Chapter 4 – Environmental Consequences

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter provides a description of the effects on the environment that could occur under each alternative described in Chapter 2. The information about the existing condition of the environment provided in Chapter 3 was used as a baseline from which to measure and identify potential impacts from the project. The chapter begins with a summary of the terms and methods used for the impact assessment and general mitigation. Subsequent sections for each resource describe the impacts that could result from each alternative.

An impact, or effect, is defined as a modification to an 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 substantially would remain beyond short-term ground-disturbing activities.

For the surface coal mining operations, the local short-term impacts are those that would occur during the period from premining development through final relinquishment of the leased areas back to the Navajo Nation. Long-term impacts are those that would persist beyond or occur after land relinquishment.

For the power plant transmission line access roads 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 5 years). Long-term impacts are those that would persist beyond or occur after the 5-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). Chapter 4 evaluates the direct and indirect effects of the proposed action and alternatives. Chapter 5 provides a discussion of the anticipated cumulative impacts.

A number of factors were considered in identifying an impact on a resource and its magnitude, including:

- *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 of impacts than others. For example, impacts on vegetation can be partly characterized using acreage, and air quality can be measured against air quality standards. Evaluations of some resources are inherently difficult to quantify with accuracy. 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 on the natural or human environment. Generally, these terms are defined as follows:

- ***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.

In the methodology discussion for each resource, additional considerations for assessing the magnitude of an impact may be provided.

Mitigation

Once potential impacts have been identified, measures to lessen, or mitigate, the impacts are identified and may be required by a regulatory or land-managing agency. If the proposed project is approved by the relevant regulatory agencies, the mitigation measures would be implemented as part of the project. Commitment to mitigation occurs through permits and regulations that are enforced by the appropriate regulatory agencies, such as the Navajo Nation Environmental Protection Agency (NNEPA) or the Office of Surface Mining, Reclamation, and Enforcement (OSM). Enforceable mitigation commitments are made through these permitting processes.

Mitigation can be general and applied broadly to the project, or mitigation can be site-specific. The impacts disclosed in Chapter 4 are the impacts remaining after mitigation has been incorporated, and mitigation measures are summarized within each resource section. As the more detailed design and engineering are completed prior to construction, Desert Rock Energy Company LLC and/or BHP Navajo Coal Company (BNCC), in coordination with appropriate regulatory agencies, may identify and commit to additional measures to implement.

At the Navajo Mine, site reclamation is a critical and required part of the mining process and must comply with the Surface Mining Control and Reclamation Act (SMCRA). The mining operations and reclamation plans established for the Navajo Mine prevent and/or mitigate impacts from mining for all of the affected resources. The SMCRA bonding program, administered by OSM, mitigates any long-term, post-mining damage by ensuring performance of the reclamation plan past the period of active mining, through continuous monitoring, inspection, and financial incentive.

To minimize impacts, construction, operation, and maintenance activities would employ general methods that have become standard industry practices, such as the following:

- Prior to construction, all supervisory construction personnel would be instructed on the protection of cultural, paleontological, and ecological resources. To assist in this effort, the construction contract would address Federal and tribal laws regarding antiquities, fossils, plants and wildlife, including collection and removal; and the importance of these resources and the purpose and necessity of protecting them.
- Construction-vehicle movement outside of the rights-of-way and at the plant site would be restricted to designated access or public roads.
- The areal limits of construction activities would be predetermined and activity would be restricted within those limits.
- No paint or permanent discoloring agents would be applied to rocks or vegetation to indicate limits of survey or construction activity.
- In construction areas that would be reclaimed, topsoil would be removed and segregated if technically feasible for use later to facilitate reclamation.
- In construction areas where recontouring is not required, vegetation would be left in place wherever possible and the original contour would be maintained to prevent excessive root damage and allow for resprouting.
- In construction areas where ground disturbance is substantial or where recontouring is required, surface restoration would occur as required by the Navajo Nation or OSM. The method of restoration normally would consist of returning disturbed areas back to their natural contour; reseeding, if required; installing cross drains for erosion control; placing water bars in roads; and filling ditches.
- Roads would be built at right angles to streams and washes to the extent practicable. Culverts would be installed where needed. All construction and maintenance activities would be conducted in a manner that would minimize disturbance to vegetation, drainage channels, and intermittent or perennial streambanks. In addition, road construction would include dust-control measures during construction in sensitive areas. All existing roads would be left in a condition equal to or better than their condition prior to construction of the project.
- Introduction and/or spread of noxious weeds and invasive species would be controlled, in coordination with the Navajo Nation or OSM, using manual removal, herbicide application, or biological control treatment methods.
- If damaged or destroyed by construction activities, fences and gates would be repaired or replaced to their original condition prior to project disturbance as required by the Navajo Nation or OSM. Temporary gates would be installed only with the permission of the Navajo Nation or OSM.
- If damaged or destroyed by construction activities, watering facilities and other range improvements would be repaired or replaced to their conditions prior to disturbance as agreed to by the parties involved.
- On agricultural land, rights-of-way would be aligned, to the extent practicable, to reduce impact on agricultural operations and/or production.

- Nonbiological debris would be removed from construction areas and disposed of properly. Slash and other biodegradable debris would be left in place or disposed of in accordance with requirements of the Navajo Nation or OSM. Open burning of construction debris would not be allowed unless permitted by the appropriate Navajo Nation authorities.
- Transmission line towers would be marked with highly visible devices where required by government agencies (e.g., Federal Aviation Administration). Nonspecular conductors and ground wires would be used to reduce visual impacts.
- Any hazardous materials would be transported and stored in accordance with tribal regulations. Spill prevention and protection practices would be implemented during construction and operation of the proposed project. All construction waste would be removed to a disposal facility authorized to accept such materials.
- Desert Rock Energy Company LLC would develop a plant-specific environmental management program with procedures based on the Company's guidelines and in conformance with the ISO 14001:2004 standard, and implement appropriate training and record-keeping.
- BNCC would maintain current ISO 14001 certification for environmental management and similarly rigorous systems for health, safety, and community.

Additional or site-specific mitigation is provided in each resource section, where appropriate.

4.1 AIR RESOURCES

4.1.1 Impact Assessment Methodology

The proposed and alternative actions would involve a wide variety of temporary and permanent sources of regulated pollutants, requiring a multi-faceted approach to evaluation of impacts. A full discussion of the air pollutant sources, the criteria and hazardous air pollutant emission estimation techniques used, the calculated emission rates and (for the mine and power plant operations only) the predicted ambient air quality impacts, would require a lengthy discussion. Therefore, Appendix K of this environmental impact statement (EIS) contains an Air Quality Technical Support Document, which details the methodology and results for the air quality impacts evaluation pursuant to this EIS. Furthermore, the air quality permit applications and associated modeling reports for both the 1,500 megawatt (MW) and 550 MW alternatives, which were prepared pursuant to the Federal Prevention of Significant Deterioration (PSD) program, were used as resource information to prepare this EIS. The Federal PSD program requires analysis of the proposed emission source, including the power plant and mine operations only; an analysis of the impacts of project construction and mobile source emissions associated with each project is not required as part of the PSD program. It should be noted that each permit application was prepared for a different facility at different times by different consultants, and may have involved different permitting agency personnel. Consequently, the presentations of analysis methodologies, results, and conclusions presented in the application for each project are not necessarily consistent.

This analysis evaluates regulated air pollutant emissions from three broad categories of sources:

- Fugitive dust and criteria air pollutant emissions from vehicles and equipment during construction of the power plant, transmission lines, access roads and water supply system, for each alternative;
- Fugitive dust and criteria air pollutant emissions from vehicles and equipment due to operation of the BNCC mine, including coal handling to the power plant; and

- Criteria and hazardous air pollutant (HAP) emissions resulting from operation of the power plant including the in-plant handling of coal, combustion of coal to produce electrical power, other fuel-burning and petroleum storage sources, and vehicle emissions associated with employees commuting to the project site.

Criteria air pollutant emissions resulting from operation of the BNCC mine, the power plant and the associated coal handling systems (in all cases excluding vehicle/equipment tailpipe emissions) were obtained from the PSD applications and associated modeling reports for each alternative. These documents also contain the predicted ambient air quality impacts (for criteria pollutants only) in Class I and distant Class II areas (attributed to power plant operations only) and near-field (within the Navajo Nation) Class II areas (attributed to both the mine and plant operations), with respect to the National Ambient Air Quality Standards (NAAQS) and PSD increments, based on extensive dispersion modeling in accordance with U.S. Environmental Protection Agency (USEPA) requirements.

All other information contained herein, including fugitive dust emissions from construction activity, vehicle/equipment tailpipe emissions during construction and operation of the mine and power plant, and the ambient concentrations and deposition rates for HAPs, sulfates, and nitrates resulting from coal combustion, was developed by URS. A variety of published air pollutant emission factors for various sources and activities were used to estimate emission rates, as detailed in Appendix K.

For purposes of the air quality impact analysis, the following qualitative terms describe the potential impacts levels associated with the alternatives:

- *Major* – Ambient air quality would be permanently degraded, as a direct result of the action, to the extent that re-designation of the project area by the USEPA, with respect to one or more of the NAAQS pollutants, from “attainment” or “unclassified” to “non-attainment” is possible; an air quality degradation increment, applicable to attainment and unclassified areas under the Federal PSD program regulations, would be consistently exceeded; regional haze would be consistently worsened by 5 percent visibility extinction or more; or a cumulative regional emissions increase would cause one or more of the items above.
- *Moderate* – Discernible degradation of regional air quality that does not consistently exceed applicable NAAQS, PSD increments, or Federal/State visibility protection standards.
- *Minor* – Insignificant degradation of regional or local ambient air quality at levels less than 20 percent of applicable standards; temporary or transient emissions occurring within a defined time period.
- *Negligible* – Indiscernible or immeasurable degradation of regional or local ambient air quality or visibility.
- *None* – No air pollutant emissions occur.

4.1.2 Environmental Consequences

4.1.2.1 No Action (Alternative A)

Under this alternative, no construction activity would occur and no mine or power plant operations described for the other alternatives would occur. Therefore, no air pollutant emissions would occur and there would be no air quality impacts.

4.1.2.2 Proposed Action Alternative – 1,500 Megawatt Plant and Associated Facilities (Alternative B)

The following subsections present the estimated criteria and (as appropriate) HAP emissions associated with each component of the proposed project. The first three sections identify the air pollutant emissions that would be associated with (1) project construction, (2) operation of the proposed power plant, and (3) mining operations. This is followed by discussions on the predicted impacts of these emissions on ambient air quality and recommended mitigation measures.

4.1.2.2.1 Air Pollutant Emissions Due to Project Construction

Construction of the power plant, transmission lines, access roads and water supply system would involve earthmoving activity (clearing, grading, trenching, temporary storage piles, etc.), which would cause emissions of fugitive dust, including particulate matter (PM) and particulate matter nominally 10 meters or less (PM_{10}). In addition, fugitive dust would be raised by vehicles traveling over paved and unpaved surfaces. Finally, the tailpipe emissions from vehicles and equipment used during construction, which combust fossil fuels such as diesel and gasoline, would contain PM, PM_{10}, particulate matter of 2.5 microns or less ($PM_{2.5}$), nitrogen oxide (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO) and volatile organic compounds (VOC). The following paragraphs describe the basis for calculation of fugitive dust emissions for each project component, with the total project PM_{10} emissions summarized at the end of this subsection. Emission estimates associated with vehicle/equipment exhaust and dust created during construction on the entire project is presented in the aggregate (instead of separately for each component of the proposed project).

Fugitive Dust from Earthmoving Activity

Earthmoving activity associated with construction projects typically causes emissions of particulate matter in the form of fugitive dust. For this EIS, the estimation of a PM_{10} emission rate considers the actual level of activity at the site and the effect of controls. For major cut and fill operations in desert soils (such as a water well field and water pipeline), a generally accepted estimate of PM_{10} is 0.42 tons/acre/month (Countess Environmental 2006). For general construction activity in desert soils (plant site, transmission lines and access road), a generally accepted estimate of PM_{10} is 0.11 tons/acre/month of total PM (Countess Environmental 2006). These emission and control factors were used to estimate the PM_{10} emissions resulting from construction activity.

Predicted PM emissions associated with construction of the proposed project were calculated in accordance with the assumptions described above. For purposes of this impact analysis, it was assumed that disturbed ground surfaces would undergo watering every 3.2 hours during periods of active earthmoving activity. Although the schedule to complete construction and pre-commercial operation of the power plant is 48 months, it is assumed that all earthmoving activity associated with construction of the power plant site would end 14 months following commencement of activity. The duration of earthmoving activity during the construction of the water supply system (well field and water pipeline) is anticipated to be 6 months. The duration of earthmoving activity during construction of the transmission line is 9 months. The duration of earthmoving activity during construction of the access road is 6 months.

Power Plant Site. URS conservatively assumed that up to 120 acres of ground surface would undergo active earthmoving activity during the first three months of construction. The acres disturbed would then be reduced to 60 acres per month for months 4 through 6 and finally be reduced to 20 acres per month for the last eight months of the 14-month earthmoving schedule. Maximum controlled PM_{10} emissions from plant site construction are estimated to be 13.2 tons/month. Based on a 14-month earthmoving schedule, it is estimated that a maximum of 77.0 tons of PM_{10} would be emitted during plant site construction.

Water Well Field and Water Supply Pipeline. URS conservatively assumed that twenty production wells would be installed within the well fields for either alternative well field location. In addition, based on the anticipated geospatial arrangement of the wells, up to 4.75 miles of well field interconnection piping trenches with a width of 25 feet and 9.5 miles of two-track roadways with a width of 16 feet to access the work areas within the well field may be required. A total of 32.8 acres of work area was estimated for the well field associated with each sub-alternative. Maximum controlled PM_{10} emissions from the well field under either the proposed well field area B or alternative well field area A are estimated to be 13.8 tons/month. Based on a six-month construction schedule, it is estimated that a maximum of 82.7 tons of PM_{10} would be emitted during construction of the well field under either alternative. For the proposed well field B, no additional pipeline trenching or access roads would be required, due to the proximity of the wells and interconnection piping to the plant. Under alternative A, an additional 12.4 miles of water supply pipeline would be constructed along the utility corridor to bring the water to the plant site. The adjoining access road would require 4 months to build with not more than 5 miles of 25 foot wide right-of-way. Maximum controlled PM_{10} emissions from the 37.6 acre work area inclusive of the installation of the water supply pipeline and access road addition, within the utility corridor under alternative A are estimated to be 15.8 tons/month. Based on a four-month construction schedule, it is estimated that an additional 63.2 tons of PM_{10} would be emitted during installation of the water supply pipeline under well field area A.

Transmission Lines. The proposed transmission line includes segments A, C and D. Each segment would include 5 1-acre work areas per mile, to accommodate the construction of tower footings. In addition, it was assumed that a temporary 10-foot wide two-track road would be used along the full length of each segment, except for Segment D, which has pre-existing roads for access. Segment A is 8.3 miles long, with a total excavation work area of 51.6 acres. Maximum controlled PM_{10} emissions from construction of Segment A are estimated to be 5.7 tons/month. Segment C is 6 miles long, with a total excavation work area of 38.5 acres. Maximum controlled PM_{10} emissions from construction of Segment C are estimated to be 4.2 tons/month. Segment D is 10.8 miles long, with a total excavation work area of 57.0 acres. Maximum controlled PM_{10} emissions from construction of Segment D are estimated to be 6.3 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 145.6 tons of PM_{10} would be emitted during construction of Segments A, C and D. An alternate transmission line route would replace of Segment A with a longer Segment B. Segment B is 11.1 miles long, with a total work area of 68.9 acres. Maximum controlled PM_{10} emissions from construction of Segment B are estimated to be 7.6 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 162.8 tons of PM_{10} would be emitted during construction of Segments B, C and D (a net increase of 17.1 tons over the proposed transmission line).

Access Roads. The proposed access road would be approximately 2.25 miles long, with an average work area width of 75 feet, and a total project area of 20.28 acres. Maximum controlled PM_{10} emissions from construction of the road are estimated to be 2.2 tons/month. Based on a 6-month construction schedule, it is estimated that a maximum of 13.4 tons of PM_{10} would be emitted during construction of the plant access road.

Summary. Table 4-1 summarizes the estimated PM_{10} emissions due to earthmoving activity from each phase of the proposed project. For the proposed alternatives, the total maximum controlled PM_{10} emissions from construction of the plant site, well field, transmission lines and access road are estimated to be 61.2 tons/month.

Table 4-1 Alternative B – Particulate Matter (PM$_{10}$) Emissions Associated with Earthmoving During Construction of Proposed Project

Alternative\Segment	Length (mile)	Work Area (acre)[1]	Projected Earthmoving Time (months)	PM$_{10}$ EF (tons/acre/month) [2]	Controlled PM$_{10}$ Emission (tons/month) [3]	Total Project Emissions (tons)
Proposed Desert Rock Plant Site						
-	NA	120.0 [4]	14.0	0.11	13.2	77.0
Proposed Water Well Field						
Well Field Area B	NA	32.8 [5]	6.0	0.42	13.8	82.7
Proposed Transmission Lines						
Segment A	8.3	51.6 [6]	9.0	0.11	5.7	51.3
Segment C	6.2	38.5 [6]	9.0	0.11	4.2	37.8
Segment D	10.8	57.1 [6]	9.0	0.11	6.3	56.5
Subtotal	25.3	147.2	-	-	16.2	145.7
Access Road						
-	2.2	20.3 [7]	6.0	0.11	2.2	13.4
Total – Proposed Project		**320.3**	**-**	**-**	**61.2**	**381.9**
Alternatives						
Well Field Area A	NA	32.8 [5]	6.0	0.42	13.8	82.7
Water Supply Pipeline	12.4	37.6 [8]	4.0	0.42	15.8	63.2
Subtotal	-	70.4	-	-	29.6	145.8
Net Change (Water Supply System)					**15.8**	**63.2**
Segment B Transmission Line [9]	11.1	68.9 [6]	9.0	0.11	7.6	68.2
Net Change (Transmission Line)					**7.8**	**17.1**

[1] SOURCE: GIS data shown on Figure 2-1 Base map (URS 2007)

[2] From Western Regional Air Partnership (WRAP) *Fugitive Dust Handbook, Chapter 3, Construction and Demolition*, November 2004; (downloaded from www.wrapair.org/forums/)

[3] Controlled PM$_{10}$ Emission Rate = EF (tons/acre/month) x total acres

[4] Plant Site work area was assumed to be not more than 120 acres per month for the first 3 months, 60 acres per month for months 4-6, and 20 acres per month for the remaining 8 months of the 14-month projected earthmoving schedule.

[5] Assumes well spacing is ¼-mile apart requiring 4.75 miles of pipeline in series at a width of 25 feet (14.4 acres) and 9.5 miles of access roads with a width of 16 feet (18.4 acres).

[6] Work Area acreages were estimated by assuming five 1-acre excavations for every mile of transmission line for footing construction along with a 10-foot wide two-track road equal to the length of the transmission line. Segment D has pre-existing roads for access and does not require the additional excavation for the two-track road.

[7] Work Area acreage was taken from GIS data shown on Figure 2-2.

[8] Water Supply Pipeline would require the construction of 5 miles of adjoining access road with a right of way width of 25 feet and the 12.4 miles of pipeline for an estimated total of disturbed land to be 37.6 acres.

[9] Alternative Transmission Segment B would replace just Transmission Line Segment A.

Particulate and Gaseous Criteria Pollutant Emissions from Construction Vehicles and Equipment

During construction, gasoline and diesel-fueled vehicles and equipment would be operated, which generate gaseous and particulate tailpipe exhaust emissions. Emission factors for this equipment were obtained from published sources, as described in Appendix K. The duration of construction for each project element was assumed to be the same as described above for earthmoving activity, except 36 months (instead of 14 months) was assumed for power plant construction. Annual emissions for all diesel-fueled vehicles and equipment were calculated based on average engine horsepower for each type of vehicles and equipment, and an operating schedule of 10 hours per day, 6 days per week and 52 weeks per year. Annual emissions for gasoline-fueled pickup trucks and crew cabs were calculated based on a traveling distance of 10 miles per day during power plant construction, 25 miles per day during access road construction, and 50 miles per day during transmission line and water conveyance system construction, all with an operating schedule of 6 days per week and 52 weeks per year.

URS assumed that the peak construction employment would be 1,700 and that employees would use ride sharing to commute to and from the various jobsites. The ride sharing is assumed to reduce the number of gasoline-fueled commuting vehicles by 75 percent to 425. Annual emissions were calculated based on a round-trip traveling distance of 50 miles per day (round-trip) with an operating schedule of 6 days per week, 52 weeks per year, for the duration of the 48-month construction schedule.

The total maximum combustion emissions from construction of the plant site, well field, transmission lines, access road are estimated to be 91 tons per year (tpy) of VOC, 677 tpy of CO, 1,117 tpy of NO_x, 49 tpy of PM10, and 2 tpy of SO_2. Total project vehicle and equipment tailpipe emissions were estimated to be 199 tons of VOC, 1,725 tons of CO, 1,314 tons of NO_x, 56 tons of PM_{10}, and 4.4 tons of SO_2.

Fugitive Dust Caused by Project Site Vehicle and Employee Commuting Vehicle Travel Over Paved and Unpaved Roads

During construction, motor vehicles would be used on the project site and by employees to commute to the job sites. During such travel, fugitive PM_{10} emissions would be re-entrained from road surfaces. The same assumptions regarding number of employees and use of ride sharing described above were used to estimate fugitive dust emissions. Emission factors were developed, and PM_{10} emissions were calculated, as described in Appendix K. Emission factors for paved road travel were calculated based on an average vehicle weight of three tons and surface silt content of 8.5 percent. Emission factors for unpaved road travel were calculated based on a surface silt content of 18.4 percent, a mean vehicle speed of 45 miles per hour (mph), a surface moisture content of 6.5 percent, and 90 mean days with 0.01 inch or more of precipitation. The maximum annual PM_{10} emissions resulting from construction site vehicles and employee commuting were estimated to be 14,385 tons. Total project PM_{10} emissions over the 48 month construction schedule are estimated to be 56,634 tons.

Summary of Air Pollutant Emissions Due to Project Construction

Since construction-related emissions are generated by earthmoving activity operation of vehicles at ground level, it is unlikely that the PM_{10} would be transported more than a few kilometers, except on unusually windy days (see Mitigation section for dust control measures during periods of high wind). In addition, all construction-related emissions would be spatially distributed over a large area and spread out over construction schedules ranging from 6 to 36 months. Furthermore, the locations of active work areas would be transient, with work activities typically moving to a new location every few days. Finally, the construction-related emissions would be temporary, ceasing as each phase of the project is completed. Based on the foregoing, the ambient air quality impacts of project construction activity would be considered to be minor.

4.1.2.2.2 Air Pollutant Emissions Caused by Operation of Power Plant

Total Coal Combustion

Local and regional ambient air quality impacts associated with Alternatives B and C would result from the combustion of sub-bituminous coal mined from the adjacent BNCC mine. Information pertaining to maximum annual coal combustion at the proposed plant was derived from the PSD permit applications (RTP 2004a and ENSR 2006a).Table 4-2 summarizes the maximum possible annual coal combustion for the proposed power plant for both action alternatives. Using the lower coal heating value and assuming

8,760 hours of operation per year, the maximum annual coal consumption can be calculated to be approximately 7.2 million tons, which is the value presented in the PSD application (ENSR 2006a). However, a 100 percent capacity factor is virtually unattainable. Therefore, URS used an average coal heating value and assumed a 90 percent capacity factor, to estimate a more realistic average annual coal consumption value of approximately 6.2 million tons. The 6.2 million ton per year value is used as the basis for pertinent calculations throughout this air quality section.

Table 4-2 Estimate of Total Coal Usage

New Mexico Coal Specs	**Alternative B**	**Alternative C**
LHV (Btu/lb) [1]	8,479	
HHV (Btu/lb) [1]	8,910	
AHV (Btu/lb)	8,695	
Boiler Specs		
Combined Unit Gross Output (MW)	1,500	550
Plant Heat Rate, Design (Btu/kWh)	8,792	9,618
Combined Boiler Input Rating (MMBtu/hr)	13,600	5,111
Maximum Annual Coal Use at LHV, 100% CF	7,025,615(2)	2,732,605 (2)
Average Annual Coal Use at AHV, 90% CF	6,165,750 (3)	2,317,143 (3)

AHV = Average Coal Heating Value
CF = Capacity Factor
HHV = Higher Coal Heating Value
LHV = Lower Coal Heating Value

[1] Coal Specs obtained from ENSR PSD Application dated April 15, 2004

[2] This is the theoretical maximum annual amount of coal that could be combusted, based on the LHV and using a 100% CF. While this value is required for the PSD application it is overly conservative.

[3] This is a realistic estimate of average annual coal combustion, based on the AHV and a 90% CF.

Criteria Air Pollutant Emissions

Criteria air pollutant emission rates for the proposed power plant were obtained from the PSD application (ENSR 2006a). Table 4-3 presents a summary of maximum potential-to-emit (PTE) criteria air pollutant emission rates from the proposed power plant. The PSD application used CALPUFF software to model the air pollutant emissions for the proposed power plant. CALPUFF is recognized by the USEPA as a preferred/recommended model for non-steady-state puff dispersion modeling, which simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal, over a five-year period. These emission rates are based on the conservative assumption that both generating units of the plant will operate for 8,760 hours each year, at full-load operation, a virtually unattainable capacity factor. Based on these PTE values, the proposed power plant would be a major source, as defined under Federal New Source Review and PSD regulations, codified at 40 CFR §51.166, for PM_{10}, NO_x, SO_2 and CO. Accordingly, the PSD permit application must identify Best Available Control Technology (BACT) requirements, and address the ambient air quality impacts for each of these criteria pollutants. Alternative B would use dry type cooling towers with a Heller system, which have negligible PM_{10} emissions due to their design.

The particulate matter emissions modeled by ENSR only included PM_{10}. Total PM and $PM_{2.5}$ were not modeled. Based on Table 2-4 from the Desert Rock Updated Class I Modeling Report (Sithe 2006a), $PM_{2.5}$ would comprise approximately 78 percent of the total PM_{10} emissions modeled for the power plant.

Table 4-3 Summary of Maximum Potential-to-Emit (PTE) Criteria Pollutant Emissions from Proposed Power Plant

Pollutant	PC Boilers (tpy)	Auxiliary Boilers (tpy)	Emergency Generators (tpy)	Fire Water Pumps (tpy)	Material Handling (tpy)	Storage Tanks (tpy)	Project PTE (tpy)
CO	5,526	2.55	0.17	0.031	n/a	n/a	5,529
NO_x	3,315	7.13	2.26	0.41	n/a	n/a	3,325
SO_2	3,315	3.61	0.068	0.012	n/a	n/a	3,319
PM	553	1.02	0.083	0.015	22.3	n/a	576
PM_{10}	1,105	1.68	0.077	0.014	18.4	n/a	1,125
VOC	166	0.17	0.11	0.019	n/a	0.14	166
Lead	11.1 (1)	0.00064	0.000012	0.0000022	n/a	n/a	0.1
Fluorides	13.3	neg	neg	neg	n/a	n/a	13.3
H_2SO_4	221	0.062	0.002	0.0004	n/a	n/a	221
Mercury	0.057	0.00021	neg	neg	n/a	n/a	0.057
Hydrogen Sulfide	neg	neg	neg	neg	n/a	n/a	neg
Total Reduced Sulfur	neg	neg	neg	neg	n/a	n/a	neg
Reduced Sulfur Compounds	neg	neg	neg	neg	n/a	n/a	neg

SOURCE: Sithe 2006a

(1) Has since been revised to be 1.11 tons.

Hazardous Air Pollutant Emissions

For this EIS, HAP emissions were evaluated primarily for purposes of assessing ecological and human health risk and the potential for surface water contamination due to deposition of selected air toxics. HAP emission factors (in pounds emitted per ton of coal burned) for bituminous and sub-bituminous coal combustion were obtained from Tables 1.1-12 and 1.1-18 in AP-42 (USEPA 1998a). These factors were multiplied against the maximum total annual coal combustion values in Table 4-1 to derive maximum annual HAP emission rates, in pounds per year.

The annual emission rate for mercury (161 pounds per year) was derived from coal analysis data provided by BHP Billiton (BHP 2006). A total of 71 coal samples, taken from the coal seam designated for the proposed project in Areas IV South and V, were analyzed for mercury content. As a conservative approach, all values reported as “non-detect” were assumed to have the numerical magnitude of the analysis methods detection threshold of 0.05 parts per million (ppm), resulting in a mean mercury concentration of 0.065 ppm. There is uncertainty associated with this analysis because of the small number of samples; however, additional coal sampling and analysis is ongoing to verify the mean mercury content of the coal in Areas IV South and V. The results of the additional sampling will be incorporated into this EIS prior to issuance of the final document.

The following comments are important considerations regarding the estimation of mercury emissions and deposition rates:

- It was assumed that 80 percent of the mercury generated by the combustion process is of an oxidized, particulate form, and that the remaining 20 percent consists of elemental mercury vapor. The control efficiency of the baghouse and wet scrubber, with respect to oxidized particulate mercury, will be no less than 95 percent, thus a maximum of 4 percent of the amount initially generated would be emitted, or approximately 26.8 pounds per year. Consequently, the balance of the total emissions (approximately 134.2 pounds per year) would be comprised of elemental mercury vapor (which is not removed by the control equipment); hence the total mercury removal efficiency of the control equipment is approximately 80 percent.

- Deposition of a majority of the residual oxidized particulate mercury (about 26.8 pounds per year) would occur within about 25 kilometers (km) from the proposed power plant. Due to its gaseous properties, only a small percentage of the elemental mercury vapor would settle out within 25 km from the plant.

If, after operations commence, emissions testing indicates that total mercury removal is less than 80 percent (which would be attributed to an actual ratio of oxidized to elemental mercury below 80/20), Desert Rock Energy Company has committed to supplemental mercury control involving injection of activated carbon into the flue gas stream upstream of the control equipment. Elemental mercury will adsorb onto the surface of the carbon particles which are then captured (at a minimum 95 percent efficiency) in the control equipment.

For purposes of the ecological and human health risk assessments, six metals, methyl hydrazine and two dioxins were selected from the complete list of HAPs for evaluation, based on the factors described below:

- Most of the HAPs are VOCs, which do not persist in soils and vegetation, due to their tendency to evaporate, and thus were eliminated from detailed consideration.
- Specific HAPs were selected for detailed consideration on the basis of relatively higher emissions rates from coal combustion (compared to other coal combustion HAPs), relatively higher toxicity in biotic individuals and communities, relatively higher bioaccumulative and/or heightened public concern, and regulatory scrutiny.

Based on the foregoing, arsenic, cadmium, chromium, lead, mercury, selenium, methyl hydrazine, 2,3,7,8 tetrachlorodibenzo-P-dioxin and total polychlorinated dibenzo-P-dioxins were selected for further analysis. The emission rates for each of these nine toxics were converted to grams per second emission rate values; those values were used to extrapolate maximum ambient concentrations and deposition rates for calendar years 2001, 2002 and 2003, based on ENSR's modeling results. ENSR's analysis considered the varying deposition velocities of each toxic. Table 4-4 summarizes the maximum concentrations and deposition rates during the three-year period for the nine toxics evaluated.

Other than the NAAQS for lead and sulfuric acid, neither Federal nor state regulatory agencies in the vicinity of the proposed project have promulgated enforceable ambient standards for HAPs. Many states have published ambient concentration guidelines, which may be evaluated during certain permitting exercises. The predicted maximum HAP concentrations presented in Table 4-4, below, are substantially lower than the air toxic ambient guidelines published by the New Mexico Environment Department (NMED) and other state agencies.

The deposition results in Table 4-4 have been modeled for two types of particulate-bound air toxics, both fine and particle mass weighted. Organics (i.e. methyl hydrazine, 2,3,7,8-tetrachlorodibenzo-P-dioxin, and total polychlorinated dibenzo-P-dioxins) and elemental mercury vapor have been modeled as fine particles, as they tend to vaporize during combustion and then condense. Other metals (i.e. arsenic, cadmium, chromium, lead, oxidized particulate mercury and selenium) do not entirely vaporize and are conservatively assumed to be distributed in accordance with the filterable particulate size distribution.

Table 4-4 Alternative B – Highest Modeled Concentrations and Deposition Rates for Selected Air Toxics (2001 - 2003)

Contaminant	AP-42 Emission Factor (lb/ton) [1]	Emissions		Max Concentration [2]		Max Wet Deposition Flux [3]		Max Dry Deposition Flux [3]		Total Deposition Max Rate [3]	
		(lb/yr)	(g/s)	24-hour Avg. (micro g/m^3)	Annual Avg. (micro g/m^3)	24-hour Avg. (mg/m^2 day)	Annual Avg. (mg/m^2 yr)	24-hour Avg. (mg/m^2 day)	Annual Avg. (mg/m^2 yr)	24-hour Avg. (mg/m^2 day)	Annual Avg. (mg/m^2 yr)
Arsenic	4.1E-04	2.54E+03	3.66E-02	3.27E-03	1.26E-04	3.33E-01	1.07E+00	8.85E-04	1.48E-02	3.33E-01	1.07E+00
Cadmium and compounds	5.1E-05	3.16E+02	4.55E-03	4.07E-04	1.57E-05	4.14E-02	1.33E-01	1.10E-04	1.84E-03	4.14E-02	1.33E-01
Chromium VI	7.9E-05	4.90E+02	7.05E-03	6.30E-04	2.439E-05	6.42E-02	2.05E-01	1.70E-04	2.85E-03	6.42E-02	2.06E-01
Lead	4.2E-04	2.60E+03	3.75E-02	3.35E-03	1.29E-04	3.41E-01	1.09E+00	9.06E-04	1.52E-02	3.41E-01	1.09E+00
Mercury (elemental) [4]	NA	1.14E+02	1.64E-03	1.47E-04	5.66E-06	4.45E-03	9.47E-03	7.85E-07	1.45E-05	4.45E-03	9.47E-03
Selenium	1.3E-03	8.06E+03	1.16E-01	1.04E-02	4.00E-04	1.06E+00	3.38E+00	2.81E-03	4.69E-02	1.06E+00	3.38E+00
2,3,7,8-TCDD (dioxin)	1.43E-11	8.87E-05	1.28E-01	1.14E-10	4.40E-12	3.46E-09	7.36E-09	6.10E-13	1.13E-11	3.46E-09	7.37E-09
Total PCDD/PCDF	1.76E-09	1.09E-02	1.57E-07	1.40E-08	5.42E-10	4.26E-07	9.06E-07	7.51E-11	1.39E-09	4.26E-07	9.07E-07

Based on Modeled Concentrations and Deposition Rates for Hypothetical Pollutant Emitted at 1 µg/m^3 provided by ENSR

Note: Scientific notation has been used; 4.1E-04 is equivalent to 0.00041

PCDD = Polychlorinated Dibenzo-P-Dioxins

PCDF = Polychlorinated Dibenzofurans

[1] AP-42 for External Combustion Sources - Bituminous and Sub-bituminous Coal Combustion 9/98 (Emission Factors for controlled coal combustion)

[2] Max Concentration = the highest predicted concentration at any receptor for a 24-hour or annual average[3] Max Deposition Flux = Maximum predicted deposition rate per unit of soil area, at any receptor, over a daily or annual averaging period.

[3] Max Deposition Flux = Maximum predicted deposition rate per unit of soil area, at any receptor, over a daily or annual averaging period

[4] Mercury value obtained from the PSD Application (ENSR 2004)

Ammonia Emissions from Selective Catalytic Reduction (SCR) System. When SCR is used to control NO_x emissions, a small portion of the injected reagent (ammonia) does not get reacted and remains in the flue gas. Although ammonia is not listed as a Federal HAP, it is regulated as an Extremely Hazardous Substance under Sections 302, 304 and 313 of the Federal Emergency Planning and Community Right-to-Know Act, and must be reported annually under the Toxic Release Inventory requirements. In addition, ammonia is regulated by the Process Safety Management requirements under Occupational Safety and Health Administration and the Risk Management Program requirements under Section 112(r) of the Federal Clean Air Act. Most of the excess reagent used is consumed through various chemical reactions within the SCR equipment. However, a small portion remains in the flue gas and is emitted to the atmosphere as "ammonia slip." A number of factors can affect ammonia slip, including reaction temperature, residence time, degree of mixing, and molar ratio of ammonia (NH_3). The USEPA document *Emission Inventory Improvement Program – Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources* (USEPA 2004b) provides recommended emission factors for calculating ammonia emissions based on tons of coal combusted. For coal-fired boilers constructed since 1997, the document prescribes a maximum ammonia slip emission factor of 0.08 pounds of NH_3 per ton of coal, which is based on a 5 parts per million by volume (ppmv) NH_3 slip.

Multiplying the average annual coal combustion of 6.2 million tpy (assuming a 90 percent capacity factor) by the NH_3 emission factor (0.08 lb NH_3/ton coal) results in a maximum annual ammonia emissions rate of 236 tons for Alternative B. This annual emission rate equates to a maximum short-term emission rate of 6.8 grams per second (g/s). Based on ENSR's modeling results for the hypothetical pollutant, as described above, the maximum 24-hour ambient ammonia concentration would be 0.69 microgram per cubic meter ($\mu g/m^3$), and the maximum annual ambient ammonia concentration would be 0.02 $\mu g/m^3$. These values are less than 1 percent of the ambient air toxic "guidelines" published by the NMED and other western states. Therefore, the ambient air quality impacts associated with ammonia slip emissions from the power plant would be negligible.

Tailpipe Emissions Resulting from Plant Employee Commuting During Operations

Criteria air pollutant emissions resulting from employees driving vehicles to commute to the plant were estimated. URS conservatively assumed that 200 employees would work five days per week for Alternative B, and that each person would drive a gasoline-fueled vehicle separately to work each day. Emission factors for vehicles were obtained from USEPA document AP-42, Volume II, Emission Factors for Mobile Sources (USEPA 1995, 5^{th} edition and updates). Emission factors for pickup trucks and crew cabs were obtained from a MOBILE5 run based on national average fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit (^{o} F). Annual emissions were calculated based on a traveling distance of 45 miles/day with an operating schedule of 5 days/week (Monday through Friday) and 52 weeks/year. Based on the foregoing, maximum annual tailpipe emissions from plant employees commuting to the project site would be 13.5 tons VOC, 132.0 tons CO, 6.9 tons NO_x, 2.7 tons PM_{10} and 0.3 tons of SO_2. These emissions would be mobile and distributed across a large rural area; therefore, the ambient air quality impacts would be considered negligible.

Fugitive Dust Emissions Due to Employee Commuting Vehicle Travel Over Paved and Unpaved Surfaces

During operation of commuter vehicles, fugitive PM_{10} emissions would be generated during travel over the paved and unpaved surfaces. Emission factors for paved and unpaved roads and PM_{10} emission estimates for vehicle travel were calculated as described in Section 3.3.3.2.2 of Appendix K, using the same parameters (number of employees, vehicle miles traveled, etc.) described above for tailpipe emissions. The maximum annual PM_{10} emissions resulting from employee commuting vehicles traveling over paved and unpaved surfaces is estimated at 6,128 tons.

4.1.2.2.3 Air Emissions from Mining Operations in BNCC Lease Areas IV South and V

ENSR estimated PM_{10} emissions associated with the BNCC coal mining operations, coal handling activities, and vehicular traffic on roads, based on “Option 4” developed by BNCC (ENSR 2006e), which includes the use of an enclosed conveyor to transport coal from the active mining area to the processing area within the mine. URS estimated particulate and gaseous pollutant tailpipe emissions from diesel-fueled vehicles and equipment and PM_{10} emissions resulting from mine employees commuting to work. The total PM_{10} emissions from mining operations were estimated to be 153.1 tpy.

Total annual criteria air pollutant tailpipe emissions from mining and coal transport vehicles were estimated based on the roster of vehicles developed by ENSR for the PSD application, as described in Appendix K. The total maximum combustion emissions from mining and coal transport equipment are estimated to be 9 tpy VOCs, 36 tpy CO, 175 tpy NO_x, 6 tpy PM_{10}, and 0.15 tpy SO_2.

4.1.2.2.4 Predicted Ambient Air Quality Impacts of Mine and Power Plant Operations

The predicted effects on air quality are evaluated below in terms of potential impacts on (1) Class I areas, (2) Class II areas, (3) Visibility and Regional Haze, (4) deposition of sulfates and nitrates, and (5) carbon dioxide emissions.

Class I Area Impacts

The following text is excerpted from the Executive Summary of the ENSR report, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update,* January 2006 (ENSR 2006b):

> Dispersion modeling of the air quality impacts of the proposed Desert Rock Energy Facility has been completed for PSD Class I areas. The results are summarized below.
>
> - The project impacts are above the PSD [significant impact level (SIL)] for SO_2 in a number of areas (including three PSD Class II areas that have special Colorado designation as Class I for SO_2). The Project has an insignificant impact for NO_2 and PM_{10} increment.
> - The project’s impact is a small fraction of the total PSD increment (slightly over 20 percent for SO_2 at most). The cumulative analysis shows that the Project does not cause or contribute to a PSD Class I increment violation, and that no Class I increment violations are predicted in the areas modeled. The 3-hour and 24-hour 3-year maximum SO_2 impacts are 66 percent and 74 percent of the PSD increments, respectively, at Petrified Forest (mainly due to local sources in the area).
> - The project’s impacts on sulfur and nitrogen deposition are higher than the [Deposition Analysis Threshold (DAT)] levels that trigger additional review in a few areas. However, the annual cumulative SO_2 impacts shown in [Table 1-19] indicates that with other emission reductions as of 2004, there is a reduction in the deposition load for many of these areas. It is noteworthy to account for additional large reductions in SO_2 and NO_x emissions being undertaken at the nearby San Juan Generating Station, fully effective by the year 2010, relative to emissions in 1999:

- SO_2 annual emissions reduced by nearly 7,000 tpy (vs. about 3,300 tpy Desert Rock)
- NO_x annual emissions reduced by about 7,000 tpy (vs. about 3,300 tpy Desert Rock)
- PM_{10} emissions reduced by nearly 2,500 tpy (vs. about 1,100 tpy Desert Rock)

> In addition, recent changes in emissions at the nearby Four Corners Power Plant are also important to account for in the cumulative impact evaluation. These changes appear to be voluntary SO_2 emission reductions through 2004 due to increased scrubbing efficiency, and can be seen from the data posted on the USEPA's Acid Rain Database. Annual SO_2 emissions appear to be dropping from about 35,000 tpy to about 15,000 tpy, a reduction of some 20,000 tpy.
>
> It is clear from the above tallies of emission reductions in the Four Corners area that an overall reduction in acidic deposition is expected. The data further indicate that the minimal Lake acid neutralizing capacity impacts would be further reduced.

Class II Area Impacts

The following text is excerpted from the Executive Summary of the ENSR report, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class II Area Modeling Update,* June 2006 (ENSR 2006c). Note that the "material handling sources" mentioned below include coal extraction, processing, and transport between the BNCC mine and the proposed power plant.

> This report documents the results of the updated PSD Class II modeling analysis for the proposed Desert Rock Energy Facility project. The modeled project emissions include the main stack emissions that were included in the Class I modeling, as well as emissions from the following sources: auxiliary boilers, emergency generators, fire water pumps, material handling sources, and emissions from road traffic.
>
> The CALPUFF model was used to compute the project impacts in PSD Class II areas, with consistent meteorological data and technical options that were used in the Class I modeling. Modeling domains and receptor networks appropriate for the Class II analysis were employed.
>
> The results of the modeling analysis are summarized as follows:
>
> - The Project impacts are above PSD Class II [SIL] for a limited area around the facility (about 11 km for SO_2 and 1.7 km for PM_{10}). The project has insignificant impacts for CO and NO_x.
> - Emissions data provided by the State of New Mexico was used to compile a nearby background source inventory for SO_2 and PM_{10}.
> - The peak impacts from the facility are located very close to the fenceline (within 1 km in most cases). These impacts are likely due to the emergency generator or auxiliary boilers that do not run continuously.
> - The PSD increment consumption due to the facility emissions is well within PSD Class [II] increments. The cumulative modeling analysis shows compliance with PSD Class II increments and the NAAQS.

- The SO_2 3-hour and 24-hour impacts are 19 percent and 12 percent of the PSD increments and are located between 1 and 1.5 km from the main stack. The PM_{10} 24-hour and annual impacts are 29 percent and 12 percent of the PSD increments and are located within 1 km of the main stack.
- The SO_2 3-hour and 24-hour impacts are 16 percent and 15 percent of the NAAQS and are located 11 km from the main stack. Distant impacts from the Four Corners Power Plant and the San Juan Generating Station are likely contributors to this total. The PM_{10} 24-hour and annual impacts are 32 percent and 39 percent of the NAAQS and are located within 1 km of the main stack.
- There are no modeled significant impacts from the proposed project in areas beyond the Navajo Nation, including New Mexico lands and the Ute Mountain range to the north.
- Impacts on numerous distant PSD Class II areas (located beyond 50 km) show increment consumption below significance limits. [Increment is defined as the maximum allowed increase in concentration of a pollutant, above a baseline concentration in an area.] Steag has provided regional haze and deposition results for informational purposes, since PSD Class I limits are not applicable in Class II areas. No further modeling analysis for these distant areas is needed.
- The results of the additional impacts analysis indicate no predicted impacts above screening levels for soils and vegetation.

In conclusion, the potential effects on air quality due to emissions from the proposed Desert Rock Energy Facility, in conjunction with nearby area source emissions, are expected to result in predicted concentrations in Class II areas that are in compliance with PSD and NAAQS limits.

Visibility/Regional Haze Impacts

ENSR's initial visibility modeling used the screening procedures developed by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG). Impacts on regional haze are presented in terms of the change in light extinction from natural background extinction. Light extinction is the loss of light due to scattering and absorption as it passes through the atmosphere. The modeling showed a greater than 5 percent change in extinction, which under FLAG guidance triggers the need for additional analysis. Because there are uncertainties in visibility modeling, and also because ther is no universally accepted metric for assessing visibility impacts, ENSR performed additional analyses using alternative inputs for some model parameters. The 98th percentile day metric is the approach specified in USEPA guidance for modeling sources eligible for Best Available Retrofit Technology under the Regional Haze Rules. These alternative approaches supported the conclusion that the Desert Rock Energy Facility would have no adverse impact on visibility.

The following text is excerpted from the Executive Summary of the ENSR report, Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update, January 2006 (ENSR 2006b):

- The project's impacts on regional haze are above the significance threshold of 5 percent change to background extinction with the use of the FLAG screening procedures and Method 2. The Method 6 results with P-G coefficients indicate that the 98 percentile day has impacts only marginally higher than a 5 percent change in extinction only at Mesa Verde.

- The results of the sensitivity run with a lower background ammonia concentration during cold weather months show lower impacts, and with the Method 6 results for the 98 percentile day showing one area, Mesa Verde, at the significance threshold and all other areas below that threshold.
- The results of the sensitivity run with turbulence-based dispersion also shows lower impacts than the base case, and the Method 6 results for the 98 percentile day showing all years and areas below the 5 percent significance threshold.
- The modeling with a finer PSU/NCAR Mesoscale Model Version 3 (MM5) grid shows consistently lower impacts for the worst case year (at least for January), suggesting that better MM5 data may lead to lower predicted impacts. The finer grid MM5 data consistently led to lower impacts at the Grand Canyon than the coarser grid MM5 did.
- The discussion above regarding current plans to reduce emissions from the adjacent plants (FCPP [Four Corners Power Plant] and SJGS [San Juan Generating Station]) with amounts higher than the proposed project emissions indicates that any cumulative regional haze analysis would result in lower impacts than these reported above, and most likely negative impacts due to the overwhelming levels of emission reductions. The cumulative SO_2 increment results for Mesa Verde, for example indicate that with emission reductions as of 2004, there would be, on average, negative impacts for sulfates on a cumulative basis, and this accounts for a large portion of the extinction. With the additional emission reductions being planned by the year 2010, the visibility improvements will be further enhanced, even accounting for the proposed project emissions.

In conclusion, the potential effects on air quality and air quality related values analyzed here due to emissions from the proposed Desert Rock Energy Facility, especially in conjunction with the nearby source emission reductions, are expected to result in no adverse impacts.

Deposition of Sulfates and Nitrates

ENSR modeled the maximum off-site concentrations and deposition rates (24-hour and annual) for sulfates and nitrates (aerosols which form from the oxidation and particle agglomeration of emitted SO_2 and NO_x in the atmosphere), based on the CALPUFF model output files. ENSR prepared a table showing the location and magnitude of maximum predicted deposition rates for sulfates and nitrates, resulting from SO_2 and NO_x emitted by the proposed power plant (see Appendix K). The maximum predicted deposition rate for sulfates and nitrates occurred in 2003. The 2003 sulfate and nitrate results for the 24-hour averaging period were 0.8284 and 0.0947 milligram-seconds per meter squared ($mg/m^2/s$) at distance of 0.36 km (0.22 miles) north of the main stack. The 2003 sulfate and nitrate results for the annual averaging period were 0.0077 and 0.0009 $mg/m^2/s$ at distance of 0.26 km (0.16 miles) northeast of the main stack. These maximum predicted deposition rates are very low and occur less than a kilometer from the main stack. Therefore, the deposition impacts due to power plant operation will be negligible. All of the annual sulfur and nitrogen deposition values are below the Class I DAT value of 0.005 kilograms per hectare per year (kg/ha/yr) or 1.59E-12 $mg/m^2/s$.

4.1.2.2.5 Carbon Dioxide Emissions

As described above, the proposed power plant would emit criteria pollutants, including particulates and gaseous pollutants (sulfur dioxide and nitrogen oxides) that form aerosols in the atmosphere. Although measurable concentrations of emissions from the proposed power plant would likely extend to less than hundred kilometers from the facility, due to global wind patterns, minute quantities of these chemicals could eventually be dispersed across a wider area. In addition, combustion of biomass and all fossil fuels (coal, coke, petroleum and natural gas) result in emissions of carbon dioxide (CO_2). CO_2 is widely considered to be a "greenhouse gas". Greenhouse gases, which also include methane, nitrous oxides, 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 infared heat reflected or transmitted from the ground. Natural sources of greenhouse gases include volcanic eruptions, plant respiration and decomposition of organic matter.

Carbon dioxide forms when one atom of carbon unites with two atoms of oxygen, either during combustion or in the atmosphere after being emitted from the stack. Because the atomic weight of carbon is 12 and oxygen is 16, the atomic weight of carbon dioxide is 44. Based on that ratio and a 99 percent fraction of fuel oxidized during combustion 72.6 pounds of carbon dioxide is produced for every percent-ton of carbon as shown by the following equation, obtained from AP-42, Volume I, Fifth Edition, Chapter 1: External Combustion Sources - Bituminous And Sub-bituminous Coal Combustion 9/98 (USEPA 1998a).

$$(44 \text{ ton } CO_2 / 12 \text{ ton C}) * 0.99 * 2000 (\text{lb } CO_2 / \text{ton } CO_2) * 1/100\% = 72.6 \text{ lb } (CO_2 / \text{ton } \%C)$$

The proposed project would combust sub-bituminous coal, which is assumed to have an average carbon content of 56.38 percent. Therefore, using the equation above, the CO_2 emission factor for sub-bituminous coal is 4,093.2 pounds of CO_2 per ton of coal. Assuming a 90 percent capacity factor, Alternative B is assumed to combust 6.2 million tons of coal per year. Multiplying the average annual coal combustion times the CO_2 emission factor results in estimated annual carbon dioxide emissions of 12.7 million tons.

4.1.2.2.6 Mitigation to Reduce Impacts

Construction Emissions

The predicted PM emission rates that would result from earthmoving and other construction activity were calculated assuming an aggressive surface watering schedule during all on-site activity. Where necessary, water would be used to control dust during construction, including the grading of roads or the clearing of land and right-of-way, and would be applied on unpaved roads, material stockpiles, and other surfaces which can create airborne dust. In addition, open-bodied trucks transporting materials likely to become airborne would be applied with water or covered and earth or other materials that may become airborne will promptly be removed from paved roads. Exhaust emissions from vehicles and heavy equipment would be minimized by proper maintenance and no open burning of construction trash would be allowed unless permitted by the NNEPA. Where required, matting would be used in rock blasting operations to contain dust and debris if rock blasting is required.

The following additional measures will be employed, as appropriate, during the construction phase of the project:

- Restriction of vehicle travel only on designated routes within the site;
- Restriction of vehicle speeds within the plant site and on access roads;
- Ensure that diesel-powered construction equipment is properly tuned and maintained, and shut off when not in direct use. Employ periodic, unscheduled inspections to limit unnecessary idling and to ensure that construction equipment is properly maintained, tuned, and modified consistent with established specifications.

- Prohibit engine tampering to increase horsepower, except when meeting manufacturer's recommendations.
- Locate diesel engines, motors, and equipment staging areas as far as possible from residences.
- Reduce construction-related trips of workers and equipment, including trucks. Develop a construction traffic and parking management plan that minimizes traffic interference and maintains traffic flow.
- Restriction of vehicles and equipment with excessive visible emissions resulting from age or poor maintenance;
- Lease or buy newer, cleaner equipment (1996 or newer model), using a minimum of 75 percent of the equipment's total horsepower.
- Ensure visible emissions from all heavy duty off road diesel equipment not exceed 20 percent opacity for more than three minutes in any hour of operation.
- Restriction of open burning, including vegetation and refuse disposal, outdoor comfort heating;
- Stabilization of material piles with chemical palliatives, woven fabrics or plastic sheeting; and
- Restriction of earthmoving activity and vehicle travel during periods of high winds (e.g., >30 mph).

In accordance with the PSD Permit (draft issued in July 2006), the project would use best available control technologies to reduce criteria pollutant emissions. Project emissions would be monitored by use of a continuous emissions monitoring system for gaseous criteria pollutants as a demonstration of continuous compliance with applicable permit conditions.

In addition to installing best available control technologies as required by the permit, project proponents have agreed to implement a voluntary mitigation plan to further reduce air quality impacts. This plan was negotiated with and accepted by the National Park Service and the U.S. Forest Service as an acceptable approach to mitigate any potential adverse impact on Class I areas. This voluntary mitigation plan, which would be enforced by the Navajo Nation Environmental Protection Agency under its Title V authority, would require the project proponents to invest in a third party capital improvement project to generate actual SO_2 reductions equivalent to 110 percent of the total SO_2 emissions that would be generated from the proposed Desert Rock Energy Project. If such investment opportunity is not readily available, project proponents would alternatively acquire and retire SO_2 allowances equivalent to those of Desert Rock's generated within 300 km (186 miles) of the project site. In essence, this voluntary mitigation plan would result in a complete local offset of all SO_2 emissions that are likely to be generated by the proposed project. In addition, the voluntary mitigation plan calls for a minimum of 80 percent mercury control with the possibility for 90 percent control depending on the cost effectiveness of the activated carbon injection technology. The air mitigation plan is provided in Appendix K.

4.1.2.3 550 Megawatt Sub-critical Plant and Associated Facilities

The Alternative C facility includes one 550 MW generation unit, as well as a plant-cooling system, coal handling facilities, power transmission interconnection facilities, a water-supply system, access to the plant site, and waste-management operations. There would also be a diesel-powered emergency generator and firewater pump along with a distillate oil storage tank.

The analysis methodologies for the Alternative C facility are, in most cases, identical to the approach described above for the Alternative B facility. Information pertaining to the design, operation and emissions from the 550 MW power plant was obtained from the PSD permit application (RTP 2004a); (note that the PSD application for the 550 MW alternative did not include an analysis of mine emissions). To avoid repetitive text, the following sections only identify instances where the impact analysis methodology deviates from that described above for Alternative B, and otherwise presents the analysis findings pertinent to Alternative C.

4.1.2.3.1 Air Pollutant Emissions Caused by Project Construction

The following information enumerates pertinent characteristics of Alternative C (compared to Alternative B), relative to estimation of air pollutant emissions generated during project construction:

- The footprint of the power plant would be about 110 acres (39 fewer acres than Alternative B);
- The schedule for earthmoving during power plant construction is 12 months (2 months less than for Alternative B);
- The water requirements for the Alternative C facility would be 500-acre feet less than Alternative B, reducing the size requirements for the well field by about 11 percent;
- There would be reduced right-of-way requirements for the transmission line that would extend to the Four Corners Generating Station switchyard and then to the Navajo Transmission Project (NTP) at the Shiprock Substation. Therefore, the number of acres disturbed during transmission line construction under Alternative C (27 line miles) is assumed to be 36 percent less than under Alternative B (42 line miles); and
- Earthmoving emissions due to access road construction and the Water Supply Pipeline associated with water well field A would be essentially the same as calculated for the Alternative B.

Fugitive Dust Due to Earthmoving Activity

Table 4-5 summarizes the estimated PM_{10} emissions due to earthmoving activity from each phase of the proposed project. For the proposed water supply and transmission line locations, the total maximum controlled PM_{10} emissions from construction of the plant site, well field, transmission lines and access road are estimated to be 36.9 tons per month. The use of water well field A would increase PM_{10} emissions by 15.8 tons per month. Segment B of the alternative transmission line would increase PM_{10} emissions by 1.2 ton per month.

Table 4-5 Alternative C – Particulate Matter (PM_{10}) Emissions Associated with Earthmoving During Construction of Alterative C Plant Site, Water Conveyance System, Transmission Lines and Access Roads

Alternative \ Segment	Length (mile)	Work Area (acre)[1]	Projected Construction Time (months)	PM_{10} EF (tons/acre/month) [2]	Controlled PM_{10} Emission (tons/month) [3]	Total Project Emissions (tons)
Proposed Desert Rock Plant Site						
-	NA	110.0 [4]	12.0	0.11	12.1	67.7
Water Well Field						
Well Field Area B	NA	29.2 [5]	6.0	0.42	12.3	73.8
Transmission Lines						
Segment A	8.3	33.0[6]	9.0	0.11	3.6	32.4
Segment C	6.2	24.6 [6]	9.0	0.11	2.7	24.3
Segment D	10.8	36.5 [6]	9.0	0.11	4.0	36.0
Subtotal	25.3	94.1	-	-	10.3	92.7
Roads						
-	2.2	20.3 [7]	6.0	0.11	2.2	13.4
Proposed Project Totals		**253.6**	**-**	**-**	**36.9**	**247.6**
Alternatives						
Well Field Area A	NA	29.2 [5]	6.0	0.42	12.3	73.8
Water Supply Pipeline	12.4	37.6 [8]	4.0	0.42	15.8	63.2
Subtotal	-	66.8	-	-	28.1	137.0
Net Change (Water Supply System)					**15.8**	**63.2**
Segment B Transmission Line [9]	11.1	44.1 [6]	9.0	0.11	4.8	43.2
Net Change (Transmission Line)					**1.2**	**10.8**

[1] SOURCE: URS 2007

[2] From Western Regional Air Partnership (WRAP) *Fugitive Dust Handbook, Chapter 3, Construction and Demolition*, November 2004; (downloaded from www.wrapair.org/forums/)

[3] Controlled PM_{10} Emission Rate = EF (tons/acre/month) x total acres

[4] Plant Site work area was assumed to be not more than 110 acres per month for the first three months, 55 acres per month for month 4-6, and 20 acres per month for the remaining 8 months of the 12-month projected earthmoving schedule.

[5] Assumes water requirements for the Alternative C facility would be 500-acre feet less than Alternative B, reducing the size requirements for the well field by about 11 percent.

[6] Assumes construction area 36 percent smaller than estimated for Alternative B.

[7] Work Area acreages are generally based on GIS data shown on Figure 2-1 since they are not expected to change greatly for Alternative C.

[8] Water Supply Pipeline would require the construction of 5 miles of adjoining access road with a right-of-way width of 25 feet and the 12.4 miles of pipeline for an estimated total of disturbed land to be 37.6 acres.

[9] Alternative Transmission Segment B would replace Transmission Line Segment A.

Particulate and Gaseous Criteria Pollutant Emissions from Construction Equipment and Vehicles

All construction activities associated with the plant site for Alternative C are assumed to be the same as for Alternative B. Therefore, annual criteria pollutant emissions from construction vehicles and equipment are predicted to be exactly the same as Alternative B on an annual basis. However, the total emissions were estimated to be slightly less than estimated for Alternative B, because the construction schedule would be 30 months as opposed to 36 months. The total maximum combustion emissions from construction of the plant site, well field, transmission lines, access road, and employee commuting are estimated to be 91 tpy VOCs, 677 tpy CO, 1,117 tpy NO_x, 49 tpy PM_{10}, and 1.8 tpy SO_2. Total emissions for the duration of the construction activities were estimated to be 158 tons VOCs, 1,348 tons CO, 1,156 tons NO_x, 49 tons PM_{10}, and 3.5 tons SO_2.

Fugitive Dust Caused by Project Site Vehicle and Employee Commuting Vehicle Travel Over Paved and Unpaved Surfaces

Predicted PM emissions associated with construction of the proposed project were calculated in accordance with the procedures described above. The maximum PM_{10} emissions were estimated to be 14,307 tpy with a project total of 26,632 tons during the 36-month plant construction.

Summary of Air Pollutant Emissions Due to Project Construction

The maximum annual onsite emissions from construction of the project are estimated to be 91 tpy VOC, 677 tpy CO, 1,117 tpy NO_x, 14,393 tpy PM_{10}, and 1.8 tpy SO_2.

4.1.2.3.2 Air Emissions Caused by Operation of 550 MW Power Plant

Criteria Air Pollutant Emissions

Criteria air pollutant emission rates were obtained from the PSD application (RTP 2004a). Table 4-6 presents a summary of maximum PTE criteria air pollutant emission rates from the Alternative C power plant. These emission rates are based on the conservative assumption that the generating unit of the plant would operate for 8,760 hours each year, at full-load operation. Based on these PTE values, the proposed power plant would be a major source, as defined under Federal New Source Review and PSD regulations, codified at 40 CFR §51.166, for PM_{10}, NO_x, SO_2, and CO. Accordingly, the PSD permit application must identify Best Available Control Technology (BACT) requirements, and address the ambient air quality impacts for each of these criteria pollutants. Mercury emissions were not addressed in the PSD application. However, URS conservatively estimated mercury emissions by applying the ratio of maximum annual coal usage of Alternative C over Alternative B (2,732,605 tpy/ 7,025,615 tpy or 39 percent) to the estimated mercury emissions estimated for Alternative B on Table 4-3, above.

Table 4-6 Summary of Maximum Potential Criteria Pollutant Emissions from Power Plant (Alternative C)

Pollutant	PC Boilers (tpy)	Cooling Towers (tpy)	Auxiliary Boilers (tpy)	Emergency Generator (tpy)	Fire Water Pump (tpy)	Material Handling (tpy)	Storage Tank (tpy)	PTE (tpy)
CO	3,134	n/a	4.4	0.6	0.3	n/a	n/a	3,139
NO_x	1,343	n/a	7.3	0.7	0.3	n/a	n/a	1,351
SO_2	1,343	n/a	6.9	0.04	0.02	n/a	n/a	1,350
PM	269	3.37	1.8	0.03	0.02	n/a	n/a	284
PM_{10}	448	3.37	2.9	0.03	0.02	5.85	n/a	464
VOC	161	n/a	0.2	0.3	0.1	n/a	0.03	162
Lead	0.59	n/a	0.001	0.00001	0.000003	n/a	n/a	0.59
Fluorides	18	n/a	neg	neg	neg	n/a	n/a	18
H_2SO_4	114	n/a	0.3	n/a	n/a	n/a	n/a	114
Mercury[1]	0.02	n/a	0.00008	n/a	n/a	n/a	n/a	0.02

SOURCE: RTP Environmental Associates, Inc. *Cottonwood Energy Center PSD Permit Application,* March 2004

n/a – not applicable, neg. – negligible

[1] Mercury emissions were estimated by URS to be the ratio of maximum annual coal usage of Alternative C over Alternative B multiplied times the estimated mercury emissions for Alternative B.

Hazardous Air Pollutant Emissions

HAP emissions were not estimated in the PSD permit application for Alternative C. However, due to the lower coal consumption rate, HAP emissions, and the associated ambient air quality impacts, would be proportionally lower than those described for Alternative B, which are negligible.

Ammonia Emissions from SCR System. Ammonia slip emissions from the power plant under Alternative C were estimated in the same manner as described above for Alternative B. Annual ammonia emissions would be 92.7 tpy (2.7 g/s). The maximum 24-hour ambient concentration of ammonia would be 0.24 µg/s, and the maximum annual ambient concentration of ammonia would be 0.01 µg/s. These values are proportionally lower than the corresponding ambient concentrations estimated for Alternative C, which are less than 1 percent of state guidelines.

Employee Commuting Vehicle Tailpipe Emissions

The number of employees required to operate the Alternative C plant (125) is roughly 62 percent of what would be required under Alternative B (200). Therefore, the predicted maximum annual tailpipe emissions resulting from power plant employees commuting to work would be approximately 38 percent less than the emissions estimated for Alternative B. The maximum annual tailpipe emissions due to commuting plant employees are estimated to be 8.45 tpy VOC, 82.43 tpy CO, 4.31 tpy NO_x, 0.17 tpy PM_{10} and 0.20 tpy SO_2.

Fugitive Dust Due to Employee Commuting Vehicle Travel on Paved and Unpaved Roads During Plant Operations

During plant operation, vehicles would be used by employees commuting to the plant site. During operation of these vehicles, fugitive PM_{10} emissions would be generated during travel over the paved and unpaved surfaces. Predicted fugitive PM_{10} emissions associated with employee commuting were calculated in the same manner described above for Alternative B. The maximum annual PM_{10} emissions resulting from fugitive dust raised by employee commuting vehicles is estimated to be 3,830 tons.

4.1.2.3.3 Air Emissions Caused by Mining Operations in BNCC Lease Areas IV South and V

Coal Mining Operations

For the 550 MW alternative, only Area IV South would be mined, and large trucks, instead of the enclosed conveyor, would be used to transport coal from the active pit to the processing area.

PM emission rates for the mining operations and coal handling/transport were obtained from ENSR (ENSR 2006d). Table 4-7 summarizes the annual PM_{10} emissions from the BNCC mining and coal handling operations assuming the use of haul trucks rather than the overland conveyor system proposed under Alternative B. Note these emissions estimates were originally prepared as options for the Alternative B facility and have been multiplied by the ratio of maximum annual coal usage of Alternative C over Alternative B (2,732,605 tpy/ 7,025,615 tpy or 39 percent). The maximum annual coal consumption was used to calculate this ration rather than megawatt output, because Alternative C would be a slightly less efficient unit and requires more the combustion of more coal per mega-watt hour when compared with Alternative B.

The total PM_{10} emissions from mining and coal handling operations are estimated to be 100.16 tpy.

Mining Vehicle and Equipment Tailpipe Emissions

Although less coal would be mined annually under Alternative C, greater use of mining vehicle and equipment per unit of coal would occur compared to Alternative B, due to the lack of the enclosed coveyor. Total annual criteria air pollutant tailpipe emissions from mining and coal transport vehicles were estimated based on the roster of vehicles developed by ENSR (ENSR 2006d), and using emission factors from the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004 (USEPA 2004c), in the same manner as previously described for Alternative B. The total maximum combustion emissions from mining and coal transport equipment are estimated to be 8.6 tpy VOCs, 33.9 tpy CO, 166.5 tpy NO_x, 6.0 tpy PM_{10}, and 0.14 tpy SO_2.

4.1.2.3.4 Predicted Ambient Air Quality Impacts of Mine and Power Plant Operations

Class I Area Impacts

Table 1-45 in Appendix K presents the maximum predicted ambient concentrations of NO_x, SO_2 and PM_{10} within 12 Class I areas (located within 300 km of the project site) during the calendar years 1992, 1996, and 2003. Exceedances of the SO_2 3-hour and 24-hour averaging periods occurred at Canyonlands National Park, Capital Reef National Park, Great Sand Dunes National Monument, Mesa Verde National Park, San Pedro Parks Wilderness, and Weminuche Wilderness. Therefore, a cumulative PSD increment analysis for SO_2 was performed using all background source emissions within a 50 km (~31 miles) radius and source emissions larger than 1 lb/hr within 300 km (~186 miles) of the affected Class I areas. Based on RTP's analysis compliance has been met at all Class I areas for the SO_2 PSD cumulative analyses. Details regarding the PSD increment analysis can be found in Section 6.2 of *PSD Class I Cumulative Impact Results of Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico* (RTP 2004b).

Based on the predicted maximum ambient pollutant concentrations, the air quality impacts of the proposed power plant in Class I Areas would be considered minor. No exceedances of the NAAQS, nor excessive consumption of Class I increments, would be anticipated to occur.

Class II Area Impacts

Table 1-46 of Appendix K summarizes the predicted ambient air quality impacts of Alternative C, based on the CALPUFF modeling results. The maximum predicted ambient concentrations for CO (1-hour and 8-hour) are below the SIL. In accordance with the USEPA document "*Guideline on Air Quality Models*" (USEPA 1999), no further analysis of this pollutant (i.e., Class I impacts and increment consumption), for the specified averaging times, is required under the PSD regulations. The maximum predicted ambient concentrations for NO_x (annual), SO_2 (3-hour and 24-hour) and PM_{10} (24-hour and annual) are above the corresponding SIL. All pollutants and averaging periods were below the PSD Increment for all receptors within the modeling domain, with the exception of the 24-hour PM10 value. A maximum of 63.0 $\mu g/m^3$ was predicted, which exceeds the PSD Increment standard of 30 $\mu g/m^3$. However, at none of the receptors is the Alternative C facility a significant contributor of 24-hour PM_{10}, as all of the concentrations for the facility are below the PM_{10} SIL of 5 $\mu g/m^3$. Detailed results of the analysis of receptors in excess of the 24-hour PM_{10} increment can be found within section 6.5 –Results of Class II PSD Increment Analysis, specifically Table 6-20 of the Cottonwood Energy Center Modeling Results. Therefore, all of the receptors have demonstrated to be in compliance with the Class II PSD Increments.

Certain national parks, monuments and wildlife areas are not designated as Class I areas, but are considered sensitive receptors by Federal and state land managers responsible for these lands. RTP predicted the maximum ambient concentrations for NO_x, SO_2 and PM_{10} at 26 such areas within New Mexico, Arizona, Utah and Colorado, based on power plant emissions only (e.g. mine emissions not included). Table 1-47 of Appendix K summarizes the predicted ambient concentrations for NO_x, SO_2 and PM_{10} in the 26 sensitive Class II areas. The SILs for NO_x, PM_{10}, and SO_2 were not exceeded at any of these 26 sensitive receptors.

Based on the predicted maximum ambient pollutant concentrations, the air quality impacts of Alternative C in Class II Areas would be considered minor. No exceedances of the NAAQS, nor excessive consumption of Class II increments, would be anticipated to occur.

Visibility/Regional Haze Impacts

The following text is excerpted from Section 6.7 of *Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico*. (RTP 2004b) and addresses the affects on visibility:

> The Project has the potential to affect visibility near the site primarily as a result of condensed water vapor from the wet mechanical draft cooling tower plume. The pulverized coal (PC) boiler stack plume may also occasionally contain condensed water vapor.
>
> Due to the very low facility emissions of particulates and other pollutants that may impact local visibility, no visible plume is expected as a resulting of pollutant emissions from the PC boiler stack under normal operating conditions, as a result of the use of high efficiency emission control systems.
>
> The cooling tower will dissipate heat by evaporating water and discharging the water vapor into the atmosphere. If the ambient air is cold and/or moist, a portion of the emitted water vapor will condense to form water droplets. This condition results in a visible, white plume emanating from the cooling system. The plume evaporates downwind because of mixing with unsaturated air. Similarly, moisture emitted from the project's stack may also condense at times, resulting in a visible plume. The frequency, persistence, and size of a visible plume depends on the type of cooling system or stack conditions, local climate, and season. Visible plume formation occurs more frequently during the cooler seasons or during periods with high relative humidity when ambient conditions are less conducive to evaporation of the condensed water droplets.
>
> A visible plume of condensed water vapor exhausted from the cooling tower during winter months, or during other cool weather periods with high humidity, may extend hundreds of meters or more from the tower. During warmer and dryer periods, a very short plume is typically observed.
>
> Stack plumes have significantly less water vapor than cooling tower plumes, and as such are typically observed to extend less than several hundred meters from the stack, even under colder or more humid conditions.

Sulfate/Nitrate Deposition Impacts

Based on the CALPUFF model output files, RTP prepared a table of predicted deposition rates for sulfates and nitrates (in Class I areas only), resulting from SO_2 and NO_x emitted by Alternative C. Table 1-49 in the Air Quality Technical Support Document (Appendix K) summarizes the maximum predicted deposition rates for these chemical species. There were a few instances when the total annual nitrogen and sulfur deposition (i.e. wet plus dry deposition) was higher than the corresponding NPS DAT of 0.005 kg/ha/year, triggering additional analysis requirements. Note that the table of results only shows the highest values for each year. Nitrate deposition is higher than the DAT at Mesa Verde in 1992 and 1996. The sulfate deposition exceeds the SIL at a number of parks for all three years. All nitrate depositions are below 0.01 kg/ha/yr. All sulfate deposition values are below 0.02 kg/ha/yr.

Carbon Dioxide Emissions

CO_2 emissions that would occur under Alternative C were calculated in the same manner described above for Alternative B. Using a 90 percent capacity factor the average annual coal consumption rate of 2,317,143 ton per year, annual CO_2 emissions would be 4.74 million tons.

4.1.2.3.5 Mitigation to Reduce Impacts

Mitigation measures for construction emissions under Alternative C would be the same as Alternative B.

4.1.3 Summary of Impact Analysis

Although the Alternative B facility would have almost three times the generating capacity of the Alternative C facility, the ambient air quality impacts of these alternatives would be similar. The following statements help to illuminate the reasons for this.

- The Alternative B plant would employ highly efficient super-critical boiler technology, which generates approximately 20 percent less air pollutant emissions per unit of electricity produced, compared to the sub-critical boiler technology proposed under Alternative C.

- The flue gas desulfurization (FGD) technology proposed for Alternative B would provide superior performance compared to the FGD technology proposed for the Alternative C facility. About 20 percent less emissions would be formed in the boiler, and the SO_2 removal efficiency of the Alternative B FGD system would be approximately 30 percent greater than the removal efficiency of the Alternative C FGD system.

- The "Good Engineering Practice" stack height for the Alternative B facility would be 917 feet. The stack height for the Alternative C facility would be about 490 feet. The higher stack height under Alternative B would result in lower ambient air quality impacts, compared to Alternative C, since greater atmospheric dispersion would occur.

Table 4-7 compares the maximum emissions due to construction activities from Alternatives B and C. The emissions of VOC, CO, NO_x, and SO_2 would be equal, as the roster of construction vehicles and equipment would be the same on a tpy basis. Total emissions over the entire duration of the construction activities would be higher for the Alternative B because the activities would occur over a longer construction schedule. However, PM_{10} emissions from construction operations were estimated to be 14,495 tpy for Alternative B and 14,393 tpy for Alternative C. The difference in PM_{10} emissions would be attributed to a slightly smaller footprint for the plant and transmission line under Alternative C. It is important to note that the majority of the PM_{10} emissions (~99 percent) would be due to earthmoving and fugitive dust generated by employee commuting vehicles. Since these emissions would occur at ground level, it is unlikely that the emissions would be transported more than a few kilometers, except on unusually windy days. In addition, all of these emissions would be temporary, spatially distributed over a large area, and spread out over construction schedules ranging from 6 to 36 months. The mitigation measures would be expected to reduce these impacts.

Table 4-8 compares the maximum emissions due to plant and mine operations from Alternatives B and C. The maximum annual coal combustion under Alternative C would be approximately 39 percent of the maximum annual coal combustion under Alternative B. Consequently, the total annual emissions of VOC, CO, NO_x, SO_2, and PM_{10} for Alternative C would be less than estimated for Alternative B. Alternative C would have lower efficiency and higher emissions per unit of power produced, but would have lower overall lower emissions because of the smaller size of the unit.

Under Alternative B, an air mitigation agreement would be implemented that would offset SO_2 emissions from the proposed project, either through investment in capital improvement projects or acquiring and retiring SO_2 credits. This air mitigation agreement also commits the project proponents to control a minimum of 80 percent of mercury emissions associated with the power plant, and to make investments (subject to spending limits) to achieve 90 percent mercury control.

Table 4-7 Comparison of Maximum Pollutant Emissions for the Duration of Construction Activities

Criteria Pollutant	Alternative B (1,500 MW Plant) (tons)	Alternative C (550 MW Plant) (tons)
VOC	199	158
CO	1,725	1,348
NO_x	1,314	1,156
SO_2	4.4	3.5
PM_{10}	57,072	26,929

Note: Construction duration of project elements vary.

Table 4-8 Comparison of Maximum Pollutant Emissions from Plant and Mine Operations

Criteria Pollutant	Alternative B (1,500 MW Plant) (tpy)	Alternative C (550 MW Plant) (tpy)
VOC	390	179
CO	5,697	3,255
NO_x	3,507	1,522
SO_2	3,319	1,350
PM_{10}	7,415	4,400
CO_2	12,700,000	4,740,000
NH_3	236	92.7
HAPs	7	3

4.2 WATER RESOURCES

4.2.1 Surface Water

4.2.1.1 Impact Assessment Methodology

This section provides an analysis of the potential environmental effects on the surface water resource that could occur under each of the alternatives described in Chapter 2. Information on existing surface water conditions in Section 3.2 was used as the baseline by which to measure and identify potential impacts of the alternatives. Mitigation measures were considered and incorporated in the assessment of impacts described in this analysis.

Impacts (or impairment) are described in terms of magnitude: *major, moderate, minor, negligible, or none*. These terms, as they are used in the surface water analysis, are briefly described below.

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

4.2.1.2 Environmental Consequences on Surface Water

4.2.1.2.1 No Action (Alternative A)

The No Action Alternative would have no effect on surface water at or near the proposed project site. However, there could be negligible impacts from existing land uses. Runoff from grazing on the proposed project site could carry sediments, and possibly nutrients and other pollutants, to surface waters where they could potentially degrade water quality.

Sedimentation is the leading cause of stream and river impairment in New Mexico and the U.S. and can cause disturbances in aquatic ecosystems such as the degradation of fish spawning grounds, the potential reduction of recreational activities, increased cost of domestic water purification, and decreased life span or dams and levies. Continuing agricultural practices such as grazing, plowing, harvesting, fertilizing, and using pesticides in the northern portion of the project area would contribute incrementally to this long term, regional water quality problem.

Insofar as the region would need to meet its energy needs by purchasing power from other generation sources, the No Action Alternative could potentially be contributing indirectly to ongoing water resource impacts at different generating stations in the region or potentially new generating stations located outside of the region.

4.2.1.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

Throughout the discussion of environmental consequences associated with the action alternatives, permanent impacts on Waters of the United States are quantified, as possible. A permanent impact on Waters of the U.S. is defined as a modification to an existing surface water feature that meets the definition of a Water of the U.S. Table 4-9 provides a summary of the quantification of impacts on Waters of the U.S. Commitments to reduce impacts on Waters of the U.S. would be made through the U.S. Army Corps of Engineers (USACE) permitting process in accordance with the Clean Water Act.

Table 4-9 Permanent Impacts to Waters of the United States

	Alternative B	Alternative C
Power Plant	0.92 acre (47,281.90 square feet)	0.84 acre (36,653.80 square feet)
Transmission Line Segment A	0.02 acre (1,066.80 square feet)	Same as Alternative B
Transmission Line Segment B	Zero impacts	Same as Alternative B
Transmission Line Segment C	Zero impacts	Same as Alternative B
Transmission Line Segment D	0.04 acre (1,918 square feet)	Same as Alternative B
Access Road	0.17 acres (7,210.00 square feet)	Same as Alternative B
Water-supply system (well field A)	0.01 acre (605.48 square feet)	Same as Alternative B
Water-supply system (well field B)	0.18 acre (7,840.80 square feet)	Same as Alternative B
Coal Preparation Facilities	0.12 acre (5,089.80 square feet)	Lease Area V would not be mined

Power Plant

The Pinabete Arroyo and the Chaco Wash are the two main drainages located in the vicinity of the proposed power plant site. Emissions from the proposed power plant could affect water quality in regional surface water bodies (San Juan River and Navajo Reservoir).

Floodplains have not been delineated for this area of the Navajo Indian Reservation. Therefore, at this time it is not possible to determine potential effects on floodplains. Review of existing hydrologic data suggests that all project facilities can and would be located outside of average high water areas.

Construction – The power plant site would be located within a 592-acre leased area. Within that area, the footprint of the power plant facilities would require approximately 149 acres. Up to 1.2 million cubic yards of soil would be moved for construction of the power plant. The cut-and-fill activities would be balanced over the site such that soil may not need to be imported or exported. Permanent impacts to Waters of the United States from the access road and the power plant would be 0.92 acres (47281.9 square feet).

Construction of the power plant site could indirectly affect surface water resources by increasing stormwater runoff from the site, carrying sediment and contamination loads into surface water and by contamination from construction equipment and activities infiltrating area surface waters. Implementation of construction best management practices (BMPs) would prevent degradation of surface waters. During site preparation and grading activities, soils in the construction area could become exposed, rutted, and compacted. Soil exposure, rutting, and compaction have the potential to increase water yields from the site, concentrate and channelize sheet flow, increase erosion rates, and increase sediment delivery to nearby water bodies. These effects, if unmitigated, could deliver sediment and nutrient loadings to the San

Juan River, the Chaco River, and their respective tributaries. Again, implementation of industry standard BMPs for construction activities would prevent degradation of surface waters and washes. BMPs for each construction phase would be implemented as part of a construction Storm Water Pollution Prevention Plan in compliance with Section 402 of the Clean Water Act.

As with almost any construction project involving the use of heavy equipment, there is also some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spilled fluid were to percolate into groundwater or directly enter an adjacent surface water body. Fuel products (petroleum, oils, hydraulic fluids, lubricant) would be needed to operate and fuel construction equipment. Hazardous fluid spill prevention and protection practices would be implemented on all construction and equipment maintenance and fueling sites related to the project, in compliance with Spill Prevention, Control, and Countermeasure rules under the Oil Pollution Prevention regulations. Therefore, it is anticipated that there would be no measurable impact to surface waters or groundwater from accidental hazardous fluid spills.

Operation – The power plant would be operated in accordance with a Storm Water Pollution Prevention Plan in compliance with Section 402 of the Clean Water Act, mitigating potential impacts of stormwater runoff from the plant site.

Recent studies (Grey et. al 2004) have determined that emissions from coal-fired power plants in the region contribute mercury and other pollutants to local surface waters. Therefore, coal-fired power plants represent a source of atmospheric mercury in the Four Corners region. Because prevailing winds in the region are generally from the southwest, stack emissions from the proposed power plant could affect surface waters to the northeast such as the San Juan River and the Navajo Reservoir. Therefore, emissions from the proposed power plant, in particular small quantities of mercury, would be deposited into the San Juan River and possibly the Navajo Reservoir and incrementally add to existing concentrations in the project area. However, pollutant concentrations are likely to vary depending on location, prevailing winds, and rainfall.

Based on the results of air toxics modeling, it is estimated that the proposed power plant would release about 161 pounds of mercury per year through air emissions. The emitted mercury would consist of both particulates and vapors. Some particulate mercury could be deposited both near to and far from the proposed plant site. Some portion of the mercury would be carried away by the atmosphere and would not be deposited in the region at all. It is estimated that about 26.8 pounds of mercury would be deposited within 25 km of the plant. The San Juan River is about 28 km from the power plant site.The actual quantity of mercury deposition that could eventually enter the San Juan River system or Morgan Lake directly or via runoff is difficult to quantify. As shown in Table 3-9, existing mercury concentrations (dissolved) in the San Juan River at Shiprock Bridge during the period 1994-2001 ranged from 0.1 to 0.3 µg/L (average of 0.1 µg/L), below the Federal chronic ambient water quality criterion (AWQC) for dissolved mercury of 0.77 µg/L (USEPA 2006f) and New Mexico's drinking water quality standard for mercury in a domestic water supply of 2 µg/L.

Transmission Lines

The San Juan River, Chaco River, Morgan Lake, Eagle Nest Arroyo, Coal Creek, Coal Mine Creek, Chinde Wash, Cottonwood Arroyo, and numerous unnamed drainages would be traversed by proposed transmission line Segments A, C, and D and alternative transmission line Segment B.

Construction – The alternative transmission line corridor would be longer than the proposed alignment by nearly 3 miles. The primary difference between the alternative routes is that they would parallel opposite sides of Chaco Wash. Clearing of natural vegetation would be required for construction of access roads and tower sites, land-surveying activities, clearances for electrical safety, long-term maintenance, and reliability of the transmission line.

For Segment A, permanent impacts to Waters of the United States would total 0.02 acre (1066.80 square feet), and no direct impacts on Waters of the U.S. would be associated with Segments C and D. Impacts to surface water during the construction of the transmission line would be very similar to the impacts described above for the construction of the proposed power plant. General construction of the transmission lines could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water, and by contamination from construction equipment and activities infiltrating area surface waters. However, implementation of standard construction BMPs would prevent degradation of surface waters. During site preparation and grading activities, soils in the construction area could become exposed, rutted, and compacted. Soil exposure, rutting, and compaction have the potential to increase water yields from the site, concentrate and channelize sheet flow, increase erosion rates, and increase sediment delivery to nearby water bodies. These effects, if unmitigated, could deliver sediment and nutrient loadings to the water bodies in the proposed area of the transmission lines. Again, BMPs for each construction phase would be implemented as part of a construction Storm Water Pollution Prevention Plan in compliance with Section 402 of the Clean Water Act.

In addition, with the use of heavy equipment, there is some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spilled fluid were to percolate into groundwater or directly enter an adjacent surface water body. To protect surface water and groundwater, hazardous fluid spill prevention and protection practices would be implemented in compliance with Spill Prevention, Control, and Countermeasure rules under the Oil Pollution Prevention regulations.

Operation – Impacts on surface water from the operation of the transmission lines would occur only during maintenance and repair to the lines. Maintenance and repair of the transmission lines would have the same possible impacts as construction activities, just to a lesser extent. The same mitigation measures and BMPs required by the appropriate authority would be used during maintenance and repair of these facilities as would be used during their construction.

Access Road

Several unnamed drainages would be traversed by the proposed access road. This access road would also run north of a stock watering pond. This small man-made pond receives surface water from a 500-acre drainage area and outlets to the Pinabete Arroyo. The access road alignment has been modified to avoid this feature.

Construction – Roads would be needed to enable access for both construction and long-term maintenance. Access roads must be sufficient to bear the weight and endure heavy construction vehicle use and other long-term use. Although existing access is available within the project area, some development of new access may be required. Roads would be upgraded or constructed in accordance with standard construction practices and in coordination with the Navajo Nation. It should be noted that the majority of the access road is currently approved for construction under the existing BNCC lease area SMCRA permit.

Permanent impacts to Waters of the United States would be 0.17 acres (7210.0 square feet). Impacts to surface water during the construction of the access road would be very similar to the impacts described above for the construction of the proposed power plant. General construction of the access roads could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water and by contamination from construction equipment and activities infiltrating area surface waters. However, implementation of construction BMPs would prevent degradation of surface waters and washes. During site preparation and grading activities, soils in the construction area could become exposed, rutted, and compacted. Soil exposure, rutting, and compaction have the potential to increase water yields from the site, concentrate and channelize sheet flow, increase erosion rates, and increase sediment delivery to nearby water bodies. These effects, if unmitigated, could deliver small quantities of sediment and nutrient loadings to the water bodies in the proposed area of the access roads. BMPs for each construction phase would be implemented as part of a construction Storm Water Pollution Prevention Plan in compliance with Section 402 of the Clean Water Act. In addition, with the use of heavy equipment, there is some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spilled chemical were to percolate into groundwater or directly enter an adjacent surface water body. Spill prevention and protection practices would be implemented to protect surface and groundwater from accidental hazardous fluid spills in compliance with Spill Prevention, Control, and Countermeasure rules under the Oil Pollution Prevention regulations.

Impacts on surface water quantity and quality from construction and maintenance of the proposed project access road would be similar to those from existing roads, and is expected to be negligible. The impact on surface-water quantity would be to increase, slightly, the amount of runoff over that from undisturbed land. This water would have slight amounts of petroleum products from truck traffic and some sediment, but the impact on receiving streams would be statistically impossible to quantify. Therefore, the impact on surface water from the proposed access road is defined as negligible.

Operation – Impacts on surface water from the operation of the access roads would occur during vehicle use and regular maintenance activities (assuming the roads are properly placed and maintained) and would be similar to impacts from construction activities except on a much smaller scale. The same mitigation measures and BMPs required by the appropriate authority would be used during use and maintenance of access roads as would be used during their construction.

Water-supply System

Construction – Impacts to surface water during well field construction would be very similar to the impacts described above for the construction of the proposed power plant. General construction of the well fields could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water and by contamination from construction equipment and activities infiltrating area surface waters. During site preparation and grading activities, soils in the construction area could become exposed, rutted, and compacted. Soil exposure, rutting, and compaction have the potential to increase water yields from the site, concentrate and channelize sheet flow, increase erosion rates, and increase sediment delivery to nearby water bodies. These effects, if not mitigated, could deliver small quantities of sediment and nutrient loadings to the water bodies in the proposed area of the well fields and water-transmission pipeline. BMPs for each construction phase would be implemented as part of a construction Storm Water Pollution Prevention Plan in compliance with Section 402 of the Clean Water Act. In addition, with the use of heavy equipment, there is some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spilled chemical were to percolate into groundwater or directly enter an adjacent surface water body. To protect surface water and groundwater, hazardous fluid spill prevention and protection practices would be implemented in compliance with Spill Prevention, Control, and Countermeasure rules under the Oil Pollution Prevention regulations. Construction activities would follow the guidelines of the Nationwide General Construction Permit.

Operation – Since the San Juan River originates in the mountains of southwestern Colorado, it is doubtful that there would be any hydrologic connection with the Morrison Aquifer. The location of the proposed well field would avoid residential areas and livestock wells. It is unclear whether there is a potential for impacts on surface water due to pumping of the Morrison Aquifer, since available data do not indicate conclusively whether changes in the water levels in the aquifer would affect conditions of nearby seeps and springs. As noted in the groundwater discussion below, seeps and springs would be monitored as required by the Navajo Nation Department of Water Resources. If adverse impacts are predicted, project operators would consult with the Navajo Nation on appropriate actions.

Water for the Navajo Mine expansion (primarily dust and fire control) would be supplied from the San Juan River under BNCC's existing water rights. The additional consumption of approximately 600 acre-feet per year (af/yr) associated with this expansion is within BNCC's existing consumptive right.

Mining Operations in BNCC Lease Areas IV South and V

Mining operations could have potential impacts to surface water in three areas: surface water quality, channel morphology, and depletion of stream flows.

Surface Water Quality

In accordance with OSM, USEPA, and NNEPA regulations for surface water discharges, no surface water from disturbed areas—including those used for coal combustion byproduct (CCB) placement—would be permitted to commingle with stormwater and discharge. Discharges from disturbed areas would occur only after the area is adequately reclaimed (i.e., area is regraded to approved topography, topsoil replaced, and revegetated) and operator has demonstrated using established models (e.g., SEDCAD) that post-mine sediment yields would be equal to or less than pre-mine levels per 40 CFR 434 Subpart H. Current OSM regulations for CCB disposal are provided in Chapter 2; any further rulemaking on this topic would be complied with as part of the proposed project. CCB disposal is discussed further as part of the groundwater section below.

Channel Morphology – Changes in runoff or in sediment yield from watersheds affected by mining have the potential to disrupt the existing stability of receiving streams, and in extreme circumstances, cause major changes in the existing channel pattern and geometry. Sediment control systems for mining operations are typically designed to yield a sediment load below equilibrium with the natural hydraulic regime. Erosion of streambeds and banks is usually expected for a short distance downstream of any discharge point, as the stream regains geomorphic equilibrium. Sediment 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.

Diversions of natural stream flow also are designed to preserve geomorphic stability and prevent uncontrolled or destructive erosion and sedimentation. Channel diversions on the BNCC lease area are designed using quantitative hydraulic modeling programs (e.g., SEDIMONT II) that simulate the geometry required to maintain geomorphic equilibrium in a natural channel. Where this is not possible, specific structures (such as grade-control structures) are designed and constructed in the channel to correct the problem. As with pond discharges, these channels and structures are regularly inspected and maintained by BNCC staff and reviewed by OSM and tribal inspectors.

Any impacts of the mine drainage system on natural stream patterns would be temporary and confined to the BNCC lease area. Because these variations would be far less than the natural variability of these arroyos and washes, and would include a small proportion of the affected washes, the impact of the mine on the geometry, morphology, or location of the natural stream patterns is expected to be negligible.

Depletion of Stream Flow – Sediment ponds are designed to detain water long enough to allow settling of suspended sediment, and 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 would allow some amount of surface water to be lost, either through infiltration into the ground or evaporation from the surface of the ponded water. This lost surface flow represents a depletion 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 in order to allow surface mine excavations and reclamation to proceed.

Within the BNCC lease area, it appears that the small amount of surface water flow lost by the mining operations would be further reduced by the large percentage naturally lost through infiltration in the receiving stream or wash. The increment of change in stream flow would, therefore, be too small to measure. Accordingly, there would be negligible to no surface-water quantity impacts from surface-water diversion, impoundments, and sediment ponds on the mining operations areas.

Mitigation to Reduce Impacts

Construction – General construction of the power plant site and associated facilities could indirectly affect surface water resources by increased stormwater runoff from the site carrying sediment and contamination loads into surface water and by contamination from construction equipment and activities infiltrating area surface waters. Mitigation for these possible impacts would include revegetation of temporarily disturbed areas. Proper native seed selection would result in grasses with deep root systems and denser foliage, which would increase local retention times and reduce site outflows. Internal site drainage would be accomplished through the use of open ditches and culverts. The ditches would be constructed to encourage infiltration of storm flows and would further reduce site outflows. Specific plans or proposed measures for fugitive-dust control, erosion, and sedimentation control, site reclamation, and stormwater-runoff control would be implemented as part of the construction process.

Sizing of the Pinabete Arroyo diversion is established by regulation at a capacity sufficient to safely convey the peak flows from a 10-year, 6-hour event. However, it is likely that the final design would be sized for larger flows to reduce the risks to the surrounding environment and to the mining operations. Where boxcut spoils impinge on the established channel of the Pinabete Arroyo, the spoils would be selectively handled to reduce the risk of significant sediment yield to the stream during the active pit life. The stream channel would be re-established during the final reclamation phase.

BMPs such as silt fences, straw bales, and other temporary measures, would be placed in ditches and along portions of the site perimeter to control erosion and meet National Pollutant Discharge Elimination System (NPDES) requirements during all construction activities. In order to protect the water quality of the San Juan River, Chaco Wash, and the smaller washes during construction activities, any and all of the BMPs required by the appropriate authorities would be implemented and maintained. These BMPs could include such measures as the installation of a double-walled silt curtain in the river or wash surrounding construction activities and installation of silt fencing and other erosion and sediment control measures when working in the floodplain to protect all adjacent wetland and drainage ways.

Surface waters in the proposed project area could be impacted by filling, bridging, or the installation of culverts during construction activities. Permanent impacts on Waters of the United States are shown in Table 4-9. These activities could have a localized adverse effect on the hydrological and biological functions of surface waterways and the stability of channel geomorphology. Mitigation measures for these impacts would include:

- Place all facilities outside of riparian area, where possible.
- Construct fords instead of culverts at access road crossings of dry washes or seasonal streams, where possible.
- Where culverts are required, design and install to accommodate flows associated with a 100-year flood event. OSM would require culverts to be designed for 10-year and 24-hour events.
- Where access roads cross a dry wash, the road gradient would be 0 percent to avoid diverting surface waters from the channels.
- Maximize the use of existing roads, minimizing the need for new road construction.
- Install appropriate water and sediment control devices at all dry wash crossings, if necessary.
- Avoid construction on potentially unstable slopes, where feasible.

Fueling activities would be restricted to the equipment staging area, away from drainages. To reduce the potential for water resource contamination, fuels would be stored and maintained in a designated equipment staging area, away from water bodies. A person(s) designated as being responsible for equipment fueling would closely monitor the fueling operation, and an emergency spill kit containing absorption pads, absorbent material, and other cleanup items, would readily be available in the event of an accidental spill. Depending on the amount of fuel stored onsite, Spill Prevention, Control, and Countermeasure regulations may require secondary containment around the fueling area. Following these precautions, the potential for an accidental chemical or fuel spill to occur and result in adverse impacts on surface water resources would be negligible. Fueling areas would be maintained in accordance with spill prevention control and countermeasure (SPCC) requirements.

Additional mitigation measures would be implemented for transmission line construction. Where the proposed transmission line would parallel an existing transmission line or other linear facility, the access road along the existing facility would be used where possible to minimize the amount of new road construction. In addition, the work area would be cleared of vegetation only to the extent needed. After construction, disturbed area not needed for normal maintenance of the transmission line would be graded to blend as near as possible with the natural contours, and revegetated with indigenous plant species. Areas would be reseeded prior to the season(s) when precipitation is normally received.

Mitigation measures following construction activities would include reseeding approximately 100 acres around the power plant site, 25 miles along the proposed transmission line, and 20 acres around the well field. Proper native seed selection would result in grasses with deep root systems and denser foliage, which would increase local retention times and reduce site outflows.

Operation – Impacts on surface water from the operation of the transmission lines and access roads would occur during maintenance and repair to the lines or roads. Maintenance and repair of the transmission lines and access roads would have the same possible impacts as construction activities, just to a lesser extent. The same mitigation measures and BMPs required by the appropriate authority would be used during maintenance and repair of these facilities as would be used during their construction.

The BNCC mining operations must comply with SMCRA and Clean Water Act 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.” (30 CFR Parts 700-877). The Clean Water Act requires that discharges to streams meet all applicable water quality standards. OSM approval 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.

Permanent impoundments, including seep discharges, must meet specific performance standards as outlined in 30 CFR 816.49 (b), including having water quality suitable for the intended post-mining land use (livestock grazing). BNCC will be required to submit information to OSM to demonstrate that permanent impoundments would meet performance standards. If any of the impoundments do not meet the performance standards, OSM would not approve them to be retained in the post-mining landscape.

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 stream flow inside and outside the permit area to the extent possible using the best technology currently available, and otherwise prevents water pollution (30 CFR 816.41(d)(1)). To comply with this requirement, sedimentation structures would be constructed near disturbed areas to impound surface water runoff and sediment. Discharge of the impounded surface water may be necessary to maintain the appropriate designed storage capacity after the storm event, or surface water discharge could result when the surface water runoff exceeds the design storm flow event. No water would be discharged that did not meet applicable water quality standards, irrespective of storage capacity.

4.2.1.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

Power Plant

The alternatively sized power plant under Alternative C would be located on the same site as the proposed project (Alternative B). Within the 592-acre leased area, the footprint of the power plant facilities would require approximately 110 acres, which is a reduction of about 39 acres compared to the proposed Desert Rock Energy Project.

Construction – Construction activities for the subcritical facility and the BMPs employed to reduce the impacts associated with construction activities, would be very similar to Alternative B. The total area for disturbance for construction activities at this site would be smaller, but the nature of the impacts would be the same. Permanent impacts on Waters of the United States would be 0.84 acre (36,653.80 square feet), which is 0.08 acre less than Alternative B.

Operation – The operation the subcritical facility would be almost identical to the operation of the Alternative B, with similar implications for water resources.

Transmission Lines

Construction – Construction activities for the subcritical facility transmission lines and the BMPs employed to reduce the impacts associated with construction activities would be very similar to those under Alternative B. The total area disturbed by construction activities at this site would be smaller, but the nature of the impacts would be the same.

Operation – The operation the subcritical facility transmission lines would be almost identical to the operation of Alternative B transmission lines, with similar implications for water resources. The total area disturbed by maintenance and repair activities for these transmission lines would be smaller, but the nature of the impacts would be the same.

Access Road

There is no difference in the access road between Alternative C and the proposed Alternative B. Therefore, impacts and mitigation measures would be the same under both alternatives.

Water-supply System

The average annual water use under this alternative would be a total of 4,450 af/yr for a period of 40 to 50 years. This water demand is somewhat smaller than the proposed alternative. Based on evaluations of the hydrologic characteristics of the Morrison aquifer, it is estimated that 9 to 18 new production wells could meet the anticipated water demand under Alternative C. This new production well estimate is slightly smaller than the estimate for Alternative B (10 to 20 wells), which would require about 11 percent less surface disturbance. As with the proposed alternative, each well would be networked to the water transmission pipeline mains that would deliver the water to the on-site water tank.

Construction – Construction activities for the subcritical facility water-supply system and the BMPs employed to reduce the impacts associated with construction activities, would be very similar to Alternative B. However, a smaller amount of wells would be needed to meet the water demand for the smaller power plant. The total area for disturbance for construction activities for this system would be smaller, but the nature of the impacts would be the same.

Operation – The operation the subcritical facility water-supply system would be almost identical to the operation of Alternative B water-supply system, with similar implications for water resources. However, there is less water pumped for this alternative (approximately 500 af/yr less) than Alternative B. As mentioned in the discussion of impacts to surface water from Alternative B, any connection between the use of the groundwater from the Morrison aquifer and stream baseflow (low flow) and spring flow would be monitored as directed by the Navajo Nation.

Mining Operations in BNCC Lease Area IV South

Construction and operational activities for the subcritical facility water-supply system and the BMPs employed to reduce the impacts associated with mining operations, would be very similar to the Alternative B. However, the Subcritical facility would use conventional haul roads rather than a conveyor to transport the coal from the mining areas to the power plant. This modification could cause more fugitive dust, increase the possibility of fuel leaks, and increase erosion in the proposed project area.

Another difference in this alternative is that less coal would be required to power the smaller plant, so the BNCC mining operation would not be expanded to Lease Area V. This would reduce the amount of surface disturbance required by nearly 8,000 acres. Not mining this additional area would lessen the surface water impacts discussed above in the Alternative B mining operation section.

Mitigation to Reduce Impacts

Construction activities for the subcritical facility and the BMPs employed to reduce the impacts associated with construction activities, would be very similar to Alternative B.

Mitigation measures following construction activities would include reseeding approximately 90 acres around the power plant site, 25 miles along the proposed transmission line, and 20 acres around the well field. Proper native seed selection would result in grasses with deep root systems and denser foliage, which would increase local retention times and reduce site outflows.

In addition, there is little to no difference in operations between Alternatives B and C. Therefore, operational mitigation measures for this alternative would be the same as Alternative B.

4.2.1.3 Summary of Surface Water Impacts

Under the No Action Alternative, negligible to minor, long-term adverse impacts would continue from existing land uses. Runoff from the agricultural and grazing lands has the potential to carry sediments, and possibly nutrients and other pollutants, to surface waters where they could degrade water quality. Because the region would need to meet its energy needs by purchasing power from other generation sources, the No Action Alternative could potentially contribute to indirect water resource impacts at other power plant sites in the region or, possibly, outside of the region.

Proposed construction and operation of a power plant and associated mining under Alternatives B and C would result in similar potential impacts on surface water resources. Initial studies have occurred to evaluate the potential for a hydrologic connection between existing artesian wells and groundwater,as described in Section 4.2.2 below. Once the power plant is operational, project operators would finalize a monitoring program with the Navajo Nation Department of Water Resources to track potential impacts on surface water from groundwater withdrawal; such a program would be developed based on data that is continuing to be collected. If adverse impacts are predicted, project operators would consult with the Navajo Nation on appropriate actions.

Emissions of mercury from the proposed power plant, in particular small quantities of mercury, would be deposited into the San Juan River and possibly the Navajo Reservoir and incrementally add to existing concentrations in the project area. Based on the results of air toxics modeling, it is estimated that the proposed power plant could release about 161 pounds of mercury per year via air emissions. The emitted mercury would consist of both particulates and vapors, and it is estimated that about 26.8 pounds of emitted mercury would be deposited on land or water within 25 km of the power plant stack. The actual quantity of mercury that could eventually be deposited in the San Juan River system or Morgan Lake is difficult to quantify and would be dependent upon precipitation and other factors. Currently, mercury concentrations in the San Juan River are well below established standards.

Diversions of natural stream flow or changes in runoff or sediment yield in areas affected by mining have the potential to disrupt the existing stability of receiving streams, and in extreme circumstances, cause major changes in the existing channel pattern and geometry. Channel diversions are designed using quantitative hydraulic modeling programs that simulate the geometry required to maintain geomorphic equilibrium in a natural channel. Erosion of streambeds and banks is usually expected for a short distance downstream of any discharge point as the stream regains geomorphic equilibrium. Sediment control systems for mining operations are typically designed to yield a sediment load below equilibrium with the natural hydraulic regime. With adequate on-site drainage and sediment control measures in place during the life of the project, potential impacts to surface water from streamflow diversions would be minor and long term.

Mines associated with the power plants in the region are designed for “total containment” (retention on-site) of surface runoff from disturbed areas. Because of the low precipitation and high evaporation rates, total runoff containment is feasible in the San Juan River Basin. Stormwater is typically ponded and used in the mining operation (e.g., dust control) or evaporated. However, the containment and consumptive use of surface runoff on the mine sites could lead to a decrease in flow downstream. In turn, this decreased quantity could affect the quality of the remaining streamflows due to changes in total dissolved solids and total suspended solids loading. With adequate on-site drainage and sediment control measures in place during the life of the project, potential impacts to existing streamflow volumes would be minor and long term.

4.2.2 Groundwater

4.2.2.1 Impact Assessment Methodology

Potentially adverse effects on groundwater supply directly attributable to the proposed project could fall into two broad categories of (1) reductions in groundwater flow currently or foreseeably assigned to existing and future uses, and (2) lowering of the groundwater table. Each of these effects might proximally or cumulatively result from the commitment of groundwater resources.

Reductions in groundwater flow could occur if groundwater diversions are sufficient to alter groundwater flow to existing wells, seeps or springs, or cause physical damage to the aquifer through dewatering. This effect could also be realized if the project caused a diminution of recharge at the site, either surface recharge or through subsurface flow.

Merely changing groundwater dynamics would not necessarily be a significant adverse effect if groundwater flow velocities simply adjusted to re-supply existing wells. However, if this disruption brought about the lowering of the water table, impairment of neighboring water rights could result. By increasing the depth to water, wells might become inoperative by reducing the water column and reducing pumping efficiency. This would result in increased energy cost to the well owner, increased maintenance of the pump and well, and possibly even lead to deepening or relocation of the well. This result would be particularly damaging to the rural and often low-income residents of the region.

Current well yields in the region suggest that the Morrison Formation, the targeted formation for the acquisition of groundwater, ranges between 0.38 and 3.98 gallon/minute/foot of drawdown and well discharge rates range between 4 and 135 gallons/minute (Dam et al. 1990). Common well construction practice is to set pumps approximately 100 feet below the projected drawdown. Thus an increased drawdown of 70 percent of this (70 feet) might be considered a significant adverse amount, causing an increase in depth to water for a water table well or a decrease in head for a confined aquifer and resultant increased power consumption by the well pumps.

As assessment of the magnitude of this effect is based on an estimate of pumping costs. Most of the wells within the project area are stock-watering wells, many of which have windmills. These wells do not experience an increase in pumping when the water level declines, so long as the decline is not a significant percentage of the standing water in the well. Those wells that do have pumps have relatively low annual pumping costs ($26/af) due to the need to pump only about 3 af/yr to meet stock-watering demand. While the total annual pumping costs are relatively small, many of the ranchers would be sensitive to even small increases in costs. The following definition of impact levels is thought to be conservative:

Impact Level	Percent Increase in Annual Pumping Cost ($)
Major	>200
Moderate	100-200
Minor	50-100
Negligible	20-50
None	<20

Impacts on groundwater quality would occur if the uses of the groundwater were impaired. Impairment would clearly result if water quality declined below established groundwater quality standards for established uses. This would include primary and secondary drinking water standards and standards for stock watering and irrigation. Industrial water use is very limited in the project vicinity and, in most cases, is already treated. The severity of these impacts would be influenced by the difficulty of finding alternate supplies or treatment. On the Navajo Indian Reservation, water quality standards are set by the NNEPA. For effects outside of the Reservation, State of New Mexico Standards, set by the Water Quality Control Commission, would be in effect.

Impact Level	Water Quality Criteria Exceeded
Major	Primary Drinking Water Criteria
Moderate	Secondary Drinking Water Criteria
Minor	Agricultural or Stock Watering Criteria
Negligible	Industrial Use Criteria
None	No Water Quality Standard

4.2.2.2 Environmental Consequences on Groundwater

4.2.2.2.1 No Action (Alternative A)

The No Action Alternative would have no effect on groundwater resources at or near the proposed project site. Existing activities at the site, primarily cattle grazing and rural domestic consumption, would cause minimal to no impact upon the existing groundwater system. Therefore, if existing uses are continued there would be little change.

4.2.2.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

Power Plant

Construction –Water would be required for construction of the plant and support of the site workers. The construction of an on-site water well would be the most logical way to supply this remote location, and this well could be one of the eventual supply wells. The small amounts used to support this effort would be equivalent to, or slightly more than, the level of current groundwater uses and therefore would not have a measurable impact outside of the project area.

As with almost any construction project involving the use of heavy equipment, there is also some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spilled fluid were to percolate into groundwater or directly enter an adjacent surface water body. Fuel products (petroleum, oils, hydraulic fluids, lubricant, etc.) would be needed to operate and fuel construction equipment.

Hazardous fluid spill prevention and protection practices would be implemented on all construction and equipment maintenance and fueling sites related to the project, as described in Section 4.2.1. Therefore, it is anticipated that there would be no measurable impact on groundwater from accidental hazardous fluid spills.

Operation – Other than the supply well field discussed below, operation of the power plant would not impact groundwater quantity. Any operation of a power plant has the potential for the improper or illegal disposal of contaminants that could migrate to the subsurface and impact groundwater quality. However, no injection of material into the subsurface is planned and any accidental spills or other surface discharges would be protected by the measures discussed under the surface water impacts. In addition, the plant would include a groundwater monitoring system and plan, including water level measurements, which would be determined through regulatory negotiation with NNEPA. A generic plan is described as part of the mitigation discussion below.

Concern has been voiced by stakeholders about the disposal of CCBs such as fly ash. A 2006 study by the National Academy of Sciences (NRC 2006) identified potential impacts on water quality from CCBs. The study suggested that, while there were no cases where water quality exceedences were directly attributable to the burial of CCBs, concern about proper management was warranted. Characterization of a mine CCB disposal site and of the materials placed in it was essential and the report recommended that characterization methods, including leach tests that are currently used by OSM permittees on the Navajo Nation, were the correct approach. The report suggested that SMCRA be amended to disseminate these methods throughout the industry. Reclamation plans need to specify how CCBs would be used and what sorts of covers are placed to prevent root invasion and uptake of trace elements. The report also suggested that monitoring plans be designed to target potential releases from CCB disposal areas, and establish performance standards.

The current Navajo Mine SMCRA permit stipulates all of these conditions and has been approved by OSM and the Navajo Nation. It is expected that these stipulations would also exist in the permit for BNCC Lease Areas IV South and V.

Transmission Lines

Construction – Impacts to groundwater during the construction of the transmission line would be very similar to the impacts described above for the construction of the proposed power plant. General construction of the transmission lines could affect groundwater resources by way of contamination from construction equipment and activities infiltrating the subsurface. To protect groundwater, hazardous fluid spill prevention and protection practices would be implemented.

Operation – Operation of the transmission lines is not expected to impact groundwater quality or quantity.

Access Road

Construction – Impacts to groundwater during the construction of access roads would be very similar to the impacts described above for the construction of the proposed power plant. With the use of heavy equipment, there is some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spilled chemical were to percolate into groundwater. Spill prevention and protection practices would be implemented to protect and groundwaters from accidental hazardous fluid spills.

Operation – Impacts on surface water from the operation of the access roads would only occur during vehicle use and regular maintenance activities, and would be similar to impacts from construction activities except on a much smaller scale. The same mitigation measures and BMPs required by the appropriate authority during construction would be used during use and maintenance of access roads.

Water-supply System

Part of both action alternatives is the location of a well field to provide 4,500 af/yr (plus 450 af/yr for Navajo municipal uses) for Alternative B and 4,000 af/yr (plus 450 af/yr for Navajo municipal uses) for Alternative C. There are two locations for the proposed well field that were modeled to assess potential impacts. One location is coincident with the southern boundary of the proposed project site, and the other is approximately 7 miles north of the plant. Ten equally spaced wells pumping at 307 gallons per minute were simulated. A slight difference in groundwater impacts exists between operating either or both of the sites. Although the supply lines and other infrastructure associated with the two sites are different, no difference in impact on groundwater is expected from these variations in construction.

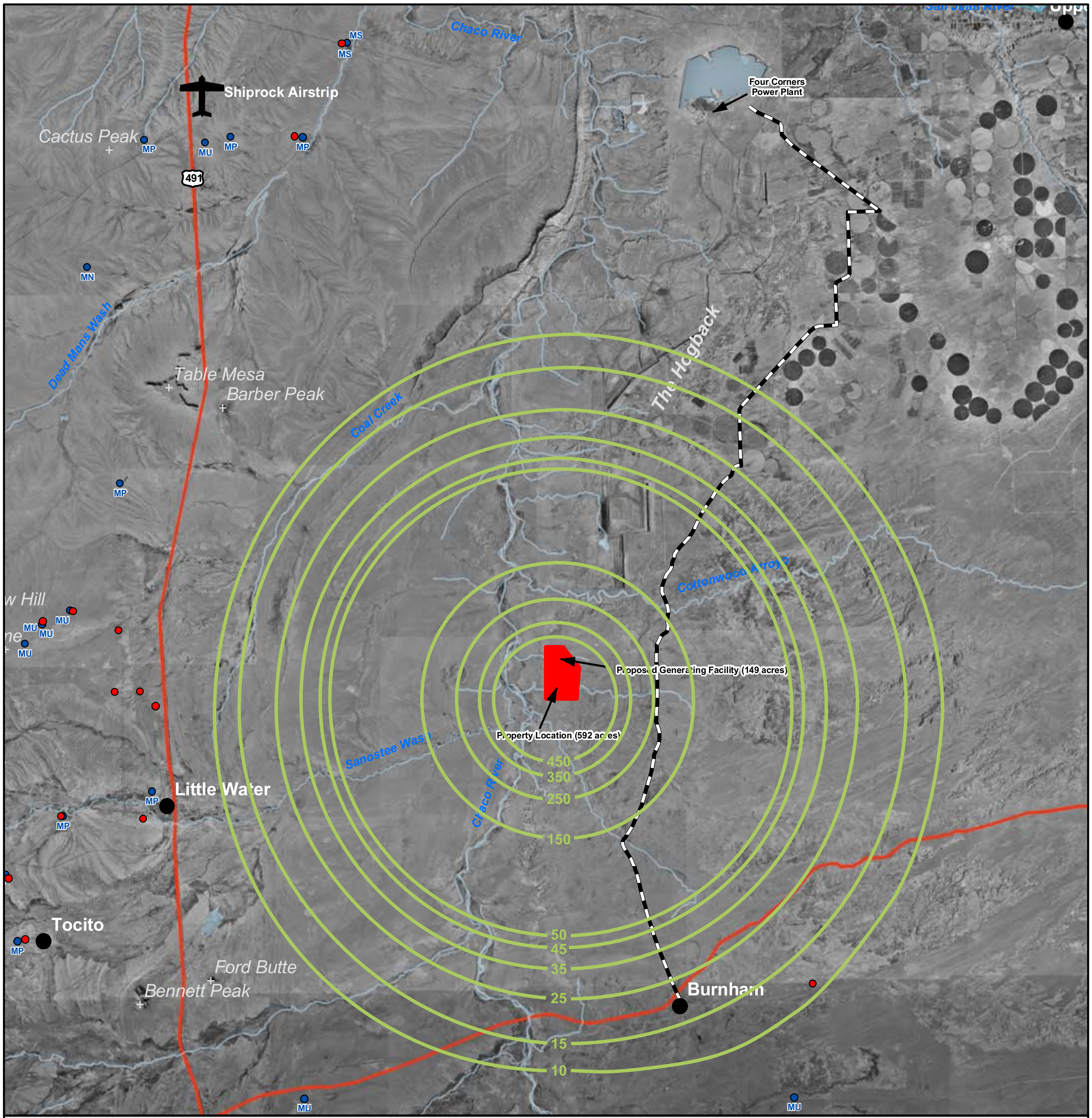
Construction – Impacts on groundwater during the construction of the well fields would be very similar to the impacts described above for the construction of the proposed power plant. Similar protective measures described in that section would apply. The construction of wells always has the potential for contamination of groundwater if done improperly. Specific drilling requirements and regulations written by the Navajo Nation Department of Water Resources would apply to these wells and be enforced during construction.

Operation – A groundwater predictive computer model (Miller Brooks 2007a), using the program MODFLOW, was constructed to evaluate the various combinations of well locations under Alternative B. The model boundaries were constructed as a rectangle, from near Morgan Lake south to Burnham and from Shiprock east to Fruitland. The source aquifer was the Morrison Formation, assumed to be confined and at a constant thickness of 600 feet. Hydraulic conductivity for the Morrison Formation was estimated at 0.075 to 0.175 ft/day. Simulations were run for 20 years and for 40 years. Drawdown contour lines of ten feet or greater were mapped onto the model surface (see Appendix B for more information on the well impact studies, including figures of drawdown contours).

At the center of the northern portion of the proposed well field, reductions in the potentiometric head were 1,885 feet for the 20-year simulation and 2,010 feet for 40 years. The southern portion of the proposed well field incurred drawdowns of 1,920 feet for 20 years of pumping and 2,020 feet for 40 years of pumping. If both well field locations are used, the maximum drawdown would be experienced at the southern center, and would total 960 feet for 20 years of pumping and 1,020 feet over 40 years.

The 10-foot contour line reaches one well registered by the New Mexico State Engineer's Office (see Figure 4-1). There are no wells at the proposed well field locations. No well is predicted to be significantly impacted because 10 to 15 feet of drawdown is less than the level of significance, using the criteria identified in Section 4.2.2.1. Although the deep reduction in potentiometric head predicted by the model could impact future use of water at the site, it is not expected that there will be any users in the immediate vicinity other than the proposed project; alternative sources of water are available and could be conveyed to the site, if needed. The project proponents would continue to refine and calibrate the ground water model following construction, installation, testing, and logging of test and monitoring wells.

P:\Sithe\gis\plots\wells\Draw_Down.pdf



Legend

🔴	New Mexico Office of the State Engineer Registered Well Location
🔵	Navajo Nation Department of Water Resources Registered Well Location showing well ID
MP	Indicates well produces primary volume of groundwater from the Morrison Formation
MS	Indicates well produces secondary volume of groundwater from the Morrison Formation
MN	Indicates well produces no significant volume of groundwater from the Morrison Formation
MU	Indicates well produces unknown volume of groundwater from the Morrison Formation

NOTE: Drawdown contours are based on 40-year projections.

—	Rivers/Streams
—	Roads
—	Groundwater Drawdown Contour
▬ ▬	Burnham Road

Source:
Navajo Nation Department of Water Resources, 2005.
New Mexico Office of the State Engineer, 2003.
New Mexico Resource Geographic Information System (RGIS), 1988.
ESRI Data, 2004.
MBE 2007

0 2.5 5
Miles
UTM, NAD83, Zone12, Meters

N W E S

FIGURE 4-1
WELL DRAWDOWN IMPACTS DUE TO PUMPING

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Predictable impacts to groundwater quality cannot be measured with a computer model because there are no elements of the proposed action or alternatives that are intended to add contaminants to the subsurface. Since the site and facilities would be permitted and regulated by tribal and Federal agencies, it is assumed that these programs would provide all protective actions consistent with the law. In addition, corporate policy of the operators would further ensure that no pollutants would be allowed to migrate to the subsurface. Although a specific groundwater monitoring plan would be dependent upon the regulatory requirements of these tribal and Federal agencies, a generic description of USEPA groundwater monitoring used in other programs is included in the mitigation section below for reference.

Initial studies to analyze samples from artesian well locations in Burnham and Sanostee Chapters were conducted to evaluate the potential for a relationship between those water sources and the Morrison Aquifer. The Burnham Chapter artesian wells and the Morrison Aquifer analysis showed the two water sources have dissimilar geochemical “footprints” (MBE 2007a). The geochemical comparisons of samples from the Sanostee Chapter do not conclusively indicate a similarity or dissimilarity with respect to the geochemical “footprints” of either water source (MBE 2007b). Further sampling from test wells at the proposed water well field B will assist in determining classification of the water supply and any geochemical footprint between the Morrison Aquifer and seeps and springs, as well as provide more information on the depth and quality of groundwater.

Subsidence in alluvial aquifer systems could occur due to compression of unconsolidated sediments. Also, the removal of cavity filling material and dissolution of the 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 aquifers in the study area are not comprised of limestone and the groundwater withdrawal is not expected to have any measurable impact on the alluvial sediments.

Mining Operations in BNCC Lease Areas IV South and V

Under the contemporaneous reclamation strategy advanced by BNCC, construction, operation, and reclamation of all mining at Navajo Mine is inseparable. These BNCC mining operations must comply with SMCRA regulations, which require that the permittee

> “minimize the disturbance to the prevailing hydrologic balance of the mine site and in associated areas and to the quality and quantity of water in surface and groundwater systems both during and after surface coal mining operations and during reclamation . . .” (30 CFR §1265)

At present, the mine plan for the new lease areas has not been fully developed and approved by OSM (a preliminary mine plan is provided in Appendix D). The approved plan would comply with SMCRA and would address potential disturbance to the hydrologic balance and the detailed steps to avoid disturbance. The approval of the permit would be a major Federal action, as such, triggering analysis of the plan in accordance with the National Environmental Policy Act (NEPA). While nothing can be said about the specific threats and remedies offered by the plan at this time, potential impacts to the groundwater balance that would be addressed in mining plans include:

- The disruption of coal-seam aquifers in the mined out area
- The disruption of shallow alluvial aquifers during mining and recovery during reclamation
- The chemical contamination of shallow and deep aquifers by mining activities
- The contamination of groundwater by the placement of coal waste and/or CCBs

Each of these threats is possible in Lease Areas IV South and V and each has been successfully mitigated during the construction and operation of the existing Navajo Mine. There is no particular challenge to these mitigation methods offered in the IV South and V lease areas. Therefore, with the exception of the loss of the coal-seam aquifers that are mined out, there would be no adverse impacts at the new mine to groundwater expected to be created by either of the action alternatives.

Loss of the coal-seam aquifers would occur under both of the action alternatives. Mining out of the coal destroys the portion of the aquifer supported by the coal seam and any permeable interburden. Re-saturation of the reclaimed subsurface (minus the coal seams) is not predictable, if even possible. Most of the coal seams mined by the existing Navajo Mine are dry.

Water quality studies of the few coal-seam aquifers at Navajo Mine indicate that the quantity of water available is erratic, and of poor quality, with total dissolved solids up to 17,800 ppm (Link and Kelly 1980). Consequently, they are not currently used. While some of these aquifers could be used in the future for irrigation or other non-drinking water uses, there are alternate, shallow sources of higher quality water to accommodate the current projected demand in the area. Water from Morgan Lake that contains selenium and is used for dust suppression would not impact ground water selenium levels.

Coal seams in the Fruitland Formation directly overlie the Pictured Cliffs Sandstone, which also would be affected by coal mining, in places where the lowest seam is mined. However, any wells located in the lease area are expected to be abandoned or replaced. In addition, most wells in the Pictured Cliffs are high in dissolved solids and not suitable for agricultural or domestic uses (Link and Kelley 1980).

4.2.2.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

There is no measurable difference in the expected groundwater quantity or quality effects from the construction and operation of the 550 MW subcritical facility. Alternative B proposes the use of 4,500 af/yr (4,950 total), while Alternative C proposes the use of 4,000 af/yr (4,450 total). Modeling provides virtually identical results for groundwater impacts between Alternatives B and C. The same water demand would be required and the same well field would be constructed. A smaller foot print would be required for the facility, but there would be no scientifically discernable difference in potential spills or discharges of pollutants and infiltration to groundwater. There would be no change in the operation of the BNCC Lease Area IV South with regard to CCB disposal, and no change in the potential for CCB impact on groundwater. Lease Area V would not be developed to support the project.

4.2.2.2.4 Mitigation to Reduce Impacts

General construction of the power plant site and associated facilities could indirectly affect groundwater if uncontrolled spills or leaks of hazardous or degrading materials either leach and infiltrate or directly infiltrate to groundwater. In the case of the proposed project, spill prevention and control methods, surface water control methods, material handling regulatory requirements, and BMPs are a standard operating condition of the construction industry. It is assumed that active inspection and regulation of the site by Navajo Nation and Federal agencies would assure that these mitigation measures are accomplished.

These same conditions would apply to the transmission line construction. For the construction of the mine extension, these same measures would be followed with the addition of oversight by Navajo Nation and OSM surface mine inspectors.

Construction and Operation of the Project under Alternatives B and C

The primary threat to groundwater quality from the generation and transmission system would be from spills and leaks of hazardous and water quality degrading materials. The plant would operate under a myriad of tribal and Federal hazardous materials regulations, most importantly Resource Conservation and Recovery Act, which together comprise the most advanced waste management control system applicable.

Monitoring wells would be constructed as another source of groundwater protection and mitigation. Well data would be used to determine threats to both water quality and quantity, in areas close to the supply well field. Locations and monitoring plans await final design of the physical plant and cannot be determined at this point.

Monitoring of seeps and springs in the area would be the responsibility of the Navajo Nation Department of Water Resources, as a function of their authority over tribal water rights. A monitoring plan would be stipulated in the lease agreement for the proposed project after negotiations between the Navajo Nation and the project proponents. A long-term monitoring plan would be developed based on data that is continuing to be collected about the project area.

Operation of the transmission line would pose no measurable impact to groundwater. Contemporaneous reclamation, the preferred mining method used at Navajo Mine, implies that construction and operation of the mine is essentially the same continuous activity. Operation of the IV South and V lease area mine would include the same mitigation measures as were identified for construction.

Construction activities for the Alternative C subcritical facility, water supply well field, and transmission lines and the BMPs employed to reduce the impacts associated with construction activities would be very similar to Alternative B. The total area disturbed by construction activities at this site would be smaller, but the nature of the impacts would be the same.

The operation of the Alternative C water supply well field and transmission lines would be almost identical to the operations under Alternative B, with similar implications for water resources.

Groundwater Monitoring System

Any groundwater protection plan would require an exact understanding of the operation of the facility and general layout of the site. This is not known at present. In addition, there are specific Navajo Nation and Federal regulatory agencies that would consult with Desert Rock staff on the details of the monitoring plan. For these reasons and others, there is no groundwater monitoring plan at present. Nevertheless, there are certain generic aspects to an efficient and protective plan that would be part of the groundwater protection plan eventually designed for the proposed project.

The primary method for protection of groundwater from operation of the generating station would be a series of monitoring wells drilled to a designated subsurface point of compliance. In addition, monitoring of these wells for water level would provide an indication of the extent of that impact. Standard NNEPA methodology for designing monitoring systems is very similar to USEPA. It would include a series of wells drilled to points in the subsurface that are chosen as to intercept any downward migration of surface or shallow subsurface leaks or spills. Generally such points are constructed as monitoring wells, at a minimum one upgradient and two downgradient of the plant operation so that a direction of contaminant movement can be estimated.

From the groundwater data, Desert Rock staff would select the most likely location for the first appearance of a pollutant release from the facility. This location would be negotiated with the regulatory agency. A well would be constructed at the surface location and depth. This well would be the point of compliance (POC) for the future monitoring program. Groundwater monitoring wells should be placed to monitor both possible CCB impacts and any mine-related impacts

Over the first year or two prior to site operation, it might be advisable to collect data from the POC and other wells to establish the background concentration, if measurable, of any pollutant used at the site that could be released in a spill or leak. This value would be averaged or otherwise statistically reduced to accommodate seasonal changes in groundwater dynamics or other natural variability. From these data and interpretation, a pre-existing level of contaminant concentration would be estimated. This could include naturally variable metals and inorganic elements, on-site migrating organic compounds, nitrates, or other anthropogenic (human-caused) pollutants. This step is essential to understanding if the presence of a pollutant is actually due to activities at the proposed project or off-site generators. All eight Resource Conservation and Recovery Act (RCRA) toxins should be analyzed (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) as well as boron and aluminum, as these metals occur frequently in CCBs.

Once background data and its seasonal variability has been established, Desert Rock staff would work with regulatory staff at NNEPA to establish the levels of contaminant concentration in wells that suggest a pollutant release at the proposed project, the so-called alert levels for each pollutant. Alert levels generally are tied to specific remedial responses by the facility. In general, groundwater protection plans use an elevating threat method of approaching alert level exceedences and an increasing need for explanatory investigation of the exceedence. In many plans these responses are negotiated as part of the permitting process.

If a release is documented, NNEPA could require a remedial action plan, which might include a full RCRA investigation and remediation. Alternatively, a simple investigation and rapid response clean-up might be a more effective strategy. These actions are usually negotiated with the agency, with possible concurrence by USEPA and Bureau of Indian Affairs (BIA). If the release impacts off-reservation groundwater, NMED might also require action.

4.2.2.3 Summary of Groundwater Impacts

Under the No Action Alternative, little change on the groundwater system would occur.

The construction and operation of any power plant and associated facilities has a possibility to result in impacts on groundwater quality in the absence of regulation. However, adverse impacts are not predicted for either the proposed Alternative B or Alternative C because mitigation measures, BMPs, and appropriate permitting would prevent any significant impacts to water resources. The mitigation includes additional protective elements provided by a generic groundwater monitoring plan similar to those required by USEPA, State, or tribal regulatory agencies.

Operation of the power plant and associated facilities would involve groundwater withdrawals from the Morrison aquifer that could affect local springs and seeps in the area. If approved, once the power plant is on-line, project operators would finalize a monitoring program with the appropriate regulatory agencies to determine the potential for long-term impacts to surface water from groundwater withdrawal. If adverse impacts are predicted, project operators would consult with the Navajo Nation on appropriate actions.

4.3 BIOLOGICAL RESOURCES

This section addresses potential impacts to vegetation, wildlife, and special status species that could result from air, water, and noise pollution, as well as from infrastructure-related and human-related disturbances from development of the Desert Rock Energy Project. Potential impacts to federally listed threatened, endangered or as candidate species and to special status species, such as those listed by the Navajo Endangered Species List are detailed in the project Biological Assessment (BA) and Biological Evaluation (BE) and are provided in Appendix G. This section summarizes the potential impact determinations detailed in the BA and BE.

4.3.1 Impact Assessment Methodologies

Information used to compile this section was gathered from data collected during field-based evaluations conducted in 2005 and 2006, from reviews of published literature, and from the project *Ecological Risk Assessment* (Appendix J). Potential impacts to vegetation resulting from impacts to air quality closely follow recommendations made by *The Federal Land Managers' Air Quality Related Values Work Group* (FLAG) which was formed to develop a more consistent approach for the Federal land managers to evaluate air pollution effects on their resources.

Impact analyses and conclusions are based on the best available scientific literature, a thorough analysis of the potential effects of the project, and the professional judgment of the wildlife and fisheries biologists and ecologists who completed the evaluation. Impacts are quantified where possible. In the absence of quantitative data, best professional judgment was used. For biological resources, an impact would be considered significant if it resulted in a substantial loss of habitat function or the disruption of life history requirements of a species, or population segment, which would make them eligible for listing under the Federal Endangered Species Act (ESA) or a substantial loss of habitat function or disruption of life history requirements of special status species that would preclude improvement of their status.

4.3.1.1 Field Investigations

Intensive biological investigations, including species-specific surveys for federally listed and special status plants and animals were conducted during both the 2005 and 2006 field season by biologists and botanists from Ecosphere Environmental Services (Ecosphere). In addition to surveys completed specific to the proposed action, since 2002 biologists and botanists from Ecosphere have conducted numerous biological and botanical investigations within and adjacent to the boundaries of Navajo Mine, the Four Corners Generating Station, Shiprock and Nenanhazad Chapters, and along the eastern end of the Navajo Transmission Project, all areas within or immediately adjacent to the analysis area for the proposed project.

4.3.1.2 Literature Reviews

Extensive literature resources were reviewed in preparation of this biological resources impact section. Citations from pertinent literature are provided within the text. A notable reference resource was *The FLAG Phase I Report* (FLAG 2000), which provided a recommended framework for addressing the effects of ozone impacts and particulate deposition on plants and organisms.

4.3.1.3 Evaluating Risk of Particulates to Plants, Soil Invertebrates, and Wildlife

Potential risks to ecological receptors from the proposed plant's chemical emissions were evaluated in combination with the concentrations of these chemicals already present in the environment, to the extent that existing conditions are known. The risk analysis generally followed risk assessment procedures developed by USEPA (1992 and 1998b). Details of the ecological risk evaluation are presented in Section 4.0 of Appendix J. The ecological assessment includes a **screening** process where chemicals of potential ecological concern (COPECs) are selected and the subsequent **risk-based assessment** where site-specific risks and impacts are evaluated.

Soil and vegetation samples were collected for chemical analysis of metals. Results were used as baseline concentrations in the assessment of impacts from airborne dispersal and deposition of particulates on soils and plants, and ultimately, on wildlife and humans. By collecting soil and vegetation metals data, site-specific uptake rates could be generated for use in estimating metals concentrations in plants after 50 years of operation. Details of the soil and vegetation sampling are provided in Section 2.0 of Appendix J.

Twenty-four sampling locations within a 25-km radius air impact area (1,962 km^2) were sampled in June 2006. At each location, samples of four media were collected:

- Surface soil (0-2 centimeters [cm])
- Subsurface soil (2 cm down to the root zone [typically less than 40 cm])
- Vegetation leaves and stems
- Vegetation roots or tubers

ENSR (Conners 2006) modeled particulate deposition rates (wet, dry, and total) of the proposed boilers using CALPUF and 3 years of meteorological data (2001-2003). Wet deposition dominated the total deposition rates in all 3 years. The area of wet deposition was sampled along with areas in the two down-wind/dry deposition directions.

The plant species collected (one species per location) included the following:

- Shadscale (*Atriplex confertifolia*)
- Alkali saccaton (*Sporobolus airoides*)
- New Mexico saltbush (*Atriplex obovata*)
- Four-winged saltbush (*Atriplex canescens*)
- Torrey's ephedra (*Ephedra torreyana*)
- Broom snake weed (*Gutierrezia sarothrae*)

Each soil and plant sample was analyzed for the eight naturally occurring RCRA metals most likely to represent a health concern for either human or ecological receptors—arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Six of these metals (excluding barium and silver) are also listed as HAPs that could be deposited on soil and plants in the air impact area.

Summaries of surface, subsurface, and surface-subsurface soil (combined) results are shown in Tables 2.1-1, 2.1-2, and 2.1-3 in Appendix J. The combined soil summaries are based on the higher of surface or subsurface soil concentrations at each sampling location.

Concentrations of metals in surface soils were found to not be substantially different from area to area. A similar pattern of metals concentrations among areas was seen in the subsurface soils. Differences among metal uptake rates in the various plants (subsurface soils to upper plant parts) and in the exposure areas also were examined.

Because different plants were sampled in the three exposure areas, uptake rates varied among areas and among plants, and uptake rates were different for each metal, the overall combined 90th percentile uptake rates for each plant part (upper or lower) and each metal are used in the subsequent analyses. Summaries of plant uptake rates (ratios of subsurface soil to upper plant parts and subsurface soil to lower plant parts [i.e., roots]) are shown in Tables 2.1-4 and 2.1-5 in Appendix J. All uptake rates are based on dry-weight metals concentrations.

4.3.1.3.1 Screening

The ecological screening phase is a conservative evaluation used to select COPECs. The goal of the screening process is not to provide an indication of potential for risk, but rather to identify chemicals that may warrant further evaluation using more detailed procedures. Sources for soil (terrestrial) ecological screening levels (ESLs) for metals include: (1) USEPA's *Ecological Soil Screening Levels* (2005), and (2) the Los Alamos National Laboratory (LANL) Ecorisk Database Release 2.2 (2005).

Two metals (mercury and selenium) have estimated 50-year concentrations in soil that exceed ESLs and are therefore considered COPECs. Estimated concentrations of the COPECs, which include deposition plus baseline, in both the 0-2 and 0-10 cm depth profiles exceed the respective ESLs. The higher of these two soil estimates for each metal are used as exposure point concentrations (EPCs) as these two metals are carried forward into the risk-based assessment. The mercury EPC is 2.69E-02, and the selenium EPC is 8.33E-01.

The estimated concentration of bis(2-ethylhexyl)phthalate in soil (2.5E-02) after 50 years of plant operation also exceeds a conservative ESL from LANL (2005) for birds (2.0E-02). It does not exceed the ESL for mammals (5.9E-01). Bis(2-ethylhexyl)phthalate is not carried forward into the risk-based assessment, however, because the modeled soil concentration does not take into account the several conservative factors that act preferentially to reduce organic compound concentrations.

4.3.1.3.2 Risk-based Assessment

The risk-based assessment includes six steps, as described below.

Problem Formulation

Three key aspects of the Problem Formulation are assessment endpoints, associated testable hypotheses, and measurement endpoints (measures of effect) to determine whether a potential risk to the assessment endpoint exists.

Assessment endpoints are explicit expressions of the actual ecological value that is to be protected; typically this is defined by an ecological entity and its attributes. Two elements are required to form an assessment endpoint. The first element is the identification of the specific valued ecological entity. This can be a species (e.g., red-tailed hawk), a group of species (e.g., avian herbivores), a community (e.g., soil invertebrates), an ecosystem function or characteristic, or a specific habitat. The second element is the set of characteristics or attributes of the entity of concern that is important to protect and potentially is at risk. Therefore, it is necessary to define what is important for avian herbivores (e.g., survival growth and reproduction) or a plant community (e.g., viability and function). Together "viability and function of the plant community" form the assessment endpoint.

In this risk-based assessment, testable hypotheses are specific risk questions that are based on the ecological values to be protected (e.g., assessment endpoints such as avian herbivores) and what responses those ecological values may show when they are exposed to a stressor. In this evaluation the stressors are the COPECs of mercury and selenium.

Measurement endpoints (measures of effect) are measurable or quantifiable changes in an attribute of an assessment endpoint in response to a stressor to which it is exposed.

A summary of assessment endpoints (in bold type) and associated testable hypotheses and measurement endpoints is presented below. The testable hypotheses are based on concentrations on estimated COPECs concentrations after 50 years of Desert Rock power plant operation. All of the wildlife species listed as receptors (ecological entity exposed to the stressor) are known to occur in the site area.

The general strategies used to evaluate ecological risks in the risk-based assessment are: (1) comparisons of the exposure concentration in soil with a toxicity reference value (TRV) for plants or soil invertebrates, or (2) comparisons of the dietary dose for a wildlife receptor with a dietary TRV. In the evaluation, TRVs are selected based on both no effect (e.g., no adverse observed effect level [NOAEL]), and low effect (e.g., lowest observed adverse effect level [LOAEL]) concentrations or doses to provide a range in the potential for effects.

Viability and Function of the Plant Community

Testable Hypothesis 1 – Are the concentrations of COPECs in soils sufficient to impair the viability and function of the plant community?

Measurement Endpoint 1 – Conservative exposure concentrations of COPECs in soil are compared with plant TRV concentrations available for screening and risk assessment.

Viability and Function of the Soil Invertebrate Community

Testable Hypothesis 2 – Are the concentrations of COPECs in soils sufficient to impair the viability and function of the soil invertebrate community?

Measurement Endpoint 2 – Conservative exposure concentrations of COPECs in soil are compared with invertebrate TRV concentrations available for screening and risk assessment.

Survival, Growth, and Reproduction of Birds and Mammals (Herbivores)

Testable Hypothesis 3 – Are the concentrations of COPECs in the upper portions of plants sufficient to impair the survival, growth, and reproduction of birds and mammals described as herbivores?

Measurement Endpoint 3 – To evaluate this assessment endpoint in the evaluation, the dietary dose that a wildlife receptor receives from plants and soils is compared with TRVs from the literature. TRVs for each soil COPEC representing NOAEL and LOAEL doses are selected or developed to provide a range in potential effects in the evaluation. The herbivorous receptors used in the assessment are the horned lark (*Eremophila alpestris*) and the black-tailed jackrabbit (*Lepus californicus*). Both receptors are assumed to ingest upper portions of plants.

Survival, Growth, and Reproduction of Birds and Mammals (Insectivores)

Testable Hypothesis 4 – Are the concentrations of COPECs in soils sufficient to impair the survival, growth, and reproduction of birds and mammals described as insectivores (a subset of carnivores)?

Measurement Endpoint 4 – To evaluate this assessment endpoint in the evaluation, the dietary dose that a receptor receives from soils and soil invertebrates is compared with TRVs from the literature. TRVs for each soil COPEC representing NOAEL and LOAEL doses are selected from the literature to provide a range in potential effects. The insectivorous receptors used in the assessment are the western meadowlark (*Sturnella neglecta*) and the deer mouse (*Peromyscus maniculatus*). It is assumed that the deer mouse eats primarily insects, although it also reportedly eats seeds and some green vegetation (USEPA 1993).

Survival, Growth, and Reproduction of Birds and Mammals (Carnivores)

Testable Hypothesis 5 – Are the concentrations of COPECs in soils sufficient to impair the survival, growth, and reproduction of higher tropic level carnivorous birds and mammals?

Measurement Endpoint 5 – To evaluate this assessment endpoint in the evaluation, the dietary dose that a receptor receives from soil and from small mammalian prey is compared with TRVs from the literature. For the assessment, TRVs for each COPEC representing a NOAEL and LOAEL are selected from the literature. The carnivorous receptors used in the assessment are the red-tailed hawk (*Buteo jamaicensis*) and the kit fox (*Vulpes macrotis*).

Exposure Analysis

Exposure of receptors would occur through direct contact (i.e., direct exposure) or through the ingestion pathway. For both types of exposure, the EPC of each COPEC must be estimated. Metals concentrations from the 0-2 cm assumed mixing depth profile are used as EPCs. Exposure of the receptors is illustrated in the conceptual site model (CSM) diagram in Figure 4.2-1 in Appendix J. The principal release mechanism is Deposition – Wet, Dry, and in the direction of the Prevailing Winds. Exposure pathways expected to be complete (and evaluated) are shown with a “C” under each receptor. Plants and soil invertebrates are in direct contact with COPECs in soils. Ingestion-pathway exposures of the vertebrate receptors are estimated as average daily doses (ADDs) using the approach outlined in USEPA (1993) as follows:

For food and soil:

$$ADD = [(IR_f*C_f) + (IR_s*C_s)] * BA*AUF/bw$$

where:

IR_f = Ingestion rate of food (kg/day)
IR_s = Ingestion rate (incidental) of soil/sediment (kg/day)
C_f = Concentration of COPEC in food (mg/kg)
C_s = Concentration of COPEC in soil (mg/kg)
BA = Bioavailability of COPEC in soil and food (assumed to be 1.0)
AUF = Area use factor (assumed to be 1.0)
bw = Body weight of the receptor (kg)

Concentrations of COPECs in plants or prey organisms ingested by terrestrial wildlife in 2056 (following 50 years of plant operation) are estimated by the application of a bioconcentration factor (BCF) or bioaccumulation factor (BAF) to the calculated soil EPC for the COPEC:

$C_f = BCF*C_s$ or

$C_f = BAF*C_s$

As described above, BCFs for plants and the six metals of interest were calculated from site-specific data for subsurface soil and plant upper portions (leaves and stems). These site-specific BCFs were then applied to 50-year soil column (0-10 cm) concentrations to estimate metals concentrations in plants after 50 years when projected soil concentrations reach anticipated maximums due to aerial deposition of particulates. BCFs from the literature are used with 50-year soil (0-10 cm) concentrations to estimate metals concentrations in soil invertebrates. BAFs are used with 50-year surface soil (0-2 cm) concentrations to estimate concentrations in small birds or mammals (prey organisms).

Ecological Impacts of Contaminants

The effects of contaminants on ecological receptors can be based on direct comparisons of TRVs with measured concentrations in the abiotic exposure media expressed as mg/kg or mg/L, or effects can be based on comparisons of the reference doses with estimated doses that a wildlife receptor receives from the environment. Doses are expressed as mg/kg-body weight/day.

To evaluate potential risks to plants and soil invertebrates, comparisons of EPCs were made with 10 times the ESLs, used to represent lowest observed effect concentrations (LOECs).

In accordance with assessment endpoints involving survival, reproduction, development, and/or growth for the terrestrial-feeding wildlife, appropriate dietary toxicological endpoints (i.e., doses) for COPECs were reviewed for application in the evaluation. Both LOAEL and NOAEL values are applied in the evaluation to provide a range of risk assessment results for wildlife. The primary source for all ingestion pathway TRVs is the LANL.

Risk Estimates

Risk estimates, expressed in terms of hazard quotients (HQs), based on both NOAELs and LOAELs or equivalent benchmarks to provide a range of predicted outcomes, and were calculated for each appropriate receptor group for the site.

$$HQ = EPC \text{ or } Dose / TRV$$

HQs are interpreted as follows:

- HQ_{NOAEL} <1 suggests no risk.
- HQ_{NOAEL} >1 but HQ_{LOAEL} <1 suggests potential risks, and the uncertainty associated with this conclusion must be evaluated further.
- HQ_{LOAEL} >1 suggests potential risks.

Although the HQ is not a definitive measure, it can be used to estimate the potential level at which the measured or predicted exposure (EPC or Dose) relates to known levels at which adverse effects have been observed in laboratory toxicological studies or found not to be statistically significant (the LOAEL and NOAEL, respectively). Nevertheless, these HQs contribute to the "line-of-evidence" for interpreting the potential for ecological risks.

Risk Estimate Results

Results of the risk estimation process in terms of HQs are provided in the following tables. These results are discussed further in the vegetation and wildlife sections below and in the Ecological Risk Assessment in Appendix J.

Table 4-10 Risk Estimate Results in Hazard Quotients (HQs) for Plants and Soil Invertebrates

Analyte	Concentration in Soil After 50 Years of Deposition (mg/kg)	Plant Surrogate LOEC (mg/kg)	Plant HQ	Soil Invertebrate Surrogate LOEC (mg/kg)	Soil Invertebrate HQ
Surface Soil (0-2 cm)					
Mercury	2.41E-02	340	7.09E-05	0.5	4.82E-02
Selenium	3.20E+00	1	3.20E+00	77	4.16E-02
Soil Column (0-10 cm)					
Mercury	2.15E-02	340	6.32E-05	0.5	4.30E-02
Selenium	9.98E-01	1	9.98E-01	77	1.30E-02

Source: URS 2007
Hazard Quotients exceeding 1.0 are shown in bold.
cm = centimeters
ESL = Ecological Screening Level. See LANL (2005) in Table 4.1-1
HQ = hazard quotient; concentration in soil/ESL
LANL = Los Alamos National Laboratory
LOEC = lowest observed effect concentration; estimated at 10 X ESL
mg/kg = milligrams per kilogram
SSL = Soil Screening Level

Table 4-11 Risk Estimate Results in Hazard Quotients (HQs) for Plants and Soil Invertebrates

	Avian Herbivore **Horned Lark**		**Avian Carnivore** **Red-tailed Hawk**		**Avian Insectivore** **Western Meadowlark**	
COPECs	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Mercury	**2.0E+00**	2.0E-01	2.7E-02	2.7E-03	1.0E-01	1.0E-02
Selenium	**2.8E+00**	8.3E-01	7.1E-03	2.1E-03	6.0E-02	1.8E-02
	Mammalian Herbivore **Black-tailed Jackrabbit**		**Mammalian Insectivore** **Deer Mouse**		**Mammalian Carnivore** **Kit Fox**	
COPECs	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Mercury	5.5E-03	5.5E-04	7.0E-03	7.0E-04	3.1E-04	3.1E-05
Selenium	1.3E+00	8.0E-01	6.0E-01	3.6E-01	3.9E-02	2.4E-02

Source: URS 2007
Hazard Quotients exceeding 1.0 are shown in bold.
COPECs = chemicals of potential ecological concern
LOAEL = lowest observed adverse effects level
NOAEL = no observed adverse effects level

4.3.2 Vegetation Environmental Consequences

4.3.2.1 No Action (Alternative A)

Under this alternative there would be no construction or operation of the Desert Rock power plant, transmission lines, access road, and water-supply system. There would be no loss or modification of vegetation communities.

4.3.2.2 Proposed Action Alternative—1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

This section describes impacts to vegetation resulting from each of the Alternative B project components. Table 4-12 provides a summary of the maximum projected disturbance to vegetation communities resulting from each project component under this alternative.

Table 4-12 Maximum Projected Disturbance in Acres to Vegetation Communities, Alternative B

Habitat Type	Power Plant	Coal Processing Plant	Transmission Line Segment A	Transmission Line Segment B	Transmission Line Segments C and D	Access Road	Water Well Field A	Water Well Field A Utility Corridor	Water Well Field B	BNCC Lease Areas
Colorado Plateau Mixed Bedrock Canyon and Tableland	1.56	0.00	2.22	0.00	45.81	0.44	2.22	1.6	9.56	5.12
Inter-Mountain Basins Shale Badland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado Plateau Piñon-Juniper Woodland	0.00	0.00	1.11	0.00	15.35	1.11	0.00	0.00	10.67	6.00
Inter-Mountain Basins Big Sagebrush Shrubland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11
Colorado Plateau Mixed Low Sagebrush Shrubland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado Plateau Blackbrush-Mormon-tea Shrubland	0.00	0.00	0.00	0.00	21.35	0.00	0.00	0.00	0.00	0.00
Inter-Mountain Basins Mixed Salt Desert Scrub	24.69	10.01	307.13	338.33	235.29	4.45	47.59	61.5	447.68	1332.37
Inter-Mountain Basins Semi-Desert Shrub Steppe	46.93	18.01	22.02	30.30	24.69	2.45	3.34	3.18	102.97	475.70
Inter-Mountain Basins Semi-Desert Grassland	75.84	70.94	166.80	274.31	298.01	11.34	0.00	31.07	302.90	5893.46
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	0.00	0.00	0.00	1.60	2.22	0.00	0.00	0.00	0.00	4.89
Inter-Mountain Basins Greasewood Flat	0.00	1.78	3.34	24.30	23.80	0.44	836.2	52.4	16.46	379.18
Southern Colorado Plateau Sand Shrubland	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00	0.00
Open Water	0.00	0.00	0.00	0.00	3.34	0.00	0.00	0.00	0.00	3.78
Barren Lands, Non-specific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	10.90	0.00	0.00	0.00	0.00	0.00
Recently Mined or Quarried	0.00	0.00	0.00	0.00	14.90	0.00	0.00	0.00	0.00	0.00
Invasive Southwest Riparian Woodland and Shrubland	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00	0.00
Invasive Annual and Biennial Forbland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**149**	**101**	**503**	**669**	**705**	**20**	**889**	**150**	**890**	**13,051**

SOURCE: USGS 2006a.

4.3.2.2.1 Power Plant

Chemical air pollution is often manifested in two general forms: photochemical smog and acid rain, both of which can adversely impact vegetation. Photochemical smog is the product of chemical reactions driven by sunlight and involving NO_x of urban and industrial origin and VOCs from either vegetation (biogenic hydrocarbons) or human activities (anthropogenic hydrocarbons). Ozone (O_3) and peroxyacetylnitrate (PAN) produced in these complex reactions, can become injurious to plants and other life forms depending on concentration and duration of exposure. Indeed, ozone is phytotoxic, and some plant species are more sensitive to it than are humans (USEPA 1996).

Acid rain is formed when compounds including NO_x and SO_2 are dissolved in atmospheric water, decreasing the pH of rain from normal levels of 5.6 to a pH in the range of 3.0 to 4.0 (USEPA 2006g). Acid rain can negatively impact vegetation by removing mineral nutrients from leaves and by degrading the waxy cuticle that protects the leaf from desiccation and absorption of additional pollutants (Zeiger et al. 2002). Likewise, the addition of acids to soils can result in the release of aluminum ions from soil minerals, causing aluminum toxicity in plants. Generally, concentrations of SO_2 and NO_x in air that exceed 0.5 mL L^{-1} are known to be inhibitory to plant growth (Zeiger et al. 2002). The severity of acid rain is greatly influenced by the abundance of free calcium carbonate in soils, which acts as a buffering agent. Thus, in areas rich in calcium carbonate, including the western U.S. and in the project area, the impacts of acid rain can be negligible. Plants are capable of a number of innate enzymatic processes that effectively detoxify chemical pollutants. However, when the concentration of chemical pollutants in plant tissue exceeds their innate detoxification mechanisms, processes including photosynthesis, water regulation, and respiration are impaired, reducing growth and development (Brace et al. 1999). In addition, accumulation of chemical pollutants in plant tissue can result in deleterious genetic mutations, which can greatly reduce the fitness of the organism and its offspring (Zeiger et al. 2002).

The concentrations of pollutants that plants in the project area would be exposed to are expected to be variable and depend on location, wind direction, rainfall, and sunlight. Furthermore, the responses of plants to pollutants are also expected to be affected by other ambient conditions, such as light, humidity, temperature, and the supply of water and minerals. In general, chemical pollution that interferes with the ability of plants to photosynthesize may be indicated by changes in the physical appearance. Alternatively, O_3 is often responsible for oxidative damage to cell membranes, limiting photosynthetic capacity, which can result in reduced growth and may increase the severity and susceptibility of plants to fungal diseases (Zeiger et al. 2002). Therefore, air pollution has the potential to limit and/or reduce growth of vegetation. Likewise, chemical air pollution may increase susceptibility of plants to fungal disease, as well as infection with parasitic, viral and bacterial pathogens (Curtis 1996).

Results of the risk estimation process in terms of HQs on vegetation are provided in Plants and Soil Invertebrates in Appendix J and are summarized in Table 4-10 above. A discussion of air emissions and associated impacts is provided in Section 4.1. Results of the ecological screening indicate that two metals, mercury and selenium, may have 50-year concentrations in soil that exceed ESLs (ecological screening levels) and as such, should be considered COPECs. The predicted EPC for mercury in the project area are 2.41E-02 and 3.20E+00 for selenium in surface soils (0-2 cm) within a 25-km radius from the proposed plant site. The EPCs for mercury and selenium within the 0-10 cm soil column would be 2.15E-02 and 9.98E-01, respectively, within a 25-km radius of the proposed plant site. Based on this information, tests were conducted to determine whether concentrations of COPECs in soils would be sufficient to impair the viability and function of the plant community. Hazard quotients (HQs) less than 1.0 suggest no indication of potential risk of adverse effects. For mercury, HQs for plants sampled in the project area are 7.09E-05 at a depth of 0-2 cm and 6.32E-05 at a depth of 0-10 cm. For selenium, HQs for plants are 3.20E+00 at 0-2 cm and 9.98E-01 at 0-10 cm. Based on these results maximum selenium concentrations in soil after

50 years present a possible risk (HQ = 3.2) to plants. However, the calculated HQ for plants exposed to selenium is overly conservative due to conservative estimates of exposure and toxicological benchmarks. The selenium HQ of 3.2 is based on estimated surface soil (0-2 cm) concentrations; however, soil column (0-10 cm) concentrations in contact with plant root zones do not exceed the plant lowest observed effect concentrations (LOEC), and the LOAEL HQ is lower than 1.0. Also, the ESL (ecological screening level) for plants exposed to selenium (0.1 mg/kg) in LANL (2005) is overly conservative compared with screening benchmark from Efroymson et al. (1997). Therefore, the ecological risk assessment concludes that plants likely are not at risk from selenium deposited on the soils over 50 years of power plant operation (URS 2007).

Sediment in water reduces light penetration, which can reduce the ability of plants to photosynthesize (USGS 2006). Reduction in the ability of plants to photosynthesize can slow their growth and development. Construction and operation of the proposed power plant would result in discountable increases in sedimentation following the implementation of mitigation measures.

Construction and operation of the proposed project would necessitate a substantial increase in human presence above existing levels, which would be likely to impact area vegetation. Human presence has the potential to disturb vegetation in the project area, particularly in areas where humans travel beyond the boundaries of established roads, corridors, rights-of-way, or facilities. Vegetation could be directly impacted by humans trampling or damaging individual plants or plant communities or disrupting soils outside of established travel routes. Disruption and degradation of soil can lead to increased wind and water erosion, making it difficult for vegetation to become or remain established. The impact of dust pollution (fugitive dust) on vegetation is expected to be localized near construction areas and along unpaved travel corridors and would be negligible with adherence to mitigation measures (see Section 4.1).

Construction and operation of the power plant site would directly impact approximately 149 acres of vegetation, approximately half of which (51 percent) would be comprised of inter-mountain basins semi-desert grasslands (see Table 4-12). Mixed salt desert scrub and inter-mountain basins semi-desert shrub steppe comprise the majority of the remaining vegetation in the power plant site. A coal processing plant, requiring approximately 101 acres, would be located adjacent to the power plant site within BNCC Lease Area IV North. The vegetation in this area is dominated (70 percent) by inter-mountain basins semi-desert grassland. Such moderate impacts would result in temporary and long-term ground disturbance, as well as the development of permanent structures that would result in permanent vegetation loss. Temporary soil disturbance and permanent soil removal would likely result in some plant mortality, and could negatively impact seed sources by reducing seed viability and subsequently decreasing the success of recolonization. The density and diversity of vegetation species would be modified in areas reclaimed following construction. Impacts would be moderate and short-term in areas rehabilitated following construction or long-term where permanent facilities would be located.

Project construction could alter natural seed dispersal patterns, which could impact recruitment of plant species. Disturbance of natural plant communities can lead to invasion of exotic species, which may be more likely to out-compete native species. Indirect impacts resulting from alteration of natural vegetation communities and the potential for the introduction of non-native or exotic species would be minor and long term.

4.3.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Construction and operation of this transmission line alignment has potential to directly impact up to 1,205 acres of vegetation (Segment A: 503 acres; Segment C: 376 acres, and Segment D: 327 acres), resulting in temporary and long-term ground disturbance. This acreage is based on utilization of the entire transmission corridor right-of-way. In reality the potential disturbance would be much less as it would be limited to the 200- by 200-foot dimension of tower pad locations, temporary access roads and other ancillary construction components described in Chapter 2. Existing access roads would be used to the greatest extent possible to minimize overland travel for temporary access. The vegetation communities that occur along these proposed transmission lines are predominantly inter-mountain basin mixed salt desert scrub lands (44 percent) and inter-mountain basin semi-desert grassland (39 percent). The Segment D corridor contains a greater diversity of vegetation communities than any other project component. The greatest proportion of Colorado Plateau mixed bedrock canyons and tablelands in the project area also exists within the Segment D corridor.

Construction of tower structures would result in the direct impacts from the removal of vegetation at tower locations and staging areas. The density and diversity of vegetation species would be modified in areas reclaimed following construction. Temporary soil disturbance could negatively impact seed sources by reducing seed viability and subsequently decreasing the success of recolonization. Vehicles and other equipment accessing the tower locations and stringing wire would crush and flatten vegetation. Trampling or compression of vegetation could result in some plant mortality, though generally most vegetation would only be stressed and would likely recover. Direct impacts from vegetation removal at tower locations or vegetation compression along the alignment would be minor and short term. Indirect impacts resulting from alteration of natural vegetation communities and the potential for the introduction of non-native or exotic species would be minor and long term.

Alternative Transmission Line Segment B

This alternative would disturb approximately 1,373 acres, 168 more than under the proposed alignment that includes transmission line Segment A. Construction and operation of Segment B would directly impact mostly inter-mountain basin mixed salt desert scrub lands and (50 percent) and inter-mountain basin semi-desert grasslands (43 percent), resulting in moderate temporary and long-term ground disturbance. The impacts to vegetation would be similar to those described above for the proposed transmission line alternative.

4.3.2.2.3 Access Road

Access road construction would permanently remove approximately 21 acres of vegetation, resulting in minor long-term impacts. The primary vegetation communities that would be impacted along the access road are inter-mountain basin semi-desert grasslands (57 percent) and inter-mountain basin mixed salt desert scrub lands (22 percent). Indirect impacts resulting from alteration of natural vegetation communities and the potential for the introduction of non-native or exotic species would be minor and long term.

4.3.2.2.4 Water-supply System

Water Well Field A

Under this alternative, the water well field would require between 10 and 20 new production wells. The 10 to 20 wells generally would be placed equally apart at a minimum of 0.25-mile spacing. Water well field A would encompass about 890 acres, almost all of which is inter-mountain basin greasewood flats (93 percent). Vegetation would be removed from a maximum of 45 acres within the well field for construction, drilling, and operation of 20 water wells, the construction of collector pipelines, and an access road. These direct impacts would be moderate and long term. The remaining acres of vegetation would be impacted by perforation effects at the well sites, where vegetation would be altered.

This alternative would require construction of a 12.4-mile utility corridor/water pipeline, which would directly impact 150 acres of vegetation, resulting in moderate short- and long-term ground disturbance. The dominant vegetation communities that occur along the utility corridor/water pipeline are inter-mountain basin mixed salt desert scrub lands (42 percent), inter-mountain basin semi-desert grasslands (21 percent), and inter-mountain basin greasewood flats (34 percent). Vegetation within the corridor would be removed during excavation and trenching. The density and diversity of vegetation species would be modified in areas reclaimed following construction. Temporary soil disturbance could negatively impact seed sources by reducing seed viability and subsequently decreasing the success of recolonization. After construction, reclamation would result in short-term impacts to 137.5 acres of vegetation. Long-term impacts would occur on 15 acres within the permanent 10-foot-wide access corridor.

Water Well Field B

Water well field B would be located on the 592-acre power plant site lease area and along the proposed transmission line Segment A. Impacts to vegetation would be similar to those under water well field A but fewer because it would not be necessary to construct and operate the 12.4-mile utility corridor/water pipeline. The total acreage for well field B would be 890 acres; the vegetation community in this area is co-dominated by inter-mountain basin semi-desert grasslands (33 percent) and inter-mountain basin mixed salt desert scrub (50 percent). Approximately 10.5 acres of piñon-juniper woodland occurs within the proposed well field area. Vegetation would be removed from a maximum of 45 acres within the well field for construction, drilling, and operation of 20 water wells, the construction of collector pipelines, and an access road.

4.3.2.2.5 Mining Operations in BNCC Lease Areas IV South and V

Vegetation within BNCC Lease Areas IV South and V would gradually be impacted on an ongoing basis as mining activities expand over time. A maximum of 13,051 acres of vegetation would be removed and converted over the life of the lease areas. The density and diversity of vegetation species would be modified in areas reclaimed following mining activities. Soil disturbance could negatively impact seed sources by reducing seed viability and subsequently decreasing the success of recolonization. Currently, the area is composed mostly of inter-mountain basin semi-desert grasslands (45 percent) and inter-mountain basin mixed salt desert scrub (10 percent). The area also contains 6 acres of piñon-juniper woodland.

Some soil productivity could be lost during long-term topsoil storage due to potential changes in soils structure and texture, and reduced biological activity and nutrient content. Short-term impacts including vegetation removal would be moderate to major on the vegetation in the lease areas; however, over the long -erm, impacts would be offset by OSM vegetation reclamation standards. BNCC must have an approved mining permit from OSM prior to commissioning construction for mine-related facilities, and would commit to specific mitigation through that permitting process.

4.3.2.2.6 Mitigation to Reduce Impacts

Prior to Construction

- An Oil and Hazardous Materials Spill Prevention, Control, and Countermeasure Plan would be prepared to address hazardous materials storage and spill prevention.
- A Storm Water Pollution Prevention Plan would be prepared and implemented for construction activities to control surface runoff, reduce erosion, and prevent sedimentation from entering waterbodies during construction.
- An Environmental and/or Biological Resource Compliance Monitoring Plan would be prepared for all construction projects to ensure implementation of mitigation measures. The plan would identify the frequency and type of monitoring required by qualified natural/biological resources personnel. The plan would be submitted to Navajo Nation Department of Fish and Wildlife (NNDFW) for approval prior to any construction.
- All construction personnel would attend an environmental protection briefing prior to working on any construction site in the project area. This briefing is designed to familiarize workers with statutory and contractual environmental requirements and the recognition of and protection measures for sensitive vegetation community and wildlife habitats.
- Protective barriers would be placed around specified sensitive vegetation communities as identified by the NNDFW. Barriers would be installed prior to construction and field inspected by NNDFW or OSM personnel to verify proper placement.
- Aboveground structures (i.e., transmission towers) would be sited and designed in order to minimize disturbance to sensitive wildlife habitats and to minimize adverse effects to landscape features such as topography and vegetation.
- Imported soils, fills, or aggregates would be free of deleterious materials (i.e., trash, construction debris, noxious weeds). Sources of imported materials would be submitted for OSM or Navajo Nation approval prior to construction.
- A Non-native Species Management Plan would be prepared prior to the commencement of any ground-disturbing activities that specifies the locations and methods for removing non-native species, prescriptions for monitoring activities after construction, and reporting requirements. The plan would be submitted to OSM or NNDFW approval prior to ground-disturbing activities.
- A Revegetation Plan would be prepared for approval by OSM or NNDFW prior to the commencement of any ground-disturbing activities that prescribes plant salvage, revegetation, and post-construction monitoring activities.
- Preconstruction surveys would be conducted, as specified by OSM or NNDWF, by a qualified biologist to identify the number, type, and location of special-status species that potentially occur within the project area.

During Construction

- All construction contractors would implement and comply with requirements of the Oil and Hazardous Materials Spill Prevention, Control, and Countermeasure Plan prepared for all construction projects.
- All construction contractors would implement and comply with operational compliance requirements of the Storm Water Pollution Prevention Plan.
- Construction activities would be monitored by qualified natural resources personnel as outlined in the Environmental and/or Biological Resource Compliance Monitoring Plan.
- All project construction contractors would implement and comply with the Non-native Species Management Plan prepared for each project component.
- All construction equipment entering the project area for transmission line construction would be cleaned by means of pressure washing and/or steam cleaning so as to arrive on site free of mud or seed-bearing material.
- Clearing of vegetation and ground disturbance would be minimized to the greatest extent possible. Vegetation clearing would be conducted incrementally, prior to the construction of each project component to reduce erosion, siltation, and establishment of invasive species.
- Vegetation salvage, seed collection, and revegetation would be implemented as defined in the Revegetation Plan. Topsoil would be salvaged, segregated during storage, and reused in the proper location and depth as specified by the NNDFW. Specific SMCRA performance standards relative to soil handling and replacement would be implemented within the BNCC lease areas.

Post-Construction

- All tools, equipment, barricades, signs, surplus materials, debris, and rubbish would be removed from the project work limits upon project completion.
- The success of revegetation efforts would be monitored. Plant materials used for revegetation would remain alive and in a healthy, vigorous condition for a period of one year after final acceptance of planting. The project site would be monitored in accordance with the Non-native Species Management Plan and Revegetation Plan. All plants determined to be in an unhealthy condition would be replaced.

4.3.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

This section describes impacts to vegetation resulting from each Alternative C project components. Table 4-13 provides a summary of the maximum projected disturbance to vegetation communities resulting from each project component under this alternative.

Table 4-13 Maximum Projected Disturbance in Acres to Vegetation Communities Alternative C

Habitat Type	Power Plant	Coal Processing Plant	Transmission Line Segment A	Transmission Line Segment B	Transmission Line Segments C and D	Access Road	Water Well Field A	Water Well Field A Utility Corridor	Water Well Field B	BNCC Lease Areas
Colorado Plateau Mixed Bedrock Canyon and Tableland	0.67	0.00	1.10	0.00	43.99	0.22	2.22	1.60	9.56	1.11
Inter-Mountain Basins Shale Badland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado Plateau Piñon-Juniper Woodland	0.00	0.00	1.43	0.55	9.28	1.53	0.00	0.00	10.67	18.02
Inter-Mountain Basins Big Sagebrush Shrubland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado Plateau Mixed Low Sagebrush Shrubland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado Plateau Blackbrush-Mormon-tea Shrubland	0.00	0.00	0.00	0.00	20.78	0.00	0.00	0.00	0.00	0.00
Inter-Mountain Basins Mixed Salt Desert Scrub	18.71	8.69	155.31	170.54	173.53	4.37	47.17	57.45	447.68	1593.72
Inter-Mountain Basins Semi-Desert Shrub Steppe	33.86	17.39	14.10	14.03	15.47	2.40	1.56	7.99	102.97	180.39
Inter-Mountain Basins Semi-Desert Grassland	56.81	73.57	82.19	137.34	189.89	11.35	0.00	33.56	302.90	3093.67
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	0.00	0.00	0.00	0.89	2.65	0.00	0.00	0.00	0.00	2.89
Inter-Mountain Basins Greasewood Flat	0.00	1.34	1.20	11.34	22.33	0.44	838.539	47.29	16.46	203.52
Southern Colorado Plateau Sand Shrubland	0.00	0.00	0.00	0.00	5.75	0.00	0.00	0.00	0.00	0.00
Open Water	0.00	0.00	0.00	0.00	2.87	0.00	0.00	0.00	0.00	5.12
Barren Lands, Non-specific	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	11.27	0.00	0.00	0.00	0.00	0.00
Recently Mined or Quarried	0.00	0.00	0.00	0.00	12.82	0.00	0.00	0.00	0.00	0.00
Invasive Southwest Riparian Woodland and Shrubland	0.00	0.00	0.00	0.00	4.2	0.00	0.00	0.00	0.00	0.00
Invasive Annual and Biennial Forbland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**110**	**101**	**255**	**335**	**515**	**20**	**890**	**148**	**890**	**5097**

SOURCE: USGS 2006a.

4.3.2.3.1 Power Plant

The alternative sized power plant would be located at the same site as Alternative B. However, construction and operation of the power plant site would directly impact approximately 110 acres of vegetation as opposed to 149 acres under Alternative B. Approximately half (53 percent) of the vegetation in the site is comprised of inter-mountain basins semi-desert grasslands (see Table 4-13). A coal processing plant, approximately 101 acres in dimension would be located adjacent to the power plant site within BNCC Lease Area IV North. The vegetation in this area is dominated (70 percent) by inter-mountain basins semi-desert grassland. Moderate impacts would result in temporary and long term ground disturbance, as well as the development of permanent structures that would result in permanent vegetation loss. Direct and indirect physical impacts to vegetation would be similar to those described above for Alternative B.

Emissions from the 550 MW power plant would be approximately 39 percent of those emitted from the 1500 MW power plant under Alternative B (based on pounds of pollution per ton of coal consumed). A more detailed discussion of air quality impacts from Alternative C is provided in Section 4.1. Concentrations of criteria pollutants including SO_2, NO_x, CO, $PM_{2.5}$ and PM_{10} would all be below the current NAAQS criteria. Operation of the 550 MW plant is not expected to add significantly to the existing air quality conditions, particularly at distances greater than 1 km from the project area boundary. Therefore, it is not expected that vegetation within the analysis area would be subject to any adverse effects resulting from air pollutant emissions, including SO_2, NO_x, CO, $PM_{2.5}$ and PM_{10} under this alternative. The concentrations of chemical air pollutants that plants in the project area would be exposed to are expected to be variable and depend on location, wind direction, rainfall, and sunlight.

The ecological risk assessment indicates that emission of particulates from the proposed power plant (Alternative B) would not result in potential risks to vegetation resources. Given that particulate emissions under Alternative C would be approximately 61 percent less than Alternative B, results of the ecological risk assessment can be extrapolated to determine that vegetation in the project area and vicinity would not be at potential risk for adverse effects from the deposition of mercury or selenium particulate deposition under this alternative.

4.3.2.3.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

The proposed transmission line would require about 766 acres under Alternative C, a reduction of about 439 acres relative to Alternative B. The entire right-of-way would be 250 feet in width compared to 500 feet under Alternative B. This acreage is based on utilization of the entire 250-foot-wide right-of-way. In reality, the potential disturbance would be much less as it would be limited to the 200- by 200-foot dimension of tower pad locations, temporary access roads, and other ancillary construction components described in Chapter 2. Direct and indirect impacts to vegetation would be similar to those under Alternative B.

Alternative Transmission Line Segment B

The alternative Segment B would require 829 acres under Alternative C, 544 acres fewer than under Alternative B. The entire right-of-way would be 250 feet in width compared to 500 feet under Alternative B. Impacts to vegetation under this alternative would be similar to those under Alternative B.

4.3.2.3.3 Access Road

The access road under this alternative would be the same as that under Alternative B.

4.3.2.3.4 Water-supply System

Water Well Field A

Under this alternative, the water well field would require 9 to 18 new production water wells, compared to the 10 to 20 wells under the proposed action (Alternative B). Vegetation would be removed from a maximum of 40.5 acres within the well field for construction, drilling, and operation of a maximum of 18 water wells, the construction of collector pipelines, and an access road. Impacts to vegetation under this alternative would be similar to those under Alternative B.

Water well field A would require construction of a utility corridor/water pipeline that would directly impact 150 acres of vegetation, resulting in moderate short- and long-term ground disturbance. Impacts from the utility corridor/water pipeline would be the same as those under Alternative B.

Proposed Water Well Field B

Impacts to vegetation would be similar to those under water well field A (as described above). However, this alternative would have fewer impacts on vegetation than Alternative A because it would not require the construction and operation of the 12.4-mile utility corridor/water pipeline.

4.3.2.3.5 Mining Operations in BNCC Lease Area IV South

Vegetation within BNCC Lease Areas IV South would gradually be impacted on an ongoing basis as mining activities expand over time. Under this alternative, Area V would not be mined, as Area IV South would provide sufficient coal over the lifetime of the power plant. A maximum of 5,097 acres of vegetation would be removed and converted over the life of the lease area. The density and diversity of vegetation species would be modified in areas reclaimed following mining activities. Soil disturbance could negatively impact seed sources by reducing seed viability and subsequent decrease in the success of recolonization. Currently, the area is composed mostly of inter-mountain basin semi-desert grasslands (60 percent) and inter-mountain basin mixed salt desert scrub (31 percent). The area also contains 18 acres of piñon-juniper woodland.

Some soil productivity could be lost during long-term topsoil storage due to potential changes in soils structure and texture, and reduced biological activity and nutrient content. Short-term impacts on vegetation, including vegetation removal, would be moderate to major; however, over the long term, impacts would be offset by OSM vegetation reclamation standards.

4.3.2.3.6 Mitigation to Reduce Impacts

Mitigation measures for impacts to vegetation under Alternative C would be the same as those described under Alternative B.

4.3.2.4 Summary of Impact Analysis

The types of short- and long-term direct and indirect impacts on vegetation would be similar under both Alternatives B and C. These impacts would include permanent removal of vegetation, such as along the proposed access road, or changes in density and diversity in reclaimed areas. The primary difference in potential impacts to vegetation communities resulting from the two action alternatives would be the amount of disturbance per alternative, particularly related to mining of the BNCC lease areas. Comparatively, Alternative C would result in fewer impacts based on a smaller footprint size than Alternative B. Alternative B would use approximately 149 acres for the power plant site as opposed to 110 under Alternative C. Transmission line rights-of-way would generally be 500 feet wide under Alternative B, requiring 1,205 acres for the proposed transmission line alignment (Segments A, C, and D) or 1,373 acres under the alternative transmission line route (Segments B, C and D). Alternative C would use 250-foot-wide rights-of-way for transmission lines, resulting in 439 acres less disturbance for the proposed transmission line and 544 acres less disturbance under the alternative transmission line. The most pronounced difference, in terms of acres disturbed, between the two action alternatives is the proposed BNCC mine lease development. Alternative B would require development of BNCC Lease Areas IV South and V (13,050 acres) while Alternative C would only require development of BNCC Lease Area IV South (5,097 acres), a difference of nearly 8,000 acres. Under Alternative B, the water well field (both A and B) would be approximately 11 percent larger than under Alternative C.

4.3.3 Wildlife Environmental Consequences

4.3.3.1 No Action (Alternative A)

Under this alternative there would be no construction or operation of the Desert Rock power plant, transmission lines, access road, and water-supply system. There would be no loss or modification of wildlife habitat and no direct or indirect impacts to wildlife.

4.3.3.2 Proposed Action Alternative—1500 Megawatt Power Plant and Associated Facilities (Alternative B)

Construction and operation of the power plant and facilities is likely to impact terrestrial wildlife via several mechanisms: (1) air quality impacts, (2) unwanted and excessive noise, (3) avoidance by wildlife in areas with increased human activity, (4) habitat loss and fragmentation, (5) altering wildlife corridors or prohibiting wildlife movements, (6) increased roads and vehicle traffic, and (7) increased fugitive dust and sedimentation.

4.3.3.2.1 Wildlife Impacts Common to All Facilities

Fugitive dust has the potential to impair respiratory functions of wildlife. At high levels, fugitive dust can impair visibility, limiting the ability of predators to spot prey and, conversely, reduce the ability of prey to evade predators. In the project area, the impact of dust pollution on wildlife is expected to be of localized importance near construction areas and would be mitigated (see Section 4.1), and would be considered to have only minor impacts on area wildlife.

Noise is generally defined as unwanted sound that is associated with human activity or human-created infrastructure that disrupts normal activity patterns. Noise is expected to be generated during construction and operation of the proposed power plant and facilities. Conventional construction activities in the project area would result in a short-term increase in the ambient noise level resulting from the operation of construction equipment. The increase in noise levels would be primarily restricted to the areas surrounding construction zones and the magnitude of noise generated would depend on the type of construction activity, equipment used, duration of the activity, and distance between the noise source and the receiver. Unwanted and excessive noise generated from the construction of the power plant and facilities would directly impact wildlife. Mild annoyance could cause some wildlife to avoid or temporarily evacuate an area until the source of the noise abates. Panic or escape behavior could result in accidental injury or death, especially coupled with increased vehicle traffic and habitat fragmentation.

Although the impacts of noise pollution on human health have been well studied, the effect of noise on wildlife has only recently been considered a potential threat to animal health and long-term survival. Assessing the impact of noise on wildlife is complicated by the variations between different species and between individuals within a single population. In addition, variation can arise depending on the characteristics of the noise and its duration, the life history characteristics of the species, habitat type, season, and activity at the time of exposure, sex and age of the individual, level of previous exposure, and whether other physical stresses such as drought are occurring around the time of exposure (Busnel 1978). Despite these inherent sources of variation, the general consensus among acoustic ecologists is that noise can affect an animal's physiology and behavior, and if it becomes a chronic stress, noise can be injurious to an animal's energy expenditure, reproductive success, and long-term survival (Busnel and Fletcher 1978).

Long-term studies have shown that depending on the characteristics of the noise and the species, the reaction of the animal to noise can range from mild annoyance to panic and escape behavior (Fletcher 1980). Mild annoyance may cause wildlife to avoid or temporarily evacuate an area until the source of the noise abates. Panic or escape behavior may result in accidental injury, as animals could fall, run into objects or become trampled in panic. More specifically, studies have documented a short-term increase in heart rate among ungulates (Larkin 1996), reduced ability of small mammals to detect predators (Immel 1995), and alteration of nesting and roosting sites among raptors (Larkin 1996).

Section 4.12 provides detailed information on the maximum noise levels generated by typical construction equipment; however, the average sound level generated by construction equipment is 89 A-weighted decibels (dBA) at 50 feet from the source. Because construction noise is expected to be below the 90 dBA hourly levels recommended by the Federal Transit Administration (US Department of Transportation 1995), general impacts from noise are expected to be minor and localized. Depending upon the timing and location of noise generated, noise levels over 90 dBA could have a moderate impact on area wildlife, causing noticeable flight or stress behaviors.

In general, wildlife tend to avoid contact or confrontation with humans. Wildlife in the project area may temporarily avoid areas where human disturbances are occurring, or may permanently emigrate from areas where human presence is more continuous or permanent. This could result in alterations of nesting, foraging, hunting, and breeding behavior in species that are particularly sensitive to human presence (Stillman RA, Goss-Custard JD. 2002). Wildlife may be especially sensitive to human presence during significant periods of their annual cycles, including the breeding season. For example, interactions between humans and bald eagles during the breeding season can be detrimental to reproductive success (Fraser 1985, Grubb et al. 1992). Depending upon the activity occurring, the proximity of the activity to wildlife, and the species encountered, human activity impacts would range from negligible to moderate. A moderate impact would be attributable to harm caused to wildlife, either accidentally or intentionally from human activity in the area, which could result in serious injury or death.

Impacts could affect the wildlife community at multiple trophic levels. For example, disturbance of ground cover may cause small mammals such as rodents and rabbits to emigrate from the area. Reductions in the densities of these primary consumers from shrublands and grasslands are likely to be followed by emigration of higher level consumers, including carnivorous mammals such as coyotes and raptors. Thus, removal of shrubland and grassland habitat is likely to result in displacement of wildlife to adjacent, undisturbed habitat with similar vegetation structure. If vegetation is permanently removed from an area it is likely that multiple species will not inhabit the area again. It is also possible, however, that generalist species, such as jackrabbits and coyotes, may be more successful than habitat specialists at colonizing newly created successional (reclaimed) habitat types. However, such effects would also disrupt normal ecological processes by creating environments more suitable for generalist predators such as coyotes, having more moderate and potentially long-term impacts to the population size of prey species (Schneider 2001).

According to multiple wildlife baselines studies completed for various areas of Navajo Mine since the 1960s and contained in the current BNCC SMCRA permit, recent and historical surveys indicate overall densities of small mammals in shrubland habitats within the proposed project area are generally low. Thus, while ground disturbance may have localized impacts to populations that occur within the project area, such disturbance would not be expected to have large impacts to species as a whole. However, mammalian carnivores are thought to be especially vulnerable to habitat loss and fragmentation because of their relatively large ranges and low densities across a landscape (Noss et al. 1996). Although small mammal densities appear to be low in the analysis area, their importance to carnivores may be that much more important as carnivore survival is dependent upon them. However, as permanent losses of shrubland and other habitats would be primarily limited to the power plant site, and because there are extensive adjacent acres of similar undisturbed habitats, it is unlikely that area wildlife populations would more than negligibly impacted.

Roads are an important feature in wildlife habitat, especially with regard to wildlife movement. Roads can serve as either a facilitator or an inhibitor to dispersal, fragment habitats, and result in mortality (Trombulak and Frissel 2000). Several factors influence traffic-caused mortality to wildlife including vehicle speed, volume, and traffic pulses, local topography, accessibility of cover, structural and features of the road, as well as behavioral traits of wildlife (Dodd et al. 2004). While no road kill numbers are known from the project area or in adjacent areas such as through NAPI lands, a variety of wildlife would inevitably be injured or killed by the vehicle traffic estimates associated with the power plant and other facilities. These impacts are expected to be higher during the construction phase of the project when vehicle traffic would be the highest. Reptiles are more prone to being killed along the paved access road to the power plant due to their attraction to the warm road surface and their inability to quickly avoid on-coming traffic.

The proposed action alternative has the potential to directly and indirectly impact wildlife by disturbing and/or removing surface soil and vegetation used for foraging, hunting, burrowing/nesting, and breeding. Habitat loss and fragmentation are inevitable where surface soils and vegetation would be removed (Crooks 2002). Table 4-14 provides a breakdown of wildlife habitat types impacted by each Alternative B project component. The types of wildlife habitat expected to experience the greatest amount of loss and disturbance are shrublands and grasslands, followed by blackbrush-ephedra-greasewood shrublands. In addition, canyonlands and to a lesser extent, piñon-juniper woodlands are also expected to experience substantial amounts of ground disturbance.

Table 4-14 Total Acres of Maximum Potential Disturbance to Wildlife Habitat Types per Project Component Alternative B

Habitat Type	Power Plant	Coal Processing Plant	Transmission Line Segment A	Transmission Line Segment B	Transmission Line Segments C and D	Access Road	Water Well Field A	Water Well Field A Utility Corridor	Water Well Field B	BNCC Lease Areas
Open Water	0.00	0.00	0.00	0.00	3.34	0.00	0.00	0.00	0.00	8.67
Canyonlands	1.56	0.00	2.22	0.00	45.81	0.44	2.22	2.00	9.56	5.12
Riparian Shrublands	0.00	0.00	0.00	1.10	6.89	0.00	0.00	0.00	0.00	7.78
Recently Mined	0.00	0.00	0.00	0.00	14.90	0.00	0.00	0.00	0.00	0.00
Barren Lands and Badlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shrublands	71.61	28.02	329.14	369.76	264.65	6.89	50.93	63.75	550.65	3514.06
Blackbrush Ephedra Greasewood Shrubland	0.00	1.78	3.34	26.53	45.15	0.44	836.20	55.25	16.46	579.56
Piñon-juniper Woodland	0.00	0.00	1.11	0.00	15.35	1.11	0.00	0.00	10.67	24.02
Invasive Forblands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	10.90	0.00	0.00	0.00	0.00	0.00
Grasslands	75.84	70.94	166.80	272.51	298.01	11.34	0.00	28.64	302.90	8910.92
Total	**149**	**101**	**503**	**670**	**705**	**21**	**889**	**150**	**890**	**13,050**

SOURCE: USGS National GAP Analysis Program 2006. Acreages are approximate based on GIS polygon calculations.

Shrublands, grasslands and blackbrush-ephedra-greasewood shrublands are expected to host among the highest densities of fossorial and semi-fossorial small mammals in the project area, including species such as prairie dogs, deer mice, pocket mice, kangaroo rats, and antelope ground squirrels, as well as desert cottontails and black-tailed jackrabbits. As such, these habitat types are also expected to have relatively high densities of carnivorous mammals, like coyotes and foxes. Shrublands and grasslands in the project area are also likely to provide critical foraging habitat for a number of upland bird species, including ferruginous and red-tailed hawks, ravens, and meadowlarks.

Canyonlands and piñon-juniper woodlands also provide critical habitat for a number of wildlife species. In particular, these habitats provide nesting habitat for a number of specialist small mammals, like desert woodrats and piñon mice, as well as roosting sites for bats, including the small-footed bat and Western pipistrel. Likewise, canyonlands and piñon-juniper woodlands provide critical nesting and perching sites for a variety of upland bird species. Thus, disturbance or removal of these habitat types would at least temporarily have a negative impact on the associated wildlife species. However, whereas disturbance associated with the proposed project may negatively impact localized wildlife populations, the scale of such impacts may be less extensive. Many of the project components, such as the transmission corridors and water well fields, would have relatively little human activity associated with them following completion of construction activities. Consequently some wildlife would return to these areas following the departure of construction crews; whereas areas where permanent facilities are constructed, such as the plant site, active mining areas and the facility access roads, would be more likely to having changing and/or diminishing population densities.

Impacts on Raptors and Migratory Birds

Alternative B could have an adverse affect on migratory birds and raptors that utilize the area. Vegetation clearing and development of electrical transmission and distribution lines could all have a negative effect on birds by causing direct mortality and disrupting breeding, nesting, and foraging behaviors. In addition, nests could be disturbed during the construction phase, and less area would be available for or desirable for nesting as a result of the Alternative B.

Power poles provide attractive perch, nest, and roost sites, especially in relatively flat and treeless areas, a positive impact of powerline construction for raptors. However, the size of some birds makes it possible for them to simultaneously contact two charged objects (phases or conductors) or one charged object and a ground wire. Most problems occur on distribution lines 69 kilovolts (kV) or less, particularly at junction poles and transformers. Raptors and large birds are electrocuted through phase to phase and phase to ground contacts, while small birds can be electrocuted from bushings and transformers and other pole hardware. Studies have shown that golden and bald eagles suffer some of the highest mortalities; one study based on 10 years of data collected from 13 western states and Canada found that out of 1,450 confirmed raptor electrocutions, 272 were golden eagles.

In the project area, raptors (i.e., golden eagles and ferruginous hawks) and corvids (i.e., crows, ravens and magpies) are most likely to be affected by electrocution due to their relatively wide wingspans and tendency to use poles as nesting platforms and perches from which they survey for prey (Lehmann 2001).

Raptor collisions are documented most frequently on transmission lines greater than 69kV. Collisions occur when birds cross transmission lines in daily use areas (i.e., moving from roosting to foraging habitat); when birds migrate through an area; and when rain, fog, night and other low visibility conditions can contribute to collision risk. Other factors that contribute to birds colliding with transmission lines are the body size of the bird, maneuverability, and the height that birds commonly fly. Few studies on bird flight diverters have been completed, but most found they reduced collision rates (Crowder and Rhodes 2001).

Other potential effects on raptors and migratory birds include proximity to noise and human activity (discussed above) to breeding and foraging areas. As with other area wildlife, increases in area noise and human activity could have a minor to moderate impact on area raptors and migratory birds.

Impacts on Aquatic Wildlife

Under Alternative B, during construction increased sediment deposited in waterways would have the potential to adversely affect aquatic wildlife. Indirect impacts from increased sediment loads could potentially impair vegetation resulting in a minor decrease in available forage. Short term increases in sediment loads in waterways during construction would have the potential to adversely affect aquatic wildlife, although the potential for high sediment loads in the project area are expected to be low and short term. Indirect impacts from increased sediment loads could potentially impair aquatic vegetation resulting in a minor decrease in available forage and habitat for fish and aquatic wildlife.

Aquatic wildlife could be affected by the deposition of particulates or by runoff from areas impacted by deposition. However, most streams in the vicinity of the proposed power plant, including the Chaco River, are ephemeral. The closest permanent water bodies are Morgan Lake (approximately 22 km) northwest of the proposed power plant and the San Juan River (approximately 28 km) north of the power plant.

The proposed power plant would release mercury through air emissions that would consist of both particulates and vapors. Mercury is an extremely mobile pollutant and is emitted from natural and anthropogenic sources, occurring in several different chemical states in the environment (USEPA 2005a). Mercury emissions could persist in vapor form in the atmosphere and travel large distances to be deposited, or could be deposited near the proposed plant site. Deposited mercury in water courses could be re-emitted to air, remain suspended or dissolve in the water, be deposited in sediments, or absorbed or ingested by aquatic plants and wildlife (U.S. Fish and Wildlife Service [USFWS] 2005). A portion of mercury in water or sediment can be converted into methylmercury, which is easily absorbed by aquatic organisms and accumulates in aquatic vegetation, phytoplankton and invertebrates.

The actual quantity of mercury deposition that could eventually enter the San Juan River system or Morgan Lake is difficult to quantify. It is estimated that the proposed power plant would release up to 161 pounds of mercury per year through air emissions. Based upon available data on the distribution of mercury emissions, it is estimated that about 26.8 pounds of mercury would be actually deposited on land and water within 25 km of the power plant stack. As shown in Table 3-9, existing mercury concentrations (dissolved) in the San Juan River at Shiprock Bridge during the period 1994-2001 ranged from 0.1 to 0.3 µg/L (average of 0.1 µg/L). For the protection of aquatic wildlife, the Federal chronic AWQC for dissolved mercury is 0.77 µg/L (USEPA 2006a).

Selenium is an essential element for both aquatic and terrestrial wildlife. However, it also has the narrowest range of what is beneficial and what is detrimental. Selenium has been shown to mitigate the toxic effects of mercury and other heavy metals in some organisms. There is also evidence that it may reduce the uptake of mercury in some aquatic organisms while increasing the mercury uptake in different organisms. Aquatic wildlife is exposed to selenium through ingesting food containing selenium and not through direct exposure to the chemical in water. Selenium is a bioaccumulative pollutant, meaning it accumulates in the tissues of aquatic wildlife. However, unlike mercury, concentrations of selenium do not increase significantly (biomagnify) in animals at each level of the food chain going from prey to predator (USEPA 2004).

The AWQC for total selenium is 5.0 µg/L, and the mean concentration of total selenium in the San Juan River during the period of 1994–2001 was 0.73 µg/L, or 15 percent of the criterion. According to the (USFWS 2005), selenium concentrations in fish from Morgan Lake may pose health risks to people and wildlife that consume a large amount of fish from the lake. However, the average dissolved selenium concentration measured in Morgan Lake was 1.0 µg/L, which is substantially lower than the USEPA (2006b) chronic water quality criterion (5.0 µg/L [total]) and the Navajo Nation Aquatic Habitat Criterion (2.0 µg/L) (USFWS 2005).

Based on the results of air toxics modeling, it is estimated that the Desert Rock power plant could release up to 9,133 pounds of selenium per year through air emissions.

The proposed power plant would result in the deposition of small quantities of mercury and selenium in the San Juan River and Morgan Lake and would incrementally add to existing concentrations. Heavy metal concentrations are likely to vary depending on location, prevailing winds and rainfall and a number of other factors. How this incremental increase in mercury and selenium would potentially affect different aquatic species, or those species which primarily feed on aquatic wildlife or vegetation, is difficult to quantify. Species would differ in the amount and pathway of heavy metals ingested, the rate of tissue bioaccumulation, and in what, if any, potential effects to growth, reproduction or longevity may occur. This would depend on many site-specific and species-specific factors. The ecological effects of mercury and selenium to aquatic wildlife remain greatly unknown and require additional study to fully understand (USFWS 2005). Potential adverse impacts to area aquatic resources from incremental increases in mercury and selenium concentrations would be minor and long term. These impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing.

4.3.3.2.2 Power Plant

Wildlife can uptake air pollutants via inhalation of gases or small particles, consumption of particles in food or water, and/or via absorption of gases through the skin. In general, only soft-bodied invertebrates or amphibians are affected by the absorption of air pollutants; however, chemicals can be biomagnified as wildlife ingests these invertebrates or amphibians. Individual's response to a pollutant varies greatly and depends on the type of pollutant involved, the duration and time of exposure, and the amount taken up by the animal (USEPA 2006b).

Impacts of chemical pollution on wildlife have the potential to be more widespread than that caused by fugitive dust, and has potential to impact wildlife further from the pollution source. Similar to atmospheric dust, compounds including O_3, SO_2 and NO_2 have particularly negative impacts on the respiratory systems of animals. Compared to other groups of animals, birds may be most susceptible to illness or injury related to airborne chemical pollutants, due to their relatively higher respiratory rates (Kimball 2006). In addition to causing respiratory problems, chemical pollutants may accumulate in the tissues of both plants and wildlife, which can lead to tissue damage, genetic mutations and other negative impacts. The accumulation of chemical pollutants in the tissues of wildlife can also have additive impacts among successively higher trophic levels, as compounds bioaccumulate in vegetation that are consumed by herbivores, which are in turn consumed by predators. This tendency for pollutants to reach progressively higher concentrations among higher levels in food chains is referred to as biomagnification (Kimball 2006). Wildlife at the top of the food chain, such as carnivores, may accumulate much greater concentrations of chemicals, simply through its regular diet, than present in organisms lower in the food chain. Through biomagnification, concentrations of chemicals in wildlife at the top of the food chain can reach high enough levels to cause adverse effects on behavior, reproduction, longevity, or disease resistance, and even cause death when levels in the water, air, or soil are low (Cornell University 1993). The concentrations of chemical air pollutants that wildlife in the project area would be exposed are expected to be variable and dependent upon location, wind direction, and rainfall.

A more detailed discussion of the ecological risk assessment is provided above in Section 4.3.1.3, Evaluating Risk of Particulates to Plants, Soil Invertebrates and Wildlife and in the Ecological Risk Assessment in Appendix J. TRVs for each soil COPEC representing NOAEL (no observed adverse effect level) and LOAEL (lowest observed adverse effect level) doses are selected or developed to provide a range in potential effects in the evaluation. The HQ tool as applied in the evaluation should not be construed as an accurate “measure” of risk, but rather as an “indication” of the potential for risk. Based on LOAELs, none of the wildlife species, which represent herbivores, insectivores, and carnivores, are at risk from mercury or selenium deposited on soils. HQs (LOAEL-based) for wildlife range from 3.1E-05 to 8.3E-01. The highest HQs are for the horned lark (avian herbivore) and the black-tailed jackrabbit (mammalian herbivore) exposed to selenium. The sensitivity of these two receptors to selenium (and to mercury) is seen in the NOAEL-based HQs that are greater than 1.0. The calculated HQs for the horned lark and the black-tailed jackrabbit are, by design, very conservative, because the majority of uncertainties discussed in Appendix J contribute to an overestimate of exposure and risk. The only HQs exceeding 1.0 are based on NOAEL dose TRVs (toxicity reference values). In the context of assessing risk to common species, LOAELs are the more appropriate TRVs because an impact at the population level is the threshold for significance. The HQs calculated using LOAEL TRVs are all lower than 1.0. Therefore, the LOAEL-based HQs indicate unlikely potential risk for adverse effects to the survival, growth, or reproduction of terrestrial herbivorous birds or mammalian herbivores at the population level by the year 2056 in areas of greatest deposition.

Section 4.1 identifies that operation of the proposed power plant is not expected to add significantly to the existing air quality conditions. Concentrations of criteria pollutants including SO_2, NO_x, CO, $PM_{2.5}$ and PM_{10} would all be below the current NAAQS criteria at distances less than or equal to 1 km from the proposed power plant site. Predicted ozone concentrations were not modeled as is not required under the PSD permitting procedures and the modeled ambient concentrations of ozone precursor compounds (NO_x and VOC) were deemed insignificant (per the PSD criteria).

Once construction is completed, operation of the power plant would result in the ongoing generation of noise throughout the project area for the lifetime of the project. According to Section 4.12, operation of the power plant facility is expected to generate less than 30 $dBAL_{eq}$ at sound receptors located within 1 mile of the perimeter fence of the power plant, which is below common residential land use requirements. Vibrations resulting from operation of the power plant would be expected to have negligible impacts, as the equipment used in the power plant facility would be designed to produce very low vibration levels and shut down automatically if an unforeseen imbalance develops.

Construction and operation of the power plant would likely impede normal wildlife movement patterns. For example, because of the size of the power plant's physical structure, wildlife corridors could be altered and the movement patterns of some wildlife disrupted, potentially resulting in localized clumping and restricted dispersal among sub-populations. Over time, restricted movement and dispersal could reduce genetic diversity in the local population, or limit the ability of individual sub-populations to recolonize following random demographic or environmental events (e.g., disease epidemics or extreme drought).

Construction and operation of the power plant site is expected to remove 149 acres of wildlife habitat, primarily grasslands (50 percent) and shrublands (49 percent). Loss of these habitat types would affect a variety of wildlife species as this area provides suitable habitat for nesting/burrowing, foraging, and breeding for terrestrial wildlife, birds, and raptors.

4.3.3.2.3 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Construction and operation of the proposed transmission line alignment would have moderate impacts to 1,205 acres of wildlife habitat, primarily shrublands (49 percent) and grasslands (39 percent). Segment D represents all non-invasive wildlife habitats, with large portions of canyonlands (13 percent) and blackbrush-ephedra-greasewood shrublands (13 percent).

Construction of tower structures would result in direct moderate impacts from habitat removal and alteration at tower locations and staging areas. Vehicles and other equipment accessing the tower locations and stringing wire would crush and flatten vegetation, but would not remove wildlife habitat. Overland vehicular travel would increase the possibility of introducing non-native plant species which could result in habitat conversion. Habitat removal and alteration would result in the displacement of wildlife to adjacent, undisturbed habitat with similar vegetation structure. While construction and operation of the transmission line would have localized moderate impacts to individuals that occur in proximity to the proposed alignments, these impacts would be minor to area populations.

The addition of electrical transmission towers and lines would increase the long-term potential for large bird or raptor line strikes/collisions and electrocution from perching on or near tower conductors. With implementation of mitigation measures this potential impact would be minor and long term.

Alternative Transmission Line Segment B

This alternative to Segment A would result in 672 acres of disturbance, resulting in 168 more acres of disturbance than the proposed transmission line alignment. The total acreage affected under this alternative would be 1,373 acres. Disturbance along Segment B would primarily impact shrublands (53 percent) and grasslands (43 percent). Impacts to wildlife would be similar to those described above for the proposed transmission line alignment.

4.3.3.2.4 Access Road

Construction of the access road would directly impact approximately 20 acres of wildlife habitat. Impacts would be mostly to grassland (54 percent) and shrubland habitats (32 percent).

Construction of the plant access road would disturb and remove soil and vegetation, causing altered wildlife corridors, habitat fragmentation, potential vehicle-wildlife collisions, wildlife avoidance due to increased human activity, and increases in sediment loads in waterways and fugitive dust emissions.

4.3.3.2.5 Water-supply System

Water Well Field A

Disturbance and removal of soil and vegetation would directly and indirectly impact wildlife by removing or modifying 890 acres of wildlife habitat, predominantly blackbrush-ephedra-greasewood shrubland (94 percent) used for foraging, burrowing/nesting, and breeding. Direct impacts would result from vegetation removal from 45 acres within the water well field for construction, drilling, and operation of a maximum of 20 water wells, and construction of collector pipelines and an access road. The remaining 845 acres of wildlife habitat would be indirectly impacted by perforation effects and habitat degradation, which could result in changes in wildlife habitat utilization and alteration of wildlife corridors.

Additional impacts are similar to those reported for all the construction activities associated with the project. These include impacts to wildlife due to disturbance and removal of soil and vegetation, increased sediment deposition in waterways, increased fugitive dust emissions, unwanted and excessive noise, and wildlife avoidance in areas due to increased human activity. During construction and drilling of the well field, potential impacts to area wildlife would be moderate due to these factors. During operation of the well field, the impacts would be reduced to minor impacts limited to periodic human presence and associated noise.

Under this water well field alternative, construction of a utility corridor/water pipeline would be necessary, directly impacting an additional 150 acres of wildlife habitat. Impacts would be primarily to shrubland (34 percent), blackbrush-ephedra-greasewood shrubland (43 percent), as well as grassland (21 percent) habitats. The utility corridor/water pipeline would be constructed within a 6-month period. Following construction, short-term impacts would occur on 137.5 acres of vegetation. Long-term impacts would occur on 14.5 acres within the permanent 10-foot-wide corridor. Disturbance and removal of soil and vegetation would directly and indirectly impact wildlife by removing habitat used for foraging, burrowing/nesting, and breeding. During excavation and trenching activities some less mobile wildlife could be killed. Habitat removal and alteration would result in habitat loss, habitat fragmentation, and alteration of wildlife corridors.

In addition to the likely impediment of wildlife corridors due to construction of the utility lines, other impacts would include short-term increase in sediment load in waterways, short-term increase in fugitive dust emissions, unwanted and excessive noise, and wildlife avoidance of the area due to human presence.

Proposed Water Well Field B

Impacts to wildlife would be similar to those under water well field A, but fewer overall due to the smaller development footprint. This alternative would impact 890 acres of wildlife habitat, primarily shrublands (56 percent) and grasslands (37 percent). This alternative would not require the construction and operation of the 12.4-mile utility corridor/water pipeline. Rather, under this alternative the utility/water pipeline corridor would be constructed within the disturbance acres of transmission line Segment A.

4.3.3.2.6 Mining Operations in BNCC Lease Areas IV South and V

Wildlife habitat within BNCC Lease Areas IV South and V would gradually be impacted on an ongoing basis as mining activities expand over time. A maximum of 13,051 acres of habitat would be removed and altered over the life of the lease areas, primarily grassland (68 percent), shrubland (27 percent), and blackbrush-ephedra-greasewood shrubland (5 percent). The impact to these habitats would be moderate to major as some aspects of the habitats would be irretrievably lost (e.g., natural rock outcrops) while these habitats would be reclaimed in accordance with SMCRA standards, which provide performance standards for re-establishment of vegetation communities and wildlife habitat based on post-mining land use.

Because of the size of the impact, movement corridors of wildlife would likely be altered also, causing moderate impacts to area wildlife. Additional impacts resulting from development of Lease Areas IV South and V would be similar to those common to all alternatives discussed above. These include habitat loss due to disturbance and removal of soil and vegetation, the potential for increased sediment deposition in waterways, increased fugitive-dust emissions, unwanted and excessive noise, and wildlife avoidance in areas due to increased human activity.

4.3.3.2.7 Mitigation to Reduce Impacts

Prior to Construction

- A construction work schedule would be prepared for all construction projects that minimizes noise and human activity effects on wildlife in adjacent habitats.
- Protective barriers would be placed around specified sensitive wildlife habitats. Barriers would be installed prior to construction and field inspected by natural resources personnel to verify proper placement.
- Aboveground structures would be sited and designed in order to minimize disturbance to sensitive wildlife habitats and to minimize adverse effects to landscape features such as topography and vegetation.
- Preconstruction surveys would be conducted, as specified by the NNDFW, by a qualified biologist to identify the number, type, and location of special-status species potentially occur within the project area.

- If any grading, clearing, brushing, or construction occurs during the bird breeding season (approximately February 15 through August 31), a qualified biologist would conduct a survey of the habitat to determine whether there are active bird nests in the area, including raptors and ground nesting birds. The survey would begin not more than 3 days prior the beginning of work. If an active nest is observed, a minimum 300-foot buffer (500 feet for raptors) would be established using temporary fencing. The buffer would be in effect as long as work is occurring and until the nest is no longer active.

During Construction

- Speed limits would be posted to minimize vehicular collisions with wildlife.
- Construction activities would be monitored by qualified natural resources personnel as outlined in the Environmental and/or Biological Resource Compliance Monitoring Plan.
- All construction activities would be completely confined to the areas of potential ground disturbance for each project component as described in Chapter 2. Clearing of vegetation and ground disturbance would be minimized to the greatest extent possible.
- Stationary noise sources would be located as far as possible from sensitive wildlife habitat areas. All on-site work that generates noise levels above 76 decibels at the site boundary would be completed between 7:00 a.m. and 7:00 p.m.
- Excavation sites would be monitored or covered to avoid trapping wildlife, and routes of escape for wildlife would be maintained. The construction site would be inspected daily for appropriate covering and flagging of excavation sites. Each morning the project area would be inspected for wildlife trapped in excavation pits. A qualified biologist would be available to inspect excavations before refilling occurs.
- Proposed electrical transmission and distribution lines would be designed and constructed utilizing "raptor-safe" design. The most complete manual on this work is: "Suggested Practices For Raptor Protection On Power Lines: The State of the Art in 1996" (APLIC 1996)

Post-Construction

- All tools, equipment, barricades, signs, surplus materials, debris, and rubbish would be removed from the project work limits upon project completion.

4.3.3.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

General impacts to wildlife, aquatic wildlife, raptors and migratory birds from construction and operation of the facilities would be similar to those described above for Alternative B. However, these impacts would be to a lesser degree as the amount of wildlife habitat removed or modified would be less. Table 4-15 provides a breakdown of wildlife habitat types impacted by each Alternative C project component.

Table 4-15 Total Acres of Maximum Potential Disturbance to Wildlife Habitat Types per Project Component Alternative C

Habitat Type	Power Plant	Coal Processing Plant	Transmission Line Segment A	Transmission Line Segment B	Transmission Line Segments C and D	Access Road	Water Well Field A	Water Well Field A Utility Corridor	Water Well Field B	BNCC Lease Areas
Open Water	0.00	0.00	0.00	0.00	3.34	0.00	0.00	0.00	0.00	4.89
Canyonlands	0.89	0.00	1.11	0.00	46.04	0.44	2.22	2.06	9.56	1.11
Riparian Shrublands	0.00	0.00	0.00	0.00	6.89	0.00	0.00	0.00	0.00	2.89
Recently Mined	0.00	0.00	0.00	0.00	13.34	0.00	0.00	0.00	0.00	0.00
Barren Lands and Badlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shrublands	50.48	28.02	86.07	187.59	197.71	6.89	50.93	54.51	550.43	1776.27
Blackbrush Ephedra Greasewood Shrubland	0.00	1.78	884.46	12.79	45.15	0.44	835.98	49.80	16.46	200.38
Piñon-juniper Woodland	0.00	0.00	0.67	0.00	9.12	1.11	0.00	0.00	10.67	18.01
Invasive Forblands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	10.67	0.00	0.00	0.00	0.00	0.00
Grasslands	58.49	70.94	17	133.43	185.70	11.79	0.00	27.64	302.23	3093.07
Total	**110**	**101**	**248**	**335**	**518**	**21**	**889**	**148**	**889**	**5,097**

SOURCE: USGS 2006a.

4.3.3.3.1 Power Plant

The alternative sized power plant would be located at the same site as Alternative B. However, construction and operation of the power plant site would directly impact approximately 110 acres of wildlife habitat as opposed to 160 acres under Alternative B. Approximately half of the wildlife habitat impacted by the power plant would be inter-mountain basins semi-desert grasslands (see Table 4-15). Moderate impacts would result in temporary and long term ground disturbance, as well as the development of permanent structures that would result in permanent vegetation loss. Direct and indirect physical impacts to wildlife habitat would be similar to those described for Alternative B.

Emissions from the 550 MW power plant are expected to be approximately 39 percent of those emitted from the 1500 MW power plant under Alternative B (see Section 4.1). Operation of the 550 MW plant is not expected to add significantly to the existing air quality conditions, particularly at distances greater than 1 km from the project area boundary. Therefore, it is not expected that wildlife within the analysis area would be subject to any adverse effects resulting from air pollutant emissions, including SO_2, NO_x, CO, $PM_{2.5}$ and PM_{10} under this alternative. The ecological risk assessment indicates that emission of particulates from the proposed power plant (Alternative B) would not result in adverse effects to wildlife. Given that particulate emissions under Alternative C would be approximately 61 percent less than Alternative B, results of the ecological risk assessment can be extrapolated to determine that wildlife in the project area and vicinity would not be at potential risk for adverse effects from the deposition of mercury or selenium emissions under this alternative.

4.3.3.3.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C and D)

The proposed transmission line alignment would require about 766 acres under Alternative C, a reduction of about 439 acres relative to Alternative B. Construction and operation of this transmission line alignment has the potential to directly impact approximately 766 acres of wildlife habitat compared to 1,205 acres under Alternative B. This acreage is based on utilization of the entire 250-foot wide right-of-way. In reality the potential disturbance would be much less as it would be limited to the 200- by 200-foot dimension of tower pad locations, temporary access roads, and other ancillary construction components described in Chapter 2. Direct and indirect impacts to wildlife and wildlife habitat would be similar to those under Alternative B.

Alternative Transmission Line Segment B

The alternative transmission line would result in 829 acres of disturbance, 63 more acres than the proposed alternative, which includes transmission line Segment A. Under this alternative, the right-of-way would be 250 feet in width, resulting in disturbance to 544 fewer acres relative to Alternative B. Impacts to wildlife under this alternative would be similar to those under Alternative B.

4.3.3.3.3 Access Road

The access road under this alternative would be the same as described under Alternative B.

4.3.3.3.4 Water-supply System

Water Well Field A

Under this alternative, the water well field would require 9 to 18 new production water wells compared to 10 to 20 wells under the proposed Alternative B. The well field would encompass about 890 acres, almost all of which is inter-mountain basin greasewood flats. Wildlife habitat would be removed from a maximum of 40.5 acres within the well field for construction, drilling, and operation of a maximum of 18 wells, the construction of collector pipelines, and an access road. The remaining wildlife habitat, on approximately 847 acres, would be impacted by habitat fragmentation effects. Water well field A would require construction of a utility corridor/water pipeline, which would directly impact 150 acres of wildlife habitat. Indirect and direct impacts from the pipeline would be the same as those under the proposed action.

Proposed Water Well Field B

Impacts to wildlife and wildlife habitat would be similar to those under water well field A. However, this alternative would have fewer impacts because it would not require the construction and operation of the 12.4-mile utility corridor/water pipeline.

4.3.3.3.5 Mining Operations in BNCC Lease Area IV South

Wildlife habitat within BNCC Lease Area IV South would gradually be impacted on an ongoing basis as mining activities expand over time. A maximum of 5,097 acres of habitat would be removed and altered over the life of the lease areas, primarily grasslands (60 percent), shrublands (34 percent), and blackbrush-ephedra-greasewood shrubland (4 percent). The impact to these habitats would be moderate to major, as some aspects of the habitats would be irretrievably lost (e.g., natural rock outcrops). These habitats would be reclaimed in accordance with SMCRA standards, which provide performance standards for re-establishment of vegetation communities and wildlife habitat based on post-mining land use.

Because of the size of the impact, movement corridors of wildlife would likely be altered also, causing moderate impacts to area wildlife. Additional impacts resulting from development of Lease Area IV South would be similar to those common to all facilities discussed above. These include habitat loss due to disturbance and removal of soil and vegetation, the potential for increased sediment deposition in waterways, increased fugitive dust emissions, unwanted and excessive noise, and wildlife avoidance in areas due to increased human activity.

4.3.3.3.6 Mitigation to Reduce Impacts

Mitigation measures under Alternative C would be the same as those for Alternative B.

4.3.3.4 Summary of Impact Analysis

The types of short- and long-term direct and indirect impacts to terrestrial wildlife would be similar under both Alternatives B and C. These impacts would include unwanted and excessive noise, avoidance in areas with increased human activity, habitat loss and fragmentation, alteration of wildlife corridors or prohibition of wildlife movements, increased mortality from roads and vehicle traffic, and increased fugitive dust and sedimentation. Comparatively, Alternative C would result in fewer impacts to wildlife habitat based on a smaller footprint size than Alternative B. Alternative B would use approximately 149 acres for the power plant site as opposed to 110 under Alternative C. Under Alternative B, transmission line rights-of-way would be 500 feet wide for Segments A, B, and C and 250 feet wide for Segment D, requiring a total of 1,205 acres for the proposed transmission line right-of-way (Segments A, C, and D) or 1,373 acres under the alternative transmission line alignment (Segments B, C and D). Alternative C would use 250-foot-wide right-of-way for all segments of the transmission line, resulting in 439 acres less disturbance for the proposed transmission line and 544 acres less disturbance with the alternative transmission line route. Alternative B would require development of BNCC Lease Area IV South and V (13,050 acres) while Alternative C would only require development of BNCC Lease Area IV South (5,097 acres), a difference of nearly 8,000 acres. Under Alternative B, the water well field (both alternative locations) would be approximately 11 percent larger than under Alternative C.

Power plant emissions would be greater under Alternative B relative to Alternative C. However, terrestrial and aquatic wildlife in the area and surrounding region would not be adversely affected by changes in air or water quality under either action alternative. Impacts to raptors and migratory birds would be similar for Alternative B and C, though Alternative C would have fewer impacts because of the smaller footprint. Both action alternatives could have localized impacts to populations that occur within the project area, but would not have large impacts to species as a whole.

4.3.4 Special Status Species

The following sections identify the environmental consequences from the proposed project alternatives to special status plant and wildlife species known to occur, or with potential to occur, in the study area. Special status species include (1) federally listed species according to the USFWS by the authority of the ESA, (2) State of New Mexico-listed species, (3) species included on the Navajo Endangered Species List (NESL), and (4) other special status species protected by Federal legislation.

4.3.4.1 No Action (Alternative A)

Under the No Action Alternative, there would be no construction or operation of the Desert Rock power plant, transmission lines, access road, and water-supply system. There would be no impacts to special status species.

4.3.4.2 Proposed Action Alternative—1500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.3.4.2.1 Effect Determinations on Federally Listed Species

Determinations of effect were based on evaluating the potential impacts of Alternative B if the mitigation measures provided below are followed. Table 4-16 summarizes the potential effects of the proposed action on federally listed threatened, endangered, and candidate species.

Table 4-16 Summary of Determinations of Effect on Federally Listed Species with Potential to Occur in the Project Area

Species	Status	Determination of effect
MAMMALS		
Black-footed ferret	E	No Effect
BIRDS		
Bald eagle	T	May Affect, Not Likely to Adversely Affect
Mexican spotted owl	T	No Effect
Southwestern willow flycatcher	E	May Affect, Not Likely to Adversely Affect
Yellow-billed cuckoo	C	May Affect, Not Likely to Adversely Affect
FISH		
Colorado pikeminnow	E	May Affect, Likely to Adversely Affect
Razorback sucker	E	May Affect, Likely to Adversely Affect
PLANTS		
Knowlton’s cactus	E	No Effect
Mancos milkvetch	E	May Affect, Not Likely to Adversely Affect
Mesa Verde cactus	T	May Affect, Likely to Adversely Affect

SOURCE: USFWS 2006
NOTE: E = Endangered; T =Threatened; C = Candidate

4.3.4.2.2 Impact Determinations for State of New Mexico and Navajo Nation Sensitive Species

Table 4-17 summarizes the potential for sensitive species impacts resulting from Alternative B. Determinations of impact were based on evaluating the potential impacts of the proposed action if the recommended conservation and mitigation measures are followed. The potential environmental consequences to these species are addressed per action alternative components in the following sections. The BE provides detailed information concerning sensitive species impacts (Appendix G).

Table 4-17 Summary of Potential Impacts to Sensitive Species with Potential to Occur in the Project Area

Species Name	State of New Mexico	Navajo Nation	Determination of Impact
Bolack's sand verbena (*Abronia bolackii)*	Species of concern	None	No impact
San Juan false carrot (*Aletes macdougalii ssp. breviradiatus)*	Species of concern	None	No impact
Aztec gilia (*Aliciella formosa)*	Endangered	None	No impact
San Juan milkweed *(Asclepias sanjuanensis)*	Species of concern	G4	May impact
Chuska milkvetch *(Astragalus chuskanus)*	Species of concern	None	No impact
Cottam's milkvetch *(Astragalus cottamii)*	Species of concern	None	May impact
Chaco milkvetch *(Astragalus micromerius)*	Species of concern	None	No impact
Naturita milkvetch *(Astragalus naturitensis)*	Species of concern	G4	May impact
Arboles milkvetch *(Astragalus oocalycis)*	Species of concern	None	No impact
Zuni fleabane *(Erigeron rhizomatus)*	Endangered	G2	No impact
Navajo mountain phlox *(Phlox cluteana)*	Species of concern	None	No impact
Mancos saltplant *(Proatriplex pleiantha)*	Species of concern	None	May impact
Parish's alkali grass *(Puccinellia parishii)*	Endangered	G3	May impact
Brack hardwall cactus *(Sclerocactus cloveriae ssp. brackii)*	Endangered	None	No impact
Pronghorn (*Antilocapra americana)*	None	G3	No Impact
Banner-tail kangaroo rat (*Dipodomys spectabilis)*	None	G4	May impact
Kit fox (*Vulpes macrotis*)	None	G4	May impact
Spotted bat (*Euderma maculatum*)	Threatened	None	May impact
Baird's sparrow (*Ammodramus bairdii)*	Threatened	None	No impact
Common blackhawk (*Buteogallus anthracinus anthracinus*)	Threatened	None	No impact
Gray vireo (*Vireo vicinior*)	Threatened	None	No impact
Brown pelican (*Pelecanus occidentalis carolinensis)*	Threatened	None	May impact
Mountain plover (*Charadrius montanus)*	None	G3	May impact
Golden eagle (*Aquila chrysaetos)*	None	G3	May Impact

Species Name	State of New Mexico	Navajo Nation	Determination of Impact
Western burrowing owl (*Athene cunicularia hypugea)*	None	G4	May Impact
Ferruginous hawk *Buteo regalis*)	None	G3	May Impact
American peregrine falcon (*Falco peregrinus)*	Threatened	G3	May Impact
Sora (*Porzana carolina)*	None	G4	May Impact
Roundtail Chub (*Gila robusta)*	Endangered	G2	May Impact
Mottled sculpin (*Cottus bairdi*)	None	G4	May Impact
Bluehead sucker (*Catostomus discobolus)*	None	G4	May Impact
Milk snake (*Lampropeltis triangulum*)	None	G4	No Impact
Northern leopard frog (*Rana pipiens*)	None	G2	May Impact

SOURCE: Navajo Nation Natural Heritage Consultation Letter 12/30/05.
G2 = Group 2 species on the NESL
G3= Group 3 species on the NESL
G4 = Group 4 species on the NESL

4.3.4.2.3 Power Plant

Federally Listed Species

Colorado pikeminnow and razorback sucker: The power plant would result in the deposition of small quantities mercury and selenium in the San Juan River. Pollutant concentrations are likely to vary depending on location, prevailing winds and rainfall and other factors. A more detailed discussion is provided in Section 4.3.4.2 under Impacts to Aquatic Wildlife. The additive effect of mercury and selenium deposition to existing concentrations in the San Juan River would result in minor impacts to surface water quality. However, these impacts are not expected to exceed AWQC standards for the protection of aquatic wildlife. Existing selenium concentrations in the San Juan River and Morgan Lake have been linked to a low to moderate occurrence of reproductive failure in endangered fish species with selenium concentrations found in tissues and diets (USFWS 2005). The impact to surface water quality from the deposition of mercury and selenium may result in adverse effects to the reproductive success of Colorado pikeminnow and razorback sucker.

Sensitive Species

General Impacts to Sensitive Species: The power plant site provides potential habitat for sensitive species. Construction and operation of the power plant would directly and indirectly impact these species through habitat loss and modification. Increased human activity during power plant facility construction and operation would result in wildlife avoidance of the area. Some individuals would be displaced to adjacent, undisturbed habitat with similar vegetation structure. Some species may permanently emigrate from the area. Species movement and dispersal in the area would be adversely impacted by the presence of human activity and increased noise. This could result in alterations of foraging and breeding behavior. This impact would be greater during significant periods of wildlife annual cycles, including the breeding season. Wildlife would inevitably be injured or killed by the vehicle traffic associated with the power plant and other facilities. These impacts are expected to be higher during the construction phase of the project when vehicle traffic would be the highest. Impacts are not likely to result in a loss of species viability range wide, nor cause a trend to Federal listing.

San Juan milkweed: The species has several scattered populations within the proposed power plant site (Ecosphere 2005b). Impacts to this species would occur during soil removal and disturbance from power plant construction that would result in plant mortality. Temporary and permanent soil disturbance could negatively impact seed sources. The seedbed in stored topsoils could potentially result in a loss of seed viability and decrease the success of recolonization during reclamation. This species may be more abundant than previously thought (pers. comm. Daniela Roth 2004). Recommended mitigation measures provide below would minimize impacts to special status plants and habitat. Impacts would be minor to moderate and long term. Impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing.

Banner-tailed kangaroo rat: This species has been documented (i.e., trapped) in the power plant site (Ecosphere unpublished data). In addition to general impacts to sensitive species described above, some incidental mortalities could occur during construction activities since this species less regularly uses burrows and is less mobile than larger mammals. Impacts would be minor and long term following the implementation of recommended mitigation measures. Impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing.

Kit fox: The species has been recorded in the power plant site (Ecosphere unpublished data). In addition to the general impacts to sensitive species described above, habitat loss and fragmentation could result in a decreased prey base for this species. Additionally, young and nursing adult females could be harmed during construction activities if natal burrows are destroyed. Impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing. Recommended mitigation measures would minimize impacts to kit fox. Potential impacts would be minor and long term.

Golden eagle, American peregrine falcon and ferruginous hawk: There is no potential nesting habitat for these species within the power plant site. The site does provide potential foraging habitat for these raptor species. Habitat loss and fragmentation could result in a decreased prey base for these species. Impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing. Following the implementation of mitigation measures outlined below, potential impacts would be minor and long term.

4.3.4.2.4 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Federally Listed Species

Bald eagle: There would be no direct loss of suitable roosting or foraging habitat due to the removal of cottonwood trees across the San Juan River floodplain. While no nest or roost trees occur within the proposed right-of-way, there is tree nesting and roosting opportunities both up and down stream from the proposed transmission line crossing of the San Juan River. Several opportunities exist within 0.25 mile of the proposed right-of-way. Winter roost and nest surveys for bald eagle within 0.50 mile of the proposed river crossing were conducted during the 2006 field season. No bald eagle roost or nest sites were found in the area, nor are any sites known within 5 miles of the proposed transmission line crossing. The proposed transmission line crossing of the San Juan River would be placed adjacent and parallel to an existing power transmission right-of-way.

During construction of the proposed transmission corridor through the San Juan River floodplain, due to the proximity of the crossing to other suitable nesting and roosting habitats for bald eagles, eagles could be affected by noise and human activity disturbances. Bald eagles appear to be particularly sensitive to noise and human activity during the breeding season with distance to noise source as the primary factor of human activity determining bald eagle response (Grubb et al. 1992). Similarly, human activity can impact bald eagle distribution, causing bald eagles to avoid inhabiting developed areas (Buehler et al. 1991). Following the implementation of mitigation measures outlined in the BA and below, including avoiding construction activities at the river crossing between November and April when eagle densities are highest, potential impacts to eagles during construction would be negligible or minor and short term.

The addition of electrical transmission towers and lines would increase the long-term potential for bald eagle line strikes/collisions and electrocution from perching on or near tower conductors. Following the incorporation of raptor protection measures into the design of the line, the potential for bald eagles to be electrocuted or to collide with the line would be minimized. It would remain a possibility, however, that bald eagles could collide with the transmission lines and/or be electrocuted and consequently injured or killed, representing a moderate, long-term impact. This impact “may affect, is not likely to adversely affect” bald eagles.

Southwestern willow flycatcher: Potential nesting and migratory stopover habitat in the project area for this species is limited to the San Juan River corridor, the margins of Morgan Lake, and in thickets of invasive saltcedar along the Chaco River. There would be no direct removal of suitable nesting habitat for this species in any of these three habitat areas. Currently, there is an approximately 50-foot wide fringe of previously disturbed tamarisk extending for approximately 200 feet south of the San Juan River along the west edge of transmission line Segment D. At the time of the 2006 presence/absence surveys (negative results) in this area, this tamarisk fringe did not represent good nesting substrate due to its relatively short height (less than 6 feet). However, in 5 years or more, these tamarisk patches have potential to mature into suitable breeding habitats for the southwestern willow flycatcher. Should this tamarisk fringe require cutting or mowing in order to place transmission towers, it is recommended that the clearing occur outside the willow flycatcher breeding period, from May 1 through Aug 30, and prior to the patch maturing to suitable breeding habitat status.

If the tamarisk patch described above can be avoided, construction of transmission towers within the San Juan River floodplain has the potential to impact southwestern willow flycatcher as a result of increases in noise and human activity in the immediate area of suitable migratory and breeding habitats. These potential impacts would be avoided or negligible if construction of these towers is accomplished outside of the breeding period.

Potential disturbance and impacts to southwestern willow flycatcher that may be present around the perimeter of Morgan Lake are considered negligible, as these habitats are more than 0.50 mile away from the proposed transmission line Segment D and shielded from line-of-sight by topography.

Yellow-billed cuckoo: Potential habitat for the yellow-billed cuckoo is limited to small patches of native riparian (cottonwood and willow) and mixed native-exotic (Russian olive/tamarisk, cottonwood, and willow) adjacent to the transmission line crossing of the San Juan River and along the northern margin of Morgan Lake. Potential impacts to this species would be limited to noise and human activity in proximity to occupied habitats. Increases in noise and human activity would likely result in short-term temporary dispersal or avoidance of the area. Avoidance of the breeding season May through August during construction within 0.25 mile of suitable habitats would eliminate the potential for this impact.

Colorado pikeminnow and razorback sucker: Critical habitat for these species occurs in the San Juan River across the northern portion of the project area. Proposed transmission line Segment D would span this critical habitat area. Construction of the proposed alignment could result in the placement of two tower sites within the 100-year floodplain of the San Juan River. The 100-year floodplain is considered part of the critical habitat designation. Effects from the disturbance to approximately 1.8 acres of upland habitats within the 100-year floodplain would be mitigated to avoid impacts to constituent habitat elements.

Ground disturbance associated with construction within the floodplain has the potential to increase sediments reaching the San Juan River. Additionally, accidental fuel, lubrication, or other hazardous material spills in the construction zone, depending upon the size, has potential to reach the San Juan River and adversely impact localized fisheries and/or downstream habitats such as nursery backwaters. Potential impacts to fisheries, however, from sedimentation or hazardous material spills would be mitigated by implementation of the construction *Stormwater Management Plan* and by the project *Hazardous Materials Handling and Response Plan*. Following implementation of these plans, potential impacts to these fisheries would be negligible.

Mesa Verde cactus: Mesa Verde cactus populations were documented along the entire length of transmission line Segment D, north of the San Juan River to the inter-tie with the Navajo Transmission Project. During construction of tower structures, wire-pulling and wire-splicing and human and vehicular activity within the Segment D corridor would potentially result in cacti damage or mortality where the populations occur. Temporary soil disturbance could negatively impact seed sources. Seedbed disturbance in population areas and areas that may not currently support live individuals could potentially result in a loss of seed viability and decrease the success of recolonization. Disturbed soils would be subject to greater erosion, which could impact individuals by exposing roots or by smothering stems.

Construction activities would disturb and alter potential habitat, which could impact the ability of the species to colonize those areas. During revegetation efforts, further disturbance to soil structure could accelerate erosion processes, which could impact the species by uprooting of individuals during storm events. Human or vehicular activity outside the proposed right-of-way or access roads could trample individuals or disrupts soils. Though potential impacts would be greatest during construction, human or vehicular activity during maintenance would potentially trample individuals or disrupt soils.

In addition to the mitigation measures to protect special status species described in this section, the project BA has developed a comprehensive mitigation planning approach to minimize potential impacts to this federally threatened species. Please refer to the project BA for specifics regarding measures to minimize impacts to Mesa Verde cactus. An example of a conservation planning measure taken during the 2006 field season was the engineering of tower locations to avoid cactus populations digitally mapped from the 2006 field surveys. Project transmission line engineers were also taken to the field by project botanists to emphasize the sensitivity of populations and habitat areas to human/mechanical disturbance. Even with a *Mesa Verde Cactus Conservation Plan* in place, it is likely that individuals or habitat would be directly impacted. These potential impacts include the potential for cactus mortality and/or loss of viability of the cactus seed bank. It is for these reasons that the preliminary determination of “may affect, not likely to adversely affect” is warranted for this species.

Sensitive Species

The proposed transmission line alignment would cross through potential habitat for banner-tail kangaroo rat, kit fox, golden eagle, and ferruginous hawk. Impacts to these species resulting from the proposed transmission line alignment would be similar to those described above for the power plant under

Alternative B. Additional impacts to golden eagle and ferruginous hawk resulting from this alternative would include an increase in the long-term potential for raptor line strikes/collisions and electrocution from perching on or near tower conductors due to the construction of electrical transmission towers and lines.

Western burrowing owl: The proposed transmission line alignment would also cross through potential habitat for this species. There is no potential nesting habitat for this species along the proposed transmission line alignment; however, potential foraging habitat is present in that area. Impacts to western burrowing owl resulting from this alternative are described under general impacts to sensitive species.

Sora and brown pelican: These species would likely occur as incidental migrants within the San Juan River corridor or at Morgan Lake within transmission line Segment D. Potential nesting habitat does not occur along the transmission line alignment. Impacts to this species would be limited to temporary avoidance of the river corridor and Morgan Lake during construction. These impacts would be negligible and short term.

American peregrine falcon: There is no potential nesting habitat for this species within the action area; however, the site does provide potential foraging habitat for these raptor species. General impacts are described above. In addition, electrical transmission and distribution lines could negatively impact this species by causing direct mortality and disrupting breeding, nesting, and foraging behaviors. Habitat loss and fragmentation could result in a decreased prey base for this species. Mitigation measures outlined below would minimize or avoid impacts. Potential impacts would be negligible and long term following the implementation of mitigation measures.

Roundtail chub, mottled sculpin, and bluehead sucker: Impacts to these aquatic species would be potential impacts occurring during transmission line construction activities that result in discharge of sediment into the San Juan River. Human activity during construction in portions of the San Juan River that these species are known to frequent has the potential to directly impact these species by causing temporary dispersal. Additionally, accidental fuel, lubrication, or other hazardous material spills in the construction zone, depending upon the size, has potential to reach the San Juan River and adversely impact localized fisheries and/or downstream habitats such as nursery backwaters. Potential impacts to fisheries, however, from sedimentation or hazardous material spills would be mitigated by implementation of the construction *Stormwater Management Plan* and by the project *Hazardous Materials Handling and Response Plan*. Following implementation of these plans, impacts to these fisheries would be negligible.

Northern leopard frog: This species has not been recorded in the action area. Potential habitat for this species is limited to riparian areas adjacent to the San Juan River and at Morgan Lake. Removal of some shrub riparian habitat at the San Juan River would result in a minimal short-term disturbance to potential habitat. Impacts to this species would be short term, occurring during transmission line construction activities that result in discharge of sediment into the San Juan River. Human activity during construction in portions of the San Juan River that these species are known to frequent has the potential to directly impact these species by causing temporary dispersal. Additionally, accidental fuel, lubrication, or other hazardous material spills in the construction zone, depending upon the size, has potential to reach the San Juan River and adversely potential habitat. Potential impacts from sedimentation or hazardous material spills would be mitigated by implementation of the construction *Stormwater Management Plan* and by the project *Hazardous Materials Handling and Response Plan*. Following implementation of these plans, potential impacts would be negligible.

Alternative Transmission Line Segment B

Federally Listed Species

Impacts to federally listed species under this alternative would be similar to those under the proposed transmission line alignment, with the additional impacts addressed below.

Southwestern willow flycatcher: Similar negligible to minor impacts from noise and human activities are possible during construction of alternative transmission line Segment B where tower placements and line-stringing activities could impact southwestern willow flycatchers when these activities are within 0.25 mile of the Chaco River and conducted during the breeding season. This assumes that willow flycatcher could, in the future, utilize the Chaco River. To date there are no records, albeit limited surveys completed (2006 presence/absence surveys were negative) of this drainage. Avoidance of construction activities during the breeding season within 0.25 mile of the Chaco River would eliminate the potential for impacts to willow flycatchers.

Western burrowing owl: This species has been recorded as breeding within the BNCC Lease Areas IV South and V and along transmission line Segment B. Impacts to western burrowing owl resulting from the action alternatives are described under general impacts to sensitive species. Though individuals would be impacted by the proposed action, the population as a whole would not. Mitigation measures for burrowing owl are provided below. Potential impacts would be minor and long term following implementation of mitigation measures.

Sensitive Species

Impacts to sensitive species under this alternative would be similar to those under the proposed transmission line alignment.

4.3.4.2.5 Access Road

Federally Listed Species

Construction and operation of the proposed access road would have no adverse effects to federally listed species.

Sensitive Species

The access road alignment provides potential habitat for banner-tail kangaroo rat, kit fox, golden eagle, ferruginous hawk, and western burrowing owl. Potential impacts to these species would be similar to those described above for the power plant.

4.3.4.2.6 Water-supply System

Water Well Field Area A

Federally Listed Species

Mesa Verde cactus populations were documented along a small portion of the utility/water corridor associated with water well field A, just west of the Chaco River. Potential impacts to this species would be similar to those described above for Alternative B – Proposed Transmission Line Alignment (Segments A, C, and D).

Mancos milkvetch: No Mancos milkvetch were found in the project area during 2006 surveys. Limited habitat exists where minor protrusions of Point Lookout Sandstone occur along the water well field A utility/water pipeline corridor. Following the implementation of mitigation presented below, potential impacts would be limited to disturbance of potential habitat during construction and maintenance.

Sensitive Species

Potential habitat for banner-tail kangaroo rat, kit fox, golden eagle, western burrowing owl, and ferruginous hawk is present within the water well field A area. Potential impacts to these species would be similar to those described above for the power plant under Alternative B.

Proposed Water Well Field B

Federally Listed Species

Construction and operation of water well field B is not expected to adversely affect any federally listed species.

Sensitive Species

Impacts to sensitive species from this action alternative would be less than development of water well field A as it would not require construction of the utility corridor/water pipeline. The area provides potential habitat for banner-tail kangaroo rat, kit fox, golden eagle, American peregrine falcon, western burrowing owl, and ferruginous hawk. Potential impacts to these species would be similar to those described above in Section 4.3.6.2.1, Power Plant Environmental Consequences.

Mining Operations in BNCC Lease Areas IV South and V

Federally Listed Species

Mining operations in BNCC Lease Areas IV South and V would not be expected to adversely affect any federally listed species.

Sensitive Species

San Juan milkweed: This species occurs in seven dispersed small populations within BNCC Lease Areas IV and V (Ecosphere unpublished data). Impacts to this species would occur during soil removal and disturbance from mining activities and power plant construction that would result in plant mortality. Temporary and permanent soil disturbance could negatively impact seed sources. The seedbed in stored topsoils could potentially result in a loss of seed viability and decrease the success of recolonization during reclamation. This species may be more abundant than previously thought (pers. comm. Daniela Roth 2004). Recommended mitigation measures provide below would minimize impacts to special status plants and habitat. Impacts would be moderate and long term. Impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing.

Bolack's sand verbena, Cottam's milkvetch, Naturita milkvetch, Mancos saltplant, and Parish's alkali grass: The action area offers potential, but unoccupied, habitat for these species. None of the above listed special status plant species were observed within the proposed project area during surveys. However, prolonged drought conditions may have precluded germination over the past several years. Seed viability for these species can range up to 10 years, as in the case of Mancos saltplant. Potential impacts would be through loss and modification of suitable habitat. Dormant seedbeds could be adversely impacted by construction activities or long-term topsoil storage. Recommended mitigation measures provided below would minimize impacts to special status plants and habitat. Impacts to potential, but currently unoccupied, habitat would be low and long term.

Mountain plover: This species has been recorded as breeding with BNCC Lease Areas IV South and V. General impacts to this species are described above. Mountain plovers do not nest in the same areas from year to year. A pre-construction survey to determine presence/absence, and no ground disturbance activities within occupied habitat during the period between April 1 and July 15 would minimize impacts to mountain plover. Impacts are not likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing. Implementing mitigation measures would minimize potential impacts, which are expected to be negligible and long term.

BNCC Lease Areas IV South and V provide potential habitat for banner-tail kangaroo rat, kit fox, golden eagle, ferruginous hawk, and western burrowing owl. Potential impacts to these species would be similar to those described above for Alternative B operations.

4.3.4.2.7 Mitigation to Reduce Impacts

- Timing restrictions for construction and maintenance of transmission towers within and above the San Juan River floodplain (i.e., all towers within 0.25 mile of the San Juan River) and similar restrictions on timing for stringing conduit across the San Juan River. Work would be avoided between November 1 and March 31 to avoid disturbance to over-wintering bald eagles; if not practicable, a biological monitor would be on site.
- Should a bald eagle(s) be observed perched within 0.25 mile of the transmission line crossing of the San Juan River, or of tower placements near the Chaco River, no construction activities would commence until the eagle leaves the area of its accord.
- Hospital-grade mufflers would be installed on all permanent project components that generate noise above acceptable levels in areas that are likely to be utilized by bald eagles for roosting or foraging.
- Proposed electrical transmission and distribution lines would be designed and constructed utilizing "raptor-safe" design. The most complete manual on this work is: "Suggested Practices For Raptor Protection On Power Lines: The State of the Art in 1996" (APLIC 1996).
- Although few studies on bird flight diverters have been completed, and most found that they reduced collision rates (Crowder and Rhodes 1999), diverters would be installed on all lines at the river crossing, per recommended specifications.
- Spacing of phase-to-phase and phase-to-ground wire would be sufficient to allow passage for large-winged birds (Manville 2006). To minimize electrocutions that could occur while eagles are perching, cross-arm braces on steel distribution poles or artificial perches on wooden distribution poles would be installed (as recommended in Manville 2006).

- Timing restrictions for construction of transmission towers and stringing of conduit lines, as well as other construction and maintenance activities within and above the San Juan River floodplain and within 0.25 mile of the Chaco River, would be implemented. Work should be avoided in these areas between May 1 and August 30 to avoid disturbance to migrant or potential breeding flycatchers. If not practicable to avoid these months, a biological monitor would be on site.
- Should clearing of riparian vegetation in areas of suitable southwestern willow flycatcher habitat be necessary, Desert Rock Energy Company LLC, in coordination with the Navajo Natural Heritage Program and the USFWS, would develop a compensatory mitigation plan to offset the potential loss of habitat.
- Because southwestern willow flycatcher habitat along the Chaco River was not subject to protocol surveys in 2006 in all survey periods, the Chaco River would be resurveyed for willow flycatchers if habitat conditions change over the course of project development and construction.
- Timing restrictions for construction of transmission towers and stringing of conduit lines, as well as other construction and maintenance activities within and above the San Juan River floodplain and within 0.25 mile of the Chaco River, would be implemented. Work would not be conducted between May 1 and August 30 to avoid disturbance to yellow-billed cuckoos.
- Should clearing of riparian vegetation in areas of suitable cuckoo habitat be necessary, Desert Rock Energy Company LLC, in coordination with the Navajo Natural Heritage Program and the USFWS, would develop a compensatory mitigation plan to offset the potential loss of habitat.
- Because yellow-billed cuckoo habitat along the Chaco River was not subject to protocol surveys in 2006 in all survey periods, the Chaco River would be resurveyed for cuckoo if habitat conditions change over the course of project development and construction.
- Modifications of constituent habitat elements within a 100-year flood plain would be prohibited within areas of designated Colorado pikeminnow and razorback sucker critical habitat.
- A Storm Water Pollution Prevention Plan for all construction activities with potential to discharge of sediment into the San Juan River would be implemented. This would include project components that are adjacent to the San Juan River, as well as those components constructed away from the San Juan River but with potential for runoff to flow into the San Juan River.
- A Hazardous Materials Handling and Response Plan would be developed and implemented for all proposed project components.
- In areas of potential Mancos milkvetch habitat, pre-construction surveys for all potentially disruptive activities and for all ground-disturbing activities would be conducted. This would include all construction and maintenance activities, or any activity requiring human presence. Surveys would include a minimum of a 200-foot buffer around the areas that have potential to be disturbed. The recommended survey period is during the flowering period (April to early May); however, surveys can be conducted by experienced botanists year-round. If individuals are encountered during surveys, construction plans would be altered to minimize or eliminate disturbance.
- Human activity in portions of the project area where Mancos milkvetch have potential to occur would be minimized. Workers associated with the Desert Rock project would limit their activities to established construction and maintenance areas, roads, and walkways.
- Intensive pedestrian surveys for Mesa Verde cacti were performed in May of 2006. All Mesa Verde cacti and associated habitat that could potentially be affected by construction, operation, or maintenance of the transmission line was documented. All areas that could be affected (directly

or indirectly) by construction, operation, or maintenance of the transmission line or access roads, within the 250-foot right-of-way and access roads outside the right-of-way, would be resurveyed prior to construction activities to develop a pre-engineering map which would include all cacti locations from previous surveys. Unoccupied habitat would be classified in terms of quality, based on substrate suitability, the degree to which suitable substrate is fragmented or isolated, previous presence of cacti (based on Navajo Nation records and the 2006 surveys), and proximity to occupied habitat.

- Based on the results of the 2006 surveys and pre-engineering surveys, a detailed *Mesa Verde Cactus Construction Plan* would be developed for the purposes of avoiding cacti and minimizing disturbance of habitat, to the greatest extent practicable. The construction plan would include a map of all cacti identified through the spring 2006 surveys, pre-engineering surveys, habitat classification by quality, and all construction work areas. The construction plan would be submitted to the USFWS, NNDFW, and the BIA for review. In order to discourage the illegal harvesting of cacti, the locations of cacti would be kept confidential and no universal transverse mercator coordinates would be included in the final reports. Project Construction Inspectors and biological monitor(s) would be the only individuals with detailed cacti location information. All agency comments would be addressed and incorporated into the plan, as appropriate, prior to construction. The plan, without the maps of specific cacti locations, would be included in the project plan of development (POD) and adherence to the recommendations included therein would be a requirement of the construction contractor.
- Construction areas, including tower sites and spur roads, would be located in coordination with project engineers and resource specialists so as to avoid individual cacti and habitat identified during the surveys. Wire-pulling and wire-splicing sites and materials staging areas would be evaluated for the presence of individual cacti prior to the clearing of any vegetation necessary in order to store equipment on site. Placement of these areas would be within, or would be as near as practicable, to existing roadways and/or heavily used areas. The siting of these areas also would take into consideration indirect effects from operation and maintenance (e.g., long-term utilization of access roads in areas where cacti are known to occur) as well as effects related to potential increase of access by off-road/highway vehicles. The pre-engineering surveys would determine the level of impact on cacti or their habitat in areas of conventional access.
- To the extent practicable, the placement of access roads would minimize disturbance to Mesa Verde cactus habitat. The approximate locations of overland spur access roads would be included as part of the detailed maps included in the POD. The locations of access roads would be further refined once final engineering has been completed and the exact locations of the tower sites are determined. The edges of the access roads would be flagged in the field and to the extent practicable, would take advantage of existing disturbance, slope, and topography. Access roads would not be proposed in any area known to contain individual Mesa Verde cacti based on the results of both the 2006 surveys and pre-construction surveys. To the extent possible, access roads would be sited no closer than 50 feet from a known individual cactus location.
- Overland spurs would not be bladed to the extent that is technically feasible and construction personnel would be advised to follow existing tire tracks within the designated area and minimize their trips along these spurs to the extent possible in order to reduce disturbance. When construction is complete, all tower sites and spur roads would be hand-raked to remove tire tracks. An emphasis would be placed on obscuring access points at intersections with paved and improved dirt roads and re-creating the topography and natural barriers (e.g., washes). Reclamation techniques would be specifically designed to address site-specific soil properties and the potential for long-term erosion.

- Pre-construction surveys for Mesa Verde cacti would be conducted in the spring of the year preceding the initiation of construction to identify any new areas of cacti. The locations of any additional cacti identified during pre-construction surveys would be added to the project maps developed for the POD. Appropriate mitigation would be developed and reviewed with the Bureau of Indian Affairs, and other applicable agencies, and included in the POD.
- A worker education and awareness program for Mesa Verde cacti would be developed and presented to all personnel that would be on site during pre-construction surveying and construction. The program would include information on the legal and biological status of Mesa Verde cactus, the importance of habitat, the occurrence of cactus and unoccupied habitat in the study area, conservation measures, fines and penalties for damaging or removing cacti, and reporting procedures to be used if cacti not previously identified are discovered or disturbed cacti are discovered. A simple pamphlet or card summarizing critical information for avoiding cactus and minimizing effects on habitat would be provided to all field personnel.
- Qualified biologists would be on site to monitor avoidance of cacti and habitat during all construction-related activities, including the initial delineation of construction exclusion areas (e.g., fenced and flagged areas). All sites where Mesa Verde cacti are present would be monitored daily. Construction activity within 200 feet of a cactus site would be monitored continuously during construction activity. Any disturbance to cactus or habitat outside the construction zone would be reported immediately by the biological monitor to the Construction Inspection Contractor, who would report to the BIA and the NNFWD. A written account including a map, the extent of the disturbance, the number of cacti and/or quantity of habitat disturbed, and the circumstances surrounding the disturbance would be submitted to the BIA within 48 hours. The incident reporting procedures for all construction activity is part of the project POD.
- Access roads and tower sites in areas where Mesa Verde cacti are present would be enclosed with construction fencing. Fencing along access roads would extend 200 feet in both directions beyond the limits of areas that contain cacti or designated suitable habitat. Any cacti located within the right-of-way would be enclosed with construction fencing including, where possible, a buffer radius of 50 feet around the cacti. All project personnel would be instructed that their activities must be confined to the designated construction area. All construction fencing would be inspected daily by the on-site biologist and maintained in a functional capacity by the contractor.
- All traffic would be restricted to the right-of-way, designated work areas, and authorized access roads. Overland spur roads would be used in areas to minimize surface disturbance and would be staked or flagged in the field. Construction vehicle movement would be restricted to designated access.
- The pneumatic cleaning of construction equipment would be required before it is permitted on the right-of-way, as well as when equipment is moved from an area where noxious plant species are known to be present. Water would not be used to clean equipment since it may provide moisture for germination of noxious weed seed that may be present.
- Because of the delicate nature of soil structure in areas that support Mesa Verde cacti, no post-construction reseeding would be implemented. Such soils are typically fine-grained, possess a low cohesion and in-place density, and are highly subject to erosion. Disturbance to soil structure during revegetation efforts conducted in these types of soils can accelerate erosional processes, which are known to be detrimental to Mesa Verde cacti. Reseeding would establish plants in Mesa Verde cactus habitat, in some instances where there is currently minimal vegetation that would compete with the cacti for water and other resources. A restoration plan for all areas of disturbance would be included in the POD.

- Routine post-construction inspections of the line in Mesa Verde cactus habitat would be performed using aircraft. For minor maintenance or repair of structures or line that may be required, access would be accomplished by helicopter. If extensive repairs are required, all stipulations governing the placement and restoration of access routes covered in this document would be required. Surveys for Mesa Verde cactus would be required prior to any ground disturbing activities for maintenance. Surveys performed would be valid for 3 years.
- Individual Mesa Verde cacti that cannot be avoided during the construction process would be transplanted in cooperation with the NNDFW. Transplanted cacti would be monitored for a minimum of 5 years. Desert Rock Energy Company LLC would provide funding for the annual monitoring and monitoring report.
- Desert Rock Energy Company LLC would monitor the Mesa Verde cactus population for a 5-year period in the vicinity of where the proposed transmission line would connect to the Navajo Transmission Project.
- Locked gates would be installed at strategic locations to restrict unauthorized vehicle access to protect Mesa Verde cacti along the right-of-way. Strategic locations are those areas where a gate can be placed into a topographic feature that cannot be crossed by vehicles. Signs would be placed at intersections of the access road with other roads to discourage vehicular traffic along the right-of-way. They would alert people to the sensitivity of the area.
- Desert Rock Energy Company LLC would develop a comprehensive weed management plan that addresses the management of exotic species for a period of time post construction (preferably at least 5 years).
- Following the completion of preconstruction surveys, if it is determined that special status plant species occur within the project area the NNDFW would be consulted in accordance with the project Environmental and/or Biological Resource Compliance Monitoring Plan to develop strategies to minimize or avoid impacts to identified species.
- No ground disturbing activities within 1/8 mile of mountain plover occupied nesting habitat between April 1 and July 15th. If construction activities occur within the mountain plover breeding season a pre-construction presence/absence survey would be conducted.
- To avoid direct impact to any burrowing owl or nest, conduct a pre-construction survey no more than 30 days prior to construction according to the Burrowing Owl Survey Protocol and Mitigation Guidelines (California Burrowing Owl Consortium 1993). If owls are found to be using the site and avoidance is not feasible, a passive relocation effort (displacing the owls from the site) may be conducted, subject to the approval of the NNDFW.
- If construction activities occur during the owl breeding season, and if burrowing owls are observed on or within 250 feet of a project site during preconstruction surveys, a 250-foot protective buffer would be established with the placement of a barrier fence. The fence would remain in place for the duration of the breeding season. The fence integrity would be monitored by a qualified biologist.
- If possible, construction would be timed to avoid activities within specified buffers (to be determined by the NNDWF), of known raptor breeding areas until after young have fledged. If construction must occur within the specified protection zone for a given nest, NNDFW would prescribe additional mitigation (e.g., screening the nest from construction activity, monitoring the nest during construction) to protect the nest from disturbance, to be determined on a case-by-case basis.

- Mitigation measures approved by the NNDFW should be employed to avoid disturbing any current or future potential area golden eagle or ferruginous hawk nesting sites. The following are recommended conservation/coordination measures that would, at a minimum, be implemented:
    - ➢ If a nest is identified in the project area, construction or other disruptive human activities would be avoided between January 15th and May 30th to avoid sensitive nesting time periods for golden eagle and ferruginous hawk.
    - ➢ If these time periods cannot be avoided, pre-activity raptor survey would be conducted to determine the presence/absence of courting and/or nesting raptors within a 1-mile radius of proposed activities.
    - ➢ If occupied raptor territories or nests are identified, a *Monitoring Plan* would be developed in coordination with the NNDFW to monitor raptor behavior during any NNDFW approved activities. This *Monitoring Plan* would include procedures for terminating/delaying activities if raptors are being impacted by the activities.
- Prior to any ground disturbing activities, conduct reconnaissance surveys to document whether there are any kit fox burrows, burrowing owl burrows, or bannertail kangaroo rat mounds along or within 0.25 mile of proposed disturbance areas.
- Should active burrows be detected, NNDFW would be consulted to determine impact minimization or avoidance measures.

4.3.4.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

Impacts to special status species under Alternative C would be similar to those under Alternative B, given that the footprints are similar. Refer to the summary of effect determinations to federally listed species in Table 4-15 and the summary for sensitive species impacts in Table 4-16.

4.3.4.3.1 Power Plant

Power plant particulate emissions under this alternative would be about 61 percent less than those under Alternative B. Effects to federally listed species and sensitive species impacts under this alternative would be similar but of less intensity to those described above under Alternative B.

4.3.4.3.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Effects to federally listed species and sensitive species under this alternative would be similar but of less intensity than those under Alternative B, since this alternative would require about 766 acres, a reduction of about 439 acres relative to Alternative B. The 250-foot corridor width would result in smaller area of disturbance to potential yellow-billed cuckoo, bald eagle, and southwestern willow flycatcher habitat where the transmission line would cross the San Juan River.

Alternative Transmission Line Segment B

This alternative would result in 829 acres of disturbance, 63 acres more than the proposed alternative that includes transmission line Segment A. Under this alternative, the right-of-way would be 250 feet in width, resulting in disturbance to 544 fewer acres relative to Alternative B. Impacts to federally listed species and sensitive species would be similar but reduced from those under Alternative B. The smaller corridor width would disturb fewer acres of potential yellow-billed cuckoo, bald eagle, and southwestern willow flycatcher habitat where the transmission line would cross the San Juan River.

4.3.4.3.3 Access Road

The access road under this alternative would be the same as that under Alternative B.

4.3.4.3.4 Water-supply System

Water Well Field A

Under this alternative, the water well field would require 9 to 18 new production water wells, compared to the 10 to 20 wells under the proposed Alternative B. The well field under this alternative would encompass about 890 acres. Long-term disturbance would occur on 40.5 acres within the well field for construction, drilling, and operation of a maximum of 18 water wells, and the construction of collector pipelines and an access road. Water well field A would require construction of a utility corridor/water pipeline, which would directly impact 150 acres. Impacts to federally listed and sensitive species would be similar to those under Alternative B.

Proposed Water Well Field B

Impacts to federally listed species and sensitive species would be similar to those under water well field A, described above. However, impacts would be fewer because it would not be necessary to construct and operate the 12.4 -mile utility corridor/water pipeline. The total acreage of the well field would be 890 acres, with approximately 40.5 acres where disturbance would be long term.

4.3.4.3.5 Mining Operations in BNCC Lease Area IV South

Impacts to federally listed species and sensitive species would be similar to those under Alternative B. However, since this alternative would not use Lease Area V for mining, there would be fewer impacts to sensitive species. Approximately 7,954 acres in Area V would not be developed. Area V provides potential habitat for San Juan milk weed, mountain plover, banner-tail kangaroo rat, kit fox, golden eagle, ferruginous hawk, and western burrowing owl.

4.3.4.3.6 Mitigation to Reduce Impacts

Mitigation measures under Alternative C would be the same as those described under Alternative B.

4.3.4.4 Summary of Impact Analysis

Although Alternative C would have a smaller footprint and thus result in less disturbance and fewer impacts overall, effects to federally listed species generally would be similar under Alternatives B and C. However, with the smaller transmission line right-of-way width under Alternative C, less occupied and potential but unoccupied habitat for Mesa Verde cactus would be disturbed. The transmission line river crossing under Alternative C would result in less disturbance to potential migratory stopover habitat and potential nesting habitat for southwestern willow flycatcher. Although Alternative B would produce more emissions than Alternative C, both alternatives would result in small increases in mercury and selenium levels within the San Juan River and Morgan Lake. The subsequent minor change in water quality may affect, is likely to adversely affect federally listed aquatic species (Colorado Pikeminnow and razorback sucker).

Impacts to sensitive species under both action alternatives would be similar. The use of a smaller transmission line right-of-way width under Alternative C would result in reduced disturbance to occupied habitat and potential, unoccupied habitat for several sensitive species (banner-tail kangaroo rat, kit fox, golden eagle, ferruginous hawk, and western burrowing owl) compared to Alternative B. Alternative B would require the development of BNCC Area V in addition to Area IV South, disturbing approximately 7,954 more acres relative to Alternative C and resulting in greater impacts to sensitive species including golden eagle, ferruginous hawk, and western burrowing owl. Under both action alternatives, impacts to sensitive species generally would be localized and would not be likely to result in a loss of species viability range-wide, nor cause a trend to Federal listing.

4.4 LAND USE AND RECREATION

4.4.1 Impact Assessment Methodology

The evaluation of the potential for impacts on land use caused by project construction or operation included the following considerations:

- Would a residence or other land use be displaced from an established location?
- Would the proposed project conflict with existing land use plans, policies, or regulations?
- Would there be a loss in the availability of recreational uses or changes to access?

The displacement of a land use would constitute a major impact, as the use would be substantively changed. A conflict with existing plans or regulations would vary from negligible to major depending on the nature of the conflict. The loss of recreational uses could range from negligible to major, depending on the uniqueness of the resource and the number of users. Changes to access that might affect existing uses could vary from negligible to major depending on the availability of alternative access routes. The remainder of this section describes the impacts on land use and recreation that would be anticipated to result from the proposed project and alternatives, as well as mitigation measures to reduce the effect of any potentially adverse impacts. Impacts relating to farming and livestock grazing are evaluated separately in Section 4.6, Agriculture.

4.4.2 Environmental Consequences

4.4.2.1 No Action (Alternative A)

Under Alternative A, no power plant, transmission facilities, access road, water supply facilities, or any other component of the proposed project would be constructed. This would result in no change to any existing land uses.

4.4.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

During construction, most direct impacts on land use and recreational resources stemming from the implementation of the proposed action would be temporary, such as modifications of access to existing residential areas. Other impacts would include increased construction-related noise, dust, and traffic during the construction period, which is expected to last approximately 3 years. Long-term permanent impacts would include the removal or relocation of structures or the displacement of leased home sites within the BNCC Lease Areas IV South and V.

Coordination with local chapters, utility companies, or other entities would be required to avoid potential disturbance to existing and planned projects, other rights-of-way, and cultural sites. However, most land use conflicts identified could be avoided through mitigation measures identified below. No conflicts were identified with existing or planned land use plans.

4.4.2.2.1 Power Plant

Residential – No residences are located on the proposed power plant site. The closest structure appears to be abandoned and is located on BNCC Lease Area IV North, approximately 0.5 mile northeast of the proposed power plant site. This homesite was already relinquished through an agreement with BHP to allow expansion of mining operations to support the Four Corners Power Plant. Future mining activities unrelated to the Desert Rock Energy Project would result in the displacement of this structure.

Commercial, Industrial, Other Public Uses – No existing commercial or industrial uses are located within the power plant site. The BNCC lease area is located adjacent to the eastern boundary of the plant site, and would be considered a compatible industrial land use. Collection of plants or eagle feathers for ethnobotanical purposes at the power plant site would be prohibited on the approximately 592-acre parcel.

It should be noted that prior to construction-related activities, the Federal Aviation Administration would be consulted regarding potential interference of navigable air space pursuant to Federal law. As of the date of this document, it is unknown whether the proposed 917-foot stack or other ancillary facilities associated with the proposed action would interfere with navigable air space.

Rights-of-way – The power plant site would have no impact on existing rights-of-way.

Recreation – While no developed recreational facilities or areas have been designated on the power plant site, recreational use is passive and dispersed. Recreational activities that could be limited with the construction of the power plant include small game, furbearer, and game-bird hunting and trapping.

Future Land Use – The proposed power plant has no identified effects on future land use plans.

4.4.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Residential – The majority of land that would be crossed by the proposed transmission line is undeveloped, with the exception of rural residential areas along Segment D near the San Juan River. No residences are located within the 500-foot right-of-way along Segments A and C. One residence located on the Navajo Indian Reservation would be adjacent to the 250-foot right-of-way along the Segment D alignment, near Milepost 7. Any impacts on this homesite lease would be avoided by adjusting the locations of the lattice towers to the extent practicable, or the homesite lease could be adjusted to accommodate the right-of-way. Construction of the 500kV transmission line could temporarily disrupt access to residences located north and south of the San Juan River.

Commercial, Industrial, Other Public Uses – Construction of the 500kV transmission line along Segment D could temporarily disrupt access to the San Juan Chapter house located south of the San Juan River. Most existing structures located within the right-of-way (such as a water pipeline and two irrigation canals) could be avoided during construction by adjusting the alignment or lattice spacing. A grave plot located within the 250-foot right-of-way near Milepost 7 of Segment D would be avoided by spanning this site (lattice placement). The Four Corners Generation Station and associated facilities (evaporation ponds, radio tower, etc.) would not be affected and are considered a compatible industrial land use.

Rights-of-way – The proposed transmission line alignment would parallel and cross several high-voltage transmission lines. A portion of the Segment C alignment would parallel four 345kV transmission lines and one 500kV transmission line, and a portion of Segment D would parallel one 345kV transmission line and one 230kV line. Existing access roads could be used for construction of Segments C and D of the proposed transmission line; however, Segment A does not parallel any existing transmission lines and would require development of a new access road for construction and long-term maintenance. Distribution lines crossed by Segment D would not be affected during construction or operation of the proposed transmission line alignment. Impacts on the natural gas pipeline crossed by Segment C at Milepost 2.5 would be avoided by spacing lattice towers to span the pipeline. It is anticipated that owners of existing facilities would be coordinated with prior to construction-related activities to avoid unnecessary impacts on these facilities.

Recreation – Construction of access and maintenance roads for Segment A or improvement to existing access roads for Segments C and D would increase access throughout the area, potentially providing additional opportunities to access remote areas for dispersed recreation. Visual impacts that could affect the recreational experience would be minimized due to the collocation of the majority of the new lines associated with the Desert Rock Energy Project with existing transmission lines (see Section 3.7, Visual Resources). The proposed alignment would not affect recreational activities at Morgan Lake, but construction could temporarily restrict recreational activities (fishing) along the San Juan River in the immediate vicinity of Segment D of the proposed alignment.

Future Land Use –The proposed transmission line alignment could affect one planned burial area located directly beneath Segment C and could also affect undisclosed scattered ceremonial and/or burial areas in the San Juan Chapter (see Section 4.9, Cultural Resources for more information related to this discussion). According to the San Juan Chapter Community-Based Land Use Plan (2002), burial and ceremonial sites should not be disturbed. Complying with the Native American Graves Protection and Repatriation Act (1990) and the Navajo Nation Policy for the Protection of Jishchaá: Gravesites, Human Remains, and Funerary Items (1996) and avoidance of sensitive areas through lattice placement would minimize impacts to burial areas. The proposed alignment would not impact planned commercial tourist enterprises along N36 and planned community facilities.

Construction and operation impacts resulting from the proposed alignment on a proposed nature trail from San Juan River to Morgan Lake and open space areas planned along The Hogback and the San Juan River would be minimized due to the alignment's collocation with existing transmission line corridors. Impacts on the proposed Navajo Nation Municipal Pipeline would be avoided through coordination with the Bureau of Reclamation.

4.4.2.2.3 Alternative Transmission Line Segment B

Alternative transmission line Segment B, an alternative to transmission line Segment A, would connect to Segment C at the same location as Segment A. Impacts from Segments C and D are discussed above.

Residential – Segment B crosses an area that is generally rural and primarily used for livestock grazing, with very few residences west of the Chaco River. One residence and one hogan are located within the proposed 500-foot right-of-way (no residences are located within the proposed right-of-way for Segment A). The alternative Segment B would be sited to avoid residences wherever possible. Construction of the 500kV transmission line could cause temporary indirect/secondary impacts on residences, such as increased dust and noise.

Commercial, Industrial, Other Public Uses – Since Segment B passes through an area largely devoid of development, no land use impacts would occur.

Rights-of-way – Segment B of the transmission line alignment would partially parallel four 345kV transmission lines and would parallel and cross a natural gas pipeline, which would not be impacted. Existing access roads could be used for construction of the portions of the segment paralleling the transmission line and pipeline, but the development of new access roads for construction and maintenance could be required.

Recreation – Creation of or improvement to access and maintenance roads for Segment B could provide access to previously inaccessible areas, thereby providing increased opportunities for access to remote areas for dispersed recreation. Construction of the alignment could temporarily restrict dispersed recreational activities (such as small game and bird hunting) along the Chaco River.

Future Land Use – Alternative transmission line Segment B would have no effect on future land use plans.

4.4.2.2.4 Access Road

Residential – The access road would cross between Areas IV North and IV South of the BNCC lease area (approximately 2.2 miles in length) currently being used for livestock grazing, with very few residences located in the vicinity of the access road. No residences, however, are located within the 75-foot proposed right-of-way. Construction of the access road could cause temporary impacts on residences in the vicinity of the access road with increased dust and noise. It is expected that after construction-related activities, this road would be paved up to a point where it would intersect with the proposed BNCC Burnham Road Realignment Project.

Commercial, Industrial, Other Public Uses – As stated previously, the proposed access road crosses land within the BNCC lease area, but would be considered a compatible industrial land use and would not impact BNCC's mining operations. No commercial, industrial, or public uses are located within the access road alignment; therefore, no impacts would occur on these types of land uses.

Rights-of-way – No existing rights-of-way would be impacted by the access road.

Recreation – Impacts on recreational resources would not occur.

Future Land Use – The proposed access road would have no effects on future land use.

4.4.2.2.5 Water-supply System

Proposed Water Well Field B

Wells would be dispersed within the 592-acre power plant parcel mostly south of Pinabete Wash and within the right-of-way for proposed transmission line Segment A, with each well requiring approximately 1 acre of land surrounded by a chain link fence and spaced between 0.25 and 1 mile apart within and along the 500-foot-wide corridor. Total surface disturbance associated with each well would be between 0.25 and 0.5 acre. Final well spacing would be determined based on the results of test well data.

Residential – No residences were identified within the 592-acre power plant site parcel or along transmission line Segment A; therefore, no direct impacts on residential land use would occur from water well field B. Indirect impacts to nearby residences (within 0.5 mile) could include increased dust and noise from construction (refer to Section 4.1, Air Quality for a discussion of mitigation for these impacts).

Commercial, Industrial, Other Public Uses – There would be no impacts on existing commercial or industrial uses (see Section 4.2, Water Resources related to effects on existing local water sources) from construction or operation of water well field B. Collection of plants or eagle feathers for ethnobotanical purposes would be prohibited on the 592-acre parcel power plant site that includes not only the power plant, but also up to 10 to 14 water wellheads south of the power plant that make up part of water well field B, as well as on the remaining 6 to 8 water wellheads that would be located along transmission line Segment A.

Rights-of-way – There would be no impacts on rights-of-way from construction or operation of water well field B. The portion of the well field along Segment A would not parallel or cross any existing rights-of-way.

Recreation – While no developed recreational facilities or areas have been designated within the proposed water well field, passive and dispersed recreation uses currently present could be slightly restricted due to perimeter fencing that would be installed in conjunction with the well field for safety reasons.

Future Land Use – Water well field B has identified no effects on future land use plans.

Alternative Water Well Field Area A

Wells would be dispersed within the water well field. Each water well would require approximately 1 acre of land surrounded by a chain link fence.

Residential – Land within the water well field would be located within the Sanostee Chapter boundary and is rural and primarily used for livestock grazing. No residents are located within the approximate 890-acre parcel; therefore, no direct impacts on residential land use would occur. Indirect impacts on two nearby residences within 0.5 mile could include increased dust and noise from construction and long-term maintenance activities.

Commercial, Industrial, Other Public Uses –There would be no impacts on commercial, industrial, or public uses from construction or operation of the water well field (see Section 4.2, Water Resources related to effects on existing local water sources). Since construction and operation activities would be restricted to the identified well field study areas, an inventoried burial site, located approximately 0.25 mile south of the well field area A, would not be impacted.

Rights-of-way – There would be no impacts to rights-of-way from construction or long-term operation of the water well field.

Recreation – Impacts would be the same as those associated with water well field B.

Future Land Use – Water well field A has identified no effects on future land use plans.

Utility Corridor/Water Pipeline

Residential – Land that would be crossed by the proposed utility corridor and water pipeline is undeveloped and primarily used for livestock grazing with very few residences located adjacent to the proposed corridor. No residences are located within the 100-foot proposed right-of-way. Construction of the utility corridor and water pipeline could cause temporary indirect impacts on residences in the vicinity, such as increased dust and noise.

Commercial, Industrial, Other Public Uses – Since the proposed utility corridor and water pipeline passes through an area largely devoid of development, there would be no impacts on these uses.

Rights-of-way – Construction of the utility corridor and water pipeline across U.S. Highway 491 could cause temporary traffic delays, thereby inconveniencing the occupants of dispersed residences and other travelers in the area. Generally, because the utility corridor and water pipeline alignment would be constructed below ground, existing utility rights-of-way would not be adversely impacted with the exception of an existing pipeline at Milepost 9. The utility corridor and water pipeline would parallel an existing access road for the majority of its length, which could be used during construction. New access roads may be required for construction and long-term maintenance along the new corridor.

Recreation – Creation of or improvement to access and maintenance roads for the utility corridor and water pipeline could provide improved access to remote areas used for dispersed recreation (such as Chaco River). Construction of the alignment could temporarily restrict dispersed recreational activities (such as small game and bird hunting) along Chaco Wash. The utility corridor and water pipeline would not affect recreation at nearby tourist attractions such as Table Mesa or Barber Peak.

Future Land Use – The utility corridor and water pipeline could restrict placement of the future 100-acre housing site proposed by the Sanostee Chapter near Milepost 10; however, due to lack of development in the area there would be ample space for both the utility corridor and water pipeline and the proposed residential development. Construction or operation of the utility corridor and water pipeline is not expected to affect open space or planned recreational facilities near Table Mesa or Barber Peak. Construction of the utility corridor and water pipeline is not expected to affect plans for the widening of U.S. Highway 491 or the proposed Navajo-Gallup Water Supply Project; however, coordination with the Navajo Department of Transportation, Federal Highway Administration, and the Bureau of Reclamation prior to construction would prevent any unforeseen impacts to either project.

4.4.2.2.6 BNCC Lease Areas IV South and V

Residential – Lands within Areas IV South and V of the BNCC lease area are rural and primarily used for livestock grazing, with 9 residences and 5 hogans dispersed throughout the approximately 13,000-acre area. Mining operations, including ground-clearing activities such as blasting and excavation, would require either removing or relocating the structures or limiting access to existing residences. These residences are located on home sites, leased from the Navajo Nation. Indirect impacts that could affect land uses would include increased dust, noise, and blasting vibrations from mining activities and traffic along haul roads.

Holders of impacted homesites, grazing permits, and customary-use areas would be compensated for the value of disrupted livestock production and relocation or replacement of improvements to their grazing area or homesite. Agreements with homesite users on BNCC's lease area are scheduled to be entered into when the residential areas are to be fenced for mining and closed to grazing users. These agreements would comply with 13 Navajo Tribal Code Section 1401-1403, which requires compensation for all surface use. Agreements would be reviewed by the Navajo Land Administration and BIA to ensure fair and equitable compensation.

Commercial, Industrial, Other Public Uses – No commercial or public uses were inventoried within Areas IV South and V; therefore, no direct impact would occur to these types of land uses. Indirect impacts that could affect the Community of Burnham (located 1.5 miles south of the lease areas) would include increased dust, noise, and vibrations from mining activities as these activities continue to progress in a southern direction.

Rights-of-way – Burnham Road would need to be rerouted as a result of mining activities in Lease Areas IV South and V. It is anticipated that BNCC would realign this portion of Burnham Road to interconnect with the proposed power plant access road on the east terminus to the north and south to Navajo Road 5 east of the lease area.

Recreation – While no developed recreational facilities or areas have been designated on Areas IV South and V, recreation is passive and dispersed. Mining activities could result in prohibiting recreational opportunities such as small game, furbearer, and game-bird hunting and trapping.

Future Land Use – A proposed housing and commercial site is located 0.5 mile southeast of the lease area. Impacts that could indirectly affect this area could include increased dust and noise or vibrations resulting from mining.

4.4.2.2.7 Mitigation to Reduce Impacts

The following mitigation measures would avoid or reduce impacts on land use:

- Lattice tower (transmission line) locations would be spaced to avoid potential impacts within the right-of-way (especially to culturally significant areas such as burial sites and ceremonial sites).
- Coordination with the Hogback and San Juan Chapters would occur to mitigate or avoid disturbance to culturally significant areas (e.g., burial sites, ceremonial sites) along Segments C and D of the proposed transmission line alignment.
- Coordination with the Bureau of Reclamation would occur to avoid possible impacts to the proposed Navajo Nation Municipal Pipeline and the Navajo-Gallup Pipeline.
- Coordination with the Sanostee Chapter would occur regarding the proposed 100-acre housing site.
- Compensation and relocation assistance would be provided for structures within Lease Areas IV South and V of the BNCC lease area, as appropriate.

Additional mitigation would be required for water well field A and the associated utility corridor and water pipeline, as follows:

- Directional boring would be implemented under U.S. Highway 491 to construct the water pipeline.
- Coordination with the owners of four 345 kV transmission lines, two pipelines, a small power line, a telephone line, and a water distribution line would occur prior to construction of the utility corridor/water pipeline.

4.4.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.4.2.3.1 Power Plant

The impacts on land use and recreation under this alternative would be similar to those under Alternative B.

4.4.2.3.2 Transmission Lines

Under Alternative C, impacts from the proposed transmission line alignment (Segments A, C, and D) and from alternative transmission line Segment B would be similar to those under Alternative B. However, under Alternative C the single 500kV circuit would only occupy a 250-foot right-of-way for the length of Segments A, B, and C (one-half the width relative to Alternative B).

4.4.2.3.3 Access Road

Impacts would be the same as under Alternative B.

4.4.2.3.4 Water-supply System

Impacts would be similar to those discussed under Alternative B. However, under Alternative C, passive and dispersed recreation and ethnobotanical uses would be restricted approximately over a slightly smaller area than under Alternative B (by perimeter fencing that would be installed in conjunction with the well field for safety reasons).

4.4.2.3.5 Mining Operations in BNCC Lease Areas IV South and V

Impacts would be the similar to those under as under Alternative B for Area IV South. Under Alternative C, no mining activities are proposed for BNCC Lease Area V and thus there would be no relocation of the 6 residences or grazing uses within Area V.

4.4.2.3.6 Mitigation to Reduce Impacts

Mitigation measures are the same as those described for Alternative B.

4.4.3 Summary of Impact Analysis

Alternative A, as the No Action Alternative, would result in no changes to current conditions. The mining operations would require the relocation of existing uses on Lease Areas IV South and V, for which the holders of impacted home sites or grazing permits would be compensated. Proposed transmission line Segment A would have fewer land use impacts than the alternative Segment B, since two residences are within the Segment B right-of-way. Alternative C would not require the use of Lease Area V, which would avoid impacts on six residences and one agricultural structure located in that area.

4.5 TOPOGRAPHY, SOILS, GEOLOGY, AND MINERAL RESOURCES

4.5.1 Impact Assessment Methodology

Impacts on earth resources would be classified as adverse if the action being considered would result in the following:

- Construction or clearing would be required on slopes that are prone to mass movement or have very high susceptibility to erosion;
- Soil properties would be so unfavorable or difficult that standard mitigation measures, such as revegetation, would be ineffective;

- Long-term impacts associated with accelerated erosion, sedimentation, or disruption of unstable slopes would occur;
- Destruction of unique geologic features or resources, including mineral resources, would be required; and
- A large volume release of fuel oil from an uncontained area that would flow overland and pool in drainages and swales.

No impact would occur where earth materials would remain unchanged. The magnitude of an impact could range from negligible to major depending on the sensitivity, quality, and quantity of the affected resource.

4.5.2 Environmental Consequences

4.5.2.1 No Action (Alternative A)

The No Action Alternative would result in no effects on topography, soils, geology and mineral resources at or near the proposed project site. Negligible impacts would occur from continued existing land uses. For example, agricultural and grazing uses of lands on the proposed project site could result in negligible degradation of topography and soils. However, these impacts would be less than the impacts resulting from implementation of the power plant project and use of the land during the life of the project.

4.5.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.5.2.2.1 Power Plant

The following are general impacts of concern relating to earth resources that potentially could result from the Desert Rock Energy Project:

- Surface disturbance can increase the potential for wind and water erosion of exposed soils; and
- Soil contamination can occur due to spills, runoff, or CCB disposal from operation of the plant.

Topography

Construction of the proposed plant and associated facilities could slightly alter the surface topography of an existing plateau. In addition to the general site grading, there would be additional topographic alteration to accommodate ditches and coal storage and handling areas. The estimated total surface disturbance is expected to be approximately 149 acres. This acreage would be irreversibly altered due to the development activities.

Soils

Table 4-18 summarizes the soil impacts. An average of 3 inches of topsoil and subsoil suitable for topdressing would be salvaged over the 149-acre plant site, for a total of about 80,000 cubic yards. This topdressing soil would be stored in stockpiles located around the property. The soil would be available for future reclamation activities.

Table 4-18 Summary of Impacts on Geology and Soils from Construction and Operation of the Proposed Desert Rock Energy Project

Impact	Impact Level	Rationale
Geologic features would be disturbed	Low	No unique or irreplaceable features present in the construction footprint.
Increased soils erosion and off-site sedimentation	Low to moderate	Soil would be affected on about 149 acres. Soil would be salvaged to an average depth of three inches over this area. Wind and water erosion during construction would be minimized using standard mitigation practices stipulated in water and air quality permits. Some salvaged soil would be spread on sediment dam faces or other exposed subsoil areas following construction. Stockpiled soils and all soiled surfaces would be revegetated.
Soil contamination from leakage or product spills	Low	Storage tank areas would be designed to comply with Tribal and Federal law.
Long-term loss of soil productivity	Low	Soils productivity would be reduced over the short-term, but would be recovered over the long-term.

Construction activities, including topsoil and suitable subsoil salvage, would increase the potential for wind and water erosion and offsite sedimentation. Water and wind erosion on the site would be controlled using mitigation practices established for other environmental permits, specifically water quality permits required under the Navajo Nation Clean Water Act and operating permits for maintaining air quality under the Navajo Nation Air Quality Control Program. For example, fugitive dust emissions would be mitigated by wet suppression control methods (see Section 4.1). Drainage ditches would be installed along roads and sediment control dams would be constructed in washes and maintained through the life of the Desert Rock Energy Project to mitigate erosion and sediment runoff to prevent off-site sedimentation. Any impacts would be further mitigated by timely topsoil replacement and revegetation after construction of exposed surfaces such as the outfaces of sediment control dams, dikes, slopes, and other "idle" areas within the plant site.

Sanitary water effluent would be discharged to the shallow subsurface in an engineered drainfield. Construction of the drainfield would cause permanent, localized saturation in the soil column beneath the drainfield, and add increased nitrogen, phosphate, TDS, and coliform loads to the current condition. Septic system design in accordance with BIA regulations would result in low impact to the local soil conditions.

Fuel oil tank area controls are required by BIA MPDES and by USEPA, National Pollutant Discharge Elimination System, and SPCC requirements. Implementation of these controls would minimize the potential for releases. Hazardous materials or petroleum hydrocarbon use, storage, and disposal in other areas should be conducted in accordance with manufacturers recommendations and USEPA RCRA, Toxic Substance Control Act, and other applicable state and Federal regulations.

In summary, impacts to soil productivity in areas where soil was replaced after construction and operation of the generation plant would be low with implementation of standard mitigation measures. Productivity losses on unreclaimed portions of the plant site would be irretrievable. Impacts on soil from pond, landfill, or septic system leachate, petroleum hydrocarbon, or hazardous material releases would also be low with implementation of standard design controls and mitigation measures.

Geology

The anticipated level of impacts to geologic features is low for construction of the proposed plant and appurtenances. The proposed plant would be sited on outcrops of Lewis Shale and Pictured Cliff Sandstone. There are no existing or proposed areas of geologic significance that could be impacted by construction activities. The presence of thin bentonitic clay layers in the Lewis Shale could impact construction slightly due to swelling in soil. There is a low probability potential for an earthquake to impact construction activities in the area. There is minor potential for landslides in the study area, particularly in areas with steeper slopes where formations that contain bentonitic clays are exposed. Landslides could adversely impact construction activities at those locations.

Mineral Resources

There are no oil and gas, CO_2, helium, geothermal, metallic, nonmetallic, or mineral materials resources present within 2 miles of the proposed power plant site that could be impacted. The coal seams underlying the area pose little possibility for resource impact since they are minor deposits.

4.5.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Topography – Construction of the proposed transmission line could slightly alter the surface topography.

Soils – Direct impacts to soils would be caused by construction of the transmission line towers, access road construction, maintenance activities, and site preparation. Small quantities of earth materials would be irretrievably lost due to construction and operation activities. These resources are not considered unique or irreplaceable in that there are abundant quantities of like material in the vicinity. Following construction of the transmission line, implementation of the mitigation measures listed below, including erosion control and revegetation, would reduce impacts to negligible.

Geology – The anticipated level of impacts to geologic features is low for construction of the transmission line as there are no existing or proposed areas of geologic significance in or around the area. The steeply dipping sedimentary rocks at The Hogback along Segment D could pose an adverse impact for construction activities due to geologic hazards caused by unstable slopes and rockslides.

Mineral Resources – There are no CO_2, helium, geothermal, metallic, or nonmetallic resources present in the area of the proposed transmission line that could be impacted. There are no oil and gas or mineral material resources along Segments A or C of the transmission line that could be impacted. Segment D traverses the Jewet Valley gas field at the San Juan River and could potentially have a minor adverse impact on this resource due to temporary construction activities. The coal seams underlying the area pose little possibility for resource impact since they are minor deposits. There are four mineral material pits present along Segment D of the proposed transmission line. The mineral material pits may be used as a source of construction materials and, if so, would be impacted by construction activities.

Alternative Transmission Line Segment B

Soils – Construction of the transmission line along Segment B could slightly alter the surface topography.

Topography – Direct impacts to soils would be caused by construction of the transmission line towers, access road construction, maintenance activities, right-of-way clearing, and site preparation. Minor displacement of earth materials can be expected during construction. Small quantities of earth materials would be irretrievably lost due to these activities. These resources are not considered unique or irreplaceable in that there are abundant quantities of like material in the vicinity.

Geology – The anticipated level of impacts to geologic features is low for construction of the access road as there are no existing or proposed areas of geologic significance in or around the area.

Mineral Resources – There are no oil and gas, CO_2, helium, geothermal, metallic, nonmetallic, or mineral material resources present in this area that could be impacted. The coal seams underlying the area pose little possibility for resource impact since they are minor deposits.

4.5.2.2.3 Access Road

Topography – Construction of the proposed access road could slightly alter the surface topography.

Soils – Direct impacts to soils would be caused by construction of the proposed access road, maintenance activities, right-of-way clearing, and site preparation. Minor displacement of earth materials can be expected during construction. Small quantities of earth materials would be irretrievably lost due to these activities. These resources are not considered unique or irreplaceable in that there are abundant quantities of like material in the vicinity.

Geology – The anticipated level of impacts to geologic features is low for construction of the proposed access road as there are no existing or proposed areas of geologic significance in or around the area.

Mineral Resources – There are no oil and gas, CO_2, helium, geothermal, metallic, nonmetallic, or mineral material resources present in this area that could be impacted. The coal seams underlying the area pose little possibility for resource impact since they are either minor deposits or deeper than 250 feet and considered unminable.

4.5.2.2.4 Water-supply System

Well Field Areas A and B

Topography – Construction of the well field at proposed water well field area B or alternative water well field area A could slightly alter the surface topography.

Soils – Direct impacts to soils would be caused by construction, maintenance activities, and site preparation. Minor displacement of earth materials can be expected during construction. Small quantities of earth materials would be irretrievably lost due to these activities. These resources are not considered unique or irreplaceable in that there are abundant quantities of like material in the vicinity of either area.

Geology – The anticipated level of impacts to geologic features is low for construction of the well field at either location as there are no existing or proposed areas of geologic significance in or around those areas.

Mineral Resources – There are no oil and gas, CO_2, helium, geothermal, metallic, nonmetallic, or mineral material resources present within 2 miles of either of the proposed well field locations that could be impacted. The coal seams underlying those areas pose little possibility for resource impact since they are minor deposits.

Utility Corridor

Topography – Construction of the water-supply system utility corridor could slightly alter the surface topography. Of the three sections discussed in Chapter 3, the segment west of Coal Creek would most likely be affected. The corridor would climb the hogback ridge, traverse a low saddle at the top of The Hogback, then drop down into Red Valley. The corridor could have heightened erosive potential on the slopes either side of The Hogback, and the drainage system could be altered by the corridor and pipeline construction activities.

Soils – Direct impacts to soils would be caused by construction, maintenance activities, and site preparation. Minor displacement of earth materials can be expected during construction. Small quantities of earth materials would be irretrievably lost due to these activities. These resources are not considered unique or irreplaceable in that there are abundant quantities of like material in the vicinity.

Geology – The anticipated level of impacts to geologic features is low for construction of the water-supply system corridor as there are no existing or proposed areas of geologic significance in or around the area.

Mineral Resources – There are no oil and gas, CO_2, helium, geothermal, or mineral material resources present in this area that could be impacted. The coal seams underlying the area pose little possibility for resource impact since they are minor deposits. Historical uranium and vanadium deposits, including one mapped mine, are found in the proposed water-supply system corridor west of Coal Creek. There is potential that mineral resources would be slightly impacted by this presence. There is also potential for impacts to construction activities from the possible presence of radioactive tailings.

4.5.2.2.5 Mining Operations in BNCC Lease Areas IV South and V

Topography and Landforms – The impact on landforms and topography resulting from mining activities in Areas IV South and V of the BNCC lease area would be extensive and long-term, and would continue through the proposed life of the mine. Surface mining of overburden and subsurface coal resources to depths of up to 240 feet would 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 excavated overburden rock.

Site reclamation is an important part of the mining process. Reclamation of landforms to 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 three or more spoil ridges have accumulated and would continue as mining progressed until the final pit is backfilled and the entire mined area is graded, topsoiled, and revegetated. Restoration to the approximate original contour would re-establish the drainage pattern to approximate original conditions and mitigate the impact on the hydrologic balance, topography, and landforms. Generally, regraded mined land would have the same general landform as the land had before mining but without any steep slopes (i.e., not steeper than 3 horizontal to 1 vertical [3h:1v]).

Large drainage features such as Pinabete Arroyo and tributary washes would be permanently altered where mineable coal seams are exposed on the sides of the arroyo, or occur beneath the arroyo channel. The restoration of the approximate original contour would re-establish the drainage pattern of the mined area to approximate original conditions, and conform to drainage in the surrounding unmined areas to mitigate the impact on the hydrologic balance. Construction of sediment containment ponds would mitigate stormwater runoff and reduce the potential sedimentation of offsite drainages.

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 failures.

There would be long-term impacts on landforms and topography resulting from coal mining. These impacts would be 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 escarpments or narrow canyons). The flatter topography would make the reclaimed area more suitable for multiple land uses.

Soils – Surface mining activities drastically disturb soil resources. The topsoil and suitable subsoil would be removed prior to mining activities and stockpiled for reclamation following backfilling and regrading of the mined areas. OSM would require a Topdressing Management Plan (TMP) that details the requirements for topsoil replacement over regraded spoil piles. OSM guidelines for reclamation programs and projects identify soil conditions that must be considered during reclamation including: soil pH and acid-forming spoils, sodic zones, and toxic substance occurrence in soil.

Soil Salvage and Replacement. By definition, topsoil means the A and E soil horizon layers of the four master soil horizons (30 CFR Part 701.5). Most soil series in the BNCC lease area have A horizons that range in thickness between 0 to 2 inch and 1 to 5 inches, depending on the soil. The most recent soil survey in BNCC Lease Areas IV and V was completed by Buchanan Consultants, Ltd. (1998) in the No Name Mine Area, which is located between Pinabete Wash and No Name Wash within the southern portion of Area IV South. Results from the No Name Mine soil survey indicate that the topsoil in the lease area is often 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 topdressing mixture suitable for reclamation (Buchanan Consultants 1998). When topsoil material requirements must be met to support a reclamation plan, it would be prudent to salvage the residual soils unless their depth makes salvage impractical.

Soil surveys completed for the Navajo Mine (WESCO 1976) and the No Name Mine (Buchanan Consultants 1998) concluded that sodic zones having high sodium absorption ratios (SAR) may be present in regraded spoils and could restrict revegetation growth. The 1989 Navajo Mine EA (OSM 1989) supported these conclusions and indicated that revegetation success has not been demonstrated in regraded sodic spoils because of low precipitation and high SAR. The Navajo Mine EA proposed 4 special permit conditions to establish physical and chemical parameters for the upper 4 feet of regraded spoil to mitigate impacts on vegetation and promote post-mining land use. These conditions define a soil sampling program for regraded spoil and establish acceptable suitability limits on soil chemistry parameters based on information provided in the application permit package. Results of the No Name Mine soil survey are directly applicable to the BNCC lease area and can be compared to the permit special conditions to assess residual soils unsuitability for restoration based on soil chemistry parameters, such as selenium concentration, sodic zones, pH, and acid-forming spoils (Buchanan Consultants 1998).

If there is insufficient salvageable topsoil for reclamation, overburden material could be chemically evaluated for use in a mixture to provide additional topdressing for reclamation. For example, overburden materials having elevated sodium absorption ratios also may have unsuitable pH values: either alkaline pH values greater than 8.8, or acidic pH values less than 5.5.

Soil Loss. Soil replacement 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. An approved TMP would help 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 mulching and/or cover cropping.

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 affected by terracing, ripping, contour furrowing, and other methods. By implementing the practices in the OSM-approved Reclamation Surface Stabilization Design Handbook and BTCA practices, the impact of soil loss by erosion on newly reclaimed and terraced slopes could 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.

Soil Unsuitability. A TMP would include plans and procedures to salvage the topsoil (A horizon) 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 would be protected from wind and water erosion by seeding of the stockpiles and placement of berms around the perimeter of the stockpile. Graded spoil would be sampled and inventoried to determine how much topsoil and/or supplemental plant growth material is needed to create a nontoxic, nonacid-forming root zone. An assessment of spoil suitability for use in the reclamation root zone would based on several soil parameters including: pH, electrical conductivity, saturation percentage, SAR, texture, total and soluble selenium, boron, and acid-base accounting.

Implementation of the TMP 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 achieve a suitable 4-foot thick root-zone. Graded suitable overburden material would be covered with up to 12 inches of soil, with a minimum of 6 inches (OSM 1989). Implementation of the TMP would result in the creation of an approximately 4-foot-thick nontoxic, nonacid-forming root zone capable of restoring and even exceeding the predisturbance productivity of the disturbed areas.

Soil Productivity. The original soil profile would be lost permanently. Long-term soil erosional stability would be maintained by establishing and maintaining an effective and permanent vegetative cover. Although the reclaimed (post-mining) land cannot be restored to pre-mining 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 plant root zone over the entire reclaimed area and establish an effective, diverse, and permanent vegetative cover.

Geology – The anticipated level of impacts to geologic features is low as there are no existing or proposed areas of geologic significance in or around the area.

Mineral Resources – There are no oil and gas, CO_2, helium, geothermal, metallic, nonmetallic, or mineral materials resources present in this area that could be impacted. The coal beds in the area are part of the Fruitland Formation and are generally less than 250 feet deep. The beds contain up to 10 coal-bearing horizons suitable for mining. These resources would be removed from the area for economic use. The impact to resources would be irretrievable, but expected.

4.5.2.2.6 Mitigation to Reduce Impacts

Although there are no mitigation measures for the irreversible alteration of topography resulting from the proposed project, adjustments and alterations of the drainage patterns are recommended to mitigate impacts to other resources, including soils. Recommended standard mitigation measures for soil erosion would include design controls identified as best management practices in applicable permits and reclamation plans for the facility, such as drainage ditches and sediment control dams. Recommendations to mitigate impacts to soil productivity include replacement of topdressing and revegetation to restore and enhance vegetation growth and grazing/habitat improvement in the long term.

4.5.2.3 550 Megawatt Subcritical Facility and Associated Facilities

4.5.2.3.1 Power Plant

Impacts to topography, soils, geology and mineral resources resulting from implementation of the 550 MW facility would be comparable to the impacts resulting from Alternative B, except approximately 39 fewer acres would be disturbed.

4.5.2.3.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Impacts to topography, soils, geology, and mineral resources resulting from construction of the proposed transmission line for the 550 MW facility would be comparable to the impacts resulting from construction of the proposed transmission line for Alternative B, except approximately 439 fewer acres would be disturbed.

Alternative Transmission Line Segment B

Impacts to topography, soils, geology, and mineral resources resulting from construction of the alternative transmission line alignment for the 550 MW facility would be comparable to the impacts resulting from construction of the alternative transmission line alignment for Alternative B, except approximately 544 fewer acres would be disturbed.

4.5.2.3.3 Access Road

Impacts to topography, soils, geology, and mineral resources resulting from construction of the proposed access road for the 550 MW facility would be the same as impacts resulting from construction of the proposed access road for Alternative B.

4.5.2.3.4 Water-supply System

Well Field Alternatives

Impacts to topography, soils, geology, and mineral resources resulting from construction of either well field alternative would be comparable to the impacts described for Alternative B, except fewer acres would be disturbed by fewer wells.

Utility Corridor

Impacts to topography, soils, geology, and mineral resources resulting from construction of the water-supply system corridor for the 550 MW facility would be the same as impacts resulting from construction of the water-supply system corridor for Alternative B.

4.5.2.3.5 Mining Operations in BNCC Lease Area IV South

Impacts to topography, soils, geology, and mineral resources resulting from mining operations for the 550 MW facility would be the same as impacts resulting from mining operations for Alternative B, although a smaller area would be impacted.

4.5.2.3.6 Mitigation to Reduce Impacts

Although there are no mitigation measures for the irreversible alteration of topography resulting from the proposed project, adjustments and alterations of the drainage patterns are recommended to mitigate impacts to other resources, including soils. Recommended standard mitigation measures for soil erosion would include design controls identified as best management practices in applicable permits and reclamation plans for the facility, such as drainage ditches and sediment control dams. Recommendations to mitigate impacts to soil productivity include replacement of topdressing and revegetation to restore and enhance vegetation growth and grazing/habitat improvement in the long term.

4.5.3 Summary of Impact Analysis

Alternative A would result in no effects on topography, soils, geology and mineral resources at or near the proposed project site. Some impacts could occur from continued existing land uses; however, these impacts would be negligible compared to the impacts resulting from Alternatives B and C during the life of those projects. Implementing either Alternative B or C would result in surface disturbances that would irreversibly alter the topography, increase soil erosion, and reduce soil productivity. There would be no difference in the nature of the impacts to topography and soil resources between Alternatives B and C, except that fewer acres would be impacted by Alternative C. These impacts would be mitigated by implementing best management practices such as design controls and reclamation plans.

4.6 AGRICULTURE

4.6.1 Impact Assessment Methodology

Assessment of impacts on agricultural resources is based on the type and amount of disturbance that would be caused by construction and operation of project facilities. Potential adverse impacts that would affect agriculture could include loss of agricultural fields or forage, or exclusion of grazing within a grazing customary-use area. The magnitude of impacts are measured by the amount and type of loss of farmland, grazing area, or property damage, with a significant or major impact defined as an effect that would render a farm or grazing use unviable. Other impacts that affect agriculture and grazing could range from negligible to major. Mitigation would be required where it would be effective and practicable, including but not limited to replacement of damaged range improvements and ensuring that transmission lines would span cultivated fields to avoid disturbance to farm operations.

Impacts on agricultural resources were evaluated within the expected areas of ground-disturbance activities: within the proposed and alternative rights-of-way for linear facilities (transmission lines, roads, and utility lines), and within the boundaries of the well field and power plant site. Agricultural use data within the study area were obtained from the BIA Navajo Branch of Natural Resources and the Navajo

Department of Agriculture. An examination of the United States Department of Agriculture Soil Surveys and Navajo Chapter community-based land use plans was conducted. Impacts were assessed using the best available information; however, estimates were used to assess disturbance within areas where data were not complete (particularly for grazing).

4.6.2 Environmental Consequences

4.6.2.1 No Action (Alternative A)

Under Alternative A there would be no change in current agricultural conditions or land uses as a result of the proposed project.

4.6.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

A majority of the proposed project's impact on agricultural use (e.g., forage material and farmland) would be temporary and would primarily result from construction-related, ground-disturbing activities. Temporary impacts on forage and exclusion of grazing would occur in localized areas (particularly the power plant site and the BNCC lease area). However, impacts from the Desert Rock Energy Project would not preclude grazing from continuing at current levels within the grazing districts.

Short-term impacts to grazing could occur from construction activities (e.g., ground clearing, leveling, trenching, equipment installation, staging, backfilling, and reclamation). These ground-disturbing activities could require the removal of range improvements or forage used for livestock grazing. These areas would be reclaimed following construction. Mining operations such as blasting, extraction, and excavation would result in longer-term impacts to grazing. Mining areas also would be reclaimed after operations cease.

Construction and operation of linear components would limit future construction of additional (agricultural related) structures within the proposed project rights-of-way. Further, linear facilities would limit expansion of existing agricultural areas adjacent to the right-of-way, or reduce the amount of available land for agricultural permits.

In accordance with the Farmland Protection Policy Act (PL 97-98, 7 USC 4201 et. seq.), the San Juan and Shiprock offices of the Natural Resource Conservation Service (NRCS) were contacted to identify whether prime and unique farmland is present within the study area. It was determined that some farmland of statewide importance is present along Segment D of the proposed transmission line alignment, but potential impacts would be mitigated in this area through sensitive tower placement and measures to mitigate impacts on soils and noxious weeds.

4.6.2.2.1 Power Plant

Livestock Grazing – Long-term impacts would include the exclusion of grazing from 592 acres to accommodate the lease area for the power plant site, which would be completely fenced along the perimeter. Table 4-19 shows the estimated number of acres of grazing land that would be permanently removed by the construction of each project facility. The grazing area for 6 permit holders would be reduced by the permanent removal of forage area. However, loss of grazing area on the power plant site would be a minor impact since it would not be expected to impact the ability of these permit holders to graze sheep within the grazing district, which is substantially larger than the project area.

Table 4-19 Land Permanently Removed from Grazing for Project Facilities

Project Component	Maximum Acres Permanently Removed from Grazing	
	Alternative B	Alternative C
Power Plant Site	592	592
Proposed Transmission Line (Segments A, C and D)	5.3	5.3[1]
Alternative Transmission Line (Segments, B, C, D)	5.7	5.7[1]
Proposed Water Well Field B	10	9
Alternative Water Well Field A and Utility Corridor	10	9
Proposed Access Road	20[2]	20[2]
BNCC Lease Areas IV South and V	13,012	5,097

SOURCES: Burnham Chapter Community Land Use Planning Committee 2005; U.S. Department of the Interior, Bureau of Indian Affairs 2006

NOTES: Numbers are estimates only.

[1] These figures are associated with the lattice tower locations, which would be similar to Alternative B.

[2] Any current grazing in this area would be displaced by mining operations regardless of access road construction.

Farming – No farming plots were identified within the power plant site; therefore, no impacts to farming have been identified.

4.6.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, and D)

Livestock Grazing – Grazing would be impacted along the proposed transmission line alignment since forage removal would be required to accommodate tower sites, staging areas, and in some areas, new access routes. Standard BMPs for reseeding with native species and noxious weed invasion control would be utilized. Following rehabilitation of the impacted areas, the only areas that would restrict grazing would include the tower footings, rights-of-way associated with access roads, at well pads, and at the power plant site. The remainder of rangeland within the transmission line right-of-way would be available for grazing. Overall, the proposed project would not displace or preclude grazing as a land use in the region.

Long-term displacement of forage resulting from the location of the lattice towers associated with Segments A, C and D would occur on approximately 5.3 acres of land. Overall, the proposed project would not displace or preclude grazing as a land use. The proposed transmission line alignment is located within a 500-foot right-of-way corridor (Segments A and C) and a 250-foot right-of-way corridor (Segment D) that traverse portions of approximately 45 grazing permit areas. Short-term impacts on grazing forage during construction would include soil compaction.

Approximately 65 percent of the proposed transmission line alignment parallels existing transmission line rights-of-way; existing access roads would be used during construction and long-term maintenance to minimize ground-disturbing activities.

Farming – The potential for both long- and short-term impacts on agriculture would be localized (primarily between Mileposts 4.5 and 6.5 of Segment D near the San Juan River) because of the limited amount of cultivated farmlands within the study area. In areas where the transmission line would cross farmland, tower placement would be designed to either bypass or span over agricultural areas. Of the approximately 35 acres of farmland located within the proposed transmission line alignment (along

Segment D) permanent right-of-way, under 1 acre would permanently be restricted from farming uses to accommodate the placement of lattice towers.

Alternative Transmission Line Segment B

Transmission line Segment B is an alternative to transmission line Segment A that would connect to Segment C. Impacts resulting from Segment B, along with impacts resulting from Segments C and D, are discussed below.

Livestock Grazing – Grazing would be impacted in some areas as a result of forage removal from the alternative transmission line alignment, primarily during construction. Alternative transmission line alignment Segment B is located within a 500-foot right-of-way corridor that traverses portions of an estimated 5 claimed-use areas used by 6 permittees who are authorized to graze approximately 394 sheep units. Segments B, C and D (combined) would traverse an estimated 14 claimed-use areas used by 44 permittees who are authorized to graze approximately 2,401 sheep units.

Long-term displacement of forage resulting from the concrete footings of the lattice towers would occur on approximately 5.7 acres of land for Segments B, C and D combined . Overall, the proposed project would not displace grazing as a land use.

Approximately 75 percent of the alternative transmission line Segment B would parallel existing transmission lines; therefore, existing access roads would be used during construction to minimize disturbance to forage and sheep, resulting in less disturbance to grazing areas than Segment A, which would not parallel existing facilities.

Farming – No farming plots were identified along Segment B; therefore, no impacts on farming would occur. Impacts on farmland crossed by Segment D would be the same as discussed for Alternative B.

4.6.2.2.3 Access Road

Livestock Grazing – The proposed access road alignment would be located within a 75-foot right-of-way corridor that traverses the Navajo Mine. Consent to relinquish grazing rights on claimed-use areas has already been provided to BHP to allow mining in Area IV North. Any current grazing in this area would be displaced by mining operations regardless of access road construction.

Farming – No farming plots were identified along the proposed access road; therefore, no impacts to farming have been identified.

Upon completion of construction, the road would be accessible only to authorized personnel, as it would be paved and locked.

4.6.2.2.4 Water-supply System

Water Well Field Area A

Livestock Grazing – Grazing would be impacted as a result of forage removal during construction of the water wells (20 wells at approximately 1 acre of disturbance per site), pipeline collector lines, and the access road. Construction and operation of the water well field would displace up to 10 acres temporarily during construction and up to 10 acres permanently of forage area.

Farming – No farming plots were identified within water well field A. The construction and operation of this field could reduce the land available for farming if the irrigation system concept proposed in the Sanostee Chapter Land Use Plan is implemented.

Proposed Water Well Field Area B

Livestock Grazing – Construction and operation of the water well field would displace up to 10 acres temporarily during construction and up to 10 acres permanently of forage area. This alternative would have fewer impacts on grazing than Area A because it would not require the construction and operation of the 11.5-mile utility corridor/water pipeline. Approximately 7 miles of connector pipelines would be constructed between the water wells within Segment A of the proposed transmission line corridor interconnecting seven independent well heads along this corridor.

Farming – No farming plots were identified within or along water well field B (including along transmission line Segment A); therefore, no impacts on farming have been identified.

Utility Corridor/Water Pipeline

The corridor and water pipeline would only be needed for well field A.

Livestock Grazing – Grazing would be impacted as a result of forage removal during pipeline and access road construction activities. The utility corridor/water pipeline would be located within a 100-foot corridor that traverses portions of 8 claimed-use areas used by 18 permittees who are authorized to graze approximately 1,689 sheep units. Construction of the pipeline and other facilities within the corridor would temporarily displace grazing within the construction right-of-way. A majority of the utility corridor/water pipeline would parallel an existing unimproved road, minimizing potential impacts to forage or sheep that would be associated with temporary access road construction.

Farming – No farming plots were identified along the utility corridor/water pipeline. The utility corridor would have no foreseeable impacts on the irrigation system concept proposed in the Sanostee Chapter Land Use Plan.

4.6.2.2.5 Mining Operations in BNCC Lease Areas IV South and V

Livestock Grazing – Livestock grazing throughout BNCC Lease Areas IV South and V would gradually be displaced on an ongoing basis as mining activities expand over time. The maximum amount of forage area removed would be approximately 13,012 acres, affecting 7 claimed-use areas and up to 20 permit holders who are authorized to graze a total of 1,420 sheep units. BNCC would compensate customary users for loss of grazing areas in accordance with Navajo Nation and BIA requirements and would restore the land in BNCC Lease Areas IV South and V to conditions suitable for livestock grazing post-mining.

Farming – No farming plots were identified in BNCC Lease Areas IV South and V; therefore, no impacts to farming have been identified.

4.6.2.2.6 Mitigation to Reduce Impacts

- Any range improvements damaged as a result of project construction or operation would be repaired or replaced.
- Where farmland would be crossed, impacts of transmission line towers on agricultural operations would be minimized through careful tower placement or spanning cultivated fields.

- Use of existing access roads during construction would minimize disturbance to forage and sheep.
- Best management practices for reseeding temporarily disturbed areas with appropriate native species would be followed after construction (see section on general mitigation beginning on page 4-2 as well as section on vegetation, Section 4.3).

4.6.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.6.2.3.1 Power Plant

The impacts on agriculture under this alternative would be similar to those described under Alternative B, as the affected areas and construction activities would be similar.

4.6.2.3.2 Transmission Lines

Under Alternative C, impacts from proposed transmission line Segments A, C, and D, and alternative transmission line Segment B would be similar to those under Alternative B. However, the single 500kV circuit would only occupy a 250-foot right-of-way for the length of Segments A, B and C (half the width relative to Alternative B). Ground disturbance of grazing area resulting from construction and operation of a single 500kV transmission line would be slightly less than under Alternative B; however, disturbance from access during construction would be similar to that under Alternative B.

4.6.2.3.3 Access Road

Impacts would be the same as under Alternative B.

4.6.2.3.4 Water-supply System

Impacts would be similar to those under Alternative B. However, under Alternative C, grazing would be restricted approximately over an 11 percent smaller area than under Alternative B (by perimeter fencing that would be installed in conjunction with the well field for safety reasons).

4.6.2.3.5 Mining Operations in BNCC Lease Areas IV South and V

Impacts would be the similar to those under Alternative B for Area IV South. Under Alternative C, no mining activities would be proposed for BNCC Lease Area V and thus there would be no impacts on grazing or agriculture in those areas.

4.6.2.3.6 Mitigation to Reduce Impacts

Mitigation measures are the same as those described for Alternative B.

4.6.3 Summary of Impact Analysis

Alternative A, as the No Action Alternative, would not change current conditions for agriculture and grazing. Under both Alternatives B and C, negligible to minor impacts on grazing would be expected because of the small acreage affected relative to the larger use area. In addition, best management practices that minimize surface disturbance and its effects during construction would be implemented. Potential impacts on existing agricultural areas, such as along the proposed transmission line Segment D, would be avoided or mitigated by paralleling existing lines and by sensitive placement of towers.

4.7 VISUAL RESOURCES

The primary source of impacts on visual resources would be the result of the construction and long-term operation of the Desert Rock Energy Project. The relationship between sensitive viewers, viewing distance, and project facilities provided the basis for evaluation of visual impacts. Visual impacts occur in environments where viewers experience discernible changes in the landscape as viewed from residences, sensitive cultural sites, travel routes, and recreation or designated scenic areas. Impacts on landscapes, or scenic integrity impacts, occur when new features or activities represent a change to, and a deviation from, the current condition. Impacts associated with the visibility of atmospheric or regional haze are discussed in Section 4.1.

4.7.1 Impact Assessment Methodology

This section discusses the assessment methodologies used to evaluate impacts of the proposed project and alternatives on landscape character/scenic integrity and sensitive viewers. Also discussed is the use of photo simulations and line-of-sight diagrams, which aided in the assessment of impacts. Assessment of impacts on *landscape character/scenic integrity* was performed using the following main considerations: (1) the level of existing scenic integrity, and (2) the degree of perceived change (or project contrast) to current naturalness of the area (or scenic integrity). Impacts on *sensitive viewers* considered the following: (1) existing scenic integrity, (2) project contrast, and (3) distance of viewer from project features (or distance zone).

The assessment of the magnitude of visual impacts is based primarily on the following considerations:

- Would there be a substantial adverse effect on a scenic vista?
- Would there be substantial damage or disturbance of scenic resources, including but not limited to vegetation, rock outcroppings, and historic buildings?
- Would substantial degradation of the existing visual character or quality of the site and its surroundings occur? In this analysis, substantial degradation is defined as a perceptible, long-term (longer than 1 year), high level of visual impacts occurring within moderately to highly sensitive public views.
- Would the project comply with tribal guidelines or goals related to scenic quality?
- Would the project significantly alter the existing natural viewsheds, including any changes in natural terrain?
- Would the project significantly change the existing scenic quality of the region or eliminate visual resources?

The level of impact significance is determined in accordance with the following definitions:

- High (or Major) Impact – will likely cause a substantial long-term and adverse effect on landscape character or scenic quality on an existing viewshed due to the contrast between the proposed project and the level of existing scenic integrity.
- Moderate Impact – will create a noticeable but not substantial change in landscape character/scenic quality; or will cause a noticeable, but not substantial change on a sensitive viewer viewshed.

- Low (of Minor)/Negligible Impact – will create negligible or no change in contrast, severity, and susceptibility to changes in scenic integrity, viewer sensitivity, project visibility, and viewer exposure.

4.7.1.1 Impacts on Landscape Character/Scenic Integrity

Consideration of the current scenic integrity levels and the magnitude of change resulting from the proposed project (or project contrast) provided the basis for the assessment of impacts on landscape character/scenic integrity (Table 4-20). Evaluations of the project area illustrated that most areas retain a high level of scenic integrity. Areas with low scenic integrity included existing power generation and transmission facilities, active mining areas and mining facilities, and travelways.

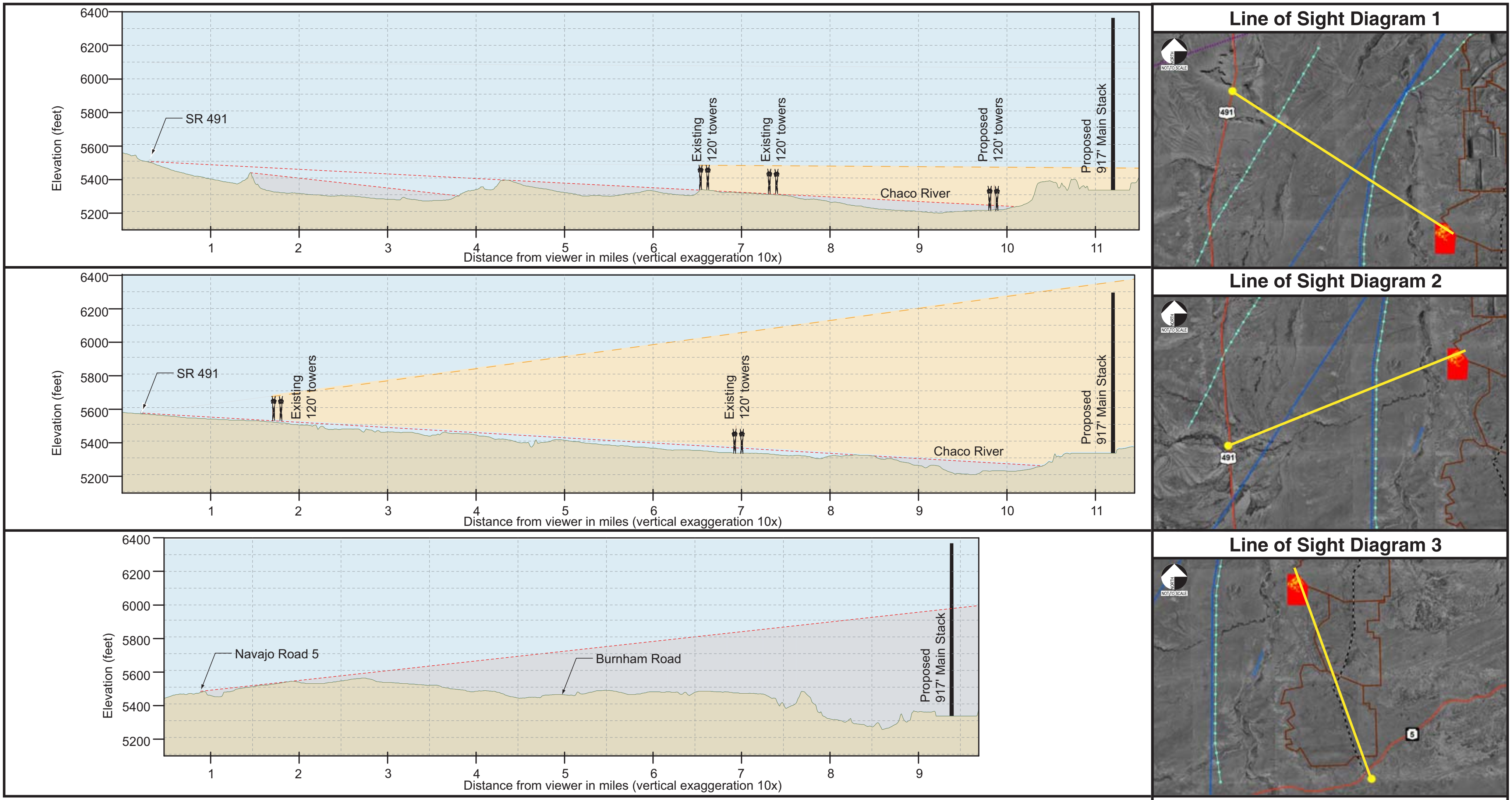
Table 4-20 Impacts on Scenic Integrity

		Scenic Integrity			
		Very High	**High**	**Moderate**	**Low**
Project Contrast	Strong	High Impact	Moderate to High Impact	Moderate Impact	Low to Moderate Impact
	Moderate	Moderate to High Impact	Moderate Impact	Low to Moderate Impact	Low Impact
	Weak	Moderate Impact	Lowto Moderate Impact	Low Impact	Negligible Impact

Typically, areas with high existing scenic integrity levels would incur greater impacts from the introduction of project facilities (e.g., those with a higher project contrast) than those areas with moderate or low scenic integrity. In other words, areas with no existing industrial features would experience the highest level of impact; whereas areas already influenced by industrial features received a lower level of impact. Impacts on scenic integrity in the project area would vary greatly depending on location but generally would be high.

4.7.1.2 Visual Impacts on Sensitive Viewers

For the purposes of this analysis, impacts would result from the reduction of the landscape character/scenic integrity, or other qualities that establish a "sense of place" by the introduction of project facilities that would be seen from sensitive viewpoints (e.g., residences, recreation areas, areas of critical environmental concern, and travelways). These potential impacts on sensitive viewers associated with the project were determined by consideration of existing scenic integrity, project contrast, and distance zones (Table 4-21). Additionally, analysis of the ability of sensitive viewers to view the project facilities was considered and is demonstrated by visibility mapping that were developed into line-of-sight evaluations (Figure 4-2).



Legend:

— — —	Direct Line of Sight
— — —	Extent of obstructed views
▭	Area of Open views
▭	Area of Views with visual interference
▭	Area where views are blocked by terrain
⚡	Symbol represents 120-foot lattice structure

Note:
These Line-of-Sight Diagrams represent a very small viewing opportunity along regionally important travel ways

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Line-of-Sight Diagrams

Figure 4-2

Table 4-21 Impacts on Sensitive Viewers

Scenic Integrity	Distance Zones														
	Immediate Foreground			Foreground			Middle Ground			Background			Seldom Seen		
Very High	5	5	5	5	4	4	4	3	3	3	2	2	2	1	1
High	5	5	5	4	4	4	3	3	3	2	2	2	1	1	1
Moderate	5	5	4	4	4	3	3	3	2	2	2	1	1	1	0
Low	5	4	4	4	3	3	3	2	2	2	1	1	1	0	0
	Strong	Moderate	Weak	Strong	Moderate	Weak	Strong	Moderate	Weak	Strong	Moderate	Weak	Strong	Moderate	Weak

Project Contrast

Notes: 5 = High Impact; 4 = Moderate - High Impact; 3 = Moderate Impact; 2 = Low - Moderate Impact; 1 = Low Impact; 0 = No Impact

4.7.1.3 Visibility Mapping

Visibility analysis of the project main stack was conducted within a 12-mile radius. To model visual influence the eye level height of the typical viewer was assumed to be 5.5-feet and one point representing the main stack was elevated to 917-feet. This method revealed the viewpoints that have the highest potential to see the tallest project feature. Additionally, visibility analysis was conducted within 3 miles of project transmission facilities (assuming 120-foot-tall towers). This analysis identified which viewers had the potential to observe vertical facilities of the project power plant. Project facilities laying low to the ground (i.e., roads, pipelines) were evaluated at 0.5 miles.

4.7.1.4 Photo Simulations

Photo simulations were used to evaluate the accuracy of the predicted visual impacts. To provide a high level of confidence in the visual accuracy of the simulations, Computer Aided Design software, 3D simulation software, professional camera, and Global Positioning System (GPS) equipment were used to create a life-sized model of the project facilities and surrounding topography within the computer. This model is referenced to real world scale and coordinates, allowing the production of simulation figures to illustrate project facilities in the study area environment.

Three photo simulations were created for this analysis. One simulation depicts the Desert Rock Energy Project generation facility and two show the transmission line facilities (Figures 4-3, 4-4, and 4-5).

4.7.1.5 Line-of-Sight Analysis

The line-of-sight analysis depicted a straight line between the observer and the object being viewed, for this analysis the main stack and transmission lines. This analysis showed which natural or manmade features might provide visual interference/screening between the viewer and the target, such as existing transmission lines, hills, mountains, or bluffs. This type of analysis also provides some indication of which portions of the main stack or transmission lines might be seen from the observation point.

Two points along U.S. Highway 491 were selected to investigate potential project exposure along this main travel route between Gallup and Farmington, New Mexico. A third point was selected near the Burnham Chapter House to assess potential exposure from Burnham. A line-of-sight analysis was performed between these points and the main stack to illustrate the extent of their potential views (Figure 4-5).

4.7.2 Environmental Consequences

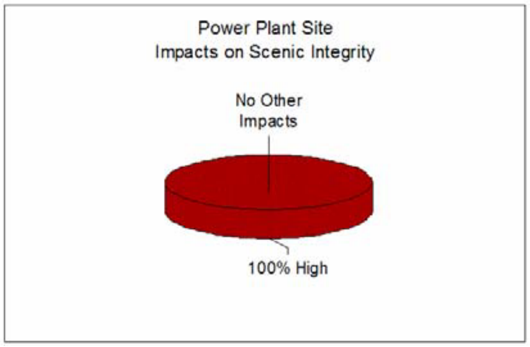
4.7.2.1 No Action (Alternative A)

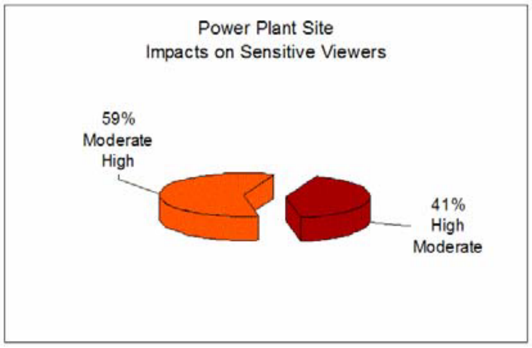
Under Alternative A, no power plant, transmission facilities, access road, water supply facilities, or any other component of the proposed project would be constructed. This would result in no change to any of the existing visual characteristics and therefore no impacts on visual resources.

4.7.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.7.2.2.1 Power Plant Site

The construction of the power plant would cause high scenic integrity impacts and moderate to high impacts on sensitive viewers in the foreground-viewing threshold. Short-term impacts would occur through the removal of vegetation, operation of construction equipment, and the presence of temporary construction facilities. Long-term impacts would stem from the maintenance and operation of the power plant. The large facilities such as generation buildings, cooling towers, switchyard, on-site coal storage, conveyors, a 917-foot-tall main stack, 541-foot cooling towers, and other associated facilities would be very noticeable to a viewer within 0.5 mile of the power plant. A single residence (potentially abandoned) has been identified in the foreground distance zone. A photo simulation has been developed to illustrate the potential views from this location (Figure 4-3). Viewers beyond 3 miles, such as viewers traveling U.S. 491, would experience intermittent views of the main stack in the extreme background only when looking to the east while traveling north or south (Figure 4-2). Impacts are summarized in the charts below.





4.7.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

The construction and operation of the proposed transmission line, a double circuit 500kV line on lattice towers, would cause a range of impacts in the study area. From Milepost 1 to approximately Milepost 6.5 of Segment A, the facility would not parallel existing transmission lines or other linear features. This

AFFECTED ENVIRONMENT

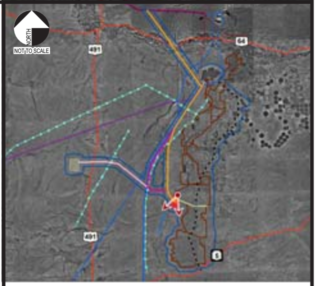
This viewpoint is located approximately 0.25 mile from the proposed power plant site. Views from this location toward the plant site are expansive and wide open. From this viewpoint, there are currently no significant man-made features on the landscape. It is anticipated that the power plant will have an adverse effect on the natural setting and potentially moderate-high to high impact on sensitive viewers (see diagrams to right).

ENVIRONMENTAL CONSEQUENCES

The power plant would dominate views from this location. Views of the horizon from this direction are blocked by the proposed power plant as simulated in the picture. This simulation represents the highest level of impact on sensitive viewers.

Simulation Location In Study Area

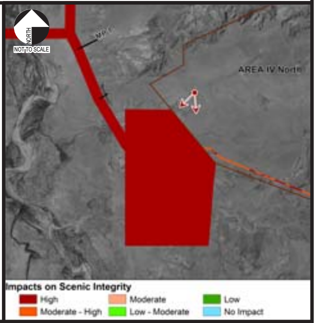
This viewpoint is located approximately 0.25 mile from the proposed power plant site. This simulation represents a view typical of what the closest residence (potentially abandoned) would experience.



Simulation Location in Study Area

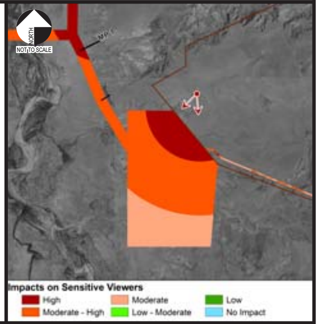
Impacts On Scenic Integrity

The landscape of the proposed power plant site lacks significant man-made modifications. This area represents high existing scenic integrity resulting in potential high impacts on the existing natural setting.



Impacts On Sensitive Viewers

The power plant site lies within the immediate foreground of a residence (potentially abandoned). A high impact on the viewer is due to the close proximity, high existing scenic integrity, and strong project contrast caused by the project facilities.



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Visual Simulation

Figure **4-3**

AFFECTED ENVIRONMENT

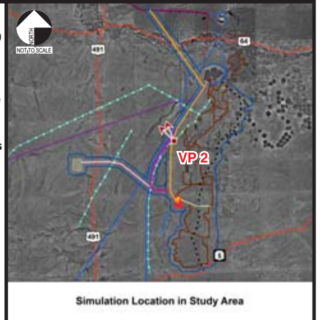
This viewpoint is looking toward the northwest at The Hogback (a regionally significant topographic feature) and represents a view with existing transmission facilities in the background, thus reducing overall project contrast. The backdropping provided by the topography in this view helps to reduce the visibility of the proposed project.

ENVIRONMENTAL CONSEQUENCES

This simulation represents a view toward the Proponent's Preferred Transmission Line Alignment at The Hogback. The backdropping provided by the topography and the existing transmission line help to "absorb" the Proponent's Preferred Transmission Line into the modified setting. Impacts on sensitive viewers are considered moderate because of increased viewing distance and reduced project contrast.

Simulation Location In Study Area

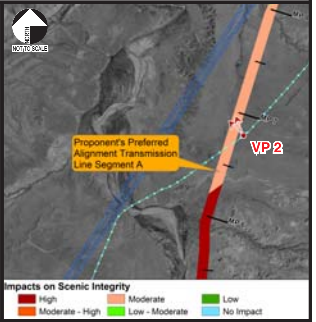
This simulation location is located approximately 0.10 miles from the Proponent's Preferred Transmission Line Alignment along a pipeline access road. This alignment parallels existing transmission lines and is back-dropped by The Hogback which reduces impact levels.



Simulation Location in Study Area

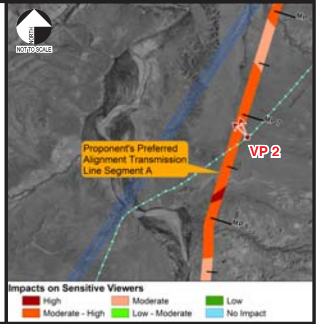
Impacts On Scenic Integrity

At this viewpoint there are potentially moderate impacts on scenic integrity due to the close proximity of existing similar features.



Impacts On Sensitive Viewers

This simulation illustrates a moderate visual impact due to the backdropping of The Hogback, and the existing transmission lines.



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Visual Simulation

Figure 4-4

AFFECTED ENVIRONMENT

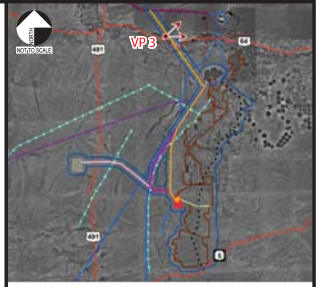
This viewpoint is looking toward the east at existing transmission line facilities visible against the sky in a superior position on the terrain. This sky-lining effect tends to highlight project features making them become more visible.

ENVIRONMENTAL CONSEQUENCES

This simulation represents a view toward the existing transmission line facilities showing the proposed project. The tower type and construction materials help to make the proposed structures less dominant than the existing transmission line. However, the backdropping of the project against the sky still renders it more visible resulting in moderate to moderate-high impacts from this viewpoint.

Simulation Location In Study Area

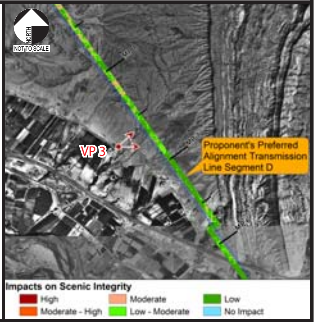
This simulation location is located approximately 0.33 mile from the Proponent's Preferred Transmission Line Alignment north of U.S. Highway 64.



Simulation Location in Study Area

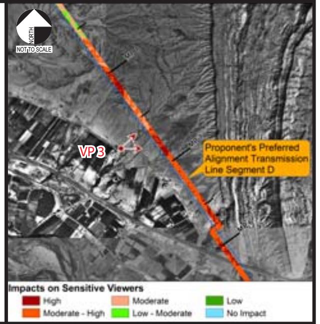
Impacts On Scenic Integrity

This simulation represents low to moderate-low impact levels on scenic integrity due to the close proximity of the existing transmission line corridor providing reduced project contrast in the modified setting.



Impacts On Sensitive Viewers

This simulation illustrates moderate to moderate-high impacts on sensitive viewers resulting from the proposed transmission line due to the viewing distance and the sky-lining effect of the project within this setting.



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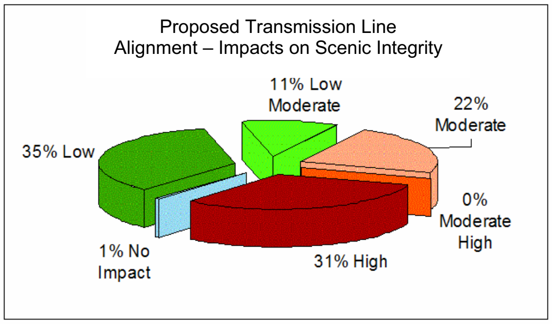
Visual Simulation

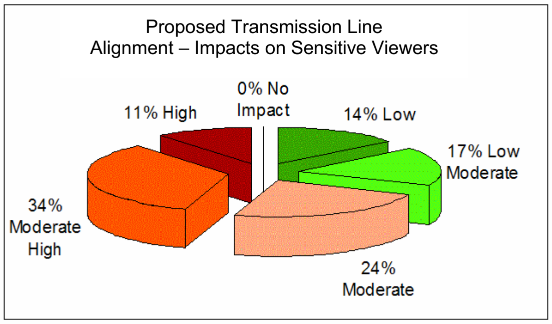
Figure **4-5**

would result in a noticeable change to the existing scenic integrity. Additionally, along this area the transmission line would pass within the immediate foreground and foreground of up to three residences. These conditions would result in high impacts on scenic integrity and moderate to high impacts on sensitive viewers.

Segment C, from the end of Segment A to the Four Corners Generating Station, would parallel existing transmission facilities. This would result in impacts on both scenic integrity and sensitive viewers that would be generally low moderate to moderate. An exception is a residence in the immediate foreground near the junction of Segments A, B, and C. This would produce a high impact from the transmission line and a representative illustration of the potential viewer impact is shown in a photo simulation (refer to Figure 4-5).

Segment D would parallel existing transmission lines, thus reducing project contrast along the entire segment resulting in lower impact. From the Four Corners Generating Station to approximately Milepost 3 on Segment D, the transmission line would generate low to low-moderate impacts on both scenic integrity and sensitive viewers. From Milepost 3 to approximately Milepost 8 Segment D enters a rural setting with dispersed residences and agriculture from Milepost 4.5 to Milepost 6.5, resulting in low-moderate to moderate impacts on scenic integrity. Impacts on sensitive viewers produce moderate to high impacts from the many residences within immediate foreground, foreground, and middle-ground viewing conditions. A photo simulation has been developed to illustrate a typical worst-case potential view from a residence of the new facilities (refer to Figure 4-4). From Milepost 8 to the terminus at Milepost 10.8, impacts on scenic integrity vary from low to moderate based largely on the rolling topography. Impacts on sensitive viewers in this area are mainly low to a small amount of moderate as sensitive viewers are in the middle-ground, background, and seldom seen distance zones. A summary of impacts is illustrated in the following charts.

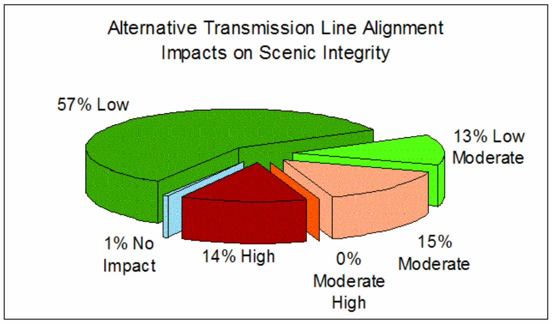


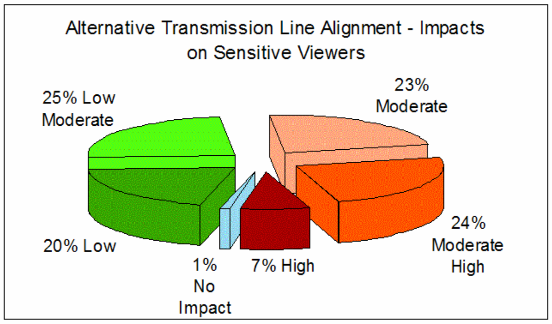


Alternative Transmission Line Segment B

The construction of the alternative transmission line alignment, also a double circuit 500kV on lattice towers, also would impart the full range of impacts. From Milepost 1 to approximately Milepost 3 of Segment B, the transmission line would not parallel existing transmission lines or other linear features, and crosses the Chaco River. Lack of existing facilities would produce a noticeable change to the existing scenic integrity. This change creates high impacts on scenic integrity in the area. A single residence is in the middle-ground receiving a moderate impact. Just after Milepost 3 on through Milepost 9, the segment is adjacent to existing transmission lines in a relatively flat area producing low impacts on scenic integrity. In this area, residences near Milepost 5 and Milepost 7 in the foreground and immediate foreground distance zones would produce moderate to moderate-high visual impacts respectively. Milepost 9 to the end of Segment B represents low to moderate impacts on scenic integrity due to increased topography and the Chaco River. Between Milepost 9 and Milepost 10, two residences in the immediate foreground would result in moderate-high and high impacts. Finally, from Milepost 10 to the end of Segment B at Milepost 11.1, scenic integrity impacts would be low to moderate and a small area of moderate-high visual impact to sensitive viewers is represented from a residence in the foreground near the junction of Segments A, B, and C.

Segments C and D of the alternative transmission line are the same as those for the proposed transmission line alignment, and therefore exhibit the same impacts discussed previously. A summary of impacts is illustrated in the following charts.

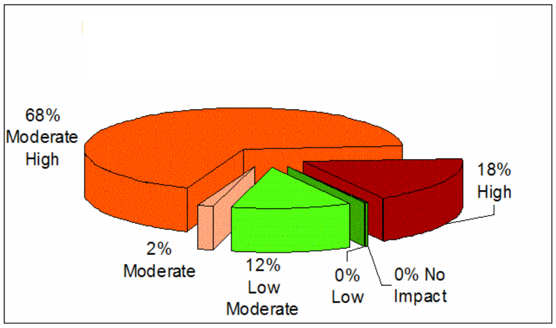

Alternative Transmission Line Alignment Impacts on Scenic Integrity

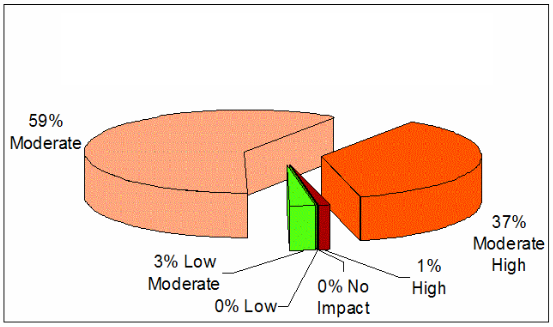

Alternative Transmission Line Alignment - Impacts on Sensitive Viewers

4.7.2.2.3 *Access Road*

Construction of the access road alignment from the power plant site to Burnham Road would generate short-term impacts from construction equipment, and earth scraping. Long-term impacts from dirt/gravel materials needed to construct the access road would be a departure from the existing scenic integrity and would thus produce largely moderate-high impacts on scenic integrity along its length.

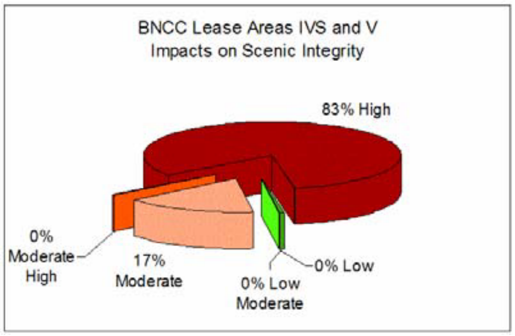
Impacts on sensitive viewers range from low-moderate to moderate-high from the power plant to Milepost 3.5 due to middle-ground and foreground viewing distances. A summary of impacts is illustrated in the following charts.

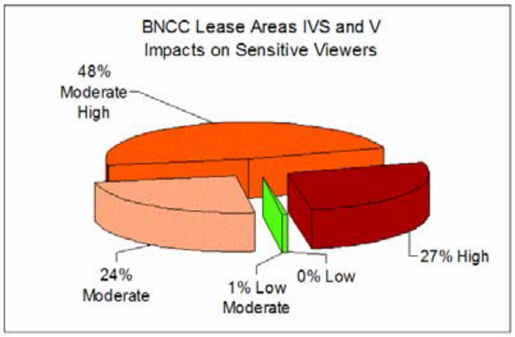




4.7.2.2.4 *BNCC Lease Areas IV South and V*

Areas IV South and V would produce moderate to high visual and high scenic integrity impacts as a result of mining operations. These operations would include the excavation of earth and vegetation removal resulting in a substantial change to the current landscape setting. Additionally, other associated mining facilities would create an industrial type setting with heavy equipment, buildings, conveyors, and other associated mining facilities. To reduce long-term impacts on scenic integrity, reclamation would seek to re-establish compatible landform contours and vegetation to reduce visual impacts. Impacts are illustrated in the following charts.


BNCC Lease Areas IVS and V
Impacts on Scenic Integrity

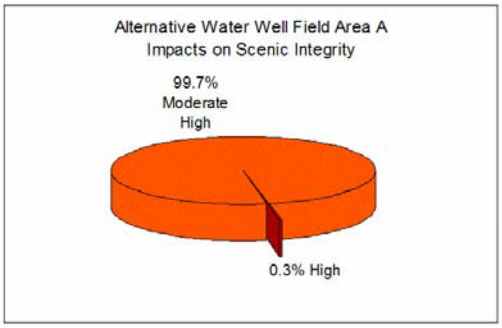

BNCC Lease Areas IVS and V
Impacts on Sensitive Viewers

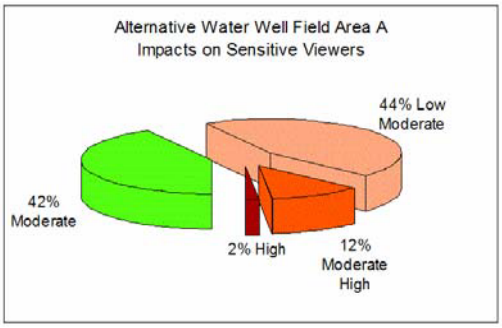
4.7.2.2.5 Water-supply System

Alternative Water Well Field Area A

Installation of 20 water well facilities including pumps, well pads, small structures, fences, and the electrical distribution lines required to power them would result in moderate to high impacts on scenic integrity due to a moderate project contrast. These facilities would be noticeable in a landscape that is largely undisturbed.

Detectable visual impacts on sensitive viewers would result in moderate to high impacts for roughly half the site in the immediate foreground, foreground, and middle-ground distance zones. The remaining portions of the site would exhibit low impacts on sensitive viewers due to background distance zone viewing. A summary of impacts is illustrated in the following charts.

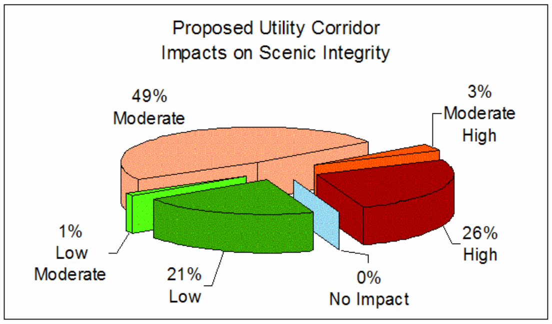

Alternative Water Well Field Area A
Impacts on Scenic Integrity

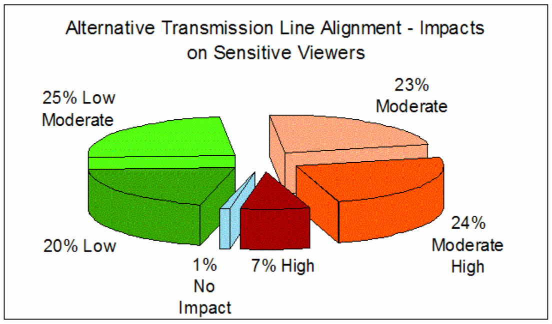

Alternative Water Well Field Area A
Impacts on Sensitive Viewers

Utility Corridor/Water Pipeline

Impacts associated with the utility corridor water pipeline would result from the removal of earth and vegetation and the establishment of an access road for pipeline maintenance. The water pipeline corridor would utilize an existing two-track primitive road for the vast majority of its length, thus reducing project contrast.

Detectable impacts on scenic quality would occur along the water pipeline corridor with high impacts occurring from the project power plant site to approximately Milepost 3. Along the remainder of the route the impacts on scenic quality range from low to moderate. Visual impacts on sensitive viewers along the water pipeline corridor would predominantly be low to moderate with the exception of high impacts at Milepost 1. Impacts are illustrated in the following charts.





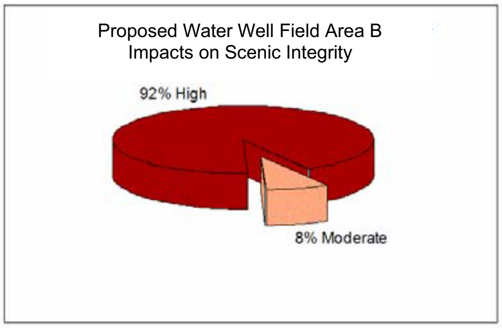
Proposed Water Well Field Area B

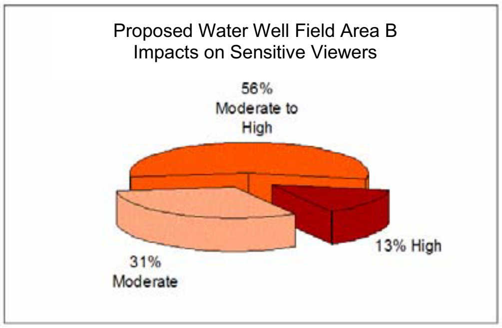
Impacts related to water well field B are significantly influenced by their proximity and adjacency to the power plant location. Nearly half of this well field would be on the leased power plant site. This means that in the well field the viewing conditions would be dominated by the power plant. Minimal additional impacts would occur in this area from the approximately 12 water wells and their facilities.

The remainder of water well field B would parallel the proposed transmission line Segment A. Eight wells would be spaced approximately every mile and a collector water pipeline would run the length to bring the water to the plant site. Impacts from this portion of well field B would vary depending on which transmission line segment (A or B) is constructed.

If Segment A of the transmission line is constructed, impacts on scenic integrity and impacts on sensitive viewers would be consistent with the transmission line. The transmission line is a more dominant feature on the landscape and additional water well facilities would not significantly increase impacts.

If Segment B of the transmission line is constructed, impacts on scenic integrity would largely be moderate-high. There are few cultural modifications in the area and thus a moderate project contrast. The presence of three residences in the immediate foreground, foreground, and middle-ground would produce moderate to moderate-high impacts on sensitive viewers from Milepost 1 to Milepost 4 along the Segment A alignment. The remainder of the area to Milepost 7.5 would be low-moderate to moderate impacts on sensitive viewers. A summary of impacts is illustrated in the following charts.





4.7.2.2.6 Mitigation to Reduce Impacts

Mitigation measures that would provide a reduction in the contrast of project facilities with the existing landscape and to reduce the effects of lighting include the following:

- All structures, stacks, buildings, and tanks would be constructed of materials that would restrict glare, and would be finished with flat tones intended to blend with the surrounding environment.
- All fencing would be constructed of non-reflective materials, and would be treated or painted to blend with the surrounding environment.
- Signs at the plant site would be constructed of materials that are non-glare, and would be painted using unobtrusive colors.
- Lighting would be limited to areas required for safety and security, and would be shielded and directed downward to the extent possible. Highly directional, high-pressure sodium vapor fixtures (or other fixtures that meet the criteria specified) would be used where practicable.
- The transmission structures would be finished with flat, neutral tones that would relate to the colors of the structures in the existing transmission corridors and that would blend with the surrounding environment.
- Non-specular conductors and non-reflective and non-refractive insulators would be used to reduce conductor and insulator visibility.

4.7.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.7.2.3.1 Power Plant

The types of impacts on scenic integrity and visual impacts under this alternative would be consistent with Alternative B. While impacts from the 550 MW subcritical facility would be generally similar to Alternative B, the construction of a single unit would represent a reduction in overall impacts on scenic integrity and sensitive viewers, primarily due to the reduced stack height.

4.7.2.3.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

The types of impacts along the proposed transmission line Segments A, C, and D would be generally similar to Alternative B. However, localized impacts would vary from Alternative B because of the fewer towers associated with the single 500kV circuit.

Alternative Transmission Line Segment B

In general, the types of impacts along alternative transmission line Segment B would be similar to Alternative B. Localized impacts would vary because of the construction of fewer towers associated with the single 500kV circuit.

4.7.2.3.3 Access Road

Impacts for the access road under Alternative C would be the same as those of Alternative B.

4.7.2.3.4 BNCC Lease Areas IV South and V

Mining operations on BNCC Lease Area IV South would produce moderate to high visual and high scenic integrity impacts. The source of these impacts is the same as those described for Alternative B. To reduce long-term impacts on scenic integrity, reclamation would seek to re-establish compatible landform contours and vegetation to reduce visual impacts. Under Alternative C, no mining activities are proposed for BNCC Lease Area V and thus there would be no impacts on scenic integrity or visual impacts.

4.7.2.3.5 Water-supply System

Alternative Water Well Field Area A

Impacts for the water well field area A would be the same as those discussed in Alternative B.

Utility Corridor/Water Pipeline

Impacts for the utility corridor/water pipeline under Alternative C would be the same as those of Alternative B.

Proposed Water Well Field Area B

Impacts for the proposed water well field area B would be the same as those discussed in Alternative B.

4.7.2.3.6 Mitigation to Reduce Impacts

Mitigation would be the same as Alternative B.

4.7.3 Summary of Impact Analysis

Overall impacts from the three alternatives fall into two categories. First, the No-Action or Alternative A would result in no impacts on scenic integrity or sensitive viewers because no changes would be made to the existing visual condition. Impacts on scenic integrity and sensitive viewers from either Alternative B or C would be very similar, with only minor reductions in impacts under Alternative C due to the smaller power plant footprint, shorter main-stack, single circuit 500kV transmission line, and smaller area that would be mined.

4.8 SOCIOECONOMIC CONDITIONS

4.8.1 Impact Assessment Methodology

The project is considered as a whole, rather than as separate components (e.g., transmission lines, power plant site, access road, mining operations, etc.), in the assessment of impacts on socioeconomic resources. Because all project components are in the same geographic area, employees would be drawn from the same labor market areas. Wages, salaries, training, and other employment benefits would affect the employees regardless of which project component employed them. In addition, revenue would flow from the operator(s) into the same government treasuries, regardless of which project component was the source of the revenue.

The proposed project is divided into separate phases. It is assumed that the phases of the project and their durations would be defined as follows:

- Construction, 5 years
- Operations, 50 years
- Shutdown (permanent decommissioning, at the end of operations)

Other assumptions made for the impact assessment include:

- Proportions of employees would come from the local area, the region of influence, and outside the region (these terms are defined in Section 3.8.2) as identified in Table 4-22:

Table 4-22 Assumptions Regarding the Sources of Workforce

	Construction Phase (percent of workforce)	Operations Phase (percent of workforce)
Region of Influence	35	75
Local Area	10	50
Remainder of Region	25	25
Outside the Region of Influence	65	25

- There would be no substantial changes in the technology to be used over the life of the project. Technologies used for power plant construction, power plant operations, mining, and water delivery would be the same as described today.
- The government legislation and regulations would largely stay the same as they are currently. Some of such legislation and regulations of particular importance to the project address taxation, employment, water resources, and environmental impacts.

The magnitude of potential socioeconomic impacts was considered in several ways. Direct, indirect, and induced wage income is considered to be a benefit that would be a major, positive effect at the household level. The economic effects from employment would be considered more significant in areas where unemployment is higher than average. Tax revenues paid to jurisdictions would be considered a positive effect, and the magnitude of the impact would grow along with the percentage of overall revenue that it would represent (to the extent that information is known).

Social impacts are more subjective, in that individuals or groups may experience different positive or adverse impacts simultaneously. The following assessment of impacts characterizes the predicted effects on social and cultural values based on the input that was received during the scoping process. Public input during the scoping process is summarized in Section 1.3.

4.8.2 Environmental Consequences

4.8.2.1 No Action (Alternative A)

4.8.2.1.1 Economy

Under the No Action Alternative, no direct, indirect, or induced income or tax revenue would be generated by the proposed project. The decision to not build the Desert Rock Energy Project would not preclude other opportunities and it is anticipated that other commercial and/or industrial development projects would continue. The No Action Alternative; however, would represent a lost opportunity to leverage Navajo resources into economic development. The magnitude of the foregone wages and tax revenue are described in Sections 4.8.2.2 and 4.8.2.3,which describe the potential impacts of the project.

As previously stated in Chapter 3.8, unemployment rates on the Navajo Indian Reservation are typically much higher than those in surrounding areas. According to the 2000 Census, the unemployment rate for the civilian labor force was 20.4 percent for the 15 chapters closest to the proposed project, while it was 7.2 percent in Farmington and the other two census tracts in the local area.

4.8.2.1.2 Social and Cultural Values

During the scoping process for this EIS, some commenters expressed concern about the effect on social and cultural values associated with uninterrupted natural processes. Under the No Action Alternative, the introduction of another developed feature on the landscape and the use of natural resources to support it would not occur.

4.8.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.8.2.2.1 Construction Phase

Economy (Employment, Incomes, and Fiscal Conditions)

The construction phase would comprise between 48 and 56 months. During this phase, the direct labor workforce would include actual construction labor and indirect labor workforce for support services (e.g., commuter bus drivers, flagmen, or administrative staff). The size of the indirect workforce would average one indirect worker for every 65 direct workers. Each step in the construction of the first of the two 750-MW generation units would occur about 6 months before the equivalent step for the second of the two units. The peak workforce would be present for the first unit at month 29 of the schedule, and for the second unit at month 35. During each peak, there would be about 1,700 workers on the project.

Time periods within the construction phase and the associated total workforce levels are:

- Months 25 through 37 (13 months), over 1,000 workers
- Months 19 through 24 and 38 through 42 (11 total months), between 500 an 1,000 workers
- Months 1 through 18 and 43 through 56 (32 total months), fewer than 500 workers

Currently, there is one private establishment with over 1,000 workers in the local area of influence (San Juan Regional Medical Center, with 1,056 employees). There are 5 private establishments with over 500 workers (Table 3-31). Therefore, for 2 years during the construction phase, the Desert Rock Energy Project would be one of the top 5 private employers in the area.

The unemployment rates in the local area of the proposed project are slightly higher than New Mexico state rates. Further, the unemployment rates for the Navajo Nation chapters' resident populations, who represent about 28 percent of the civilian labor force of the local area, are two to three times higher than the rates in Farmington-area communities.

The prospective construction wages for the project would be typical of those paid for similar projects in the local area. Construction wages are higher than the area's average wages overall (for all industries).

Given both project construction wage levels and local unemployment, the construction jobs would be attractive to local workers, on and off the Navajo Indian Reservation. The Navajo Preference in hiring is described in Section 4.14, Environmental Justice. A large proportion of the civilian labor force in the local area might seek and obtain construction jobs at the project. For those who are residents of the 15 local Navajo chapters, the jobs would result in much higher incomes, on average, than result from most existing jobs. The construction phase could not be fully staffed by members of the 15 local Navajo chapters because there would not be enough workers available. Those chapters had a civilian labor force of fewer than 9,000 persons in 2000 and fewer than 1,800 workers were unemployed. Clearly the project would draw from a much larger labor market area. The remainder of the local area (Farmington and two of its suburban census tracts) had a labor force of over 23,000 persons in 2000, and would be a potential source of many additional construction workers for the project.

Considering that other employment opportunities in the local area would compete for the same job candidates and the specialized skills necessary for certain aspects of the project's construction, the project would draw employees from the entire region of influence and beyond. Important areas within the region (besides San Juan County) would be the remainder of McKinley County, and La Plata and Montezuma Counties in Colorado. The four-county area together had a labor force of almost 125,000 in 2005 (see Table 3-35) In addition, Navajo Indian Reservation areas further from the project would be an important labor source. The entire Navajo Indian Reservation had a civilian labor force of 56,054 in 2001.

The assumptions concerning the labor market areas from which construction workers would come were derived as follows. First, the likely number of construction employees to be hired over the course of the construction phase was determined. The peak construction employment would be 1,700, but the workforce would be variable. If there were 10 percent employee turnover in each year, and accounting for the employment level for the year, about 300 additional employees would be hired over the course of the construction phase, or 2,000 employees.

The number of construction sector employees in the local area's economy was 1,986 in the year 2000 (Table 3-25, Census 2000). It would be reasonable for the local area to contribute 200 construction employees to the project, (or 10 percent of year 2000 construction employment in the area). At the time construction occurs, that figure probably would represent a smaller proportion of the local labor force, considering growth in the local area since 2000.

The components of the region of influence (the four-counties and the entire Navajo Indian Reservation) have labor force totals as identified above. When the local area of influence is subtracted, the labor force in the remainder of the region is over 140,000. A rate of participation in the construction phase that is only 60 percent as high as that for the local area would yield 500 construction workers from the remainder of the region.

The assumptions concerning the rates of participation in both the local area and region of influence take into account the high unemployment rates on the Navajo Indian Reservation and also the Navajo preference in hiring, both of which would tend to attract Navajo workers to apply for construction work. The remaining 65 percent, or 1,300 construction workers, would come from outside the region of influence.

The incomes of all construction workers at the project would constitute direct effects upon the area's economy. Additional income effects upon the region, or indirect effects, would include purchases of goods and services from local businesses and suppliers to support the project. Finally, workers would spend their wages in the local economy and purchase additional goods and services; these purchases are referred to as induced effects of the proposed project.

The Navajo Nation Tax Department, working with Diné Power Authority and Desert Rock Energy Company LLC, worked with an independent accounting firm to craft a tax structure that generates tax revenues for the Navajo Nation and still allows the plant to be competitive with other proposed plants that could be built off Navajo lands. The agreement, passed by the Navajo Nation Council on May 22, 2006, is described in more detail in the operations phase discussion below. The agreement included a prorated tax amount to be paid during the plant construction phase. The agreement assumes the construction of both 750 MW units.

The impact of construction phase employment on the local area would include the creation of a workplace that would be one of the five largest employers in the local area for a period of 2 years. In addition, in terms of employment by place of residence, a high proportion of construction phase workers would be expected to come from Navajo chapters in the local area, and from the City of Farmington and its suburbs.

Construction wages would be higher than the average wages in the local area, so some households' incomes might increase substantially during the construction phase of the proposed project. There would be an overlap between the skills required for construction jobs at the project and those required for utility and mining jobs in the area. An example would be the skills of various types of equipment operators. Therefore, certain other employers in the area would compete for the same applicants as the proposed project.

A prorated tax amount according to the tax structure agreement passed by the Navajo Nation Council in 2006 would become a part of the yearly revenue of the Navajo Nation and would be allocated as part of the total Navajo Nation nongrant budget.

Population and Housing

Construction workers from the local area generally would be expected to continue to reside in their current homes. Some Navajo members of home chapters close to the project have lived and worked away from their home chapters because of a lack of job opportunities in the home chapters. Construction phase employment might bring them back to their home chapters. Some workers in that situation would reside in their family households, and others might use the transient housing described below.

Motor homes, considered to be transient housing, would house those construction employees that are not from the local area. There would be no on-site housing facilities. At the times of peak construction employment, up to 500 motor homes might be needed for housing. They would be placed in existing motor home parks and/or would be built in the area in coordination with the appropriate local jurisdiction. A prospective Recreational Vehicle Park planned for Shiprock would provide a location for temporary housing, depending upon the phasing of the park's development (Navajo Nation 2004).

There would be induced economic effects from all of the construction workers, whether or not they are from the local area. Those not from the local area, however, would often return to their permanent homes on weekends, so they would spend a smaller proportion of their incomes in the local area than would the local residents.

No employees would move into the area on other than a transient basis for the construction phase. Therefore there would be no effect on the permanent resident population or the housing inventory in the local area.

4.8.2.2.2 Operations Phase

Economy (Employment, Incomes, and Fiscal Conditions)

There would be a total of 200 permanent employees at the proposed project throughout the entire 50-year operations phase. Nearly all of the employees would be based at the power plant. A few would provide support to both the power plant and ancillary facilities such as the well field. The assumptions stated in Section 4.8.1 concerning the labor market areas from which operations workers would come were derived by a method consistent with those for the construction phase. While the method was similar, the base data were different because of the different required skill sets and number of employees for the operations phase.

First, the persons who are already employed in utilities in the local area were considered. Next, the location of the project was noted, further south and further from Farmington than the existing power plants. Then the effect of the Navajo Preference in hiring, which would apply to the permanent jobs, was noted (the preference is discussed in Section 4.14, Environmental Justice). Project-related training opportunities were noted (see *Education and Training*, below). When all of that information was considered, a workforce of 50 percent, or 100 workers, from the local area and an additional 25 percent, or 50 workers, from the remainder of the region of influence, is a reasonable assumption.

The remaining 50 workers would be assumed to come from outside the region of influence. That is partly because of certain specific job skills that would be required. That portion of workers also results from the competition for workers with similar skills among the project and the other two existing power plants in the region.

The wages for workers at the project would be similar to those at the Four Corners Generating Station and the San Juan Power Plants. The wage scale is somewhat higher than that for construction phase jobs.

The project would be a basic industry in San Juan County and on the Navajo Nation, bringing revenue into the area from outside of it. There would be the same types of direct, indirect, and induced effects of the presence of the project in the area during the operations phase as described for the construction phase, above. There would be new indirect effects as the power plant jobs would be supported by other new jobs, and as revenue brought into the area from production of electricity and spending by power plant employees circulated throughout the local economy.

The 200 operations phase jobs at the Desert Rock Energy Project would not rank in the top ten largest private employers in the local area. Its ranking would likely be between eleven and fifteen. The stability of the employment level over a period of 50 years is important to the stability of the region.

The mining operation at the BNCC Lease Areas IV South and V would require a workforce of about 220, most of whom would be miners. Mining would take place over the same 50-year interval as the operations phase of the proposed project and would provide all of the coal required by the Desert Rock Energy Project. At shutdown, a 3-year surface mining final reclamation phase would occur concurrent with the power plant abandonment, dismantling, and land reclamation.

It is assumed that 60 percent of the mining operation workforce would come from the local area and 40 percent would come from the remainder of the region of influence. Few or none would come from outside the region. Based upon the current and historical workforce at coal mines on the Navajo, Hopi, and Ute Indian Reservations, it is assumed that 65 to 80 percent of the workforce, or 130 to 160 workers, would be American Indian. Most of them would be Navajo. The Navajo preference in hiring would apply to the mining operation. The workforce available in the region includes both experienced miners and others. Given the reservation's high unemployment rate, the mining tradition, and high mining wages, many others would seek to enter the coal mining occupation.

The local area of influence had over 2,000 mining workers in the year 2000 and the region of influence also had a relatively large proportion of its workforce in mining. Mining jobs with some employers have decreased, indicating that experienced miners would likely be available. Surface coal mining ceased at the San Juan mine in New Mexico (underground mining continued) and the Black Mesa mining operation near Kayenta, Arizona suspended mining in 2005. Therefore, the skill sets needed for mining employment would be readily available locally.

The mining wages would be similar to those at the existing Navajo Mine (BNCC Lease Areas I, II, and III). Agreements reached in 2004 indicated that the average earnings would be over $48,000 by 2006 (Gallup Independent 2004; Militant 2004).

The analysis that was the basis for the tax revenue agreement between Desert Rock Energy Company LLC and the Navajo Nation compared the tax costs on the Navajo Nation to tax costs in the four adjacent states (New Mexico, Arizona, Colorado, and Utah). The resulting agreement was reviewed by the Navajo Tax Commission and subsequently approved by the Navajo Nation Council. The total taxes to be paid by the proposed project under the agreement would be higher, on average, than taxes on a similar project located outside the Navajo Nation. In general, the arrangement requires that the owners of the Desert Rock Energy Project pay the Navajo Nation the higher of two amounts that would be calculated each year. One calculation would be a fixed amount that is then escalated for inflation. The other calculation would be a percentage of revenues for the plant operations in the given year.

The agreement assumes that both 750 MW units would be operated throughout the 25-year term of the agreement. It is estimated that the average yearly tax to the Navajo Nation would exceed $17 million per year. In addition, the tax agreement requires that the basis of the tax be evaluated 15 and 20 years after the plant starts operations to ensure that the tax amounts are comparable to taxes that would be paid if the project were located off the Navajo Indian Reservation. The tax agreement is included in the lease/sublease legislation that was approved by the Navajo Nation Tribal Council in May 2006.

The prospective coal sales agreement between Desert Rock Energy Company LLC and BNCC includes an estimated $26 million per year in taxes and royalties that would be received by the Navajo Nation. BNCC also would be responsible for an array of taxes received by other government entities, such as the State of New Mexico. There have been intergovernmental tax credits against coal severance taxes to benefit all parties that have resulted from collaborative efforts by the State of New Mexico, the Navajo Nation and coal and utility companies (New Mexico Legislature 2004).

The amount of nongrant revenue received by the Navajo Nation in 2003 was approximately $122 million (URS 2006). If inflation and new revenue sources were to increase that revenue to $170 million by the first year of operation of the Desert Rock Energy Project, the revenue from the power plant would represent 10 percent of the Navajo Nation's nongrant revenue. Using the same assumption, the revenue from the coal sales agreement would represent 15 percent of the Navajo Nation's nongrant revenue, and the $7 million transmission-line related revenue would represent 4 percent, for a total of $50 million, or 29 percent.

The proposed project's operations also would be subject to the following State of New Mexico taxes: gross receipts tax, corporate income tax, and property tax. The gross receipts and income taxes are a large proportion of public school district funding in the state. Gross receipt tax rates within the study area are approximately 6.2 percent. Corporate income tax rate is currently 34 percent while property tax rates tend to vary substantially. Further tax information can be found in *Section 3.8.3 Fiscal Conditions*.

In summary, the largest economic impact associated with the operation phase would be associated with the revenue paid to the Navajo Nation. Given the 50-year life of the operations, the requirement for reevaluation of the basis of the tax to the Navajo Nation would have the effect of maintaining an equitable revenue situation for Desert Rock Energy Company LLC, the Navajo Nation, and other governmental entities. Other substantial effects within the region would include the revenue to the State of New Mexico, and the direct and indirect effects of employment and incomes.

Population and Housing

The assumption that 50 operations employees would come from outside the local area and 50 operations employees would come from outside the region would mean that there would be a net project-associated migration of nearly 100 households to the local area. The housing demand associated with that level of in-migration could be accommodated by the housing construction expected to occur in the rapidly-growing San Juan County in the next decade. Project-related housing demand in the Navajo chapters could come from chapter members who, when hired as permanent employees, establish a new household in their home chapters. Those who are not chapter members could rent housing within a chapter if it were made available. Convenience to the workplace would be one of several reasons that workers might choose to reside in the chapters.

Just as housing for the in-migrant households would not represent an extraordinary increase in housing demand in the area, the demand for services such as public or BIA school enrollment would not be a demand of unusual magnitude.

4.8.2.2.3 Shutdown Phase

There would be several socioeconomic effects of project shutdown and decommissioning. The annual revenue stream would terminate, both to the Navajo Nation and to the State of New Mexico. Two hundred workers would no longer be employed. Desert Rock would no longer be one of the establishments that comprise the utility sector basic industry, bringing revenue into the area from outside. The direct, indirect, and induced effects of the Desert Rock jobs, income, and production rippling through the local economy would cease.

The 50-year operations phase of the project is an extended time period within which all persons, establishments, and governments who have economic dependency upon the project could plan for its shutdown at a known date.

4.8.2.2.4 Local Utility Service

The proposed project would not affect local utility services during the constructions or operations phases.

At this time, it cannot be determined whether the power supply generated from Alternative B would be distributed locally. It is possible that NTUA would opt to purchase power from the proposed project. Revenue is expected to contribute to the local economy and improve overall socioeconomic conditions of the Navajo Nation. It is anticipated that the Navajo Nation would analyze the local situation and determine how funding would be appropriated to serve its local community.

4.8.2.2.5 Education and Training

It is the intent of the project proponents to pursue programs in conjunction with local educational centers and labor unions to train permanent employees for employment with the proposed project. The majority of the programs would take place in preparation for or during the operations phase. Training programs already supported by the employers in the region include:

- college scholarships for area American Indian students (some of them specifically for disciplines related to the electric utility industry),
- scholarships offered for mining disciplines,
- work-study and internship programs,
- training performed by the New Mexico Building Trades and International Brotherhood of Electrical Workers, and
- financial support to start training programs tailored to the needs of the employer.

Similar programs on the part of the Desert Rock Energy Project would provide the project with the staff it would require. Any individual who received educational assistance would retain that benefit after he or she terminated employment at the project.

A portion of the various tax revenues (described in Section 3.8.3, *Fiscal Conditions*) received by the State of New Mexico would be distributed to the school districts. The state taxes paid by the project during the construction phase would become a part of that revenue stream.

4.8.2.2.6 Agriculture and Grazing

As described in Section 4.6, negligible to minor impacts on grazing would occur during construction and operation of the project, and disturbed areas would be reclaimed following the decommissioning of the project. Effects on the availability of surface water resources are described in Section 4.2.

Some of the prospective construction workers for the project are also grazing permittees. A worker could choose to use income from construction project work to fund out-of-pocket expenses of maintaining a herd, such as leasing pasture from NAPI (described in Section 3.8.3, *Agriculture and Grazing*). Impacts on agriculture and grazing in the local area are described in Section 4.6.6.

4.8.2.2.7 Social and Cultural Values

There would be effects on local communities that would result from the influx of a large group of temporary construction employees. There would be interaction between local residents and the larger group of construction employees from outside the local area at the local businesses where the project and construction workers would purchase goods and services. Annual population growth rates above five percent are more likely to have deleterious impacts to communities associated with energy extraction

(Lapping et al. 1989). Rapid growth in small communities can result in higher rates of crime (property crime during expansion periods), suicide, and stress-related mortality (Hardt 1994). During operation, it is unlikely that a dramatic population change would occur as a result of the proposed project because of the relatively low number of employees and the availability of qualified job candidates that already reside in the area. During construction, there would be higher personnel requirements, but at this time it is not certain how many would migrate in from outside the region, or where they would reside.

While the numbers of construction workers, especially during the peak employment months with the largest construction workforce, would represent a social effect on the local area, that effect would be dampened somewhat because the workers' housing would be clustered in particular areas and they would be bussed to the construction site. Any new motor home park Navajo Indian Reservation would be planned and operated subject to agreements with the Navajo Nation. Residents of the park, many of whom would not be registered Navajo tribal members, would be informed that they were residing temporarily on Indian trust land. Tribal members who otherwise would have free access to the motor home park site would be accommodated in their activities.

Plants and animals important to Navajo culture are found at the project site and all of them are also available throughout and outside the study area (described in Section 3.8.3, *Plants and Animals*). They are used for practical and ceremonial purposes. Potential impacts on vegetation are assessed in Section 4.3, Biological Resources.

Navajo Nation tribal members who had opposed the generation plant might continue to be adversely affected by its approval. These residents might be more likely to experience feelings of anxiety, stress, and a perceived loss in the quality of life.

4.8.2.2.8 Health Conditions and Health Care

During scoping, some residents of the local area and region of influence were concerned about disproportionate exposure to pollutants resulting from development of the proposed project, which might be anticipated to include particulate air emissions during the construction phase. The assessment of air quality effects indicates that the levels of emissions would be within Federal and state air quality standards (see Sections 4.1 and 4.13).

The health care situation in the local area is described in Section 3.8.3, *Health Care Conditions and Health Care Situation.* Health insurance generally would be provided to construction workers. The local area is termed medically underserved. Co-risk factors associated with medically underserved populations such as nutritional status, access to health care, multiple historical exposures, and stress factors can combine to affect a population's susceptibility to adverse health effects. The revenues received by the Navajo Nation from the proposed project could allow the Navajo Nation to provide better health care services to the local area and the entire Reservation. Preventative health care, such as better nutrition and well-person checkups, are correlated closely with income, so households with income from construction work would have more opportunity for preventative health care.

4.8.2.2.9 Mitigation to Reduce Impacts

To prevent or mitigate any impacts associated with the development of temporary housing during construction (in the event it must be developed), the Desert Rock Energy Company would coordinate with the appropriate land use agency and jurisdiction. The project proponents also have committed to supporting local training programs.

4.8.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.8.2.3.1 Construction Phase

Economy (Employment, Incomes, and Fiscal Conditions)

The types of impacts resulting from the construction phase of Alternative C would be similar to those of Alternative B, except that the smaller scale of the project would reduce the number of employees, overall incomes, and revenues generated by the project. The construction phase would occur over 40 months. The direct labor workforce is actual construction labor, while the indirect labor workforce is support services (e.g., commuter bus drivers, flagmen, or administrative staff). The indirect workforce would average one indirect worker for every 65 direct workers. The peak workforce of 1,200 direct and indirect employees would be present at month 29 of the schedule.

Population and Housing

Impacts to population and housing would be similar to those of Alternative B. The peak number of the workforce would be 500 less than Alternative B, which would reduce induced economic effects. There would be fewer temporary workers who would spend a portion of their disposable income on local businesses and services.

4.8.2.3.2 Operations Phase

Economy (Employment, Incomes, and Fiscal Conditions)

The types of impacts resulting from the construction phase of Alternative C would be similar to those of Alternative B, except that the smaller scale of the project would reduce the number of employees, overall incomes, and revenues generated by the project. Throughout the entire 50-year operations phase, there would be a total of 125 permanent employees at the power plant and associated facilities.

A tax agreement has not been completed for Alternative C, although it is assumed that it would be similar to that of Alternative B. It is estimated that the annual taxes paid to the Navajo Nation under Alternative C would total $6.5 million per year.

The mining operation at the BNCC Lease Area IV South would require a workforce of about 130, most of whom would be miners. Under Alternative C, the types of impacts would be same as described for Alternative B but the effects of direct, indirect, and induced income would be reduced as a result of the reduced employment that would be provided. In addition, royalty revenue from the sale of coal would be reduced. It is estimated that taxes and royalties associated with Alternative C would total $11.5 million annually.

Population and Housing

Impacts resulting from the operations phase of Alternative C would be similar to those of Alternative B. Due to a lower number of permanent employees, there would be fewer demands on housing.

4.8.2.3.3 Shutdown Phase

Impacts resulting from the shutdown phase under Alternative C would be similar to those of Alternative B.

4.8.2.3.4 Mitigation to Reduce Impacts

To prevent or mitigate any impacts associated with the development of temporary housing during construction (in the event it must be developed), the Desert Rock Energy Company would coordinate with the appropriate land use agency and jurisdiction.

4.8.3 Summary of Impact Analysis

Under the No Action Alternative, no economic benefits would accrue to the Navajo Nation or individuals as a result of the development of the proposed project. This effect would be more substantial in an area of high unemployment such as the Navajo Indian Reservation. Alternative B would benefit the Navajo Nation and individuals through the provision of employment (about 420 permanent jobs through direct employment, plus construction employment) and tax and royalty payments (estimated to be about $17 million annually for the power generation component of the project and $26 million annually related to coal development). Alternative C would provide employment (about 255 permanent jobs, plus construction employment) and tax and royalty payments (estimated to be $6.5 million and $11.5 million).

4.9 CULTURAL RESOURCES

4.9.1 Impact Assessment Methodology

Assessment of the potential effects on the cultural environment was based primarily on criteria defined by regulations for *Protection of Historic Properties*, 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 of Historic Places. Effects are adverse when the alterations would diminish the integrity of a property's location, setting, design, materials, workmanship, feeling, or association. Examples of adverse effects include the following:

- Physical destruction, damage, or alteration of all or part of a property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provisions of handicapped access, that is not consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties (Title 36, Code of Federal Regulations, Part 68) and applicable guidelines;
- Removal of a property from its physical 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 properties 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; and
- 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 [Title 36, Code of Federal Regulations, Part 800.5(a)(2)].

The region of influence, or area of potential effects, varies for each type of potential impact on the cultural environment. Direct impacts on cultural resources would result from the construction of the project and the long-term mining of coal to supply the operation of the power plant. The area of potential direct effects on cultural resources is the geographic extent of the project's construction and the coal mining lease areas.

There is limited potential for indirect impacts on cultural resources due to visual intrusion, vibrations, and increased noise. The area of potential effects on cultural resources to evaluate the potential for increases in noise, vibration, and visual changes due to construction and operation of the proposed project was defined as extending 1 mile beyond the plant site and coal mining areas. The area of potential effects for similar impacts of the ancillary facilities was defined as a 1-mile-wide corridor centered on the linear ancillary facilities and 0.5 mile around the well field.

The criteria for an adverse effect were applied to each cultural resource identified within the area of potential effects and listed in or evaluated as eligible for listing on 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 adverse effect that cannot be avoided or satisfactorily mitigated through consultation with parties participating in the review of the project in compliance with Section 106 of the National Historic Preservation Act.

4.9.2 Environmental Consequences

4.9.2.1 No Action (Alternative A)

Under Alternative A, the proposed power plant, transmission lines, well field, and access roads would not be built; therefore, there would be no associated direct impacts to historic properties or traditional cultural properties. Additionally, the archaeological sites and traditional cultural properties located within Lease Areas VI South and V would not be impacted by mining activities because there would be no need to mine the coal to supply the power plant. However, direct impacts to archaeological sites and traditional cultural properties located within Lease Areas IV South and V could occur if the mining of coal within these lease areas were implemented due to the identification of coal purchasers.

4.9.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.9.2.2.1 Power Plant

Three archaeological sites considered as eligible for listing in the National Register were identified within the currently designed construction footprint for the power plant construction (Table 4-23). NM-H-36-115 is located near one of the proposed stacks for the power plant. Both NM-H-36-92 and NM-H-36-102 are located within the route of a drainage canal and/or near a catch basin.

Table 4-23 Potential Impact to Archaeological Sites within the Power Plant Site under Alternative B

Site Number		Site Type	National Register Status	Effects, Recommended Treatment
1	NM-H-36-115	Lithic reduction/ procurement site	Eligible, Criterion D	Adverse effect, data recovery
2	NM-H-36-92	C1: PII-PIII habitation C2: Navajo multihabitation (1880s-1930s) C3: Navajo rock art (1982)	Eligible, Criterion D Eligible, Criterion D Ineligible	Adverse effect, data recovery Adverse effect, data recovery No further consideration
3	NM-H-36-102	Isolated hearth	Eligible, Criterion D	Adverse effect, data recovery

Direct construction disturbances to all or portions of these sites could adversely affect the potential of these sites to yield important historical information. There is a good likelihood of avoiding impacts to these sites through modification of the construction designs or to satisfactorily mitigate direct impacts through data recovery studies.

Traditional Cultural Resources. There are no identified traditional cultural properties located within the proposed power plant construction footprint.

Indirect impacts to cultural resources that result from the construction and operation of the power plant were considered in the form of the visual intrusion and an increase in regional haze that would result from air quality changes as an effect of power plant operation.

Setting is an important characteristic that contributes to the integrity of some historic properties. Views to and from these resources are important because they often represent a characteristic of the historic property that conveys their significance. The stack for the proposed power plant would be about 917 feet tall. Although the stack for the proposed power plant would be visible from a significant distance, the visual intrusion to the one Register-eligible property, a lithic reduction and procurement site, located within the power plant area would in all likelihood not affect the integrity of this historic property.

Air quality deterioration resulting in increased regional haze at Class I areas such as Mesa Verde National Park and Chaco Culture National Historical Park was an indirect impact concern raised by the National Park Service during scoping efforts. The dispersion modeling performed to support the PSD permit application predicted that emissions from power plant operations would be well below the USEPA’s thresholds and would not adversely impact Class I areas in the region. In addition, the modeling performed for the initial PSD permit application indicated that all days where the predicted visibility extinction was greater than 5 percent in Class I areas could be attributed to natural events (such as fog or snow). Subsequent refined Class I visibility modeling generally predicted lower impacts. Therefore, visibility impacts on Class I areas attributable to the operation of the power plant would be insignificant.

Another indirect impact associated with air quality on cultural resources as a result of power plant operations is the potential for acidic pollutants (acid rain or dry acid deposition) that could damage archaeological sites with petroglyphs and pictographs, or prehistoric ruins built of stone. There is also concern that acidic pollutants could have an adverse impact on plants that are collected for traditional purposes by the local Navajo people. Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are the primary sources of acid deposition. In the southwestern United States, little acidic precipitation occurs because relative humidity levels are quite low. Acidic precipitation tends to occur in areas with higher atmospheric humidity and rainfall, such as the midwestern and eastern states. The modeling performed for this EIS indicates that both wet and dry deposition of sulfates and nitrates, which form from the oxidation of SO_2 and NO_x in the atmosphere, would be highest within a few kilometers of the power plant site. There impact of deposition of sulfates and nitrates on plants used for traditional purposes in proximity to the power plant appears to be negligible.

The modeling performed to support the PSD permit application indicated that the project emissions for NO_x – annual (<1 μg/m^3), SO_2 – annual (<1 μg/m^3), SO_2 – 3 hour (<25 μg/m^3), would be insignificant beyond the power plant boundary. The significant impact radius for SO_2 – 3 hour (>5 μg/m^3) is 11.0 km (6.8 miles), which is well within the Navajo Nation reservation. The maximum predicted 3-hour SO_2 concentration of 30.62 μg/m^3 is predicted to occur at a location 1.1 km (0.7 mile) from the power plant boundary. This value is only 10 percent of the NAAQS (1,300 μg/m^3) and therefore, would not be expected to present adverse effects on cultural resources beyond the power plant boundary, especially Class I areas, like Mesa Verde National Park or Chaco Culture National Historical Park.

Dust generation due to construction of the power plant could affect viewsheds, but would be controlled (see Air Quality, Section 4.1). Dust is not expected to affect the integrity of cultural resources more than 0.5 mile beyond the plant site.

Coal Preparation Facilities

Two archaeological sites considered as eligible for listing on the National Register were identified within the coal preparation facilities area. NM-H-29-34 (LA 19591) is a multicomponent site consisting of an Anasazi Pueblo II artifact scatter and a Navajo habitation dating from 1900 to 1940 and NM-H-29-103 (LA 19582) is a Navajo camp site. Both sites could be directly impacted by the construction of the coal preparation facilities, which could adversely affect the potential of these sites to yield important historical information. Impacts to these sites could be avoided through modification of the coal preparation facilities construction design, or mitigated through data recovery studies that include a Navajo ethnographic research component.

In addition, the Navajo habitation component of NM-H-29-34 contains 2 Navajo burials. These burials could be directly impacted by the construction of the coal preparation facilities; however, these burials could be avoided through modification of the coal preparation facilities construction design. In the event that these two burials cannot be avoided and would be impacted by the construction or operation of the proposed coal preparation facilities then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

4.9.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

Archaeological and Historical Resources within the Segment A Corridor. Twenty-three archaeological and historical properties were identified within the proposed transmission line Segment A corridor, representing 20 Anasazi components and 7 Navajo components. Of these, only NM-H-29-132 (a PIII habitation site) is listed on the National Register of Historic Places, and 19 are considered eligible for the National Register, and one (NM-H-29-120) is currently unevaluated but is considered eligible. NM-H-29-132 is located on top of a rock crag and would be avoided by the construction of the transmission line.

The other 20 components, representing 18 archaeological sites, are located within the corridor for transmission line Segment A and there is a potential for the construction of the transmission line to adversely affect a portion or all of the sites and their potential to yield important historical information. Placement of transmission towers may be flexible enough to span these sites and avoid impacts to these 18 historic properties.

Table 4-24 Historic Properties located within the Transmission Line Segment A Corridor

	Site Number	Site Type	National Register Status, Criterion	Effect, Recommended Treatment
1	NM-H-29-59	PII field house	eligible, Criterion D	Potential adverse, avoid
2	NM-H-29-60	PII habitation	eligible, Criterion D	Potential adverse, avoid
3	NM-H-29-61	**C1**: PII special use **C2**: historical Navajo, habitation	eligible, Criterion D/ eligible, Criterion D?	Potential adverse, avoid Potential adverse, avoid
4	NM-H-29-63	PII special use area	eligible, Criterion D	Potential adverse, avoid
5	NM-H-29-64	PII habitation	eligible, Criterion D	Potential adverse, avoid
6	NM-H-29-70	PII special use area	eligible, Criterion D	Potential adverse, avoid
7	NM-H-29-72	PII habitation	eligible, Criterion D	Potential adverse, avoid
8	NM-H-29-73	PII habitation	eligible, Criterion D	Potential adverse, avoid
9	NM-H-29-120	historical Navajo habitation	unevaluated but treated as eligible, Criterion D	Potential adverse, avoid
10	NM-H-29-121	PI-II special use area	eligible, Criterion D	Potential adverse, avoid
11	NM-H-29-126	PII-III special use area	eligible, Criterion D	Potential adverse, avoid
12	NM-H-29-127	PI-II special use area	eligible, Criterion D	Potential adverse, avoid
13	NM-H-29-128	PI-II special use area	eligible, Criterion D	Potential adverse, avoid
14	NM-H-29-132	PIII habitation	listed, Criterion D	No effect, Avoided
15	NM-H-29-133	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid
16	NM-H-29-134	PII-III habitation	eligible, Criterion D	Potential adverse, avoid
17	NM-H-29-135	PII field house	eligible, Criterion D	Potential adverse, avoid
18	NM-H-29-136	**C1:** PII field house **C2:** historical Navajo trash dump and cairn	eligible, Criterion D/ eligible, Criterion D	Potential adverse, avoid Potential adverse, avoid
19	NM-H-29-137	PII field house	eligible, Criterion D	Potential adverse, avoid

Traditional Cultural Properties within the Segment A Corridor. Three Navajo traditional cultural properties were identified near the proposed transmission line Segment A corridor, and consist of a lightning struck corral and offering area (TCP 23), a lightning struck house (TCP 14), and a death hogan (TCP 26). All of these properties are located outside the corridor for transmission line Segment A and would not be affected by the proposed construction.

Three Navajo burials were located within the proposed transmission line Segment A corridor. Two burials, both unmarked graves (Burials 21 and 22), are within the transmission line corridor and can be avoided through designing the placement of the transmission towers away from these places.

The 20 Anasazi components are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These components could be avoided through designing the placement of the transmission towers away from these places; however, if one or more of these components would be affected by the placement of the transmission towers, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

Archaeological and Historic Resources within the Segment C Corridor. Eleven archaeological sites and historic properties were identified within Segment C corridor, representing 9 Anasazi components and 2 historic Navajo components. Ten components are considered eligible to the National Register and one (Navajo special use area) is currently unevaluated but is considered eligible for this anlaysis (Table 4-25). There is a potential for the construction of the transmission line to adversely affect a portion or all of these 11 components and their potential to yield important historical information. Placement of transmission towers may be flexible enough to span these sites and avoid impacts to these 11 historic properties.

Table 4-25 Historic Properties located within the Transmission Line Segment C Corridor.

	Site Number	**Site Type**	**National Register Status, Criterion**	**Effect, Recommended Treatment**
1	NM-H-20-39	PII-III habitation	eligible, Criterion D	Potential adverse, avoid
2	NM-H-20-96	PII field house	eligible, Criterion D	Potential adverse, avoid
3	NM-H-20-97	PII special use area	eligible, Criterion D	Potential adverse, avoid
4	NM-H-20-129	PII field house	eligible, Criterion D	Potential adverse, avoid
5	NM-H-20-134	PII special use area	eligible, Criterion D	Potential adverse, avoid
6	NM-H-20-135	PIII special use area	eligible, Criterion D	Potential adverse, avoid
7	NM-H-20-136	PII-III special use area	eligible, Criterion D	Potential adverse, avoid
8	NM-H-20-139	PIII habitation	eligible, Criterion D	Potential adverse, avoid
9	NM-H-21-204	historical Navajo lambing pen and corrals	eligible, Criterion D	Potential adverse, avoid
10	NM-H-29-122	**C1**:PI-II special use area **C2**: historical Navajo special use area	eligible, Criterion D/ unevaluated; eligible, Criterion D	Potential adverse, avoid

Traditional Cultural Properties within the Segment C Corridor. No Navajo traditional cultural properties would be affected by the construction of Segment C of the proposed transmission line.

Nine Anasazi components are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These components could be avoided through designing the placement of the transmission towers away from these places; however, if one or more of these components would be affected by the placement of the transmission towers, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

Archaeological and Historic Properties within the Segment D Corridor. Five archaeological and historic properties were identified within the proposed transmission line Segment D corridor, representing six components. Only 4 of these components are considered eligible to the National Register (Table 4-26) and there is a potential for the construction of Segment D to adversely affect a portion or all of these 4 components and their potential to yield important historical information. Placement of transmission towers may be flexible enough to span these sites and avoid impacts to these 4 historic properties.

Table 4-26 Historic Properties located within the Transmission Line Segment D Corridor

	Site Number	Site Type	National Register Status, Criterion	Effect, Recommended Treatment
1	NM-H-20-130	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid
2	NM-H-20-132	historical Navajo rock bin, rock art, and graffiti	eligible, Criterion D	Potential adverse, avoid
3	NM-H-20-133	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid
4	NM-H-20-138	PIII field house	eligible, Criterion D	Potential adverse, avoid

Traditional Cultural Properties within the Segment D Corridor. Four Register-eligible Navajo traditional cultural properties were identified within or near the proposed transmission line Segment D corridor. Two Navajo offering areas (TCP 7 & 3) are located 100 feet and 1,500 feet, respectively, east of the Segment D. TCP 3 is located far enough away from the proposed centerline of Segment D to avoid impacts to this property. TCP 7, however, is located near the proposed centerline and could be avoided through the placement design of transmission towers away from this area.

The San Juan River (TCP 18) is considered a National Register-eligible property for the significant role it plays in Navajo history and culture. The central portion of proposed transmission Segment D crosses the San Juan River, but should not have an adverse impact on this important Navajo traditional cultural property. Similarly, the Hogback Monocline (TCP 19), a National Register-eligible Navajo traditional cultural property, is located 0.3 mile west of Segment D and would not be adversely impacted by the construction of Segment D.

Three Navajo burials were identified within or close to the proposed transmission line Segment D corridor. Burial 1 is located somewhere near the centerline of Segment D, but its precise location is unknown and burial 2 (a fenced burial plot) is crossed by the centerline of Segment D. There is a potential for the construction of Segment D to adversely affect both burials 1 & 2. Therefore, close coordination with the Navajo Nation should be performed in designing the placement of transmission towers in the area of these burials to avoid impacts. The third burial is a marked burial (Burial 15) that is located 800 feet west of Segment D and should not be impacted by the proposed development.

NM-H-20-138, an Anasazi PIII field house, is considered by the Hopi Tribe and other interested Native American groups to be an ancestral site and therefore a traditional cultural property. This site could be avoided through designing the placement of the transmission towers away from this place; however, if this site cannot be avoided and would be affected by the placement of the transmission towers, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to this property would be implemented through the process established in the programmatic agreement.

Alternative Transmission Line Segment B

Archaeological and Historical Properties within the Alternative Segment B Corridor. Five archaeological and historic properties were identified within the alternative transmission line Segment B corridor, representing 4 Anasazi sites and a historic Navajo habitation site. All five properties are considered eligible for the National Register (Table 4-27) and there is a potential for the construction of alternative Segment B to adversely affect a portion or all of these five properties and their potential to yield important historical information. Placement of transmission towers may be flexible enough to span these sites and avoid impacts to these five historic properties.

Table 4-27 Historic Properties located within the Alternative Transmission Line Segment B Corridor

	Site Number	Site Type	National Register Status, Criterion	Effect, Recommended Treatment
1	NM-H-29-119	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid
2	NM-H-29-125	PI permanent use area	eligible, Criterion D	Potential adverse, avoid
3	NM-H-29-129	PII habitation	eligible, Criterion D	Potential adverse, avoid
4	NM-H-29-130	PII-III habitation	eligible, Criterion D	Potential adverse, avoid
5	NM-H-29-131	PI-II habitation	eligible, Criterion D	Potential adverse, avoid

Traditional Cultural Properties within the Alternative Segment B Corridor. No Register-eligible Navajo traditional cultural properties are located within the alternative transmission line Segment B corridor or the buffer zone.

Three Navajo burials are located within or near the alternative transmission line Segment B corridor. Burial 17, an unmarked grave, is located near the centerline of Segment B. Burial 19, a fenced family burial plot with multiple graves, and Burial 20, a marked grave, are both located on the eastern edge of alternative transmission line Segment B corridor. There is a potential for the construction of alternative transmission line Segment B to adversely affect Burial 17. Burial 17 could be avoided through modification of the placement of towers associated with alternative transmission line Segment B. In the event that Burial 17 cannot be avoided and would be impacted by the construction of alternative transmission line Segment B then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

The four Anasazi archaeological sites are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites may be avoided through designing the placement of the transmission towers away from these places; however, if one or more of these sites would be affected by the placement of the transmission towers, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

4.9.2.2.3 Access Road

Archaeological and Historical Properties Located within the Proposed Access Road. Four archaeological sites (NM-H-36-26; NM-H-36-28, NM-H-36-35 & NM-H-36-87) were identified within the proposed route of the access road (Table 4-28). Three of the archaeological sites contain 3 Anasazi components and 2 historic Navajo components represented by a Navajo sheep camp dating from 1900-1950, a Navajo habitation dating from 1880-1950, a PI-PII artifact scatter, a PII field house, and a PII-PIII activity area. All 5 historic components are considered eligible for listing in the National Register. The fourth archaeological site consists of a Navajo sheep camp that dates from 1900-1970 and is considered ineligible to the National Register.

Table 4-28 Historic Properties Located within the Proposed Access Road

	Site Number	Site Type	National Register Status, Criterion	Effects, Recommended Treatment
1	NM-H-36-26	C1: Navajo sheep Camp C2: PI-PII artifact scatter	Eligible, Criterion D Eligible, Criterion D	Potential adverse; avoidance
2	NM-H-36-28	C1: PII field house C2: Navajo habitation	Eligible, Criterion D Eligible, Criterion D	Potential adverse; avoidance
3	NM-H-36-35	PII activity area	Eligible, Criterion D	Potential adverse; avoidance
4	NM-H-36-87	Navajo sheep camp	Ineligible	No further consideration

All 5 historic components are located within or near the route of the proposed access road and there is a potential for the construction of the access road to adversely affect a portion or all of these five historic components and their potential to yield important historical information. Flexibility in the design of the access road may be sufficient to avoid impacts to these 5 historic components.

Traditional Cultural Properties Located within the Access Road. There are no Navajo traditional cultural properties located within or near the proposed access road.

The four Anasazi components are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These components could be avoided through designing the route of the access road away from these places; however, if one or more of these components would be affected by the construction of the access road, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

4.9.2.2.4 Water-supply System

Water Well Field Area A

Archaeological and Historical Properties Located within Water Well Field A. Water well field A has 2 National Register-eligible properties (one Anasazi site and one historic Navajo habitation site) located within the proposed water well field and there is a potential for the construction associated with the development of the well field to adversely affect a portion or all of these 2 properties and their potential to yield important historical information. Placement of individual wells and associated water lines may be flexible enough to avoid these 2 sites.

Traditional Cultural Properties Located within Water Well Field A. No Navajo traditional cultural properties are located within water well field alternative A.

The one Anasazi site is considered by the Hopi Tribe and other interested Native American groups to be an ancestral site and therefore a traditional cultural property. This archaeological site could be avoided through designing the placement of individual wells away from this site; however, if this site would be affected by the placement of the water wells, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to this place would be implemented through the process established in the programmatic agreement.

Water Well Field Area B

Archaeological and Historical Properties Located within Water Well Field B. Water well field B includes approximately 451 acres that surround the power plant footprint and approximately 438 acres that are contained within the buffer zone corridor of proposed transmission line Segment A.

There are 27 archaeological and historic sites containing 34 historic components located within the area that surrounds the power plant footprint. Of these, 12 components are considered eligible for the National Register and there is a potential for the construction associated with the development of the well field sub-alternative B to adversely affect a portion or all of these 12 historic components and their potential to yield important historical information. Placement of individual wells and associated water lines may be flexible enough to avoid these 12 historic components.

The portion of water well field B that is contained within the 438 acres that follows the buffer zone corridor of transmission line Segment A contains 22 archaeological and historic properties that represent 19 Anasazi and 6 Navajo components. One historic property is listed on the National Register (NM-H-29-132; a PIII Chuskan habitation site) and 18 are considered eligible for listing. NM-H-29-132 is located on top of a high, sheer rock crag and should not be impacted by the development of water well field Alternative B. There is a potential for the construction associated with the development of the well field Alternative B to adversely affect a portion or all of these 18 National Register-eligible historic properties and their potential to yield important historical information. Placement of individual wells and associated water lines may be flexible enough to avoid these 18 historic properties.

Traditional Cultural Properties Located within Water Well Field B. No National Register-eligible Navajo traditional cultural properties are located within water well field B. However, Burial 21, an unmarked grave, is located within the portion of alternative water well field B that is contained within the buffer zone corridor of transmission line Segment A and could be adversely impacted by the proposed construction associated with the development of this well field alternative. In order to avoid Burial 21, consultation with the Navajo Nation should occur during the design of water well and water line placement within the area of water well field B. In the event that Burial 21 cannot be avoided and would be impacted by the construction of water well field B then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

All Anasazi archaeological sites contained within the proposed water well field B are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites could be avoided through designing the placement of individual water wells away from these places; however, if one or more of these sites would be affected by the installation and operation of the water wells, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

Utility Corridor/Water Pipeline

Archaeological and Historical Properties Located within the Utility Corridor/Water Pipeline. Ten archaeological and historical properties were identified within the utility corridor representing 3 Anasazi components and 8 Navajo components. Of the 11 historic components 7 are considered National Register-eligible and 2 are unevaluated but are considered eligible for the purposes of this analysis. There is a potential for the construction associated with the development of the utility corridor/water line to adversely affect a portion or all of these 9 National Register-eligible historic properties. Design of the utility corridor route may be flexible enough to avoid these 9 historic properties. If these properties cannot be avoided through the design of the utility corridor route, then data recovery should be implemented to retrieve important historical information.

Table 4-29 Historic Properties Located within Utility Corridor/Water Pipeline

	Site Number	Site Type	National Register Status, Criterion	Effect, Recommended Treatment
1	NM-H-29-74	**C1:**PII habitation **C2:**historical Navajo cairn	eligible, Criterion D/ eligible, Criterion D	Potential adverse, avoid
2	NM-H-29-114	PII special use area	eligible, Criterion D	Potential adverse, avoid
3	NM-H-29-115	PII special use area	eligible, Criterion D	Potential adverse, avoid
4	NM-H-29-116	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid
5	NM-H-29-117	historical Navajo rock art	unevaluated; eligible, Criterion D	Potential adverse, avoid
6	NM-H-29-118	historical Navajo trail and rock cairn	unevaluated; eligible, Criterion D	Potential adverse, avoid
7	NM-H-30-22	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid
8	NM-H-36-124	historical Navajo habitation	eligible, Criterion D	Potential adverse, avoid

Traditional Cultural Properties Located within the Utility Corridor/Water Pipeline. Two Navajo traditional cultural properties were identified within the general area of the proposed utility corridor. Table Mesa, a Navajo offering area (TCP 9), is located 1.9 miles north of the utility corridor and is considered a National Register-eligible property and would not be affected by the proposed utility corridor. A National Register-eligible Navajo offering area (TCP 25) is located near, but outside of, the southern edge of the proposed utility corridor and should not be affected by the proposed utility corridor.

Two Navajo burials were identified within the proposed utility corridor. Burial 9, a burial inside a house, is located near the southern edge of the corridor and Burial 8, a hogan burial, is located along the southern edge of the corridor boundary. Both burials can be avoided through consultation with the Navajo Nation during the final design of the utility corridor route. In the event that Burials 8 and 9 cannot be avoided and would be impacted by the construction of the utility corridor/water pipeline then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

The 3 Anasazi components are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites could be avoided through designing the route of the utility corridor/water pipeline to avoid these places; however, if one or more of these sites would be affected by the installation of the utility corridor/water pipeline, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

4.9.2.2.5 Mining Operations in BNCC Lease Areas IV South and V

The impact assessment for the Desert Rock Energy Project is limited to the proposed future expansion of mining into Areas IV South (7.9 square miles) and V (12.4 square miles) of the BNCC lease area. The direct effects of the project on historic properties would result from the mining of Lease Areas IV South and V. Indirect effects to historic properties could result from air quality impacts on visibility due to mining activities and vibrations resulting from mine blasting that could affect the structural integrity of prehistoric sites with surface and subsurface architecture.

Area IV South

Historic properties located within BNCC Lease Areas IV South and V were identified during a previous cultural resource study which consisted of an archaeological survey of approximately 70 square miles for the Coal Gasification Project, which overlapped the current coal mine lease areas on an almost one-to-one relationship. As a result of this study and a subsequent Class I overview of mine lease Areas IV South and V conducted by the San Juan County Museum's Division of Conservation Archaeology, it was estimated that there are 103 previously recorded historic properties representing 112 historic components comprised of 1 Paleoindian, 38 Archaic, 46 Navajo, and 3 unknown within Lease Area IV South. The proposed mining within Lease Area IV South would have a direct adverse effect on all 103 previously recorded sites. However, the 103 previously recorded sites have yet to be evaluated for their eligibility for listing on the National Register of Historic Places, and therefore, the total number of sites that would need to be mitigated would be determined and plans for mitigation designed as BNCC applies for mining permits. Table 4-30 presents the previously recorded historic properties located within Lease Area IV South.

Table 4-30 Previously Recorded Historic Properties in Mine Lease Area IV South

Site Number (LA#)	Site Type	Cultural Affiliation	Register Eligibility Status	Effects, Recommended Treatment
19371	Unknown	Anasazi	Unknown	Adverse; data recovery
19665	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19666	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19667	Unknown	Anasazi	Unknown	Adverse; data recovery
19673	Unknown	Anasazi	Unknown	Adverse; data recovery
19674	Unknown	Navajo	Unknown	Adverse; data recovery
19675	Unknown	Anasazi	Unknown	Adverse; data recovery
19676	Unknown	Archaic	Unknown	Adverse; data recovery
19683	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19684	Unknown	Anasazi	Unknown	Adverse; data recovery
19685	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19690	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19691	Unknown	Navajo	Unknown	Adverse; data recovery
19692	Unknown	Archaic	Unknown	Adverse; data recovery
19693	Unknown	Navajo	Unknown	Adverse; data recovery
19694	Unknown (Ceremonial?)	Navajo	Unknown	Adverse; data recovery
19697	Unknown	Navajo	Unknown	Adverse; data recovery
19698	Unknown	Anasazi	Unknown	Adverse; data recovery
19699	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19700	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19704	Unknown	Navajo	Unknown	Adverse; data recovery
19707	Simple Feature	Navajo	Unknown	Adverse; data recovery
19708	Unknown	Archaic	Unknown	Adverse; data recovery
19712	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19713	Unknown	Archaic	Unknown	Adverse; data recovery

Site Number (LA#)	Site Type	Cultural Affiliation	Register Eligibility Status	Effects, Recommended Treatment
19714	Unknown	Navajo	Unknown	Adverse; data recovery
19720	Unknown	Anasazi	Unknown	Adverse; data recovery
19721	Unknown	Navajo	Unknown	Adverse; data recovery
19725	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19726	Unknown	Archaic	unknown	Adverse; data recovery
19728	Unknown	Navajo	unknown	Adverse; data recovery
19729	Unknown	Navajo	unknown	Adverse; data recovery
19730	**C1**: Unknown	Anasazi	unknown	Adverse; data recovery
19730	**C2**: Unknown	Navajo	unknown	Adverse; data recovery
19731	Unknown	Navajo	unknown	Adverse; data recovery
19735	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19736	Unknown	Navajo	unknown	Adverse; data recovery
19737	Unknown	Navajo	unknown	Adverse; data recovery
19748	Unknown	Navajo	unknown	Adverse; data recovery
19755	Unknown	Navajo	unknown	Adverse; data recovery
19774	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19785	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19900	Unknown	Navajo	unknown	Adverse; data recovery
19901	Unknown	Navajo	unknown	Adverse; data recovery
19902	**C1**: Unknown	Archaic	unknown	Adverse; data recovery
19902	**C2**: Unknown	Paleo-Indian	unknown	Adverse; data recovery
19903	Unknown	Navajo	unknown	Adverse; data recovery
19904	Unknown	Anasazi	unknown	Adverse; data recovery
19905	Unknown	Navajo	unknown	Adverse; data recovery
19906	Unknown	Anasazi	unknown	Adverse; data recovery
19907	Unknown	Navajo	unknown	Adverse; data recovery
19908	Unknown	Navajo	unknown	Adverse; data recovery
19909	Unknown	Navajo	unknown	Adverse; data recovery
19910	Unknown	Archaic	unknown	Adverse; data recovery
19911	Unknown	Archaic	unknown	Adverse; data recovery
19912	Unknown	Archaic	unknown	Adverse; data recovery
19913	Unknown	Navajo	unknown	Adverse; data recovery
19914	Unknown	Navajo	unknown	Adverse; data recovery
19915	Unknown	Archaic	unknown	Adverse; data recovery
19916	Unknown	Archaic	unknown	Adverse; data recovery
19917	Unknown	Archaic	unknown	Adverse; data recovery
19918	Unknown	Navajo	unknown	Adverse; data recovery
19919	**C1**: Unknown	Archaic	unknown	Adverse; data recovery
19919	**C2**: Unknown	Unknown	unknown	Adverse; data recovery
19920	Unknown	Archaic	unknown	Adverse; data recovery
19921	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19922	Unknown	Navajo	unknown	Adverse; data recovery
19923	Unknown	Archaic	unknown	Adverse; data recovery
19924	Unknown	Archaic	unknown	Adverse; data recovery
19925	**C1**: Unknown	Anasazi	unknown	Adverse; data recovery
19925	**C2**: Unknown	Archaic	unknown	Adverse; data recovery
19926	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19927	Unknown	Archaic	unknown	Adverse; data recovery
19928	Unknown	Archaic	unknown	Adverse; data recovery
19929	Unknown	Archaic	unknown	Adverse; data recovery
19931	Unknown	Archaic	unknown	Adverse; data recovery
19932	Unknown	Archaic	unknown	Adverse; data recovery
19933	**C1:** Unknown	Archaic	unknown	Adverse; data recovery
19933	**C2**: Unknown	Unknown	unknown	Adverse; data recovery
19934	Unknown	Archaic	unknown	Adverse; data recovery

Site Number (LA#)	Site Type	Cultural Affiliation	Register Eligibility Status	Effects, Recommended Treatment
19935	Unknown	Archaic	unknown	Adverse; data recovery
19936	Unknown	Anasazi	unknown	Adverse; data recovery
19937	Unknown	Navajo	unknown	Adverse; data recovery
19938	Unknown	Archaic	unknown	Adverse; data recovery
19939	**C1**: Unknown	Archaic	unknown	Adverse; data recovery
19939	**C2**: Unknown	Navajo	unknown	Adverse; data recovery
19940	Unknown	Navajo	unknown	Adverse; data recovery
19941	Unknown	Archaic	unknown	Adverse; data recovery
19942	Unknown	Archaic	unknown	Adverse; data recovery
19943	Unknown	Archaic	unknown	Adverse; data recovery
19944	Unknown	Unknown	unknown	Adverse; data recovery
19945	Unknown	Archaic	unknown	Adverse; data recovery
19946	Unknown	Navajo	unknown	Adverse; data recovery
19947	Unknown	Archaic	unknown	Adverse; data recovery
19948	Unknown	Archaic	unknown	Adverse; data recovery
19949	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19950	Unknown	Navajo	unknown	Adverse; data recovery
19951	Unknown (Habitation?)	Navajo	unknown	Adverse; data recovery
19957	Unknown	Navajo	unknown	Adverse; data recovery
19958	Unknown	Archaic	unknown	Adverse; data recovery
19959	Unknown	Navajo	unknown	Adverse; data recovery
19960	Unknown	Archaic	unknown	Adverse; data recovery
19961	Unknown	Navajo	unknown	Adverse; data recovery
19962	Unknown	Archaic	unknown	Adverse; data recovery
19963	Unknown	Anasazi	unknown	Adverse; data recovery
53941	**C1**: Unknown	Anasazi	unknown	Adverse; data recovery
53941	**C2**: Unknown	Archaic	unknown	Adverse; data recovery
53942	**C1**: Unknown	Anasazi	unknown	Adverse; data recovery
53942	**C2**: Unknown	Archaic	unknown	Adverse; data recovery
113808	Habitation (Habitation?)	Navajo	unknown	Adverse; data recovery
126355	**C1:** Multiple Residence	Anasazi	unknown	Adverse; data recovery
126355	**C2**: Simple Feature	Navajo	unknown	Adverse; data recovery

Traditional Cultural Properties within Area IV South

There is one Navajo traditional cultural property, a death hogan (*hook'eeghan*), and 4 Navajo burials located with in Area IV South (see Table 4-31). The death hogan is located on an archaeological site (LA 19712) and would be directly affected by the proposed mining activities within Area IV South. Avoidance by 100 feet is recommended, although if this is not possible, then the former Navajo occupants request that they be contacted to assist in the development of appropriate mitigation measures.

Burials 9, 10, and 11, are all located within Lease Area IV South and would be directly impacted by the proposed mining of the area. Avoidance of these burials is recommended through a process that involves re-identifying the location of each burial and then establishing a 100 foot avoidance radius for marked graves and a 500 foot avoidance radius for unmarked graves. Burial 12 is located within the buffer zone of Lease Area IV South and would not be impacted by the proposed mining.

In the event that Burials 9, 10, 11, and the death hogan cannot be avoided and would be impacted by the mining of Lease Area IV South then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

All the Anasazi archaeological sites located within Lease Area IV South are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites would be adversely impacted by the mining of Lease Area IV South and the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

Table 4-31 Potential Impacts on Traditional Cultural Resources within Mining Lease Area IV South

Resource	Cultural Affiliation	National Register Status	Effects, Recommended Treatment
Eagle nesting area and *ntł'iz* (TCP 5)	Navajo	Eligible, Criteria A & D	No adverse effect (located in buffer zone of Area IV South)
Death hogan/house (*hook'eeghan*) (TCP 7)	Navajo	Eligible, Criteria A & D	Avoid by 100 feet
Burial 9 (marked plot)	Navajo	Protected by NAGPRA	avoid or treat in accordance with Navajo Nation Jischáá' policy
Burial 10	Navajo	Protected by NAGPRA	avoid or treat in accordance with Navajo Nation Jischáá' policy
Burial 11	Navajo	Protected by NAGPRA	avoid or treat in accordance with Navajo Nation Jischáá' policy
Burial 12 (marked plot)	Navajo	Protected by NAGPRA	No adverse effect (located within buffer zone)

Lease Area V

According to the Division of Conservation Archaeology, Lease Area V contains a total of 82 previously recorded historic properties that are represented by 84 components consisting of 11 Archaic, 12 Anasazi, 57 Navajo, and 4 unknown. Similar to Area IV South, the proposed mining within Lease Area V would have a direct adverse effect on all 82 previously recorded historic properties. However, the 82 previously recorded historic properties have not yet been evaluated for their eligibility for listing on the National Register of Historic Places and therefore, the total number of properties that would need to be mitigated would be determined and plans for mitigation designed as BNCC applies for mining permits. Table 4-32 presents the previously recorded historic properties located within Lease Area V.

Table 4-32 Previously Recorded Historic Properties in Mine Lease Area V

Site Number (LA#)	Site Type	Cultural Affiliation	Register Eligibility	Effects, Recommended Treatment
19207	Unknown	Navajo	Unknown	Adverse; data recovery
19753	Unknown	Navajo	Unknown	Adverse; data recovery
19754	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19759	Unknown (Habitation?)	Anasazi	Unknown	Adverse; data recovery
19760	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19761	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19766	Unknown	Navajo	Unknown	Adverse; data recovery
19767	Unknown	Anasazi	Unknown	Adverse; data recovery
19768	Unknown	Archaic	Unknown	Adverse; data recovery
19769	Unknown	Anasazi	Unknown	Adverse; data recovery
19770	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19771	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19772	Unknown	Archaic	Unknown	Adverse; data recovery
19773	Unknown	Navajo	Unknown	Adverse; data recovery

Site Number (LA#)	Site Type	Cultural Affiliation	Register Eligibility	Effects, Recommended Treatment
19780	**C1**: Unknown	Anasazi	Unknown	Adverse; data recovery
19780	**C2:** Unknown	Unknown	Unknown	Adverse; data recovery
19781	Unknown	Navajo	Unknown	Adverse; data recovery
19782	Unknown	Archaic	Unknown	Adverse; data recovery
19783	Unknown	Archaic	Unknown	Adverse; data recovery
19784	Unknown	Navajo	Unknown	Adverse; data recovery
19788	Unknown	Archaic	Unknown	Adverse; data recovery
19789	Unknown	Navajo	Unknown	Adverse; data recovery
19790	Unknown	Unknown	Unknown	Adverse; data recovery
19791	Unknown	Navajo	Unknown	Adverse; data recovery
19792	Unknown	Navajo	Unknown	Adverse; data recovery
19795	Unknown	Anasazi	Unknown	Adverse; data recovery
19796	Unknown	Navajo	Unknown	Adverse; data recovery
19797	Unknown	Navajo	Unknown	Adverse; data recovery
19798	Unknown	Navajo	Unknown	Adverse; data recovery
19799	Unknown	Archaic	Unknown	Adverse; data recovery
19801	Unknown	Navajo	Unknown	Adverse; data recovery
19802	Unknown	Archaic	Unknown	Adverse; data recovery
19805	Unknown	Navajo	Unknown	Adverse; data recovery
19806	Unknown	Navajo	Unknown	Adverse; data recovery
19807	Ranching/Agricultural (Habitation?)	Navajo	Unknown	Adverse; data recovery
19808	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19809	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19810	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19811	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19812	**C1**: Unknown	Archaic	Unknown	Adverse; data recovery
19812	**C2:** Unknown	Navajo	Unknown	Adverse; data recovery
19816	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19817	Unknown	Navajo	Unknown	Adverse; data recovery
19818	Unknown	Navajo	Unknown	Adverse; data recovery
19819	Unknown	Navajo	Unknown	Adverse; data recovery
19820	Unknown	Anasazi	Unknown	Adverse; data recovery
19821	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19822	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19831	Ranching/Agricultural (Habitation?)	Navajo	Unknown	Adverse; data recovery
19832	Unknown	Navajo	Unknown	Adverse; data recovery
19833	Unknown	Archaic	Unknown	Adverse; data recovery
19836	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19837	Unknown	Anasazi	Unknown	Adverse; data recovery
19838	Unknown	Unknown	Unknown	Adverse; data recovery
19842	Unknown	Navajo	Unknown	Adverse; data recovery
19843	Unknown	Navajo	Unknown	Adverse; data recovery
19844	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19847	Unknown	Anasazi	Unknown	Adverse; data recovery
19848	Unknown (Ceremonial?)	Navajo	Unknown	Adverse; data recovery
19849	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19850	Unknown	Navajo	Unknown	Adverse; data recovery
19851	Unknown (Habitation?)	Anasazi	Unknown	Adverse; data recovery
19854	Unknown	Navajo	Unknown	Adverse; data recovery
19856	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19857	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19858	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19863	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19864	Unknown	Navajo	Unknown	Adverse; data recovery

Site Number (LA#)	Site Type	Cultural Affiliation	Register Eligibility	Effects, Recommended Treatment
19865	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19873	Unknown	Navajo	Unknown	Adverse; data recovery
19875	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19888	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19889	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19890	Unknown	Navajo	Unknown	Adverse; data recovery
19891	Unknown	Navajo	Unknown	Adverse; data recovery
19892	Unknown	Anasazi	Unknown	Adverse; data recovery
84689	Sheep Camp	Navajo	Unknown	Adverse; data recovery
113811	Activity Area	Anasazi	Unknown	Adverse; data recovery
126365	Artifact Scatter	Unknown	Unknown	Adverse; data recovery
126371	Artifact Scatter	Archaic	Unknown	Adverse; data recovery
126372	Feature and Artifact Scatter	Archaic	Unknown	Adverse; data recovery
19868	Unknown	Navajo	Unknown	Adverse; data recovery
19886	Unknown (Habitation?)	Navajo	Unknown	Adverse; data recovery
19887	Unknown (Habitation?)	Anasazi	Unknown	Adverse; data recovery

Traditional Cultural Properties Located in Area V

There is one Navajo traditional cultural property, an offering place (*ntł'iz*), located within Lease Area V and two Navajo traditional cultural properties (a herb gathering area and an offering area) and 6 Navajo burials located within the buffer zone of Lease Area V (see Table 4-33). No adverse effects would occur to the two Navajo traditional cultural properties or the 6 burials located within the Area V buffer zone. The one Navajo offering place located within Lease Area V would be adversely affected by the proposed mining. This Navajo traditional cultural property is considered sacred by the Navajo and steps should be taken to avoid this place by a 100-foot radius.

Table 4-33 Potential Impacts on Traditional Cultural Resources within Mining Area V

Resource	Cultural Affiliation	National Register Status	Effects, Recommended Treatment
Ntł'iz (offering area – TCP 6)	Navajo	Eligible, Criteria A & D	Adverse, avoidance
Ntł'iz (offering area – TCP 8)	Navajo	Eligible, Criteria A & D	No adverse effect (located in buffer zone for Area V)
Herb gathering area/ Burial 17 (TCP 9)	Navajo	Eligible, Criteria A & D Protected by NAGPRA	No adverse effect (outside of buffer zone for Area V)
Herb gathering area (TCP 10)	Navajo	Eligible, Criteria A & D	No adverse effect (within buffer zone for Area V)
Burial 13 (marked plot)	Navajo	Protected by NAGPRA	
Burial 14	Navajo	Protected by NAGPRA	No adverse effect (within buffer zone for Area V)
Burial 15	Navajo	Protected by NAGPRA	No adverse effect (outside of buffer zone for Area V)
Burial 16	Navajo	Protected by NAGPRA	No adverse effect (within buffer zone for Area V)
Burial 17	Navajo	Protected by NAGPRA	No adverse effect (outside of buffer zone for Area V)

All the Anasazi archaeological sites located within Lease Area V are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites would be adversely impacted by the mining of Lease Area V and the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

All archaeological and historical properties that are subsequently determined to be Register-eligible that are located within Lease Areas IV South and V can have the direct impacts satisfactorily mitigated through data recovery studies. The BIA and OSM are working with the Navajo Nation Historic Preservation Department to develop a Section 106 programmatic agreement that would stipulate procedures for continuing to consider measures to avoid, reduce, or mitigate adverse effects on significant cultural resources during the long-term mining of Lease Areas IV South and V. In addition, BNCC would be required to initiate cultural resource studies over the coming decades to inventory, reevaluate, and treat cultural resources as they submit applications to OSM for permits to mine within Areas IV South and V.

The indirect effects of mining on cultural resources that would result from ground vibrations caused by blasting associated with mining activities in Lease Areas IV South and V were also evaluated. According to seismographic records maintained on blasting episodes at the Navajo Mine, most common blasting episodes have no human-perceptible vibration at a distance of 13,000 to 15,000 feet (2-3 miles) from the blast event. For example, a typical blast measured at 10,000 feet the vibrations will average a velocity of 0.02 to 0.06 inches per second (ips) and have duration of 2 to 5 seconds. Human detection for an event of this duration is above a velocity of 0.10 ips and any structural response (damage) for prehistoric ruins or historic buildings is between 0.08 ips and 0.30 ips.

For those archaeological and historic properties located within Lease Area IV South and V, the indirect impacts caused by vibrations resulting from mine blasting would not be adverse because these properties would be considered and the adverse effects mitigated prior to the initiation of mining activities. The closest archaeological site with recorded surface and subsurface architecture is the Sanostee Chacoan Outlier which is located west of Area IV South and is designated as a Chaco Culture Archaeological Protection site. The Sanostee site (LA 7292) is composed of 2 great kivas, 2 kivas, 2 roomblocks, and 4 middens and is located approximately 2.25-2.5 miles west of Area IV South. The Sanostee site would not experience any significant structural impact from blasting that occurs within the Lease Areas IV South and V because it is located farther than the radius of detectable vibrations. Moreover, Class I sites, like Mesa Verde National Park and Chaco Culture National Historical Park, are located at distances greater than 20 miles from Lease Areas IV South and V and these sites would not receive vibrations impacts from mine blasting that could cause structural damage or are human-perceptible vibrations.

4.9.2.2.6 Mitigation to Reduce Impacts

Avoidance of historic properties through redesign of project components that are part of Alternative B is the preferred method of reducing impacts. If that is not possible, all archaeological and historical properties that are subsequently determined to be Register-eligible that are located within the power plant site, rights-of-way for associated facilities, and the coal mining Lease Areas IV South and V can have the direct impacts of the project satisfactorily mitigated through data recovery studies. The BIA and OSM are working with the Navajo Nation Historic Preservation Department to develop a Section 106 programmatic agreement that would stipulate procedures for continuing to consider measures to avoid, reduce, or mitigate adverse effects on significant cultural resources during the implementation of Alternative B and the associated long-term mining of Lease Areas IV South and V. In addition, BNCC would be required to initiate cultural resource studies over the coming decades to inventory, re-evaluate, and treat cultural resources as they submit applications to OSM for permits to mine within Areas IV South and V.

All Anasazi archaeological sites located within Alternative B project components and within the Lease Area IV South and V are considered by the participating interested Native American tribes to be ancestral sites and therefore traditional cultural properties. These sites, if not avoided by the project components, could be adversely impacted by Alternative B and the impacts to Native American concerns for these sites could be reduced through the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places.

All Navajo burials that cannot be avoided by the Alternative B project components could have the impacts reduced through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and adherence to the Native American Graves Protection and Repatriation Act.

4.9.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.9.2.3.1 Power Plant

There would be no National Register-eligible historic properties located near the Alternative C 550 MW subcritical facility.

Traditional Cultural Properties

There are no identified Navajo traditional cultural properties located within the proposed power plant construction footprint under Alternative C.

Indirect impacts to cultural resources in the form of visual intrusion and increased regional haze that results from the construction and operation of the Alternative C power plant would be the same or less than those considered under Alternative B.

4.9.2.3.2 Transmission Lines

The impacts to historic properties from the construction of the transmission lines under Alternative C would be less than those considered under Alternative B. Under Alternative C there would be only one transmission line constructed which would require a smaller right-of-way and therefore, greater flexibility in avoiding impacts to historic properties.

4.9.2.3.3 Access Road

The impacts to historic properties from the construction of the access road under Alternative C would be the same as those considered under Alternative B.

4.9.2.3.4 Water-supply System

Water Well Field A

Archaeological and Historical Properties Located within Water Well Field A. Under Alternative C, development of water well field A has the potential to adversely affect 2 National Register-eligible properties (one Anasazi site and one historic Navajo habitation site) that would be located within the water well field. However, because of the reduced need for water to the power plant there is a reduction in the number of water wells and therefore greater flexibility in the placement of individual wells and associated water lines to avoid these two historic properties.

Traditional Cultural Properties Located within Water Well Field A. No Navajo traditional cultural properties are located within water well field A.

Water Well Field B

Archaeological and Historical Properties located within Water Well Field B. Water well field B includes approximately 451 acres that surround the power plant footprint and approximately 438 acres that are contained within the buffer zone corridor of proposed transmission line Segment A.

There are 27 archaeological and historic sites containing 34 historic components located within the area that surrounds the power plant footprint. Of these, 12 components are considered eligible for the National Register and there is a potential for the construction associated with the development of the well field sub-alternative B to adversely affect a portion or all of these 12 historic components and their potential to yield important historical information. Under the Alternative C there is a reduced power generating capacity of the power plant and an associated reduction in the need for water and a reduction in the number of water wells. This reduction in the number of water wells would provide greater flexibility in the placement of individual wells and associated water lines to avoid the12 historic components.

The portion of water well field B that is contained within the 438 acres that follows the buffer zone corridor of transmission line Segment A contains 22 archaeological and historic properties that represent 19 Anasazi and 6 Navajo components. One historic property is listed on the National Register (NM-H-29-132; a PIII habitation site) and 18 are considered eligible for listing. NM-H-29-132 is located on top of a high, sheer rock crag and should not be impacted by the development of water well field B. There is a potential for the construction associated with the development of the well field Alternative B to adversely affect a portion or all of these 18 National Register-eligible historic properties and their potential to yield important historical information. Under the Alternative C there is a reduced power generating capacity of the power plant and an associated reduction in the need for water and a reduction in the number of water wells. This reduction in the number of water wells would provide greater flexibility in the placement of individual wells and associated water lines to avoid the18 National Register properties.

Traditional Cultural Properties Located within Water Well Field B. No National Register-eligible Navajo traditional cultural properties are located within water well field B. However, Burial 21, an unmarked grave, is located within the portion of water well field B that is contained within the buffer zone corridor of transmission line Segment A and could be adversely impacted by the proposed construction associated with the development of this water well field alternative. In order to avoid Burial 21, consultation with the Navajo Nation should occur during the design of water well and water line placement within the area of water well field B. In the event that Burial 21 cannot be avoided and would be impacted by the construction of water well field B then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

All Anasazi archaeological sites contained within the proposed water well field B are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites could be avoided through designing the placement of individual water wells away from these places; however, if one or more of these sites would be affected by the installation and operation of the water wells, then the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

Utility Corridor/Water Pipeline

Archaeological and Historical Properties Located within the Utility Corridor/Water Pipeline. Impacts to historic properties located within the utility corridor/water pipeline would be the same under Alternative C as those considered under Alternative B. If the 9 National Register-eligible properties cannot be avoided through the design of the utility corridor route, then data recovery should be implemented to retrieve important historical information.

Traditional Cultural Properties Located within the Utility Corridor/Water Pipeline. Impacts to traditional cultural properties located within the utility corridor/water pipeline would be the same under Alternative C as those considered under Alternative B.

4.9.2.3.5 Mining Operations in BNCC Lease Areas IV South

The impact assessment for Alternative C of the Desert Rock Energy Project is limited to the proposed future expansion of mining into only Area IV South (7.9 square miles) of the BNCC lease area. Due to the reduced generating capacity of the power plant under Alternative C, there would be no need to mine coal from mining Lease Area V. Therefore, the proposed mining within Lease Area IV South would have a direct adverse effect on 103 previously recorded sites. However, the 103 previously recorded sites have yet to be evaluated for their eligibility for listing on the National Register of Historic Places, and therefore, the total number of sites that would need to be mitigated would be determined and plans for mitigation designed as BNCC applies for mining permits.

Traditional Cultural Properties within Area IV South

Under Alternative C, there is one Navajo traditional cultural property, a death hogan (*hook'eeghan*), and 4 Navajo burials located with in Area IV South (see Table 4-31). The death hogan is located on an archaeological site (LA 19712) and would be directly affected by the proposed mining activities within Area IV South. Avoidance by 100 feet is recommended, although if this is not possible, then the former Navajo occupants request that they be contacted to assist in the development of appropriate mitigation measures.

Burials 9, 10, and 11, are all located within Lease Area IV South and would be directly impacted by the proposed mining of the area. Avoidance of these burials is recommended through a process that involves re-identifying the location of each burial and then establishing a 100 foot avoidance radius for marked graves and a 500 foot avoidance radius for unmarked graves. Burial 12 is located within the buffer zone of Lease Area IV South and would not be impacted by the proposed mining.

In the event that Burials 9, 10, 11, and the death hogan cannot be avoided and would be impacted by the mining of Lease Area IV South then the impacts would be mitigated through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and the Native American Graves Protection and Repatriation Act.

All the Anasazi archaeological sites located within Lease Area IV South are considered by the Hopi Tribe and other interested Native American groups to be ancestral sites and therefore traditional cultural properties. These sites would be adversely impacted by the mining of Lease Area IV South and the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places would be implemented through the process established in the programmatic agreement.

Indirect effects to historic properties under Alternative C could result from air quality impacts on visibility due to mining activities and vibrations resulting from mine blasting that could affect the structural integrity of prehistoric sites with surface and subsurface architecture. However, these impacts would be reduced because mining of coal would not be extended into Lease Area V.

4.9.2.3.6 Mitigation to Reduce Impacts

Avoidance of historic properties through redesign of project components that are part of Alternative C is the preferred method of reducing impacts. If that is not possible, all archaeological and historical properties that are subsequently determined to be Register-eligible that are located within the power plant, associated facilities, and the coal mining Lease Area IV South can have the direct impacts of the project satisfactorily mitigated through data recovery studies. The BIA and OSM are working with the Navajo Nation Historic Preservation Department to develop a Section 106 programmatic agreement that would stipulate procedures for continuing to consider measures to avoid, reduce, or mitigate adverse effects on significant cultural resources during the implementation of Alternative C and the associated long-term mining of Lease Area IV South. In addition, BNCC would be required to initiate cultural resource studies over the coming decades to inventory, re-evaluate, and treat cultural resources as they submit applications to the Office of Surface Mining for permits to mine within Area IV South.

All Anasazi archaeological sites located within Alternative C project components and within the Lease Area IV South are considered by the participating interested Native American tribes to be ancestral sites and therefore traditional cultural properties. These sites, if not avoided by the project components, can be adversely impacted by Alternative C and the impacts to Native American concerns for these sites can be reduced through the design of appropriate mitigative procedures that consider the various traditional cultural values that are ascribed to these places.

All Navajo burials that cannot be avoided by the Alternative C project components can have the impacts reduced through adherence to the Navajo Nation's Policy for the Protection of *Jishchaá:* Gravesites, Human Remains, and Funerary Items and adherence to the Native American Graves Protection and Repatriation Act.

4.9.3 Summary of Impact Analysis

Alternative A, the No Action Alternative, would have no impact on cultural resources because the proposed project would not be built. The identified historic properties located within the project area would remain in their current condition. Alternative B has the potential for the greatest adverse impact on cultural resources. Alternative C, the development of the 550 MW subcritical power plant and associated facilities, would have a lesser potential adverse impact on cultural resources primarily because the mining of coal would not extend into Lease Area V. However, residual impacts to Register-eligible historic properties under either Alternative B or C would be expected to be negligible because any adverse impacts to cultural resource would be addressed through the development of the programmatic agreement, which will delineate measures to avoid, reduce, or mitigate those impacts.

Residual impacts on traditional cultural properties and Navajo burials also would be expected to be negligible because any adverse impacts to these resources would be addressed through consultation with the Navajo Nation Historic Preservation Department and through compliance with the Navajo Nation's Policy for the Protection of *Jishchaá*: Gravesites, Human Remains, and Funerary Items. Residual impacts to traditional Navajo culture and to the traditional cultures of the other participating tribes is unknown, but would be anticipated to be negligible due to ongoing consultation between these tribes, the BIA, and OSM in the implementation of the programmatic agreement.

4.10 PALEONTOLOGY

Paleontological resources constitute a fragile and nonrenewable scientific record of the history of life on earth. Once damaged, destroyed, or improperly collected, the scientific and educational value of these resources can be greatly reduced or lost forever. In addition to their scientific, educational, and recreational values, paleontological resources can be used to understand interrelationships between the biological and geological components of ecosystems over long periods of time.

4.10.1 Impact Assessment Methodology

Specific impacts on paleontological resources have not been determined as part of this EIS because paleontological resources are subject to an active discovery process; that is, fossils and other paleontological resources continue to be discovered either during professional or amateur surveys or simply by chance as resources are exposed due to surface erosion or man-caused disturbance, or remote areas are surveyed. Additional paleontological resources may be found on Navajo Nation lands. Impacts on paleontological resources are anticipated to be minimal or none with adherence to project mitigation guidelines and recommendations. In keeping with historical policies adopted by the BIA and the U.S. Department of the Interior, vertebrate fossils are less abundant and are treated differently than plant and invertebrate fossils, and typically vertebrate fossils have more significance. However, noteworthy occurrences of invertebrate or plant fossils may be identified and should be mitigated appropriately. Known paleontological resources have been used to determine the potential for a geologic unit to yield scientifically significant fossils and were presented in Section 3.10, Paleontology, and Table 3-36, List of Paleontological Resources Reported in San Juan County and Navajo Indian Reservation.

4.10.2 Environmental Consequences

4.10.2.1 No Action (Alternative A)

Paleontological resources would continue to be subject to discovery and/or loss through natural processes such as soil erosion, and as a result of surface disturbance such as blading and grading for roads or facilities and trenching for pipelines. Surface disturbance may promote increased soil erosion from wind and water or unearth a specimen during earth moving activities. The “discovery” of the paleontological resource with proper evaluation and curation may result in increased knowledge about the history of the area or life on Earth. However, if discovered and not properly evaluated, the paleontological resource may be exposed to damage or loss through vandalism or theft.

4.10.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.10.2.2.1 Power Plant

The leased area for power plant site includes approximately 592 acres that overlie the Kirtland, Fruitland, Pictured Cliffs, and Lewis Shale deposits and may contain fossils. The areas to be disturbed may warrant mitigation to include an on-the-ground survey conducted prior to construction or a paleontologist available as a monitor during construction.

4.10.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

This alignment would cross approximately 25.3 miles. Segments A and C cross Pictured Cliffs and Lewis Shale deposits. Segment D crosses Pictured Cliffs, Lewis Shale, Cliff House, Menefee, Point Lookout, and Mancos Shale geologic units. Many of these deposits have potential for paleontological resources. Since surface disturbance is expected to be minimal, mitigation to include training of construction staff in recognizing possible resources and contacting a paleontologist if a possible paleontological resource is discovered is expected to be adequate.

Alternative Transmission Line Segment B

This alignment would cross 11.1 miles. Transmission line Segment B crosses Pictured Cliffs and Lewis Shale deposits. These deposits have potential for paleontological resources. Since surface disturbance is expected to be minimal, mitigation to include training of construction staff in recognizing possible resources and contacting a paleontologist if a possible paleontological resource is discovered is expected to be adequate.

4.10.2.2.3 Utility Corridor/Water Pipeline

The utility corridor for the water pipeline from water well field A would be 12.4 miles in length. The utility corridor crosses Pictured Cliffs, Lewis Shale, Cliff House, Menefee, Point Lookout, and Mancos Shale geologic units. Many of these deposits have potential for paleontological resources. The areas to be disturbed would warrant mitigation to include an on-the-ground survey conducted prior to construction or a paleontologist available as a monitor during construction.

4.10.2.2.4 Access Road

The proposed access road would cross lands associated with the Kirtland and Fruitland deposits. These deposits have potential for paleontological resources (refer to Table 3-36). The areas to be disturbed would warrant mitigation to include an on-the-ground survey conducted prior to construction or a paleontologist available as a monitor during construction.

4.10.2.2.5 BNCC Lease Areas IV South and V

BNCC Lease Area IV South is located on Kirtland and Fruitland deposits. Lease Area V is located on Kirtland, Fruitland, and a minor amount of Pictured Cliffs deposits. These deposits have potential for paleontological resources (refer to Table 3-36). Any areas to be disturbed by mining operations (including blasting and stripping) would warrant an on-the-ground survey conducted prior to the onset of surface disturbance as mitigation.

4.10.2.2.6 Water-supply System

The water well field area A covers 889 acres and is located on Mancos Shale deposits. These deposits have not yielded fossil resources in the area. Since these deposits have not yielded fossils, mitigation to include training of construction staff in recognizing possible resources and contacting a paleontologist if a possible paleontological resource is discovered is expected to be adequate.

The proposed water well field area B includes 889 acres and is located on Kirtland, Fruitland, Pictured Cliffs, and Lewis Shale deposits and may contain fossils (refer to Table 3-36). The areas to be disturbed would warrant mitigation to include an on-the-ground survey conducted prior to construction or a paleontologist available as a monitor during construction.

4.10.2.2.7 Mitigation to Reduce Impacts

The purpose of these mitigation measures is to ensure that any new paleontological discoveries that occur during the construction and operation of the proposed project would be appropriately evaluated, mitigated, and curated. These measures include:

- Conduct an on-the-ground survey prior to construction, or have a paleontologist available as a monitor during construction. This measure would apply to the proposed power plant site, the utility corridor/water pipeline (if well field A is selected), access road, or areas to be disturbed by mining operations on Lease Areas IV South or V.
- Train construction personnel for the transmission line and well field in recognizing possible resources and how to contact a paleontologist if a possible paleontological resource is discovered.

4.10.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

Because the areas of surface disturbance associated with Alternative C would be the same or less than under Alternative B, the analysis would be very similar for the smaller facility. Impacts would be the same as described for Alternative B—minimal or none with adherence to the proposed mitigation measures identified above.

4.10.3 Summary of Impact Analysis

Paleontological resources are subject to an active discovery process. Additional paleontological resources may be found on Navajo Nation lands but quantity and quality are not known until discovered and properly evaluated. However, paleontological resources on Navajo Nation lands are administered in accord with the principles and recommendations of the Assessment of Fossil Management on Federal & Indian Lands (USDI Secretary of the Interior 2000). The Navajo Nation follows these principles and recommendations. Any actions proposed for Navajo Nation lands should include an evaluation of the potential for important paleontological resources and potential impacts to paleontological resources. Surface disturbance may result in damage or loss of the resource and, therefore, mitigation measures should be adhered to so that any new discoveries are appropriately evaluated, mitigated and curated. Paleontological resources are expected to be properly evaluated and mitigated as part of the proposed project. Impacts on paleontological resources are anticipated to be minimal or none with adherence to these mitigation guidelines and recommendations.

4.11 TRAFFIC AND TRANSPORTATION

4.11.1 Impact Assessment Methodology

This section discusses the potential impacts on traffic, transportation, and access in the vicinity of the proposed project. The impact analysis for traffic and transportation includes the potential effects generated by the construction and operation of the proposed project on traffic and transportation in the project area. The analysis is based on review of existing transportation networks in the project area, and project access requirements during construction, operation, and long term maintenance. Road use and closures and construction could impact various resources, including biological, cultural, or earth resources; the potential impacts on those resources are addressed in their respective sections.

4.11.2 Environmental Consequences

4.11.2.1 No Action (Alternative A)

Under Alternative A, no power plant, transmission line facilities, access roads, water supply facilities, or any other component of the proposed project would be constructed. Therefore no impacts would occur on the existing traffic and transportation networks.

4.11.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.11.2.2.1 Power Plant

The proposed project would be constructed over a period of 54 months and operation of the plant would consist of 50 years. Normal construction hours are expected to be between 7:00 a.m. and 6:00 p.m., Monday through Friday. Some activities might require extended construction hours and weekend work, and nighttime construction might be necessary to meet the overall project schedule.

During construction and operation of the proposed project, most workers would come from within San Juan County, from the towns of Shiprock, Kirtland, Fruitland, and Farmington, resulting in a direct increase in average daily traffic on Highway 64. The average construction workforce is estimated at 1,100 individuals, resulting in an increase of 2,200 average daily vehicle trips on Highway 64 if each worker drove alone to and from the project site. Peak workforce levels are estimated at 1,600 individuals, resulting in an increase of 3,200 average daily vehicle trips on Highway 64 if each worker drove alone to and from the project site. Long-term post-construction employment at the facility would employ up to 200 people, or an estimated increase of 400 daily vehicle trips on Highway 64.

The increased traffic on Highway 64 would require additional responses to accidents. The increased traffic would peak during years 2, 3, and 4, which reflect construction activity. Where the power plant workers reside also would determine areas or patterns of traffic increases.

Other roads, which would experience increases in traffic from workers and other work related vehicle movement, would be Navajo Road 36 (N36), Navajo Road 3005 (N3005), Navajo Road 5 (N5), and Burnham Road. U.S. Highway 491 would experience increases in traffic if access to the project site is provided via Navajo Road 5017 (N5017) or if the alternative water well field area A is chosen for development. Portions of these roads would need to be improved to accommodate material delivery vehicles, equipment, and construction worker transport vehicles.

Due to the large number of vehicles and traffic control concerns, workers would be required to park in a designated parking area. Workers would utilize an approximately 30-acre space on the BNCC lease area adjacent to the project site. On-site parking would be planned as close as possible to the work site to allow personnel to walk to the construction site.

The increased traffic from construction, operation, and maintenance of the proposed power plant on the existing roadway networks would not impact any unique characteristics in the project area. Permanent changes to transportation networks would include improvements on N36, N3005, N5, and Burnham Road. U.S. Highway 491 has planned improvements unrelated to the proposed project. No impacts would occur to U.S. Highway 491 if neither the alternative well field area A, nor access to the project site from U.S. Highway 491 is developed; thus, eliminating project related increases in traffic.

4.11.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

Traffic and transportation impacts associated with the Preferred Transmission Line Alignment Segments A, C, and D, for both construction and operation could provide short-term impacts to existing Navajo roads. Short-term traffic delays on Highway 64 for Segment D would be encountered during construction where the proposed transmission lines would cross the highway.

Alternative Transmission Line Segment B

Additional access roads would need to be constructed for alternative transmission line Segment B, providing increased accessibility to the area. Traffic impacts associated with Segment B for both construction and operation would be similar to those described for the proposed power plant. Transmission line installation is not expected to impact traffic flow along major roadways (i.e., Highway 64) in affected areas during construction.

4.11.2.2.3 Access Road

The proposed access road alignment would cross approximately 2.2 miles of rural, undeveloped terrain on the BNCC lease area. Developing this alignment would have no additional impact on transportation, but would act to create additional access to otherwise inaccessible areas.

4.11.2.2.4 Water-supply System

The extension of a permanent access road east from U.S. Highway 491 to the proposed project would increase traffic flow along U.S. Highway 491. Installation of a water supply pipeline could impact traffic flow along U.S. Highway 491 areas during construction.

Water well field area A covers 889 acres west of U.S. Highway 491. Because of the rural nature of the area, construction west of U.S. Highway 491 in the well field area would increase traffic flow during periods of construction. Access to and within the water well field area could be increased by the addition of temporary and permanent project-related access roads that could enter and exit onto U.S. Highway 491.

The proposed water well field B includes 889 acres east of U.S. Highway 491, immediately south of the Proposed Power Plant site. Due to its close proximity to the Proposed Power Plant site, negligible impacts on traffic would be realized. The addition of project related access roads would provide beneficial increases in access to and in the water well field, as well as the power plant site.

4.11.2.2.5 Mining in the BNCC Lease Areas IV South and V

As part of the proposed power plant project, the existing road system within areas of the BNCC lease area would continue to be used until the mining and reclamation operations are completed, and Burnham Road has been realigned to accommodate existing mining operations, and further realignment is anticipated to occur as mining progresses. Minor/temporary 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, maintenance roads and mine roads would be used over a long duration. Because of the extent and nature of BNCC's mining activities, very few of the roads would be reclaimed until the end of mining and reclamation activities on the entire BNCC lease area.

Traffic impacts associated with the BNCC lease area would be similar to those described in the proposed action except that 200 people are expected to be employed for coal mining operations, resulting in the addition of 400 average daily trips on Highway 64 if each worker drives alone to and from the work site.

4.11.2.2.6 Mitigation to Reduce Impacts

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 streams (and land within 100 feet of streams) prior to construction of these crossings.

Major intersections would be bored or trenched and steel plated until the alternative well field pipeline is installed. A traffic management plan for all roads near the project area 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 2 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).

4.11.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.11.2.3.1 Power Plant

Impacts would be similar to those described for Alternative B except that the construction phase would comprise 40 months instead of 54 months. Workforce levels would peak at month 29 of construction with 1,200 employees resulting in an increase of 2,400 average daily vehicle trips on Highway 64, instead of an increase of 3,200 vehicle trips for the proposed action. .

4.11.2.3.2 Transmission Lines

Impacts would be similar to those under Alternative B; however, fewer transmission lines would be needed, resulting in fewer short-term impacts to roads and highways from construction.

4.11.2.3.3 Access Road

Impacts would be the same as those described for Alternative B because use of the re-aligned Burnham Road would be necessary.

4.11.2.3.4 Water-supply System

Impacts would be the same as those described for Alternative B because the same two well field alternative locations would be considered.

4.11.2.3.5 Mining Operations in BNCC Lease Areas IV South and V

Impacts would be similar to those described for Alternative B except that Lease Area V would not be mined; therefore, access roads within Area V (i.e., U-11 or U-12), for the sole purpose of reaching Area V, would not be necessary.

4.11.2.3.6 Mitigation to Reduce Impacts

Mitigation measures are the same as those described for Alternative B.

4.11.3 Summary of Impact Analysis

Alternative A (No Action Alternative) would result in no impacts or changes on current traffic or transportation conditions. Impacts would occur to traffic and transportation with Alternatives B and C. Alternative B would require an average of 1,100 employees during peak construction activity resulting in an increase of 2,200 average daily vehicle trips on Highway 64 and Navajo Roads leading to the proposed plant site. Alternative B has a projected construction period of 54 months and an operation period of approximately 50 years. Alternative B would utilize BNCC Lease Areas IV South and V, and would require access routes within this area. Alternative B also would result in permanent changes to transportation networks including improvements on N36, N3005, N5, and Burnham Road. Alternative C would require approximately 400 fewer employees during peak construction activity, which would result in less traffic on existing highways and roads such as Highway 64 and Navajo Roads. This translates to approximately 800 less vehicle trips per day. Alternative C also has a shorter construction phase of 14 months less than Alternative B, thus providing a shorter period of construction vehicle travel and construction workforce travel.

4.12 NOISE AND GROUND VIBRATIONS

4.12.1 Impact Assessment Methodology

This section describes the potential noise and vibration impacts associated with the proposed project alternatives. The following discussion describes the results of potential acoustical and vibration calculations from construction and operation of the project and mining operations. A discussion on the fundamentals of acoustics and vibration, along with an assessment of existing noise levels are presented in Section 3.12 of this EIS.

4.12.1.1 Construction

The construction phase of the proposed project from site preparation and grading to commercial operation is scheduled to last approximately 40-54 months, depending on the selected Alternative. During that time many activities would be taking place, including construction of foundations, installation of piping and equipment, connection of major site interfaces, erecting major structures and development of mining facilities. During these activities, a varying number of construction equipment and personnel would be in the area of the proposed project, resulting in varying levels of construction noise. The proposed project would utilize conventional construction techniques and equipment including excavators, bulldozers, heavy trucks (water truck, dump truck) and similar heavy construction equipment. Additionally, mining activities and equipment would generate quantifiable amounts of noise throughout the life of the proposed project. A limited amount of specialized construction using pile-driving equipment would also be needed.

4.12.1.1.1 Conventional Construction Noise

Conventional construction activities at the proposed project site would result in a short-term, temporary increase in the ambient noise level resulting from the operation of construction equipment. The increase in noise level would be primarily experienced close to the noise source. The magnitude of the noise effects would depend on the type of construction activity, noise level generated by various construction equipment, duration of the construction phase, and the distance between the noise source and receiver. Sound levels of typical construction equipment range from approximately 65 dBA to 95 dBA at 50 feet from the source, with an average level of 89 dBA at 50 feet during the noisiest activities (USEPA 1971). This analysis will use 89 dBA at 50 feet as the reference noise level for conventional construction noise.

Acoustical calculations were performed to estimate noise from conventional construction activities at the closest residences from various project components. Noise from the activity was assumed to have point source acoustical characteristics. Strictly speaking, a point source sound decays at a rate of 6 dB per doubling of distance from the source. This is a logarithmic relationship describing the acoustical spreading of a pure, undisturbed spherical wave in air. The rule applies to the propagation of sound waves with no ground interaction. The calculations are based on the formula below (Harris 1991):

$$SPL_2 = SPL_1 - 20\log\left(\frac{d_2}{d_1}\right), \text{ where:}$$

SPL_1 = known sound level,

SPL_2 = desired sound level,

d_1 = known distance, and

d_2 = desired distance.

Approximately one decibel per 1,000 feet is also deducted for air absorption and anomalous excess attenuation.

4.12.1.1.2 Special Construction Noise

Portions of the proposed project's construction (e.g., the foundations under the boiler) may require driven piles. Noise from pile-driving activity is different in character from the typical, conventional "construction phase" noise and its potential noise impact is, therefore, analyzed separately. Also, because the primary source of noise from pile drivers is somewhat elevated, it does not typically benefit from attenuation due to intervening buildings and structures. The noise attenuation from other factors such as air absorption with distance still applies to noise from pile driving.

Maximum noise levels at 50 feet from a pile driver can range from 89 dBA to 114 dBA L_{max}, depending on many factors (e.g., driver power, driver type, pile size, soil characteristics) with a typical maximum level range of 101 to 105 dBA produced at 50 feet. The typical L_{eq} produced during pile driving ranges from 82 to 100 dBA at 50 feet. The higher typical noise level values of 100 dBA L_{eq} and 105 dBA L_{max} at 50 feet for the pile driver noise source were selected for calculation purposes. Allowing for point-source divergence and excess attenuation, the maximum and average sound levels which might occur in noise-sensitive areas during pile driving activity were calculated for each project component.

4.12.1.1.3 Construction Vibration

Calculations were performed to estimate vibration from pile driving activities at the closest residences, as detailed in Section 3.12.1.2 Vibration from construction and pile driving was assumed to have point source propagation characteristics. Vibration levels for impact pile drivers are typically 0.644 inches/second peak particle velocity (PPV) at 25 feet and for construction equipment typically range from 0.076 to 0.089 PPV (FTA 1995).

4.12.1.2 Operation

The Cadna/A Noise Prediction Model (Version 3.5.115) was used to estimate the proposed project-generated sound level at the property lines and noise-sensitive receptors. Cadna/A is a Windows® based software program that predicts and assesses noise levels near industrial noise sources based on International Standards Organization (ISO) 9613-2 standards for noise propagation calculations. The model uses industry-accepted propagation algorithms and accepts sound power levels (in decibels re: 1 pico Watt) provided by the equipment manufacturer and other sources. The calculations account for classical sound wave divergence, plus attenuation factors resulting from air absorption, basic ground effects, and barrier/shielding. Air absorption was determined using "standard day" conditions. The proposed project and surrounding areas were assumed to be flat; therefore, no intervening topographical barrier effects were considered. Therefore, the model is considered worst-case.

Calculations were performed using octave band sound power spectra as inputs from each noise source. The model outputs are in terms of octave band and overall A-weighted sound pressure levels. The sound power levels, type of source, and acoustic height of each component are provided in Table 4-34 and Table 4-35 for Alternatives B and C, respectively. Sound level data from URS database were used, as manufacturer specifications were not available at the time of the analysis. The spectra shown in these two tables are, unless otherwise noted, for individual components and do not include the effect of additional decibels for component quantities greater than unity.

Table 4-34 Noise Model Parameters – Alternative B

Proposed Project Component	**Type of Source**	**Sound Power Level (PWL) at Octave Band Center Frequency (Hz)**									**A-Weighted**	**Acoustic Height**
		31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**		
(2) Steam Turbine Generators	Area Source	116	122	120	115	111	107	104	96	90	113	60 ft
(2) SCR Units	Area Source	123	122	117	111	110	108	106	106	106	114	60 ft
(4) Induced Draft Fans	Area Source	–	100	112	115	116	115	112	110	106	120	16 ft
(1) Exhaust Stack	Point Source at Top	–	–	100	99	101	103	105	107	108	112	917 ft
(2) Main Transformers	Area Source	87	93	95	90	90	84	79	74	67	90	16 ft
(2) Cooling Towers	Area Source	108	111	111	108	105	101	98	95	87	107	60 ft
(1) Aux. Steam Generator	Area Source	93	97	98	95	94	94	92	91	87	99	30 ft
(1) Start Up Transformer	Area Source	108	111	105	105	100	94	91	88	88	102	16 ft
(2) 4160 V transformers	Area Source	108	111	105	105	100	94	91	88	88	102	16 ft
(1) Diesel Generators	Area Source	84	101	96	99	97	98	99	99	110	113	16 ft

SOURCE: URS Database for General Coal-Fired Plants

Table 4-35 Noise Model Parameters – Alternative C

Proposed project Component	Type of Source	Sound Power Level (PWL) at Octave Band Center Frequency (Hz)									A-Weighted	Acoustic Height
		31.5	63	125	250	500	1000	2000	4000	8000		
(1) Steam Turbine Generator	Area Source	116	122	120	115	111	107	104	96	90	113	60 ft
(1) Boiler	Area Source	121	120	115	109	108	106	104	104	104	112	60 ft
(2) Induced Draft Fans	Area Source	–	99	111	114	115	114	111	109	105	119	16 ft
(1) Exhaust Stack	Point Source at Top	–	–	100	99	101	103	105	107	108	112	492 ft
(1) Main Transformer	Area Source	87	93	95	90	90	84	79	74	67	90	16 ft
(7) Cooling Towers *	Area Source	117	120	120	117	114	110	107	104	96	116	52 ft
(1) Aux. Steam Generator	Area Source	93	97	98	95	94	94	92	91	87	99	30 ft
(1) Start Up Transformer	Area Source	108	111	105	105	100	94	91	88	88	102	16 ft
(1) 4160 V transformer	Area Source	108	111	105	105	100	94	91	88	88	102	16 ft
(1) Diesel Generator	Area Source	84	101	96	99	97	98	99	99	110	113	16 ft

Source: URS Database for General Coal-Fired Plants

* All seven cooling towers arranged as a row of adjacent sources; spectra above are for aggregate sound.

The proposed project configuration for Alternative B was imported into Cadna/A from the project CAD files. The configuration for Alternative C was also modeled with Cadna/A using applicable project information available at the time of analysis. Both of these proposed project Alternatives were assumed to operate 24 hours per day, so the average noise output (including variations due to start-ups and shut-downs) would be essentially constant regardless of time of day. The model uses the octave band sound power levels (PWL) of the major subcomponents to calculate the corresponding sound pressure levels (SPL) for the equipment. The formula used to derive the SPL (in dBA) is as follows:

$$\text{SPL} = \text{PWL} - 10 \log (2 * r^2) \text{ dBA, where } r \text{ is in meters}$$

Because the final sound data for the proposed project components were not available at the time of analysis, URS presents a property line and far-field design goal based on the USEPA 55 dBA L_{dn} (61 dBA L_{eq}) limit at the closest receptor at a distance of 1.5 miles. Based on the distance of the residence, the power plant must be designed to not exceed 63 dBA L_{eq} at the property lines or 85 dBA L_{eq} at 500 feet. To be conservative, possible sound attenuation from atmospheric effects has not been included in the determination of these two limits. If the proposed project noise levels exceed these design goals, there would likely be a significant impact at the closest receptor.

4.12.1.2.1 Thresholds of Significance

Thresholds used to evaluate potential noise and/or vibration impacts are based on applicable criteria. Noise or vibration from the proposed project would be considered significant if:

- There are no Federal, State, or local guidelines for construction noise. However, the Federal Transit Administration (FTA) has published a guideline that specifically addresses issues of community noise. This guideline recommends that hourly sound levels of 90 dBA at residential uses from construction noise, including pile driving, would be considered a significant impact (USDOT FTA 1995).
- Vibration from construction or long term blasting activities at the mine would exceed 0.2 inches/second peak particle velocity (PPV) at residential structures based on FTA guidelines.
- There are no Federal, State, or local guidelines that regulate property line limits of power plants. However, the USEPA guideline recommends that noise levels of 55 dBA L_{dn} at residential land use would be considered a significant impact.

4.12.2 Environmental Consequences

4.12.2.1 No Action (Alternative A)

Under the No-Action scenario, in which no power plant is constructed and mining operations at the BNCC lease area may continue at current levels of activity and yield, sound levels should remain similar to those described in Section 3.12 of Chapter 3, all well below thresholds of significance as described above.

4.12.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

4.12.2.2.1 Power Plant

Construction

Conventional Construction Noise – Acoustical calculations were performed to estimate noise from conventional construction activities at the closest residences. The closest offsite residential uses to the proposed project consist of single-family residences approximately 1.5 miles east, a residence approximately 2 miles northeast, a residence approximately 2.5 miles east, and a residence approximately 3 miles southeast. Based on the direct line-of-sight distance from the proposed project components to be constructed, sound levels at the residence 1.5 miles east would average 45 dBA, 43 dBA at the residence 2 miles northeast, 41 dBA at the residence 2.5 miles east, and 39 dBA at the residence 3 miles southeast, as summarized in Table 4-36. Because of the intermittent nature of construction work, as well as intervening topography, the average sound level for an 8-hour work day would be expected to be substantially less than the calculation predicts. Because conventional construction noise at the receptors would be well below the 90 dBA hourly levels recommended by the FTA, there would not be a significant impact.

Special Construction Noise – Allowing for point-source divergence and excess attenuation, the maximum and average sound levels which might occur in noise-sensitive areas during pile driving activity were calculated. The resulting L_{eq} and L_{max} sound levels expected at the sensitive receptors are presented in Table 4-36. Based on the direct line-of-sight distance from the proposed project components to be constructed, sound levels at the residence 1.5 miles east would average 56 dBA L_{eq} (61 dBA L_{max}), 54 dBA L_{eq} (59 dBA L_{max}) at the residence 2 miles northeast, 52 dBA L_{eq} (57 dBA L_{max}) at the residence 2.5 miles east, and 50 dBA L_{eq} (55 dBA L_{max}) at the residence 3 miles southeast, as summarized in Table 4-36. Therefore, because special construction noise at the receptors would be well below the 90 dBA hourly levels recommended by the FTA, there would not be a significant impact.

Table 4-36 Calculated Sound and Vibration Levels from Construction Activities, Alternative B

Receptor	Distance	Conventional Construction (dBA)	Special Construction (dBA L_{eq}, dBA L_{max})	Vibration (PPV in./sec)
Residence to east	1.5 miles	45	56, 61	0.0001
Residence to northeast	2 miles	43	54, 59	<0.0001
Residence to east (Residence A)	2.5 miles	41	52, 57	<0.0001
Residence to southeast (Residence B)	3 miles	39	50, 55	<0.0001

Construction Vibration – Calculations were performed to estimate vibration from conventional and special construction activities at the closest residences. Under normal propagation conditions, vibration levels at the closest residence 1.5 miles from the activities would be 0.0001 in./sec, which is well below the FTA threshold of 0.20 in./sec; resulting in a less than significant impact.

OSHA – Based upon construction noise data, noise levels on the construction site could exceed Federal Occupational Safety and Health Administration (OSHA) guidelines for worker noise exposure. Compliance with OSHA regulations would ensure that construction personnel are adequately protected from potential noise hazards. The noise exposure level to protect hearing of workers is regulated at 90 dBA over an 8-hour work shift. The proposed project’s construction contractors would comply with all OSHA regulations.

Off-site Laydown and Parking Areas – Designated areas would be used as off-load and staging areas. The use of the proposed project site for equipment laydown and parking would not impact the surrounding area with respect to noise.

Construction Traffic – Access to the proposed project site for construction activities would be from Albuquerque to Highway 550 to Bloomfield, then Highway 64 to Hwy 371 to the entrance of the mine off Navajo Road 3005. The construction workforce would typically arrive and depart by private vehicles. Residences within 500 feet could experience increased sound levels from truck pass-bys, but no significant impacts are expected to occur.

Commissioning and Start-up – During final construction, a method used to clean piping and testing called “steam blows” creates substantial noise. A steam blow results when high-pressure steam is allowed to escape into the atmosphere through the steam piping to clean it. A series of short steam blows, lasting two or three minutes each, would be performed several times daily over a period of 2 to 3 weeks. Steam blows are necessary after erection and assembly of the feedwater and steam systems because the piping and tubing that comprises the steam path accumulate dirt, rust, scale, and construction debris. They prevent debris from entering the steam turbine.

Steam blows can produce noise as loud as 130 dBA at a distance of 100 feet. The resultant sound level at the residential receptors would be 92 dBA at the residences to the east. To minimize these short-term, temporary noise impacts, the piping would be equipped with a silencer that would reduce noise levels by 20 dBA to 30 dBA.

Operation

Plant Noise – Calculations were performed using linear octave band sound power levels as inputs from each noise source in the Cadna/A noise model (Table 4-37). The calculated sound levels at the receptors are less than 30 dBA L_{eq} (<30 dBA L_{dn}). Therefore, sound levels would be below the USEPA 55 dBA L_{dn} residential land use requirement and would result in no significant impact.

Table 4-37 Calculated Sound Levels from Power Plant Operation, Alternative B

Receptor	Calculated Hourly L_{eq} (dBA)	Calculated L_{dn} (dBA)
North property line	58	64
South property line	42	48
East property line	56	62
West property line	52	58
Residence 1.5 miles east	<30	<30
Residence 2 miles northeast	<30	<30
Residence 2.5 miles east (Residence A)	<30	<30
Residence 3 miles southeast (Residence B)	<30	<30

Plant Vibration – Ground and airborne induced vibration from operation of the proposed project and mining activities would not affect the local area. The proposed project is primarily driven by turbines exhausted into a selective catalytic reduction (SCR) duct. These very large ducts greatly reduce low frequency noise, which is mainly the source of airborne induced vibration of structures. The equipment that would be used in the proposed project is well balanced and is designed to produce very low vibration levels throughout the life of the proposed project. An imbalance could contribute to ground vibration levels in the vicinity of the equipment. However, vibration-monitoring systems installed in the equipment are designed to ensure that the equipment remains balanced. Should an imbalance occur, the event would be detected and the machines would automatically shut down.

4.12.2.2.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

Construction Noise – Acoustical calculations were performed to estimate noise from conventional construction activities at the closest residences. The closest receptors from the transmission lines are three residences from approximately 1,000 feet to 2,600 feet from Segment D and a school and a residence approximately 3 miles west of Segment C (measured perpendicularly from the transmission lines). No receptors were found near Segment D. Segment D, on the other hand, appears to traverse a considerable quantity of noise-sensitive receptors clustered near the north and south banks of the San Juan River. For any of these receptors, with a location at a given perpendicular distance from the proposed transmission line Segment, conventional construction noise can be estimated with the following table.

Perp. Dist. to Segment (feet)	**Est. Hourly (dBA)**
16,000	39
8,000	45
4,000	51
2,000	57
1,000	63
500	69
250	75
125	81
63	87

For example, the aforementioned closest receptor in proximity to Segment A would experience 63 dBA, while the school and residence nearly 3 miles from Segment C would only experience 39 dBA. These estimates are based on a model that assumes the construction of a single tower occurs at the other endpoint of the perpendicular distance, and that if concurrent construction of the two adjacent towers on the same transmission Segment line takes place, each is distant from the receptor by at least twice this perpendicular distance to the closest tower. If they are closer and concurrently under construction, the estimated levels in the preceding table could rise by up to an additional 5 dBA. Because of the intermittent nature of construction work, the average sound level received at the receptors would be expected to be substantially less than what these calculated estimates predict; and hence, as resulting conventional construction noise at the receptors would be well below the 90 dBA hourly levels recommended by the FTA, there would not be a significant impact.

Construction Vibration – Calculations were performed to estimate vibration from conventional activities at the closest residences. Under normal propagation conditions, vibration levels at the closest residence 1.5 miles from the activities would be 0.0001 in./sec, which is well below the FTA threshold of 0.20 in./sec; resulting in a less than significant impact.

Operation – No noise or vibration impacts are expected from operation of the transmission lines.

Alternative Transmission Line Segment B

Construction – Although some receptors appear to be located within one mile of this Segment, the preceding discussion for Segments A, C, and D that relates perpendicular distance to estimated conventional construction noise level suggests no impacts per FTA recommended guidelines would occur. For example, a receptor would have to be closer than an unlikely 100 feet to the construction of the nearest of three nearby towers in order to exceed the 90 dBA limit. Similarly, even for receptors just 100 feet away from conventional construction activity and under normal propagation conditions, estimated vibration levels would be less than the 0.2 in./sec FTA threshold.

Operation – No noise or vibration impacts are expected from operation of the transmission lines.

4.12.2.2.3 Access Road

Construction – Based on the distance from the proposed project components to be constructed, sound levels at the closest sensitive receptor from construction activities would average 83 dBA. Because of the intermittent nature of construction work, the average sound level received at the receptors would be expected to be substantially less than the calculation predicts. Because conventional construction noise at the receptors would be below the 90 dBA hourly levels recommended by the FTA, there would not be a significant impact. However, mitigation measures are identified below to reduce the impacts that would occur.

Construction Vibration – Calculations were performed to estimate vibration from conventional construction activities at the closest residences. Under normal propagation conditions, vibration levels at the closest residence 100 from the activities would be 0.011 in./sec, which is below the FTA threshold of 0.20 in./sec; resulting in a less than significant impact.

Operation – Residences within 500 feet could experience increased sound levels from increased operational traffic, but no significant impacts are expected to occur.

4.12.2.2.4 Water-supply System

Construction – No sensitive receptors were found within 2 miles of water well field area A; therefore, no noise impacts from construction would occur.

Operation – No sensitive receptors were found within 2 miles of well field A; therefore, no noise impacts from operation would occur. No noise or vibration impacts are expected from the operation of the utility corridors or water pipeline.

4.12.2.2.5 BNCC Lease Areas IV and V

Except for the loading and hauling operations, there generally would be only one activity in progress at a specific location at any given time. Generally the locations of different activities would be separated sufficiently so that noise levels at one work location would not be influenced by the levels at other work locations.

In the work areas of the existing mine, noise levels were found range from 68 to 82 dBA measured at distances of 50 to 150 feet from the source. Noise levels in the vicinity of machinery used in exposing and removing coal from the coal seams vary with the operations and the machine involved. Sound pressure levels range from 62 dBA measured 170 feet from Marion 7900 Dragline to 72 dBA measured 100 feet from the loading operation. Maximum noise levels measured 75 feet from the centerline of a haul road were 82 dBA for loaded trucks going uphill and 80 dBA for empty trucks going downhill. The trucks used for hauling coal from the mine to the stockpiles nominally have 120 ton capacity. A typical passage of a coal haul truck would affect the noise level of the environment for approximately one minute. The distance at which truck noise would not be noticeable would vary from 1/3 mile to 1 mile, depending on wind conditions. Blasting would be done during the day and the noise generated would be of a short duration and be of impulse noise classification.

The noise levels at the mine would result in minimal impacts since applicable standards would be met, and employees in noisy areas would be provided with hearing protection.

4.12.2.2.6 Mitigation Measures to Reduce Impacts

The following measured are recommended to reduce noise and annoyance at receptors during construction of the access road:

- All construction equipment should be operated and maintained to minimize noise generation. Equipment and vehicles should be kept in good repair and fitted with “manufacturer-recommended” mufflers.

- Portable noise screens or enclosures to provide shielding for high noise activities or equipment should be used as necessary. The effectiveness of a barrier depends upon factors such as the relative height of the barrier relative to the line-of-sight from the source to the receiver, the distance from the barrier to the source and to the receiver and the reflections of sound. To be effective, a barrier must block the line-of-sight from the source to the receiver. A properly designed noise barrier can reduce noise as much as 20 dBA.
- Combine noisy operations to occur in the same period. The total noise produced would not be significantly greater than the level produced if the operations were performed separately.

4.12.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.12.2.3.1 Power Plant

Construction

Noise – Although the construction phase is only expected to last 40 months for Alternative C, required construction activities and their intensities (e.g., personnel and equipment, schedule) are expected to resemble those for Alternative B. The construction of only one power generation system reasonably accounts for the reduced construction phase duration. Hence, sound levels from conventional and special construction noise for Alternative C should also resemble estimates for Alternative B.

Because conventional and special construction noise at the receptors would be well below the 90 dBA hourly levels recommended by the FTA, there would not be significant impacts.

Vibration – Similarly, calculations performed for Alternative B to estimate vibration from conventional and special construction activities at the closest residences could also reasonably apply for Alternative C. Under normal propagation conditions, vibration levels at the closest residence 1.5 miles from the activities would be 0.0001 in./sec, which is well below the FTA threshold of 0.20 in./sec; resulting in a less than significant impact.

OSHA – Based upon construction noise data, noise levels on the construction site could exceed Federal OSHA guidelines for worker noise exposure. Compliance with OSHA regulations would ensure that construction personnel are adequately protected from potential noise hazards. The noise exposure level to protect hearing of workers is regulated at 90 dBA over an 8-hour work shift. The proposed project's construction contractors would comply with all OSHA regulations.

Off-site Laydown and Parking Areas – Designated areas would be used as off-load and staging areas. The use of the proposed project site for equipment laydown and parking would not impact the surrounding area with respect to noise.

Construction Traffic – Access to the proposed project site for construction activities would be via from Albuquerque to Highway 550 to Bloomfield, then Highway 64 to Hwy 371 to the entrance of the mine off Navajo Road 3005. The construction workforce would typically arrive and depart by private vehicles. Residences within 500 feet could experience increased sound levels from truck pass-bys, but no significant impacts are expected to occur.

Commissioning and Start-up – During final construction, a method used to clean piping and testing called "steam blows" creates substantial noise. A steam blow results when high-pressure steam is allowed to escape into the atmosphere through the steam piping to clean it. A series of short steam blows, lasting two or three minutes each, would be performed several times daily over a period of 2 to 3 weeks. Steam blows are necessary after erection and assembly of the feedwater and steam systems because the piping and tubing that comprises the steam path accumulate dirt, rust, scale, and construction debris. They prevent debris from entering the steam turbine.

Steam blows can produce noise as loud as 130 dBA at a distance of 100 feet. The resultant sound level at the residential receptors would be 92 dBA at the residences to the east. To minimize these short-term, temporary noise impacts, the piping would be equipped with a silencer that would reduce noise levels by 20 dBA to 30 dBA.

Operation

Plant Noise – Calculations were performed using linear octave band sound power levels as inputs from each noise source in the Cadna/A noise model (Table 4-38). The calculated sound levels at the receptors are less than 30 dBA L_{eq} (<30 dBA L_{dn}). Therefore, sound levels would be below the USEPA 55 dBA L_{dn} residential land use requirement and would result in no significant impact.

Table 4-38 Calculated Sound Levels from Power Plant Operation, Alternative C

Receptor	Calculated Hourly L_{eq} (dBA)	Calculated L_{dn} (dBA)
North property line	55	62
South property line	39	46
East property line	60	67
West property line	50	57
Residence 1.5 miles east	<30	<30
Residence 2 miles northeast	<30	<30
Residence 2.5 miles east (Residence A)	<30	<30
Residence 3 miles southeast (Residence B)	<30	<30

Plant Vibration – Ground and airborne induced vibration from operation of the proposed project and mining activities would not affect the local area. As described for Alternative B, the equipment that would be used in the proposed project is well balanced and is designed to produce very low vibration levels throughout the life of the proposed project. An imbalance could contribute to ground vibration levels in the vicinity of the equipment. However, vibration-monitoring systems installed in the equipment are designed to ensure that the equipment remains balanced. Should an imbalance occur, the event would be detected and the machines would automatically shut down.

4.12.2.3.2 Transmission Lines

Proposed Transmission Line Alignment (Segments A, C, D)

Construction Noise – Calculations were performed for Alternative B to estimate noise from conventional construction activities at the closest residences. Since Alternative C also requires construction of proposed transmission line Segments A, C, and D, it was concluded that construction noise levels would be similar to those for Alternative B. Because conventional construction noise at the receptors would be well below the 90 dBA hourly levels recommended by the FTA, there would not be a significant impact.

Construction Vibration – Calculations were performed for Alternative B to estimate vibration from conventional activities at the closest residences. Since Alternative C also requires construction of proposed transmission line Segments A, C, and D in order to reach the NTP line, one could reasonably conclude construction vibration levels would be similar to those for Alternative B. Under normal propagation conditions, vibration levels at the closest residence 1.5 miles from the activities would be 0.0001 in./sec, which is well below the FTA threshold of 0.20 in./sec; resulting in a less than significant impact.

Operation – No noise or vibration impacts are expected from operation of the transmission lines.

Alternative Transmission Line Segment B

Construction – No sensitive receptors were found within 2 miles of Segment B; therefore, no noise or vibration impacts from construction would occur.

Operation – No noise or vibration impacts are expected from operation of the transmission lines.

4.12.2.3.3 Access Road

Construction – The analysis of impacts would be the same as Alternative B.

Construction Vibration – Calculations were performed to estimate vibration from conventional construction activities at the closest residences. Under normal propagation conditions, vibration levels at the closest residence 100 from the activities would be 0.011 in./sec, which is below the FTA threshold of 0.20 in./sec; resulting in a less than significant impact.

Operation – Residences within 500 feet could experience increased sound levels from increased operational traffic, but no significant impacts are expected to occur.

4.12.2.3.4 Water-supply System

Construction – No sensitive receptors were found within 2 miles of water well field area A; therefore, no noise impacts from construction would occur.

Operation – No sensitive receptors were found within 2 miles of well field A; therefore, no noise impacts from operation would occur. No noise or vibration impacts are expected from the operation of the utility corridors or water pipeline.

4.12.2.3.5 BNCC Lease Areas IV and V

Following is an excerpt from the Navajo Mine EIS 1976. Current noise levels remain consistent with this assessment.

> Except for the loading and hauling operations, there generally would be only one activity in progress at a specific location at any given time. Generally the locations of different activities would be separated sufficiently so that noise levels at one work location would not be influenced by the levels at other work locations.
>
> In the work areas of the existing mine, noise levels were found to be ranged from 68-82 dBA measured at distances of 50 to 150 feet from the source. Noise levels in the vicinity of machinery

used in exposing and removing coal from the coal seams vary with the operations and the machine involved. Sound pressure levels range from 62 dBA measured 170 feet from Marion 7900 Dragline to 72 dBA measured 100 feet from the loading operation. Maximum noise levels measured 75 feet from the centerline of a haul road were 82 dBA for loaded trucks going uphill and 80 dBA for empty trucks going downhill. The trucks used for hauling coal from the mine to the stockpiles nominally have 120 ton capacity. A typical passage of a coal haul truck would affect the noise level of the environment for approximately one minute. The distance at which truck noise would not be noticeable would vary from 1/3 mile to 1 mile, depending on wind conditions. Blasting would be done during the day and the noise generated would be of a short duration and be of impulse noise classification.

The noise levels at the mine would result in minimal impacts since applicable standards would be met and employees in noisy areas would be provided with hearing protection.

4.12.2.3.6 Mitigation Measures to Reduce Impacts

The mitigation measures identified for construction of the access road would be the same as Alternative B.

4.12.3 Summary of Impact Analysis

4.12.3.1 Construction Noise

There are no Federal, state, or local guidelines for construction noise. However, the FTA has published a guideline that specifically addresses issues of community noise. This guideline recommends that hourly sound levels of 90 dBA at residential uses from construction noise, including pile driving, would be considered a significant impact (FTA 1995).

Construction activities associated with all the proposed project components for Alternatives B and C did not exceed the 90 dBA hourly sound level limit recommended by the FTA; therefore, there would not be significant impact as a result of construction noise.

4.12.3.2 Operational Noise

There are no Federal, state, or local guidelines that regulate property line limits of power plants. However, the USEPA guideline recommends that noise levels of 55 dBA L_{dn} at residential land use would be considered a significant impact.

The slight dissimilarities in predicted sound levels at the property line limits between the two build Alternatives B and C, shown in Table 4-39, appear to generally reflect the difference in power generation output.

Table 4-39 Difference in Calculated Sound Levels from Power Plant Operation (Alternatives B-C)

Receptor	Calculated Hourly L_{eq} (dBA)	Calculated L_{dn} (dBA)
North property line	58 – 55 = **3**	64 – 62 = **2**
South property line	45 – 39 = **3**	48 – 46 = **2**
East property line	56 – 60 = **-4**	62 – 67 = **-5**
West property line	52 – 50 = **2**	58 – 57 = **1**

The negative difference values for the East property line comparison largely correspond to the dissimilar power plant cooling techniques and the locations of the cooling towers. While the natural-draft type towers for Alternative B are located towards the West property line, the mechanical-draft type cooling towers utilized in the Alternative B system arrangement are located nearer to the East property line of the same site.

Using URS databases for sound level data, the proposed project operational noise for Alternatives B and C did not exceed the USEPA 55 dBA Ldn limit at sensitive receptors; therefore, there would not be a significant impact. Actual equipment must meet the design goals discussed previously to avoid impacts at receptors.

4.12.4 Construction and Operation Vibration

Vibration from construction that would exceed 0.2 inches/second peak particle velocity (PPV) at residential structures would be considered a significant impact. No vibration impacts at sensitive receptors were identified for either Alternative B or C.

4.13 PUBLIC HEALTH

This section addresses the health impacts to humans of the proposed plant emissions combined with the impacts of the existing conditions for both criteria pollutants and air toxics.

4.13.1 Impact Assessment Methodology

The assessment methodology used here is divided between the criteria pollutants and air toxics (see Section 3.13), as health effects from these two materials are assessed using different methodologies. The regulatory environment with respect to human health and compliance within the regulatory framework is discussed in the sections below pertaining to the criteria pollutants and the air toxics. The significance criteria for identifying a public health concern associated with the criteria pollutants and the air toxics are as follows:

- Exceedance of the criteria pollutants over NAAQS levels
- Exceedance of target health goals resulting from exposure to air toxics in affected media, as determined by the human health risk assessment

The six criteria pollutants are evaluated by comparing their concentrations with their respective NAAQS levels. If plant emissions are combined with existing air concentrations and the cumulative concentrations are below the NAAQS, then health effects are anticipated to be insignificant, except for certain sensitive subpopulations under certain circumstances. The establishment of NAAQS by USEPA is a rigorous, science-based process that sets standards that protect public health without regard to cost concerns. As noted in Section 4.1 and discussed further in Section 4.13.2.1, no NAAQS would be exceeded either due to plant emissions alone, or by adding to the concentrations of the criteria pollutants already present in the environment. However, in the scoping meetings for the EIS, public concern regarding possible health effects from the emissions was identified as a major issue, and emissions of particulates were particularly noted. Therefore, Section 4.13.2 discusses health effects for the criteria pollutants, emphasizing particulates, focusing on potential health effects to those residing within 50 km of the plant. Section 4.13.3 summarizes the findings of a risk assessment for the air toxics chemicals that was conducted using standard USEPA risk assessment methodology, emphasizing mercury as a chemical of concern identified during the scoping meetings. Details of the risk assessment are included as Appendix J.

4.13.2 Environmental Consequences

4.13.2.1 No Action Alternative (Alternative A)

As discussed in Chapter 3, existing sources in the area, including power plants, are contributing to current concentrations of criteria pollutants and air toxics in ambient air (refer to Table 3-1), regardless of the operation of the proposed plant. The No Action Alternative would not affect the existing sources of criteria pollutants and air toxics in the region. The ambient concentrations of criteria pollutants in the vicinity of the proposed project currently meet Federal and state air quality levels, and under current conditions, are anticipated to have minimal to no adverse health impacts. Chapter 3.1 discusses the current ambient concentrations of criteria pollutants and air toxics in the region.

4.13.2.2 Proposed Action Alternative – 1,500 Megawatt Power Plant and Associated Facilities (Alternative B)

The discussion of potential impacts on human health focuses on the effect of criteria pollutant emissions and air toxic emissions from the proposed project.

4.13.2.2.1 Environmental Consequences of Criteria Pollutant Emissions from Power Plant Site

Under the Clean Air Act, USEPA establishes air quality standards to protect public health, including the health of sensitive subpopulations (i.e., asthmatics, children, and elderly). As discussed in Section 3.16, USEPA has set NAAQS for the six criteria pollutants: particulate matter (including PM_{10} and $PM_{2.5}$), SO_2, NO_2, O_3, Pb, and CO. Table 3-3 summarizes the NAAQS for each of the six criteria pollutants. Existing concentrations of the criteria pollutants in the project area are at or below the acceptable levels presented in Section 3.1. Although existing concentrations are at or below acceptable concentration, the purpose of this analysis is to evaluate and describe the incremental effect of emissions from the proposed power plant. Subsequent sections will discuss the environmental consequences of criteria pollutant emissions from the proposed power plant and their contribution to the existing air quality in the study area, as well as the potential health impacts associated with the incremental increase in criteria pollutant concentrations.

Impacts of Predicted Concentrations on Existing Concentrations

This section evaluates the predicted cumulative concentrations of the criteria pollutants in light of the existing concentrations of the criteria pollutants and the model-predicted air concentrations. Modeling analysis was conducted under three submittals: the May 2004, Steag, LLC (now Desert Rock Energy Company LLC) PSD permit application to USEPA Region 9 (Steag 2004), the January 2006, Desert Rock Energy Company LLC PSD application – Class I modeling update (Sithe 2006a), and the June 2006, Desert Rock Energy Company LLC PSD application – Class II Area modeling update (Sithe 2006b). The June 2004 modeling submittal presents the results for short-range receptors (within 55 km) both within the Navajo Nation and in New Mexico beyond the Navajo Nation, as well as the long-range (greater than 50 km) modeling results for Class II Areas in the vicinity of the proposed plant (all sensitive Class II Areas would be located greater than 50 km from the proposed plant). The January 2006 modeling submittal presents the long-range (greater than 50 km) modeling results for the Class I Areas in the vicinity of the proposed plant (all Class I Areas are located greater than 50 km from the proposed plant). The June 2006 modeling submittal presents the updated modeling results for short-range receptors (within 55 km) within the Navajo Nation and in New Mexico beyond the Navajo Nation, assuming both 40 percent load and 100 percent load. For this evaluation, the results of the June 2006 modeling conducted for the short-range receptors in New Mexico on and off the Navajo Nation were conservatively used, because this modeling effort resulted in the maximum predicted air concentrations of the criteria pollutants. Table 4-40 summarizes the existing concentrations of the criteria pollutants and the maximum predicted air concentrations for short-range receptors within the Navajo Nation and in New Mexico beyond the Navajo Nation, assuming 100 percent load.

Note, the maximum predicted PM10 concentrations in New Mexico on the Navajo Nation are based on modeled emissions from the proposed plant and mining operations; while the maximum predicted concentrations in New Mexico beyond the Navajo Nation are based on modeled emissions from the proposed plant only. This is because the emissions from mining are primarily fugitive dust generated from the coal mining and handling processes, and consist primarily of larger particles that settle out within a few kilometers.

Table 4-40 Summary of Existing Air Concentrations and Predicted Air Concentrations

		Existing Ambient Air Background Measurements (as presented on Table 3-3)		**Maximum Predicted Concentration On the Navajo Nation**		**Maximum Predicted Concentration in New Mexico Beyond the Navajo Nation**	
Criteria Pollutant	**Time Frame**	**Existing Air Concentration year 2005 (µg/m^3)**	**Monitor Site**	**Predicted Air Concentration (µg/m^3)**	**Distance from Proposed Site (km)**	**Predicted Air Concentration (µg/m^3)**	**Distance from Proposed Site (km)**
SO_2	Annual	5.2	USBR Shiprock Substation	0.41	1.0	0.12	24.4
	24-hour	–		23.59	0.2	1.09	29.3
	3-hour	194		271.18	0.2	7.47	29.3
NO_x	Annual	13.2	USBR Shiprock Substation	0.56	0.9	0.12	24.4
CO	8-hour	573	040 Trading Post Road Sandoval, NM	465.16 (2)	0.2	8.2 (2)	29.3
	1-hour	1374		1375.7	0.2	14.71	29.3
$PM_{2.5}$	Annual	5.1	EIA Office 724 W. Animas Farmington, NM	1.37 (1)	0.4	0.03 (1)	24.4
	24-hour	11		21.6 (1)	0.2	0.29 (1)	29.3
PM_{10}	Annual	15	EIA Office 724 W. Animas Farmington, NM	1.75 (3)	0.4	0.04 (4)	24.4
	24-hour	26		27.73 (3)	0.2	0.37 (4)	29.3

(1) Only PM_{10} emissions from the proposed plant and mining operations were modeled. Based on Table 2-4 from Desert Rock Updated Class I Modeling Report (Sithe 2006a), $PM_{2.5}$ comprises approximately 78 percent of the total PM_{10} emissions modeled for the power plant. Therefore, the $PM_{2.5}$ concentrations reported on this table were calculated from the maximum modeled PM_{10} concentrations.

(2) CALPUFF does not provide 8-hour average results, so a conservatively high 3-hour average is provided for CO.

(3) The maximum predicted concentrations on the Navajo Nation are based on modeled emissions from the proposed plant and mining operations.

(4) The maximum predicted concentrations in New Mexico beyond the Navajo Nation are based on modeled emissions from the proposed plant only.

Note, this section evaluates the existing concentrations and the predicted concentrations of all the criteria pollutants, with the exception of ozone and lead. Ozone is not directly emitted from the power plant. Therefore, model predicted air concentrations for ozone are not available. As discussed in Section 3.16 above, ground level ozone is formed when VOCs react in sunlight with NO_x. The effects of the proposed plant emissions on the formation of ground level ozone and its associated health impacts are discussed further below.

Maximum predicted lead concentrations that would be emitted from the proposed plant are 0.00015 μg/m^3 and 0.0043 μg/m^3 for annual average concentration and maximum 24-hour concentration, respectively. These predicted lead concentrations are less than 1 percent of the NAAQS criteria for lead of 1.5 μg/m^3. Local current air concentrations are not available for lead, but New Mexico is considered an "attainment" area, e.g., airborne lead concentrations are below the NAAQS at every location for which lead is monitored, both in New Mexico and in the surrounding states (USEPA, 2001). Therefore, current levels of lead are also very unlikely to be present at levels that are a health concern. Even if existing ambient concentrations of lead in the vicinity of the proposed plant are near the NAAQS criteria for lead, the incremental increase in lead concentrations in air from the plant emissions would be insignificant relative to the Federal standards. Therefore, lead emissions from the proposed plant would not be a human health concern associated with the proposed project.

Table 4-41 shows that the maximum predicted cumulative air concentrations for the criteria pollutants, calculated by summing the existing air concentrations with the model predicted maximum concentrations, are all below the current NAAQS criteria (also presented on Table 4-41). As shown on Table 4-41, power plant and mining operations would not be expected to contribute an adverse impact on existing air quality conditions, particularly at distances greater than 1 km from the plant fence line. Cumulative concentrations (which include existing pollutant levels plus the emissions from the proposed project) would still comprise a fraction of the NAAQS.

Table 4-41 Comparison of Maximum Cumulative Predicted Concentrations with the Current Primary Standards

Criteria Pollutant	Time Frame	Current Primary Standard (μg/m^3)	Maximum Predicted Cumulative Concentration On the Navajo Nation [(1)] (μg/m^3)	Percent of Current Primary Standard	Maximum Predicted Cumulative Concentration in New Mexico Beyond the Navajo Nation [(1)] (μg/m^3)	Percent of Current Primary Standard
SO_2	Annual	78.7	5.61	7%	5.32	7%
	24-hour	367	–	–	–	–
	3-hour	–	465.18	–	201.47	–
NO_x	Annual	100	13.76	14%	13.32	13%
CO	8-hour	10000	1038.16	10%	581.2	6%
	1-hour	40000	2749.7	7%	1388.71	3%
$PM_{2.5}$	Annual	15	6.47	43%	5.13	34%
	24-hour	35	32.6	93%	11.29	32%
PM_{10}	Annual	–	16.75	–	15.04	–
	24-hour	150	53.73	36%	26.37	18%

(1) Maximum Cumulative Concentrations on and beyond the Navajo Nation were estimated by summing the existing ambient air concentrations with the maximum predicted concentrations on and beyond the Navajo Nation presented on Table 4-47.

Overall trends in concentrations of the criteria pollutants unrelated to the proposed Desert Rock power plant are not expected to result in net increases in pollutants. In general, electric power companies have lowered their SO_2 and NO_x emissions across the U.S. (major contributors to particulate matter formation) over the last years (EPRI 2005b). By 2002, power plants had reduced SO_2 emissions by more than 40 percent and NO_x emissions by more than one-third relative to 1980 levels (EPRI 2005b). Additional reductions are occurring as existing and planned regulatory programs are implemented (EPRI 2005b).

The predicted cumulative air concentrations include the maximum concentrations emitted from the proposed plant and thus the cumulative concentrations are likely an over-estimate of average concentrations in the vicinity of the site during plant operations. In addition, the maximum concentrations on Navajo Nation would occur within 1 km of the proposed plant fence line. There is little likelihood for public exposure to these maximum concentrations of the criteria pollutants, because the nearest residential receptor is located at a greater than 1 km distance from the proposed plant fence line. Even if someone were located at the fence line, cumulative air concentrations are below the NAAQS levels.

The same conclusions are reached when this analysis is conducted using the short-range model predicted concentrations in New Mexico beyond the Navajo Nation. As expected, and as shown on Table 4-40, the maximum model predicted concentrations off Navajo Nation land are much less than those predicted on Navajo Nation land, because of the greater distance from the proposed site. These maximum predicted concentrations would be approximately 25 km from the site. The maximum predicted cumulative air concentrations for the criteria pollutants beyond the Navajo Nation, as shown on Table 4-41, are not much different than the cumulative air concentrations calculated for receptors on the Navajo Nation. This indicates that the cumulative air concentrations of the criteria pollutants are being driven by the existing air concentrations in the vicinity of the site, not by the predicted emissions from the proposed power plant, because the emissions from the power plant are small relative to the total cumulative concentration. The maximum predicted cumulative air concentrations beyond the Navajo Nation are also less than the NAAQS criteria.

The model predicted air concentrations of the criteria pollutants decrease with greater distance from the proposed site. This analysis indicates that the predicted plant emissions are not expected to increase air concentrations of any of the criteria pollutants to concentrations exceeding the NAAQS criteria, at any location outside the plant fence line.

Incremental Health Risk Associated with Predicted Emissions

The previous section indicated that plant emissions would not be expected to result in increased concentrations of the criteria pollutants greater than the NAAQS criteria. The NAAQS criteria were derived to be protective of the majority of the population. In general, exposure to the criteria pollutants at concentrations below the NAAQS criteria would not be expected to result in adverse health affects, nor would concentrations below NAAQS be expected to contribute to increased incidence of illness in communities, even for sensitive subpopulations. This section further evaluates the health effects from exposure to criteria pollutants and the incremental health risk that would be associated with predicted plant emissions.

The following subsections discuss the potential health effects associated with exposure to the criteria pollutants. The largest emitters from the power plant (PM, NO_x, and SO_2) are all associated with similar health effects: respiratory and cardiovascular illnesses. While health effects associated with direct exposure to gaseous SO_2 and NO_x are also described, most of the health concern with power plant emissions of SO_2 and NO_x is due to their formation into small particulate matter once they are emitted to the atmosphere. Therefore, the particulate health effects discussion includes the likeliest health effects due to emission of SO_2 and NO_x.

Nitrogen Dioxide (NO_2) – Short-term exposures to low levels of NO_2 may lead to changes in airway responsiveness and lung function in individual with preexisting respiratory illnesses (USEPA 2005a). These exposures may also increase respiratory illnesses in children (USEPA 2005a). Long-term exposures to NO_2 may lead to increased susceptibility to respiratory infection and may cause irreversible alterations in lung structure (USEPA 2005a). With regard to NO_2, asthmatics are considered to be one of the groups in the population most responsive to NO_2 exposure (USEPA 1995b). There is evidence that asthmatics exposed to low levels of NO_2 ranging from 377 µg/m^3 to 566 µg/m^3 (0.2 ppm to 0.3 ppm) would experience an increase in airway responsiveness (USEPA 1995b). As shown on Table 4-41, the maximum predicted cumulative concentration on Navajo Nation land (i.e., the maximum predicted concentration from the plant plus the existing ambient air concentration) of NO_2 is 13.76 µg/m^3, more than an order of magnitude below the levels of NO_2 that have been associated with adverse health affects in asthmatics. Therefore, predicted emissions from the proposed plant would not result in adverse health affects from exposure to NO_2 from cumulative sources, even for sensitive subpopulations such as asthmatics and young children.

NO_x can react with VOCs in the air to form ground-level ozone and fine particle pollution, which are potentially associated with adverse health effects. See discussions below for health effects associated with particulate matter and ozone.

Sulfur Dioxide (SO_2) – High concentrations of SO_2 can result in temporary breathing impairment for asthmatic children and adults who are active outdoors. Short-term exposures of asthmatics to elevated SO_2 may result in breathing difficulties accompanied by wheezing, chest tightness, or shortness of breath. Aggravation of existing cardiovascular disease, respiratory illness, and alterations in the lungs' defenses have also been observed in longer-term exposures to high concentrations of SO_2 in conjunction with exposures to high levels of PM (USEPA 2005b). Sensitivity to SO_2 among asthmatic persons has been well documented (USEPA 1994). Decreased lung function has been experienced by asthmatic individuals exposed to concentrations of SO_2 as low as 525 to 1312 µg/m^3 (USEPA 1994). However, considerably larger lung function changes have been more regularly observed in asthmatic individuals exposed to 1,574 to 2,623 µg/m^3 of SO_2 (USEPA 1994). As shown on Table 4-41, the maximum predicted cumulative annual and 3-hour average concentration of SO_2 is 5.61 and 465.18 µg/m^3, respectively. Both these annual and 3-hour average concentrations of SO_2 are well below the levels of SO_2 that have been associated with adverse health affects in asthmatics. Therefore, predicted emissions from the proposed plant would not result in adverse health effects from exposure to SO_2 from cumulative sources, even for sensitive subpopulations such as asthmatics and young children.

As discussed above for NO_x, SO_x react in the air to form fine particle pollution, which is potentially associated with adverse health effects. See discussion below for health effects associated with particulate matter.

Ozone – Ground-level ozone, sometimes called smog, is the product of an atmospheric reaction that is most prevalent during the earth's warmest seasons. Ozone is formed when VOCs react in sunlight with NO_x. Ozone is a powerful oxidant and respiratory tract irritant in adults and children, causing shortness of breath, chest pain when inhaling deeply, wheezing, and cough (American Academy of Pediatrics 2004). Increases in ozone have been associated with respiratory or asthma hospitalizations, emergency department visits for asthma, and school absences for respiratory tract illness (American Academy of Pediatrics 2004). In healthy adults, ozone causes airway inflammation and hyper-reactivity, decrements in pulmonary function, and increased respiratory tract symptoms (American Academy of Pediatrics 2004).

Ozone is not directly emitted from coal-fired power plants. How much of the NO_x emitted from power plants contributes to ground-level ozone formation is difficult to attribute because ozone formation depends on many different climate variables combined with different emission sources (e.g., motor vehicles emit NO_x). Some research indicates that NO_x emitted from tall stacks, as at a power plant, is less of a concern for ground-level ozone formation than cars (EPRI 2005a). Adding further complexity, ozone formation conditions can vary rapidly and may change from hour to hour. Ozone may be a potential concern in the Four Corners area because the current ozone levels shown on Table 3-3 of 171 µg/m^3 for the 1-hour maximum and 155 μg/m^3 for the 8-hour maximum approach Federal and state air quality standards (University of New Mexico 2004). USEPA (2006f) has concluded that the lowest observed effect levels from short-term exposure to ozone is 235 μg/m^3 for the 1-hour maximum and 157 μg/m^3 for the 8-hour maximum. These concentrations of ozone form the basis for the ozone NAAQS criteria (USEPA 2006f).

Exposure to concentrations of ozone less than the NAAQS criteria are not expected to result in adverse health effects, including lung function decrements and increased respiratory symptoms, for either health or asthmatic individuals (USEPA 2006f). A recent study by the New Mexico Environmental Department concluded that even with proposed new sources (including the proposed project), ozone concentrations would continue to meet standards and even decrease slightly in the period up to 2012 (www.nmenv.state.nm.us/ozonetf). In addition, the predicted NO_x emissions from the power plant are significantly lower (by nearly 2 orders of magnitude) than the existing NO_x air concentrations. Therefore, it can be concluded that predicted plant emissions would not cause or contribute to significant ozone formation in the region.

Carbon Monoxide (CO) – Carbon monoxide is a health concern because it replaces oxygen in blood cells. Thus people exposed to carbon monoxide do not get enough oxygen. At lower levels, the lesser amount of oxygen puts a strain on body tissue with high oxygen demands, such as the heart and the brain (Fierro et al. 2001). Health effects range from relatively minor impacts on the cardiovascular and respiratory systems at low levels, through neurobehavioral effects, to unconsciousness and death after prolonged exposures at concentrations in excess of 500 ppm. The major source of carbon monoxide in ambient air is automobile exhaust. A recent study (Klemm 2004) has found an association between visits to the emergency room for cardiovascular problems with levels of carbon monoxide in the atmosphere. This research found no association between sulfates, (likely the major component of $PM_{2.5}$ emitted from coal-fired power plants), and cardiovascular deaths or emergency department admissions.

The health effects from exposure to CO are measured based on increases in carboxyhemoglobin (COHb) concentrations. The scientific basis for the primary NAAQS for CO was a study suggesting that low levels of CO exposure resulting in COHb concentrations of 2 to 3 percent were associated with neurobehavioral effects in exposed subjects (USEPA 2000). The NAAQS for carbon monoxide are 10,000 μg/m^3 (9 ppm) and 40,000 μg/m^3 (35 ppm) for the 8-hour and 1-hour averaging times, respectively. At the 8-hour standard, fewer than 0.1 percent of the nonsmoking cardiovascular-disease population would experience a COHb level greater than 2 percent. Therefore, the NAAQS criteria are considered protective of the general population, including sensitive subpopulations (i.e., cardiovascular-diseased populations) (USEPA 2000). As shown on Table 4-41, the maximum predicted cumulative 8-hour concentration of CO for the Navajo Nation is 1,038 μg/m^3 and for New Mexico beyond the Navajo Nation is 581 μg/m^3. Both these 8-hour average concentrations of CO are well below the NAAQS criteria for CO. Therefore, predicted emissions from the proposed plant would not result in adverse health affects from exposure to CO from cumulative sources, even for sensitive subpopulations including cardiovascular-diseased populations.

Particulates – Of the six criteria pollutants, emissions of particulates from coal-fired power plants or mining operations and their associated health impacts would be of greatest interest to the nearby communities of the proposed project area. Therefore, a more detailed discussion of the health effects from exposure to particulates is provided than was provided for the other criteria pollutants. Also provided in the section is a discussion of the potential for health impacts from the proposed plant in light of the current health conditions and susceptibility of the Native American population living in and around the Navajo Indian Reservation.

A broad range of health effects have been associated with ambient PM. As stated in USEPA's Staff Paper (USEPA 2005a), "the epidemiologic evidence for PM-related effects was found to be strong, suggesting a 'likely causal role' of ambient PM in contributing to a range of 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 PM might also be contributing to the health effects seen with PM exposures. As discussed above, PM 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. The make-up of the particulates that form from power plant emissions likely would be primarily sulfates and nitrates. There is some evidence that sulfates are not associated with some of the common $PM_{2.5}$ health outcomes (Klemm et al. 2004); however, this issue requires on-going research. In addition to unanswered questions regarding whether the composition of PM 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 PM 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 PM. Thus, the PM effects discussed here are emphasized as being the most likely reflecting overall effects exerted by $PM_{2.5}$ either acting alone and/or in combination with other ambient air pollutants.

Evidence from toxicological and controlled human exposure studies indicate that exposures to $PM_{2.5}$ result in direct pulmonary effects (USEPA 2005a). Direct pulmonary effects can include lung injury and inflammation, increased airway reactivity and asthma exacerbation, and increased susceptibility to respiratory infections. In addition to the direct pulmonary effects, new evidence suggests that systemic effects secondary to lung injury can occur. Injury or inflammation in the respiratory system can lead to changes in heart rhythm, reduced oxygenation of the blood, changes in blood cell counts, or changes in the blood that can increase the risk of blood clot formation, a risk factor for heart attacks or strokes (USEPA 2005a). In addition, more recent studies have shown that particles can have direct cardiovascular effects including effects related to uptake of particles or particle constituents in the blood and effects on the autonomic control of the heart and circulatory system.

Based on the large body of evidence for health effects associated with PM evaluated in the USEPA's criteria document for particulates (USEPA 2004c), the following broad categories of health endpoints have been identified as causally associated with $PM_{2.5}$ exposures:

Short-term $PM_{2.5}$ exposure:

- Cardiovascular and respiratory mortality
- Hospital admissions for cardiovascular and respiratory causes
- Respiratory symptoms not requiring hospitalization

Long-term $PM_{2.5}$ exposure:

- Cardiopulmonary and lung cancer mortality

One important issue that USEPA focused on in their latest review of particulate 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 pre-existing disease conditions (i.e., asthma or reactive airway disease), it is extremely difficult to mathematically demonstrate that a clear threshold exists in population studies. This is especially true if the most sensitive members of a population (generally children and the elderly) have pre-existing conditions (e.g., asthma) that make them unusually sensitive even down to very low concentrations. Because of these issues with determining a threshold, there may be some health effects associated with $PM_{2.5}$ for sensitive individuals even if ambient $PM_{2.5}$ levels meet the air quality criteria.

The particulate matter emissions modeled by ENSR only included PM_{10}. Total PM and $PM_{2.5}$ were not modeled. Based on Table 2-4 from the Desert Rock Updated Class I Modeling Report (Sithe 2006a), $PM_{2.5}$ comprises approximately 78 percent of the total PM_{10} emissions modeled for the power plant. Therefore, the $PM_{2.5}$ concentrations were calculated from the maximum modeled PM_{10} concentrations. As shown on Table 4-41, the estimated cumulative 24-hour $PM_{2.5}$ concentrations on the Navajo Nation would be slightly less than the current NAAQS criteria of 35 $\mu g/m^3$, and in New Mexico beyond the Navajo Nation concentrations would be approximately one-third of the current NAAQS criteria. In addition, the cumulative annual $PM_{2.5}$ concentrations are less than the NAAQS criteria for $PM_{2.5}$ of 15 $\mu g/m^3$. Therefore, while a threshold for exposure to $PM_{2.5}$ has not been clearly demonstrated, the proposed plant would not be expected to emit concentrations of $PM_{2.5}$ at concentrations that would result in a health concern for the majority of the population because cumulative concentrations are less than the current NAAQS criteria.

As noted earlier, USEPA no longer recommends an annual PM_{10} standard, but has retained PM_{10} 24-hour standard of 150 ug/m^3. As shown on Table 4-41, the estimated cumulative annual PM_{10} concentrations on the Navajo Nation would be approximately one-third of the current of 150 $\mu g/m^3$, and in New Mexico beyond the Navajo Nation concentrations would be approximately one quarter of the current NAAQS criteria.

Susceptible Subpopulations and Asthma. Population susceptibility has been raised as an issue of concern to be addressed in this EIS. In particular, concerns have been raised that the nearby communities of the proposed plant are medically underserved and are of higher susceptibility for health effects related to particulate matter emissions from the proposed plant than other communities, specifically regarding asthma levels. A number of studies have been published which demonstrate a positive relationship between particulate matter and increased symptoms of asthma for those people who already have the condition. However, the role of outdoor air pollution, in particular ozone and particulate matter, has not been associated with an increase in the incidence of asthma. A recent study found that the risk of developing asthma (the incidence) was not greater, overall, in children living in communities with high levels of ozone or particulate air pollution (American Academy of Pediatrics 2004).

Review of the available literature has not found that the communities in the vicinity of the proposed plant have higher susceptibility to particulate matter emissions than other populations in the United States, because asthma rates in New Mexico are not significantly different than for other populations in the United States. A study conducted by the New Mexico Department of Health (Hubbard 2005) concludes that asthma prevalence in New Mexico is similar to the asthma prevalence for the rest of the United States. In addition, the study concluded that asthma prevalence in New Mexico was similar across educational levels, household income levels, and in urban counties versus rural and frontier counties (Hubbard 2005).

While exposure to particulates does not appear to increase the incidence of asthma, numerous studies have shown that outdoor air pollution can exacerbate asthma (American Academy of Pediatrics 2004); thus, asthmatics have become a marker for sensitive subpopulation susceptibility. There remains some uncertainty regarding whether the small increases in $PM_{2.5}$ concentrations from the proposed power plant, at the maximum concentration, 0.2 km from the fence line, could slightly exacerbate asthma if someone lived at that location. Concentrations lessen with distance from the proposed plant such that even sensitive populations would be unlikely to have their health affected. Levy et al. (2002) estimated that a 1 $\mu g/m^3$ increase in daily $PM_{2.5}$ concentration could result in a 1 percent increase in asthma-related emergency room visits. The average annual increase in $PM_{2.5}$ at the fence line is approximately equal to 1 $\mu g/m^3$ (although the maximum 24-hour concentration is much higher), and the maximum 24-hour concentration at 25 km is 0.3 $\mu g/m^3$. The majority of the human population in the area is located more than 25 km from the proposed plant.

As discussed in Section 3.4, the predominant land use in the study area is low density, sporadic grazing and mining. As such, most of the land within and near the study area is unoccupied, or is occupied by dispersed residences. The maximum plant emissions were determined to occur less than 1 km of the proposed plant fence line. No communities were identified within 1 km of the plant fence line, with the exception of a single residence located approximately 1 km from the site. Therefore, exposures to the particulate matter at the predicted concentrations within the Navajo Nation would not be expected to occur. Predicted air concentrations would decrease with increasing distance from the proposed plant. The maximum concentrations predicted for New Mexico beyond the Navajo Nation are more appropriate for determining the most likely maximum exposures that nearby residents would encounter.

4.13.2.2.2 Environmental Consequences of Air Toxic Emissions from Power Plant Site

In addition to the criteria pollutants, other chemicals would be emitted from the proposed plant. USEPA identifies approximately 60 chemicals as being potentially emitted during combustion of coal (USEPA 1998a). Not all of these chemicals would necessarily be emitted from the proposed Desert Rock plant as part of the predicted concentrations, because of plant-to-plant variations that are the result of the specific type of coal and combustion processes used and specific control technologies that would be employed at the proposed facility. However, the risk assessment evaluated the full list of chemicals, using USEPA's default emission factors (which tend to overestimate emission rates) in order to assess whether emissions of any of the possible chemicals could potentially result in adverse health effects. Most of these chemicals are predicted to be emitted in amounts that are far too small to present a health concern.

Standard USEPA risk assessment techniques were used to assess whether these predicted chemical emissions might present a risk to human health according to the risk assessment procedures specified by USEPA (1989, 1991, 2005b). The risk assessment was performed using four basic steps: (1) data evaluation and selection of chemicals of potential concern (COPCs), (2) evaluation of human exposure to the COPCs, (3) assessment of the toxicity of the COPCs, and (4) characterization of the health risks of the COPCs. The result of the risk assessment process is numerical estimates of health risk that are compared to target health risk goals established by government and public health agencies. These health goals are generally no more than a one in 10,000 to a one in a million (i.e., 1×10^{-4} to 1×10^{-6}) risk of contracting cancer from exposure to carcinogenic chemicals or, in the case of chemicals with toxic effects other than cancer, the chemical dose from exposure to the COPCs must be equal to or less than the safe dose established by USEPA. Details of the risk assessment are presented in Appendix J, and the results are summarized below.

Impacts of Predicted Concentrations on Existing Concentrations

Potential risks to humans from the proposed plant's chemical emissions were evaluated in combination with the concentrations of these chemicals already present in the environment, to the extent that existing conditions are known. Health risks were calculated for selected chemicals using predicted air concentrations and deposition rates for the proposed plant plus baseline data from soil and plant tissue. Baseline data were available for eight metals (including arsenic, chromium, and mercury) but not any organic compounds. Because predicted air emissions of the air toxics were much lower than health-based screening values for the majority of the chemicals being emitted from the proposed facility (except those selected as COPCs), health impacts from air toxics being emitted from neighboring power plants combined with the proposed facility emissions are unlikely to be significant. In addition, maximum predicted air concentrations generally occur quite close to the emitting facility; thus there is less potential for cumulative effects from different facilities. Specifically the following data were used to select COPCs and calculate health risks.

- Existing concentrations of chemicals in soil and plants. This risk analysis is concerned with cumulative impacts, therefore, plant emissions are considered not only in isolation, but also on how they might increase the concentrations already present in the environment. Baseline concentrations of 6 metals in sampled soil and plants were used in the risk evaluation (see sampling methodology and the sampling results in Section 4.3.2.1).
- Modeled concentrations of chemicals in air. Air concentrations of chemicals were calculated based on estimated chemical emission rates and modeling conducted as part of the permit application process for the plant (ENSR 2006a,b). Modeled maximum 24-hour and annual average concentrations were used in the risk assessment, regardless of whether people might be present at those locations. Existing concentrations of air toxics are not available.
- Modeled concentrations of chemicals in soil. Airborne chemicals would be deposited on the soil in the surrounding area throughout the operational life of the plant. Current levels of metals in soil along with predicted soil concentrations over 50 years of deposition are used to estimate future concentrations of chemicals in soil. As with air modeling, maximum deposition concentrations were used in the calculations regardless of whether people might be present at those locations.
- Modeled concentrations of chemicals in plants. Airborne chemicals could be directly deposited on plants; also, chemicals in soil could be taken into the plants through the roots. Current levels of metals in plants and soil along with predicted soil concentrations over 50-years of deposition are used to estimate future concentrations of chemicals in plants.
- Surface water and sediment could potentially be impacted via deposition and/or runoff; however, because of the ephemeral nature of the streams in the vicinity of the proposed plant (including Chaco River), the distance to the nearest permanent water bodies, and the low amount of rainfall in the area, these media are not considered to be significantly impacted (see further discussion below). Possible impacts to animals (which could eat impacted plants and incidentally swallow impacted soil) are discussed in Sections 4.3.2.1 and below.

4.13.2.2.3 Selected Chemicals of Potential Concern (COPCs)

All concentrations of chemicals in air and soil were compared to health-based screening values. If the predicted concentrations, using maximum predicted air concentrations and deposition rates, are below health-based values, then the chemicals are not a health concern. In general, if chemicals exceed health-based values, or were within one order of magnitude (one-tenth) of these values, they were selected for in-depth evaluation in the risk assessment. Table 3.1-1 (in Appendix J) presents the COPC selection for air and 2.3-1 in Appendix J presents the initial screening for soil. For all but three of the 62 chemicals potentially emitted from the plant (selenium, hydrogen fluoride and hydrogen chloride), predicted surface soil concentrations accumulated over 50 years are less than or equal to 1 mg/kg (1 part per million), and in many cases, are several orders of magnitude below 1 mg/kg. None of the chemicals shown on Table 4.13-4 have 50-year soil concentrations that exceed their respective health-based screening levels. In addition, for the volatile and semi-volatile organic compounds, 50-year concentrations are over-estimated because they do not take into account volatilization and biodegradation, both of which would reduce concentrations of these chemicals in the environment over time. Consequently, none of the volatile or semi-volatile organic compounds possibly emitted from the proposed plant would represent a health risk through the soil exposure pathways, with the possible exception of monomethyl hydrazine. Monomethyl hydrazine was selected because the predicted concentration in soil over 50 years is greater than 1/10th of the health-based screening level and because monomethyl hydrazine is not a VOC. For the metals, baseline concentrations already present in the soil were taken into account when evaluating the 50-year soil concentrations as shown on Table 3.1-2 in Appendix J.

Four chemicals were selected as COPCs and were quantitatively evaluated in the risk assessment in at least one media, hexavalent chromium, arsenic, monomethyl hydrazine, and mercury as follows (see Table 4.13-6 in Appendix J).

- **Hexavalent Chromium** was selected as a COPC in air (Table 4-42). However, the compound was not selected as a COPC in soil because its predicted concentration did not exceed one-tenth of its health-based level in soil even when baseline conditions and 50-year emission rates are taken into consideration. In addition, the compound readily reduces to trivalent chromium (chromium III), the less toxic valence state of chromium, once in the environment (ATSDR 2000). Therefore, chromium is not expected to remain in the hexavalent state for any significant period of time, and significant exposures to hexavalent chromium in soil and vegetation would not occur. Inhaling hexavalent chromium can cause irritation to the nose and over the long term may contribute to an increased risk of lung cancer.
- **Arsenic** was also selected as a COPC in air (Table 4-42), and was selected in both soil and vegetation. Predicted emissions of arsenic from the proposed plant result in a relatively small increase in existing arsenic concentrations in soil over the next 50 years, from 3.2 mg/kg to 4.1 mg/kg; however, the existing (baseline) concentration is well above the screening level (this is typical of natural arsenic concentrations and natural concentrations of 3 mg/kg or more in soil are found throughout the U.S.). Thus, while proposed facility emissions would not increase arsenic concentrations in soil substantially above the baseline concentrations and therefore would not cause substantial cumulative impacts, levels are above risk-based screening levels and thus arsenic was selected as a COPC. In addition, while arsenic does not bioaccumulate in the food chain (i.e., increase in concentration in plants and animals), food chain pathways were included in the risk assessment to fully address cumulative effects. Low levels of arsenic can cause a darkening of the skin, and cause warts or corns to appear. Long term exposures to inorganic arsenic have been associated with an increased risk of lung cancer, skin cancer, and bladder cancer. Arsenic is considered a human carcinogen.
- **Monomethyl hydrazine** was selected as a COPC in air and soil because predicted concentrations were within one order of magnitude of the PRGs for air and soil. The chemical was not selected in food chain pathways because its half-life in the environment is very short, and it does not bioaccumulate. Monomethyl hydrazine exposure can result in damage to the liver and kidneys.

The chemical is considered an animal carcinogen (benign tumors) with an unknown relevance to humans (i.e., there is no evidence of human carcinogenicity).

- **Mercury** was selected as a COPC in soil and food chain pathways. The predicted air concentrations of mercury from proposed facility emissions would be approximately 10,000 times below the ambient air PRG for mercury; thus mercury does not present a health risk from inhalation. Mercury was selected as a COPC in soil even though its predicted 50-year soil concentration was 1,000 times lower than the PRG, because of its potential to bioaccumulate. After absorption into living tissue it is metabolized to a more toxic form, methyl mercury. Therefore, mercury was also selected as a COPC in the food chain pathways. The toxic effects of mercury are damage to the brain, kidneys, and developing fetus. Children exposed to mercury in utero can be born with brain damage, and older children can develop problems with their nervous and digestive systems, and have kidney damage if exposed to mercury concentrations in excess of safe levels.

Table 4-42 Summary of Chemicals of Potential Concern

Chemical of Potential Concern	Air	Soil	Food Chain
Chromium VI	X		
Arsenic	X	X	X
Mercury		X	X
Monomethyl Hydrazine	X	X	

4.13.2.2.4 Population Potentially Impacted by COPCs

Section 3.13.4 detailed the current land use in the area of the proposed plant. The proposed power plant site and the majority of the land within 31 miles (50 km) is Navajo Indian Reservation land. Land use in the immediate vicinity of the proposed site is primarily open range used for the grazing of livestock (sheep, goats, cattle, and horses) (refer to Section 3.4 for land use within 0.5 mile of the proposed plant). The Navajo Nation and BIA have indicated that future land use in this vicinity will continue to be primarily grazing of domestic livestock. The nearest agricultural land to the proposed plant is land farmed by the NAPI. The nearest NAPI land is located approximately 2 miles east and slightly north of the proposed power plant site, and NAPI land extends in that direction to the San Juan River. Morgan Lake (about 15 miles north of the proposed power plant site) is the nearest recreational area. Human development close to the proposed power plant is limited to a few scattered residences and dirt or gravel roads. Only about 75 people were identified as living within 7 miles of the site. The nearest residential area is the town of Burnham, home to about 50 families, located approximately 10 miles southeast of the proposed power plant. The bulk of the population in the area is located north of the proposed plant site in the towns of Shiprock, Kirtland, Fruitland, and Farmington along U.S. Highway 64 approximately 20 to 35 miles (32 to 56 km) from the proposed plant. According to USEPA (USEPA 2005b), the primary effects of emissions from power plants are generally limited to within 10 km of the plant. Therefore, the population of concern with regards to emissions from the proposed plant are people living within 10 km of the proposed facility.

At this site, there are no population centers, developed recreational areas, or major water resources (e.g., the San Juan River) within 10 km of the proposed plant site. However, two recreational fishing water bodies are present within the 50 km air quality study area: Morgan Lake and the San Juan River. Air concentrations from plant emissions and deposition rates decrease significantly with increasing distance from the proposed plant site. The San Juan River and Morgan Lake are located at distances greater than 10 km from the plant (28 km and 22 km, respectively). Therefore, water quality of Morgan Lake and the

San Juan River are not expected to be significantly impacted by atmospheric deposition from the proposed plant operations and recreational fishers consuming fish caught from these water bodies were not selected as a population of concern.

Local mercury data are available for the San Juan River (see Table 3-9). The maximum reported total mercury concentration in the San Juan River of 1.6 ug/L is below the Federal MCL for mercury of 2 ug/L, and the maximum dissolved mercury concentration in the San Juan River of 0.3 ug/L is below the chronic AWQC of 0.7 ug/L. As discussed in Section 4.2, it is estimated that the proposed power plant could release up to 161 pounds of mercury per year through air emissions, of which approximately 26.8 pounds would be deposited within 25 kilometers of the site, and the rest either removed from the emissions via control technologies or emitted as mercury vapor which would not deposit locally (see Section 4.1). Due to the uncertainties involved, it is not possible to estimate how much of the deposited mercury might reach the San Juan River through erosion and surface water runoff. However, due to the fact that the river is farther away than 25 kilometers, and the majority of the deposition occurs within 1 kilometer of the plant, a significant contribution of mercury to the San Juan River is unlikely.

According to information presented in *Methylmercury and Other Environmental Contaminants in Water and Fish Collected from Four Recreational Fishing Lakes on the Navajo Nation, 2004* (USFWS 2005b), selenium concentrations in fish from Morgan Lake may pose health risks to people that consume a large amount of fish from the lake. However, the average dissolved selenium concentration measured in Morgan Lake was 1.0 µg/L (USFWS 2005b). This is substantially lower than the USEPA chronic water quality criterion of 5.0 µg/L (total) and lower than the Navajo Nation Aquatic Habitat Criterion of 2.0 µg/L as listed in USFWS (2005b). Morgan Lake is located 22 km from the proposed plant; it is well beyond 1 km (where the maximum modeled deposition rates are expected) and beyond 10 km (where USEPA [2005b] states that the greatest impacts are expected). Because selenium concentrations in Morgan Lake are substantially lower than water quality criteria and Morgan Lake is located well outside the area where maximum particulate deposition is expected, impacts to selenium concentrations in the lake are expected to be insignificant.

In conclusion, no permanent surface water bodies in the vicinity of the proposed plant are expected to be impacted by deposition of particulates because these water bodies are at least 22 km away from the proposed plant and current concentrations of the metals of interest are well below chronic water quality criteria. Therefore, these water bodies are not expected be significantly impacted by the proposed plant site operations. While the water quality criteria do not specifically take into account the bioaccumulation potential of mercury in fish tissues, the San Juan River and Morgan Lake are currently under fish consumption advisories due to chemical contributions from other source areas unrelated to the proposed plant. The fish consumption advisories recommend that some consumers limit their intake of fish caught from these waters. The San Juan River fish consumption advisory was issued due to mercury contamination in fish tissues. The Morgan Lake fish consumption advisory was issued due to selenium contamination in fish tissues. Based on the surface water evaluations (Sections 3.2 and 4.2), contributions of selenium and mercury from the proposed plant to these two water bodies would be insignificant. Likewise, the subsequent potential uptake of mercury into fish tissues from the proposed plant operations would be additive but potentially insignificant relative to contributions from other source areas unrelated to the proposed plant.

Incremental Health Risks Associated with Predicted Emissions

Concentrations of chemicals in air, soil, plants, and beef, were combined with exposure "factors," which define the magnitude, frequency and duration of exposure for the populations and pathways selected for quantitative evaluation, in order to estimate the chemical dose. Chemical dose estimates are then combined with information on the specific toxicity of the COPCs to provide estimates of health risk. Health risks are calculated differently depending on whether cancer or non-cancer health effects are a concern. For carcinogens, the assumption is that no dose of the chemical is without some risk of contracting cancer; therefore, health risk estimates for cancer are expressed in terms of the probability of cancer resulting from exposures expressed as a "one in a million risk" or risk of 1×10^{-6}. Cancer risk estimates are compared to cancer health goals of no more than a one in 10,000 to a one in a million (i.e., 1×10^{-4} to 1×10^{-6}) risk of contracting cancer from exposure to carcinogenic chemicals. For chemicals with toxic effects other than cancer, the chemical dose from exposure to the COPCs must be equal to or less than the safe dose established by USEPA. Where the chemical dose is equal to the safe dose, it is referred to as a "hazard quotient" (HQ) or "hazard index" (HI) of 1. HQ's and HI's greater than 1 could be associated with an adverse non-cancer toxic effect. Of the COPCs evaluated in this analysis, hexavalent chromium, monomethyl hydrazine, and arsenic are considered carcinogens. Hexavalent chromium, arsenic, and mercury also have non-cancer health effects that are a potential concern. Details of the risk calculations are presented in Appendix J.

Risk and hazards were estimated for residents living in the area near the plant who could be exposed to air toxics emitted from the plant through both direct pathways of exposure (inhalation of arsenic, monomethyl hydrazine, and chromium VI) and indirect pathways of exposure (ingestion and dermal contact with arsenic, mercury, and monomethyl hydrazine in soil, and ingestion of mercury and arsenic in wheat, native plants, and beef). Two different plant ingestion scenarios were evaluated to fully assess potential exposures to mercury and arsenic in plants: 1) ingestion of arsenic and mercury from cultivated plants that were a regular part of the diet (wheat grown in the NAPI area was used to evaluate this plant pathway) and 2) ingestion of arsenic and mercury in wild plants that were used less frequently, but still on a regular basis, for medicinal and ceremonial purposes. The beef ingestion scenario evaluated health risks from ingestion of arsenic and mercury in beef from cattle grazing on wheat grown in the NAPI agricultural area (beef was used as a surrogate for other domestic or wild animals that might graze in the area surrounding the proposed facility).

Baseline concentrations of inorganic chemicals were included in the evaluation for the indirect pathways of exposure. No baseline concentrations of air toxics in air were available. Risk results are presented on Table 4-43. The total hazards, including the contribution from background sources, meet USEPA's target health goal of HI's less than or equal to 1. The cumulative cancer risk of 2×10^{-4} is greater than USEPA's acceptable risk range of 10^{-6} to 10^{-4}; however, nearly all of that risk is due to existing concentrations of arsenic and the contribution of arsenic from the operation of the facility is slight.

The majority of the noncancer hazard for mercury is driven by the ingestion of wheat and the ingestion of native/wild plants through ceremonial and medicinal uses pathways, while for arsenic, the ingestion of ceremonial and medicinal plants is the largest contributor of non-cancer health hazards. The majority of the cancer risk for arsenic is also driven by the ingestion of native/wild plants through ceremonial and medicinal uses pathway. Arsenic is naturally occurring in soil. The baseline soil concentration of arsenic in the vicinity of the proposed plant is 3.2 mg/kg and after 50 years the increase in arsenic concentration is small (increase from 3.2 to 4.1 mg/kg). Background concentrations of arsenic commonly result in health risks in excess of USEPA's target health goals because of the toxicity of the chemical. Because proposed facility operations are not expected to increase arsenic concentrations significantly above the concentrations of arsenic currently in the area, the total risk without including the contribution from baseline arsenic concentrations was also considered in this evaluation in order to estimate whether the increase in arsenic concentrations would result in a significant increase in health risks. As shown on Table 4-43, comparison of baseline arsenic risks with the cumulative risks after 50 years of facility operations and risks due only to the contributions from the facility, indicates that the facility contributions would be insignificant. Arsenic's non-cancer health hazards do not change due to plant operations and cancer health risks increase only slightly, from 1×10^{-4} to 2×10^{-4}.

The residential exposure scenario quantified in this assessment has the highest amount of exposures of any potential exposure scenario. Therefore, when risks and hazards do not exceed target health goals under a residential scenario, they are not expected to be exceeded under other scenarios, including commercial and industrial scenarios. This risk analysis was conducted assuming that a resident receptor lives in very close proximity to the proposed plant fenceline (less than 1 km), where maximum air concentrations and soil deposition are predicted to occur. Proposed facility emissions (thus, air concentrations and soil concentrations) decrease with increasing distance from the proposed site. There are no residences located less than 1 km from the proposed facility fenceline. Thus, exposures to the nearest residential communities are likely to be less than those estimated in this analysis. The results of this analysis indicate that there are not likely to be public health concerns from exposure to air toxics resulting from the operations of the proposed facility, even over 50 years of operation.

There is uncertainty in these risk and hazard estimates due to the use of modeling to predict environmental concentrations 50 years from now and due to uncertainties regarding the exact amount of exposure (e.g., the quantity of plants ingested for medicinal and ceremonial purposes); however, the risk assessment process is designed to over-estimate, rather than under-estimate health risks. Thus, because the results of the risk analysis indicate health risks are at or below target risk goals, and risks from plant operations do not significantly increase health risks in the area, there is confidence in the conclusion that there are unlikely to be health risk in excess of target health goals from exposure to air toxics resulting from the operations of the proposed facility, even over 50 years of operation.

4.13.2.2.5 Transmission Lines Electric and Magnetic Fields (EMF)

EMF emanates from transmission lines; EMF is strongest underneath a transmission line, and the strength of the fields decrease with distance from the transmission line. Studies on effects of EMF on human health have occurred over the past 20 years, and findings of direct connections have been inconclusive. The states of New Mexico and Arizona have not recommended standard field limits for transmission lines, and there are no national standards for electric magnetic fields from transmission lines. The most direct impacts on human health from transmission lines would result from any direct contact with the conductors (DOE 1996).

Effects from EMF on agriculture and wildlife were assessed as part of the Navajo Transmission Line Project EIS. Induced currents from transmission lines have been observed to disrupt performance of bees in hives if the hives are not shielded. Studies have shown that domestic livestock are unaffected by EMF from transmission lines, in that they grow and function normally (DOE 1996).

4.13.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

The previous section presented the potential health impacts associated with Alternative B. A 550 MW subcritical facility (Alternative C) would require less annual coal usage. Consequently, emissions from the 550 MW Facility would be less and the potential impact on air quality and human health would be less. As described in Chapter 3.0, predicted emissions of the 550 MW Facility would be 39 percent of the predicted emissions of the 1,500 MW facility.

Table 4-43 Summary of Risks and Hazards for Residential Populations Living Near the Proposed Facility

		Cumulative Total (Baseline + 50-years of Facility Operation)			**Incremental Risks from Arsenic After 50-years of Facility Operation**			**Baseline Arsenic Risks**		
Pathway of Exposure		**Child HI**	**Child/ Adult HI[a]**	**Child/ Adult CR[a]**	**Child HI**	**Child/ Adult HI[a]**	**Child/ Adult CR[a]**	**Child HI**	**Child/ Adult HI[a]**	**Child/ Adult CR[a]**
Inhalation of Air Toxics[c]		0.0005	0.0003	3E-06	NA	NA	NA			
Exposure to Soil[d]	Arsenic	0.3	0.08	4E-05	0.06	0.02	8.E-06	0.2	0.06	3.E-05
	Mercury	0.002	0.0004							
Ingestion of Wheat	Arsenic	0.03	0.01	3E-06	0.0006	0.0	6E-08	0.02	0.006	2.E-06
	Mercury	0.2	0.04							
Ceremonial and Medicinal Ingestion of Plants	Arsenic	0.9	0.3	1E-04	0.04	0.01	5E-06	0.9	0.24	1.E-04
	Mercury	0.4	0.1							
Ingestion of Beef	Arsenic	0.00002	0.00002	1E-08	0.000005	0.000005	2E-09	0.00002	0.00	9.E-09
	Mercury	0.003	0.003							
TOTAL Arsenic[e]	Arsenic	1	0.3	2E-04	0.1	0.03	1E-05	1	0.3	1E-04
TOTAL Mercury[e]	Mercury	0.6	0.2							
TOTAL Cancer Risks[e]				2E-04						

[a] Risks are calculated for lifetime exposures

[b] Hazards are calculated separately for lifetime exposures (labeled “adult/child”) and for exposures only during childhood (labeled “child”)

[c] Hazards due to inhalation are from exposures to chromium VI; cancer risks are from exposures to chromium VI, arsenic, and monomethyl hydrazine

[d] Monomethyl hydrazine was also evaluated for cancer risks in soil, but if risks for this chemical are added to the arsenic total, risks are unchanged to one significant figure.

[e] The totals presented on this table reflect the total values calculated using the un-rounded risk and hazard results.

HI = hazard index
CR = Cancer risk

Environmental Consequences of Criteria Pollutant Emissions from the 550 Megawatt Facility

The previous section concluded that predicted cumulative concentrations of the criteria pollutants would be below the NAAQS criteria. Therefore, Alternative C would result in predicted concentrations of the criteria pollutants that are also below the NAAQS criteria. Table 4-44 presents the predicted concentrations of the criteria pollutants associated with Alternative C. Note these predicted concentrations were calculated by multiplying the concentrations presented on Table 4-39 for Alternative B, the 1,500 MW facility, by 39 percent.

Table 4-44 Comparison of Maximum Cumulative Predicted Concentrations Associated with Alternative C with the Current Primary Standards

Criteria Pollutant	Time Frame	Current Primary Standard (μg/m^3)	Maximum Predicted Cumulative Concentration On the Navajo Nation (μg/m^3)	Percent of Current Primary Standard	Maximum Predicted Cumulative Concentration in New Mexico Beyond the Navajo Nation (μg/m^3)	Percent of Current Primary Standard
SO_2	Annual	78.7	2.1879	3%	2.0748	3%
	24-hour	367	–	–	–	–
	3-hour	–	181.4202	–	78.5733	–
NOx	Annual	100	5.3664	5%	5.1948	5%
CO	8-hour	10000	404.8824	4%	226.668	2%
	1-hour	40000	1072.383	3%	541.5969	1%
$PM_{2.5}$	Annual	15	2.5233	17%	2.0007	13%
	24-hour	65	12.714	20%	4.4031	7%
PM_{10}	Annual	–	6.5325	–	5.8656	–
	24-hour	150	20.9547	14%	10.2843	7%

Environmental Consequences of Air Toxic Emissions from the 550 Megawatt Facility

The previous section concluded that exposures to air toxics resulting from 50 years of plant operation under Alternative B would not result in an unacceptable health risk. Exposures from all of the evaluated pathways were below target health goals even if it was assumed that a resident would have exposures through all pathways simultaneously for their entire 70-year lifetime. Therefore, exposures to air toxics associated with Alternative C would also not result in an unacceptable health risk. The risk and hazard equations presented in the previous section are linear. Therefore, risks and hazards for the evaluated exposures pathways can be estimated for Alternative C by multiplying the risk and hazard estimates presented on Table 4-42 for Alternative B by 39 percent. Table 4-45 presents the risk and hazards associated with Alternative C. Note that, because the majority of the arsenic hazards and risks are due to baseline conditions, the cumulative risks and hazards for Alternative C are not lower than those for Alternative B; however, the risks due to plant operations would be reduced by about half for arsenic (the middle column on Tables 4-42 and 4-44) and hazards from exposure to mercury would be reduced by about one-third.

Table 4-45 Summary of Risks and Hazards Associated with Alternative C

Pathway of Exposure		Cumulative Total			Incremental Risk Over Baseline Arsenic Concentration			Baseline Arsenic Risks		
		Child HI	Child/ Adult HI	Child/ Adult CR	Child HI	Child/ Adult HI	Child/ Adult CR	Child HI	Child/ Adult HI	Child/ Adult CR
Inhalation of Air Toxics (1)		0.0002	0.0001	1E-06	–	–	–			
Exposure to Soil (2)	Arsenic	0.2	0.07	3E-05	0.02	0.007	3E-06	0.2	0.06	3.E-05
	Mercury	0.0006	0.0002							
Ingestion of Wheat	Arsenic	0.02	0.006	3E-06	0.0002	0.00005	2E-08	0.02	0.006	2.E-06
	Mercury	0.1	0.02							
Cermonial and Medicinal Ingestion of Plants	Arsenic	0.9	0.2	1E-04	0.02	0.004	2E-06	0.9	0.2	1.E-04
	Mercury	0.2	0.05							
Ingestion of Beef	Arsenic	0.00002	0.00002	1E-08	0.000002	0.000002	9E-10	0.00002	0.00002	9.E-09
	Mercury	0.001	0.001							
	Arsenic	1	0.3	1E-04	0.04	0.01	5.E-06	1	0.3	1.E-04
	Mercury	0.2	0.06							
TOTAL				1E-04						
Notes										

(1) Hazards due to inhalation are from exposures to chromium VI; cancer risks are from exposures to chromium VI, arsenic, and monomethyl hydrazine.

(2) Monomethyl hydrazine was also evaluated for cancer risks in soil, but if risks for this chemical are added to the arsenic total, risks are unchanged to one significant figure.

[a] These totals include the evaluation of risks and hazards using soil concentrations associated with baseline conditions for arsenic and mercury in addition to those associated with deposition from proposed plant activities.

[b] These totals include the evaluation of risks and hazards using soil concentrations associated with baseline conditions for mercury, in addition to those associated with deposition from proposed plant activities, but excluding baseline concentrations of arsenic

[c] Hazards are calculated separately for lifetime exposures (labeled "adult/child") and for exposures only during childhood age 0 to 6 years (labeled "child")

[d] Risks are calculated for lifetime exposures

[e] The totals presented on this table reflect the total values calculated using the un-rounded risk and hazard results.

HI = hazard index

CR = cancer risk

4.13.3 Summary of Impact Analysis

Proposed plant emissions for the criteria pollutants, combined with existing concentrations of these pollutants, would not result in exceedances of the health-protective NAAQS criteria. In particular, cumulative concentrations of particulates are not expected to result in adverse health affects for the nearby communities of the proposed plant for the following reasons:

- Predicted maximum cumulative concentrations of particulates are below the NAAQS criteria at the location of the maximum concentration (0.2 km from the plant's fence line) and concentrations decrease with distance.
- The highest predicted PM concentrations resulting from proposed plant emissions are less than 1 $\mu g/m^3$ (predicted 24-hour maximum) within 25 km of the proposed plant and most of the population in the area lives farther than 25 km from the plant.
- No receptors are present within 0.5 km of the plant fence line where the maximum concentrations would occur; also, these maximum concentrations would be below the NAAQS.
- Nearby communities of the proposed plant do not appear to have greater susceptibility to asthma than the general population.
- Lastly, existing air concentrations of particulate matter, unrelated to the proposed project, are expected to decline.

Risk and hazards estimated for residential exposures to air toxics emitted from the plant through both direct pathways of exposure (inhalation of air toxics) and indirect pathways of exposure (residential contact with soil, ingestion of wheat, native plants, and beef) met USEPA's target non-cancer health goal of an HI less than or equal to 1. Cumulative cancer risks slightly exceeded USEPA's target health goal of cancer risks of 10^{-4}, with cumulative risks of 2×10^{-4}. However, this cumulative risk is overwhelmingly due to the existing, baseline concentrations of arsenic in soil. The incremental increase in cancer risk due to arsenic and emissions from the other evaluated air toxic chemicals (i.e., mercury, monomethyl hydrazine, and chromium VI) from plant operations is unlikely to be significant even if it was assumed that:

- Exposures would occur to the maximum concentrations in air and maximum deposition rates over 50 years, and
- a resident living near the proposed facility would have exposures through all these pathways simultaneously for their entire 70-year lifetime.

In addition, health-protective assumptions were used in the calculation of risks and hazards in order to over-estimate rather than under-estimate actual exposure conditions.

The total hazards, including the contribution from background sources, would meet USEPA's target health goal of HI's less than or equal to 1. The cumulative cancer risk of 2×10^{-4} is greater than USEPA's acceptable risk range of 10^{-6} to 10^{-4}; however, nearly all of that risk is due to existing concentrations of arsenic in soil and native vegetation and the contribution of arsenic from the operation of the facility would be slight. The majority of the noncancer hazard for mercury is driven by the ingestion of wheat and the ingestion of native/wild plants through ceremonial and medicinal uses pathways, while for arsenic, the ingestion of ceremonial and medicinal plants is the largest contributor of non-cancer health hazards. The majority of the cancer risk for arsenic is also driven by the ingestion of native/wild plants through ceremonial and medicinal uses pathway. Arsenic is naturally occurring in soil and background concentrations of arsenic commonly result in health risks in excess of USEPA's target health goals because of the toxicity of the chemical. A comparison of baseline arsenic risks with the cumulative risks after 50 years of facility operations and risks due only to the contributions from the facility, indicates that the facility contributions would be insignificant. Arsenic's non-cancer health hazards do not change due to plant operations and cancer health risks increase only slightly, from 1 x 10^{-4} to 2 x 10^{-4}.

While risks and hazards were evaluated only for a residential population, other populations such as occupational or recreational would have lower exposures than those living in the area; therefore, because risks and hazards are at or below target risk goals, and risks from plant operations do not significantly increase health risks in the area under a residential scenario, they would not exceed health goals under other scenarios. This risk analysis was conducted assuming that a resident lives in very close proximity to the proposed plant fence line (less than 1 km). Proposed facility emissions (thus, air concentrations and soil concentrations) decrease with increasing distance from the proposed site. There are no residents less than 1 km from the proposed facility fence line. Thus, exposures to the nearest residential communities are likely to be less than those estimated in this analysis.

There are currently no occupational populations within 10 km of the site, and none are expected in the future. Occupational activities typically occur 5 days per week for 25 years, and residential exposures were assumed to occur daily for an entire lifetime (70 years). Therefore, even if a resident of the area lived and worked within the assumed exposure area, the assumptions used to calculate risks and hazards in this evaluation are considered to be protective. However, the risks and hazards presented in this evaluation are overestimated for occupational populations who live at distances greater than 10 km from the site. Using USEPA default exposure assumptions for occupational/industrial exposures, risks and hazards for future occupational populations are 7 x 10^{-7} for inhalation of airborne air toxics and 1 x 10^{-6} for exposures to soil through the ingestion and dermal pathways, below and equal to USEPA's de minimus cancer risk level of 1 x 10^{-6}.

While nearly all assumptions were health-protective (over-estimating, rather than underestimating exposure), there is uncertainty regarding what an individual's actual exposures might be and there would be variability within the population. Increases in the exposure assumptions used in the risk assessment, for example increases in the assumption of how much native vegetation a person might eat, would increase the estimated risks and hazards. Cumulative hazards without including the contribution from baseline arsenic concentrations are due almost entirely to the ingestion of mercury in plants (50-year concentrations) with hazards below the target health goal of 1. If there are individuals regularly consuming large amounts of native vegetation in the area of the maximum mercury deposition (i.e., within 1 km of the proposed plant fenceline), hazards above the health goal of 1 might be possible. In addition, while the results of this analysis indicate that there are not likely to be any concerns for public health from exposure to air toxics resulting from the operations of the proposed facility, even over 50 years of operation, people who live within the 10 km maximum impact area, could potentially ingest fish caught from the San Juan River and Morgan Lake, which are located at distances of approximately 28 km and 22 km, respectively, of the proposed plant site. As discussed in previous sections, these water bodies have fish consumption advisories due to elevated mercury and selenium concentrations in fish tissues, respectively.

4.14 ENVIRONMENTAL JUSTICE AND INDIAN TRUST ASSETS

4.14.1 Impact Assessment Methodology

The assessment of potential environmental justice impacts evaluates whether a disproportionate, adverse impact on a minority or low-income population would occur. Section 3.1 identified "environmental justice" populations located in proximity to the proposed project. The entire Navajo Indian Reservation and the chapters that are located closest to the project are overwhelmingly Navajo populations, and therefore of concern with regard to environmental justice due to their minority status. In addition, the Navajo Indian Reservation and the nearby chapters exhibit high poverty and unemployment rates, which also defines them as an environmental justice population.

The analysis was conducted to review (1) what types of impacts would be expected to occur under each alternative, and (2) who or where would experience the impact. The discussion below summarizes this analysis, and draws conclusions as to whether an environmental justice population would disproportionately bear any adverse impacts associated with the proposed project. Particular attention is paid to the concerns that were raised during scoping, including impacts on jobs and revenues for the Navajo Nation, health issues associated with water and air quality, and water use.

Another component of environmental justice is to ensure that there continues to be adequate communication with potentially affected communities throughout the NEPA process and project implementation, as appropriate. Public outreach efforts associated with the NEPA process are outlined in Chapter 6, *Consultation and Coordination* and include public meetings at local chapter houses, the development of informational materials, scoping meetings, and public hearings on the Draft EIS. A Navajo translator will attend public meetings and comments may be provided in Navajo at the public hearings.

4.14.2 Environmental Consequences

4.14.2.1 Alternative A (No-Action)

4.14.2.1.1 Indian Trust Assets

As previously stated in Section 3.8.5, the United States has a trust responsibility to protect and maintain rights reserved by or granted to Indian Tribes by treaty, statutes, regulations, Supreme Court decisions, and executive orders. This trust responsibility requires Federal agencies such as the BIA to take actions reasonably necessary to protect Indian Trust Assets. If the proposed project were not implemented, no trust resources would be affected or consumed as the direct result.

4.14.2.1.2 Environmental Justice

Under the No Action Alternative, no direct, indirect, or induced income or tax revenue would be generated from the proposed project. The population that would have been recipients of wages and other fiscal benefits from the proposed project are an environmental justice population, as over 95 percent of the Navajo Indian Reservation is part of a minority group and 40 percent of households on the reservation live below the poverty line (see Section 3.8.4).

4.14.2.2 Proposed Action – 1,500 Megawatt Plant and Associated Facilities (Alternative B)

4.14.2.2.1 Indian Trust Assets

The Indian Trust Assets that would be affected or consumed as a result of the proposed project would include land, water, and coal. The lands that would be affected include all of the lands on the Navajo Indian Reservation that would be a part of the project, including lands to be leased at the power plant site, and rights-of-way for access roads, power transmission lines, and the water-supply system. The water that would be affected includes the water to be extracted from the well field.

The Navajo Nation Council supported the use of Indian Trust Assets for the Desert Rock Energy Project when it approved a business site lease for the project on May 12, 2006. The lease is subject to approval by BIA.

While Indian water rights are not defined by statute, the source of Indian water rights is found in the 1908 Supreme Court decision of Winters v. United States (207 U.S. 564, 576 cited in McCarthy 2004). 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 assisted tribes in implementing a water rights settlement. The Navajo Nation asserts the authority, independent of BIA, to manage the use of the water asset.

The coal resource is also an Indian Trust Asset. The coal is on the lands of the Navajo Indian Reservation that are held by the Federal Government in trust. The primary authorization for leasing of Indian minerals is the Indian Mineral Leasing Act (IMLA) of 1938 (McCarthy 2004). The Act aims to provide Indian tribes with a profitable source of revenue and to foster tribal self-determination by giving Indians a greater say in the use and disposition of the resources on their lands. The leases now known as those for BNCC Lease Areas I through V originated as mining leases between the Navajo Nation and BHP (Utah Construction Company) dated July 26, 1957. They have subsequently been amended several times. The tribal council negotiates the terms of any mineral lease under IMLA, subject to approval by BIA acting as the representative of the Secretary of the Interior. The OSM is the regulatory agency for surface coal mining and reclamation operations on Indian lands, so OSM would approve the SMCRA permit application to mine Area IV South and Area V of the BNCC lease area. The BLM would approve the mine plan for Areas IV South and V.

4.14.2.2.2 Environmental Justice

Economy (Employment, Incomes, and Fiscal Conditions)

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 individual registered members of the Navajo Nation, some of whom live in their home chapters, and some of whom live in Farmington or other communities. If an individual is a registered member and has the educational background and necessary experience that match the job requirements, he/she would 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. The New Mexico Department of Transportation and New Mexico Community Development Block Grant Program compile lists of these businesses for federally supported projects. Several cities and counties in the area of the proposed project keep their own registries or refer to one of the state registries. It is possible for a business to be registered on both the Certified Navajo Businesses registry and various MBE/DBE/WBE 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 Preference in hiring would be applied to job applicants who are Navajo chapter members, whether living on the Navajo Indian Reservation or outside the Navajo Indian Reservation. Minority persons, whether American Indian or Hispanic or of another race, also would be affirmatively recruited.

The three construction wage examples in Table 4-35 would yield yearly incomes between $29,000 and $45,000 per year. The median household incomes in the Navajo chapters in the local area were $25,638 or below in the year 2000. Even with post-2000 inflation factored in, the construction wages would represent a higher household income than the median in any of the local chapters.

The effects on local business during the construction phase would include seeking qualified construction suppliers and subcontractors, first from the Certified Navajo Businesses list and then those who are registered in the various MBE/DBE/WBE program(s).

During operations, the proposed project would result in the same type of beneficial economic effects on the local workforce and applicable businesses that are registered on the Certified Navajo Businesses list or registered in the various MBE/DBE/WBE program(s). The population employed by the proposed project would benefit from education and training opportunities (see Section 4.8).

The tax revenue paid to the Navajo Nation would be allocated as part of the tribe’s normal budget process. These revenues would support a variety of programs on the reservation that could benefit the population in the vicinity of the proposed project and the Nation generally. Section 4.8 provides additional information on estimated taxes and royalties.

Human Health

The residential population within 1.1 miles of the power plant site includes two American Indian persons, according to the 2000 Census. According to the 2000 Census, the residential population within 6.8 miles of the site is no more than 76 persons, all of whom are American Indian. Some of the 76 persons may live beyond 6.8 miles from the site, since the Census units in which their households are located extend beyond that radius. Because all residents of the area immediately surrounding the site are American Indian, any deterioration in local air quality would be borne by the local American Indian population, which fits the criteria for an environmental justice population. During the operations phase, power plant emissions would meet all NAAQS standards. During construction, impacts from dust emissions would be mitigated through practices described in Section 4.1. It is anticipated that there would no adverse impacts on health in the local population from proposed plant emissions combined with existing concentrations of pollutants, based on compliance with established standards. Emissions from power facilities would decrease with increasing distance from the proposed site. There are no residents located within 1 km of the proposed facility fence line, where the highest deposition rates are predicted to occur.

Concerns have been raised that low funding for the Indian Health Service has resulted in a medically underserved population on the Navajo Indian Reservation. Co-risk factors associated with medically underserved populations such as nutritional status, access to health care, multiple historical exposures, and stress factors can combine to affect a population's susceptibility to adverse health effects. However, because the slight deterioration in air quality would still result in a concentration of only a fraction of the standard for each pollutant, no adverse health effects resulting from proposed plant operations are anticipated.

Based on available data, nearby communities of the proposed plant do not appear to have greater susceptibility to asthma than the greater population (see Section 4.13). While there are health concerns related to respiratory diseases within the Navajo population, data sets that are specific to this population are unavailable and impacts under existing conditions have not been quantified.

Health concerns related to water quality have also been raised throughout the scoping process. Currently, there are pollutant advisories posted for Morgan Lake and the San Juan River to limit the consumption of fish from these waters. These advisories are due to chemical contributions from other source areas unrelated to the proposed plant. Contributions of mercury and selenium from the proposed plant to Morgan Lake and the San Juan River would be insignificant relative to established standards. Further discussion of human health is provided in Section 4.13.4.

Water Resources

During the scoping phase of the NEPA process, local community members were concerned that the use of local water sources by the power plant would be disproportionately damaging to them. Section 4.2 on water resources discusses the potential for impacts on water quantity and quality as a result of the proposed project.

Informational materials to be supplied on an ongoing basis would provide local residents with a status update of the quality of the water sources and any ongoing monitoring efforts. To ensure that local benefits result from the development of the water-supply system, Desert Rock Energy LLC and Navajo Nation entered into a Large Water User Master Agreement. Under this agreement, the proposed project would supply 450 af/yr annually from the well field for Navajo municipal use.

Other Resource Impacts

The visual prominence of the proposed facilities would be objectionable to some residents because of the cultural significance of the lands in the landscape that it shares. The visual intrusion would not be expected to interfere with cultural observances. Visual impacts are further described in Section 4.7 (Visual Resources) and impacts to cultural resources are described in Section 4.9 (Cultural Resources).

Plants used for ceremonial and medicinal purposes by the Navajo would not be adversely affected by impacts to surface water and air quality. Consumption of such plants would not pose a significant risk to human health (see discussion in Section 4.9).

4.14.2.2.3 Mitigation to Reduce Impacts

To address any concerns specific to environmental justice populations, continued coordination with local Navajo chapters should occur for the duration of the project. Communication channels with potentially affected communities on the Navajo Indian Reservation have been established by the project proponents and would be maintained to obtain information and guidance as well as ensure that the public is well informed of any potential impacts. The project proponent has held numerous meetings with Navajo chapters and other groups prior to the NEPA process. These are identified in Chapter 6 and fully described in Appendix L.

4.14.2.3 550 Megawatt Subcritical Facility and Associated Facilities (Alternative C)

4.14.2.3.1 Indian Trust Assets

Impacts on Indian Trust Assets under Alternative B would be the same for Alternative C, although less water and coal would be required for the project.

4.14.2.3.2 Environmental Justice

Economy (Employment, Incomes, and Fiscal Conditions)

Impacts to the local economy would be reduced in comparison to Alternative B. Alternative C would provide about half the number of permanent jobs, and less than half of the tax and royalty income, compared to Alternative B.

Human Health

The 550 MW facility under Alternative C would produce lower overall emissions than the larger 1,500 MW power plant and ancillary facilities of Alternative B. Concentrations of criteria pollutants would be below the NAAQS criteria. Exposure to air toxics resulting from 50 years of plant operation would not result in an unacceptable health risk (see Section 4.13).

Water Resources

Impacts on water resources would be the same as described for Alternative B. Although Alternative C would require less groundwater, the potential impacts on drawdown and other local users would be virtually the same.

Other Resource Impacts

Under Alternative C, these impacts would generally be the same as Alternative B.

4.14.3 Summary of Impact Analysis

There are environmental justice concerns because of the disproportionately minority and low-income population in the area. The emissions of air pollutants would increase under both of the action alternatives; however, modeling indicates that the cumulative impacts would be below health-protective Federal standards. Plants used for medicinal and ceremonial purposes also would not be adversely affected. The local economy and associated fiscal conditions would experience the most impact from both alternatives, primarily Alternative B. It is anticipated that the economic benefit to the Navajo Nation would be substantial in terms of wage and tax income, and the action alternatives would encourage or support further economic development that could improve the overall quality of life for local residents and businesses.