would occur from Cutter Reservoir (figure F-3), an existing regulating reservoir on the Navajo Indian Irrigation Project (NIIP), conveying water to the eastern portion of the Navajo and the Jicarilla Apache Nations. The water would be provided to Window Rock, Arizona, and Crownpoint, New Mexico, through sublaterals. While basic design components were described in chapter IV, other components specific to the preferred alternative are described in this attachment.

TOTAL PROJECT WATER SUPPLY AND DEMAND

The proposed project is designed to divert a total of 37,764 acre-feet per year (AFY) from the San Juan River with a resulting depletion of 35,893 acre-feet to the San Juan River Basin, based on 2040 projected population with a demand rate of 160 gallons per capita per day (gpcd). The Cutter diversion would require 4,645 AFY with no return flow to the San Juan River. The PNM diversion would take the remaining 33,119 AFY of diversion, with an average return flow of 1,871 AFY. (The planned diversion and depletion by location is shown in table F-1).

It is assumed that the only return flow from the proposed project to the San Juan River would enter the river at the Shiprock waste water treatment plant. There may be some water delivery to users with individual septic systems in the Shiprock area, but the delivery is expected to be a small percentage of the total. All other deliveries would have similar losses, but the resulting return flow would be lost to evaporation or to recharging local groundwater aquifers. For water balance purposes, no return flow to the San Juan River from these other locations is expected or accounted for. Return flow to the Rio Grande or Little Colorado Rivers is highly unlikely, even though there would be discharge to the groundwater in these areas. Local groundwater storage space, together with local pumping, would limit the potential for surface discharge. Even if surface discharge does occur, the distance to the Rio Grande or Little Colorado Rivers is so great that it is unlikely that return flows would reach these rivers.

Deliveries typically vary depending on changes in demand, and the largest demand is in the summer months. The Shiprock water delivery pattern for March 1992 through February 1993, shown in table F-2, was used to determine average monthly deliveries, and return flows were assumed to follow the same distribution. The system would be designed to handle a 7-day peak demand for pumping plants and pipelines and is computed as 1.3 times the peak average monthly demand. Daily and diurnal demand peaking would be handled by the proposed project storage tanks.

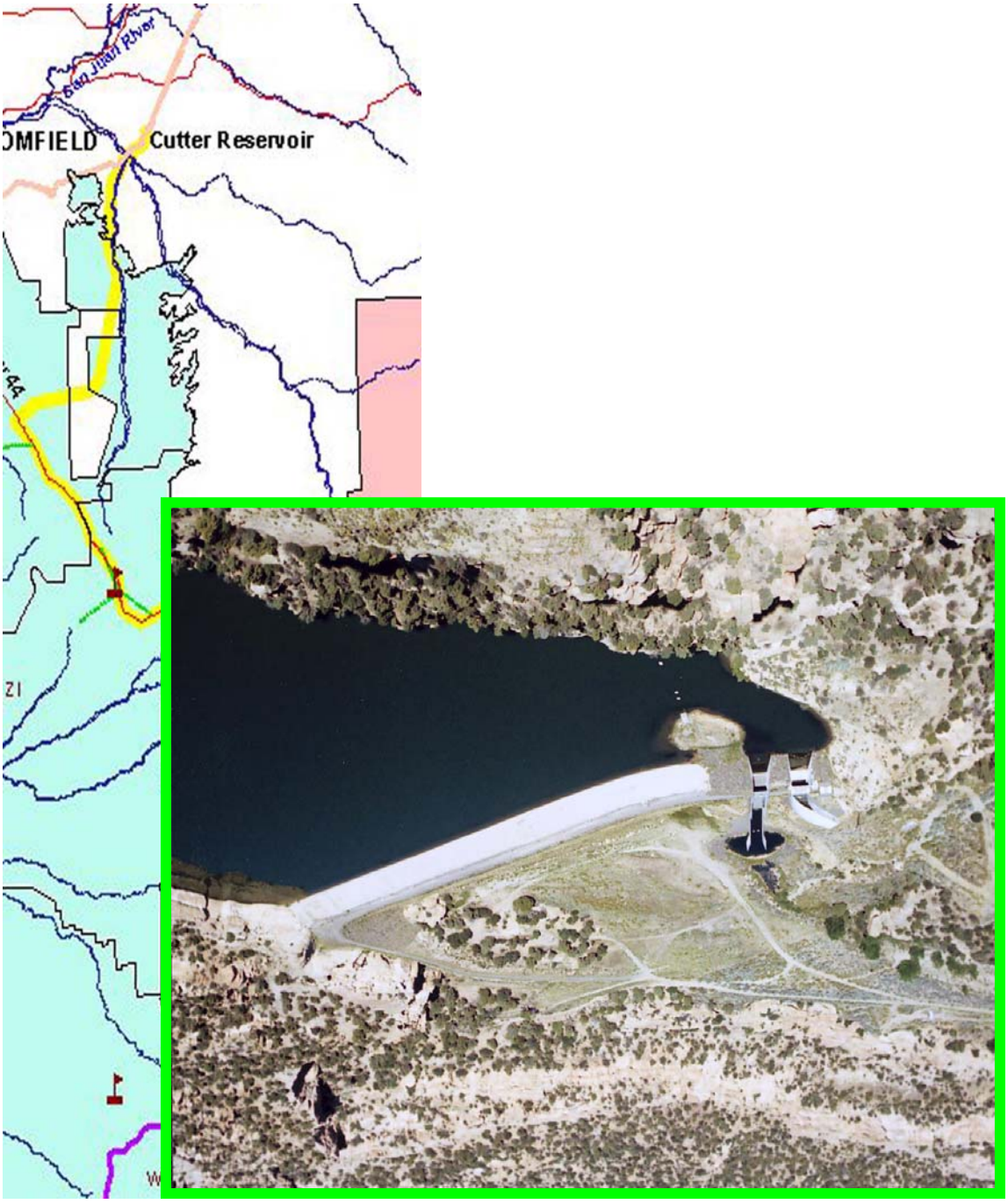

Figure F-3.—Cutter Dam and Reservoir.

Table F-1.—Project forecast 2040 demand and design capacity by service area

Location	San Juan River diversion (AFY)	San Juan River depletion (AFY)
City of Gallup, New Mexico	7,500	7,500
Jicarilla Apache Nation	1,200	1,200
Navajo Nation, New Mexico		
Central area	834	834
Crownpoint	2,473	2,473
Gallup area	4,316	4,316
Huerfano	864	864
Rock Springs	2,118	2,118
Route 491	5,366	5,366
Torreon	2,240	2,240
San Juan River	3,742	1,871
Navajo Agricultural Products Industry industrial uses	700	700
Navajo Nation, Arizona (Window Rock area)	6,411	6,411
Total Navajo Nation	29,064	27,193
Project total	37,764	35,893

Table F-2.—Monthly demand pattern for all deliveries

Month	Percent demand	Month	Percent demand
January	7	July	10
February	6	August	10
March	9	September	10
April	7	October	8
May	9	November	7
June	10	December	7

Navajo Nation

The proposed projected project water need for the Navajo Nation is a total diversion of 29,064 AFY. Of this, 6,411 AFY is for use in the Window Rock area of Arizona and 22,653 AFY is for use in the eastern portion of the reservation in New Mexico. The 22,653 AFY of water would come from Navajo Reservoir (3,445 AFY) through the Cutter diversion and from the San Juan River at the existing PNM diversion dam (19,208 AFY).

Water for the proposed project's New Mexico part of the Navajo Nation (22,653 AFY) would be supplied from New Mexico State Engineer File Nos. 2849 and 3215 held by the Secretary of the Interior (Secretary). This would be administered through a long-term water supply contract between the Bureau of Reclamation (Reclamation) and the Navajo Nation.

Consumptive uses by the Navajo Nation under the proposed project within Arizona in and near Window Rock must be supplied from the apportionments or allocations of water made to the State of Arizona by compact or decree. The *Colorado River System Consumptive Uses and Losses Report*, 1996–2000 (Reclamation, February 2004), estimates that current consumptive uses within the Upper Basin in Arizona amount to about 38,100 AFY. Thus, there appears to be adequate unused apportionment within the 50,000 AFY of Upper Basin consumptive use apportioned to the State of Arizona by article III(a) of the Upper Colorado River Basin Compact to source the Arizona portion of the proposed project. Use of Arizona's Upper Basin apportionment in the Lower Basin in Arizona for the Navajo Nation's project uses in the Window Rock area would be consistent with the provisions of section 303(d) of the Colorado River Basin Project Act and the June 2003 Resolution of the Upper Colorado River Commission consenting to New Mexico's use of its Upper Basin apportionment in the Lower Basin in New Mexico for project uses in Gallup and surrounding areas. The Arizona Water Settlements Act (S 437 – 108th Congress, January 20, 2004, §104, Allocation of the Central Arizona Project) provides that the Secretary is to retain 6,411 acre-feet of water from the Central Arizona Project for a future water rights settlement agreement. The State of Arizona and the Navajo Nation are in the process of determining which State water would be identified and accounted for to supply project demands. A diversion permit from the State of New Mexico would be required to divert water in New Mexico. Permits and/or contracts for using the Arizona water would be required and would be dependent on which source of water is used to supply the proposed project demand.

Jicarilla Apache Nation

The projected project water need for the Jicarilla Apache Nation is a total diversion of 1,200 AFY. All of this water would come from Navajo Reservoir to be supplied from

New Mexico State Engineer File No. 2849. This is part of the water obtained by the Jicarilla Apache Nation through the Jicarilla Apache Nation Apache Tribe Water Right Settlement Act, Public Law 102-441, October 23, 1992. This water would be made available through the existing Settlement Contract between the Jicarilla Apache Nation and the United States.

City of Gallup, New Mexico

The city of Gallup holds no water rights in the San Juan River and would be obtaining a long-term water supply contract for 7,500 AFY of water. The city has requested a water supply contract from Reclamation. As part of water right settlement and trust responsibilities, Reclamation asked the Jicarilla Apache Nation if it would be interested in providing this need with water it holds from its water rights settlement agreement. The Jicarilla Apache Nation was interested and is in the process of discussing terms and conditions of a long-term water contract with the city of Gallup (see attachment C). A long-term water supply subcontract between the city of Gallup and the Jicarilla Apache and/or the Navajo Nation and approved by the United States would consummate this arrangement.

Physical Description

The river intake would divert 33,118 AFY of water from the San Juan River from the water pool created by the existing PNM diversion dam. Water entering the intake would pass through a self-cleaning screen and then enter a sump where low-head pumps would lift the water into settling ponds for removal of suspended sediment. From the settling ponds, the water would enter a water treatment plant to be treated to meet safe drinking water standards. The treatment plant and pumping plant would occupy approximately 18 acres of land on the north side of the river just upstream from the existing PNM diversion dam.

The treated water would be pumped into the San Juan Lateral, a buried pipeline that crosses the San Juan River and ascends a mesa south of the river. Seven relift pumping stations would be constructed along the San Juan Lateral to keep the water flowing in the pipeline. The pipeline would extend south to Ya-ta-hey, New Mexico, and would connect to spur pipelines extending to Window Rock, Arizona; Gallup, New Mexico; and Crown Point, New Mexico. Navajo communities that have an existing water distribution system would have a storage tank and a method to increase (by means of a pumping plant) the pressure for proper distribution. In the city of Gallup, one new pumping plant would be constructed, three pumping plants upgraded, five new storage tanks constructed, and 32 miles of pipeline upgraded. The upgraded Gallup Regional System would be connected to five Navajo Nation water distribution systems on the outskirts of the city.

The Cutter Lateral would be constructed to carry water from Cutter Reservoir (an existing feature of the NIIP) to the eastern portion of the Navajo and Jicarilla Apache Nations. A water treatment plant would be constructed at the base of Cutter Reservoir to deliver treated water to the relift pumps and pipeline that make up Cutter Lateral. Existing Navajo Nation water distribution systems would be connected to the pipeline, and a tee with a blind flange would be provided for a future connection by the Jicarilla Apache Nation. Primary project features and their purposes are shown in table F-3.

Table F-3.—Primary project features and their purposes

Component	Purpose	Total project number
River intakes	Draw water from the San Juan River	1
River pump plants	Pump San Juan River water to treatment plant	1
Treatment plants	Treat water from San Juan River and the NIIP	2
Forebay tanks	Provide water for operation of relift pumping plants	19
Pumping plants	Force water through pipelines	24
Regulating tanks	Moderate fluctuations in system pressures	5
Community storage tanks	Provide for fluctuations in the water users' demands	25
Pipelines	Transmit treated water to point of distribution	266.4 miles

A typical relift pumping plant has a forebay tank, pumps and motors within an enclosed building, an air chamber, and re-chlorination equipment. The forebay tank provides an adequate supply of water to minimize the number of times the pumps cycle on and off. The air chamber provides protection of the pumping plant and pipeline when the pumps are started and stopped. Re-chlorination equipment provides the required chlorine residual in the treated water. The turnout pumping plants have the same components as the relift pumping plants except that a storage tank replaces the forebay tank. Figure F-4 shows a schematic of the proposed project's order of operation.

San Juan Lateral Water Treatment and Pumping Plant

The San Juan Lateral water treatment and pumping plant would include seven ultrafiltration units, seven ultraviolet (UV) disinfection units, a 797,000-gallon water tank, two waste water ponds, two sediment drying beds, mixing and flocculation tanks, chemical storage buildings, an operation and maintenance (O&M) building, a four-unit

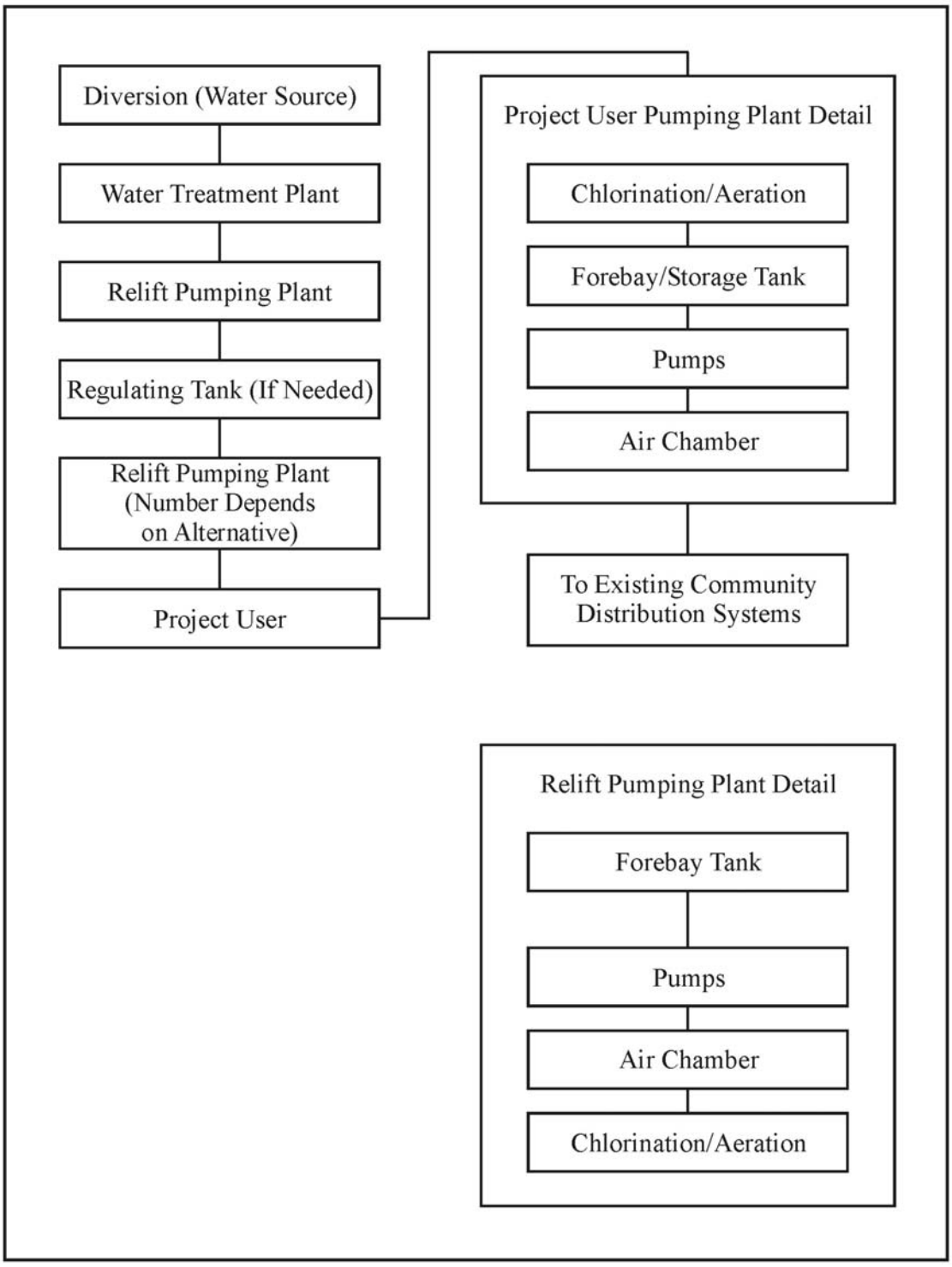

Figure F-4.—Typical schematic for the proposed project.

pumping station, and electrical control equipment. The capacity of the treatment plant would be approximately 38.25 million gallons per day (MGD) of water (59.19 cubic feet per second [cfs]).

The San Juan Lateral pumping plant would pump treated water into approximately 145 miles of buried 12- to 48-inch-diameter pipeline. From the pumping plant, the pipeline would cross the San Juan River upstream of the treatment plant and PNM diversion dam and ascend a mesa south of the river. From the mesa, the pipeline would extend west along the ROW of Navajo Highway 64 to U.S. 491. At U.S. 491, the pipeline would extend south along the highway ROW to Ya-ta-hey, New Mexico. At Ya-ta-hey, the pipeline would connect to spur waterlines extending to Window Rock and the city of Gallup. In the city of Gallup, one new pumping plant would be constructed, and three existing pumping plants, five storage tanks, and 32 miles of pipeline would be upgraded.

Seven booster pumping stations would be constructed along the San Juan Lateral. Each booster pumping station would occupy approximately 1 acre of land and would consist of a water tank, pumping plant, air chamber, chlorination building, and an electrical control structure. The San Juan Lateral would also include the construction of 17 water storage tanks, 3 water regulating tanks, junctions to the existing water supply systems, and a turnout to the NIIP and Navajo Nation chapters that do not have existing water supply systems.

The San Juan Lateral would serve the Shiprock, Burnham, Sanostee, Two Grey Hills, Newcomb, Sheep Springs, Naschitti, Tohatchi, Twin Lakes, and Mexican Springs Chapters. The Crown Point Lateral, which follows Navajo Route 9, would serve the Coyote Canyon, Standing Rock, Nahodishgish, Crown Point, Little Water, Becenti, Lake Valley, and White Rock Chapters. The Window Rock Lateral following Navajo Route 3 would serve the Rock Springs, Tsayatoh, St. Michaels, and Fort Defiance Chapters. The Gallup Junction Lateral would serve the city of Gallup and the Red Rock, Bread Springs, Chichillah, Manuelito, Church Rock, Iyanbito, Pinedale, and Mariano Lake Chapters. The proposed project would also include the construction of a new overhead electrical transmission line that parallels the San Juan Lateral pipeline and would provide power to the booster pumping stations.

The SJRPNM Alternative would also include construction of the Cutter Lateral pipeline. The Cutter Lateral would serve the Huerfano, Nageezi, Counselor, Pueblo Pintado, Ojo Encino, Toreon, and Whitehorse Chapters in the eastern portion of the proposed project area in New Mexico as well as the Jicarilla Apache Nation. The Cutter Lateral would originate at Cutter Reservoir and provide up to 4,645 AFY of water to the eastern service area. This lateral would include a water treatment and pumping plant that occupies approximately 3 to 4 acres of land. The Cutter Lateral water treatment and pumping plant would be smaller than the San Juan Lateral plant, but would contain much

of the same equipment. The plant would include three ultrafiltration units, three UV disinfection units, a 112,000-gallon subsurface pumping plant forebay, two waste water ponds, mixing and flocculation tanks, chemical storage buildings, an O&M building, a four-unit pumping station, and electrical control equipment. The capacity of the Cutter Lateral treatment plant would be approximately 5.39 MGD (8.34 cfs).

The Cutter Lateral pumping plant would pump treated water into approximately 89 miles of buried 10- to 24-inch-diameter pipeline. The Cutter Lateral would include the construction of five 1-acre booster pumping stations, three community water storage tanks, and two water regulating tanks. Similar to that of the San Juan Lateral, an overhead electrical transmission line would be constructed along the Cutter Lateral to power the booster pumping stations. A substation would also be constructed to provide power from an existing PNM transmission line to the newly constructed transmission line.

Cutter Dam and Reservoir

The Cutter Lateral would serve communities in the eastern portion of the Navajo and Jicarilla Apache Nations by delivering water from Cutter Reservoir via the outlet works (see figure F-3). Water in Cutter Reservoir comes from Navajo Reservoir through an existing intake structure and a series of tunnels and siphons that would be operated throughout the year under the proposed project. The Cutter water treatment plant would deliver treated water to a pumping plant, which would then pump the water into Cutter Lateral for transmission to the various communities.

Service to Municipal Subareas

The 2040 population of the Navajo communities (1990 population with 2.48 percent annual growth rate) was used with an average daily water demand of 160 gpcd to determine the average daily demand. Surface diversion required for the proposed project was the average demand minus the available groundwater sources in each of the subareas. Supporting information can be found in volume II, appendix A. Peak daily demand was computed by multiplying the surface diversion for the proposed project by a 1.3 peaking factor. The peaking factor was derived from a 7-day average in mid-July. Navajo Nation communities that have an existing water distribution system would have a storage tank and a method to increase (by means of a turnout pumping plant) the pressure for proper distribution. Delivery locations in the transmission line that do not have an existing water distribution system would be provided with a tee and a blind flange for future use. The proposed project would connect to approximately 31 existing Navajo Nation municipal systems and would provide a pressure of 70 pounds per square inch at those

locations. The storage capacity for each of the municipal systems was based on the individual service area 5-day demand for the year 2020 for those communities with existing water distribution systems.

The city of Gallup and Jicarilla Apache Nation surface diversion requirements are 7,500 and 1,200 AFY, respectively, for all years in the proposed project. An independent analysis (volume II, appendix B) conducted by the city of Gallup identifies the system requirements for the city and the surrounding Navajo communities served by the Gallup Regional System. No storage is provided for the Jicarilla Apache Nation.

WATER TREATMENT CONSIDERATIONS

Water Quality

Water from the Navajo Indian Irrigation Project

The water source for the Cutter Reservoir diversion is Navajo Reservoir. The water quality parameters, shown in table F-4, indicate that the only treatment requirements are filtration and disinfection as required under the Surface Water Treatment Rule (SWTR), which is part of the Safe Drinking Water Act (SDWA). Further sampling and analysis would be required before final design and construction to verify that the data presented in table F-4 are correct, especially during low- and high-precipitation years.

Table F-4.—Water quality (NIIP source water)

Parameter	Average[1]	Design range	Secondary maximum contaminant level (MCL)[2]
Electrical conductivity (umhos/cm)	195	205-187	
pH	7.72	7.75 – 7.71	
Temperature (degrees Fahrenheit)	46.7	49.1 – 45.3	
Turbidity (NTU)[3]	2.6	3.16 – 1.47	
Total suspended solids (mg/L)[4]	1.15	1.3 – 1	
Total dissolved solids (mg/L)	154	181 – 140	500
Sulfates, SO_4 (mg/L)	32.5	38.2 – 2.29	250
Total organic carbon (mg/L)	4.47	8 – 2.29	
Chlorides (mg/L)	1.6	1.9 – 1.2	250

[1] Data from three samples collected from the Cutter diversion April 2000 to June 2000.
[2] Secondary standards for MCLs are established by the Environmental Protection Agency for control of aesthetic qualities relating to public acceptance and include contaminants that may affect taste, color, odor, and appearance.
[3] Nestler Turbidity Units.
[4] Milligrams per liter.