

4.18 Cumulative Effects

This section assesses the cumulative impact of the project-specific impacts of the alternatives analyzed together with past, present, and reasonably foreseeable projects. Although project-specific impacts may be minor, when taken together with past, present, and reasonably foreseeable impacts of other projects the impacts may be cumulatively major. The CEQ regulations for implementing the procedural provisions of NEPA define cumulative impacts as those impacts “on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508.7).

Past projects are typically accounted for as part of the existing, or “baseline,” environment, although in some cases specific past projects may be identified (CEQ 2005). In general, the environmental analysis required under NEPA is forward-looking, in that it focuses on the potential impacts of the proposed action that an agency is considering. This analysis includes past actions as the existing environment, and includes site-specific information regarding past action in the vicinity of the FCPP and the Navajo Mine. FCPP and Navajo Mine are considered as the cumulative effect of 25 years of continued operations.

The CEQ developed a guidance document, *Considering Cumulative Effects under the National Policy Act* (CEQ 1997), and the EPA augmented this guidance in 1999 with *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (EPA 1999). Neither document offers a checklist for conducting a cumulative impact analysis, but they provide significant guidance to such an analysis. This cumulative impact analysis follows these two guidance documents to the extent applicable.

Both guidance documents stress the importance of scoping to the cumulative impact analysis section. In this analysis, public scoping comments identified issues and projects to be considered. The scoping process was enhanced by conducting extensive public agency scoping among the cooperating agencies. Comments received during the scoping period helped to establish the geographic scope, the time frame for each action and the analysis, and other actions and projects that may affect the resources of concern. This enhanced scoping effort produced the list of projects to be considered in the cumulative impact assessment.

The specific geographic scale of the cumulative impact analyses depends upon the resource under consideration. In general, the ROI for cumulative impacts differs for the specific resource under consideration. For example, for water quality, the appropriate scale is the watershed; for air quality, the appropriate scale is the airshed; for socioeconomics, the appropriate scale is the affected Tribal trust lands, county, and state.

The type of impact for each project under consideration is also central to the analysis. To be considered for cumulative impacts, the other projects must have effects on the environment, and those effects must be of a similar type to that for the proposed action and alternatives. By its nature, a cumulative impact assessment evaluates effects that may be individually minor, but cumulatively major. However, the integration of contributing incremental and multi-media effects is discussed within each resource category. Criteria for assessing if a cumulative impact is minor, moderate, or major, each analysis relies upon the threshold or significance criteria provided in the resource analyses in Sections 4.1 through Section 4.17.

Finally, the time period of the analysis and the timing of impacts of individual projects control cumulative impacts. The time period of the analysis for cumulative impacts includes the proposed lease period (to 2041) and the reclamation period for the Pinabete SMCRA Permit Area of the Navajo Mine. For the timing of impacts of individual projects, the life cycle of a project is the key factor; for example, a simple life cycle could be construction, followed by operations, followed by termination activities. For each element of the life cycle, the impacts may differ in type and intensity. The cumulative impact analysis must recognize the temporal variation in the effects of individual projects prior to quantifying the integrated impacts.

4.18.1 Criteria for Project Selection

Considering the CEQ guidance, an initial list of projects, and actions, and existing facilities in the Four Corners region was developed. This list was augmented during scoping and with input from the Cooperating agencies. The list was refined based on the geographic scope, temporal scale, and type of impact that may occur, compared to the Proposed Action and alternatives.

The projects/actions presented in Table 4.18-1 and Figure 4.18-1 meet both the temporal and spatial criteria to be considered in the cumulative analysis. A project would meet the temporal criteria if that action has already occurred, is ongoing, or is “reasonably foreseeable” within the timeframe of the analysis (2041, plus the reclamation period for the Pinabete SMCRA Permit Area). Reasonably foreseeable projects are those that are funded for future implementation, have all relevant permits and approvals, or are included in firm near-term plans that would be implemented during the timeframe of the Proposed Action. Since the Proposed Action would extend operations of the FCPP and Navajo Mine and Pinabete SMCRA Permit Area through 2041, the list includes all reasonably foreseeable projects that have the potential to be executed within this long-term time frame. Types of actions with firm near-term plans include:

- Actions for which NEPA documents are in preparation or finalized;
- Actions in a detailed design or planning phase;
- Actions listed in formal Notices of Intent published in the Federal Register or State publication clearinghouses;
- Actions for which enabling legislation has been passed or a Memorandum of Understanding has been signed; and,
- Actions that have been submitted to Federal and State regulators to begin the permitting process (i.e., land use/ROW applications).

Projects and actions that meet the long-term criteria for inclusion in the cumulative effects analysis include all existing projects, projects with near-term plans, as stated above, and projects that have plans to operate at any time during the timeframe of the Proposed Action.

A project would meet the spatial criteria if that action could have an environmental effect in same ROI as the Proposed Action. Considering that environmental impacts are manifested in various ways depending on the resource category, the cumulative study area for each resource was developed specifically for that resource’s potential ROI. For example, air emissions can travel long distances, whereas noise would travel shorter distances.

4.18.2 Projects Considered in the Cumulative Effects Analysis

After a review of existing and proposed projects in the relative vicinity of the FCPP and Navajo Mine, the following types of projects could have environmental consequences that are similar to the Proposed Action, and therefore have the potential for cumulative impacts:

1. Energy Generation and Transmission Projects
2. Oil and Gas Projects
3. Mining Projects
4. Transportation Projects
5. Water-Related Projects
6. Other Development Projects

Table 4.18-1 provides a comprehensive list of these project types in the vicinity of the proposed Project and includes a brief description of each project. The table also provides a rationale for why each project is either carried forward or excluded from the cumulative effects analysis.

Table 4.18-1 Projects Considered in the Cumulative Effects Analysis

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Energy Generation and Transmission Projects				
San Juan Generating Station	Existing	San Juan Generating Station is operated by PNM and consists of four coal-fired, pressurized units that generate about 1,800 gross megawatts of electricity. San Juan Generating Station went online in 1973. It is the seventh-largest coal-fired generating station in the west, and is PNM's primary generation source, serving 58 percent of the power needs of PNM customers. The regional haze provision of the CAA requires the San Juan Generating Station to reduce NO _x emissions by September 2016 through the installation of BART. The New Mexico Regional Haze SIP, which was approved by EPA in May 2014, requires San Juan Generating Station to install Selective Non-Catalytic Reduction controls on Units 1 and 4 by Final EPA approval or January 31, 2016, and shut down the remaining Units 2 and 3 in 2017. These measures are expected to significantly reduce NO _x (62 percent), SO ₂ (67 percent), PM (50 percent), CO (44 percent), GHG (50 percent), VOC (50 percent), and Mercury (50 percent).	About 15 miles northwest of Farmington, New Mexico	This is an existing generating station, and compliance with BART would occur within the same timeframe as the Proposed Action and alternatives. Therefore, for the purposes of this cumulative effects analysis, the facility as in compliance with BART is considered in the cumulative effects analysis.
Navajo Generating Station	Existing	Navajo Generating Station is a coal-fired power plant with a capacity of 2,250 MW from three 750-MW units. Navajo Generating Station serves electric customers in Arizona, Nevada, and California. It began producing commercial power in 1974. The power plant is served by coal mined at Peabody's Kayenta mining operations (see below under Mining), which is located 50 miles to the east of Navajo Generating Station and hauled by the Black Mesa and Lake Powell Railroad. Salt River Project and Peabody have submitted applications to the BOR, OSMRE, BIA, and	About 5 miles east of Page, Arizona	This is an existing generating station. For the purposes of this cumulative analysis, this project is assumed to continue operations through 2044.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		<p>other agencies to continue operations of the power plant and mine through 2044. The Navajo Generating Station applicants have also agreed to terms with the Navajo Nation to amend the existing Navajo Generating Station lease to include the Moenkopi switchyard (not substation) and a transmission line running from the switchyard to the Reservation boundary. The Navajo Generating Station applicants have filed Section 323 ROW grant requests to BIA for review. If the approvals are not granted, the power plant would shut down in 2019 and the Section 323 grants would not be authorized.</p>		
Escalante Generating Station	Existing	<p>Escalante Generating Station, located in Prewitt, New Mexico, is a single-unit, 250 MW, coal-fired power plant, constructed in 1984. Escalante Generating Station is owned and operated by Tri-State Generation & Transmission Association, a cooperative. Western Fuels Association purchases coal from the Lee Ranch Mine and operates the Escalante-Western Railway to transport it to the Escalante Generating Station. Western Fuels Association provided 1.1 million tons of coal in 2005.</p>	Prewitt, New Mexico, 27 miles northwest of Grants, New Mexico	<p>This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.</p>
Centennial West Clean Line	Proposed	<p>The Centennial West Clean Line transmission line is proposed to transmit 3,500 MW of renewable energy from New Mexico and Arizona to California. Although the transmission route has not yet been determined, it is anticipated that 900 miles of high-voltage direct current overhead line will be constructed. In January 2011, Clean Line submitted an application for ROW across Federal lands to the BLM. Although a Notice of Intent for NEPA analysis has not been published yet, BLM and Western Area Power Authority have been selected as co-lead agencies for the NEPA process. Construction is planned for 2015-2018.</p>	Undetermined location in Arizona and New Mexico	<p>The project location and details are not yet defined; therefore, even though an application has been submitted to agencies to begin the permitting process, the project may be denied or significantly modified. Any evaluation of the project would be entirely speculative. Therefore, this project is not considered further in this cumulative effects analysis.</p>

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Animas/Bloomfield Power Plant	Existing	Animas/Bloomfield Power Plant is a 51 MW cogeneration and natural gas power plant, owned and operated by the City of Farmington.	Bloomfield, New Mexico	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Desert Rock Energy Project	Suspended	In 2006, Sithe Global Power, LCC (Sithe Global) proposed to construct a hybrid dry-cooled, coal-fired, 1,500-MW electrical power generating plant approximately 30 miles southwest of Farmington, New Mexico, on the Navajo Indian Reservation. Sithe Global developed the project with the Diné Power Authority, an enterprise of the Navajo Nation. A Draft EIS was prepared in June 2007. No Final EIS or Agency Decision has been released. In 2012, the President of the Navajo Nation submitted a letter to the BIA requesting the project remain active and indicated that the Nation plans to propose a new alternative at an undetermined future date. The details of the new alternative are unknown. Until this new information is received, this project is considered suspended.	Approximately 30 miles southwest of Farmington, New Mexico	Although the President of the Navajo Nation requested that BIA retain this project as an open application, there have been no details or even concepts of the new alternative to be proposed by the Navajo Nation and Sithe. Accordingly, any analysis of this project would be entirely speculative. Therefore, this project is not considered further in this cumulative effects analysis.
EPE Sale of FCPP Interest to APS	Proposed	At the end of 2013, EPE and APS filed an 8-K Form with the Federal Securities & Exchange Commission that seeks approval for the sale/transfer of EPE's 7 percent stake in FCPP to APS. EPE did not enter into the Coal Supply Agreement executed between the FCPP co-owners and NTEC and intends to exit FCPP ownership entirely.	FCPP, near Fruitland, New Mexico	This is a pending transaction that may occur after the RODs are issued for this project. However, this action has a formal document in place and meets the criteria as reasonably foreseeable. Therefore, this action is considered in this cumulative effects analysis.
NTEC as an FCPP Ownership Party	Possible	EPE is selling its 7 percent ownership stake in FCPP and per the Coal Supply Agreement between APS and NTEC, NTEC has first right of refusal on purchasing this interest. It is possible that NTEC becomes an ownership party in FCPP.	FCPP, near Fruitland, New Mexico	This scenario exists as a possibility, but APS does not expect any sort of possible transaction until after the RODs are published for this environmental review. There are no formal applications or business agreements to reference to determine if this action is reasonably foreseeable. Therefore, this possibility

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
				is considered speculative and not considered further in this cumulative analysis.
Comanche Generating Stations	Existing	Comanche Generating Station is a cogeneration 1,410 MW power plant owned by Xcel Energy. Two of the power plant's units were constructed in the 1970s. Unit 3 was approved in 2004, constructed in 2005, and became operational in 2010.	Pueblo, Colorado	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Navajo Transmission Project	Proposed	The Navajo Transmission Project, proposed by the Diné Power Authority (an enterprise of the Navajo Nation), would involve the construction of 470 miles of 500 kV alternating current transmission lines. The line would connect the Four Corners area to the Las Vegas area, with an interconnection point north of Flagstaff to allow access to the metropolitan Phoenix market. Navajo Transmission Project received a ROD and Grant of ROWs from the BLM for Segments I and II on September 29, 2008. BIA issued a similar ROD for the Navajo Nation tribal trust lands in Segments I and II on October 8, 2008. However, both RODs have been rescinded. The project is currently on hold.	New Mexico, Arizona, Nevada	Although an EIS was prepared for this project, both records of decision have been rescinded and it is uncertain of the timeline of any future decisions by BIA or BLM; therefore, this project is not considered further in this cumulative effects analysis.
New Mexico Gas Co. Transmission Line Extension Project	Proposed	Gas services would be canceled for residents in rural San Juan County. New Mexico Gas Co. announced that it can extend transmission lines to the majority of those losing service. The New Mexico Public Regulation Commission held a public meeting in Farmington in May 2012. At the public meeting, various options were discussed to ensure that rural residents maintain power, but no conclusions were reached. No formal plans are publically available. The transmission line extension project would result in a rate increase and is subject to Public Regulation Commission approval.	San Juan County, New Mexico	This project does not meet the criteria for a "reasonably foreseeable" project and is therefore not considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Ute Mountain Ute Power Generation Facility	Proposed	The Ute Mountain power generation facility would include new coal-bed methane and oil and gas wells. The Ute Mountain Indian Tribe has filed a water rights claim with the Eleventh Judicial District Court and is currently adjudicating water rights claims on the San Juan River. The tribe claimed between 7,300 and 9,300 acre-feet of water. It is unknown when a decision regarding water rights will be made.	San Juan Basin, Colorado	This project does not meet the criteria for a “reasonably foreseeable” project and is therefore not considered in the cumulative effects analysis.
Milagro Power Plant	Existing	The Milagro power plant is a natural gas power plant that consists of two 61 MW units and is owned and operated by William Field Services. The first 61 MW unit was installed in 1981 and the second was installed in 1996.	Bloomfield, New Mexico	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Cimarron Solar Facility	Existing	The Cimarron Solar Facility is a large-scale solar photovoltaic plant located in Colfax County, New Mexico. It is owned by Southern Power and has a 30-MW capacity. Electricity generated by the plant serves a 25-year power purchase agreement with Tri-State Generation and Transmission Association and serves consumers across Colorado, Nebraska, New Mexico, and Wyoming.	Colfax County, New Mexico	This is an existing solar facility with a purchase agreement in place that extends to 2035. This facility is considered in the cumulative effects analysis.
Algodones Solar Facility	Existing	The Algodones Solar Facility is a 25-KW solar generating station operated and owned by PNM. Through its customer-owned solar photovoltaic program, PNM purchases renewable energy certificates from participating customers at a rate of 13 cents every time their interconnected solar PV systems generate a KW-hour of electricity. There are currently 59 customers enrolled in the program, for a combined capacity of 113 KW (AC) of solar energy.	Algodones, New Mexico	This facility is located outside of the spatial scope of the cumulative impacts analysis and is therefore not considered.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Coronado Generating Station	Existing	The Coronado generating station is a coal-fired power plant owned and operated by Salt River Project. It consists of two units that together produce 773 MW. Unit 1 was constructed in 1979 and the second unit was constructed in 1980.	Apache County, Arizona	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Springerville Generating Station	Existing	The Springerville generating station is a coal-fired power plant owned and operated by Salt River Project. It consists of four units. The first two units each produce 380 MW and were installed in 1985 and 1990, respectively. The third and fourth units each produce 400 MW and were installed in 2006 and 2009, respectively.	Apache County, Arizona	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Fountain Valley Power Plant	Existing	The Fountain Valley Facility is a 240-MW simple cycle, natural gas-fired, peaking facility.	El Paso County, Colorado	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Front Range Power Plant	Existing	The Front Range Power Plant is a 480 MW combined cycle, air-cooled condenser plant that consists of two General Electric 7FA combustion turbines, two Vogt-NEM three pressure heat recovery steam generators and one Alstom steam turbine. Operations began in 2003.	El Paso County, Colorado	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Martin Drake Generating Station	Existing	The Martin Drake Generating Station is a coal-fired power plant owned and operated by the City of Colorado Springs. It consists of three units with a total capacity of 257 MW. The units were installed in 1962, 1968, and 1974.	El Paso County, Colorado	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Nucla Generating Station	Existing	Nucla Generating Station is a coal-fired power plant owned and operated by Tri-State Generation and Transmission. It consists of four units, three 12 MW units, and one 79 MW unit, for a total capacity of 114 MW. The 12 MW units were all installed in 1959 and the 79 MW unit was installed in 1991.	Montrose County, Colorado	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Bluffview Power Plant	Existing	The Bluffview Power Plant consists of a single natural gas turbine that produces a total of 60 MW.	San Juan County, New Mexico	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Delta-Person Generating Project	Existing	Established in 2000, the Delta-Person Generating Station is owned and operated by Delta Power LLC and John Hancock Insurance. The facility consists of a single natural gas turbine that produces 132 MW.	Bernalillo County, New Mexico	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Reeves Generating Project	Existing	Established in 1958, the Reeves Generating Station is owned and operated by PNM and consists of three natural gas turbines that produce a total of 154 MW.	Bernalillo County, New Mexico	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
Valencia Power Plant	Existing	Established in 2007, the Valencia Power Plant is owned by Southwest Generation and consists of two natural gas turbines that produce a total of 319 MW.	Valencia County, New Mexico	This is an existing generating station that would operate during the life of the proposed lease amendment. Therefore, this facility is considered in the cumulative effects analysis.
San Juan Basin Energy Connect Project	Proposed	Tri-State Generation & Transmission Association is proposing to construct a 245-kV transmission line from the Shiprock substation located near Waterflow, New Mexico to the Iron Horse substation located near Ignacio, Colorado. The proposed transmission corridor is approximately 65 miles. The purpose of the project is to reinforce energy transmission in the San Juan Basin. An EIS is currently being prepared for this project, and the BLM is serving as the lead Federal agency. Tri-State is requesting ROW grants from the BLM and the BIA. The BLM initiated scoping in October 2009 for the proposed EA. Scoping revealed that an EIS would be more appropriate, so additional scoping meetings for the EIS were held in March 2011. The Draft EIS was published March 2014. Construction is planned to commence in 2015, and the	Waterflow, New Mexico to Ignacio, Colorado	This project meets the criteria for consideration in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		transmission line is scheduled to be operational by early 2017.		
Energy Utility Corridor Planning	Planned	The final programmatic EIS to designate energy corridors in 11 western states was published in 2008 by an interagency project management team (Department of Energy, BLM, USFS, and Department of Defense) to identify energy utility corridors for the implementation of Section 368 of the Energy Policy Act of 2005 (designation of West-wide energy corridors). The ROD was published in January 2009. Only one new energy corridor in San Juan County was analyzed in the study – 80-273 – running north-south from San Juan National Forest in Colorado, through the southern Ute Reservation, and into San Juan County, New Mexico, terminating at approximately Zia Pueblo, New Mexico.	Various locations throughout the western U.S.	This project meets the criteria for consideration in the cumulative effects analysis.
Sunshine Wind Project (Hopi)	Planned	The Hopi Tribal Council and the Coconino County Planning & Zoning Department approved the project. The proposed Sunshine Wind Park in eastern Coconino County is the most fully developed and market-ready wind project in Arizona. Approximately 40 wind turbines would be installed and provide 60 megawatts of generating capacity. The wind park was targeted for development in 2007, and turbines would be sited on a combination of Hopi private fee lands and private ranch lands (Bar-T-Bar Ranch and other private lands); however, the project was delayed due to purchase issues with APS, a viewshed lawsuit by a nearby landowner, and rising costs of materials.	35 miles east of Flagstaff near the Meteor Crater exit along I-40	Although project implementation has been delayed, it is foreseeable that the project would be implemented during the timeframe of the proposed project. Therefore, this project meets the criteria for consideration in the cumulative effects analysis.
Other FCPP Transmission Lines (not included in Proposed Action)	Existing	PNM operates the FCPP to Pillar/Ambrosi transmission line, a 230-kV line that spans 102 miles. The ROW for this line was approved in 2012. In addition, two other transmission lines transmit power generated by the FCPP; the FCPP to Shiprock 345-kV	Extending to the northwest and southeast from the FCPP	These are existing transmission lines that would be operational during the timeframe of the Proposed Action and alternatives and therefore are considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		line operated by the Western Area Power Association, which runs 6.1 miles to Shiprock and PacifiCorp's 345-KV line, which runs 30.6 miles to the northwest. The easement for the power of the Western Area Power Association line on Navajo Nation tribal trust land expires in 2019. The remaining portion of this transmission line, as well as all of the PacifiCorp line, is within a perpetual ROW.		
<i>Oil and Gas Projects</i>				
Western Oil & Gas Proposed Drilling	Planned	Western Oil and Gas has proposed approximately 600 natural gas wells in eastern Burnham Chapter extending north into Upper Fruitland and Nenahnezad/San Juan Chapters. The installation of each well would require well pads (approximately 50 by 50 feet each) and construction areas, in addition to access roads, pipelines, or distribution power lines as needed (for productive wells). The BIA will perform NEPA review on this project.	NAPI area, Navajo Reservation, New Mexico	This project meets the criteria for consideration in the cumulative effects analysis.
Oil & Gas Development on BLM Lands - Farmington Field Office	Planned	The Resource Management Plan for the lands managed by the BLM Farmington Office includes development of 9,942 new oil and gas wells from 2003 and 2023 in the San Juan Basin, allowing for about 16,100 acres of long-term disturbance.	San Juan County, New Mexico	This project meets the criteria for consideration in the cumulative effects analysis.
Oil and Gas Development - Tres Rios Field Office	Planned	According to the Final EIS on the San Juan Land and Resource Management Plan (2013), approximately 1.65 million acres of USFS- and BLM-managed land, as well as an additional 0.91 million acres of private land, in the San Juan Basin would be made available to oil and gas leases during the project period. A Final EIS analyzing impacts was released September 2013. The Final EIS states that approximately 2,900 new wells may be drilled within all jurisdictions in the planning area over the next 15 years. A ROD has not yet been published.	Tres Rios Field Office La Plata and Montezuma Counties, Colorado	This project meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
San Juan Refinery, Bloomfield	Existing	Giant owns and operates the Bloomfield oil and gas refinery, located on 285 acres near Farmington, New Mexico. The total approximate refining capacity of the refinery is 16,600 barrels per day. A locally produced, high-quality crude known as Four Corners Sweet is the primary feedstock, although the supply is supplemented, as necessary, with other feedstocks from within and outside the Four Corners area. Crude oil supply to the refinery comes primarily from the Four Corners area and is either collected by Giant's pipeline network or delivered by truck transports to pipeline injection points and/or refinery tankage.	Bloomfield, New Mexico	This is an existing facility that would operate during the timeframe of the proposed project and is therefore considered in this cumulative effects analysis.
San Juan River Gas Plant	Existing	<p>The San Juan River gas plant is a natural gas treatment plant owned by Western Gas Resources and located near Fruitland, New Mexico. The San Juan River Gas Plant consists of several units; a purification plant, a natural gasoline plant, a compressor station, and a dehydration unit.</p> <p>The gas plant facility includes compression, amine gas treating, liquids stabilization, Claus sulfur recovery plant, dehydration, and a cryogenic liquid recovery plant. The plant produces a lean, dry residue gas stream, a mixed natural gas liquid stream and a liquid sulfur stream. The liquid products contain ethane, propane, butanes, pentanes and heavier components. The plant handles regulated flammables such as ethane, propane, mixed butanes and mixed pentanes. The plant uses an amine process to remove carbon dioxide and hydrogen sulfide but does not contain threshold quantities of any materials classified as toxic.</p>	Located about 10 miles west of Farmington, New Mexico	This is an existing facility that would operate during the timeframe of the proposed project and is therefore considered in this cumulative effects analysis.
Transwestern Pipeline Company's Phoenix Expansion Project	Existing	Construction has been completed on the Phoenix Expansion Project, which expands the Transwestern Pipeline Company's natural	San Juan County, New Mexico	This is an existing pipeline and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		gas pipeline system by approximately 260 miles from its mainline in Yavapai, County, Arizona to delivery points in the Phoenix metropolitan area market. As part of the overall project, Transwestern built approximately 25 miles of pipeline I parallel to its existing San Juan Lateral, in San Juan County (Federal Energy Regulatory Commission 2006). The pipeline is currently in service. The San Juan Lateral extends from San Juan County, New Mexico, to connect with Transwestern's mainline in McKinley County, New Mexico, and is located approximately 15 miles or further from the study area.		
Oil and Gas Development (BLM Farmington Office)	Planned	The ROD for the Farmington Final EIS indicates the potential development of 9,942 new oil and gas wells on lands managed by the BLM Farmington Office.	San Juan, McKinley, and Rio Arriba Counties, New Mexico	This project meets the criteria for consideration in this cumulative effects analysis.
Southern Ute Indian Tribe Development of Fruitland Coal Bed Methane	Planned	Current basin-wide Fruitland coalbed spacing allows one gas well per 320 acres. Infill applications for specific areas have been approved by the Colorado Oil and Gas Cooperation Commission, allowing an optional second Fruitland coal bed gas well on each 320-acre spacing unit. Infill drilling within 320-acre spacing units is currently occurring and may be a future trend basin-wide. If oil and gas operators and regulators continue to see sufficient economic merit and legal justification to perpetuate the current trend of drilling optional infill wells on existing 320 acre spacing units, 1000 additional infill Fruitland coal bed methane wells (350 north of the Ute Indian Reservation) could be drilled in the Colorado portion of the San Juan Basin.	San Juan Basin, Colorado	Approval of infill applications that would allow additional wells meets the criteria for consideration in this cumulative effects analysis.
Mid-America Pipeline	Existing	BLM approved a proposed natural gas liquids pipeline project in 2005 and granted ROWs and temporary use permits for 12 pipeline sections that were constructed by the Mid-	Passes through San Juan County, New Mexico (to pass through Huerfano, New Mexico, 30 miles east	This is an existing pipeline and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		America Pipeline Company. Parallel sections of pipeline total 202 miles along an 840-mile route between Granger and Wamsutter areas in Wyoming, and Hobbs, New Mexico. The pipelines are 8 to 16 inches in diameter, buried, steel, and carry natural gas liquids. Existing ancillary facilities, including pump stations, were expanded to have more capacity.	of the project site)	
Ciniza Refinery	Existing	Giant owns and operates the Ciniza refinery. The total approximate refining capacity of the refinery is 26,000 barrels per day. A locally produced, high-quality crude known as Four Corners Sweet is the primary feedstock. Crude oil supply to the refinery comes primarily from the Four Corners area and is either collected by Giant's pipeline network or delivered by truck.	Near Gallup, New Mexico	This is an existing refinery and meets the criteria for consideration in this cumulative effects analysis.
Mining				
San Juan Coal Company, San Juan Mine	Existing	This is an active underground mine and is the exclusive supplier of coal to the San Juan Generating Station. Surface mining at San Juan reached a depth in the early 2000s that represented an economic limit, but underground mining is feasible and the coal supply contract with San Juan Generating Station extends through 2017. It is expected that the contract will be renewed for 25 years in 2017.	15 miles west of Farmington, New Mexico	This is an existing mine and would be operational during the early timeframe of the proposed project. No application has yet been submitted for a SMCRA permit renewal for the San Juan Mine. Therefore, operations beyond 2017 are speculative, but the existing operations are accounted for as part of the existing environment.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
<p>Kayenta Mine Complex Permit Revision (Peabody Western Coal Company)</p>	<p>Existing</p>	<p>The Kayenta Mine Complex permit area is located on about 44,073 acres of land leased within the boundaries of the Hopi Tribe and Navajo Nation tribal trust lands in northern Arizona, about 15 miles south of the town of Kayenta, in Navajo County. The Kayenta Mine Complex operation has historically produced about 8.2 million tons of coal per year. If Navajo Generating Station is reduced to two operating units, as specified in the EPA Bart determination, Kayenta Mine Complex will only need to deliver 5.5 million tpy to Navajo Generating Station. The coal is delivered by electric railroad 78 miles northwest to the Navajo Generating Station near Page, in northern Coconino County, Arizona. Peabody Western Coal Company has submitted a permit revision application to OSMRE, proposing modifications to the life of mine plan for the Kayenta Mine Complex. The permit revision would approve a revised life of mine plan that addresses all of the leased tons and reserves under the existing permit, would incorporate the existing support facilities under a single permit, and would abandon future plans to mine coal reserves in the area that was previously operated as the Black Mesa Mine. Approval of the proposed permit revision application would not change the mining methods or average annual production rate of the Kayenta Mine.</p>	<p>Kayenta Mine Complex is located on land within the boundaries of the Hopi and Navajo Nation tribal trust lands in northern Arizona, near the town of Kayenta, in Navajo County (about 125 miles northeast of Flagstaff, Arizona).</p>	<p>This is an existing mine. For the purposes of this cumulative analysis, we consider the proposal to continue operations through 2044.</p>
<p>El Segundo Mine</p>	<p>Existing</p>	<p>The El Segundo Coal Mine opened in 2008 and is owned and operated by Peabody Energy. The mine shipped 8.4 million tons of coal in 2012 and is considered highly productive due to a low overburden ratio. The mine occupies two sub-watersheds, separated by the continental divide, and ultimately drains into the Chaco River.</p>	<p>The El Segundo Mine is located approximately 70 miles southeast from the southern boundary of the Navajo Mine.</p>	<p>This is an existing mine and meets the criteria for consideration in this cumulative effects analysis.</p>

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
San Juan Coal Company La Plata Mine	Past	From 1986 through 2002, the La Plata mine also supplied coal to the San Juan Generating Station. The mine ceased operation in 2002 and reclamation continued through 2005.	State Highway 170, La Plata, San Juan County, New Mexico	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
McKinley Mine (Pittsburgh and Midway Company)	Past	McKinley Mine is located between Gallup, New Mexico and Window Rock, Arizona and was owned and operated by the Pittsburgh and Midway Company. The mine closed in 2009. Initial reclamation activities began in 1980 and are in the final phases of completion.	Navajo Reservation, Four Corners area	This is a past project and is considered in the cumulative effects analysis of this project.
Chimney Rock Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1976 to 1985. The final bond release was issued in 2005.	Approximately 30 miles due east of Durango, Colorado, near the Piedra River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Coal Gulch Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1978 to 1998. The final bond release was issued in 2010.	Approximately 5 miles southwest of Durango, Colorado.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Carbon Junction Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1983 to 1990. Reclamation was completed in 2008, but the final bond release has not yet been issued.	Approximately 15 miles southwest of Durango, Colorado.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Peacock Mine	Past	OSMRE issued a SMCRA permit for this historic underground coal mine that no longer operates. Mining activities were conducted from 1905 to 1981. Reclamation was completed in 1996, but the final bond release has not yet been issued.	Approximately 18 miles southwest of Durango, Colorado, near the San Juan Arroyo.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
National King Coal Mine	Existing	OSMRE issued a SMCRA permit for this active underground mine. Mining activities were initiated in 1941 and are ongoing.	Approximately 20 miles southwest of Durango, Colorado.	This is an existing mining operation and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Blue Flame Mine	Past	OSMRE issued a SMCRA permit for this historic underground coal mine that no longer operates. Mining activities were conducted from 1950 to 1991. The final bond release was issued in 2008.	Approximately 1 mile east of Cameo, Colorado.	This is a past project and is beyond the potential area of effect and is not considered in the cumulative impact analysis.
Burnham Mine	Existing	OSMRE issued a non-permanent program SMCRA permit for this past surface coal mine. Mining activities were conducted from 1980 to 1984. This mine area is currently under reclamation and the final bond release has not been issued.	Approximately 1 mile southwest of Burnham, New Mexico, near the Chaco River	This is an existing mining operation and meets the criteria for consideration in this cumulative effects analysis.
Black Diamond Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1983 to 1993. The final bond release was issued in 2007.	Approximately 10 miles north of Farmington, New Mexico, near the La Plata River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
De-Na-Zin Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1980 to 1992. The final bond release was issued in 2003.	Approximately 5 miles south of Burnham, New Mexico, near the Chaco River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
Gateway Mine	Past	OSMRE issued a SMCRA permit for this historic surface coal mine that no longer operates. Mining activities were conducted from 1982 to 1990. The final bond release was issued in 2004.	Approximately 10 miles southeast of Burnham, New Mexico, near the Chaco River.	This is a past project and is considered in the cumulative effects analysis as part of the existing environment.
San Juan Mine	Existing	OSMRE issued a SMCRA permit for this active surface and underground coal mine. Surface mining operations were initiated in 1973 and underground mining was initiated in 2000. Mining operations are ongoing.	Approximately 8 miles west of Farmington, New Mexico, near the San Juan River.	This is an existing mining operation and meets the criteria for consideration in this cumulative effects analysis.
BAR-D In-stream Gravel Mine	Existing	The BAR-D in-stream gravel mine extracts sand and gravel from the Animas River by means of a "vortex bar." The developers also engineered the neighboring floodplains with flood/erosion control measures. Operations commenced in 2009 and are ongoing. The USACE issued a 404 permit for this project.	Animas Valley, La Plata County, Colorado	This is an ongoing mine project and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Kayenta Mine Complex	Part Existing/Part Past, Suspended, Proposed	This Project includes mining operations at the Kayenta and Black Mesa mines. Black Mesa mine provided coal to the Mohave Generating Station in Laughlin, Nevada. Operation of the Black Mesa mine, however, was abandoned at the end of 2005 and the Mohave Generation Station dismantled/demolished from 2009-2012. The project also included Black Mesa Pipeline's proposed operation and reclamation plan for the Coal Slurry Preparation Plant at the Black Mesa mine, the reconstruction of Black Mesa Pipeline's 273-mile long Coal Slurry Pipeline across northern Arizona to Laughlin, and the project water supply (see Black Mesa Project, project water supply). With the operation now in shutdown, the coal slurry pipeline is being abandoned.	Mining operations south of Kayenta, Arizona. Other components to south of Leupp, Arizona, and to Laughlin, Nevada.	This project is currently suspended and it is unknown if, and when, it may be implemented. Therefore, this project is not considered further in this cumulative effects analysis.
Transportation				
Improvements to U.S. Highway 160	Existing	Highway improvements on U.S. Highway 160 from Durango to Bayfield are currently ongoing, although the project has just begun. Improvements include resurfacing and installing additional safety features. Construction was initiated in 2011 and is slated for completion by 2014-2015.	From Durango to Bayfield, Colorado	Construction of the proposed project would be completed prior to the proposed project timeline but the operational changes to the highway would occur within the timeframe; therefore, these are considered in the cumulative effects analysis.
Gallup-to-Farmington Freight Rail Line	Planned	BNSF, shippers, the Navajo Nation, and economic development agencies in northwest New Mexico are considering building a potential rail line to provide freight service. This rail line is considered a long-term project, if determined feasible, and construction for this freight line would be at least a decade away.	Gallup to Farmington, New Mexico	The feasibility of this project is still being determined and construction would not occur for at least ten years. Therefore, this rail line is considered speculative and does not meet the criteria for consideration in the cumulative analysis.
Improvements to U.S. Highway 491	Planned	Highway improvements have been planned for U.S. Highway 491 and include widening the existing 2-lane highway to 4 lanes. The new roadway is being constructed on the eastern side of the existing roadway and would be fully contained within the existing ROW (FHWA et	U.S. Highway 491, 10 miles south of Shiprock, New Mexico to Sheep Springs, New Mexico	Ongoing construction activities would occur within the timeframe of the proposed project; therefore, this project meets the criteria for consideration in the cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		al. 2006). This project underwent NEPA review, and a FONSI was issued in 2007. Improvements to U.S. Highway 491 were initiated in 2007 and are currently ongoing.		
Water				
Animas – La Plata Project	Existing	<p>Implementation of the Colorado Ute Settlement Act Amendments of 2000. The project is being built to fulfill the water rights settlement of the Ute Mountain Ute Tribe and the Southern Ute Indian Tribe. Fulfillment of the settlement obligations, one of which is completing the Animas-La Plata Project, would provide non-Indian water users in southwest Colorado certainty regarding their continued use of water. Storage would largely be reserved for Indian water users, but nearly 33 percent of the storage in Lake Nighthorse would be for use by non-Indian entities in the Four Corners region. Seven entities would benefit: 1) Southern Ute Indian Tribe, 2) Ute Mountain Ute Tribe, 3) Animas-La Plata Water Conservancy District, 4) State of Colorado, 5) Navajo Nation, 6) San Juan Water Commission, and 7) La Plata Conservancy District.</p> <p>The Navajo Municipal Pipeline, sometimes referred to as the Farmington to Shiprock Pipeline, was authorized under the Animas-La Plata Project. Construction of the pipeline was completed in 2012. The filling of Lake Nighthorse reservoir was initiated in 2010 and completed in 2011.</p>	Approximately 3 miles southwest of downtown Durango, Colorado.	This is an ongoing project and is considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Durango Pumping Plant (tied to the Animas – La Plata Project)	Existing	The Durango Pumping Plant was proposed as part of the Animas – La Plata Project and the water settlement with the Ute Mountain Ute Tribe and the Southern Ute Indian Tribe. These tribes have water rights that date back to 1868. Under the settlement, the BOR’s obligations, one of which is completing the Animas-La Plata Project, will provide non-Indian water users in southwest Colorado certainty regarding their continued use of water. The Durango Pumping Plant lifts water from the Animas River up through the Ridges Basin Inlet Conduit into Lake Nighthorse. Lake Nighthorse impounds approximately 120,000 acre-feet of water and includes an inactive pool of approximately 30,000 acre-feet for recreational, fishery, and water quality purposes. The pumping plant is located about 200 feet from the river and includes an intake structure, a service yard, eight pumps of various sizes, and a surge chamber. Construction was initiated in 2003 and completed in 2011.	Just south of downtown Durango, Colorado across from Santa Rita Park	This is an existing pumping plant and is considered in this cumulative effects analysis.
Navajo Water Settlement Agreement	Existing	On April 19, 2005, the State of New Mexico and the Navajo Nation signed the Navajo Settlement Agreement (Navajo Nation - State of New Mexico, 2005). The Navajo Nation President, New Mexico State Governor, and Secretary of the Interior signed the settlement agreement in December 2010. It will resolve the claims of the Navajo Nation to the use of waters of the San Juan basin in New Mexico. The Navajo Settlement Agreement is intended to provide water rights and associated water development projects, including the proposed project, for the benefit of the Navajo Nation in exchange for a release of claims to water that potentially might otherwise displace existing non-Navajo water uses in the basin in New Mexico. Additional NEPA compliance may be needed to implement other portions of the	Navajo Reservation, New Mexico	This is an existing settlement agreement and is considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		agreement (Fruitland-Cambridge, Hogback-Cudei, conjunctive use groundwater wells, and others).		
Enlargement of Stevens Reservoir	Existing	The Stevens Reservoir underwent an expansion that included the construction of a dam and spillway. The purpose of the expansion was to raise the overall dam height 10 additional feet and enlarge capacity from 580 acre-feet to 1,775 acre-feet. Construction activities occurred from 2007 and 2008. The USACE continues to require mitigation to offset approximately 40 acres of waters of the US impacts.	Near Pagosa Springs, Archuleta County, Colorado	This is an existing reservoir expansion project and the USACE continues to implement mitigation measures, so it is considered in this cumulative effects analysis.
Long Hollow Reservoir Development	Existing	The Long Hollow Project will create a 5,400 acre-foot reservoir to store winter runoff and floodwater that will be used to accommodate New Mexico's water right to the La Plata River. Construction for this project was initiated in July 2011 and is scheduled for completion in spring 2013. This new reservoir will result in approximately 3 miles of stream impacts and approximately 3 acres of wetland impacts. The USACE is requiring mitigation for permitted impacts.	Near Red Mesa, Colorado, approximately 3 miles north of New Mexico State Line	This is an ongoing reservoir development project that would operate during the life the proposed project and is considered in this cumulative effects analysis.
Jicarilla Apache Nation Navajo River Water Supply Project	Existing	This project involves the BOR approving a subcontract between the Jicarilla Apache Nation and the city of Santa Fe. Under the subcontract, the Jicarilla Apache Nation would make available for delivery to the city of Santa Fe at the outlet works of Heron Dam up to 3,000 acre-feet per year of the Jicarilla Apache Nation's San Juan-Chama Project water. The term of the subcontract would be limited to 50 years beginning in 2007. Santa Fe's development of its distribution system, located near Santa Fe, is covered by a separate EIS.	Rio Arriba and Santa Fe counties, New Mexico	This is an approved agreement and is considered in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Navajo Indian Irrigation Project (NIIP) & San Juan Irrigation Projects	Existing	Irrigation water is released at Navajo Dam through diversion headworks and travels through a series of concrete-lined open canals, membrane-lined open canals, 7 tunnels, 15 siphons, and an in-line earth channel and reservoir behind Cutter Dam. Three pumping plants lift water to concrete-lined open laterals. At full capacity, the system can carry 1,800 cubic feet per second. Two open lateral systems, totaling 40.6 miles in length, convey water to the southern and eastern parts of the development. Water is distributed to the turnouts at the individual farm units through about 340 miles of underground pipe lateral systems ranging from 6 to 84 inches in diameter.	San Juan River, New Mexico	This is an existing water project and meets the criteria for consideration in this cumulative effects analysis.
Kutz Pumping Plant	Existing	The Kutz Pumping Plant is east of New Mexico State Highway 44. It lifts water from the Main Canal to Coury Lateral, which flows southward through Block 5. Using five electric motor-driven pumps, this plant has a capacity of 200 cubic feet per second with a dynamic head of 365 feet. It was completed in 1982.	NIIP Area, San Juan County, New Mexico	This is an existing pumping plant and meets the criteria for consideration in this cumulative effects analysis.
Gallegos Pumping Plant	Existing	The Gallegos Pumping Plant is near where the Main Canal crosses Gallegos Canyon. It lifts water from the Main Canal to Burnham Lateral, Stage 1. It has eight electric motor-driven pumps and has a capacity of 880 cubic feet per second, with a total dynamic head of 337 feet. It was completed in 2000.	NIIP Area, San Juan County, New Mexico	This is an existing pumping plant and meets the criteria for consideration in this cumulative effects analysis.
Moncisco Pumping Plant	Existing	Construction of the Moncisco pumping plant began operation in 2003. It lifts water into the Burnham lateral, Stage 2, and open channel lateral, which provides water for pumping plants to irrigate Blocks 10 and 11. Current design estimates call for this pumping plan to have a total capacity of 440 cfs and a total dynamic head of 168 feet.	NIIP Area, San Juan County, New Mexico	This is an existing pumping plant and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
Navajo Dam Power Plant	Existing	Construction of the Navajo Dam was initiated in 1962 and was originally not designed for power generation. In 1983, the city of Farmington received authorization from BOR to install a 32-MW hydrological power plant and switchyard. However, a U.S. District judge ordered that construction of the Navajo Dam power plant cease. The decision cited an inadequate EIS and lack of authority to construct the plant. After conducting further environmental studies the city of Farmington successfully applied with the Federal Energy Regulatory Commission to construct a power plant at Navajo Dam for their use. The Federal Energy Regulatory Commission issued a license to the city of Farmington to construct the power plant in 1983, and the license expires in 2035.	Approximately 34 miles (45 miles upstream) east of Farmington, New Mexico	This is an existing power plant that would operate during the life of the proposed lease and meets the criteria for consideration in this cumulative effects analysis.
Hogback Diversion Dam & Irrigation Project	Existing	The BOR constructed the Hogback dam in 1971. This dam diverts water from the San Juan River and provides irrigation water to the NIIP. An annual diversion of 48,550 acre-feet, or the quantity of water necessary to supply a depletion of 21,280 acre-feet from the San Juan River, of surface water from the direct flow of the San Juan River at the diversion dam for the Hogback-Cudei Irrigation Project provides irrigation for 8,830 acres of land generally located along the north and south sides of the San Juan River. The dam diverts water (approximately 24,200 acre-feet annually) into the NIIP irrigation system during periods of low water flow. As part of the San Juan Recovery Implementation Program, fish access was restored at the site by removing the Cudei Diversion Dam at river mile 142 and fish passages were constructed at the Hogback Diversion Dam (river mile 159) in 2001. Recently in 2013, the Recovery Implementation Program also modified the diversion and canal system to include a fish	San Juan River, near Shiprock, New Mexico	This is an existing dam and meets the criteria for consideration in this cumulative effects analysis.

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		weir wall to prevent fish from becoming entrained in the canal system.		
Navajo-Gallup Water Supply Project	Existing	The BOR was authorized to construct two lateral pipelines for water delivery – the San Juan and Cutter laterals. The San Juan lateral will predominantly parallel U.S. Highway 491 and transport San Juan River water to the Navajo Nation and the Gallup area. The Cutter lateral will serve the eastern portion of the Navajo Nation and the Jicarilla Apache south and east of Highway 550. Storage tanks and re-chlorination facilities are included in the project. This project underwent NEPA review and BOR issued a ROD in September 2009. Pre-construction activities have been initiated, and the project is slated for completion in 2024.	U.S. Highway 491 and Highway 550, Navajo Reservation, New Mexico	This is an approved water supply project that has undergone NEPA review and has been initiated. Therefore, it is considered in the cumulative effects analysis.
Fruitland-Cambridge Irrigation Project	Existing	An annual diversion of 18,180 acre-feet, or the quantity of water necessary to supply a depletion of 7,970 acre-feet from the San Juan River, of surface water from the direct flow of the San Juan River at the diversion dam for the Fruitland-Cambridge Irrigation Project for irrigation of 3,335 acres of land generally located along the south side of the San Juan River.	Along the San Juan River in Fruitland, New Mexico	This is an existing water project and meets the criteria for consideration in this cumulative effects analysis
Municipal Water Development	Existing	Navajo Tribal Utility Authority public water systems and other wells serve residential and livestock purposes on the Navajo Reservation. Planned developments include Public Law 87-121 projects on the Indian Health Service's sanitation deficiency list. Many of these projects would rely on groundwater.	Navajo Reservation	This is an existing water development project and meets the criteria for consideration in this cumulative effects analysis
Navajo Reservoir Operations & San Juan River Basin Recovery Implementation Program	Existing	Navajo Dam and Reservoir is owned, operated, and maintained by the BOR. Since its original authorization in 1956, Congress has approved the use of Navajo Reservoir to fulfill a portion of the Jicarilla Settlement Act. After completion of the Navajo Unit in December 1963, the criteria for releasing water from the dam focused primarily on flood	Approximately 34 miles (45 miles upstream) east of Farmington, New Mexico	This is an existing water project that underwent NEPA review and is considered in this cumulative effects analysis

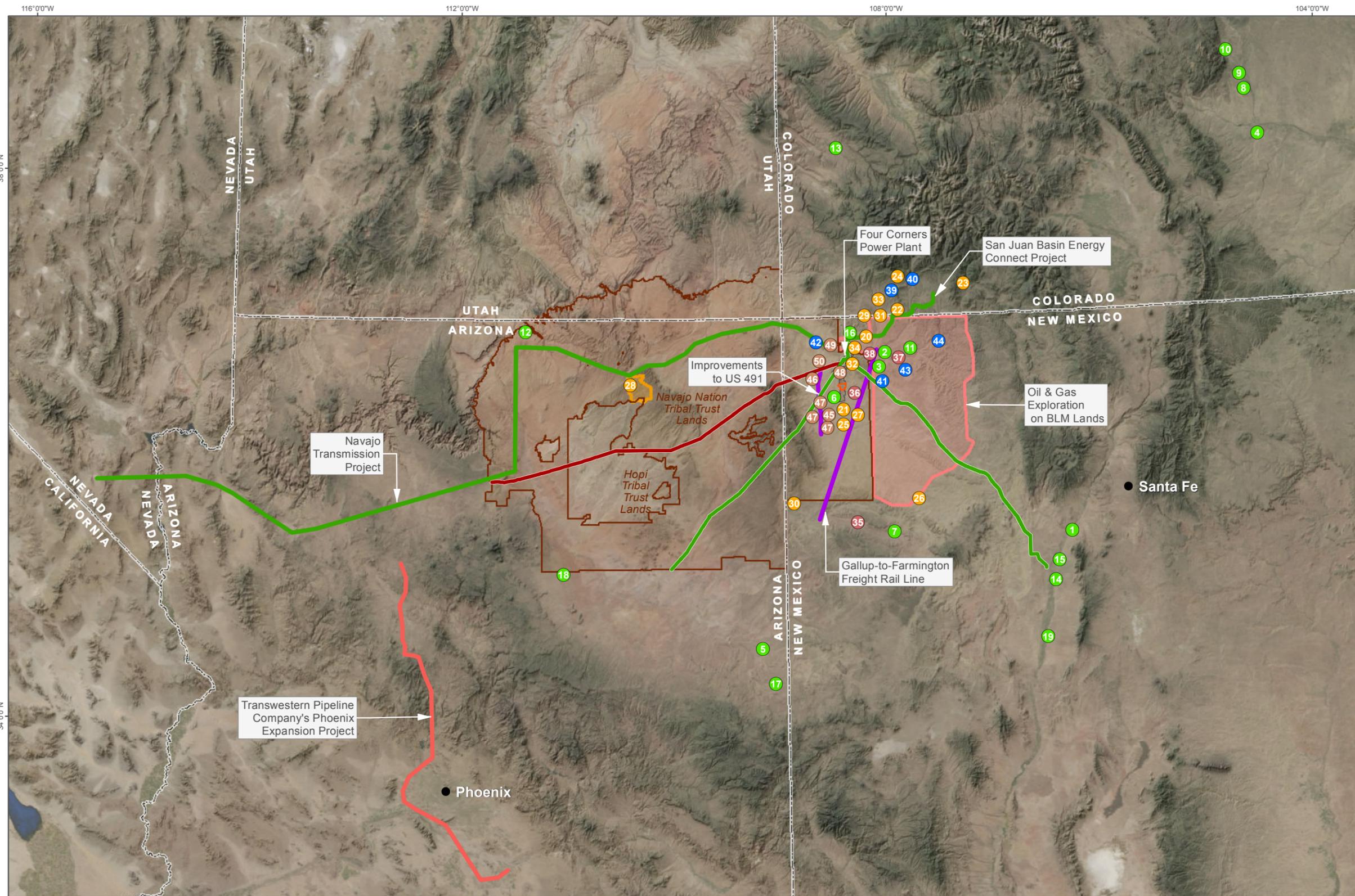
Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		control, NIIP supplies, and water storage. However, in the 1990s, the focus of the criteria and associated pattern of releasing water from the dam changed. The new focus included the needs of the endangered fish species, such as the Colorado pikeminnow and the razorback sucker, in the San Juan River. This project underwent NEPA review in 2006, for which the BOR was the lead Federal agency.		
Other Projects				
Burnham Airstrip	Past	Not in service. The Burnham Chapter community would like to see it reactivated as a regional airstrip or airport for emergency services or commercial development since it is centrally located between chapters.	Near the Burnham Chapter House	This is a past project and meets the criteria for consideration in the cumulative effects analysis.
San Juan Community-Based Land Use Plan	Planned	The San Juan Chapter Community-Based Land Use Plan (2002) identifies various Navajo trust lands in the San Juan Chapter area for grazing, recreation (i.e., nature trail from San Juan River to the San Juan Chapter house) and additional protections for an existing ceremonial burial area. These lands are located approximately 2 miles southwest of the FCPP.	Approximately 2 miles southwest of FCPP, Navajo Reservation, New Mexico	Details as to the scale and timeline for the projects described in this plan remain unclear; therefore, it would be speculative to include this project for analysis in the cumulative effects analysis.
Sanostee Prison	Existing	A prison was developed in 2013 approximately 3 miles southwest of the FCPP.	Between milepost 7 and milepost 9 of Alternative Segment B	This project was completed in 2013, prior to the release of this Draft EIS and meets the criteria for consideration in the cumulative effects analysis.
Proposed Housing (Sanostee Chapter)	Planned	The Sanostee Land Use Plan (2004) identifies a possible 100-acre housing site adjacent to the eastern side of US 491 and directly south of the proposed utility corridor/water pipeline.	U.S. Highway 491, San Juan County, New Mexico	Details as to the scale and timeline for this project remain unclear; therefore, it would be speculative to include this project for analysis in the cumulative effects analysis.
Three Springs Residential and Commercial Development	Planned and Existing	The Three Springs Project includes the development of housing, commercial space, and open-space to achieve a "traditional neighborhood." This project is comprised of five	Just east of Durango, Colorado	This is an existing residential and commercial development and meets the criteria for consideration in the cumulative effects analysis. Air quality

Project Name	Status	Project Description	Location	Rationale for Consideration or Elimination
		neighborhoods in a 620+ acre site. The USACE issued a permit for these developments with a mitigation package to offset approximately 21 acres of wetlands impacts.		and climate change are the only resource categories that include projects at this distance away.
Shiprock Airport	Existing	A Navajo Nation Primary Airport used primarily for medical emergencies and secondarily for tribal government.	Shiprock, New Mexico	This existing project meets the criteria for consideration in the cumulative effects analysis.
Proposed Housing and Commercial Development (Burnham Chapter)	Planned	The Burnham Chapter Land Use Plan (2005) identifies two areas for potential housing development. One site is located approximately a quarter mile south of the Chapter House, and the other site is approximately 2 miles west of the Chapter House on the north side of BIA Highway 5. The Land Use Plan also identifies two locations at the junction of BIA Highway 5 and BIA Road 5082 for commercial development.	1 mile from the southernmost portion of Navajo Mine	Details as to the scale and timeline for this project remain unclear. However, based on the general location and nature of the activity, it is considered in the cumulative effects analysis.

Four Corners Power Plant and Navajo Mine Energy Project

ENVIRONMENTAL SETTING & CONSEQUENCES

Figure 4.18-1
Cumulative Effects



PROJECT BOUNDARIES
 Navajo Mine Lease Area
 Proposed Pinabete SMCRA Permit Boundary

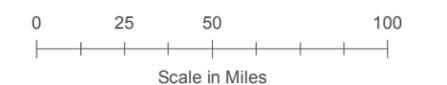
TRANSMISSION LINES
 345kV —
 500kV —

CUMULATIVE EFFECT PROJECTS
 Energy Generation & Transmission ●
 Mining ●
 Oil & Gas ●
 Water ●
 Transportation ●
 Other ●

OTHER FEATURES
 Cities ●
 State Boundary
 Tribal Land Trusts

PROJECT LOCATIONS ARE APPROXIMATE

- | | | | | |
|--|---|--|---|--|
| <p>● Energy Generation & Transmission</p> <ol style="list-style-type: none"> 1. Algodones Solar Facility 2. Animas/Bloomfield Power Plant 3. Bluffview Power Plant 4. Comanche Generating Station 5. Coronado Generating Station 6. Desert Rock Energy Project 7. Escalante Generating Station 8. Fountain Valley Power Plant 9. Front Range Power Plant 10. Martin Drake Generating Station 11. Milagro Power Plant 12. Navajo Generating Station 13. Nucla Generating Station 14. Person Generating Project 15. Reeves Generating Project 16. San Juan Generating Station 17. Springerville Generating Station 18. Sunshine Wind Project 19. Valencia Power Plant | <p>● Mining</p> <ol style="list-style-type: none"> 20. Black Diamond Mine 21. Burnham Mine 22. Carbon Junction Mine 23. Chimney Rock Mine 24. Coal Gulch Mine 25. De-Na-Zin Mine 26. El Segundo Mine 27. Gateway Mine 28. Kayenta Mine Complex 29. La Plata Mine 30. McKinley Mine 31. National King Coal Mine 32. Navajo Mine 33. Peacock Mine 34. San Juan Mine | <p>● Oil & Gas</p> <ol style="list-style-type: none"> 35. Ciniza Refinery 36. Proposed Oil & Gas Drilling 37. San Juan Refinery 38. San Juan River Gas Plant | <p>● Water</p> <ol style="list-style-type: none"> 39. Animas-La Plata Project 40. Durango Pumping Plant 41. Gallegos Pumping Station 42. Hogback Diversion Dam Project 43. Kutz Pumping Station 44. Navajo Dam Power Plant | <p>● Other</p> <ol style="list-style-type: none"> 45. Burnham Airstrip 46. Proposed Housing - Sanostee Chapter 47. Proposed Housing & Commercial Development - Burnham Chapter 48. Proposed Prison 49. San Juan Community-Based Land Use Plan 50. Shiprock Airport |
|--|---|--|---|--|



This Page Intentionally Left Blank

4.18.3 Effects Analysis

This section evaluates the cumulative effects of the Proposed Action and alternatives together with the past, present, and reasonably foreseeable effects of future projects, as described earlier in this section. The effects for different project alternatives, with the exception of No Project, are similar at this scale, and are not individually discussed.

4.18.3.1 *Air Quality*

The cumulative effects ROI for air quality is the greater Four Corners region, composed of northeastern Arizona, southwestern Colorado, Navajo Nation, and northwestern New Mexico. There are 17 other energy generation facilities occurring with the ROI (see Table 4.18-1 and Figure 4.18-1) that represent the other major emission sources in the Four Corners region and are thus the focus of this cumulative analysis. There are no generating facilities in southeastern Utah within an equivalent distance of 400 km (248 miles). Future operation of FCPP would emit SO₂, NO_x, PM₁₀, and PM_{2.5} (also VOCs and CO) and, therefore, contribute incrementally to ambient air quality deterioration, visibility impairment, and dry and wet deposition in the region.

Table 4.18-2 accumulates these regional emissions as reported to, and published by, the EPA for the 12-year period 2000 to 2011. Also included in this table is the relative percentage of FCPP's contribution to this cumulative regional emissions inventory on a year-by-year basis. Please see Section 4.1.2 and Section 4.1.4 for information on FCPP historic and future emissions; this information served as the basis for measuring FCPP's contribution to the cumulative air quality environment. As shown, FCPP historically generated about 19 percent of the electric power and emitted 15 and 18 percent of the SO₂ and CO₂, respectively, as well as 29 percent of NO_x in the Four Corners region.

Table 4.18-3 shows the estimated future regional Part 75 emissions (SO₂ and NO_x) and composite rates for the 17 power plants. These projections for 2016 through 2026 are based on the following assumptions; however, actual future occurrences may differ from predictive estimates:

- 2014: FCPP Units 1, 2, and 3 have been shut down and regional emissions are about 3 percent greater than in 2011 (based on the 95th percentile of historic rates) and improving economic conditions;
- 2014 to 2016: APS operates FCPP Units 4 and 5 at historic 84 percent annual capacity factor, and regional criteria emissions grow due to load demand growth on underutilized capacity at an annual rate of 0.75 percent calculated from historic criteria emissions data during the 7-year baseline period (the period from 2005 to 2011 when FGD became active on Units 4 and 5);
- 2017: APS installs the first SCR on Unit 4 or 5, thus reducing annual NO_x emissions by about 6,600 tons. Annual emissions are mainly from the other operating unit, which would be retrofitted the following year. Regional load demand growth continues;
- 2018: APS installs the second SCR on Unit 4 or 5, thus reducing annual NO_x emissions by about another 6,600 tons, mainly from the other operating unit, which was retrofitted in the prior year. Regional load demand growth continues;
- 2019: APS operates Units 4 and 5 at the historic 84 percent annual capacity factor, thus reducing annual NO_x emissions by an additional 6,600 tons from pre-Project levels since both retrofitted units would be operating full-time with lowered NO_x emissions. Total average annual NO_x reduction is about 19,800 tons in future years compared to typical pre-Project levels. Regional load demand growth continues; and

Table 4.18-2 Historic Cumulative Contribution of FCPP (Pre-2014)

Year	Historic Cumulative Generation and Emissions (17 Plants including FCPP) Generation MW-hrs/yr	Historic Cumulative Generation and Emissions (17 Plants including FCPP) Sulfur Dioxide tons/yr	Historic Cumulative Generation and Emissions (17 Plants including FCPP) Sulfur Dioxide kg/MW-hr	Historic Cumulative Generation and Emissions (17 Plants including FCPP) Nitrogen Oxides tons/yr	Historic Cumulative Generation and Emissions (17 Plants including FCPP) Nitrogen Oxides kg/MW-hr	FCPP Contribution Generation Percent	FCPP Contribution SO ₂ percent	FCPP Contribution NO _x percent
2000	79,878,600	153,800	1.75	171,700	1.95	20%	25%	27%
2001	79,286,300	152,500	1.74	166,700	1.91	21%	26%	28%
2002	78,170,000	140,000	1.62	163,200	1.89	19%	23%	25%
2003	79,909,400	135,800	1.54	160,600	1.82	21%	26%	28%
2004	82,383,400	115,400	1.27	156,100	1.72	20%	18%	26%
2005	83,957,500	100,900	1.09	156,100	1.69	20%	13%	27%
2006	86,062,900	98,300	1.04	158,200	1.67	20%	15%	28%
2007	86,819,100	100,500	1.05	154,700	1.62	18%	10%	27%
2008	84,752,100	84,700	0.91	145,400	1.56	19%	12%	28%
2009	84,175,600	62,300	0.67	133,000	1.43	20%	20%	32%
2010	86,325,900	56,100	0.59	119,200	1.25	17%	20%	33%
2011	87,944,900	53,700	0.55	116,200	1.20	17%	22%	33%
Historic Average	85,719,700	79,500	0.84	140,400	1.49	19%	15%	27%

Source: EPA 2012h.

Notes:

For 17 regional electric power producers in geographic New Mexico, Arizona, and Colorado.

Aggregated values rounded to nearest 100 short tons or metric tons.

1 short ton = 2,000 lbs.

1 metric tonne = 1,000 kg or 2,204.6 lbs.

Baseline period is 2005-11 (same as FCPP)

Table 4.18-3 Future Contribution of FCPP to Cumulative Emissions (Post-2014)

Year	Historic Future Cumulative Generation and Emissions (17 Plants Including FCPP) Generation MW-hrs/yr	Historic Future Cumulative Generation and Emissions (17 Plants Including FCPP) Sulfur Dioxide tons/yr	Historic Future Cumulative Generation and Emissions (17 Plants Including FCPP) Sulfur Dioxide kg/MW-hr	Historic Future Cumulative Generation and Emissions (17 Plants Including FCPP) Nitrogen Oxides tons/yr	Historic Future Cumulative Generation and Emissions (17 Plants Including FCPP) Nitrogen Oxides kg/MW-hr	FCPP Contribution Generation Percent	FCPP Contribution SO ₂ percent	FCPP Contribution NO _x percent
2014	90,385,600	55,200	0.55	119,400	1.20	14%	18%	23%
2015	91,101,000	55,600	0.55	120,300	1.20	14%	18%	23%
2016	91,822,100	56,000	0.55	121,300	1.20	14%	18%	22%
2017	92,548,900	56,400	0.55	115,700	1.13	13%	17%	17%
2018	93,281,500	56,800	0.55	110,000	1.07	13%	17%	11%
2019	94,019,900	57,200	0.55	104,300	1.01	13%	17%	5%
2020	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2021	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2022	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2023	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2024	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2025	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%
2026	94,764,100	57,700	0.55	105,100	1.01	13%	17%	5%

Source: EPA 2012h, 2012i (final rule).

Notes:

Projected emissions for years 2027 through 2041 same as year 2026 (flat extrapolation assumed).

For 17 regional electric power producers in geographic New Mexico, Arizona, and Colorado.

Aggregated values rounded to nearest 100 short tons or metric tonnes.

1 short ton = 2,000 lbs.

1 metric tonne = 1,000 kg or 2,204.6 lbs.

- 2020 and beyond: Regional load demand growth is assumed to “top out” at about 5 percent above the historic 95th percentile, which represents a “mature” system, notwithstanding construction of new regional generating capacity in the future. Projected annual emissions for years 2027 through 2041 are assumed to be the same as year 2026 (i.e., flat extrapolation).

As shown in Table 4.18-2, FCPP emissions would comprise about 17 percent of regional SO₂ emissions and about 5 percent of NO_x emissions from electric power generation beginning in 2019, when SCR would be fully operational on Units 4 and 5. Projected percentages for years 2027 through 2041 are assumed to be the same as year 2026 (i.e., flat extrapolation).

The Four Corners area is in attainment for criteria pollutants. In addition, the FCPP will comply with EPA’s BART determination to further improve the air quality of the region. Therefore, the cumulative impacts of air quality are moderate and no further mitigation is required.

4.18.3.2 Climate Change

The CEQ considers climate change an inherently cumulative issue (CEQ 2010). In accordance with this directive and the 2014 guidance on climate change, this analysis revisits much of the information provided in Section 4.2, but broadens the scope to discuss how the global effects of climate change could affect the Four Corners Region, while ensuring that the impacts analysis is performed on a regional and local scale.

Over the past 30 years, changes in the U.S. climate have included an increase in average temperature, an increase in the proportion of heavy precipitation events, changes in snow cover, and an increase in sea level (Climate Change Science Program 2008). Climate change can exacerbate stresses on ecosystems through high temperatures, reduced water availability, and altered frequency of extreme precipitation events and severe storms (Climate Change Science Program 2008). However, in certain settings, climate change can also ameliorate stresses on ecosystems through warmer springs, longer growing seasons and related increased productivity (Climate Change Science Program 2008).

Anticipated impacts from climate change in North America applicable to the regions crossed by the proposed Project include:

- Stream temperatures are likely to increase and are likely to have effects on aquatic ecosystems and water quality; and,
- Proliferation of exotic grasses and increased temperatures are likely to cause an increase in fire frequency in arid lands.

Decreased streamflow, increased water removal, and competition from non-native species are likely to adversely affect river ecosystems in arid lands (Climate Change Science Program 2008). There are no established Federal or state thresholds for determining the significance of GHG emissions; however, this assessment of the direct and indirect contributions of the proposed Project to global GHG emissions was conducted in accordance with CEQ draft guidance for GHG (CEQ 2010). This guidance established the draft criteria for purposes of NEPA analysis of 25,000 metric tpy for CO_{2e}. The FCPP is estimated to emit approximately 10 million tpy for the life of the project. There is a general scientific consensus that the cumulative effects of GHG have influenced the ambient environment on a global scale, which is considered a major cumulative impact.

The ROI for cumulative climate change impacts includes northeastern Arizona, southwestern Colorado, Navajo Nation, and northwestern New Mexico. As discussed in Section 4.2, FCPP and Navajo Mine both emit GHGs and, therefore, contribute incrementally to climate change; however, these emissions comprise approximately 0.6 percent of the U.S. GHG inventory and the national electric power sector. Please see Section 4.2.2, Section 4.2.3, and Tables 4.2-2 – 4.2-10 for information on FCPP GHG emissions when compared to the other GHG generation sources in the Four Corners region. This information served as the basis for assessing the incremental cumulative effect of the Project’s contribution to climate change. Mobile

source emissions from the Navajo Mine Pinabete SMCRA Permit Areas although quantifiable, are relatively small compared to future power plant emissions; therefore, this discussion focuses on the contribution of FCPP to regional climate change impacts. While all projects in Table 4.18-1 would contribute some GHG emissions, the major producers of GHG emissions within this study area are the 17 power plants, as such, the amount of power produced directly relates to the amount of GHG emitted. Table 4.18-4 shows the relative contribution of future FCPP emissions to regional GHG emissions.

As part of APS's compliance with EPA's BART rule, the amount of energy generated, and therefore, the amount of GHG emitted, from FCPP was substantially reduced (26 percent) as a result of the shut-down of Units 1, 2, and 3. Although not a part of the Proposed Action or alternatives, FCPP compliance with the BART rule will lead to a reduction in cumulative GHG emissions.

Table 4.18-4 Relative Regional Contribution of FCPP GHG Emissions (Future 2014 to 2041)

Year	Percent of Regional Electrical Power Generation	Percent of Regional CO ₂ e Emissions
2014	13.7%	12.7%
2015	13.6%	12.6%
2016	13.5%	12.5%
2017	13.4%	12.4%
2018	13.3%	12.3%
2019	13.2%	12.2%
2020	13.1%	12.2%
2021	13.1%	12.2%
2022	13.1%	12.2%
2023	13.1%	12.2%
2024	13.1%	12.2%
2025	13.1%	12.2%
2026	13.1%	12.2%
2027	13.1%	12.2%
2028	13.1%	12.2%
2029	13.1%	12.2%
2030	13.1%	12.2%
2031	13.1%	12.2%
2032	13.1%	12.2%
2033	13.1%	12.2%
2034	13.1%	12.2%
2035	13.1%	12.2%
2036	13.1%	12.2%
2037	13.1%	12.2%
2038	13.1%	12.2%
2039	13.1%	12.2%
2040	13.1%	12.2%
2041	13.1%	12.2%

Sources: EPA 2012b, d, f.

Notes:

For 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico.
2014-41 estimated values.
CO₂e = carbon dioxide equivalents.

4.18.3.3 Earth Resources

Geology and Soils

Although effects on geology and soils would stem from all existing and proposed earth-disturbing activities in the Four Corners region through the year 2041, these impacts are site-specific and would not occur on a regional level. Potential impacts such as erosion, landslides, or topsoil loss caused by activities in the Navajo Mine and Pinabete SMCRA Permit Areas or at FCPP are concentrated in the lease area for both of these facilities and would not contribute cumulatively to the impacts caused by construction or mining activities at other locations within the Four Corners region. Erosion caused by operations in the Navajo Mine and Pinabete SMCRA Permit Areas could increase sedimentation and turbidity levels in adjacent arroyos, which discharge to the San Juan River. Potential erosion at other mines and construction sites in the vicinity also could affect water quality of the San Juan watershed, as discussed in Section 4.3 and Section 4.5. However, all mines and construction projects would be required to implement erosion control measures as part of their SMCRA permit and General Construction NPDES permit. Therefore, the cumulative effect of minor erosion at all sites would be minor because the conditions of these permits would prevent long-term adverse impacts. There would be negligible long-term cumulative impact on topography because the SMCRA permit would require all mines in the area to reclaim affected areas to the approximate original contours following mining.

Paleontological Resources

The cumulative effects ROI for paleontological resources is the Navajo Nation and Hopi tribal trust lands. As discussed in Section 4.3, past surveys have recorded the presence of paleontological resources in this area, including dozens of known sites within the Navajo Mine and Pinabete SMCRA Permit Areas. The Proposed Action would directly impact known paleontological resources due to ground-disturbing activities (i.e., excavation, construction). The other reasonably foreseeable future projects that propose similar ground-disturbing activities on the Navajo Nation tribal trust lands include 1) San Juan Basin Energy Connect Project, 2) Western Oil and Gas Drilling Project, and 3) Improvements to U.S. Highway 491. An adverse cumulative effect would occur if these other projects damage or destroy additional paleontological resources on the Navajo or Hopi tribal trust lands. However, the effects of the Project Action and alternatives would be minimized by implementation of conditions that would be developed as part of the SMCRA permit, and the three future projects would require environmental review and the likely development of similar mitigation measures and/or permit conditions intended to minimize the potential for adverse impacts on paleontological resources. Therefore, while there is the potential for cumulative impacts from the disturbance or destruction of paleontological resources, mitigation measures would likely minimize effects on these resources.

4.18.3.4 Archaeological/Cultural Resources

The cumulative effects ROI for archaeology and cultural resources is the APE as defined in Section 4.4, which is within the traditional use areas for the Navajo Nation and Hopi Tribe. The reasonably foreseeable future actions within this ROI that include ground-distributing activities include the Western Oil and Gas project, oil and gas development on BLM lands, and improvements to U.S. Highway 491. The ROI contains numerous historic properties and cultural resources. As demonstrated on Figure 4.4-1 and in Section 4.4, much of the proposed Pinabete SMCRA Permit Area is designated a TCP. Please also see Section 4.4.3, Section 4.4.4, and Tables 4.4-2 – 4.4-6 for information on historic and potential future effects to cultural resources as result of FCPP and Navajo Mine operations. As stated in Section 4.4.4, OSMRE is consulting with the Navajo Nation THPO on determinations of eligibility for 20 resources and Project effects for historical properties within the APE. These potential Project effects served as the basis for assessing cumulative effects in the Four Corners region and on tribal trust lands.

Due to the ground-disturbing activities proposed by the alternatives, historic properties, including properties of religious and/or cultural significance (i.e., TCPs) that are eligible for the NRHP, may be

damaged or destroyed. Disturbance to these resources from Project activities would be limited primarily through avoidance and through mitigation where avoidance is not achievable. The avoidance techniques and mitigation measures prescribed in the Programmatic Agreements significantly lessen the potential to permanently lose or damage an identified resource. In the event that a resource would be impacted, a mitigation plan would be implemented, including but not limited to, data recovery and other forms of formal documentation and curation. The mitigation measures included in the Programmatic Agreements serve to preserve the legacy and quality of the subject artifact or physical resource. However, the cultural resources lost during Project activities would contribute to the regional loss of these resources. Mitigation measures can minimize the significance of resource degradation and destruction, but the loss or damage to cultural resources from Project activities allows for a potential cumulative effect if other projects in the ROI also disturb cultural resources. While it is likely that the future projects would avoid or mitigate known cultural resources to the degree practicable as required by Section 106 of the NHPA, a cumulative effect would occur if another project in the ROI:

- Damages or destroys historic properties that cannot be avoided;
- Introduces visual or audible elements that would diminish the integrity of a historic property's significant historic features;
- Changes the character of the historic property's use; or,
- Changes the physical features within a historic property's setting that contribute to its significance.

If traditional use areas are affected (i.e., grazing lands lost/relocation) by another project, there is potential for a cumulative cultural effect to the Navajo and Hopi people. Historical use is a key component of preserving TCPs. If another project proposed within the ROI would adversely affect other traditional use areas, there is the potential that a cumulative effect to the historical legacy use of the area. Furthermore, the loss of traditional use areas and/or practices can have lasting psychological effects on indigenous people through the permanent alteration of a way-of-life. Even if tribal members live a great distance from the area, there is a spiritual identification connection to the tribal practices that have been performed in memoriam.

4.18.3.5 Water Resources/Hydrology

The scope for the water resources/hydrology cumulative impact analysis includes both groundwater resources and surface water resources. The cumulative effects ROI for groundwater is the area of the San Juan Basin within 1,000 feet of the Navajo Mine and the FCPP ash disposal areas. This limit on the ROI is based on the permeability of the formations beneath the project sites and the velocity of groundwater flow, as described in detail in Section 4.5.

Please see Section 4.5.4 for a discussion of potential project-related effects that were taken into account for assessing cumulative effects. The cumulative effects ROI for surface water includes the San Juan River watershed, extending approximately 300 km to the north-northwest of the FCPP and Navajo Mine, which accounts for the potential area of emissions deposition from the FCPP. Past projects are accounted for in this analysis as part of the affected environment. All existing and reasonably foreseeable projects listed in Table 4.18-1 are considered in the cumulative effects analysis for water resources.

Groundwater

Potential cumulative impacts to groundwater quantity would occur if multiple projects required the extraction of groundwater resources, thereby over-drawing aquifer resources or if potential surface and sub-surface releases from the Proposed Action or alternatives in combination with other projects considered caused an impairment of groundwater quality. As described in Section 4.5.4, the FCPP does not require the use of groundwater in order to continue operations. FCPP has installed extraction wells in

areas of known seepage in the ash disposal area and monitoring data does show a decline in groundwater level. Continued operation of these extraction wells would therefore contribute to cumulative impacts to groundwater quantity; however any contributions are considered minor based on the anticipated extraction rates.

Past, current, and proposed mining at the Navajo Mine has resulted, is resulting, and is expected to result in a local drawdown of groundwater levels in the Fruitland Formation and in the underlying PCS. However, described in Section 4.5, the effects of drawdown would be negligible because there are no potable water wells completed in the Fruitland Formation and the PCS that could be impacted and these units are not capable of providing a sustainable water supply (BNCC 2011a). The potential exists for other ground-disturbing projects proposed within the Navajo Nation, as well as continued operation of NAPI lands in the areas surrounding the Navajo Mine to require dewatering or groundwater extraction; however, the contribution of activities at the Navajo Mine SMCRA Permit and Pinabete SMCRA Permit Areas to contribute to this cumulative effect would be negligible because NTEC conducts contemporaneous reclamation concurrent with ongoing mining.

Further, although produced water extraction from existing coal bed methane operations to the east of the Navajo Mine and the reasonably foreseeable coal bed methane development project in the eastern Burnham Chapter would likely occur during the same timeframe as the proposed Project, these activities are not expected to overlap or have a cumulative effect with respect to drawdown within the Navajo Mine Lease Area due to the low permeability and limited produced water extraction from these deeper coal beds.

With regard to groundwater quality, as described in Section 4.5, minimal effects to groundwater quality are anticipated as a result of mining operations and reclamation activities in the Navajo Mine and Pinabete SMCRA Permit Areas. TDS concentrations in the alluvial groundwater flow in Cottonwood Arroyo may increase due to the contribution to the alluvial groundwater from backfill water and from irrigation return flows from full expansion of NAPI irrigation within the headwaters of Cottonwood Arroyo. NAPI irrigation return flows can leach salts from badlands upgradient of mining and from overburden materials across the Navajo Mine Lease Area. Increasing TDS and sulfate concentrations have been observed in the alluvial groundwater in Chinde Arroyo due to the NAPI irrigation water return flows as well as discharges to Chaco River from Morgan Lake, operated by the FCPP. The discharge from Morgan Lake appears to have resulted in perennial flow in the Chaco River downstream of the discharge point and has apparent increases in TDS and sulfate in the alluvium downgradient of the discharge point. As noted by Myers and Villanueva (1986), the increased concentrations may be related to rising groundwater encountering sediments previously enriched with soluble salts. Both Myers and Villanueva (1986) and Thorn (1993) show a general increase in TDS and sulfate concentrations in the downstream direction in the alluvium of the Chaco River; although Thorn (1993) shows the water quality as quite variable.

Similar increases in TDS and sulfate may be expected to occur in the Cottonwood alluvium, although the TDS and sulfate concentrations will be lower than in the Chinde alluvium due to the coarser grained nature of the alluvium in Cottonwood Arroyo. Any increase in TDS concentrations in the alluvium of the Chaco River would be limited by the low groundwater flow in the alluvium from Cottonwood and Pinabete Arroyos, and Brimhall Wash (BNCC 2011a). Furthermore, the timing of the effects on the flow and water quality within the alluvium of Chaco River to any changes in the alluvial groundwater in each of the tributaries will be different, which functions to minimize cumulative effects.

Other than discharges from Morgan Lake listed above, continued operation of FCPP would have a negligible cumulative effect on groundwater quality. The potential exists for operation of the ash disposal area at FCPP to adversely affect groundwater quality through the leaching of materials. However, an analysis of groundwater quality data found no statistically significant correlation between monitoring locations (proximity to ash ponds) and water quality results. Further, in areas of known historic seepage, groundwater remediation activities are underway. Therefore, while adverse cumulative effects to

groundwater quality could result from the combined impacts of the projects considered in this analysis, the contribution of the Proposed Action would be minimal.

Surface Water

Potential cumulative effects to surface water resources would result if the Proposed Action would contribute to a regional impairment of surface water quality. Contributions to cumulative impacts on surface waters are expected from mining and reclamation activities in the Navajo Mine and Pinabete SMCRA Permit Areas, the NAPI, FCPP operations, and various regional San Juan River water projects, as well as other reasonably foreseeable future projects that propose similar ground-disturbing activities on the tribal trust lands of the Navajo Nation, including 1) San Juan Basin Energy Connect Project, 2) Western Oil and Gas Drilling Project, and 3) Improvements to U.S. Highway 491. Similar to the Proposed Action and alternatives, each of these projects would need to comply with the Clean Water Act and implementation of a SWPPP, Erosion Control Management Plan, which include BMPs to reduce potential impacts to water quality during ground-disturbing activities. Mining activities do not contribute substantially to surface water quality impacts due to extensive regulation under SMCRA and the CWA's NPDES program. Under the NPDES program, BNCC has installed 29 downgradient retention ponds, in Areas III and IV North, to avoid and reduce impacts on surface water quality as part of the water management plan to capture or divert surface flows around active mining areas. There are not likely to be any long-term surface water impacts following bond release for reclamation of areas disturbed by mining within the Navajo Mine SMCRA Permit Area or the Pinabete SMCRA Permit Area. Any cumulative impacts would be related to short-term sedimentation or flow changes, associated with land disturbance. Because the Proposed Action would have a negligible impact to downstream surface water quality, the cumulative impact, when added to other projects anticipated to involve ground disturbance (listed above), would also be minor.

Other than impacts associated with sedimentation and flow, surface water quality impacts are associated with deposition of metals and particulate matter emitted from the FCPP. Although modeling and ecological risk assessments for the proposed Project found that the depositional area of emissions from the FCPP is less than 50 km, 16 other power plants are located in the ROI. The cumulative deposition of metals caused by emissions from the FCPP in combination with the 16 other power plants in the region could result in potentially major impacts to water quality. As discussed in Section 4.1, mercury and selenium deposition as a result of the FCPP is expected to decrease over the Project period and therefore, the FCPP contribution to potential cumulative impacts to surface water quality would also decrease proportionally over time. Therefore, while this is considered a potentially major, long-term cumulative impact, no additional mitigation measures are proposed to further reduce the FCPP contribution beyond what will occur as a result of compliance with the EPA BART Rule.

4.18.3.6 Vegetation

The cumulative effects ROI for vegetation encompasses the Navajo Nation tribal trust lands. The continued operation of the FCPP and Navajo Mine would result in a maximum 6,622 acres of future disturbance, which serves as the basis for assessing cumulative effects. The proposed new DFADAs at FCPP would permanently disturb 1,052 acres and activities in the Navajo Mine and Pinabete SMCRA Permit Areas would disturb up to 5,570 acres. The vast majority of the disturbance at Navajo Mine would eventually be reclaimed using native seed mixes and reclaimed to support wildlife habitat and grazing uses. Please see Sections 4.6.3 and 4.6.4 for information on Project-specific effects. Air dispersion modeling in support of the ERAs defined a 50-km area that may be impacted by the deposition of future FCPP emissions. This area is referred to in ERAs as the Deposition Area.

Resource extraction and development activities that would remove native vegetation within the Navajo Nation could result in cumulatively major impacts to native vegetation types and associated habitat functions, seed variability, and biological activity and nutrient content in the soil. Potential projects considered in the cumulative effects analysis that would occur on the Navajo Nation and involve ground disturbance and vegetation removal include proposed oil and gas drilling by Western Oil and Gas, the San

Juan Basin Energy Connect Project, all other mining projects within the Navajo Nation, improvements to U.S. Highway 491, the Animas-La Plata project, and the Navajo-Gallup Water Supply Project.

As shown in Table 4.18-5, implementation of all these projects would result in the removal of at least 6,622 acres of vegetation and habitat area. The Proposed Action would result in substantial long-term impacts to vegetation on the Navajo Mine Lease Area that would be reclaimed following mining and, therefore, not contribute to any permanent cumulative effects. The Proposed Action would also result in minor permanent impacts at the FCPP Lease Area with removal of vegetation for the DFADA expansion project in the area of the proposed borrow pits. In comparison to all other projects listed, the Proposed Action would represent the majority of the total expected cumulative disturbance on tribal trust lands.

Similar to the Navajo Mine, all other mining activities on the Navajo Nation would require a SMCRA permit and would have to implement reclamation activities at the end of the mining operation. Similarly, impacts of the Animas-La Plata project would be offset through compensatory mitigation. It is unknown if other development projects proposed on the Navajo Nation would be required to mitigate for impacts to vegetation and habitat area. However, the land area to be disturbed by these other projects is minimal compared to the size of the Navajo Nation, and the total amount of open space. Therefore, cumulative impacts to vegetation are considered minor.

For future FCPP emissions, the deposition of COPECs within the Deposition Area was shown to have a negligible impact, with all plant HQs resulting from FCPP emissions well below 1 for all COPECs, and that these emissions would not contribute appreciably to those risks that are already present under baseline conditions, or cause the concentrations of any COPECs currently below levels of concern to increase to a level of concern. Over the life of the project, sources other than the FCPP and Navajo Mine Energy Project would be expected to contribute COPECs to the local environment. Other local sources of COPECs include other power plants within the region, as well as industrial and municipal discharge, runoff and emissions, vehicle emissions, and agriculture. These other sources would be expected to increase the levels of some COPECs above those anticipated to occur from future FCPP operations and baseline conditions, but these increases have not been quantified.

Table 4.18-5 Cumulative Areas of Vegetation Removal on Navajo Nation through the Project Period

Project	Affected Vegetation
FCPP	1,052 acres
Pinabete SMCRA Permit Area	4,104 acres
Oil and Gas Drilling	Approximately 35 acres permanent disturbance for well pads, unknown disturbance for additional infrastructure
San Juan Basin Energy Connect Project	Intermittent disturbance along 65 miles for transmission towers and vegetation management throughout the entire ROW
Improvements to US 491	275-320 acres permanent removal (source FHWA et al. 2006)
Animas-La Plata Project	202 acres permanent removal, mitigated by purchase of 2,900 acres of equivalent habitat area (source BOR 2002)
Navajo-Gallup Water Supply Project	62.1 acres permanently removed, 31,686 acres of temporary disturbance (source BOR 2009)

4.18.3.7 Wildlife and Habitats

The cumulative effects study area for wildlife includes each species' natural range in the vicinity of the FCPP and Navajo Mine Lease Area. As described in Section 4.7, the Proposed Action would result in short-term disturbance (e.g., increased noise, vegetation removal, human presence) to wildlife habitat during mining operations, construction, and operational activities associated with the ash disposal areas at FCPP, and inspection and maintenance activities associated with the transmission line ROWs. Wildlife is expected to return to the mined areas once reclamation is complete. Wildlife habitat removal at the FCPP would occur until decommissioning activities return the landscape to close to pre-project conditions. The total area of disturbance at FCPP is approximately 1,052 acres; however, all areas of disturbance would be located within the FCPP Lease Area and it is expected that wildlife would migrate to similar habitats nearby. Operational noise and vehicular collisions with wildlife would be commensurate with current operations at FCPP. Continued operation of the subject transmission lines would increase the long-term potential for large bird or raptor collisions and electrocution from perching on or near tower conductors. A cumulative effect to wildlife and habitat would occur in the event of substantial loss of habitat function or disruption caused by another project in addition to the effects from proposed FCPP and Navajo Mine and Pinabete SMCRA Permit Area operations.

As discussed in Section 4.1, emissions from the FCPP result in the deposition of metals and other compounds in the surrounding area. Air dispersion models were completed to estimate the area over which these contaminants would be deposited and to evaluate the relative contribution of the plant to the concentrations of these contaminants relative to baseline conditions (AECOM 2013c). The results of the deposition models indicate the emissions are dispersed less than 50 km from the FCPP. The contribution from other regional and global sources of mercury, selenium, and arsenic was also evaluated. These contaminants have the potential to adversely affect special status species both within the Deposition Area, which extends beyond the FCPP lease area, and on the aquatic environment in the San Juan River downstream of Farmington. For future FCPP emissions, the deposition of COPECs within the Deposition Area was shown to have a negligible impact, with all wildlife and fish HQs resulting from FCPP emissions well below 1 for all COPECs, and that FCPP emissions would not cause the concentrations of any COPECs currently below levels of concern to increase to a level of concern, or contribute appreciably to those risks that are already present under existing background conditions. Over the life of the project, sources other than the FCPP and Navajo Mine Energy Project would be expected to contribute COPECs to the local environment. The EPRI model examined the projected future contribution of arsenic, mercury and selenium from other regional and global sources, as these COPECs are globally distributed. These results focus on impacts to listed fish species and are discussed in Section 4.18.3.8. Other COPECs are not expected to receive significant contributions from atmospheric deposition from out-of-basin sources. Other local sources of COPECs include other power plants within the region, as well as industrial and municipal discharge, runoff and emissions, vehicle emissions, and agriculture. These other sources would be expected to increase the levels of some COPECs above those anticipated to occur from future FCPP operations and baseline conditions, but have not been quantified.

The past, present, and reasonably foreseeable projects identified in Table 4.18-1 have affected and are expected to continue to affect wildlife through habitat loss and fragmentation, impacts from noise and human disturbance, and chemical exposures similar in type to those described in Section 4.7. Impacts would vary depending upon species' life history strategies, habitat requirements, the availability of suitable habitats, and where species live in relation to future disturbances. Given the abundance of the available adjacent habitats, the Proposed Action is not expected to contribute appreciably to wildlife impacts resulting from past, present, and reasonably foreseeable activities.

4.18.3.8 Special Status Species

This section evaluates the potential cumulative impacts to special status species; cumulative impacts to plants and wildlife are addressed in Sections 4.18.3.6 and 4.18.3.7, respectively. As discussed in Section 4.1, emissions from the FCPP result in the deposition of metals and other compounds in the surrounding area. Air dispersion models were completed to estimate the area identified as having a 1 percent future increase in soil metals concentrations above present-day concentrations per data provided by the USGS and to evaluate the relative contribution of the plant to the concentrations of these contaminants relative to baseline conditions (AECOM 2013c). The results of the deposition models indicate the emissions are dispersed less than 50 km from the FCPP. The contribution from other regional and global sources of mercury, selenium, and arsenic was also evaluated (AECOM 2013h). Emissions-related contaminants associated with the Proposed Action and local and regional sources have the potential to adversely affect special status species both within the deposition area, which extends beyond the FCPP lease area, and on the aquatic environment in the San Juan River downstream of Farmington. Therefore, the cumulative effects ROI for threatened and endangered wildlife species includes the Deposition Area, as well as the San Juan River from the eastern boundary of the Deposition Area downstream into the San Juan arm of Lake Powell. Projects considered in the cumulative effects analysis include all 17 power plants in the Four Corners region.

As described in detail in Section 4.6.2.5, two ERAs were conducted to evaluate potential ecological impacts associated with future emissions from the combustion of coal at the FCPP. One ERA was conducted for both terrestrial and aquatic environments within the area identified by air dispersion modeling as having a 1 percent future increase in soil metals concentrations above present-day concentrations per USGS data (AECOM 2013c). This area was defined as the Deposition Area, and the ERA is hereafter referred to as the Deposition Area ERA. The other ERA was conducted for the aquatic environment of the San Juan River within the deposition area and downstream of the deposition area into the San Juan River arm of Lake Powell (AECOM 2013h). This ERA is hereafter referred to as the San Juan River ERA. For both ERAs, the aquatic environment may include receptors that live in the aquatic environment as well as those that forage within the aquatic environment.

The Deposition Area ERA evaluated ecological risks within the FCPP stack emissions deposition area to representative terrestrial and aquatic species as well as to special status species, including Federally listed species, under two scenarios (AECOM 2013c). One scenario evaluated potential ecological risks associated only with the proposed future 25-year project. The other scenario evaluated current conditions, which may include contributions from natural sources (e.g., metals) and non-specific historical and current local, regional, and global anthropogenic sources, including contributions from FCPP stack emissions during the past 50 years of operation. The San Juan River ERA evaluated ecological risks to representative and special status ecological receptors associated with aquatic and riparian habitats along the San Juan River, within and downstream of the deposition area and into the San Juan River arm of Lake Powell (AECOM 2013h). The San Juan River ERA also evaluated ecological risks associated only with the proposed future 25-year project and separately for current conditions, but also for several other future scenarios related to specific regional and global contributions. Modeling of air emissions, dispersion, and deposition as well as fate and transport processes for the San Juan River ERA was conducted by EPRI (2013).

Section 4.8 estimates ecological risks associated with the future operations of FCPP to target receptors, including representative terrestrial and aquatic species, as well as special status species. Although several classes of chemicals were evaluated as COPECs (metals, PAHs, dioxins/furans) in the ERAs, metals were the only class of chemicals that were shown to potentially pose ecological risks. In total, for the "Current Conditions + FCPP Contributions" scenario, the two ERAs reported 67 instances in which

total HQs¹ exceeded a value of 1 indicating a potential risk to ecological receptors. For terrestrial receptors within the deposition area, total HQs greater than 1 ranged from 1.5 to 37 with boron, chromium, and vanadium presenting the highest total HQs, most frequently for terrestrial plants. These elevated total HQs were observed for representative terrestrial invertebrates, plants, birds, and wildlife as well as the Federally listed Mancos milk-vetch and Mesa Verde cactus (AECOM 2013c).

Within the deposition area aquatic and riparian habitats of Morgan Lake, total HQs greater than 1 ranged from 2.3 to 190, largely due to potential barium, lead, nickel, and selenium exposures to generic aquatic receptors and fish. The highest total HQ of 190 was due to selenium exposure to generic adult life stage Morgan Lake fish. Riparian birds and wildlife also exhibited total HQs greater than one, most notably the willow flycatcher which serves as the species representative of the Federally listed southwestern willow flycatcher for which total HQs of 16 and 9.8 were reported for lead and selenium, respectively (AECOM 2013c).

The aquatic and riparian habitat of the San Juan River within the deposition area exhibited total HQs greater than 1 ranging from 1.5 to 47 largely due to potential aluminum, barium, copper, lead, methylmercury, nickel, selenium, vanadium, and zinc exposures to generic aquatic receptors and fish. The highest total HQs of 21 and 47 were due to nickel and selenium exposures to generic San Juan River aquatic receptors. Similar to Morgan Lake, the willow flycatcher, which represents the Federally listed southwestern willow flycatcher, exhibited elevated total HQs ranging from 2.3 to 16 with the highest total HQs of 9.8 and 16 due to selenium and lead, respectively (AECOM 2013c). For all metals and all ecological receptors evaluated in the two ERAs, HQs exceeding 1 were entirely due to current conditions; assessment of FCPP emissions associated with the proposed future 25-year project did not result in any HQs greater than 1. These existing conditions are the result of geological conditions, anthropogenic sources other than the project facilities, as well as the historic operation of those facilities. These findings do not mean that the FCPP would not contribute to ecological risk during the life of the proposed project, but they do indicate that such contributions would be negligible as compared to current conditions.

Current Conditions

The definition of cumulative impacts (e.g., cumulative effects) can be somewhat tentative, especially where a portion of the impact may be of natural origin; 42 USC Part 1508.7 specifically refers to cumulative impacts associated with “projects” which seems to imply anthropogenic impacts. However, from a purely ecological perspective, an organism may be at risk to adverse effects if a toxicological threshold is exceeded for a substance regardless of whether the substance is of natural or anthropogenic origin. For example, the EPA’s soil ecological screening levels for barium protective of plants and invertebrates are 500 and 330 mg/kg, respectively (AECOM 2013a), yet naturally-occurring soil barium concentrations are reported to range up to 1,300 mg/kg in New Mexico (USGS 1981) and up to 2,000 mg/kg across the U.S. (USGS 1984). This suggests that plants and invertebrates may be at risk of adverse effects in areas of higher naturally occurring barium concentrations.

In both the Deposition Area ERA and the San Juan River ERA, current conditions were characterized as measured COPEC concentrations in soil, sediment, surface water, and fish tissue. It is reasonable to assume that these media concentrations integrate past and present contributions over space and time that are of natural origin with those of anthropogenic origin including local, regional, and global sources as well as historical FCPP impacts over the past 50 years. While it is not possible to quantitatively discern an accurate estimate of the contribution from each of these sources, it is possible to put the soil metals concentrations in perspective with soil metals concentration reported by the USGS for the continental

¹ A HQ greater than 1 indicates that adverse effects to ecological receptors are likely to occur whereas an HQ less than 1 indicates that adverse effects are unlikely to occur. The magnitude of the HQ value does not indicate the severity of effects but may provide some indication on the likelihood of adverse effects occurring. The “total HQ” referred to herein is the HQ associated with both current conditions and predicted future impacts associated with the proposed 25-year project. In the ERAs, the total HQ is called the “Total Potential Risk HQ.”

U.S. Table 4.18-6 compares maximum soil metals concentrations recently measured within the future FCPP deposition area (e.g., current conditions) with the range of soil metal concentrations reported for the U.S.

Table 4.18-6 Comparison of Soils Metals Concentrations in the U.S. to Soil Metals Concentration in the Future FCPP Deposition Area

Metal	Range for U.S. Soils from 1961 to 1974	Range for New Mexico Soils in 1971	Maximum for FCPP Deposition Area
Barium	10 – 5,000	250 – 1,300	836
Cadmium	<0.005 - 2	-	1.27
Chromium	1 – 2,000	7.9 – 41	17
Copper	<1 - 700	2.3 – 33	35
Lead	<10 - 700	6.5 – 22	76.1
Manganese	<2 – 7,000	58 – 710	489
Mercury	<0.01 – 4.6	0.01 – 0.07	0.055
Molybdenum	<3 - 15	0.4 – 3.5	3
Nickel	<5 - 700	3.1 – 24	23
Selenium	<0.1 – 4.3	1.4 – 10	1.77
Vanadium	<7 - 500	18 – 110	42
Zinc	<20 – 2,000	13 – 100	101

Source of data for U.S.: Shacklette and Boerngen (USGS 1984).

Source of data for New Mexico: Severson and Gough (USGS 1981).

All concentrations are in units of mg/kg.

From the comparison of these data, it can be seen that recently measured soil metals concentrations within the future FCPP deposition area are generally within the range reported by the USGS for New Mexico and for the U.S. While regional variation in soil metals concentrations would be expected across the U.S., these data show that the metals concentrations currently within the deposition area (e.g., current conditions) would not be unexpected based on geological origin alone. However, it is also possible that metals concentrations measured in soils across the U.S. by the USGS in 1984 reflect a mixture comprising both a natural geologic source as well as long-term historical anthropogenic contributions. Regardless of source, the current conditions data relates directly to past and present cumulative impacts since they integrate across time and space all local, regional, and global sources including naturally occurring metals and those released from the first 50 years of FCPP emissions that may have been deposited in the San Juan Basin.

Contribution of Pollutants from Global and Regional Sources

Section 4.8 estimates ecological risks associated with the future operations of FCPP special status species, focusing those COPECs with HQs greater than one. For all COPECs and ecological receptors evaluated, HQs exceeding 1 were entirely due to current background conditions; FCPP emissions associated with the proposed future 25-year project did not result in any HQs greater than 1, nor contribute appreciably to those risks already present under current conditions. These existing conditions are the result of geological conditions, anthropogenic sources other than the project facilities, as well as the historic operation of the FCPP. These findings do not mean that the FCPP would not contribute to ecological risk during the life of the proposed project, but they do indicate that such contributions would be negligible as compared to current conditions.

In addition to evaluating impacts associated with current conditions and future FCPP emissions, the San Juan River ERA also evaluated several future scenarios related to arsenic, mercury, and selenium contributions from other regional sources as well as from China ranging from no change, low increase, and high increase in China mercury emissions between 2016 and 2050 (AECOM 2013h). These scenarios represent potential future changes in global mercury emissions over time, that are unrelated to the operation of the FCPP, but which could affect species in the region. As previously discussed, the combination of current conditions and FCPP-related impacts can be viewed as future cumulative impacts if contributions from other sources remain constant. If mercury emissions are expected to increase in the future, then the comparison of San Juan River fish tissue mercury and selenium HQs for “Current Conditions + FCPP Only Contributions” and HQs for “Scenario 8 Contributions”² for the Area 1 reach of the San Juan River (e.g., the deposition area) illustrates potential future impacts when the worst-case future China emissions are included in the analysis (see Table 4.18-7). These data show that including the future Scenario 8 high China mercury emissions results in a marked increase in HQs, particularly for the Federally listed Colorado pikeminnow. The potential for increased China emissions in the future is discussed in more detail later in this section.

Table 4.18-7 Comparison of San Juan River Area 1 Mercury and Selenium Fish HQs for Current Conditions + Future FCPP Emissions and Scenario 8 High China Emissions

Exposure	CC + FCPP	Scenario 8
Hg Forage Fish	3.0	3.6
Hg CPM <400 mm	1.8	6.1
Hg CPM >400 mm	1.8	16
Hg RS <400 mm	3.0	4.2
Hg RS >400 mm	3.0	8.7
Se (generic fish)	1.5	0.55

Notes:

- CC = current conditions
- CPM = Colorado pikeminnow
- Hg = mercury
- HQ = hazard quotient
- RS = razorback sucker
- Se = selenium

In developing their global deposition model, EPRI relied on predictions of future China mercury emissions incorporated in the CMAQ model. These predictions included both no change, low and high future China emissions of mercury. However, there have been a number of studies and international agreements relating to future mercury emissions that make future trends in global mercury emissions unclear. While there is concern that China mercury emissions will continue to increase over the next 25 years, a recent United Nations report showed that global mercury emissions to the atmosphere were relatively stable between 1990 and 2005 with increased emissions in Asia offset by decreased emissions in Europe and North America (United Nations Environmental Programme 2013a). In late 2011, China released new national emissions standards to control SO₂, NO_x, and particulate emissions, which should result in mercury emissions reduction if successfully implemented (China Council for International Cooperation on Environment and Development 2011). On October 10, 2013, China joined 91 other countries in signing the Minamata Convention on Mercury, also known as the Global Mercury Treaty, which includes provisions for

² Scenario 8 represents the highest emissions-related contributions to the watershed modeled in the San Juan River ERA and assumes a high increase in mercury emissions from China (AECOM 2013h).

controlling mercury releases from large-scale industrial plants including coal-fired power plants (United Nations Environmental Programme 2013b). Nevertheless, there are also indications that increased mercury emissions from China are now offsetting more recent reductions in North America and Europe (United Nations Environmental Programme 2013a). Therefore, based on the available information it appears to be prudent to assume a net increase in mercury deposition within the San Juan River watershed, though such an increase may be minor because of the balances between increased mercury emissions in some parts of the world and reduced mercury emissions in other parts of the world. The emissions scenarios incorporated in the model appear to provide a reasonable bounding case for increased future emissions. The San Juan River ERA reports that based on the results of the air modeling and watershed modeling (AECOM 2013c) there would be little difference between the three China scenarios.

In summary, regardless of the source of emissions, metals concentrations under current conditions alone may pose a potential risk to some ecological receptors within the deposition area as well as in the San Juan River downstream of the deposition area. Because of the considerable uncertainty in predicting future regional and global metals emissions, future cumulative impacts to ecological resources may be best described by bounding potential impacts within the range of HQs reported for “Current Conditions + FCPP Only Contributions” and “Scenario 8 Contributions.” Even at the lower range of HQs that assume status quo current conditions in combination with future FCPP emissions, several highly elevated HQs (e.g., HQ of 190 for selenium exposure to generic San Juan River aquatic receptors; HQs as high as 12 for mercury exposure to Colorado pikeminnow in the San Juan River; HQs as high as 71 for selenium exposure to early life stage fish in the San Juan River) indicate the potential for adverse effects to individual receptors, as well as potential for population level effects. Cumulative impacts associated with past, present, and future conditions may be substantial regardless of whether China mercury emissions increase in the future, but this risk would remain with or without the future operation of FCPP, and as indicated in the ERAs, its future operation would not meaningfully increase those risks. Therefore, the contribution of future FCPP operations would not be cumulatively substantive with respect to these ecological risks.

As a result of the past, present, and reasonably foreseeable emissions from power plants in the region, as well as other sources of emissions (e.g., coal burned in private homes), the potential exists for cumulatively major impacts to aquatic species, such as the pikeminnow and razorback sucker. However, as modeled in the two ERAs described above, the contribution of FCPP to this potential cumulative effect would be significantly less than historic conditions, and still represent a decline over baseline emissions. Consequently, the long-term contribution of FCPP to cumulative impacts to threatened and endangered species is considered moderate.

Climate Change

Climate change will occur and affect listed species and their habitats over the life of the Proposed Action and beyond, whether or not the Proposed Action occurs, as described in Section 4.18.3.2. Climate change has the potential to change precipitation patterns, including the timing, intensity, and type of precipitation received; runoff patterns based on the amount of precipitation falling as snow and when snowmelt occurs; and atmospheric temperatures, which exhibit a strong influence on water temperatures. Climate change models generally agree that the southwest will get drier in the next century, with runoff decreasing 8 to 25 percent (Seager et al. 2007), resulting in decreased water availability to meet all demands, including those of terrestrial wildlife, fish, and plants.

Listed plant species, along with general vegetation (Section 4.18.3.6), would be affected by climate change and associated changes in precipitation and atmospheric temperatures. Many plant populations have been observed to decrease during periods of drought. Because special status plant species are often endemic to a restricted set of geological formations and have limited dispersal ability, climate change may threaten the long-term persistence of these species. Long-lasting drought cycles could have a negative effect on the long-term viability of plant populations. Periods of drought in the southwest are

not uncommon. However, the frequency and duration of droughts may be altered by climate change. Changes in precipitation patterns that lead to either wetter or drier conditions for narrow endemics could lead to conditions that are no longer suitable for their survival. In addition, climate changes could lead to the establishment or spread of non-native plants, to the detriment of some species. Almost certainly, plant species and their habitats will be affected in some manner by climate change; the magnitude and extent of the change cannot be quantified at this time.

The effects of climate change have the potential to affect many species of wildlife, including listed wildlife species, and have the potential to change regional climate patterns, which exhibit a strong influence on water availability, which could influence the health and abundance of existing habitats across the region. Change in precipitation patterns and atmospheric warming would likely affect the distribution of suitable habitat for wildlife species, as terrestrial landscapes adapt to these changes. Fire frequency and severity may increase as a result of these changes, which may further affect the distribution of the habitats that species depend upon. Wildlife species will likely change their distribution or behavior in response, selecting alternate home range and migration habitats. These combined factors could have any number of effects on wildlife including shifts in the distribution of individual species, along with major prey species and potential competitors and predators, possibly along elevational or latitudinal gradients; effects on demographic rates, such as survival and reproduction; and changes in coevolved interactions, such as prey-predator relationships.

Mobile organisms can move and select alternate home range habitats and migratory habitats in response to climate changes and seasonal wildlife patterns would shift to more favorable habitats as a behavioral adaptation to changing climate conditions. Wildlife species are expected to alter migration patterns, as they could migrate to suitable habitats earlier or later in the year. Similarly wildlife species might benefit from the longer growing season before entering their first winter, but other challenges may present themselves, such as insufficient water, inadequate habitat, or decreased food supply. These factors cannot be adequately predicted at this time.

The predicted reduction in precipitation will make it increasingly challenging to meet the flow recommendations for the San Juan River established to protect listed fish and other native fish species, especially the high-flow requirements that provide for channel maintenance and create habitat for listed fish and which have a strong influence on the riparian habitats upon which many species rely.

Reduced flow levels may also exacerbate contaminant issues, as less dilution of contaminants in the river would occur. Additionally, if increased water is required for agricultural uses, it could result in increased runoff of pesticides and selenium from agricultural return flows. However, as water becomes more valuable, return flows are more likely to be recaptured and reused, rather than running off into the rivers, streams, and lakes.

Native fish in the San Juan River cannot move upstream in response to climate changes because their migration is blocked by Navajo Dam (USFWS 2002a,b), which precludes migration to what may be more favorable upstream areas as a behavioral adaptation to changing climate conditions. However, Navajo Dam currently releases water that is colder than what would naturally be present during the summer and fall months (USFWS 2006). Thus, the temperature effect of climate change could be offset by the dam's operation.

4.18.3.9 Land Use and Transportation

The cumulative effects ROI for land use and transportation includes the Navajo Mine and Pinabete SMCRA Permit Areas, FCPP, and transmission line ROWs as well as surrounding roadways and Navajo Nation tribal trust lands because potential impacts such as relocation of housing, temporary loss of grazing land, loss of access to grazing, and a slight increase in traffic caused by activities at the Navajo Mine and Pinabete SMCRA Permit Areas or FCPP would be concentrated in or near the respective lease areas. Cumulative effects would occur if other resource extraction or development activities occurred on

Navajo Nation tribal trust lands within the same time period that caused a greater loss of acreage for grazing or resulted in even greater traffic increases on local roadways. The Proposed Action would not result in any majorly adverse effects to existing land use; therefore, there would be no contribution of the project to any cumulative effects in this regard. Potential projects considered in the cumulative effects analysis that would occur on the Navajo Nation include, Navajo Generating Station, proposed oil and gas drilling by Western Oil and Gas, the Navajo Indian Irrigation Project, the Hogback Diversion Dam Project, the Navajo-Gallup Water Supply Project, and the Hogback-Cudei Irrigation Project.

The Proposed Action would result in a minor increase in traffic during construction activities associated with Burnham Road reconstruction, as well as minor long-term increases in truck traffic (8-10 truck trips per day) as a result of delivery of ammonia and lime to the FCPP. Although other existing or planned projects would occur on the Navajo Nation during the project period, and the increase in traffic flows to the FCPP and surrounding area could increase dust, noise, and light pollution, the contribution of continued operations at the Navajo Mine SMCRA Permit and Pinabete SMCRA Permit Areas and FCPP to any cumulative traffic impacts would be negligible because they would assumedly go unnoticed.

With regard to loss of grazing areas and access to grazing lands, operation of the Navajo Mine SMCRA Permit and Pinabete SMCRA Permit Areas and subsequent long-term removal of grazing land, in conjunction with other development projects (i.e., oil and gas development on tribal trust lands) could diminish the livelihood and cultural heritage of grazers and residents. This cumulative loss of grazing lands would result in an adverse cumulative impact until the land is reclaimed and returned grazing. Although NTEC would be required to compensate any residents for loss of grazing land as part of its lease with the Navajo Nation which would reduce its contribution to cumulative effects, it is unknown if compensation would be required by other proposed projects.

4.18.3.10 Socioeconomics

The ROI for socioeconomics is McKinley County, San Juan County, the city of Farmington, Navajo Nation tribal trust lands, and Hopi tribal trust lands. The State of New Mexico is also considered in the analysis to offer a comparison between how the alternatives and reasonably foreseeable future actions would affect the local and state economies. As described in detail in Section 4.10, the regional economy is composed primarily of educational services and healthcare and social assistance industries; construction industry; the public administration industry; the arts, entertainment, recreation, accommodation and food services industries; and the retail trade industry. There would be an adverse cumulative effect if the Proposed Action or alternatives affected the region's employment, income, public revenue, social welfare, and/or demographic composition. Please see Sections 4.10.3 and 4.10.4 for a discussion of potential project-related effects that were taken into account for assessing cumulative effects.

The following future projects could be implemented and/or developed in the ROI within a reasonably foreseeable future timeframe: San Juan Basin Energy Connect Project, Western Oil and Gas Project, Oil and Gas Exploration on BLM Lands, Southern Ute Indian Tribe, and improvements to U.S. Highway 491. It is worth noting that lasting economic effects from past projects, such as the closure of the McKinley and La Plata mines, are captured in the project-specific analysis as part of the existing environment.

The only alternative expected to have an adverse effect on the regional economy is the No Action Alternative. All other action alternatives are not expected to result in major alterations to the demographic, social welfare, or economic conditions when assessed against forecasted baseline conditions (i.e., 2016 conditions). However, the No Action Alternative would result in the loss of approximately 2,070 jobs (see Table 4.10-22). This loss of jobs would add to the already high unemployment rate (approximately 51 percent) in the Navajo Nation as 410 direct jobs at the Navajo Mine and 380 direct jobs at the FCPP are occupied by tribal members. Secondary and induced effects (i.e., the downsizing or closure of businesses that support project operations) as result of the closure of FCPP and the Navajo Mine are captured in the direct effects analysis provided in Section 4.10. All other projects proposed for development in the area of analysis are not expected to reduce, but rather increase, employment

opportunity or economic benefits. Therefore, while the closure of FCPP and Navajo Mine would directly affect regional economic conditions, other future projects would positively contribute to the region's economic vitality and not result in a detrimental cumulative effect.

Additionally, the implementation of the No Action Alternative would allow for future reclaimed lands to be repurposed, albeit for grazing or other uses. While minor in comparison to the adverse effects of closing FCPP and Navajo Mine, this change in land use would allow for beneficial economic opportunity to be realized in the future.

4.18.3.11 Environmental Justice

The ROI for Environmental Justice includes all of San Juan County, New Mexico and Navajo and Hopi tribal trust lands, the same area as considered in the project-specific effects analysis. Within the ROI, members of the Navajo Nation and Hopi Tribe are considered a minority and, where applicable, low-income population. As described in Section 4.11 and Section 4.10, the Alternatives could result in moderate potential environmental justice impacts with regard to hazardous/solid wastes and visual resources, but also provide economic benefits (i.e., jobs, income) to the Navajo Nation.

Other future projects in the area that contribute to potential effects for hazardous/solid waste and visual resources include the 1) San Juan Basin Energy Connect Project, 2) Western Oil and Gas Drilling Project, and 3) Improvements to U.S. Highway 491. The continued presence of the transmission lines energized by FCPP would create a lasting visual effect in the ROI, including for the No Action Alternative which could allow for the transmission facilities to be left in place to continue to provide transmission, but wheel power from another energy generation source than FCPP. The San Juan Basin Energy Connect Project proposes to install a 245 kV transmission line from Shiprock Substation to Ignacio, Colorado, although no portion of the transmission line would be constructed on Navajo Nation tribal trust lands. The installment of additional transmission facilities within the ROI may contribute to a disproportionate cumulative effect to visual resources on tribal trust lands. U.S. Highway 491 is an existing road scheduled for improvements so there are not expected to be additional visual effects resulting from these proposed activities. None of these projects is anticipated to produce hazardous waste or an amount of solid waste that would affect capacity at local landfills; therefore, no cumulative effect is anticipated to occur to these resources.

The No Action Alternative would result in the loss of up to 2,070 jobs in the ROI, which would constitute a major long-term adverse effect to the Navajo Nation. The projects discussed above would likely create jobs and other economic benefits, therefore these projects would not contribute adversely to a cumulative socioeconomic effect.

4.18.3.12 Indian Trust Assets

The cumulative effects ROI for ITAs is the Navajo Nation and Hopi Tribe tribal trust lands. As discussed in Section 4.12, project-specific effects to mineral, land, water, cultural, and grazing/hunting/gathering ITAs as result of the alternatives would be minor and/or beneficial. DOI/BIA reviews each proposed trust-related project with the intent to approve only those projects found beneficial to the Tribe and do not create a liability for the US (see Section 4.12.2). Therefore, other DOI/BIA approved projects that involve ITAs on the Navajo Nation tribal trust lands are assumed to have a beneficial or minor effect. The only other project that is occurring on Navajo Nation tribal trust lands and directly involves ITAs is the Western Oil and Gas project. Western Oil and Gas propose to develop 600 natural gas wells in the Burnham, Upper Fruitland, and Nenahnezad/San Juan Chapters. Per DOI/BIA trust policy, the Navajo Nation is expected to receive fair compensation for utilization of energy resources (i.e., natural gas royalties) and potential effects to physical ITAs (i.e., cultural, natural resources) will be limited through the application of mitigation/preventive measures developed during the environmental review process. When effects from the Western Oil and Gas project are aggregated with the effects resulting from the Alternatives, cumulative effects to ITAs are considered minor.

4.18.3.13 Visual Resources

The cumulative effects ROI for visual resources is the immediate vicinity of FCPP and Navajo Mine Lease Area and the Four Corners region (for effects that affect the greater visual setting of the region). There would be an adverse cumulative effect if the Proposed Action or alternatives would contribute a direct effect to the subject viewshed and other future projects also affected the area's scenic quality. With regard to direct impacts, operations within the Navajo Mine SMCRA Permit and Pinabete Permit Areas would have moderate to high impacts on visual resources within the immediate ROI, which would be reduced through the application of reclamation as per the SMCRA permit. The San Juan Basin Energy Connect Project would construct transmission towers and lines within the same viewshed as the mine. These new facilities would introduce a new linear feature in the landscape, directly affecting the scenic quality in the area. Therefore, there would be a major cumulative effect while mining operations are occurring, but this effect would cease to be an issue once the mine is reclaimed back to the original landscape.

Indirect effects on visual resources include reduced visibility and increased haze in the region as a result of emissions from various projects and facilities. As described in detail in Section 4.1, visibility and haze conditions have improved over the last decade, presumably as a result of increased regulation and compliance. Since all facilities considered in this cumulative effects analysis would be required to abide by all Federal and state air quality regulations, it is anticipated that any adverse cumulative effects to visual resources would be negligible.

4.18.3.14 Noise and Vibration

The cumulative effects ROI for noise and ground-borne vibration includes all proposed construction and development projects in and around the FCPP, Navajo Mine SMCRA Permit and Pinabete Permit Areas, and transmission lines through the year 2041. Potential noise and ground-borne vibration caused by activities at the Navajo Mine SMCRA Permit and Pinabete Permit Areas or FCPP are localized to the Lease Area and would not contribute cumulatively to the impacts caused by construction or mining activities at other locations in the Four Corners region. Noise and ground-borne vibrations result from mining and construction projects, as well as transit, and everyday activities (i.e., lawn-mowers). Blasting, coal removal, and reclamation mining activities could produce noise and ground-borne vibration for residents living within 1 mile of the Navajo Mine Lease Area, which can cause annoyance and damage to structures. Other reasonably foreseeable future construction projects that would expose the same receptors to noise and vibration at the same time as mining activities could further exceed thresholds; however, the only project occurring within the 1 mile radius is the existing Sanostee Prison and this operation is not expected to contribute major noise or vibration effects for sensitive receptors in addition to the project-specific effects produced from mining activities. Furthermore, OSMRE requires NTEC to routinely measure the vibrations associated with their mining activity at nearby receptors to ensure that vibrations do not exceed established thresholds. In addition, as addressed in Section 4.14, a number of measures would be in place at the mine to decrease impacts, such as construction of noise barriers and use of noise mufflers on equipment. Therefore, cumulative impacts with regard to noise and vibration would be negligible.

4.18.3.15 Hazardous and Solid Wastes

The cumulative effects ROI for hazardous and solid wastes includes all major permitted mine sites and generating stations in the Four Corners region through the year 2041. Cumulative effects that could occur with regard to hazardous and solid waste include the generation of such wastes that exceed the capacity of local permitted landfills. All facilities included within this cumulative effects analysis would be required to dispose of hazardous waste in accordance with all state and Federal regulations. Furthermore, as discussed in Section 4.15, multiple solid waste landfills are present within the Four Corners region with the capacity to accommodate the generated waste.

The potential impacts from an accidental release of hazardous or solid waste from the Navajo Mine Lease Area, FCPP, or transmission line operators would be limited to the release area of the specific material

and would not contribute cumulatively to the impacts caused by other hazardous waste generating or managing facilities at other locations in the Four Corners region. An accidental release of hazardous or solid waste has the potential to damage infrastructure and harm individuals nearby and is dependent on the substance and its quantity. There is no relationship between the potential accidental release of hazardous or solid waste at a nearby project and an accidental release of hazardous or solid waste at the proposed project site. All existing and new hazardous waste generators and managers are required to comply with Federal, state, and local laws limiting the quantities of hazardous materials available along with their transportation, handling, storage, and emergency response in the event of an accidental release to limit the impact to nearby receptors.

With specific reference to mining and generation stations, cumulative effects could occur as result of disposal of CCR either in ash ponds or as part of reclamation activities at the mines. As listed in Table 4.18-1, three other coal-fired power plants are located in the Four Corners region. Only one of the three coal-fired power plants in the region, San Juan Generating Station, is of similar capacity as the FCPP and is located within the same groundwater basin. Therefore, it is anticipated that a similar volume of CCR would be generated at this plant and require disposal or impoundment. In contrast, Escalante Generating Station only produces 250 MW and is expected to produce a much smaller volume of CCR; neither Escalante Generating Station nor Navajo Generating Station are located within the San Juan River groundwater basin. As described in Section 4.15, the EPA considered whether to manage CCR as either a Subtitle C hazardous waste or a Subtitle D solid waste. The EPA published a Draft Rule in 2010, and announced the Notice of Data Availability for additional information obtained by EPA on August 2, 2013. The Final Rule was published in December 2014, confirming the CCR will be regulated as a Subtitle D solid waste (see Sections 4.5, 4.11, and 4.15). All of the generating stations included in this cumulative effects analysis would be required to comply with EPA's Final Rule. CCR placement at mines is not included in the provisions of the Final Rule. The cumulative effects analysis considered the current and historical engineering controls, coupled with the hydrologic environment, as they relate to mobility and the potential to degrade existing and reasonably foreseeable uses. The FCPP and San Juan Generating Station manage CCR by placement adjacent to the generating stations in storage facilities constructed of earthen liners to reduce the mobility of constituents associated with CCR. Additionally, the hydrologic environment of the semi-arid region supports relatively flat groundwater gradients which further limit the mobility of constituents. Areas where engineering controls are not in place (i.e., ineffective earthen liners) could cause localized degradation to water quality, but not changes to the existing or reasonably foreseeable uses. The Proposed Action and Action Alternatives include engineering controls such as HDPE and earthen liners, a downgradient groundwater intercept collection trench, and a system of groundwater monitoring wells to manage potential impacts to surface and groundwater. Therefore, potential impacts from storage of CCR at FCPP are minor where engineering controls are in place, moderate when engineering controls are not in place, and cumulatively minor for the Four Corners Region.

4.18.3.16 Recreation

The cumulative effects ROI for recreation includes the immediate vicinity of the FCPP and Navajo Mine Lease Area and the Four Corners region, within approximately 15 to 20 miles of the Project facilities. The Proposed Action would neither directly impact nor indirectly alter the recreational experience at any public recreation areas in the region, so it would not cumulatively contribute to impacts caused by other projects in the Four Corners region. Public access restrictions to the Navajo Mine and Pinabete SMCRA Permit Areas would have the potential to displace dispersed recreational opportunities within the Navajo Mine SMCRA Permit and Pinabete SMCRA Permit Areas, such as trapping, hunting, fishing, and hiking activities. However, these impacts would be negligible and limited to the Permit Areas, so they would not contribute to cumulative impacts in the area. Please see Sections 4.16.3 and 4.16.4.2 for a discussion of potential project-related effects that were taken into account for assessing cumulative effects.

If the No Action Alternative is selected, Morgan Lake would eventually cease to exist. As discussed in Section 4.16.2.2, Morgan Lake offers fishing, on-water activities (i.e., windsurfing), and shoreline activities (i.e., picnicking). There would be a reduction in opportunity at this specific location, but the surrounding Four Corners area offers a wealth recreational opportunities. No other recreational resource (i.e., park, trail) is scheduled for closure, so there would be a negligible cumulative effect to recreational resources as result of the No Action Alternative.

4.18.3.17 Public Health and Safety

As described in Section 4.1, mobile source emissions and fugitive dust emissions associated with the Navajo Mine SMCRA Permit and Pinabete Permit Areas are minor in comparison to stationary source emissions from FCPP. In addition, the geographic area affected by fugitive dust is in the immediate vicinity of the Navajo Mine SMCRA Permit and Pinabete Permit Areas, and as such there would be no overlap with other dust sources. Therefore, the cumulative impacts of health and safety focuses on the potential public health impacts associated with air emissions from the FCPP in combination with past and present sources of public health impacts in the study area. The cumulative effects study area for Public Health and Safety is therefore the measured dispersion and deposition plume area of FCPP emissions. Please see Sections 4.17.3 and 4.17.4 for a discussion of potential project-related effects, including past environmental effects that were taken into account for assessing cumulative effects.

As described in Section 4.17, the HHRA process followed the HHRAP procedures established by the EPA for hazardous waste combustion facilities (EPA 2005a). The EPA's HHRAP recommends that three human exposure scenarios that represent individuals or groups who live in the vicinity of a facility be considered. The recommended scenarios include: a) residential exposure; b) farming exposure; and c) fish consumption exposure. These exposure scenarios consider the potential exposure of both adults and children through direct and indirect pathways associated with these scenarios. The potential exposure pathways include inhalation of compounds emitted from the stack (a direct exposure pathway) and incidental ingestion of trace compounds that enter the food chain. The COPCs enter the food chain through deposition from the air to soil, deposition on plants, or deposition to water bodies and their associated watersheds in the vicinity. The HHRA considered consumption of produce, beef, pork, chickens, fish, and water. The HHRA used conservative default exposure assumptions recommended by EPA unless site-specific exposure parameters were available and determined to be appropriate. For example, the HHRA applied ingestion rates of locally caught fish specific to a water body, based on local advisories for fish consumption rather than HHRAP default values.

As described in Section 4.17, there were no human health risks above the EPA-recommended level of 10^{-4} to 10^{-6} ; all of the results were more protective than the highest level of protection (10^{-6}). The HHRA addresses future risk within the dispersion plume of FCPP. The past and present cumulative risk was evaluated by soil sampling conducted within the footprint of the dispersion and deposition plume for FCPP (AECOM 2013). Samples were collected from shallow levels (0-30 cm depth) and deeper levels (30-100 cm depth). The shallower levels were representative of deposition from FCPP, while the deeper samples are more likely to represent background conditions. Based on a statistical comparison of the data, the shallow and deep samples have similar concentrations of metals (AECOM 2013). When compared to EPA standards for residential land uses, only arsenic exceeds the recommended values (average of 4.17 mg/kg in shallow samples). All other soil sample results are protective of residential land uses. Arsenic is known to be high in soils of the southwestern U.S. (AECOM 2013). Cumulative health risks from deposition are within applicable standards and are therefore minor.

The cumulative public health effects also depend on the ambient air quality in the San Juan Air Basin and the respiratory health status of residents in the area. San Juan County's most recent Community Health Profile includes a comprehensive overview of health indicators including respiratory health (San Juan County 2010). This study found that San Juan County has a higher incidence of chronic lower respiratory disease comprised of chronic bronchitis, asthma, and emphysema compared to New Mexico or the rest of

the United States. Another study found that elevated levels of ozone in San Juan County were linked to incidence of asthma-related medical visits. This study found that San Juan County residents are 34 percent more likely to have asthma-related medical visits after 20 parts per billion increases in local O₃ levels (New Mexico Department of Health 2007).

Another study, whose study area also included the ROI, was undertaken to better understand the relationship between the perceived risk to respiratory health from ambient air quality and the risk presented by coal combustion inside of dwellings for cooking and heating. The study considered special exposures for vulnerable populations, and examined the relationship between coal combustion in homes in the Shiprock area (in addition to the prevalence of coal sources used for in-home burning of coal, Shiprock residents also have access to the low or no-cost coal which is made available to Navajo Mine employees as part of the lease agreement between BHP and Navajo Nation) and impacts on respiratory health.

The conclusion of the report states that “the presence of two large coal-fired power plants near Shiprock may contribute to that risk, but results from this study suggest that the risk could be reduced by making relatively simple and inexpensive changes to methods of home heating.” (Bunnell et al. 2010). In their comments to the Draft EIS, EPA recommended consideration of funding for replacement of old stoves with more efficient stoves appropriate for the fuel types being used; funding for replacement of old coal and wood stoves with propane gas heaters; assistance to the affected community for residential solar, wind or other electrical generation projects; assistance to Navajo Tribal Utility Authority for local electricity connections and subsidies to any affected residents; and education on how to properly operate, vent, and maintain existing stoves, perhaps locating this information in Navajo at the Community Coal Stockpile or producing an instructional video to play in Indian Health Service clinic waiting rooms. As noted below, several of the measures are in place. For the past three years, Navajo Mine has provided safety and health awareness training to Chapters that participate in the coal distribution program. Chapter coordinators are required to give the training to all Chapter members who request a coal permit. Additionally, IHS provides radio public service announcements on coal dump rules, preparedness, and safety guidelines throughout the winter season. NTEC plans to continue this educational program in coordination with IHS and is committed to improving the training to specifically require that coal permittees certify that they have attended the safety and health training on an annual basis before obtaining their annual coal permit.

San Juan County and the other counties within the San Juan Air Basin are all designated as attainment areas for criteria pollutants. With the implementation of BART at FCPP, emissions from FCPP were reduced in comparison to baseline emissions. Given current regulatory trends, it is likely that allowable PM and O₃ precursor emissions for all sources in San Juan County, including Navajo Mine, would be reduced to meet tighter ambient air quality standards for O₃ and PM_{2.5}. As a result, ambient air concentrations of O₃ and PM in San Juan County would be lower. Overall, there would be minor cumulative public health effects of the Proposed Action because there would be no measureable change to ambient air quality compared to baseline conditions, and there would be a reduction in FCPP emissions as a result of compliance with EPA’s BART rule.

While the public health impacts of the Proposed Action alone are negligible for criteria pollutants and minor for HAPs, the cumulative impacts on an already compromised population are minor to moderate. The primary impairment to public health is the indoor burning of coal. Although the Navajo Mine Community Coal Stockpile does provide coal to mine employees, it is a relatively minor source; other local sources of community collecting of coal for home use are readily available. Coal from non-project sources is also sold for the purpose of indoor burning.

There is a permit system that limits the use and transport of coal from the community coal stockpile at Navajo Mine. In addition, representatives from local chapter houses receive training on the safe use and transport of coal, and these representatives are expected to inform the community. This training is conducted with participation of Northern Navajo Medical Center, Indian Health Services and includes a video produced by Four Directions, Office of Environmental Health that informs the participants on the safe home use of coal.

Because the cumulative public health impact is minor to moderate, and the contribution of the Proposed Action to that condition is negligible to minor, no further mitigation is required beyond the ongoing permit/training program, Indian Health Services public education program on safe indoor burning of coal, and NTEC's stated intention to team with Navajo Nation agencies to further address the issue.