4.6 Vegetation

The FCPP, Navajo Mine, and subject transmission lines are located in the Colorado Plateau physiographic region of northwestern New Mexico and northeastern Arizona. This area has a variety of physical features that offer a diverse range of habitat types, represented by a characteristic assemblage of vegetative cover classes, vegetation communities, and associated plant species identified in this section. The large size of this region, together with geology, soils, climate, and anthropogenic influences, has combined to produce a mosaic of floristic components and habitats. Dry air masses, high summer temperatures, infrequent precipitation, and a high rate of evaporation characterize the climate. Precipitation in the area averages approximately 7 inches annually and occurs primarily during the late summer months. For most of the region, the availability of water and soil moisture is a critical factor that determines the broad distribution of vegetation types across the region.

This section presents a description of vegetation communities that exist on and in the vicinity of the Project facilities. For the purposes of this analysis, and to identify broad patterns in vegetation structure, vegetation modeling and mapping has been conducted across the ROI, which is defined for potential effects to vegetation as those areas occurring within 1 mile of the Navajo Mine Lease Area, 1 mile of the FCPP Lease Area, and 0.5 mile of the PNM and APS transmission lines. The ROI also includes the area within which the cumulative future air emissions from FCPP over the next 25 years is anticipated to increase baseline concentrations of chemicals of potential concern by more than 1 percent, as described in Section 4.6.2.5. Finally, it includes the San Juan River from the upstream boundary of the Deposition Area downstream to, and including, the San Juan arm of Lake Powell (Figure 4.6-1). This ROI was discussed with representatives from various regulatory agencies and found to meet the needs for this EIS.

4.6.1 <u>Regulatory Compliance Framework</u>

SMCRA is the primary regulation that applies to vegetation management at the Navajo Mine Lease Area. Federally and tribally designated sensitive (endangered or threatened) plant species and critical habitat areas are regulated by the Federal ESA and the Navajo Tribal Code, which contains a Navajo Endangered Species List. These resources are under the jurisdiction of the USFWS and NNDFW, respectively, and are discussed in detail in Section 4.8, Special Status Species. The Federal Government, and States of Arizona and New Mexico have developed lists of plant species considered invasive and noxious and have programs to limit the spread of these species. Plant species not designated as sensitive (e.g., critical habitat, threatened, or endangered) by Federal or tribal agencies located within the FCPP Lease Area or the transmission ROWs are not afforded any protection, and are considered common throughout the area.

4.6.1.1 Surface Mining Control and Reclamation Act

Under SMCRA, NTEC is required to provide an adequate description of the existing pre-mining environmental resources within the Project Area and proposed disturbance area(s). OSMRE uses this information to determine whether the applicant can comply with the performance standards of the regulations for surface coal mining and whether reclamation of these areas is feasible (30 CFR Part 779.10). NTEC is required to map and delineate existing vegetative types and provide descriptions of the plant communities within the permit area (30 CFR Part 779.19).

NTEC must also determine the productivity of the proposed permit area before mining. This productivity is expressed as an average yield of food, fiber, forage, or wood products by yield data or estimates for similar sites based on current data from the U.S. Department of Agriculture, state agricultural universities, or appropriate state natural resource or agricultural agencies (30 CFR Part 780.23).

A reclamation plan is required to describe the proposed land use within the permit area following reclamation, including a discussion of the utility and capacity of the reclaimed land to support a variety of alternative uses, and the relationship of the proposed use to existing land use policies and plans (30 CFR Part 780.23).

Pursuant to 30 CFR Part 816.111, NTEC must meet revegetation success standards. The standards for determining success of revegetation are measured on the basis of reference areas or such other success standards approved by OSMRE. Reference areas are land units of varying size and shape identified and maintained under appropriate management for the purpose of measuring ground cover, productivity, and species diversity that are produced naturally (30 CFR Part 715.20 (f)). A revegetation plan that includes a description of the measures proposed to be used to determine the success of revegetation is required. Success of revegetation is judged on the effectiveness of the vegetation for the approved post-mining land use, the extent of cover compared to the cover occurring in natural vegetation of the area, and other general requirements (30 CFR Part 816.111 - 816.116).

Site-specific revegetation specifications, including reference areas, seed mixes, success criteria, and noxious weed control are summarized in the existing NTEC mine permits and the Pinabete SMCRA Mine Plan permit application package (BNCC 2009, 2012a).

4.6.1.2 Noxious and Invasive Weeds

Executive Order 13112, Invasive Species (February 3, 1999), mandates that Federal agencies take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. Also, pursuant to the Noxious Weed Management Act of 1998, New Mexico Department of Agriculture has identified several species to be targeted as noxious weeds for control or eradication.

The BLM, the BIA Navajo Region, Arizona Department of Agriculture, and New Mexico Department of Agriculture have all developed lists of invasive and noxious weeds (Ecosphere 2012c, Arizona Department of Agriculture 2005). The species are grouped into three management classifications:

- *Class A:* Nonnative plants that have a limited distribution within or have not yet invaded the state. Some are found on public lands within the planning area, and preventing and eliminating infestations of these weeds has the highest priority in the BLM management plan.
- *Class B:* Nonnative plants that are presently limited to a particular part of the planning area. The management priorities are to contain them within their current areas and prevent new infestations.
- *Class C:* Nonnative plants that are widespread throughout much of the public land within the planning area. Long-term programs of management and suppression are encouraged (BLM 2003).

4.6.2 Affected Environment Pre-2014

4.6.2.1 General Vegetation Communities and Land Cover

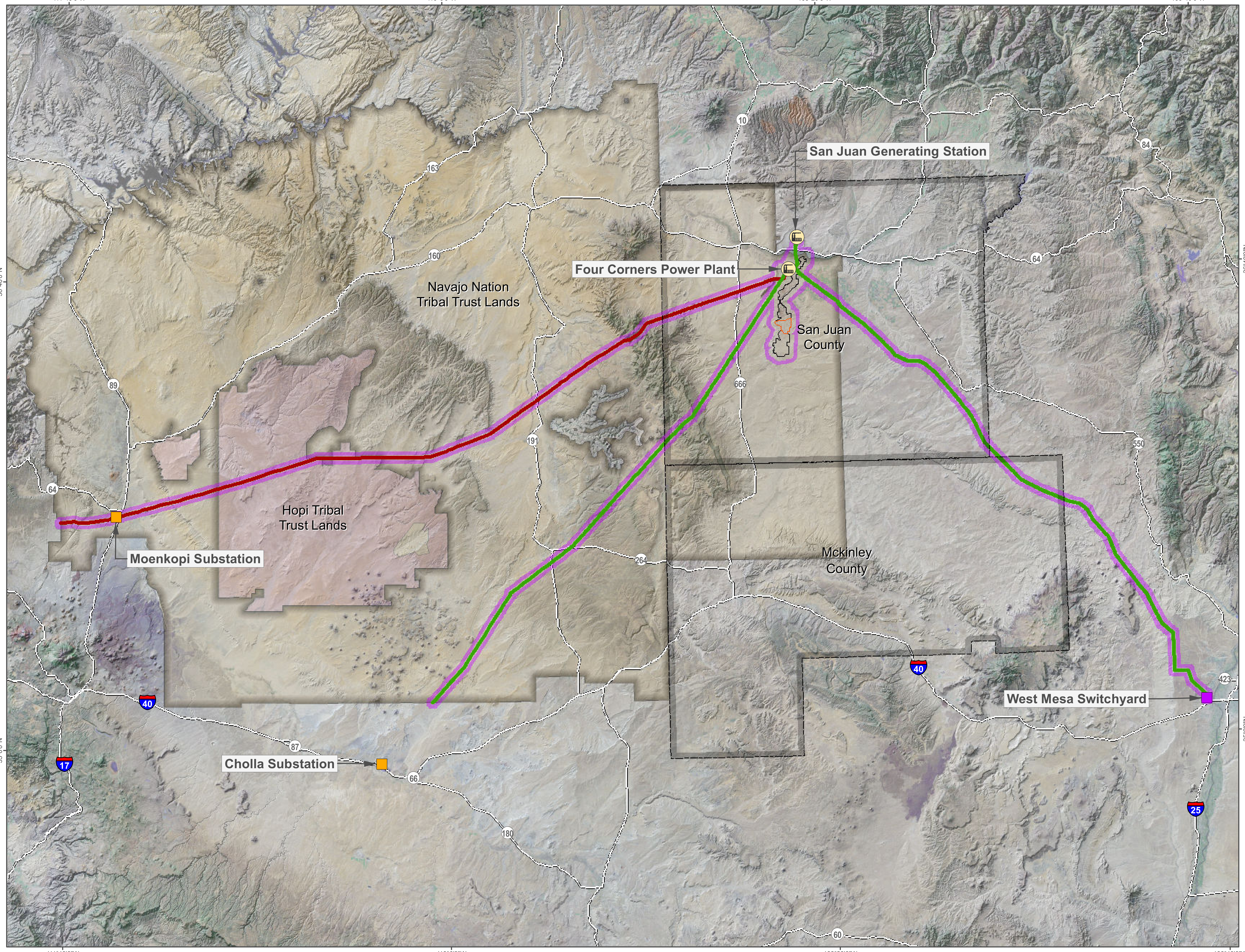
Vegetation communities in the ROI were identified using the USGS National Gap Analysis Program (GAP) Land Cover Data, Version 2 (USGS 2011). The GAP analysis was used to provide broad geographic estimates on the status of ordinary species and their habitats to provide consistency in identification and management of vegetation communities over the large geographic area in the ROI. Additionally, Dick-Peddie's 1993 treatment of the vegetation of New Mexico; vegetation was characterized using this method for the PNM transmission lines.

Four Corners Power Plant
and Navajo Mine Energy Project

ENVIRONMENTAL SETTING
& CONSEQUENCES

Figure 4.6-1

Region of Influence (ROI)
for Wildlife and Habitat



PROJECT FACILITIES

- Four Corners Power Plant
- Substation
- Switchyard

PROJECT BOUNDARIES

- Navajo Mine Lease Area
- Proposed Pinabete SMCRA Permit Boundary
- Region of Influence

TRANSMISSION LINES

- 345kV
- 500kV

OTHER FEATURES

- County Boundaries
- Hopi Tribal Trust Lands
- Navajo Nation Tribal Trust Lands

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0 20 40

Scale in Miles

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FCPP DFADAs and APS transmission lines were both evaluated using the USGS Geographic Information System data noted above, and referenced specific vegetation communities associated with the regional GAP analysis.

Table 4.6-1 lists the six broad vegetation cover classes (as well as two additional cover classes) identified within the vicinity of Project features and provides an overview of the size and percent of each cover class identified within the buffer area for each feature. Figure 4.6-2 illustrates the geographic distribution of the major land cover vegetation classes identified in the ROI for each Project component.

Based on the GAP analysis, land cover data were classified per the National Vegetation Classification System nomenclature. The respective vegetation communities associated with these land cover classes are discussed by Project component below. Full descriptions of these land cover classes and associated vegetation communities can be found on the USGS SWReGAP land cover descriptions (USGS 2005).

Table 4.6-1 Land Cover Classes Occurring within 1 Mile of Navajo Mine Lease Area, 1 Mile of FCPP Lease Area, and 0.5 Mile of Transmission Line ROWs

Cover Class	Acres	Percent of ROI
Agricultural Vegetation	6,544.5	1.6
Developed and Other Human Use	9,209.6	2.3
Forest and Woodland	75,668.9	18.7
Introduced and Semi-Natural Vegetation	1,269.1	0.3
Nonvascular and Sparse Vascular Rock Vegetation	22,707.4	5.6
Open Water	2,826.3	0.7
Semi-Desert	262,371.4	64.9
Shrubland and Grassland	23,391.6	5.8
Grand Total	403,988.9	100.0

Source: USGS 2005.

Agricultural Vegetation

The Agricultural Vegetation cover type is an aggregated land cover type that includes both pasture/hay, where pasture/hay vegetation accounts for more than 20 percent of total vegetation, and cultivated crops, where crop vegetation accounts for more than 20 percent of total vegetation. This cover type also includes all actively tilled land.

Developed and Other Human Use

Developed and Other Human Use includes land cover classes and associated vegetation communities that are disturbed, mined, or otherwise developed; impervious surfaces comprise between 20 to 100 percent of the total cover, and a mixture of constructed material and vegetation persists.

Forest and Woodland

Forest and Woodland cover class represent 12 distinct vegetation cover communities listed below. These vegetation communities include forested lands of coniferous or deciduous vegetation representing a wide array of moisture regimes and elevation differences present in the region.

- Colorado Plateau Pinyon-Juniper Woodland
- Inter-Mountain Basins Juniper Savanna
- Rocky Mountain Aspen Forest and Woodland

- Rocky Mountain Lower Montane Riparian Woodland and Shrubland
- Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
- Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
- Southern Rocky Mountain Juniper Woodland and Savanna
- Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
- Southern Rocky Mountain Pinyon-Juniper Woodland
- Southern Rocky Mountain Ponderosa Pine Woodland
- Western Great Plains Riparian Woodland and Shrubland

Introduced and Semi-Natural Vegetation

The Introduced and Semi-Natural Vegetation cover class includes two subclasses of vegetation cover communities closely associated with introduced or invasive species. These two subcategories represent vegetation communities that have been altered, disturbed, or are dominated by nonnative grasses, forbs, or woody vegetation, and where natural vegetation types are no longer recognizable.

- Introduced Riparian and Wetland Vegetation
- Introduced Upland Vegetation- Perennial Grassland and Forbland

Nonvascular and Sparse Vascular Rock Vegetation

Nonvascular and Sparse Vascular Rock Vegetation cover class consists of vegetation communities that consist of barren or sparsely vegetated (10 to 30 percent) open-canopy landscapes associated with steep cliff faces, narrow canyons, sand dunes, shale, siltstone and mudstone deposits, and barren bedrock deposits. These cover communities include:

- Colorado Plateau Mixed Bedrock Canyon and Tableland
- Inter-Mountain Basins Active and Stabilized Dune
- Inter-Mountain Basins Shale Badland
- Rocky Mountain Cliff, Canyon and Massive Bedrock
- Undifferentiated Barren Land

Open Water

This land cover class identifies areas of open water, generally with less than 25 percent cover of vegetation or soil, and includes all naturally occurring and man-made impoundments, ponds, and rivers.

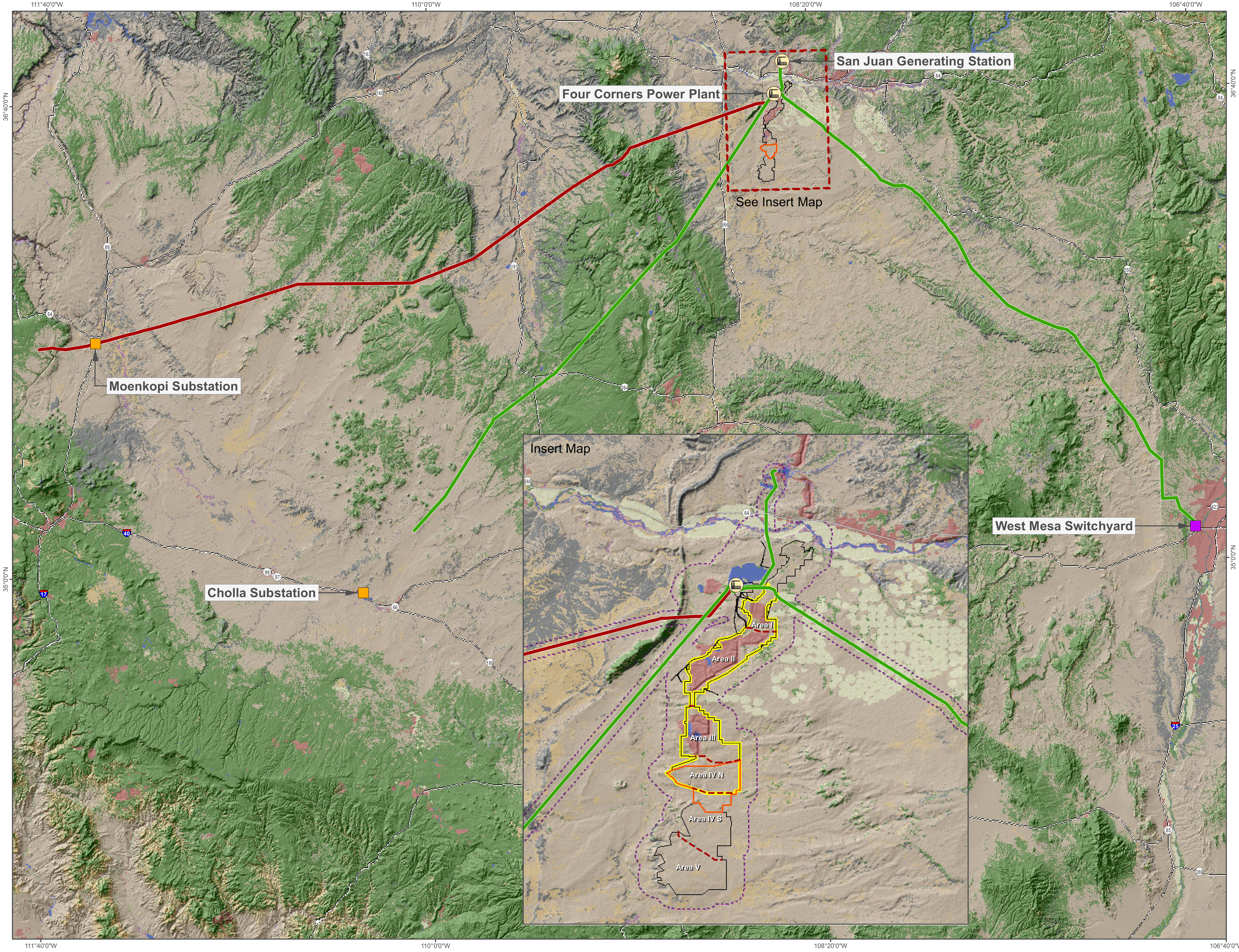

Figure 4.6-2

Habitat Types in the Project Vicinity

PROJECT FACILITIES

Four Corners Power Plant

Substation

Switchyard

PROJECT BOUNDARIES

Navajo Mine Resource Areas

Navajo Mine Lease Area and ROWs

Navajo Mine SMCRA Permit Boundary

Proposed Pinabete SMCRA Permit Boundary

ROI Boundary

TRANSMISSION LINES

345kV

500kV

HABITAT TYPES

Agricultural Vegetation

Developed & Other Human Use

Forest & Woodland

Introduced & Semi Natural Vegetation

Nonvascular & Sparse Vascular Rock

Open Water

Semi-Desert

Shrubland & Grassland

Data Source: US Geological Survey, Gap Analysis Program (GAP), Land Cover Data, Version 2.

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Scale in Miles

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Semi-Desert

The Semi-Desert cover class includes a wide range of arid to semiarid vegetation communities, including grassland and shrubland transition areas in low elevation to subalpine environments across the western U.S. These vegetation communities are typically characterized as extensive open-canopied shrublands and occur on a variety of soil types ranging from rocky to fine sedimentary deposits. Ten vegetation communities from this cover class were identified within the region.

- Apacherian-Chihuahuan Mesquite Upland Scrub
- Colorado Plateau Blackbrush-Mormon-tea Shrubland
- Colorado Plateau Mixed Low Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Montane Sagebrush Steppe
- Inter-Mountain Basins Semi-Desert Grassland
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Inter-Mountain Basins Wash
- Southern Colorado Plateau Sand Shrubland

Shrubland and Grassland

The Shrubland and Grassland cover class represents a diverse group of vegetation communities that occurs in a broad range of ecological areas ranging from arid lowlands to wet alpine meadows. These vegetation communities occur at a range of elevations along the transition zone among the Rocky Mountains, Great Plains, Sonoran Desert, Chihuahuan Desert, and Inter-Mountain West.

- Inter-Mountain Basins Greasewood Flat
- North American Arid West Emergent Marsh
- Rocky Mountain Alpine-Montane Wet Meadow
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland
- Southern Rocky Mountain Montane-Subalpine Grassland
- Western Great Plains Foothill and Piedmont Grassland

4.6.2.2 Navajo Mine

A more detailed evaluation of land cover classes and associated vegetation communities within 1 mile of the Navajo Mine Lease Area is provided in Table 4.6-2 This evaluation includes the identification of land cover classes and associated vegetation communities occurring within the approximately 78,000-acre Navajo Mine ROI. Vegetation within the Navajo Mine Lease Area and in the general vicinity is composed of 15 vegetation communities. Semi-Desert accounts for 77.2 percent of the land cover in the Navajo Mine Lease Area, followed by 12.3 percent land cover classes associated with human development within the Navajo Mine Lease Area, and adjacent agricultural development. Dominant vegetation communities include Inter-Mountain Basins Semi-Desert Grasslands, Inter-Mountain Basins Mixed Salt Desert Scrub, and Inter-Mountain Basins Semi-Desert Shrub Steppe communities, which represent 76.3 percent of the total area. These vegetation communities are extensive, and the majority of ecological communities consist of open-canopied to moderately dense shrublands and grasslands in saline basins, alluvial slopes, and plains across the Inter-Mountain West, including a suite of commonly occurring shrubs, subshrubs, and grasses common to the Inter-Mountain West (USGS 2005).

Table 4.6-2 GAP-Identified Land Cover Classes, Associated Vegetation Communities, and Acreage, Including a 1-Mile Buffer around the Navajo Mine Lease Area

Cover Class Vegetation Community/Ecological Region	Acres	Percent of Navajo Mine ROI
Agricultural Vegetation	**1,949.1**	**2.5**
Developed and Other Human Use	**7,651.0**	**9.8**
Forest and Woodland	**2,001.8**	**2.6**
Colorado Plateau Pinyon-Juniper Woodland	1,071.1	
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	930.7	
Introduced and Semi-Natural Vegetation	**257.8**	**0.3**
Introduced Riparian and Wetland Vegetation	231.3	
Introduced Upland Vegetation - Perennial Grassland and Forbland	26.4	
Nonvascular and Sparse Vascular Rock Vegetation	**966.2**	**1.2**
Colorado Plateau Mixed Bedrock Canyon and Tableland	915.1	
Inter-Mountain Basins Shale Badland	51.1	
Open Water	**1,165.0**	**1.5**
Semi-Desert	**60,297.9**	**77.2**
Colorado Plateau Blackbrush-Mormon-tea Shrubland	462.8	
Colorado Plateau Mixed Low Sagebrush Shrubland	5.8	
Inter-Mountain Basins Big Sagebrush Shrubland	110.4	
Inter-Mountain Basins Mixed Salt Desert Scrub	13,847.1	
Inter-Mountain Basins Semi-Desert Grassland	40,593.3	
Inter-Mountain Basins Semi-Desert Shrub Steppe	5,276.3	
Inter-Mountain Basins Wash	1.1	
Southern Colorado Plateau Sand Shrubland	1.1	
Shrubland and Grassland	**3,983.3**	**5.1**
Inter-Mountain Basins Greasewood Flat	3,983.3	
Navajo Mine Lease Area – Plus 1-Mile Buffer	**78,272.0**	

Source: USGS 2005.

While the GAP analysis provides a broad overview of existing vegetation communities, more detailed vegetation analysis was required within the Pinabete SMCRA Permit Area to quantify existing vegetation communities. This analysis identified six vegetative communities: Alkali Wash, Arroyo Shrub, Badlands, Dunes, Sands, and Thinbreaks (Table 4.6-3) (BNCC 2012a).

Table 4.6-3 Vegetation Types within the Proposed Pinabete SMCRA Permit Area

Vegetation Type	Acres
Alkali Wash	1,273
Arroyo Shrub	31
Badlands	836
Dunes	267
Sands (Sandy Soils)	1,094
Thinbreaks	603
Total	**4,104**

Source: BNCC 2012a.

Alkali Wash

Alkali Wash is a vegetation community associated with minor waterways, typically located in washes and drainages, as well as the base of badlands, and is most closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2.[1] Alkali wash represents the largest community type in the Pinabete SMCRA Permit Area at 31.0 percent. Alkali wash communities are typically broad and level with occasional small, dense patches of galleta grass (*Pleuraphis jamesii*) and alkali sacaton (*Sporobolus airoides*). Other plants that are locally common in alkali wash include tansy mustard (*Descurainia pinnata*), Russian thistle (*Salsola tragus*), scorpion weed (*Phaceila crenulata*), mound saltbush (*Atriplex obovata*), woolly plantain (*Plantago patagonica*), and annual Townsend daisy (*Townsendia annua*) (BIA 2007, BNCC 2012a, OSMRE 2012a).

Arroyo Shrub

Arroyo Shrub communities are commonly found in major drainages and are generally flat and level in the Pinabete SMCRA Permit Area. This community is closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The Arroyo shrub community is the smallest vegetation type in the Pinabete SMCRA Permit Area, comprising 0.8 percent (BNCC 2012a). Vegetation characteristic of this community includes greasewood (*Sarcobatus vermiculatus*), Russian thistle, tansy mustard, alkali sacaton, four-winged saltbush (*Atriplex canescens*), cryptantha (*Cryptantha* sp.), and snakeweed (*Gutierrezia sarothrae*) (BIA 2007, BNCC 2012a, OSMRE 2012a).

Badlands

Badlands have the least vegetation of any vegetation community in the Project Area and are associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The Badlands vegetation community accounts for 20.4 percent of the Pinabete SMCRA Permit Area. This community type is the most unproductive, and none of the soil material is suitable for salvage because of the high clay content and high sodium values (BNCC 2012e). Badland vegetation communities consist of exposed weathered shale with moderate to steep topography. Common plants along the small relief channels of these barren areas are Powell's saltbush (*Atriplex powellii* var. *powellii*), mound saltbush, annual Townsend daisy, stickseed (*Lappula occidentalis),* woolly plantain, salty buckwheat (*Stenogonum salsuginosum*), Gordon's buckwheat (*Eriogonum gordonii*), scorpion weed, and globemallow (*Sphaeralcea parvifolia*) (BIA 2007, BNCC 2012a, OSMRE 2012a).

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[1] While alkali wash vegetation communities are associated with waterways, they are not necessarily indicative of jurisdictional areas as defined under the CWA.

Dunes

The deep sands found in dune communities allow for more consistent water availability and are most closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The dunes represent the second to the smallest vegetation community in the Pinabete SMCRA Permit Area, covering 6.5 percent. The dunes community type is one of the more productive found in the Navajo Mine Lease Area (BNCC 2012e). Dune vegetation communities occupy flat to rolling terrain. Due to the sandy nature of the dunes vegetation community, unique plant species are present, including San Juan milkweed (*Asclepias sanjuanensis*), as well as canaigre dock (*Rumex hymenosepalus*) and sand sagebrush (*Artemisia filifolia*). Other common species include cryptantha (*Cryptantha crassisepala*), tansy mustard, twinpod (*Dimorphocarpa wislizeni*), globemallow, Indian ricegrass (*Achnatherum hymenoides*), galleta grass, and evening primrose (*Oenothera pallida*) (BIA 2007, BNCC 2012a, OSMRE 2012a).

Sands

The Sands vegetation community contains predominantly sandy soils, which allows for greater water availability and increases plant species diversity. It is most closely associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The sands vegetation community makes up 26.7 percent of the Pinabete SMCRA Permit Area. The types of sand in this vegetation community can vary from saline to calcareous. The sands community often transitions to and can be mixed with the thinbreaks community. In years with high amounts of spring rainfall, sandy soils display an abundance of annuals, especially scorpion weed, annual Townsend daisy, and cryptantha. Other common species include Russian thistle, pincushion *(Chaenactis stevioides*), galleta grass, and wire lettuce (*Stephanomeria exigua*) (BIA 2007, BNCC 2012a, OSMRE 2012a).

Thinbreaks

Thinbreaks are characteristic of rocky areas with loose rock and occasionally with large pieces of rock, usually shale, that are firmly embedded in the ground and associated with the Semi-Desert cover class and associated vegetation communities identified in Table 4.6-2. The Thinbreaks vegetation community comprises 14.7 percent of the Pinabete SMCRA Permit Area. Thinbreaks are typically upland vegetation communities with surface rock as a unifying feature. Thinbreaks plant species can occur in rock fissures and include Russian thistle, tansy mustard, cryptantha, shadscale saltbush (*Atriplex confertifolia*), alkali sacaton, stickseed, dwarf gilia (*Ipomopsis pumila*), and scorpion weed (BIA 2007, BNCC 2012a, OSMRE 2012a).

Noxious Weeds

Two noxious weeds were identified within the Pinabete SMCRA Permit Area, including portions of the Burnham Road Realignment. Halogeton (*Halogeton glomeratus*) and saltcedar (*Tamarix* sp.) were documented as common occurrences within these areas during the baseline vegetation community surveys (BIA 2007, BNCC 2012a, OSMRE 2012a). Halogeton was also documented within the Burnham Road realignment.

4.6.2.3 Four Corners Power Plant

An evaluation of land cover classes and associated vegetation communities within 1 mile of the FCPP Lease Area is provided in Table 4.6-4. The dominant land cover class within and around the FCPP is the Semi-Desert cover class, which accounts for 65.4 percent of the FCPP Lease Area. The dominant vegetation communities found within this vegetation class include Inter-Mountain Basins Semi-Desert Grassland and Inter-Mountain Basins Mixed Salt Desert Scrub. These vegetation communities are extensive and commonly occurring ecological communities consisting of open-canopied to moderately dense shrublands and grasslands in saline basins, alluvial slopes, and plains across the Intermountain West including a suite of commonly occurring shrubs, subshrubs, and grasses common to this area (USGS 2005). The second largest land cover class is human development (directly associated with the

FCPP) and agricultural development, which accounts for 15.1 percent of the land cover in the FCPP Lease Area. The FCPP Lease Area covers 15 vegetation communities (not including agricultural or other human development areas), which represent a wide range of arid to semiarid vegetation communities, including grassland and shrubland transition areas in low elevation to subalpine environments. These vegetation communities are typically characterized as extensive open canopied shrublands and woodlands that occur on a variety of soil types ranging from rocky to fine sedimentary deposits. In addition to the GAP analysis, a survey of existing vegetation was conducted in the proposed DFADA. These results were compared to the GAP analysis, and results were found to corroborate each other (AECOM 2012b, Ecosphere 2012b).

Table 4.6-4 GAP-Identified Land Cover Classes, Associated Vegetation Communities, and Acreage, Including a 1-Mile Buffer around the FCPP Lease Area

Cover Class Vegetation Community/Ecological Region	Acres	Percent of FCPP ROI
Agricultural Vegetation	**2462.4**	**11.4**
Developed and Other Human Use	**794.9**	**3.7**
Forest and Woodland	**901.3**	**4.2**
Colorado Plateau Pinyon-Juniper Woodland	532.6	
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	368.7	
Introduced and Semi-Natural Vegetation	**467.3**	**2.2**
Introduce Riparian and Wetland Vegetation	382.3	
Introduced Upland Vegetation – Perennial Grassland and Forbland	85.0	
Nonvascular and Sparse Vascular Rock Vegetation	**371.2**	**1.7**
Colorado Plateau Mixed Bedrock Canyon and Tableland	346.3	
Inter-Mountain Basins Shale Badland	24.9	
Open Water	**1,957.8**	**9.1**
Semi-Desert	**14,124.0**	**65.4**
Colorado Plateau Blackbrush-Mormon-tea Shrubland	776	
Colorado Plateau Mixed Low Sagebrush Shrubland	1.3	
Inter-Mountain Basins Big Sagebrush Shrubland	22.4	
Inter-Mountain Basins Mixed Salt Desert Scrub	2,011.6	
Inter-Mountain Basins Semi-Desert Grassland	10,912.9	
Inter-Mountain Basins Semi-Desert Shrub Steppe	355.2	
Inter-Mountain Basins Wash	1.1	
Southern Colorado Plateau Sand Shrubland	43.5	
Shrubland and Grassland	**527.8**	**2.4**
Inter-Mountain Basins Greasewood Flat	527.8	
Four Corners Power Plant – Lease Boundary Plus 1-Mile Buffer	**21,606.6**	

Source: USGS 2005.

4.6.2.4 Transmission Lines

Vegetation analysis completed for the APS and PNM transmission line ROWs, support facilities, and half-mile buffer area represents an approximately 320,000-acre ROI. The results of the GAP analysis are provided in Table 4.6-5.

Table 4.6-5 GAP-Identified Land Cover Classes, Associated Vegetation Communities, and Acreage, Including a Half-Mile Buffer Around the APS and PNM Transmission Line ROWs

Cover Class Vegetation Community/Ecological Region	Acres	Percent of Transmission Line ROI
Agricultural Vegetation	**3,688.4**	**1.2**
Developed and Other Human Use	**1,293.3**	**0.4**
Forest and Woodland	**73,452.1**	**22.9**
Colorado Plateau Pinyon-Juniper Woodland	47,987.5	
Inter-Mountain Basins Juniper Savannah	1,668.4	
Rocky Mountain Aspen Forest and Woodland	484.5	
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	1,106.7	
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	125.6	
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	77.8	
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	136.9	
Southern Rocky Mountain Juniper Woodland and Savannah	2,857.9	
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	52.8	
Southern Rocky Mountain Pinyon-Juniper Woodland	1,574.1	
Southern Rocky Mountain Ponderosa Pine Woodland	17,368.8	
Western Great Plains Riparian Woodland and Shrubland	11.3	
Introduced and Semi-Natural Vegetation	**871.41**	**0.3**
Introduced Riparian and Wetland Vegetation	533.0	
Introduced Upland Vegetation – Perennial Grassland and Forbland	**338.4**	
Nonvascular and Sparse Vascular Rock Vegetation	**21,601.59**	**6.7**
Colorado Plateau Mixed Bedrock Canyon and Tableland	16,320.2	
Inter-Mountain Basins Active and Stabilized Dune	80.0	
Inter-Mountain Basins Shale Badland	4,517.8	
Rocky Mountain Cliff, Canyon and Massive Bedrock	25.9	
Undifferentiated Barren Land	657.7	
Open Water	**1,044.3**	**0.3**
Semi-Desert	**199,465.1**	**62.2**
Apacherian-Chihuahuan Mesquite Upland Scrub	846.4	
Colorado Plateau Blackbrush-Mormon-tea Shrubland	2,589.3	
Colorado Plateau Mixed Low Sagebrush Shrubland	1,495.0	
Inter-Mountain Basins Big Sagebrush Shrubland	22,526.8	
Inter-Mountain Basins Mixed Salt Desert Scrub	24,680.7	
Inter-Mountain Basins Montane Sagebrush Steppe	237.9	

Cover Class **Vegetation Community/Ecological Region**	**Acres**	**Percent of Transmission Line ROI**
Inter-Mountain Basins Semi-Desert Grassland	74,948.3	
Inter-Mountain Basins Semi-Desert Shrub Steppe	61,588.6	
Southern Colorado Plateau Sand Shrubland	10,552.1	
Shrubland and Grassland	**19,423.24**	**6.1**
Inter-Mountain Basins Greasewood Flat	18,762.5	
North American Arid West Emergent Marsh	13.1	
Rocky Mountain Alpine-Montane Wet Meadow	149.2	
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	435.6	
Southern Rocky Mountain Montane-Subalpine Grassland	7.1	
Western Great Plains Foothill and Piedmont Grassland	55.7	
Transmission Lines – Plus One-Half Mile Buffer	**320,839.4**	

Source: USGS 2005.

The dominant land cover class within and around the transmission lines is the Semi-Desert cover class, which accounts for 62 percent of the ROI, followed by 23 percent land cover classes associated with forest and woodland cover classes. The ROWs traverse 34 vegetation communities (not including agricultural or other human development areas), which represent a wide range of arid to semiarid vegetation communities, including grassland and shrubland transition areas in low elevation to subalpine environments. These vegetation communities are typically characterized as extensive open canopied shrublands and woodlands that occur on a variety of soil types ranging from rocky to fine sedimentary deposits.

Noxious Weeds

Eight noxious weeds were identified within the APS ROW and include cheatgrass (*Bromus tectoruma*), spotted knapweed (*Centaurea stoebe*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), Russian olive, halogeton, saltcedar, and spiny cocklebur (*Xanthium spinosum*) (AECOM 2013f). Eight noxious weeds were identified within the PNM ROW and include Russian olive, tamarisk, cheat grass, Siberian elm, cocklebur, musk thistle, and Canada thistle (Marron and Associates 2012a, b, 2013; New Mexico Department of Agriculture 2009; Arizona Department of Agriculture 2005).

4.6.2.5 Ecological Risk Modeling

The evaluation of the potential effects of future emissions from the FCPP was based on two ecological risk assessments (ERAs) conducted to evaluate potential ecological impacts associated with future emissions from the combustion of coal at the FCPP (AECOM 2013c,h)[2]. One ERA was conducted to evaluate ecological risks to both terrestrial and aquatic environments within the area identified by air dispersion modeling as having a 1 percent future increase in soil metals concentrations above current condition (baseline) metals concentrations (AECOM 2013c). This area was defined as the deposition area, and the ERA is hereafter referred to as the Deposition Area ERA. The second ERA was conducted to evaluate the ecological risks associated with current conditions, future FCPP emissions, as well as future regional global emissions to the aquatic environment of the San Juan River within the deposition area and downstream of the deposition area into the San Juan River arm of Lake Powell (AECOM

[2] The scope of the ERA was limited to the FCPP stack emissions because the proposed operations at the mine site would not result in atmospheric emissions of constituents of potential ecological concern (COPECs) of sufficient magnitude to cause adverse environmental effects. The potential effects of runoff from the mine are considered outside of the ERA.

2013h). This ERA is hereafter referred to as the San Juan River ERA. The ERA process is used to inform environmental decision making by evaluating the potential for adverse ecological effects that may occur as a result of exposure to one or more environmental stressors. The approach used in the ERAs for evaluating the potential impacts of the Proposed Action is consistent with the EPA's Guidelines for Ecological Risk Assessment (EPA 1998a), Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA 1997), and the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (Screening Level Ecological Risk Assessment Protocol; EPA 1999). The tiered approach for risk assessment recommended by the EPA (1997, 1998a) has been adopted in these ERAs. Consistent with the Screening Level Ecological Risk Assessment Protocol (EPA 1999), a conservative screening level evaluation was conducted first using maximum media concentrations and conservative assumptions. A more refined evaluation was conducted for receptors and scenarios that indicated potential risks in the screening level evaluation. Both the Deposition Area ERA and the San Juan River ERA were conducted following EPA (1997, 1998) guidance whereby the ERA framework comprises four key elements: (1) Problem Formulation, (2) Exposure Assessment, (3) Toxicity Assessment, and (4) Risk Characterization.

The ERA results are expressed as Hazard Quotients (HQs) whereby the target HQ of 1 represents a threshold below which adverse ecological effects are not likely and above which adverse ecological effects are possible.

For plants, the HQ is calculated as follows: $HQ = \frac{EPC}{ESV}$

Where,

HQ = hazard quotient (unitless)
EPC = exposure point concentration in soil (milligram(s) per kilogram [mg/kg])
ESV = ecological screening value protective of plants (mg/kg)

For wildlife, the HQ is calculated as follows: $HQ = \frac{ADD}{TRV}$

Where,

HQ = hazard quotient (unitless)
ADD = average daily dose (mg/kg-day)
TRV = toxicity reference value (mg/kg-day)

For fish, the HQ is calculated as follows: $HQ = \frac{EPC}{CBR}$

Where,

HQ = hazard quotient (unitless)
EPC = exposure point concentration for fish tissue (mg/kg)
CBR = critical body residue in fish tissue (mg/kg)

Baseline conditions for both ERAs were determined through review of existing datasets (USGS gages, Simpson and Lusk 1999, APS 2011, USFWS 2005, Esplain 1995, USGS 2012 PLUTO database, URS 2008, all as cited in AECOM 2013c) and collection of project specific soil and sediment samples within the deposition area (AECOM 2013c). Project specific samples were collected from 35 locations comprising different soil and vegetation types within the deposition area. Eight sediment samples were collected from Morgan Lake to supplement existing information. Future conditions associated with the Proposed Action (e.g., future FCPP emissions) were estimated using predictive air models and fate and transport models.

The different approaches taken in the Deposition Area ERA and the San Juan River ERA are described below.

Deposition Area ERA

In order to delineate the area to be evaluated in the Deposition Area ERA (AECOM 2013c), preliminary air dispersion and deposition modeling was conducted to assess the potential extent of future deposition associated with the Proposed Action. Modeling was used to estimate potential changes to soil concentrations associated with 25 years of additional deposition from future FCPP operations under the Proposed Action. Based on a study by EPRI (2011) as well as other studies, arsenic, cadmium, chromium, mercury, antimony, lead, copper and selenium are understood to be the primary risk drivers for adverse ecological effects associated with coal-fired power plants. Therefore, dispersion and deposition modeling of these eight metals was completed to delineate the terrestrial area to be evaluated in the Deposition Area ERA. The CALPUFF[3] model was applied within a 300-km radius of the FCPP to simulate dispersion and deposition of the metals to estimate the contribution of future continuous full load operations of the FCPP stacks[4] for 25 years to surface soil concentrations in the region.

The future surface soil concentrations of each metal calculated to accumulate over 25 years were computed (based on CALPUFF modeling and IRAP-h software[5]) and compared to the corresponding 95 percent upper confidence limit on the mean (95 percent UCL)[6] of the estimated existing soil concentrations derived from the PLUTO database for San Juan County, New Mexico (USGS 2012).[7] The ROI (Figure 4.6-1) was developed from the ERA Deposition Area, which was determined by delineating the area where the predicted incremental increase in soil concentration of any of the metals due to 25 years of future full load plant operations is projected to be more than 1 percent of current concentrations (based on the PLUTO data). As noted previously, beyond this area, the very small increase in soil concentration associated with the Proposed Action was sufficiently low to be considered discountable.

Because the Deposition Area extended less than 50 km from the FCPP, further detailed air dispersion and deposition modeling needed to support the Deposition Area ERA was performed using AERMOD (version 12345)[8] to quantify future emissions from the FCPP stacks that would be added to the existing concentrations in the soils within the Deposition Area over 25 years. This was done in order to assess the terrestrial exposure to COPECs from FCPP stack emissions under the Proposed Action. This is also referred to in the Deposition Area ERA as "Deposition-Related Contributions." The AERMOD modeling was extended to a 50-km radius of the FCPP in order to allow the ERA fate and transport model (IRAP-h software) to predict the contributions of COPECs to the water bodies within the Deposition Area from upstream watersheds. AERMOD and IRAP-h were used to estimate deposition-related contributions to soil, sediment, and water concentrations associated with future contributions from the Proposed Action. This modeling was done in order to assess the exposure to COPECs within the Deposition Area from FCPP stack emissions under the Proposed Action.

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3 CALPUFF is the EPA-approved model to simulate dispersion and deposition over a large area for long-range transport and complex terrain on scales of tens to hundreds of kilometers.
4 For the purposes of evaluating future operations, this refers to units 4 and 5 with SCR installed.
5 IRAP-h (Lakes Environmental, Waterloo, Ontario, Canada) is a commercial software package that implements the EPA (2005) Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. The fate and transport modeling components of this software were used in the Deposition Area ERA.
6 The 95 percent UCL is an estimate of the average concentration with 95 percent confidence that the true mean concentration is less than this value. This value was used to help determine the extent of the Deposition Area because it is expected to represent a reasonable estimate of soil concentrations across the potentially impacted area.
7 USGS data from the county were used at this early stage of the project due to a lack of site-specific soil data. Once the Deposition Area was established, site-specific soil data were collected to support the ERA.
8 AERMOD is the EPA-approved steady-state plume model that incorporates air dispersion for simple and complex terrains. It is designed for short-range modeling up to 50 km.

The Deposition Area ERA established Current Concentrations within the Deposition Area for surface soils, surface water, sediment, and fish tissue based on available data sets and site-specific sampling. Soil sampling was undertaken at 35 locations and eight sediment samples were collected from Morgan Lake.

The Deposition Area ERA considered both generic ecological receptors and special status species receptors.[9] The Deposition Area ERA identified potentially complete exposure pathways for the identified receptors, selected assessment endpoints and measures of effect to evaluate impacts on the receptors, and developed an ecological conceptual site model to describe how ecological receptors may come into contact with deposition-related constituents, including direct contact with surface soil, surface water or sediment, root uptake by terrestrial plants, ingestion of impacted food items, soil, sediment, and drinking water by wildlife, and bioaccumulation into higher trophic levels for fish, birds, and mammals.

To assess potential risks to identified receptors, HQs[10] were calculated for each COPEC/receptor combination, as described above. The HQ is not a predictor of risk but rather is an index used to indicate whether there is potential risk. When the screening level HQ based on the maximum detected or maximum modeled concentration was less than 1 (i.e., the maximum concentration was less than the ecological screening value), exposure to the COPEC was assumed to fall below the range associated with adverse effects. For screening level HQs greater than 1, the COPEC/receptor combination was carried through to the refined evaluation. The refined evaluation considered alternative exposure point concentrations, typically represented by the 95 percent UCL (unless sufficient samples were not available and the maximum value was used). In the refined evaluations, HQs were also calculated based on average exposure point concentrations, represented by the arithmetic average.

A food web model was used to evaluate potential ecological risk via bioaccumulation pathways to representative mammalian and avian receptors that may feed within the Deposition Area and may potentially be exposed to bioaccumulative compounds found in these environments. To address potential food web impacts to fish due to bioaccumulative compounds, fish tissue concentrations were estimated and evaluated against tissue-based screening levels referred to as CBRs.

For the purpose of evaluating potential risks to wildlife, toxicity reference values (TRVs) were established for each COPEC for both avian and mammalian receptors according to EPA guidance (EPA 2002, 2007a, 2009a,b), ORNL's publication Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al. 1996), and the Los Alamos National Laboratory EcoRisk Database (Los Alamos National Laboratory 2012). The TRVs were based on endpoints commonly evaluated in ERAs, including mortality, growth, and reproduction to be protective of a wide range of adverse effects, including effects that may result from relatively short-term exposure during sensitive life stages (e.g., breeding).

The Deposition Area ERA then estimated risks based on the integration of COPEC exposure and stressor response and characterized the potential for risks within the Deposition Area due to Current Concentrations and FCPP future operations (i.e., emissions and deposition associated with the Proposed Action [referred to as Deposition-Related Contributions]). After addressing uncertainties in the ERA process, the ERA concluded with a summary of risk conclusions.

EPRI Modeling

To assess the contributions of arsenic and selenium from regional power plants (FCPP, San Juan Generating Station, Navajo Generating Station) and the local, regional, and global contributions of mercury to water, watershed compartments, and biota in the San Juan River basin extending down to the San Juan arm of Lake Powell, EPRI developed a regional air quality model and coupled the output with a watershed

[9] A habitat model and biological survey were developed for the terrestrial environment within the Deposition Area to assess where habitat for various species was likely to occur (AECOM 2013f).

[10] An HQ is calculated as an exposure point concentration (or dose) divided by the appropriate ecological screening value (or toxicity reference value).

biogeochemical cycling and aquatic biota bioaccumulation model. The methods used are summarized below from EPRI (2014).

The EPRI Community Multiscale Air Quality (CMAQ)-Advanced Plume Treatment (APT) model was used for modeling atmospheric transport and deposition of arsenic, mercury, and selenium in the San Juan Basin region. This regional-scale model has as its core the U.S. EPA CMAQ model and applies an APT module for more precision closest to the sources. The Weather Research and Forecasting meteorological model was used to simulate the entire depth and breadth of the regional atmosphere. For mercury, the global Goddard Earth Observing System (GEOS)-Chem model, based on the National Aeronautics and Space Administration GEOS atmospheric global transport model combined with a Harvard University atmospheric chemistry simulation model, was used to simulate the movement of mercury from distant sources into U.S. airspace. This modeling included consideration of all inorganic (elemental, reactive gaseous mercury, and particulate mercury) and organic mercury species.

The CMAQ-APT model was used to produce wet and dry atmospheric deposition inputs to the Watershed Analysis Risk Management Framework (WARMF) model. WARMF is a three-dimensional dynamic model that uses a comprehensive mechanistic based modeling framework, which was applied to the San Juan River watershed and used to simulate the watershed transport, transformation and bioaccumulation processes to calculate concentrations of arsenic, selenium, and mercury in the water and mercury in the fish. WARMF calculates concentrations and movement of particular substances through the terrestrial and aquatic components of the San Juan Basin. WARMF quantifies the relationship between atmospheric deposition plus direct input from watershed sources of chemicals, and resulting concentrations in surface water (concentrations in invertebrate and fish tissue were also estimated for mercury).

Prior to the use of WARMF in the San Juan River Basin, the mercury processes included in WARMF had been the subject of a peer review by experts in a number of specific areas of study of mercury. The review panel’s recommendations were incorporated into the WARMF algorithms, and a follow-up review confirmed that the model’s simulation algorithms represent the state of the science. The WARMF model was also set up to simulate both the transport and transformations of arsenic and selenium.

CMAQ-APT was used to generate atmospheric deposition for several potential scenarios of emissions from local coal fired power plants as well as atmospheric sources of mercury external to the San Juan Basin. The four air dispersion and deposition modeling simulations performed were:

1. base case “current” emissions, with all five FCPP units operating, current San Juan Generating Station and Navajo Generating Station emissions, and current world mercury emissions;
2. post-EPA MATS rule emissions for FCPP (2014 for post-MATS, also assuming Units 1-3 were retired[11])), San Juan Generating Station (2016 for post-MATS) and Navajo Generating Station (2016 for post-MATS);
3. a lower estimate of future Chinese emissions; and
4. a higher estimate of future Chinese emissions.

In each of the China cases, FCPP, Navajo Generating Station, and San Juan Generating Station were modeled post-MATS, and current world emissions were also included in the modeling.

To evaluate the effect of these different emission scenarios on selenium and arsenic concentrations in the water column and mercury in the water column and aquatic biota, the watershed model was run using output from each of the CMAQ-APT scenarios. Six scenarios identified below were then evaluated using WARMF. The WARMF modeling was run from 1990 thru 2074 to provide a continuous trajectory for the fish tissue concentrations.

[11] There was no information on the incremental benefit of new SCR for Units 4-5, thus no additional reductions were applied for that element.

- **Scenario 1 (Base Case).** FCPP closes in 2041, Navajo Generating Station closes 2044, no change in China emissions.[12]
- **Scenario 3.** FCPP closes in 2016, Navajo Generating Station closes 2044, low increase in China emissions.[13]
- **Scenario 4.** FCPP closes in 2016, Navajo Generating Station closes 2044, high increase in China emissions.
- **Scenario 5 (Four Corners Removed).** FCPP never existed, Navajo Generating Station closes 2044, no change in China emissions.
- **Scenario 7.** FCPP closes 2041, Navajo Generating Station closes 2044, low increase in China emissions.
- **Scenario 8.** FCPP closes 2041, Navajo Generating Station closes 2044, high increase in China emissions.[14]

In all scenarios, San Juan Generating Station was kept in operation until 2074, and conservatively assumed no reduction in emissions beyond post-MATS operation for all units (e.g., no potential emissions reductions from possible future BART requirements were modeled). Scenario 8 represents the highest emissions-related contributions to the watershed, with Scenarios 1, 3, 4, 5, and 7 representing slightly lower contributions. By comparing the watershed model results among the scenarios, it was possible to isolate the effects of various potential future emissions conditions. For example, subtracting the results for Scenario 4 from Scenario 8 (or Scenario 3 from Scenario 7) allows us to isolate FCPP-only contributions.

San Juan River ERA

The EPRI modeling was used in the San Juan River ERA (AECOM 2013h) to address potential risks due to arsenic, mercury, and selenium deposition from multiple sources to aquatic and riparian (birds and mammals) receptors in the San Juan River basin. The ERA analysis encompassed the area between the eastern boundary of the area evaluated in the Deposition Area ERA downstream to the confluence of the San Juan River with the Colorado River. This included the San Juan River arm of Lake Powell. For the purposes of the San Juan River ERA, this portion of the river was divided into three ecological exposure areas based on the USFWS reaches evaluated by Simpson and Lusk (1999), while the San Juan River arm of Lake Powell was evaluated as a fourth exposure area.

The San Juan River ERA quantitatively evaluates potential ecological risks associated with two of the exposure scenarios: (1) Current Concentrations + FCPP-only Contributions and (2) Scenario 8 Contributions, summarized above. As already noted and as used in the San Juan River ERA, “Current Concentrations” refers to the data set representing existing media COPEC concentrations within the San Juan River Study Area.[15] “FCPP-only Contributions” and “Scenario 8 Contributions” are those modeled by EPRI to quantify the deposition of arsenic, mercury, and selenium under various scenarios. Current Concentrations data were not added into the Scenario 8 evaluation because the WARMF model calibration accounts for current concentrations within the San Juan River. In the San Juan River ERA, contributions to ecological risks due to Scenarios 1, 3, 4, 5, and 7 were considered qualitatively relative to the risks identified for the Scenario 8 Contributions exposure scenario. These alternate values are not considered in this EIS, as they were very similar in magnitude of COPEC concentrations.

[12] Mercury emissions held constant at 2007 levels.
[13] Mercury transport and deposition to the watershed decreases slightly because of a shift in the speciation, or chemical form, of the emitted mercury. See EPRI (2013) for details.
[14] Unlisted scenario numbers have been reserved for future calculations that do not include FCPP emissions scenarios.
[15] Current Conditions concentrations were established based on a review of available data for surface water, sediment, and tissue. Historic analytical data were obtained from various governmental and non-governmental agencies and reports.

Similar to the Deposition Area ERA, the San Juan River ERA identified appropriate ecological receptors and potentially complete exposure pathways.[16] The San Juan River ERA then selected assessment endpoints and measures of effect to develop a conceptual ecological site model. Also similar to the Deposition Area ERA, HQs were calculated for each COPEC/receptor combination, to assess potential risks to identified receptors. The San Juan River ERA then estimated and characterized the potential for risks within the San Juan River Study Area due to Current Concentrations, FCPP future operations (i.e., emissions and deposition associated with the Proposed Action), and regional and global contributions to the watershed modeled by EPRI. After addressing uncertainties in the ERA process, the San Juan River ERA concluded with a summary of risk conclusions.

Summary of Differences Between the Two ERAs

The two ERAs were conducted following the same methodology with the following key exceptions:

1. The Deposition Area ERA evaluated potential ecological risks to both terrestrial and aquatic (and riparian) receptors within the Deposition Area. The San Juan River ERA evaluated potential ecological risks only to aquatic and riparian receptors in the San Juan River both within the Deposition Area and in the San Juan River from the Deposition Area downstream to, and including, the San Juan River arm of Lake Powell.
2. The Deposition Area ERA identified 20 metals, 17 PAH compounds, 17 polychlorinated dibenzo-p-dioxin and dibenzofuran (dioxin/furan) congeners, acrolein, benzene, sulfuric acid, hydrogen chloride, and hydrogen fluoride as COPECs. The San Juan River ERA evaluated ecological risks associated with exposure to three metals known to have regional and/or global distribution patterns: arsenic, mercury, and selenium.
3. Air dispersion and deposition modeling was conducted by AECOM for the Deposition Area ERA using the AERMOD short-range dispersion model, whereas air dispersion and deposition modeling for the San Juan River ERA was conducted by EPRI using a global-scale model (GEOS-Chem) and a regional-scale model (CMAQ-APT). The air dispersion and deposition modeling conducted by AECOM is described in the Deposition Area ERA (AECOM 2013c). The air modeling and deposition conducted by EPRI is described in EPRI (2014).
4. Fate and transport modeling for the Deposition Area ERA was conducted by AECOM using IRAP-h software, developed by Lakes Environmental, which implements the EPA (2005a) Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities. Fate and transport modeling for the San Juan River ERA was conducted by EPRI using the WARMF model to estimate surface-water concentrations for arsenic, mercury, and selenium, and fish tissue concentrations for mercury (AECOM 2013h, EPRI 2014).
5. In the Deposition Area ERA, fish exposure to mercury was estimated using literature-based bioaccumulation factors. In the San Juan River ERA, mercury exposure to fish was estimated using a food-web model (included in the WARMF model).
6. The Deposition Area ERA evaluated and compared ecological risks associated with Current Concentrations and future FCPP emissions, but not future regional and global emissions. The San Juan River ERA evaluated and compared ecological risks associated with Current Concentrations and future FCPP emissions, and future regional/global emissions.
7. A habitat model and biological survey were developed for the terrestrial environment within the Deposition Area to assess where habitat for various species was likely to occur (AECOM 2013f).

[16] EPA (1997, 1998a) defines a complete exposure pathway as "one in which the chemical can be traced or expected to travel from the source to a receptor that can be affected by the chemicals."

It is important to recognize that these ERAs do not directly address potential impacts to communities or populations, but rather address potential impacts to individuals. It is generally assumed that as the number of affected individuals increases, the likelihood of population-level effects also increases. However, effects on individual organisms may occur with little or no population or community-level effects. For generic ecological receptors population-level effects may be of greater relevance than impacts to individuals. Thus, potential risks to individuals are likely not representative of risks to populations; in general, for the same exposures, population risk tends to be lower than individual risk and therefore the analysis presented here is considered conservative with regard to its' assessment of risks to populations. However, for special status species, and in particular, federally listed species, potential effects to individuals may be relevant, especially for immobile early life stage individuals. For both ERAs, the aquatic environment may include receptors that live in the aquatic environment as well as those that forage within the aquatic environment.

4.6.3 Changes to Vegetation Affected Environment Post-2014

Two completed Federal Actions have been incorporated into the baseline for this analysis: (1) the EPA has made its ruling with respect to BART to control air emissions, and (2) OSMRE has approved the SMCRA permit transfer from BNCC to NTEC (Section 2.4). These completed Federal Actions are considered part of the environmental baseline to which the effects of continuing operations and the Proposed Action are compared in the following section. Neither of these completed Federal Actions would change the affected environment for vegetation.

4.6.4 Environmental Consequences

Impacts of the Proposed Action and alternatives were based on a qualitative comparison achieved by overlaying the location of proposed activities and disturbance areas on known vegetated areas, to determine potential acreages of impacts. For vegetation resources, an impact would be considered major if it resulted in a substantial loss of habitat function or the disruption of life-history requirements of a species, or plant population, which would make them eligible for listing under the Federal ESA, or would limit the recovery of a listed species. The following criteria are used to determine impacts:

- *Major.* Effects that result in economically, technically, or legally eliminating the resource and subsequently make it eligible for listing under the Federal ESA, or which limit recovery of a listed species.
- *Moderate.* Effects that are outside of the random fluctuations of natural processes but do not cause a significant loss of the resource.
- *Minor.* Changes that would affect the quality of vegetation but are similar to those caused by random fluctuations in natural processes.
- *Negligible.* Impacts of lesser magnitude, but still predictable under current technology (e.g., computer models) or measurable under commonly employed monitoring technology.
- *None.* Effects that are not predicted or cannot be measured.

4.6.4.1 Alternative A – Proposed Action

Navajo Mine

The following activities associated with the Proposed Action at the Navajo Mine SMCRA Permit area and the Pinabete Permit Area would result in removal of existing vegetation and are discussed in greater detail below:

- Renewal of existing Navajo Mine SMCRA permit and associated mining activities in Area III.
- Approval of the Pinabete SMCRA Permit and mining activities in Areas IV North and IV South.

- Realignment of Burnham Road and construction of other access roads.
- Construction of additional transmission lines.

The renewal of the existing Navajo Mine SMCRA Permit would allow mining in Area III to continue until the resource was depleted (anticipated in 2016). As a result of mining activities, vegetation in the permit area would be removed until reclamation commenced. Surface disturbance development of infrastructure associated with mining, within the Navajo Mine Lease Area would also remove existing vegetation communities within the Pinabete SMCRA Permit Area. The removal of vegetation for both the Navajo Mine SMCRA Permit and the Pinabete SMCRA Permit would take place in areas of active mining and in areas where support roads are required. It is estimated that between 90 and 150 acres per year would be disturbed by mining activities (see Table 3-3). No removal of vegetation communities is proposed for the continued use of the coal-handling and transportation facilities associated with the continued operation of Navajo Mine SMCRA Permit Area. Mining would physically remove native vegetation, resulting in direct impacts to existing vegetation communities by reducing overall vegetative cover and causing a short-term loss of productivity during the active mining phase. Soil disturbance could negatively impact naturally occurring seed sources by reducing seed yield and/or viability and, subsequently, decrease the success of native plant re-colonization. Vegetation removal would result in short-term impacts until disturbed areas were reclaimed in accordance with OSMRE reclamation standards.

Vegetation within the permit areas would gradually be removed and reclaimed on an ongoing basis as mining activities occurred over time. As proposed within the Pinabete SMCRA Permit Area, 4,104 acres of the 5,570 acres would be disturbed as a result of mining activities over the 25 year life of the project (see Table 4.6-3 for a breakdown of the vegetation types identified within the Pinabete SMCRA Permit Area). The density and diversity of vegetation species would be modified in areas reclaimed following mining activities. However, reclamation would restore vegetation within the disturbed areas using topsoil salvage practices to maximize vegetative regrowth and using the approved NTEC Revegetation Plan. NTEC would implement a geomorphic approach to reclamation by creating landforms that possess compatible topography and comparable erosional stability and create topographic variability. Revegetation species may show preference for certain topographic conditions, such as nearly level slopes, north or south aspects, or locations within the landscape such as in low-lying areas. This approach would ultimately help to meet the revegetation goals by creating a diverse, stable, and self-sustaining vegetation community.

Vegetation communities not directly impacted by mining activities within the permit areas may be affected by wind-borne dust, off-road travel, and weed invasion (OSMRE 2012a). Fugitive dust that settles on plants can block photosynthesis, respiration, and transpiration and can cause physical injuries to plants (OSMRE 2012a). Air-borne dust concentrations decrease with increasing distance from the source, with the majority of dust deposition that can impact plant photosynthesis settling within 100 meters of the dust source in arid conditions (OSMRE 2012a). Potential impacts from fugitive dust would be localized and decreased through the implementation of fugitive dust control measures (see Section 4.1, Air Quality).

With surface disturbance, the potential for the spread or introduction of noxious weeds by wind, water, and vehicles increases. Noxious weed seeds would be deposited and may germinate in disturbed soils and could extend beyond the immediate area of disturbance. NTEC's Noxious Weed Management Plan employs multiple measures to minimize the introduction and spread of noxious weeds within Navajo Mine (BNCC 2012a).

The proposed realignment of Burnham Road would include permanent removal of 13.6 acres of vegetation for the road surface and an estimated additional 33.9 acres of temporary disturbance during roadway development. The affected vegetation generally would be associated with badlands and alkali wash vegetation types (BIA 2007). Additionally, approximately 86.7 acres of vegetation would be disturbed for the development of other ancillary dirt roads that would be used during mining activities. This acreage would be reclaimed upon completion of mining activities.

NTEC would implement all BMPs and protective measures as required by the SMCRA permit, as described in Section 2.1. With the implementation of these measures, as well as the Noxious Weed Management Plan, indirect impacts to vegetation during construction of ancillary facilities would be minor.

All areas proposed to be mined under the Proposed Action would be reclaimed. NTEC performs reclamation at Navajo Mine pursuant to its SMCRA permit (BNCC 2012a), commencing once an area is mined out and as soon as practical, considering that some infrastructure may impede immediate reclamation. Reclamation would result in the restoration of vegetative cover, though the species composition and density would be different from that which was disturbed. Under the Proposed Action, both the Pinabete SMCRA Permit Area and Navajo Mine SMCRA Permit Area would be reclaimed such that:

- total vegetative cover is at least equal to the annual mean cover of reference area,
- total production is at least equal to the annual mean production of reference area,
- shrub density is equal to or greater than 190 shrubs per acre on 80 percent of the area and greater than or equal to 500 shrubs per acre on 20 percent of the area in shrub islands and corridors,
- species diversity includes two perennial grass species, where at least one perennial grass species has a relative perennial herbaceous cover value equal to or greater than 5 percent, and a second perennial grass species will have a relative perennial herbaceous cover value equal to or greater than 3 percent. No one species shall account for more than 85 percent relative herbaceous cover,
- species diversity includes perennial forbs, where perennial forbs on the reclamation area are greater than or equal to 0.5 percent relative perennial herbaceous cover. This forb standard would be adjusted in drought years when cumulative total precipitation for January through April is less than or equal to 0.85 inch, the forb component will be successful if at least one perennial forb is observed within at least one of the 100 square meter shrub density belt transects, and
- species diversity includes two shrub species, where in addition to the dominant shrub species, there would be a minimum of 20 shrubs per acre of additional combined species (BNCC 2012a).

Revegetation would replace existing plant communities with native grass, forb, and shrub species to establish post-mining land uses of livestock grazing and wildlife habitat. As a result, species composition within the existing vegetation communities would change from vegetation areas described in Section 4.6.2 and be replaced with native seed mix that would increase the vegetative cover in most areas reclaimed.

BNCC has developed and NTEC will implement comprehensive revegetation plans in both the Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area based on experience reestablishing vegetation on previously disturbed areas at the Navajo Mine. Implementation of the revegetation plans would establish a diverse, stable, and self-sustaining vegetation community composed of native species capable of meeting the post-mining land use. Both plans have been reviewed by OSMRE and would satisfy the following criteria:

- Adequate cover capable of stabilizing the soil surface from erosion.
- Adequate forage to sustain the post-mining land uses (i.e., livestock grazing and wildlife habitat).
- Suitable species composition for enhancement of wildlife forage and cover.

NTEC would implement revegetation success comparisons. The revegetated areas would be compared to an arithmetic mean of the reference area vegetation communities. Revegetation would be considered successful when the total vegetation cover, total vegetative production, and shrub density are not less than 90 percent of the revegetation success criteria. Table 4.6-6 describes NTEC's success criteria.

Table 4.6-6 Pinabete SMCRA Permit Area Revegetation Success Criteria

Vegetation Sampling Parameter	Revegetation Areas Standard
Total vegetation cover[1]	• Annual mean
Total vegetative production[1]	• Annual mean
Shrub density	• 190 or 500 shrubs per acre2
Species diversity	• Two perennial grasses species3 • Perennial forbs ≥ 0.5 percent relative perennial herbaceous cover4 • Two shrub species5

Source: BNCC 2012a.

Notes:

[1] Total vegetation cover (i.e., percent cover of live plants plus litter) and total vegetation production (i.e., annual and perennial vegetation production) will reflect only current year's growth.

[2] Shrub density is considered successful if the number of shrubs is equal to or greater than 190 shrubs per acre on 80 percent of the area and greater than or equal to 500 shrubs per acre on 20 percent of the area in shrub islands and corridors.

[3] At least one perennial grass with a relative perennial herbaceous cover of greater than or equal to 5 percent and a second perennial grass species with a relative perennial herbaceous cover value greater than or equal to 3 percent. No one species will account for more than 85 percent relative herbaceous cover.

[4] In drought years, when the cumulative precipitation between January and April is less than or equal to 0.85 inch, the forb parameter is successful if at least one perennial forb is observed within at least one of the 100-square-meter shrub density belt transects.

[5] In addition to the dominant shrub species there will be a minimum of 20 shrubs per acre of additional combined species.

Four Corners Power Plant

Under the Proposed Action, FCPP would continue to operate and maintain existing facilities. The only areas of surface disturbance would be the DFADAs and areas proposed as borrow pits for the creation of impoundments in the DFADAs. Construction of the DFADAs would result in the permanent loss of up to 355 acres of existing vegetation communities, resulting in direct impacts to existing vegetation communities by reduction in overall vegetative cover and permanent loss of productivity during facility life. Further, use of the borrow areas to facilitate DFADA development would disturb an additional 697 acres, for a total disturbance of 1,052 acres in the DFADAs (Table 4.6-7).

Table 4.6-7 Disturbed Vegetation Types within the Ash Disposal and Borrow Areas

Vegetation Type	Acres
Inter-Mountain Basins Mixed Salt Desert Scrub	776
Inter-Mountains Basins Shale Badland	187
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	89
Total Ash Disposal Facility	**1,052**

Source: Ecosphere 2012c.

Construction of the additional DFADAs would also alter natural seed dispersal patterns, which could indirectly impact recruitment of plant species in the immediate area. Disturbance of natural plant communities can lead to invasion of noxious weed species, which can outcompete native species. Indirect impacts resulting from alteration of natural vegetation communities and the potential for the introduction of nonnative or exotic species would be permanent and minor due to the relatively small area involved and the ubiquitous nature of the vegetation communities within the area.

Vegetation communities adjacent to the DFADA construction areas may also be affected by wind-borne dust and off-road travel. Fugitive dust that settles on plants can block photosynthesis, respiration, and transpiration and can cause physical injuries to plants. Air-borne dust concentrations decrease with increasing distance from the source, with the majority of dust that can impact plant photosynthesis settling within 100 meters in arid conditions (OSMRE 2012a). However, potential impacts from fugitive dust would be localized and minimized through the implementation of fugitive dust control measures; as a result impacts would be expected to be minor.

In addition to direct impacts of the construction of the DFADAs, potential indirect impacts to vegetation in the ROI could occur as a result of the deposition of air emissions from the FCPP. Ecological risks associated with future emissions from the FCPP were evaluated to address the impacts of direct contributions from the FCPP stacks under the Proposed Action that are deposited on nearby terrestrial and aquatic habitats. The methods used to assess potential ecological risks were described in Section 4.6.2.5. Total future risks were calculated by considering risks from constituents currently present in the environment, as well as constituents associated with future emissions from the FCPP for an additional 25 years, from 2016 to 2041.

The ecological risk assessment conducted for non-special status terrestrial plants was based on the comparison of conservative plant-protective soil screening levels to the concentrations of constituents in soils within the deposition area under current conditions as well as the predicted concentrations in soils following 25 years of future FCPP operation, 2016 through 2041. The results for plants are presented in Table 4.6-8. ERA results for special status plants are presented in Section 4.8.4.

Table 4.6-8 Comparison of HQs for Current Conditions, Future FCPP Emissions, and Current Conditions + Future FCPP Emissions for Non-Special-Status Plants

Constituent	Current Conditions Soil EPC (mg/kg)	Current Conditions HQ	Future FCPP Emissions Soil EPC (mg/kg)	Future FCPP Emissions HQ	Total HQ	% HQ from Future FCPP Emissions
Boron	8.9	18	1.5E-04	3.0E-04	18	0.0017
Chromium	11	11	4.2E-04	4.2E-04	11	0.0038
Chromium, hexavalent	1.3	1.3	5.1E-05	5.1E-05	1.3	0.0039
Selenium	0.74	1.4	5.9E-08	1.1E-07	1.4	7.9E-06
Vanadium	24	12	0.0031	0.0015	12	0.013

Notes:

The EPC used to calculate HQs for non-special-status plants is the 95 percent upper confidence limit on the mean concentration (95 percent UCL), defined in the AECOM (2013c) ERA as the “Refined Maximum EPC”.

Only those constituents with HQs exceeding 1 for either Current Conditions or Future FCPP Emissions are shown.

Total HQ is the sum of the Current Conditions HQ and the Future FCPP Emissions HQ.

Values less than or equal to 0.0001 are expressed in scientific notation (e.g., 1.0E-04 = 0.0001, 1.0E-05 = 0.00001, 1.0E-06 = 0.000001, etc.).

EPC = exposure point concentration

mg/kg = milligram per kilogram

HQ = hazard quotient

The ERA results show that HQs exceed 1 for some metals under current conditions, indicating a potential for adverse ecological effects to plants. As described in AECOM (2013c) these HQs for plants are likely overestimated due to the very conservative soil screening levels used to estimate the HQs. The ERA results also show that HQs for the Proposed Action are well below 1 and contribute less than 0.01 percent to the Total HQ. Based on this evaluation, the Proposed Action is not expected to increase risks above those already present, nor would they increase the risk of metals not currently identified as potential risks to a level of concern (AECOM 2013c).

An organism may be at risk to adverse effects if a toxicological threshold is exceeded for a substance regardless of whether the substance is of natural or anthropogenic origin. For example, the EPA's soil ecological screening levels for barium protective of plants and invertebrates are 500 and 330 mg/kg, respectively (AECOM 2013a), yet naturally occurring soil barium concentrations are reported to range up to 1,300 mg/kg in New Mexico (USGS 1981) and up to 2,000 mg/kg across the U.S. (USGS 1984). This suggests that plants and invertebrates may be at risk of adverse effects in areas of higher naturally occurring barium concentrations.

In both the Deposition Area ERA and the San Juan River ERA, current conditions were characterized as measured COPEC concentrations in soil, sediment, surface water, and fish tissue. It is reasonable to assume that these media concentrations integrate past and present contributions over space and time that are of natural origin with those of anthropogenic origin including local, regional, and global sources, as well as historical FCPP impacts over the past 50 years. While it is not possible to accurately estimate the contribution of COPECs from each of these sources, it is possible to put the soil metals concentrations in perspective with soil metals concentration reported by the USGS for New Mexico and the continental U.S. Table 4.6-9 compares maximum soil metals concentrations recently measured within the future FCPP deposition area (e.g., current conditions) with the range of soil metal concentrations reported for the U.S.

Table 4.6-9 Comparison of Soils Metals Concentrations in the U.S. to Soil Metals Concentration in the Future FCPP Deposition Area

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

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

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

Note:

All concentrations are in units of mg/kg.

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

Transmission Lines

Under the Proposed Action, no construction or changes in operations would be associated with the renewal of the APS or PNM transmission line ROWs.

APS and PNM manage vegetation within the transmission line ROWs to prevent this vegetation from interfering with the transmission lines and to maintain access to the lines for conducting maintenance. These activities are conducted in accordance with each company's vegetation management program, and are subject to their environmental screening programs and additional measures to protect avian species and special status plants within the ROW (see Section 3.2.6). Vegetation management in any given area occurs every 2 to 5 years, depending on growth rates and would keep the vegetative communities within the ROWs in a similar condition to the environmental baseline.

Repair to transmission line infrastructure is completed as needed. While most inspections and repairs would not result in ground disturbance, larger repairs, such as tower replacement or anchoring, may result in limited ground disturbance in discreet areas within and directly adjacent to the ROWs. While regular maintenance and repair are expected to occur as a continued part of regular operation, ground-disturbing activities would be subject to agency consultation and permitting prior to construction, if sensitive resources are identified, which cannot be avoided.

Renewal of the ROWs would have no direct additional impacts on vegetation communities within the APS or PNM ROWs other than those occurring under current operations; therefore, impacts to vegetation from transmission lines are considered negligible.

4.6.4.2 Alternative B – Navajo Mine Extension Project Mine Plan

Navajo Mine

Vegetation communities occurring under Alternative B would be temporarily removed and reclaimed over the mine's life. Alternative B would result in a disturbance footprint approximately 894 acres larger than the Proposed Action (See Section 3, Table 3-7). For Alternative B, operations and reclamation would be conducted as described under the Proposed Action. Use of the existing Navajo Mine buildings, support facilities, and coal-handling areas would continue as described under the Proposed Action. Under Alternative B, 8 additional miles of transmission lines would be constructed. Fugitive dust and noxious weed management and control would be conducted as described under the Proposed Action. Therefore, impacts to vegetation under Alternative B would be similar to those described under the Proposed Action.

Under Alternative B, additional primary and ancillary roads would be required to support mining activities. Vegetation removal would be required for construction of these roads, but these roadways would be reclaimed upon closure of the Navajo Mine. Vegetation removal, reclamation, dust control, and noxious weed control associated with use of these support roads would be conducted as described under the Proposed Action.

Under Alternative B, the realignment of Burnham Road would be 6.2 miles long and would include permanent removal of 30.1 acres of vegetation for the road surface and an estimated 75.2 acres of temporary disturbance during roadway development. This vegetation impacted is generally associated with badlands and alkali wash vegetation types (BIA 2007). Additionally, approximately 173.2 acres of vegetation would be disturbed for the development of other primary and ancillary dirt roads that would be used during mining activities. This acreage would be reclaimed upon completion of mining activities.

Fugitive dust and noxious weed management and control would be conducted as described under the Proposed Action. Therefore, direct impacts to vegetation under Alternative B would be proportionally greater to those described under the Proposed Action.

Under Alternative B, the Pinabete SMCRA Permit Area would be reclaimed as described under the Proposed Action. Therefore, impacts to vegetation under Alternative B would be similar to those described under the Proposed Action.

Four Corners Power Plant

Under Alternative B, all impacts for the FCPP would be as described under the Proposed Action.

Transmission

Under Alternative B, all impacts that would result from continued operation and maintenance of the transmission lines would be as described under the Proposed Action.

4.6.4.3 Alternative C – Alternative Pinabete Mine Plan

Navajo Mine

Under Alternative C, mining would be located in both Area IV North and Area IV South, as described for the Proposed Action. Alternative C would result in a footprint of 6,492.2 acres; approximately 2,388.7 acres larger than the Proposed Action (see Section 3, Table 3-8). Operations and reclamation would be conducted as described under the Proposed Action. Reclamation, dust control, and noxious weed control would be conducted as described under the Proposed Action. Therefore, short-term impacts to vegetation under Alternative C would be greater than (more acres disturbed) but similar to (all direct impacts would be revegetated) those described under the Proposed Action.

Use of the existing Navajo Mine buildings, support facilities, and coal-handling areas would continue as described under the Proposed Action. Under Alternative C, 8 more miles of transmission lines would be constructed than under the Proposed Action. Although fugitive dust and noxious weed management and control would be conducted as described under the Proposed Action, construction of a greater distance of transmission line would result in greater permanent vegetation removal. Therefore, impacts to vegetation under Alternative C would be similar to those described under the Proposed Action.

Also under Alternative C, additional primary and ancillary roads would be required to support mining activities. Vegetation removal would be required for construction of these roads. These roadways would be reclaimed upon closure of the Navajo Mine. Reclamation, dust control, and noxious weed control associated with the construction and use of these support roads would be conducted as described under the Proposed Action.

Under Alternative C, the realignment of Burnham Road would be 6.2 miles long (same as Alternative B), and would include permanent removal of 30.1 acres of vegetation for the road surface, and an estimated 75.2 acres of temporary disturbance during roadway development. The affected vegetation is generally associated with badlands and alkali wash vegetation types (BIA 2007). Additionally, approximately 204.5 acres of vegetation would be disturbed for the development of other primary and ancillary dirt roads that would be used during mining activities. This acreage would be reclaimed upon completion of mining activities.

Four Corners Power Plant

Impacts to vegetation under Alternative C would be the same as described for the Proposed Action.

Transmission Lines

Impacts to vegetation under Alternative C would be the same as described for the Proposed Action.

4.6.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Navajo Mine

Under this alternative, OSMRE would approve the Pinabete SMCRA permit application and renew the Navajo Mine SMCRA Permit. The Navajo Mine SMCRA Permit and Pinabete Permit Areas would operate as described under the Proposed Action. Impacts would be the same as described for the Proposed Action.

Four Corners Power Plant

Under this alternative, the area of disturbance required for the DFADAs would be 350 acres instead of 385 acres. The types of direct and indirect effects on the vegetation occurring as a result of the DFADAs would be of the same nature as those described for the Proposed Action, but would result in less impact to the local vegetative community. The 10 percent reduction in surface area of the DFADAs would result in less permanent loss of the existing vegetative community and less potential for indirect impacts, such as impacts to seed dispersal or introduction of invasive species. All other FCPP components of this alternative are the same as for the Proposed Action. Therefore, impacts would the same as described for the Proposed Action.

Transmission Lines

Under this alternative, the transmission line ROWs would be approved and they would continue to be operated and maintained as described for the Proposed Action. As such, impacts would the same as described for the proposed action.

4.6.4.5 Alternative E – No Action Alternative

Navajo Mine

Under the No Action Alternative mining would cease when the ROD is issued in 2015 and reclamation would be conducted through 2021. Removal of ancillary mining facilities could result in some temporary disturbance of vegetated areas during demolition but these areas would be revegetated according to the approved reclamation plan. No additional disturbance to vegetation would occur under the No Action Alternative.

Four Corners Power Plant

Under the No Action Alternative, the FCPP would shut down and the DFADAs would not be constructed. Demolition and dismantling of the power plant components is unlikely to result in disturbance to vegetation as power plant units and buildings are on paved areas. It is unknown if these areas would be revegetated following demolition. No direct adverse or beneficial impacts to vegetation would be anticipated as a result of the No Action Alternative.

FCPP shutdown would eliminate deposition of air emissions from the power plant, which would reduce potentially adverse indirect effects of mercury and selenium and other metal uptake by plants in the ROI over the long term. However, since the FCPP contributes a small proportion of the COPECs in the watershed, relative to global, U.S. and other regional sources potential metal uptake by plants would not be eliminated and it is unknown if any beneficial impacts to vegetation would occur as a result of FCPP shutdown.

Transmission Lines

Under the No Action Alternative, the APS and PNM transmission lines would either be decommissioned and dismantled or left in place. If they were decommissioned and dismantled, direct impacts to vegetation surrounding the structures would occur; however, following completion of these activities it is expected that vegetation would reestablish itself. Further, disturbance to vegetation resulting from decommissioning and dismantling activities would be coordinated with the Navajo Nation and the BLM to maintain compliance with all environmental laws and regulations that would occur throughout the demolition process. If the transmission lines are left in place, APS and PNM would be required to continue maintenance of the facilities for fire protection purposes (e.g., weed clearance and other vegetation clearance); therefore, impacts to vegetation would be as described for the Proposed Action.

4.6.5 Vegetation Mitigation Measures

The Project Applicants have proposed measures that would be implemented to reduce or eliminate some of the environmental impacts of the Proposed Action. These measures include specific mitigating measures for certain environmental impacts, standard operating procedures that reduce or avoid environmental impacts, and BMPs for specific activities. These are described in Section 3.2.6.6 and 3.2.6.8. These measures are part of their application materials and are enforceable through permit or lease conditions. In addition, the Project Applicants must comply with additional protective regulatory requirements including laws, ordinances, regulations, and standards that are enforceable by the responsible agency over that activity. These are described in the Regulatory Compliance Framework Section for each resource category. Where the environmental analysis in this EIS recommends additional protective measures, over and above the applicant proposed measures and regulatory compliance, they are listed below as specific mitigation measures.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, would not result in major adverse effects to vegetation. Therefore, no additional mitigation is recommended.

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