved disposal facilities according to its type. Excess rocks, not reburied in the trench, would be scattered within the right-of-way in a way that would not impede vehicle or game movement. Windrows of rock would not be allowed. Materials would be recycled whenever practical. The disposal of all materials would be in accordance with applicable Federal, tribal, State, and local laws and regulations.

Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement would apply. Records would be kept of the types and amounts of waste materials produced during construction and of the disposal of all waste materials on or off the job site.

In addition, an environmental site assessment would be performed at the following construction locations: all hazardous waste accumulation areas and all hazardous material and petroleum-dispensing and storage areas where the aggregate storage of hazardous materials or petroleum at the site is 110 gallons or more.

This site assessment would be performed by a qualified environmental consultant or equivalent and would document through appropriate analytical sampling and testing that all sites are free of the effects of contamination (i.e., contaminant concentrations are less than applicable Federal, tribal, State, or local action cleanup levels).

Upon completion of the work, and following removal of all materials from the project area, work areas would be regraded and left in a neat manner conforming to the natural appearance of the landscape.

Hazardous materials, as defined by 40 CFR 261.3, as defined by Federal Standard No. 313, as amended, and any other hazardous materials or substances identified by Federal, tribal, State, and local laws or regulations that are used during construction would be disposed of in accordance with the applicable laws and regulations. Only disposal facilities that are approved for disposal of hazardous wastes would be used and records would be kept of all such disposal. Hazardous wastes would be recycled whenever possible.

Construction-generated waste materials that may be hazardous would be tested and the results submitted to the appropriate agency for review as needed. Construction-generated waste materials known or found to be hazardous by testing shall be disposed of in approved treatment or disposal facilities in accordance with applicable Federal, tribal, State, and local regulations, standards, codes, and laws. A copy of the hazardous waste manifest would be retained.

Waste materials not generated during construction but discovered at the site during construction would be identified immediately. If the waste is suspected to be hazardous, the on-site personnel would avoid the waste. The on-site personnel would continue to avoid the waste area until the material has been properly and legally evaluated. The waste then would be sent to an appropriate disposal facility.

All nonhazardous waste materials including, but not restricted to, refuse, garbage, sanitary waste, industrial wastes, oil and other petroleum products, and roadway pavement materials would be disposed of during construction by removal from the construction area to an approved disposal facility. No burying or burning of any materials would be allowed on site. Material to be disposed of by removal from the construction area would be removed prior to completion of the work. All materials removed would be disposed of in compliance with all applicable Federal, tribal, State, and local ordinances.

Hydrostatic Testing

Hydrostatic testing would be conducted to verify the integrity of the pipeline. Once the pipeline is installed, hydrostatic testing would be performed in segments. Integrity is tested by capping the pipeline segments with test manifolds and filling the capped segments with water. The water then is pressurized and held for not less than 4 hours. Any significant loss of pressure indicates that a leak may have occurred and would require further inspection.

The primary source of water for the hydrostatic testing would be water wells owned by BMPI at Kayenta, Arizona, and Pump Station 4. Municipal water also would be available at numerous points along the pipeline, but it is anticipated that the existing coal-slurry pipeline may be used to move hydrostatic-test water up and down the pipeline from the company-owned wells. The water required for hydrostatically testing the pipeline would be minimized by transferring the water used to test one section to the next section for testing, where possible.

Prior to filling the pipeline with water, a sizing plate and cup pegs would be pushed with air through the proposed test segment to ensure that no abnormalities or dents are present along the pipeline. The volume of water used to test each pipeline segment would be pushed by air through the pipeline to each successive pipeline segment.

Where required, the test water would be discharged onto the surface of the ground within the right-of-way using energy dissipation and filtration devices (e.g., hay bales and silt fences) to reduce the velocity of the discharged water, thereby reducing potential for erosion.

Access Roads

Existing roads would be used to access the pipeline. The cleared right-of-way would be used for travel during construction. After construction, access along the route for inspections and maintenance would be along the right-of-way. New roads would be required only in a few locations.

OPERATION AND MAINTENANCE

The coal-slurry pipeline would be operated and maintained in accordance with ASME Code B31.11, "Slurry Transportation Piping System," and standard procedures established by the pipeline owner to ensure safe operation and integrity of the pipeline. The operation and maintenance of the pipeline would be performed by qualified and trained employees. Personnel would be capable of monitoring the pipeline's operating conditions as well as controlling flows and pressure through the pipeline.

Facilities at the pump stations include pump houses, a water well, a cooling tower, a water pond, and coal-slurry pond. Chemicals used at the facility include ethylene glycol (for pump temperature control), a liquid oxygen scavenger (to prevent rust in the pipeline), oil, paint, and various greases and lubricants. Chemical wastes at the pump station are collected and hauled offsite by a licensed contractor for disposal.

Field operations personnel would make regular visits to the pipeline facilities. During these visits, they would inspect the facilities and conduct routine maintenance in conformance with established procedures. Qualified operating and service personnel would, as necessary, check and repair all equipment to ensure safe and reliable operations. BMPI would have an Emergency Response Plan in place.

Pipeline Releases

When the Black Mesa Pipeline was designed in the late 1960s, a corrosion allowance of 0.002 inch per year was specified to allow for loss of pipe wall thickness due to corrosion or erosion during the life of the pipeline. Since there was no operating history for long-distance coal slurry pipelines, the designers did not have historical data on which to base their corrosion allowance.

When the current operators of the pipeline purchased it in 1987, they found that the previous operator had not taken steps to reduce or eliminate the entrainment of oxygen into the slurry at the pump stations nor had they used chemical treatments to scavenge the oxygen that may have entered the system or eliminate corrosive bacteria that could be present in the pipeline. Upon assuming operations, the current operator modified the mainline pump operation to eliminate oxygen entering the pipeline at the pump stations and introduced a program to monitor and treat for corrosive bacteria. It has been observed that the slurry is generally not erosive to the inner wall of the pipeline and the primary mode of most failures has been corrosion.

Although there have been 31 pipeline failures of varying types and sizes during the 35 years that it was operated, only one event occurred in the first 20 years of operation that was not the result of human error (e.g., third-party backhoe excavation accidents, operator error with a control valve). Some of these failures appeared to be the result of corrosion acting on poor quality pipe. Extensive wall thickness losses have been observed in random joints of the pipe. Adjacent joints, produced by the same mill and with the same specifications and wall thickness exhibited widely different corrosion rates. Remote pressure-monitoring devices were installed after the pipeline had operated for some time that would prevent many of the leaks that occurred initially and would prevent many potential leaks in the reconstructed system.

In preparing the design for reconstructing the coal-slurry pipeline, BMPI reviewed the corrosion and failure history of the pipeline since initial operation began. This study revealed that most of the failures occurred immediately downstream of the pump stations, where oxygen had entered the pipeline. This study also revealed that the highest historical corrosion rate immediately downstream of the pump stations could reach 0.003 inch to 0.004 inch per year.

BMPI subsequently developed the following design criteria for reconstructing the pipeline:

- Design corrosion allowance, 0.005 inch per year;
- Minimum pipe yield strength, 60,000 pounds per square inch (the original pipe yield strength is 52,000 pounds per square inch); and
- Minimum pipe wall thickness, 0.250 inch (there is approximately 80 miles of 0.219 inch wall thickness pipe in the current pipeline).

Also, the pipeline would be protected from corrosion with external coating and a cathodic protection system designed according to National Association of Corrosion Engineers standard RP-01-69-92. The main characteristics of this system are as follows:

- Sacrificial anodes along the pipeline and at road crossings, block valves, and station pipeline.
- Installation of test leads at various points along the pipeline to read potentials.
- An integrated current system provided by rectifiers would be installed, if needed.
- Effects due to high-voltage electric conductors would be mitigated if and where needed.

Using these design criteria, implementing rigid independent inspection programs at the pipe mill and continuing the operating practices developed since 1987, including elimination of oxygen entering the system at the pump stations and maintaining a corrosion monitoring and treatment program, the reconstructed pipeline is expected to operate for its design life of 16 years with no internal failures.

In the unlikely event of a pipeline failure, procedures have been established to respond immediately. The failure would be detected by the Supervisory Control and Data Acquisition System (SCADA), which monitors pressures and flow rates along the pipeline 24 hours per day. Mainline block valves are located at key points along the pipeline, such as major water crossings and at the top of major elevation drops to isolate the pipeline into sections. The block valves are remotely operated and connected to the pipeline system's SCADA system. In the event of a leak or any other abnormality in the operation of the pipeline, the SCADA system would close the remotely operated valves, and isolate that particular section of the pipeline. Closure of the valve would stop the majority of the slurry flow out of the pipeline because there would no longer be pressure in that section of the pipeline to force the slurry out.

The amount of slurry that may be released from a leak would not be equivalent to the volume of slurry contained between two block valves, rather, it would be a fraction of that amount. Determining the actual amount of slurry that may be released during a spill is difficult, and dependent on numerous variables (i.e., location of the leak on the pipe—top of the pipe versus bottom of the pipe, or the terrain where the leak occurred—in a flat location versus on a slope). A reasonable estimate of slurry that may be lost during a pipeline failure can be derived by reviewing the failure data from the original pipeline, and calculating an average amount of slurry lost based on those failures. BMPI has reviewed this historical data, and calculated that an average leak over the life of the pipeline was 100 cubic yards of slurry. More than 90 percent of the leaks were less than 30 cubic yards, or approximately two dump truck loads. Five large leaks occurred on the original line that resulted in slurry spills of approximately 565 cubic yards each. This size of a spill would cover a land area of approximately 0.7 acre with 6 inches of coal.

Unlike an oil or gas pipeline, a coal slurry leak results in the release of fresh water and inert, nontoxic coal. The water tends to immediately soak into the ground and the coal remains on the surface. Clean-up techniques are developed for each spill on a site-specific basis. Depending upon the size of the spill and the landowner's wishes, the spill would either be: (1) left as is; (2) buried on location; or (3) removed with a front-end loader and hauled away to a user who can burn the coal. The coal recovered from the last leak on the Black Mesa Pipeline was hauled, at the request of BLM, to a site for use in the restoration of an abandoned mine.

Concurrent with closing the block valves, the SCADA system automatically would notify BMPI operations personnel who immediately would travel to the location of the leak to evaluate the situation, for both responding to the spill and beginning to plan a repair of the pipeline. If the leak were to occur on-land, typically the slurry would leak to the surface and flow in a narrow meandering path, the direction and length of which would depend on the terrain. If needed, the remaining slurry in that segment of pipeline would be pumped into a pond, designed and constructed for that purpose, at the closest pump station along the pipeline. BMPI would employ one of the following as possible courses of action for remediation:

- ***Leave the coal in place as deposited.*** Leaving the coal in place and allowing natural attenuation to dissipate the discharge is a viable option wherever the coal is of such insignificant volume that its potential environmental harm is negligible. A volume is considered insignificant when the native soil can still be seen through the coal deposit (i.e., a "dusting"). Coal fines are nontoxic and do not present a hazard to the public or local wildlife. The primary impact of a release would be visual. When the discharged coal is greater than a dusting, BMPI may propose to leave the coal in place as deposited when it is determined that (a) the damage to the vegetation and terrain in the area caused by removal of the deposit would outweigh the overall potential benefit of removing the coal; or (b) the deposit causes no potential harm to human health or the environment.
- ***Partial removal and burial of the coal.*** In those areas where the coal deposit threatens growth of native vegetation but BMPI determines that complete removal is not practical, mechanical removal of the coal and burial on or off-site is appropriate if BMPI has obtained written permission of the landowner and has obtained any required permits.
- ***Complete removal of the coal and contaminated soils.*** Complete removal is appropriate when BMPI determines that removal will not harm native vegetation or the terrain, the deposit is accessible, and is of a significant volume.

All coal removed from the discharge area is (a) buried on- or off-site with the land-manager's or landowner's permission and only after having obtained any required permit; (b) taken to a BMPI facility for storage and use; (c) returned to the mine; and/or (d) disposed of in an ADEQ-permitted landfill.

The likelihood of a leak occurring under the Colorado River, the only perennial river crossed by the pipeline, is extremely low. The existing pipeline operated for 35 years with no leaks under or near the Colorado River. The original design specified very heavy wall thickness pipe near and under the river. The existing pipeline under the river has a wall thickness of 0.750 inch, which is several times the thickness required to contain the pressure experienced under normal operation. As an additional safety device, a block valve will be installed upstream of the river crossing, approximately 700 feet from the river. This valve would be controlled by the SCADA system as previously discussed, and would be closed automatically in the event of a leak or any other abnormality in the operation of the pipeline. Closure of the valve adjacent to the Colorado River crossing would stop coal-slurry flow into the leak area.

The new pipeline design includes the use of pipe material and wall thickness equal to, or exceeding, the design of the original pipeline. In the extremely unlikely event of a leak occurring under the river, BMPI anticipates that the environmental impact would be limited to a short-term sedimentation type of release extending for a short distance down stream of the point of the leak. The coal slurry consists of fresh water and finely ground coal, an inert, nontoxic substance. There are no chemical additives, petroleum, or petrochemicals contained in the slurry. The coal slurry would be diluted quickly by the large volume of river water, and the coal would settle on the bottom of the river bed in a very dispersed fashion.

ABANDONMENT

Should coal-slurry pipeline operations not resume, aboveground structures and equipment would be removed and salvaged to the extent feasible and, in most cases, the pipeline would be purged, capped, and abandoned in place. Any areas disturbed during abandonment would be revegetated and restored in accordance with landowner requests or the applicable agency requirements in effect at the time.

Appendix A-3
Alternative A
C Aquifer Water-Supply System:
Typical Well Field and Pipeline Construction, Operation, and Maintenance

Appendix A-3
C Aquifer Water-Supply System:
Typical Well Field and Pipeline
Construction, Operation, and Maintenance

INTRODUCTION

The co-owners of the Mohave Generating Station proposed to construct a new water-supply system including a pipeline and two pump stations to supply water from a new well field near Leupp, Arizona, to the Black Mesa Mine, a distance of approximately 108 miles (Figures A-8 and A-9). The primary purpose of the pipeline is to convey 6,000 acre-feet per year (af/yr) of water to the Black Mesa Complex for mine operations-related and local domestic uses as well as for a medium for transporting coal (in a slurry that is 50 percent water and 50 percent coal) from Black Mesa mining operation to the Mohave Generating Station. However, the pipeline also could be sized and constructed to convey an additional 5,600 af/yr to provide water to Hopi and Navajo tribal communities along the way. Two alternative volumes of water are addressed: (1) 6,000 af/yr to meet project needs only and (2) 11,600 af/yr to meet project needs plus convey water to tribal communities.

Under the 6,000 af/yr alternative, the well field would be located on Navajo Nation land in the triangular area approximately bounded by (Arizona) State Route 99, Canyon Diablo, and the Burlington Northern Santa Fe Railroad just north of Red Gap Ranch and Interstate 40 (I-40). Twelve wells would be developed to provide 6,000 af/yr of water to the Black Mesa Complex. Collector piping would transport the water to a storage tank located near Indian Route 6930 and Canyon Diablo. The 12 wells chosen for the 6,000 af/yr development would not be the closest to the storage tank. Figure A-10 is a conceptual diagram of the well field to show the potential spacing of the wells; however, the specific locations for well sites have not yet been identified. The wells that were chosen represent the locations where the maximum amount of access roads and collection piping would need to be installed during the initial phase of work when the greatest amount of construction work would be done. By choosing this method of installation, the impact would be reduced in the future if additional wells should need to be installed. Under the 11,600 af/yr alternative, the well field would be composed of two sections. Five additional wells would be developed in the Navajo section of the well field identified above to provide up to 3,600 af/yr of water to the Navajo Nation. A second section of the well field would be developed just south of the main well field on Hopi Tribe land in the triangular area approximately bounded by the Burlington Northern Santa Fe Railroad, Canyon Diablo, and I-40, an area known as Hart Ranch, owned by the Hopi Tribe. Four wells would be developed in this section of the well field to provide up to 2,000 af/yr of water to the Hopi Tribe. Collector piping would transport the water from all wells to a single storage tank located near Indian Route 6930 and Canyon Diablo. All together, the well field would comprise 21 wells providing 11,600 af/yr of water to the Black Mesa Complex and to the tribes.

The specific location of individual wells would be determined following detailed well-field engineering, which would include judicious siting to avoid sensitive environmental areas. Archaeological surveys of the well sites would be conducted and the Navajo Nation would be consulted to minimize disruptions to local residents.

The pipeline facilities required to supply 11,600 af/yr of water are slightly larger than those required for a 6,000 af/yr project. Where it is more cost effective to build for the expansion to 11,600 af/yr at the time of initial construction, all piping, buildings, and equipment would be sized accordingly. This initial upsizing would include the well field, one pump station, and the main water-supply pipeline. As tribal demand develops, additional facilities would be constructed as needed.

For example, the long-distance water-supply pipeline would need to have a maximum size of 26 inches in diameter to supply 6,000 af/yr to the mine with most piping being 21, 23, and 24 inches. However, those sections of the pipeline that eventually would need to convey up to 11,600 af/yr would have larger diameter pipe sizes installed during initial construction, as it is more cost effective to install a larger size now than it would be to replace the smaller pipeline with a larger size later or install a second pipeline to convey the additional 5,600 af/yr. Similarly, the electrical-supply system that would be installed would be capable of supplying power for the total system. One pump station also would be constructed using a slightly larger building such that an additional pumping position could be added at minimal cost when needed.

C-Aquifer Well Field

The well field would consist of production wells, access roads, a distribution electric-power system, a storage tank, and associated piping. The wells would be spaced such that there is a minimum separation between each site of 1.2 to 1.5 miles. One main collector line would be constructed along the southern edge of each developed well field to convey pumped groundwater to the storage tank. One main collector line would be constructed on the Navajo portion of the well field for the 6,000 af/yr alternative. For the 11,600 af/yr alternative, an additional five wells would be connected to the main collector on the Navajo portion of the well field and the additional four wells on the Hopi portion of the well field would be connected to a second main collector line. Piping from the individual wells would discharge to the collector lines. Individual wells would be brought on line or turned off to maintain a constant water level within the storage tank.

The preliminary design of each well incorporates the following:

- 1,100-foot-deep, 24-inch-diameter pilot borehole;
- 1,000-foot-deep, 18-inch-diameter standard casing;
- 400 feet of 12-inch-diameter manufactured steel well screen;
- Filter pack;
- Cement seal and conductor casing;
- Bottom trap (tailpipe); and
- Casing centralizers.

Screened intervals may alternate with blank sections to maximize infiltration from isolated water-bearing zones, depending on the formation materials. The filter pack would be washed and screened natural siliceous sand composed of not less than 95 percent hard, dense, well rounded, stable grains so as to be nonreactive and insoluble to weak reducing agents or other common components of groundwater.

Each developed well site would be approximately 50 feet by 50 feet and would require a permanent right-of-way or easement to accommodate the well site. Each well site would include security fencing, lighting, gravel paving, electrical equipment, and associated instrumentation and control equipment. Deep well submersible pumps, each rated at approximately 400 gallons per minute (gpm) and 300 horsepower,

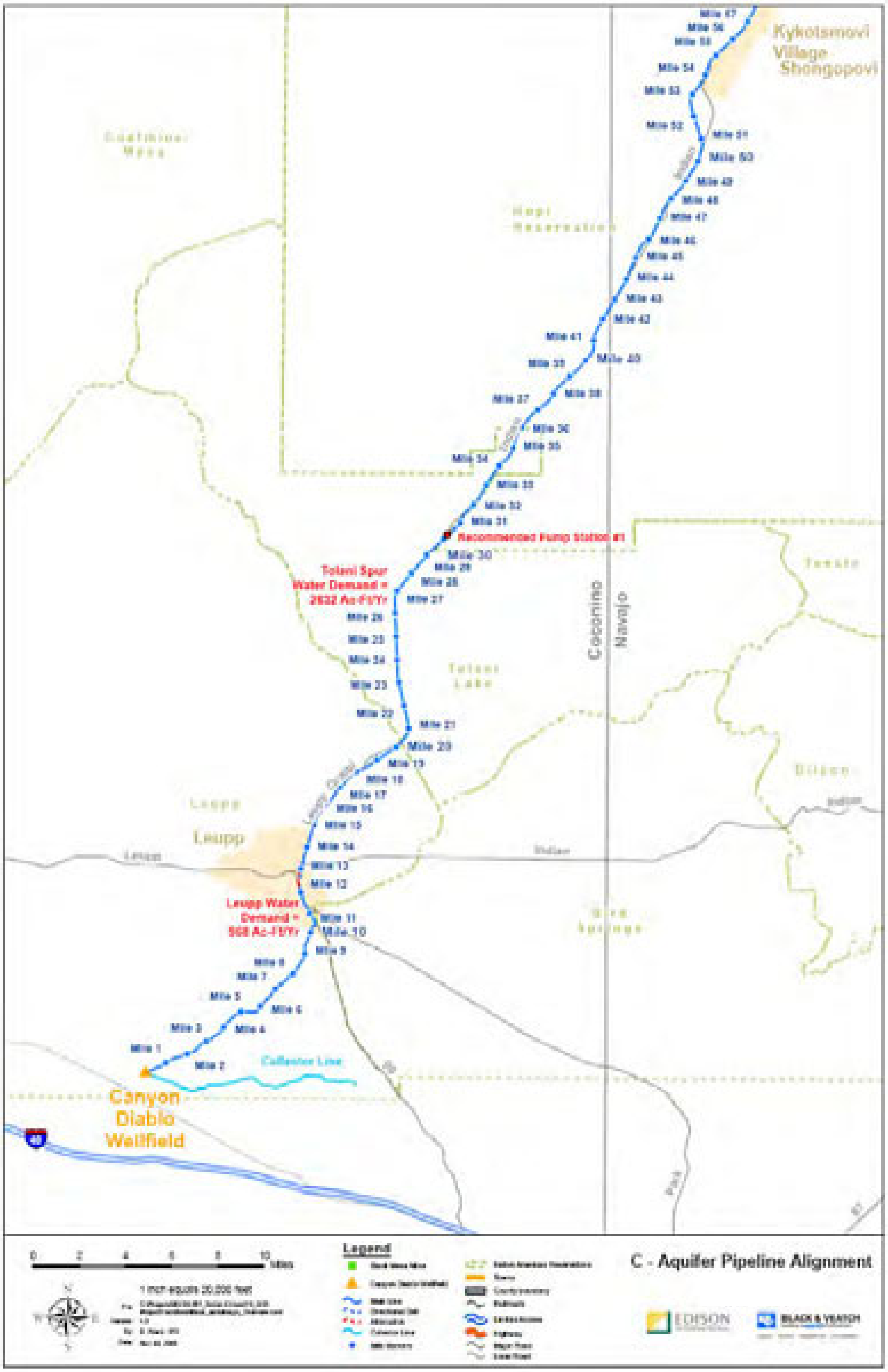


Figure A-8 (1 of 2)

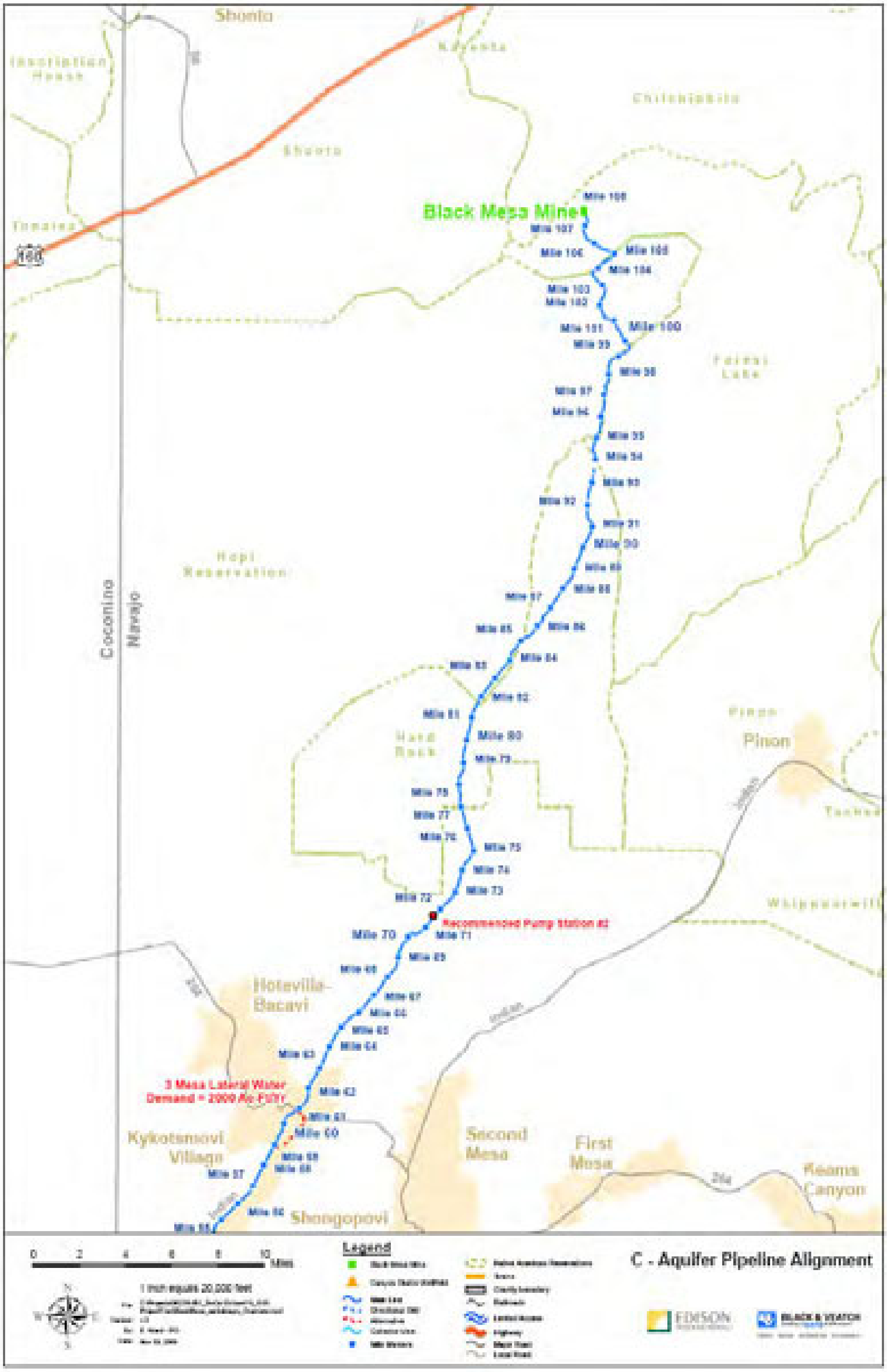


Figure A-8 (2 of 2)

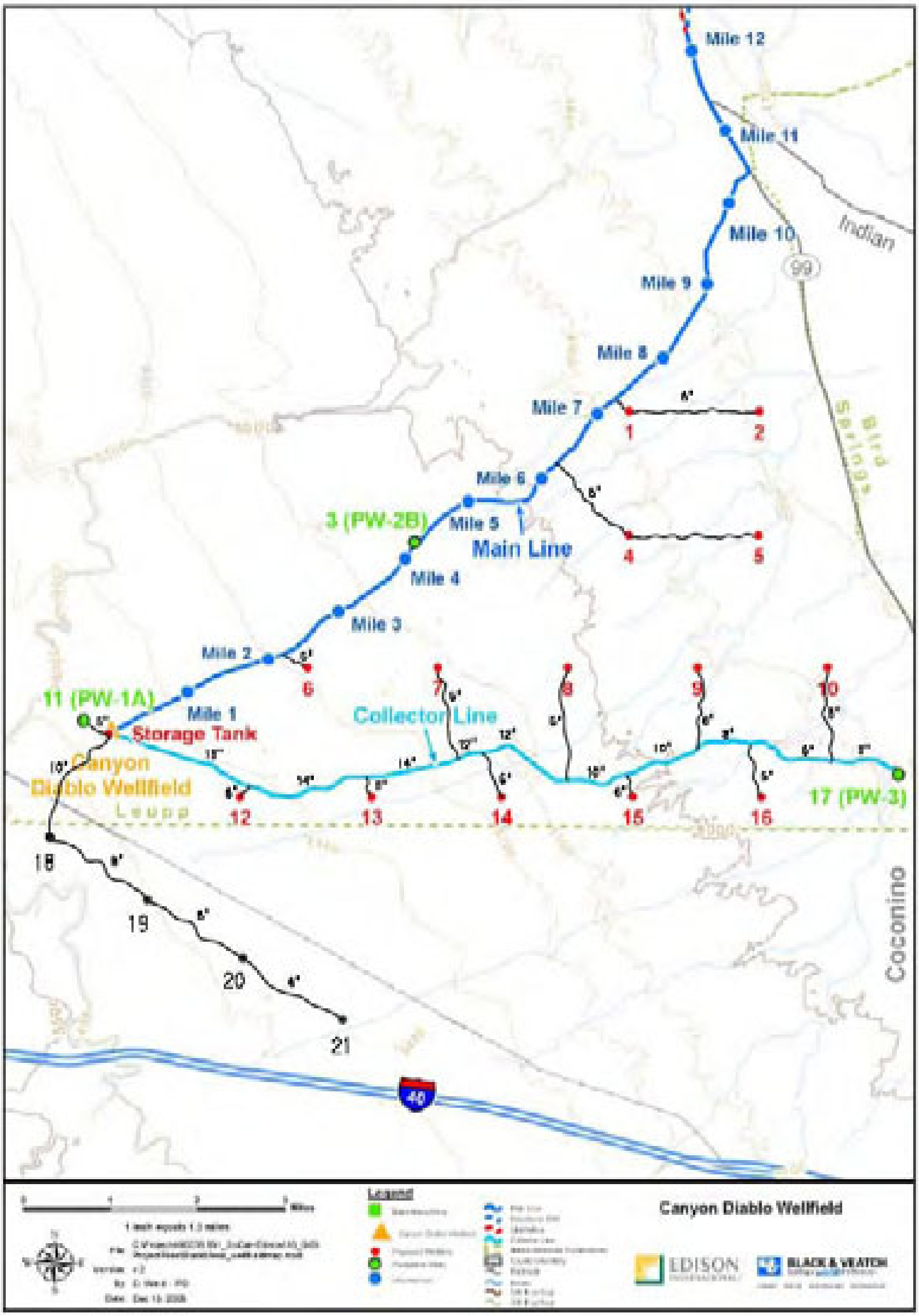
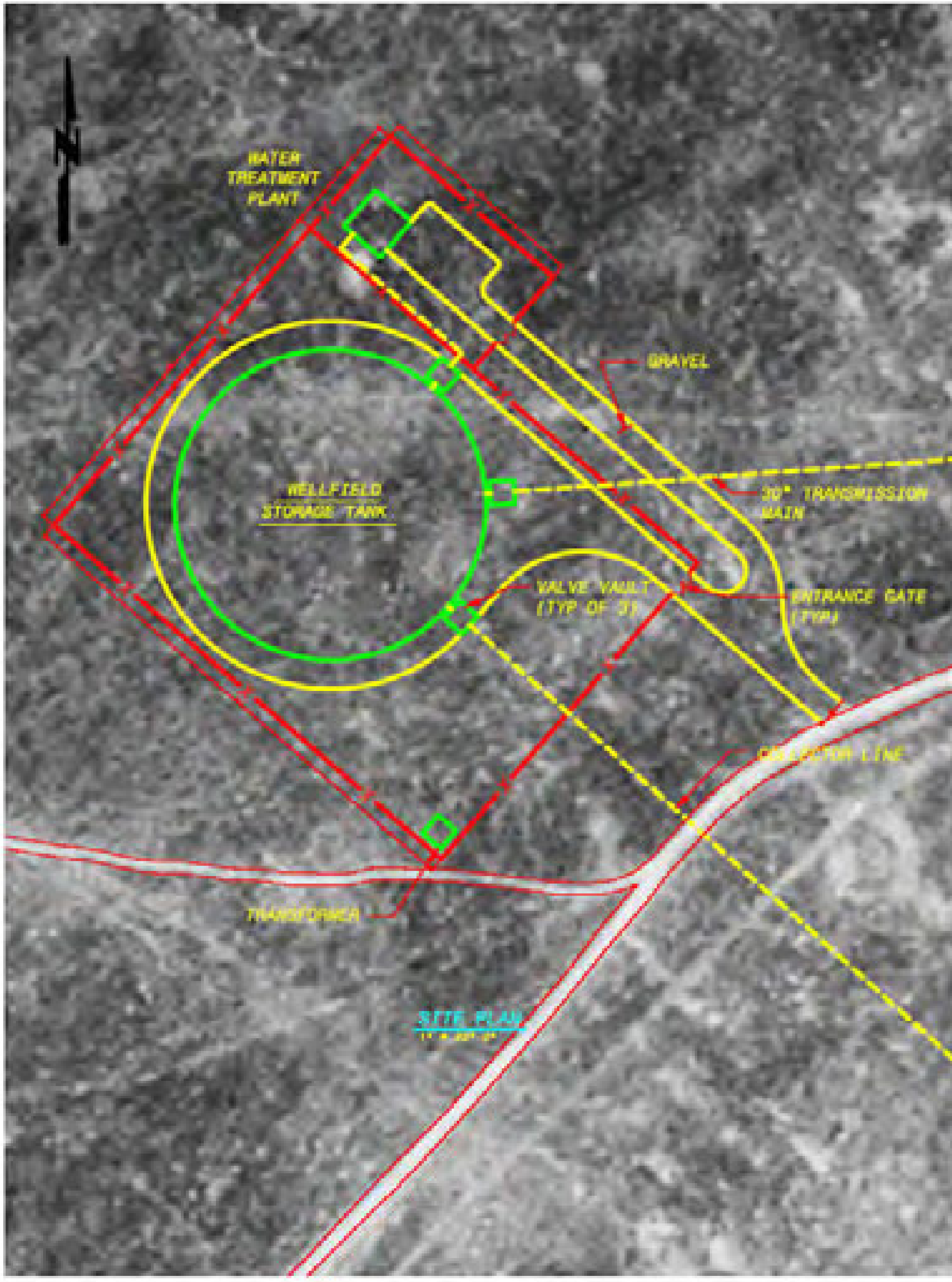

Mile 12
Mile 11
Mile 10
Indian
99
Mile 9
Mile 8
Mile 7
1
2
Bird Springs
Mile 6
3 (PW-2B)
Mile 5
Main Line
4
5
Mile 4
Mile 3
Mile 2
6
11 (PW-1A)
Mile 1
Storage Tank
Collector Line
7
8
9
10
Canyon Diablo Wellfield
Leupp
12
13
14
15
16
17 (PW-3)
18
19
20
21
Coconino
40
Canyon Diablo Wellfield
EDISON
BLACK & VEATCH

Figure A-9



Well-field Storage Tank Site Plan

Figure A-10

would be used for groundwater pumping. Each pump would discharge groundwater through a 6-inch-diameter steel pipe with isolation valves and backflow prevention valves to either the nearest collector pipeline or the main water-supply pipeline. All piping and valves (in valve boxes) would be buried below ground with at least a 3-foot minimum cover. The only aboveground equipment at each well site would be the security fencing, lighting, and a small electrical-power and control cubicle. Lights would be designed and operated so as to minimize the amount of light visible at night to local residents. Each well site would be monitored and operated from a remote location, either from the main water-supply pipeline pump stations; a main control room in Flagstaff, Winslow, Leupp, or Window Rock, Arizona; or a secondary control room at the Black Mesa Complex.

Well-field collector piping would range in size from 6 inches to 16 inches in diameter, depending on the location and alternative selected. The piping would be steel, cement-mortar lined (CML) and tape wrapped, or epoxy or polyurethane coated, for corrosion protection and buried below ground with at least a 3-foot minimum cover. The collector piping would be buried in the roadway of the new access roads to the well sites. Below-ground system-isolation valves in valve boxes would be provided, as necessary. The approximate amount of piping is as follows:

- 6,000 af/yr Alternative

Pipe Size	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch
Length, miles	11.6	0.7	1.7	1.5	2.6	1.8

- 11,600 af/yr Alternative

Pipe Size	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch
Length, miles	15.2	2.2	3.2	1.5	2.6	1.8

One storage tank requiring a permanent right-of-way or easement of approximately 215 feet by 215 feet would be provided at the well field to provide one day’s storage for the mine and supply the local well-field distribution system (refer to Figure A-10). The storage tank site would be equipped with security fencing and lighting. Lights would be designed and operated so as to minimize the amount of light visible at night to local residents. The storage tank would be as follows:

Type	Fixed roof
Material	Welded steel[2]
Diameter, feet	130
Height, feet	60
Capacity, gallons	6,000,000
Days storage	One

Single-lane access roads with turnouts for passing, as appropriate, would be constructed to each site from the existing roads in the area. The expected permanent right-of-way or easement width required is estimated to be 25 feet. The roads would be graded and compacted and would not be paved. The collector piping would be buried along one side of the road and the electric power line of the power distribution system would be constructed along the other side of the road. All roads and well sites would be routed or sited in a manner to avoid sensitive areas (e.g., cultural resources, biological resources). The proponent would incorporate other features, such as culverts and cattleguards, where needed.

A new, wood-pole power-distribution system would be provided by Navajo Tribal Utility Authority (NTUA) to supply power to each well site located on Navajo Nation land. NTUA would supply 24.9 kilovolt (kV), 3-phase, 60-Hertz power to each site where pole top transformers would transform the power down to 4.16kV at each well site. A small transformer at each site would transform the 4.16kV power down to lower voltages, as necessary, for such uses as lighting, communication, and control power.

The power supply for the new NTUA[3] distribution system would be supplied by Arizona Public Service (APS)[4] from a new 230/69kV substation that also would provide power to water-supply pipeline pump stations. Power to the new 230/69kV substation would come from an existing 230kV transmission line that essentially parallels Indian Route 15. The new substation would be built along the existing APS 230kV transmission line right-of-way approximately 4 miles west of the intersection of Indian Route 15 and State Route 99. The new 230/69kV substation would be comprised to two sections. The first section would be to provide 69kV power to the pump stations and the second section would be to provide 69kV power to the NTUA. The well field would be supplied through a new substation that would be built by NTUA. The NTUA substation would be located adjacent to the APS 230/69kV substation. APS would install a 69kV primary metered delivery point to NTUA at this location. NTUA would then extend a service line southeast towards the well field following the 230kV transmission right-of-way until it intersects Indian Route 6930 where it would turn and follow Indian Route 6930 into the well field. APS would construct a new radial 69kV line that would parallel Indian Route 15 until it intersects the new pipeline; at that point the line would parallel the proposed pipeline route to the location of Pump Station No. 1 near the Navajo Hopi Reservation boundary at about Milepost 30 where APS would install a 69kV

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[2] The steel tank would be lined.

[3] This is a "best guess" based on discussions with NTUA as NTUA has not formally replied to the request for the Method of Service.

[4] This is a "best guess" based on discussions with APS as APS has not formally replied to the request for the Method of Service.

primary metered delivery point for the NTUA. Construction of the radial 69kV line would continue from Pump Station No. 1 to Pump Station No. 2 north of Kykotsmovi at about Milepost 72. The NTUA would build a 69/24.9kV substation adjacent to the APS substation or at approximately Milepost 6 along the main transmission line route in the well field, in order to provide power to the well field. (This substation arrangement also would be capable of supplying power for the additional 3,600 af/yr of water for the Navajo Nation.) At each well site, the power would be transformed from 24.9kV to 4kV or 480 volts from a pole-top transformer.

The system would be designed such that NTUA could extend the well-field distribution system to provide power to local residents living within the well field area. Similarly, the transmission line could be designed such that it could be upsized by APS or NTUA to serve other existing or future load centers on the Hopi and Navajo Reservations.

Power to the four wells on Hopi Tribe land would be provided in the same manner as above, except that the power would be supplied by APS. To provide power to the Hopi well field, APS would either extend a new line from the NTUA 24.9kV wood-pole line to the Hopi well field or provide service from some other nearby APS location. APS also would use wood-pole structures.

Figure A-11 shows a concept of the well field power distribution system.

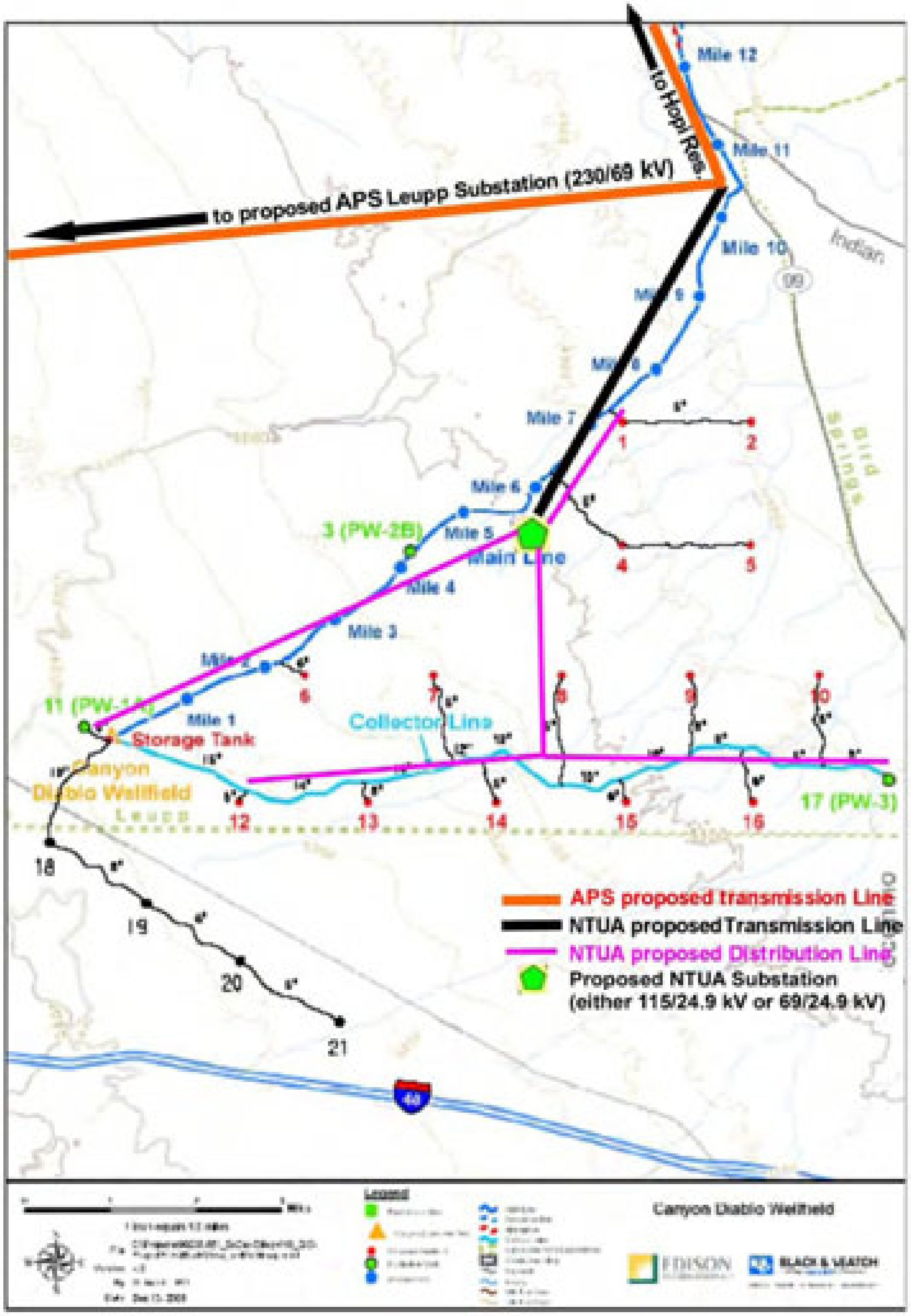

Figure A-11
Concept of Power Distribution System for Well Field

C Aquifer Water-Supply Pipeline

General Description

The main water-supply pipeline would extend approximately 108 miles from the storage tank in the well field near Leupp, Arizona, to the Black Mesa Complex. The permanent expected rights-of-way or easement width required is estimated to be 20 feet. For the 6,000 af/yr alternative, the pipeline would be designed for a constant flow of 6,000 af/yr to the mine. For the 11,600 af/yr alternative, it would be designed for an eventual maximum flow of 11,600 af/yr of total water supply with a constant flow of 6,000 af/yr to the mine. Depending on which alternative is constructed initially, the pipe sizes would range from 18 to 26 or 30 inches. The maximum working pressure is 574 pressure per square inch gauge (psig). The pipe material would be American Water Works Association (AWWA) C200 steel pipe. The approximate amount of piping is as follows:

- 6,000 af/yr Alternative:

Pipe Size	18-inch	21-inch	23-inch	24-inch	26-inch
Length, miles	12.2	20.1	36.0	33.7	7.0

- 11,600 af/yr Alternative:

Pipe Size	18-inch	24-inch	25-inch	26-inch	30-inch
Length, miles	8.0	31.0	24.9	32.0	13.1

The pipe would be CML and tape wrapped, or epoxy or polyurethane coated, for corrosion protection and buried with a 3-foot minimum cover (for freeze protection). The pipeline also would be cathodically protected with an active system of anodes placed approximately every 30 miles. The anode spacing allows for the power sources to be located at the well field, pump stations, and the mine.

The pipeline would contain two pump stations: one located at about Milepost 30 and the second at about Milepost 73. Water would flow by gravity from the storage tank in the well field to the Tolani Lake Pump Station (Pump Station 1). From there it would be pumped to Oraibi Pump Station (Pump Station 2). The Oraibi Pump Station would pump the water to the high point in the pipeline at approximately Milepost 101 from which it would flow by gravity to the Black Mesa Complex.

Canyon Diablo Well Field to Leupp

This pipeline segment would begin at the Canyon Diablo well-field storage tank. From the storage tank, the pipeline would run northeast along Indian Route 6930 approximately 10 miles to State Route 99. Along Indian Route 6930 the pipeline alignment would be within the graded roadway alignment. The pipeline then would run northeast along State Route 99 and then north approximately 3 miles to Leupp. The pipeline in this area would be 21 inches in diameter for the 6,000 af/yr alternative or 30 inches in diameter for the 11,600 af/yr alternative.

Two floodplain crossings occur between about Mileposts 4 and 5 and between Mileposts 10 and 11. The pipeline would be buried deeper in these two locations and encased in concrete through the floodplain crossing. The pipeline alignment along Indian Route 6930 and State Route 99 is mostly high desert plain and would be within the roadway easement. In this section, the pipeline alignment would be offset from the paved roadway on the west side of the road.

Leupp-Little Colorado River Crossing

This section of the pipeline between about Mileposts 12 and 14 would run south of Leupp and across the Little Colorado River. The 100-year flood elevation establishes the limits of the river crossing. Two types of crossings are being considered for the Little Colorado River: (1) directional drilling and (2) using an abandoned steel bridge. Briefly, these two alternatives are described below.

<u>Directional Drilling</u>

This alternative would involve drilling a horizontal tunnel approximately 50 to 200 feet beneath the Little Colorado River and pulling the pipeline through the tunnel. In this segment, the pipeline would be 24 inches for either alternative to minimize the cost of the directional drill. Also in this segment, the internal coating of the pipe would be either a fusion bonded epoxy or polyurethane rather than the CML because the CML would crack due to the curvature required to feed the steel pipe into the tunnel bore. This alternative is estimated to cost approximately $6.5 million.

<u>Bridge Crossing</u>

The second alignment would use an existing abandoned steel bridge. The pipe would be buried up to the bridge and daylight prior to the bridge access ramp. The pipe would be supported above the deck along the length of the bridge and then transition to below grade once across the bridge. Using the existing bridge would include modifications to the bridge including a new walkway, pipe supports, and gates at each end to restrict access. The entire length of the open trench constructed pipeline within the limits of the floodplain would require concrete encasement. This option also may require conducting a Section 404 process for construction activities within the floodplain. Furthermore, the bridge is considered by the Navajo Nation to be a historical site. The bridge is not, however, currently listed in the National Register of Historic Places as a historical site. Preliminary investigation indicates that the Navajo Nation would allow the pipeline to use the bridge to cross the Little Colorado River. This alternative is estimated to cost approximately $1.7 million.

Both crossing alternatives are technically feasible. Directional drilling would most likely be the most environmentally favorable of the two options. However, directional drilling is significantly more expensive and the issue of drilling mud disposal would have to be addressed. Even though significantly more expensive, directional drilling is presently the preferred alternative because it allows the pipe to be buried much deeper to avoid potential adverse impacts on the pipe from flood conditions as well as result in less environmental impact. However, more detailed engineering investigations may result in a change in preference to use the bridge crossing.

Leupp to Kykotsmovi

This pipeline segment would begin at Leupp and continue on to Kykotsmovi, Milepost 60. In this segment, the pipeline would run parallel to Indian Route 2 and the Tolani Lake Pump Station would be located at about Milepost 30. The pipeline alignment along Indian Route 2 is mostly high desert plain and would be within the roadway easement. In this section, the pipeline alignment would be offset from the paved roadway on the west side of the road. Between Leupp and the Tolani Lake Pump Station, the pipeline would consist of 21-, 24-, and 19-inch-diameter segments for the 6,000 af/yr alternative. For the

11,600 af/yr alternative, the pipeline would be 24 or 25 inches in diameter between Leupp and the Tolani Lake Pump Station. Between the Tolani Lake Pump Station and Kykotsmovi, the pipeline would be 23 inches in diameter for the 6,000 af/yr alternative or 26 inches in diameter for the 11,600 af/yr alternative.

Kykotsmovi

This section of the pipeline, from about Milepost 59 to 61, would run through Kykotsmovi. The pipe in this area would be 23 inches in diameter for the 6,000 af/yr alternative or 26 inches in diameter for the 11,600 af/yr alternative. Two alternative alignments are being considered for Kykotsmovi. The first option follows the main road through town and would be buried beneath the paved roadway. The second option follows the bypass road along the eastern edge of Kykotsmovi. This pipeline alignment would be within the roadway easement. In this option, the pipeline alignment would be offset from the paved roadway on the west side of the road. The advantages of the main road option are that the length of the pipeline is shorter and the route is currently the preferred option of the community. Although this alignment contains numerous utilities located in the roadway, it is expected that fewer utilities are present than on the alternate route. These utilities are mostly unmarked and would have to be located prior to final design and construction. The bypass alignment also would encounter some conflicts, and the right-of-way along Indian Route 2 at this location is narrower. The main road option is considered the preferred alternative at this time.

Kykotsmovi to Dinnebito Wash

This section of the pipeline from about Milepost 61 to 94 would run along Indian Route 2 and from Kykotsmovi to the Dinnebito Wash. This section includes Oraibi Pump Station at about Milepost 72 along a section of unimproved road. The area north of Kykotsmovi includes traditional Hopi farmlands. Therefore, the pipeline alignment would be in the western portion of the graded roadway to avoid disturbing active farmlands. At approximately Milepost 70, the roadway is elevated above the surrounding floodplain. The pipeline alignment in this area would remain within the roadway. However, the route may entail removal and replacement of an existing corrugated metal pipe drain that crosses the road. This segment of the pipeline would be 24 inches in diameter for the 6,000 af/yr per year alternative or 25 inches in diameter for the 11,600 af/yr alternative from Kykotsmovi to Oraibi Pump Station. For both alternatives, the pipeline would be 24 inches in diameter from the pump station to Milepost 94.

At about Milepost 71.5, the pipeline alignment would separate from Indian Route 2 and follow an existing unimproved two-track road to Milepost 75. The pipeline would run on the west side of the two-track road to avoid interference with the Oraibi Wash to the east. Road improvements would be made once the pipeline construction is complete. The improvements would consist of grading (blading) and compaction. In this section of the pipeline, the permanent right-of-way or easement would be 25 feet to accommodate the access road.

From about Milepost 75 to 94.5, the pipeline alignment would follow Indian Route 41 (Turquoise Trail). The pipeline alignment would again leave the graded roadway at approximately Milepost 91. The alignment would follow an existing power line easement to the Dinnebito Wash. The alignment was selected to avoid significant rock formations along the roadway from Milepost 91 to the Dinnebito Wash.

Dinnebito Wash Crossing

The original proposed pipeline alignment from the Bureau of Reclamation consisted of two separate nonboring wash crossing options in this area. These types of crossings would require extremely deep trenching, more than 40 feet in depth in the vertical walls on each side of the wash to ensure that the pipeline is buried at least 10 feet below the bottom of the wash, or routing the pipeline above ground across two separate bridges spanning the wash. To avoid these complications, directional drilling is proposed to cross the wash. Directional drilling would begin at Milepost 93 and extend to Milepost 94.5. Unlike the Little Colorado River crossing, the diameter of the Dinnebito Wash boring can be reduced to a more optimal diameter of 18 inches.

Dinnebito Wash to Black Mesa Complex

This section of the pipeline from Milepost 94.5 to 108 would run along Indian Route 8034 and Indian Route 41 to the mine entrance road at Milepost 108. From this point, the pipeline would follow the Black Mesa Complex entrance road through the mining operations area. The pipeline would terminate at the existing 5-million-gallon storage tank at the coal-preparation facilities. This section of the pipeline would be 24 inches in diameter to the high point in the route at approximately Milepost 101 where it would be reduced to 18 inches to slow the gravity flow to the mine. The pipeline alignment would be in the western side of the graded roadway.

Tolani Lake and Oraibi Pump Stations

The pipeline would have two pump stations located at Mileposts 30 and 72. The overall footprints for the pump station are approximately 31,350 square feet (0.7 acre) for Tolani Lake Pump Station and 25,500 square feet (0.6 acre) for Oraibi Pump Station. Permanent rights-of-way or easements to accommodate these two sites and the access road into each would be required (Figures A-12 and A-13). Each pump-station site would be enclosed by a security fence and the open areas within the fence would be covered with gravel. A 10-foot-wide concrete apron has been incorporated on the sides of the pump station that would have the most vehicular or pedestrian traffic. A 4-foot-wide sidewalk has been incorporated on the other sides of the building.

Each pump station would have a building to enclose the pumps and other equipment such as motor control centers, air compressor, fire protection, etc. to provide both weather protection and security and to allow maintenance during inclement weather. The building sizes are approximately 60-feet wide by 65-feet long by 20-feet high for Tolani Lake Pump Station and 60-feet wide by 56-feet long by 20-feet high for Oraibi Pump Station. Both pump stations would be identically sized for the 6,000 af/yr and 11,600 af/yr alternatives. The buildings also would have an indoor lay-down area to allow some maintenance to be performed. Each pump station would have a water-storage tank to help regulate flow and maintain net positive suction head to the pumps. The tanks also are sized to provide a maximum flow for approximately one hour with no water coming into them. Lighting would be designed to minimize the amount of light visible at night.

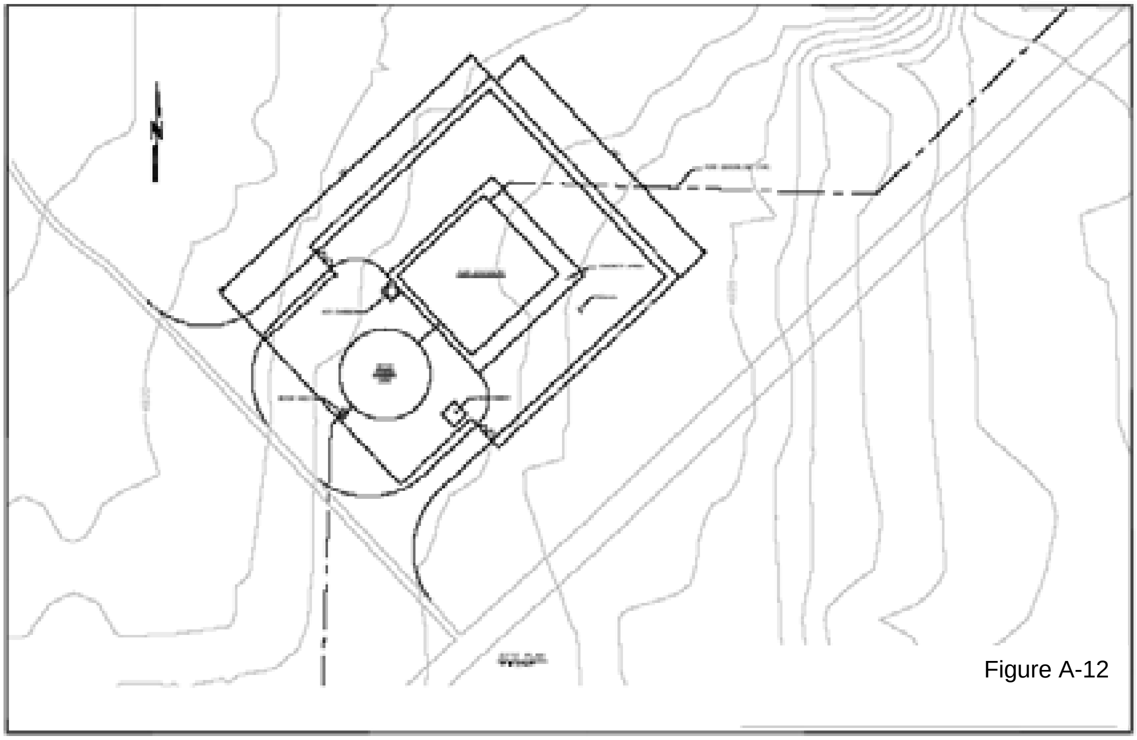

Figure A-12

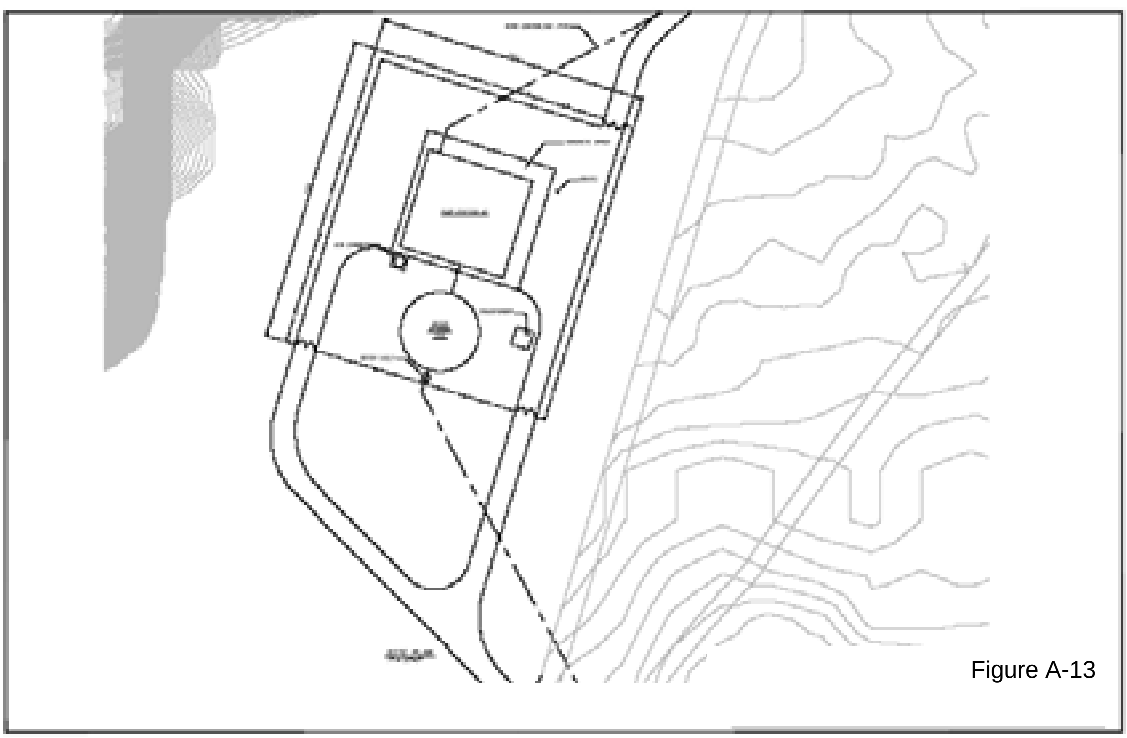

Figure A-13

Both pump stations would have three pumps for delivering water to the mine plus an installed fourth pump as a spare. For the 11,600 af/yr alternative, the Tolani Lake Pump Station would be constructed slightly larger to accommodate a fifth pump position for providing water to the local communities. The fifth pump position would be constructed at the time the additional wells are developed in the Hopi Tribe well field. To ease operation and maintenance of the system, all of the pumps at both pump stations would be interchangeable. The data for the major pump station equipment are as follows:

Design Conditions	Tolani Lake Pump Station	Oraibi Pump Station
Location, mile	30	72
Elevation, feet	4,922	5,814
Maximum flow rate gpm (af/yr)	4,960 (8,000)	3,720 (6,000)
Minimum flow rate gpm (af/yr)	3,720 (6,000)	3,720 (6,000)
Total dynamic Head, feet (psig)	1,325 (574)	1,325 (574)
Water storage tank, diameter x height[5]	50'-0" x 20'-0"	44'-0" x 20'-0"
Water storage tank volume, gallons	294,000	227,500
Type of pump	Vertical	Vertical
Number of pumps (ultimate)	4 (5)	4 (4)
Electrical load maximum/ running, kilovolt amperes	3,220/2,565[6]	2,600/1,950

The pump stations would be designed to be unmanned and operated from a remote location, either from the main control room, the secondary control room at the Black Mesa Complex, or from each other. Each pump station also would have facilities for periodic visits by operating and maintenance personnel including restroom facilities. Potable water would be supplied by using bottled water. Industrial use and toilet flush water would come from the pipeline pump discharge. Sewage treatment would use a septic tank and leach field. Any other liquid wastes within the buildings would be collected and removed using a vacuum truck.

Electrical Supply

Electrical power to the pump stations would be provided by APS via a 69kV, 3-phase, 60-Hertz steel-pole transmission line constructed on the opposite side of the roadway (east side) from the pipeline. For the Tolani Lake Pump Station, which is on the Navajo Reservation, APS would supply power to a NTUA meter and NTUA then would provide the power to the pump station. For the Oraibi Pump Station, the power would be supplied directly by APS as the pump station is on the Hopi Reservation.

A 69/4.16kV step-down transformer located outside of the building would be required to provide power to each pump station. All other 480 volt and 110 volt power requirements within the building would be provided from the 4.16kV system. Control and voice communications between the pump stations, control rooms, and well field would be made via a fiber optic cable underbuilt on the new transmission line, by microwave or by a fiber-optic cable buried along side of the pipeline; the final selection would be determined later.

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[5] The pump station storage tanks would be bolted or welded steel and lined.

[6] Initially, this load would be 1,950 kilovolt amperes. Only when the fifth pump is installed is when the load would be 2,565 kilovolt amperes.

CONSTRUCTION PROCEDURES

Construction techniques and procedures would be basically the same as those described in Appendix A-2, Construction Procedures, except construction would be performed by a single engineering, procurement, and construction (EPC) contractor that would design the pipeline, well field, and pump stations and who then would subcontract and manage the actual work done by contractors that specialize in the specific type of construction being performed; i.e., cross-country pipeline, well drilling, directional drilling, or tank erector work. The EPC would construct the access roads and pump stations. SRP would oversee and manage the EPC contractor.

General

General construction would be the same as described in Appendix A-2, General, except the provisions of the AWWA would be followed in the design, construction, operation, and maintenance of the well field, collector pipelines, and the main water-supply pipeline. Furthermore, any additional requirements imposed by the Hopi Tribe, Navajo Nation, Bureau of Reclamation, or the Bureau of Indian Affairs also would be followed. Both tribes would be consulted to ensure that all clearing, grading, and construction activities are conducted in such a manner as to minimize disturbance to traditional lifeways.

Clearing and Grading

Clearing and grading would be the same as Appendix A-2.

Blasting

This would be the same as Appendix A-2. Blasting would be considered only if conventional trenching were not possible.

Clean-Up and Restoration

Clean-up and restoration would be the same as Appendix A-2.

Well Field Construction

There are five major activities that would be performed to develop the well field. These are (1) constructing access roads; (2) drilling well sites; (3) installing collector piping; (4) erecting storage tank; and (5) installing the electrical-power supply. It is expected that the design and contractor selection for this work would take approximately 14 months and that the construction activities would require approximately 18 months. Except for APS and NTUA materials, all materials for the wellfield construction would be shipped directly from the manufacturer to either Flagstaff, Arizona, or an equivalent location if delivery is by rail and the materials transshipped to a storage area near the well-field storage tank. Materials would be shipped directly to the storage area if delivery is by truck. From the storage area, material would be moved to where it would be installed at the time of construction. APS materials would be shipped to their service center in Flagstaff, Arizona, and NTUA materials to their facilities in Window Rock, Arizona.

Constructing Access Roads

Wherever possible, existing roads such as Indian Road 6930 would be used for access. However, approximately 19.9 miles of new access roads for the 6,000 af/yr alternative or 26.5 miles for the 11,600 af/yr alternative ultimately would be required for the collector piping and to access each of the well sites. The access roads would require a permanent right-of-way or easement width of 25 feet and an additional 15 feet of temporary right-of-way or easement width during construction. The new access roads would be single lane with turnouts, as appropriate, to allow vehicles to pass one another. The roads would be constructed by using bulldozers, a road grader for blading, and compaction equipment. After the vegetation is removed, the area would be graded to the proper contour, and be compacted, where necessary. If necessary, streams and washes would be crossed using corrugated metal pipe drain crossings.

Typically the access roads would be constructed by a single crew consisting of 14 people (surveyors, heavy equipment operators, laborers, drivers, foremen) with 9 pieces of heavy construction equipment (bulldozers, road graders, roller, watering truck, front-end loader, dump trucks). The work is expected to take approximately 1 month.

Drilling Well Sites

In addition to the 50 feet by 50 feet permanent well site area, each well site would require an additional 200 feet by 200 feet temporary construction lay-down area for drilling equipment, materials, etc. The work at each site would consist of drilling the well; installing the pump; connecting the well to the collector piping; installing the electrical, communication, and control equipment; and testing the well.

The wells would be drilled using appropriate and approved drilling methods. Bentonite drilling fluids would not be allowed. Biodegradable or biopolymer drilling fluids would be allowed if used in accordance with manufacturer's instructions. Drill cuttings would be disposed of in accordance with the Stormwater Prevention Pollution Plan (SWPPP), the Navajo Nation Department of Water Resources and/or the Hopi Tribe Standard Specifications for Well Drilling, and the National Environmental Policy Act Categorical Exclusion Checklist. After drilling the 24-inch bore hole, an 18-inch standard casing would be installed with 12-inch standard well screens and a filter pack.

Determination as to whether drill cuttings are contaminated or noncontaminated would be determined by appearance, odors, or tested characteristics (e.g., pH).

Contaminated drill cuttings (e.g., cuttings containing sewage, contaminated material, or other toxic or waste residues) would be stockpiled temporarily on a minimum 20-mil thick, lined barrier and covered with visqueen or other tarp material and then removed from the project area and disposed of at a permitted waste disposal facility during the final site cleanup consistent with the SWPPP.

Uncontaminated drill cuttings would be spread in areas that are already disturbed or devoid of vegetation to the extent practicable. The drill cuttings would be spread to blend with the existing terrain, to a depth of no greater than 6 inches. Disturbed areas would be stabilized to minimize erosion and sedimentation.

Each well would be production tested individually. Temporary discharge piping would be installed to direct the water discharged from the well site. It is estimated that the development and production testing of the wells may generate as much as 7 million gallons of water per well. Water from drilling and development operations would be disposed of in the following manner or in a similar manner as approved by the local regulators, as follows:

- Any water containing additives would be collected and contained in lined ponds, the additives allowed to settle, and the water allowed to evaporate. If evaporation is not practicable, any water containing additives would be collected and contained in "baker" tanks, the additives allowed to settle, and the water separated from the waste. The additives would be disposed of consistent with the description in the paragraph titled Clean-Up and Restoration in Appendix A-2. The remaining water would be considered to be free of additives and would be disposed of as described below.

- Water that contains greater than 5,000 part per million (ppm) or 5 milliliter (ml) sediment per 1,000 ml of discharge water, as determined using an Imhoff Cone, and 10 nephelometric turbidity units (NTU) for turbidity, would be discharged into temporary settling tanks or lined pits until the water contains 5,000 ppm or 5 ml sediment per 1,000 ml of discharge water or less, as determined using an Imhoff Cone, and 10 NTU or less for turbidity. The water then would be discharged as described below. The remaining material would be disposed of consistent with the description in the paragraph titled Clean-Up and Restoration in Appendix A-2.
- Water that contains 5,000 ppm or 5 ml sediment per 1,000 ml of discharge water or less, as determined using an Imhoff Cone, and 10 NTU or less for turbidity, would be disposed of at approved locations (e.g., charco or approved depressions) consistent with the SWPPP. To prevent erosion or damage to channels and depressions at discharge locations, suitable diffusers, or energy dissipaters as required in the SWPPP would be used. Such discharge would not make any access route impassable.
- Clean aquifer water from pump-testing operations that contains 5,000 ppm or 5 ml sediment per 1,000 ml of discharge water or less, as determined using an Imhoff Cone, and 10 NTU or less for turbidity), also may be made available for beneficial use by the local inhabitants, or may be discharged to their steel storage tanks, if capacity is available. The remaining water would be discharged at approved locations (e.g., charco or approved depressions), consistent with the SWPPP. To prevent erosion or damage to channels and depressions at discharge locations, suitable diffusers or energy dissipaters as required in the SWPPP would be used. Such discharge would not make any access route impassable.

In addition to the development and production testing, water would be sampled and tested for quality. Water samples would be collected and analyzed for each completed well in accordance with Table A-2 below or as otherwise required by permit or regulation. Water-quality samples would be submitted to a state certified (inorganics) analytical laboratory, preferably one in Arizona. All results of laboratory analysis would be included in the well-installation report.

Table A-2 Groundwater Sampling, Collection, and Preservation Details for Wells

Constituent	Sample Container/ Preservative	Volume (ml)	Recommended Testing Method/ Maximum Holding Time
Total dissolved solids	Plastic or glass/4°C	250	SM 2540C/7 days USEPA 160.1
Chloride, sulfate, fluoride, nitrate (as nitrogen)	Plastic or glass/4°C	250	USEPA 300.0/28 days
pH	Plastic or glass/4°C	250	SM 9040/EPA150.1/Immediately
Calcium, magnesium, sodium, potassium, silica, arsenic, iron	Plastic or glass/4°C/ HNO_3	1,000	USEPA 200.7,8/6 months
Total alkalinity	Plastic or glass/4°C	250	SM 2320B/USEPA 310.1/14 days
Isotope analysis (D/H and O18/O16)	Plastic or Glass/4°C/ HNO_3	1,000	6 months
Metals: Copper, lead mercury, nickel, selenium, zinc	Plastic or glass/4°C/ HNO_3	1,000	USEPA 200.7 (ICP total metals)/ 6 months

NOTES: ml = milliliters
°C = degrees Centigrade
HNO_3 = nitric acid
USEPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma spectrometry

Typically the wells would be installed by a single, specialized crew consisting of 8 people using a drill rig and supply truck. The work is expected to take approximately 13 to 14 months for the 12 wells needed for the 6,000 af/yr alternative. Approximately 22 months would be needed for the 11,600 af/yr alternative if all 21 wells were installed at the time of initial construction. It is estimated that a single crew of eight people would conduct the drilling (driller, laborers, electrician, driver, foremen).

Installing Collector Piping

It is expected that the collector piping would be AWWA C151 slip jointed, CML, ductile iron pipe. Standard pipeline construction techniques would be employed along the pipeline route and typically involve the following sequence of activities: surveying and flagging the route, clearing and grading, excavation, placing the pipe bedding, stringing, lowering into the trench, joining the pipe, backfilling, hydrostatic testing, startup and testing, cleanup, restoration, and post-construction monitoring.

The pipe trench would be excavated on one side of the access road such that there is a minimum 3-foot cover. The trench would be excavated such that it is 36 inches wide or there is a clearance of 12 inches on either side of the pipe, whichever is greater. Trench minimum widths would be as follows:

Pipe Size	6-inch	8-inch	10-inch	12-inch	14-inch	16-inch
Trench width, inches	36	36	36	36	38	40

The majority of the excavation would be accomplished using equipment such as a ditch wheel that cuts a vertically sided trench approximately 36 inches wide at the bottom and generally to a depth sufficient to accommodate a minimum of 36 inches of cover. When necessary, a rock breaker would be used and the broken material removed using a back hoe or similar type equipment. If necessary, blasting would be used as a last resort. Topsoil and subsoil would be side cast to the same side of the trench in a two-cut process. The first cut is a shallow excavation that removes the topsoil and stockpiles it to the far edge of the nonwork side of the trench. The second cut is the deeper excavation that removes the subsoil and stockpiles it adjacent to the topsoil also to the far edge of the nonwork side of the trench. It is anticipated that the maximum length of trench that would be open at any one time would be approximately 1,250 feet for a time period of about three days.

Existing graded roads would be crossed using an excavated trench. Where the collector piping crosses steams and washes, the trench would be excavated to provide at least 10 feet of cover between the top of the pipe and the bottom of the stream/wash bed and the pipe would be encased in concrete.

The pipe lengths, either 18 or 20 feet with a factory applied CML, would be unloaded from the supply trucks along the working side of the open trench. After excavation, where necessary, the trench would be partially filled with a compacted granular bedding material made up from local materials, which would be either crushed rock or pea gravel (coarse aggregate size No. 7). This bedding material would either consist of 3 inches of granular soil or 6 inches of crushed rock depending on the local materials.

The pipe lengths then would be lowered into the trench using a small crane. After the pipe has been laid in the trench, typically 2 to 3 joints would be made up at a time by using chokers and come-alongs to pull the pipe together to make up bell and spigot type slip joints. These 2 to 3 sections then would be joined to the pipe installed previously. The pipe cannot be joined and then lowered into the trench because the bending that would occur would damage the CML.

The trench would be backfilled up to the centerline of the pipe with additional compacted granular material. The trench then would be backfilled to 6 inches above the top of the pipe with compacted embedment of finely divided job-excavated material free from debris, organic material, and stones. The trench then would be backfilled with the excavated side-cast material with the topsoil filling in the last 1 to 2 feet of the trench. The pipeline then would be hydrostatically tested in segments. Water for the hydrostatic testing would come from the well development tests.

A typical single crew for collector piping construction would consist of 22 people (heavy equipment operators, laborers, drivers, foremen, superintendent) and would be installed by a single crew using 16 pieces of heavy construction equipment (trench excavator, bulldozer, front-end loader, backhoe, small cranes, rock breaker, dump trucks, road grader, 18-wheel flatbed trucks). The work is expected to take approximately 13 to 14 months for the 6,000 af/yr alternative and 22 months for the 11,600 af/yr alternative, if all 21 wells are installed.

Erecting Storage Tank

The well-field collection storage tank would be a field erected, coated, welded or bolted carbon-steel tank fabricated and stamped in compliance with AWWA D100, D102 or D103 code requirements. The tank would have a maximum diameter of 130 feet and a maximum height of 60 feet. Tank materials would be rolled at a factory to the required curvature and shipped to the job site in small radial arc components of approximately 10 feet by 25 feet and welded or bolted in place. Steel shell segments would be positioned in place by on-site cranes of approximately 10- to 20-ton capacity. The tank shell foundation would use a perimeter ring wall construction method. Steel girders, beams, and poles would be used for structural support of the tank roof with a few center supports. The structural welding of supports would require code-certified welders.

Site conditions in the tank pad area of 215 feet by 215 feet would need forms placed and concrete poured for the ring wall foundation as well as reinforced steel cages embedded in concrete to strengthen and provide support for the tank shell. In addition to the permanent right-of-way or easement, a temporary easement of 300 feet by 300 feet would be needed as a construction lay-down area for equipment and materials and a construction office trailer. All of the well-field work would be coordinated from this location as well.

Typically a single crew consisting of 15 people (crane operator, welders, pipefitters, electricians, laborers, drivers, foremen) using a small crane, welding machines, diesel generator, 18-wheel flatbed trucks, and an office trailer would erect the tank. The work is expected to take approximately 3 months.

Installing Electrical-Power Supply

The electrical supply for the wells located on land owned by the Navajo Nation would be constructed by and would receive power from NTUA. The electrical supply for the four wells located on land owned by the Hopi Tribe (11,600 af/yr alternative) would be constructed by and would receive power from APS. It is expected that both NTUA and APS would use the same construction methods to erect their distribution lines. Wooden poles would be set within the rights-of-way or easements for the access roads and well sites and on the opposite side of the road from the collector piping. The excess spoils from the holes would be used either in the grading of the access roads or well sites, or would be disposed of in an approved disposal location. The location of the holes for the poles would be adjusted in the field to avoid any sensitive environmental or cultural resource areas.

Typical distribution lines would be installed by a single crew consisting of 18 (journeymen linemen, apprentice linemen, utility laborers, driver, foreman) using line trucks, cable truck, and an 18-wheel flatbed. The work is expected to take approximately 13 to 14 months for 6,000 af/yr alternative and 22 months for the 11,600 af/yr alternative if all 21 wells are constructed. The work could be finished earlier until all of the well sites are completed.

Water-Supply Pipeline and Pump-Station Construction

Water-supply pipeline and pump station construction would be the same as the well field construction with the following changes. There are five major activities that would be performed to construct the main water-supply pipeline and pump stations. These are (1) constructing the main water-supply pipeline; (2) the directional drilling crossings; (3) constructing the two pump stations; (4) installing the electrical-power supply; and (5) road improvements. It is expected that the design and contractor selection for this work would take approximately 14 months and that the construction activities would require approximately 22 months. It is expected that the main water-supply pipeline and the pump stations would be constructed at the same time.

Constructing Main Water-Supply Pipeline

Construction of the water-supply pipeline would be the same as the collector piping with the following changes. It is expected that the main water-supply would be AWWA C200, CML, exterior tape wrapped, welded-steel pipe. Standard pipeline construction techniques would be employed along the pipeline route.

The pipe trench would be excavated on the western side of the road for paved roads or on one side of the road bed for unpaved roads such that there is a minimum of 3 feet of cover. The trench also would be excavated such that the minimum widths would be as follows:

Pipe Size	18-inch	24-inch	25-inch	26-inch	30-inch
Trench width, inches	64	72	75	77	85

The extra trench width is required so that there is room to weld the sections together in the trench, to repair the exterior coating in the trench and to provide room to install the granular embedment material up to the centerline of the pipe ensuring that there are no voids between the embedment material and the pipe.

Existing graded roads would be crossed by excavated trench. Existing paved roads would be crossed using directional drilling. Where the pipeline crosses the Little Colorado River and the Dinnebito Wash, the crossings would be made by directional drilling.

The pipe lengths, up to 80 feet with a factory applied CML and external tape wrap, would be unloaded from the supply trucks along the working side of the open trench. Bedding material would either consist of 3 inches of granular soil or 6 inches of crushed rock (depending on the local materials) beneath piping up to 26 inches in diameter and 6 and 9 inches respectively beneath 30-inch pipe.

After the pipe has been laid in the trench, it would be joined by welding in accordance with AWWA C206 using appropriate weld procedures and welders qualified by American National Standards Institute/ American Welding Society D1.1. Both the interior and exterior coatings then would be repaired.

Excess spoils from the excavation would be hauled away a disposed of in an approved disposal site. In lieu of a hydrostatic test, 100 percent radiography of 10 percent of the welds may be used in accordance with AWWA C206.

Typically each main water-supply pipeline crew would consist of 33 people (heavy equipment operators, welders, laborers, drivers, foremen, superintendent, construction manager) using 30 pieces of construction equipment (trench excavator, bulldozer, front-end loader, backhoe, small cranes, rock breaker, dump trucks, road grader, welding machines, portable rock crushing plant, 18-wheel flatbed trucks). It is anticipated that the main water supply would be installed by three crews, and the work is expected to take approximately 22 months for either alternative.

Directional Drilling Crossings

Horizontal directional drilling for the water-supply pipeline would be conducted in the same manner as described in Appendix A-2 under the heading Construction Methods in Special Areas.

It is anticipated that this work would take one week for each paved road crossing and four weeks each for the Little Colorado River (24-inch-diameter pipe, 7,920 feet long) and Dinnebito Wash (18-inch-diameter pipe, 5,280 feet long) crossings for either alternative.

Constructing Two Pump Stations

The pump stations would be constructed of filled concrete-block walls on a concrete-slab foundation, open web joist roofing with metal decking and single-ply roofing, and bullet- and intrusion-proof exterior doors and roof hatches. A single, general engineering contractor would be used to construct both pump stations. Once a crew is finished at the first site, for example, the crew pouring the concrete foundations and erecting the concrete block walls would move on to the second site.

At each site, the sequence of construction would be to clear and grade the site; excavate for the septic field, foundations, building, storage tank; pour the foundations; erect the walls; install the roof; install all of the piping valves, pumps, surge tanks, electrical switchgear, controls and communication equipment, air compressor, carbon dioxide fire-suppression system, water-storage tank, gravel paving, and security fence and security lighting; and make the connection to the APS and/or NTUA transmission system.

It is anticipated that the pump stations would be constructed one after the other by a single crew of 56 (heavy equipment operators, welders, pipe fitters, electricians, instrument technicians, carpenters, laborers, drivers, foremen, superintendent) using 23 pieces of equipment (bulldozer, front-end loader, backhoe, small and large cranes, welding machines, diesel-power generator, 18-wheel flatbed trucks, dump trucks, portable concrete batch plant, concrete delivery trucks, office trailer). The work is expected to take approximately 14 months for either alternative.

Installing Electrical-Power Supply

Providing power to the pump stations would require building a new 230/69kV substation approximately 4 miles west of the intersection of State Route 99 and Indian Route 15 near Leupp, Arizona, in the existing 230kV transmission line right-of-way, building a new 61-mile-long 69kV transmission line to the two pump stations, and installing a 69/4.16kV step-down transformer at each pump station. All of this work would be performed by APS except for the 69/4.16kV step-down transformer at the Tolani Lake Pump Station, which would be installed by the NTUA.

It is estimated that the new substation would require a permanent 200 feet by 200 feet site plus a 1-acre temporary site for construction lay down. Steel poles for the transmission line would be set either within the main water transmission pipeline right-of-way or easements on the opposite side of the road from the main water-supply pipeline. The excess spoils from the substation construction and the transmission line foundation holes would be hauled away and be disposed of in an approved disposal location. The location of the holes for the poles would be adjusted in the field to avoid any sensitive cultural or environmental areas.

Building the new substation would include clearing and grading, excavating for foundations, pouring the concrete foundations, erecting steel switch racks and busses, installing insulators, disconnect switches, circuit breakers, transformers, conductors, control and communication cabinets, stringing new conductors from the existing 230kV transmission line into the substation (which also may require erecting two new dead-end transmission towers), paving the area with gravel, and installing security fencing and lighting. To install the steel-pole transmission line, the work would include digging holes for the foundations, pouring concrete, setting the anchor bolts, erecting the steel poles, installing the insulators and stringing the conductors. Communication cable(s) would be under built on the transmission line steel poles.

It is anticipated that a single crew consisting of 36 people (journeymen linemen, apprentice linemen, utility laborers, heavy equipment operators, instrument technicians, drivers, superintendent) using 16 pieces of equipment (line truck, bulldozer, front-end loader, backhoe, small cranes, welding machines, diesel-power generator, 18-wheel flatbed trucks, dump trucks, office trailer) would install the new substation. The new transmission line would be constructed using a crew of 19, using line trucks, a small crane, cable pulling rig, and an 18-wheel flatbed. The work is expected to take approximately 12 months for the substation and 14 months for the transmission line for either the eastern or western water-supply pipeline alternative. The transmission line cannot be completed until both pump stations are completed.

Road Improvements

Road improvements would be the same as for well field access roads except for the following changes. Existing roads such as Indian Route 6930, State Route 99, Indian Route 2, Indian Route 22, Indian Route 8034, and Indian Route 41 would be used to the maximum extent possible. Where necessary, dirt roads would be improved to accommodate the main water-supply water pipeline and existing traffic. However, approximately 5 miles of new access roads would be required between Mileposts 71 and 76 and in the vicinity of the Dinnebito Wash to allow access to the main water-supply water pipeline. The new road between Mileposts 71 and 76 would be single lane with turnouts as appropriate to allow vehicles to pass one another.

APPENDIX B

Appendix B

Estimated Costs for Proposed Coal-Delivery System

Appendix B
Estimated Costs for Proposed Coal-Delivery System

Coal-Slurry Pipeline

	Capital Cost ($ Million)	Annual Operation and Maintenance Cost ($ Million)
Existing Route	200	24
Existing Route with Realignments	200	24

SOURCE: Black Mesa Pipeline, Inc. 2005
NOTES: The capitol costs do not include right-of-way costs.

Water-Supply System

Route/Component	6,000 af/yr Alternative		11,600 af/yr Alternative	
	Capital Cost[4] ($ Million)	Annual Operation and Maintenance Cost[4] ($ Million)	Capital Cost[4] ($ Million)	Annual Operation and Maintenance Cost[4] ($ Million)
Eastern Route				
Well Field	23	1.0	30	1.3
Pump Stations	11	2.2[6]	12	2.6[6]
Water-supply pipeline[3]	145	-	155	-
Water[5]	-	5.4	-	5.4
Total[1]	179	8.6	197	9.3
Western Route				
Well Field	23	1.0	30	1.3
Pump Stations	22	5.0[6]	23	5.4[6]
Water-supply pipeline[3]	169	-	179	-
Water[5]	-	5.4	-	5.4
Total[2]	214	11.4	232	12.1

SOURCES: Peabody Western Coal Company 2005; Southern California Edison Company 2006
NOTES: [1] Includes costs for well field, 108 miles of pipeline (includes West Kykotsmovi and north crossing of the Little Colorado River subalternatives), and two pump stations.
[2] Includes costs for well field, 137 miles of pipeline, and four pump stations.
[3] Does not include costs for right-of-way.
[4] 2006 dollars.
[5] Annual water royalties to Hopi Tribe and Navajo Nation.
[6] Includes operation and maintenance for pipeline

Kykotsmovi Area Subalternatives

Subalternative	Capital Cost ($ Million)
West Kykotsmovi	2.7
East Kykotsmovi	3.4

NOTE: The estimate for the West Kykotsmovi subalternative is the applicant's preferred alternative and included as part of the eastern alternative cost estimate above.

Little Colorado River Crossing

Subalternative	Capital Cost ($ Million)
North crossing (horizontal bore under river)	6.5
South crossing (historic highway bridge)	1.7

NOTE: The estimate for the horizontal bore under the Little Colorado River is the applicant's preferred alternative and included as part of the eastern alternative cost estimate above.

APPENDIX C

Appendix C

Legal Authorities and Mandates

Appendix C
Legal Authorities and Mandates

A number of Federal statutes have been enacted over time to establish and define the authority of Federal agencies. Following is a list of major legal authorities.

The National Environment Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.) requires the consideration and public availability of information regarding the environmental impacts of major Federal actions significantly affecting the quality of the human environment. The law further requires the Federal authorized officers to identify and describe the significant environmental issues associated with their decisions and to develop alternatives to a proposed action (including the alternative of no action). Federal authorized officers must disclose the direct, indirect, and cumulative effects of the decisions; adverse environmental effects that cannot be avoided; the relationship between short-term uses of the human environment and the maintenance of long-term productivity; and any irreversible or irretrievable commitments of resources made by the decision.

The Clean Air Act (CAA) of 1990, as amended (42 U.S.C. 7418) requires Federal agencies to comply with all Federal, state, and local requirements regarding the control and abatement of air pollution. This includes abiding by the requirements of state implementation plans. The Clean Air Act provides that each state is responsible for ensuring achievement and maintenance of air quality standards within its borders so long as such standards are at least as stringent as Federal standards established by the U.S. Environmental Protection Agency (USEPA).

The Clean Water Act (CWA) of 1987, as amended (33 U.S.C. 1251) establishes objectives to restore and maintain the chemical, physical, and biological integrity of the Nation's water. Upon passage of the Environmental Quality Acts and adoption of the water-quality standards, state agencies were empowered to enforce water quality standards as long as they are at least as stringent as the Federal standards established by the USEPA. Also, Section 404 of the CWA, administered by the U.S. Army Corps of Engineers, requires that "waters of the U.S." be protected by permits prior to dredge or fill activities occurring in such areas. Waters include intermittent streams, mud flats, and sand flats. Wetlands that meet jurisdictional criteria of Section 404 of the CWA are partially protected in that a permit is required prior to any dredge or fill activity occurring in such areas.

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) provides a means whereby the ecosystems upon which threatened and endangered species depend may be conserved and to provide a program for the conservation of such threatened and endangered species (section 1531 (b), Purposes). The ESA requires all Federal agencies to seek to conserve threatened and endangered species, utilize applicable authorities in furtherance of the purposes of the ESA (Sec. 1531 (c) (1), Policy), and avoid jeopardizing the continued existence of any species that is listed or proposed for listing as threatened and endangered or destroying or adversely modifying its designated or proposed critical habitat (Sec. 1536 (a), Interagency Cooperation). The U.S. Fish and Wildlife Service (FWS) is responsible for administration of this Act, which also requires all Federal agencies to consult (or confer) in accordance with Section 7 of the ESA with the Secretary of the Interior, through the FWS and/or the National Marine Fisheries Service, to ensure that any Federal action or activity is not likely to jeopardize the continued existence of any species listed or proposed to be listed under the provisions of the ESA, or result in the destruction or adverse modification of designated or proposed critical habitat (Sec. 1536 (a), Interagency Cooperation, and 50 CFR 402). In conjunction with Alternative A, conservation measures were developed through the consultation process. If Alternative A were to be implemented, the conservation measures would be analyzed in a formal FWS biological opinion, which would address whether the action was likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat designated for any threatened or endangered species.

The Federal Water Pollution Control Act (33 U.S.C. 1323) requires the Federal land manager to comply with all Federal, state, and local requirements, administrative authority, process, and sanctions regarding the control and abatement of water pollution in the same manner and to the same extent as any nongovernmental entity.

The Safe Drinking Water Act (42 U.S.C. 201) is designed to make the Nation's waters "drinkable" as well as "swimmable." Amendments in 1996 established a direct connection between safe drinking water and watershed protection and management.

The Resource Conservation and Recovery Act (RCRA) of 1976 (PL 89-72) gave the USEPA the authority to control hazardous waste from "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous wastes.

The Wilderness Act, as amended (16 U.S.C. 1131 et seq.) authorizes the President to make recommendations to the Congress for Federal lands to be set aside for preservation as wilderness.

The Antiquities Act of 1906 (16 U.S.C. 431-433) protects cultural resources on Federal lands and authorizes the President to designate national monuments on Federal lands.

The Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C 470) secures, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands and American Indian lands, to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data which were obtained before October 31, 1979.

The National Historic Preservation Act (NHPA) (1966), as amended (16 U.S.C. 470) expands protection of historic and archaeological properties to include those of national, state, and local significance and directs Federal agencies to consider the effects of proposed actions on properties eligible for or included in the National Register of Historic Places (NRHP). The Act mandates that when Federal undertakings (i.e., Federal projects or federally funded or licensed projects) are planned and implemented, the responsible Federal agencies give due consideration to historic properties (i.e., resources eligible for the NRHP), regardless of land status. Regulations for *Protection of Historic Properties* (36 CFR Part 800) define a process for demonstrating such consideration by consulting with the State Historic Preservation Officers, Federal Advisory Council on Historic Preservation, and other interested organizations and individuals.

The American Indian Religious Freedom Act (AIRFA) of 1978 (42 U.S.C. 1996) establishes a national policy to protect and preserve the right of American Indians to exercise traditional Indian religious beliefs or practices.

The Historic Sites Act of 1935 (16 U.S.C. §461-467) defines a national policy to identify and preserve historic sites, buildings, objects, and antiquities of national significance. The law authorizes the Secretary of the Interior to conduct surveys, collect and preserve data, and acquire historic and archaeological sites.

The Archaeological and Historic Preservation Act (AHPA) of 1974 (16 U.S.C. §§469-469c) provides for preservation of archaeological and historical information that might otherwise be lost as a result of Federal construction projects and other federally licensed activities and programs. This Act stipulates that up to one percent of the funding appropriated by Congress for Federal undertakings can be spent to recover, preserve, and protect archaeological and historical data. A subsequent amendment authorized the one percent limit to be administratively exceeded under certain circumstances.

The Native American Grave Protection and Repatriation Act (NAGPRA) of 1990 (25 U.S.C. §§3001-3013) protects the human remains of indigenous peoples and funerary objects, sacred objects, and items of cultural patrimony on Federal lands. The Act also provides for the repatriation of such remains and cultural items previously collected from Federal lands and in the possession or control of a Federal agency or federally funded repository.

The Curation of Federally Owned and Administered Archaeological Collections (36 CFR Part 79) stipulates standards for facilities that curate federally owned archaeological collections, which include not only artifacts but also all associated records and reports in order to ensure long-term preservation of such collections.

The White House Memorandum on Government-to-Government Relations with Native American Tribal Governments of 1994 set forth guidelines requiring Federal agencies to adhere to directives designed to ensure that the rights of sovereign tribal governments are fully respected

Indian coal leasing statutes govern the leasing, exploration, mining, and reclamation of Indian lands and include Sec. 4, Act of May 11, 1938, (52 Stat. 347); Act of August 1, 1956 (70 Stat. 774); 25 U.S.C. 396a-g; and 25 U.S.C. 2 and 9; 34 Stat. 539; 35 Stat. 312; 25 U.S.C. 355 NT; 35 Stat. 781; Sec. 1, 49 Stat. 1250; 25 U.S.C. 473a; 49 Stat. 1967; 25 U.S.C. 501, 502; and 52 Stat. 347.

The Surface Mining Control and Reclamation Act (SMCRA) of 1977 (30 U.S.C. 1201 et seq.) requires application of unsuitability criteria prior to coal leasing and also to proposed mining operations for minerals or mineral materials other than coal.

The Mining and Mineral Policy Act of 1970 (30 U.S.C. 21a) establishes a policy of fostering development of economically stable mining and minerals industries, their orderly and economic development, and studying methods for disposal of waste and reclamation.

The Public Rangelands Improvement Act (PRIA) of 1978 (43 U.S.C. 1901) provides that the public rangelands be managed so that they become as productive as feasible in accordance with management objectives and the land use planning process established pursuant to 43 U.S.C. 1712.

The Carlson-Foley Act of 1968 (P.L. 90-583) directs Federal agencies to enter upon lands under their jurisdiction having noxious plants (weeds), and destroy noxious plants growing on such land.

The Federal Noxious Weed Act of 1974 (7 U.S.C. 2801-2814) provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The Act requires that each Federal agency develop a management program to control undesirable plants on Federal lands under the agency's jurisdiction; establish and adequately fund the program; implement cooperative agreements with state agencies to coordinate management of undesirable plants on Federal lands; establish integrated management systems to control undesirable plants targeted under cooperative agreements. A Federal agency is not required to carry out management programs on Federal lands unless similar programs are being implemented on state or private lands in the same area.

The Act also directs the Secretaries of Agriculture and the Interior to coordinate programs for control, research, and educational efforts associated with noxious weeds. The Secretaries must identify regional control priorities and disseminate technical information to interested state, local, and private entities.

The Plant Protection Act of 2000 (P.L. 106-224) prohibits the import, export, and movement in interstate commerce, or mailing of any plant pest unless authorized by the Secretary of Agriculture; authorizes the Secretary to prohibit or restrict the import, export, or movement in interstate commerce of any plant, plant product, biological control organism, noxious weed, or means of conveyance to prevent the introduction or dissemination of a plant pest or noxious weed; and combines all or a portion of 11 acts or resolutions into one act.

The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.

The Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C 661-667) proposes to assure that fish and wildlife resources receive equal consideration with other values during the planning of water resources development projects. The Act requires coordination with FWS by the U.S. Department of Energy when a project is planned that may affect a body of water. It also requires coordination with the head of the state agency that administers wildlife resources in the affected state.

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911) authorizes financial and technical assistance to the states for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife.

The Wild and Free Roaming Horse and Burro Act of 1971 (16 U.S.C. 1331) places all wild and free roaming horses and burros under the jurisdiction of the Secretary of the Interior for the purpose of management and protection to achieve and maintain a thriving natural ecological balance on the public lands. The Act calls for the maintenance of current population inventories, provides for the humane destruction of sick or lame animals, and allows for adoption by qualified individuals in the case of excess populations.

Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (49 *Federal Register* 7629 [1994]) requires that each Federal agency consider the impacts of its programs on minority populations and low-income populations.

Executive Order 13007 – Indian Sacred Sites (61 *Federal Register* 26771 [1996]), requires Federal agencies to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.

Executive Order 13287 – Preserve America directs Federal agencies to provide leadership in preserving America's heritage by actively advancing the protection, enhancement and contemporary use of historic properties owned by the government, emphasizing partnerships. Under this order, agencies shall cooperate with communities to increase opportunities for public benefit from, and access to, Federally owned historic properties.

Executive Order 13084 – Consultation and Coordination with Indian Tribal Governments provides, in part, that each Federal agency shall establish regular and meaningful consultation and collaboration with American Indian tribal governments in the development of regulatory practices on Federal matters that significantly or uniquely affect their communities.

Executive Order 13112 – Invasive Species provides that no Federal agency shall authorize, fund or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk or harm will be taken in conjunction with the actions.

Secretarial Order 3175 (incorporated into the Departmental Manual at 512 DM 2) requires that if Department of the Interior agency actions might impact Indian trust resources, the agency explicitly address those potential impacts in planning and decision documents, and the agency consult with the tribal government whose trust resources are potentially affected by the Federal action.

Secretarial Order 3206 – American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act requires Department of the Interior agencies to consult with Indian Tribes when agency actions to protect a listed species, as a result of compliance with the ESA, affect or may affect of Indian lands, tribal trust resources, or the exercise of American Indian tribal rights.

Federal Land Policy and Management Act (FLPMA) of 1976, as amended (43 U.S.C. 1701 et seq.) provides the authority for the Bureau of Land Management (BLM) land use planning. This statute and its implementing regulations define principles for the management of public land and its resources. This Act directs the Secretary of the Interior to develop, maintain, and, when appropriate, revise land use plans that provide for the use of public land managed on the basis of multiple use and sustained yield unless otherwise specified by law. Through FLPMA, BLM is responsible for the management of the public land and resources and their various values. FLPMA specifically states that public land will be managed under the principles of multiple use, and, further, indicates that multiple use includes harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment.

The Forest and Rangeland Renewable Resources Planning Act of 1974 called for the management of renewable resources on national forest lands. The National Forest Management Act of 1976 reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

The Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. §§ 528-531, June 12, 1960, declares that the purposes of the national forest include outdoor recreation, range, timber, watershed and fish and wildlife. The Act directs the Secretary of Agriculture to administer national forest renewable surface resources for multiple use and sustained yield.

APPENDIX D

Appendix D
Truck Alternative Study

Appendix D
Truck Alternative Study
Technical Memorandum
Black Mesa Project EIS

Prepared for

Office of Surface Mining Reclamation and Enforcement

Prepared by

URS Corporation

April 2006

TABLE OF CONTENTS

1.0 PURPOSE OF REPORT

The purpose of this technical memorandum is to address the conceptual feasibility of the transportation of coal by truck between the Black Mesa mining operation in northeastern Arizona and the Mohave Generating Station near Laughlin, Nevada.

2.0 PROJECT DESCRIPTION

One of the purposes of the Black Mesa Project is to continue to supply the coal from the Black Mesa mining operation in northeastern Arizona (approximately 125 miles northeast of Flagstaff) to the Mohave Generating Station in Laughlin, Nevada. Since 1970, Peabody Western Coal Company (Peabody) has been supplying coal from the Black Mesa mining operation to the Mohave Generating Station, a coal-fired, steam electric-generating power plant with a capacity of 1,580 megawatts of power. The plant is owned jointly by Southern California Edison (SCE), Salt River Project, Los Angeles Department of Water and Power, and Nevada Power Company. The Black Mesa mining operation is the sole supplier of coal for the Mohave Generating Station and the Mohave Generating Station is its sole customer. Coal is delivered some 273 miles from the Black Mesa mining operation in the form of slurry (about 50 percent water and 50 percent coal) to the Mohave Generating Station by the Black Mesa Pipeline, owned and operated by Black Mesa Pipeline, Inc.

On February 17, 2004, Peabody submitted a permit application proposing several revisions to the life-of-mine (LOM) mining plans for the Black Mesa Complex to the Office of Surface Mining Reclamation and Enforcement (OSM). The Black Mesa mining operation is authorized to mine coal until such time as OSM makes a decision on the LOM permit application submitted by Peabody. Issuance of the LOM revision for the Black Mesa mining operation would allow continued coal mining at the operation in order to supply the Mohave Generating Station through 2026.

OSM determined that an environmental impact statement (EIS) would be required to address the LOM revisions and associated actions. As a result of public outreach at the beginning of the EIS process, one of the issues identified from public comments was opposition to the use of water for the industrial purpose of transporting the coal. One alternative means of transporting the coal that was suggested by the public was shipping the coal by trucks. Although trucking the coal has been addressed by the Department of the Interior and SCE in previously conducted studies, for the purposes of the current EIS (in progress), OSM requested that URS Corporation review the previous studies and address the conceptual feasibility and cost for transporting the Black Mesa coal by trucks.

3.0 CONCEPTUAL OPERATIONS PLAN

3.1 DESCRIPTION OF TRUCK ROUTE

The truck alternative would require trucks loaded with coal to travel 330 miles one-way southwest on U.S. Highway 160 through Tuba City, south on U.S. Highway 89 to Flagstaff, west on Interstate 40 (I-40) to Kingman, and west on State Highway 68 to the Mohave Generating Station in Laughlin. The reverse trip would use the same route. The segment distances for the proposed truck route would be as follows:

Segment	Distance (in miles)
Black Mesa Complex on U.S. Highway 160 to intersection of U.S. Highway 89	69
U.S. Highway 89 to Flagstaff	65
Flagstaff to Kingman on I-40	159
Kingman to Mohave Generating Station along State Highway 68	37
Total One-Way Truck Route Distance	**330**

3.2 TRAFFIC VOLUME (LOADED DIRECTION)

If the LOM permit application is approved, the average annual production of the Black Mesa mining operation that is transported to the Mohave Generating Station will increase from about 4.8 million tons to 5.4 million tons of washed coal.

3.3 TRUCK FREQUENCY

To develop truck frequencies, operating characteristics such as travel distances, operating speeds, and vehicle capacities must be determined. This section will outline the operating characteristics required to develop the required truck frequencies.

3.3.1 <u>Travel Distances, Operating Speeds, and Trip Time</u>

For the overall truck route, the average speed is assumed to be 50 miles per hour. Given the 330-mile one-way route distance (derived in Section 2) the travel time would range between 6.5 and 7 hours. For the purpose of estimating costs and required vehicles, 7 hours was used to account for the loading and unloading of trucks. This equates to a 14-hour round-trip time.

To haul the 5.4 million tons of coal that would be required to be transported annually between the Black Mesa Complex and the Mohave Generating Station, it would take 216,000 truckloads (assuming a 25-ton payload per truck). This equates to 592 loaded trucks per day assuming 355 days per year to account for holidays and potential highway closures caused by major storms. Divide 592 by 24 hours equals about 24.7 trucks per hour or an average of one loaded truck every 2.4 minutes (a truck in either direction every 1.2 minutes).

For a 7-hour one-way trip (with loading and unloading) the total trip time would be 14 hours, or 840 minutes. Divide 840 minutes by a 2.4-minute frequency equals a total of 350 trucks. For efficient operation, approximately 20 percent of the fleet would need to be spares for operation and maintenance. In this case, 70 spares would be required, bringing the total number of trucks to 420.

The 216,000 truckloads per year with 660-mile round trips would log 142,560,000 truck miles per year. Divided by the number of trucks, 420, each truck would log approximately 339,429 miles per year, which is about three times the average annual mileage for trucks.

3.3.2 Truck Tractor and Trailer Types and Quantity

Tractors with heavy haul specifications would be required, as they would be required to pull a 25-ton payload for the 330-mile trip to the generating station. This is due to the 80,000-pound weight limit for a 19,000-pound tractor and a 50,000-pound weight limit for an 11,000-pound trailer. These tractors would be equipped with three or four axles, tandem drive axles, with or without a pusher axle, a 16,000- to 18,000-pound front axle, and a 46,000-pound tandem rear axle. Tractors with or without sleepers could be used.

The average cost for tractors that would meet these specifications is $110,000 for 2005-2006 models. Due to the continuous heavy payloads, the service life would be approximately three years. It should be noted that the normal average service life of a tractor is approximately nine years; however, in this setting, trucks would log nearly three times as many annual miles as a typical truck would ordinarily experience.

Trailer specifications would include a 38- to 40-foot-length by 102-inch-width, aluminum construction with end dump and tandem axles. Trucks also would be required to have and use a tarp. The average cost for trailers that would meet these specifications is $50,000 for 2005-2006 models. Due to the continuous heavy payloads, the service life would be approximately six years.

3.3.3 Other Operational Information

The Federal Motor Carrier Safety Administration under the Department of Transportation provides Federal regulations that govern the trucking industry that operators must adhere to in terms of hours of driving that are allowed per day or week. Truck drivers are allowed a maximum of 11 service hours after 10 hours of off-duty time. Further, truck drivers are allowed a maximum of 60 hours in 7 days or 70 hours in 8 days. This cycle may resume after a 34-hour “weekend.”

With 14 hours for a round trip, 216,000 truckloads per year equates to 3,024,000 truck hours per year. Each driver is expected to work 1,904 hours per year, which is basically 365 days minus eight holidays, 10 vacation days, 5 sick days, and 104 weekend days (a total of 127 days off), which equals 238 8-hour days per year. Divide 3,024,000 hours by 1,904 hours per year equals 1,589 full-time drivers needed for this operation. For the past few years, the trucking industry has experienced a driver shortage, and this operation would add a large amount to this shortage. The work hours specified will likely be necessary in order to attract and keep drivers. These work hours will be possible if a relay system is used that allows drivers to be home every night or day.

4.0 TRUCK RELATED IMPROVEMENTS

4.1 HIGHWAYS

The 330 miles of highways used along the truck route would need to be upgraded to higher standards suitable for continuous heavy truck traffic. As a comparison, U.S. Highway 287 in southern Colorado was recently reconstructed to better accommodate large volumes of truck traffic. What became known as the "Super 2" project involved a reconstruction of the two-lane state highway. Because of the large volume of trucks along this route, the project constructed two 12-foot through lanes (one in each direction) as well as 10-foot shoulders on both sides of the roadway. This would allow enough room for trucks to be completely off of the roadway in the case of breakdowns. Additionally, the significant truck traffic required the use of 10 to 12 inches of concrete rather than shallower bituminous (asphalt) surface that is traditionally used on such roadways. It is assumed that this infrastructure upgrade would be required for the entire truck route between the Black Mesa Complex and the Mohave Generating Station, with improvements to both two- and four-lane portions of the proposed highway network of the truck alternative. The four-lane segment of the route is located on I-40 between Flagstaff and Kingman, which is classified as rural interstate and is generally separated by a depressed median.

4.2 COAL FACILITIES

The improvements required for each segment involving the Black Mesa Complex and the Mohave Generating Station would be a new conveyor belt from the coal-washing facility to a new silo, and truck flood loader to serve the Black Mesa mining operation. At the Mohave Generating Station, a new coal stacker and reclaim facilities would be required, as would a conversion of the Mohave Generating Station to allow the burning of dry coal.

5.0 COST ESTIMATES

5.1 CAPITAL COST ESTIMATES

The truck alternative would require significant capital costs including upgrades to existing infrastructure and purchasing new equipment to facilitate the transfer of coal. Such costs include the following:

- Upgrading the current highway infrastructure;
- Purchasing truck equipment for coal hauling; and
- Upgrading the coal facilities to accommodate hauling by truck.

The total of these costs are expected to be approximately $2,410 million.

5.1.1 Highways

The 330 miles of highways used along the truck route is projected to cost $3.0 million per mile per two lanes to upgrade for heavy trucks. The section of I-40 that the route would use is priced at $6.0 million per mile because the interstate is essentially the equivalent of two, two-lane sections. The total cost for 330 miles would be approximately $2,113 million including design, construction, and contingency costs.

Segment	Cost/Mile (millions)	Miles	Total Segment Cost (millions)
Black Mesa Complex on U.S. Highway 160 to intersection of U.S. Highway 89	$3.0	69	$207.0
U.S. Highway 89 to Flagstaff	$3.0	65	$195.0
Flagstaff to Kingman on I-40	$6.0	159	$954.0
Kingman to Mohave Generating Station along State Highway 68	$3.0	37	$111.0
Subtotal		*330*	*$1,467.0*
Design, Construction, Contingency, etc.			$645.5
Total One-Way Truck Route Distance		**330**	**$2,112.5**

5.1.2 Truck Tractors and Trailers

The truck alternative requires the purchase of 420 new tractor-trailer sets for semi-truck operation. Current tractors required for this operation cost about $110,000 each and trailers cost about $50,000 each. The 420 tractors would cost a total of $46.2 million and the 420 trailers would cost a total of $21 million, which comes to a grand total of $81 million including design, construction, and contingency costs for 420 semi-truck sets for the initial cost.

The Black Mesa mining operation is expected to be in operation for a period of 16 years; as a result, additional semi-trucks would need to be purchased as the initial sets wear out. Due to the heavy use that would be required, it is estimated that tractors would have a 3-year life and the trailers would have a 6-year life. In this scenario, 2,520 tractors and 1,260 trailers would need to be purchased over the 16-year operation. The total capital cost for the semi trucks over the 16-year operation would be approximately $408.2 million, including $277.2 million for the tractors and $63.0 million for the trailers.

Segment	Cost/Unit	Units	Total Initial Year Cost (millions)	16-Year Life Span Units	16-Year Life Span Cost (millions)
Semi-Truck Tractors	$110,000	420	$46.2	2,520	$277.2
Semi-Truck Trailers	$50,000	420	$21.0	1,260	$63.0
Subtotal			**67.2**		**$340.2**
Design, Construction,					**$68.0**
Contingency, etc.			**$13.4**		
Total Cost (millions)			**$80.6**		**$408.2**

5.1.3 Coal Facilities

Improvements to existing coal facilities for truck transport are expected to be similar to the rail alternative improvements. The estimated capital cost for new coal loading and unloading facilities and for the conversion of the Mohave Generating Station to dry coal are taken from the Peabody Corporation Mohave Power Plant Coal Conversion Study, March 2003, by Burns & McDonnell and SCE (2005, personal communication, L. Johnson, September 9), respectively. The cost estimates including design, construction management, etc., and contingency are:

- $30.0 million for coal loading and unloading facilities
- $99.1 million for conversion to dry coal
- $10.0 million for truck inspection and maintenance facility
- $77.4 million for design, construction management, contingency, etc.
- **$216.5 million Total**

Use of dry coal at the Mohave Generating Station is not allowed under the station's existing Title V air quality permit and would require the facility to undergo New Source Review under the Clean Air Act. This could result in a change in operations or the installation of additional air pollution control equipment to meet Best Achievable Control Technology Standards. The cost of any such additional air pollution control equipment or changes in operations required by air permitting activities have not been included in these cost estimates.

5.1.4 Total Cost Summary

Once the capital costs are calculated for highway improvements, purchase of trucks, and construction of new facilities, the total cost in millions of 2006 dollars is as shown on the following table.

Category	Cost
Highway	$2,112.5
Trucks	408.2
Facilities	216.5
Total Cost (millions)	**$2,737.2**

Financing costs are not included.

5.2 ANNUAL OPERATING COST ESTIMATES

5.2.1 Black Mesa Complex to Mohave Generating Station

The annual operation and maintenance cost is based on $1.90 per mile to own and operate a truck in 2006. This $1.90 includes owner operation with fuel ($.90), driver cost ($.70), and other expenses ($.30). The average owner operation cost is $.60; this cost is increased 150 percent for this study due to the high miles on the trucks. Other expenses generally count for 20 percent of the operation cost. With an estimated 142,560,000 truck miles per year, the annual operation and maintenance cost would be approximately $271 million. This includes the operation of 216,000 truckloads per year over 330 miles for a one-way trip and the maintenance of a semi-truck fleet of 420 tractor-trailers.

5.3 ANNUALIZED COST PER TON OF COAL

The annualized cost per ton of coal is calculated from the annualized capital and operation and maintenance (O&M) costs divided by the annual coal tonnage. The annualization factors are based upon the 16-year life expectancy of the coal operation and annualized factors used by the Federal Transit Administration. The details for the annualized cost per ton of coal are shown in the following table.

Cost Category	Useful Life (years)	Annualization Factor	Truck Total Cost ($ millions)	Contingency ($ millions)	Total Capital Cost Including Contingency ($ millions)	Truck Annualized Cost ($ millions)
Support Facilities						
Running Maintenance Facility	16	0.1059	$10.000	$2.500	$12.500	$1.324
Coal Facilities	16	0.1059	$129.100	$74.878	$203.978	$21.601
Trucks						
Highways and Roads	16	0.1059	$1,467.000	$645.480	$2,112.480	$223.712
Traffic Signals	16	0.1059		$0.000	$0.000	$0.000
Purchase/Lease, Real Estate	16	0.1059		$0.000	$0.000	$0.000
Truck Tractors	16	0.1059	$277.200	$55.440	$332.640	$35.227
Truck Trailers	16	0.1059	$63.000	$12.600	$75.600	$8.006
Capital Cost			$1,946.300	$790.898	$2,737.198	**$289.869**
Annual O&M Cost						$271.000
Total Capital and O&M Cost						$560.869
Annualized Cost per Ton of Coal						**$103.86**

NOTE: Annualized cost per ton of coal = Annualized cost divided by annual coal tonnage.

APPENDIX E

Appendix E
Railroad Alternative Study

Appendix E
Railroad Alternative Study
Technical Memorandum
Black Mesa Project EIS

Prepared for
Office of Surface Mining Reclamation and Enforcement

Prepared by
URS Corporation

June 2006

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF ACRONYMS

AAR	Association of American Railroad
BNSF	Burlington Northern Santa Fe
CTC	Centralized Traffic Control
EIS	Environmental Impact Statement
GIS	Geographic Information System
LOM	Life-of-Mine
mph	miles per hour
O&M	operating and maintenance
OSM	Office of Surface Mining Reclamation and Enforcement
Peabody	Peabody Western Coal Company
SCE	Southern California Edison
USGS	U.S. Geological Survey

1.0 PURPOSE

The purpose of this technical memorandum is to address the conceptual feasibility and cost for the transportation of coal by railroad between Black Mesa Complex in northeastern Arizona and the Mohave Generating Station near Laughlin, Nevada.

2.0 PROJECT DESCRIPTION

One of the purposes of the Black Mesa Project is to continue to supply the coal from the Black Mesa Complex in northeastern Arizona (approximately 125 miles northeast of Flagstaff) to the Mohave Generating Station in Laughlin, Nevada. Since 1970, Peabody Western Coal Company (Peabody) has been supplying coal from the Black Mesa Complex to the Mohave Generating Station, a coal-fired, steam electric-generating power plant with a capacity of 1,580 megawatts of power. The plant is owned jointly by Southern California Edison Company (SCE), Salt River Project, Los Angeles Department of Water and Power, and Nevada Power Company. The Black Mesa mining operation is the sole supplier of coal for the Mohave Generating Station and the Mohave Generating Station is its sole customer. Coal is delivered some 273 miles from the Black Mesa Complex in the form of slurry (about 50 percent water and 50 percent coal) to the Mohave Generating Station by the Black Mesa Pipeline, owned and operated by Black Mesa Pipeline, Inc.

On February 17, 2004, Peabody submitted a permit application proposing several revisions to the life-of-mine (LOM) mining plans for the Black Mesa Complex to the Office of Surface Mining Reclamation and Enforcement (OSM). The Black Mesa mining operation is authorized to mine coal until such time as OSM makes a decision on the LOM permit application submitted by Peabody. Issuance of the LOM revision for the Black Mesa Complex would allow continued coal mining at the Black Mesa mining operation in order to supply the Mohave Generating Station through 2026.

OSM determined that an environmental impact statement (EIS) would be required to address the LOM revisions and associated actions. As a result of public outreach at the beginning of the EIS process, one of the issues identified from public comments was opposition to the use of water for the industrial purpose of transporting the coal. One alternative means of transporting the coal that was suggested by the public was shipping the coal by rail. Although rail has been addressed by the U.S. Department of the Interior, SCE, and Peabody in previously conducted studies, for the purposes of the current EIS (in progress), OSM requested that URS Corporation review the previous studies and address the conceptual feasibility and cost for transporting the Black Mesa coal by rail.

3.0 CONCEPTUAL RAILROAD ALIGNMENTS

The closest rail line to the Black Mesa Complex and the Mohave Generating Station is the Burlington Northern Santa Fe (BNSF), a major U.S. east-west rail line (Map E-1). To reach the BNSF from the Black Mesa Complex and then from the BNSF to the Mohave Generating Station, it would be necessary to construct a spur for each segment. This section discusses the basic criteria used for new railroad construction and contains a description of potential new railroad alignments and each of the existing BNSF Railway Company alignments.

3.1 CONCEPTUAL DESIGN CRITERIA

The design criteria used for developing the conceptual railroad alignments involving new construction included current BNSF standards and American Railway Engineering and Maintenance Association standards and practices. The design criteria selected gives consideration for the operation of 125-car coal trains. The basic criteria included:

- Maximum gradient of 1.5 percent with 1.0 percent preferred.
- Maximum (tightest) mainline curve radius of 6 degrees (approximately 1,000-foot radius).
- Maximum right-of-way width of 60 feet to accommodate main track and a siding or future second main track on 15-foot centers, a 15-foot-wide maintenance access road located 10 feet from the nearest track centerline, as well as 10 feet for drainage along each side of the right-of-way.
- All new railroad track construction would consist of continuous-welded 141# rail section (the rail weighs 141 pounds per yard of length), concrete crossties, spring clips, and double shoulder tie plates to fasten the rail to the ties, 12 inches each of subballast and ballast, and concrete highway/railroad crossing surfaces.
- Turnouts (track that allows a train to switch from one track to another, diverging track) have 141# rail on wood crossties and would be #24 for main line junctions and sidings and #10 for yard and spur tracks (the larger the turnout number, the higher the train speed allowed).
- New railroad construction on existing BNSF track would be equipped with bidirectional Centralized Traffic Control (CTC) railroad signaling.
- Highway/railroad at-grade crossings would be equipped with crossbucks and stop signs for private roads, flashing lights, and bells for low-volume public roads, and flashing lights, bells, and gates for high-volume public highway crossings. Intersections with interstate and U.S. highways would be grade separated.

Bridges on new railroad construction would be either pre-stressed concrete or steel-through-plate girder bridges.

3.2 CONCEPTUAL RAILROAD ALIGNMENTS

The railroad alignments considered in this technical memorandum include:

- New construction from the Black Mesa Complex to the BNSF near Winslow, Arizona.
- Existing BNSF between Winslow and Franconia, Arizona.

- New construction between Franconia and the Mohave Generating Station from the east.
- Existing BNSF between Franconia, Arizona, and a location west of Needles, California, plus new construction between the BNSF and the Mohave Generating Station from the west.

3.2.1 Black Mesa Complex to BNSF at Winslow

This segment of the proposed railroad coal route extends for approximately 164 miles between the Black Mesa Complex end of the route and the BNSF at Winslow, Arizona (refer to Map E-1). It involves new railroad construction, as there is no railroad in the vicinity. The north end, or mine, of the alignment is located near the existing loadout for the Kayenta Mine. A new conveyor system from the mine to the loadout, a new coal-storage silo, a new loop track, and a new unit train loading facility would be required at the Black Mesa Complex. A 120- to 130-car coal train would be loaded in approximately 4 hours.

From the Black Mesa Complex, the alignment would run southwest along U.S. Highway 160, parallel to the electrified Black Mesa and Lake Powell Railroad to Cow Springs, pass south of Tuba City, and follow the Little Colorado River the rest of the way into Winslow. At Winslow, the coal-haul line would join the existing BNSF double-track main line just west of town. In several locations, the maximum railroad gradient exceeds the 1.5 percent maximum specified in the design criteria. This may or may not be resolved should engineering be performed on the alignment. Following the Little Colorado River represents the easiest railroad course compared to any other potential alignments investigated in previous studies.

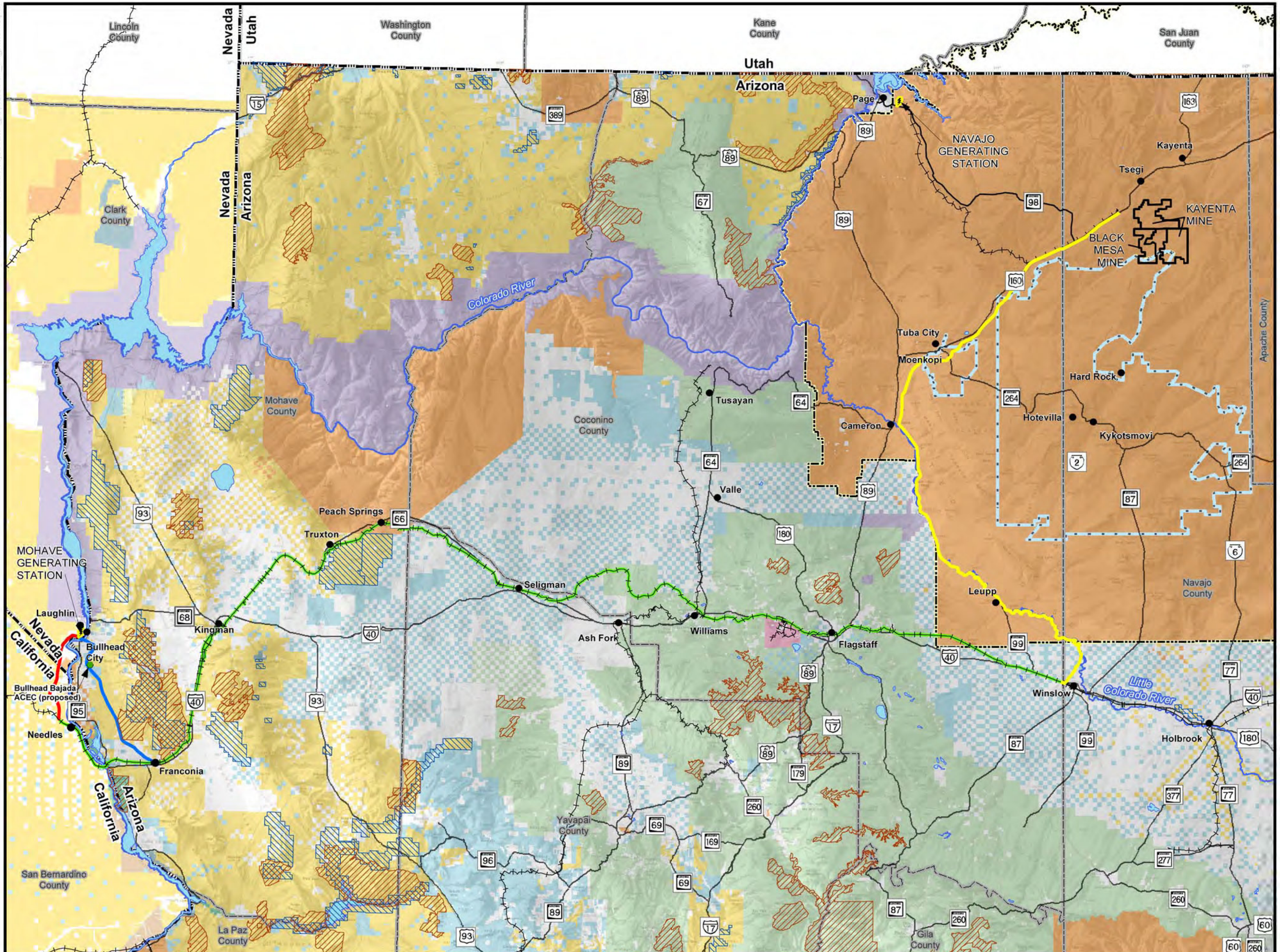
3.2.2 Existing BNSF Railway Between Winslow and Franconia, Arizona

This segment is different than previously recommended alignments. Previous alignments went as far as Kingman before diverging from the BNSF to Laughlin. The route between Kingman and Laughlin from the east is not viable due to residential and commercial development just west of Kingman and the Black Mountains that trend north and south between Laughlin and Kingman. By going approximately 36 miles farther west to Franconia, the railroad alignment passes to the south of the development and mountains before turning northward to Laughlin and the Mohave Generating Station.

The existing BNSF route between Winslow and Franconia consists of approximately 267 miles of double track. The track is in excellent condition due to the fact that it is the BNSF's primary route between Los Angeles and Chicago. The line handles top priority intermodal traffic along with a variety of merchandise and other traffic. Currently, traffic over the line averages more than 60 trains per day. The operating speed limit for freight trains over most of the line is 70 miles per hour (mph).

3.2.3 Franconia to the Mohave Generating Station from the East

This proposed segment of the railroad coal route approaches the Mohave Generating Station from the southeast and involves approximately 35 miles of new railroad construction (Maps E-2 and E-3). The alignment diverges from the BNSF main line just west of Franconia, parallels the Black Mountains to the west of the wilderness area and the development along the Colorado River as it runs northward, and approaches the Mohave Generating Station from the east in the vicinity of Silver Creek Wash. A new railroad bridge will be required across the Colorado River. In several locations, the maximum railroad gradient exceeds the 1.5 percent maximum specified in the design criteria. This may or may not be resolved should engineering be performed on the alignment.



Map E-1
Conceptual Rail Alignments

Black Mesa Project EIS

LEGEND

- New Rail Alignment: Black Mesa Mine to BNSF at Winslow
- New Rail Alignment: Franconia to Mohave Generating Station from the East.
- New Rail Alignment: West of Needles to Mohave Generating Station from the West
- Existing BNSF Railway
- Peabody Lease Boundary
- Areas of Critical Environmental Concern
- Wilderness Areas

Surface Management

- Bureau of Land Management
- U.S. Forest Service
- National Park Service
- U.S. Fish and Wildlife Service National Wildlife Refuge
- Bureau of Reclamation
- Indian Lands
- Military Reservations
- State Trust
- County, Park and Outdoor Recreation Areas
- Private

General Features

- River
- Lake
- Navajo Reservation Boundary
- Hopi Reservation Boundary
- State Boundary
- County Boundary
- Interstate/US Highway/State Route
- Railroad

SOURCE:
URS Corporation 2005
Arizona State Land Department 2005
Environmental Research Institute 2004

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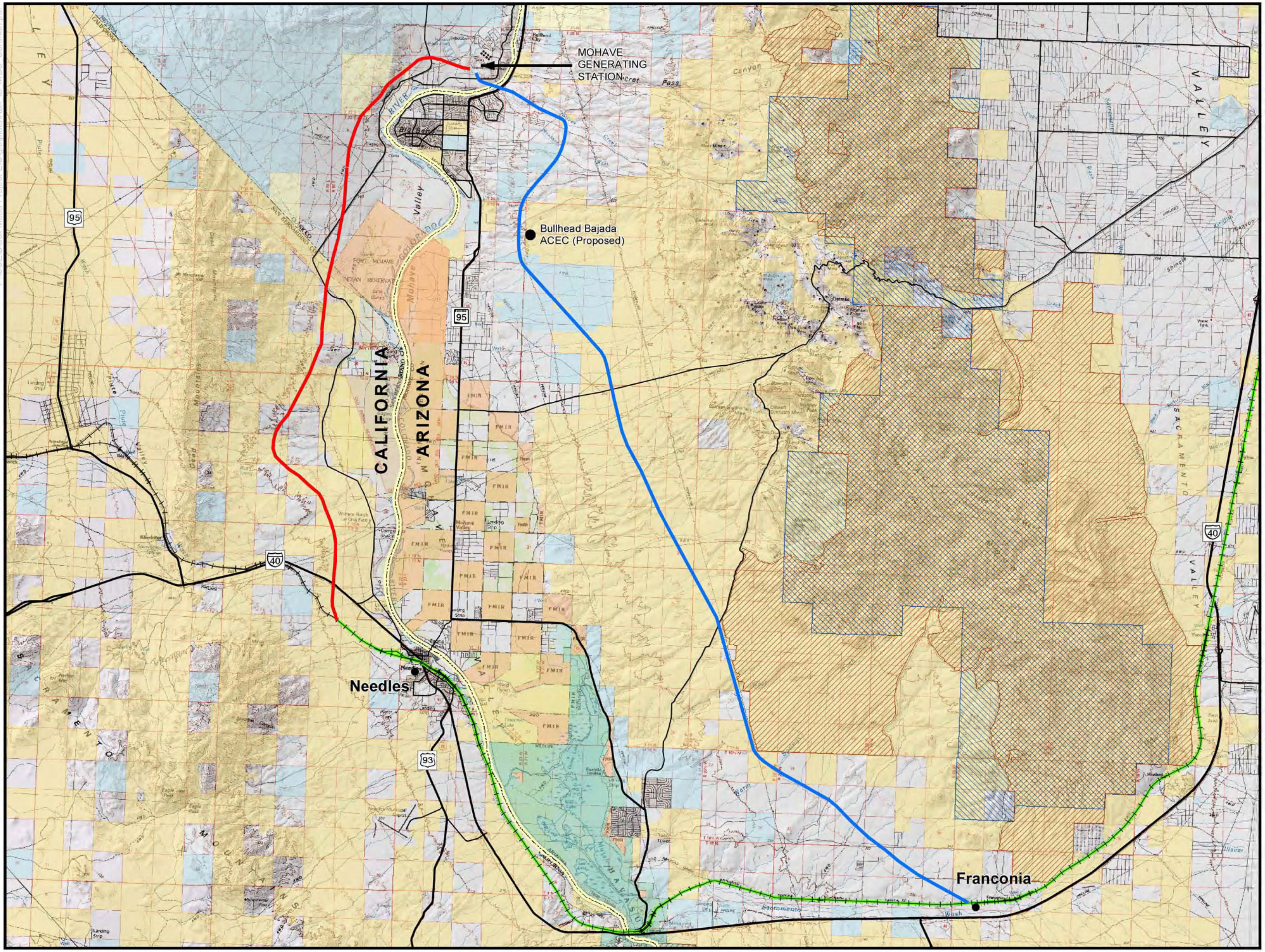
Prepared By:
URS

Map E-2
Rail Spur: BNSF to Mohave Generating Station

Black Mesa Project EIS



LEGEND

- New Rail Alignment: Franconia to Mohave Generating Station from the East.
- New Rail Alignment: West of Needles to Mohave Generating Station from the West
- Existing BNSF Railway
- Areas of Critical Environmental Concern
- Wilderness Areas

Surface Management

- Bureau of Land Management
- U.S. Forest Service
- National Park Service
- U.S. Fish and Wildlife Service National Wildlife Refuge
- Bureau of Reclamation
- Indian Lands
- State Trust
- Private

General Features

- State Boundary
- Interstate/US Highway/State Route
- County/Local Road
- Railroad

NOTE: Potential ACEC in Bullhead City Area

SOURCE:
URS Corporation 2005
Arizona State Land Department 2005
Environmental Systems Research Institute 2004
Map created with TOPO!(tm) (c)2002 National Geographic Holdings (www.topo.com)

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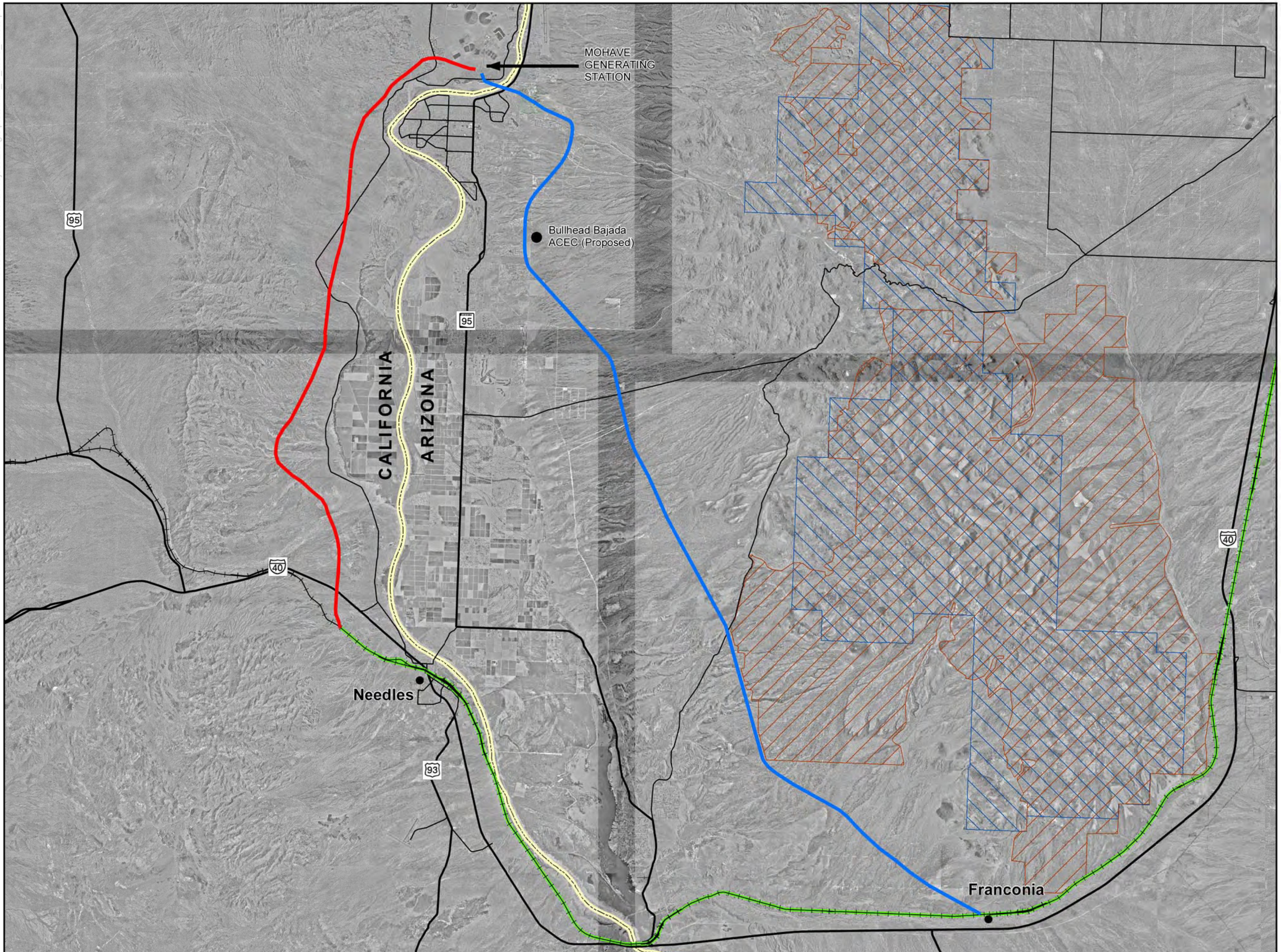
Prepared By:
URS

Map E-3
Rail Spur: BNSF to Mohave Generating Station (aerial imagery)

Black Mesa Project EIS



LEGEND

- New Rail Alignment: Franconia to Mohave Generating Station from the East.
- New Rail Alignment: West of Needles to Mohave Generating Station from the West
- Existing BNSF Railway
- Areas of Critical Environmental Concern
- Wilderness Areas

General Features

- State Boundary
- Interstate/US Highway/State Route
- County/Local Road
- Railroad

NOTE: Potential ACEC in Bullhead City Area

SOURCE:
URS Corporation 2005
Arizona State Land Department 2005
Environmental Systems Research Institute 2004

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Miles

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF SURFACE MINING

Prepared By:
URS

3.2.4 BNSF Between Franconia and a Location West of Needles, California, and New Construction to the Mohave Generating Station from the West

This segment provides a potential alignment into the Mohave Generating Station from the west (refer to Maps E-2 and E-3). As the BNSF track heads west out of Needles, it climbs away from the Colorado River. At a location 3 or 4 miles west of Needles, this alignment diverges northward and then finally eastward to the Mohave Generating Station. The distance between Franconia and the point where the alignment diverges is approximately 29 miles. The distance from the BNSF to the Mohave Generating Station is approximately 23 miles. In several locations between west Needles and the Mohave Generating Station, the maximum railroad gradient exceeds the 1.5-percent maximum specified in the design criteria. This may or may not be resolved should engineering be performed on the alignment. The total distance from Franconia to the Mohave Generating Station is approximately 52 miles with 23 miles of the total involving new railroad construction.

4.0 CONCEPTUAL OPERATIONS PLAN

The proposed operations plan for the transportation of coal by railroad from the Black Mesa Complex to the Mohave Generating Station is based on previous studies with revisions as necessary. The operations plan brings together traffic volume, travel distances, operating speeds, trip time, frequency, railroad rolling stock (locomotives and cars), and other pertinent operational considerations into a cohesive operating entity that is capable of performing the transportation function as intended.

4.1 TRAFFIC VOLUME

If the LOM permit application is approved, the average annual production of the Black Mesa mining operation that is transported to the Mohave Generating Station will increase from about 4.8 million tons to 5.4 million tons of washed coal.

4.2 TRAVEL DISTANCE, OPERATING SPEEDS, AND TRIP TIME

The proposed railroad route between the Black Mesa Complex and the Mohave Generating Station consists of a total of approximately 466 to 483 miles, depending on the route. The mileage for each of the two potential routes is described in Table E-1.

Table E-1 Mileage for Each Segment

Segment	Miles
Eastern Approach to Mohave Generating Station	
Black Mesa Complex to BNSF at Winslow	164
Winslow to Franconia	267
Franconia to Mohave Generating Station from east	35
Total Railroad Miles	***466***
Western Approach to Mohave Generating Station	
Black Mesa Complex to BNSF at Winslow	164
Winslow to Franconia	267
Franconia to 3 to 4 miles west of Needles	29
West of Needles to Mohave Generating Station	23
Total Railroad Miles	***483***

The maximum train operating speed limits and trip times for the various route segments would vary depending on curves, grades, and congestion along the alignment. Using typical operating speeds for similar alignments, the maximum and average train operating speeds, in mph, and the average trip time, in hours, for loaded trains are shown in Table E-2.

For empty train movements, the average trip time from the Mohave Generating Station to the Black Mesa mining operation loadout is estimated to be 11 hours (rounded to the nearest half-hour) for either the eastern approach or the western approach.

Table E-2 Typical Operating Speeds and Trip Time

Segment	Maximum Speed (mph)	Average Speed (mph)	Trip Time (hours)
Eastern Approach to Mohave Generating Station			
Black Mesa Complex to BNSF at Winslow	40	20	8.2
Winslow to Franconia	70	45	6.0
Franconia to Mohave Generating Station from east	40	20	1.8
Total Railroad Miles			***16.0***
Western Approach to Mohave Generating Station			
Black Mesa Complex to BNSF at Winslow	40	20	8.2
Winslow to Franconia	70	45	6.0
Franconia to west of Needles	70	40	0.7
West of Needles to Mohave Generating Station	40	20	1.2
Total Railroad Miles			***16.1***

4.3 TRAIN REQUIREMENTS

Based on the volume of 5.4 million tons of coal to be transported from the Black Mesa Complex to the Mohave Generating Station, the terrain encountered and current unit coal train technology, the following assumptions about train requirements have been made:

- The average train would include 125 aluminum, rotary dump, coal gondola cars with four modern, six-axle locomotives (two locomotives pulling at the front of the train and two distributed power units pushing at the rear of the train).
- The overall train length would be approximately 7,800 feet.
- The average load per car would be 115 tons of coal (143 tons gross car weight less 28 tons empty car weight equals 115 tons for load).
- The total average weight of coal load per train would be 14,375 tons (125 cars times 115 tons of coal per car).
- The average time to load or to unload 125 cars is 4 hours (about 2 minutes per car including train movement. During unloading, 2 cars are dumped at a time and the train is inspected before heading back to the mine).
- The operation of the coal trains would be based on a 6 days per week, 50 weeks per year schedule (300 days per year).
- The total round trip time is estimated to be 39 hours (4 hours to load plus 16 hours loaded movement plus 4 hours to unload plus 11 hours empty movement plus 4 hours for unscheduled delay time).

Given these assumptions, 3 train sets would be needed to transport 5.4 million tons of coal per year from Black Mesa to the Mohave Generating Station. The number of train sets required is based on the following calculations:

- Number of loaded trains per year: 5.4 million tons of coal per year divided by 14,375 tons per train equal 376 loaded trains per year.

- Number of loaded trains per day: 376 trains per year divided by 300 operating days per year equal 1.25 loaded trains per day.
- 300 days per year times 24 hours per day equals 7,200 available hours per year. 7,200 hours minus 1,400 hours per year for FRA and AAR Interchange inspections and other such downtime equals 5,800 operating hours per year per train. 5,800 hours divided by 39 hours per round trip equals 149 trips per year per train set. 376 loaded trains per year divided by 149 trips per train equals 2.5 or 3 train sets. The difference between 2.5 and 3 train sets would provide service reliability in the event of weather, train delays, accidents, track maintenance windows, and other unforeseen conditions. Note that if only 2 train sets were provided, then only 298 loaded trains would be operated per year (2 times 149 trips each) or each train would have to operate 188 trips per year (376 divided by 2 trains) continuously for 364 days per year (188 trips times 39 hours plus 1,400 hours for inspections, etc. divided by 24 hours per day) without allowance for unexpected downtime. Number of locomotives: 4 locomotives per train times, 3 train sets equal 12 locomotives.
- Number of coal cars: 125 cars per train times 3 train sets equal 375 cars.
- Other operational information

The identification of the entity that would perform the railroad operations over the new railroad segments is not considered in this report. The operation of the existing BNSF segment would definitely remain under the control of the BNSF due to the importance of the line. The operation of the new railroad segments could be performed under contract by the BNSF, a shortline railroad or regional carrier, a private company or joint owner, or a new operating entity.

It is assumed that locomotive and coal-car inspection and routine maintenance would be performed at a new facility to be located in Needles (preferred location due to its proximity to BNSF's facilities located in Barstow) or Winslow and that major repairs and overhauls would be contracted to the BNSF or a private repair shop.

5.0 RAILROAD IMPROVEMENTS

The railroad improvements required for the transportation of coal from the Black Mesa Complex to the Mohave Generating Station over the new railroad segments and the existing BNSF segment are identified in this section. The improvements are based on current railroad construction practices for heavy-haul lines. Distances, quantities, and other characteristics are estimated based on BNSF System Timetable information and the mapping approach described below.

Alignment Delineation and Digitizing: The Black Mesa Project alternative alignments were hand-drawn onto 1:100,000 Scale U.S. Geological Survey (USGS) quadrangle paper-copy maps, which then were converted into geographic information system (GIS) format using “heads-up” digitizing techniques. Scanned, digital copies of the paper-copy quadrangle maps were used in Arc/Info, ArcMap 8.3 GIS software to digitize the line features from the paper-copy maps.

Alternatives Intersection Analysis: To determine where alternatives intersected with a road or stream, vector-based GIS datasets were required. USGS 1:100,000 scale digital line graph, which are the features found on the quadrangle maps (roads, streams, sections, etc), were overlaid with the alternatives. A spatial analysis routine was then performed to determine these intersections, and a corresponding database listing the conflicts was generated.

Slope Analysis: Since a slope of 1.5 percent or less is required for proper function of coal rail car operations, a slope analysis of the alternatives was performed. Within the GIS software, USGS 30-meter digital elevation models were color-coded by their percent slope values, the alternatives were overlaid, and segments in violation of the 1.5 percent rule can easily be identified.

5.1 NEW RAILROAD CONSTRUCTION

The improvements required for each segment involving new railroad construction are listed below.

5.1.1 Black Mesa Complex to BNSF at Winslow

The improvements for this 164-mile segment of the route include:

- 164 miles of new main track
- 12 miles of new passing siding track (3 miles each for four sidings; 1 siding at the Black Mesa loadout, 1 at Winslow, and 2 along the route approximately 55 miles apart at milepost 55 and milepost 110)
- New connection with BNSF and universal crossover at Winslow
- New control points, interlockings, and modifications to existing CTC signal system at Winslow
- 3 miles for new loop track at coal load-out at Black Mesa Complex
- 72 new bridges totaling an estimated average of 6,900-track-feet in length (12 at 200 feet, 30 at 100 feet, and 30 at 50 feet or less)
- 130 new highway/railroad at-grade crossings (82 with crossbucks, 43 with flashers, and 5 with flashers and gates)
- 656 new drainage culverts (estimated 4 culverts per mile for new construction)

- Excavation estimated to total 98,400,000 cubic yards of cut and fill (600,000 cubic yards per mile average)
- 1,197 acres of right-of-way (based upon 60-foot width and 7.3 acres per mile)

5.1.2 Franconia to Mohave Generating Station from the Southeast

The improvements for this 35-mile segment of the route include:

- 35 miles of new main track
- 6 miles of new passing siding track (3 miles each for 2 sidings; 1 siding near the unloading loop at the Mohave Generating Station and 1 near Franconia)
- New connection with BNSF and universal crossover at Franconia
- New control points, interlockings, and modifications to existing CTC signal system at Franconia
- 3 miles for new loop track at coal rotary dumper at Mohave Generating Station
- 52 new bridges totaling an estimated average of 3,450 track-feet in length (one at 500 across Colorado River, 1 at 200 feet, 5 at 100 feet, and 45 at 50 feet or less)
- 30 new highway/railroad at-grade crossings (12 with crossbucks, 16 with flashers and gates, and 2 grade separations)
- 140 new drainage culverts (estimated 4 culverts per mile for new construction)
- Excavation estimated to total 17,500,000 cubic yards of cut and fill (500,000 cubic yards per mile average)
- 256 acres of right-of-way (based upon 60-foot width and 7.3 acres per mile)

5.1.3 West of Needles to Mohave Generating Station from the West

The improvements for this 23-mile segment of the route include:

- 23 miles of new main track
- 6 miles of new passing siding track (3 miles each for 2 sidings; 1 siding near the unloading loop at the Mohave Generating Station and 1 west of Needles)
- New connection with BNSF and universal crossover west of Needles
- New control point, interlocking, and modifications to existing CTC signal system west of Needles
- 3 miles for new loop track at coal rotary dumper at Mohave Generating Station
- 6 new bridges totaling an estimated average of 600-track-feet in length (6 at 100 feet)
- 22 new highway/railroad at-grade crossings (9 with crossbucks, 12 with flashers and gates, and 1 grade separation)
- 92 new drainage culverts (estimated 4 culverts per mile for new construction)
- Excavation estimated to total 11,500,000 cubic yards of cut and fill (500,000 cubic yards per mile average)
- 168 acres of right-of-way (based upon 60-foot width and 7.3 acres per mile)

5.2 EXISTING BNSF RAILWAY

The improvements required for each segment involving existing BNSF Railway Company trackage are listed below.

5.2.1 BNSF Between Winslow and Franconia

The improvements for this 267-mile segment of the route include:

- 30 miles of new third main track and 4 associated universal crossovers (located in conjunction with westbound grades and current congested areas)
- New control points, interlockings, and modifications to existing CTC signal system for new third main track
- Estimated 3 new bridges at 100 feet each for new third main track
- Modifications to estimated 15 highway/railroad crossings for new third main track (average of 1 crossing every 2 miles)

5.2.2 BNSF Between Franconia and New Connection West of Needles

The improvements identified for this 29-mile segment of the route include:

- 2 miles for new siding and universal crossover at Needles
- New control point, interlocking, and modifications to existing CTC signal system at Needles for new siding

In addition, a contract would need to be negotiated with the BNSF for the movement of the coal trains.

5.3 OTHER RAILROAD FACILITIES

The improvements required for Federal Railroad Administration regulations (49 CFR Part 229 for example) and AAR Interchange rules (particularly for wheels, air brakes, and couplers) for routine servicing, inspection, and maintenance of the locomotives and coal cars would include a running inspection and maintenance facility which would consist of a two-track shop with support facilities: one track for two locomotives with a pit and floor jacking work positions and one track for two coal cars with floor jacking work positions. This would require an estimated total of 20,000 square feet of shop floor space. Capability for locomotive fueling and sanding and storage of locomotives and coal cars also will be provided.

5.4 COAL FACILITIES

The improvements required for each segment involving the Black Mesa Complex and the Mohave Generating Station would be a new conveyor belt, storage silo, and flood loader to serve the Black Mesa mining operation and loading of coal trains for the Black Mesa Mine facilities. At the Mohave Generating Station facilities a new rotary coal dumper, stacker, and reclaim facilities would be required, as would a conversion of the Mohave Generating Station to allow the burning of dry coal.

6.0 COST ESTIMATES

The capital costs and annual operating and maintenance (O&M) costs associated with the transportation of coal from the Black Mesa Complex to the Mohave Generating Station are based upon the following:

- All costs are in 2006 U.S. dollars.
- Unit prices for railroad track, facilities, and rolling stock reflect current U.S. railroad industry costs.
- Annual O&M cost estimates include all labor and non-labor (parts, materials, supplies, contracts, rentals, leases, insurance, shipping, fees, etc.) associated with railroad operations and maintenance for the transportation of coal from the Black Mesa Complex to the Mohave Generating Station. Annual O&M costs for the Black Mesa Complex and the Mohave Generating Station are not included.

6.1 APPROACH FOR DEVELOPING THE COST ESTIMATE

The cost estimates provided in this technical memorandum are based upon the best data that were available within the time and resources allocated. The unit costs used in this technical memorandum are the same as those used on other similar recent railroad projects.

Realizing that the project is in the Draft EIS stage and that only conceptual engineering (conceptual planning) would be available, the concept for developing the railroad cost estimate included the following considerations:

- The topography and sensitive environment encountered along the route in Arizona and Nevada will make new construction more expensive than if it were built in existing railroad right-of-way;
- Of the total route mileage (466 miles for the eastern approach or 483 miles for the western approach to the Mohave Generating Station), new construction would be required for 199 miles (east approach) or 187 miles (west approach);
- The existing BNSF segment is double track with CTC signaling with an average of almost 100 trains per day – which is essentially the capacity of the line;
- Current BNSF main line track design and standards would be used;
- Unit costs would be based upon current railroad and railroad contractor costs; and
- The new construction would be performed by qualified track and signal contractors rather than by BNSF forces due to the extent of the trackage and the fact that it would not become BNSF track once it was constructed.

A review of the 1993 phase two study (USDI 1993) produced very little detail for the basis of the capital and annual operating cost estimates. Major cost categories were simply listed as a dollar cost in tables with little or no detail as to what items or quantities were actually included in the cost. In other instances, data such as average train speed were based on two mid-western coal hauls rather than on the conditions that exist over the BNSF route in Arizona. Therefore, it is not possible to know exactly what was, or was not, included in the estimated costs other than a few quantities and unit costs for major cost categories. It also must be noted that the 2006 cost estimate is based on extending the rail line for approximately an additional 3 miles to the Black Mesa Mine loadout area rather than just to Cow Springs as contained in the 1993 study. Given inflation over the 13 years between the 1993 phase two study and this 2006 Technical Memorandum, it should be expected that capital costs would increase significantly. This becomes even more pronounced if the 1993 cost estimates were low in some cases (e.g., the amount of track and cut and fill, number of bridges, or the fee per ton mile as mentioned on page A-95 of the 1993 Phase Two Study), if conditions have changed (e.g., traffic over the Santa Fe increased significantly since the merger with BNSF which it has), which now requires additional capacity improvements, or if some cost items were inadvertently left out of the estimate (e.g., spare rolling stock, servicing and maintenance facilities, and railroad signaling).

The Association of American Railroad (AAR) Railroad Facts, 2004 Edition was used for developing annual operating cost. The book contains various statistics for the railroad industry for 2003. The average operating expense and operating revenue for the BNSF were used to establish a cost per ton-mile estimate for the Black Mesa Project. Based upon the BNSF data shown on page 70 of the AAR Facts Book, a cost of $0.0153 per ton-mile was calculated for operating expenses and $0.0032 per ton-mile was calculated for revenue for the BNSF for their portion of the haul. From the AAR Railroad Facts Book, operating expense includes transportation (train crews, fuel, etc.), equipment (maintenance of such as locomotives and cars), way and structures (maintenance of track, bridges, signaling, etc.), and general and administrative expenses.

The calculations resulting in the requirement for three train sets are based on the number of trains per year, operating days per year, and the total round trip time. Please note, too, that four locomotives were used for trains of 125 cars rather than three locomotives per 100-car train stated in the 1993 report.

The pipeline costs are current and were provided by Peabody from data calculated for the EIS.

The implied 9.4429 is the annualized factor for an expected project life of 16 years and a 7 percent inflation factor in accordance with the Federal Transit Authority annualization factors revised as of January 21, 2005.

The estimate of 24 percent for design, construction management, etc., and other such costs reflect total engineering (preliminary and final) costs, bid-related costs, construction management, contractor mobilization, permitting, environmental evaluations, and owner-related costs for the design and construction process. A contingency factor of 20 percent reflects the fact that very little engineering has been done for the project. Typically, these costs can range from 20 percent to 50 percent for project estimates. A Class 1 railroad project would normally incur less cost because the design would proceed to final engineering quickly and the design and construction management would be accomplished in-house.

The $1,056,000 per mile ($200 per track foot) for new track construction is based on heavy-haul track including 12 inches of crushed rock sub-ballast, 12 inches of crushed rock ballast, concrete ties, and 141# rail section. This estimate is compatible with recent estimates approved or provided by Class 1 western railroads for new construction (e.g., $900,000 per mile for track with 136# rail section). The estimate excludes turnouts, which were priced separately for the project. The unit costs for turnouts also were provided by the Class 1 western railroads.

The $792,000 per mile ($150 per track foot) for new CTC signaling includes switch machines, communications, a new or modified dispatching center, wayside signal masts, signal aspects, track circuits, bungalows, and all other CTC related hardware and systems except for control points and interlockings. The cost for the installation of new control points and interlockings varies depending on the complexity of the train operations involved.

The estimates for the bridges are based on various estimates for recent Class 1 railroad and Amtrak projects. Because no engineering was available and because the cost of bridges varies depending on the length and height, the estimates used represent a "rule of thumb" cost. These unit costs for bridges are commonly used by the engineering consultant industry for planning and EIS studies.

The earthwork estimates were made without benefit of engineering drawings. Given the tendency for flash flooding in Arizona, the slopes for cut and fill will be important. The unit cost of $1,000,000 per mile for earthwork for a single track is equivalent to approximately $190 per track foot or the moving of approximately 9 to 12 cubic yards of material per track foot at $15 to $20 per cubic yard. The $15 to $20 per cubic yard for earthwork is based on a Class1 western railroad project in mountainous desert topography. (See Figure E-1 for a profile of the railroad elevations at key locations along the route.)

The average cost per mile for various segments of this project ranges from $0.3 million per mile over existing BNSF trackage to $6.8 million per mile for new construction in the vicinity of the Mohave Generating Station. The overall average for the project is $2.6 million per mile for the eastern approach and $2.3 million per mile for the western approach. These costs appear to be reasonable in light of the above costs and the fact that the cost for rail and signaling has increased significantly in the last 5 years.

The cost for coal facilities including loading, unloading, and conversion to dry coal, were provided by Peabody and SCE. The cost for coal facilities is independent of the route for the coal movement as such facilities are located at the mine and the generating station.

6.2 CAPITAL COST ESTIMATES

The estimated capital costs including design, construction, and contingency related costs associated with new railroad construction, the existing BNSF Railway trackage, and the railroad locomotives and coal cars are shown in the subsections below. Right-of-way and financing costs are not included.

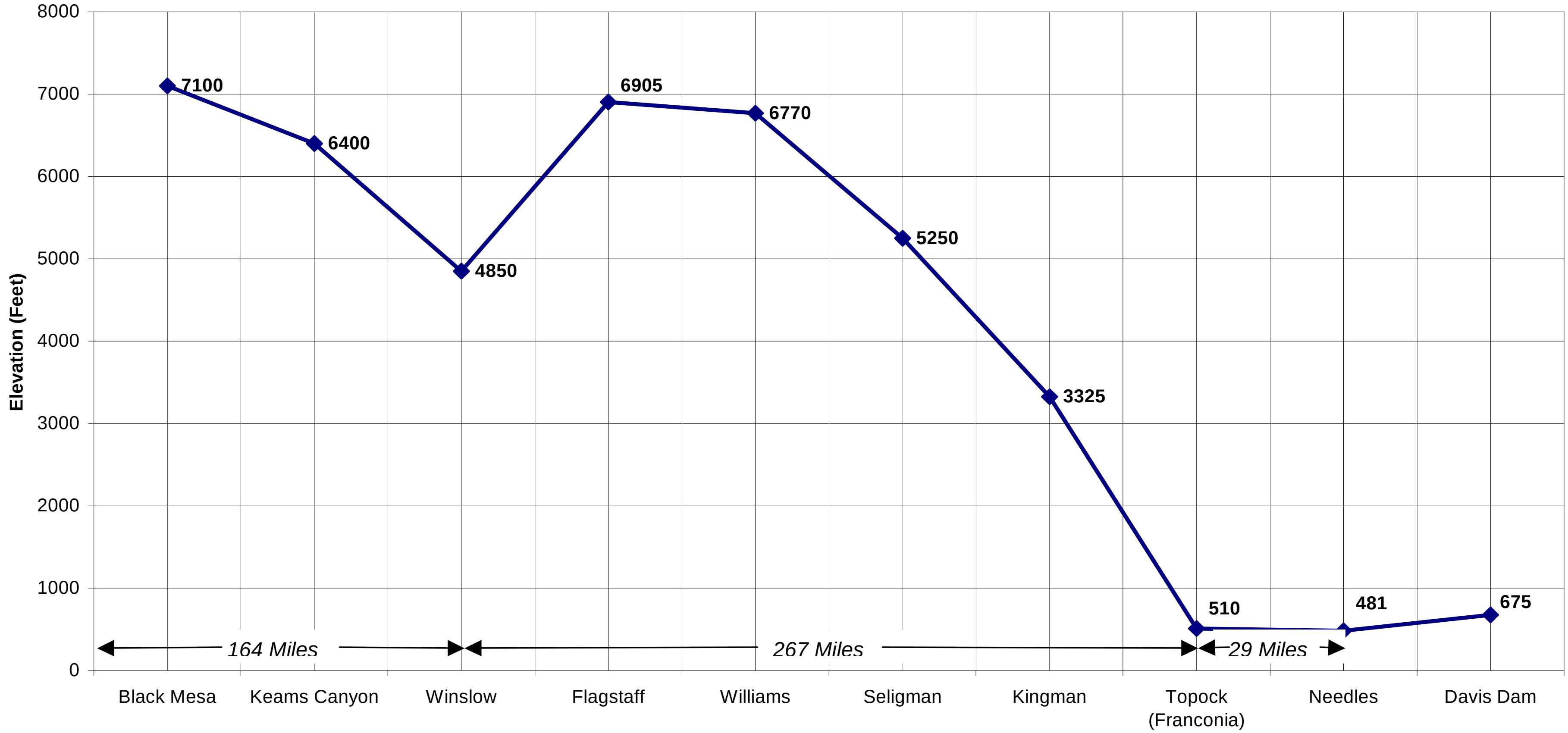
6.2.1 New Railroad Construction

The capital cost estimates including design, construction, and contingency related costs for new railroad construction include the alternative segments between the Black Mesa Complex and the BNSF at Winslow, Arizona; the BNSF at Franconia, Arizona, and the Mohave Generating Station from the east; and the BNSF at Franconia, Arizona, and the Mohave Generating Station from the west by way of Needles, California. A summary of the estimated capital cost for each of these alternatives is outlined in Table E-3.

Table E-3 Estimated Capital Cost for Each Alternative

Alternative Segment	Route Miles	Capital Cost (millions)	Average Cost per Mile (millions)
Black Mesa Complex to BNSF at Winslow	164	$ 821.1	$ 5.0
BNSF at Franconia to Mohave Generating Station from the east	35	$230.1	$ 6.6
BNSF at Franconia to Mohave Generating Station via Needles and the west	23	$156.6	$6.8

Figure E-1: Black Mesa Project EIS Railroad Elevations



The details for each of the capital cost estimates are shown in the applicable rows of Tables 1 through 3 in the Appendix.

6.2.2 Existing BNSF Railway

The estimated capital costs including design, construction, and contingency related costs for the alternative segments of the existing BNSF Railway Company include the line between Winslow and Franconia and Franconia and a point 3 or 4 miles west of Needles. A summary of the estimated capital cost for each of these alternatives is described in Table E-4.

Table E-4 Estimated Capital Cost for Each Alternative

Alternative Segment	Route Miles	Capital Cost (millions)	Average Cost per Mile (millions)
BNSF at Winslow to Franconia	267	$141.0	$0.5
BNSF at Franconia to west of Needles	29	$9.7	$0.3

The details for each of the capital cost estimates are shown in the applicable rows of Tables 4 and 5 of the Appendix.

6.2.3 Railroad Rolling Stock

The estimated capital cost for the locomotives and coal cars required to transport coal from the Black Mesa Complex to the Mohave Generating Station are described in Table E-5. Contingency and other related costs are normally not added to the basic cost of rolling stock.

Table E-5 Estimated Capital Cost

Rolling Stock	Quantity	Unit Price	Total Cost (millions)
Diesel Locomotives	12	$2,500,000	$30.0
Coal Gondolas	375	$100,000	$37.5
Total			***$67.5***
Less salvage value at 16 years of 25 year life		***$12.5***	***$55.0***

6.2.4 Coal Facilities

The estimated capital costs for new coal loading and unloading facilities are taken from the Peabody Corporation Mohave Power Plant Coal Conversion Study, March 2003, by Burns & McDonnell and SCE (personal communication with L. Johnson, September 19, 2005). The capital cost estimates for the conversion of the Mohave Generating Station to dry coal are from the Southern California Edison Company provided on February 3, 2006. The cost estimates, including design, construction management, etc. and contingency related costs are:

- $50.0 million for coal loading facilities at the Black Mesa mining operation
- $95.1 million for coal unloading facilities at Mohave Generating Station
- $99.1 million for conversion to dry coal
- $145.1 million for design, construction management, contingency, etc.
- **$389.3 million total**

Use of dry coal at the Mohave Generating Station is not allowed under the station's existing Title V air quality permit and would require the facility to undergo New Source Review under the Clean Air Act. This could result in a change in operations or the installation of additional air-pollution-control equipment to meet Best Achievable Control Technology Standards. The cost of any such additional air-pollution-control equipment or changes in operations required by air permitting activities have not been included in these cost estimates.

6.2.5 Total Estimated Capital Cost Summary

The capital costs can be combined into the total estimated cost for each of two railroad alternatives. One alternative involves access to the Mohave Generating Station from the east and one alternative involves access to the Mohave Generating Station from the west. The estimated capital cost for each of the two combinations of alternative segments are summarized in Table E-6.

Table E-6 Estimated Capital Cost for Each Alternative

Alternative Segment	Route Miles	Capital Cost (millions)	Average Cost per mile (millions)
Black Mesa Complex to Mohave Generating Station from the east	**466**		
Excluding rolling stock and coal facilities		$1,192.2	$2.6
Including rolling stock, excluding coal facilities		$1,247.2	$ 2.7
Including rolling stock and coal facilities		**$1,636.5**	**$3.5**
Black Mesa Complex to Mohave Generating Station from the west	**483**		
Excluding rolling stock and coal facilities		$1,128.4	$2.3
Including rolling stock, excluding coal facilities		$1,183.4	$2.5
Including rolling stock and coal facilities		**$1,572.7**	**$3.3**

6.3 ANNUAL OPERATING COST ESTIMATES

The estimated annual operating and maintenance costs for each of the two potential alternatives are based upon BNSF cost data from the AAR Railroad Facts Book, 2004 Edition, page 70, as follows:

- Annual operating expense of $0.015 per revenue ton-mile
- Annual operating revenue to BNSF of $0.0032 per revenue ton-mile (operating revenue of $0.0185 per ton-mile minus operating expense of $0.0153 per ton-mile).

6.3.1 Black Mesa Complex to Mohave Generating Station via Franconia and from the East

For this alternative, the pertinent annual operating statistics are as follows:

- 2,518,730,000 revenue ton-miles (376 trains times 466 miles times 14,375 tons per train)
- 1,443,135,000 revenue ton-miles (376 trains times 14,375 tons per train times 267 miles on BNSF)

The annual O&M cost for this alternative is estimated to be:

- $38.5 million for operations expense
- $4.6 million for BNSF coal transportation revenue
- **$43.1 million total**

6.3.2 Black Mesa Complex to Mohave Generating Station via Franconia and from the West

For this alternative, the pertinent annual operating statistics are as follows:

- 2,610,615,000 revenue ton-miles (376 trains times 14,375 tons per train times 483 miles)
- 1,599,880,000 revenue ton-miles over BNSF (376 trains times 14,375 tons per train times 296 miles over BNSF)

The annual O&M cost for this alternative is estimated to be:

- $39.9 million for operations expense
- $5.1 million for BNSF coal transportation revenue
- **$45.0 million total**

6.4 ANNUALIZED COST PER TON OF COAL

The annualized cost per ton of coal is calculated from the annualized capital and O&M costs divided by the annual coal tonnage. The annualization factors are based upon the 16-year life expectancy of the coal operation and annualized factors used by the Federal Transit Administration. The details for the annualized cost per ton of coal are shown in Table 6 (in the Appendix) for the east approach alternative to the Mohave Generating Station and Table 7 (in the Appendix) for the west approach alternative to the Mohave Generating Station. The annualized cost per ton of coal for each of the two alternatives is as follows:

- $40.07 for the east approach alternative
- $39.18 for the west approach alternative

APPENDIX

ANNUALIZED COST PER TON OF COAL

TABLES

TABLE 1

RAILROAD LINE: Black Mesa Mine to BNSF at Winslow					164	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	$580,800	$0	
2	New track, 141# CWR, Conc. Ties	179	Mile	$1,056,000	$189,024,000	164 main + 12 siding + 3 loop
3	Upgrade track to Class 3 (60 mph)		Mile	$264,000	$0	
4	Upgrade track to Class 4 (79 mph)		Mile	$528,000	$0	
5					$0	
6					$0	
7	Line and surface track		Mile	$6,000	$0	
8	Grind rail head contour		Mile	$12,000	$0	
9	New turnout, #10		Each	$125,000	$0	
10	New turnout, #20	9	Each	$200,000	$1,800,000	4 sidings on coal line + loop
11	New turnout, #24	1	Each	$250,000	$250,000	BNSF connection at Winslow
12	#24 Universal Crossover	1	Each	$1,000,000	$1,000,000	Pair of crossovers (4 turnouts)
13					$0	
14	New railroad diamond crossing		Each	$500,000	$0	
15	Rebuild turnout or diamond		Each	$75,000	$0	
16					$0	
17	New railroad interlocking	1	Each	$1,000,000	$1,000,000	At Winslow
18	Modify railroad interlocking	1	Mile	$700,000	$700,000	At Winslow
19	New CTC signaling system		Mile	$792,000	$0	
20	Upgrade railroad signal system		Mile	$500,000	$0	
21					$0	
22	New highway crossing, quad gates		Each	$250,000	$0	
23	New highway crossing w/ gates	5	Each	$150,000	$750,000	
24	New highway crossing w/ flashers	43	Each	$100,000	$4,300,000	
25	New highway crossing w/crossbucks	82	Each	$2,500	$205,000	Also includes stop signs
26	Upgrade/modify highway crossing		Each	$75,000	$0	
27					$0	
28	Highway/railroad grade separation		Each	$8,000,000	$0	
29	New bridge, stl/conc, over 300'		Trk Ft	$5,000	$0	
30	New bridge, stl/conc, 200' to 300'	2400	Trk Ft	$4,500	$10,800,000	11 bridges
31	New bridge, stl/conc, 100' to 199'	3000	Trk Ft	$4,000	$12,000,000	29 bridges
32	New bridge, stl/conc, up to 99'	1500	Trk Ft	$3,000	$4,500,000	29 bridges
33	Rehabilitate existing bridge		Trk Ft	$1,500	$0	
34					$0	
35	New culvert	656	Each	$15,000	$9,840,000	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	$5,000	$0	
37					$0	
38	Earthwork, 1 track, basic		Mile	$500,000	$0	
39	Earthwork, 1 track, significant		Mile	$1,000,000	$0	
40	Earthwork, 1 track, major		Mile	$1,500,000	$0	
41					$0	
42	Earthwork, 2 tracks, basic		Mile	$750,000	$0	
43	Earthwork, 2 tracks, significant	179	Mile	$1,800,000	$322,200,000	Approx 600,000 CY / mile
44	Earthwork, 2 tracks, major		Mile	$2,500,000	$0	
45					$0	
46	Retaining wall, 1 side up to 10' high	28354	LF	$200	$5,670,800	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side,11' to 20' high		LF	$500	$0	Est. at 5% of items 40 and 44
48					$0	
49					$0	
50					$0	
	Subtotal and average cost per mile				$564,039,800	$3,439,267

TABLE 1 Continued

RAILROAD LINE: Black Mesa Mine to BNSF at Winslow					164	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		$0	At Black Mesa Mine load-out
52	Conveyor Belt Syatem		LS		$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		$0	At Mohave Generating Station
55	Conversion to burn dry coal		LS		$0	At Mohave Generating Station
56	Running Inspection/Service Facility		SF	$400	$0	
57	Maintenance and Repair Facility		LS	$500	$0	
58					$0	
59	Right-of-way allowance	1197	Acre	$1,000	$1,197,000	7.3 acres / mile (60' wide)
60					$0	
61	Environmental mitigation	33	Mile	$100,000	$3,300,000	20% of rail miles
62					$0	
63	Utilities allowance	17	Mile	$100,000	$1,700,000	10% of rail miles
64					$0	
65					$0	
66					$0	
67					$0	
68					$0	
69					$0	
70					$0	
	Subtotal and average cost per mile				$6,197,000	$37,787
	Total and Average Cost per Mile				**$570,236,800**	**$3,477,054**
71	Design, Construction Management, Etc.		24%		$136,856,832	
72	Contingency		20%		$114,047,360	
73						
	Subtotal and average cost per mile				$250,904,192	$1,529,904
74	New Locomotive		Each	$2,500,000	$0	
75	New Coal Gondola (rotary dump)		Each	$100,000	$0	
76					$0	
77					$0	
	Subtotal and average cost per mile				$0	$0
	Grand Total and Average Cost per Mile				**$821,140,992**	**$5,006,957**

TABLE 2

RAILROAD LINE: BNSF- Franconia to Mohave Generating Station from East					35	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	$580,800	$0	
2	New track, 141# CWR, Conc. Ties	44	Mile	$1,056,000	$46,464,000	35 main + 6 siding + 3 loop
3	Upgrade track to Class 3 (60 mph)		Mile	$264,000	$0	
4	Upgrade track to Class 4 (79 mph)		Mile	$528,000	$0	
5					$0	
6					$0	
7	Line and surface track		Mile	$6,000	$0	
8	Grind rail head contour		Mile	$12,000	$0	
9	New turnout, #10		Each	$125,000	$0	
10	New turnout, #20	4	Each	$200,000	$800,000	2 sidings on coal line
11	New turnout, #24	1	Each	$250,000	$250,000	BNSF connection at Franconia
12	#24 Universal Crossover	1	Each	$1,000,000	$1,000,000	Pair of crossovers (4 turnouts)
13					$0	
14	New railroad diamond crossing		Each	$500,000	$0	
15	Rebuild turnout or diamond		Each	$75,000	$0	
16					$0	
17	New railroad interlocking	1	Each	$1,000,000	$1,000,000	At Franconia
18	Modify railroad interlocking		Mile	$700,000	$0	
19	New CTC signaling system		Mile	$792,000	$0	
20	Upgrade railroad signal system		Mile	$500,000	$0	
21					$0	
22	New highway crossing, quad gates		Each	$250,000	$0	
23	New highway crossing w/ gates	16	Each	$150,000	$2,400,000	
24	New highway crossing w/ flashers		Each	$100,000	$0	
25	New highway crossing w/crossbucks	12	Each	$2,500	$30,000	Also includes stop signs
26	Upgrade/modify highway crossing		Each	$75,000	$0	
27					$0	
28	Highway/railroad grade separation	2	Each	$8,000,000	$16,000,000	I-40 and Hwy 95
29	New bridge, stl/conc, over 300'	500	Trk Ft	$5,000	$2,500,000	Colorado River bridge
30	New bridge, stl/conc, 200' to 300'	200	Trk Ft	$4,500	$900,000	1 bridge
31	New bridge, stl/conc, 100' to 199'	500	Trk Ft	$4,000	$2,000,000	5 bridges
32	New bridge, stl/conc, up to 99'	2250	Trk Ft	$3,000	$6,750,000	45 bridges
33	Rehabilitate existing bridge		Trk Ft	$1,500	$0	
34					$0	
35	New culvert	140	Each	$15,000	$2,100,000	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	$5,000	$0	
37					$0	
38	Earthwork, 1 track, basic		Mile	$500,000	$0	
39	Earthwork, 1 track, significant		Mile	$1,000,000	$0	
40	Earthwork, 1 track, major		Mile	$1,500,000	$0	
41					$0	
42	Earthwork, 2 tracks, basic		Mile	$750,000	$0	
43	Earthwork, 2 tracks, significant	44	Mile	$1,500,000	$66,000,000	Approx 500,000 CY / mile
44	Earthwork, 2 tracks, major		Mile	$2,500,000	$0	
45					$0	
46	Retaining wall, 1 side up to 10' high	6970	LF	$200	$1,394,000	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side,11' to 20' high		LF	$500	$0	Est. at 5% of items 40 and 44
48					$0	
49					$0	
50					$0	
	Subtotal and average cost per mile				$149,588,000	$4,273,943

TABLE 2 Continued

RAILROAD LINE: BNSF- Franconia to Mohave Generating Station from East					35	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		$0	At Black Mesa Mine load-out
52	Conveyor Belt Syatem		LS		$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		$0	At Mohave Generating Station
55	Conversion to burn dry coal		LS		$0	At Mohave Generating Station
56	Running Inspection/Service Facility	20000	SF	$400	$8,000,000	At Needles or Franconia
57	Maintenance and Repair Facility		LS	$500	$0	
58					$0	
59	Right-of-way allowance	256	Acre	$5,000	$1,280,000	7.3 acres / mile (60' wide)
60					$0	
61	Environmental mitigation	4.4	Mile	$100,000	$440,000	10% of rail miles
62					$0	
63	Utilities allowance	4.4	Mile	$100,000	$440,000	10% of rail miles
64					$0	
65					$0	
66					$0	
67					$0	
68					$0	
69					$0	
70					$0	
	Subtotal and average cost per mile				$10,160,000	$290,286
	Total and Average Cost per Mile				**$159,748,000**	**$4,564,229**
71	Design, Construction Management, Etc.		24%		$38,339,520	
72	Contingency		20%		$31,949,600	
73						
	Subtotal and average cost per mile				$70,289,120	$2,008,261
74	New Locomotive		Each	$2,500,000	$0	
75	New Coal Gondola (rotary dump)		Each	$100,000	$0	
76					$0	
77					$0	
	Subtotal and average cost per mile				$0	$0
	Grand Total and Average Cost per Mile				**$230,037,120**	**$6,572,489**

TABLE 3

RAILROAD: BNSF- West Needles to Mohave Generating Station from West					23	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	$580,800	$0	
2	New track, 141# CWR, Conc. Ties	32	Mile	$1,056,000	$33,792,000	23 main + 6 siding + 3 loop
3	Upgrade track to Class 3 (60 mph)		Mile	$264,000	$0	
4	Upgrade track to Class 4 (79 mph)		Mile	$528,000	$0	
5					$0	
6					$0	
7	Line and surface track		Mile	$6,000	$0	
8	Grind rail head contour		Mile	$12,000	$0	
9	New turnout, #10		Each	$125,000	$0	
10	New turnout, #20	4	Each	$200,000	$800,000	2 sidings on coal line
11	New turnout, #24	1	Each	$250,000	$250,000	BNSF connection at W Needles
12	#24 Universal Crossover	1	Each	$1,000,000	$1,000,000	Pair of crossovers (4 turnouts)
13					$0	
14	New railroad diamond crossing		Each	$500,000	$0	
15	Rebuild turnout or diamond		Each	$75,000	$0	
16					$0	
17	New railroad interlocking	1	Each	$1,000,000	$1,000,000	West of Needles
18	Modify railroad interlocking		Mile	$700,000	$0	
19	New CTC signaling system		Mile	$792,000	$0	
20	Upgrade railroad signal system		Mile	$500,000	$0	
21					$0	
22	New highway crossing, quad gates		Each	$250,000	$0	
23	New highway crossing w/ gates	12	Each	$150,000	$1,800,000	
24	New highway crossing w/ flashers		Each	$100,000	$0	
25	New highway crossing w/crossbucks	9	Each	$2,500	$22,500	Also includes stop signs
26	Upgrade/modify highway crossing		Each	$75,000	$0	
27					$0	
28	Highway/railroad grade separation	1	Each	$8,000,000	$8,000,000	Highway 95
29	New bridge, stl/conc, over 300'		Trk Ft	$5,000	$0	
30	New bridge, stl/conc, 200' to 300'		Trk Ft	$4,500	$0	
31	New bridge, stl/conc, 100' to 199'	600	Trk Ft	$4,000	$2,400,000	6 bridges
32	New bridge, stl/conc, up to 99'		Trk Ft	$3,000	$0	
33	Rehabilitate existing bridge		Trk Ft	$1,500	$0	
34					$0	
35	New culvert	92	Each	$15,000	$1,380,000	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	$5,000	$0	
37					$0	
38	Earthwork, 1 track, basic		Mile	$500,000	$0	
39	Earthwork, 1 track, significant		Mile	$1,000,000	$0	
40	Earthwork, 1 track, major		Mile	$1,500,000	$0	
41					$0	
42	Earthwork, 2 tracks, basic		Mile	$750,000	$0	
43	Earthwork, 2 tracks, significant	32	Mile	$1,500,000	$48,000,000	Approx 500,000 CY / mile
44	Earthwork, 2 tracks, major		Mile	$2,500,000	$0	
45					$0	
46	Retaining wall, 1 side up to 10' high	5069	LF	$200	$1,013,800	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side,11' to 20' high		LF	$500	$0	Est. at 5% of items 40 and 44
48					$0	
49					$0	
50					$0	
	Subtotal and average cost per mile				$99,458,300	$4,324,274

TABLE 3 Continued

Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
RAILROAD: BNSF- West Needles to Mohave Generating Station from West					23	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		$0	At Black Mesa Mine load-out
52	Conveyor Belt Syatem		LS		$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		$0	At Mohave Generating Station
55	Conversion to burn dry coal		LS		$0	At Mohave Generating Station
56	Running Inspection/Service Facility	20000	SF	$400	$8,000,000	At Needles
57	Maintenance and Repair Facility		LS	$500	$0	
58					$0	
59	Right-of-way allowance	168	Acre	$5,000	$840,000	7.3 acres / mile (60' wide)
60					$0	
61	Environmental mitigation	2.3	Mile	$100,000	$230,000	10% of rail miles
62					$0	
63	Utilities allowance	2.3	Mile	$100,000	$230,000	10% of rail miles
64					$0	
65					$0	
66					$0	
67					$0	
68					$0	
69					$0	
70					$0	
	Subtotal and average cost per mile				$9,300,000	$404,348
	Total and Average Cost per Mile				**$108,758,300**	**$4,728,622**
71	Design, Construction Management, Etc.		24%		$26,101,992	
72	Contingency		20%		$21,751,660	
73						
	Subtotal and average cost per mile				$47,853,652	$2,080,594
74	New Locomotive		Each	$2,500,000	$0	
75	New Coal Gondola (rotary dump)		Each	$100,000	$0	
76					$0	
77					$0	
	Subtotal and average cost per mile				$0	$0
	Grand Total and Average Cost per Mile				**$156,611,952**	**$6,809,215**

TABLE 4

RAILROAD LINE: BNSF - Winslow to Franconia					267	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	$580,800	$0	
2	New track, 141# CWR, Conc. Ties	30	Mile	$1,056,000	$31,680,000	Third main track
3	Upgrade track to Class 3 (60 mph)		Mile	$264,000	$0	
4	Upgrade track to Class 4 (79 mph)		Mile	$528,000	$0	
5					$0	
6					$0	
7	Line and surface track		Mile	$6,000	$0	
8	Grind rail head contour		Mile	$12,000	$0	
9	New turnout, #10		Each	$125,000	$0	
10	New turnout, #20		Each	$200,000	$0	
11	New turnout, #24		Each	$250,000	$0	
12	#24 Universal Crossover	4	Each	$1,000,000	$4,000,000	Pair of crossovers (4 turnouts)
13					$0	
14	New railroad diamond crossing		Each	$500,000	$0	
15	Rebuild turnout or diamond		Each	$75,000	$0	
16					$0	
17	New railroad interlocking	4	Each	$1,000,000	$4,000,000	At universal crossovers
18	Modify railroad interlocking		Mile	$700,000	$0	
19	New CTC signaling system	30	Mile	$792,000	$23,760,000	
20	Upgrade railroad signal system		Mile	$500,000	$0	
21					$0	
22	New highway crossing, quad gates		Each	$250,000	$0	
23	New highway crossing w/ gates		Each	$150,000	$0	
24	New highway crossing w/ flashers		Each	$100,000	$0	
25	New highway crossing w/crossbucks		Each	$2,500	$0	Also includes stop signs
26	Upgrade/modify highway crossing	15	Each	$75,000	$1,125,000	Third main track, 1 per 2 miles
27					$0	
28	Highway/railroad grade separation		Each	$8,000,000	$0	
29	New bridge, stl/conc, over 300'		Trk Ft	$5,000	$0	
30	New bridge, stl/conc, 200' to 300'		Trk Ft	$4,500	$0	
31	New bridge, stl/conc, 100' to 199'	300	Trk Ft	$4,000	$1,200,000	3 bridges for new third main
32	New bridge, stl/conc, up to 99'		Trk Ft	$3,000	$0	
33	Rehabilitate existing bridge		Trk Ft	$1,500	$0	
34					$0	
35	New culvert		Each	$15,000	$0	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	$5,000	$0	
37					$0	
38	Earthwork, 1 track, basic		Mile	$500,000	$0	
39	Earthwork, 1 track, significant	30	Mile	$1,000,000	$30,000,000	
40	Earthwork, 1 track, major		Mile	$1,500,000	$0	
41					$0	
42	Earthwork, 2 tracks, basic		Mile	$750,000	$0	
43	Earthwork, 2 tracks, significant		Mile	$1,500,000	$0	
44	Earthwork, 2 tracks, major		Mile	$2,500,000	$0	
45					$0	
46	Retaining wall, 1 side up to 10' high	4752	LF	$200	$950,400	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side,11' to 20' high		LF	$500	$0	Est. at 5% of items 40 and 44
48					$0	
49					$0	
50					$0	
	Subtotal and average cost per mile				$96,715,400	$362,230

TABLE 4 Continued

RAILROAD LINE: BNSF - Winslow to Franconia					267	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		$0	At Black Mesa Mine load-out
52	Conveyor Belt Syatem		LS		$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		$0	At Mohave Generating Station
55					$0	
56	Running Inspection/Service Facility		SF	$400	$0	
57	Maintenance and Repair Facility		LS	$500	$0	
58					$0	
59	Right-of-way allowance		Acre	$1,000	$0	7.3 acres / mile (60' wide)
60					$0	
61	Environmental mitigation	6	Mile	$100,000	$600,000	20% of new track mileage
62					$0	
63	Utilities allowance	6	Mile	$100,000	$600,000	20% of new track mileage
64					$0	
65					$0	
66					$0	
67					$0	
68					$0	
69					$0	
70					$0	
	Subtotal and average cost per mile				$1,200,000	$4,494
	Total and Average Cost per Mile				**$97,915,400**	**$366,724**
71	Design, Construction Management, Etc.		24%		$23,499,696	
72	Contingency		20%		$19,583,080	
73						
	Subtotal and average cost per mile				$43,082,776	$161,359
74	New Locomotive		Each	$2,500,000	$0	
75	New Coal Gondola (rotary dump)		Each	$100,000	$0	
76					$0	
77					$0	
	Subtotal and average cost per mile				$0	$0
	Grand Total and Average Cost per Mile				**$140,998,176**	**$528,083**

TABLE 5

RAILROAD LINE: BNSF - Franconia to West of Needles					29	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
1	New track, 115# CWR, Wood Ties		Mile	$580,800	$0	
2	New track, 141# CWR, Conc. Ties	2	Mile	$1,056,000	$2,112,000	New siding at Needles
3	Upgrade track to Class 3 (60 mph)		Mile	$264,000	$0	
4	Upgrade track to Class 4 (79 mph)		Mile	$528,000	$0	
5					$0	
6					$0	
7	Line and surface track		Mile	$6,000	$0	
8	Grind rail head contour		Mile	$12,000	$0	
9	New turnout, #10		Each	$125,000	$0	
10	New turnout, #20		Each	$200,000	$0	
11	New turnout, #24		Each	$250,000	$0	
12	#24 Universal Crossover	2	Each	$1,000,000	$2,000,000	Pair of crossovers (4 turnouts)
13					$0	
14	New railroad diamond crossing		Each	$500,000	$0	
15	Rebuild turnout or diamond		Each	$75,000	$0	
16					$0	
17	New railroad interlocking		Each	$1,000,000	$0	
18	Modify railroad interlocking	2	Mile	$700,000	$1,400,000	At new Needles siding
19	New CTC signaling system		Mile	$792,000	$0	
20	Upgrade railroad signal system		Mile	$500,000	$0	
21					$0	
22	New highway crossing, quad gates		Each	$250,000	$0	
23	New highway crossing w/ gates		Each	$150,000	$0	
24	New highway crossing w/ flashers		Each	$100,000	$0	
25	New highway crossing w/crossbucks		Each	$2,500	$0	Also includes stop signs
26	Upgrade/modify highway crossing		Each	$75,000	$0	
27					$0	
28	Highway/railroad grade separation		Each	$8,000,000	$0	
29	New bridge, stl/conc, over 300'		Trk Ft	$5,000	$0	
30	New bridge, stl/conc, 200' to 300'		Trk Ft	$4,500	$0	
31	New bridge, stl/conc, 100' to 199'		Trk Ft	$4,000	$0	
32	New bridge, stl/conc, up to 99'		Trk Ft	$3,000	$0	
33	Rehabilitate existing bridge		Trk Ft	$1,500	$0	
34					$0	
35	New culvert		Each	$15,000	$0	Estimated at 4 per mile
36	Clean and rehabilitate culvert		Each	$5,000	$0	
37					$0	
38	Earthwork, 1 track, basic	2	Mile	$500,000	$1,000,000	New siding at Needles
39	Earthwork, 1 track, significant		Mile	$1,000,000	$0	
40	Earthwork, 1 track, major		Mile	$1,500,000	$0	
41					$0	
42	Earthwork, 2 tracks, basic		Mile	$750,000	$0	
43	Earthwork, 2 tracks, significant		Mile	$1,500,000	$0	
44	Earthwork, 2 tracks, major		Mile	$2,500,000	$0	
45					$0	
46	Retaining wall, 1 side up to 10' high		LF	$200	$0	Est. at 3% of items 39 and 43
47	Retaining wall, 1 side,11' to 20' high		LF	$500	$0	Est. at 5% of items 40 and 44
48					$0	
49					$0	
50					$0	
	Subtotal and average cost per mile				$6,512,000	$224,552

TABLE 5 Continued

RAILROAD LINE: BNSF - Franconia to West of Needles					29	Route Miles
Item	Cost Category	Quantity	Unit	Unit Cost	Total Cost	Remarks
51	Coal Loadout/Silo Facility		LS		$0	At Black Mesa Mine load-out
52	Conveyor Belt Syatem		LS		$0	Black Mesa Mine to load-out
53	Rotary Dump Facility		LS		$0	At Mohave Generating Station
54	Coal Stacker/Reclaim Facility		LS		$0	At Mohave Generating Station
55					$0	
56	Running Inspection/Service Facility		SF	$400	$0	
57	Maintenance and Repair Facility		LS	$500	$0	
58					$0	
59	Right-of-way allowance		Acre	$1,000	$0	7.3 acres / mile (60' wide)
60					$0	
61	Environmental mitigation		Mile	$100,000	$0	
62					$0	
63	Utilities allowance	2	Mile	$100,000	$200,000	
64					$0	
65					$0	
66					$0	
67					$0	
68					$0	
69					$0	
70					$0	
	Subtotal and average cost per mile				$200,000	$6,897
	Total and Average Cost per Mile				**$6,712,000**	**$231,448**
71	Design, Construction Management, Etc.		24%		$1,610,880	
72	Contingency		20%		$1,342,400	
73						
	Subtotal and average cost per mile				$2,953,280	$101,837
74	New Locomotive		Each	$2,500,000	$0	
75	New Coal Gondola (rotary dump)		Each	$100,000	$0	
76					$0	
77					$0	
	Subtotal and average cost per mile				$0	$0
	Grand Total and Average Cost per Mile				**$9,665,280**	**$333,286**

Table 6 - Black Mesa Project: Railroad Alternative - Black Mesa Mine to Mohave Generating Station From East

Annualized Capital and Operating Cost
Category Annual Coal Tonnage: 5,400,000

Cost Category	Useful Life (yr)	Annualization Factor	Railroad Total Cost ($mil)	Contingency 44% ($mil)	Total Capital Cost Incl. Contgcy ($mil)	Railroad Annualized Cost ($mil)
RAILROAD						
Track	16	0.1059	$276.268	$121.558	$397.826	$42.130
Bridges and structures	16	0.1059	$60.590	$26.660	$87.250	$9.240
Train Control/Crossing Signals	16	0.1059	$55.270	$24.319	$79.589	$8.428
Eathwork/Utilities,Environment	16	0.1059	$433.295	$190.650	$623.945	$66.076
Right-of-way	16	0.1059	$2.477	$1.090	$3.567	$0.378
Subtotal			$827.900	$364.276	$1,192.176	$126.251
Rolling Stock	16	0.1059	$55.000	$0.000	$55.000	$5.825
Subtotal					$1,247.176	
Coal Facilities	16	0.1059	$244.200	$145.100	$389.300	$41.227
Subtotal					$1,636.476	
Capital Cost			$1,127.100	$509.376	$1,636.476	**$173.303**
Annual O&M Cost						$43.100
Total Capital and O&M Cost						$216.403
Annualized Cost per Ton of Coal						**$40.07**

Notes:

1. Annualized Cost per Ton of Coal = Annualized Cost divided by Annual Coal Tonnage.

Table 7 - Black Mesa Project: Railroad Alternative - Black Mesa Mine to Mohave Generating Station From West

Annualized Capital and Operating Cost
Category   Annual Coal Tonnage: 5,400,000

Cost Category	Useful Life (yr)	Annualization Factor	Railroad Total Cost ($mil)	Contingency 44% ($mil)	Total Capital Cost Incl. Contgcy ($mil)	Railroad Annualized Cost ($mil)
RAILROAD						
Track	16	0.1059	$267.708	$117.792	$385.500	$40.824
Bridges and structures	16	0.1059	$50.120	$22.053	$72.173	$7.643
Train Control/Crossing Signals	16	0.1059	$48.062	$21.147	$69.209	$7.329
Eathwork/Utilities,Environment	16	0.1059	$415.695	$182.906	$598.601	$63.392
Right-of-way	16	0.1059	$2.037	$0.896	$2.933	$0.311
Subtotal			$783.622	$344.794	$1,128.416	$119.499
Rolling Stock	16	0.1059	$55.000	$0.000	$55.000	$5.825
Subtotal					$1,183.416	
Coal Facilities	16	0.1059	$244.200	$145.100	$389.300	$41.227
Subtotal					$1,572.716	
Capital Cost			$1,082.822	$489.894	$1,572.716	**$166.551**
Annual O&M Cost						$45.000
Total Capital and O&M Cost						$211.551
Annualized Cost per Ton of Coal						**$39.18**

Notes:

1. Annualized Cost per Ton of Coal = Annualized Cost divided by Annual Coal Tonnage.

APPENDIX F

Appendix F
Biological Resources

Table F-1 Noxious Weeds and Invasive Plant Species

	Listed as Noxious Weed				Known or Likely Occurrence[a]					
Common Name	Arizona State List	Kaibab National Forest Species Rank	BLM	Nevada State List[b]	Black Mesa Complex	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
African mustard *(Brassica tournefortii)*			X						X	X
Bull thistle *(Cirsium vulgare)*		20	X		X			X	Potential	Potential
Camelthorn *(Alhagi pseudalhagi)*	Restricted Prohibited	4	X	A		X	X	X	X	X
Common purslane *(Portulaca oleracea)*	Prohibited Regulated				X	Potential	Potential	Potential	Potential	Potential
Dalmation toadflax *(Linaria genistifalia* ssp. *dalmatica)*		18	X	A					X	X
Diffuse knapweed *(Centaurea diffusa)*	Prohibited Restricted	9	X	B	X			X	X	X
Field bindweed *(Convolvulus arvensis)*	Regulated Prohibited		X		X	Potential	Potential	X	X	X
Halogeton *(Halogeton glomeratus)*	Restricted Prohibited	Unassigned	X			X	X	X		
Musk thistle *(Carduus nutans)*		8	X	B	X	X		X		
Puncture vine *(Tribulus terrestris)*	Prohibited Regulated		X	C	Potential	X	X	X		
Russian knapweed *(Acroptilon repens)*	Prohibited Restricted	5	X	B	X	X	X	X	X	X
Russian olive *(Elaeagnus angustifolia)*		12	X			X	X	X	X	X
Scotch thistle *(Onopordum acanthium)*	Restricted Prohibited	11	X	B	Potential	Potential	X	X	X	X
Spotted knapweed *(Centaurea maculosa)*	Restricted Prohibited	10	X	A			X		X	X
Tamarisk *(Tamarix* spp.*)*		13	X	C	X	X	X		X	X

SOURCES: Bureau of Land Management 2000; California Information Node 2005; ESCO Associates 2003; Nevada Department of Agriculture 2005; Peabody Western Coal Company 2004; U.S. Forest Service 2003; U.S. Geologic Survey 2004

NOTES: [a] X = Present; Potential = Known from general vicinity or habitat; may occur.
[b] Nevada State List definitions: A = weeds of limited distribution that are actively eradicated when found; B = weeds in scattered populations, actively eradicated where possible; C = weeds currently established and widespread, actively eradicated from nurseries—abatement at discretion of state quarantine officer.

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses[1]	Hopi Uses[1]
Trees, Shrubs, and Cacti					
Amelanchier utahensis	Serviceberry			F, M, R	U
Artemisia filifolia	Sand sage		Hovaqpi	R	R, M
Artemisia frigida	Mountain sagebrush		Kuungya	R, U	R
Artemisia ludoviciana	Wormwood		Paakungya	M	R, M, F
Artemisia tridentata	Big sagebrush	Gah biłakani, Ts'ah, Tse'eziih, Tsetah ts'ah, Ma'iiłizhin natoh	Wi:'kwapi	M, R, U	M
Artemisia sp.			Tavotqa	M, R	M
Atriplex canescens	Fourwing saltbush	Díwózhiiłbáí, Díwózhii łbáí	Suwvi, Suwaftsoki, Suwafqölö	F, U, R, M	R, U, M, F
Atriplex confertifolia	Saltbush, shadscale	Díkóózh, Díkóózh sízílinii, Díkóózh bihosh łání	Znga'toki, Ki'tsvi	F, M, U	F, M
Baccharis emoryi	Emory baccharis		Awtangavi, Masiqwhavi		R
Baccharis sarathoides	Desertbroom		Sivàapi, Sivàptoski, Qahavi		M
Berberis fremontii	Holly grape		Hoongavi, Hoongwi	M	R, M, F
Ceratoides lanata (=Krascheninnikovia lanata)	Winter fat, white sage	Gahtsohdáá'	Tavotqa, Wutaq'vala, Masvi	M	R, M
Cercocarpus montanus	Mountain mahogany			M, R, U	U
Chrysothamnus spp.	Rabbit brush, chamisa	Ts'iilyésiitso	Siva'pi, Masi'siva'pi	M, U	U, R
Chrysothamnus nauseosus (=Ericameria nauseosa)	Rubber rabbit brush, chamiso	K'iiłtsoi	Masi'siv'àapi, Sivàapi, Sivà'pa	M, U	M,R, U
Chrysothamnus viscidiflorus	Douglass rabbit rrush	Tc'iltiilyéesiitshoh		M, R	M, R
Echinocereus spp.	Hedgehog cactus		Pöna	F, M	R
Echinocereus triglochidiatus	Hedgehog cactus		Pöna	F	R
Ephedra torreyana	Torrey's jointfir, Mormon tea		Ösvi, Ösaptsoki, Masi'ösvi	F, M	M, U
Ephedra viridis	Mountain jointfir, Mormon tea			F, M, U	F, M
Fallugia paradoxa	Apache plume		Moopovi, Mo'povi, Mongpuwvi		R, M, F
Gutierrezia sarothrae	Snakeweed	ch'ildiilyésii	Maa'ővi, Tsaatsakw'maa'övi	M	R, M, U
Juniperus monosperma	Oneseed juniper		Hohu, Hotski, Ngömaapi, Leposi	F, R, M, U	R, J, U

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses[1]	Hopi Uses[1]
Lycium pallidum	Pale desertthorn, tomatillo, wolfberry	Haashch'éédáá'	Kyeeve, Kyeftsoki, Kyevefsi	F, M, R	F, M, R
Mammillaria spp.	Ball cactus, pincushion cactus, fishhook cactus		Pöna, Yöngötspölö	F	R
Opuntia erinacea	Mohave prickly pear		Yöngö		R, M, F, U
Opuntia phaeacantha	Prickly pear		Naavu	F, M	M, U
Opuntia polyacantha	Plains prickly pear			F, U	
Opuntia sp.	Prickly pear, cholla, nopales	Tit chin pixwoc, Hosh, Hosh'atiniit'oo iih, Hosh'íneecbijeeh, Hosh líbaíí	Yöngö, Ösö	F, M	M
Opuntia whipplei	Whipple cholla		Ösö	M	R, M, F, U
Parryella filifolia	Dunebroom		Kotoksulvi, Siwi		R, M, F, U
Pinus edulis, Pinus monophyla	Two-needle piñon, singleleaf piñon	Deestsiin, Bijech, Cha'oł	Tuve'e	F. M, R, U	R, F, U
Pinus ponderosa	Ponderosa pine	Nídíshchíí'	lzqz	R, M	U
Populus fremontii, Populus spp.	Fremont cottonwood	T'iis	Söhövi, Söhövtsoki, Heesööliwma	U	R, F, U
Populus tremuloides	Quaking aspen	T'iis báí	tzvo'vi	R	R
Prunus virginiana	Chokecherry			F, M, R, U	
Pseudotsuga menziesii	Douglas fir	'Azee ts'óóz, Ch'óh deeníní	Salavi	R, M, U	R
Purshia stansburiana (Cowania mexicana)	Cliff rose	awééts'áál	Hunvi, Hunaptsoki	M, U, R	R, M, U
Purshia tridentata	Antelope bitter brush	'Awééts'áál, K'íníjíł'ahí		U, M	
Quercus gambelii	Gambel oak	tséch'il	Kwingvi, Kwingvituva	F, M, R, U	R, F, U
Rhus sp., Rhus trilobata	Squaw bush		Suuvi, Suvaptsoki, Suvifsi, Suvipsi	F, M	R, M, F, U
Sarcobatus vermiculatus	Greasewood, chico	Díwózhii, Díwózhiiłzhiin	Teeve, Teptsoki	F, M, R, U	R, U
Salix exigua	Coyote willow		Maisqwhavi, Palaqwhavi	M	R
Salix sp.	Willow		Qahavi, Masiqwhavi, Palawhavi	U	R, U
Tamarix chininsis	Fivestamen tamarisk			M, U	
Tessaria sericea	Desert arrowweed		Hoongavi, Sanavi		U

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses[1]	Hopi Uses[1]
Vitus arizonica	Wild grape		Oova, Ova'uyi		F
Yucca angustissima	Narrow-leaved yucca	Tsá'ászi'ts'óóz, Tsa'laguoc, Ni doodlóhii, Nteestijiin	Moohu, Mooho, Piitö	F, M, U	R, U, M, F
Yucca baccata	Banana yucca		Samowa, Saahu	R, U	R, F, U
Yucca spp.	Yucca	Tsá'ászí', Tsá'ászí'niteelí, Tsá'ászi'ts'óóz	Moohu, Mooho, Piitö	R	R
Forbs					
Abronia elliptica	Sand verbena		Tòòkilsi, Poliisi		R, M
Acanthochiton wrightii	Greens		Wiiwa		F
Adiantum capillus-veneris	Maidenhair fern		Paatusaqa		R, M
Amaranthus spp.	Pigweed	Naazkaadii		F, M	F
Asclepias spp.	Milkweed	Ch'il abe'étsoh		F, M, R	
Aster sp.	Purple aster		Tootim, Íslöhavu, Walapope	R	R, M
Astragalus sabulonum			Patoto		M, U
Calamovilfa gigantea	Big sandreed				R
Calochortus spp.	Mariposa lily			F, M	F
Castilleja chromosa, C. applegatei	Indian paintbrush	Dahiitíhídáá, Na'ashjć'iidáá'		M	
Castilleja sp.	Indian paintbrush		Palamansi		R, M, F
Castilleja spp.	Indian paintbrush	Dahiitíhídáá'		M	
Chenopodium album	Lamb's quarters	tl'oh deii, tl'oh deii tsoh, tl'oh deii nááłgai, díkóózh	Si'swa, Hzhz'la	F, M	F
Chenopodium spp.	Goosefoot, lamb's quarters	Tł'ohedii	Höhöla, Kutuki, Sirwa, Öngarki	F, M, U	F
Cirsium sp.	Thistle	Azeehókánii	Tsi'ninra	M	M
Cleome serrulata	Rocky Mountain bee weed		Tumi	F, M, U	R, F, M, U
Cryptantha spp.	Cryptantha	'Azec'łibáíí		M	
Cucurbita foetidissimia			Mösiftanga		M
Cycloloma sp.			Kutuki		M, F, U
Datura meteloides	Sacred datura		Tsimona, Tsimonmana		R, M
Descurainia sp.	Tansy mustard		Aasa	F	F, U
Erigeron concinnus	Navajo fleabane		Na'palnga		M
Erigeron utahensis	Fleabane		Tiiqatsmansi		R, M
Eriogonum rotundifolium	Roundleaf wild buckwheat	Wóláchíí'dáá'		M	
Eriogonum spp.	Wild buckwheat	Xóchóódzí ch'il łíbáí, Wóláchíí'dáá'	Powa'wi	M, R	M

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses[1]	Hopi Uses[1]
Eriogonum umbellatum	Sulfur-flower buckwheat			R	
Gaura coccinea	Scarlet beeblossom	‘Azee’bilátah łichíí’ígí, ‘Azee‘líbáí, na’ashje’iidáá’, iiníziin ch’il		M, R	
Ipomopsis aggregata	Scarlet gilia	Dahyiiłíhídáá, Dloziłgai bich’il	Pala’ka’tsi	M, R	U
Helianthis annuus, Helinathus anomalus, Helianthus petiolaris	Sunflower, common sunflower, annual sunflower, western sunflower, prairie sunflower	dz’o’xonaa’ai bina toh, nídíyílii tsoh	Aqawsi	F,.M, R, U	R, F, U, M
Lappula occidentalis, Lappula redowskii	Western stickseed	‘Iitjiihíh, Ch’il bohoshí		M	
Lithospermum spp	Stoneseed			M, R	M
Lupinus pusillus	Lupine		Íslöhavu, Katsin’nakvu		R, M
Lupinus spp.	Lupine	Azeediilch’íłii		M, R	M
Lesquerella intermedia	Bladderpod	tóneinilii binákee’atíí	hohoi’yáwnga	M, R	
Machaeranthera canescens	Purple aster		Tsorsi, Tsorosi		R, M
Medicago sativa	Alfalfa	Tł’oh waa’í, Dine’é ch’il		M	
Melilotus indica	Annual yellow sweetclover	‘Azee’bílátah hal tsoi		M	
Mentha spicata	Spearmint		Hot’öqlangnga		M, F
Mentzelia sp.	Stickleaf		Sililtiaqa	F, M, R	R, M, F
Mimulus cardinalis	Monkey flower		Palamansi, Mansi, Oattsi		R, M
Mirabilis multiflora	Colorado four o’clock	K’íneetlíciidáá’, Tł’éé’yigáahii, Tsé dídééh, Tsé dídééh tsoh		F, M, U	M, R
Nicotiana attenuata	Tobacco		Piiva, Hopiviva	R	R, M
Oenothera caespitosa	Tufted evening primrose	Tł’éé’ii gahí, ‘Azee’łitsoi, ‘Azee’łabáhí, Tł’éé’yigáahii tsoh		M, R	
Oenothera pallida	Evening primrose		Políisi, Leemansi		R, M
Oenothera spp.	Evening primrose	Tł’éé’yigáahii tsoh, ‘Azee’łaatilt’ihíh		M	M

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses[1]	Hopi Uses[1]
Oxytropis lambertii	Lambert locoweed	Dibé'nát'oh, Dibe'haich'iidii, tádídíín dootl'izh nitsaá gíí	sita'ngwi	R, M, U	
Pectis angustifolia	Lemonscent		Tu'itsma		M, F
Penstemon barbatus	Scarlet bugler		pala'kasti	F	
Petalosstemon oligophyllum	White prairie clover		Tawasi		R, M
Phacelia crenulata var. ambiqua	Purplestem phacelia	'Azee'nichíi'íi	Wíítsorosi, Wì'tsorosi	U	M
Plantago patagonica	Woolly plantain	'Azec'it'ił, Yiitjih, Ts'aa'xalts'aa'	Hahai'nga	F	
Plantago sp.	Plantain		Hahay'inga, Tsukunga	M	M
Portulaca oleracea	Purslane		Pihala	F, M	F
Rumex crispus	Curly dock			M, R	
Rumex hymenosepalus	Wild rhubarb			F, U	
Senecio flaccidus	Groundsel, threadleaf ragwart	'Azee'hááldzidí	Masi'muyi'tka	M	M
Senecio spartioides (=S. multicapitatus	Groundsel		Muyi'tka		U
Senecio spp.				M	
Solanum sp.	Wild potato		Tumna, Aatsivosi, Kawayngahu		R, M, F
Salsola iberica	Russian thistle		Koti, Kuuta, Pahanatuusaqa		F
Sphaeralcea coccinea	Scarlet globemallow	'Azéé'hókánii		M	
Sphaeralcea spp., Sphaeralcea groossulariaefolia	Globemallow		Kopona, Leetofmansi, Yaqaspi	M, R	R, M, F
Stanleya pinnata	Desert prince's plume	'Azee'haagaií, Tshetc'oc'azee', Ts'ahbįįh, 'Azéé'ta'iitsóhii, Tsé'éya hataał	Kwiivi	F, M	R, F, M
Symphyotrichum ericoides, Aster ericoides	White health aster		To:tim, Ho'n'ngapi		M
Symphyotrichum spp. (= Aster spp.)	Aster	Atsá halchinii		R	
Thelesperma megapotamicum	Indian tea			F, M	F, M, U
Thelesperma subnudum	Indian tea			F, M	

Table F-2 Culturally Important Native Plants of the Hopi and Navajo

Scientific Name	Common Name	Navajo Name	Hopi Name	Navajo Uses[1]	Hopi Uses[1]
Grasses					
Agropyron smithii	Western wheatgrass			M	
Aristida sp.	Three-awn		Hahhay'I qalmongwa		U
Bouteloua barbata	Six-weeks grama grass		Harus'hö, Puvùwpi		F
Bouteloua gracilis	Blue grama	tł'oh nástasí	haru shu	M, R	U
Bromus tectorum	Cheatgrass	ghe'iats'osii		U, R	
Equisetum hiemale	Scouring rush		Mumuri, Mururu, Paasölöli, Pona	M	R, M, F, U
Juncus sp.	Bulrush		Pas'hö	M	R, M, F
Hilaria jamesii	Galleta grass		Söhö		U
Muhlenbergia asperifolia	Scratchgrass		Tsa'tsakw'wuusi, Wuusi, Wu'si		R, M, F
Muhlenbergia pungens,	Sand muhly		Wuusi		R, F, U
Munroa squarrosa	False buffalo grass	tl'oh shoh dak'áá nii	kwai'pz'hz	R, F	
Oryzopsis hymenoides	Indian ricegrass	ntitłitih	Leehu, Letski	F	R, F, U
Phragmites australis	Reed		Paaqavi	M, U	R, M, U
Pleuraphis jamesii (Hilaria jamesii)	Galleta grass	tl'oh łichíí, tł'ohtshá híh	sz hz	M, U, F	U
Sporobolus airoides	Alkali sacaton	tl'oh tsahii, tł'ohtsózhitso	Nöönö		F, U
Sporobolus contractus	Spike dropseed		Mokiwkwaakwi, Kwaakwi		R, F
Sporobolus cryptandrus	Sand dropseed	tł'ohts'óozíh	Mokiwkwaakwi, Mokiwkwawki	F	R, F
Sporobolus giganteus	Giant dropseed		Kwaakwi, Kwawki, Kwaawi		R, F
Sporobolus sp.	Dropseed		Kwaakwi, Kwawki, Kwaawi		R, U
Stipa comata	Needle and thread grass	tl'ohdeí'chíní	Hooki	U	R
Stipa speciosa			Hooki		U
Typha angustifolia	Narrow leaf cattail		Wipho, Wifho		R, M, F, U
Xanthium strumarian	Cocklebur		Paatsotso, Paatso		R, F, U

SOURCES: Begay 1979; Dunmire and Tierney 1997; Lomaomvaya, Ferguson, and Yeatts 2001; Mayes and Lacy 1989; Rainey and Adams 2004

NOTES: [1]Uses: F= Food, M= Medicinal, R= Ritual, U= Other uses.

Table F-3 Endangered, Threatened, and Other Special Status Plant Species Potentially Present along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignment
Federally Listed Plant Species				
Fickeisen plains cactus (*Pediocactus peeblesianus* var. *fickeiseniae)*	C, BLM, USFS, NESL3, HS, S1, S2	Exposed layers of Kaibab limestone on canyon margins or hills of Navajoan desert at elevations ranging between 4,000 and 5,000 feet.	Likely	Likely
Welsh's milkweed (*Asclepias welshii)*	LT, NESL3, HS, S1	Active sand dunes from Navajo sandstone in sagebrush, juniper, and ponderosa pine.	Potential	Potential
Other Special Status Plant Species				
Arizona bugbane (*Cimicifuga arizonica)*	USFS, HS, S2	Canyons and lower canyon slopes in association with Douglas fir, white fir, maple, and sometimes aspen. Some populations are found on mountain seeps and springs, in drainages, and on shaded north slopes. Grows in moist, loamy soil of ecotones between coniferous forest and riparian habitat. Elevations ranging from 4,700 to 8,800 feet. Range includes the Kaibab National Forest, tributaries to Oak and West Clear Creeks, Workman Creek, and Cold Springs Canyon.	No	No
Beath milkvetch (*Astragalus beathii)*	NESL4, S2	Great Basin desertscrub in dry washes and disturbed sites at elevations ranging from 4,380 to 5,481 feet.	Potential	Potential
Cameron water-parsley (*Cymopterus megacephalus)*	USFS, S3	Found in Great Basin desertscrub and desert grassland from elevations ranging from 4,440 to 5,170 feet. McDougall (1973) reports elevation ranges from 4,500 to 7,000 feet. In Yavapai County, collected on Canotia hillsides with limey soils. It is endemic to northern Arizona from eastern Coconino County, north and south of Cameron, and north of Gray Mountain, northeast of Flagstaff.	No (for Forest Service land)	No (for Forest Service land)
Parish's alkali grass (*Puccinellia parishii)*	NESL4, HS, S2	Alkaline seeps, springs, and seasonally wet areas such as washes.	Potential	Potential
Peeble's blue-star (*Amsonia peeblesii)*	NESL4, S3	Plains grassland, Great Basin shrub-grassland, and Great Basin desertscrub communities. Substrate types range from strongly alkaline sedimentary conglomerates to volcanic cinders at elevations ranging from 4,000 to 5,600 feet.	Likely	Likely
Round dunebroom/ roundleaf errazurizia (*Errazurizia rotundata)*	NESL4, BLM, SR, S2	Known from several types of outcrops ranging from sandy soils in sandstone, gravelly soils in calcareous outcrops, to deep, alluvial cinders in sandstone breaks. Generally in exposed habitats in the semi-arid environment of the Great Basin desertscrub. On the Navajo Reservation, populations are known from sandy pockets between outcroppings of Moenave Sandstone at elevations ranging from 4,800 to 5,200 feet.	Potential	Potential

Table F-3 Endangered, Threatened, and Other Special Status Plant Species Potentially Present along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignment
Tusayan rabbitbrush (*Chrsoythamnus molestus)*	USFS, S3	Prefers a limestone-derived soil substrate in piñon/juniper woodland and associated grassland and shrubland, generally above 5,500-foot elevation. Species confined to 21 remaining populations on the Coconino Plateau of northern Arizona.	Present	Present
Two-color beardtongue (*Penstemon bicolor* spp. *roseus*)	BLM, SR, S2	Occurs in Black Mountains, in dry washes and mountainside sites in volcanic hills in the Mohave Desert.	Potential	Potential
Chalk liveforever (*Dudleya pulverulenta spp. arizonica*)	Vulnerable (Nevada Heritage Program)	Dry, granitic, or limestone outcrops, rock crevices and desert slopes with *Mammillari*a and creosotebush (Kartesz 1988).	Potential	Potential

SOURCES: Arizona Game and Fish Department 2001-2005 (species accounts); Arizona Rare Plant Committee 1994; Bureau of Land Management 1993; Center for Plant Conservation 2005; Detsoi 2005; Kartesz 1988; Miskow 2005; Navajo Natural Heritage Program 2005

NOTES: Status: LT = Listed as threatened; C = Candidate; BLM = BLM sensitive; USFS = Forest Service sensitive; NESL3 = Species likely to become endangered on the Navajo Reservation; NESL4 = No significant information on the Navajo Reservation; S1 = Very rare Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; HS = Highly safeguarded under the Arizona Native Plant Act; SR = Salvage restricted under the Arizona Native Plant Act.

Potential for Occurrence:

- Present = Known occurrence
- Likely = Suitable habitat present, not documented but likely to occur; or known to occur within 1 mile
- Potential = Potentially present based on general habitat and range
- No = No suitable habitat and/or outside known range

Table F-4 Endangered, Threatened, and Other Special Status Plant Species Potentially Present in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status[1]	Habitat	Potential for Occurrence[2]: C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Federally Listed Plant Species							
Welsh's milkweed (*Asclepias welshii)*	LT, NESL3, HS, S1	Active sand dunes from Navajo sandstone in sagebrush, juniper, and ponderosa pine, 4,700-6,250-foot elevation.	Not applicable.	No	No	Potential	Not applicable.
Peebles Navajo cactus (*Pediocactus peeblesianus* var. *peeblesianus)*	LE, HS, S1	Gravelly soils of the Shinarump conglomerate of the Chinle Formation.	Not applicable.	No	No	No	Not applicable.
Navajo sedge (*Carex specuicola)*	LT, NESL3, HS, S2	Silty soils at shady seeps and springs at elevations ranging between 5,700 and 6,000 feet. Designated critical habitat is on the Navajo Reservation near Inscription House Ruins. Found at seep springs on vertical cliffs of pink-red Navajo sandstone.	No	No	No	No	Potential
Other Special Status Plant Species							
Parish's alkali grass (*Puccinellia parishii)*	NESL4, HS, S2	Alkaline seeps, springs, and seasonally wet areas such as washes. Restricted to alkaline or salty moist soils with a white crust. A geographically widespread but rare plant.	Potential	No	Potential	Potential	Potential
Round dunebroom/ roundleaf errazurizia (*Errazurizia rotundata)*	NESL4, BLM, SR, S2	Known from several types of outcrops ranging from sandy soils in sandstone, gravelly soils in calcareous outcrops, to deep, alluvial cinders in sandstone breaks. Generally in exposed habitats in the semiarid environment of the Great Basin desertscrub. On the Navajo Reservation, populations are known from sandy pockets between outcroppings of Moenave Sandstone at elevations ranging from 4,800 to 5,200 feet.	Not applicable.	No	Potential	Potential	Not applicable.

SOURCES: Arizona Game and Fish Department 2001-2005 (species accounts); Arizona Rare Plant Committee 1994; Center for Plant Conservation 2005; Detsoi 2005; Miskow 2005; Navajo Natural Heritage Program 2005

NOTES: [1]Status: LE = Listed as endangered; LT = Listed as threatened; BLM = BLM sensitive; NESL3 = Species likely to become endangered on the Navajo Reservation; NESL4 = No significant information on the Navajo Reservation; HS = Highly safeguarded under the Arizona Native Plant Act; S1 = Very rare (Arizona Natural Heritage Program State rank); S2 = Rare; SR = Salvage restricted under the Arizona Native Plant Act.

Potential for Occurrence:

Potential = Potentially present based on general habitat and range

No = No suitable habitat and/or outside known range

2

Table F-5 Common Bird Species Present at the Black Mesa Complex

	Piñon/Juniper Woodland	Sagebrush/Mixed Shrub	Riparian (Moenkopi Wash)
Species	Bewick's wren (*Thryomanes bewickii)*	Sage sparrow (sagebrush) (*Amphispiza belli)*	Rock wren (*Salpinctes obsoletus)*
	Plain titmouse (*Parus inornatus)*	Horned lark (sagebrush) (*Eremophila alpestris)*	White-crowned sparrow (*Zonotrichia leucophrys)*
	Mountain chickadee (*Parus gambeli)*	Brewer's sparrow (sagebrush and greasewood) (*Spizella breweri)*	Dark-eyed junco (*Junco hyemalis*)
	Black-throated gray warbler (*Dendroica nigrescens)*	Rock wren (greasewood) (*Salpinctes obsoletus)*	House finch (*Carpodacus mexicanus)*
	Gray flycatcher (*Empidonax wrightii)*	Say's phoebe (greasewood) (*Sayornis saya)*	Northern mockingbird (*Mimus polyglottos)*
	Ash-throated flycatcher (*Myiarchus cinerascens)*	Black-throated sparrow (greasewood) (*Amphispiza bilineata)*	Killdeer (*Charadrius vociferous)*
	Piñon jay (*Gymnorhinus cyanocephalus)*	House finch (greasewood) (*Carpodacus mexicanus)*	Various warblers
	White-breasted nuthatch (*Sitta carolinensis)*		
	Red-tail hawk *(Buteo jamaicensis)*		
	Common raven *(Corvus corax)*		

SOURCES: BIOME Ecological and Wildlife Research 2003; Peabody Western Coal Company 2004

Table F-6 Occurrence of Federally Listed Threatened or Endangered Animal Species at the Black Mesa Complex

Species	Status	Habitat	Black Mesa Complex
Birds			
Bald eagle (*Haliaeetus leucocephalus)*	LT, USFS, WSC, S2,S3B, S4N	Large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. In Arizona, perch in large riparian trees, pines, or on cliffs.	Occasional during migration or winter.
California condor (*Gymnogyps californianus*)	LE, WSC, SX, S1, NESL 4	High desert canyonlands and plateaus at various elevations. Nesting sites are in various rock formations, including caves, crevices, and potholes in isolated regions. Flights follow route over foothills and mountains. Roosting is usually on rock cliffs, snags, or in live conifer stands.	May occur occasionally during foraging; nesting is 50 or more miles away.
Mexican spotted owl (*Strix occidentalis lucida)*	LT, USFS, NESL3, WSC, S3, S4	Occurs in varied habitat, consisting of mature montane forest and woodland, shady wood canyons, and steep canyons. They also can be found in mixed conifer and pine-oak vegetation types at elevations from 4,100 to 9,000 feet.	Potential occurrence during foraging at north end of complex. Nesting occurs about 2 miles north of leasehold; no observations or nesting habitat in mine leasehold area.
Southwestern willow flycatcher (*Empidonax trailli extimus)*	LE, USFS, NESL2, WSC, S1	Cottonwood/willow and tamarisk vegetation communities along rivers and streams at elevations below 8,500 feet.	Occasional during migration in tamarisk scrub.
Mammals			
Black-footed ferret (*Mustela nigripes)*	LE, USFS, NESL2, WSC, S1	Grassland plains generally found in association with prairie dogs.	Not present; potentially suitable habitat.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:
Status: LE = Listed as endangered by U.S. Fish and Wildlife Service; LT = Listed as threatened by U.S. Fish and Wildlife Service; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

Table F-7 Occurrence of Other Special Status Animal Species at the Black Mesa Complex

Species	Status	Habitat	Black Mesa Complex
Birds			
Ferruginous hawk (*Buteo regalis)*	NESL3, WSC, S2B, S4N	Nest in badlands, flat or rolling desert grassland, and desertscrub. Habitat surrounding nest site must support populations of their preferred prey items of cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers.	Occasional; no nesting documented, though suitable nesting habitat is available.
Golden eagle (*Aquila chrysaetos)*	NESL3	Most habitats including piñon/juniper woodlands, grassland, chaparral, and sagebrush shrubland. Nest on cliffs, tall trees, junipers, and rock outcrops.	Present; observed foraging. No known nests.
Mountain plover (*Charadrius montanus)*	NESL4, USFS, S1B, S2N	Includes short-grass prairie (vegetation less than 4 inches tall). Dry land, cultivated farms, and prairies dog towns. Habitat-defining characteristics: short vegetation, bare ground, and a flat topography. Breeding birds documented in Apache County. Wintering birds documented in Yuma, Pima, Cochise, Pinal, and Apache Counties.	Potential; southeast portion of complex is suitable habitat. No known nesting populations. Species has not been recorded on Black Mesa.
Northern goshawk (*Accipiter gentilis)*	NESL4, USFS, WSC, S3	Typically nests in drainages, canyon bottoms, or north-facing forested slopes with ponderosa pine stands (also mixed-species, spruce-fir, and aspen stands) composed of large, mature trees and high canopy closure.	Potentially present in extreme northern part of Black Mesa Complex. Nests in vicinity; no confirmed nesting in Black Mesa Complex. A female was observed approximately 2 miles north of the leasehold in Yellow Water Canyon in 2001.
Peregrine falcon (*Falco peregrinus)*	NESL4, USFS, WSC, S4	Nests on steep cliffs in a scrape on sheltered ledges or potholes. Foraging habitat quality is important factor; often, but not always, extensive wetland and/or forest habitat is within the falcon's hunting range of 30 to 60 miles. Found at elevations between 3,500 and 9,000 feet.	Occasional; during foraging.
Western burrowing owl (*Athene cunicularia hypugaea)*	BLM, S3, NESL4	In Arizona, Great Basin shrubsteppe, Chihuahuan desertscrub, Mohave desertscrub, annual grassland; open well-drained areas, often associated with burrowing mammals, 650 to 6,600 feet.	Potential; no nesting records or observations; potentially suitable habitat in prairie dog towns.
Mammals			
Navajo mountain Mexican vole (*Microtus mexicanus navaho)*	NESL4, USFS, WSC, S1	Sagebrush, drainage bottoms with tamarisk	Present.
Pale Townsend's big-eared bat (*Plecotus townsendii pallescens/ Corynorhinus t.p.)*	NESL4, S3, S4	Desertscrub, oak woodland, oak/pine, piñon/juniper, and coniferous forests, 550 to 7,520 feet, primarily 3,000 to 7,520 feet.	Likely present.
Pronghorn (*Antilocapra americana)*	NESL3	Found in grassland or desertscrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees like juniper and sagebrush.	Not present; no observations on leasehold.
Spotted bat (*Euderma maculatum)*	BLM, WSC, S1, S2	Found from low desert in southwestern Arizona to high desert and riparian habitats in northwestern Arizona and Utah, and coniferous forests in northern Arizona.	Potentially present.

Table F-7 Occurrence of Other Special Status Animal Species at the Black Mesa Complex

Species	Status	Habitat	Black Mesa Complex
Kit fox (*Vulpes macrotis*)	NESL4	Desertscrub and desert grassland	Not likely to be present.
Reptiles and Amphibians			
Milk snake (*Lampropeltis triangulum)*	NESL4	Occurs primarily in plains grassland habitat in Arizona, and with snakeweed and rabbitbrush.	Potentially present; suitable habitat present.
Northern leopard frog (*Rana pipiens)*	NESL2, USFS, WSC, S2	Grassland, brushland, woodland, and forest; usually in permanent waters with rooted aquatic vegetation. Also ponds, canals, marshes, springs, and streams, 4,500 to 10,000 feet.	Unlikely; no documented occurrences; potentially suitable habitat exists at the water impoundments.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: BLM = BLM sensitive; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation ; NESL3 = Threatened on the Navajo Reservation; NESL4 = Any species or subspecies for which the Navajo Fish and Wildlife Division does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them. The Navajo Fish and Wildlife Division is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under tribal code but should be considered in project planning.

WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

Table F-8 Occurrence of Federally Listed Threatened or Endangered Animal Species along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Alignment Realignments
Birds				
Bald eagle (*Haliaeetus leucocephalus)*	LT, USFS, WSC, S2,S3B, S4N	Large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. In Arizona, perch in large riparian trees, pines, or on cliffs.	Occasional during migration or winter.	Occasional during migration or winter.
California brown pelican (*Pelecanus occidentalis californicus)*	LE, USFS, S1N	Coastal areas, with nesting occurring on islands. Species found occasionally along Arizona's lakes and rivers.	Occasional along Colorado River.	Occasional along Colorado River.
California condor *(Gymnogyps californianus)*	LE, WSC, SX, S1	High desert canyonlands and plateaus at various elevations. Nesting sites are in various rock formations, including caves, crevices, and potholes in isolated regions. Flights follow route over foothills and mountains. Roosting is usually on rock cliffs, snags, or in live conifer stands.	May occur occasionally during foraging; nesting is 50 or more miles away.	May occur occasionally during foraging; nesting is 50 or more miles away.
Mexican spotted owl (*Strix occidentlis lucida)*	LT, USFS, NESL3, WSC, S3, S4	Occurs in varied habitat, consisting of mature montane forest and woodland, shady wood canyons, and steep canyons. They can also be found in mixed conifer and pine-oak vegetation types at elevations from 4,100 to 9,000 feet.	Not present; no habitat.	Not present; no habitat.
Southwestern willow flycatcher (*Empidonax trailli extimus)*	LE, USFS, NESL2, WSC, S1	Cottonwood/willow and tamarisk vegetation communities along rivers and streams at elevations below 8,500 feet.	Occasionally or regularly present during migration in tamarisk scrub along Moenkopi Wash and at crossing of Little Colorado River.	Occasionally or regularly present during migration in tamarisk scrub along Moenkopi Wash and at crossing of Little Colorado River.
Mammals				
Black-footed ferret (*Mustela nigripes)*	LE, USFS, NESL2, WSC, S1	Grassland plains generally found in association with prairies dogs at elevations below 10, 500 feet.	Unlikely, although alignment is about 1.4 miles from Aubrey Valley reintroduction area near Seligman and much of route is within historic range; suitable habitat is not present along the pipeline alignment.	Same as existing alignment.
Hualapai Mexican vole Microtus mexicanus hualapaiensis	LE WSC S1	Associated with woodland forest types containing grasses and grass-sedge associates. Only known to occur in Hualapai Mountains in Mohave County.	Not present; no habitat on alignment; nearest occupied habitat about 6 miles away.	Not present; no habitat on alignment; nearest occupied habitat about 6 miles away.

Table F-8 Occurrence of Federally Listed Threatened or Endangered Animal Species along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Alignment Realignments
Reptiles and Amphibians				
Mohave desert tortoise (*Gopherus agassizii)* (Mohave population)	LT, WSC, S2	Mohave desertscrub north and west of the Colorado River at elevations between 500 to 5,100 feet. Habitat ranges from flatlands to rocky slopes and bajadas. Prefers sandy loam to rocky soils in valleys, bajadas, and hills.	Potentially present on Nevada portion of route.	Potentially present on Nevada portion of route.
Fish				
Bonytail chub (*Gila elegans)*	LE, NESL1, WSC, S1	Warm, swift, turbid mainstream rivers of the Colorado River basin, reservoirs in lower basin.	Present in Colorado River.	Present in Colorado River.
Razorback sucker (*Xyrauchen texanus)*	LE, NESL2, WSC, S1	Riverine and lacustrine areas, generally not in fast moving water and may use back water.	Present in Colorado River.	Present in Colorado River.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; Corman and Wise-Gervais 2005; Detsoi 2005; Entrix 2002; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005

NOTES:

Status: LE = Listed as endangered by U.S. Fish and Wildlife Service; LT = Listed as threatened by U.S. Fish and Wildlife Service; USFS = Forest Service sensitive; NESL1 = No longer occurring on the Navajo Reservation (Navajo Endangered Species List); NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SN = State nonbreeding; SX = State extirpated or extinct.

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Birds				
Ferruginous hawk (*Buteo regalis*)	NESL3, WSC, S2B, S4N	Nest in badlands, flat or rolling desert grassland, and desertscrub. Habitat surrounding nest site must support populations of their preferred prey items of cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers.	Likely nests along alignment; documented nesting north of vicinity of Seligman; suitable nesting habitat is available. Also present in winter.	Likely, same as existing alignment.
Golden eagle (*Aquila chrysaetos)*	NESL3	Most habitats including piñon/ juniper woodland, grassland, chaparral, and sagebrush shrubland. Nest on cliffs, tall trees, junipers, and rock outcrops.	Present; nests documented or likely in suitable habitat along alignment.	Same as existing alignment.
Peregrine falcon (*Falco peregrinus)*	NESL4, USFS, WSC, S4	Nests on steep cliffs in a scrape on sheltered ledges or potholes. Foraging habitat quality is important factor; often, but not always, extensive wetland and/or forest habitat is within the falcon's hunting range of 30 to 60 miles. Found at elevations between 3,500 to 9,000 feet.	May occur during foraging by nesting or wintering/migrating birds, unlikely nesting.	Same as existing alignment.
Western burrowing owl (*Athene cunicularia hypugaea)*	BLM, S3, NESL4	In Arizona, Great Basin shrubsteppe, Chihuahuan desertscrub, Mohave desertscrub, annual grassland; open well-drained areas, often associated with burrowing mammals, including ground squirrels, kangaroo rats, and prairie dogs 650 to 6,600 feet.	Potentially present in suitable habitat along much of the alignment. Documented nesting east of Kingman.	Potentially present in suitable habitat along much of the alignment.
Mammals				
Allen's big-eared bat (*Idionycteris phyllotis*)	BLM, S2, S3	Ponderosa pine, piñon/juniper, Mexican woodland, and riparian areas. Also Mohave desertscrub. 1,320 to 9,800 feet, mostly 3,500 to 7,500 feet.	Reported to occur in Black Mountains and near Kingman. May occur on BLM land in Cerbat Mountains and from Black Mountains west to the Colorado River.	May occur on BLM lands south of Kingman and from the Black Mountains west to the Colorado River.
Arizona myotis (*Myotis occultus)*	BLM, S3	Known from the Mogollon Rim from Alpine northwest to near Flagstaff. In summer, found in ponderosa pine and oak-pine woodland near water. Also found along permanent water or in riparian forest in some desert areas. Most common at higher elevations (6,000 to 9,200 feet).	Reported to occur in Hualapai Mountains southeast of Kingman. Unlikely to occur on existing alignment.	Same as existing alignment.

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Cave myotis (*Myotis velifer*)	BLM	Sonoran Desert, with creosote, paloverde, brittlebrush, and cacti, but within several miles of a water source.	Reported to occur near Hualapai Mountains. May occur on BLM land from the Black Mountains to the Colorado River.	Reported to occur near Hualapai Mountains. May occur on BLM land south of Kingman and from the Black Mountains to the Colorado River.
Fringed myotis (*Myotis thysanodes)*	BLM	Occur in habitats ranging from chaparral to ponderosa pine woodland, most common in oak and piñon.	Not likely to occur where alignment crosses BLM land, but likely to occur elsewhere.	May occur on BLM land on eastern part of Kingman re-route.
Greater Western mastiff/bonneted bat (*Eumops perotis californicus)*	WSC, S1, S2	Mostly Sonoran desertscrub, 420 to 7,520 feet.	Reported to occur in project vicinity in several locations from Milepost 220 to 266.	Same as existing alignment.
Long-legged myotis (*Myotis volans)*	BLM, S3, S4	Coniferous trees or riparian and desert habitats. 6,600 to 10,000 feet. Typically occurs in forested mountains, including areas of piñon and juniper.	Reported to occur in Hualapai Mountains. May occur elsewherein piñon/ juniper woodland habitat on existing alignment, but there is no suitable habitat on BLM land along the alignment.	Reported to occur near east end of Kingman re-route, where suitable habitat may be present on BLM land. May occur elsewhere in piñon/juniper woodland habitat on existing alignment, on non-BLM land.
Pale Townsend's big-eared bat (*Plecotus townsendii pallescens/ Corynorhinus t.p.)*	NESL4, S3, S4	Desertscrub, oak woodland, oak-pine, piñon/juniper, and coniferous forests. Roosts in abandoned mines, 550 to 7,520 feet; primarily 3,000 to 7,520 feet.	Reported to occur within 3 miles in Kingman area and near Black Mountains. Potentially present elsewhere in piñon/juniper and desertscrub habitat.	Same as existing alignment.
Pocketed free-tail bat (*Nyctinomops femorosaccus)*	BLM, S2, S3	Arid lowlands, usually around high cliffs and rugged outcrops. 190 to 7,520 feet.	Reported to occur in Hualapai Mountains southeast of Kingman. May occur on existing alignment in and near Cerbat and Black Mountains.	Reported to occur in Hualapai Mountains near east end of Kingman re-route. May also occur in and near Black Mountains.
Pronghorn (*Antilocapra americana)*	NESL3	Found in grassland or desertscrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees such as juniper and sagebrush.	Likely to occur west of Cameron on Navajo Reservation. Also occurs in grasslands west of where it is not special status.	Same as existing alignment.
Spotted bat (*Euderma maculatum)*	WSC, S1, S2	Found from low desert in southwestern Arizona to high desert and riparian habitats in northwestern Arizona and Utah, and coniferous forests in northern Arizona.	Potentially present in suitable habitat.	Potentially present in suitable habitat.

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Western small-footed myotis (*Myotis ciliolabrum*)	BLM, S3	Deserts, oaks, chaparral and riparian areas. Winters in central Mohave County, 4,360 to 8,670 feet.	Reported to be present in Hualapai Mountains near Kingman. Potentially present in area west of Kingman.	Similar to existing alignment; may occur along Kingman re-route and west of Kingman.
Wupatki Arizona pocket mouse (*Perognathus amplus cineris)*	USFS, S3	Cacti, creosotebush, rabbitbrush, paloverde, mesquite, greasewood and sometimes juniper. Subspecies limited to area from Echo Cliffs to Wupatki National Monument, 3,900 to 5,420 feet (AGFD 2004).	Potentially present near Little Colorado River and Cameron (AGFD 2004).	Same as existing alignment.
Kit fox (*Vulpes macrotis)*	NESL4	Desertscrub and desert grassland.	Potentially present on much of the alignment on the Navajo Reservation. Likely to be present on western portion of alignment, where it is not special status.	Same as existing alignment.
Amphibians and Reptiles				
Banded Gila monster (*Heloderma suspectum)*	BLM, S4	In Arizona, primarily Sonoran Desert and extreme western edge of Mohave Desert. Also desert grassland and rarely oak woodland. Undulating rocky foothills, bajadas, and canyons. Less often open sandy plains. To 4,100 feet.	Present; suitable habitat from about Milepost 237 west to Bullhead City.	Present, suitable habitat from about Milepost 230 west to Bullhead City.
Common chuckwalla (*Sauromalus ater)*	NESL4, BLM, S4	Desertscrub, grassland, piñon/ juniper, and coniferous forests. Predominantly found near cliffs, boulders or rocky slopes where they use rocks as basking site and rock crevices for shelter. In Arizona, found in western part of state, including canyons of the Colorado River in northern Arizona. Range in Navajo land not well know.	High potential of occurrence through the Black Mountains.	High potential of occurrence along the Kingman area reroute (wherever boulders are present).
Milk snake (*Lampropeltis triangulum)*	NESL4	Occurs primarily in plains grassland habitat in Arizona, and with snakeweed and rabbitbrush.	There are records of occurrence near Seligman (AGFD 2003b). May occur in grassland and desertscrub elsewhere on alignment.	Same as existing alignment.
Sonoran desert tortoise (*Gopherus agassizii)* (Sonoran population)	WSC, S4	(Sonoran population, which includes part of Mohave Desert.) Sonoran and Mohave desertscrub, juniper woodland, and desert grassland, especially paloverde-mixed cacti associations. 510 to 1,615 feet.	Present; Mileposts 238-243 near Kingman and 256-270 from the Black Mountains to Bullhead City are in Category III Tortoise Habitat (BLM 1993).	Present; Mileposts 230-241 southeast of Kingman Milepost 257 -271 on preferred alignment are in Category III Tortoise Habitat (BLM 1993).

Table F-9 Other Special Status Species Potentially Occurring Along the Coal-Slurry Pipeline: Existing Route and Realignments

Species	Status	Habitat	Coal-Slurry Pipeline: Existing Route	Coal-Slurry Pipeline: Realignments
Northern leopard frog (*Rana pipiens)*	NESL2, USFS, WSC, S2	Grassland, brushland, woodland, and forest; usually in permanent waters with rooted aquatic vegetation. Also ponds, canals, marshes, springs, and streams. 4,500 to 10,000 feet.	Documented occurrence near Cameron and Little Colorado River (AGFD 2002c). May occur in limited areas along other portions of the alignment.	Same as existing alignment.
Fish				
Flannelmouth sucker (*Catostomus latipinnis)*	USFS, S2	Primarily large and moderately large rivers. Larvae inhibit shallow, slow flowing near shore areas. 1,540 to 3,160 feet.	Present in Colorado River.	Same as existing alignment.
Invertebrates				
Maricopa tiger beetle (*Cinindela oregona maricopa)*	BLM, USFS, S3	Central highlands below Mogollon Rim. Sandy streambanks or gravels and clays along streambanks. Also seeps and reservoirs. 1,092 to 6,940 feet.	Potentially present; documented occurrence south of alignment near U.S. 40, east of Kingman (AGFD 2001c).	Same as existing alignment.
Navajo Jerusalem cricket (*Stenopelmatus navajo)*	BLM, USFS	Sand dunes and sandy washes, in Great Basin desertscrub with greasewood and Mormon tea. Occurs from Moenkopi to Petrified Forest National Park (AGFD 2003d).	May occur along alignment from Moenkopi to Cameron.	Same as existing alignment.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; Corman and Wise-Gervais 2005; Detsoi 2005; Entrix 2002; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005

NOTES:

Status: BLM = BLM sensitive; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; NESL4 = Any species or subspecies for which the Navajo Fish and Wildlife Division does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them. The Navajo Fish and Wildlife Division is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under tribal code but should be considered in project planning.
WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare (Arizona Natural Heritage Program state rank); S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

Table F-10 Forest Service Management Indicator Species

Species	Vegetation Characteristic	Applicability to Coal-Slurry Pipeline[a]
Cinnamon teal *Anas cyanoptera*	Late-seral wetlands	Not applicable.
Lucy's warbler *Vermivora luciae*	Later-seral, low elevation (less than 7,000 feet riparian)	Not applicable.
(Merriam's) turkey *Meleagris gallopavo*	Late-seral ponderosa pine	Not applicable.
Plain (juniper) titmouse *Baeolophus ridgwayi*	Late-seral piñon/juniper, and snags in piñon/juniper	Likely present.
Yellow-breasted chat *Icteria virens*	Late-seral, low elevation (less than 7,000 feet riparian)	Not applicable.
Aquatic macroinvertebrates (e.g., mayflies, stoneflies, caddisflies)	Riparian	Not applicable.
Elk *Cervus elaphus*	Early-seral ponderosa pine, mixed conifer, spruce-fir	Not applicable.
Mule deer *Odocoileus hemionus*	Early-seral aspen and piñon/juniper	Present.
Pronghorn antelope *Antilocapra americana*	Early and late-seral grassland	Likely present.

SOURCE: Bennetson 2005
NOTE: [a] Habitat present on land administered by the Forest Service in the vicinity of the coal-slurry pipeline.

Table F-11 Common Wildlife Species by Habitat

Habitat	Mammals	Birds	Reptiles and Amphibians
All habitats (except urban)	Mule deer Coyote Gray fox Badger Spotted skunk Bobcat Desert cottontail Rock squirrel Botta’s pocket gopher Big brown bat White-throated woodrat	Mourning dove Turkey vulture Red-tailed hawk American kestrel Great horned owl Ash-throated flycatcher Common raven Rock wren Northern mockingbird House finch	
Plains and Great Basin grassland	Pronghorn Black-tailed jackrabbit White-tailed antelope Ground squirrel Gunnison's prairie dog Western harvest mouse Ord’s kangaroo rat	Golden eagle Burrowing owl Common nighthawk Say's phoebe Horned lark Vesper sparrow Lark sparrow Western meadowlark	Lesser earless lizard Western terrestrial garter snake Great Plains toad Plains spadefoot
Great Basin desertscrub	Pronghorn Black-tailed jackrabbit desert cottontail White-tailed antelope Ground squirrel Spotted ground squirrel Gunnison’s prairie dog Ord's kangaroo rat Western pocket mouse	Common nighthawk Piñon jay Gray flycatcher Say’s phoebe Loggerhead shrike Horned lark Lark sparrow Western meadowlark	Sagebrush lizard Leopard lizard Collared lizard Northern side-blotched lizard Whiptails Fence lizards Great basin gopher snake Wandering garter snake Rattlesnakes
Great Basin conifer woodland	Elk Mountain lion Gray fox Porcupine Western harvest mouse Piñon mouse	Golden eagle Cooper’s hawk Common poorwill Black-chinned hummingbird Northern flicker Gray flycatcher Cassin’s kingbird Gray vireo Plumbeous vireo Western scrub jay Piñon jay Plain titmouse Bushtit Bewick’s wren Spotted towhee Chipping sparrow Black-throated Gray warbler Black-headed grosbeak Scott's oriole	Plateau striped whiptail sagebrush lizard

Table F-11 Common Wildlife Species by Habitat

Habitat	Mammals	Birds	Reptiles and Amphibians
Semidesert grassland	Kit fox Black-tailed jack rabbit Harris’ antelope ground squirrel Merriam's kangaroo rat Ord’s kangaroo rat Cactus mouse	Golden eagle Gamble’s quail Roadrunner Burrowing owl Lesser nighthawk Common poorwill Western kingbird Ladder-backed woodpecker Western kingbird Ash-throated flycatcher Say’s phoebe Canyon towhee Black-throated sparrow Scott’s oriole	Rattlesnakes Great Plains toad Tiger whiptail
Mohave desertscrub	Desert bighorn sheep Kit fox Black-tailed jackrabbit Harris’ antelope ground squirrel Round-tailed ground squirrel Merriam's kangaroo rat Desert woodrat Cactus mouse	Gamble’s quail Roadrunner Costa’s hummingbird Say’s phoebe Loggerhead shrike Verdin Curve-billed thrasher Phainopepla Black-throated sparrow	Zebra-tailed lizard Western shovel-nosed snake Tiger whiptail banded gecko Rattlesnakes Eastern collared lizard Long-nosed leopard lizard Chuckwalla Desert tortoise Desert iguana Gila monster California kingsnake Coachwhip
Urban	House mouse Norway rat	Mourning dove House sparrow European starling Rock dove Northern mockingbird House finch Great-tailed grackle	
In or near streams and ponds (intermittent and perennial)	Striped skunk Raccoon	Mallard Killdeer	Great plains toad Red-spotted toad Mexican spadefoot toad Canyon treefrog Western terrestrial garter snake Tiger salamander

SOURCES: Arizona Partners in Amphibian and Reptile Conservation 2005; Brown 1982; Corman and Wise-Gervais 2005; Hoffmeister 1986

Table F-12 Occurrence of Federally Listed Threatened or Endangered Animal Species in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Birds							
Bald eagle (*Haliaeetus leucocephalus)*	LT, USFS, WSC, S2, S3B, S4N	Large trees in forests, river bottoms, or near canyon rims, usually within a few miles of ponds, lakes, and rivers with adequate prey. In Arizona, perch in large riparian trees, pines, or on cliffs.	Occasional during migration or winter in riparian areas.	Unlikely, during migration or winter.	Unlikely during migration or winter.	Unlikely during migration or winter.	Occasional during migration or winter in riparian areas.
Mexican spotted owl (*Strix occidentlis lucida)*	LT, USFS, NESL3, WSC, S3, S4	Occurs in varied habitat, consisting of mature montane forest and woodland, shady wood canyons, and steep canyons. They also can be found in mixed conifer and pine-oak vegetation types at elevations from 4,100 to 9,000 feet.	Not applicable.	Not present; no habitat.	Not present; no suitable habitat.	Potential occurrence; known nesting areas within 1 to 3 miles, Mileposts 103 to 134.	Not applicable.
Southwestern willow flycatcher (*Empidonax trailli extimus)*	LE, USFS, NESL2, WSC, S1	Cottonwood/willow and tamarisk vegetation communities along rivers and streams at elevations below 8,500 feet.	Likely to occur in riparian habitat along lower Clear Creek, lower Chevelon Creek, and the Little Colorado River; breeding not documented.	Not present; no habitat.	Occasional during migration in tamarisk scrub.	Occasional during migration in tamarisk scrub.	Likely to occur in major washes; breeding not documented.
Mammals							
Black-footed ferret (*Mustela nigripes)*	LE, USFS, NESL2, WSC, S1	Grassland plains generally found in association with prairies dogs at elevations below 10,500 feet.	Not applicable.	Not present; potentially suitable habitat, in historic range.	Not present; potentially suitable habitat, in historic range.	Not present; potentially suitable habitat, in historic range.	Not applicable.
Reptiles and Amphibians							
Chiricahua leopard frog (*Rana chiricahuensis)*	LT, USFS, WSC, S3	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs from 3,300 to 8,900 feet in elevation.	Not present, out of range.	Not present, out of range.	Not present; not in known range.	Not present; not in known range.	Not present, out of range.

Table F-12 Occurrence of Federally Listed Threatened or Endangered Animal Species in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Fish							
Bonytail chub (*Gila elegans)*	LE, NESL1, WSC, S1	Warm, swift, turbid mainstream rivers of the Colorado River basin, reservoirs in lower basin.	Not present, out of range.	Not present; not in known range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Gila Chub (*Gila intermedia)*	PE, USFS, WSC, S2	Pools, springs, cienegas, and streams.	Not present, out of range.	Not present, not in range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Humpback chub (*Gila cypha)*	LE, NESL2, WSC, S1	Large warm turbid rivers especially canyon areas with deep fast water.	Not present, not in range.	Not present ; not in known range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Little Colorado spinedace (*Lepidomeda vittata)*	LT, WSC, S1, S2	Moderate to small streams in pools and riffles with water flowing over gravel and silt.	Present in lower Chevelon Creek; potentially present in lower Clear Creek. Not observed since 1960. Could occur occasionally, but not likely to persist.	Not present, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.
Razorback sucker (*Xyrauchen texanus)*	LE, NESL2, WSC, S1	Riverine and lacustrine areas, generally not in fast-moving water and may use back water.	Not present, not in range.	Not present, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, no suitable habitat.

Table F-12 Occurrence of Federally Listed Threatened or Endangered Animal Species in the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Invertebrates							
Page springsnail (*Pyrgulopsis morrisoni)*	C, BLM, USFS, S1	Occur in springs, seeps, marshes, spring pools, outflows, and diverse lotic waters. The most common habitat is a spring emerging from the ground as a free-flowing stream at an elevation around 3,500 feet. Range includes the Upper Verde River drainage of central Arizona. All populations are known within a complex of streams within a 1-mile area along the west side of Oak Creek.	Not present, out of range.	Not present, out of range, no suitable habitat.	Not present; no habitat.	Not present; no habitat.	Not present, out of range.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: LE = Listed as endangered by U.S. Fish and Wildlife Service; LT = Listed as threatened by U.S. Fish and Wildlife Service; PE = Proposed as endangered by U.S. Fish and Wildlife Service; C = Candidate for listing by U.S. Fish and Wildlife Service; BLM = BLM sensitive; USFS = Forest Service sensitive; NESL1 = No longer occurring on the Navajo Reservation (Navajo Endangered Species List); NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare; (Arizona Natural Heritage Program state rank);
S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Birds							
Ferruginous hawk (*Buteo regalis)*	NESL3, WSC, S2B, S4N	Nest in badlands, flat or rolling desert grassland, and desertscrub. Habitat surrounding nest site must support populations of their preferred prey items of cottontails, jackrabbits, prairie dogs, ground squirrels, and gophers.	Not applicable.	Wintering range; no known nests.	Wintering range; no known nests.	Wintering range; no known nests.	Not applicable.
Golden eagle (*Aquila chrysaetos)*	NESL3	Most habitats including piñon/juniper woodlands, grassland, chaparral, and sagebrush shrubland. Nest on cliffs, tall trees, junipers, and rock outcrops.	Not applicable.	Present; nesting reported within 1 mile.	Present; nesting reported within 1 mile.	Present; nesting reported within 1 mile.	Not applicable.
Mountain plover (*Charadrius montanus)*	NESL4, USFS, S1B, S2N	Includes short-grass prairie (vegetation less than 4 inches tall). Dry land, cultivated farms, and prairies dog towns. Habitat-defining characteristics: short vegetation, bare ground, and a flat topography.	Not applicable.	Not present; not known to occur in project vicinity.	Potentially present from Black Mesa to Little Colorado River.	Potentially present from Black Mesa to Little Colorado River.	Not applicable.
Northern goshawk (*Accipiter gentiles*)	NESL4, USFS WSC S3	Typically nests in drainages, canyon bottoms, or north-facing slopes of ponderosa pine stands (also mixed species, spruce-fir, and aspen) composed of large, mature trees and high canopy closure.	Not applicable.	Not present; no habitat.	Not present; no habitat.	Present within 1 mile on northern part of route by Shonto Plateau and Black Mesa.	Not applicable.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Peregrine falcon (*Falco peregrinus)*	NESL4, USFS, WSC, S4	Nests on steep cliffs in a scrape on sheltered ledges or potholes. Foraging habitat quality is important factor; often, but not always, extensive wetland and/or forest habitat is within the falcon's hunting range of 30 to 60 miles. Found at elevations between 3,500 and 9,000 feet.	Occasional use by foraging birds.	Occasional use by foraging birds.	Occasional use by foraging birds.	Occasional use by foraging birds.	Occasional use by foraging birds.
Western burrowing owl (*Athene cunicularia hypugaea)*	BLM, S3 NESL4	In Arizona, Great Basin shrubsteppe, Chihuahuan desertscrub, Mohave desertscrub, annual grassland; open, well-drained areas, often associated with burrowing mammals. 650 to 6,600 feet.	Not applicable.	Possible; no recent nesting records.	Likely; nesting records in vicinity of alignment (Corman and Wise-Gervais 2005).	Likely; nesting records in vicinity of alignment.	Not applicable.
Mammals							
Pale Townsend's big-eared bat (*Plecotus townsendii pallescens/ Corynorhinus t.p.)*	NESL4, S3, S4	Desertscrub, oak woodland, oak/pine, piñon/juniper, and coniferous forests, 5,500 to 7,520 feet, primarily 3,000 to 7,520 feet.	Not applicable.	Potential; generally suitable habitat.	Potential; generally suitable habitat.	Potential; generally suitable habitat.	Not applicable.
Pronghorn (*Antilocapra americana)*	NESL3	Found in grassland or desertscrub areas with rolling or dissected hills or small mesas, and usually with scattered shrubs and trees like juniper and sagebrush.	Not applicable.	Potential.	Potential; may occur in southern portion of alignment.	Potential; may occur in southern portion of alignment.	Not applicable.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Kit fox (*Vulpes macrotis)*	NESL4	Desertscrub and desert grassland.	Not applicable.	Potentially present.	Potentially present.	Potentially present.	Not applicable.
Reptiles and Amphibians							
Milk snake (*Lampropeltis triangulum)*	NESL4	Occurs primarily in plains grassland habitat in Arizona, and with snakeweed and rabbitbrush (AGFD 2003b).	Not applicable.	Potentially present.	Potentially present; records of occurrence at southern end of alignment (AGFD 2003b).	Potentially present; records of occurrence at southern end of alignment (AGFD 2003b).	Not applicable.
Northern leopard frog (*Rana pipiens)*	NESL2, USFS, WSC, S2	Grassland, brushland, woodland, and forest; usually in permanent waters with rooted aquatic vegetation. Also ponds, canals, marshes, springs, and streams, 4,500 to 10,000 feet.	Potentially present.	Unlikely; no suitable habitat in well field.	Unlikely; no record of occurrence.	Unlikely; no record of occurrence.	Potentially present.
Fish							
Bluehead sucker (*Catostomus discobolus)*	NESL4, USFS, S3	Occurs in a wide variety of areas, from headwater streams to large rivers; prefers riffle areas with rocky substrates.	Present in Clear Creek, Chevelon Creek, and Little Colorado River	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.
Flannelmouth sucker (*Catostomus latipinnis)*	USFS, S2	Primarily large and moderately large rivers. Larvae inhibit shallow, slow-flowing near shore areas, 1,540 to 3,160 feet.	Not present, out of range.	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.

Table F-13 Occurrence of Other Special Status Animal Species within the Project Water-Supply Infrastructure and Groundwater Withdrawal Areas

Species	Status	Habitat	C-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)	C-Aquifer Well Field	Water-Supply Pipeline: Eastern Route	Water-Supply Pipeline: Western Route	N-Aquifer Drawdown Area (Aquatic, Wetland and Riparian Species)
Roundtail chub (*Gila robusta)*	NESL2, USFS, WSC, S2	Occur in cool- to warm-water, mid-elevation rivers and streams throughout the Colorado River basin, often occupying open areas of the deepest rock pools and eddies of middle-sized to larger streams. They occasionally concentrate in relatively swift, turbulent waters below rapids, moving into less turbulent chutes in small groups.	Present in Clear Creek and Chevelon Creek.	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.
Little Colorado River sucker (*Catostomus* sp. 3)	BLM, USFS, S2	Endemic to upper portion of Little Colorado River and its north-flowing tributaries; occurs in creeks, small to medium rivers, and impoundments.	Present in Clear Creek, Chevelon Creek, and Little Colorado River.	Not present, no habitat.	Not present.	Not present.	Not present, no habitat.
Invertebrates							
Navajo Jerusalem cricket (*Stenopelmatus navajo)*	BLM, USFS	Sand dunes and sandy washes in desertscrub.	Not applicable.	Unlikely	Potential; sandy habitats present.	Potential; sandy habitats may be present.	Not applicable.

SOURCES: Arizona Game and Fish Department 2001-2005 (species abstracts); Arizona Partners in Amphibian and Reptile Conservation 2005; BIOME Ecological and Wildlife Research 2004; Corman and Wise-Gervais 2005; Detsoi 2005; Hoffmeister 1986; Miskow 2005; Navajo Fish and Wildlife Department 2005; Peabody Western Coal Company 2004

NOTES:

Status: BLM = BLM sensitive; USFS = Forest Service sensitive; NESL2 = Endangered on the Navajo Reservation; NESL3 = Threatened on the Navajo Reservation; NESL4 = Any species or subspecies for which the Navajo Fish and Wildlife Division does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them. The Navajo Fish and Wildlife Division is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under tribal code but should be considered in project planning.
WSC = Wildlife of special concern in Arizona (Arizona Game and Fish Department); S1 = Very rare; (Arizona Natural Heritage Program state rank);
S2 = Rare; S3 = Uncommon or restricted; S4 = Apparently secure; SB = State breeding; SN = State nonbreeding.

APPENDIX G

Appendix G
Land Use

G-1 Hopi Tribe Grazing

G-2 Navajo Nation Grazing

G-3 Grazing on Arizona State Trust Land

G-4 Grazing on Land Administered by the Forest Service (Kaibab National Forest)

G-5 Grazing on Land Administered by BLM

Table G-1 Hopi Tribe Grazing

	Range Unit (Number or Name)	Total Acres within Range Unit	Number of Permittees	Total Carrying Capacity for Range Unit (AUs)	Component/ Route: Acreage within Range Unit[1]	Percent within Range Unit[1]
Kayenta Mining Operations (Permanent Permit Area)						
1	263	52,909	6	95	3,041	5.75
Black Mesa Mining Operations (Unpermitted Area)						
1	263	52,909	6	95	3,162	5.98
Coal-Haul Road						
1	263	52,909	6	95	20	< 1
Coal-Slurry Pipeline: Existing Route						
1	263	52,909	6	95	38	< 1
2	254[2]	28,204	NA	NA	NA	NA
3	261	26,830	3	49	17	< 1
4	260	24,473	4	54	5	< 1
5	252	43,658	0[3]	118	17	< 1
6	253	50,687	1	65	79	< 1
7	251	28,828	6	176	44	< 1
Coal-Slurry Pipeline: Eastern Route (Moenkopi Wash Realignment)						
1	263	52,909	6	95	70	< 1
2	261	26,830	3	49	33	< 1
3	260	24,473	4	54	21	< 1
4	253	50,687	1	65	15	< 1
C-Aquifer Water-Supply Pipeline: Eastern Route						
1	263	52,909	6	95	62	< 1
2	262	32,973	6	42	30	< 1
3	351	27,985	6	86	52	< 1
4	North Oraibi	52,430	12	82	80	< 1
5	South Oraibi	31,066	5	94	87	< 1
6	Shonto	37,598	23	131	62	< 1
7	553	35,553	4	90	40	< 1
8	555	35,674	5	36	9	< 1
9	554[2]	30,262	NA	NA	NA	NA
Water-Supply Pipeline: Eastern Route (Kykotsmovi Area Subalternatives)						
1	South Oraibi	31,066	5	94	17	< 1
2	North Oraibi	52,430	12	82	<1	< 1

SOURCE: Hopi Office of Community Planning & Economic Development 2001

NOTES: Grazing is fee-based on Hopi land.

AU = The Hopi Tribe defines an animal unit as one cow is equal to four sheep.

Detailed baseline studies of the native plant communities on the Peabody Black Mesa leasehold, including composition and production data, indicate that stocking rates estimated from available forage data are much lower than the levels allowed for under the existing permits and at the current grazing levels.

Approximate acreage along the pipeline alignment was calculated at 65 feet.

[1] Numbers are approximate.

[2] Grazing is not permitted, based on rough terrain and wilderness designations within the Range Unit.

[3] There are currently no grazing permittees using this range unit as of April 2006.

Table G-2 Navajo Nation Grazing

	Range District	Total Acres within Range Unit	Number of Permits	Total Sheep Units Permitted for Range Unit (AUs)	Component/Route: Acreage within Range District[1]	Percent within Range District[1]
Kayenta Mining Operations (Permanent Permit Area)						
2	4[2]	607,987	83	3,250	13,247	2
3	8[2]	1,472,048	695	30,363	27,403	2
Black Mesa Mining Operations (Unpermitted Area)						
2	2[2]	1,012,872	357	17,144	902	< 1
3	4[2]	607,987	83	3,250	5,904	1
4	8	1,472,048	695	30,363	8,918	1
Coal-Slurry Pipeline: Existing Route						
1	2[2]	1,012,872	357	17,144	5	< 1
2	3[3]	1,518,199	668	40,448	438	< 1
3	4[2]	607,987	83	3250	54	< 1
Coal-Slurry Pipeline: Existing Route (Moenkopi Wash Realignment)						
1	2	1,012,872	357	17,144		< 1
2	4	1,007,987	83	3,250		< 1
C-Aquifer Water-Supply Pipeline: Eastern Route						
1	4[2]	607,987	83	3,250	147	< 1
2	5[2]	641,237	356	22,280	358	< 1
C-Aquifer Water-Supply Pipeline: Western Route						
1	1[2]	927,292	526	26,466	158	< 1
2	2[2]	1,012,872	357	17,144	147	< 1
3	3[3]	1,518,199	668	40,446	353	< 1
4	4[2]	607,987	83	3,250	15	< 1
5	5[2]	6,941,237	356	22,280	344	< 1
6	8[2]	1,472,048	695	30,363	83	< 1

SOURCE: Bureau of Indian Affairs 2005

NOTES: AU = The Navajo Nation defines an animal unit in sheep units as one cow is equal to four sheep, or one horse or one burro or one mule is equal to five sheep, or one goat is equal to one sheep.

Detailed baseline studies of the native plant communities on the Peabody Black Mesa leasehold, including composition and production data, indicate that stocking rates estimated from available forage data are much lower than the levels allowed for under the existing permits and at the current grazing levels.

Approximate acreage along the pipeline alignment was calculated at 65 feet.

[1] Numbers are approximate.

[2] AUs are not permitted within the Navajo Partitioned Land (NPL) in accordance to 25 CFR Part 161; therefore, data indicate permits outside the previously identified NPL boundary. However, grazing is known to occur on NPL land without permit.

[3] District includes land owned by the Hopi Tribe; however, Hopi currently do not graze this land.

Table G-3 Grazing on Arizona State Trust Land

	Lease No.	Name	Acres	AUMs	Coal-Slurry Pipeline Route: Acreage within Allotment	Percent within Allotment
Coal-Slurry Pipeline (Existing Route)						
1	12	Aja Sheep Company, Inc.	3,062	571	8	<1
2	252	Babbitt Ranches LLC	81,314	22,060	42	<1
3	124	Blake Cattle Company	31,714	345	74	<1
4	132	Navajo Nation	238,034	35,620	52	<1
5	531	Gross Family Ltd Partnership	977	73	11	1
6	541	Seibert Land Company LLC	86,477	19,402	45	<1
7	624	JM Ranch LLC	10,454	1,567	8	<1
8	894	Michelback Livestock LLC	959	15	7	1
9	1045	Perrin Ranch LLC	15,090	4,169	16	<1
10	1161	Diamond 7 Ranch, LLC	30,867	5,458	39	<1
11	1423	WF Cattle Company	18,659	2,092	24	<1
12	1559	Yavapai 10000 LLC	26,049	3,195	28	<1
13	1641	Rudy Echeverria Et Al	16,631	2,802	24	<1
14	1702	JM Ranch LLC	7,329	1,567	9	<1
15	1703	Manterola Sheep Company	12,165	1,816	33	<1
16	2136	Hafley Family Ltd. Partnership	4,631	1,102	5	<1
17	2672	X-One Ranch, Inc.	48,310	582	16	<1
18	93762	Mike Oden Family Trust	14,478	2,170	22	<1
Coal-Slurry Pipeline (Kingman Reroute)						
1	908	Clay Overson	1,390	156	9	1
2	1423	WF Cattle Company	18,659	2,092	7	<1
3	489	Roger D Rolands	4,688	611	8	<1

SOURCES: Arizona State Land Department GIS data transfer on August 1, 2005; Stephen Williams 2005

NOTES: Numbers are approximate.

AUM = Animal unit month is defined by Arizona State Land Code, Title 37, as one animal unit grazing for one month.

AU = Animal unit is defined by the Arizona State Land Code, Title 37, as one weaned beef animal more than 6 months of age, or one horse, or five goats, or five sheep, or the equivalent (personal communication with Stephen Williams, July 22, 2005).

Grazing is fee-based on State land.

Table G-4 Grazing on Land Administered by the Forest Service (Kaibab National Forest)

	Name	Acres	AUMs	Coal-Slurry Pipeline Route: Acreage within Allotment	Percent within Allotment
Coal-Slurry Pipeline: Existing Route					
1	Smoot Lake	41,133	1,800	14	<1
2	Ebert	5,400	700	25	<1

SOURCES: Forest Service Kaibab National Forest Land Management Plan, as amended 1996; Higgins 2005

NOTES: Numbers are approximate.

AUM = An animal unit month is defined by the Forest Service as the quantity of forage required by one mature cow (1,000 pounds) or the equivalent for 1 month (Forest Service 1996).

Grazing is fee-based on land administered by the Forest Service.

Table G-5 Grazing on Land Administered by BLM

	Allotment	Name	Acres	Forage Availability[1]	AUMs[2]	Coal-Slurry Pipeline Route: Acreage within Allotment	Percent within Allotment
Coal-Slurry Pipeline: Existing Route							
1	0010	Black Mountain	52,904	P/E	1,247 (1,735-suspended)	18.5	<1
2	0068	Thumb Butte	18,050	E	0	84	<1
3	0024	Cook Canyon	4,583	P/E	269	6	<1
4	0074	West Peacock	1,849	P	204	58	3
Coal-Slurry Pipeline: Existing Route (Kingman Reroute)							
1	0010	Black Mountain	52,904	P/E	1,247 (1,735-suspended)	7	<1
2	0047	Hualapai Peak	24,914	P	2,052 (432-suspended)	61	<1
3	0052	Lazy YU	12,852	P/E	941	22	<1
4	0074	West Peacock	1,849	P	204	14	1

SOURCES: Bureau of Land Management 1993 (supplemented with GIS grazing data 1999); Spears 2005

NOTES: Numbers are approximate.

Silver Creek Allotment is located within the Black Mesa Project Study Area near Bullhead City; however, the allotment has been closed.

AUM = An animal unit month is defined by the BLM as the amount of forage necessary for the sustenance of one cow or five sheep for 1 month (Bureau of Land Management 1993).

[1] P/E = Perennial/Ephemeral, P = Perennial only and E = Ephemeral only.

[2] Suspended animal unit months is defined as when the number of animal unit months an area can produce is reduced due to drought or other reduction in forage production.

Grazing is fee-based on Bureau of Land Management-administered land.

APPENDIX H

Appendix H

Impact Assessment Methodology: Water Resources (Hydrology)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

ADWR	Arizona Department of Water Resources
af/yr	acre-feet per year
C aquifer	Coconino aquifer
cfs	cubic feet per second
CHIA	Cumulative Hydrologic Impact Analysis
D aquifer	Dakota aquifer
EIS	environmental impact statement
GeoTrans	HIS GeoTrans and Waterstore
LOM	life of mine
mg/L	milligrams per liter
N aquifer	Navajo aquifer
NTUA	Navajo Tribal Utility Authority
OSM	Office of Surface Mining Reclamation and Enforcement
Peabody	Peabody Western Coal Company
ppm	parts per million
R aquifer	Redwall aquifer
SSPA	S.S. Papadopulos and Associates
USGS	United States Geological Survey
2-D	two-dimensional
3-D	three-dimensional

Appendix H
Impact Assessment Methodology:
Water Resources (Hydrology)

This appendix describes the rationale and impact factors applied to assessing changes to the water resources of the study area due to the proposed actions. Some of the alternatives include several subalternatives with impacts expected to be similar in type, varying only in degree. In order to reduce repetition in the text and improve readability factors, which apply to the analysis of all alternatives and subalternatives, are discussed in this appendix. This includes the definition of key hydrologic impacts and the rationale for assigning impacts. A section also is presented that describes the analytical tools that were available for quantifying impacts, where appropriate and possible.

HYDROLOGIC IMPACTS

Region of Influence

Groundwater

The primary region of influence from groundwater pumping is the area that would be impacted by the projected drawdown caused by that pumping. As a practical matter, the area might reasonably be defined as the area within the 0.1-foot drawdown contour under the maximum pumping scenario, as this is the lower limit of what is assumed to be potentially measurable (water levels are often measured to 0.01 foot; however, this is arguably within the measuring error of most commonly used equipment). Furthermore, ambient water-level fluctuations due to tides, barometric pressure, and temperature changes usually exceed 0.01 foot and even 0.1 foot, making it difficult if not impossible to measure changes relative to ambient conditions. However, the scoping process identified some areas of particular interest to the general public and to Federal and State agencies that lie outside the 0.1-foot drawdown contour. For the Coconino aquifer (C aquifer), these include critical habitat areas near Blue Springs on upper East Clear Creek and in lower Chevelon Creek. Therefore, the region of influence relative to the C-aquifer well field is from Blue Springs on the Little Colorado River near its confluence with the Colorado River on the north to upper East Clear Creek near the Mogollon Rim on the south, and from Flagstaff on the west to past Holbrook on the east (refer to Map 3-5 in Chapter 3).

For the Navajo aquifer (N aquifer), the region of influence includes the confined area of the aquifer and extends to the gages on measured streams and springs located in the unconfined portions of the aquifer. Gaged streamflow data are available for four washes that are supported by N-aquifer discharge—Moenkopi Wash, Laguna Creek, Dinnebito Wash, and Polacca Wash. Measured N-aquifer springs include Moenkopi School, Pasture Canyon, Burro, and the unnamed spring near Dennehotso (U.S. Geological Survey [USGS] 2005a). Location of the washes, springs, and other key features relative to the N-aquifer well field are shown on Map 3-4 (refer to Chapter 3).

Surface Water

The region of influence for surface water is the entire study area since the mines, coal-slurry pipeline, and C aquifer water-supply pipeline all involve construction activities in or near surface-water drainages.

Key Hydrologic Impacts

Based on the scoping process, hydrologic impacts can be summarized under three key types. These include:

- Impacts of drawdown on the aquifer and other water users;
- Diminution of stream and spring flow; and
- Changes in groundwater and surface-water quality.

Impact Levels

In assessing the principal hydrologic impacts it is necessary to assess the severity of an impact. This is accomplished through the assignment of an *impact level* to the identified impact. Impact levels for hydrology are defined below.

- *Major* – Adverse impacts: effects that result in a violation of water-quality standards or that economically, technically, or legally eliminate use of the resource. Beneficial impacts: those that would improve water quality or contribute to or restore water resources capability to the region, such as to greatly increase the potential for human or ecological use.
- *Moderate* – Effects that are outside of the random fluctuations of natural processes but do not cause a significant loss of the use of the resource. Moderate beneficial impacts would simply extend the beneficial use beyond natural variations about the current mean value.
- *Minor* – Changes that would affect the cost or quality but not the use of water or are similar to those caused by random fluctuations in natural processes.
- *Negligible* – Impacts of less magnitude, but still predictable under current technology (e.g., computer models) or measurable under commonly employed monitoring technology.
- *None* **–** Effects that are not predicted or cannot be measured.

Assignment of the impact levels is based on analysis and professional judgment. In general this study follows the impact evaluation criteria developed for Reclamation's Assessment of Western Navajo and Hopi Water Supply Needs, Alternatives and Impacts (HDR 2003). The analysis and determination of impact levels for each of the key hydrologic impacts are described below. It should be noted that the hydrologic impacts in this section focus on the quantity and quality of surface and ground water available for municipal, irrigation and industrial uses; it is understood, however, that other uses, such as for fish and wildlife are also important. Impacts on these uses have impact values developed separately (see Chapter 4.8)

Impacts of Drawdown on the Aquifer and Other Water Users

The impact of pumping is commonly measured by a projected lowering of the water level in the pumping wells and in wells located within the cone of depression created by the pumping well(s). The lowering of the water level creates five primary effects, as follows:

- Increase the cost of pumping by increasing the lift to get the water to the land surface.
- In unconfined aquifers a reduction in saturated thickness of the aquifer surrounding the well and consequently the transmissivity (ability of the aquifer to transmit water to the well). In severe cases, a well can cease to produce water or "go dry."
- Lowering of aquifer water levels in the area of perennial streams and springs. Lowered aquifer water levels can result in a diminution of groundwater discharge and/or depletion of stream base flow and spring flow.
- Migration of man-caused or natural poor quality groundwater toward the well field.
- Extensive long-term pumping can increase the potential for subsidence in unconsolidated aquifer systems due to compression of fine-grained layers and, in some limestone aquifers, can foster sinkhole development due to removal of cavity filling material and dissolution of the limestone.

Cost of Pumping

The cost of pumping groundwater is given by the following equation (Campbell and Lehr 1974):

$$Cost\ /\ Hour = \frac{(pumping\ rate\ (gpm))\ x\ (Lift + friction\ (ft))\ x\ (0.746)\ x\ (power\ (K/kW-hr))}{(3960)\ x\ (pump\ efficiency)\ x\ (motor\ efficiency)}$$

The cost of groundwater pumping in the study area was estimated by applying typical Arizona well values for the following parameters (HDR 2003):

- Power ($0.07 kilowatt hour)
- Pump efficiency (75 percent)
- Motor efficiency (90 percent)

Wells that tap the confined portion of the N aquifer (where the greatest N-aquifer pumping impacts occur) are generally deep and limited to industrial (e.g., Peabody Western Coal Company [Peabody]) or municipal users. Based on modeling studies, Navajo Tribal Utility Authority (NTUA) Forest Lake Well #1 is projected to experience the greatest drawdown due to mine pumping (GeoTrans 2006). Depth to water in this well in 2001 (latest measurement available) was 1,163 feet below ground surface (USGS 2005b). Assuming the above unit cost factors and the 2003 average pumping rate of 10 acre-feet per year (af/yr), the cost per hour is $0.4. Converting this to an annual power cost (at 85 percent usage) yields $2,668 for the NTUA Forest Lake Well #1.

Community wells at Piñon produce more water, supplying about 316 af/yr in 2003 with a lift of 887 feet. Annual cost of power for these wells is estimated to be $46,152. Wells at Piñon are farther from the mine than Forest Lake and will experience less drawdown and increased lift due to project pumping. For example, under the maximum proposed N-aquifer pumpage (6,000 af/yr), increased lift due to project pumping at Piñon is predicted to be 32.8 feet at the end of 2025 versus 75.8 feet at Forest Lake. This translates into an estimated increase in annual power cost of $1,665 at Piñon and $168 at Forest Lake, or a 3.7 and 6.5 percent increase, respectively. Given the higher percentage increase at Forest Lake, this well is used to assess impacts under the various proposed pumping options.

Most of the wells within the region of influence of the C-aquifer well field are stock-watering wells. For wells with electric pumps, an average annual pumping cost can be estimated using the above equation and unit cost factors. Using median values of well-pumping rates (15 gallons per minute) and depth to water, or lift (240 feet) for wells within 10 miles of the well field, yields a cost per hour of $0.07; converting this cost to dollars per acre-foot gives $26. This is between $78 and $130 per year based on 3 to 5 af/yr for a stock well (Prosser 2005).

It should be noted that many C aquifer stock-watering wells have windmills and not electric pumps. For these wells, costs do not increase when the water level declines, as long as the decline does not require the pump to be set deeper. The pump setting depth in wells in the area is generally unknown. Assessing the impact of project pumping on these wells relies on available data on the height of the water column in the well (depth of the well minus the static water level) and is evaluated in the same manner as the potential reduction in aquifer saturated thickness, as described in the subsequent subsection, Impacts on Aquifer Thickness (Saturation).

The difference in annual well-pumping costs associated with the N and C aquifer well-field pumping is significant, with annual costs being much greater for N-aquifer municipal users based on higher pumping rates and greater pumping lift. A 10 percent increase in pumping cost at a C aquifer stock-water well is on the order of $8 to $10 per year whereas the same percent increase at Forest Lakes NTUA #1 and Piñon is $267 and $4,615, respectively. Therefore, different impact levels were established for each aquifer, as given in Table H-1 and Table H-2.

Table H-1 N-Aquifer Impact Levels, Increase in Pumping Cost Criteria

Impact Level	Percent Increase in Pumping cost
Major	>51
Moderate	26-50
Minor	11-25
Negligible	1-10
None	0

Table H-2 C-Aquifer Impact Levels, Increase in Pumping Cost Criteria

Impact Level	Percent Increase in Pumping Cost
Major	>201
Moderate	101-200
Minor	51-100
Negligible	1-50
None	0

Impacts on Aquifer Thickness (Saturation)

When water levels in the area of influence of the well fields are below (or fall below) the top of the aquifer, the aquifer is potentially subject to dewatering over time (so long as aquifer water levels decline). Dewatering reduces the aquifer's saturated thickness (amount of the aquifer that is full of water) and therefore its ability to yield water to wells (transmissivity) in the area of the well field. Theoretically, maximum well yield occurs at 100 percent of the drawdown, or when the water level is at the bottom of the aquifer. For unconfined aquifers, 90 percent of the maximum well yield is obtained at 67 percent of the maximum drawdown (Driscoll 1986). In practice, however, the water level cannot be drawn down to the bottom of the aquifer. In addition, most wells exhibit some well loss (a function of the aquifer, well construction and pumping rate), resulting in the pumping water level inside the well being deeper than the water level in the aquifer immediately outside the well. A conservative range of between 20 percent (negligible) and 50 percent (major) reduction in aquifer thickness criterion was selected for this study to account for these expected variations from the theoretical.

Within the region of influence, most of the potentially impacted C-aquifer wells are within the unconfined portion of the aquifer (Figure H-1). This is not the case in the N and D aquifers. In these aquifers almost all of the wells that are predicted to experience water-level declines due to project-related pumping are located in the confined portion of the aquifer and are not predicted to have their water levels lowered below the top of the aquifer (Figure H-2). In other words, the aquifer remains fully saturated and no reduction in saturated thickness or transmissivity is predicted for the N and D aquifers.

The criteria shown in Table H-3 are applied to assess the effect of aquifer dewatering on a well's ability to sustain its long-term yield.

Table H-3 Impact Levels, Reduction in Saturated Thickness Criteria

Impact Level	Percent Reduction in Saturated Thickness
Major	>51
Moderate	31-50
Minor	21-30
Negligible	1-20
None	0

Impacts on Stream and Spring Flow

Changes in the annual average flows in streams and springs due to mining activities and withdrawal of groundwater were identified as an issue during project scoping. Impacts on biological resources are discussed in Chapter 4, Sections 4.7 and 4.8 of this Draft Environmental Impact Statement (EIS) and are not addressed here.

The closest significant stream to the C-aquifer well field is Canyon Diablo, which drains approximately 1,200 square miles of watershed south of the Little Colorado River. Canyon Diablo is an ephemeral stream with few uses and it is not expected to be impacted by pumping at the well field due to the fact that groundwater in the well field is more than 200 feet below the bottom of the stream channel.

The nearest C aquifer perennial streams where the groundwater level is at or above the stream channel are upper East Clear Creek, lower Clear Creek, and lower Chevelon Creek, located approximately 41, 26, and 33 miles, respectively, south and southeast of the proposed C-aquifer well field (refer to Map 3-5 in Chapter 3).

The Arizona Department of Water Resources (ADWR) estimates that the average annual outflow of Clear and Chevelon Creeks at their confluence with the Little Colorado River, after all diversions, is 61,860 af/yr and 40,680 af/yr, respectively (ADWR 1994). Historic baseflow (1906-1972) in Chevelon Creek has ranged between 4 and 6 cfs; the gauged data for Clear Creek are less consistent due to up stream diversions (SSPA 2005). In June 2005, the USGS measured base flow at several locations in lower Clear and Chevelon Creeks. Measured base flow near the confluence with the Little Colorado River was 5.4 cubic feet per second (cfs) in Clear Creek and 2.7 cfs in Chevelon Creek. Converting this to af/yr yields 3,903 af/yr for Clear Creek and 1,951 af/yr for Chevelon Creek. Current base flow, as a percent of depleted average annual outflow, is approximately 5 to 6 percent for both creeks.

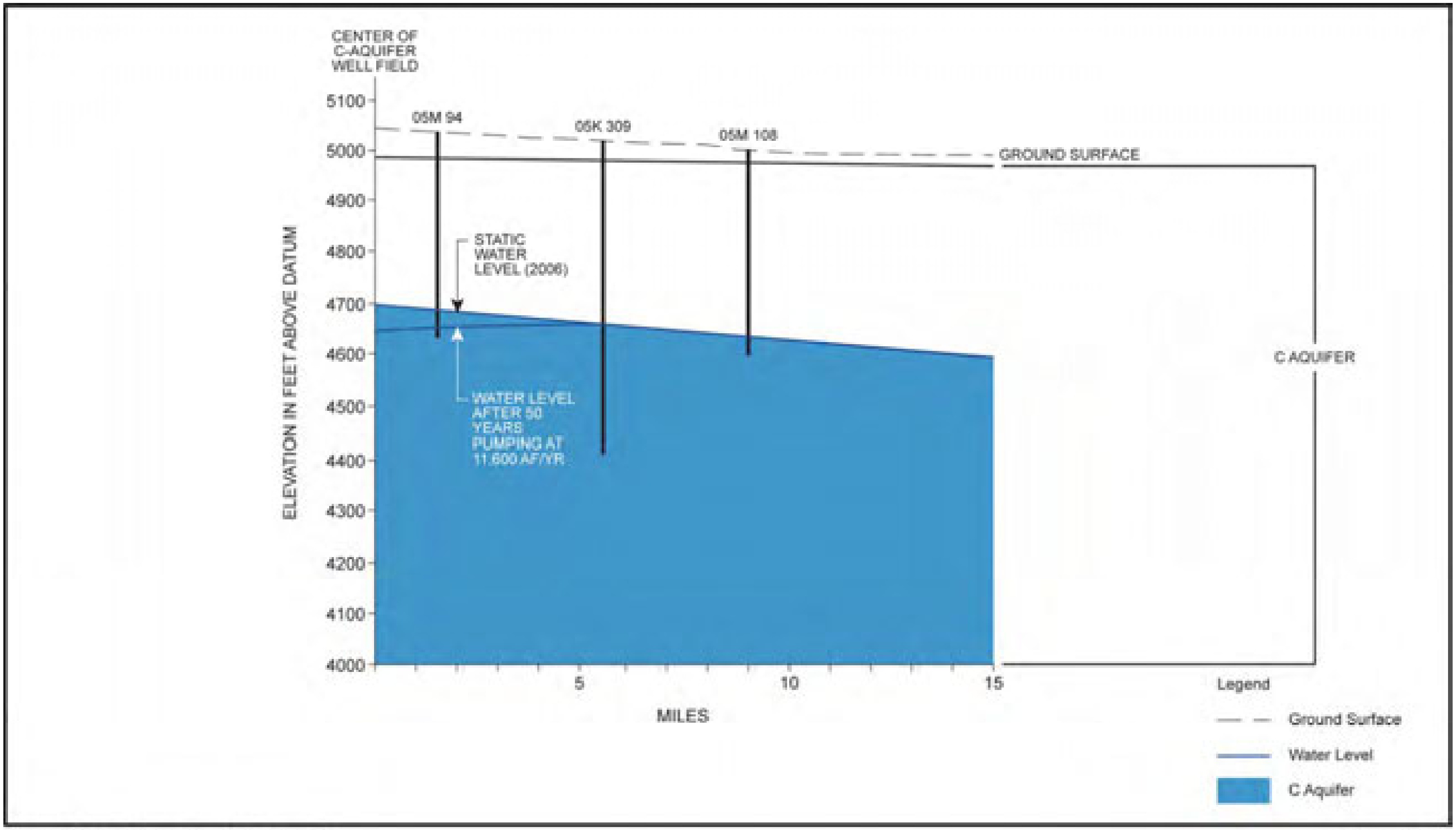
On an average annual streamflow basis, the loss of all the base flow would have no more than a moderate impact on the available supply. However, during the dry summer months, the water available for diversion is just the base flow component and whatever storm water is not captured by upstream storage reservoirs. Ignoring water available from storage adds a degree of conservatism to the estimation of impacts; therefore, the impact on existing and future users is measured against any reduction in summer base flow, as well as annual flow.

The USGS monitors streamflow in four washes (Moenkopi Wash, Laguna Creek, Dinnebito Wash, and Polacca Wash) that overlie the N aquifer. These washes (and others) were modeled by Peabody to assess potential changes in streamflow due to mine pumping. Of the monitored and modeled washes, Moenkopi Wash is predicted to experience the greatest, albeit small (13.3 af/yr or 0.02 cfs), depletion due to pumping from the N-aquifer well field under the maximum pumping alternative (GeoTrans 2006). (Begashibito Wash/Cow Springs is closest to the Peabody well field and is predicted by the model to have the greatest depletion, but flow in this wash is not monitored [refer to Table 4-8 in Chapter 4]). Streamflow in Moenkopi Wash near Tuba City has been measured since 1976. The wash is intermittent with zero flow during many of the summer months. Median annual flow has varied from approximately 1 to 5 cfs, with no long-term trend (USGS 2005a). Average annual streamflow for the period of record is 9.7 cfs (USGS 2005b). Maximum predicted depletion is about 0.2 percent of average annual flow.

Blue Springs is the major discharge point for the C aquifer, releasing over 164,000 af/yr into the Little Colorado River between river miles 3 and 15 upstream from its confluence with the main stem of the Colorado River. Water at the springs discharges from the Muav and Redwall limestones (R aquifer), but originates in the overlying C aquifer, migrating downward through faults and fractures. Water from the springs is not potable (salinity is 3,000 parts per million [ppm]), but is of cultural significance to the Hopi and Navajo people and supports a critical habitat for the humpback chub. Blue Springs is approximately 77 miles north-northwest of the C-aquifer well field (refer to Map 3-5 in Chapter 3).

The USGS has been monitoring N-aquifer spring flow from four springs (Moenkopi School, Pasture Canyon Spring, Burro Spring, and an unnamed spring near Dinnehotso) for a minimum of 10 years (some springs have been monitored for much longer but not always at the same location). The closest USGS monitored spring (the unnamed spring near Dinnehotso) is more than 35 miles from the Black Mesa Complex. The USGS concludes that “for the consistent periods of record at all four springs, the discharges have fluctuated but long-term trends are not apparent” (USGS 2005a). It appears that pumping to-date has not measurably reduced the monitored N-aquifer spring flow. However, modeling of N-aquifer groundwater discharge suggests that as future non-mining related ground water pumping in close proximity to some of these springs increases, flows from springs could be impacted (GeoTrans 2006).

There are other N-aquifer springs that are not monitored and past changes to these springs, if any, are unknown. As discussed in a subsequent section of this appendix, numerical models of the N aquifer are not designed to simulate discharge from individual springs (Brown and Eychaner 1988; GeoTrans 1999). However, the GeoTrans model does simulate groundwater discharge to Begashibito Wash approximately 25 miles west of the leasehold. Cow Springs, located at the southwestern extent of Begashibito Wash, is an area of groundwater discharge as expressed by seeps and small springs. Cow Springs is the closest modeled area of seeps and springs to the mine and would therefore experience the greatest impact due to project pumping. Predicted reduction in groundwater discharge into Begashibito Wash/Cow Springs (combined) due to maximum project-related pumpage (6,000 af/yr) at the end of 2025 is estimated to be 14.9 af/yr, or 0.69 percent of the estimated 2005 groundwater discharge (refer to Table 4-8 in Chapter 4).

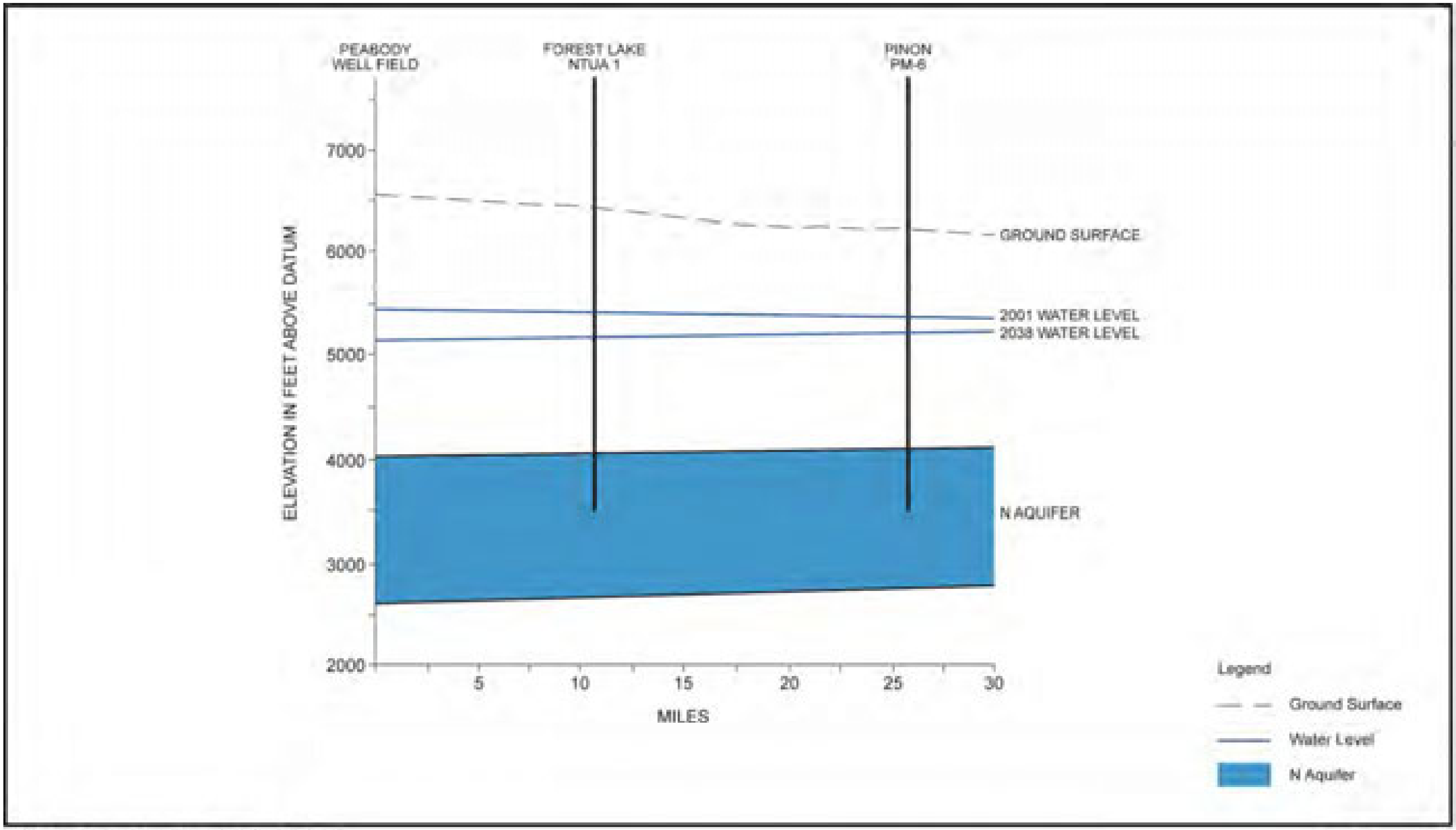


SOURCE: Southwest Ground-water Consultants 2006

C Aquifer
Relationship Between Maximum Project Pumping and Aquifer Saturated Thickness

URS

Figure H-1



SOURCE: Southwest Ground-water Resources 2000

N Aquifer
Relationship Between Maximum Project Pumping and Aquifer Saturated Thickness

Figure H-2

Impact levels for the effects on surface water uses in washes, creeks, and springs are defined as shown in Table H-4.

Table H-4 Diminution of Groundwater Discharge (Base Flow) to Streams and Springs

Impact Level	Percent Reduction
Major	>31
Moderate	21-30
Minor	11-20
Negligible	<10
None	0

Migration of Poor Quality Groundwater

In some situations, extensive long-term groundwater pumping can cause poor quality groundwater to migrate toward a pumping center. Concerns have been raised that pumping from the N aquifer could cause poorer Dakota-aquifer (D aquifer) water to migrate downward into the N aquifer. Geochemical studies have shown that downward leakage from the D aquifer to the N aquifer has been occurring for thousands of years. Most natural leakage occurs in the southern portion of Black Mesa Basin where the intervening Carmel aquaclude is less than 120 feet thick and has a higher sand content than in other areas of the basin (Truini and Macy 2005). The areas of known leakage are located more than 20 miles from the Peabody wellfield. While leakage has occurred under natural conditions over a long period of time, water-quality monitoring of the N aquifer for more than 10 years during the period that mining-related and coal-slurry pumping has been occurring has shown no trend in water-quality degradation (USGS 2005a). Peabody monitors the quality of water produced from its production wells. Over the more than 20-year period that pumpage has occurred, there has been no discernible trend to suggest that water quality is declining. Total dissolved solids, sulfate, and chloride have all remained stable over the life of the wells. If leakage is occurring, it is too small to be detected in the concentration of these constituents.

Peabody conducted an analysis of potential leakage from the D aquifer to the N aquifer using the GeoTrans model and standard mixing calculations. Pumping from the N aquifer was similar to that proposed under the preferred alternative with the exception that some additional pumpage was simulated for wellfield maintenance (Scenario K). Results of this analysis indicated a maximum increase in N-aquifer sulfate concentration of 1 percent in 2039 in the eastern part of the aquifer (Peabody 1986, revised 2003, Table 23).

Under the three N-aquifer pumping options considered in this study, two would result in reduced pumpage in the future and consequently less drawdown than has occurred in the past and less potential for water-quality degradation. One option would result in a 33 percent increase in recent past (2004-2005) pumping over the life of the mine. While there is no known reason to suspect that water quality would deteriorate over the life of the mine, there is a level of uncertainty not associated with the other options. Any impact would not be sufficient to cause a loss of the resource; however, an impact level of minor is conservatively assigned.

Groundwater quality in the C-aquifer well field, while not as good as the N aquifer, is suitable for most drinking water and industrial uses. However, water quality declines to the northeast with total dissolved solid levels reaching 2,000 milligrams per liter (mg/L) approximately 10 miles from the center of the proposed well field. The potential for this water to migrate into the well field was evaluated using particle tracking methods. The capture area of the well-field pumping at the maximum rate (11,600 af/yr) does not reach the 2,000 mg/L isopleth, although it does reach the 1,500 mg/L isopleth. Based on the modeling, it was concluded that water quality would remain suitable for drinking water purposes over the modeled period (S.S. Papadopulos and Associates [SSPA] 2005). Some deterioration in water quality over the planning period cannot be ruled out, however. Given this uncertainty, a potential impact level of moderate is conservatively assigned.

Subsidence and Sinkholes

As discussed in Chapter 3, Section 3.4, the N and C aquifers are principally comprised of sandstone. These sandstones are indurated and are not subject to significant compaction and subsequent land subsidence. Studies of the lithology and compressibility of the Navajo Sandstone in the Black Mesa Complex indicate that it would be subject to compaction of less than 1 percent if the water level was drawn down to the top of the aquifer (GeoTrans 1993). None of the N-aquifer pumping scenarios result in the water level being lowered to the top of the aquifer within the Black Mesa Basin. No evidence of casing distress has been noted in any of the surveyed Peabody production wells as might be expected if significant compression of the Navajo Sandstone or overlying units had occurred (Office of Surface Mining Reclamation and Enforcement [OSM] 2006).

In 2003 land subsidence features in the form of sinkholes, cracks, and slumps were reported near Forest Lake, about 7 miles south of the Black Mesa Complex. After investigation by OSM, Navajo Nation Minerals Department, Navajo Nation Water Resources Department, and USGS, all of the subsidence features of concern were determined to be either in or adjacent to unconsolidated alluvial valley deposits and due to surface water entering and eroding desiccation features following an extended period of drought (OSM 2006). These features are unrelated to the mining or water production facilities on Black Mesa.

In the area of Snowflake, about 50 miles southeast of the proposed C-aquifer well field, there are numerous sinkholes in the Kaibab Limestone. These features may be associated with another structural feature referred to as the Holbrook anticline. The cause of the sinkholes is not well understood; however, they occur in the same general area as a natural plume of high-salinity groundwater. The source of the salinity is thought to be the solutioning and upwelling of water that has passed through halite and gypsum beds in the underlying Supai Formation (ADWR 1989). This same solutioning may cause the overlying Coconino Sandstone and Kaibab Limestone to subside or collapse, forming downwarps and sinkholes. There are no known sinkholes in the area of the proposed C-aquifer well field. Salinity in Coconino Sandstone at the well field site ranges from 600 to 800 ppm and is not as saline (>2,000 ppm) as in the area of known sinkholes, suggesting that significant solutioning in the Supai Formation has not occurred in the well-field area.

Subsidence and formation of sinkholes in the N- and C-aquifer well field areas are considered highly unlikely.

IMPACT ASSESSMENT TOOLS

<u>Surface Water</u>

The life-of-mine (LOM) permit application package provided detailed analysis of surface-water flow and water quality. The Final EIS, Proposed Permit Application, Black Mesa-Kayenta Mine, Navajo and Hopi Indian Reservations, Arizona (OSM 1990) provided data on impacts up to 1989. A Cumulative Hydrologic Impact Analysis (CHIA) was written by OSM in 1989 for Kayenta and Black Mesa mining operations (OSM 1989). At that time the impact area did not extend beyond the mines because no other permitted or anticipated surface-mining activity existed. The groundwater impact area included all of the Black Mesa groundwater basin. The CHIA currently is being updated by OSM to include all pertinent LOM permitted facilities. OSM will complete the CHIA prior to making its decision on the LOM revision application.

The assessment of impacts on surface water in this EIS used data and analysis presented in the LOM Permit Application Package and included design drawings for typical sedimentation ponds, impoundments, and diversions, as permitted by OSM and tribal authorities. Runoff amounts were validated against gaging stations operated by either the USGS or Peabody. Other runoff volumes were estimated using the program SEDIMOT II. SEDIMOT II also was used to predict the suspended sediment concentration of water entering the major washes (Peabody 1986, revised 2005). Other water-quality impacts were evaluated using experience and literature review of typical Surface Mining Control and Reclamation Act-permitted coal-mining operations.

Data supplied by OSM also yielded pertinent information regarding surface water. The area of consideration for surface water extended to the mouth of Dinnebito and Moenkopi Washes. The analysis examined surface-water quantity and quality in the two washes, pre- and postmining (OSM 2006).

Groundwater

The effects of groundwater pumping for the Kayenta and Black Mesa mining operations on the shallow aquifers (Wepo and stream alluvium) and on the deeper C and N aquifers have been investigated in numerous studies. Evaluation of project effects on groundwater considered information available from these studies and models and are discussed below.

Wepo and Alluvial Aquifers

Potential groundwater impacts of the mining plan were assessed as part of the LOM permit application using a variety of methods. Inflow to the mining pit from the Wepo Formation (coal) aquifer was assessed using an analytical model based on the constant drawdown, variable-discharge formula for confined aquifers (Jacob-Lohman method, in Kruseman and de Ridder 1994). Other modeling was accomplished using the computer code TWODAN.

N Aquifer

In the 1989 CHIA, N-aquifer groundwater impacts were analyzed using a reconstructed version of the USGS groundwater MODFLOW model of Eychaner (1983). This model is a two-dimensional (2-D) model of the N-aquifer system (Brown and Eychaner 1988). Peabody commissioned HSI GeoTrans and Waterstone to develop a three-dimensional (3-D) groundwater flow model of the N and D aquifers (Peabody 1999). These models are described below.

- ***USGS Black Mesa Model***. The USGS developed a finite-difference model of the N aquifer in 1983. This model was upgraded, including reformatting to the MODFLOW code, in 1988 by Brown and Eychaner and again in 2000 to reflect 1999 conditions. The model was designed to evaluate the impacts of current and future groundwater withdrawals for Peabody coal mining, as well as municipal withdrawals from surrounding Indian communities.

  The model is 2-D and is comprised of one layer that represents the N aquifer. A general head boundary was used to simulate vertical flow between the D aquifer and N aquifer. The model was calibrated to equilibrium conditions (pre-1965) and to transient conditions (1965-1984). The aquifer's response to pumping was predicted to 2051 for five pumping alternatives.

This model has undergone the most extensive peer review of the available models. It is generally recognized as providing a reasonable simulation of the N aquifer's response to pumping.

- ***GeoTrans D- and N-Aquifer Model***. Peabody retained HSI GeoTrans and Waterstone to develop a finite-difference model of the D and N aquifers using the MODFLOW numerical code. This is a regional 3-D groundwater flow model developed to estimate the effects of pumping by Peabody and several Indian communities on the aquifers and on surface-water flows.

  The GeoTrans model covers a slightly larger area than the USGS model. Additional hydrogeologic field data were collected and compiled as part of studies to develop the model. The model has seven layers and simulates the D aquifer, N aquifer, and intervening Carmel aquitard. Recharge is estimated through a complex function of precipitation, soils, and topography. Predevelopment water levels (1956) were used for steady-state calibration of the model. Initial transient calibration used 1956 to 1996 water levels and was subsequently updated to 2002 data. The model has undergone extensive sensitivity testing and validation. Evaluation of the model indicates that it successfully simulates historic water-level response to pumping in the N aquifer. It also produces N-aquifer drawdowns that are essentially the same as the USGS model.

Both the USGS and GeoTrans models estimate changes in groundwater levels and aquifer discharge over time. Aquifer discharge occurs primarily through discharge to streams and springs. Neither model attempts to simulate individual spring flows, however, which typically occur within a limited local area. This is due to (1) the regional nature of the models (including grid size); (2) the lack of detailed hydrogeologic information on individual springs, including measured spring flow; and (3) the limited drawdown in the unconfined area of the aquifer where springs occur (Peabody 1989, revised 2003). The models do, however, simulate groundwater discharge to streams on a regional scale where discharge occurs over many miles of stream reach. This discharge is essentially made up of multiple spring discharges, in that groundwater is moving into the stream channel or alluvium, such as at Begashibito Wash/Cow Springs, discussed previously. In an arid environment such as Black Mesa, not all of this groundwater discharge appears as stream flow; much of it is evapotranspired or becomes alluvial-aquifer subflow.

OSM independently reviewed the GeoTrans model and determined that the model satisfies the intended objectives and is the most comprehensive groundwater assessment tool for predictive impact evaluations necessary to address concerns related to Peabody's pumping of the N aquifer. For the following reasons, the GeoTrans model, rather than the USGS model, is used to describe the impacts (water-level and streamflow changes) due to N aquifer pumping scenarios evaluated in this EIS:

- It has a more comprehensive inclusion of hydrologic features and multiple aquifers;
- It has a finer grid spacing, which allows for a more accurate simulation of pumping effects near both the mine and adjacent communities;
- It incorporates more recent data on water levels and withdrawals;
- It examined a longer historical data period (beginning in 1956 rather than 1965);
- It provides a more detailed characterization and analysis of system recharge;
- It evaluates geologic structure that influences groundwater flow;

- It provides better model boundaries and increases the model extent; and
- It provides a more complex definition of the hydrologic system, using additional model layers to simulate the D-aquifer system.

C Aquifer

To evaluate water availability, impacts on other water users, and issues associated with threatened and endangered species, three separate ground-water flow models have been developed over the past several years. These models are described below.

- ***Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study (HDR 2003)*** In 2003, under the Bureau of Reclamation's Western Navajo and Hopi Water Supply Needs, Alternative and Impacts Study, HDR developed a 3-D numerical flow model of the Clear and Chevelon Creek area (HDR 2003). The numerical model (MODFLOW) covered only a portion of the C aquifer and did not include all pumping centers. The area outside the numerical model was simulated with an analytical model. Head conditions along the numerical model boundaries were changed over time (in response to pumping) by the output of the analytical model. The analytical model was calibrated to historic water-level change. The numerical model was calibrated to streamflow in Clear and Chevelon Creeks and to water levels in the C aquifer.

  When the numerical model was developed, the location of the C aquifer well field had not yet been identified. The well field was subsequently located on the northern boundary of the numerical model. This fact plus some concerns about the use of the analytical model to generate heads for the numerical model boundary led the C aquifer Technical Advisory Group to recommend the development of a new model of the entire C aquifer.

- ***USGS Superposition Model (Leake et al. 2005)***. The USGS was retained by the Bureau of Reclamation to develop a model of the entire C aquifer. Given the Black Mesa EIS schedule constraints, the USGS proposed to develop a simplified model of the C aquifer that addressed only pumpage from the proposed well field and its impact on Clear and Chevelon Creek streamflow. This "superposition" or change model is a 2-D MODFLOW numerical model designed to be conservative (greater flow depletion) in that the efficiency of the connection between the groundwater and surface water in the creeks was assumed to be high and the length of the perennial stream reaches is held constant. The model does not include any natural recharge or regional groundwater flow and was not calibrated to stream and spring flow or to historic water levels in wells. All water pumped from the proposed well field comes from aquifer storage or Clear and Chevelon Creeks and the Little Colorado River.

- ***SSPA Model (SSPA 2005)***. Given the limitations of the HDR and USGS models, SSPA was retained by the applicant, Southern California Edison Company, to develop a 3-D MODFLOW model of the entire C aquifer that would include recharge, regional flow, and all known pumping centers. The model was calibrated to spring discharges, measured flow in lower Clear and Chevelon Creeks and to water-level change in wells.

The three groundwater models were developed independently by different investigators. In general, the models relied on the same published and unpublished hydrogeologic data such as aquifer characteristics, precipitation, and water levels in wells. The only significant difference in available data is the fact that data from the C aquifer well-field test wells were not available for the HDR model. All numerical models used the same basic model code (MODFLOW). Differences between the models result largely from their intended purposes and their calibration. Some difference in projected pumping, both from the C aquifer well field and by tribal and nontribal groundwater users, occurred between the HDR model (less well-field pumpage and more tribal and nontribal pumpage) and the subsequent USGS and SSPA models. The USGS and SSPA models used the same project well field pumping sets. The SSPA model used the most recent tribal and nontribal pumpage as developed by the C aquifer Technical Advisory Group. The USGS model did not simulate tribal and nontribal pumpage, only project pumping.

Model-predicted streamflow depletion due to project-only pumping in lower Clear Creek and lower Chevelon Creek at the confluence with the Little Colorado River at the end of the planning period is compared in Tables H-5 and H-6. The predicted value is the most likely value of streamflow depletion as generated by the model. The 90 percent upper bound level is a value that would not be exceeded, with 90 percent confidence, according to the statistical methods and is presented to provide an indication of the level of uncertainty in the estimates of streamflow depletion. However, the values are skewed to the high side because streamflow is bounded on the low side by zero. The predicted values should be used as the best estimates of computed depletion (USGS 2005).

Table H-5 Comparison of Model Predicted Stream Base Flow Depletion (cfs) in Lower Clear Creek, Project-only Pumping (2060)

	USGS		SSPA		HDR
Scenario	Predicted	90 Percent Upper Bound	Predicted	90 Percent Upper Bound	Predicted
Mine[1] (6,000 af/yr)	NA	NA	0.05	0.09	NA[2]
6,500 af/yr	0.26	0.71	0.05	0.13	NA[2]
11,600 af/yr	0.31	0.90	0.06	0.18	NA[2]

SOURCES: HDR 2003; Leake, S.A., J.P. Hoffman, and J.E. Dickinson 2005; S.S. Papadopulos and Associates 2005

NOTES: [1]6,000 af/yr 2010-2025; 505 af/yr 2026-2028

[2]Flow in lower Clear Creek not reported with C Aquifer well field pumping

Table H-6 Comparison of Model Predicted Stream Base Flow Depletion (cfs) in Lower Chevelon Creek, Project-only Pumping (2060)

	USGS		SSPA		HDR
Scenario	Predicted	90 Percent Upper Bound	Predicted	90 Percent Upper Bound[3]	Predicted
Mine[1] (6,000 af/yr)	NA	NA	0.03	0.06	0.01
6,500 af/yr	0.05	0.08	0.03	0.06	NA
11,600 af/yr	0.06	0.14	0.04	0.07	0.01[2]

SOURCES: HDR 2003; Leake, S.A., J.P. Hoffman, and J.E. Dickinson 2005; S.S. Papadopulos and Associates 2005

NOTES: [1]6,000 af/yr 2010-2025; 505 af/yr 2026-2028

[2]10,000 af/yr

[3] Maximum depletion occurs in 2045, as flow is near zero (0.3 cfs) after 2053 due to pumping by others

The USGS and SSPA models predict essentially the same streamflow depletion in lower Chevelon Creek The USGS model predicts a five times greater depletion in lower Clear Creek. Both the USGS and SSPA models predict greater depletion in lower Chevelon Creek than the HDR model, due in part to the lower project pumpage assumed in the HDR model.

The SSPA model best simulates the physical conditions in the study area. It encompasses the entire C aquifer and, unlike the USGS model, it accounts for all the major hydrogeologic components of the flow system, is calibrated to spring discharge and streamflow in lower Clear and Chevelon Creeks and to water levels in wells. Results from the SSPA model are used to assess the impacts of pumping from the C aquifer well field on the surface-water and groundwater system, except for upper East Clear Creek.

The SSPA model does not simulate base flow in the upper East Clear Creek perennial streamflow area. While groundwater levels in the model may indicate a stream connection in this area, the lack of measured flow data, on which to calibrate the model, led to a decision not to attempt to simulate flow in this area. The HDR and USGS models did estimate streamflow reduction in this reach, however. For this study, the USGS model is considered to be the more conservative and was used to evaluate potential impacts on streamflow in upper East Clear Creek.

APPENDIX I

Appendix I
Scenic Quality Classes and Descriptions

Appendix I
Scenic Quality Classes and Descriptions

INTRODUCTION

The BLM and Forest Service, as land-managing agencies concerned with visual characteristics of landscape, have developed methodologies to assess the scenic quality of landscapes to help determine a project's effects on the surrounding environment. These methodologies were used for Federal land and were borrowed for use in assessing landscapes outside areas where formal guidelines apply. The BLM's Visual Resource Management approach assigns classes to landscapes indicating aesthetic value based on defined characteristics. Classes derived from the BLM and Forest Service approaches were used to develop a consistent description of the scenic quality of the natural landscapes within the study area and a class was created for developed land. The description is a composite of separate components of visual resources and is further explained in Table I-1. Scenic quality classes assigned to the landscapes of each project component and a description of the character specific to each landscape follow in Tables I-2 through I-7 below. Also, these scenic quality classes are shown in Map 3-16. Landscape characteristics are described in Chapter 3, Section 3.14.

Table I-1 General Description of Scenic Quality Classes

Scenic Quality Class	General Description
Class A	Unique land of outstanding or distinctive diversity or interest, such as high relief mountains, escarpments, highly dissected canyons, monumental landforms, and scenic riverways.
Class B	Land of common or average diversity of interest, consisting of rolling vegetated hills and valleys, mesas, and buttes.
Class C	Highly common land and/or land of minimal diversity or interest, such as high desert plateaus or desert basin areas.
Class D	Landscapes that have a modified appearance and that exhibit human-made modifications as a result of development, including residential, commercial, and industrial land uses.

BLACK MESA COMPLEX

Table I-2 Black Mesa Complex

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Black Mesa Complex (natural landscape)	Class B. The scenic quality of the natural landscape is characterized by woodlands, reclaimed mining areas (typically grassland), and rock outcroppings.
Black Mesa Complex (active mining operations)	Class D. The active mining operations were inventoried as developed-industrial landscape.

COAL-SLURRY PIPELINE

Table I-3 Coal-Slurry Pipeline: Existing Route

Landscape	Scenic Quality Class(s) Assigned and Specific Description
Coal-Slurry Pipeline: Existing Route (Navajo/Hopi Landscape Character Type)	Class A. The Adeii Eechi Cliffs crossed within the Navajo/Hopi landscape exhibit prominent edges, contrasting colored rock striations, and domination of the surrounding landscape, resulting in high scenic quality. Class B. The pipeline also crosses through large swaths of natural landscape with varying degrees of landform dominance, distinctive colors, and moderate vegetation density. The eroded cliffs, terraces, plateaus, and dry washes give definition to the surrounding landscape. Class D. The disturbance of soil, removal of trees, and presence of industrial facilities within the Black Mesa Complex is developed-industrial landscape.
Coal-Slurry Pipeline: Existing Route (Flagstaff and Grand Canyon Landscape Character Types)	Class C. The majority of the natural landscape is commonly occurring grassland with sporadic rock and lava outcrops. Class B. The pipeline crosses some landscapes with a higher-density piñon/juniper woodlands, rolling terrain with scattered occurrences of grassland, and lava outcrops. Class D. The landscapes in the Town of Seligman, Arizona, and surrounding areas are characterized as developed or otherwise disturbed.
Coal-Slurry Pipeline: Existing Route (Upper Tonto Landscape Character Types)	Class B. The natural landscape includes notable areas of rolling piñon/juniper woodland, isolated areas of plains grassland, and the Juniper Mountains. Class C. The natural landscape passes through expansive dissected desert plains immediately west of the Juniper Mountains. The landscape in this area exhibits limited variation in color and texture, sparse vegetation, and relatively unvaried topography.
Coal-Slurry Pipeline: Existing Route (Mohave Landscape Character Types)	Class B. The natural landscape in the study area is typically characterized by varied topographic relief and distinctive natural appearance within the foothills of the Hualapai and Cerbat Mountains. Class D. The areas of Kingman, Arizona, and immediately surrounding are characterized as extensively modified and developed.

Table I-4 Coal-Slurry Pipeline: Kingman Reroute

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Coal-Slurry Pipeline: Kingman Reroute	Class A and Class B. The Hualapai and Black Mountain ranges are very evident features in the landscape. However, the Kingman reroute is slightly offset from the dominant and unique portions of these mountain ranges, and would travel the foothills or the areas immediately adjacent to the mountains. Class C and Class D. The reroute would traverse the Sacramento Valley through developed or disturbed landscape devoid of unique or distinguishing vegetation, water features, or terrain.

C-AQUIFER WATER SUPPLY SYSTEM

Table I-5 Well Field

Landscape	Scenic Quality Class(es) Assigned and Specific Description
C-Aquifer Water-Supply System: Well Field	Class C. The natural landscape is flat and has no water; sparse desertscrub vegetation and dispersed tufts of grass, red soils, and exposed sandstone provide some unique landscape characteristics.

Table I-6 C-Aquifer Water-Supply Pipeline: Eastern Route

Landscape	Scenic Quality Class(es) Assigned and Specific Description
Water-Supply Pipeline: Eastern Route	Class B. The natural landscape is characterized by washes, desertscrub and grassland, and flat to rolling topography with occasional occurrences of less distinctive dissected plateaus and eroded mesas. Areas near the Little Colorado River and several mesas, washes, and valleys within the area provide some variety to the landscape, as well as do landscapes with moderate- or high-density piñon/juniper woodland. Class C. Areas at the beginning of the route and north to the community of Leupp, the area of Tolani Lake, and the Black Mesa Complex have the characteristic low topographic relief, including dissected plains, sandstone plains, and high desert plateaus. Class D. The developed areas of the Black Mesa Complex have little diversity of vegetation or are developed, industrial operations.

Table I-7 C-Aquifer Water-Supply Pipeline: Western Route

Landscape	Scenic Quality Class(s) Assigned and Specific Description
Water-Supply Pipeline: Western Route	Class A. The natural landscape that includes the Red Rock Cliffs, Adeii Eechii Cliffs, Ha Ho No Gey Canyon, Begabashito Canyon, and Coal Mine Canyon are outstanding landforms that exhibit a variety of unique elements and uncommon features such as eroded precipices, colorful contrasting rock striations, and narrow chasms within the canyons. The landforms also exhibit vivid warm and cool contrasting colors as well as the distinguishing textures of rock outcrops and exposed sandstone strata. Class B. The natural landscapes along the western route include the Little Colorado River, Painted Desert, Ward Terrace, Red River Valley, Kletha Valley, and many distinctive mesas (Tohnali, Newberry, Coal Mine, and Black Mesa). Plateau grassland, various mesas, and other unique landscapes mostly characterize this area; however, they are not uncommon features in the area. Class D. The western route begins north of the community of Leupp and the area of the Black Mesa Complex mining operation is characterized by unvaried terrain, with little spacial definition, vast expanses of sagebrush or plains grassland vegetation, and developed industrial areas.

APPENDIX J

Appendix J

Visual Simulations
Alternative A: C Aquifer Water-Supply System

Simulation 1: Alternative A: C Aquifer Water-Supply System – Well Collection Field and Proposed Water Storage Tank

Simulation 2: Alternative A: C Aquifer Water-Supply System – Proposed Tolani Lake Pump Station (#1)

Simulation 3: Alternative A: C Aquifer Water-Supply System – Proposed Oraibi Pump Station (#2)

Simulation 4: Alternative A: C Aquifer Water-Supply System – 69kV Transmission Line Along Indian Route 1

Simulation 5: Alternative A: C Aquifer Water-Supply System – 69kV Transmission Line Near Kykotsmovi

Simulation 6: Alternative A: C Aquifer Water-Supply System – Substation Near Leupp

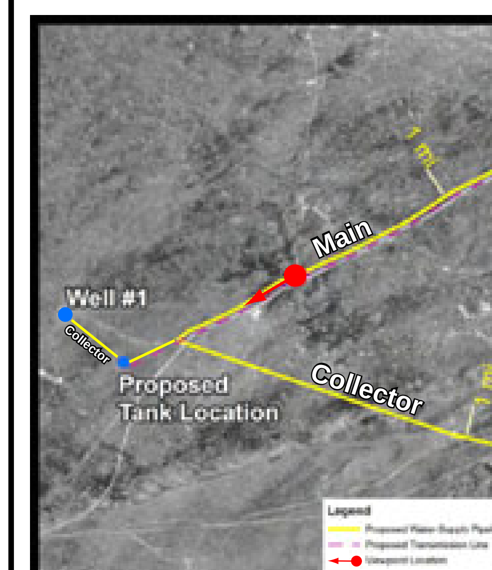
Simulation 1
Alternative A: C Aquifer Water-Supply System – Well Collection Field and Proposed Water Storage Tank

Black Mesa Project EIS

Existing Conditions: View west from Milepost 0.5 of the water-supply pipeline route

Simulation: Proposed water-storage tank and 24.9kV power line

Location Map



Vicinity Map

SOURCE:
URS Corporation 2005

Prepared By:
URS

Simulation 2

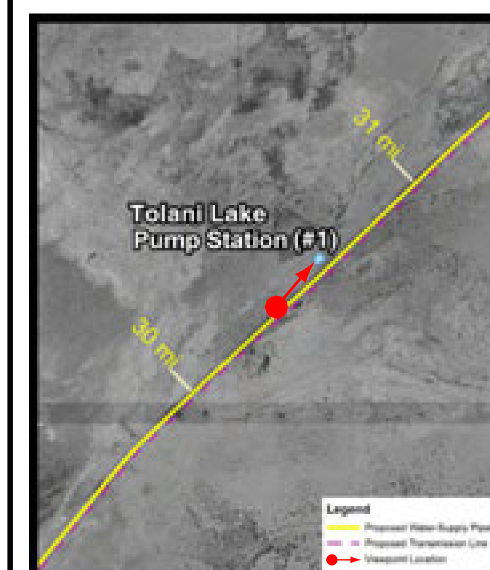
Alternative A: C Aquifer Water-Supply System – Proposed Tolani Lake Pump Station (#1)

Black Mesa Project EIS

Existing Conditions: View northeast along Indian Route 2 at Milepost 30 of the water-supply pipeline route

Simulation: Proposed Tolani Lake Pump Station (#1)

Location Map



Vicinity Map

SOURCE:
URS Corporation 2005

Prepared By:
URS

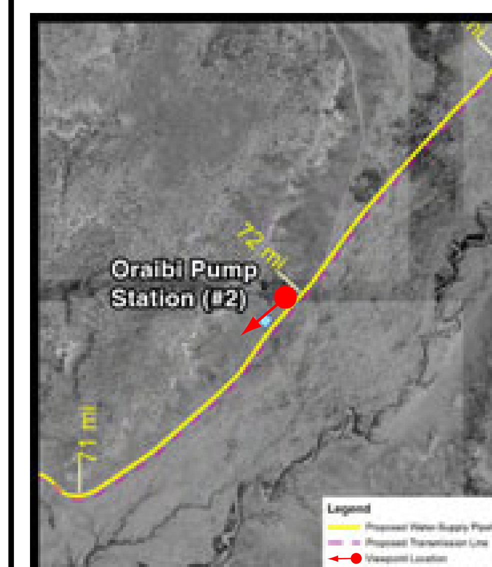
Existing Conditions: View southwest near Milepost 73 of water-supply pipeline

Simulation: Proposed Oraibi Pump Station (#2) and 24.9kV power line

Simulation 3 Alternative A: C Aquifer Water-Supply System – Proposed Oraibi Pump Station (#2)

Black Mesa Project EIS

Location Map



Vicinity Map

SOURCE:
URS Corporation 2005

Prepared By:
URS

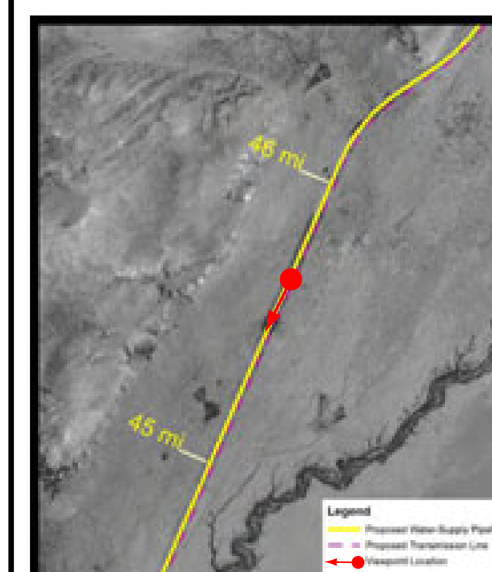
Simulation 4
Alternative A: C Aquifer Water-Supply System – 69kV Transmission Line Along Indian Route 2

Black Mesa Project EIS

Existing Conditions: View southwest along Indian Route 2 at milepost 45.5 of the water-supply pipeline route

Simulation: Proposed 69kV (with 24.9kV underbuild) transmission line

Location Map



Vicinity Map

SOURCE:
URS Corporation 2005

Prepared By:
URS

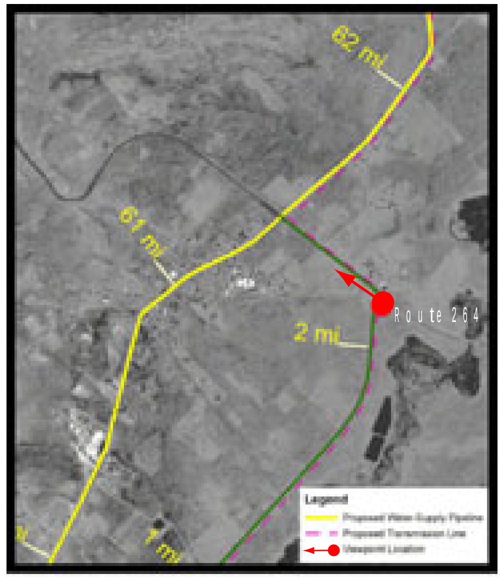
Existing Conditions: View northwest on Route 264 east of Kykotsmovi

Simulation: Proposed 69kV (with 24.9kV underbuild) transmission line

Simulation 5
69kV Transmission Line Near Kykotsmovi

Black Mesa Project EIS

Location Map



Vicinity Map

SOURCE:
URS Corporation 2005

Prepared By:
URS

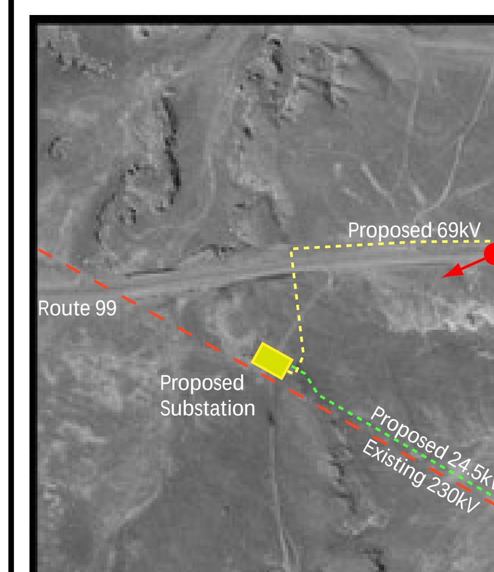
Simulation 6
Alternative A: C Aquifer Water-Supply System – Substation Near Luepp

Existing Conditions: View west on State Route 99 at location of existing 230kV transmission line

Simulation: Proposed substation with accompanying 69kV Corten single pole structures and 24.5kV wood pole structures

Black Mesa Project EIS

Location Map



Vicinity Map

SOURCE:
URS Corporation 2005

Prepared By:
URS

APPENDIX K

Appendix K
Consultation and Coordination Letters

- Letter dated August 20, 2004, from OSM to invite agencies to serve as cooperators in preparation of the EIS
- Letter dated May 10, 2005, on behalf of OSM to initiate coordination with agencies
- Letter dated May 20, 2005, from OSM regarding cultural resources
- Letter dated May 20, 2005, from OSM to invite participation from tribes

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 46667
Denver, Colorado 80201-6667

IN REPLY REFER TO:

August 20, 2004

Linda Beals, Manager
Arizona State Land Department
Rights-of-Way Section
1616 West Adams
Phoenix, AZ 85007

Subject: Request to Participate as Cooperating Agency in the Preparation of an Environmental Impact Statement for the Black Mesa and Kayenta Mines and C-aquifer Water Supply System

Dear Ms. Beals:

The Office of Surface Mining Reclamation and Enforcement (OSM) is preparing an Environmental Impact Statement (EIS) for the Black Mesa and Kayenta Mines and C-aquifer Water Supply System. The four components of the overall proposed project to be considered in the EIS are:

- Approvals of a Life-of-Mine Permit Revision and Changes to the Mining Plans for the Black Mesa and the Kayenta Mines on the Navajo and Hopi Reservations in northeastern Arizona
- Approval of a Permit Application for the Black Mesa Coal Slurry Preparation Plant
- Approvals associated with reconstruction of the Coal Slurry Pipeline from the Coal Slurry Preparation Plant to the Mohave Generating Station in Laughlin, Nevada
- Approvals associated with construction and operation of a new Coconino aquifer (C-aquifer) Water Supply System to be located on the Navajo Reservation and, possibly, on Hopi-owned lands adjacent to the Navajo Reservation and northwest of Winslow, Arizona

A brief description of each component of the proposed project is enclosed. We believe that the Williams Ranger District may have one or more actions associated with the proposal proposal (i.e., approval of additional rights-of-way for the Coal Slurry Pipeline). Therefore, we request your participation in the preparation of the subject EIS as a Cooperating Agency. Please advise us, in writing, of your decision and of any documentation that you may require to implement your participation as a Cooperating Agency. If you have any questions, please contact Peter Rutledge at 303-844-1400, ext. 1425.

Sincerely,

Allen D. Klein
Regional Director

Enclosure

[Similar letters were sent to the following recipients.]

Marjorie Blaine, Senior Project Manager
U.S. Army Corps of Engineers
Los Angeles District, Regulatory Branch
Arizona Section, Tucson Project Office
5205 East Comanche Street
Tucson, AZ 85707

Elouise Chicharello, Regional Director
Bureau of Indian Affairs
Navajo Regional Office

City of Kingman
310 North 4th Street
Kingman, AZ 86401

Lisa Hanf, Director
U.S. Environmental Protection Agency
Region 9
Federal Activities Office (CMD-2)
75 Hawthorne Street
San Francisco, CA 94105

Tom Mutz, Lands and Minerals Specialist
U.S.D.A. Forest Service
Kaibab National Forest
Williams Ranger District
742 South Clover Road
Williams, AZ 86046

Wayne Nordwall, Regional Director
Bureau of Indian Affairs
Western Regional Office

Joe Shirley, Jr., President
Navajo Nation
PO Box 9000
Window Rock, AZ 86515

Wayne Taylor, Jr., Chairman
The Hopi Tribe
PO Box 123
Kykotsmovi, AZ 86039

Ron Walker, County Manager
County of Mohave County Manager's Office
PO Box 7000
Kingman, AZ 86402-7000

URS

May 10, 2005

Mr. Steve Spangle
Field Supervisor
U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021

RE: Initiate Coordination of the Proposed Black Mesa Project Environmental Impact Statement

Dear Mr. Spangle:

I am writing to initiate coordination with you regarding the proposed Black Mesa Project. URS Corporation is under contract with Southern California Edison (SCE) on behalf of the Office of Surface Mining Reclamation and Enforcement (OSM) to prepare an Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) to analyze the environmental impacts resulting from the approval of a permit application proposing numerous revisions to the life-of-mine plans for the Kayenta and Black Mesa Mines (LOM revision). Additional components to be addressed in the EIS include:

- Operation of the coal-slurry preparation plant located at the Black Mesa Mine.

- Reconstruction of the coal-slurry pipeline from the coal-slurry preparation plant to the Mohave Generating Station in Laughlin, Nevada. The 273-mile-long buried pipeline that conveys the coal in slurry (a 50/50 percent mixture of water and finely crushed coal) has been in operation since 1970 and has a 35-year design life. Pipeline reconstruction would involve decommissioning the existing pipeline and burying a new coal-slurry pipeline adjacent to the existing one. About 95 percent of the existing pipeline would be abandoned and left in place underground. A limited number of sections would require removal. A temporary right-of-way width of about 15 feet would be needed for construction activities in addition to the existing 50-foot-wide right-of-way for the majority of the alignment. Existing pumping stations (one at the coal-slurry preparation plant and three along the pipeline alignment) are expected to require only minor modification, if any. The pipeline would pass under the Colorado River at Laughlin, Nevada and under the Little Colorado River east of Cameron, Arizona.

- Construction and operation of a new water-supply system conveying water from a well field near Leupp, Arizona (completed in the Coconino [or "C"] aquifer) to the Black Mesa Mine primarily for the coal-slurry. Components include (1) A well field in the southwest part of the Navajo Reservation and possibly a well field on Hopi lands immediately south of the Navajo Reservation well field, (2) an approximately 108-mile-long main pipeline from the well field(s) north-northwest to the Black Mesa Mine following, to the extent practicable, existing roads, (3) an estimated three pump stations and associated facilities, and (4) a resizing of the pipeline delivery system. Under the alternative configuration, the main pipeline-delivery system would

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be upsized to convey up to an additional 5,600 acre-feet and would include taps to allow connection of future spur pipelines to supply water to Navajo and Hopi communities for municipal and industrial uses.

In addition to any issues or concerns you want to identify for consideration in the EIS, we would appreciate a list of federally listed endangered, threatened, proposed, and candidate species that may be affected by this project. The list will be used to identify those species that have the potential to occur within the project area. We can fully appreciate the Service's work-load and standard response time for requests, but in order to maintain the project schedule, we would appreciate a list of species no later than **May 27, 2005**.

We look forward to working with you and your Flagstaff office staff to discuss issues, the planning process, and preliminary planning criteria, as well as to request relevant data. Enclosed is a map showing the project area. If you need more information, you are welcome to contact me by telephone at (520) 407-2856 or by electronic mail at barbara_garrison@urscorp.com. Or you may contact Danny Rakestraw, who can be reached by telephone at (702) 951-3285 or by electronic mail at danny_rakestraw@urscorp.com. Thank you in advance for your assistance.

Sincerely,

Barbara A. Garrison
Senior Biologist
URS Corporation

Enclosure: Map 2-1 Project Area

Cc: John Nystedt, Fish and Wildlife Biologist, Flagstaff Sub-Office

file

[Similar letters were sent to the following recipients.]

Mr. Steve Best
District Ranger
Williams Ranger District
Kaibab National Forest
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United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
P.O. Box 46667
Denver, Colorado 80201-6667

IN REPLY REFER TO:

May 20, 2005

Mr. Alan Downer
Tribal Historic Preservation Officer
Navajo Nation
P.O. Box 4950
Window Rock, Arizona 86515

Dear Mr. Downer:

The Office of Surface Mining Reclamation and Enforcement is preparing an environmental impact statement (EIS) to evaluate potential impacts of the proposed Black Mesa Project. The project consists of the following components:

- Revision to Peabody Western Coal Company's life-of-mine plans for the Kayenta and Black Mesa surface coal mines.

  The Kayenta Mine and Black Mesa Mine are on the Hopi and Navajo reservations on Black Mesa about 125 miles northeast of Flagstaff. The 44,073-acre Kayenta Mine supplies coal to the Navajo Generating Station in Page, Arizona, and the 18,849-acre Black Mesa Mine supplies coal to the Mohave Generating Station in Laughlin, Nevada.

- Continued operation of Black Mesa Pipeline's coal-slurry preparation plant at the Black Mesa Mine.

  The plant prepares a 50 percent coal – 50 percent water mixture for shipment in the coal-slurry pipeline. Only minor modifications to the existing plant are proposed.

- Black Mesa Pipeline's reconstruction of the coal-slurry pipeline.

  The 273-mile long coal-slurry pipeline originates at the coal-slurry preparation plant at the Black Mesa Mine and terminates at the Mohave Generating Station. The pipeline has a 35-year design life and needs to be replaced because it has been in operation since 1970. The replacement line would generally be immediately adjacent to the existing line, which would mostly be abandoned in place, but deviations from the existing line will be considered to avoid developed areas around Kingman, Arizona, and to avoid a few areas where erosion has become a problem.

- Southern California Edison Company's development of a new water supply system from the Coconino Aquifer.

  Currently, the Kayenta and Black Mesa Mines pump water from the Navajo Aquifer for use at the mines and in preparing the coal and water slurry at the preparation plant. Use of Navajo-Aquifer water would be largely reduced through development of an alternate water supply in the Coconino Aquifer north of Interstate 40 in the vicinity of Leupp, Arizona. A water delivery pipeline (including pumping plants, storage tanks, power lines, and access roads) would be built from the well field to the coal-slurry preparation plant at the Black Mesa Mine. Two routes for the pipeline are being considered: a 108-mile long corridor through the Navajo and Hopi reservations and a 140-mile long corridor through the Navajo reservation.

Enclosed is a map that shows the locations of the project components and land ownership in the project vicinity. For further details on the project and EIS, visit the Office of Surface Mining's Internet Web site at http://www.wrcc.osmre.gov/bmk-eis/Default.htm.

The Office of Surface Mining expects to issue a draft EIS for public review in late 2005 or early 2006 and to issue a final EIS and record of decision on the life-of-mine revision in mid-2006.

Cultural resource studies will be conducted to identify potential impacts so they can be described and addressed in the EIS and to provide data for evaluating alternatives. The studies also will support consultations pursuant to Section 106 of the National Historic Preservation Act. The Office of Surface Mining is contacting you at this time to initiate the Section 106 consultation process. We anticipate that a Section 106 Programmatic Agreement will be developed to address potential adverse effects on cultural resources.

Direct and indirect impacts on cultural resources will be assessed. The area of potential effects for construction impacts would be defined as those areas where ground-disturbing construction activities would occur. There appears to be relatively little potential for less-direct impacts on cultural resources that could result from factors such as modifications of visual settings, increased noise, and surface water impacts, but they also will be considered. We would appreciate your advice regarding the definition of the area of potential effects for other types of impacts that should be addressed.

The planned cultural resource studies will include:

- Records and literature reviews to compile information about prior cultural resource studies and previously recorded cultural resources,

- Intensive field surveys to identify and evaluate unrecorded archaeological and historical resources, and

- Studies of traditional cultural places and lifeways.

Many of the areas that would be affected by the Black Mesa Project are on the Hopi and Navajo reservations, and the Hopi Tribe and Navajo Nation are cooperating in the preparation of the EIS. The Hopi Cultural Preservation Office and Navajo Nation Archaeology Department will be conducting the cultural resource studies on their respective reservations. The one component of the project that extends well beyond the reservations is the coal slurry line, which crosses about 180 miles of private land, Arizona State Trust land, and Federal land managed by the Bureau of Land Management and the Kaibab National Forest. We would appreciate any advice you may have regarding the design of the cultural resource inventory strategy.

Many agencies and organizations are involved in the project, and we are organizing a cultural resources subcommittee to provide advice and review as the EIS is prepared. A tentative list of members is enclosed.

We are aware that several tribes have traditional cultural affiliations with the project area and OSM is initiating consultations in a government-to-government framework with the tribes identified on the enclosed list. We would appreciate your advice about whether additional tribes or other potentially interested parties should be contacted.

We look forward to your comments and collaboration as the planning for this challenging project continues. If you have any questions, please contact Foster Kirby, Archeologist, by telephone at 303-844-1400, extension 1467, or by e-mail at fkirby@osmre.gov.

Sincerely,

Peter A. Rutledge, Chief
Program Support Division

Enclosures

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(preliminary – 11 May 2005)

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United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
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Denver, Colorado 80201-6667

IN REPLY REFER TO:

May 20, 2005

Charles Vaughn, Chair
Hualapai Tribe
P.O. Box 179
Peach Springs, Arizona 86434-0179

Dear Chairman Vaughn:

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- Revision to Peabody Western Coal Company's life-of-mine plans for the Kayenta and Black Mesa surface coal mines.

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Cultural resource studies will be conducted to identify potential impacts so they can be described and addressed in the EIS and to provide data for evaluating alternatives. The studies also will support consultations pursuant to Section 106 of the National Historic Preservation Act. The Office of Surface Mining is contacting you at this time to initiate the Section 106 consultation process. We anticipate that a Section 106 Programmatic Agreement will be developed to address potential adverse effects on cultural resources.

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We are aware that several tribes have traditional cultural affiliations with the project area, but there is little information available about places that have traditional cultural significance for those communities. We invite you to provide relevant information or express concerns that we should consider as the EIS and cultural resources studies are prepared. We would appreciate any suggestions regarding the types of direct or indirect impacts that should be considered, particularly with respect to traditional cultural lifeways and traditional cultural resources that have significance for your community. The Office of Surface Mining intends to conduct tribal consultations in an appropriate government-to-government framework, and we invite your community to participate in the Section 106 consultations. **By June 7, 2005, please let us know whether your community wants to participate in the consultations.**

We look forward to your comments and collaboration as the planning for this challenging project continues. If you have any questions, please contact Foster Kirby, Archeologist, by telephone at 303-844-1400, extension 1467, or by e-mail at fkirby@osmre.gov.

Sincerely,

Peter A. Rutledge, Chief
Program Support Division

Enclosure

[Identical letters to addressees, with copies to cultural specialists when identified.]

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Nancy Hayden, Director of Research
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Las Vegas Paiute Tribe
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Las Vegas, Nevada 89106

Richard Arnold, Tribal Chair
Pahrump Paiute Tribe
P.O. Box 3411
Pahrump, Nevada 89041

APPENDIX L

Appendix L
Federal Register Notices

1) Volume 69, Number 230, Wednesday, December 1, 2004: Notice of Intent to prepare an environmental impact statement and to hold public scoping meetings.

2) Volume 70, Number 23, Friday, February 4, 2005: Extension of the scoping comment period for an environmental impact statement.

3) Volume 71, Number 225, Wednesday, November 22, 2006: Notice of availability of draft environmental impact statement for the Black Mesa Project.

4) Volume 71, Number 231, Friday, December 1, 2006: Environmental impact statement; Notice of availability, EIS No. 20060490, Draft EIS, OSM, Black Mesa Project.

5) Volume 72, Number 9, Tuesday, January 16, 2007: Extension of comment period for the Black Mesa Project draft environmental impact statement (EIS) and scheduling of additional public meeting.

6) Volume 73, Number 101, Friday, May 23, 2008: Reopening of comment period for the Black Mesa draft environmental impact statement (EIS).

1) **Volume 69, Number 230, Wednesday, December 1, 2004: Notice of Intent to prepare an environmental impact statement and to hold public scoping meetings**

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Mines, Life-of-Mine Plans and Water Supply Project, Coconino, Navajo, and Mohave Counties, AZ, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Notice of intent to prepare an environmental impact statement and to hold public scoping meetings.

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), the Office of Surface Mining Reclamation and Enforcement (OSM), as the lead Federal agency, plans to prepare an environmental impact statement (EIS) to analyze the effects of Peabody Western Coal Company's proposed operation and reclamation plans for the Black Mesa and Kayenta coal mines; the Coal Slurry Preparation Plant at the Black Mesa Mine; the reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station (electrical) in Laughlin, Nevada; the construction and operation of water wells in the Coconino aquifer (C-aquifer) northwest of Winslow, Arizona; and construction and operation of a water supply pipeline running about 120 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant.

The Hopi Tribe, Navajo Nation, Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Bureau of Reclamation (BOR), U.S. Environmental Protection Agency (USEPA); U.S. Department of Agriculture Forest Service (USFS), County of Mohave, Arizona; and City of Kingman, Arizona, will cooperate with OSM in the preparation of the EIS.

OSM solicits public comments on the scope of the EIS and significant issues that should be addressed in the EIS.

At *http://www.wrcc.osmre.gov/bmk-eis*, interested persons may view information about the proposed projects; the comment period during which persons may submit comments; the locations, dates, and times of public scoping meetings; and the procedures that OSM will follow at the scoping meetings.

DATES: Written comments must be received by OSM by 4 p.m. on January 21, 2005, to ensure consideration in the preparation of the draft EIS.

Public scoping meetings will be held in:

- Saint Michaels, Arizona, on Monday, January 3, 2005, from 6 p.m. to 10 p.m. at the Saint Michaels Chapter House on Indian Route 12 about 2 miles south and west of Window Rock, Arizona.
- Forest Lake, Arizona, on Tuesday, January 4, 2005, from 12 p.m. to 4 p.m. at the Forest Lake Chapter House on Navajo Route 41 about 20 miles north of Pinon, Arizona.
- Kayenta, Arizona, on Tuesday, January 4, 2005, from 6 p.m. to 10 p.m. at the Kayenta Chapter House on Highway 163 at the intersection with Navajo Route 6485, Kayenta, Arizona.
- Kykotsmovi, Arizona, on Wednesday, January 5, 2005, from 6 p.m. to 10 p.m. at the Community Center, Kykotsmovi, Arizona.
- Leupp, Arizona, on Thursday, January 6, 2005, from 12 p.m. to 4 p.m. at the Leupp Chapter House on Navajo Route 15, Leupp, Arizona.
- Kingman, Arizona, Wednesday, January 12, 2005, from 12 p.m. to 4 p.m. at the Mohave County Board Room, Negus Building, 809 E. Beale Street, Kingman, Arizona.
- Laughlin, Nevada, on Wednesday, January 12, 2005, from 6 p.m. to 10 p.m. at the Laughlin Town Hall, 101 Civic Way, Laughlin, Nevada.
- Flagstaff, Arizona, on Thursday, January 13, 2005, from 6 p.m. to 10 p.m. at the Coconino County Board Room, 219 E. Cherry, Flagstaff, Arizona.

ADDRESSES: Comments may be submitted in writing or by e-mail. At the top of your letter or in the subject line of your e-mail message, please indicate that the comments are ''BMK EIS Comments.''

- E-mail comments should be sent to: *BMK-EIS@osmre.gov*.
- Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Richard Holbrook, Chief, Southwest Branch, OSM WRCC, P.O. Box 46667, Denver, Colorado 80201–6667.
- Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Richard Holbrook, Chief, Southwest Branch, OSM WRCC, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

FOR FURTHER INFORMATION CONTACT: Richard Holbrook, Chief, Southwest Branch, Program Support Division, OSM Western Regional Coordinating Center, by telephone at (303) 844–1400, extension 1491, or by e-mail at *BMK–EIS@osmre.gov*.

SUPPLEMENTARY INFORMATION:

I. Background on the Black Mesa and Kayenta Mines

The contiguous Black Mesa and Kayenta surface coal mines have operated since 1970 and 1973, respectively. Peabody Western Coal Company operates the mines on three leaseholds comprising about 65,000 acres within the boundaries of the Navajo and Hopi Reservations. The mines are located on the Black Mesa about 125 miles northeast of Flagstaff, Arizona, and 10 miles southwest of Kayenta, Arizona. The Kayenta Mine produces about 8.5 million tons of coal per year, all of which are delivered to the Navajo Generating Station near Page, Arizona, by electric railroad. Currently, the Kayenta Mine is to provide coal to the Navajo Generating Station through 2011. The Black Mesa Mine produces about 4.8 million tons of coal annually, all of which are delivered to the Mohave Generating Station at Laughlin, Nevada, through the 273-mile long Coal Slurry Pipeline originating at the Black Mesa Coal Slurry Preparation Plant. Currently, the Black Mesa Mine is to provide coal to the Mohave Generating Station through 2005.

Black Mesa Pipeline, Inc., operates the Coal Slurry Preparation Plant and the Coal Slurry Pipeline that transports coal from the Black Mesa Mine to the Mohave Generating Station. Currently, about 3,100 acre-feet of water from Peabody Western Coal Company's wells in the Navajo aquifer (N-aquifer) are used annually to slurry the coal.

II. Proposals for the Mines, Coal Slurry Pipeline, and C-Aquifer Water Supply System

In the past, public concern about the mines and related projects has centered on use of the N-aquifer water. Under the proposals, most of the water used by the Black Mesa and Kayenta Mines and Coal Slurry Pipeline would come from the C-aquifer rather than the N-aquifer. Peabody Western Coal Company would continue to pump some water from wells in the N-aquifer (about 500 acre-feet per year) for domestic uses at the mines, providing potable water for use by the local residents in the vicinity of the mines, and to ensure that the wells are functional in the event that they are needed for mining-related purposes or for the Coal Slurry Pipeline if there is a temporary or emergency disruption in water delivery from the C-aquifer Water Supply System.

Peabody Western Coal Company's life-of-mine revision proposes that the Black Mesa and Kayenta Mines would continue mining through at least 2026. Mining methods would not change at either mine. The annual coal production rate at the Black Mesa Mine would increase from 4.8 million tons to 6.2 million tons and would remain unchanged at the Kayenta Mine. A coal wash plant would be constructed at the Black Mesa Mine to remove waste from the coal. The plant would extract about 0.8 million tons of waste from the coal each year. About 500 acre-feet of water would be used each year for washing the coal. Waste would be dewatered and disposed in the mining pits. The wastewater would be recycled through the wash plant. About 5.4 million tons of washed coal produced each year would be crushed and slurried with C-aquifer water at the Coal Slurry Preparation Plant and would be shipped to the Mohave Generating Station through the Coal Slurry Pipeline. Because of the increased coal production, the amount of water needed to slurry coal from the mine would increase from about 3,100 to 3,700 acre-feet per year. The Black Mesa Mine would use an additional 1,300 acre-feet of water for mine-related and domestic purposes (including coal washing). The Kayenta Mine would use an additional 800 acre-feet of water for mine-related and domestic purposes.

Black Mesa Pipeline, Inc., would replace about 95 percent of the 273-mile long Coal Slurry Pipeline because the existing pipeline is reaching its design life. The pipeline passes through the Navajo and Hopi Reservations; through Federal lands administered by the Bureau of Land Management and the U.S. Forest Service (Kaibab National Forest); through lands owned by the State of Arizona, the County of Mohave, Arizona, and the City of Kingman, Arizona; and through privately-owned lands. Pipeline reconstruction would involve decommissioning the existing buried pipeline (mostly leaving it in place) and burying a new coal slurry pipeline adjacent to the existing pipeline. Additional right-of-way width (about 15 feet) would be needed for construction activities along much of the 50-foot wide right-of-way. The new pipeline would pass under the Colorado River at Laughlin, Nevada and under the Little Colorado River east of Cameron, Arizona. The C-aquifer Water Supply System would provide an alternative water source to N-aquifer water currently used to slurry coal at the Black Mesa Preparation Plant and for mine-related uses at the Black Mesa Mine and Kayenta Mine. The system would be capable of providing 6,000 acre-feet per year for coal slurry and mine-related uses. Development of this water supply system would provide an opportunity to make water available to the Navajo Nation and Hopi Tribe for municipal and industrial uses by expanding the system. In anticipation of the potential future use of the system for tribal purposes, OSM anticipates that it would evaluate an alternative that provides an expanded delivery system and well configuration design for up to an additional 5,600 acre-feet per year (*i.e.*, up to a total capacity of 11,600 acre-feet per year). The additional capacity would allow future spur pipelines to be constructed to Navajo and Hopi communities.

Major components of the C-aquifer Water Supply System would include:

- A well field in the southwest part of the Navajo Reservation (southwest of Leupp, Arizona) and, possibly, a well field on Hopi-owned lands immediately south of the Navajo Reservation well field, consisting of approximately 20 production wells (for the 11,600 acre-foot maximum capacity) and associated collector pipelines.
- An approximately 120-mile long main pipeline from the well field(s) north-northeast to the Black Mesa Mine following, to the extent possible, existing roads.
- Associated facilities (*e.g.*, an estimated five pump stations, access roads and electrical transmission lines).

III. Decisions To Be Made by OSM and the Cooperating Agencies

Under applicable laws, OSM and the cooperators would need to make several decisions on whether to approve various aspects of the Black Mesa and Kayenta Mines life-of-mine revision, the Coal Slurry Preparation Plant, the Coal Slurry Pipeline, and the C-aquifer Water Supply System. OSM has approval authority for the permit revision application for the Kayenta and Black Mesa Mines and the permit application for the Coal Slurry Preparation Plant. BLM has approval authority for the mining plan for the Kayenta and Black Mesa Mines. BIA, Navajo Nation, and Hopi Tribe would have various realty actions to undertake such as granting of rights-of-way, as well as approval authorities and responsibilities for several other components of the project, such as C-aquifer water usage. BLM, USFS, Mohave County, and City of Kingman also would have realty actions to undertake such as granting of rights-of-way. USEPA has a number of responsibilities under the Clean Water Act including section 401 certification authority, which is a prerequisite to section 404 permit authorization. Under section 402, USEPA issues and enforces National Pollutant Discharge Elimination System (NPDES) permits. USEPA also is responsible for implementing the Clean Air Act requirements on the Hopi reservation and for implementing most Clean Air Act requirements on the Navajo reservation. USEPA recently delegated to the Navajo Environmental Protection Agency the Clean Air Act Part 71 Operating Permit Program for sources located on Navajo land. Some aspects of the proposed projects will require a Department of the Army permit from the U.S. Army Corps of Engineers under section 404 of the Clean Water Act and section 10 of the River and Harbor Act of 1899.

The EIS would evaluate the environmental effects of the proposed project and a variety of alternatives. Alternatives that may be evaluated include alternative alignments for the Coal Slurry Pipeline and the C-aquifer water supply pipeline, amounts of water to be withdrawn from the C-aquifer for tribal municipal and industrial uses as well as mine related and coal slurry uses, and a variety of approval and disapproval options related to the various components of the project. Other alternatives may be evaluated based on the comments received during the scoping comment period.

IV. Public Comment Procedures

In accordance with the Council on Environmental Quality's regulations for implementing NEPA, 40 CFR parts 1500 through 1508, OSM solicits public comments on the scope of the EIS and significant issues that it should address in the EIS.

Written comments, including email comments, should be sent to OSM at the addresses given in the **ADDRESSES** section of this notice. Comments should be specific and pertain only to the issues relating to the proposals. OSM will include all comments in the administrative record.

If you would like to be placed on the mailing list to receive future information, please contact the person listed in the section, **FOR FURTHER INFORMATION CONTACT**, above.

Availability of Comments

OSM will make comments, including names and addresses of respondents, available for public review during normal business hours. OSM will not consider anonymous comments. If individual respondents request confidentiality, OSM will honor their requests to the extent allowable by law. Individual respondents who wish to withhold their name or address (except for the city or town) from public review must state this prominently at the beginning of their comments and must submit their comments by regular mail. All submissions from organizations or businesses and from individuals identifying themselves as representatives or officials of organizations or businesses will be available for public review in their entirety.

Scoping Meetings

If you wish to speak at a scoping meeting, you should sign up to speak when you arrive at the meeting. OSM will call upon persons to speak in the order of the sign-in. If you are in the audience and have not signed up to speak, you will be allowed to speak after those who have signed up. For persons who wish not to speak, OSM also will accept written comments at the meeting.

A transcriber will be present at the meetings to record comments. To assist the transcriber and ensure an accurate record, OSM requests that each speaker provide a written copy of his or her comments, if possible. OSM will end the meeting after everyone who wishes to speak has been heard. If a large number of people wish to speak at a meeting, OSM may limit the length of time each person has to speak in order to give everyone an opportunity to speak.

Hopi and Navajo interpreters will be present at meetings on the Hopi and Navajo Reservations.

If you are disabled or need special accommodations to attend one of the meetings, contact the person under **FOR FURTHER INFORMATION CONTACT** at least one week before the meeting.

Dated: November 17, 2004.

Allen D. Klein,

Regional Director, Western Regional Coordinating Center.

[FR Doc. 04–26439 Filed 11–30–04; 8:45 am]

BILLING CODE 4310–05–P

INTERNATIONAL TRADE COMMISSION

[Inv. No. 337–TA–508]

Certain Absorbent Garments; Notice of a Commission Determination Not To Review an Initial Determination Terminating the Investigation With Respect to all Respondents on the Basis of a Consent Order; Issuance of Consent Order; Termination of Investigation

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined not to review an initial determination (''ID'') of the presiding administrative law judge (''ALJ'') granting the joint motion of the complainants and four respondents, Grupo ABS Internacional, S.A. de C.V., Absormex S.A. de C.V., and ABS Bienes de Capital S.A. de C.V. all of Mexico, and Absormex USA, Inc., of Laredo, Texas, to terminate the above-captioned investigation with respect to those respondents on the basis of a consent order. The investigation is terminated in its entirety.

FOR FURTHER INFORMATION CONTACT: Michael K. Haldenstein, Esq., telephone 202–205–3041, Office of the General Counsel, U.S. International Trade Commission, 500 E Street, SW., Washington, DC 20436. Copies of all nonconfidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street SW., Washington, DC 20436, telephone 202–205–2000. General information concerning the Commission may also be obtained by accessing its Internet server (*http://www.usitc.gov*). The public record for this investigation may be viewed on the Commission's electronic docket (EDIS–ON–LINE) at *http://edis.usitc.gov*. Hearing-impaired persons are advised that information on the matter can be obtained by contacting the Commission's TDD terminal on 202–205–1810.

SUPPLEMENTARY INFORMATION: The Commission instituted this investigation on May 2, 2004, based on a complaint filed by Tyco Healthcare Retail Group, Inc. and Paragon Trade Brands, Inc. A supplement to the complaint was filed on April 26, 2004. The complaint, as supplemented, alleges violations of section 337 in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain absorbent garments by reason of infringement of claims 1, 9, 12–13 of U.S. Patent No. 5,275,590, claims 1–2 of U.S. Patent No. 5,403,301, and claims 8–9 of U.S. Patent No. 4,892,528. The complaint further alleges that there exists an industry in the United States as required by subsection (a)(2) of section 337. The complaint named three respondents: Grupo ABS Internacional, S.A. de C.V. and Absormex S.A. de C.V. of Mexico, and Absormex USA, Inc. of Laredo Texas. ABS Bienes de Capital S.A. de C.V. was added as a respondent on July 15, 2004.

On October 12, 2004, the two complainants and the four respondents filed a joint motion to terminate the investigation as to all four respondents. The joint motion was based on a proposed consent order, filed pursuant to a consent order stipulation and Memorandum of Understanding (MOU) between the parties. The Commission Investigative Attorney (''IA'') filed a response in support of the motion on October 22, 2004. The ALJ denied the joint motion on October 27, 2004 because it appeared to him that the parties may have intended to have the Commission enforce the MOU. The parties then moved for reconsideration of the denial of the joint motion on October 29, 2004.

The ALJ issued the subject ID on November 2, 2004, granting the motion for reconsideration and terminating the investigation as to all four respondents on the basis of a consent order. The ALJ indicates in the ID that he is satisfied that the parties made clear in their motion for reconsideration that they do not intend for the Commission to enforce the MOU. The ID also indicates that the consent order stipulation satisfies the provisions of Commission rule 210.21(c)(3)(i). No petitions for review of the subject ID were filed.

This action is taken under the authority of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. 1337, and Commission rule 210.42, 19 CFR 210.42.

Issued: November 24, 2004.

By order of the Commission.

Marilyn R. Abbott,

Secretary to the Commission.

[FR Doc. 04–26485 Filed 11–30–04; 8:45 am]

BILLING CODE 7020–02–P

2) **Volume 70, Number 23, Friday, February 4, 2005: Extension of the scoping comment period for an environmental impact statement**

6107, Salt Lake City, Utah, 84138; telephone (801) 524–3715; faxogram (801) 524–3858; e-mail at *dkubly@uc.usbr.gov* at least five (5) days prior to the meeting. Any written comments received will be provided to the AMWG and TWG members.

FOR FURTHER INFORMATION CONTACT: Dennis Kubly, telephone (801) 524–3715; faxogram (801) 524–3858; or via e-mail at *dkubly@uc.usbr.gov*.

Dated: January 24, 2005.

Randall V. Peterson,

Manager, Environmental Resources Division, Upper Colorado Regional Office, Salt Lake City, Utah.

[FR Doc. 05–2142 Filed 2–3–05; 8:45 am]

BILLING CODE 4310–MN–P

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Mines, Life-of-Mine Plans and Water Supply Project, Coconino, Navajo, and Mohave Counties, AZ, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Extension of the scoping comment period for an environmental impact statement.

SUMMARY: Pursuant to the National Environmental Policy Act of 1969 (NEPA), the Office of Surface Mining Reclamation and Enforcement (OSM) is extending the scoping comment period for the Black Mesa Project environmental impact statement (EIS). The Black Mesa Project includes Peabody Western Coal Company's proposed operation and reclamation plans for the Black Mesa and Kayenta coal mines; the Coal Slurry Preparation Plant at the Black Mesa Mine; the reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station (electrical) in Laughlin, Nevada; the construction and operation of water wells in the Coconino aquifer (C-aquifer) northwest of Winslow, Arizona; and construction and operation of a water supply pipeline running about 120 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant.

DATES: Written comments must be received by OSM by 4 p.m. on March 4, 2005, to ensure consideration in the preparation of the draft EIS.

ADDRESSES: Comments may be submitted in writing or by e-mail. At the top of your letter or in the subject line of your e-mail message, please indicate that the comments are ''BMK EIS Comments.''

- E-mail comments should be sent to: *BMK-EIS@osmre.gov*.
- Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Richard Holbrook, Chief, Southwest Branch, OSM WRCC, P.O. Box 46667, Denver, Colorado 80201–6667
- Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Richard Holbrook, Chief, Southwest Branch OSM WRCC, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733

FOR FURTHER INFORMATION CONTACT: Richard Holbrook, Chief, Southwest Branch, Program Support Division, OSM Western Regional Coordinating Center, by telephone at (303) 844–1400, extension 1491, or by e-mail at *BMK-EIS@osmre.gov*.

SUPPLEMENTARY INFORMATION: On December 1, 2004, OSM published in the **Federal Register** a notice of intent to prepare an EIS for the Black Mesa Project and to hold public scoping meetings (69 FR 69951).

OSM held eight scoping meetings to solicit public comments on the scope of the EIS and significant issues that should be addressed in the EIS. Due to the complex nature of the project and numerous concerns expressed during the scoping meetings, OSM is extending the scoping comment period.

The Black Mesa Project includes Peabody Western Coal Company's proposed operation and reclamation plans for the Black Mesa and Kayenta coal mines; the Coal Slurry Preparation Plant at the Black Mesa Mine; the reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station (electrical) in Laughlin, Nevada; the construction and operation of water wells in the Coconino aquifer (C-aquifer) northwest of Winslow, Arizona; and construction and operation of a water supply pipeline running about 120 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant. At *www.wrcc.osmre.gov/bmk-eis*, interested persons may view information about the proposed projects.

In accordance with the Council on Environmental Quality's regulations for implementing NEPA, 40 CFR Parts 1500 through 1508, OSM solicits public comments on the scope of the EIS and significant issues that it should address in the EIS.

Written comments, including email comments, should be sent to OSM at the addresses given in the **ADDRESSES** section of this notice. Comments should be specific and pertain only to the issues relating to the proposals. OSM will include all comments in the administrative record.

If you would like to be placed on the mailing list to receive future information, please contact the person listed in the section, **FOR FURTHER INFORMATION CONTACT**, above.

OSM will make comments, including names and addresses of respondents, available for public review during normal business hours. OSM will not consider anonymous comments. If individual respondents request confidentiality, OSM will honor their requests to the extent allowable by law. Individual respondents who wish to withhold their name or address (except for the city or town) from public review must state this prominently at the beginning of their comments and must submit their comments by regular mail. All submissions from organizations or businesses and from individuals identifying themselves as representatives or officials of organizations or businesses will be available for public review in their entirety.

Dated: January 27, 2005.

Allen D. Klein,

Regional Director, Western Regional Coordinating Center.

[FR Doc. 05–2180 Filed 2–3–05; 8:45 am]

BILLING CODE 4310–05–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 731–TA–101 (Second Review)]

Greige Polyester/Cotton Printcloth From China

AGENCY: United States International Trade Commission.

ACTION: Revised schedule for the subject review.

EFFECTIVE DATE: January 28, 2005.

FOR FURTHER INFORMATION CONTACT: Gail Burns (202–205–2501), Office of Investigations, U.S. International Trade Commission, 500 E Street SW, Washington, DC 20436. Hearing-impaired persons can obtain information on this matter by contacting the Commission's TDD terminal on 202–205–1810. Persons with mobility impairments who will need special

3) Volume 71, Number 225, Wednesday, November 22, 2006: Notice of availability of draft environmental impact statement for the Black Mesa Project.

designating Federal lands unsuitable for certain types of surface mining operations and for terminating designations pursuant to a petition. The information requested will aid the regulatory authority in the decision making process to approve a disapprove a request.

Bureau Form Number: None.

Frequency of Collection: Once.

Description of Respondents: People who may be adversely affected by surface mining of Federal lands.

Total Annual Responses: 1.

Total Annual Burden Hours: 1,067.

Title: AML Contractor Information Form.

OMB Control Number: 1029–0119.

Summary: 30 CFR 874.16 requires that every successful bidder for an AML contract must be eligible under 30 CFR 773.15(b)(1) at the time of contract award to receive a permit or conditional permit to conduct surface coal mining operations. Further, the regulation requires the eligibility to be confirmed by OSM's automated Applicant/Violator System (AVS) and the contractor must be eligible under the regulations implementing Section 510(c) of the Surface Mining Act to receive permits to conduct mining operations. This form provides a tool for OSM and the States/Indian tribes to help them prevent persons with outstanding violations from conducting further mining or AML reclamation activities in the State.

Bureau Form Number: None.

Frequency of Collection: Once per contract.

Description of Respondents: AML contract applicants and State and tribal regulatory authorities.

Total Annual Responses: 428.

Total Annual Burden Hours: 161.

Send comments on the need for the collection of information for the performance of the functions of the agency; the accuracy of the agency's burden estimates; ways to enhance the quality, utility and clarity of the information collection; and ways to minimize the information collection burden on respondents, such as use of automated means of collection of the information, to the following address. Please refer to the appropriate OMB control number in all correspondence.

ADDRESSES: Submit comments to the Office of Information and Regulatory Affairs, Office of Management and Budget, Attention: Department of Interior Desk Officer, by telefax at (202) 395–6566 or via e-mail to *OIRA_Docket@omb.eop.gov.* Also, please send a copy of your comments to John A. Trelease, Office of Surface Mining Reclamation and Enforcement, 1951 Constitution Ave., NW., Room 210–SIB, Washington, DC 20240, or electronically to *jtrelease@osmre.gov.*

Dated: October 11, 2006.

John R. Craynon,

Chief, Division of Regulatory Support.

[FR Doc. 06–9296 Filed 11–21–06; 8:45 am]

BILLING CODE 4310–05–M

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Coal Mines, Coal Slurry Preparation Plant and Pipeline, and Coconino Aquifer Water-Supply System, Coconino, Mohave, and Navajo Counties, AZ, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Notice of availability of draft environmental impact statement for the Black Mesa Project.

SUMMARY: The Office of Surface Mining Reclamation and Enforcement (OSM) announces availability of the draft environmental impact statement (EIS) for the Black Mesa Project, the public comment period and procedures, and public meetings and procedures.

DATES: To ensure consideration in the preparation of the final EIS, written comments must be received by OSM by 4 p.m., m.s.t., on January 22, 2007.

Public meetings will be held in:

• Window Rock, Arizona, on January 2, 2007, from 6 p.m. to 9 p.m. in the Resource Room at the Navajo Nation Museum, Highway 64 and Loop Road.

• Forest Lake, Arizona, on January 3, 2007, from 6 p.m. to 9 p.m. at the Forest Lake Chapter House on Navajo Route 41 about 20 miles north of Pinon, Arizona.

• Moenkopi, Arizona, on January 3, 2007, from 6 p.m. to 9 p.m. at the Community Center.

• Kayenta, Arizona, on January 4, 2007, from 6 p.m. to 9 p.m. at the Monument Valley High School cafeteria, north Highway 163.

• Kykotsmovi, Arizona, on January 4, 2007, from 6 p.m. to 9 p.m. at the Veterans Center.

• Peach Springs, Arizona, on January 9, 2007, from noon to 3 p.m. at the Hualapai Lodge, 900 Route 66.

• Kingman, Arizona, on January 9, 2007, from 6 p.m. to 9 p.m. at the Hampton Inn, 1791 Sycamore Avenue.

• Leupp, Arizona, on January 9, 2007, from 6 p.m. to 9 p.m. at the Leupp Chapter House on Navajo Route 15.

• Winslow, Arizona, on January 10, 2007, from 6 p.m. to 9 p.m. at the Winslow High School, Student Union, 600 E. Cherry Avenue.

• Laughlin, Nevada, on January 10, 2007, from 6 p.m. to 9 p.m. at the Laughlin Town Hall, 101 Civic Way.

• Flagstaff, Arizona, on January 11, 2007, from 6 p.m. to 9 p.m. at the Little America Hotel, 2515 East Butler Avenue.

ADDRESSES: The draft EIS is available for review on OSM's Internet Web site at *www.wrcc.osmre.gov/WR/BlackMesaEIS.htm.* Paper and computer compact disk (CD) copies of the draft EIS are also available for review at the Office of Surface Mining, Western Region, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

A limited number of CD and paper copies of the draft EIS have been prepared and are available upon request. Because of the time and expense in producing and mailing CD and paper copies, OSM requests that you review the Internet or publicly-available copy, if possible. You may obtain a CD or paper copy by contacting the person identified below in **FOR FURTHER INFORMATION CONTACT.** In your request, indicate whether you want a CD or paper copy.

Comments on the draft EIS may be submitted in writing or by e-mail over the Internet. At the top of your letter or in the subject line of your e-mail message, indicate that the comments are ''BMP Draft EIS Comments.'' Include your name and return address in your letter or e-mail message.

• E-mail comments should be sent to *BMKEIS@osmre.gov.* If you do not receive a confirmation from the system that OSM has received your e-mail comment, contact the person identified in **FOR FURTHER INFORMATION CONTACT** below.

• Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, P.O. Box 46667, Denver, Colorado 80201–6667.

• Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

FOR FURTHER INFORMATION CONTACT: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, by telephone at (303) 844–1400, extension 1440, or by e-mail at *BMKEIS@osmre.gov.*

SUPPLEMENTARY INFORMATION:

I. Background on the Black Mesa Project EIS

I. Background on the Black Mesa Project EIS

Pursuant to the National Environmental Policy Act of 1969 (NEPA), OSM prepared a draft EIS analyzing the effects of the proposed Black Mesa Project. The proposed Project consists of Peabody Western Coal Company's operation and reclamation plans for coal mining at the Black Mesa Mine Complex near Kayenta, Arizona; Black Mesa Pipeline Incorporated's (BMPI's) Coal Slurry Preparation Plant at the Black Mesa Mine Complex; BMPI's reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station in Laughlin, Nevada; and Salt River Project's and Mohave Generation Station co-owners' construction and operation of a water supply system consisting of water wells in the Coconino aquifer (C aquifer) near Leupp, Arizona, and of a water supply pipeline running 108 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant. More information about the project and EIS can be found on OSM's Internet Web site at *www.wrcc.osmre.gov/WR/BlackMesaEIS.htm*.

The Bureau of Indian Affairs; Bureau of Land Management; Bureau of Reclamation; U.S. Environmental Protection Agency; U.S. Department of Agriculture Forest Service; Hopi Tribe; Hualapai Tribe; Navajo Nation; County of Mohave, Arizona; and City of Kingman, Arizona, cooperated with OSM in the preparation of the draft EIS. As a part of its National Environmental Policy Act activities for the proposed project, U.S. Environmental Protection Agency will attend at least the January 3 and 4, 2007, meetings respectively in Moenkopi and Kayenta, Arizona.

II. Availability of Your Comments for Public Review

Our practice is to make comments, including names and home addresses, home phone numbers, and e-mail addresses of respondents, available for public review. Individual respondents may request that we withhold their names and/or home addresses, etc., but if you wish us to consider withholding this information you must state this prominently at the beginning of your comments and submit your comments by regular mail, not by e-mail. In addition, you must present a rationale for withholding this information. This rationale must demonstrate that disclosure would constitute an unwarranted invasion of privacy. Unsupported assertions will not meet this burden. In the absence of exceptional, documentable circumstances, this information will be released. We will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

III. Specificity of Written Comments

Written comments, including email comments, should be sent to OSM at the addresses given in the **ADDRESSES** section of this notice. Be specific in your comments and indicate the chapter, page, paragraph, and sentence your comments pertain to.

IV. Public Meetings

Public meeting rooms will be set up in four areas: (1) An area where an audio-visual presentation on the Black Mesa Project and EIS will be made, (2) an area with displays where meeting attendees may discuss the project proposal and the EIS process with OSM and others, (3) an area where meeting attendees may record and submit written comments, and (4) an area where an OSM representative and a transcriber will record oral comments.

To assist the transcriber and ensure an accurate record, OSM requests that each presenter of oral comments provide a written copy of his or her comments, if possible.

Hopi, Hualapai, and Navajo interpreters will be present respectively at meetings on the Hopi, Hualapai, and Navajo Reservations.

If you are disabled or need special accommodations to attend one of the meetings, contact the person under **FOR FURTHER INFORMATION CONTACT** at least 1 week before the meeting.

Dated: November 15, 2006.

Willie R. Taylor,

Director, Office of Environmental Policy and Compliance.

[FR Doc. E6–19672 Filed 11–21–06; 8:45 am]

BILLING CODE 4310–05–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 332–479]

Certain Textile Articles: Performance Outerwear

AGENCY: International Trade Commission.

ACTION: Institution of investigation and request for public comments.

DATES: *Effective Date:* November 16, 2006.

SUMMARY: Following receipt on October 25, 2006 of a request from the House Committee on Ways and Means, the Commission instituted investigation No. 332–479, Certain Textile Articles: Performance Outerwear, under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)).

FOR FURTHER INFORMATION CONTACT: Kimberlie Freund, Co-Project Leader, Office of Industries (202–708–5402; *kimberlie.freund@usitc.gov*) or Heidi Colby-Oizumi, Co-Project Leader, Office of Industries (202–205–3391; *heidi.colby@usitc.gov*). For information on legal aspects, contact William Gearhart of the Office of the General Counsel (202–205–3091; *william.gearhart@usitc.gov*). The media should contact Margaret O'Laughlin, Office of External Relations (202–205–1819; *margaret.olaughlin@usitc.gov*).

Background

In its letter, the Committee on Ways and Means, U.S. House of Representatives asked the U.S. International Trade Commission to conduct an investigation under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)) and provide a report that contains, to the extent possible, data for 2005 and 2006 on the level of U.S. production and shipments of certain high-performance outerwear jackets and pants and the fabrics used to make such articles. The Committee also asked the Commission to define the products that it is covering in the report. The Committee asked the Commission to provide its report no later than 9 months following receipt of the letter (by July 25, 2007).

In its letter, the Committee also requested that the Commission provide similar data on U.S. production and shipments of certain travel goods with an outer surface of textile materials and the textile materials used to make such goods, and that the Commission submit this second report no later than 12 months following receipt of the letter (by October 25, 2007). The Commission has instituted investigation No. 332–

4) **Volume 71, Number 231, Friday, December 1, 2006: Environmental impact statement; Notice of availability, EIS No. 20060490, Draft EIS, OSM, Black Mesa Project.**

Route to Construct and Reconstruct Roads, Funding, NPDES Permit and U.S. Army COE Section 404 Permit, Okanogan and Wenatchee National Forests, Tonasket Ranger District, Okanogan County, WA.

Summary: EPA expressed environmental concerns about water resource impacts, and requested that information about water resources be updated. EPA is also expressed concern about monitoring and mitigation issues.

Rating EC2.

EIS No. 20060347, ERP No. D-BLM-J70014-ID, Cottonwood Resource Management Plan, Implementation, Latah, Clearwater, Nez Perce, Lewis, Idaho and Adams Counties, ID

Summary: EPA expressed environmental concerns about water quality/source water protection impacts and monitoring/maintaining old growth forest habitat. EPA supports the higher level of resource protection and improvement activities described in Alternative C.

Rating EC2.

EIS No. 20060372, ERP No. D-COE-F67004-MN, East Reserve Project, Construct and Operate an Open Pit Taconite Mine between the Towns of Biwabik and McKinley, St. Louis County, MN.

Summary: EPA expressed environmental objections to potential environmental impacts and requested additional analysis regarding project alternatives, wetland mitigation, water quality impacts, cumulative effects, impacts to Tribal rights, and impacts from the potential presence of asbestos and asbestiform material.

Rating EO2.

EIS No. 20060383, ERP No. D-NPS-E61070-00, South Florida and Caribbean Parks Exotic Plant Management Plan, Manage and Control Exotic Plants in Nine Parks, Five in South Florida Parks: Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park and Four in Caribbean Parks: Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park, Florida and Caribbean.

Summary: EPA does not object to the Preferred Alternative(3) as the most effective solution for controlling invasive plant species, and recommended monitoring to determine if pesticide residues are accumulating in selected indicator species.

Rating LO.

EIS No. 20060395, ERP No. D-USA-D11040-VA, Fort Lee, Virginia and Fort A. P. Hill, Virginia Project, Implementation of Base Closure and Realignment (BRAC) Recommendations and Other Army Actions, Prince George County, Petersburg, Virginia Hopewell, Virginia; Caroline County, Essex County, VA.

Summary: EPA expressed environmental concerns about wetlands, natural habitats, wildlife, noise, and water resources impacts at Fort Lee.

Rating EC2.

EIS No. 20060416, ERP No. D-NOA-E91017-00, Gulf of Mexico Red Snapper Total Allowable Catch and Reduce Bycatch in the Gulf of Mexico Directed and Shrimp Trawl Fisheries, To Evaluate Alternatives, Gulf of Mexico.

Summary: EPA does not object to the proposed action.

Rating LO.

Final EISs

EIS No. 20060341, ERP No. F-AFS-L65483-ID, Three Basins Timber Sale Project, Proposal to Treat 760 Acres of Mature Forest, Implementation, Caribou-Targhee National Forest, Montpelier Ranger District, Bearlake and Caribou Counties, ID.

Summary: EPA's previous issues have been resolved; therefore, EPA does not object to the proposed action.

EIS No. 20060417, ERP No. F-COE-C40162-NJ, NJ–92 Project, New Jersey Turnpike Authority, Transportation Improvement from East-West Highway Link connecting U.S. Route 1 in South Brunswick Township with the New Jersey Turnpike at Interchange 8A in Monroe Township, Middlesex County, NJ.

Summary: EPA recommended that the Corps consider several issues in its upcoming permitting evaluation and decision document, *i.e.*, issues regarding the alternatives screening process, impacts to surface water, wetlands mitigation and air quality regional emissions analysis.

EIS No. 20060421, ERP No. F-AFS-L65487-OR, Blue Mountain Land Exchange—Oregon Project, Proposed Exchange of Federal and Non-Federal Lands, Malheur, Umatilla, and Wallowa-Whitman National Forests, Baker, Grant, Morrow, Umatilla, Union and Wallowa Counties, OR.

Summary: The Final EIS addressed EPA's concerns; therefore, EPA does not object to the proposed action.

Dated: November 28, 2006.

Dawn E. Roberts,

Management Analyst, Office of Federal Activities.

[FR Doc. E6–20350 Filed 11–30–06; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–6681–8]

Environmental Impacts Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7167 or *http://www.epa.gov/compliance/nepa/*.

Weekly receipt of Environmental Impact Statements

Filed 11/20/2006 Through 11/24/2006

Pursuant to 40 CFR 1506.9.

Emergency Comments

EIS No. 20060486, Draft EIS, NPS, MD, White-Tailed Deer Management Plan, Implementation, Catoctin Mountain Park, Frederick and Washington Counties, MD, *Comment Period Ends:* 01/29/2007, *Contact:* Dana Swauger, 301–416–0136

EIS No. 20060487, Final EIS, AFS, CA, South Yuba Canal Maintenance Project, Hazardous Trees Removal, Implementation, Tahoe National Forest, Nevada County, CA, *Wait Period Ends:* 01/17/2007, *Contact:* Dennis W. Stevens, 530–478–6253

EIS No. 20060488, Final EIS, BLM, WY, Atlantic Rim Natural Gas Field Development Project, Proposed Natural Gas Development to 2000 Wells, 1800 to Coal Beds and 200 to Other Formations, Carbon County, WY, *Wait Period Ends:* 01/02/2007, *Contact:* David Simons, 307–328–4328

EIS No. 20060489, Final EIS, COE, 00, Lock and Dam 3 Mississippi River Navigation Safety and Embankments, To Reduce Related Navigation Safety and Embankment Problems, Upper Mississippi River, Goodhue County, MN and Pierce County, WI, *Wait Period Ends:* 01/02/2007, *Contact:* Daniel Wilcox, 651–290–5276.

EIS No. 20060490, Draft EIS, OSM, 00, Black Mesa Project, Revisions to the Life of Mine Operation and Reclamation for the Kayenta and Black Mesa Surface-Coal Mining Operations, Right-of-Way Grant, Mohave, Navajo, Coconino and Yavapai Counties, AZ and Clark County, NV, *Comment Period Ends:* 01/22/2007, *Contact:* Peter A Rutledge, 303–844–1400 Ext. 1440.

EIS No. 20060491, Second Final EIS (Tiering), FHW, WA, WA–167

Freeway Project, Construction, from 161 (Meridian Street North) in the City of Puyallup to the WA–509 Freeway in the City of Tacoma, Funding, U.S. Coast Guard, NPDES, U.S. Army COE Section 10 and 404 Permits, Cities of Puyallup, Fife, Edgewood, Milton, and Tacoma, Pierce County, WA, *Wait Period Ends*: 01/02/2007, *Contact*: Megan Hall, 360–753–3579.

EIS No. 20060492, Final EIS, BIA, OR, Coyote Business Park, Confederated Tribes of the Umatilla Indian Reservation, Proposes to Develop, Build and Manage a Light Industrial Commercial Business Park, Umatilla County, OR, *Wait Period Ends*: 01/02/2007, *Contact*: Jerry Lauer, 541–278–3786.

EIS No. 20060493, Draft EIS, IBR, CA, Folsom Dam Safety and Flood Damage Reduction Project, Addressing Hydrologic, Seismic, Static, and Flood Management Issues, Sacramento, El Dorado and Placer Counties, CA, *Comment Period Ends*: 01/16/2007, *Contact*: Shawn Oliver, 916–989–7256.

EIS No. 20060494, Draft EIS, DOE, WV, Western Greenbrier Co-Production Demonstration Project, Construction and Demonstration of a 98 megawatt (MWe) Net Power Plant and Ash Byproduct Manufacturing Facility, Rainelle, WV, *Comment Period Ends*: 01/17/2007, *Contact*: Roy Spears 304–285–5460.

EIS No. 20060495, Final EIS, FHW, WA, WA–28 Eastside Corridor Project, Proposal to Improve WA–28 (Sunset Highway) Corridor from WA–2/97 (Odabashian Bridge) to 9th Street N.E. in East Wenatchee, City of East Wenatchee, Douglas County, WA, *Wait Period Ends*: 01/02/2007, *Contact*: Steve Saxton, 360–753–9411.

EIS No. 20060496, Final EIS, FWS, AL, Gulf Highlands Condominium and Beach Club West Residential/Recreational Condominium Projects, Application for Two Incidental Take Permits for the Construction and Occupancy, Fort Morgan Peninsula, Baldwin County, AL, *Wait Period Ends*: 01/02/2007, *Contact*: Aaron Valenta, 404–679–4144.

EIS No. 20060497, Final EIS, FRC, MS, Clean Energy Liquefied Natural Gas (LNG) Import Terminal and Natural Gas Pipeline Facilities, Construction and Operation, U.S. Army COE Section 10 and 404 Permits, (FERC/EIS–0192D), Port of Pascagoula, Jackson County, MS, *Wait Period Ends*: 01/02/2007, *Contact*: Bryan Lee, 1–866–208–3372.

Amended Notices

EIS No. 20060401, Draft EIS, FRC, CA, Oroville Facilities Project, Issuing an New Federal License to Continue Hydroelectric Power (FERC No. 2100), Feather River, Sierra Nevada, Butte County, CA, *Comment Period Ends*: 12/19/2006, *Contact*: James Fargo, 202–502–6095. Revision to FR Notice Published on 10/06/2006: Extending Comment Period from 11/20/2006 to 12/19/2006.

EIS No. 20060414, Draft EIS, USA, CO, Pinon Canyon Maneuver Site (PCMS) Transformation Program, Implementation, Base Realignment and Closure Activities, Fort Carson, Las Animas, Otero and Huerfano Counties, CO, *Comment Period Ends*: 01/11/2007, *Contact*: Karen Wilson, 703–602–2861. Revision to FR Notice Published 10/13/2006: Extending Comment Period from 11/27/2006 to 01/11/2007.

EIS No. 20060415, Draft EIS, USA, CO, Fort Carson Transformation Program, Implementation, Base Realignment and Closure Activities, Fort Carson, El Paso, Pueblo and Fremont Counties, CO, *Comment Period Ends*: 01/11/2007, *Contact*: Karen Wilson, 703–602–2861. Revision to FR Notice Published 10/13/2006: Extending Comment Period from 11/27/2006 to 01/11/2007.

EIS No. 20060434, Draft Supplement EIS, AK, Kenai Winter Access Project, Updated Information on New Alternative, Develop a Winter Access Management Plan for 2006/2007 Winter Season, Implementation, Seward Ranger District, Chugach National Forest, Located on the Kenai Peninsula in Southcentral, AK, *Comment Period Ends*: 12/18/2006, *Contact*: Sharon Randall, 907–743–9497. Revision to FR Notice Published on 10/20/2006: Extending Comment Period from 12/04/2006 to 12/18/2006.

Dated: November 28, 2006.

Robert W. Hargrove,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. E6–20450 Filed 11–30–06; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–8250–4]

State Innovation Grant Program, Notice of Availability of Solicitation for 2007 Awards

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The U.S. Environmental Protection Agency's National Center for Environmental Innovation (NCEI) is giving notice of the availability of its solicitation for pre-proposals for the 2007 "State Innovation Grant Program," an assistance agreement program to support innovation by state environmental regulatory agencies.

Only the principal environmental regulatory agency within each state, U.S. territory, or the District of Columbia (generally, where delegated authorities for federal environmental regulations exist) is eligible to receive funding under this solicitation.

DATES: Eligible agencies will have until January 18, 2007 to respond with a pre-proposal, budget, and project narrative. Eligible agencies from the fifty (50) states, four (4) U.S. territories, and Washington, DC were notified of the solicitation's availability by e-mail and transmittals on November 27 and November 28, 2006.

ADDRESSES: Copies of this solicitation can be downloaded from EPA's State Innovation Grant Web site at: *http://www.epa.gov/innovation/stategrants/solicitation2007.pdf*. Copies of this solicitation may also be requested from the Agency by telephone ((202) 566–2186), by e-mail (*innovation_state_grants@epa.gov*), or by mail (see below).

Applicants are requested to apply electronically through *http://www.grants.gov*, as explained in Section IV of the solicitation. Applicants must submit all information, as explained in Section IV of the solicitation, with their application package. Questions concerning the solicitation, and/or questions about responding to this notice may be submitted in writing via: E-mail to: *innovation_state_grants@epa.gov*; Fax to: (202) 566–2220; or USPS mail to: State Innovation Grants Program, National Center for Environmental Innovation, Office of the Administrator, U.S. Environmental Protection Agency (MC 1807T), 1200 Pennsylvania Ave., NW., Washington, DC 20460; or EPA will respond to all questions in writing, and all questions and responses will be posted on the EPA State Innovation Grant Web site at: *http://www.epa.gov/innovation/stategrants/*

SUPPLEMENTARY INFORMATION: The U.S. Environmental Protection Agency (EPA) is soliciting pre-proposals for the "State Innovation Grant Program," an assistance agreement program. In an effort to support innovation by state environmental regulatory agencies, in

5) **Volume 72, Number 9, Tuesday, January 16, 2007: Extension of comment period for the Black Mesa Project draft environmental impact statement (EIS) and scheduling of additional public meeting.**

Whitefield Union Hall, 901 Townhouse Rd., Whitefield, 07000014

Washington County

Chaloner House, 3 Pleasant St., Lubec, 07000009

York County

Pike, LeRoy F., Memorial Building, 17 Maple St., Cornish, 07000010

MISSOURI

Henry County

Clinton Square Historic District, Roughly 100 Blocks on N & S Main; S. Washington; W Franklin; W Jefferson, Clinton, 07000019

Jackson County

Holy Rosary Historic District, Roughly bounded by 5th and Campbell, 5th and Harrison and 9th E. Missouri Ave., Kansas City, 07000007

Twenty-Ninth Street Colonnaded Apartments Historic District, (Colonnade Apartment Buildings of Kansas City, MO MPS) 900–906 E. 29th St. and 2843 N. Campbell; 910–912 E. 29th St.; 914 E. 29th St., Kansas City, 07000018

Montgomery County

Gloe, Heinrich, House, 358 Hwy P, Rhineland, 07000022

St. Louis Independent City

Falstaff Brewing Corporation Plant Number 1, 3644–3690 Forest Park Blvd., St. Louis (Independent City), 07000008

Forest Park Southeast Historic District (Boundary Increase II), 4121–25, 4127–29, 4131, 4133, 4137, 4139–41, 4143, 4145, 4501–07, 4509–11, 4510, and 4512–14 Manchester Ave., St. Louis (Independent City), 07000015

Jack Rabbit Candy Company Building, 1928–1930 Martin Luther King, St. Louis (Independent City), 07000024

Jones, William Cuthbert, House, 3724 Olive St., St. Louis (Independent City), 07000017

Koken Barbers' Supply co. Historic District, Bounded by Ohio, Sidney and Victor Sts., and alley E of Texas Ave., St. Louis (Independent City), 07000023

Laclede Gas Light Company Pumping Station G, 4401 Chouteau Ave., St. Louis (Independent City), 07000020

Lee, Robert E., Hotel, 205 N. 18th St., St. Louis (Independent City), 07000021

NORTH DAKOTA

Cass County

Union Storage & Transfer Cold Storage Warehouse and Amour Creamery Building, 1026–1032 Northern Pacific Ave. and 1034–1102 Northern Pacifice Ave., Fargo, 07000016

OHIO

Coshocton County

Muskingum River Navigation Historic District, Coshocton, Muskingum, Morgan, Washington Counties, Coshocton, 07000025

Franklin County

Canal Winchester School, 100 South Washington St., Canal Winchester, 07000026

Hamilton County

West Fourth Street Historic District (Boundary Increase), 1–35, 2–18 W. Fourth St., Cincinnati, 07000028

Marion County

Marion Township Sub-District #8 School, 2473 OH 4 N, Marion, 07000027

PENNSYLVANIA

Bucks County

Funk, Jacob, House and Barn, 3609 PA 212, Springfield, 07000030

Dauphin County

Legislative Route 1 Sycamore Allee, Legislative Route 1, approx. 1 mil N and S of Halifax, Halifax and Reed, 07000029

McKean County

Lynn Hall, W side of U.S. 6, 1.5 mi. W of Port Allegany, Liberty Township, 07000033

Philadelphia County

Rohm and Haas Corporate Headquarters, 100 Independence Mall West, Philadelphia, 07000031

Washington County

First National Bank of Charleroi, 210 Fifth St., Charleroi Borough, 07000032

WISCONSIN

Crawford County

Cipra Wayside Mound Group, (Late Woodland Stage in Archeological Region 8 MPS) Address Restricted, Wauzeka, 07000034

Richland County

Shadewald I Mound Group, (Late Woodland Stage in Archeological Region 8 MPS) Address Restricted, Eagle Township, 07000035

[FR Doc. E7–376 Filed 1–12–07; 8:45 am]

BILLING CODE 4312–51–P

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Coal Mines, Coal Slurry Preparation Plant and Pipeline, and Coconino Aquifer Water-Supply System, Coconino, Mohave, Navajo, and Yavapai Counties, Arizona, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Extension of comment period for the Black Mesa Project draft environmental impact statement (EIS) and scheduling of additional public meeting.

SUMMARY: The Office of Surface Mining Reclamation and Enforcement (OSM) is extending the comment period for the Black Mesa Project draft EIS and scheduling an additional public meeting in Leupp, Arizona.

DATES: To ensure consideration in the preparation of the final EIS, written comments must be received by OSM by 4 p.m., m.s.t., on February 6, 2007. A public meeting to receive comments on the draft EIS will be held in Leupp, Arizona, on January 11, 2007, from noon to 4 p.m. at the Leupp Chapter House on Navajo Route 15.

ADDRESSES: The draft EIS is available for review on OSM's Internet Web site at *http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm.* Paper and computer compact disk (CD) copies of the draft EIS are also available for review at the Office of Surface Mining, Western Region, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

A limited number of CD and paper copies of the draft EIS have been prepared and are available upon request. Because of the time and expense in producing and mailing CD and paper copies, OSM requests that you review the Internet or publicly-available copy, if possible. You may obtain a CD or paper copy by contacting the person identified below in **FOR FURTHER INFORMATION CONTACT**. In your request, indicate whether you want a CD or paper copy.

Comments on the draft EIS may be submitted in writing or by e-mail over the Internet. At the top of your letter or in the subject line of your e-mail message, indicate that the comments are ''BMP Draft EIS Comments.'' Include your name and return address in your letter or e-mail message.

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- Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, P.O. Box 46667, Denver, Colorado 80201–6667.
- Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

FOR FURTHER INFORMATION CONTACT: Dennis Winterringer, Leader, Black

Mesa Project EIS, OSM Western Region, by telephone at (303) 844–1400, extension 1440, or by e-mail at *BMKEIS@osmre.gov.*

SUPPLEMENTARY INFORMATION:

I. Extension of the Comment Period and Scheduling of an Additional Public Meeting
II. Background on the Black Mesa Project EIS
III. Availability of Your Comments for Public Review
IV. Specificity of Comments
V. Public Meetings

I. Extension of the Comment Period and Scheduling of an Additional Public Meeting

On November 22 and December 1, 2006, OSM and the Environmental Protection Agency respectively published in the **Federal Register** notices announcing availability of the Black Mesa Project draft EIS for comment (71 FR 67637 and 71 FR 69562). In the former notice, OSM announced a comment period closing date of January 22, 2007, and the locations, dates, and times for 11 public meetings that will be held from January 2 through 11, 2007.

Subsequent to the publishing of the notices OSM received requests to extend the comment period and a request to reschedule one of the meetings. In consideration of the comment period extension requests, OSM is extending the comment period for 15 days to February 6, 2007. In consideration of the request to reschedule the public meeting in Leupp, Arizona, that was originally announced for January 9, 2007, from 6 p.m. to 9 p.m. at the Leupp Chapter House, OSM has decided to hold the meeting as planned and to also hold another meeting at the same location on January 11, 2007, from noon to 4 p.m.

II. Background on the Black Mesa Project EIS

Pursuant to the National Environmental Policy Act of 1969 (NEPA), OSM prepared a draft EIS analyzing the effects of the proposed Black Mesa Project. The proposed Project consists of Peabody Western Coal Company's operation and reclamation plans for coal mining at the Black Mesa Mine Complex near Kayenta, Arizona; Black Mesa Pipeline Incorporated's (BMPI's) Coal Slurry Preparation Plant at the Black Mesa Mine Complex; BMPI's reconstruction of the 273-mile long Coal Slurry Pipeline across northern Arizona from the Coal Slurry Preparation Plant to the Mohave Generating Station in Laughlin, Nevada; and Salt River Project's and Mohave Generation Station co-owners' construction and operation of a water supply system consisting of water wells in the Coconino aquifer (C aquifer) near Leupp, Arizona, and of a water supply pipeline running 108 miles across the Navajo and Hopi Reservations from the wells to the Coal Slurry Preparation Plant. More information about the project and EIS can be found on OSM's Internet Web site at *http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm.*

III. Availability of Your Comments for Public Review

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IV. Specificity of Written Comments

Written comments, including e-mail comments, should be sent to OSM at the addresses given in the **ADDRESSES** section of this notice. Be specific in your comments and indicate the chapter, page, paragraph, and sentence your comments pertain to.

V. Public Meetings

Meeting rooms for the 12 public meetings will be set up in four areas: (1) An area where an audio-visual presentation on the Black Mesa Project and EIS will be made, (2) an area with displays where meeting attendees may discuss the project proposal and the EIS process with OSM and others, (3) an area where meeting attendees may record and submit written comments, and (4) an area where an OSM representative and a transcriber will record oral comments.

To assist the transcriber and ensure an accurate record, OSM requests that each presenter of oral comments provide a written copy of his or her comments, if possible.

Hopi, Hualapai, and Navajo interpreters will be present respectively at meetings on the Hopi, Hualapai, and Navajo Reservations.

If you are disabled or need reasonable accommodations to attend one of the meetings, contact the person under **FOR FURTHER INFORMATION CONTACT** at least 1 week before the meeting.

Dated: January 10, 2007.

Willie R. Taylor,

Director, Office of Environmental Policy and Compliance.

[FR Doc. E7–454 Filed 1–12–07; 8:45 am]

BILLING CODE 4310–05–P

DEPARTMENT OF JUSTICE

[OMB Number 1103–NEW]

Office of Community Oriented Policing Services; Agency Information Collection Activities: Proposed Collection; Comments Requested

ACTION: 30-Day notice of information collection under review: COPS Interoperable Communications Technology Program (ICTP) assessment.

The Department of Justice (DOJ) Office of Community Oriented Policing Services (COPS) will be submitting the following information collection request to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act of 1995. The proposed information collection is published to obtain comments from the public and affected agencies. This proposed information collection was previously published in the **Federal Register** Volume 71, Number 205, page 62298, on October 24, 2006, allowing for a 60 day comment period.

The purpose of this notice is to allow for 30 days for public comment until February 15, 2007. This process is conducted in accordance with 5 CFR 1320.10.

If you have comments especially on the estimated public burden or associated response time, suggestions, or need a copy of the proposed information collection instrument with instructions or additional information, please contact Rebekah Dorr, Department of Justice Office of Community Oriented Policing Services, 1100 Vermont Avenue, NW., Washington, DC 20530.

Written comments and suggestions from the public and affected agencies concerning the proposed collection of information are encouraged. Your

6) **Volume 73, Number 101, Friday, May 23, 2008: Reopening of comment period for the Black Mesa draft environmental impact statement (EIS).**

obligated to care for and return to the appropriate Nation, Haudenosaunee cultural objects that are not specifically affiliated with any one Haudenosaunee Nation. Written evidence of Haudenosaunee oral tradition presented during consultation identifies the False Face masks as being sacred objects needed by traditional Haudenosaunee religious leaders and objects of cultural patrimony that have ongoing historical, traditional, and cultural significance to the group and could not have been alienated by a single individual.

Officials of the Seton Hall University Museum have determined that, pursuant to 25 U.S.C. 3001 (3)(C), the two cultural objects described above are specific ceremonial objects needed by traditional Native American religious leaders for the practice of traditional Native American religions by their present–day adherents. Officials of the Seton Hall University Museum also have determined that, pursuant to 25 U.S.C. 3001 (3)(D), the two cultural items described above have ongoing historical, traditional, or cultural importance central to the Native American group or culture itself, rather than property owned by an individual. Lastly, officials of the Seton Hall University Museum have determined that, pursuant to 25 U.S.C. 3001 (2), there is a relationship of shared group identity that can be reasonably traced between the sacred objects/objects of cultural patrimony and the Cayuga Nation of New York; Oneida Nation of New York; Oneida Tribe of Indians of Wisconsin; Onondaga Nation of New York; Seneca Nation of New York; Seneca–Cayuga Tribe of Oklahoma; Saint Regis Mohawk Tribe, New York; Tonawanda Band of Seneca Indians of New York; and Tuscarora Nation of New York.

Representatives of any other Indian tribe or Nation that believes itself to be culturally affiliated with the sacred objects/objects of cultural patrimony should contact Dr. Thomas W. Kavanagh, Seton Hall University Museum, Seton Hall University, 400 South Orange Ave., South Orange, NJ 07079, telephone (973) 375–5873, before June 23, 2008. Repatriation of the sacred objects/objects of cultural patrimony to the Onondaga Nation of New York may proceed after that date if no additional claimants come forward.

The Seton Hall University Museum is responsible for notifying the Cayuga Nation of New York; Oneida Nation of New York; Oneida Tribe of Indians of Wisconsin; Onondaga Nation of New York; Seneca Nation of New York; Seneca–Cayuga Tribe of Oklahoma; Saint Regis Mohawk Tribe, New York; Tonawanda Band of Seneca Indians of New York; Tuscarora Nation of New York; and Haudenosaunee Standing Committee on Burial Rules and Regulations, a non–federally recognized Indian organization, that this notice has been published.

Dated: April 29, 2008.

Sherry Hutt,

Manager, National NAGPRA Program.

[FR Doc. E8–11572 Filed 5–22–08; 8:45 am]

BILLING CODE 4312–50–S

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

Black Mesa and Kayenta Coal Mines, Coal Slurry Preparation Plant and Pipeline, and Coconino Aquifer Water-Supply System, Coconino, Mohave, Navajo, and Yavapai Counties, AZ, and Clark County, NV

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Reopening of comment period for the Black Mesa Project draft environmental impact statement (EIS).

SUMMARY: The Office of Surface Mining Reclamation and Enforcement (OSM) is reopening the comment period for the proposed Black Mesa Project draft EIS and preferred alternative. Since the close of the extended comment period on the draft EIS on February 6, 2007, the scope of the proposed project has been reduced. The proposed project no longer includes supplying coal to the Mohave Generating Station (MGS). The draft EIS is the same document as previously issued, and comments are solicited on the preferred alternative as described in this notice. Previously submitted comments will be considered in the final EIS and do not need to be resubmitted.

DATES: To ensure consideration in the preparation of the final EIS, written comments must be received by OSM by 4 p.m., m.d.t., on July 7, 2008.

ADDRESSES: The draft EIS is available for review on OSM's Internet Web site at *http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm*. Paper and computer compact disk (CD) copies of the draft EIS are also available for review at the Office of Surface Mining, Western Region, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

Comments on the Black Mesa Project draft EIS and preferred alternative may be submitted in writing or by e-mail over the Internet. At the top of your letter or in the subject line of your e-mail message, indicate that the comments are ''BMP Draft EIS Comments.'' Include your name and return address in your letter or e-mail message.

- E-mail comments should be sent to *BMKEIS@osmre.gov*. If you do not receive a confirmation from the system that OSM has received your e-mail comment, contact the person identified in **FOR FURTHER INFORMATION CONTACT** below.
- Written comments sent by first-class or priority U.S. Postal Service should be mailed to: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, P.O. Box 46667, Denver, Colorado 80201–6667.
- Comments delivered by U.S. Postal Service Express Mail or by courier service should be sent to: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, 1999 Broadway, Suite 3320, Denver, Colorado 80202–5733.

FOR FURTHER INFORMATION CONTACT: Dennis Winterringer, Leader, Black Mesa Project EIS, OSM Western Region, by telephone at (303) 293–5048, or by e-mail at *BMKEIS@osmre.gov*.

SUPPLEMENTARY INFORMATION:

I. Reopening of the Comment Period
II. Background on the Black Mesa Project EIS
III. Public Comment Procedures

I. Reopening of the Comment Period

On November 22 and December 1, 2006, OSM and the Environmental Protection Agency respectively published in the **Federal Register** notices announcing availability of the Black Mesa Project draft EIS for comment (71 FR 67637 and 71 FR 69562).

On January 16 and 19, 2007, OSM and EPA respectively published in the **Federal Register** notices extending the comment period (72 FR 1764 and 72 FR 2512). The extended comment period closed on February 6, 2007.

Because of events that have occurred since the close of the comment period for the draft EIS, OSM is reopening the comment period. Previously submitted comments will be considered in the final EIS and do not need to be resubmitted.

The draft EIS identified Alternative A, which contemplated continued coal supply to the MGS, as the proposed project and preferred alternative. In letters dated February 25 and April 30, 2008, Peabody Western Coal Company (Peabody) notified OSM that it no longer intended to supply coal to MGS because it believed the reopening of MGS is remote, but it would continue to supply coal to the Navajo Generating Station.

Peabody also stated its intention to amend the pending permit revision application for the Black Mesa Mine Complex to remove proposed plans and activities that supported supplying coal to MGS. By amending the permit revision application, the proposed project would be reduced to permitting the Black Mesa Complex mining operations as described and analyzed as Alternative B of the draft EIS. Alternative B is now the preferred alternative.

II. Background on the Black Mesa Project EIS

Pursuant to the National Environmental Policy Act of 1969 (NEPA), OSM prepared a draft EIS analyzing the effects of the proposed Black Mesa Project. It analyzed effects of the following three alternatives.

Alternative A

- Approval of Peabody's life-of-mine permit revision for the Black Mesa Mine Complex (Black Mesa and Kayenta Mines), including mining of coal to supply the Mohave Generating Station, a new coal wash plant and associated coal waste disposal, and construction, use, and maintenance of a new haul road between mine areas on the southern ends of Peabody's coal leases;
- Approval of Black Mesa Pipeline's existing coal-slurry preparation plant and rebuilding the 273-mile-long coal-slurry pipeline to the Mohave Generating Station; and
- Approval of a new Coconino Aquifer water-supply system, including a 108-mile-long pipeline to convey the water to the minesite.

Alternative B

- Conditional approval of Peabody's life-of-mine permit revision, including incorporation of the Black Mesa Mine surface facilities and coal deposits into the Kayenta Mine permit area and construction, use, and maintenance of a haul road between mine areas on the southern ends of Peabody's coal leases;
- No approval for coal mining at the Black Mesa Mine to supply the Mohave Generating Station;
- No approval to reconstruct the coal-slurry pipeline; and
- No approval to construct the Coconino Aquifer water-supply system.

Alternative C

- Disapproval of Peabody's life-of-mine permit revision.
  - No approval for mining coal at the Black Mesa Mine to supply the Mohave Generating Station but continued operation of mining at the Kayenta Mine to supply coal to the Navajo Generating Station, because Peabody already has an approved permit for this mine and has the right of successive permit renewals;
  - No incorporation of Black Mesa Mine surface facilities and coal deposits into the Kayenta Mine permit area;
- No approval to reconstruct the coal-slurry pipeline; and
- No approval to construct the Coconino Aquifer water-supply system.

At the time the draft EIS was released, the purpose of the proposed project was to continue to supply coal to MGS and to the Navajo Generating Station, and Alternative A in the draft EIS described the proposed project. In letters dated February 25 and April 30, 2008, Peabody notified OSM that it did not intend to continue to supply coal to MGS in the future because it believed the reopening of MGS is remote. Peabody would continue to supply coal to the Navajo Generating Station and stated its intention to amend the pending permit revision application for the Black Mesa Mine Complex to remove proposed plans and activities that supported supplying coal to MGS. Specifically, the pending permit revision application would be amended to (1) remove the plans for a coal wash plant and coal waste disposal site, (2) modify the probable hydrologic consequences section of the application to indicate use of 1,236 ac-ft/yr of Navajo aquifer water for domestic and mine-related uses instead of the initially proposed long-term average of about 2,000 ac-ft/yr for mine-related uses and as a backup water supply to the proposed new Coconino aquifer water supply, and (3) remove the plan for a new road between the southern parts of its coal leases. By amending the permit revision application, the proposed project is reduced to permitting the Black Mesa Complex mining operations as described and analyzed as Alternative B of the draft EIS, except that the new road that was included in Alternative B is no longer being proposed. In the analysis of alternative B in the draft EIS, OSM had considered the impacts of the proposed new road that would have disturbed 127 acres. With elimination of the plans for a new proposed road, the impacts would be less than those identified in the draft EIS for Alternative B.

More information about the project and EIS can be found on OSM's Internet Web site at *http://www.wrcc.osmre.gov/WR/BlackMesaEIS.htm.*

III. Public Comment Procedures

Written Comments: If you submit written comments, they should be specific, confined to issues pertinent to the draft EIS, and explain the reason for any recommended changes. Please indicate the chapter, page, paragraph, and sentence of the draft EIS your comments pertain to.

We will make every attempt to log all comments into the record for this draft EIS; however, we cannot ensure that comments received after the close of the comment period (see **DATES**) or sent to a location other than those listed above (see **ADDRESSES**) will be included in the record and considered.

Public Availability of Comments: Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Dated: May 6, 2008.

Allen D. Klein,

Regional Director, Western Region.

[FR Doc. E8–11265 Filed 5–22–08; 8:45 am]

BILLING CODE 4310–05–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 337–TA–598]

In the Matter of Certain Unified Communications Systems, Products Used With Such Systems, and Components Thereof; Notice of Commission Decision to Reverse-in-Part and Modify-in-Part a Final Initial Determination Finding a Violation of Section 337 and Termination of the Investigation With a Finding of No Violation

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined to reverse-in-part and modify-in-part a final initial determination (''ID'') of the presiding administrative law judge (''ALJ''). The Commission has determined that there is no violation of section 337 in the above-captioned investigation.

FOR FURTHER INFORMATION CONTACT: Clint Gerdine, Esq., Office of the General Counsel, U.S. International Trade Commission, 500 E Street, SW., Washington, DC 20436, telephone (202) 708–5468. Copies of non-confidential documents filed in connection with this investigation are or will be available for

GLOSSARY

GLOSSARY

Acre-foot: The volume (as of irrigation water) that would cover 1 acre to a depth of 1 foot (43,560 cubic feet).

Action: In the context of the National Environmental Policy Act (NEPA), describes actions proposed to meet a specific purpose and need and that may have effects on the environment, which are potentially subject to Federal control and responsibility. Federal actions generally fall into the categories of adoption of official policy, formal plans, and programs; or approval of specific projects. For this document, the term action applies to a specific project.

Aesthetic quality: A perception of the beauty of a natural or cultural landscape.

Aggradation: The deposition of sediment by running water, as in the channel of a stream.

Air quality: A measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.

Air quality classes: Classifications established under the Prevention of Significant Deterioration portion of the Clean Air Act that limit the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air quality would be significant, Class II applies to areas where the deterioration normally accompanying moderate, well-controlled growth would be permitted, and Class III applies to areas where industrial deterioration generally would be allowed.

Alluvium: A general term for clay, silt, sand, gravel, or similar consolidated material deposited during comparatively recent geologic time by a stream or other body of running water in the bed of the stream, river, or floodplain, or as a cone or fan at the base of a mountain slope.

Alternative: Any one of a number of options for a project.

Alternative energy: Renewable energy sources such as wind, flowing water, solar energy, and biomass, which create less environmental damage and pollution than fossil fuels, and offer an alternative to nonrenewable resources.

Ambient. Of the environment surrounding a body, encompassing on all sides. Most commonly applied to air quality and noise.

American Indian tribe (or tribe): Any American Indian group in the conterminous United States that the Secretary of the Interior recognizes as possessing tribal status (listed periodically in the Federal Register).

Ancillary road: Any road not classified as a primary road.

Animal unit month: The amount of forage necessary to sustain one cow and one calf (e.g., a 1,000-pound cow and calf) for a period of one month.

Annual (ecology): A plant that completes its development in one year or one season and then dies.

Aquatic: Growing or living in or near the water.

Aquifer: A water-bearing rock unit (unconsolidated or bedrock) that will yield water in a usable quantity to a well or spring.

Aquitard: Refers to any layer in an aquifer or aquifer system that is much less permeable than the aquifers themselves, but not impermeable.

Archaeological site: A discrete location that provides physical evidence of past human use.

Archaeology: the scientific study of the life and culture of past, especially ancient, peoples, as by excavation of ancient cities, relics, artifacts, etc.

Archival: Pertaining to or contained in documents or records that preserve information about an event or individual.

Area of Critical Environmental Concern: A Bureau of Land Management (BLM) designation pertaining to areas where specific management attention is needed to protect and prevent irreparable damage to important historical, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards.

Arroyo: A dry gully, or a stream in a dry region.

Artifact: Any object showing human workmanship or modification, especially from a prehistoric or historic culture.

Ash: The residue that remains when something is burned. Also, one component of coal; generally, high ash-content coal is considered to be low-grade.

Assessment: The act of evaluating and interpreting data and information for a defined purpose.

Attainment area (air): Designation of a geographical area by the U.S. Environmental Protection Agency (USEPA) where the air quality is deemed to be better than the National Ambient Air Quality Standards (NAAQS). This designation is based on the measured ambient criteria pollution data available for the geographic area. Areas where the measured ambient criteria pollution data are worse than the NAAQS are identified as nonattainment. An area can be designated as unclassified when there are insufficient ambient criteria pollutant data for the USEPA to form a basis for attainment status. An area can be in attainment for some pollutants but not others.

Backfill: The fill, often mine waste or rock, that replaces the void left from where a rock or ore has been removed. Also, the material used to fill in a trench in the groundbed (i.e., pipeline trench). The composition of the backfill varies based on the soil type being used and the component being covered.

Background (visual): That portion of the visual landscape lying from the outer limit of the middleground to infinity. Color and texture are subdued in this area, and visual sensitivity analysis here is primarily concerned with the two-dimensional shape of landforms against the sky.

Baghouse: An air pollution control device containing a large fabric bag, usually made of glass fibers, used to eliminate intermediate and large (greater than 20 PM [particulate matter] in diameter) particles. This device operates like the bag of an electric vacuum cleaner, passing the air and smaller particles while entrapping the larger ones.

Base flow: The contribution of stream discharge from groundwater seeping into the stream.

Baseline: The existing conditions against which impacts of the proposed action and its alternatives can be compared.

Basin: A depressed area having no surface outlet (topographic basin); a physiographic feature or subsurface structure that is capable of collecting, storing, or discharging water by reason of its shape and the characteristics of its confining material (water); a depression in the earth's surface, the lowest part often filled by a lake or pond (lake basin); a part of a river or canal widened (drainage, river, stream basin).

Best management practices: A suite of techniques that guide, or may be applied to, management actions to aid in achieving desired outcomes and help to protect the environmental resources by avoiding or minimizing impacts of an action.

Big game: Large species of wildlife that are hunted (such as elk, deer, pronghorn antelope).

Biological assessment: Information prepared by, or under the direction of, a Federal agency to determine whether a proposed action is likely to (1) adversely affect listed species or designated critical habitat; (2) jeopardize the continued existence of species that are proposed for listing; or (3) adversely modify proposed critical habitat.

Biological opinion: A document that is the product of formal consultation, stating the opinion of the U.S. Fish and Wildlife Service (FWS) on whether or not a Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

Black Mesa Complex: Comprises two separate mining operations surface coal-mining operation—the Kayenta mining operation and the Black Mesa mining operation—on Black Mesa in Navajo County, Arizona. The Black Mesa Complex is located on contiguous coal leases within the boundaries of the Hopi and Navajo Indian Reservations.

Boiler: Any device used to burn coal fuel to heat water for generating steam.

Butte: A steep hill standing alone in a plain.

Candidate species: A plant or animal species not yet officially listed as threatened or endangered, but which is undergoing status review by the FWS.

Capital cost: The total investment needed to complete a project and bring it to a commercially operable status. The cost of construction of a new plant. The expenditures for the purchase or acquisition of existing facilities.

Carbon dioxide: An atmospheric gas composed of one carbon and two oxygen atoms. Carbon dioxide results from the combustion of organic matter if sufficient amounts of oxygen are present. Liquid carbon dioxide is a good solvent for many organic compounds (for example, it is used to remove caffeine from coffee).

Centrifuge: An apparatus consisting essentially of a compartment spun about a central axis to separate contained materials of different specific gravities, or to separate colloidal particles suspended in a liquid. In the case of this project, the centrifuge would remove water from the slurry.

Chapter (Navajo): Navajo unit of local government; nearly all Navajo land is assigned to chapters. There are 110 Chapters on the Navajo Reservation.

Clean Air Act of 1990: Federal legislation governing air pollution. The Clean Air Act established NAAQS for carbon monoxide, nitrogen oxide, ozone, particulate matter, sulfur dioxide, and lead. Prevention of Significant Deterioration classifications define the allowable increased levels of air quality deterioration above legally established levels and include the following:

> **Class I** – minimal additional deterioration in air quality (certain national parks and wilderness areas)
>
> **Class II** – moderate additional deterioration in air quality (most lands)
>
> **Class III** – greater deterioration for planned maximum growth (industrial areas)

Clean Water Act of 1987: National environmental law enforced by the USEPA that regulates water pollution.

Cliff dwelling: A rock and adobe dwelling built on sheltered ledges in the sides of a cliff; cliff dwellings are ruins that represent the abandoned homes of ancient cultures.

Coal: A fossil fuel extracted from the ground by deep mining. It is a readily combustible black or brownish-black sedimentary rock composed primarily of carbon and hydrocarbons along with other elements including sulfur. Coal is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. It is primarily used as a solid fuel to produce heat through combustion and is the most common source of electricity generation worldwide.

Coal resource area: An area of high potential for unmined coal.

Coal washing: The process of separating undesirable materials from coal based on differences in densities. For example, pyritic sulfur, or sulfur combined with iron, is heavier and sinks in water; coal is lighter and floats.

Collection area: Geographic location or specific area in which native plants that have cultural significance to the Hopi and Navajo people are collected for use as food and medicine, in rituals, and other uses such as for tools, construction, and baskets.

Commercial area: A land use zoning term used to describe or designate areas in which business facilities, rather than residential uses, are concentrated.

Compaction: Process by which the volume or thickness of rock is reduced due to pressure from overlying layers of sediment.

Conduit: A pipe, usually made of metal, ceramic, or plastic, that protects buried cables or wires.

Consent decree: A legal document, approved by a judge, that formalizes an agreement reached between USEPA and potentially responsible parties through which potentially responsible parties will conduct all or part of a cleanup action at a Superfund site; cease or correct actions or processes that are polluting the environment; or otherwise comply with USEPA initiated regulatory enforcement actions to resolve the contamination at the Superfund site involved. The consent decree describes the actions potentially responsible parties will take and may be subject to a public comment period.

Construction, operation, and maintenance plan (COMP): A detailed plan depicting engineering, access, construction, environmentally sensitive areas, and reclamation that is prepared prior to construction and operation.

Contrast rating: A method of determining the extent of visual impact for an existing or proposed activity that would modify any landscape feature (land and water form, vegetation, and structures).

Conveyor: An apparatus for moving material from one point to another in a continuous fashion. This is accomplished with an endless (that is, looped) procession of hooks, buckets, or wide rubber belt, etc. In the case of this project, a conveyor moves coal from the Kayenta mining operation to the area where the coal is loaded onto the Black Mesa and Lake Powell Railroad, which transports the coal to the Navajo Generating Station.

Cooperating agency: Assists the lead Federal agency in developing an environmental assessment or environmental impact statement. The Council on Environmental Quality regulations implementing NEPA define a cooperating agency as any agency that has jurisdiction by law or special expertise for proposals covered by NEPA (40 CFR 1501.6). Any Federal, state, or local government jurisdiction with such qualification may become a cooperating agency by agreement with the lead agency.

Corridor: As discussed in this document, a wide strip of land within which a proposed linear facility (e.g., pipeline, transmission line) could be located.

Cost/benefit ratio: The number that results from a quantitative evaluation of the costs which would have incurred by implementing an environmental regulation versus the overall benefits to society of the proposed action.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effort on environmental studies, and advises the President on environmental matters.

Criteria: Standards on which a judgment or decision can be based.

Cubic foot/feet per second (cfs): As a rate of stream flow, a cubic foot of water passing a reference section in one second of time. One cfs flowing for 24 hours will yield 7.983 acre-feet of water.

Cultural resources: Remains of human activity, occupation, or endeavor as reflected in districts, sites, buildings, objects, artifacts, ruins, works of art, architecture, and natural features important in human events.

Cumulative effect (or impact): The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions. Cumulative impacts are evaluated as part of the environmental impact statement (EIS), and may include consideration of additive or interactive effects regardless of what agency or person undertakes the other actions.

Decibel: A unit for expressing the relative intensity of sounds on a logarithmic scale from zero for the average least perceptible sound to about 130 for the average level at which sound causes pain to humans. For traffic and industrial noise measurements, the A-weighted decibel, a frequency-weighted noise unit, is widely used. The A-weighted decibel scale corresponds approximately to the frequency response of the human ear and thus correlates well with loudness.

Degradation: The wearing down or away, and general lowering or reducing, of the earth's surface by the processes of weathering and erosion.

Diné Bikeyah: The traditional land of the Navajo covers parts of northeastern Arizona, northwestern New Mexico, southeastern Utah, and southwestern Colorado between four sacred mountains (Mount Hesperus, Blanca Peak, Mount Taylor, and the San Francisco Peaks).

Discharge: Outflow of surface water in a stream or canal (water). Discharge from an industrial facility that may contain pollutants harmful to fish or animals if it is released into nearby water bodies usually requires a permit issued by the USEPA and is monitored.

Distance zone: A visibility threshold distance where visual perception changes. They usually are defined as foreground, middleground, and background.

Diversion: A channel, embankment, or other manmade structure constructed to divert water from one area to another; the process of using these structures to move water.

Drainage: The natural or artificial removal of surface water and groundwater from a given area. Many agricultural soils need drainage to improve production or to manage water supplies.

Drawdown: The decrease in elevation of the water surface in a well, the local water table or the pressure head on an artesian well due to extraction of groundwater or decrease in recharge to the aquifer.

Easement: A right afforded a person, agency, or organization to make limited use of another's real property for access or other purposes.

Ecology: The relationship between living organisms and their environment.

Ecosystem: A complex system composed of a community of plants and animals, and that system's chemical and physical environment.

Effect (or impact): A modification of the existing environment as it presently exists, caused by an action (such as construction or operation of facilities). An effect may be direct, indirect, or cumulative. The terms effect and impact are synonymous under the NEPA. A direct effect is caused by an action and occurs at the same time and same place (40 CFR 1508.8(a)). An indirect effect is caused by the action later in time or farther removed in distance, but still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Emission: Effluent discharged into the atmosphere, usually specified by mass per unit time, and considered when analyzing air quality.

Endangered species: A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are rarely identified by the Secretary of the Interior in accordance with the Endangered Species Act (ESA) of 1973.

Endangered Species Act of 1973: Provides a means whereby the ecosystems upon which threatened and endangered species depend may be conserved and to provide a program for the conservation of such threatened and endangered species. The ESA requires all Federal agencies to seek to conserve threatened and endangered species, use applicable authorities in furtherance of the purposes of the ESA, and avoid jeopardizing the continued existence of any species that is listed or proposed for listing as threatened and endangered or destroying or adversely modifying its designated or proposed critical habitat. The FWS is responsible for administration of this act.

Energy conservation: A means of saving energy.

Environment: The surrounding conditions, influences, or forces that affect or modify an organism or an ecological community and ultimately determine its form and survival.

Environmental impact statement (EIS): A document prepared to analyze the impacts on the environment of a proposed action and released to the public for review and comment. An EIS must meet the requirements of NEPA, CEQ, and the directives of the agency responsible for the proposed action.

Environmental justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, state, local, and tribal programs and policies (see Executive Order 12898).

Ephemeral range: A rangeland that does not consistently produce enough forage to sustain a livestock operation but may briefly produce unusual volumes of forage that may be utilized by livestock.

Ephemeral stream: A stream that flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice and has a channel bottom that is always above the local water table.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as “gravitation creep.”

Extirpation: To destroy completely.

Extraction: The act of extracting or drawing a substance out of the earth (e.g., mining).

Federal Register: Published by the Office of the Federal Register, National Archives and Records Administration, the Federal Register is the official daily publication for rules, proposed rules, and notices of Federal agencies and organizations, as well as executive orders and other presidential documents.

Floodplain: That portion of a river or stream valley, adjacent to a river channel, that is built of sediments and is inundated with water when the stream overflows its banks.

Foreground: The visible area from a viewpoint or use area out to a distance of 0.5 mile. The ability to perceive detail in a landscape is greatest in this zone.

Fossil: Any remains, trace, or imprint of a plant or animal that has been preserved by natural process in the earth’s crust since some past geologic time.

Game management unit: A land management classification used by the Arizona Game and Fish Department to assist in managing hunting, such as hunting seasons allowed and number of permits to be issued for specific species, within the State of Arizona.

Geochemistry: The study of the chemical components of the earth’s crust and mantle. Geochemistry is applied to mining exploration to detect sites that indicate abnormal concentrations of either the elements being sought or of their more readily detected associate elements. Depending on circumstance, geochemical exploration samples soils, rock, and lake and stream sediments.

Geographic information system: A system of computer hardware, software, data, people and applications that capture, store, edit, analyze, and graphically display a potentially wide array of geospatial information.

Geologic formation: A rock unit distinguished from adjacent deposits by some common character, such as its composition, origin, or the type of fossil associated with the unit.

Geology: The science that relates to the earth, the rocks of which it is composed, and the changes that the earth has undergone or is undergoing.

Geothermal resource: Heat found in rocks and fluids at various depths that can be extracted by drilling or pumping for use as an energy source. This heat may be residual heat, friction heat, or a result of radioactive decay.

Global warming: An increase in the average temperature of the earth's atmosphere and oceans. The term also is used to describe the theory that increasing temperatures are the result of a strengthening greenhouse effect caused primarily by manmade increases in carbon dioxide and other greenhouse gases.

Gray water: Any nonsewage water that is nonpotable because it has been used in some way; for example, water from sinks, bathtubs, showers, or laundry operations. It may be recycled for toilet and outside water uses including irrigation.

Greenhouse gas: A component of the atmosphere that contributes to the greenhouse effect, or the process by which an atmosphere warms a planet. The major natural greenhouse gases are water vapor, carbon dioxide, and ozone. Minor greenhouse gases include methane, nitrous oxide, sulfur hexafluoride, and chlorofluorocarbons.

Groundwater: Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

Grubbing: To dig up and remove all plants (roots and stems or trunk) in order to clear the land.

Gysum: A soft white mineral, the most common sulfate mineral.

Habitat: A specific set of physical conditions in a geographic area(s) that surrounds a single species, group of species, or large community. In wildlife management, the major components of habitat are food, water, cover, and living space.

Halite: A white and colorless mineral, sodium chloride or rock salt.

Historic property: Any prehistoric or historical district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. The term includes artifacts, records, and remains that are related to and located within such properties; the term also includes properties of traditional religious and cultural importance to an American Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

Hydrology: The study of the movement, distribution, and quality of water throughout the earth, addresses both the hydrologic cycle and water resources.

Impact (or effect): A modification of the existing environment as it presently exists, caused by an action (such as construction or operation of facilities). An impact may be direct, indirect, or cumulative. The terms effect and impact are synonymous under NEPA.

Impoundment: A closed basin, naturally formed or artificially built, which is dammed or excavated for the retention of water, sediment, or waste.

Indian Lands Program: The program's emphasis is addressing environmental impacts on Indian lands that are not currently addressed by other programs. The Office of Surface Mining Reclamation and Enforcement (OSM) is the regulatory authority for coal-mining operations that occur on Indian lands in the western United States. As such, OSM is responsible for the review and decisions on all applications to conduct mining operations and, if a mining permit is issued, OSM is responsible for inspection of the mines to ensure that the public and the environment are protected. Ultimately, OSM is responsible for ensuring that mining operations are fully reclaimed before the lands are returned to the tribes.

Indirect effect (or impact): Secondary effects that occur in locations other than the initial action or later in time, but that are caused by the proposed action.

Indurated rock: Hardened or cemented sedimentary rock.

Industrial area: A land use zoning term used to describe or designate areas in which heavy industry is concentrated or allowed.

Infrastructure: The facilities, services, and equipment needed for a community or facility to function, such as and including roads, sewers, water lines, and electric lines.

Initial Program: A transitional program designed by Congress to implement the requirements of the Surface Mining Control and Reclamation Act of 1977, established as a nationwide program to protect society and the environment from the adverse effects of surface coal-mining operations and to assist the states in developing and implementing a program to achieve the purposes of the Act. The Initial Program took effect six months after the enactment of the Act and created a dual inspection and enforcement role for OSM and the states in ensuring compliance with certain key provisions of the Act at all surface-coal-mining and reclamation operations. The Initial Program was to be replaced by a permanent state regulatory program as approved by the Secretary of the Interior based on findings that the program provisions met the purposes of the Act and the state had the capability of carrying them out; or, where a state did not submit an application for a state program, upon promulgation and implementation of a Federal program.

Intermittent: A river or stream that flows for a period of time, usually seasonally during rainy periods, and stops during dry periods. In arid regions, dry periods may be interrupted by occasional flash floods from brief but intense rain storms.

Invasive species: Describes a large number of nonnative plant species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Issue: Describes the relationship between actions (proposed, connected, cumulative, similar) and environmental (natural, cultural, and socioeconomic) resources. Issues may be questions, concerns, problems, or other relationships, including beneficial ones. Issues do not predict the degree or intensity of harm the action might cause, but simply alert the reader as to what the environmental problems might be. The NEPA document should address issues identified through interaction with agencies and/or the public, and/or through resource studies.

Labor force: All persons 16 years of age or over who are either employed or unemployed and actively looking for a job.

Land use plan: A plan or document developed by a government entity, which outlines specific functions, uses, or management-related activities of an area, and may be identified in combination when joint or seasonal uses occur and may include land used for support facilities that are an integral part of the use.

Landform: A term used to describe the many land surfaces that exist as a result of geologic activity and weathering (e.g., plateaus, mountains, plains, and valleys).

Landscape: An area composed of interacting ecosystems that are repeated because of geology, landform, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern, which are determined by interacting ecosystems.

Landscape character: Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Lawsuit: A civil action brought before a court in which the party commencing the action, the plaintiff, seeks a legal remedy. If the plaintiff is successful, judgment will be given in the plaintiff’s favor, and a range of court orders may be issued to enforce a right, impose a penalty, award damages, impose an injunction to prevent an act or compel an act, or to obtain a declaratory judgment to prevent future legal disputes.

Lease: An authorization or contract by which one party (lessor) conveys the use of property to another (lessee) in return for rental payments. In cases of resource production, lessees pay royalties to the lessor in addition to rental payments.

Life of mine: The estimated time period within which a mine is expected to operate, which also is the duration for which a permit is issued. The adjective “life-of-mine (LOM)” is used with “plan” or “permit.” Relevant Federal or state agencies have the authority to approve a modification of a LOM permit or a transfer of a LOM permit from one company to another.

Lifestyle: A way of living based on identifiable patterns of behavior based on an individual’s choice, and influenced by the individual’s personal characteristics, their social interactions, socioeconomic and environmental factors, and cultural, ethnic, or religious background.

Locomotive: A railway vehicle that provides the motive power for a train and has no payload capacity of its own; its sole purpose is to move the train along the tracks.

Management indicator species: Designated by the U.S. Forest Service, these species are selected because their population changes are believed to indicate the effects of management activities.

Megawatt: A unit for measuring power equal to one million watts. The productive capacity of electrical generators is measured in megawatts.

Mesa: An isolated, nearly level land mass, formed on nearly horizontal rocks, standing above the surrounding country and bounded with steep sides.

Methane: A colorless, nonpoisonous, flammable gas created by anaerobic decomposition of organic compounds. A major component of natural gas used in the home.

Methanol: An alcohol that can be used as an alternative fuel or as a gasoline additive. It is less volatile than gasoline; when blended with gasoline it lowers the carbon monoxide emissions but increases hydrocarbon emissions. Used as pure fuel, its emissions are less ozone-forming than those from gasoline. Poisonous to humans and animals if ingested.

Mineral resources: Any inorganic or organic substance occurring naturally in the earth that has a consistent and distinctive set of physical properties. Examples of mineral resources include coal, nickel, gold, silver, and copper.

Mitigation: The abatement or reduction of an impact on the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, (5) replacing or providing substitute resources to the environment, or (6) gathering data (e.g., archaeological or paleontological) prior to disturbance.

National Ambient Air Quality Standards: The allowable concentrations of air pollutants in the air specified by the Federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare) from any unknown or expected adverse effects of air pollutants.

National Environmental Policy Act of 1969: Our nation's basic charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. In accordance with NEPA, all Federal agencies must prepare a written statement on the environmental impacts of a proposed action. The provisions to ensure that Federal agencies act according to the letter and spirit of NEPA are in the CEQ regulations for implementing NEPA (43 CFR 1500-1508).

National Register of Historic Places. A listing, maintained by the Secretary of the Interior, of districts, sites, buildings, structures, and objects worthy of preservation. To be eligible a property must normally be at least 50 years old, unless it has exceptional significance, and have national, State, or local significance in American history, architecture, archaeology, engineering, or culture; and possess integrity of location, design, setting, material, workmanship, feeling, and association; and (a) be associated with events that have made a significant contribution to the broad patterns of history, (b) be associated with the lives of persons significant in our past, or (c) embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction; or (d) have yielded, or may be likely to yield, information important to prehistory or history.

Noise: Loud, unpleasant, unexpected, or undesired sound that disrupts or interferes with normal human activities.

Noxious weed: Nonnative plant species that negatively impact crops, native plant communities, and/or management of natural or agricultural systems. Noxious weeds are officially designated by a number of states (including Arizona and Nevada) and Federal agencies.

Operating cost: The expense of maintaining property or a facility (e.g., paying property taxes, wages, utilities, supplies, and insurance); it does not include depreciation or the cost of financing or income taxes.

Perennial stream: A stream or that part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff.

Pipeline: A continuous pipe conduit for transporting fluids such as natural gas and/or supplemental gaseous fuels, oil, or water from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of use. Pipelines require associated equipment as valves, compressor stations or booster pumps, communications systems, and meters.

Plateau: In geology and earth science, a plateau is an area of high land, usually consisting of relatively flat open country if the uplift was recent in geologic history. Plateaus, like mesas and buttes, are formed when land has been uplifted by tectonic activity and then eroded by wind or water.

Prime farmland: A special category of highly productive cropland that is recognized and described by the U.S. Department of Agriculture's Soil Conservation Service and receives special protection under the Surface Mining Law of 1977.

Public land: Land or interest in land owned by the United States and administered through the Secretary of the Interior through the BLM without regard to how the United States acquired ownership, except lands on the Outer Continental Shelf, and land held in trust for the benefit of American Indians, Aleuts, and Eskimos.

Pump station: Mechanical device installed in sewer or water system or other liquid-carrying pipelines to move the liquids to a higher level so gravity can assist with moving the liquid across long distances.

Range: A large, open area of land over which livestock can wander and graze.

Raptor: A bird of prey.

Rare: A plant or animal restricted in distribution. May be locally abundant in a limited area or few in number over a wide area.

Recharge: Replenishment of a groundwater reservoir (aquifer) by the addition of water, through either natural or artificial means.

Reclaimed water: Treated, recycled wastewater not safe for consumption. Also known as nonpotable water. Reclaimed water is often used for irrigation and other nonconsumptive purposes.

Reclamation: Restoration of land disturbed by natural or human activity (e.g., mining, pipeline construction) to original contour, use, or condition. Also describes the return of land to alternative uses that may, under certain circumstances, be different from those prior to disturbance.

Recontouring: Return a surface to or near to its original form through some type of action such as grading.

Record of Decision: A document separate from, but associated with, an EIS that publicly and officially discloses the responsible official's decision on a proposed action.

Recreation Opportunity Spectrum: The Recreation Opportunity Spectrum (ROS) provides a framework that allows forest managers to plan for and provide a variety of recreational environments. It allows managers to describe and provide a range of recreational opportunities from highly developed areas (Urban, Rural, Roaded Natural, Roaded Modified) to areas with little or no development (Semi-Primitive

Motorized and Nonmotorized, Primitive). Attributes typically considered in describing the setting are size, scenic quality, type and degree of access, remoteness, level of development, social encounters, and the amount of onsite management. By providing and maintaining this spectrum of recreational settings and opportunities, a broad segment of the public can find quality recreational opportunities for a variety of recreational activities and experiences, now and in the future. Change in a national forest's mix of ROS classes affect the recreational opportunities offered (USDA, USFS 1986).

Refuse: Nonliquid, nonsoluble materials ranging from municipal garbage to industrial wastes that contain complex and sometimes hazardous substances. Refuse also includes sewage sludge, agricultural refuse, demolition wastes, and mining residues. Also referred to as solid waste. In the case of this project, refuse refers to the waste that would remain after coal washing.

Reservation: Land set aside to achieve a particular land use or conservation objective. For the purposes of this document, reservation refers to those lands managed by an American Indian tribe under the U.S. Department of the Interior‘s Bureau of Indian Affairs. The reservation land is Federal territory held in trust for tribes. The American Indian tribes have limited national sovereignty.

Retention pond: Wastewater pond, or retention area, in which floating wastes are skimmed off and settled solids are removed for disposal before the water leaves the permit area. Also called a sediment pond.

Revegetation: The re-establishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as reseeding.

Right-of-way: Land authorized to be used or occupied for the construction, operation, maintenance, and termination of a project, such as a road or utility.

Riparian: Referring or relating to areas adjacent to water or influenced by free water associated with streams or rivers on geologic surfaces occupying the lowest position of a watershed. Pertaining to, living or situated on banks of rivers, streams, or other body or water. Normally used to refer to the plants of all types that grow along, around, or in wet areas.

Rolling stock: Rail-borne railroad equipment such as locomotives, freight cars, passenger cars, and maintenance-of-way work cars that can be assembled into a train.

Royalty: A percentage of value of the resource production of a facility or project paid in the instance of a leasing situation, from a lessee to a lessor. Terms of royalties are determined in and outlined within the lease.

Rural: Sparsely settled places away from the influence of large cities and towns. Such areas are distinct from more intensively settled urban and suburban areas, and also from unsettled lands such as outback or wilderness. People tend to live in villages, on farms, and in other isolated houses on large plots of land.

Salinity: A measure of the amount of dissolved salts given a volume of water.

Scoping: The process open to the public early in the preparation of an EIS for determining the scope of issues related to a proposed action and identifying significant issues to be addressed in an EIS.

Screen: An initial assessment performed with few data and many assumptions to identify alternatives that should be evaluated more carefully.

Scrubber: Any of several forms of chemical/physical devices that remove sulfur compounds formed during coal combustion. These devices, technically know as flue gas desulfurization systems, combine the sulfur in gaseous emissions with another chemical medium to form inert "sludge," which must then be removed for disposal. Scrubbers are used as air pollution control devices to trap pollutants in emissions.

Sediment: Solid fragmental material, either mineral or organic, that is transported or deposited by air, water, gravity, or ice.

Sediment pond: Wastewater pond, or retention area, in which floating wastes are skimmed off and settled solids are removed for disposal before the water leaves the permit area.

Sedimentation: The result when soil or mineral is transported by moving water, wind, gravity, or glaciers and deposited in streams or other bodies of water, or on land. Also, letting solids settle out of wastewater by gravity during treatment.

Seismicity: The geographic and historical distribution of earthquakes.

Sensitive receptor: In terms of noise, people or animals that may hear a noise or be sensitive to increased noise levels within their range of hearing.

Sensitivity: The state of being readily affected by the actions of external influence.

Significant (impact): "Significant" has been used in this document to describe any impact that would cause a substantial adverse change or stress to one or more environmental resources.

Sinkhole: A depression in the earth's surface caused by dissolving of underlying limestone, salt, or gypsum. Sinkholes also form from human activity, such as the collapse of abandoned mines, due to water main breaks in urban areas, or from the overpumping and extraction of groundwater and subsurface fluids.

Slurry: In the case of this project, the slurry is a mixture of 50 percent water and 50 percent finely ground coal. The coal from the Black Mesa Mine is transported in this slurry mixture via pipeline to the Mohave Generating Station.

Special status species: Wildlife and plant species either federally listed or proposed for listing as endangered or threatened; state-listed; or priority species of concern to Federal agencies or tribes.

Spoil: The dirt or rock removed from its original location through excavation as in strip-mining, trenching, dredging, or construction.

Spur: A road, pipeline, or rail line that diverges from its primary path or route (i.e., a larger arterial or pipeline) to serve a specific area or connect to another road, pipeline, or rail line.

Storage coefficient: The volume of water the aquifer releases from or takes into storage per unit of surface area of the aquifer per unit decline or rise of head.

Subsidence: The lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction).

Substation: A facility with a collection of equipment for the purpose of raising, lowering, and regulating the voltage of electricity.

Suburban area: Inhabited districts located either on the outer rim or outside the official limits of a city. Although suburbs may be located within city limits, the density of habitation is usually lower than in an inner city area and there is generally a transportation system(s) that allows commuting into more densely populated areas with higher levels of commerce.

Surface Mining Control and Reclamation Act: Requires mine operators to minimize disturbances and adverse effects on fish, wildlife, and related environmental values, and to restore land and water resources.

Surface water: All bodies of water on the surface of the earth and open to the atmosphere such as rivers, lakes, reservoirs, ponds, seas, and estuaries.

Terrain: Used to describe the geophysiographic characteristics of land in terms of elevation, slope, and orientation.

Thoroughfare: A public road from one place to another.

Threatened or Endangered Species: Animal or plant species that are listed under the Federal Endangered Species Act of 1973, as amended (federally listed), or under similar state laws (state-listed).

Total dissolved solids: A term that describes the quantity of dissolved material in a sample of water.

Total maximum daily load: An estimate of the total quantity of pollutants (from all sources: point, nonpoint, and natural) that may be allowed into waters without exceeding applicable water-quality criteria.

Traditional cultural lifeway/resources: Resources that are significant for retention and transmission of traditional cultures. Biological resources that could have traditional cultural significance include plants collected for food, medicine, ceremonies, and other traditional uses, as well as raptors (e.g., eagles and hawks) collected for ceremonial uses. Other natural resources that could have traditional cultural significance include minerals or clay deposits and sources of surface water or shallow groundwater pumped for traditional purposes.

Traditional cultural properties/landscape features: These named places (landscape features) comprise the cultural landscape that provides the context for evaluating specific traditional cultural properties.

Trans-basin: Trans-basinal diversion of water is the change in location of a water use, by conveyance of that water, between water bodies not normally in hydrologic communication. This can be either an underground or aboveground water body. Because water is generally adjudicated by the courts, this use can only occur if judicial or administrative (Arizona Department of Water Resources) approval has been obtained.

Transition zone: The area between two discrete environmental areas, and thus containing elements of each. For example, the transition zone between an upland piñon forest and a lowland desert scrub environment.

Transmissivity: The rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient.

Tribal Council: A group of officials elected by tribal members to govern tribal affairs in accordance with a tribal constitution adopted pursuant to the Indian Reorganization Act of 1934.

Tribe: Any Indian tribe, band, group, or community having a governing body recognized by the Secretary of Interior.

Tutsqwa: The Hopi heartland, encompasses much of northeastern Arizona.

Undertaking: A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license, or approval; and those subject to State or local regulation administered pursuant to a delegation or approval of a Federal agency.

Unit train: A long train of between 60 and 150 or more hopper cars, carrying only coal between a single mine and destination.

Urban: An area where there is an increased density of human-created structures in comparison to the areas surrounding it. Urban areas are frequently referred to as cities or towns. The U.S. Census Bureau defines an urbanized area as: "Core census block groups or blocks that have a population density of at least 1,000 people per square mile and (386 per square kilometer) and surrounding census blocks that have an overall density of at least 500 people per square mile (193 per square kilometer)."

Vegetation communities: Species of plants that commonly live together in the same region or ecotone.

Viewer sensitivity: A measure of the degree of concern about change in the visual character of a landscape. It is determined by assessing the types of viewers, land uses on lands facing a project, numbers of viewers, duration of time spent looking at a view, and influence of adjacent land use on the view.

Village (Hopi): The Hopi unit of local government, but much Hopi land is not assigned to a village and is administered at the tribal level.

Visibility: The distance to which an observer can distinguish objects from their background. The determinants of visibility include the characteristics of the target object (shape, size, color, pattern), the angle and intensity of sunlight, the observer's eyesight, and any screening present between the viewer and the object (i.e., vegetation, landform, even pollution such as regional haze).

Visual resource management classes: Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. There are four classes, each of which has an objective that prescribes the amount of change allowed in the characteristic landscape.

Volt: The potential difference across a conductor when a current of one ampere dissipates one watt of power. Electrical potential difference can be thought of as the ability to move electrical charge through a resistance. In essence, the volt measures how much kinetic energy each electron carries. Between two points in an electric field, such as exists in an electrical circuit, the potential difference is equal to the difference in their electrical potentials. This difference is proportional to the electrostatic force that tends to push electrons or other charge-carriers from one point to the other. Potential difference, electrical potential, and electromotive force are measured in volts, leading to the commonly used term "voltage."

Waters of the United States: All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce including adjacent wetlands and tributaries to water of the United States; and all waters by which the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce.

Watershed: All land and water within the confines of a drainage divide.

Well field: Area containing one or more wells that produce usable amounts of water or oil.

Wetlands: Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Examples of wetlands include marshes, shallow swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, and riparian areas.

Wilderness, Wilderness Area: An area formally designated by Congress as part of the National Wilderness Preservation System.

Xeroriparian: Riparian refers or relates to areas adjacent to water or influenced by free water associated with streams or rivers on geologic surfaces occupying the lowest position of a watershed. Pertaining to, living, or situated on, the banks of rivers and streams. "Xeroriparian" refers to being situated on dry washes (ephemeral streams).

INDEX

INDEX