

5. CUMULATIVE IMPACTS, UNAVOIDABLE ADVERSE EFFECTS, AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

CEQ regulations stipulate that agencies consider potential environmental impacts resulting from “the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

Cumulative impacts are most likely to arise when a relationship exists between a Proposed Action and other actions expected to occur in a similar location or during a similar period of time. Actions overlapping with or in proximity to the Proposed Action would be expected to have more potential for a relationship than those more geographically separated. Similarly, actions that coincide, even partially, in time tend to have a greater potential for cumulative effects. Cumulative impacts occur when the proposed action adds an incremental impact on a resource.

This analysis of cumulative impacts considers past, present, and reasonably foreseeable Federal and non-Federal activities that are expected to occur in the region. An estimate of the extent of development in San Juan County, New Mexico that would overlap in time or geographic extent with the Proposed Action is included in Section 5.1. Section 5.2 provides an assessment of how the Proposed Action may add to the effects of other actions for each resource.

5.1 Past, Present, Reasonably Foreseeable Actions in the Project Vicinity

The Proposed Action would be one of a number of projects that have taken place or may reasonably be expected to take place in the region. Generally, development in the region surrounding Navajo Mine are included the following categories:

- Mining projects
- Power plants and transmission lines
- Oil and gas-related projects
- Agriculture

Other development including water supply urban infrastructure such as utility and transportation development; housing and government service development, and commercial industrial development related to population and economic growth. In addition, as discussed in Section 3.2.2.2 above, 3 million gallons of tailings water were released from King Mine into the Animas River on August 5, 2015. While not an “action,” this event is relevant to the cumulative effects analysis. On September 2, 2015, US EPA released data indicating that water quality had returned to pre-event levels (EPA 2015b). However, as of late September 2015, the King Mine continues to release contaminated discharge at a rate of 550 gallons per minute. US EPA intends to install a temporary water treatment facility at the mine to remove any metals and solids from the discharged water by mid-October 2015 (EPA 2015c).

Appendix F lists specific projects or developments in these categories in San Juan County, New Mexico. The list was derived from many sources including Reasonable Foreseeable Development scenarios included in the BLM Farmington Field Office Resource Management Plan and Final EIS, San Juan County Comprehensive Plan, City of Farmington Comprehensive Plan, and the Navajo Nation Comprehensive Economic Development Strategy 2010. In addition, the cumulative project list included in Section 4.18 of the FCPP/NMEP EIS is incorporated in full by reference (OSMRE 2015).

In considering the potential cumulative impacts of the Proposed Action, the geographic and temporal scope varies by resource depending on the characteristics of potential impacts. For example, the geographic scope of cumulative socioeconomic effects is determined, in part, by the extent of the impacts of tax revenues. In this analysis, the entire Navajo reservation is considered for cumulative socioeconomic consequences because BNCC pays resource taxes that are included in the Navajo Nation's general fund revenue.

The temporal scope considered for cumulative impacts is as follows:

- Past actions are those that occurred between 1990 and 2010.
- Present actions are those that occurred in 2010 and are continuing, and are considered in determining baseline conditions in the Affected Environment (Section 3).
- Future actions are those that are reasonably expected to occur after 2011 through 2030.

A summary of land area impacts associated with past, present, and reasonable foreseeable future actions in San Juan County, New Mexico is shown in Table 5.1-1. A map showing the general location of these developments is included as Figure 5.1-1. The county was chosen as a representative area to illustrate regional trends. This pattern of development is representative for the region that would be affected by the Proposed Action and represents past, present, and reasonable foreseeable future surface disturbance for major development activities in San Juan County, New Mexico.

Table 5.1-1. Land Use Patterns for San Juan County, New Mexico (Percentage of Total Acres)

Land Area	Past (1990)	Present (2010)	Future (2030)
San Juan County, New Mexico Total (acres)	3,585,000 acres	3,585,000 acres	3,585,000 acres
<i>Land Management/Ownership</i>			
<i>Federal Agency Management</i>	26%	26%	26%
<i>Tribal Lands</i>	65%	65%	65%
<i>State</i>	3%	3%	3%
<i>Private Land</i>	6%	6%	6%
Oil and Gas Development	1.0%	1.4%	1.8%
Electric Power Development (power plants, transmission lines)	0.08%	0.08%	0.1%
Coal Mining Total Lease Area	1.25%	1.25%	1.25%
<i>Coal Mining Total Surface Disturbance</i>	0.4%	0.4%	0.4%
Navajo Indian Irrigation Project/ Navajo Agriculture Products Industry (NIIP/NAPI)	1.1%	2.2%	3.1%
Other Development (Housing, roads, government buildings, commercial buildings, water/utility infrastructure)	0.5%	0.8%	2.0%
TOTAL Development San Juan County, New Mexico	3.9%	5.7%	8.3%
Proposed Action			0.02%

Sources: BLM 2003, City of Farmington 2002, BOR 2009.

Note: Italic – not included in total development estimate.

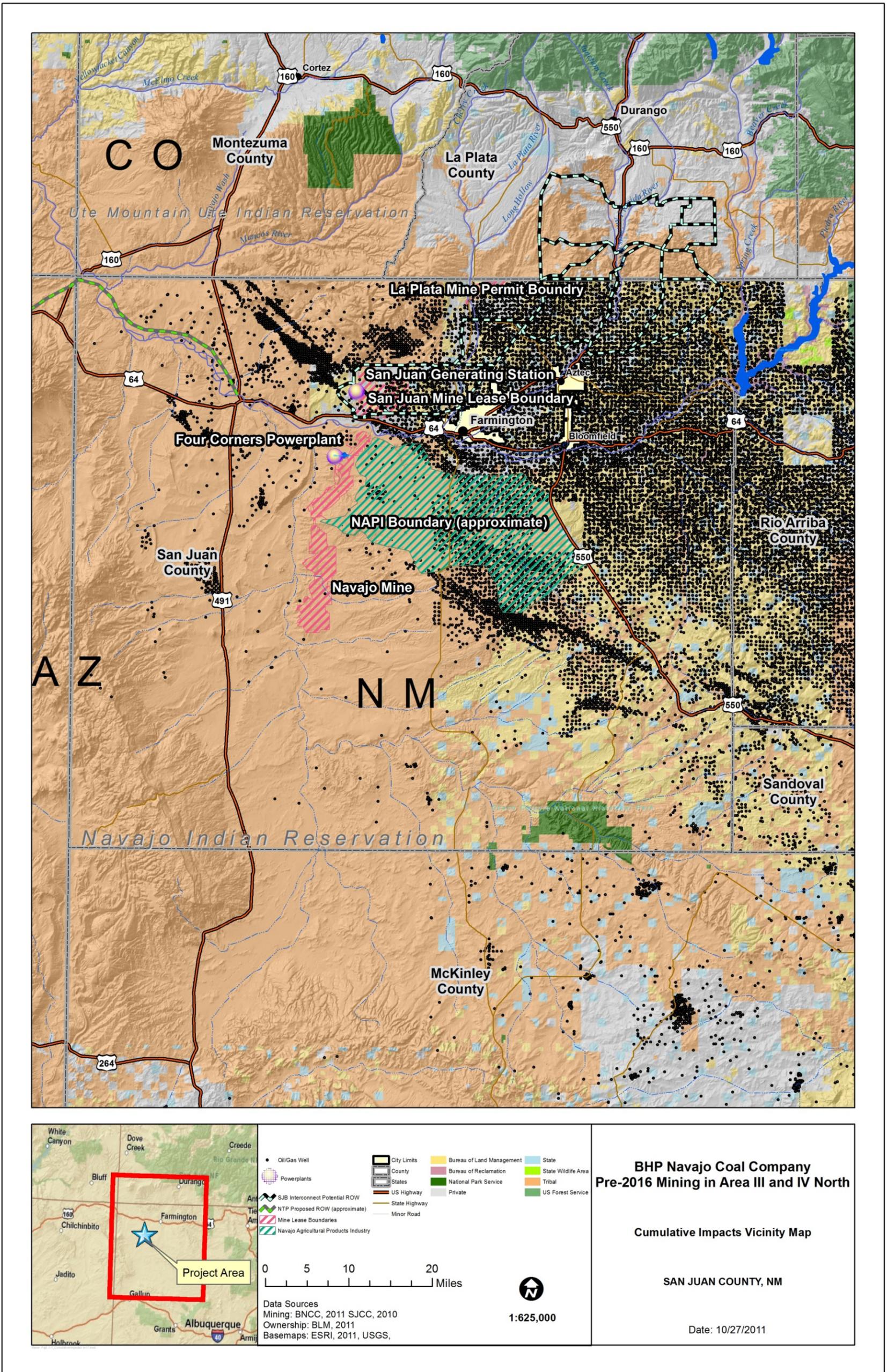
5.1.1 Reasonably Foreseeable Development Scenario

To estimate the future resource impacts that the Proposed Action may interact with, for purposes of identifying and evaluating cumulative impacts, a scenario was developed that estimates reasonably foreseeable developments. This scenario is based on permitted proposals, land use and management plans as well as major development projects that have been announced in San Juan County, New Mexico. Although each resource in the cumulative impact analysis uses a geographic scope specific to its significance and impact parameters, the pattern of development in San Juan County, New Mexico is illustrative of regional trends and is representative of the potential development in closest proximity to the project area. A list of actions included in the scenario of reasonably foreseeable development (RFD) in San Juan County is included in Appendix F.

In general, the pace and extent of development in San Juan County and resulting impacts will be shaped largely by resource and regulatory constraints in several key industries such as oil and gas production, coal mining, power generation, and water resource development. The most prominent factors that affect the RFD scenario include:

- Air quality regulation and compliance – EPA is tightening several air quality regulations for ozone and regional haze in San Juan County that have changed the allowable emissions of NO_x, PM and VOC on all major sources including FCPP, SJGS, and hundreds of engines used in the oil and gas industry. The major rulemaking efforts include EPA’s determination of BART for regional haze compliance at FCPP, the New Mexico Regional Haze SIP for SJGS, as well as the Four Corners Air Quality Task Force is evaluation of emissions reduction options for reducing ozone levels in the San Juan Basin. The result of these regulatory efforts include the following potential developments and trends:
 - In compliance with EPA’s BART determination, APS shutdown FCPP Units 1-3 in December 2013 and will install SCR controls on Units 4 and 5 by 2018 to meet an emission limit for NO_x of 0.098 lb/MMBtu. Closure of Units 1-3 reduced the total output capacity of the power plant by one third from 2060 MW to 1500 MW. SCR operation will require the transport of urea from Colorado to FCPP via daily truck trips.
 - Per the FCPP/NMEP EIS Record of Decision (ROD), BIA permitted the construction of a 350 acre “super cell” DFADA within the FCPP lease area. This facility will serve as the disposal site for all CCRs produced at FCPP, with the exception of a gypsum board producer that transports approximately 20 percent (~ 240,000 tons per year) of FCPP CCRs off-site for beneficial reuse.
 - In May 2014, EPA withdrew the FIP for SJGS due to the Agency’s approval of revisions to the New Mexico Regional Haze SIP, which includes BART requirements for NO_x emissions for SJGS. To comply with this ruling, SJGS will install selective non-catalytic reduction (SNCR) controls on all four units by 2016 and shutdown Units 2 and 3 in 2017. The SNCR is expected to result in an estimated reduction of 4,900 tpy in NO_x emissions, beginning no later than 5 years after EPA approves the State’s BART determination.
 - Oil and gas production equipment is subject to NSPS. This will likely result in conversion to use of electric motors for some oil and gas production in the San Juan Basin and a corresponding increase in the demand for electricity and new electric transmission. Timing and extent of such developments are uncertain at this point.
 - Overall, air quality in the Four Corners region is anticipated to be better protected with the implementation of tighter air emissions standards and NAAQS. In addition, the State of New Mexico has enacted House Bill 195, which created a new section of the New Mexico Air Quality Control Act to provide for regulation of sources of emissions that cause the formation of O₃. If the Environmental Improvement Board determines that emissions from sources within its jurisdiction cause or contribute to ozone concentrations in excess of 95 percent of a NAAQS for O₃, it shall adopt a plan, including regulations, to control emissions of NO_x and VOCs to provide for attainment and maintenance of the standard. At the present time, O₃ concentrations in the San Juan Basin are not within 95 percent of the standard. In the future, if the O₃ concentrations are within 95 percent of the standard, O₃ precursor emissions from sources such as Navajo Mine would likely be further restricted.

Figure 5.1-1. Cumulative Impacts Vicinity Map



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Future Development at Navajo Mine in the remainder of Area IV North and IV South.¹ – BNCC is required by its coal lease with the Navajo Nation to seek development opportunities to market the coal within BNCC’s lease. One such source is the coal sales agreement that was executed by BNCC and APS in 2013. This agreement addresses the development of Navajo Mine southward from the existing operation into the remainder of Area IV North and Area IV South (collectively referred to as the Pinabete Permit Area), as shown on Figure 5.1-1, to supply coal to FCPP from 2016 through 2041. These areas are within the current Navajo Mine lease. The land surface area of these mine additions totals approximately 10,100 acres, which would bring the total area of mining at Navajo Mine to 24,550 acres. All permits and authorizations for this mining action were issued in June 2015 with the publication of a ROD for the FCPP/NMEP EIS. These activities are expected to commence in 2016.

Future development at San Juan Mine – San Juan coal mine owned and operated by SJCC is an underground mine operation located about 15 miles northeast of Navajo Mine and produces approximately 8 MT of coal annually (BNCC 2009b). Most recent reserve estimate show that San Juan Mine has sufficient coal reserves to operate at present levels until 2022. San Juan Mine provides coal exclusively to SJGS and future coal production at San Juan Mine will decrease due to the BART ruling and other operating decisions at SJGS.

Future oil and gas development in the San Juan Basin is limited primarily by the depletion of the basin’s natural gas and oil resource. Some experts estimate that oil and gas production in the San Juan Basin in New Mexico peaked in 2002 and production will be declining in the future (UNM 2005). Additionally, lower natural gas prices and higher operating costs have supported further decline in oil and gas production in San Juan County (E>P 2011). While new oil and gas drilling technologies make it possible to develop the less acceptable resources in the San Juan Basin with a smaller footprint and lower water and air emissions, these technologies are costlier to implement and operate requiring higher prices to support development. Therefore, the future rate of oil and gas development is expected to be slower than in the past and associated surface disturbance and resulting impacts would be smaller. In the PRMP/Final EIS, it was estimated that the long-term surface disturbance associated with the 9,942 new oil and gas wells would be about 16,106 acres (BLM 2003). Currently, 3,722 wells have been spud in the BLM Farmington Field Office area since implementation of the Resource Management Plan and ROD. Of those wells, 1,452 have been twinned or co-located. Therefore, about one-third or approximately additional 6,000 acres have been permanently disturbed in the BLM Farmington Field Office area, which includes San Juan County and portions of McKinley and Cibola counties since 2003.

Water is a constraint on development in the region. Recent water developments such as the Animas La Plata Project (ALP) and the Navajo Gallup Water Supply Project have increased the quantity of water used by the Navajo Nation and other Indian tribes from the San Juan River—the major surface water source in the region. As the tribes develop more of their water rights on the San Juan River, other water users in San Juan County may have to curtail their use to stay within their water supply constraints. However, subject to finalization of the settlement in the San Juan adjudication, the Navajo Nation may market or lease its water or water rights in the region. An ongoing tribal water development project is the

¹ Although the realignment of Burnham Road, mining in Area IV North, and fill of waters of the U.S. has already occurred due to authorization of the 2012 FONSI, these actions are considered in the direct effects analysis and not considered “past actions” here in the CE analysis.

Navajo Indian Irrigation Project (NIIP) that is supplying irrigation water to the NAPI, a 110,000-acre irrigated agriculture project. NAPI is presently about two-thirds complete and will reach full size by about 2014 (BOR 2009).

Urban land use development patterns in San Juan County and Farmington have been determined in the San Juan County Comprehensive Plan and the City of Farmington's Future Land Use Plan. The population of San Juan County is expected to grow from 124,000 in 2010 to over 156,000 in 2030. The pattern of development associated with this growth is expected to total 156,600 acres in the City of Farmington in 2020 with about 40 percent being parks and open space, and the remainder residential, commercial, industrial, or infrastructure development (City of Farmington 2002).

Also included in the urban land use development pattern in San Juan County are commercial establishments such as new casinos being developed by the Navajo Nation. While these developments will not have a marked change on the surface land use pattern, they are representative of changes to the economic base and socioeconomic patterns for the Navajo Nation and San Juan County. Both governments are trying to reduce their dependence on extractive industries such as coal, oil, and gas development for government revenues. For example, the Navajo Nation has invested more than \$200 million in casino and resort properties on the reservation and is expecting to earn \$150 million annually from them (Navajo Nation 2010). Casinos and resort properties investments include \$30 million investment in Fire Rock Casino near Gallup, New Mexico that opened in November 2008. The casino employs more than 350 workers and generates more than \$40 million in net winnings annually for the Navajo Nation (Landry 2010).

Energy development in the region includes several proposed power plants and large transmission lines to move renewable energy generated in eastern New Mexico and Colorado to western electric markets. The proposed generation and transmission projects are listed in Appendix F. In general, the transmission projects—the projects most likely to have large surface impacts—would be located along existing highway or other ROWs. The generation projects would be required to comply with New Source Performance Standards and would be limited to air emissions levels that would not cause NAAQS exceedances.

5.2 Cumulative Impacts

The incremental contribution of impacts of the Proposed Action, when considered in combination with other past, present, and reasonably foreseeable actions are summarized by resource below. The following sections describe potential cumulative impacts for each resource in detail. Resources are defined in Section 3 of this document. Impact assessment criteria and methodologies are discussed in Section 4.

5.2.1 Geological Resources

5.2.1.1 Temporal and Geographic Scope

The geographic scope for assessing cumulative impacts to geological resources is the extent of the soils and geological materials in the San Juan Basin. The coal would be mined from the Fruitland Formation. Outcrop areas of the Fruitland Formation extend from the New Mexico-Colorado state line north of Farmington in a broad arc approximately 60 miles south to Hunters Wash and Coal Creek south of Burnham, New Mexico. The width of the outcrop area is highly variable ranging from hundreds of feet to 1 to 2 miles, depending on the dip of the formation and adjacent topography. The soil types found within

the assessment area (areas of proposed mining and Burnham Road realignment) are present throughout the western San Juan Basin. Impacts to geological resources are considered in both the short and long term, based on the existence of direct and indirect impacts to these time scales.

5.2.1.2 Cumulative Effects

Other mining activities throughout the extent of the San Juan Basin, including past and present mining in the Navajo, San Juan, and La Plata Mines in the San Juan Basin, could be expected to have similar long-term effects on geological resources as those described in Section 4.1. However, given the extent of the San Juan Basin, the impact of the Proposed Action, even when considered along with similar activities, is expected to be minor. Mining activities at Navajo Mine have impacted approximately 12,900 acres, or an estimated 0.07 percent, of the 30,000 square mile/19.2 million acre San Juan Basin. The Proposed Action would add about 740 acres to the total impact area for the Navajo Mine.

Past, present, and reasonably foreseeable activities in the region that are expected to impact soils include activities at the FCPP, San Juan, La Plata, and Navajo Mines, oil and gas development, pipeline and transmission line projects, and activities at NAPI. These projects are expected to result in a range of short- and long-term impacts to soils including disturbing soils, temporarily or permanently increasing erosion in areas where BMPs or reclamation are not employed, and reducing soil loss to erosion where reclamation and revegetation occurs. Given the 740 acres of soil that would be disturbed by mining and the large extent of those soils in the San Juan Basin, any impacts of the Proposed Action is not expected to contribute appreciably to cumulative impacts to soils from other activities in the San Juan Basin.

5.2.2 Water Resources

5.2.2.1 Temporal and Geographic Scope

The geographic scope and temporal parameters for the water resources cumulative impact analysis varies between groundwater resources and surface water resources. The geographic extent of the cumulative impact area for groundwater resources is quite limited but the temporal effects are long, on the order of 50 years and longer for water level recovery after mining, and on the order of 100 years and longer for mine spoil water to migrate beyond the permit area due to the extremely slow velocities of groundwater flow in the Project Area. The geographic extent of the cumulative impact area for surface water resources is somewhat larger, but the temporal effects are considerably shorter due to the nature of surface flow in the Project Area.

The temporal effects for groundwater are quite long as described in Section 4.2. Based on the permeability of the PCS of approximately 0.01 feet per day and gradients of approximately 0.2 percent across Area IV North, the velocities of groundwater flow in the PCS is on the order of 0.02 feet per year for porous rock flow and as high as 1 foot per year for fractured rock flow. Groundwater velocities in the Fruitland coals are of a similar magnitude or lower. Thus, the extent of groundwater transport in the Fruitland Formation and the PCS beyond the lease boundary in a 1,000-year time period is at most 1,000 feet and more likely considerably less than 1,000 feet. Thus, the cumulative impact area with respect to groundwater in the Fruitland Formation and PCS is determined to be within 1,000 feet of the Area III and Area IV North lease boundary.

Groundwater velocities in the alluvium are considerably higher in comparison with the bedrock due to the higher permeability in the alluvium (BNCC 2011) and higher gradient inferred from the valley slope of about 0.6 percent. The groundwater flow in the Cottonwood alluvium merges with the groundwater flow in the Chaco River alluvium. Consequently, the cumulative impact area for the alluvial groundwater includes the alluvium of Cottonwood Arroyo and the alluvium of Chaco River from the confluence of Chaco River with the Cottonwood Arroyo down valley to the confluence of Chaco River with the San Juan River.

The geographic extent of the cumulative impact area for surface water resources includes the Chaco River watershed below the confluence with Cottonwood Arroyo, and the San Juan River below the Morgan Lake intake—but the temporal effects are limited to the reclamation bonding period or up to 10 years following revegetation. This is projected to extend to about 2024 for the Proposed Action in Areas III and IV North. Impacts to flow would occur only during short periods following storm events since all the tributaries to Chaco River and Chaco River above Morgan Lake discharge are ephemeral streams except for Cottonwood Arroyo and Chinde Wash, which are intermittent and perennial respectively due to irrigation return flow from NAPI.

In addition to past and current mining activities at Navajo Mine, the following reasonable foreseeable developments from Appendix F have potential to affect water resources within the geographic areas and temporal timeframes described above; closure of FCPP units; development of a new DFADA; expansion of NAPI; future mining at Navajo Mine; and oil and gas development within the Chaco River watershed.

5.2.2.2 Cumulative Effects

5.2.2.2.1 Groundwater

Past, current, and proposed mining 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, the actual magnitude and extent of the cumulative drawdown will depend upon the time sequence of mining and pit backfilling and reclamation. Nevertheless, the cumulative effects of drawdown are determined to be negligible because there are no 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 2011).

In addition, based on the extent of drawdown from proposed mining within Area IV North, there will be no cumulative drawdown effect on the alluvial groundwater in Pinabete Arroyo that supplies water for several stock water wells (BNCC 2011). Modeling predictions indicate that mining in Area IV North is not expected to result in a drawdown in water level or depletion of groundwater in the Cottonwood alluvium downgradient of mining; however, there could be a cumulative drawdown within the alluvium of Cottonwood Arroyo, although the impact would be of short duration due to the inverse effect on groundwater post reclamation. The drawdown effects will begin to diminish quickly with backfilling of the mine pits during reclamation and recharge. In fact, because Navajo Mine conducts contemporaneous reclamation concurrent with ongoing mining, the cumulative impact on groundwater levels and quality from future mining at Navajo Mine would be negligible but long term. Additionally, the alluvial groundwater in Cottonwood from the occasional release of surface water to the North Fork channel from the NIIP Amarillo canal will return with the re-establishment of the flows in the North fork of Cottonwood Arroyo following reclamation within Area III; reducing potential alluvium drawdown.

As described in Section 4.2.2.2, a long-term effect of mine reclamation under the Proposed Action with mining in Area III and Area IV North is an increase in the rate of groundwater recharge due to the lower slopes and placement of topdressing materials within reclaimed areas. Enhanced recharge from mine reclamation associated with past and current mining in Area III, from proposed mining within Areas III and IV North, and from reasonably foreseeable mining within all of Area IV North could result in an increase in groundwater flow in the alluvium of Cottonwood Arroyo. The increase in recharge rates is projected as a long-term effect; it is unknown whether the increase would persist over the 100 to 500 year period for assessment of groundwater effects. However, the predicted increase in groundwater flow is expected to be low relative to the high baseline variability in Cottonwood alluvial groundwater, and might not result in a long term measurable change.

Full expansion of NAPI irrigation may also occur in the near future, resulting in possible increases in groundwater flow in the Cottonwood Arroyo from irrigation return flows and seepage from proposed irrigation plots located within the headwaters of Cottonwood Arroyo. The expanded NAPI irrigation plots would be far removed from mining within Area III or Area IV North and are unlikely to provide a source of water for recharge of the mine backfill following reclamation (Glaser 1998).

Produced water extraction from existing coal bed methane operations to the east of the Navajo Mine and for the reasonably foreseeable coal bed methane development project in the eastern Burnham Chapter are not expected to overlap or have a cumulative effect with respect to drawdown within the BNCC lease due to the low permeability and limited produced water extraction from these deeper coal beds.

The impact of all these changes in alluvial groundwater flows are expected to be negligible, as changes in alluvial groundwater within the coal lease areas are expected to be small relative to baseline fluctuations, given the high variability in baseline data.

Groundwater Quality and Use

Long term, after recovery of water in mine backfill within Areas III and IV North, 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 mine site. Increasing TDS and sulfate concentrations have been observed in the alluvial groundwater in Chinde Arroyo due to NAPI irrigation water return flows. 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.

Reasonably foreseeable actions within the cumulative impact area are also expected to include mining and reclamation within the remainder of Area IV North and Area IV South. Mining within the remainder of Area IV North into the future may also increase TDS concentrations in the Cottonwood alluvium. Re-establishment of the reclaimed North Fork of Cottonwood channel following reclamation within Area III would result in direct recharge of the alluvial groundwater in Cottonwood Arroyo from the periodic release of surface water, not used for irrigation, to the North fork channel from the NIIP Amarillo canal. Direct discharges are a result of an oversupply of water in the canal that is released directly to the channel, therefore unlike irrigation return flows, this water does not come into extended surface contact

with fields, badlands, and overburden materials. Increased direct recharge to the alluvium of Cottonwood Arroyo would be expected to lower TDS concentrations in the alluvial groundwater, which could offset changes that may occur because of mine backfill water and NAPI irrigation return flows.

Thus, the cumulative effects assessment indicates intermediate-term reduction in groundwater flows in the Cottonwood alluvium followed by delayed but long-term increases in both groundwater flow and TDS and sulfate concentrations in Cottonwood alluvium. The impact of these changes in alluvial groundwater flow and TDS concentrations are expected to be minor and within the natural variability in alluvial groundwater flow and TDS concentrations in the alluvial groundwater within Cottonwood Arroyo as noted in Section 4.2.2.2. In addition, as noted previously, the groundwater in the Cottonwood Alluvium has limited potential for livestock use within and downgradient of the Navajo Mine permit boundary due to variable saturation and low yields. The estimated changes in groundwater flow and groundwater quality in the Cottonwood alluvium are also not expected to affect surface water quality or potential ecological receptors since groundwater does not discharge to the surface in the area. However, changes in groundwater flow and groundwater quality in the Cottonwood alluvium will have an incremental contribution to the alluvial groundwater flow along the Chaco River.

Mining and reclamation within the remaining portions of Area IV North and within Area IV South of the BNCC coal lease could impact the alluvial groundwater within Pinabete Arroyo—similar to the changes predicted for the alluvium of Cottonwood Arroyo. Irrigation return flows from full expansion of the NAPI irrigation project are not expected to affect the alluvium of Pinabete Arroyo, but could result in increased groundwater flows and TDS concentrations within the alluvium of Brimhall Wash located south of Pinabete (Glaser 1998). Since the alluvial groundwater within Pinabete Arroyo and Brimhall Wash merges with the groundwater flow in the Chaco River alluvium, there could be a cumulative effect of the proposed project together with NAPI irrigation expansion and mining within Area IV South on the alluvial groundwater in the Chaco River valley, down valley of the Cottonwood Arroyo confluence.

Any increase in flow and 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 2011). 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 current and reasonably foreseeable actions that could affect the flow and water quality of the Chaco River alluvium include NAPI irrigation water return flows in the alluvial groundwater in Chinde Arroyo, and discharge to the Chaco River from Morgan Lake. 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 from capillarity. 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.

There are no indications that other activities at the FCPP have affected the Chaco River alluvial groundwater (GEI 2009). FCPP currently places CCB materials in the LAI located west of the power plant and east of the Chaco River (GEI 2009). Water from the LAI is decanted to the Lined Decant Water

Impoundment (LDWI). Water impounded by the LDWI is pumped to the power plant for recycle so that there is no discharge from the CCB disposal operations. Historically, CCB materials were placed in six unlined disposal cells, which are no longer in service, and as mine pit backfill material at the Navajo Mine. Use of CCB materials as mine pit backfill material at Navajo Mine was discontinued in 2008. Seepage has been noted at the downstream toe of FCPP CCB Ponds #3 and #4. Seepage is expected to reduce as available water drains from CCB ponds #3 and #4 (GEI 2009). In addition, reasonably foreseeable future activities at the FCPP include expansion of the DFADA. This will involve disturbance of approximately 200 acres. CCB would be placed on lined ash disposal areas.

APS shut down FCPP Units 1-3 in December 2013, per the EPA FIP for FCPP. Closure of these units reduced cooling water requirements, which resulted in a reduction in the rate of discharge to/from Morgan Lake. This reduced demand could lower the base flow on the perennial segment of the Chaco River and result in a reduction in the alluvial groundwater flow along this segment. However, the effect of these changes on alluvial groundwater quality is uncertain and difficult to detect because of the variability in the existing water quality in the alluvium. Consequently, the potential cumulative impacts to the water quality of the Chaco River alluvium are expected to be minor to negligible due to the natural variability in the existing water quality in the alluvium and the differences in the timing of the effects on the flow and water quality in the Chaco River, resulting from possible changes in the alluvial groundwater conditions within the Chaco tributaries.

Continued operation of FCPP would have a negligible cumulative effect on groundwater quality. CCBs from FCPP were placed in mined out pits or ramps at the Navajo Mine during the period from 1971 to 2008. Continued, reduced operations of the FCPP do not include placement of CCB materials in the mine backfill for reclamation at the Navajo Mine. Historic CCB placement occurred primarily within Area I with limited placement in Area II. There are no cumulative adverse impacts to groundwater quality resulting from its past CCB placement at Navajo Mine because there is no cumulative groundwater impact or hydrologic connection between Areas III /IV and Area I/II. Nevertheless, the potential impacts of CCB placement within Areas I and II are discussed further.

Unsaturated conditions currently exist at CCB backfill placement locations except for two locations at the northern end of Area I. CCB materials placed in the Bitsui Pit are saturated as are an isolated location of basal saturation of CCB material around the Watson-4 well. Current groundwater flow directions from the Bitsui Pit are toward the subcrop of the Fruitland Formation along the alluvium of the San Juan River (BNCC 2011). Any groundwater flow in the future from Area I and portions of Area II is also expected to be to the northeast toward Fruitland Formation subcrop along the alluvium of the San Juan River. Consequently, groundwater from CCB placement locations and associated mine backfill within Areas I and II are not expected to affect the alluvium of the Chaco River. Therefore, there will be no overlap or cumulative impacts to the Chaco River watershed associated with past mining and reclamation activities in these areas and with proposed mining and reclamation in Areas III and IV North under the Proposed Action.

A supplemental groundwater study program and monitoring well installation was implemented to assess possible impacts to groundwater from historic mine placement of CCBs at Navajo Mine (BNCC 2009a, Appendix 11-MM). BNCC has also completed a series of detailed laboratory batch leaching studies of the constituents leached from CCBs and mine spoil for the PHC determination (BNCC 2011, Appendix 11-K and 11-VV). Both of these results—the field monitoring and the laboratory leach studies—show that TDS

and sulfate concentrations do not increase in CCBs that become saturated with spoil water (water that flows through the backfilled mine spoils after mining). Arsenic, boron, fluoride, and selenium concentrations may increase in CCB leachate. Boron and fluoride in the CCB monitoring wells were above the livestock criteria. Arsenic concentrations in the CCB wells were close to the livestock criteria, while selenium concentrations were below the livestock criteria. Other trace constituents were below detection limits in the majority of the samples from both CCB and spoil wells (BNCC 2011). The arsenic, boron, and fluoride concentrations in a spoil monitoring well immediately downgradient of a CCB well showed that spoil attenuates or reduces the concentrations of these constituents (BNCC 2011).

Transport modeling of spoil water from Area I through the Fruitland Formation to its discharge location at the formation subcrop beneath the alluvium of San Juan River indicates that changes in sulfate concentrations in the San Juan River alluvial groundwater are not expected to occur. Furthermore, groundwater flow in the San Juan River alluvium is estimated to be approximately two orders of magnitude higher than the estimates of groundwater flow discharging to the San Juan River alluvium from the Fruitland Formation (BNCC 2011). Thus, TDS and trace constituents such as boron that may be above livestock suitability levels in CCB or mine spoil leachate will be reduced by mixing with the groundwater in the San Juan River alluvium even if they are not attenuated during transport to the Fruitland Formation. The existing water quality in the San Juan River alluvial aquifer is quite variable as indicated by the available water quality data from San Juan River alluvial wells provided in Appendix 6.E of the Mine Plan Revision (BNCC 2011). There are no cumulative adverse impacts to surface water quality from CCB placement at the Navajo Mine. CCB materials have not been placed within mine backfill in Area III and there are no plans for placement of CCBs within mine backfill in either Area III or IV. CCB materials were placed within Area I and portions of Area II but there is no cumulative groundwater impact or connection between Areas III and IV and Area I and II.

5.2.2.2.2 Surface Water

Cumulative impacts associated with surface water resources for the Proposed Action are limited, and should they occur, are anticipated to develop during the period of mining and reclamation. Contributions to cumulative impacts to surface waters are expected from mining and reclamation of the Navajo Mine, the NAPI, FCPP operations, and various regional San Juan River water projects.

Surface mining will result in capture of surface flows within the mine area, diversion of flows around the mine area, and mining through smaller ephemeral tributary channels as pit development proceeds across the mine area. Mining activities have occurred at the Navajo Mine since 1957. The SMCRA mine permit covers an area of about 13,430 acres, which is crossed generally from east to west by several intermittent arroyos and ephemeral channels and represents 0.63 percent of the Chaco River watershed. Cumulatively, past and present mining has affected about 12,990 surface acres within the permitted area, or 0.44 percent of the Chaco River watershed. The Proposed Action would add 488 acres of surface disturbance. The active, non-reclaimed operations plus the Proposed Action would result in disturbance of 0.19 percent of the Chaco River watershed. Potential post-2016 mining within the remainder of Areas IV North and IV South could additionally include as much as 10,100 acres of surface disturbance. While mining creates a direct, intermediate-term impact, reclamation is ongoing, resulting in a moving disturbance footprint of negligible severity to the Chaco River watershed.

The Navajo Mine has historically mined through small channels, and captured or diverted flows around active mine areas to avoid water pollution and mine safety issues. Five upstream highwall impoundments in Areas III and IV North with a total capacity of 60.8-acre feet prevent water from passing through the mine. There are 29 downgradient sediment ponds in Areas III and IV North, which can store as much as 173.7 36-acre feet of water. Approximately 83.5 percent of the 12.3-square mile Lowe watershed is retained in Area III, while 5.2 percent of the 80-square mile Cottonwood is retained from passing through Areas III and IV North. About 353 square miles of watersheds that pass through the Navajo Mine drain to the 4,563-square mile Chaco River watershed. This is 7.7 percent of the Chaco River watershed within the 14080106 HUC unit and reflects a negligible impact. About 365 square miles (includes Bitsui Wash) of watersheds within the 24,908-square mile San Juan River Watershed pass through the Navajo Mine. This is 1.5 percent of the San Juan River watershed within the 1408 HUC unit and reflects a negligible impact. Currently, mining is occurring in the Lowe and Dixon mine pits in Area III and encompass approximately 1,100 acres located between Neck Arroyo on the north and Cottonwood Arroyo on the south. Water has been routed around the mining areas in Area III in the Lowe-Dixon Diversion and the North Fork Diversion. Potential future mining in Area IV South could impact Pinabete Arroyo or its tributaries, depending on the mine plan. The Pinabete watershed is 1.28 percent of the Chaco River watershed, and discussions of the severity of impacts from mining are premature until a mine plan is prepared. Mining impacts to surface waters occur only during mining. SMCRA reclamation requirements result in re-establishment of drainage and the hydrologic balance throughout the mined area following conclusion of mining. The reclaimed topography will re-establish a similar drainage density to the original topography, and gentler slopes, covered with suitable topdressing materials should yield a more stable surface with more infiltration and lower peak flows from storm events. Thus far, about 7,925 acres have been reclaimed, primarily in Areas I, II, and III. OSMRE has terminated its jurisdiction in the Bitsui drainage, a north-draining tributary into the San Juan River. Mining and reclamation of Areas I, II, and III have occurred in tributaries draining west into the northerly flowing Chaco River, a tributary of the San Juan River. About 1,800 acres within the Navajo Mine currently support essential infrastructure and will be reclaimed following conclusion of mining. Reclamation following mining is planned, scheduled, or proceeding on the remaining 3,265 acres. Once mining and reclamation is complete and bond released, impacts to flow from mining will be non-existent.

The area developments that have the most potential for regional cumulative impacts are changes in diversion to Morgan Lake associated with the shutdown of FCPP Units 1-3, and changes in water use associated with NAPI. Changes in water use and discharge by FCPP would not affect surface water resources impacted by the Proposed Action. NAPI is currently irrigating 70,000 acres of potatoes, onions, beans and other crops using center pivots, side roll, and flood irrigation systems using 200,000 – 210,000-acre-feet per year. This volume is 14 percent of the average annual yield of 1.462 million acre-feet at the USGS site San Juan River at Shiprock (09368000). These agricultural return flows, a small percentage of the diversion, are not interrupted by mining activities, but rarely extend far into the Chaco drainage, due to infiltration and evaporation. NAPI has the potential to expand to 110,630 acres from its current 70,000 acres to the east of the Navajo Mine, an increase of 58 percent with anticipated usage of 330,000-acre feet per year (Glaser 1998).

Future development may continue further east and south of existing development into the headwaters of Cottonwood, and into the headwaters of the Brimhall and Hunters Wash (Lynch 2011, personal communication). This would have less impact on flows in the Cottonwood Arroyo than flows into the

Area 1 Bitsui Wash area, which was closer to the agricultural project. The outlook for full expansion of NAPI is uncertain at this time.

Surface Water Quality and Sedimentation

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, the Navajo Mine has emplaced 29 downgradient retention ponds, in Areas III and IV North, to avoid and reduce impacts to 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 cumulative surface water impacts following bond release for reclamation of areas disturbed by mining within Area III or Area IV North. Any cumulative impacts would be related to short-term sedimentation or flow changes.

Sedimentation is typically associated with land disturbance. As stated previously, impacts to offsite sedimentation from the mine activities are not likely, due to the use of sediment impoundments on the downstream side of pits. These impoundments, coupled with the retention of precipitation and stormwater runoff within pits, and the subsequent evaporation, can change the flow regime within watersheds downstream of the mine. Other developments within the cumulative impacts assessment area, which could potentially impact cumulative sedimentation, could be changes in water use associated with NAPI and proposed oil and gas development on surrounding Navajo Indian Reservation lands. The contemplated oil and gas development closest to BNCC would be Western Oil and Gas' proposal to develop 600 wells in the Eastern Burnham Chapter, which is in the Chaco River watershed. Because the Proposed Action would have a negligible impact to downstream surface water quality, the cumulative impact, when added to potential downstream oil and gas development, would also be negligible.

Other cumulative water quality impacts could result from deposition of pollutants emitted from power plants in the region (e.g. FCPP, SJGS, and Navajo Generating Station). This was addressed in the FCPP/NMEP EIS, Section 4.18.3.5 (OSMRE 2015), for the period between 2016 to 2044, but is accurate for the period of analysis in this EA as well (2012-2016) as air emissions from FCPP decreased beginning in 2014 as a result of the shut-down of Units 1, 2, and 3, and therefore, deposition of metals in surface waters due to the combustion of coal from FCPP decreased accordingly. The discussion from the FCPP/NMEP EIS is incorporated by reference below:

Other than impacts associated with sedimentation and flow, surface water quality impacts are associated with deposition of metals and particular matter emitted from the FCPP. Although modeling and ecological risk assessments...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....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.

5.2.3 Noise and Vibration

5.2.3.1 Temporal and Geographic Scope

Noise and vibration have been generated by mine operations since the initiation of operations at the mine in the early 1960s and are expected to continue to be generated during future operation under the Proposed Action and future reclamation of the mined area. Because noise and vibration dissipate rapidly with increasing distance from the noise source, the geographic extents of noise and vibration effects are generally limited to approximately 1 mile. The duration of noise impacts associated with the Proposed Action is limited to the life of the proposed mining and reclamation activities.

5.2.3.2 Cumulative Effects

Past, present, and reasonably foreseeable activities in the area affected by the Proposed Action include existing and proposed oil and gas development and existing mining activities, continued operation of the FCPP and Navajo Mine. Direct and indirect effects of the Proposed Action described in Section 4.3 indicate that the Proposed Action would not cause substantial impacts to nearby residences from noise or vibration. No existing or future development is expected to add to the operational noise and vibration from the Proposed Action since the mining activities that would take place under the Proposed Action do not differ in frequency or type from those that have been employed or are currently being employed at Navajo Mine, and no other RFD is expected to occur here. In addition, noise generated at the FCPP is localized to the FCPP Lease Area and would not contribute to cumulative noise impacts from the Navajo Mine (OSMRE 2015). As past and current coal production and related noise declines in Area II, mining in Area IV North and resultant noise generated would not add to noise levels within a mile of the activity. Rather, the impact would be to extend the duration of the noise until 2016 and shift its location to the northern portion of Area IV North. Given the distance of the potential receivers from this area, the low level of impact from the Proposed Action, and the distance of the Project Area to other current, planned, and reasonably foreseeable activities, substantial cumulative effects on ambient noise and vibrations are not anticipated.

5.2.4 Visual Resources

5.2.4.1 Temporal and Geographic Scope

Based on the visual resources impacts summarized in Section 4.4, past, present, and reasonably foreseeable projects that occur within the foreground (0-1 mile) or middleground (1-5 miles) of the Project Area viewshed were considered in the analysis of cumulative impacts, as this is where potential for effects to visual resources generally occurs.

5.2.4.2 Cumulative Impacts

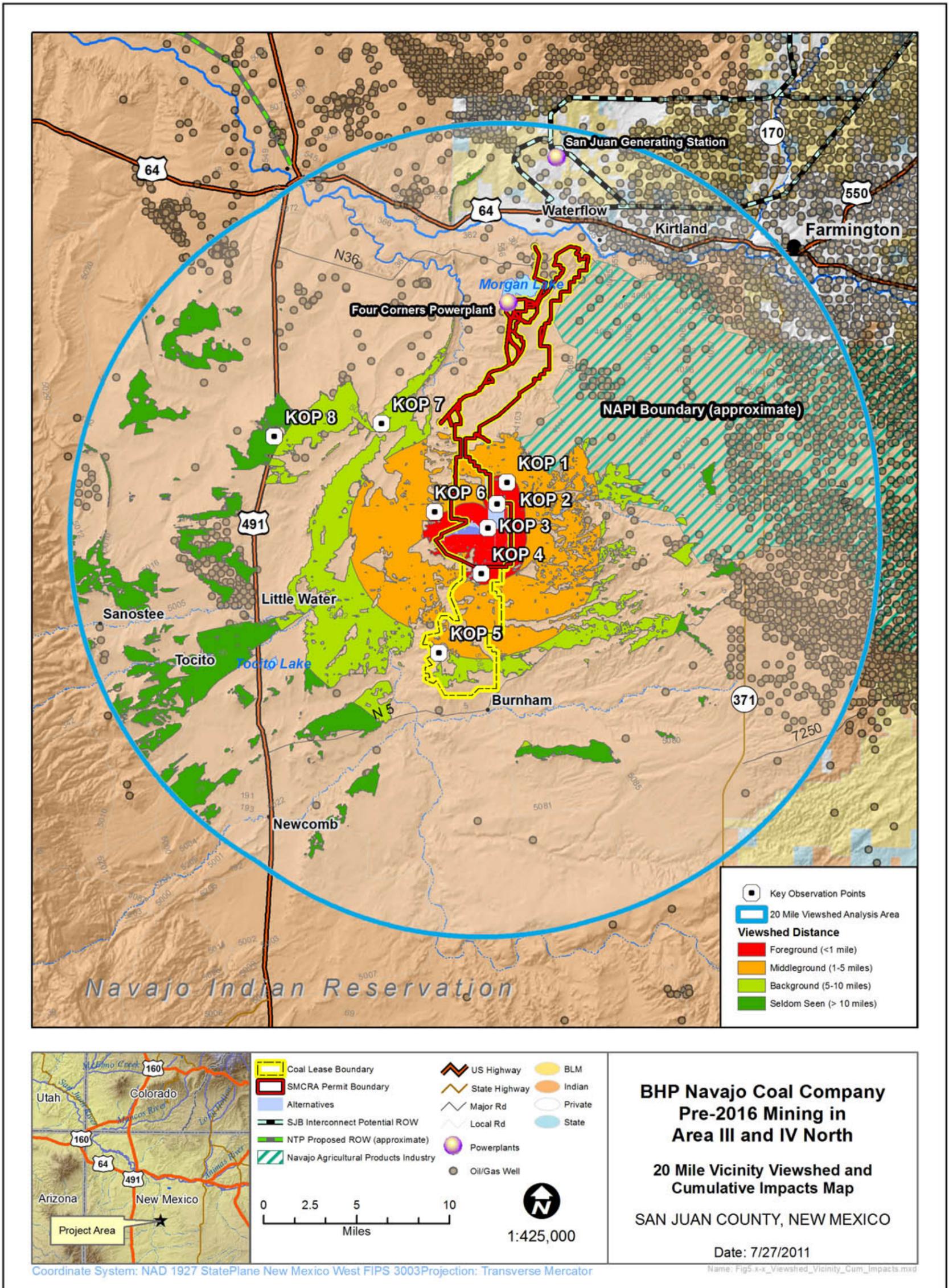
Several of the projects identified in the RFD would occur within the Project Area foreground or middleground or would affect visibility in the area. The drill rigs and pump jacks associated with projected oil and gas development are expected to occur in the middleground of the Project Area viewshed, particularly north and east of the Project Area. Ongoing mining activities at Navajo Mine could occur in the fore- and middleground. Irrigation and related activities at NAPI occur in the middleground

of the Project Area viewshed. Activities at NAPI are not expected to change from what is presently visible from the Project Area.

Contrast between the “look” of the anticipated Project landscape and a landscape that includes multiple cumulative projects described above, was estimated from sensitive viewpoints located within the foreground and middleground viewshed of the Proposed Action; these included KOPs 1, 2, 3, 4, and 6 (see Figure 5.2-1 and Table 3.4-1 for a description of the KOPs). It is expected that oil and gas activities proposed to the northeast and east of the Proposed Action would not be visible from KOPs 1, 2, 3, 4, or 6. Activities associated with initiation of mining in Area IV South would likely be visible to some extent from all 5 KOPs; however, the activities that would be conducted would be similar to those currently occurring in Area III and anticipated for Area IV North, and are not expected to overlap for an extensive period with existing conditions and the Proposed Action.

Criteria considered in assessing the cumulative impacts of the Proposed Action combined with potential effects from past, present, and reasonably foreseeable future projects on visual resources are described in Section 4.4.1. Based upon these criteria and since all facilities considered in this cumulative effects analyses would be required to abide by all Federal and state air quality regulations, the combination of the Proposed Action and past, present, and reasonably foreseeable future actions is not expected to generate potential cumulative impacts to visual resources substantially in excess of those identified for the Proposed Action.

Figure 5.2-1. 20-Mile Vicinity Viewshed and Cumulative Impacts Map



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5.2.5 Air Quality

5.2.5.1 Ambient Air Quality

5.2.5.1.1 Temporal and Geographic Scopes

The geographic scope for analysis of cumulative effects on ambient air corresponds to the AQRA for this study (i.e., a geographic area within approximately 50 kilometers of Navajo Mine). This broad area includes emission sources that contribute to regional air quality levels. The temporal scope for analysis of cumulative effects on air quality has been limited to no later than calendar year 2018 because there are no credible projections of emissions after that date from sources within and near the AQRA.

5.2.5.1.2 Cumulative Effects

Cumulative effects on air quality are assessed by examining the collective contribution of pollutants emitted by each existing and anticipated new emissions source in the AQRA. The total emissions of a pollutant from all new and existing sources in an area creates a combined ambient concentration of that pollutant to be compared to its NAAQS. That cumulative air quality impact from all existing sources may be determined by monitoring the pollutant's level in ambient air or by modeling the dispersion of that pollutant from all existing sources. The assessment of cumulative air quality effects for this EA relies on existing ambient air quality conditions in the AQRA (see Section 3.5.2.3) and the projected levels of a pollutants emitted from the Proposed Action (see Section 4.5.2.1.1) as well as other reasonably foreseeable actions that would contribute emissions to the AQRA. Contributions to cumulative effects from the Proposed Action (i.e., mining in Area IV North) will not be discernable, because the net changes in air emissions from the current baseline conditions are very small (refer to Table 4.5-5).

Past, Present, and Reasonably Foreseeable Actions

Substantial emission reductions from the two large electric generating stations in the AQRA—FCPP and SJGS—have occurred during the past few years. In 2005, PNM entered into a consent decree, since incorporated into Federally enforceable conditions in a permit issued by NMED, to reduce emissions of NO_x, SO₂, PM and mercury from SJGS. Overall emission reductions are estimated to be 8,400 tpy for NO_x, 2,450 tpy for PM, and 6,000 tpy for SO₂. In 2007, EPA finalized a source-specific FIP for FCPP that included requirements to reduce SO₂ emissions by about 25,000 tpy and “Federalized” emission limits for NO_x and PM, which FCPP had historically followed without a Federally enforceable requirement.

EPA's FIP for FCPP included the shutdown of Units 1-3 (occurred December 2013) and the installation of SCR on Units 4 and 5 by 2018. These measures will reduce NO_x emissions by 87 percent, or up to 35,700 tpy (OSMRE 2015). This reduction will yield an air quality benefit to the condition of regional haze in the AQRA.

Annual coal production at Navajo Mine declined as a result of the shutdown of FCPP Units 1-3. Should annual emissions from the mine decrease with reduced production, no substantive changes in ambient levels of PM₁₀, PM_{2.5}, or NO_x, which are already quite low, would be expected to occur. Because ambient levels of NO_x in the AQRA are dominated by the two power plants in the area and existing oil and gas operations in San Juan County, an approximate 100 tpy decrease in NO_x emissions from the mine due to

its reduced engine usage with the shutdown of FCPP Units 1-3 would have no discernible effect on existing ambient levels of NO_x.

In May 2014, EPA withdrew the FIP for SJGS due to the Agency's approval of revisions to the New Mexico Regional Haze SIP, which includes BART requirements for NO_x emissions for SJGS. To comply with this ruling, SJGS will install SNCR on all four units by 2016 and shut down Units 2 and 3 in 2017. The SNCR is expected to result in an estimated reduction of 4,900 tpy in NO_x emissions, beginning no later than 5 years after EPA approves the State's BART determination.

As documented in Section 3.5, measured ambient O₃ levels at the Navajo Lake SLAMS site are approaching the level of the O₃ NAAQS and levels of ambient O₃ at the other two SLAMS sites in San Juan County are also cause for concern. To avoid possible re-designation as an O₃ non-attainment area, a recently enacted New Mexico statute requires the adoption of regulations to control emissions of NO_x and VOCs in areas where the ambient O₃ concentration is within 95 percent of the NAAQS. Ambient levels of O₃ in San Juan County are likely to raise within 95 percent of the O₃ NAAQS in the next few years, thereby triggering requirements for NO_x and VOC emission reductions in the area.

In O₃ nonattainment areas, existing sources of NO_x and VOC emissions (which are precursors to formation of atmospheric ozone) must install "reasonably available control technology" (RACT) for those pollutants. Far more stringent controls, (i.e., "lowest achievable emission rate" [LAER] technology), is required on new and modified sources of NO_x and VOC emissions in O₃ nonattainment areas.

Although significant reductions in NO_x and VOC emissions from existing oil and gas operations are likely in the near future, new oil and gas facilities are expected to be developed in northwestern New Mexico. From 2002 to 2018, NMED has predicted statewide increases in NO_x and VOC emissions from oil and gas operations to be over 18,000 tpy and 43,000 tpy, respectively. Current NO_x and VOC emissions from oil and gas operations in San Juan County alone are estimated to be 27,500 tpy and 32,700 tpy, respectively. Due to increasing ambient O₃ concentrations in San Juan County, existing oil and gas facilities in the County will likely need to achieve a RACT-level of control on their NO_x and VOC emissions within 5-10 years. Assuming average RACT efficiencies of 30 percent, aggregate NO_x and VOC emission reductions of approximately 8,200 tpy and 9,800 tpy, respectively, are anticipated from those oil and gas operations.

Conclusion

The Proposed Action is not anticipated to cause discernible impact to ambient air quality or to contribute to any cumulative effects on air quality in the AQRA. The net change in emissions at the mine under the Proposed Action is well below the regulatory Significance levels defined for detailed new source review.

Beneficial effects caused by substantive past reductions of NO_x, PM, and SO₂ emissions from FCPP and SJGS are reflected in existing ambient concentrations of those pollutants in the AQRA. Beneficial effects on ambient levels of O₃ due to those NO_x emission reductions have already occurred as well. However, on balance, projections of continued development of oil and gas operations in New Mexico could collectively emit several thousand tons each of NO_x and VOC emissions, the precursors to formation of ambient O₃.

Reasonably foreseeable actions are projected to result in the following emission reductions in or near the AQRA: 40,000-65,000 tpy of NO_x; 360-630 tpy PM₁₀; and 9,800 tpy VOC. Given the magnitude of those reductions, lower ambient concentrations of O₃ are anticipated in the future in the AQRA and surrounding areas. No substantive increases in PM emissions are foreseen in the AQRA through 2018. However, current ambient concentrations of PM₁₀ and PM_{2.5} in the AQRA outside the mine boundary are well below the levels of their respective NAAQS and should remain so.

5.2.5.2 Regional Haze

5.2.5.2.1 Temporal and Geographic Scopes

The spatial scope for analysis of cumulative effects on regional haze extends approximately 300 kilometers from the Navajo Mine, an area that roughly coincides with the area bounded by a 300-kilometer radius around FCPP, which EPA established to evaluate potential visibility improvements from emissions control measures for NO_x BART on that power plant. That scope includes 15 mandatory Federal Class I areas within its boundary and another class I area, Grand Canyon National Park, located just beyond the 300-kilometer limit (75 Federal Register 64228). The temporal scope for the analysis of cumulative effects on regional haze extends until July 2018, the end of the first planning period under the regional haze rule and the deadline by which any control measures required by initial regional haze SIPs must be installed.

5.2.5.2.2 Cumulative Effects

The Proposed Action is expected to result in a decrease of PM_{2.5} and a small increase in PM₁₀ (3.6 tpy) emissions from Navajo Mine and in an insignificant increase in the mine's NO_x emissions of only 4.8 tpy. Additionally, FCPP and SJGS, the two primary producers of regional haze in the Four Corners area, are in the process of complying with BART rulings to significantly reduce NO_x and PM emissions, as well as permanently shut down generating units at each facility. On this basis, it is reasonable to conclude that the direct effects of the Proposed Action will not contribute to formation of regional haze.

Past, Present and Reasonably Foreseeable Actions

As described in the preceding section, implementation of BART for NO_x and PM₁₀ emissions from FCPP and implementation of BART for NO_x emissions from SJGS will both likely occur in the 2016-2018 timeframe. The greatest visibility benefits from those particular emission reductions will be realized in those Class I areas nearest to Navajo Mine.

Beginning with the baseline visibility condition for one of its Class I areas, a state calculates the uniform rate of visibility improvement ("progress") required to reach that area's natural background visibility (no man-made impairment) by 2064. That "uniform rate of progress" is then used to calculate the area's goal for minimum acceptable visibility improvement by the year 2018. The pollutants that primarily influence New Mexico's effort to achieve uniform progress in its Class I areas by 2018 were found to be organic mass carbon, coarse mass, and SO₄. Much of the source contributions for organic mass carbon and coarse mass are natural including wildfires and windblown dust.

Conclusion

Existing large contributors to regional haze, primarily the two coal-fired power plants near the AQRA, will continue to install a variety of different controls required by states and by EPA to reduce emissions of NO_x, SO₂, and PM by the July 2018 deadline for the first planning period under EPA's regional haze rule. The Navajo Mine will not be subject to any regional haze requirement during the first planning period for regional haze. EPA is now in the process of reviewing each state's regional haze SIP submittal.

The Proposed Action is expected to result in a decrease of PM_{2.5} and small increases in PM_{2.5} (3.6 tpy) and NO_x (4.8 tpy) emissions from Navajo Mine. The shutdown of Units 1-3 resulted in the reduction in NO_x emission of 39,300 tpy and 678 tpy of PM emissions. The installation of SCR on FCPP Units 4 and 5 will further reduce NO_x and regional haze by 36,100 tpy beginning in 2017 and 385 tpy of PM emissions beginning in 2016. Similarly, the installation of SCR at SJGS by 2016 and shutdown of Units 2 and 3 by 2017 are expected to reduce NO_x by 62 percent, SO₂ by 67 percent, PM by 50 percent, and CO by 44 percent (OSMRE 2015). Therefore, the Proposed Action is reasonably anticipated to cause no discernible impact on regional haze in any Class I area.

5.2.6 GHG Emissions and Climate Change

5.2.6.1 Temporal and Geographic Scope

Current draft CEQ guidance (2010) acknowledges that

it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand. The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate change impacts.

Given those current limitations, any comparison of Navajo Mine's GHG emissions to total GHG emissions at the state, national, or global level would have no context and simply be meaningless for an EA. Twenty-five thousand metric tons or more of CO₂e on an annual basis (25,000 Mtpy CO₂e) is a meaningful metric for GHG emissions in this instance, only because it corresponds to the minimum level of GHG emissions that warrant annual monitoring and reporting under the EPA's Mandatory Reporting Rule (40 CFR 98). The geographic scope of this cumulative impacts analysis therefore has been constrained to assessment only of changes in GHG emissions of that magnitude or greater within the AQRA and surrounding areas. Since GHG effects on climate change occur over lengthy and uncertain timeframe, no specific temporal scope for these cumulative effects has been defined.

5.2.6.2 Cumulative Effects

Per CEQ guidance, the focus of an assessment of the effects of climate change "should be on the aspects of the environment that are affected by the proposed action and the significance of climate change for those aspects of the affected environment." As demonstrated in Section 4.5, total baseline GHG emissions from Navajo Mine are estimated to be 72,142 MT CO₂e per year; this estimate is expected to go down by 1,890 tpy as result of the Proposed Action. Emissions of coal mine methane account for 80 percent of those CO₂e emissions, and the remainder is due to the mine's various diesel-fired and gasoline-fired engines.

FCPP historically produced approximately 14 million MT CO₂e per year, on average. Due to this shutdown, FCPP will reduce its contribution of GHG to the region by nearly 5 percent. The installation of SCR on FCPP Units 4 and 5, in 2016 and 2017 respectively, will also reduce NO_x emissions by 19,800 TPY (OSMRE 2015). With the shutdown of Units 1-3 and the installation of SCR, FCPP is expected to produce approximately 10.3 million MT CO₂e per year, resulting in a decrease of CO₂e of 26 percent.

While both operations will continue to incrementally contribute to global climate change, the Navajo Mine and FCPP are expected to reduce GHG emissions to the region as result of the Proposed Action. This reduction will improve regional air quality and lessen the project's contribution to climate change. The other major emitting source in the region is SJGS; however, SJGS will also be taking measures to reduce CO₂e emissions to comply with BART requirements (i.e., installation of SCNR, shut down generation boilers). Cumulatively, the implementation of prescribed BART and the shutdown of generating units will significantly reduce the amount of GHG in the region.

Furthermore, as discussed in Sections 3.6 and 4.6, operation of FCPP could result in a cost to society (i.e., agricultural productivity, human health, property damage). The other major source of emissions in the Four Corners region is SJGS. To comply with the BART ruling for SJGS as part of the New Mexico regional haze SIP, PNM will be shutting down SJGS Units 2 and 3 in 2017 and installing SNCR on all units in 2016. These measures will significantly reduce emissions from SJGS, and in combination with the air quality measures taken at FCPP, result in a reduction in the SCC compared to the historic regional conditions.

5.2.7 Vegetation

5.2.7.1 Temporal and Geographic Scope

The Project Area is located within the Colorado Plateau in the Great Basin Desertscrub community. Great Basin Desertscrub is located mostly in northwestern New Mexico and northeastern Arizona and occupies roughly 23,000 square miles at elevations generally between 3,900 and 7,200 feet (Brown 1994). Temporally, removal of vegetation would occur over the short-term until reclamation activities restore vegetation on mined out areas. In the long-term, though vegetation would be restored, the species composition would differ from that of the native Great Basin Desertscrub.

5.2.7.2 Cumulative Effects

Past activities within the Great Basin Desertscrub community have resulted in the permanent or long-term removal or modification of natural vegetation communities. The greatest impacts have resulted from natural resource extraction, transportation, and community development in the analysis area following the activities described in the RFD scenario. Vegetation has also been affected by livestock grazing, agriculture, the introduction of non-native invasive species, mechanical and chemical vegetation treatments, as well as naturally occurring events such as wildfires and drought. Future development and activities would continue to alter naturally occurring vegetation communities. Residential and commercial development would likely continue to concentrate around existing population centers, and transportation and river corridors. Oil and gas development would continue to occur primarily in the central and eastern portion of the extent of the Great Basin Desertscrub community.

Given the extent of the Great Basin Desertscrub and the small direct and indirect impacts of the Proposed Action, the proposed activities within approximately 1,400 acres, including reclamation, are not expected to contribute appreciably to cumulative vegetation impacts resulting from past, present, and reasonably foreseeable activities.

Potential impacts of deposition related to emissions from the FCPP and other regional sources were included in the FCPP/NMEP EIS, Section 4.18.3.6 (OSMRE 2015). This discussion is incorporated by reference here.

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 NMEP would be expected to contribute COPECs to the local environment. Other local sources of COPECs include other power plants within the region (e.g., SJGS), as well as industrial and municipal discharge, runoff and emissions, vehicle emissions, and agriculture. Mercury, selenium and arsenic are global pollutants and these pollutants may be contributed from sources thousands of miles away from the San Juan River watershed. 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.

5.2.8 Wildlife

5.2.8.1 Temporal and Geographic Scope

The geographic extent of potential cumulative impacts to wildlife species includes each species' natural range. The temporal scope of cumulative impacts to which the Proposed Action may contribute is limited to the short-term during which wildlife use of the area may be disturbed by vegetation removal, human presence, mining construction-related noise, and reclamation activities. Wildlife are expected to return to the area once reclamation is complete.

5.2.8.2 Cumulative Effects

The past, present, and reasonably foreseeable projects identified in the RFD have affected and are expected to continue to affect wildlife through habitat loss and fragmentation and impacts from noise and human disturbance similar in type to those described in Section 4.8. Impacts would vary depending upon species' life history strategies habitat requirements and the availability of suitable habitats. Given the abundance of the available adjacent available habitats, the Proposed Action, which would affect approximately 1,400 acres, is not expected to contribute appreciably to wildlife impacts resulting from past, present, and reasonably foreseeable activities.

Potential impacts of deposition related to emissions from the FCPP and other regional sources were included in the FCPP/NMEP EIS, Section 4.18.3.7 (OSMRE 2015). This discussion is incorporated by reference here.

Emissions from the FCPP result in the deposition of metals and other COPECs 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 2013a). 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 NMEP 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 5.2.9. 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 (e.g., SJGS and NGS), 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.

5.2.9 Threatened, Endangered, and Sensitive Species

5.2.9.1 Temporal and Geographic Scope

The temporal and geographic scope of cumulative impacts to threatened, endangered, and sensitive is based on population-level impacts to individual species and the effect these impacts have on the population across its distribution and range.

5.2.9.2 Cumulative Effects

The Federally endangered southwestern willow flycatcher was the only Federally-listed species with potential to occur in the action area for the BE (provided in Appendix D). As described in the BE, cumulative impacts would be immeasurable to this subspecies (*extimus*) population. Similarly, because direct and indirect impacts to Navajo Nation listed species of concern are largely limited to a small area of desert scrub habitat relative to the extent of this community type across the arid southwest, the cumulative impact would be quite small in light of the minor reduction in available desert scrub habitat in the region under the RFD scenario.

The effects of FCPP emissions on sensitive species would be similar to those described above for general wildlife and are discussed in great detail in the FCPP/NMEP EIS, Section 4.18.3.8 (OSMRE 2015). That discussion is summarized here and incorporated by reference in full.

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), as well as global sources of mercury, selenium, and arsenic, the potential exists for cumulatively major impacts to aquatic species, such as the pikeminnow and razorback sucker. For all COPECs and ecological receptors evaluated, HQs exceeding 1 were entirely due to current background conditions. As modeled in the two ERAs, the contribution of FCPP to this potential cumulative effect would be significantly less than historic conditions, and with the shutdown of Units 1-3, represents a decline over baseline emissions (OSMRE 2015).

Cumulative impacts associated with past, present, and future conditions may be substantial (regardless of future global emissions of mercury, selenium, and arsenic) to Colorado pikeminnow, and razorback sucker. This may also affect southwestern flycatcher and yellow-billed cuckoo, should suitable nesting habitat become available in the Deposition Area in the future. However, this risk would remain with or without the future operation of FCPP, as indicated in the ERAs. The emissions associated with the operation of FCPP from 2012 to 2016 would not meaningfully increase those risks. Therefore, the contribution of future FCPP operations would not be cumulatively substantive with respect to these ecological risks (OSMRE 2015).

5.2.9.2.1 Climate Change

The FCPP/NMEP EIS provides a detailed evaluation of the potential effects of climate change to listed species (Section 4.18.3.8). This discussion is incorporated by reference below.

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. 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, 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.

5.2.10 Socioeconomics

5.2.10.1 Temporal and Geographic Scope

The area that would be affected by socioeconomic impacts of the alternatives is comprised of the eight counties surrounding the Navajo Mine—San Juan County, New Mexico; McKinley County, New Mexico; Navajo County, Arizona; Apache County, Arizona; Coconino County, Arizona; San Juan County, Utah; Montezuma County, Colorado; and La Plata County, Colorado. See Figure 3.10-1 for a map of the affected area. The time period considered in this cumulative impact analysis are 1990 for past conditions, 2010 for present conditions, and 2030 for future conditions. The cumulative analysis focuses on data for San Juan County, New Mexico because economic forecasts for this county include activity at Navajo Mine and it is generally representative of the socioeconomic conditions in the rest of the affected area.

A recent economic base analysis for San Juan County, New Mexico examined some of the potential consequences of a worst-case scenario in which one-half of the energy and extractive industry jobs are lost over a 15-year period (E>P 2011). Given the trends in oil and gas resource depletion in the San Juan Basin and changes to air quality standards noted in the RFD scenario, a decline in energy and extractive industry jobs is reasonably foreseeable. This study found that a reduction in mining employment from coal, oil, and natural gas of 3,400 jobs between 2010 and 2025, would result in a total job loss of 7,500 jobs in San Juan County. These job losses would increase the County unemployment rate to between 15 and 18 percent. Additionally, annual sales tax revenues (gross receipts tax) to the City of Farmington and San Juan County would be reduced by 14 and 21 percent, respectively. The study concludes that economic development strategies that target diversity in employment and tax revenue could avoid or minimize many of these future adverse impacts to San Juan County.

5.2.10.2 Cumulative Effects

The only alternative expected to have an adverse effect on the regional economy is the No Action Alternative, which would result in about a 30 percent reduction in coal production at Navajo Mine. The direct and indirect economic impacts of this change would be a loss of jobs and combined Federal, state, and Navajo Nation tax and royalty revenues from NTEC and likely additional reduction in employment, taxes, and royalties from the FCPP. The magnitude of the cumulative socioeconomic impacts of the No Action Alternative will depend in part on the general economic conditions and trends in San Juan County when the jobs and revenues are lost. If the trends follow the worst-case scenario examined in the economic base study (E>P 2011), the job and revenue losses would add to an already depressed economic scenario. If economic development strategies are successful in reducing the employment and tax revenues losses predicted by the worst-case scenario, these job and revenues losses would not be substantial to the population as a whole. Given this range of future scenarios, the cumulative socioeconomic impacts of the No Action Alternative could be small depending on the effectiveness of economic development strategies to diversify the economic base in San Juan County and surrounding counties.

Employment and government revenues would stay at current levels with the Proposed Action. This would make the worst-case scenario presented in the San Juan County economic base study less likely. Given the trends of oil and gas resource depletion and more stringent air quality standards, it is likely that energy and extractive industry employment and output will be reduced in the future. Therefore, keeping employment, coal production, and tax revenues relatively stable at Navajo Mine will help to mitigate the impacts of employment and output decline in other parts of this industry sector. The cumulative socioeconomic impacts of the Proposed Action would be minimal or slightly beneficial depending on future economic conditions in San Juan County and the effectiveness of economic development strategies to diversify its economic base.

The cumulative impacts to the Navajo Nation would be similar to those in San Juan County in that resource extraction industries comprise a large portion of government revenue. In 2006, revenues from Navajo coal resources amounted to about \$81 million and comprised 35 percent of total gross revenue to the Navajo Nation General Fund (NNDED 2010). Since then, coal revenues have declined because mining operations ceased at the Peabody Black Mesa Mine in 2006 and Chevron McKinley Mine in 2009. In 2010, revenues from the remaining coal operations at the Navajo Mine and Peabody Kayenta mines were estimated to be about \$50 million or about 25 percent of total gross revenue to the General Fund (NNDED 2010). Other foreseeable employment and revenue reductions for the Navajo Nation are likely to occur as a result of the shutdown of FCPP Units 1-3 (December 2013). Continued operations of FCPP would not result in an effect measurably different than the existing employment, incomes, and revenues presently generated. The shutdown of Units 1-3 has resulted in a reduced demand for coal; however, this downscaling has not resulted in a significant decrease to employment and/or income, as the FCPP workforce will be reduced through attrition (i.e., retirement, leaving for another job) and not layoffs (APS 2012). Since this power plant is located on Navajo Nation land and has a Native American hiring preference, the shutdown of units at FCPP would result in employment and revenue losses to the Navajo Nation.

However, these revenue reductions could be offset by revenue diversification strategies that are being implemented by the Navajo Nation, such as casino gaming. The Navajo Nation recently invested more than \$200 million in casino and resort properties located on Navajo Nation lands in the Four Corners region. This is more than the amount planned for all other economic development investments by the Navajo Nation (NNDED 2010). The Nation is expecting to earn \$150 million per year from these investments in gaming and resort properties Navajo Nation, Navajo President Joe Shirley Jr. BIA Director Omar Bradley sign land into Trust for Twin Arrows Casino Near Flagstaff [December 23, 2010]. In 2010, it was estimated that the Fire Rock Casino near Gallup, New Mexico employed more than 350 workers and realized \$40 million in net win (a measure of casino income) (OSMRE 2011).

Therefore, the cumulative impacts to the Navajo Nation from the No Action Alternative would be small but not likely significant depending on the success of economic diversification efforts. Annual casino revenues are expected to be more than double coal resource revenues starting in 2013. The cumulative impacts to the Navajo Nation from the Proposed Action would be minimal or slightly beneficial because revenues and employment for the Navajo Nation generated by BNCC (through 2014 and subsequently, NTEC) would remain similar to baseline conditions.

5.2.11 Land Use

5.2.11.1 Temporal and Geographic Scope

For context, this section discusses land uses on the Navajo Mine as indicative of past and present impacts of mining, which has occurred here since 1957. Future mining activities are focused on the continuation of mining at Navajo Mine, specifically in Area IV North and Area IV South (collectively the Pinabete Permit Area) per OSMRE's ROD on the FCPP/NMEP EIS. Mining activities in the Pinabete Permit Area are expected to commence in 2016 and continue until after 2039 but no later than 2041. For the cumulative impact analysis, land use resource impacts are analyzed using a period of 20 years for the present and future impacts. The cumulative land use impact assessment area is the Proposed Action (including the permitted Area III, Area IV North, and Area IV South, support facilities, and the Burnham Road realignment) and a 1-mile area surrounding the Proposed Action. Approximately 17,270 acres are included within the cumulative land use impact assessment area.

Assuming that the Proposed Action is approved and is developed, it would be anticipated that development of BNCC's surface coal mining lease area would continue within the recently approved Pinabete Permit Area, as part of the SMCRA permit decision for the FCPP/NMEP EIS. The Pinabete Permit Area occupies lands within both Area IV North and in Area IV South, totaling an approximate 5,569 acres. Therefore, future foreseeable post-2016 surface coal mining in support of the Navajo Mine in these areas is considered with the RFD scenario for this resource. Of the approximately 10,100 acres associated with Area IV North and Area IV South, approximately 5,569 acres may be considered for surface coal mining over the next 20 years. 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 event greater traffic increased on local roadways. Potential projects that are considered in this analysis that occur on tribal lands include continued operation of the FCPP, Navajo Generating Station, and SJGS, proposed oil and gas drilling by Western Oil and Gas and proposed drilling on BLM lands.

As previously discussed in Section 3.11 and Section 4.11, BNCC is required by SMCRA regulations to develop adequate resource protection measures to eliminate, minimize, and/or mitigate any land use effect to meet Federal requirements. The Proposed Action wholly incorporates these SMCRA-based requirements. Likewise, the success, timing, and release of mine-land reclamation areas would be administered by OSMRE in facilitation of, and compliance for, Federal SMCRA requirements.

5.2.11.2 Cumulative Effects

There are no known past, present, reasonably foreseeable projects that would change the land use considerations in the cumulative land use impact assessment area if the Proposed Action were selected. Cumulative effects on land uses and surface management associated with foreseeable expansion of surface coal mining activities in portions of Area IV North and Area IV South on to land uses and surface management would be similar to those identified in Section 4.11. Existing, proposed, and anticipated agreements entered into between BNCC and holders of impacted grazing permits and CUAs within the cumulative land use impact assessment area, would be developed for compensation associated with mining-related effects on livestock production and the relocation or replacement of improvements to grazing areas. Other than such compensation and SMCRA-required planning and resource protection

measures included as part of the past operations, the current Proposed Action, and as part of the ROD for the FCPP/NMEP EIS, no additional mitigation or monitoring measures are proposed for cumulative land use effects of continued surface coal mining. No additional mitigation or monitoring measures are proposed for cumulative land use effects of continued surface coal mining.

The measures required under SMCRA would return post-mining areas to a natural state upon completion of operations with no long-term residual land use impacts. Land status and prior rights to the lands affected would remain unchanged during the life of the Proposed Action. In the long term, the surface and vegetation affected by development in Area III, the Proposed Action, and in the remainder of Area IV North and Area IV South mining activities, would be reclaimed and returned to a condition similar to its original status. Post-mine land use would be designated for livestock grazing and wildlife habitat, and would again be open to grazing and other tribal surface uses. The construction of impoundments incorporated into the post-mining landscape would support livestock grazing and wildlife habitat.

As discussed in the FCPP/NMEP EIS, Section 4.18.3.9 (OSMRE 2015) and incorporated by reference here, implementation of the Proposed Action in conjunction with the other resource extraction projects 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 to 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. Continued operation of the FCPP, SJGS, and Navajo Generating Station would have no impact with regard to cumulative effects to land use as all operations occur within existing lease areas.

Cumulative effects on land use if the No Action Alternative were implemented would represent continued minor to moderate impacts resulting from ongoing mining and associated actions at the Navajo Mine.

5.2.12 Environmental Justice

5.2.12.1 Temporal and Geographic Scope

Based on the census tract data for the eight counties in the affected area shown in Figures 3.12-1 and 3-12.2 and Table 3.12-1, the percentage of Native American population and individual poverty rate is substantially higher in those tracts closest to the Project Area. Therefore, the cumulative impact analysis must consider the disproportionate cumulative impacts and any “special” exposures to these vulnerable populations due to cultural or traditional use of resources such as ceremonial food or medicine gathering as well as vulnerabilities.

5.2.12.2 Cumulative Effects

The potential disproportionate impacts to vulnerable populations near Navajo Mine would be associated with changes to air quality, noise, health and safety, and socioeconomic resources. There are no significant direct or indirect impacts to these resources for the Proposed Action. Special exposures related to cultural or traditional use of resources near the Project Area are not significant because the Navajo Mine lease area would not change under the Proposed Action. As mentioned in Section 4.13.2, there is no opportunity for traditional cultural resource use in the Project Area because the Navajo Mine lease area is

excluded from public access and use. Therefore, these would be no special exposures or disproportionate impacts associated with ceremonial or traditional resource use.

5.2.13 Cultural Resources

5.2.13.1 Temporal and Geographic Scope

For the cumulative impact analysis, cultural resource impacts are analyzed using a period of 20 years for the past and future impacts. The geographic area of analysis is San Juan County, New Mexico to capture the potential impacts to cultural resources for the RFD (Appendix F). 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 area of analysis:

- 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.

It should be noted that cultural resources at all existing developments must be recorded and mitigated according to NHPA and other regulations. New developments that disturb cultural resources would also have to comply with these regulations. Therefore, direct cultural resource impacts for the development included in the RFD would be mitigated.

5.2.13.2 Cumulative Effects

The cumulative impacts of deterioration, weathering, and erosion of the tangible aspects of cultural resources accumulate over time. Prior, ongoing, and future man-made developments of various types also have degraded and destroyed cultural resources near the Project Area, and will continue to do so. Between 1980 and 2010, Navajo Mine development affected 46 cultural resource sites that are considered eligible for the NRHP. All 46 of these sites were mitigated prior to their destruction.

The Proposed Action would directly impact four eligible sites that have already been mitigated through excavation or ethnographic studies. This number is small compared to the estimated 15,000 eligible sites located in San Juan County. The four eligible cultural resources that would be impacted by the Proposed Action are not unique within the cumulative impact area. There are hundreds of similar sites throughout San Juan County. The Proposed Action would not have indirect effects at the FCPP because there would be no ground-disturbing activity.

Using site density data from recent work at Navajo Mine as a proxy and estimated new land area that would be disturbed by the development included in the RFD scenario, it is estimated that during the 20-year future period, about 100 eligible sites would be impacted by oil and gas, electrical power, and other developments. Compared to the more than 15,000 eligible sites located in San Juan County, New Mexico this is a relatively small impact. While there could be unique cultural resources affected by future

development, the cultural resources that would be affected by the Proposed Action are not unique when compared to cultural resources throughout San Juan County. Therefore, there would be no adverse cumulative impacts to cultural resources for the Proposed Action.

The No Action Alternative would not disturb any cultural resources. Therefore, there would be no direct, indirect, or cumulative impacts to cultural resources for this alternative.

5.2.14 Traffic and Transportation

5.2.14.1 Temporal and Geographic Scope

The cumulative traffic and transportation impact assessment area includes the proposed mining areas of Area III and Area IV North, support facilities, and the Burnham Road realignment and a 1-mile area surrounding the Proposed Action. Approximately 17,270 acres are included within the cumulative traffic and transportation assessment area. This area includes approximately 3,390 acres of Area III within the existing Navajo Mine permit area. Assuming that the Proposed Action is approved and is developed, it would be anticipated that development of the Navajo Mine Lease Area would continue within the remainder of Area IV North and in Area IV South. Therefore, future foreseeable surface coal mining in support of the Navajo Mine in these areas is considered within the RFD scenario for this resource, with the approximately 4,100 acres of the undeveloped portion of Area IV North and approximately 6,000 acres within the northern part of Area IV South included as part of the cumulative assessment area. Of the approximately 10,100 acres associated with Area IV North and Area IV South, approximately 5,569 acres may be considered for surface coal mining over the next 20 years.

No other existing and/or future foreseeable action identified in Appendix F occurs within the cumulative traffic and transportation impact assessment area, or has the potential to directly or indirectly impact transportation infrastructure management within this area. It is assumed for cumulative analysis that traffic and transportation, as associated with the existing mine, would remain level with new RFD mining development. As no increase in employee use or material transport use is anticipated on the regional highway roads during the RFD scenario, traffic and transportation on the existing highway road system is not considered within the cumulative resource impact assessment area. Future foreseeable surface coal mining in Area V is not within this resource's cumulative impact assessment area and would not likely occur within the next 20 years. Therefore, surface coal mining in Area V has not been included in the RFD scenario for traffic and transportation.

As previously discussed in Section 3.14 and Section 4.14, NTEC is required by SMCRA regulations (30 CFR 761.14) to develop adequate resource protection measures to eliminate, minimize, and/or mitigate any effects to public roads. The Proposed Action wholly incorporates these SMCRA-based requirements.

5.2.14.2 Cumulative Effects

Mining in Area IV North and Area IV South would continue to affect the existing unimproved two-track roads within the CUAs in these areas, but alternative access would be provided. These cumulative effects would be similar to those identified with Section 4.14. NTEC, the Navajo Nation, and local chapters would coordinate on impacts to traffic and transportation within the cumulative traffic and transportation impact assessment area. Other than SMCRA-required planning and resource protection measures included

as part of the current Proposed Action and the ROD for the FCPP/NMEP EIS, no additional mitigation or monitoring measures are proposed for cumulative effects of continued surface coal mining.

Transportation network conditions would change under the Proposed Action because the Burnham Road realignment would improve road surface conditions and safety. Burnham Chapter members and residents would benefit from safer travel to Burnham Chapter house on the realigned Burnham Road route. Based on recent traffic monitoring on Burnham Road, peak daily traffic occurs on Saturdays. This likely represents resident traffic traveling to and from the Burnham area to retail and community services located north in Shiprock and Farmington. Given this level of resident traffic, it is possible that traffic levels could increase on Burnham Road particularly because travel delays such as stoppages for blasting would be eliminated. Therefore, there would be some positive cumulative impacts to the transportation network associated with the Proposed Action.

The operation of SCR on FCPP will require solid state urea to perform NO_x emissions reduction. The urea will likely be transported from the greater Denver area to FCPP via daily truck trips, totaling an approximate 17 trips per week. This activity will commence in 2018 and proceed through 2041 and therefore, would not contribute to any cumulative effects on traffic in the area. Three additional daily truck trips would not result in a noticeable effect on the subject transportation network or traffic volumes.

It is anticipated that few, if any, cumulative effects on the transportation infrastructure would occur if the No Action Alternative were implemented. Mining would not extend beyond Area III, and location and use of the Burnham Road and the existing transportation infrastructure would remain as it is currently, with continued minor to moderate impacts resulting from ongoing mining of Area III and associated actions at the Navajo Mine.

5.2.15 Health and Safety

The cumulative impacts of health and safety focuses on the potential public health impacts associated with air emissions at Navajo Mine in conjunction with air emissions from other current and reasonably foreseeable projects. The Proposed Action would increase PM emissions in San Juan County.

5.2.15.1 Temporal and Geographic Scope

The cumulative public health impacts consider air quality and respiratory health status of residents of San Juan County in 1990, 2010, and 2030. In 1990 and 2010, San Juan County was in “attainment” status of the NAAQS for all criteria air pollutants including PM and O₃. Attainment status means that ambient air quality in San Juan County did not regularly exceed levels that protect public health. The EPA regularly evaluates and updates the NAAQS based on new scientific evidence. EPA is expected to tighten the NAAQS for O₃ and PM_{2.5} in the near future. This could mean that by 2030, San Juan County could be out-of-attainment for O₃ and PM_{2.5} if additional emissions control measures for O₃ precursors such as NO_x and for PM are not implemented. Additionally, the implementation of the BART determinations for FCPP and the FIP for SJGS will reduce regional haze. The BART measures (i.e., shutdown of Units 1-3, installation of SCR and SNCR) will substantially reduce NO_x and PM emissions from these major regional air emissions sources. Given these changes to the NAAQS and regional haze compliance rules, it is likely that allowable PM and O₃ precursor emissions at Navajo Mine and for other sources in the region

would be lower, and that ambient air quality in San Juan County in 2030 would have lower concentrations of O₃ and PM.

5.2.15.2 Cumulative Effects

The cumulative public health effects of the Proposed Action depend on the ambient air quality in San Juan County and the respiratory health status of county residents. 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 no cumulative public health effects of the Proposed Action because there would be no measureable change to ambient air quality compared to baseline conditions. Health and safety risks to workers are not expected to be substantial as extensive health and safety programs designed to minimize worker risk are implemented and enforced at Navajo Mine. The FCPP/NMEP EIS provides a detailed evaluation of the potential cumulative human health risk effects in the San Juan Basin in Section 4.18.3.17. This analysis is incorporated by reference below.

The cumulative public health effects [of the Proposed Action in conjunction with other existing and proposed projects in the region] 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.