Stormwater Pollution Prevention Plan

for:

Four Corners Power Plant
End of County Road 6675
Fruitland, NM 87416
(505) 598-8100

SWPPP Contact(s):

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SWPPP Preparation Date:

May/28/2021

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SECTION 1: FACILITY DESCRIPTION AND CONTACT INFORMATION

1.1 Facility Information.

Instructions:

- You will need the information from this section to complete your NOI.
- For further instruction, refer to the 2021 MSGP NOI form and instructions – specifically sections C and D of the 2021 MSGP Appendix G Notice of Intent (NOI). A copy of the 2021 MSGP NOI is available at https://www.epa.gov/npdes/stormwater-discharges-industrial-activities-epas-2021-msgp (Appendix G of the permit)
- You must include a copy of the 2021 MSGP, or a reference or link to where a copy can be found, in Attachment C of your SWPPP.

Facility Information

Facility Name: Four Corners Power Plant

Street/Location: End of County Road 6675

City: Fruitland State: NM ZIP Code: 87416

County or Similar Government Subdivision: San Juan

NPDES ID (i.e., permit tracking number): AZR05FK3I (if covered under a previous permit)

Primary Industrial Activity SIC code, and Sector and Subsector (2021 MSGP, Appendix D and Part 8):
SE, Sector O Subsector O1

Co-located Industrial Activity(s) SIC code(s), Sector(s) and Subsector(s) (2021 MSGP, Appendix D):

Is your facility presently inactive and unstaffed and are there no industrial materials or activities exposed to stormwater? ☐ Yes ☒ No

Latitude/Longitude

Latitude:
36.689787 ° N (decimal degrees)

Longitude:
108.483012 ° W (decimal degrees)

Method for determining latitude/longitude (check one):

☐Maps (If USGS topographic map used, specify scale:________) ☒GPS

☐Other (please specify):

Horizontal Reference Datum (check one):

☐NAD 27 ☐NAD 83 ☒WGS 84

Is the facility located in Indian country? ☒ Yes ☐ No

If yes, provide the name of the Indian tribe associated with the area of Indian country (including name of Indian reservation, if applicable). Navajo Reservation

Are you considered a "federal operator" of the facility?

Federal Operator – an entity that meets the definition of "operator" in [the 2021 MSGP] and is either any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States, or another entity, such as a private contractor, operating for any such department, agency, or instrumentality. ☐ Yes ☒ No

Estimated area of industrial activity at your facility exposed to stormwater: 72.9
(to the nearest quarter acre)

Discharge Information

Does this facility discharge stormwater into a municipal separate storm sewer system (MS4)?
☐ Yes ☒ No

If yes, name of MS4 operator: ______________________

Name(s) of surface water(s) that receive stormwater from your facility: Morgan Lake

____

____

Does this facility discharge industrial stormwater directly into any segment of an "impaired water" (see definition in 2021 MSGP, Appendix A)? ☐ Yes ☒ No

If Yes, identify name of the impaired water(s) (and segment(s), if applicable):

____

Identify the pollutant(s) causing the impairment(s):

____

Which of the identified pollutants may be present in industrial stormwater discharges from this facility?

____

Has a Total Maximum Daily Load (TMDL) been completed for any of the identified pollutants? If yes, please list the TMDL pollutants:

____

Does this facility discharge industrial stormwater into a receiving water designated as a Tier 2, Tier 2.5 or Tier 3 water (see definitions in 2021 MSGP, Appendix A)? ☐ Yes ☒ No

Are any of your stormwater discharges subject to effluent limitation guidelines (ELGs) (2021 MSGP Table 1-1)? Yes ☒ No
If Yes, which guidelines apply?

____

____

1.2 Contact Information/Responsible Parties.

Instructions:

- List the facility operator(s), facility owner and SWPPP contact(s). Indicate respective responsibilities, where appropriate.
- You will need the information from this section of the SWPPP Template for your NOI.
- Refer to Section B of the NOI instructions (available in Appendix G of the 2021 MSGP).

Facility Operator(s):

Name: Arizona Public Service

Address: P.O. Box 355

City, State, Zip Code: Fruitland, NM 87416

Telephone Number: (505) 598-8100

Email address: Jeffrey.Jenkins@aps.com

Fax number: (505) 598-8292

(repeat for multiple operators by copying and pasting the above rows)

Facility Owner(s):

Name: Arizona Public Service

Address: PO Box 53999

City, State, Zip Code: Phoenix, AZ 85072

Telephone Number: (602) 250-1000

Email address:

Fax number:

(repeat for multiple operators by copying and pasting the above rows)

SWPPP Contact(s):

SWPPP Contact Name (Primary): Pamela Norris

Telephone number: (505) 598-8781

Email address: Pamela.Norris@aps.com

Fax number: (505) 598-8292

SWPPP Contact Name (Backup): Cameron Corley

Telephone number: (505) 598-8442

Email address: Cameron.Corley@aps.com

Fax number: (505) 598-8292

1.3 Stormwater Pollution Prevention Team.

The Stormwater Pollution Prevention Team consists of personnel responsible for implementation of the SWPPP, including the following:

Staff Names	Individual Responsibilities
Jeffrey W. Jenkins Plant Manager	Signature of authority of this plan. Signature of approval on reports to EPA and NNEPA. Ensures the development and implementation of this plan.
Pamela Norris Environmental Section Leader	Responsible for compliance with MSGP requirements. Advises management on proper implementation. Assists with site inspections and updating this plan, as needed. Authorized signature representative.
Cameron Corley Environmental Scientist	Responsible for writing and revising the contents of the SWPPP to include site maps, advising management on its proper implementation, providing training and comprehensive site compliance evaluations on an annual basis. Conducts site inspections (routine, visual monitoring, sampling, etc.). Responsible for documenting any corrective actions from inspections. Ensures housekeeping and corrective actions are corrected in a timely manner. Assists in preparing quarterly report. Ensures all elements of the plan are met according to the conditions of the Multi-sector General Permit. Manages stormwater records. Coordinates the evaluation for non-stormwater discharges. Performs in-house assessments on SWPPP files. Oversees areas of Morgan Lake, Units 4&5 and Laydown yards, parking lots (Employee and Contractors), Morgan Lake Canal, Garage, 230, 345 & 500 KV Switchyard, River Station and main road leading into the Plant area concerning any potential non-permitted pollutants which could be discharged to the waters of the U.S. Recommends Best Management Practices for handling hazardous chemicals, when requested. Updates inventory of materials (chemicals, fuel, lubricants, etc.) that may be exposed to stormwater in all areas of responsibility. Identifies areas of potential spills and leaks on plant site. Assists in evaluation of inspections results. Makes Best Management Practices recommendations in areas of responsibility. Implements the Best Management practices in areas of responsibility.
Environmental Consultant	Responsible for writing and revising the contents of the SWPPP including advising Environmental Operations on its proper implementation. Informs Four Corners Power Plant about new regulation changes and updates.
Water Analyst/Auxiliary Operator	Assists with quarterly sampling of SW1 outfall per MSGP requirements. Assists with sampling outfalls. To be called upon in case of an emergency.
Kurk Woolery Support Services Foreman	Overlooks the area of the Warehouse concerning any potential non-permitted pollutants, which could be discharged to the water of the U.S. Updates inventory of all material (chemicals, fuel, lubricants, etc.) that

	may be used and stored in the Warehouse area. Updates inventory of material (chemicals, fuel, lubricants, etc.) that may be exposed to stormwater in the Warehouse area. Recommends Best Management Practices for areas of responsibility. Assists in maintaining the SWPPP.
Dennis Carlson Engineer	Provides information concerning the construction and modification of stormwater runoff control features. Recommends site-specific Best Management Practices. Will identify areas which have high potential for significant soil erosion due to the topography, activities or other factors and will identify measures to minimize erosion. Will identify reasonable and appropriate measures to minimize pollutants in stormwater discharges from the site including rerouting flows, infiltration, reuse, pretreatment (oil/water separator), etc. Assists in site compliance evaluation and revision of this plan.

1.4 Site Description.

The Four Corners Generating Station, located in Fruitland, New Mexico, has a total generating capacity of 1,595 megawatts comprised of two (2) coal-fired electrical generation units. Since its inception, the facility has served as a steam electric generating station. Units 4 and 5, located on the south end of the plant, provide 750 MW each gross generating capacity, respectively. Units 4 and 5 were designed, constructed, and placed in operation in 1970 by Bechtel Corporation.

Units 1, 2, and 3 were designed, constructed, and placed in operation during 1963 and 1964 by EBASCO Services, Inc. These units ceased operation December 31, 2013 and have been decommissioned. The Salt River Materials Group (SRMG) has a fly ash beneficiation plant within the boundaries of the plant.

All areas located east of the plant of main road drain to sedimentation ponds or to the Bottom Ash Sluice Recycle Tank for treatment before discharge to Morgan Lake. Areas west of the plant main road drain to three outfalls with the exception of the Garage area and area north of the plant. These areas are contained by berms and have holding areas or drain to the trench that is pumped to the Bottom Ash Sluice Recycle Tank for treatment.

The San Juan River provides the plant's water supply. The San Juan River pump station is located offsite and is used to pump water from the San Juan River to Morgan Lake. The pump station is self-contained with berms around the area.

1.5 General Location Map.

The general location map for this facility can be found in Attachment A.

1.6 Site Map.

The site map for this facility can be found in Attachment B.

SECTION 2: POTENTIAL POLLUTANT SOURCES

Section 2 will describe all areas at your facility where industrial materials or activities are exposed to stormwater or from which authorized non-stormwater discharges originate. Industrial materials or activities include, but are not limited to: material handling equipment or activities; industrial machinery; raw materials; intermediate products, by-products, final products, and waste products. Material handling activities include, but are not limited to: the storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product or waste product. For structures located in areas of industrial activity, you must be aware that the structures themselves are potential sources of pollutants. This could occur, for example, when metals such as aluminum or copper are leached from the structures as a result of acid rain.

For each area identified, the SWPPP must include industrial activities in the area, potential pollutants or pollutant constituents for each identified activity, documentation of where potential spills and leaks could contribute pollutants to stormwater discharges, evaluation of unauthorized non-stormwater discharges, salt storage location, stormwater discharge sampling data and descriptions of stormwater control measures.

2.1 Potential Pollutants Associated with Industrial Activity.

Industrial Activity	Associated Pollutants
Material Storage, Turbine Lube Shed at Warehouse	Petroleum products are currently stored in drums and other containers inside the turbine lube shed located at the Warehouse. During major storm events, the petroleum products are protected and have minimal contact with precipitation.
Material Storage, Unloading & Receiving Material at Warehouse	The Warehouse receiving and unloading dock is located within a concrete sump with steel grating for vehicle(s) to backup when unloading. In the past, stormwater that accumulated in the sump was discharged into SW1. The sump's discharge pipe has been welded closed to prevent contaminants, such as vehicle fuel leaks and products, from discharging to SW1.
Electrical Switchyard, 230 KV Yard	Sediment generated from the erosion of the banks along the 230 KV yard is carried with runoff to the pavement below and then into SW2.
Containment, banks along hill (SW1 & SW2)	Sediment generated from the erosion of the banks along the hill is carried with runoff into SW1 and SW2.
Maintenance and Cleaning, Parking Lots	Fugitive dust (including fly ash, coal, and dirt) is deposited on the paved parking lots and roadways that are in the path of stormwater runoff to SW1, SW2 and SW3.
Equipment/Vehicle Parking Lots	Stormwater contaminated with oil and grease from leaking vehicles parked at the employee parking

	lots, Warehouse, and the Administration's north parking lot are discharged into SW1 and SW2.
Bulk Storage, U 4&5 Circulating Cooling Water Intake	ASI 7320 (APN 111535, 119560) stored in bulk containers are located in the areas of Units 1-2-3 and Units 4&5 Circulating Cooling Water Intake area. The stormwater from this area discharges to SW1 and SW2.
Material Delivery, Main road on plant site	Petroleum products delivered to site (by route of the main road) have the potential to impact stormwater area discharged to SW1 and SW2.
Electrical Switchyard, 500 and 345 KV Yard	Sediment generated from the erosion of the banks along 500 and 345 KV yards is carried with runoff into SW1, SW2 and SW3.
Equipment, Transformer & Compressors in 500, 345, and 230 KV Yards	Leaking oil from the transformers and compressors in the 500, 345 and 230 KV yards are carried with stormwater runoff into SW1, SW2 and SW3.
Bulk Fuel Storage, Contractor	No contractors onsite with bulk fuel storage.
Laydown Yards • 4/5 • SO2 • Metal/Pipe Storage	Oil filled equipment.

2.2 Spills and Leaks.

Areas of Site Where Potential Spills/Leaks Could Occur

Location	Discharge Points
Main Street, HTH CCW Chlorination	SW1 & SW2
Main Street, Calcium Hypochlorite	SW1 & SW2
Main Street, All chemicals	SW1 & SW2
Main Street, Polyacrylic Acid (AS 7320)	SW1 & SW2
Main Street, Sewage, Porta-potties	SW1 & SW2
Main Street, Detergent, alkaline auto soap	SW1 & SW2
Main Street, Used Oil, in transit	SW1 & SW2
Main Street, Oil, Parking lots	SW1 & SW2
Main Street, Salt (Ice-melt)	SW1 & SW2
Riley Ind. Yd. – Gasoline, fuel	SW1 & SW2
Warehouse – Turbine Lube Shed	SW1 & SW2

Description of Past Spills/Leaks

Date	Description	Discharge Points
1/08/2020	The sewage line that runs below Main Street was plugged with grease and other debris, causing sewage to be emitted through the manhole cover. Approximately 2 gallons of sewage was discharged into the Four Corners Unit 4 and 5 intake canal through stormwater outfall SW1.	SW-1
1/22/2016	Sewage spill from manhole into stormwater drain	SW-1

2.3 Unauthorized Non-stormwater Discharges Evaluation.

- Date of evaluation: 1/8/2019
- Description of the evaluation criteria used: Visual evaluation. Plant Shift Supervisor received a call from an Auxiliary Operator reporting sewage was overflowing from man-hole #3 onto main street. This location is up gradient of the Units 4 and 5 intake canal. The sewage flowed to and then down the SWI outfall that leads into the intake canal (behind Building #9).
- List of the discharge points or onsite drainage points that were directly observed during the evaluation: SW1.
- Action(s) taken, such as a list of control measures used to eliminate unauthorized discharge(s), or documentation that a separate NPDES permit was obtained. For example, a floor drain was sealed, a sink drain was re-routed to sanitary or an NPDES permit application was submitted for an unauthorized cooling water discharge:
    - Auxiliary Operators, assisted by Maintenance staff, worked to minimize and mitigate the sewage on main street from reaching the canal. The potable water was shut down and the

overflowing stopped. Simultaneously, a skid-steer placed clean dirt to block with two berms, (that transected the flow paths of) the sewage flowing towards the Units 4 and 5 intake canal. The crew stated approximately 2 gallons of sewage flowed into the Units 4 and 5 intake canal, before the flow could effectively be contained.

- Operations Manager contacted the On-Call Planner and On Call Environmental Scientist regarding the situation. The Auxiliary Operators neutralized the sewage overflow using calcium hypochlorite, as recommended by the Environmental Scientist. .
- The On-Call Planner made arrangements for Contractors to come out and vacuum out the vault and then to rotor-rooter clogged sewer line. On the morning day shift, the vault under man hole #3 was vacuumed out by contractors then manholes 2 and 5 were vacuumed as well. The blockage was located and removed. .

2.4 Salt Storage.

Ice Melt is sealed in plastic 20 pounds bags and stored indoor on pallets at the Warehouse. The bags are delivered to areas as needed for de-icing during the winter months.

Kelly Contracting stores salt for de-icing at the Equipment yard located by the former Units 1-2-3 Hydrobins.

2.5 Sampling Data Summary.

Under the 2008 MSGP, Four Corners claimed the natural background exception from benchmark monitoring. Natural background sampling was initiated following receipt of sample results that exceeded the benchmark for Total Iron. A series of 18 natural background samples were taken concurrently with required benchmark monitoring. The average natural concentration results exceeded the average concentration detected from runoff from all facility outfalls that were required to be monitored under the 2008 MSGP. Four Corners Power Plant concluded that benchmark exceedances are attributable solely to high natural background levels of iron in soils and notified EPA in February 2010 that no additional benchmark monitoring would be conducted.

Although a background study was conducted previously, the 2015 MSGP required that a minimum of four quarters of benchmark monitoring to be conducted in the new permit term. Results of benchmark monitoring at SW-1 confirmed that the average concentration of total iron in samples is less than the average concentration of total iron in natural background samples collected during the 2009 study. The recent benchmark sampling has confirmed that Four Corners monitoring results are attributable solely to high background levels of iron in soils. A Change NOI was submitted on January 26, 2018 to notify EPA that benchmark monitoring provisions had been fulfilled for the 2015 MSGP Permit.

Benchmark sampling results:

Four Corners Benchmark Sampling Results						
Sample Location	**Date Sample Taken**	**Sample By**	**Total Iron (mg/l)**	**Date Result Received**	**Date Submitted to EPA**	**Remarks**
SW1	11/4/2015	A.S.	12.0	11/19/2015	12/15/2015	
SW1	4/15/2016	A.S.	8.81	4/26/2016	6/28/2016	
SW1	7/1/2016	A.S.	19.7	7/13/2016	10/27/2016	
SW1	1/5/2017	A.S.	15.8	1/23/2017	4/3/2017	
SW1	4/27/2017	P.N.	14.0	5/19/2017	6/26/2017	
SWI	7/23/2017	J.D.	17.5	8/14/2017	8/31/2017	
SWI	No sample					No runoff
Average			14.6			

Results of the natural background sampling for iron are listed below:

Sample Location	Date Sample Taken	Sampled By	Total Iron (mg/l)
Chinde' Wash	6/5/2009	A.S.	225
West of River Station on N36	5/26/2009	A.S.	780
River Station	5/22/2009	A.S.	91.8
	6/1/2009	A.S.	164
	8/14/2009	A.S.	0.67
	9/15/2009	A.S.	289
	10/14/2009	A.S.	110
	10/21/2009	A.S.	38
	11/3/2009	A.S.	12.2
East of River Station	5/26/2009	A.S.	372
	10/21/2009	A.S.	304
	11/3/2009	A.S.	193
Nenahnezad Chapter	5/22/2009	A.S.	13.7
	7/23/2009	A.S.	15.1
	8/7/2009	A.S.	2.18
	9/15/2009	A.S.	95.1
	10/14/2009	A.S.	7.49
	10/21/2009	A.S.	8.26

Average: **151.19 mg/L**

SECTION 3: STORMWATER CONTROL MEASURES (SCM)

3.1 Non-numeric Technology-based Effluent Limits (BPT/BAT/BCT)

You must comply with the following non-numeric effluent limits as well as any sector-specific non-numeric effluent limits in Part 8, except where otherwise specified.

3.1.1 Minimize Exposure.

Areas north of the plant all have berms to prevent runoff of stormwater into Morgan Lake. The grading is sloped away from the berms draining to the stormwater drains. Rock cover was placed on dirt slopes along main plant road to reduce sediment and erosion runoff. Areas on the east side of Main Road is curbed and sloped to the NPDES drains or discharged into an on-site retention basin. Areas on the southwest side of the Main Road flow to a trench where SW1 is located before it is discharged to canal. Before it discharges into the trench, there are several sandbags in the drain area to reduce sediment debris in stormwater. Stormwater from areas northwest of the Main Road flows along low spots on Main Road before it is discharged back into the canal at SW2. The areas west of main plant road discharge into a trench after flowing across gravel where SW3 is located and back into the canal. Along the west fence of the Warehouse laydown yard straw bales are installed/placed to minimize sediments onto warehouse which drains into SW1.

Below are several Structural Controls used on-site:

- Main and Chemical Warehouses store oil and chemicals inside building.
- Reduced number of oil and chemicals stored outside at the 345 switchyard.
- Concrete apron over the dirt bank at 4/5 Intake (SW1).
- Any spills and leaks are promptly cleaned up using absorbents to prevent the discharge of pollutants.
- Drip pans and absorbents are used under or around leaky vehicles and equipment.
- Wash down water drains to a proper collection system.
- Preventive Maintenance (PM) procedure has been implemented to inspect sewer manholes on routine basis.
- A barrier exists surrounding the perimeter of the plant property next to Morgan Lake and cooling water canals leaving and entering the Lake with rock or concrete to prevent runoff.

3.1.2 Good Housekeeping.

A plant wide housekeeping policy is established. This requires cleanliness in all work areas of the plant. A monthly walk-down of different areas of the plant is conducted by Management. Routine walk-downs of the plant are conducted by Stormwater team members in the Environmental Department.

Below are Best Management Practices that have been implemented:

- Trash containers are minimized in areas of SW1, SW2 and SW3 drainage
- Waste Management has several large waste containers around the Plant area which are inspected frequently. Waste Management is notified when waste containers are full.
- Various cleaning measures are done to ensure plant streets remain clear and free of debris..
- Spill response of any material is promptly contained and cleaned up.

- Waste Management has responsibility for keeping the Galbreath trash hoppers emptied.
- Routine cleanups are scheduled to maintain good housekeeping.
- Operation inspects bulk tanks on a quarterly basis and documents with check sheets.
- Maintenance personnel inspect and document integrity of portable used oil tank and bulk tanks on monthly basis.
- Vehicle maintenance is completed at the garage.
- Oil spills are cleaned up using absorbents.
- Drip pans are in use and secondary containment is utilized for barrels and used oil containers, as needed.

3.1.3 Maintenance.

In DevonWay, a Service Request (SR) is initiated to regularly schedule plant maintenance personnel to inspect all industrial equipment.

Inspections are performed. When maintenance is required, a SR is generated by the inspector. Corrective action will be completed within 14 days when the problem is noted (in the CAR, description section needs to be documented that the job needs to be completed in 14 days in areas of SW1, 2 & 3 and Ash Pond areas). Follow-up with the Planner or Work Week Coordinator on SR submitted within 5 days of issuing to ensure CAR was received and scheduled and if there are any questions.

Garage does periodic preventive maintenance on vehicles. On average, vehicles are serviced routinely.

3.1.4 Spill Prevention and Response Procedures.

Best Management Practices for spill prevention and response include:

- Containers of used oil and other materials that could be susceptible to spillage or leakage are plainly labeled to encourage proper handling and facilitate rapid response if spills or leaks occur.
- Bulk storage tanks are in secondary containment and oil-bearing equipment is in bermed areas to prevent the discharge of pollutants from these areas.
- Staff is trained on procedures to quickly stop, contain, and clean up leaks, spills, and other releases.
- Spill kits are kept on-site, located near areas where spills may occur or where a rapid response can be made.
- Waste containers used for the storage of solid waste (or materials which have been separated for recycling) must meet the standards established by the American National Standards Institute (ANSI) for waste containers as follows: Waste Containers—Safety Requirements, 1994, American National Standards Institute, ANSI Z245.30–1994; and Waste Containers—Compatibility Dimensions, 1996, American National Standards Institute, ANSI Z245.60–1996.

Refer to "Four Corners Power Plant Spill Prevention Control and Countermeasure Plan, located in the Corporate Environmental SharePoint Site (See Appendix "A" and "H" of the Plan for control measures, locations and maintenance oil tank inspection schedules & methods):

Four Corners SPCC Plan

Where a leak, spill or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302 occurs during a 24-hour period, you must notify the National Response Center (NRC) at (800) 424-8802 in accordance with the requirements of 40 CFR Part 110, 40 CFR Part 117, and 40 CFR Part 302 as soon as you have knowledge of the discharge.

3.1.5 Erosion and Sediment Controls.

Areas near SW1, SW2 and SW3 have rock/geotech and concrete curtains on slopes for erosion and sediment controls. Rip rap of rocks were added along the embankment from the security traffic island, main road into the plant, north and east of the 230KV yard for erosion and sediment control. SW3 drainage ditch has rock berms to prevent erosion. Sand wattles are in place for sediment controls on the main road north of Admin Building and north of the Security Island,. The road up to 500KV yard has straw wattles in place for sediment control.

Garage areas have been resurfaced so any precipitation and spills will flow south toward the pipe trench for containment. Areas north of the plant area that meet Morgan Lake, Morgan Lake canal and inlet canal have been bermed to prevent any discharge to the lake. The river station has been resurfaced to drain around the facility. Ash Pond 6 has been capped; drainage channels and stormwater pond have been constructed to manage stormwater flow. Ash Pond main pump house located southwest of LDWP is contained and no discharges can occur to the Chaco Wash.

3.1.6 Management of Stormwater.

Most stormwater runoff is controlled on-site by slopes and berms and discharging into the proper drains of SW1, SW2 and SW3. Stormwater runoff on the east side of the plant is mostly retained on-site in the retention basin or discharges into our internal NPDES treatment pond located northeast of the plant., West area holds any stormwater runoff and is contained from discharging into Chaco River, from close Ash Pond 6.

3.1.7 Salt Storage Piles or Piles Containing Salt.

Majority of de-icing salt is stored inside our main warehouse until issued for use. A minimal amount of consumer deicer is staged within stormwater drainage areas in barrels or steel containers, until needed for use. Kelly Contractors also use road deicer and stages them at their equipment yard. They are stored on pallets covered in plastic and out of the stormwater drainage area, or bulk salt is placed on plastic and bermed.

Ice Melt is used on plant site to thaw ice and snow on sidewalks and work areas for employee safety during the winter months. This material contains sodium chloride. The Ice Melt is stored at the warehouse in plastic-sealed bags. This product is delivered to areas as requested by the warehouse personnel.

3.1.8 Dust Generation and Vehicle Tracking of Industrial Materials.

Annual Environmental Awareness training will be conducted to stress the need for prompt cleanup and/or covering drains in stormwater drainage areas. This will prevent contaminants from entering stormwater drains.

Dust suppression and watering of plant lease roads will be ongoing. This will prevent and minimize fugitive dust.

The wetting of ash material to specific moisture content will be required prior to loading onto haul trucks.

3.2 Numeric Effluent Limitations Based on Effluent Limitations Guidelines (ELGs).

The following good housekeeping measures will be followed to satisfy Subpart O of Part 8 requirements:

- Fugitive dust emissions:
    - Units 4&5 coal belts are enclosed minimizing dust emissions.
    - Operation Units 4&5 area is periodically washed down, and the wash water is discharged to the Bottom Ash Sluice Recycle Tank.
    - Plant Vehicles are periodically washed at the wash bay and wash water is discharged to a sump and periodically pumped out by a contractor for disposal.
    - Various cleaning measures are done to ensure plant streets remain clear and free of debris and ash haul road is swept and watered down.
- Delivery vehicles:
    - All vehicle coming on site are cleared through the plant's security main gate.
    - Security personnel do checks for leaks from delivery vehicles coming on plant site.
        - Various cleaning measures are done to ensure plant streets remain clear and free of debris.
    - Fuel oil unloading areas:
        - All unloading areas have containment curbs.
        - Drivers will be trained on spill response or call the Control Room for assistance during deliveries.
        - Operations personnel are trained to evaluate oil and chemical spills to determine whether assistance is needed.
    - Chemical loading and unloading area:
        - All areas have containment curbs to contain chemicals if a spill occurs.
        - Operations personnel are trained to evaluate chemical/oil spills and get necessary assistance.
    - Liquid storage tanks:
        - All bulk storage tanks are in containment.
    - Large bulk fuel storage tanks:
        - The fuel storage tank has secondary containment and is in compliance with the SPCC plan requirements.
        - The location of the fuel storage tank is near the garage. If there is any discharge beyond the secondary containment, it will flow into the contained pipe trench.

    - Contractor fueling station northwest of the plant by gate 48.
- Spill reduction:
    - A routine inspection is conducted and is part of the SPCC requirements.
    - Refer to the Four Corners SPCC Plan.
- Oil bearing equipment in the switchyard:
    - All oil-bearing equipment is contained within the gravel berm.
    - The switchyards have graveled surfaces to retard flows and limit the spread of spills.
- Residue-hauling vehicles:
    - Inspection of residue-hauling vehicles are conducted for proper covering by drivers prior to hauling.
- Ash loading areas:
    - Areas at the Units 4&5 hydrobins are swept and washed down periodically.
    - Water is added to the ash until specific moisture amount is reached before it is loaded onto the ash haul trucks for disposal to reduce ash tracking.
- Areas adjacent to disposal ponds or landfills:
    - The areas are contained, any discharge is contained in the ash disposal area.
- Landfills, scrap yard, surface impoundments, and general refuse sites:
    - Landfills, south of the lined ponds, are contained. Any discharge will be contained within the ash disposal area.

3.3 Water Quality-based Effluent Limitations and Water Quality Standards.

Four Corners Power Plant does not have a coal pile; therefore, is not required to test for pH and TSS on an annual basis.

3.4 Sector-Specific Non-Numeric Effluent Limits.

Four Corners Power Plant falls under Subsector 0 Steam Electric Generating Facilities and is required to monitor quarterly for pH, TSS and COD and biannually (first and fourth year of permit) for PAHs.

SECTION 4: SCHEDULES AND PROCEDURES

4.1 Good Housekeeping.

Routine cleanups are scheduled to maintain good housekeeping. A routine walk-down of different areas of the plant is conducted by Management. Routine walk-down of the plant is conducted by Stormwater team members in the Environmental Department. Waste Management is notified when large waste containers are full. Various cleaning measures are done to ensure plant streets remain clear and free of debris on routine basis. Bulk tanks and portable used oil tanks are inspected on a routine basis.

4.2 Maintenance.

Routine inspections are performed and when maintenance is required, a work order is generated. Service Requests (SRs) are submitted in DevonWay, whereby Maintenance and/or Engineering support may be obtained. Corrective action needs to be completed within 14 days of the date the problem is noted. The Shift Supervisor is notified when control measures are not being properly operated or maintained.

4.3 Spill Prevention and Response Procedures.

A routine inspection is conducted and is part of the SPCC requirements. Refer to "Four Corners Power Plant Oil Spill Prevention Control and Countermeasure Plan, located in the Corporate Environmental SharePoint Site (See Appendix "A" and "H" of the Plan for control measures, locations and maintenance oil tank inspection schedules & methods).

Four Corners SPCC Plan

4.4 Erosion and Sediment Control.

Four Corners relies on rock/geotech, concrete curtains, and rip rap for erosion and sediment control. No polymers or chemicals are used for that purpose.

4.5 Employee Training.

Training is provided by Enterprise Learning Management (ELM) and leaders on plant-site. All plant employees are required to complete annual training, (with exception of those working in unaffected areas).

1. Environmental Awareness annual training will cover:
    - Water Programs,
    - Stormwater Pollution Prevention Plan,
    - Identification of potential spill areas and drainage routes,
    - Reporting spills to appropriate individuals,
    - Importance of following proper material handling procedures and storage requirements,
    - Good Housekeeping practices, including:
        - Maintaining clean working area,
        - Proper equipment storage,
        - Importance of inspections and checking for spills and leaks,
        - Utilization of spill cleanup equipment and proper disposal of contaminated materials.
    - Material management practices, including:
        - Awareness of proper location of materials on site,
        - Identification and use of container labels,
        - Deciding which materials to use first,
        - Importance of being concerned, alert, and safety-minded when working with materials.
    - Red Drains are designated stormwater drains.
2. Additional training:
    - SWPPP Team Members will be trained annually to ensure adequate understanding of MSGP requirements.
    - SWPPP contains training records of personnel who are required to have training.
3. Training records of personnel are located in the ELM training software.

4.6 Inspections and Assessments.

4.6.1 Routine Facility Inspections.

Areas to be inspected are where industrial materials or activities are exposed to stormwater and all on-site BMPs. Prior to the inspection refer to Four Corners site map identifying the locations of industrial activities exposed to stormwater, discharge points, and all BMPs. Use the Four Corners Stormwater Routine Facility Inspection form in Attachment D and site map during the inspection. Recommend using digital camera to photo areas that have changed condition or to show control measures degrading. The routine facility inspections worksheet will provide documentation this has been completed and will be signed by certifying official. All routine facility inspection worksheets will be filed with the Four Corners SWPPP.

The Routine Facility Inspection will be conducted by a SWPPP team member from Environmental Services listed in Section 1.3 of this plan.

For routine facility inspections to be performed at your site, your SWPPP must include a description of the following:

1. **Person(s) or positions of person(s) responsible for inspection.**

   Pamela Norris. Environmental Section Leader

   Environmental Scientist

2. **Schedules for conducting inspections, including tentative schedule for facilities in climates with irregular stormwater discharges.** Routine facility inspections will be conducted quarterly. At least one routine inspection each calendar year will be conducted during a period when a stormwater discharge is occurring.

3. **List areas where industrial materials or activities are exposed to stormwater**. Areas to be inspected are where industrial materials or activities are exposed to stormwater and all on-site BMPs. Prior to the inspection refer to Four Corners site map identifying the locations of industrial activities exposed to stormwater, discharge points, and all BMPs.

4. **List areas identified in the SWPPP (section 1 of the SWPPP Template) and those that are potential pollutant sources (see Part 6.2.3).** In addition to the areas listed in Section 2.2, specific areas to be inspected include:

   - Main road into the plant, starting from the Scale House north to building 18 and Warehouse to Main Road,
   - Drainage coming from the Switch Yards,
   - Ash Pipe trench south of the Garage,
   - Contractors' diesel bulk storage near gate 48,
   - Closed Ash Pond 6 north area berm,
   - West of closed Ash Pond 6, stormwater containment area,
   - Ash Pond main pump house, southwest of LDWP containment area,
   - 4&5 Circulating Cooling Water Intake, outlet area and Polymer Feed areas,

- Morgan Lake Blowdown, Bottom Ash Sluice Recycle Tank and Morgan Lake Canals,
- Units 4&5 Operation areas, and
- Stormwater Permitted Discharge Points (SW1, SW2 & SW3).

5. Areas where spills and leaks have occurred in the past three years. Units 4&5 Intake near SW1.

6. Inspection information for discharge points.

Outfall	**Latitude**		**Longitude**	
	Decimals	Degrees	Decimals	Degrees
SW1	36.6878	36° 41' 16.08" N	-108.4822	108° 28' 55.92" W
SW2	36.6908	36° 41' 26.88" N	-108.4849	108° 29' 5.64" W
SW3	36.6875	36° 41' 15" N	-108.4828	108° 28' 58.08" W

For location of outfalls, refer to site map in Attachment B.

7. List the control measures used to comply with the effluent limits contained in the 2021 MSGP.

- Minimize erosion,
- Good housekeeping practices,
- Maintenance,
- Minimize exposure,
- Spill prevention and response procedures,
- Install erosion and sediment controls.

8. Other site-specific inspection objectives. The following areas also will be inspected monthly:

- Coal belts of Units 4&5 and wash bay area.
- Loading or unloading areas at main warehouse, garage, lime unloading area, and S02 warehouse.
- 500KV, 345KV and 230KV switchyard areas.
- Fueling areas near Garage and contractor work areas.
- Bulk storage areas to include turbine lube oil, transformers, chemical storage building, 4&5 chlorine building.
- Auto oil storage room located north of garage, main warehouse, and areas located east of the plant main road.

- Ash handling areas, location Units 4&5 hydrobins, main road in the plant, Units 4&5 bottom ash hauling road.
- Areas adjacent to disposal ponds and landfills.
- Maintenance areas located at Garage, Unit circulating intake areas, Unit 4&5 maintenance shops.
- Liquid storage tanks located throughout plant such as outside chemical storage; and
- Long term and short-term material storage areas located west of 230KV switchyard, , area south of Outfall SW2, area around the garage, SO2 laydown area, and areas south and east of main warehouse, former U 1,2,3 area.

Document the findings of each inspection performed and maintain the documentation with the SWPPP. Documentation of each routine facility inspection must include (at a minimum):

- The inspection date and time.
- The name(s) and signature(s) of the inspector(s).
- Weather information and a description of any discharges occurring at the time of the inspection.
- Any previously unidentified discharges of pollutants from the site.
- Any control measures needing maintenance or repairs.
- Any failed control measures that need replacement.
- Any incidents of noncompliance observed; and
- Any additional control measures needed to comply with the permit requirements.

Refer to the Four Corners Inspection form located in Appendix D. This form will be used during inspection and will be filed with the Four Corners SWPPP.

4.6.2 Quarterly Visual Assessment of Stormwater Discharges.

Quarterly visual assessments will be conducted by SWPPP team member when the stormwater sample is collected. Sample must be collected within the first 30 minutes of an actual discharge from a storm event.

Please use the Quarterly Visual Assessment form attached in Attachment D.

Quarterly visual assessments will be conducted by SWPPP team member:

1. **Person(s) or positions of person(s) responsible for assessments.**

   Pamela Norris, Environmental Section Leader

   Environmental Scientist

   Water Analyst

2. **Schedules for conducting assessments.** Visual Assessment will be conducted quarterly.

3. **Specific assessment activities.** Visual assessments will be conducted on samples taken during a storm event and require observations of the stormwater sample in order to qualitatively assess the nature of your discharge based on several visual parameters.

   The following qualitative characteristics must be assessed:

   - Color,

- Odor,
- Clarity,
- Floating solids,
- Settled solids,
- Suspended solids,
- Foam,
- Oil sheen, and
- Other obvious indicators of storm pollution.

Refer to the visual assessments form in Appendix D and use during the assessment. Should there be any observation of objectionable characteristics in sample, backtrack upstream from the sample collection location to identify potential sources of the pollutants. All quarterly visual assessments worksheets will be signed by the certifying official and filed with the Four Corners SWPPP.

4.6.3 Exception to Routine Facility Inspections and Quarterly Visual Assessments for Inactive and Unstaffed Sites.

Not applicable.

4.7 Monitoring.

Check the following monitoring activities applicable to your facility:

☒ Indicator monitoring

☐ Benchmark monitoring

☐ Effluent limitations guidelines monitoring

☐ State- or tribal-specific monitoring

☐ Impaired waters monitoring

☐ Other monitoring required by EPA

For each type of monitoring checked above, your SWPPP must include the following information:

Select type of monitoring activity from drop-down list below (*if subject to more than one type of monitoring activity, you will need to copy and paste the items below for each monitoring activity*):

Indicator Monitoring

1. **Sample location(s).** There are three stormwater discharge points at Four Corners Power Plant. The three points are designated SW1, SW2 and SW3. All three outfalls are substantially identical and therefore only SW1 will be sampled. Samples will be collected at a point of discharge or by any automatic sampler near SW1.
2. **Pollutants to be sampled**. Indicator monitoring will be quarterly for pH, TSS and COD and

biannually for PAHs (first and fourth year of permit).The sample will be taken at SW1..

3. **Monitoring Schedules.** Quarterly samples will be taken at SW1 for a visual analysis. First quarter sampling and first biannual sampling will commence in July 2021. All results received from the lab will be reported to EPA within 30 days of receipt.

4. **Numeric Limitations**. Indicator monitoring is "report-only" and does not have a benchmark threshold or baseline value for comparison nor does it require follow-up actions. Four Corners Power Plant does not have a coal pile; therefore, it is not required to test for pH and TSS on an annual basis.

5. **Procedures**. When a storm is forecast, a member of the SWPPP team will prepare sampling supplies and, if available, ensure automatic samplers are clean and there is no build-up of debris at the sampling location. A grab sample or automatic samplers are used at SW1, SW2, and SW3 to prevent missing the first 30 minutes if discharge during a rain event. Another advantage of using automatic samplers is samples can be taken during non-business hours. If a rain event occurs during business hours, a member from the SWPPP team will take the samples. If an automatic sampler is used, samples must be picked up as soon as possible.

   The following procedures will be used for collecting samples:

   - One liter will be collected from SW1, SW2, and/or SW3 if there is a discharge.
   - If automatic samplers are used, pickup and clean bottles before transferring them to lab bottles.
   - Samples will be transferred to lab bottles that have been pre-labeled prior to start of sampling (verify date sample taken matches with rainfall event if using automatic sampling).
   - Samples will be placed in an ice chest and covered with ice bag.
   - Chain of Custody form will be filled out requesting analysis for pH, TSS, COD and PAHs.
   - Warehouse pick-up form will be filled out.
   - Warehouse will be notified to pick up sample for delivery to lab or sample will be delivered to lab by member of SWPPP Team.
   - Both Chain of Custody and Warehouse form will be left out with samples for Warehouse personnel.
   - Green Analytical Laboratory in Durango, CO will be used to analyze the samples for pH, TSS, COD and PAHs.
   - Gather precipitation data and any other information needed to submit benchmark results to EPA electronically.

Exception for Substantially Identical Discharge Points (SIDP) (if applicable)

If you plan to use the SIDP exception for your quarterly visual assessment requirements in 2021 MSGP Part 3.2.4 or your indicator, benchmark, or impaired waters monitoring requirements in 2021 MSGP Parts 4.2.1, 4.2.2, and 4.2.5, respectively, include the following information here to substantiate your claim that these discharge points are substantially identical (2021 MSGP Part 6.2.5.3.d):

Four Corners Power Plant will use the substantially identical outfall exception for indicator monitoring and for the quarterly visual assessment. Below is the information to substantiate our claim that these outfalls are substantially identical:

- Location of each SIDP: Outfall SW1 is next to the U 4/5 intake canal west of the main road between the 500KV yard and 230KV yard. Outfall SW2 outfall is west of the former U123 intake pumps. Outfall SW3 is located northeast of the 500KV yard.
- List the general industrial activities conducted in the drainage area of each discharge point: Each outfall has similar general industrial activities conducted in the drainage area, including vehicle use on paved roads; hauling of chemicals, trash, industrial equipment; and water pumps used to pump water into plant.
- List the control measures implemented in the drainage area of each discharge point: Upstream of Outfall SW3 is a small basin filled with rocks to contain and reduce erosion and discharge to SW3. Areas near Outfall SW3 also have gravel and berms reducing any discharge to SW3. Outfall SW2 is north of Outfall SW1 and has a screen to eliminate trash and large debris from entering outfall. Outfall SW1 has sand wattles located upstream of SW1 to prevent sediment debris discharging into SW1. Additionally, drainage areas near SW1 and SW2 are swept routinely.
- List the exposed materials located in the drainage area of each discharge point that are likely to be significant contributors of pollutants via stormwater discharges: There are no exposed materials located in the drainage area of each outfall that will likely be significant contributors of pollutants to stormwater discharges.
- An estimate of the runoff coefficient of the drainage areas (low = under 40%; medium = 40 to 65%; high = above 65%): The estimated runoff coefficient in the drainage areas is high, above 65%.
- Why the discharge points are expected to discharge substantially identical effluents: The outfalls are expected to discharge substantially identical effluents as they all come from the same source of parking lots and laydown areas throughout the plant. Additionally, SW1 is the first and at times the only outfall that will discharge on any storm event and SW2 and SW3 will discharge with only bigger storm events.

SECTION 5: DOCUMENTATION TO SUPPORT ELIGIBILITY CONSIDERATIONS UNDER OTHER FEDERAL LAWS

5.1 Documentation Regarding Endangered Species Act (ESA) Listed Species and Critical Habitat Protection.

US Fish and Wildlife Service and the New Mexico Ecological Services Field Office issued a Biological Opinion dated April 8, 2015, regarding actions associated with the Office of Surface Mining Reclamation and Enforcement (OSMRE) proposed Four Corners Power Plant and Navajo Mine Energy Project.

Refer to Attachment F for the Biological Opinion.

5.2 Documentation Regarding National Historic Preservation Act (NHPA)-Protected Properties.

A Programmatic Agreement has been signed by Office of Surface Mining Reclamation and Enforcement, Bureau of Indian Affairs, Bureau of Land Management, US Environmental Protection Agency, National Park Service, Navajo Nation Tribal Historic Preservation Officer, Hopi Cultural Preservation Office, Zia Pueblo, Advisory Council on Historical Preservation, New Mexico State Historic Preservation Office, Arizona State

Historic Preservation Office, New Mexico State Land Office, Arizona Public Service Company, and Public Service Company of New Mexico regarding management of historic properties associated with the Four Corners Power Plant, Ancillary Facilities, and Transmission Lines.

Refer to Attachment G for a copy of the agreement.

SECTION 6: CORRECTIVE ACTIONS AND ADDITIONAL IMPLEMENTATION MEASURES

Instructions (see 2021 MSGP Part 5):

Describe the procedures for taking corrective action and/or AIM response in compliance with Part 5 of the 2021 MSGP.

Corrective action requests (CARs) are submitted in DevonWay, whereby Maintenance and/or Engineering support may be obtained. Corrective action needs to be completed within 14 days of the date the problem is noted. The Shift Supervisor is notified when control measures are not being properly operated or maintained.

AIM response not applicable – no benchmark monitoring.

SECTION 7: SWPPP CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Pamela J. Norris Title: Environmental Section Leader

Signature: Pamela J. Norris Date: May 28, 2021

SECTION 8: SWPPP MODIFICATIONS

This SWPPP is a "living" document and is required to be modified and updated, as necessary, in response to corrective actions. If this SWPPP is modified in response to corrective actions required by Part 4.1 or 4.2 of the 2021 MSGP, then the certification statement in section 7 of this SWPPP template must be re-signed in accordance with 2021 MSGP Appendix B, Subsection 11.A.

For any other SWPPP modification, a log with a description of the modification, the name of the person making it, and the date and signature of that person will be kept with this plan. See 2021 MSGP Appendix B, Subsection 11.C.

If any of the following conditions occur, the SWPPP must be reviewed, revised, and re-signed to ensure that the condition is eliminated and will not be repeated in the future:

- An unauthorized release or discharge not authorized by this or another NPDES permit.
- A discharge violates a numeric effluent limit.
- Control measures are not stringent enough for the discharge to meet applicable water quality standards.
- A control measure was not installed, was installed incorrectly, or is not properly operated and maintained.
- Quarterly routine facility or visual inspections indicate that control measures are not properly operated or maintained.
- An inspection or evaluation of the facility by EPA or Tribal official determines that modifications to the control measures are necessary to meet the non-numeric effluent limits in this permit.

Amendment Number	Description of Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]
001	Revised SWPPP to reflect new 2021 MSGP and new requirements.	3/22/2021	Matthew Hodge, Environmental Consultant

SECTION 9: SWPPP AVAILABILITY

URL of SWPPP provided in NOI.

SWPPP ATTACHMENTS

Attachment A – General Location Map

Attachment B – Site Map

Attachment C – NOI, EPA Authorization, and 2021 MSGP

Attachment D – Routine Facility and Visual Inspections

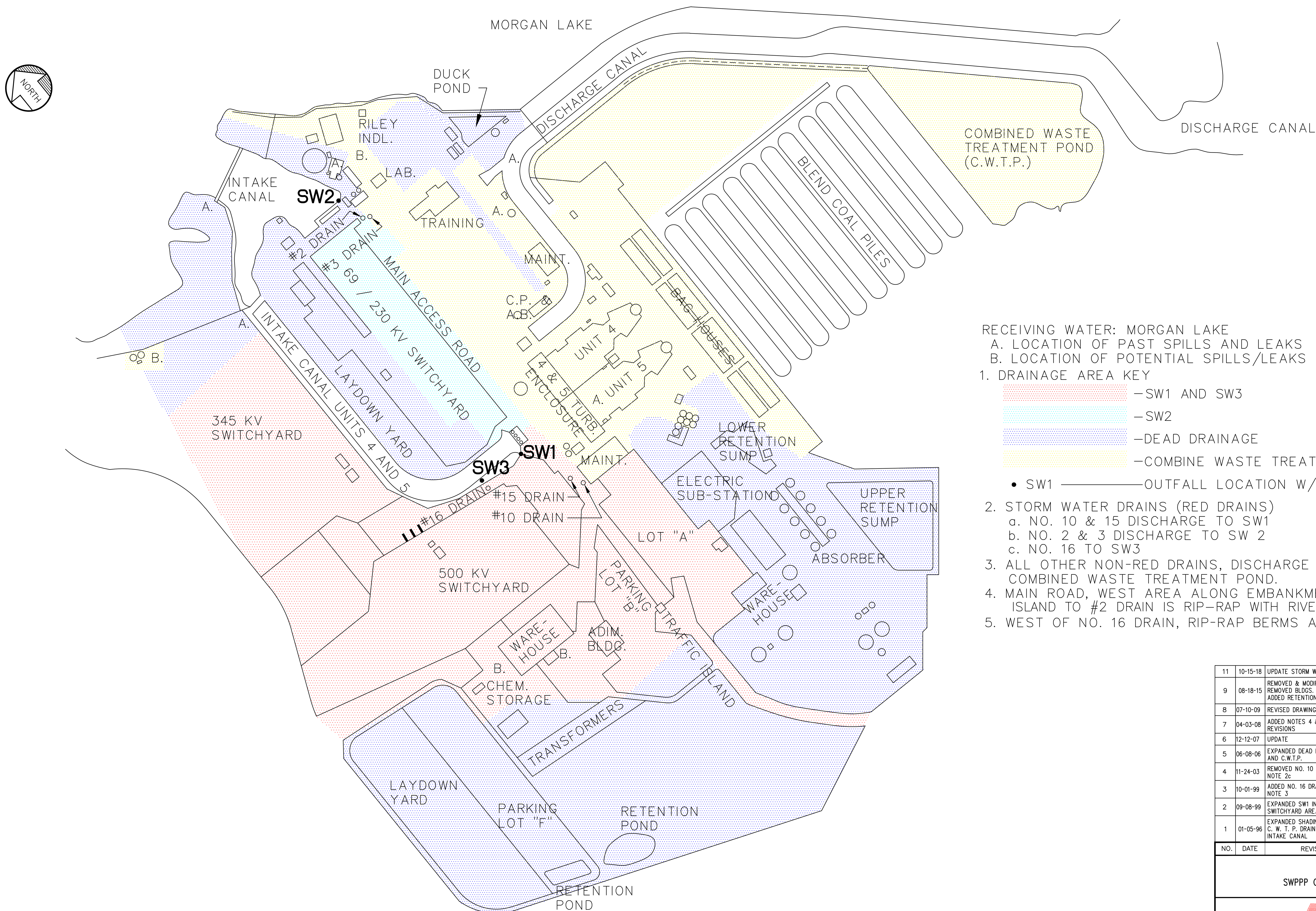
Attachment E - Annual Reports

Attachment F – Biological Opinion

Attachment G – Programmatic Agreement regarding Management of Historic Properties associated with the Four Corners Power Plant, Ancillary Facilities, and Transmission Lines.

Attachment H – Delegation of Authorized Representative

ATTACHMENT A



RECEIVING WATER: MORGAN LAKE
A. LOCATION OF PAST SPILLS AND LEAKS
B. LOCATION OF POTENTIAL SPILLS/LEAKS

1. DRAINAGE AREA KEY
   - SW1 AND SW3
   - SW2
   - DEAD DRAINAGE
   - COMBINE WASTE TREATMENT POND
   - • SW1 ——— OUTFALL LOCATION W/ID
2. STORM WATER DRAINS (RED DRAINS)
   a. NO. 10 & 15 DISCHARGE TO SW1
   b. NO. 2 & 3 DISCHARGE TO SW 2
   c. NO. 16 TO SW3
3. ALL OTHER NON-RED DRAINS, DISCHARGE TO THE COMBINED WASTE TREATMENT POND.
4. MAIN ROAD, WEST AREA ALONG EMBANKMENT FROM TRAFFIC ISLAND TO #2 DRAIN IS RIP-RAP WITH RIVER STONE.
5. WEST OF NO. 16 DRAIN, RIP-RAP BERMS ARE INSTALLED.

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
11	10-15-18	UPDATE STORM WATER DRAINS.	MDC		CM		LYM	FC1158500
9	08-18-15	REMOVED & MODIFIED TEXTS. REMOVED BLDGS. PER DECOM. ADDED RETENTION POND.	MDC	AS	CBM		WWC	
8	07-10-09	REVISED DRAWING TITLE	MDC		WB		BS	
7	04-03-08	ADDED NOTES 4 & 5 AND GENERAL REVISIONS	MDC		WB		BS	
6	12-12-07	UPDATE	MDC		WB		BS	
5	06-08-06	EXPANDED DEAD DRAINAGE AND AND C.W.T.P.	MDC		WB		BS	
4	11-24-03	REMOVED NO. 10 AND 15 FROM NOTE 2c	MDC		WB		BS	
3	10-01-99	ADDED NO. 16 DRAIN, SW3 & NOTE 3	MDC		WB		DCB	
2	09-08-99	EXPANDED SW1 INTO THE 345 KV SWITCHYARD AREA	MDC		WB		DCB	
1	01-05-96	EXPANDED SHADING FOR D. D. AND C. W. T. P. DRAINAGE AT THE INTAKE CANAL	MDC		WB		DCB	

FOUR CORNERS
COMMON
SWPPP GENERAL LOCATION MAP
PLAN

APS

SCALE N.T.S.
DATE 10-02-95

DWN BENALLY MDC
CHD
EXD W. BENALLY
RVWD
APPROVED D. BLOOMFIELD ENGINEERING SUPERVISOR
W A

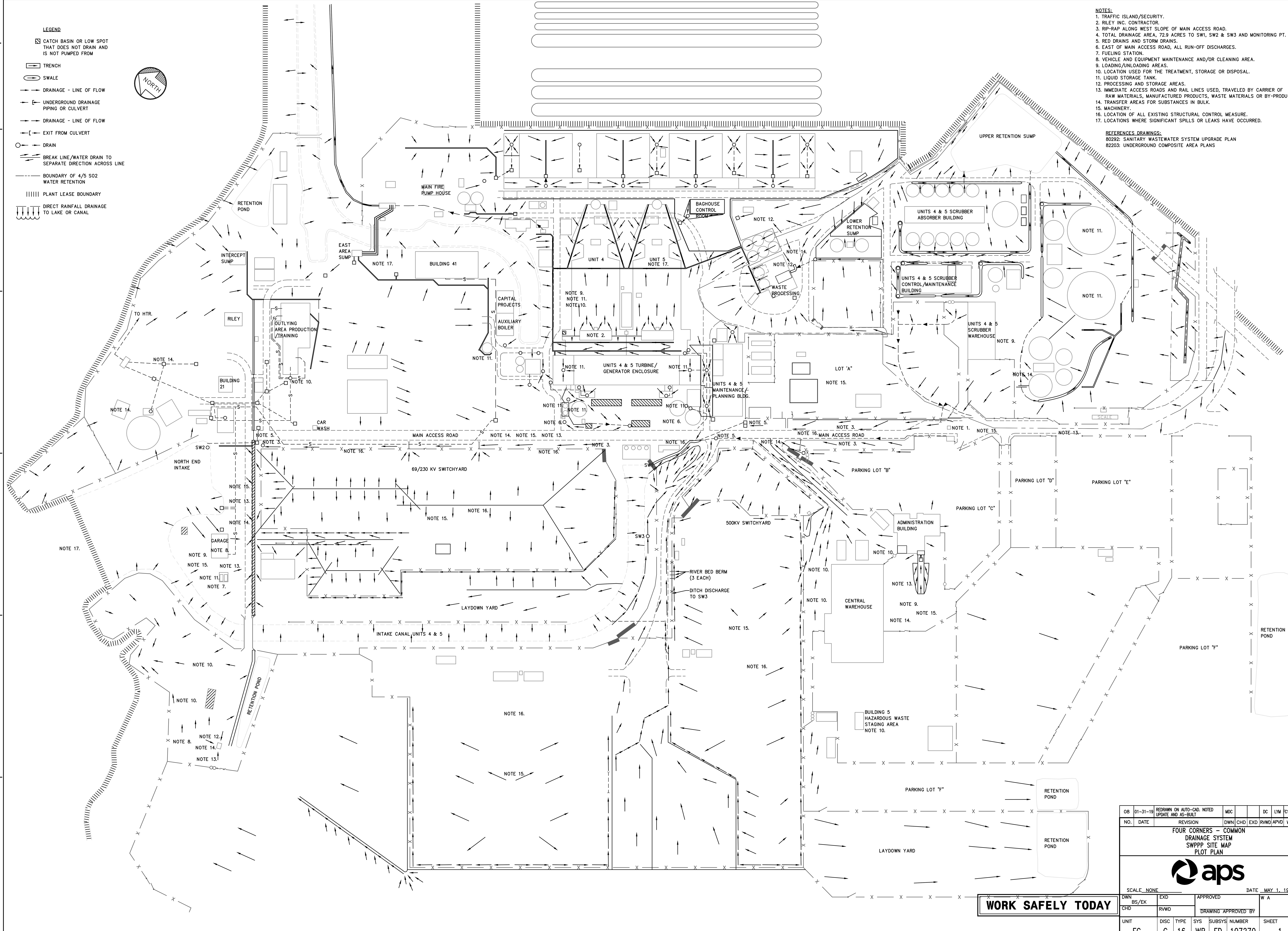
UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	16	MDS	143564	1

DRAWING: \\vs-cifs_misc\BC-Workspace\z23175\M-Wczzpa0062,D-PROD1\Masters\Fossil\A\Plants\FC\00CM\Mechanical\FC00CM-C-16-WP-FD-143564-1.dwg

ATTACHMENT B

LEGEND

- CATCH BASIN OR LOW SPOT THAT DOES NOT DRAIN AND IS NOT PUMPED FROM
- TRENCH
- SWALE
- DRAINAGE - LINE OF FLOW
- UNDERGROUND DRAINAGE PIPING OR CULVERT
- DRAINAGE - LINE OF FLOW
- EXIT FROM CULVERT
- DRAIN
- BREAK LINE/WATER DRAIN TO SEPARATE DIRECTION ACROSS LINE
- BOUNDARY OF 4/5 SO2 WATER RETENTION
- PLANT LEASE BOUNDARY
- DIRECT RAINFALL DRAINAGE TO LAKE OR CANAL



NOTES:

1. TRAFFIC ISLAND/SECURITY.
2. RILEY INC. CONTRACTOR.
3. RIP-RAP ALONG WEST SLOPE OF MAIN ACCESS ROAD.
4. TOTAL DRAINAGE AREA, 72.9 ACRES TO SW1, SW2 & SW3 AND MONITORING PT.
5. RED DRAINS AND STORM DRAINS.
6. EAST OF MAIN ACCESS ROAD, ALL RUN-OFF DISCHARGES.
7. FUELING STATION.
8. VEHICLE AND EQUIPMENT MAINTENANCE AND/OR CLEANING AREA.
9. LOADING/UNLOADING AREAS.
10. LOCATION USED FOR THE TREATMENT, STORAGE OR DISPOSAL.
11. LIQUID STORAGE TANK.
12. PROCESSING AND STORAGE AREAS.
13. IMMEDIATE ACCESS ROADS AND RAIL LINES USED, TRAVELED BY CARRIER OF RAW MATERIALS, MANUFACTURED PRODUCTS, WASTE MATERIALS OR BY-PRODUCT.
14. TRANSFER AREAS FOR SUBSTANCES IN BULK.
15. MACHINERY.
16. LOCATION OF ALL EXISTING STRUCTURAL CONTROL MEASURE.
17. LOCATIONS WHERE SIGNIFICANT SPILLS OR LEAKS HAVE OCCURRED.

REFERENCES DRAWINGS:

80292: SANITARY WASTEWATER SYSTEM UPGRADE PLAN
82203: UNDERGROUND COMPOSITE AREA PLANS

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
08	01-31-19	REDRAWN ON AUTO-CAD. NOTED UPDATE AND AS-BUILT	MDC			DC	LYM	FC1158500

FOUR CORNERS - COMMON
DRAINAGE SYSTEM
SWPPP SITE MAP
PLOT PLAN

aps

SCALE NONE DATE MAY 1, 1991

WORK SAFELY TODAY

DWN BS/EK	EXD	APPROVED	W A
CHD	RVWD	DRAWING APPROVED BY	

UNIT	DISC	TYPE	SYS	SUBSYS	NUMBER	SHEET
FC	C	16	WP	FD	107270	1

ATTACHMENT C

NPDES FORM 3510-6	EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, DC 20460 NOTICE OF INTENT (NOI) FOR STORMWATER DISCHARGES ASSOCIATED W ITH INDUSTRIAL ACTIVITY UNDER THE NPDES MULTI-SECTOR GENERAL PERM IT	FORM Approved OMB No. 2040-0004

Permit Information

Master Permit Number: AZR05I000

NPDES ID: AZR05I307

Eligibility Information

State/territory where your facility is discharging: NM

Does your facility discharge to federally recognized Indian Country lands? Yes

- **Indian Tribe associated with the area of Indian Country:** Navajo Nation, Arizona, New Mexico & Utah

Are you a *"Federal Operator"* as defined in Appendix A (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_a_-_definitions.pdf)?

No

Which type of form would you like to submit? Notice of Intent (NOI)

By indicating "Yes" below, I confirm that I understand that the MSGP only authorizes the stormwater discharges in Part 1.1.2 and the allowable non-stormwater discharges listed in Part 1.2.2. Any discharges not expressly authorized in this permit cannot become authorized or shielded from liability under CWA section 402(k) by disclosure to EPA, state, or local authorities after issuance of this permit via any means, including the Notice of Intent (NOI) to be covered by the permit, the Stormwater Pollution Prevention Plan (SWPPP), during an inspection, etc. If any discharges requiring NPDES permit coverage other than the allowable stormwater and non-stormwater discharges listed in Parts 1.2.1. and 1.2.2. will be discharged, they must be covered under another NPDES permit.

Yes

Are you a new discharger or a new source as defined in Appendix A (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_a_-_definitions.pdf)?

No

- **Have stormwater discharges from your facility been covered previously under an NPDES permit?** Yes

  - **If yes, provide your most current NPDES ID (i.e., permit tracking number) if you had coverage under EPA's MSGP or the NPDES permit number if you had coverage under an EPA individual permit:**

    AZR05I307

- **Are you discharging to any waters of the U.S. that are designated by the state or tribal authority under its antidegradation policy as a Tier 3 water (Outstanding National Resource water)? (See Appendix L (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_l_-_list_of_tier_3_tier_2_and_tier_2.5_waters.pdf))**

  No

Do you anticipate the discharge of groundwater or spring water from your facility? No

What is the legal name of the Operator as defined in Appendix A (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_a_-_definitions.pdf)?

ARIZONA PUBLIC SERVICE COMPANY, FOUR CORNERS POWERPLANT

What is the name of your facility or activity as defined in Appendix A (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_a_-_definitions.pdf)?

FOUR CORNERS POWER PLANT

Operator Information

Operator Information

Operator Name: ARIZONA PUBLIC SERVICE COMPANY, FOUR CORNERS POWERPLANT

Operator Mailing Address

Address Line 1: PO Box 355

Address Line 2:

City: Fruitland

ZIP/Postal Code: 87416

State: NM

County or Similar Division: San Juan

Operator Point of Contact Information

First Name Middle Initial Last Name: Pamela J Norris

Title: Environmental Section Leader

Phone: 505-598-8781

Ext.:

Email: pamela.norris@aps.com

NOI Preparer Information

☑ **This NOI is being prepared by someone other than the certifier.**

First Name Middle Initial Last Name: Matthew Hodge

Organization: Arizona Public Service

Phone: 602-250-5363

Ext.:

Email: matthew.hodge@aps.com

Facility Information

Facility Information

Facility Name: FOUR CORNERS POWER PLANT

Facility Address

Address Line 1: PO BOX 355

Address Line 2:

City: FRUITLAND

ZIP/Postal Code: 87416

State: NM

County or Similar Division: San Juan

Latitude/Longitude for the Facility

Latitude/Longitude: 36.689883°N, 108.483003°W

Latitude/Longitude Data Source: Map

Horizontal Reference Datum: WGS 84

General Facility Information

What is the ownership type of the facility? Corporation

Estimated area of industrial activity at your facility exposed to stormwater (rounded to the nearest quarter acre): 73

Is your facility presently inactive and unstaffed? No

Exception for Inactive and Unstaffed Facilities: The requirement for indicator monitoring, impaired waters monitoring, and/or benchmark monitoring does not apply at a facility that is inactive and unstaffed, as long as there are no industrial materials or activities exposed to stormwater.

If circumstances change during the permit term that affect your qualifications for this exception to monitoring requirements (i.e. industrial materials or activities exposure to stormwater or your facility's active/inactive and staffed/unstaffed status) you must submit a NOI notifying EPA of the change in circumstances.

Sector-Specific Information

Primary Sector: O

Primary Subsector: O1

Primary Activity Code: SE

Discharge Information

By indicating "Yes" below, I confirm that I understand that the MSGP only authorizes the stormwater discharges in Part 1.2.1 and the allowable non-stormwater discharges listed in Part 1.2.2. Any discharges not expressly authorized in this permit cannot become authorized or shielded from liability under CWA section 402(k) by disclosure to EPA, state, or local authorities after issuance of this permit via any means, including the Notice of Intent (NOI) to be covered by the permit, the Stormwater Pollution Prevention Plan (SWPPP), during an inspection, etc. If any discharges requiring NPDES permit coverage other than the authorized stormwater and non-stormwater discharges listed in Parts 1.2.1 and 1.2.2 will be discharged, they must be covered under another NPDES permit.

Yes

Federal Effluent Limitation Guidelines

Identify the Effluent Limitation Guideline(s) that apply to your stormwater discharges.

40 CFR Part/Subpart	Eligible Discharges	Affected MSGP Sector	New Source Date	Applicability
Part 423	Coal pile runoff at steam electric generating facilities	O	11/19/1982, 10/08/1974	**Does your facility have any discharges subject to this effluent limitation guideline?** No

Are you requesting permit coverage for any stormwater discharges subject to effluent limitation guidelines? No

Other Discharge Information

Do you anticipate the discharge of groundwater or spring water from your facility? No

Does your facility discharge into a Municipal Separate Sewer System (MS4)? No

Receiving Waters Information

List all of the stormwater discharge points from your facility.

Discharge Point SW1:

Applicable Sectors

Select the Sectors/Subsector(s) that apply to this discharge point.

	Sector	Subsector	SIC/Activity Code
☑	**O** - STEAM ELECTRIC GENERATING FACILITIES	**O1** - Steam Electric Generating Facilities, including coal handling sites	SE

Latitude/Longitude: 36.6878°N, 108.4822°W

☐ **This discharge point is *Substantially Identical* to an existing discharge point.**

Receiving Water

GNIS Name: n/a

Waterbody Name: Morgan Lake

Listed Water ID: n/a

Is this receiving water saltwater or freshwater? Freshwater

Is this receiving water designated by the state or tribal authority under its antidegradation policy as a Tier 2 (or Tier 2.5) water (water quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water)?

No

Will you have stormwater discharges from paved surfaces that will be initially sealed or re-sealed with coal-tar sealcoat where industrial activities are located during coverage under this permit?

No

Benchmark Monitoring

Are you subject to benchmark monitoring requirements for a hardness-dependent metal? No

Impaired Waters Monitoring

NOTE: The information automatically populated in this section for determining if the receiving water is listed as impaired on the 303(d) list and in need of a TMDL, the cause(s) of the impairment if the receiving water is impaired on the CWA 303(d) list, if a TMDL has been completed for the receiving waterbody, and the TMDL ID and pollutants for which there is a TMDL may be outdated and inaccurate. It is recommended that you consult with your state's guidance for discharges into impaired waters to determine the correct pollutants and TMDLS and update the causes for the impairment and TMDL information accordingly.

Is the receiving water listed as impaired on the 303(d) list and in need of a TMDL? No

Has a TMDL been completed for this receiving waterbody? No

Discharge Point SW3:

Applicable Sectors

Select the Sectors/Subsector(s) that apply to this discharge point.

	Sector	Subsector	SIC/Activity Code
☑	**O** - STEAM ELECTRIC GENERATING FACILITIES	**O1** - Steam Electric Generating Facilities, including coal handling sites	SE

Latitude/Longitude: 36.6875°N, 108.4828°W

☑ **This discharge point is *Substantially Identical* to an existing discharge point.**

➔ **Substantially Identical to Discharge Point ID:** SW1

Receiving Water

GNIS Name: n/a

Waterbody Name: Morgan Lake

Listed Water ID: n/a

Is this receiving water saltwater or freshwater? Freshwater

Is this receiving water designated by the state or tribal authority under its antidegradation policy as a Tier 2 (or Tier 2.5) water (water quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water)?

No

Will you have stormwater discharges from paved surfaces that will be initially sealed or re-sealed with coal-tar sealcoat where industrial activities are located during coverage under this permit?

No

Benchmark Monitoring

Are you subject to benchmark monitoring requirements for a hardness-dependent metal? No

Impaired Waters Monitoring

NOTE: The information automatically populated in this section for determining if the receiving water is listed as impaired on the 303(d) list and in need of a TMDL, the cause(s) of the impairment if the receiving water is impaired on the CWA 303(d) list, if a TMDL has been completed for the receiving waterbody, and the TMDL ID and pollutants for which there is a TMDL may be outdated and inaccurate. It is recommended that you consult with your state's guidance for discharges into impaired waters to determine the correct pollutants and TMDLS and update the causes for the impairment and TMDL information accordingly.

Is the receiving water listed as impaired on the 303(d) list and in need of a TMDL? No

Has a TMDL been completed for this receiving waterbody? No

Discharge Point SW2:

Applicable Sectors

Select the Sectors/Subsector(s) that apply to this discharge point.

	Sector	Subsector	SIC/Activity Code

☑	**O** - STEAM ELECTRIC GENERATING FACILITIES	**O1** - Steam Electric Generating Facilities, including coal handling sites	SE

Latitude/Longitude: 36.6908°N, 108.4849°W

☑ **This discharge point is *Substantially Identical* to an existing discharge point.**

➜ **Substantially Identical to Discharge Point ID:** SW1

Receiving Water

GNIS Name: n/a

Waterbody Name: Morgan Lake

Listed Water ID: n/a

Is this receiving water saltwater or freshwater? Freshwater

Is this receiving water designated by the state or tribal authority under its antidegradation policy as a Tier 2 (or Tier 2.5) water (water quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water)?

No

Will you have stormwater discharges from paved surfaces that will be initially sealed or re-sealed with coal-tar sealcoat where industrial activities are located during coverage under this permit?

No

Benchmark Monitoring

Are you subject to benchmark monitoring requirements for a hardness-dependent metal? No

Impaired Waters Monitoring

NOTE: The information automatically populated in this section for determining if the receiving water is listed as impaired on the 303(d) list and in need of a TMDL, the cause(s) of the impairment if the receiving water is impaired on the CWA 303(d) list, if a TMDL has been completed for the receiving waterbody, and the TMDL ID and pollutants for which there is a TMDL may be outdated and inaccurate. It is recommended that you consult with your state's guidance for discharges into impaired waters to determine the correct pollutants and TMDLS and update the causes for the impairment and TMDL information accordingly.

Is the receiving water listed as impaired on the 303(d) list and in need of a TMDL? No

Has a TMDL been completed for this receiving waterbody? No

SWPPP Information

Has the SWPPP been prepared in advance of filing this NOI, as required? Yes

SWPPP Contact Information:

First Name Middle Initial Last Name: Pamela J Norris

Phone: 505-598-8781 **Ext.:**

Email: pamela.norris@aps.com

SWPPP Availability:

Your current SWPPP or certain information from your SWPPP must be made available through one of the following three options. Select one of the options and provide the required information.

Note: you are not required to post any confidential business information (CBI) or restricted information (as defined in Appendix A (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_a_-_definitions.pdf)) (such information may be redacted), but you must clearly identify those portions of the SWPPP that are being withheld from public access.

☐ **Option 1: Attach a current copy of your SWPPP to this NOI.**

☑ **Option 2: Maintain a Current Copy of your SWPPP on an Internet page (Universal Resource Locator or URL).**

Provide the web address URL (e.g. http://www.example.com): https://www.aps.com/library/environmentalcompliance/SWPPP.pdf

☐ **Option 3: Provide the following information from your SWPPP:**

Endangered Species Protection Worksheet: Criterion C3

The following questions will help you determine your eligibility under Part 1.1.4 of the permit with respect to protection of Endangered Species Act (ESA) species and critical habitat(s). Please refer to Appendix E (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_e_-_procedures_relating_to_endangered_species_protection.pdf) of the 2021 MSGP for important information regarding your obligations under this permit concerning ESA-protected species and critical habitat(s).

Determine ESA Eligibility Criterion

Are your industrial activities already addressed in another operator's valid certification of eligibility for your "action area" under eligibility criteria A, C, D, or E of the 2021 MSGP?

No

Are your industrial activities the subject of a permit under section 10 of the ESA by the USFWS and/or NMFS, and this authorization addresses the effects of your facility's discharges and discharge-related activities on ESA-listed species and critical habitat?

No

You must determine whether species listed as either threatened or endangered under the Endangered Species Act, and/or their critical habitat are located in your facility's action area. ESA-listed species and critical habitat are under the purview of the NMFS and the USFWS.

Determine Your Action Area

Your "action area" (as defined in Appendix A (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_a_-_definitions.pdf)) includes all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action, including areas beyond the footprint of the facility that are likely to be affected by stormwater discharges, discharge-related activities, and authorized non-stormwater discharges. You must select and confirm that all the following are true:

- **In determining my "action area", I have considered that discharges of pollutants into downstream areas can expand the action area well beyond the footprint of my facility and the discharge point(s). I have taken into account the controls I will be implementing to minimize pollutants and the receiving waterbody characteristics (e.g. perennial, intermittent, ephemeral) in determining the extent of physical, chemical, and/or biotic effects of the discharges. I confirm that all receiving waterbodies that could receive pollutants from my facility are included in my action area.**

  True

- **In determining my "action area", I have considered that discharge-related activities must also be accounted for in determining my action area. I understand that discharge-related activities are any activities that cause, contribute to, or result in stormwater and authorized non-stormwater point source discharges, and measures such as the siting, construction, and operation of stormwater controls to control, reduce, or prevent pollutants from being discharged. I understand that any new or modified stormwater controls that will have noise or other similar effects, and any disturbances associated with construction of controls, are part of my action area.**

  True

Provide a written description of your action area and explain your rationale for the extent of the action area drawn on your map. Click here for an example.

Consultation & Biological Opinion
The action area includes all areas that the proposed action may directly or indirectly affect
endangered species or their critical habitat. The proposed action, FCPP and NMEP, is located on
the Navajo Nation approximately 15 miles southwest of Farmington, New Mexico (Figure 1).
The proposed action includes continued use and maintenance of associated transmission lines
that cross Navajo Nation and allotted lands, the Hopi Reservation, the Zia Pueblo, BLM lands,
the Petroglyph National Monument, New Mexico State Land Office lands, as well as private land
(OSMRE 2014a) (Figure 1).
The action area where direct effects occur includes the Navajo Mine lease areas (Figure 2) and
proposed Pinabete Permit Area (Figure 3), the lease area for the FCPP and associated facilities
(Figure 4), the APS Weir, and the ROWs for PNM transmission lines to the San Juan Generating
Station and West Mesa Switchyard and two ROWs for APS transmission lines within the Navajo
Nation boundary (Figure 1) (OSMRE 2014b). The action area where direct and indirect effects
occur includes the area that atmospheric trace element deposition from the FCPP emissions
would likely occur, as modeled by AECOM (2013) and EPRI (2014), which includes vast
portions of the San Juan River Basin and in the Four Corners region (Figure 5). The focus of
several analyses in the BA were from the upstream end of the Deposition Area downstream to,
and inclusive of, the San Juan Arm of Lake Powell, which may be affected by runoff of materials
from the proposed action including the Deposition Area (AECOM 2013; Figure 6).
Geographically, the action area for the proposed project is located in the Four Corners region of
the United States; an area associated with the quadripoint consisting of the southwestern corner
of Colorado, northwestern corner of New Mexico, northeastern corner of Arizona, and
southeastern corner of Utah, and including lands owned by the Navajo Nation and the Hopi. The
Four Corners region is part of a larger region known as the Colorado Plateau Provence and is
mostly rural, rugged, and arid (OSMRE 2014a).
The San Juan River originates in the San Juan Mountains of southwestern Colorado. It flows
approximately 31 miles south to the Colorado/New Mexico border, 190 miles westward to the
New Mexico/Arizona border, and 136 miles into Lake Powell, at the western edge of the action
area (Figure 6). The San Juan River has few perennial tributaries (the Animas River is the
largest) and numerous ephemeral drainages that receive substantial seasonal summer flows

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. In
1962, the U.S. Bureau of Reclamation (Reclamation or BOR 2001) constructed Navajo Dam in
the mainstem of the San Jan River just south of the Colorado border in New Mexico to sto
re
flows from the San Juan, Los Pinos, and Piedra Rivers (BOR 2001) (Figure 6).
```

Attach a map of the action area for your facility. Mapping tool IPaC (the Information, Planning, and Consultation System) located at http://ecos.fws.gov/ipac/ (https://ecos.fws.gov/ipac/) or click here (/net-msgp/documents/action_area_example.pdf) for an example.

Name	Uploaded Date	Size
2021 FC Action Area Map.pdf (attachment/718432)	05/28/2021	659.47 KB

Determine if ESA-listed species and/or critical habitat are in your facility's action area.

ESA-listed species and critical habitat are under the purview of the NMFS and the USFWS, and in many cases, you will need to acquire species and critical habitat lists from both federal agencies.

National Marine Fisheries Service (NMFS)

To obtain NMFS-listed species and critical habitat information, use the resources listed below:

General Resources:
- NOAA Fisheries, Regions Page (https://www.fisheries.noaa.gov/regions)

For the Northeastern U.S.:
- NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper (https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27)

For Puerto Rico:
- *Acropora* critical habitat map (https://www.fisheries.noaa.gov/resource/map/acropora-elkhorn-and-staghorn-coral-critical-habitat-map-and-gis-data)
- Green turtle critical habitat map (https://www.fisheries.noaa.gov/resource/map/green-turtle-critical-habitat-map-and-gis-data)
- Hawksbill Turtle critical habitat map (https://www.fisheries.noaa.gov/resource/map/hawksbill-turtle-critical-habitat-map-and-gis-data)

Western U.S.:
- West Coast Region Protected Resources App (https://www.webapps.nwfsc.noaa.gov/portal/apps/webappviewer/index.html?id=7514c715b8594944a6e468dd25aaacc9)

Pacific Islands:
- Contact the Pacific Islands Regional Office at (808) 725-5000 or pirohonolulu@noaa.gov (mailto:pirohonolulu@noaa.gov)

I have checked the webpages listed above and confirmed that: There are no NMFS-listed species and/or critical habitat in my action area.

U.S. Fish and Wildlife Service (USFWS)

To obtain FWS-listed species and critical habitat information, use the resources listed below:
- IPaC (the Information, Planning, and Consultation System) (https://ecos.fws.gov/ipac/)
- For instructions for using IPaC, click here.

I have checked the webpages listed above and confirmed that: There are FWS-listed species and/or critical habitat in my action area.

For FWS species, include the full printout from your IPaC query/Official Species List.

Name	Uploaded Date	Size
Four Corners Biological Opinion.pdf (attachment/718439)	05/28/2021	3.65 MB

You may be eligible under **Criterion C.** You must assess whether your discharges and discharge-related activities are likely to adversely affect ESA-listed species or critical habitat, and whether any additional measures are necessary to ensure no likely adverse effects. In order to make a determination of your facility's likelihood of adverse effects, you must complete the Criterion C Eligibility fields below.

Criterion C Eligibility

Select which applies:

Criterion C3: ESA-listed species and/or critical habitat likely to occur, but discharges not likely to adversely affect them.
ESA-listed species and/or habitat under the jurisdiction of USFWS and/or NMFS are likely to occur in or near your facility's "action area", and you certify to EPA that your industrial activity's discharges and discharge-related activities are not likely to adversely affect ESA-listed species and/or critical habitat.

Select which applies:

I am seeking coverage under the MSGP as an existing discharger and there are no modifications to my facility.

Provide a general description of the industrial activities that are taking place at this facility:

```
Material Storage, Turbine Lube Shed at Warehouse, Material Storage, Unloading & Receivin
g Material at Warehouse, Electrical Switchyard, 230 KV Yard, Containment, banks along hi
ll (SW1 & SW2), Maintenance and Cleaning, Parking Lots, Equipment/Vehicle Parking Lots,
Bulk Storage, U 4&5 Circulating Cooling Water Intake, Material Delivery, Main road on pl
ant site, Electrical Switchyard, 500 and 345 KV Yard, Equipment, Transformer & Compresso
rs in 500, 345, and 230 KV Yards,  Bulk Fuel Storage, Contractor, Laydown Yards (4/5, SO
2, Metal/Pipe Storage)
```

Using your species list(s) attached above, determine which of the following applies:
The species list(s) includes both terrestrial and aquatic or aquatic-dependent species and/or their critical habitat.

Evaluation of Discharge-Related Activities Effects

Most of the potential effects related to coverage under the MSGP are assumed to occur to aquatic and/or aquatic-dependent species. However, in some cases, potential effects to terrestrial species and/or their critical habitat should be considered as well from any discharge-related activities that occur during coverage under the MSGP. Examples of discharge-related activities that could have potential effects on protected terrestrial species or their critical habitat include the storage of materials and land disturbances associated with stormwater management-related activities (e.g., the installation or placement of stormwater control measures).

Select the applicable statement below: There are discharge-related activities planned as part of the proposal.

Describe your discharge-related activities:

```
Steam electric generating facility
```

In order to ensure any discharge-related activities will have no likely adverse effects on ESA-listed species and/or their critical habitat, you must certify that all the following are true:

- **Discharge-related activities will occur on previously cleared/developed areas of the site where maintenance and operation of the facility are currently occurring or where existing conditions of the area(s) in which the discharge-related activities will occur precludes its use by listed species (e.g., work on existing impervious surfaces, work occurring inside buildings, area is not used by species).**

  True

- **Discharge-related activities that will include the establishment of structures (including, but not limited to, infiltration ponds and other controls) or any related disturbances will be sited in areas that will not result in isolation or degradation of nesting, breeding, or foraging habitat or other habitat functions for listed animal species (or their designated critical habitat), and will avoid the destruction of native vegetation (including listed plant species).**

  True

- **For any vegetation removal (e.g., brush clearing) or other similar activities that will occur, no terrestrial listed species that use these areas for habitat or listed critical habitat would be expected to be present during vegetation removal.**

  True

Evaluation of Discharge Effects

Using the next few questions, you will evaluate the likelihood of adverse effects from your facility's discharges. The scope of effects to consider will vary with each facility and species/critical habitat characteristics. The following are examples of discharge effects you should consider:

- **Hydrological Effects.** Stormwater discharges may adversely affect receiving waters by causing changes in water quality parameters such as turbidity, temperature, salinity, or pH. Stormwater discharges may adversely affect the immediate vicinity of the discharge point through streambank erosion and scour. These effects will vary with the amount of stormwater discharged and the volume and condition of the receiving water. Where a stormwater discharge constitutes a minute portion of the total volume of the receiving water, adverse hydrological effects are less likely.
- **Toxicity of Pollutants.** Pollutants in stormwater may have toxic effects on listed species and may adversely affect critical habitat. Exceedances of benchmarks, effluent limitation guidelines, or state or tribal water quality requirements may be indicative of potential adverse effects on listed species or critical habitat. However, some listed species may be adversely affected at pollutant concentrations below benchmarks, effluent limitation guidelines, and state or tribal water quality standards due to exposures to multiple stressors at the same time. In addition, stormwater pollutants identified in Part 6.2.3.2 of your SWPPP, but not monitored as benchmarks or effluent limitation guidelines, may also adversely affect listed species and critical habitat.

As these effects are difficult to analyze for listed species, their prey, habitat, and critical habitat, these questions will help you to analyze your discharges to make a determination of whether your discharges will likely have adverse effects and whether there are any additional controls you can implement to ensure no likely adverse effects.

Evaluation of Pollutants and Controls to Avoid Adverse Effects

In the section below, document all of your pollutant sources and pollutants expected to be discharged in stormwater. You must also document the controls you will implement to avoid adverse effects on listed aquatic and aquatic-dependent species. You must include specific details about the expected effectiveness of the controls in avoiding adverse effects to the listed aquatic-and aquatic-dependent species.

Potential Pollution Source:

Material storage, electrical switchyard, maintenance and cleaning, containment banks, equipment/vehicle parking lots, bulk storage cooling water intake, material delivery, laydown yards

Potential Pollutants:

Petroleum products are currently stored in drums and other containers inside the turbine lube shed located at the Warehouse. During major storm events, the petroleum products are protected and have minimal contact with precipitation.

The Warehouse receiving and unloading dock is located within a concrete sump with steel grating for vehicle(s) to backup when unloading. In the past, stormwater that accumulated in the sump was discharged into SW1. The sump's discharge pipe has been welded closed to prevent contaminants, such as vehicle fuel leaks and products, from discharging to SW1.

Sediment generated from the erosion of the banks along the 230 KV yard is carried with runoff to the pavement below and then into SW2.

Sediment generated from the erosion of the banks along the hill is carried with runoff into SW1 and SW2.

Fugitive dust (including fly ash, coal, and dirt) is deposited on the paved parking lots and roadways that are in the path of stormwater runoff to SW1, SW2 and SW3.

Stormwater contaminated with oil and grease from leaking vehicles parked at the employee parking lots, Warehouse, and the Administration's north parking lot are discharged into SW1 and SW2.

ASI 7320 (APN 111535, 119560) stored in bulk containers are located in the areas of Units 1-2-3 and Units 4&5 Circulating Cooling Water Intake area. The stormwater from this area discharges to SW1 and SW2.

Petroleum products delivered to site (by route of the main road) have the potential to impact stormwater area discharged to SW1 and SW2. Sediment generated from the erosion of the banks along 500 and 345 KV yards is carried with runoff into SW1, SW2 and SW3.

Leaking oil from the transformers and compressors in the 500, 345 and 230 KV yards are carried with stormwater runoff into SW1, SW2 and SW3.

Oil filled equipment.

Controls to Avoid Adverse Effects on Protected Aquatic and Aquatic-Dependent Species:

Include information supporting why the control(s) will ensure no adverse effects, including any data you have about the effectiveness of the control(s) in reducing pollutant concentrations. You may also attach photos of your controls to this form.

- Minimize erosion,
- Good housekeeping practices,
- Maintenance,
- Minimize exposure,
- Spill prevention and response procedures,
- Install erosion and sediment controls.

Use the space below to attach any photos of your controls.

Were you able to make a preliminary determination that any of your pollutants will be controlled to a level necessary to avoid adverse effects on aquatic and/or aquatic-dependent listed species and their critical habitat?

I was able to make a preliminary determination that all of my pollutants will be controlled to a level necessary to avoid adverse effects.

Analysis of Effects Based on Past Monitoring Data

Select which of the following applies to your facility:

My facility has had exceedances of one or more benchmark(s) or numeric effluent limits under the 2015 MSGP, but I have addressed them during my coverage under the 2015 MSGP, or in my evaluation of controls to avoid adverse effects above.

Describe all actions (including specific controls) that you have/will implement to ensure that the pollutants in your discharge(s) will not result in likely adverse effects from future exceedances:

Under the 2008 MSGP, Four Corners claimed the natural background exception from benchmark monitoring. Natural background sampling was initiated following receipt of sample results that exceeded the benchmark for Total Iron. A series of 18 natural background samples were taken concurrently with required benchmark monitoring. The average natural concentration results exceeded the average concentration detected from runoff from all facility outfalls that were required to be monitored under the 2008 MSGP. Four Corners Power Plant concluded that benchmark exceedances are attributable solely to high natural background levels of iron in soils and notified EPA in February 2010 that no additional benchmark monitoring would be conducted.
Although a background study was conducted previously, the 2015 MSGP requireds that a minimum of four quarters of benchmark monitoring to be conducted in the new permit term. Results of benchmark monitoring at SW-1 confirmed that the average concentration of total iron in samples is less than the average concentration of total iron in natural background samples collected during the 2009 study. The recent benchmark sampling has confirmed that Four Corners monitoring results are attributable solely to high background levels of iron in soils. A Change NOI will bewas submitted on January 26, 2018 to notify EPA that benchmark monitoring provisions have had been fulfilled for this permit term for the 2015 MSGP Permit.

You must verify your preliminary determination of effects on listed species and designated critical habitat from your discharges and/or discharge-related activities. Select one of the following that applies:

Based on the above responses, I have provided information supporting a preliminary determination that my discharges and/or discharge-related activities are not likely to adversely affect listed species and designated critical habitats.

Identify the USFWS and NMFS information resources and expertise (e.g., state or federal biologists) used to arrive at this conclusion. Any supporting documentation should explicitly state that both ESA-listed species and critical habitat under the jurisdiction of the USFWS and/or NMFS were considered in the evaluation.

See attached biological opinion.

What ESA-listed species and/or critical habitat are located in your "action area"?

See attached biological opinion.

Distance in miles between your site and the ESA-listed species and/or critical habitat within the action area: 190

Provide a description of EPA approved measures you will implement or will continue to implement to ensure no likely adverse effects on ESA-listed species and/or critical habitat.

See attached biological opinion.

Note: Any missing or incomplete information in this section may result in a delay of your coverage under the permit.

Historic Preservation: Criterion A

The following questions will help you determine your eligibility under Part 1.1.5 of the permit with respect to preservation of historic properties. You may still use the paper instructions in Appendix F (https://www.epa.gov/sites/production/files/2021-01/documents/2021_msgp_-_appendix_f_-_procedures_relating_to_historic_properties_preservation.pdf) of the MSGP in advance or in conjunction with answering the questions in this section of the form. For more information about your State Historic Preservation Office (SHPO) or Tribal Historic Preservation Office (THPO), please visit the National Park Service (NPS) websites at:

- **State Historic Preservation Office (SHPO) (https://www.nps.gov/subjects/nationalregister/state-historic-preservation-offices.htm)**
- **Tribal Historic Preservation Office (THPO) (https://www.nps.gov/history/tribes/Tribal_Historic_Preservation_Officers_Program.htm)**

Are you an existing facility that is resubmitting for certification under the 2021 MSGP? Yes

➔ **If you are an existing facility you should have already addressed National Historic Preservation Act (NHPA) issues. To gain coverage under the 2015 MSGP, you were required to certify that you were either not affecting historic properties or had obtained written agreement from the relevant SHPO or THPO regarding methods of mitigating potential impacts.**

Will you be constructing or installing any new stormwater control measures? No

You are eligible under **Criterion A**

Certification Information

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. Signing an electronic document on behalf of another person is subject to criminal, civil, administrative, or other lawful action.

Certified By: Pamela J. Norris

Certifier Title: Environmental Section Leader

Certifier Email: pamela.norris@aps.com

Certified On: 05/29/2021 1:02 PM ET

From: no-reply@epacdx.net
To: no-reply@epacdx.net
Subject: EPA NeT MSGP Form Certified: FOUR CORNERS POWER PLANT - NPDES ID: AZR05I307
Date: Saturday, May 29, 2021 10:03:01 AM

CAUTION	***CAUTION***	***CAUTION***
This e-mail is from an **EXTERNAL** address (no-reply@epacdx.net). **DO NOT** click on links or open attachments unless you trust the sender and know the content is safe. If you suspect this message to be phishing, please report it to the APS Cyber Defense Center at ***ACDC@aps.com.***		

2021-05-29

Dear NeT User,

Pamela Norris successfully certified the following forms under the MSGP:

NPDES ID	Form Type	Operator	Facility Name	Year	Review Date Target End
AZR05I307	Renew NOI	ARIZONA PUBLIC SERVICE COMPANY, FOUR CORNERS POWERPLANT	FOUR CORNERS POWER PLANT	n/a	07/28/2021

A copy of the submission can be found here.

If you have questions about this email or about the NPDES Electronic Reporting Tool (NeT), please refer to the NeT Help Center or e-mail NPDESereporting@epa.gov for assistance.

This is an automated notification; please do not reply to this email.

For a copy of the 2021 MSGP refer to:

APS Corporate EMS ENV-FC-D5-E03-011

Or

https://www.epa.gov/npdes/stormwater-discharges-industrial-activities-epas-2021-msgp

ATTACHMENT D

Four Corners Stormwater Industrial Routine Facility Inspection Report

General Information			
Facility Name	Four Corners Power Plant		
NPDES Tracking No.	AZR05FK3I		
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			

Weather Information
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snow ❑ High Winds ❑ Other: Temperature:
Have any previously unidentified discharges of pollutants occurred since the last inspection? ❑Yes ❑No **If yes, describe:**
Are there any discharges occurring at the time of inspection? ❑Yes ❑No **If yes, describe:**

Control Measures

- *Number the structural stormwater control measures identified in your SWPPP on your site map and list them below (add as many control measures as are implemented on-site). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required control measures at your facility.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	Structural Control Measure	**Control Measure is Operating Effectively?**	**If No, In Need of Maintenance, Repair, or Replacement?**	**Corrective Action Needed and Notes** (identify needed maintenance and repairs, or any failed control measures that need replacement)
1	Garage area was re-sloped away from cooling water intake	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
2	Banks south of SW1 were gunited to prevent sediments from embankments	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
3	Rip rap (river stones) were applied on embankment of main plant road	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
4	Bermed banks within the plant along the shore lines of Morgan Lake, circulating intake area, and Morgan Lake Canal	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
5	500 KV, 345 KV, and 240 KV switchyards were regraded, graveled, and transformers were bermed to prevent runoff.	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	

	Structural Control Measure	Control Measure is Operating Effectively?	If No, In Need of Maintenance, Repair, or Replacement?	Corrective Action Needed and Notes (identify needed maintenance and repairs, or any failed control measures that need replacement)
6	Straw bales places on the sides of main street to filter out sediment	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
7	Street sweeper is periodically used along Main street	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
8	Facility effort in reducing number of oil and chemicals stored outside	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
9	Facility effort in reducing staging areas near Storm water drainage	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
10		❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	

Areas of Industrial Materials or Activities exposed to stormwater

Below are some general areas that should be assessed during routine inspections. Customize this list as needed for the specific types of industrial materials or activities at your facility.

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
1	**Material loading/unloading and storage areas at Warehouse**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
2	**Equipment operations and maintenance areas near Garage**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
3	**Fueling station near Garage**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
4	**Outdoor vehicle and equipment washing areas off of main street**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
5	**Waste handling and disposal areas (Behind coal lab, Main warehouse, N of 123 turbine, area near 123 hydrobin)**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
6	**Erodible areas/construction**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
7	**Non-stormwater/ illicit connections**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
8	**Salt storage piles or pile containing salt**	❑Yes ❑No ❑ N/A	❑Yes ❑No	

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
9	**Dust generation and vehicle tracking**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
10	**Switchyard**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
11	**Ash Pond**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
12	**Housekeeping**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
13	**Material loading/unloading and storage areas at SO2 warehouse**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
14	**Material loading/unloading and storage areas at Garage**	❑Yes ❑No ❑ N/A	❑Yes ❑No	
15	**Fueling Station at Riley Construction Area**	❑Yes ❑No ❑ N/A	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance observed and not described above:

Additional Control Measures

Describe any additional control measures needed to comply with the permit requirements:

Notes

Use this space for any additional notes or observations from the inspection:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: ____

Signature:________________________________**Date:**______________

Four Corners MSGP Quarterly Visual Assessment Form

(Complete a separate form for each outfall you assess)

Name of Facility: Four Corners Power Plant NPDES Tracking No. AZR05FK3I

Outfall Name: "Substantially Identical Outfall"? ☐ No ☐ Yes (identify substantially identical outfalls):

Person(s)/Title(s) collecting sample:

Person(s)/Title(s) examining sample:

Date & Time Discharge Began: Date & Time Sample Collected: Date & Time Sample Examined:

Substitute Sample? ☐ No ☐ Yes (identify quarter/year when sample was originally scheduled to be collected):

Nature of Discharge: ☐ Rainfall ☐ Snowmelt

If rainfall: Rainfall Amount: inches

Previous Storm Ended > 72 hours Before Start of This Storm? ☐ Yes ☐ No* (explain):

Parameter

Color ☐ None ☐ Other (describe):

Odor ☐ None ☐ Musty ☐ Sewage ☐ Sulfur ☐ Sour ☐ Petroleum/Gas ☐ Solvents ☐ Other (describe):

Clarity ☐ Clear ☐ Slightly Cloudy ☐ Cloudy ☐ Opaque ☐ Other

Floating Solids ☐ No ☐ Yes (describe):

Settled Solids** ☐ No ☐ Yes (describe):

Suspended Solids ☐ No ☐ Yes (describe):

Foam (gently shake sample) ☐ No ☐ Yes (describe):

Oil Sheen ☐ None ☐ Flecks ☐ Globs ☐ Sheen ☐ Slick ☐ Other (describe):

Other Obvious Indicators of Stormwater Pollution ☐ No ☐ Yes (describe):

* The 72-hour interval can be waived when the previous storm did not yield a measurable discharge or if you are able to document (attach applicable documentation) that less than a 72-hour interval is representative of local storm events during the sampling period.

** Observe for settled solids after allowing the sample to sit for approximately one-half hour.

Detail any concerns, additional comments, descriptions of pictures taken, and any corrective actions taken below (attach additional sheets as necessary).

Certification by Facility Responsible Official (Refer to MSGP Subpart 11 Appendix B for Signatory Requirements)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name: B. Title:

C. Signature: D. Date Signed:

ATTACHMENT E

Appendix I - Annual Report Form

Part 7.2 requires you to use the NPDES eReporting Tool, or "NeT", to prepare and submit your Annual Report. However, if you are given a waiver by the EPA Regional Office to use a paper annual report form, and you elect to use it, you must complete and submit the following form.

NPDES FORM 6100-28	EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, DC 20460 ANNUAL REPORT FOR STORMWATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY UNDER THE NPDES MULTI-SECTOR GENERAL PERMIT	OMB No. 2040-0300 OMB Approval Pending

A. Approval to Use Paper Annual Report Form

1. Have you been granted a waiver from electronic reporting from the EPA Regional Office*? ☐ YES ☐ NO

If yes, check which waiver you have been granted, the name of the EPA Regional Office staff person who granted the waiver, and the date of approval:

Waiver granted: ☐ The owner/operator's headquarters is physically located in a geographic area (i.e., ZIP code or census tract) that is identified as under-served for broadband Internet access in the most recent report from the Federal Communications Commission.

☐ The owner/operator has issues regarding available computer access or computer capability

Name of EPA staff person that granted the waiver:

Date approval obtained: / /

*** Note: You are required to obtain approval from the applicable EPA Regional Office prior to using this paper annual report form. If you have not obtained a waiver, you must file this form electronically using the NPDES eReporting Tool (NeT) at https://www.epa.gov/npdes/stormwater-discharges-industrial-activities**

B. Permit Information

1. NPDES ID:

C. Facility Information

1. Facility Name:

2. Facility Phone: - - Ext.

3. Facility Mailing Address:

Street:

City: State: ZIP Code: -

County or Similar Government Subdivision:

4. Point of Contact:

First Name, Middle Initial, Last Name

D. General Findings

1. Provide a summary of your past year's routine facility inspection documentation, including dates (see Part 3.1.6 of the permit). In addition, if you are an operator of an airport facility (Sector S) that is subject to the airport effluent limitations guidelines, and are complying with the MSGP Part 8.S.8.1 effluent limitation through the use of non-urea-containing deicers, provide a statement certifying that you do not use pavement deicers containing urea (e.g., "Urea was not used at [name of airport] for pavement deicing in the past year and will also not be used in 2021." (Note: Operators of airport facilities that are complying with Part 8.S.8.1 by meeting the numeric effluent limitation for ammonia do not need to include this statement.)

2. Provide a summary of your past year's quarterly visual assessment documentation, including dates (see Part 3.2.3 of the permit).

3. Provide a summary of your past year's corrective action and/or advanced implementation measures (AIM) documentation (See Part 5.1.3 of the permit). (Note: If corrective action is not yet completed at the time of submission of this annual report, you must describe the status of any outstanding corrective action(s).) Note that you must modify your SWPPP based on the corrective actions and deadlines required under Part 5. Also describe any incidents of noncompliance in the past year or currently ongoing, or if none, provide a statement that you are in compliance with the permit.

E. Certification Information

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

First Name, Middle, Last Name

Title:

Signature:

Date: / /

E-mail:

Instructions for Completing EPA Form 6100-28
Annual Report for Stormwater Discharges
Associated with Industrial Activity Under the NPDES Multi-Sector General Permit

This Form Replaces Form 6100-28 (06/15) OMB No. 2040-0300

Who Must File an Annual Report

Operators must submit an Annual Report to EPA electronically, per Part 7.4, by January 30th for each year of permit coverage containing information generated from the past calendar year.

Completing the Form

To complete this form, type or print, using uppercase letters, in the appropriate areas only. Please place each character between the marks. Abbreviate if necessary to stay within the number of characters allowed for each item. Use only one space for breaks between words, but not for punctuation marks unless they are needed to clarify your response. Please submit original document with signature in ink - do not send a photocopied signature.

Section A. Approval to Use Paper Annual Report Form

You must indicate whether you have been granted a waiver from electronic reporting from the EPA Regional Office. Note that you are not authorized to use this paper form unless the EPA Regional Office has approved its use. Where you have obtained approval to use this form, indicate the waiver that you have been granted, the name of the EPA staff person who granted the waiver, and the date that approval was provided. See https://www.epa.gov/npdes/contact-us-stormwater for a list of EPA Regional Office contacts.

Section B. Permit Information

Provide the NPDES ID (i.e., NOI tracking number) assigned to your facility.

Section C. Facility Information

Enter the official or legal name, phone number, and complete street address, including city, state, ZIP code, and county or similar government subdivision, for the facility that is covered by the NPDES ID identified in Section B. If the facility lacks a street address, indicate the general location of the facility (e.g., Intersection of State Highways 61 and 34). Also provide a point of contact name for the facility.

Section D. General Findings

To complete this section you must provide the following information in your annual report:

1. A summary of your past year's routine facility inspection documentation, including inspection dates, required by Part 3.1.6 of the permit.
2. A summary of your past year's quarterly visual assessment documentation, including visual assessment dates, required by Part 3.2.3 of the permit.
3. Information copied or summarized from the corrective action and/or advanced implementation measures (AIM) documentation required per Part 5.1.3 (if applicable). If corrective action and/or advanced implementation measures are not yet completed at the time of submission of this Annual Report, you must describe the status of any outstanding corrective action(s)/advanced implementation measures. You must also describe any incidents of noncompliance in the past year or currently ongoing, or if none, provide a statement that you are in compliance with the permit.

Section E. Certification Information

The Annual Report must be signed by a person described below, or by a duly authorized representative of that person.

For a corporation: By a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means:

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this Part, a principal executive officer of a federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA). Include the name and title of the person signing the form and the date of signing.

A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above;
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company, (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) and
3. The written authorization is submitted to the Director.

An unsigned or undated Annual Report form will be considered incomplete.

Paperwork Reduction Act Notice

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2040-0300). Responses to this collection of information are mandatory (40 CFR 122.26). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 1 hour per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Instructions for Completing EPA Form 6100-28
Annual Report for Stormwater Discharges
Associated with Industrial Activity Under the NPDES Multi-Sector General Permit

This Form Replaces Form 6100-28 (06/15) OMB No. 2040-0300

Submitting Your Form	**For Overnight/Express Mail Delivery:**
If you have been granted a waiver from your Regional Office to submit a paper Annual Report form, you must send your Annual Report form by mail to one of the following addresses: **For Regular U.S. Mail Delivery:** Stormwater Notice Processing Center Mail Code 4203M, ATTN: 2020 MSGP Reports U.S. EPA 1200 Pennsylvania Avenue, NW Washington, DC 20460	Stormwater Notice Processing Center William Jefferson Clinton East Building - Room 7420 ATTN: 2020 MSGP Reports U.S. EPA 1201 Constitution Avenue, NW Washington, DC 20004 Visit this website for instructions on how to submit electronically: https://www.epa.gov/npdes/stormwater-discharges-industrial-activities

ATTACHMENT F

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna Road, NE
Albuquerque, N.M. 87113

Consultation No. 02ENNM00-2014-F-0064

Memorandum

To: Manager, Indian Program Branch, Office of Surface Mining Reclamation and Enforcement, Western Regional Office, Denver, Colorado

From: Supervisor, Fish and Wildlife Service, New Mexico Ecological Services, Albuquerque, New Mexico

Subject: Biological Opinion for the Four Corners Power Plant and Navajo Mine Energy Project

This transmits the U.S. Fish and Wildlife Service (Service) biological opinion (BO) regarding effects of actions associated with the Office of Surface Mining Reclamation and Enforcement (OSMRE) proposed Four Corners Power Plant and Navajo Mine Energy Project on federally listed species and their critical habitats in accordance with section 7(b) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.) and implementing regulations (50 CFR 402). Species affected by the proposed action are: endangered Colorado pikeminnow (*Ptychocheilus lucius*) and its critical habitat, endangered razorback sucker (*Xyrauchen texanus*) and its critical habitat, endangered southwestern willow flycatcher *(Empidonax traillii extimus*) (flycatcher), threatened yellow-billed cuckoo (*Coccyzus americanus*) (cuckoo), endangered California condor (*Gymnogyps californianus*), threatened Mexican spotted owl (*Strix occidentalis lucida*), endangered Mancos milkvetch (*Astragalus humillimus*), endangered Fickeisen plains cactus (*Pediocactus peeblesianus* var. *fickeiseniae*), threatened Mesa Verde cactus (*Sclerocactus mesae-verdae*), and threatened Zuni fleabane (*Erigeron rhizomatus*). You determined that the proposed action is likely to adversely affect Colorado pikeminnow and its critical habitat, razorback sucker and its critical habitat, as well as the flycatcher and the cuckoo. You also determined that the proposed action may affect, but is not likely to adversely affect, California condor, Mexican spotted owl, Mancos milk vetch, Fickeisen plains cactus, Mesa Verde cactus and Zuni fleabane.

We concur with OSMRE's determinations (provided in the biological assessment (BA) (OSMRE 2014b)), which justify the findings that the proposed action is not likely to adversely affect California condor, Mexican spotted owl, Mancos milk vetch, Fickeisen plains cactus, Mesa Verde cactus and Zuni fleabane. We base our concurrence on the rationales provided in the BA and additional Service review and analysis. We conclude informal consultation under section 7 of the ESA for California condor, Mexican spotted owl, Mancos milk vetch, Fickeisen plains cactus, Mesa Verde cactus and Zuni fleabane. Please contact the Service if the proposed action is changed and new information reveals effects of the proposed action to these species or critical habitat to an extent not addressed in the BA or this BO.

This BO does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02; instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and the relationship of those effects to the function and conservation role of critical habitat for the Colorado pikeminnow and razorback sucker to determine whether the current proposal destroys or adversely modifies critical habitat for these species.

During formal consultation, we found that the proposed action will not jeopardize the continued existence of the Colorado Pikeminnow and razorback sucker; or the flycatcher or cuckoo, and will not adversely modify or destroy their respective designated critical habitats in the San Juan River Basin. Working with OSMRE and others, we developed Conservation Measures, Reasonable and Prudent Measures (RPM), and Terms and Conditions that can be implemented in a manner consistent with the intended purpose of the proposed action, and that can be implemented consistent with the scope of the Federal agencies’ legal authorities and jurisdiction. The RPMs are economically and technologically feasible and we believe would avoid the likelihood of jeopardizing the continued existence of Colorado pikeminnow and razorback sucker, flycatcher, and cuckoo or result in the destruction or adverse modification of their designated critical habitats in the San Juan River Basin. The RPMs are necessary and appropriate to minimize the effect of incidental take associated with the proposed action.

In accordance with section 7 of the ESA and its implementing regulations, the BA and this BO represents the best scientific and commercial information available on the effects of the proposed action to federally listed species and their critical habitats, including from any release of nonnative species, water withdrawal, entrainment, or mercury and selenium emissions and subsequent deposition and accumulation in listed species in the San Juan River Basin. A complete administrative record of this consultation is on file at the Service’s New Mexico Ecological Services Field Office, in Albuquerque, New Mexico.

If you have questions regarding this consultation, please contact David Campbell at (505) 761-4745.

Field Supervisor

Attachment

cc: (w/attch)

Regional Director, BIA, Navajo Region, Gallup, New Mexico (Attn. H. Yazzie)
(electronic copy)
Director, Water Division, USEPA, Region 9, San Francisco, California (Attn. G. Sheh)
(electronic copy)
Commander, USACE, Albuquerque District, Albuquerque, New Mexico (Attn. D. Cummings)
(electronic copy)
Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 6,
Denver, Colorado (electronic copy)
Field Supervisor, U.S. Fish and Wildlife Service, Grand Junction Ecological Services Field
Office, Grand Junction, Colorado (electronic copy)
Field Supervisor, U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office,
Phoenix, Arizona (electronic copy)

Endangered Species Act – Section 7 Consultation
Biological Opinion

Four Corners Power Plant and Navajo Mine Energy Project, New Mexico

Agency:	Office of Surface Mining Reclamation and Enforcement
Consultation Conducted By:	U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office
Date Issued:	April 8, 2015
Approved by:	Wally Murphy Field Office Supervisor
Biological Opinion Number:	02ENNM00-2014-F-0064

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LIST OF ACRONYMS

AFY	acre-feet per year
Age 0	age of fish prior to its first anniversary date of hatch, young of year
APS	Arizona Public Service Company
BA	biological assessment
BBNMC	BHP Billiton New Mexico Coal, Inc.
BIA	Bureau of Indian Affairs
BHP	Broken Hill Proprietary
BLM	Bureau of Land Management
BMP	best management practice
BO	biological opinion
BOR	Bureau of Reclamation
C	Celsius
CCR	coal combustion residues
cfs	cubic feet per second
CI	confidence interval
cm	centimeter
CNAP	Colorado Natural Area Program
CNHP	Colorado Natural Heritage Program
COPEC	chemicals of potential environmental concern
CPC	Center for Plant Conservation
DEIS	draft Environmental Impact Statement
DOI	U.S. Department of the Interior
DW	dry weight
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FCPP	Four Corners Power Plant
FGD	flue gas desulfurization
ft	feet
g	gram
GWPRF	Ground Water Protection Research Foundation
ha	hectare
hg	mercury (all forms)
in	inch
IPCC	Intergovernmental Panel on Climate Change
ITS	incidental take statement
kg	kilogram
km	kilometer
kV	kilovolt
LANL	Los Alamos National Laboratories
lb	pound
m	meter
meHg	methylmercury

mi	miles
mg/kg	milligrams per kilogram (equivalent to ug/g)
mg/L	milligrams per liter
mm	millimeter
MMCo	BHP Billiton Mine Management Company
MW	megawatt
ng/L	nanograms per liter
NIIP	Navajo Indian Irrigation Project
NMEP	Navajo Mine Energy Project
NNDFW	Navajo Nation Department of Fish and Wildlife
NNEPA	Navajo Nation Environmental Protection Agency
NNHP	Navajo Natural Heritage Program
NOAEL	no observed adverse effect level
NWR	National Wildlife Refuge
NTEC	Navajo Transitional Energy Company, LLC.
ORV	off road vehicle
OSMRE	Office of Surface Mining Reclamation and Enforcement
PAH	polycyclic aromatic hydrocarbon
PCE	primary constituent element
PNM	Public Service Company of New Mexico
POD	plan of development
ppm	parts per million
Reclamation	U.S. Bureau of Reclamation
RM	river mile
ROW	right of way
RPM	reasonable and prudent measure
Service	U.S. Fish and Wildlife Service
SJGS	San Juan Generating Station
SJRRIP	San Juan River Recovery Implementation Program
SL	standard length of a fish is its total length excluding the length of the caudal fin
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
TL	total length of a fish from tip of snout to flattened end of caudal fin
USFWS	U.S. Fish and Wildlife Service
ug/g	micrograms per gram (equivalent to mg/kg)
ug/L	micrograms per liter
WW	wet weight
YOY	young of year

INTRODUCTION

The Office of Surface Mining Reclamation and Enforcement (OSMRE) and several cooperating agencies are preparing an Environmental Impact Statement (EIS; OSMRE 2014a) for the proposed action under formal consultation (OSMRE 2014b). The proposed action involves federal agency approvals related to the continued operation (from 2016-2041) of the Four Corners Power Plant (FCPP), ongoing mining at Navajo Mine to provide a coal supply to FCPP operations, and issuance or renewal of right-of-ways (ROWs) for several transmission lines and roads associated with the operations of the FCPP and Navajo Mine. The proposed action is collectively termed the Four Corners Power Plant and Navajo Mine Energy Project (FCPP and NMEP, the Project). The OSMRE serves as the Lead Agency for Section 7 consultation on the proposed action with the Service. OSMRE (2014b) described the proposed action in their Biological Assessment (BA) and as supplemented (OSMRE 2014c,d) (the BA and these supporting documents are incorporated herein by reference). The proposed action will require the approval of several other federal Cooperating Agencies including the Bureau of Indian Affairs (BIA), U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE or Corps), and Bureau of Land Management (BLM) (OSMRE 2014a,b).

The Project Proponents are Arizona Public Service Company (APS), BHP Billiton Mine Management Company (MMCo), Public Service Company of New Mexico (PNM), and the Navajo Transitional Energy Corporation, LLC (NTEC). APS is part owner of FCPP and represents the ownership of FCPP for the proposed action. APS owns and operates two of the transmission lines that are part of the proposed action. Public Service Company of New Mexico (PNM) is part owner of the FCPP, owns, and operates two of the transmission lines that are part of the proposed action. The NTEC owns and (through a mine management contract with MMCo) operates Navajo Mine.

Background and Consultation History

The BA (OSMRE 2014a) adequately describes the consultation history for the proposed action. The best scientific and commercial data available on mercury (Hg) and selenium (Se) dynamics in the San Juan River Basin have been updated during the ESA consultation on the proposed action (OSMRE 2014a,b; EPRI 2014). Information about the numbers and distribution of endangered fish in the San Juan River Basin and their life history has also been updated (Freques 2010; Houston et al. 2010; Ryden 2012; USFWS 2011, 2012; Durst and Franssen 2014; Franssen et al. 2014; Osmundson and White 2009, 2014; Valdez 2014). Assessments of various trace element emissions, their risks, their bioaccumulation, their effects to endangered fishes in the San Juan River Basin have been updated too (Osmundson and Lusk 2011; AECOMM 2013; EPRI 2014; OSMRE 2014a,b; Miller 2014). Several effects studies specific to Hg in fish were published (Dillon et al. 2010; AECOM 2013; ERM 2014a, b, including references therein). Additionally, BIA has agreed to reconsider its effects findings associated with the Navajo Indian Irrigation Project (NIIP) and other irrigation projects. BIA has begun developing additional scientific information that may be necessary to supplement their BA (BIA 1999). Therefore, potential future Se discharges potentially from BIA irrigation projects and associated effects to listed species were not considered part of cumulative effects during this ESA consultation.

Since issuance of the BA, several additional meetings have occurred between staff and personnel representing OSMRE, the Service, BIA, APS, PNM, MMCo, and NTEC, as well as various contractors and legal representatives of these entities, to discuss options for ameliorating potential effects to listed species and their critical habitat. In addition, a work group developed a population viability analysis (PVA) for Colorado pikeminnow to identify actions that could potentially be taken to improve its status in the San Juan River Basin (Miller 2014).

On March 13, 2015, OSMRE (2015) and the Project Proponents amended the BA to include a suite of Conservation Measures that are made part of the proposed action, and thereby substantially reduced the Projects' impacts on listed species and their critical habitats. This BO analyzes the effects of the proposed action with those Conservation Measures.

DESCRIPTION OF THE PROPOSED ACTION

ACTION AREA

The action area includes all areas that the proposed action may directly or indirectly affect endangered species or their critical habitat. The proposed action, FCPP and NMEP, is located on the Navajo Nation approximately 15 miles southwest of Farmington, New Mexico (Figure 1). The proposed action includes continued use and maintenance of associated transmission lines that cross Navajo Nation and allotted lands, the Hopi Reservation, the Zia Pueblo, BLM lands, the Petroglyph National Monument, New Mexico State Land Office lands, as well as private land (OSMRE 2014a) (Figure 1).

The action area where direct effects occur includes the Navajo Mine lease areas (Figure 2) and proposed Pinabete Permit Area (Figure 3), the lease area for the FCPP and associated facilities (Figure 4), the APS Weir, and the ROWs for PNM transmission lines to the San Juan Generating Station and West Mesa Switchyard and two ROWs for APS transmission lines within the Navajo Nation boundary (Figure 1) (OSMRE 2014b). The action area where direct and indirect effects occur includes the area that atmospheric trace element deposition from the FCPP emissions would likely occur, as modeled by AECOM (2013) and EPRI (2014), which includes vast portions of the San Juan River Basin and in the Four Corners region (Figure 5). The focus of several analyses in the BA were from the upstream end of the Deposition Area downstream to, and inclusive of, the San Juan Arm of Lake Powell, which may be affected by runoff of materials from the proposed action including the Deposition Area (AECOM 2013; Figure 6).

Geographically, the action area for the proposed project is located in the Four Corners region of the United States; an area associated with the quadripoint consisting of the southwestern corner of Colorado, northwestern corner of New Mexico, northeastern corner of Arizona, and southeastern corner of Utah, and including lands owned by the Navajo Nation and the Hopi. The Four Corners region is part of a larger region known as the Colorado Plateau Provence and is mostly rural, rugged, and arid (OSMRE 2014a).

The San Juan River originates in the San Juan Mountains of southwestern Colorado. It flows approximately 31 miles south to the Colorado/New Mexico border, 190 miles westward to the New Mexico/Arizona border, and 136 miles into Lake Powell, at the western edge of the action area (Figure 6). The San Juan River has few perennial tributaries (the Animas River is the largest) and numerous ephemeral drainages that receive substantial seasonal summer flows. In 1962, the U.S. Bureau of Reclamation (Reclamation or BOR 2001) constructed Navajo Dam in the mainstem of the San Jan River just south of the Colorado border in New Mexico to store flows from the San Juan, Los Pinos, and Piedra Rivers (BOR 2001) (Figure 6).

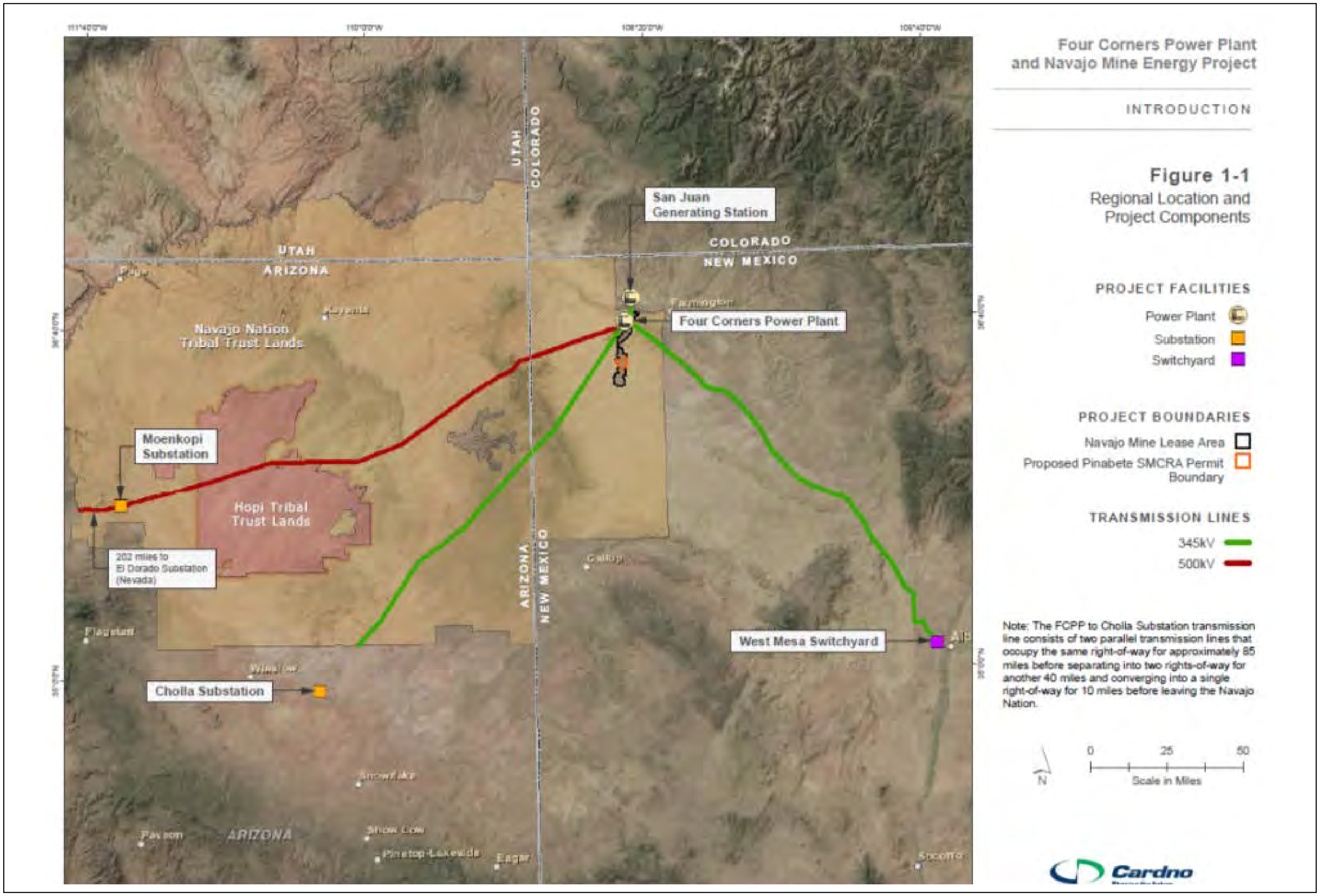


Figure 1. Location of the Four Corners Power Plant and Navajo Mine Energy Project action area (Source: OSMRE 2014a).

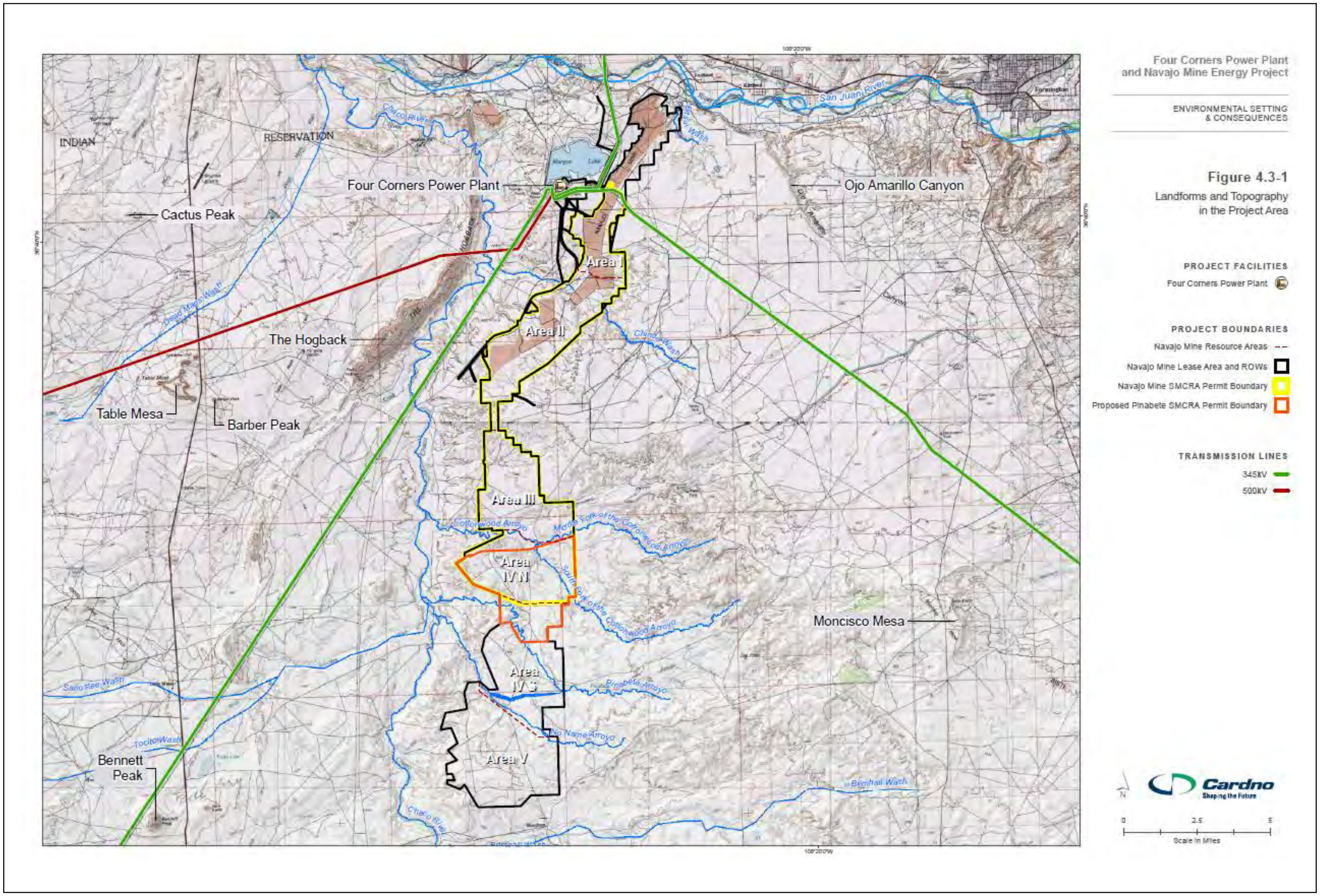


Figure 2. Location of the Navajo Mine operations in the landscape (Source: OSMRE 2014a)

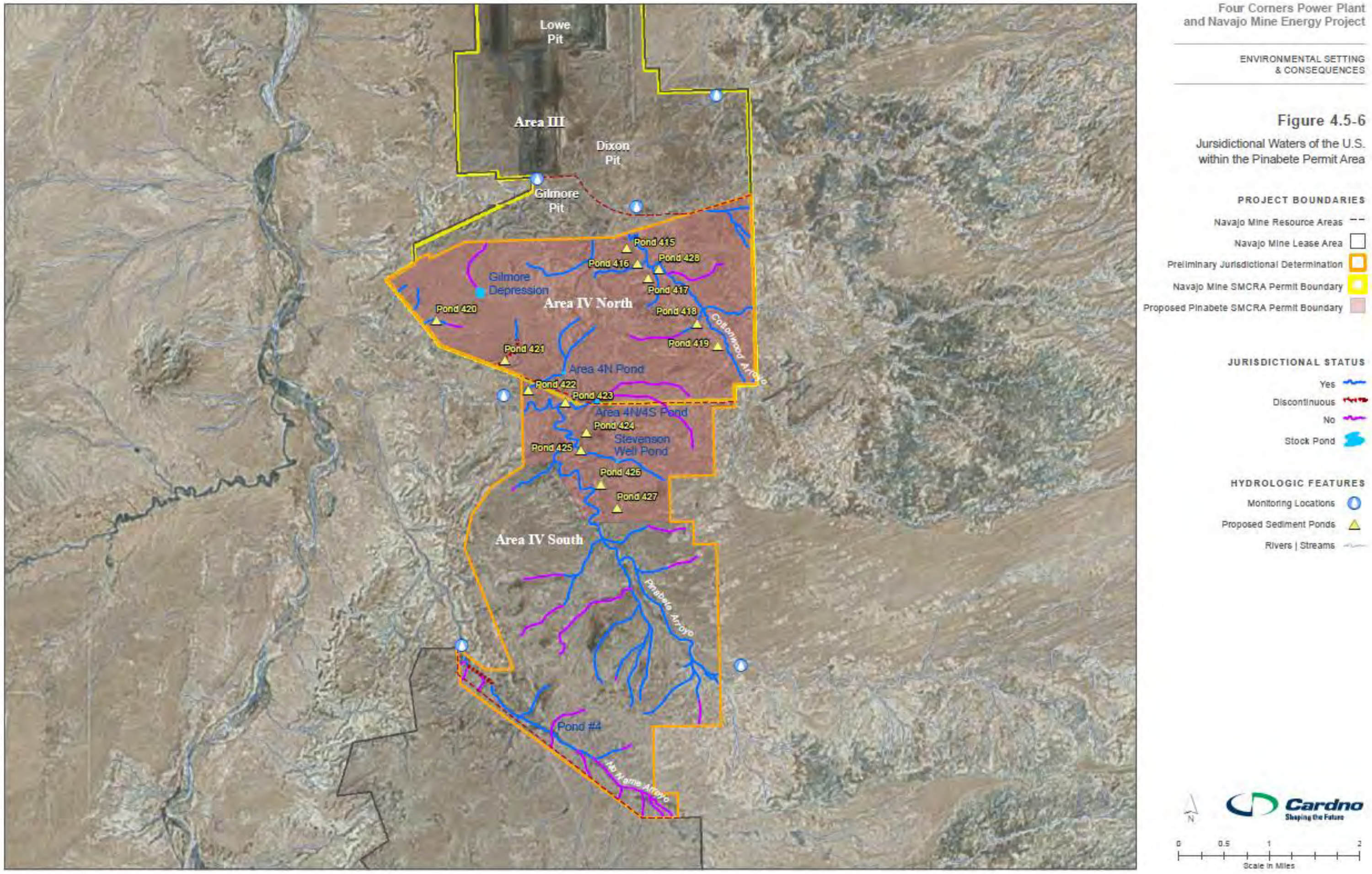
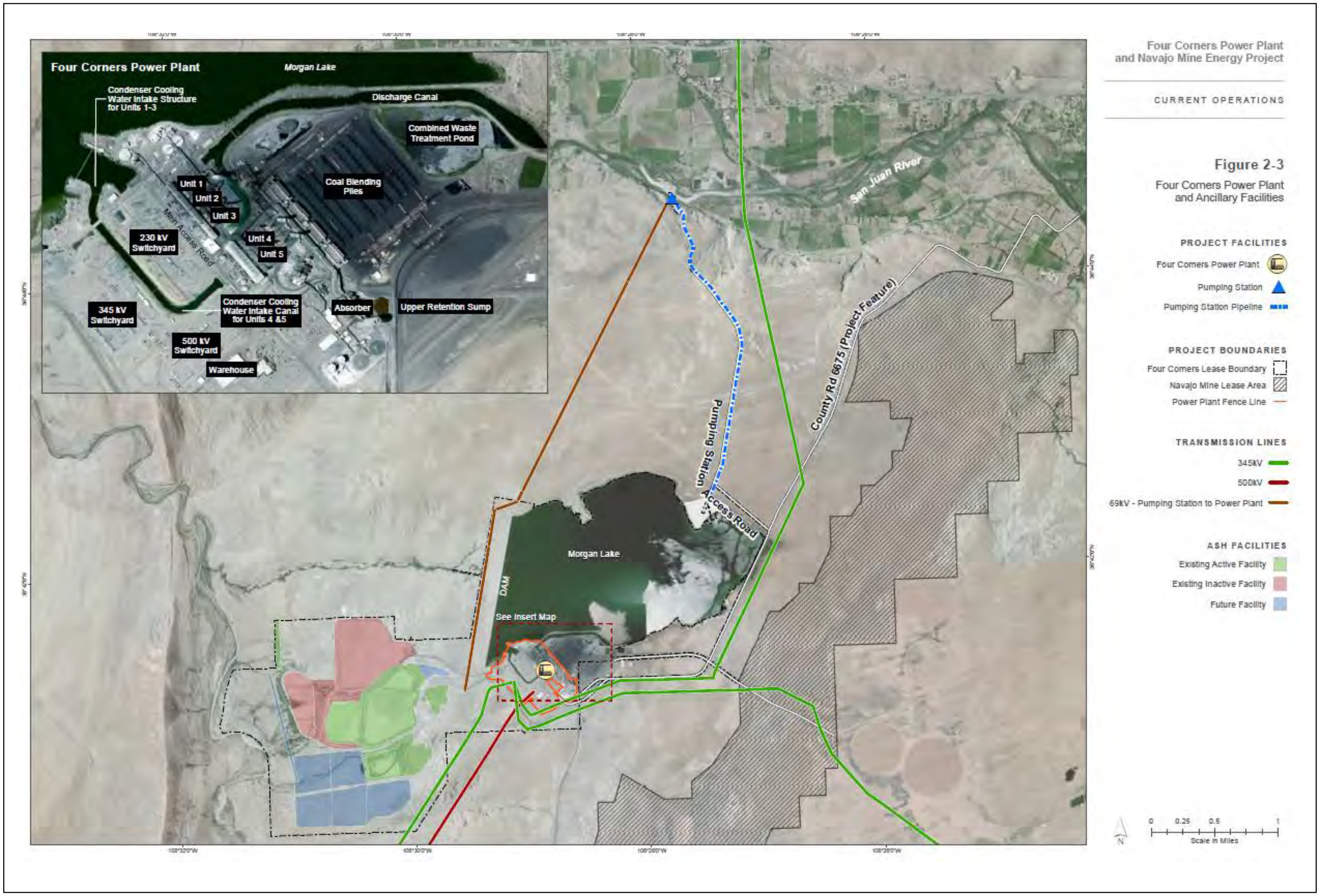


Figure 3. Location of jurisdictional waters on Pinabete Permit Area of Navajo Mine Areas IV North and IV South (OSMRE 2014a).



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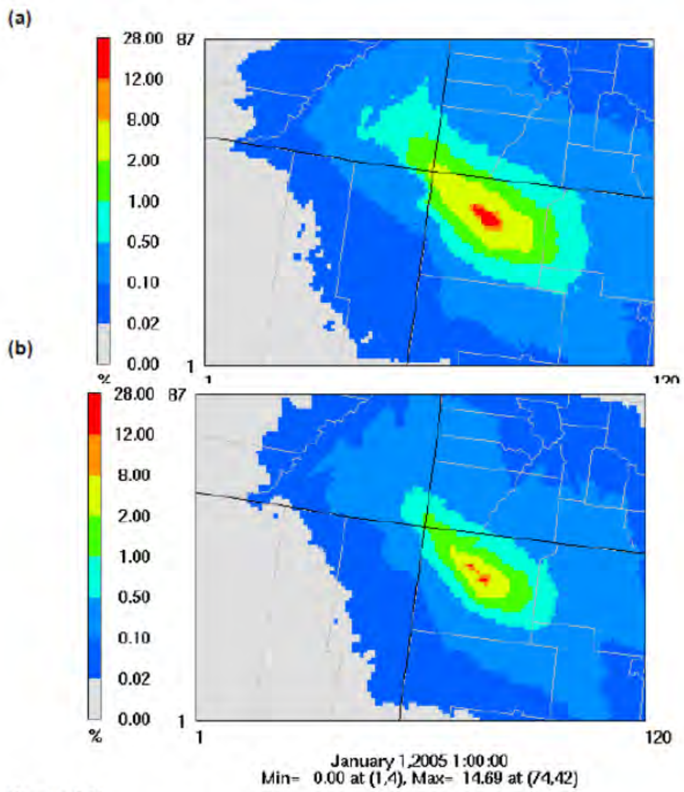
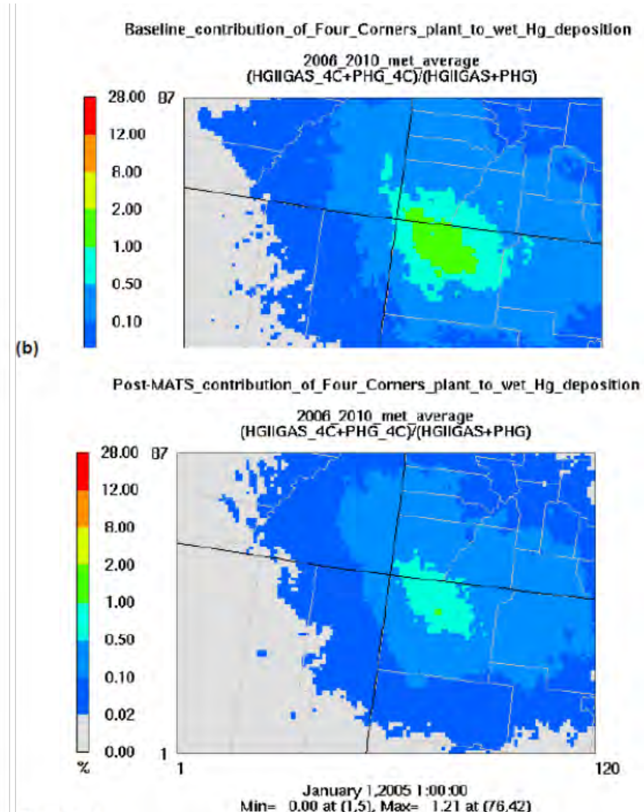


Figure 9-7
Contribution of FCPP Hg Emissions to Total Hg Deposition for (a) Current (pre-MATS) Conditions and (b) 2016 (post-MATS) Conditions



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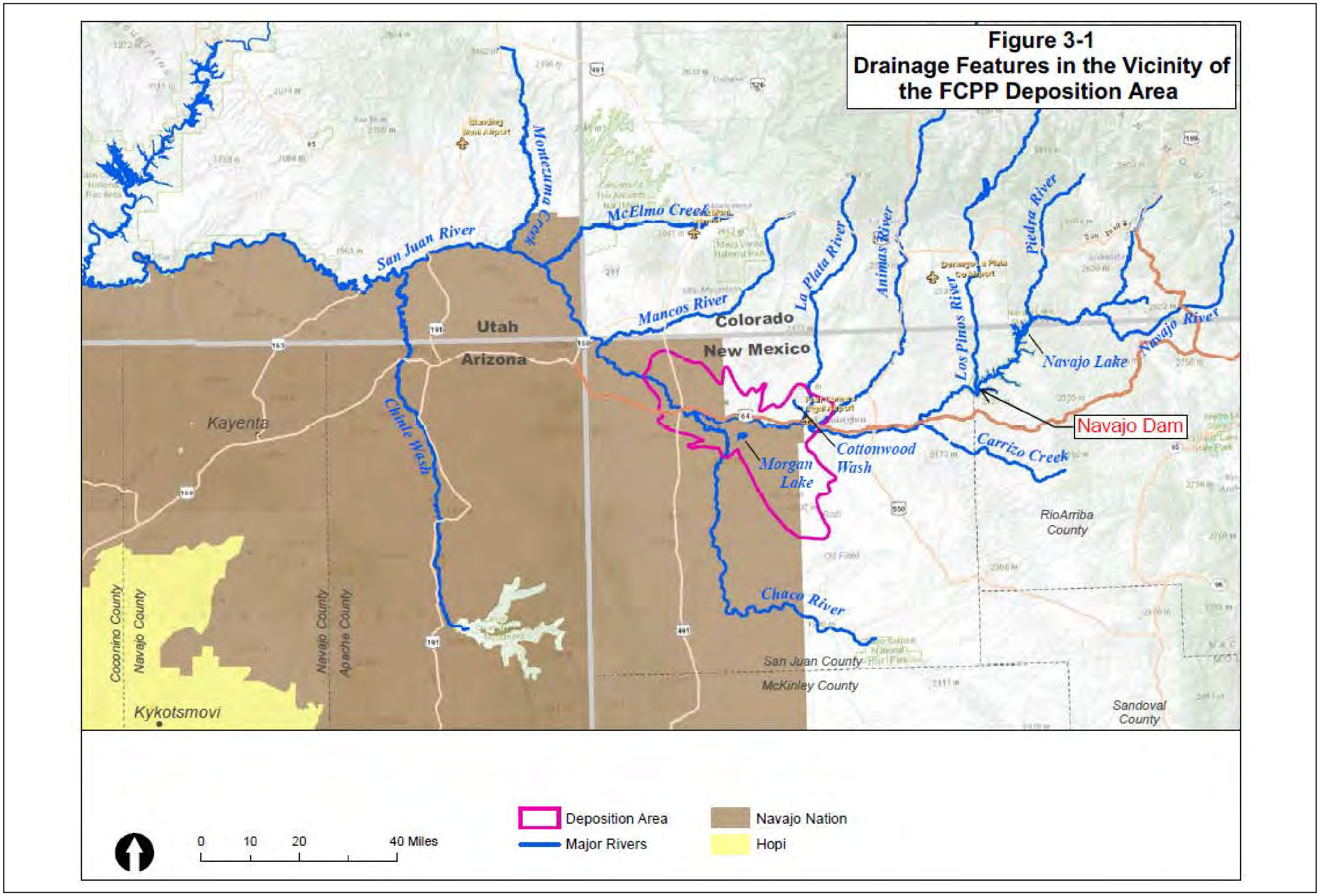

Figure 6. AECOMM (2013) focus area from upstream end of the Deposition Area downstream to the San Juan Arm of Lake Powell.

PROPOSED ACTION

The proposed action consists of the continued operation of the FCPP and NMEP from July 6, 2016, for 25 years into 2041. Based on the EPRI (2014) model, atmospheric deposition and the fate and transport of trace elements from the proposed action into the San Juan River Basin, mercury would remain in the watershed system and potentially contribute downstream after FCPP operations ceased (EPRI 2014). Therefore, the EPRI model of bioaccumulation of mercury in fish was extended through 2074 (a total of 59 years).

The BA (OSMRE 2014b) evaluates the direct and indirect effects of the proposed action to federally listed species and their critical habitats that lie within the action area. The BA also evaluates the effects of actions or activities that are interrelated and interdependent with the proposed action and cumulative effects on these species in the action area. Additional voluntary Conservation Measures were made part of the proposed action in March 2015 and minimize for Project effects on listed species and their critical habitats (OSMRE 2015). The general federal actions included in the effects analysis of this BO are as follows.

Navajo Mine

The Navajo Nation granted a 24,000-acre coal lease in July 1957 to Utah Construction and Mining Company. The Navajo Mine lease area was subsequently increased to approximately 33,600 acres (Areas I through V, Figure2). Since December 30, 2013, NTEC holds the Navajo Mine lease and the lease surface and mineral rights. Under a Mine Management Agreement with NTEC, MMCo will continue to operate and manage the Navajo Mine through 2016. As operator of the mine, MMCo will conduct surface mining and reclamation on the Navajo Mine lease area as approved in OSMRE's SMCRA Permit #NM-0003F and in future revisions or renewals.

Navajo Mine will continue to supply coal to FCPP to support operations from 2016 through 2041. For that purpose, NTEC is working with MMCo for OSMRE approval to renew the Navajo Mine SMCRA Permit NM0003F, effective September 2014, for continued access to coal reserves and to permit the Pinabete Permit Area, a new approximately 5,568-acre surface mine area within Area IV North and Area IV South of the Navajo Mine Lease Area (Figures 2 and 3). Development of coal reserves in the existing Navajo Mine lease area including the proposed Pinabete Permit Area would supply low-sulfur coal to FCPP for up to 25 years at a rate of approximately 5.8 million tons per year.

Within the Pinabete Permit Area, approximately 4,100 acres would be disturbed from surface mining, construction of haul roads (approximately 5.2 miles), light vehicle roads (approximately 20.8 miles), power lines (approximately 7.7 miles), and construction of related infrastructure such as sediment and drainage control ponds, arroyo crossings, and soil and coal stockpiles (approximately 278 acres). Approximately 2.8 miles of Burnham Road, a public access road, will be realigned as planned mining activities approach the road segment, expected to occur in 2022. Coal extraction, coal haulage, coal processing (crushing), road and infrastructure construction, and site reclamation techniques would occur at Navajo Mine. Coal would be extracted utilizing blasting, draglines, trucks, and loaders. Operators will transport mined coal to coal stockpiles using haul trucks, load it onto an existing rail transport system, and deliver it to the on-site coal preparation plant. The coal preparation plant is a stacking and reclaiming facility and not a coal cleaning operation. Water usage at the coal preparation plant is primarily limited to dust suppressant spray and equipment wash down. Surface-water runoff is collected in sediment basins and allowed to evaporate or percolate.

Land and prominent drainage features disturbed by mining and related operations would be reclaimed and restored to their approximate pre-mining conditions in a manner compatible with the designated post-mining land use of livestock grazing and wildlife habitat. Successful reclamation of mined lands would be guaranteed by a surety bond that can only be released after OSMRE determines reclamation areas meet approved performance standards.

The USEPA and/or Corps will authorize Clean Water Act permits to manage effluent discharges to surface waters and fill of five acres of jurisdictional Waters of the United States (WOUS) associated with operations within the Pinabete Permit Area. The proposed action includes the present and future issuance of National Pollutant Discharge Elimination System (NPDES) permits by USEPA for discharges associated with various activities such as coal mining, stormwater runoff, and other discharges (BA, Section 2).

Under the Proposed Action, Navajo Mine Operators would be authorized by USEPA (with certification by the Navajo Nation EPA) to discharge pollutants through various conveyance facilities (e.g., pipes, ditches, etc.) through a new or existing, or modified NPDES Permit No. NN0028193 (the permit number may also change). Additionally, stormwater discharges are authorized with implementation of a Stormwater Pollution Prevention Plan under the Multi-Sector General Permit NPDES Permit No. AZR05001 or under a general Construction Permit. The Construction and Multi-Sector General Permits authorizes discharges associated with coal mining roads, railroad lines, the storage, handling, transportation, and backfilling operations of the coal combustion byproducts, and removal of dams, berms, and ditches, to convey surface water from contact with active mining operations to pits, sumps, or ponds where the water is evaporated, or used for dust suppression. When stormwater runoff exceeds the storm event design holding capacity of the pits, sumps or ponds, or other Best Management Practices (BMPs), then effluents may be discharged to the environment or WOUS under NPDES Permit No. NN0028193, or as authorized by another USEPA-issued NPDES permit.

The U.S. Army Corps of Engineers (USACOE) may also issue an Individual Permit under Section 404 of the Clean Water Act in association with the proposed 5-acre fill of WOUS on the Navajo Mine, as authorized by Corps. Compensatory mitigation will be completed to offset the impacts to WOUS and the temporal loss of their functionality during mining and reclamation activities. USACE will condition any fill discharge authorization associated with the mine to include compensatory mitigation for loss of aquatic resource function during mining activities until reclamation occurs. Compensatory mitigation requirement development will follow USACE South Pacific Division standard operating procedures for establishment of mitigation ratios. Navajo Mine will be required to evaluate and report on the performance of the mitigation efforts on an annual basis until approved performance standards are reached.

The Bureau of Land Management's (BLM) may also approve or disapprove the revised Mine Plan for the proposed maximum economic recovery of coal reserves in the Pinabete Permit Area Resource Recovery and Protection Plan application.

Between 1971 and January 2008, Coal Combustion Residues (CCRs) from FCPP operations were used as mine backfill material in mined-out pits or ramps in Areas I and II at Navajo Mine. The USEPA (2014c) recently classified CCRs as nonhazardous, solid waste and identified management goals for CCRs.

Four Corners Power Plant

The proposed action includes the ongoing operation of FCPP under a new 25-year lease starting on July 6, 2016. In 1966, the Navajo Nation granted a lease for the FCPP and BIA granted ROWs for the plant site and various transmission lines and related facilities (Figure 1 and 4). In 2011, the Navajo Nation approved a new 25-year lease, Lease Amendment No. 3, for operation of the FCPP and forwarded it to BIA for approval. BIA is also considering APS's application to extend its FCPP ROW through 2041. Prior to 2014, the FCPP operated five units to generate approximately 2,100 MW of power. To continue to operate beginning 2016, APS has taken (and will take) a number of steps to make future operations viable over the next 25 years.

On August 6, 2012, the USEPA (2012) issued a source specific Federal Improvement Plan (FIP) requiring FCPP to achieve certain air particulate and oxide emissions reductions under the Clean Air Act (Best Available Retrofit Technology or BART provisions). To achieve air emissions reductions under the BART provisions, APS shut down Units 1, 2, and 3 on December 30, 2013. Additionally, APS proposed to install Selective Catalytic Reduction (SCR) on Units 4 and 5 by 2018 (AECOM 2014). The shutdown of Units 1, 2, and 3 substantially reduced coal consumption and air emissions from historic amounts and lowered the power output of the plant from 2,100 to 1,540 MW. The retirement of Units 1, 2, and 3 and the use of SCR on Units 4 and 5 will result in the decrease of all air pollutants (including Hazardous Air Pollutants (HAPs) emitted (Table 1).

Reductions of HAPs concentrations began in 2014 and preceded the proposed action in 2016. Because the proposed action is scheduled to begin in 2016, the actions taken to shutdown FCPP Units 1, 2, and 3 are part of the Environmental Baseline for this ESA consultation. APS had not yet prepared a final decommissioning plan for the demolition and removal of Units 1, 2, and 3 by the time of this ESA consultation, but committed to complying with all environmental laws and regulations applicable at the time of decommissioning as part of the proposed action.

Transportation and use of urea and hydrated lime are part of the proposed action because both are required for operation of the SCR on Units 4 and 5. Urea solid will be delivered to FCPP by truck and stored on site prior to use. Urea will be converted to ammonia, which will be used to reduce NOx. The use of SCR equipment tends to oxidize some SO_2 to SO_3, which results in increased emission of sulfuric acid (H_2SO_4) mist. Because of these emissions, FCPP requires a Prevention of Significant Deterioration permit from EPA because H_2SO_4 emissions will be above the PSD significant emission threshold. To minimize H_2SO_4 emissions, APS will install a sorbent injection system using hydrated lime as the sorbent. Pursuant to section 7, EPA analyzed the effects of issuance of the permit to listed species and critical habitat and determined that the issuance of the permit may affect, but is not likely to adversely affect southwestern willow flycatcher, Mexican spotted owl, Yellow-billed cuckoo, Colorado pikeminnow, razorback sucker, Mancos milk-vetch, Mesa Verde cactus, and designated critical habitat for these species within the Deposition Area (AECOM 2014, OSMRE 2014a). The USFWS issued their concurrence with these findings on June 20, 2014 (USFWS 2014).

Other than SCR installation, Units 4 and 5 would continue operating as they have historically.

Table 1. Historical and proposed FCPP Hazardous Air Pollutant (HAP) emissions

FCPP Hazardous Air Pollutants (Metals) Emissions	2000-2011 FCPP HAPs Emissions			2014-2041 FCPP HAPs Emissions	Comparison of Historical FCPP Emissions
	Units 1 to 5 (lb/yr)	Units 1 to 3 (lb/yr)	Units 4 & 5 (lb/yr)	Units 4 & 5 (lb/yr)	Reduction (%)
Antimony (Sb)	32	10	22	20	37%
Arsenic (As)	81	25	56	51	37%
Beryllium (Be)	31	10	22	20	37%
Cadmium (Cd)	57	17	39	36	37%
Chromium (Cr)	397	120	277	250	37%
Cobalt (Co)	84	25	59	53	37%
Copper[2]	876	264	612	552	37%
Lead (Pb)	465	142	323	292	37%
Manganese (Mn)	1113	336	777	702	37%
Mercury (total) (Hg)[3]	447	311	136	149	67%
Nickel (Ni)	358	108	251	226	37%
Selenium (Se)[4]	2450	1971	479	523	79%

Emission estimates based on emission factors from "Updated Hazardous Air Pollutants (HAPs) Emissions Estimates and Inhalation Human Health Risk Assessment for U.S. Coal-Fired Electric Generating Units" (Report 1017980, December), except as noted.
[1] Based on BART PM limit of 0.015 lb/MMBtu
[2] Copper based on chromium (metal with closest boiling point) and 2010 FCPP TRI Cu/Cr ratio of 2.21
[3] Source of this information is OSMRE (2014a,b,c)
[4] Based on EPRI Western coal data and 98% efficiency for Units 4 and 5 and 80% efficiency for Units 1,2 and 3.

Under the proposed action, the size of the Dry Fly Ash Disposal Area (DFADA) within the existing FCPP lease area will increase in size. The Ash Disposal Area currently consists of the Lined Ash Impoundment, reclaimed Evaporation Ponds, the Lined Decant Water Pond, inactive ash disposal areas, and the DFADA. The USEPA CCR rule will govern the future management of CCRs at FCPP as solid wastes. OSMRE (2014a,b) reported that there is an extremely low probability that a containment failure of an ash pond could occur and a Spill Contingency Countermeasures plan would address that risk.

Under the proposed action, operators of the FCPP could be authorized by USEPA (with certification by the Navajo Nation EPA) to discharge pollutants through various conveyance facilities (e.g., pipes, ditches, etc.) through a new or existing, or modified NPDES Permit No. NN0000019. Similarly, discharges of stormwater could occur under a Stormwater Pollution Prevention Plan authorized by Multi-Sector General Permit NPDES Permit No. AZR05001 or by a General Construction Permit. The USEPA's NPDES permits set technology-based limits on FCPP effluent discharges at three outfalls to Morgan Lake from condenser-cooling water, chemical metal cleaning water, and from a combined waste treatment pond, and one outfall from Morgan Lake to No Name Wash.

Transmission Lines and Ancillary Facilities

The proposed action includes BIA ROW renewals for three existing APS transmission lines (FCPP to Moenkopi 500-kilovolt (kV) line and the FCPP to Cholla 345 kV lines [2 lines]) within the Navajo Nation boundary and two PNM transmission lines (FCPP to West Mesa 345-kV line and the FCPP to San Juan 345-kV line) as well as a BLM ROW renewal for PNM's West Mesa 345-kV line. These lines will continue to be maintained and repaired as required. No new roads or access routes were anticipated under the proposed action. Other than routine maintenance and repair, no changes or modifications are anticipated for the transmission lines, the three FCPP switchyards, Moenkopi Substation, 12-kV lines, or access roads to ensure continued operation of FCPP through 2041.

San Juan River Diversion and Water Withdrawal

Surface water for industrial use is pumped from the San Juan River into Morgan Lake and then pumped from the lake into FCPP and used for cooling purposes. The intake structure on the river consists of two, 8-by8.5-foot intake bays, which are covered by screens and are placed perpendicularly to the flow of the river just upstream of the APS Weir. APS Weir is an existing concrete slab structure that crosses the entire river and has a gate and sluiceway assembly on the south side of the river. Operation of the gate at APS Weir controls the local water surface elevation to provide adequate water coverage of the intakes bays and pumping operations (Stamp et al. 2005; OSMRE 2014b). During 2001-2011, an average of 27,682 AFY of water was used by the FCPP (OSMRE 2013a, b). The closure of FCPP Units 1 to 3 is expected to reduce water use by 5,000 to 7,000 AFY.

In 1958, the State of New Mexico granted Utah International, the predecessor in interest to, BHP Billiton New Mexico Coal Inc. (BBNMC), a permit (NMOSE Permit No. 2838) for consumptive use (39,000 acre-feet per year [af/yr]) and diversion (51,600 af/yr) of surface water from the San Juan River. This water is diverted at the APS Weir through the intake bays. The State permit authorizes use of water for coal mining, coal processing and beneficiation, coal utilization including electric power generation and production of coal chemicals. Permit 2838 has provided and will continue to provide all the necessary water supply to support operations at FCPP and Navajo Mine including all water use associated with the Proposed Action.

The BA provides an itemized list of the various activities, permits, and approvals that will occur under the proposed action (OSMRE 2014a,b) that are included here by reference. A number of Conservation Measures are included as part of the proposed action to avoid or reduce the effects on listed species and their critical habitats. Such measures include those that will be or are required by the permits described in the BA, as well as conservation measures proposed by FCPP and NMEP, which include the ongoing implementation and adherence to numerous standard operating procedures and BMPs. Those conservations measures are described in the BA (OSMRE 2014b) and include updates to the best commercial and scientific information available on endangered species in the San Juan River Basin (AECOM 2013a,b; EPRI 2014; Miller 2014). Additional Conservation Measures were incorporated into the proposed action (OSMRE 2015) that minimize for Project effects on listed species.

Conservation Measures

OSMRE is the lead federal agency responsible for preparing the BA for the FCPP and NMEP as required the ESA. The BIA, as a key cooperating agency, has closely coordinated with OSMRE with the consultation in accordance with the requirements of the ESA. On August 8, 2014, OSMRE provided the US Fish and Wildlife Service New Mexico Ecological Service Field Office (NMESFO) the final BA for the project.

The BA evaluated the Proposed Action in sufficient detail to determine to what extent the Proposed Action may affect any ESA threatened, endangered, proposed or candidate species and designated or proposed critical habitat that may occur in the Action Area. In preparing this assessment, OSMRE used best scientific and commercial information available, pursuant to statutory requirements. However, since submission of the BA, OSMRE, BIA, and the USFWS had extensive conversations regarding potential effects the Proposed Action (without the Conservation Measures) could have on listed species and their critical habitats that occur in the Action Area. These conversations focused on the Colorado pikeminnow, the razorback sucker, flycatcher and cuckoo and their critical habitat. These discussions have allowed OSMRE and BIA to have a more comprehensive perspective of the measures necessary to help ameliorate those impacts. These conversations allowed OSMRE and BIA, working with the Project Proponents, to develop several voluntary conservation measures that they understand are critical to reducing the effects of the Proposed Action on listed species and critical habitats.

OSMRE amended (OSMRE, 2015) the Final BA with the following 11 Conservation Measures:

> As the lead federal agency conducting consultation under Section 7 of ESA for FCPP/NMEP, and acting under the provisions of the Surface Mining Control & Reclamation Act, OSMRE will evaluate and consult with the Service on all discretionary OSMRE permitting actions within OSMRE's authority that have the potential to deposit mercury (Hg) in the San Juan River. OSMRE will conduct this evaluation every two years and consult with USFWS upon completion of the evaluation. In evaluating and consulting on such actions, if adverse Hg effects to the Colorado pikeminnow, or adverse modification of its critical habitat due to Hg deposition, are determined likely, OSMRE will initiate formal ESA consultation to reduce these likely effects; and will ensure implementation of any subsequently developed measures to offset Hg effects to this species.
>
> 1. As a key cooperating agency coordinating with OSMRE in the ESA consultation process, BIA will obligate funding in fiscal year 2015 for the purposes of a Razorback sucker Selenium Effects Study. This study is

expected to assist with clarifying what level of selenium causes adverse impacts to razorback sucker in the San Juan Basin.

2. OSMRE will work with USEPA and the Project Proponents to minimize the effects of the Proposed Action on Colorado pikeminnow, razorback sucker, southwestern willow flycatcher, or yellow-billed cuckoo, by developing comprehensive guidelines and criteria for ESA review of future USEPA-issued NPDES permits for the Project.
3. OSMRE will coordinate with USEPA and the Project Proponents to review the likelihood and pathways of effluent exposure, the concentrations of Hg and Se necessary to protect endangered species in suitable habitats, and results of the monitoring program funded in Conservation Measure 7 to identify such concentrations in their habitats, and coordinate an approach toward subsequent ESA review of future proposed NPDES permits for the Project, as described in RPM 5.
4. Project Proponents will develop and implement a Pumping Plan to reduce the magnitude and types of entrainment of Colorado pikeminnow and razorback sucker. The Pumping Plan will optimize avoidance of entrainment of larvae and impingement of larger fishes through measures that are deemed feasible without altering the current operating configuration at the river pump station.
   a. The Pumping Plan measures shall be developed with the oversight of OSMRE and the approval of the Service.
   b. The final Pumping Plan shall be implemented within 2 years of issuance of a Record of Decision.
5. Project Proponents will develop and implement a Non-native Species Escapement Prevention Plan, which will include the following measures to minimize: (a) the risk of nonnative species (plants, invertebrates, and fish) that inhabit Morgan Lake invading San Juan River; and (b) the introduction of additional nonnative species into Morgan Lake.
   a. Project Proponents will develop and disseminate public education materials regarding the threat of non-native species targeted to recreational users of Morgan Lake. The materials will recommend practices to prevent the introduction of new nonnative species to Morgan Lake or the transfer of existing nonnative species from Morgan Lake to the San Juan River.
   b. Project Proponents will install and operate a device designed to prevent the transfer of nonnative fish species from Morgan Lake to the San Juan River.
6. Project Proponents will work with the Service to support the San Juan River Basin Recovery Implementation Program (SJRRIP) efforts to ensure that a fish passage is designed and constructed by the SJRRIP at the APS Weir by contributing funds for the fish passage, as outlined in Conservation Measure 7 below.
7. As a Conservation Measure Project Proponents shall contribute to the survival and recovery of the Colorado pike minnow and razorback sucker by funding specific Recovery Actions identified in Table 1 (see below). The

Service, in coordination and collaboration with the SJRRIP, will determine the most appropriate method for implementing these Recovery Actions.

a. Funding will be provided to the SJRRIP through the National Fish and Wildlife Foundation (NFWF) on an initial and annual basis every year that the Project remains in operation. Annual Funding will be adjusted according to the annual Consumer Price Index (CPI). Funding will contribute to both new and existing SJRRIP Recovery Actions.
b. Funding through NFWF will be managed and administered by the SJRRIP Program Office according to the terms and conditions set forth in a contract with NFWF, including a condition that the SJRRIP provide reports on implementation of Recovery Actions.
    i. Propagation of endangered fishes will contribute towards the offset of losses associated with the proposed action.
    ii. Nonnative fish removal, combined with the measures in Conservation Measure 5, will reduce the adverse effects to Colorado pikeminnow and razorback sucker designated Critical Habitat.
    iii. Protection, management and augmentation of fish habitat will contribute towards the offset of losses associated with the proposed action.
    iv. Monitoring of fish and habitat is required to track implementation of the Conservation Measures and contribute scientific information to support adaptive management by the SJRRIP.
    v. Modification of APS Weir with a fish passage will allow endangered fish increased access of up to 18 miles of fish habitat, including new portions of Colorado pikeminnow critical habitat.
    vi. Monitoring of Hg and Se in endangered fish every 5 years is required to track implementation of the Funded Recovery Actions and will contribute scientific information to support adaptive management by the SJRRIP.
    vii. Conducting Hg Studies in Colorado pikeminnow will assist the tracking of implementation of the Funded Recovery Actions and contribute scientific information to support adaptive management by the SJRRIP.
    viii. Funding a USFWS senior biologist will facilitate Hg/Se reviews and contribute towards implementation of Recovery Actions.

Table 1. Recovery Actions to be funded by Project Proponents and implemented by the SJRRIP. (* Annual costs subject to Consumer Price Index)

Funded Recovery Action	One-time Cost		Annual Cost*	
Propagate Endangered fish			$40,600	
Remove Nonnative fish			$50,361	
Protect, Manage and Augment fish habitat (including flood plains)			$153,045	
Monitor fish habitat			$103,463	
Partial funding of fish passage at the APS weir	$620,000			
Conduct Monitoring of Hg and Se in endangered fish or their surrogates			$60,000	
Conduct studies of Hg in Colorado pike minnow	$600,000			
Contribute towards SJRRIP staff biologist to conduct these and other Recovery Actions			$126,000	
Conduct a Navajo Dam Temperature Modification Feasibility Study	$100,000			
Totals	$1,320,000		$533,469	

8. Project Proponents shall provide a Spill Contingency Countermeasures Plan which addresses potential Ash Pond Failure impacts on suitable habitat of Colorado pikeminnow, razorback sucker, southwestern willow flycatchers or yellow-billed cuckoos.
    a. All necessary equipment, training, and materials will be made available for emergency response to a potential Ash Pond Failure.
    b. A practice response table-top drill with appropriate authorities will be conducted every 10 years.
9. Project Proponents shall conduct standard protocol surveys for southwestern willow flycatchers and yellow-billed cuckoos.
    a. Within at least 85 acres of the Deposition Area beginning in 2016 and continuing until 2042 or until the Project ceases operation, to monitor the effects of Hg and Se deposition to nesting flycatchers and cuckoos.
    b. Presence/absence flycatcher and cuckoo surveys will be conducted within at least one optimal or suitable habitat (AECOM 2013c,d) on the Navajo Mine Lease Area during the spring migration period to monitor the potential effects of noise and disturbance to migrant flycatchers from 2016 until 2042 or until the Project ceases operation.
10. Project Proponents shall mitigate effects of endangered plants within the rights-of-way of transmission line maintenance activities through implementation of the Environmental Screening Program.
11. Project Proponents shall share data and report to the Service and OSMRE annually on implementation of the Conservation Measures and their implementing terms and conditions.

STATUS OF THE SPECIES (INCLUDING IN THE ACTION AREA)

COLORADO PIKEMINNOW

The Colorado pikeminnow is the largest cyprinid (member of the minnow family, Cyprinidae) native to North America and it evolved as the top predator in the Colorado River system. It is an elongated pike-like fish that once grew as large as 1.8 m (6 ft) in length and weighed nearly 45 kg (100 lbs) (Behnke and Benson 1983); such fish were estimated to be 45-55 years old (Osmundson et al. 1997). Today, Colorado pikeminnow rarely exceed 1 m (approximately 3 ft) in length or weigh more than 8 kg (18 lbs). The mouth of this species is large and nearly horizontal with long slender pharyngeal teeth (located in the throat), adapted for grasping and holding prey. The diet of Colorado pikeminnow longer than 80 to 100 mm (3 or 4 in.) consists almost entirely of other fishes (Vanicek and Kramer 1969). Adults are strongly counter-shaded with a dark, olive back, and a white belly. Young are silvery and usually have a dark, wedge-shaped spot at the base of the caudal fin.

Based on early fish collection records, archaeological finds, and other observations, the Colorado pikeminnow was once found throughout warm water reaches of the entire Colorado River Basin down to the Gulf of California, including reaches of the upper Colorado River and its major tributaries, the Green River and its major tributaries, the San Juan River and some of its tributaries, and the Gila River system in Arizona (Seethaler 1978, Platania 1990; Houston et al. 2010). Colorado pikeminnow apparently were never found in colder, headwater areas. Seethaler (1978) indicated that the species was abundant in suitable habitat throughout the entire Colorado River Basin prior to the 1850s. By the 1970s, they were extirpated from the entire lower basin (downstream of Glen Canyon Dam) and from portions of the upper basin as a result of major alterations to the riverine environment. Having lost approximately 75-80 percent of its former range, the Colorado pikeminnow was federally listed as an endangered species in 1967 (Service 1967, Miller 1961, Moyle 1976, Tyus 1991, Osmundson and Burnham 1998).

Critical habitat was designated for the Colorado pikeminnow in 1994 within the 100-year floodplain of the species' historical range in the following areas of the San Juan River Basin (59 FR 13374): San Juan County, New Mexico, and San Juan County, Utah, including the San Juan River from the New Mexico State Route 371 Bridge in Township 29 North, Range 13 West, section 17 (of the New Mexico Principal Meridian), to the full pool elevation at the mouth of Neskahai Canyon on the San Juan arm of Lake Powell in Township 41 South, Range 11 East, in section 26. The primary constituent elements (PCEs) of critical habitat are the same for both the Colorado pikeminnow and the razorback sucker.

The PCEs of Colorado pikeminnow critical habitat include:

Water: a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for the species;

Physical habitat: areas of the Colorado River system that are inhabited or potentially habitable for spawning, feeding, rearing, as a nursery, or corridors between these areas, including oxbows, backwaters, and other areas in the 100-year floodplain which when inundated provide access to spawning, nursery, feeding, and rearing habitats; and,

Biological environment: adequate food supply and ecologically appropriate levels of predation and competition.

Colorado Pikeminnow Life History

The life history phases that appear to be most limiting for Colorado pikeminnow populations include spawning, egg hatching, development of larvae, and the first year of life. These phases of pikeminnow development are closely tied to specific habitat requirements. Natural spawning of pikeminnow is initiated on the descending limb of the annual hydrograph as water temperatures approach the range of 16 ˚C (60.8 ˚F) to 20 ˚C (68 ˚F) (Vanicek and Kramer 1969; Hamman 1981; Haynes et al. 1984; Tyus 1990; McAda and Kaeding 1991). However the temperatures when spawning is initiated varies by river, 20-23 ˚C (68-73 ˚F) in the Green River; 16-23 ˚C (61-68 ˚F) in the Yampa River (Bestgen et al. 1998); 18-22 ˚C (64-72 ˚F) in the Colorado River (McAda and Kaeding 1991); and 16-22 ˚C (61-72 ˚F) in the San Juan River. Spawning, both in the hatchery and under natural riverine conditions, generally occurs in a 2-month period between late June and late August. However, sustained high flows during wet years may suppress river temperatures and extend spawning into September (McAda and Kaeding 1991). Conversely, during low flow years, when the water warms earlier, spawning may commence in mid-June. On the San Juan River, based on the collection of larval fish from 1993 to 2013, spawning occurred between 23 May and 18 July (Farrington et al. 2013, 2014).

Temperature also has an effect on egg development and hatching success. In the laboratory, egg development was tested at five temperatures and hatching success was found to be highest at 20 ˚C (68 ˚F), and lower at 25 ˚C (77 ˚F). Mortality was 100 percent at 5, 10, 15, and 30˚C (41, 50, 59, and 86 ˚F). In addition, larval abnormalities were twice as high at 25 ˚C (77 ˚F) than at 20 ˚C (68 ˚F) (Marsh 1985). Experimental tests of temperature preference of yearling and adult pikeminnow indicated that 25 ˚C (77 ˚F) was the most preferred temperature for both life phases (Bulkley et al. 1981; Black and Bulkley 1985a). Additional experiments indicated that optimum growth of yearlings also occurs at temperatures near 25 ˚C (77 ˚F) (Black and Bulkley 1985b).

Males become sexually mature earlier and at a smaller size than do females, though all are mature by about age 7 and 500 mm (20 in) in length (Vanicek and Kramer 1969; Seethaler 1978; Hamman 1981). Hatchery-reared males became sexually mature at four years of age and females at five years. Of 24 nine-year-old females, average fecundity was 77,400 eggs/female (range, 57,766 – 113,341) or 55,533 eggs/kg, and average fecundity of nine 10-year old females was 66,185 eggs/female (range, 11,977 – 91,040) or 45,451 eggs/kg (Hamman 1986). Valdez (2014) summarized a relationship between number of eggs produced and female Colorado pikeminnow body weight as y = 39907.24 + 11.4117 * Female Body Weight (g). For Age 7 through Age 10 female Colorado pikeminnow the average number of eggs was 62,133/female.

Collections of Colorado pikeminnow larvae and young-of-year (YOY or Age 0) downstream of known spawning sites in the Green, Yampa, and San Juan Rivers demonstrate that downstream drift of larval pikeminnow occurs following hatching (Haynes et al. 1984; Nesler et al. 1988; Tyus 1990; Tyus and Haines 1991; Platania 1990; Ryden 2003a). Studies on the Green and Colorado rivers found that YOY used backwaters almost exclusively (Holden 2000). During their first year of life, Colorado pikeminnow prefer warm, turbid, relatively deep (averaging 0.4 m [1.3 ft]) backwater areas of zero velocity (Tyus and Haines 1991). After about 1 year, young are found rarely in such habitats, although juveniles and subadults are often located in large deep backwaters during spring runoff (Service, unpublished data; Osmundson and Burnham 1998).

Colorado pikeminnow often migrate considerable distances to spawn in the Green and Yampa Rivers (Miller et al. 1982; Archer et al. 1986; Tyus and McAda 1984; Tyus 1985; Tyus 1990), and similar movement has been noted in the main channel San Juan River. A fish captured and tagged in the San Juan arm of Lake Powell in April 1987, was recaptured in the San Juan River approximately 80 miles upstream in September 1987 (Platania 1990). Ryden and Ahlm (1996) reported that a pikeminnow captured at river mile (RM) 74.8 (between Bluff and Mexican Hat) made a 50 to 60 mile migration during the spawning season in 1994, before returning to within 0.4 miles of its original capture location. Although migratory behavior has been documented for adult Colorado pikeminnow in the San Juan River (Platania 1990, Ryden and Ahlm 1996), the majority of adults in the San Juan River appear to reside near the area in which they spawn (Ryden and Ahlm 1996; Miller and Ptacek 2000), in contrast to Colorado pikeminnow adults in the Green and Yampa Rivers. Ryden and Ahlm (1996) and Miller and Ptacek (2000) documented Colorado pikeminnow in the San Juan River aggregating at the mouth of the Mancos River prior to spawning, a behavior not documented in other rivers. Movements of juvenile Colorado pikeminnow in the San Juan River, upstream from spring to summer and back downstream over winter, may be associated with maximizing growth along longitudinal and seasonal temperature regimes (Durst and Franssen 2014).

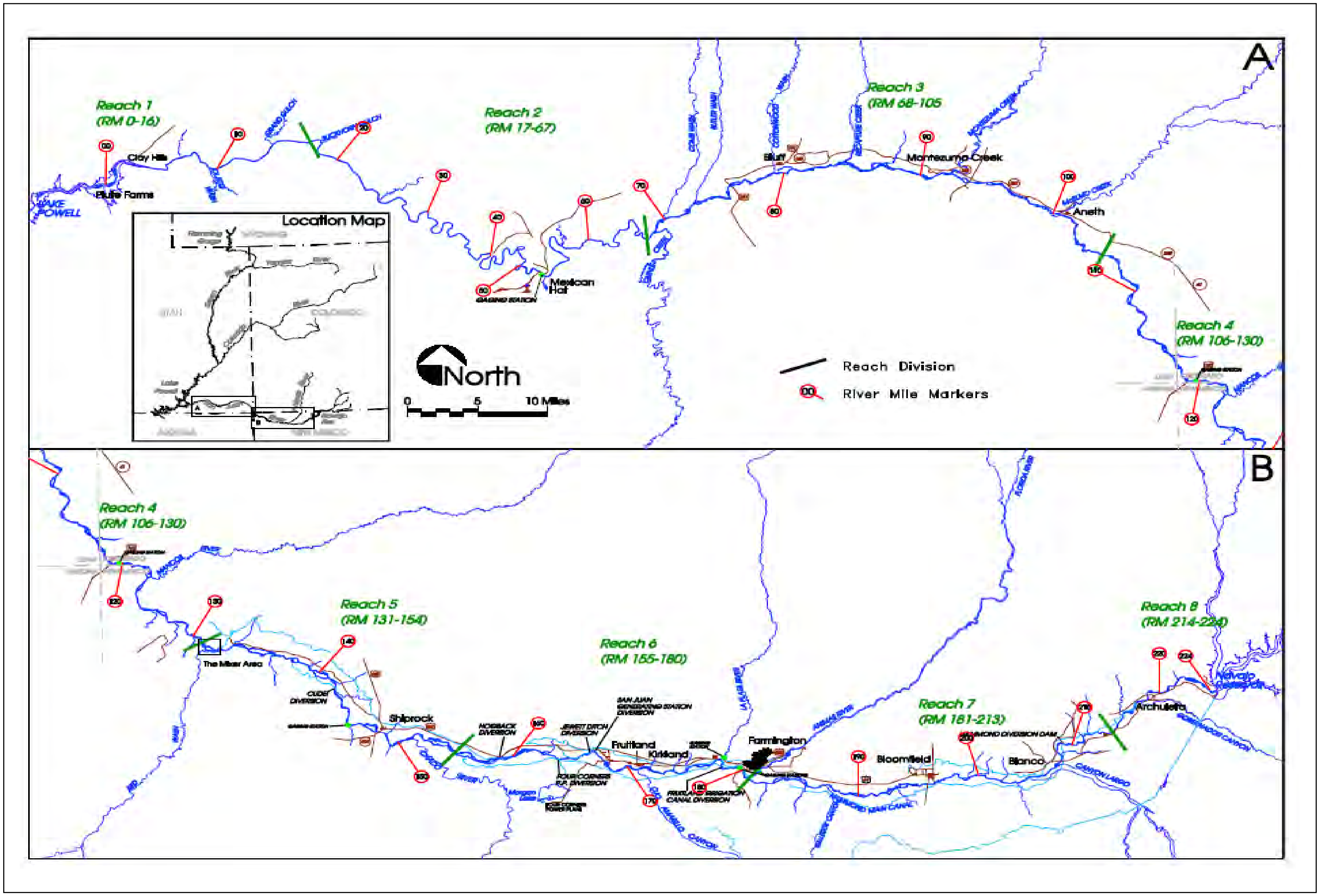

Figure 7. San Juan River location map indicating River Miles, River Reaches, and the Mixer Area.

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On the Green River, tributaries are an important habitat component for pikeminnow (Holden 2000). Both the Yampa River and White River were heavily used by Colorado pikeminnow subadults and adults, apparently as foraging areas (Tyus 1991). The tributaries were the primary area of residence to which the adults returned after spawning. Nearly all tributaries to the San Juan River no longer provide habitat for adults because they are dewatered or access is restricted (Holden 2000).

However, Colorado pikeminnow utilized the Animas River in the late 1800s, and this river or other perennial portions of tributaries could still provide suitable habitat (Zimmerman et al. 2005; Fresques et al. 2013). Five stocked Colorado pikeminnow were documented in the lower reaches of the Animas River in 2004 (Zimmerman et al. 2005). Since the installation of the selective fish passage structure at RM 166 in 2003, over 800 Colorado pikeminnow have passed upstream (SJRIP unpublished data), increasing the probability that the Animas River, 15 miles upstream, will once again be used by this species. Colorado pikeminnow aggregated at the mouth of the Mancos River prior to spawning in the early 1990s (Ryden and Ahlm 1996; Miller and Ptacek 2000). One individual was found almost 0.5 miles upstream in the Mancos River on two separate occasions (Ryden pers. obs.). Colorado pikeminnow were detected in Yellow Jacket Canyon (a tributary of McElmo Creek) each year from 2007 to 2010 (Fresques et al. 2013). All 11 pikeminnow (168-425 mm TL) detected in Yellow Jacket Canyon were thought to have originated from juvenile fish stocked in the mainstem San Juan River but only one was captured with a previously implanted PIT tag to confirm their origin (Fresques et al. 2013).

Very little information is available on the influence of turbidity on the endangered Colorado River fishes. Osmundson and Kaeding (1989) found that turbidity allows use of relatively shallow habitats, ostensibly by providing adults with cover; this allows foraging and resting in areas otherwise exposed to avian or terrestrial predators. Tyus and Haines (1991) found that young Colorado pikeminnow in the Green River preferred backwaters that were also turbid. Bestgen et al. (2006) found that in a laboratory setting, turbidity provided some protection to larval Colorado pikeminnow from predation by red shiner (Cyprinella lutrensis). Clear water conditions in shallow backwaters might expose larval and juvenile fish to predation from wading birds or non-native, sight-feeding, piscivorous fish. It is unknown whether the river was as frequently turbid historically as it is today. Currently, it is assumed that endemic fishes evolved under conditions of frequently elevated turbidity, particularly in association with high spring runoff. Therefore, the retention of seasonally appropriate turbidity is probably an important factor in maintaining the ability of Colorado pikeminnow to compete with or avoid predation by non-native fish or other predators that may not have evolved under similar conditions.

Colorado Pikeminnow Population Dynamics

Between 1991 and 1995, 19 (17 adult and 2 juvenile) wild Colorado pikeminnow were collected in the San Juan River by electrofishing between RM 142 (the former Cudei Diversion) and Four Corners at RM 119 (Ryden 2000a; Ryden and Ahlm 1996). The multi-threaded channel, habitat complexity, and mixture of substrate types in this area of the river appear to provide a diversity of habitats favorable to Colorado pikeminnow on a year-round basis (Holden and Masslich 1997). Estimates made during the seven-year research period between 1991 and 1997 suggested that there were fewer than 50 adult Colorado pikeminnow in a given year (Ryden 2000a).

Monitoring for adult Colorado pikeminnow occurs every year on the San Juan River. In 2013, 149 Colorado pikeminnow were collected during monitoring from RM 180-77 (Figure 7), the eighth consecutive year that more than 100 Colorado pikeminnow were caught in this reach (Schleicher 2014). However, only 7 of these fish were greater than 450 mm (18 in). In addition, 19 Colorado pikeminnow greater than 450 mm (18 in) were collected during the non-native fish removal trips in 2013 (Duran 2014). River wide population estimates for age-2+ pikeminnow that have been in the San Juan River at least one year was approximately 4,600 and 5,400 individuals in 2009 and 2010, respectively (Duran et al. 2011). However, because few adult Colorado pikeminnow were detected in the San Juan River, this population estimate largely consists of juveniles. Other Colorado pikeminnow abundance estimates exhibit substantial annual variation, likely due to the effects of short-term retention from recent stocking events, but no clear population trends were evident in the San Juan River Basin (Durst 2014, Figure 8).

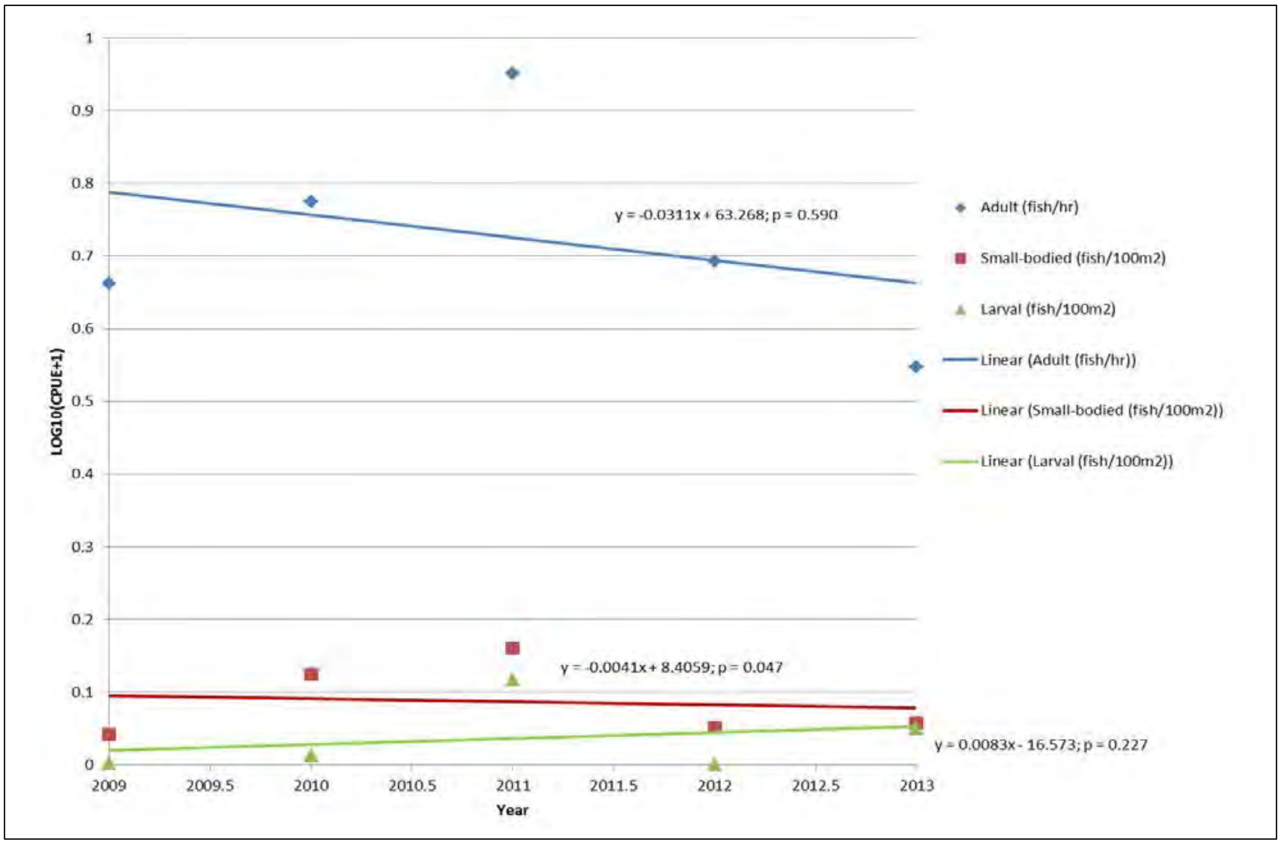


Figure 8. Summary of the recent catch (CPUE) of various life stages of Colorado pikeminnow and other small-bodied fish in the San Juan River (Durst 2014).

Successful Colorado pikeminnow reproduction was documented in the San Juan River in 1993, 1995, 1996, 2001, 2004, 2007, 2009-2011, and 2013 (Farrington et al. 2014). A total of 58 larval Colorado pikeminnow were collected since 1993 (Farrington et al. 2014); however, there has been little to no recruitment documented in the San Juan River. A total of 48 Age-1+ Colorado pikeminnow were collected in 2013; all presumably the result of augmentation efforts (Farrington et al. 2014). Since 1998, Colorado pikeminnow were collected during small-bodied monitoring every year except 2001-2003; however, YOY Colorado pikeminnow were stocked in each of these years prior to monitoring efforts so these fish were likely hatchery-reared (Gilbert

2014). Larval Colorado pikeminnow detections occurred in throughout the San Juan River from Reach 4 (RM 106-130) downstream to Reach 1 (RM 0-16) (Farrington et al. 2013, Farrington et al. 2014). Franssen et al. (2007) found that maintenance of a natural flow regime favored native fish reproduction and provided prey at the appropriate time for Age-1 Colorado pikeminnow.

Tissue samples from Colorado pikeminnow caught during research conducted under the Recovery Program have been analyzed as part of a basin-wide analysis of endangered fish genetics. The results of that analysis indicate that the San Juan River fish exhibit less genetic variability than the Green River and Colorado River populations, likely due to the small population size, but were very similar to pikeminnow from the Green, Colorado, and Yampa rivers (Morizot in litt. 1996). These data suggest that the San Juan population is probably not a separate stock (Holden and Masslich 1997; Houston et al. 2010).

Competition and Predation of Colorado Pikeminnow by Nonnative Fishes

Nearly 70 nonnative fish species have been introduced into the Colorado River Basin and at least 20 nonnative fish species live with endangered fishes in the San Juan River (Sublette et al. 1990; Maddux et al. 1993; USFWS 2002a,b; Propst and Gido 2004) and nonnative fish are predators, competitors, and vectors for parasites and diseases (Hawkins and Nessler 1991; Maddux et al. 1993; Bestgen 1997; Brandenburg and Gido 1999; Brooks et al. 2000; Tyus and Sanders 2000; Marsh et al. 2001; Drake and Bossenbroek 2004; Mueller 2005; Weber and Brown 2009; Martinez 2012; Ricciardi et al. 2013; Pigneur et al. 2014; USFWS 2002a,b, 2014). Nonnative fish in the San Juan River include striped bass (*Morone saxatilis*), walleye (*Sander vitreus*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus melas*), yellow bullhead (*Ameiurus natalis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), green sunfish (*Lepomis cyanellus*), longear sunfish (*Lepomis megalotis*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), fathead minnow (*Pimephales promelas*), red shiner (*Cyprinella lutrensis*), sand shiner (*Notropis stramineus*), western mosquitofish (*Gambusia affinis*), common carp (*Cyprinus carpio*), white sucker (*Catostomus commersonii*) (as well as white sucker hybrids), gizzard shad (*Dorosoma cepedianum*), threadfin shad (*Dorosoma petenense*), grass carp (*Ctenopharyngodon spp.*), and plains killifish (*Fundulus zebrinus*) (Sublette et al. 1990; SJRRIP 1990; Ryden 2000a; Buntjer 2003; Propst and Gido 2004). Because of the extreme and persistent threat posed by nonnative species, their eradication and management is the first priority in the endangered fish recovery plans (USFWS 2002a,b, 2014).

Small-bodied, nonnative fishes are widespread, invasive, and are predatory of larval native fish in nursery backwaters, and low-velocity habitats, where they can affect survival and recruitment of Colorado pikeminnow (Haines and Tyus 1990; Muth and Nesler 1993; Bestgen 1997; McAda and Ryel 1999; Valdez et al. 1999). Adult red shiners are predators of larval native fish in backwaters of the upper basin (Ruppert et al. 1993). In laboratory experiments on behavioral interactions, Karp and Tyus (1990) observed that red shiner, fathead minnow, and green sunfish shared activity schedules and space with young pikeminnow and exhibited antagonistic behaviors to smaller Colorado pikeminnow. Young pikeminnow exhibit high spatial overlap in habitat use with red shiner, sand shiner (Notropis stramineus), and fathead minnow (Pimephales promelas); Colorado pikeminnow may be at a competitive disadvantage in an environment that is resource limited.

Channel catfish (Ictalurus punctatus) have been identified as a threat to juvenile, subadult, and adult Colorado pikeminnow in the San Juan River. Channel catfish were first introduced in the upper Colorado River Basin in 1892 (Tyus and Nikirk 1990) and are now considered common to abundant throughout much of the upper Colorado River Basin (Tyus et al. 1982; Hawkins and Nessler 1991; Nelson et al. 1995; Duran et al. 2013; Gerig and Hines 2013). The species is one of the most prolific predators in the upper basin and is thought to have the greatest adverse effect on endangered fishes due to predation on juveniles and resource overlap with subadults and adults (Hawkins and Nesler 1991, Lentsch et al. 1996, Tyus and Saunders 1996). Adult channel catfish predation of stocked juvenile Colorado pikeminnow has been documented in the San Juan River (Jackson 2005). Stocked juvenile and adult Colorado pikeminnow that have preyed on channel catfish have died from choking on the pectoral spines (McAda 1983; Pimental et al. 1985; Quarterone 1995; Ryden and Smith 2002; Lapahie 2003).

Although mechanical removal (electrofishing, seining) of channel catfish began in 1995, intensive efforts covering limited portions of the San Juan River (10 trips/year) did not begin until 2001 (Davis 2003; indicated as “after” in Figure 9). Intensive removal efforts expanded to include nearly all critical habitats in the San Juan River starting in 2006. Mechanical removal has not yet led to a positive population response in Colorado pikeminnow, but attributing a population response to nonnative fish removal would be extremely difficult (Davis 2003; SWCA 2010).

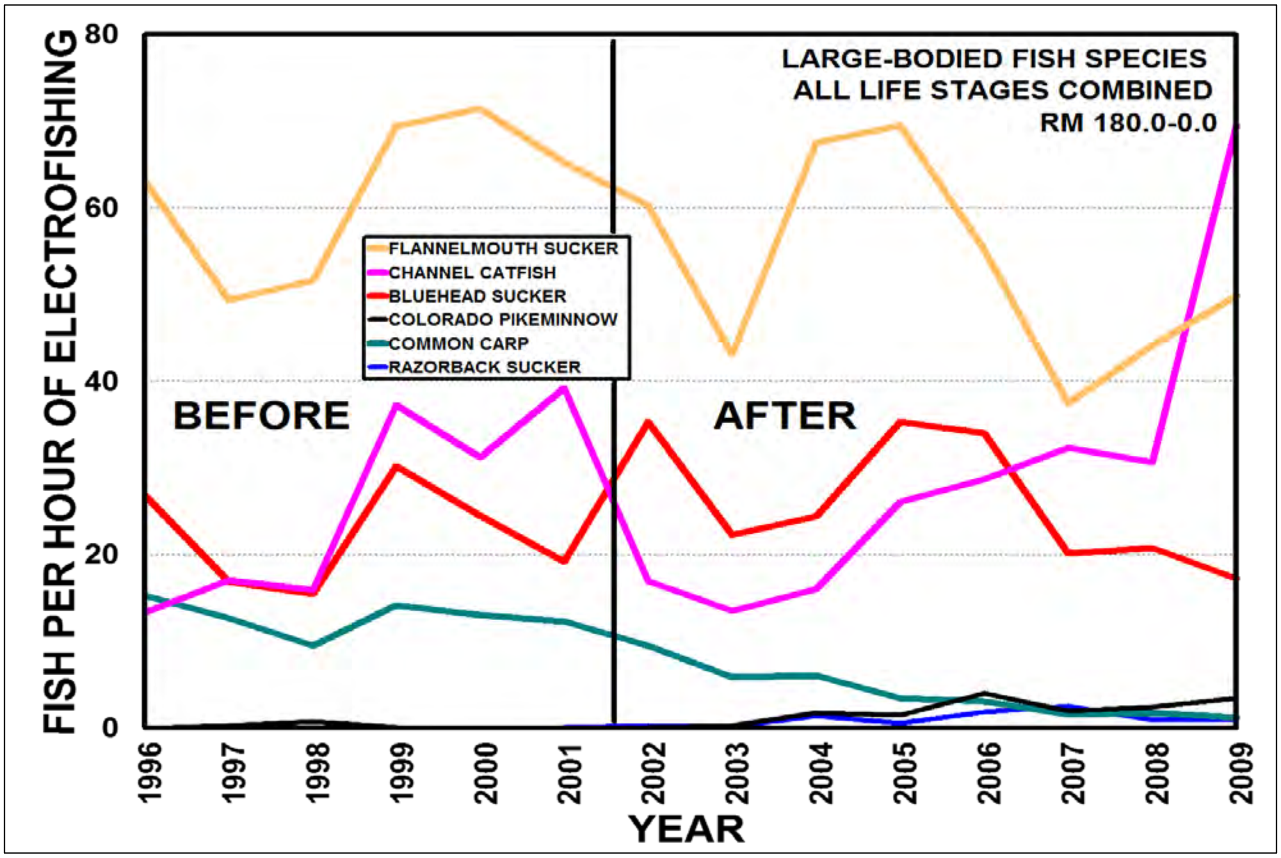


Figure 9. Summary of 14 years of catch (per hour of electrofishing) of various large-bodied fish species in the San Juan River (Ryden 2012) (See Figure 7 for River Miles (RM)).

Colorado Pikeminnow Status and Distribution

The Colorado pikeminnow was designated as endangered prior to enactment of the ESA. Construction and operation of main channel dams, nonnative fish, and local eradication of native minnows and suckers in the early 1960s were recognized as early threats (Miller 1961, Holden 1991). The Colorado Pikeminnow Recovery Plan (USFWS 2002a, 2014) summarize threats to this species as follows: stream regulation, habitat modification, competition with and predation by nonnative fish, and pesticides and pollutants.

Major declines in Colorado pikeminnow populations occurred in the lower Colorado River Basin during the dam-building era of the 1930s through the 1960s. Behnke and Benson (1983) summarized the decline of the natural ecosystem, pointing out that dams, impoundments, and water use practices drastically modified the river's natural hydrology and channel characteristics throughout the Colorado River Basin. Dams on the main channel fragmented the river ecosystem into a series of disjunctive segments, blocked native fish migrations, reduced water temperatures downstream of dams, created lake habitat, and provided conditions that allow competitive and predatory nonnative fishes to thrive both within the impounded reservoirs and in the modified river segments that connect them. The highly modified flow regime in the lower basin coupled with the introduction of non-native fishes decimated populations of native fish and led to the listing of the majority (7 of 10) of native, mainstem fishes as endangered (Mueller

2005). Historical, current range, and critical habitat for the Colorado Pikeminnow is provided below (Figure 10) (USFWS 2002a, 2014).

Colorado pikeminnow populations in the San Juan River are supported by stocking (or augmentation) with hatchery-reared fish to try to reestablish a sustainable population in this river. Approximately 3.2 million pikeminnow were stocked between 2002 and 2011 (Furr 2012). More Colorado pikeminnow (433) were caught during the large-bodied fish monitoring effort in 2010 than in any previous effort (Ryden 2012). In the 2012 monitoring event, 272 pikeminnow were captured (Schleicher and Ryden 2013) and over the last several years the SJRRIP has captured several hundred stocked pikeminnow of varying sizes (Furr 2012). Catch per unit effort (CPUE) of fish that had been in the river for one or more winters has an increasing trend since 2003, but this trend is mainly a reflection of Age 0+ fish (fish within their 1st year after birth) surviving to recapture at Age 1+ (fish that are 1 year old or older). The number of larger fish remains small, although the number of these larger fish continues to increase.

The increasing trend in catch-per-unit-effort (CPUE) is likely the result of augmentation. Schleicher and Ryden (2013) estimated that close to 1,000 pikeminnow > 300 mm TL may be in the river (based on capture of 22 individuals of this size). The observation of adult fish proves that some of the stocked fish are surviving. Between the large-bodied fish monitoring program and the more intensive non-native fish removal program 29 adults were captured in 2012, which substantially exceeds the total of 17 adults captured between 1991 and 1994.

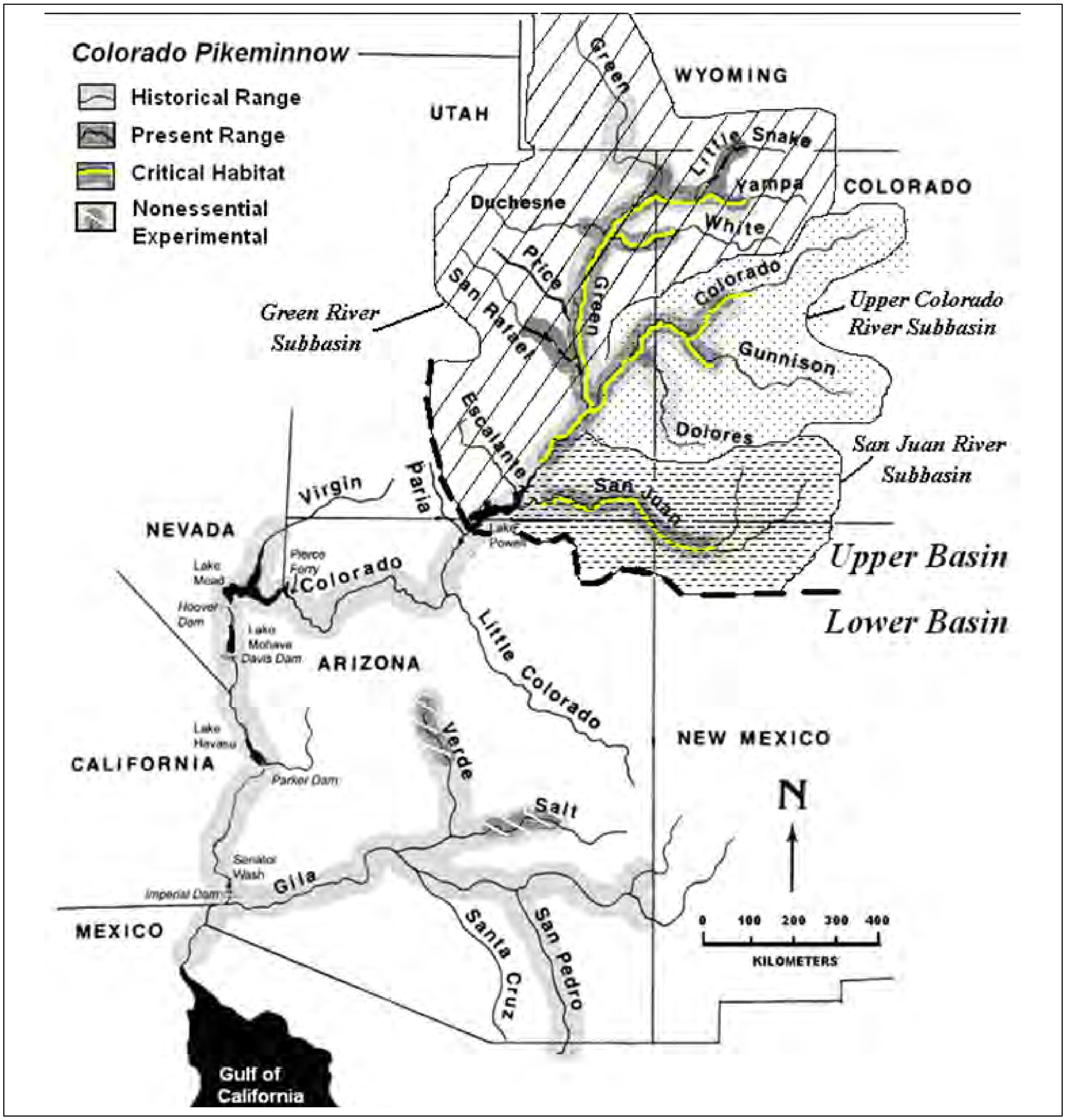


Figure 10. Historical, current range, and critical habitat distribution of Colorado pikeminnow.

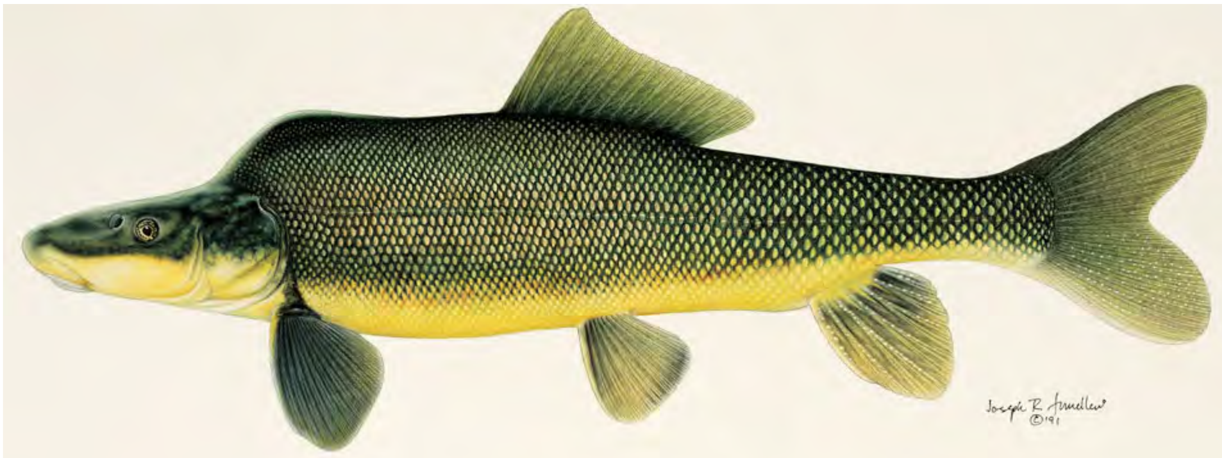
Population estimates for Colorado pikeminnow were generated in 2010, using three complete river wide non-native fish removal passes made in 2010. Two separate models yielded the following population estimates: 5,418 (CI = 4,049-7,549 Model M(t)) and 5,466 (CI = 4,082-7,614; Model M(o)) (Duran et al. 2011). Only Age 2+ Colorado pikeminnow that had been in the river for at least one, over-winter period were used in this estimate, so the total number of Colorado pikeminnow could be higher than this estimate.

While the numbers of stocked subadult and adult Colorado pikeminnow may sometimes appear to be increasing, they are not yet a self-supporting wild population. Larval Colorado pikeminnow collected over the last several years (in low numbers) give an indication that some reproduction is occurring in the wild, although not at levels sufficient to support recruitment. In spite of the positive trends in numbers of stocked fish retaining in the system, the species' long-term viability remains uncertain because of the relatively limited habitat available between Navajo Dam and Lake Powell, competition and predation from non-native fishes, water quality, and the physical changes associated with climate change that will continue to impact the San Juan River Basin. Without active recovery efforts, the Colorado pikeminnow population (as modeled) would be extirpated from the San Juan River Basin within 20-30 years (Miller 2014).

At total of 24 Colorado pikeminnow were collected in the San Juan arm of Lake Powell in 2011 and four were of adult size. All of the Colorado pikeminnow detected in Lake Powell were likely the result of stocking efforts in the San Juan River (Francis et al. 2013). These results indicate at least some of the fish stocked in the San Juan River are moving into the reservoir and surviving. Additional sampling is planned by the San Juan Recovery Implementation Program (SJRRIP) to determine the status of the species in Lake Powell.

The status of Colorado pikeminnow in other basins was summarized by Osmundson and White (2009, 2014) and the Service (USFWS 2014). In the upper Colorado River Basin, declines in Colorado pikeminnow populations occurred primarily after the 1960s, when the following dams were constructed: Glen Canyon Dam on the main channel Colorado River, Flaming Gorge Dam on the Green River, Navajo Dam on the San Juan River, and the Aspinall Unit dams on the Gunnison River. Some native fish populations in the upper basin have managed to persist, while others are nearly extirpated. River reaches where native fish have declined more slowly, more closely resemble pre-dam hydrologic regimes, where adequate habitat for all life phases still exists. The ability of the pikeminnow to withstand adverse impacts to its populations and its habitat is difficult to discern given the longevity of individuals and their scarcity within the San Juan River Basin. Younger life stages are considered the most vulnerable to predation, competition, the effects of toxic chemicals, and ongoing fish habitat degradation.

RAZORBACK SUCKER



Like all suckers (family Catastomidae, meaning "down mouth"), the razorback sucker has a ventral mouth with thick lips covered with papillae and no scales on its head. In general, suckers are bottom browsers, sucking up or scraping off small invertebrates, algae, and organic matter with their fleshy, protrusible lips (Moyle 1976). The razorback sucker is the only sucker with an abrupt sharp-edged dorsal keel behind its head. The keel becomes more massive with age. The head and keel are dark, the back is olive-colored, the sides are brownish or reddish, and the abdomen is yellowish white (Sublette et al. 1990). Adults often exceed 3 kg (6 lbs) in weight and 600 mm (2 ft) in length. Like Colorado pikeminnow, razorback suckers may live to be greater than 40 years.

Historically, razorback suckers were found in the main channel of the Colorado River and major tributaries in Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and in Mexico (Ellis 1914; Minckley 1983; USFWS 2002b) (Figure 11). Bestgen (1990) reported that this species was once so numerous that it was commonly used as food by early settlers and that a commercially marketable quantity was caught in Arizona as recently as 1949. In the upper Colorado River Basin, razorback suckers were reported to be very abundant in the Green River near Green River, Utah, in the late 1800s (Jordan 1891). An account in Osmundson and Kaeding (1989) reported that residents living along the Colorado River near Clifton, Colorado, observed several thousand razorback suckers during spring runoff in the 1930s and early 1940s. Platania (1990) documented occurrence of razorback sucker in the main channel of the San Juan River in 1988. Two adult razorback suckers were also collected from an irrigation pond attached to the San Juan River by a canal in 1976 (Platania 1990). Razorback sucker likely occurred in the main channel as far upstream as Rosa, New Mexico (now inundated by Navajo Reservoir) (Ryden 1997).

The razorback sucker was designated as endangered under the ESA in 1991 (56 FR 54957), due to little evidence of natural recruitment and declining numbers of adult fish. Threats identified at the time included diversion and depletion of water, introduction of nonnative fishes, and construction and operation of dams. Recruitment of larval razorback suckers to juveniles and adults continues to be a problem.

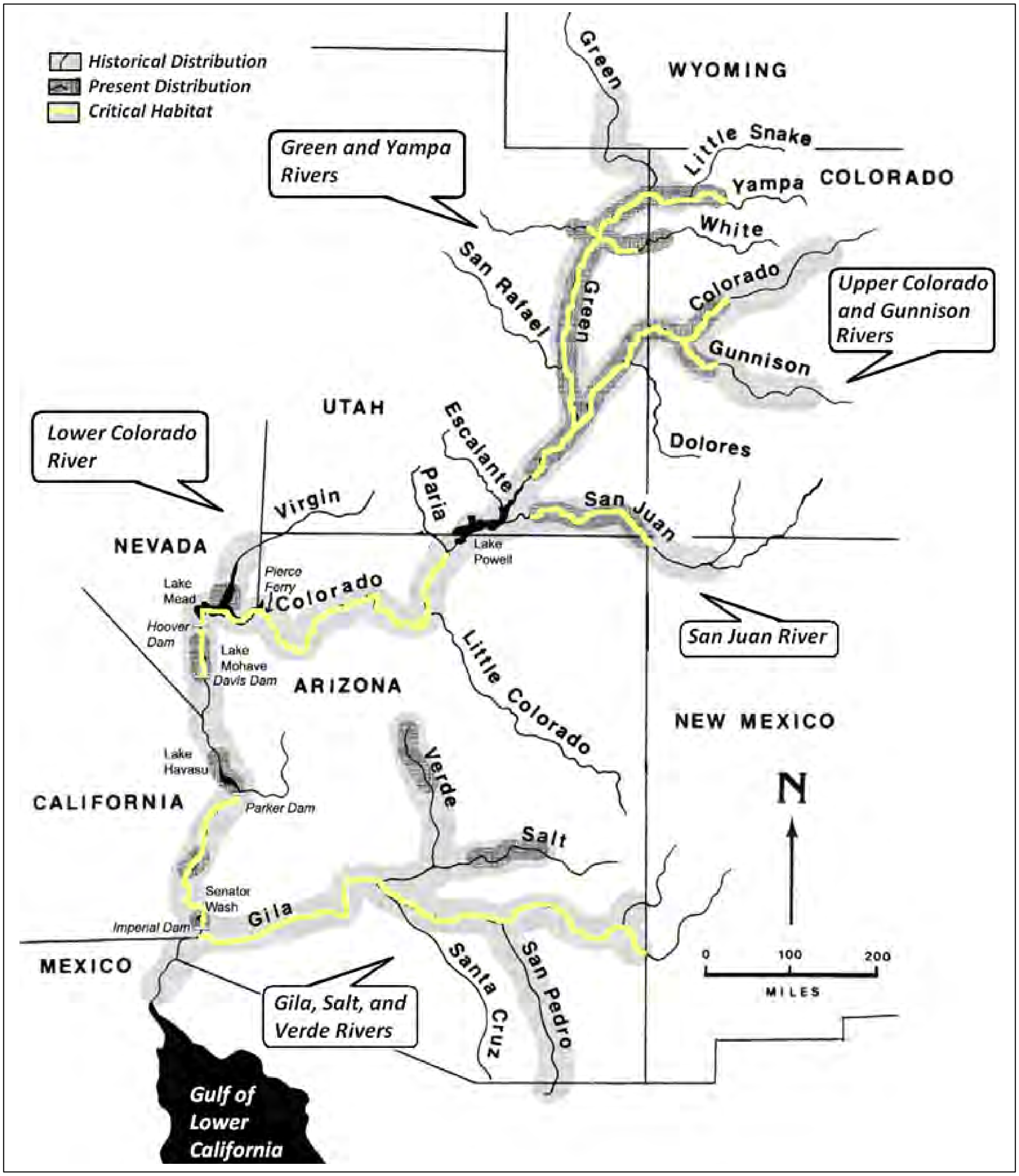


Figure 11. Historical, current range, and critical habitat distribution of razorback sucker.

Critical habitat was designated in 1994 within the 100-year flood plain of the razorback sucker historical range in the following areas of the San Juan River Basin (59 FR 13374): San Juan County, New Mexico, and San Juan County, Utah, including the San Juan River from the Hogback Diversion in Township 29 North, Range 16 West, in section 9 to the full pool elevation at the mouth of Neskahai Canyon on the San Juan arm of Lake Powell in Township 41 South,

Range 11 East, in section 26. The primary constituent elements of critical habitat are the same as those described earlier for Colorado pikeminnow.
The PCEs of razorback sucker critical habitat include:

1. Water: a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for the species;

2. Physical habitat: areas of the Colorado River system that are inhabited or potentially habitable for spawning, feeding, rearing, as a nursery, or corridors between these areas, including oxbows, backwaters, and other areas in the 100-year floodplain which when inundated provide access to spawning, nursery, feeding, and rearing habitats; and,

3. Biological environment: adequate food supply and ecologically appropriate levels of predation and competition.

Razorback Sucker Life History

McAda and Wydoski (1980) and Tyus (1987) reported springtime aggregations of razorback suckers in off-channel habitats and tributaries; such aggregations are believed to be associated with reproductive activities. Tyus and Karp (1990) and Osmundson and Kaeding (1991) reported off-channel habitats to be much warmer than the main channel river and that razorback suckers presumably moved to these areas for feeding, resting, sexual maturation, spawning, and other activities associated with their reproductive cycle.

While razorback suckers have never been directly observed spawning in turbid riverine environments within the upper Colorado River Basin, ripe males and females have been captured in the Yampa, Green, Colorado, and San Juan rivers (Valdez et al. 1982, McAda and Wydoski 1980, Tyus 1987, Osmundson and Kaeding 1989, Tyus and Karp 1989, Tyus and Karp 1990, Osmundson and Kaeding 1991, Platania 1990, Ryden 2000b, Jackson 2003, Ryden 2005). Because of the relatively steep gradient in the San Juan River and lack of a wide floodplain, razorback sucker likely spawn in low velocity, turbid, main channel habitats. Based on captures of larval fish, razorback suckers have expanded their spawning range upstream over time (Farrington et al. 2014).

Sexually mature razorback suckers are generally collected on the ascending limb of the hydrograph from mid-April through June and are associated with coarse gravel substrates. Both sexes mature as early as Age-4 (McAda and Wydoski 1980). Fecundity, based on ovarian egg counts, ranged from highs of 75,000-144,000 eggs (Minckley 1983) while McAda and Wydoski (1980) reported an average fecundity (N=10) of 46,740 eggs/fish (27,614–76,576). During spawning, several males (often 3) attend each female and no nest is built. The adhesive eggs briefly drift and hatch at the bottom of the substrate (Sublette et al. 1990). In laboratory experiments, the percentage of egg hatch was greatest at 20 ˚C (68 ˚F) and all embryos died at incubation temperatures of 5, 10, and 30 ˚C (41, 50, and 86 ˚F) (Marsh 1985). Bestgen (2008) found that growth of early life stages was positively related to water temperature and that fastest growth occurred at 25.5˚C (79.9˚F). Average weight of razorback suckers reared in 25.5˚C (79.9˚F) water was about four times that of those in 16.5˚C (61.7˚F) (Bestgen 2008).

Larval or juvenile razorback suckers are rarely encountered in the wild, therefore, their habitat requirements in the wild are not well characterized. However, it is assumed that low-velocity backwaters and side channels are important for YOY and juveniles, as it is to the early life stages of most riverine fish. Prior to construction of large dams on the main channel and the suppression of spring peak flows, low velocity, off-channel habitats (seasonally flooded bottomlands and shorelines) were commonly available throughout the upper Colorado River Basin (Tyus and Karp 1989, Osmundson and Kaeding 1991).

Reduction in spring peak flows eliminates or reduces the frequency of inundation of off-channel habitats and floodplain habitats. The absence of these seasonally flooded riparian habitats are believed to be a limiting factor in the successful recruitment of razorback suckers in other upper Colorado River tributaries (Tyus and Karp 1989, Osmundson and Kaeding 1991). Wydoski and Wick (1998) identified loss of floodplain habitats that provide adequate zooplankton densities for larval food as one of the most important factors limiting razorback sucker recruitment; low zooplankton densities in the main channel result in starvation of larval razorback suckers. Maintaining low velocity habitats is important for the survival of larval razorback suckers.

Outside of the spawning season, adult razorback suckers occupy a variety of shoreline and main channel habitats including slow runs, shallow to deep pools, backwaters, eddies, and other relatively slow velocity areas associated with sand substrates (Tyus 1987, Tyus and Karp 1989, Osmundson and Kaeding 1989, Valdez and Masslich 1989, Osmundson and Kaeding 1991, Tyus and Karp 1990). Their diet consists primarily of algae, plant debris, and aquatic insect larvae (Sublette et al. 1990).

Razorback Sucker Population Dynamics

Because wild razorback sucker a long-lived fish, are rarely encountered it is difficult to determine natural fluctuations in their population. Currently, wild razorback sucker are rare throughout their historic range and extremely rare in the main channel of the San Juan River, although over 130,000 hatchery-reared razorback sucker have been stocked there since the mid-1990s (Furr 2014). While wild-produced larval razorback sucker have been collected every year since 1998 (Farrington et al. 2014), there is limited evidence indicating natural recruitment to any population of razorback sucker in the Colorado River Basin (Bestgen 1990, Platania 1990, Platania et al. 1991, Tyus 1987, McCarthy and Minckley 1987, Osmundson and Kaeding 1989, Modde et al. 1996). However, Age-0 razorback suckers in the juvenile ontogenetic stage are regularly captured during larval fish monitoring (Farrington et al. 2014). In 2003 two juvenile (Age-2) razorback sucker, 249 and 270 mm (9.8 and 10.6 in.), thought to be wild-produced from stocked fish, were collected in the lower San Juan River (RM 35.7 and 4.8) (Ryden 2004a) and at least four wild juvenile razorback sucker were collected downstream of RM 37.4 in 2004 (Golden and Holden 2006) indicating limited recruitment may be rarely occurring.

Competition with and Predation of Razorback Suckers

Many species of nonnative fishes are predators, competitors, and vectors of parasites and diseases (Tyus et al. 1982, Lentsch et al. 1996, Pacey and Marsh 1999, Marsh et al. 2001). Many researchers believe that nonnative species are a major cause for the lack of recruitment and that nonnative fish are the most important biological threat to the razorback sucker (e.g., McAda and Wydoski 1980, Minckley 1983, Tyus 1987, USFWS 1991, 1998, 2002b, Muth et al. 2000). There are reports of predation of razorback sucker eggs and larvae by common carp, channel catfish, smallmouth bass, largemouth bass, bluegill, green sunfish, and red-ear sunfish (Jonez and Sumner 1954, Marsh and Langhorst 1988, Langhorst 1989).

Marsh and Langhorst (1988) found higher growth rates in larval razorback sucker in the absence of predators in Lake Mohave, and Marsh and Brooks (1989) reported that channel catfish and flathead catfish were major predators of stocked razorback sucker in the Gila River. Juvenile razorback sucker (average total length [TL] 171 mm [6.7 in.]) stocked in isolated coves along the Colorado River in California, suffered extensive predation by channel catfish and largemouth bass (Langhorst 1989).

Carpenter and Mueller (2008) tested nine non-native species of fish that co-occur with razorback sucker and found that seven species consumed significant numbers of larval razorback suckers. The seven species consumed an average of 54 – 99 percent of the razorback sucker larvae even though alternative food was available (Carpenter and Mueller 2008). Lentsch et al. (1996) identified six species of nonnative fishes in the upper Colorado River Basin as threats to razorback sucker: red shiner, common carp, sand shiner, fathead minnow, channel catfish, and green sunfish. Smaller fish, such as adult red shiner, are known predators of larval native fish (Ruppert et al. 1993). Large predators, such as walleye, northern pike (*Esox lucius*), and striped bass, also pose a threat to subadult and adult razorback sucker (Tyus and Beard 1990).

Razorback Sucker Status and Distribution

A marked decline in populations of razorback suckers can be attributed to construction of dams and reservoirs, introduction of nonnative fishes, and removal of large quantities of water from the Colorado River Basin (USFWS 1991, 1994). Dams on the main channel of the Colorado River and its major tributaries have fragmented populations and blocked migration routes. Dams also have drastically altered flows, water temperatures, and channel geomorphology. These changes have modified habitats in many areas so that they are no longer suitable for breeding, feeding, sheltering, or nursery areas. Major changes in species composition have occurred due to the introduction of nonnative fishes, many of which have thrived due to human-induced changes to the natural riverine system. Habitat has been significantly degraded to a point where it impairs the essential life history functions of razorback sucker, such as reproduction and recruitment into the adult population.

Currently, the largest numbers of wild adult razorback sucker remaining in the Colorado River Basin is in Lake Mohave. Estimates of the wild stock in Lake Mohave have fallen precipitously in recent years from 60,000 in 1991, 25,000 in 1993 (Marsh 1993, Holden 1994), to fewer than 3,000 in 2001 (Marsh et al. 2003). A repatriation program began in Lake Mohave in 1991, and repatriated fish have apparently begun to contribute to larval cohorts (Turner et al. 2007). Until recently, efforts to introduce young razorback sucker into Lake Mohave have failed because of predation by nonnative species (Minckley et al. 1991, Clarkson et al. 1993, Burke 1994, Marsh et al. 2003). Razorback suckers elsewhere in the Colorado River Basin have not maintained a secure, self-sustaining wild population or have been extirpated (Marsh et al. 2003).

In the upper Colorado River Basin, above Glen Canyon Dam, razorback suckers are found in limited numbers in both lentic (lake-like) and riverine environments. Lanigan and Tyus (1989) estimated a population of 948 adults (95% CI: 758-1,138) in the upper Green River. Eight years later, the population was estimated at 524 adults (95% CI: 351-696) and the population was characterized as stable or declining slowly with some evidence of recruitment (Modde et al. 1996). They attributed this recruitment to unusually high spring flows during 1983-1986 that inundated portions of the floodplain used as nurseries by young. In the Colorado River, most razorback suckers occur in the Grand Valley area near Grand Junction, Colorado; however, they are increasingly rare. Osmundson and Kaeding (1991) reported that the number of razorback sucker captures in the Grand Junction area has declined dramatically since 1974. Between 1984 and 1990, intensive collecting effort captured only 12 individuals in the Grand Valley (Osmundson and Kaeding 1991). The wild population of razorback sucker is considered extirpated from the Gunnison River (Burdick and Bonar 1997). While the role of Lake Powell in the recovery of razorback sucker is unclear, 75 individuals were detected in the San Juan arm of Lake Powell in 2011 (Francis et al. 2013).

Scientifically documented records of wild razorback sucker adults in the San Juan River are limited to two fish captured in a riverside pond near Bluff, Utah in 1976, and one fish captured in the river in 1988, also near Bluff (Platania 1990). In 1976, large numbers of razorback suckers were anecdotally reported from a drained pond near Bluff, Utah, but no specimens were preserved to verify species. During the 7-year research period (1991-1997) of the San Juan River Recovery Implementation Program (SJRRIP), no wild razorback suckers were observed (Holden 1999). Hatchery-reared razorback suckers, especially those greater than 350 mm (13.8 in.), introduced into the San Juan River in the 1990s have survived and reproduced, as evidenced by recapture data and collection of larval fish (Farrington et al. 2014, Schleicher 2014). River wide razorback sucker population estimates of 268 in October 2000 (Ryden 2001) have since grown to 1,200 in October 2004 (Ryden 2005b), and to about 2,000 and 3,000 in 2009 and 2010, respectively (Duran et al. 2011). Additional mark-recapture data indicates increasing razorback sucker abundance estimates (Durst 2014) (Figure 12). However, since there is little to no documented recruitment in the San Juan River, this population increase should be attributed almost entirely to augmentation with hatchery-reared razorback suckers.

The razorback sucker recovery goals identified streamflow regulation, habitat modification, predation by nonnative fish species, and pesticides and pollutants as primary threats to the species (USFWS 2002b). Within the upper Colorado River Basin, recovery efforts include the capture and removal of razorback suckers from all known locations for genetic analyses and development of brood stocks. In the short term, augmentation (stocking) may be the only means to prevent the extirpation of razorback sucker in the upper Colorado River Basin. However, in the long term it is expected that natural reproduction and recruitment will occur. Genetics management and augmentation plans have been implemented for razorback sucker (Crist and Ryden 2003, Ryden 2003).

At the time of listing, few razorback suckers remained in the San Juan River. Since the initiation of the SJRRIP, razorback sucker numbers have increased, due to augmentation. The long-term population viability remains uncertain because of the relatively limited or degraded habitat available to razorback sucker between Navajo Dam and Lake Powell, competition and predation from nonnative fishes, degraded water quality, and the uncertainty surrounding the changes that climate change will bring to the San Juan basin.

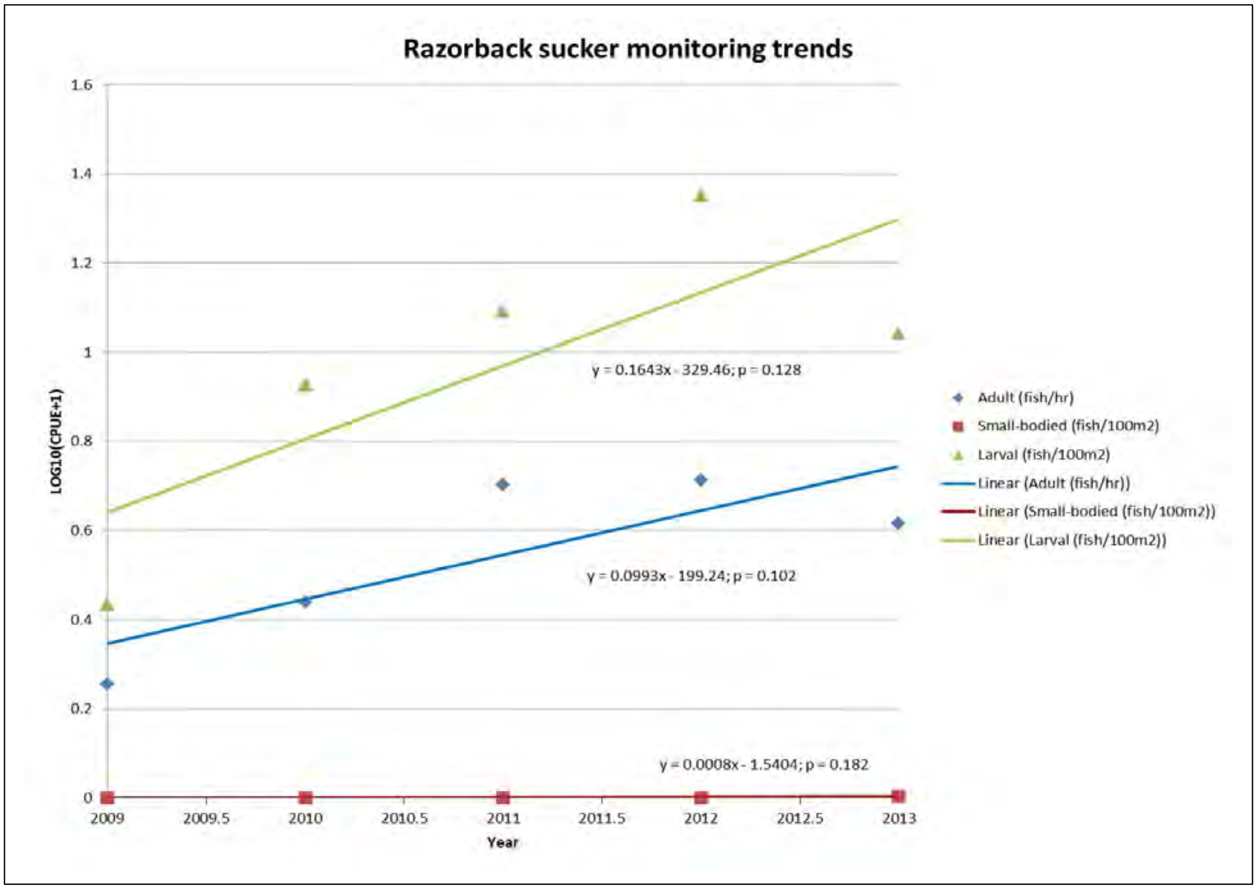


Figure 12. Summary of the recent catch (CPUE) of various life stages of razorback sucker and various small-bodied fish in the San Juan River (Durst 2014).

ENDANGERED FISHES PROPAGATION AND AUGMENTATION

Because of these extremely low numbers of wild Colorado pikeminnow and poor recruitment into the population, a stocking program was initiated to augment fish stocks in the San Juan River. Experimental stocking of 100,000 YOY Colorado pikeminnow upstream of Shiprock, New Mexico was conducted in November 1996 to test habitat suitability and quality for young life stages (Lentsch et al. 1996). Monitoring in late 1996 and 1997 found these fish scattered in suitable habitats from just below the Shiprock site to the inflow of Lake Powell. During the fall of 1997, the fish stocked in 1996 were caught in relatively high numbers and exhibited good growth and survival rates (Holden and Masslich 1997). In August 1997, an additional 100,000 YOY Colorado pikeminnow were stocked in the river. In October 1997, the YOY stocked two months previously were found distributed below stocking sites and in relatively large numbers nearly ten miles above the Shiprock stocking location. On average, the 1997 stocked fish were smaller than those stocked in 1996 and were able to move about the river to find suitable habitats (Holden and Masslich 1997). Because of the initial success of the stocked fish, Colorado pikeminnow have been stocked every year since 1996. Approximately 3.2 million pikeminnow have been stocked between 2002 and 2011 (Furr 2012).

Between 1994-2007, a total of 54,472 hatchery and pond raised razorback suckers were stocked into the San Juan River (Ryden 2008c). From 1994 through 2012, 130,473 razorback suckers were stocked. Between 2009 and 2012, the number released has ranged from 8,418 to 28,485, with an average of 17,889 razorback suckers released per year (Furr 2013). Razorback suckers that have been stocked in the river for six or more overwinter periods have been collected every year since 2001 (Ryden 2008c). Larval razorback suckers have been collected each year since 1998, indicating that the stocked fish are successfully spawning in the San Juan River (Brandenburg and Farrington 2008). The number of endangered fishes stocked in the San Juan River is reported annually (see http://www.fws.gov/southwest/sjrip/).

The status of razorback sucker critical habitat in the San Juan River Basin is described in the environmental baseline of this BO.

SOUTHWESTERN WILLOW FLYCATCHER

The flycatcher is a small grayish-green passerine bird measuring approximately 5.75 in (146 mm) in height. It has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. Two white wing bars are visible in adults, while juveniles have buffy wing bars. The eye ring is faint or absent. The upper mandible is dark, and the lower is light yellow grading to black at the tip. The song is a sneezy "fitz-bew" or a "fit-a-bew" and the call is a repeated "whitt" (Howell and Webb 1995).

The flycatcher is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in the southwestern U.S.A. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995). The historic breeding range of the flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

The flycatcher was listed as endangered in 1995 (60 FR 10694; USFWS 1995) without critical habitat designation. Critical habitat was designated for the flycatcher on July 22, 1997 along 599 river miles in Arizona, California, and New Mexico (USFWS 1997a). A correction notice was later published in the Federal Register on August 20, 1997 (USFWS 1997b). In May 2001, citing a faulty economic analysis, the 10th Circuit Court of Appeals vacated the designation of critical habitat and instructed the Service to issue a new flycatcher critical habitat designation. On October 19, 2005, critical habitat was re-designated on approximately 48,896 ha (120,824 acres) or 1,186 km (737 mi) within Arizona, California, Nevada, New Mexico and Utah (USFWS 2005). On July 13, 2010, the Service agreed to revise critical habitat for the flycatcher; while the 2005 critical habitat designation remained in place. On January 3, 2013, a final rule to designate revised critical habitat was published in the Federal Register (USFWS 2013) for the flycatcher on approximately 1,975 stream kilometers (1,227 stream miles) on a combination of Federal, State, tribal, and private lands in California, Nevada, Utah, Colorado, Arizona, and in New Mexico.

The specific physical or biological features required for the flycatcher from studies of its habitat, ecology, and life history was described by the Service (USFWS 2011c). In general, the physical or biological features of critical habitat for nesting flycatchers are found in the riparian areas within the 100-year floodplain or flood-prone areas. Flycatchers use riparian habitat for feeding, sheltering, and cover while breeding, migrating, and dispersing. It is important to recognize that flycatcher habitat is ephemeral in its presence, and its distribution is dynamic in nature because riparian vegetation is prone to periodic disturbance (such as flooding). The PCEs of critical habitat for flycatcher (USFWS 2013) include:

1. Primary Constituent Element 1— Riparian vegetation. Riparian habitat in a dynamic river or lakeside, natural or manmade successional environment (for nesting, foraging, migration, dispersal, and shelter) that is comprised of trees and shrubs (that can include Trees and shrubs that include Gooddings willow (Salix gooddingii), coyote willow (S. exigua), Geyers willow (S. geyerana), arroyo willow (S. lasiolepis), red willow (S. laevigata), yewleaf willow (S. taxifolia), pacific willow (S. lasiandra), boxelder (Acer negundo), tamarisk (Tamarix ramosissima; also known as salt cedar), Russian olive (Elaeagnus angustifolia), buttonbush (Cephalanthus occidentalis), cottonwood (Populus fremontii), stinging nettle (Urtica dioica), alder (Alnus spp.), velvet ash (Fraxinus velutina), poison hemlock (Conium maculatum), blackberry (Rubus ursinus), seep willow (Baccharis salicifolia, B. glutinosa), oak (Quercus agrifolia, Q. chrysolepis), rose (Rosa californica, R. arizonica, R. multiflora), sycamore (Platinus wrightii), false indigo (Amorpha californica), Pacific poison ivy (Toxicodendron diversilobum), grape (Vitis arizonica), Virginia creeper (Parthenocissus quinquefolia), Siberian elm (Ulmus pumila), and walnut (Juglans hindsii).

2. PCE 1 and some combination of:

   a. Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 meters (m) to 30 m (about 6 to 98 feet (ft)). Lower-stature thickets (2 to 4 m or 6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle and lower-elevation riparian forests; and/or

   b. Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub or tree level as a low, dense canopy; and/or

   c. Sites for nesting that contain a dense (about 50 percent to 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground); and/or

   d. Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 hectares (ha) (0.25 acres (acres)) or as large as 70 ha (175 acres); and

3. Primary Constituent Element 2— Insect prey populations. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and cicada (Homoptera).

The PCEs of flycatcher critical focused on the end result of all the components that culminate in the development of flycatcher breeding habitat (USFWS 2013). The Service (USFWS 2005) described those components (e.g., broad floodplain, surface water, fine sediments, hydrologic regime, channel-floodplain connectivity, elevated groundwater, etc.) in detail in the supporting text for the PCEs (69 FR 60712–60715). All the PCEs of critical habitat for the flycatcher are found in the riparian ecosystem within the 100-year floodplain or flood prone area (USFWS 2013).

Flycatcher critical habitat (27 mi (43.5 km)) occurs along the northern bank of San Juan River upstream of Chinle Creek in San Juan County, Utah. This reach of the San Juan River is part of the San Juan Management Unit in the Upper Colorado Recovery Unit (USFWS 2002c). The goal for recovery of flycatchers in the Upper Colorado Recovery Unit, San Juan Management Unit, is 25 territories (USFWS 2002, p.84). In 2002, flycatchers were known to breed at only four sites in the San Juan Management Unit, with only three flycatcher territories (less than one percent of the rangewide total) documented (USFWS 2002c). All occupied sites occurred in native (willow) habitats between 1,400 to 2,420 m elevation (USFWS 2002c). The specific river reaches within the San Juan Management Unit, where recovery efforts were considered essential to meet recovery goals included the Los Pinos River, in Colorado; and the San Juan River (north bank) in Utah (USFWS 2002c). The San Juan River near Shiprock, New Mexico, from Malpais Arroyo, one mile upstream to one mile downstream, was identified as a river segment that could contribute substantially to recovery, but was not considered essential (USFWS 2002c, 2013)

Flycatcher Life History

The flycatcher breeds in dense riparian habitat from sea level in California to approximately 8,500 ft elevation in Arizona and southwestern Colorado. Historical eggs/nest collections and species descriptions throughout its range describe widespread use of willow (Salix spp.) for nesting (Phillips 1948, Phillips et al. 1964, Hubbard 1987, Unitt 1987). Currently, flycatchers primarily use Geyer's willow, coyote willow, Goodding's willow, boxelder, saltcedar, Russian olive, and live oak for nesting. Other plant species less commonly used for nesting include buttonbush, black twinberry (Lonicera involucrata), cottonwood, white, blackberry, and stinging nettle. Saltcedar is an important component of nesting and foraging habitat in Arizona and other parts of the species' range. During 2001 in Arizona 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were in saltcedar (Smith et al. 2002). Four habitat types have been described for the flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge et al. 1997).

Throughout their range, the generalized breeding chronology of flycatchers begins with the arrival at breeding grounds in late April and May (Sogge and Tibbitts 1992; Sogge et al. 1993; Muiznieks et al. 1994; Sogge and Tibbitts 1994; Maynard 1995; Sferra et al. 1995, 1997; USFWS 2002; Sogge et al. 2010). Nesting and egg laying may begin as early as late May, but more often starts in early to mid-June. Flycatchers typically lay three to four eggs per clutch (range = 1 to 5). Eggs are laid at one-day intervals and are incubated by the female for approximately 12 days (Bent 1960, Walkinshaw 1966, McCabe 1991). Chicks can be present in nests from mid-June through early August and will typically fledge approximately 12 to 13 days after hatching (King 1955, Harrison 1979), from late June through mid-August. Young will remain in the natal area for up to 15 days (Brown 1988a,b; Sogge and Tibbitts 1992; Muiznieks et al. 1994; Maynard 1995). Adults depart from breeding territories as early as mid-August, but may stay until mid-September in later nesting efforts. Fledglings likely leave the breeding areas a week or two after adults.

Typically, one brood is raised per year, but birds have been documented raising two broods during one season and re-nesting after a failure (Whitfield 1990, Sogge and Tibbitts 1992, Sogge et al. 1993, Sogge and Tibbitts 1994, Muiznieks et al. 1994, Whitfield 1994, Whitfield and Strong 1995). The entire breeding cycle, from egg laying to fledging, is approximately 28 days. Each stage of the breeding cycle represents a greater energy investment in the nesting effort by the flycatcher pair and may influence their fidelity to the nest site or their susceptibility to quickly abandon if the conditions in the selected breeding habitat become adverse, decadent, or result in nest failure.

Flycatcher Population Dynamics, Status, and Distribution

Since the mid-1900s, populations of southwestern willow flycatcher have declined rapidly (USFWS 2002c). The historical breeding range of southwestern willow flycatcher included southern California, southern Nevada, southern Utah, Arizona, New Mexico, western Texas, southwestern Colorado, and extreme northwestern Mexico. The flycatcher's current range is similar to the historical range, but the quantity of suitable habitat within that range is much reduced from historical levels. There are currently 288 known flycatcher breeding sites in California, Nevada, Arizona, Utah, New Mexico, and Colorado (all sites from 1993 – 2007 where a resident flycatcher has been detected) holding an estimated 1,299 territories (Durst et al. 2008) (Table 3). Currently, rangewide population stability is believed to be largely dependent on the presence of four large populations (Cliff/Gila Valley, New Mexico; Roosevelt Lake, Arizona; San Pedro/Gila River confluence, Arizona; middle Rio Grande, New Mexico) where approximately 50 percent of the 1,299 territories currently exist. Therefore, the result of catastrophic events or losses of significant populations in either size or location could greatly change the status and survival of the species. Conversely, expansion into new habitats or discovery of other populations will improve the known stability and status of the flycatcher.

Since 1998, surveys for flycatcher have been completed in association with various mining, power generation, and energy transmission projects, and recently around Morgan Lake and the DFADA (OSMRE 2014b). Flycatchers have been detected sporadically near Morgan Lake and the San Juan River; however, no confirmed nesting locations of this species have been reported. In 2012, Site-specific flycatcher surveys were conducted along corridors near APS and PNM transmission lines, ROWs, and switchyards (Marron 2012a,b; AECOM 2013d). Flycatcher habitat was considered marginal on the Navajo Mine lease and therefore, flycatcher protocol surveys ceased in 1995 (OSMRE 2014b). The Navajo Nation Department of Fish and Wildlife (NNDFW) reported a male flycatcher making territorial displays near the Hogback in 2014, but protocol surveys were not completed (OSMRE 2014b).

We reviewed all available flycatcher survey reports from 1994 to 2013 conducted at all locations within the San Juan River Basin in New Mexico. Of the 143 areas surveyed in suitable habitats along the San Juan, Animas, and La Plata Rivers, flycatchers were documented 127 times, or about 88.9 percent in the 143 areas surveyed. However, the vast majority of these flycatchers were migrants and even fewer exhibited territorial behavior. Only five nesting pairs of flycatchers have been documented nesting at two locations (Shiprock, New Mexico, and below the Navajo Reservoir Dam) along the San Juan River in 1997-1998 (USFWS 2002; BOR 2006; BA, p. 6-3). The average annual flycatcher-nesting rate from survey results in suitable habitat along the San Juan River was (5 nesting pairs in 20 years of surveys) or 1.25 percent per year, over 20 years.

Riparian habitat occurs along the San Juan River along with water, wetlands, native willows, salt cedar and Russian olive for nesting substrate. Several agencies have or are conducting restoration efforts to improve riparian habitat conditions there. According to the NNDFW (2014), "there are likely patches of riparian habitat suitable for breeding in the San Juan River Deposition Area, or habitats that may become suitable for breeding during the life of the project." Therefore, we assume the San Juan River currently supports (AECOM 2013) and in the future will continue to support suitable nesting habitat for flycatchers.

Table 2. Rangewide population status for the southwestern willow flycatcher based on 1993 to 2007 survey data for Arizona, California, Colorado, New Mexico, Nevada, Utah, and Texas. (There is no recent survey data or other records to know the current status and distribution within the state of Texas.) (Durst et al. 2008).

State	Number of sites with territories as of 2007	Percentage of sites with territories as of 2007	Number of territories as of 2007	Percentage of total territories as of 2007
Arizona	124	43.1 %	459	35.3 %
California	96	33.3 %	172	13.2 %
Colorado	11	3.8 %	66	5.1 %
Nevada	13	4.5 %	76	5.9 %
New Mexico	41	14.2 %	519	40.0 %
Utah	3	1.0 %	7	0.5%
Total	288	100 %	1299	100 %

Total territory numbers recorded are based upon the most recent year's survey information from that site between 1993 and 2007.

YELLOW-BILLED CUCKOO

Western yellow-billed cuckoo (cuckoo) is a medium-sized bird about 12 inches (30 cm) in length and weighing about 2 ounces (57 grams [g]). Morphologically, cuckoos throughout the western continental United States and Mexico are generally larger, with significantly longer wings, longer tails, and longer and deeper bills compare to their eastern counterparts (Franzreb and Laymon 1993). The species has a slender, long-tailed profile, with a fairly stout and slightly down-curved bill, which is blue-black with yellow on the basal half of the lower mandible. Plumage is grayish-brown above and white below, with rufous primary flight feathers. The tail feathers are boldly patterned with large white spots on a black background on the underside of the tail. The legs are short and bluish-gray, and adults have a narrow, yellow eye ring. Juveniles resemble adults, except the tail patterning is less distinct, and the lower bill may have little or no yellow. Males and females differ slightly. Males tend to have a slightly larger bill and the white in the tail tends to form oval spots, whereas in females the white spots tend to be connected and less distinct (USFWS 2011b).

On October 3, 2013, the Western U.S. Distinct Population Segment (DPS) of yellow-billed cuckoo was listed as a threatened species under the ESA (USFWS 2014). The area for the western DPS of yellow-billed cuckoo is west of the crest of the Rocky Mountains. Critical habitat is proposed along the San Juan River where flycatcher critical habitat is designated on the north shore near Chinle Wash, in Utah (USFWS 2013c).

Cuckoo Life History

The breeding range of the entire yellow-billed cuckoo species formerly included most of North America from southeastern and western Canada (southern Ontario and Quebec and southwestern British Colombia) to the Greater Antilles and northern Mexico (AOU 1957, AOU 1983, AOU 1998). Western populations of cuckoos breed in dense riparian woodlands, primarily of cottonwood, willow, and mesquite (Prosopis spp.), along riparian corridors in otherwise arid areas (Laymon and Halterman 1989, Hughes 1999). Dense undergrowth may be an important factor in selection of nest sites. Narrow bands of riparian woodland can contribute to the overall extent of suitable habitat. Adjacent habitat on terraces or in the upland (such as mesquite) can enhance the value of these narrow bands of riparian woodland.

In the Lower Colorado River this species occupies riparian areas that have higher canopies, denser cover in the upper layers of the canopy, and sparser shrub layers when compared to unoccupied sites. Although this species is generally associated with breeding and nesting in large wooded riparian areas dominated by cottonwood trees, they have been documented nesting in salt cedar between Albuquerque and Elephant Butte Reservoir and along the Pecos River in southeastern New Mexico.

Throughout the cuckoo's range, a large majority of nests are placed in willow trees, but alder (Alnus spp.), cottonwood, mesquite, walnut (Juglans spp.), box elder, sycamore, netleaf hackberry (Celtis laevigata var. reticulata), soapberry (Sapindus saponaria), and tamarisk are also used (Laymon 1980, Hughes 1999, Corman and Magill 2000 , Corman and Wise-Gervais 2005, Holmes et al. 2008

Cuckoos reach their breeding range later than most other migratory breeders, often in June (Rosenberg et al. 1982). They construct an unkempt stick nest on a horizontal limb in a tree or large shrub. Nest height ranges from 4 ft to (rarely) 100 ft, but most are typically below 30 ft (Hughes 1999). The incubation period for cuckoo is 9 to 11 days, and young leave the nest at 7 to 9 days old. Nesting usually occurs between late June and late July, but can begin as early as late May and continue until late September (Hughes 1999).

The cuckoo primarily breeds in riparian habitat along low-gradient (surface slope less than 3 percent) rivers and streams, and in open riverine valleys that provide wide floodplain conditions (greater than 325 ft [100 m]). In the southwest, it can also breed in narrower reaches of riparian habitat. The moist conditions that support riparian plant communities that provide cuckoo habitat typically exist in lower elevation, broad floodplains, as well as where rivers and streams enter impoundments.

The optimal size of habitat patches for the species are generally greater than 200 ac (81 ha) and have dense canopy closure and high foliage volume of willows and cottonwoods (Laymon and Halterman 1989) and thus provide adequate space for foraging and nesting. Tamarisk, a nonnative tree species, may be a component of the habitat, especially in Arizona and New Mexico. Sites with a monoculture of tamarisk are unsuitable habitat for the species. The association of breeding with large tracts of suitable riparian habitat is likely related to home range size. Individual home ranges during the breeding season average over 100 ac (40 ha), and home ranges up to 500 ac (202 ha) have been recorded (Laymon and Halterman 1987, Halterman 2009, Sechrist et al. 2009, McNeil et al. 2011, McNeil et al. 2012).

In addition to the dense nesting grove, western yellow-billed cuckoos need adequate foraging areas near the nest. Foraging areas can be less dense or patchy with lower levels of canopy cover and often have a high proportion of cottonwoods in the canopy. Optimal breeding habitat contains groves with dense canopy closure and well-foliaged branches for nest building with nearby foraging areas consisting of a mixture of cottonwoods, willows, or mesquite with a high volume of healthy foliage (USFWS 2010e).

Cuckoos forage primarily by gleaning insects from vegetation, but they may also capture flying insects or small vertebrates such as tree frogs and lizards (Hughes 1999). They specialize on relatively large invertebrate prey, including caterpillars (Lepidoptera sp.), katydids (Tettigoniidae sp.), cicadas (Cicadidae sp.), and grasshoppers (Caelifera sp.)(Laymon et al. 1997). Minor prey includes beetles (Coleoptera sp.), dragonflies (Odonata sp.), praying mantis (Mantidae sp.), flies (Diptera sp.), spiders (Araneae sp.), butterflies (Lepidoptera sp.), caddis flies (Trichoptera sp.), crickets (Gryllidae sp.), wild berries, and bird eggs and young (Laymon et al. 1997, Hughes 1999). Prey species composition varies geographically. Their breeding season may be timed to

coincide with outbreaks of insect species, particularly tent caterpillars (Hughes 1999, USFWS 2001a) or cicadas (Johnson et al. 2007, Halterman 2009).
Cuckoos spend the winter in South America, east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (Ehrlich et al. 1992, AOU 1998, Johnson et al. 2008b). The species as a whole winters in woody vegetation bordering fresh water in the lowlands to 1,500 m (4,921 ft), including dense scrub, deciduous broadleaf forest, gallery forest, secondary forest, subhumid and scrub forest, and arid and semiarid forest edges (Hughes 1999). Wintering habitat of the cuckoo is poorly known.

Cuckoo Population Dynamics, Status, and Distribution

Since 1980, statewide surveys from New Mexico, Arizona, and California indicate an overall estimated 52 percent decline with numbers too low to establish trends from Idaho, Montana, Utah, Nevada, and Colorado. Trend information is also lacking from west Texas and Mexico. Yellow-billed cuckoo has been extirpated as a breeding bird in Washington, Oregon, and British Columbia (USFWS 2011b). Comparisons of historic and current information suggest that the western yellow-billed cuckoo’s range and population numbers have declined substantially across much of the western U.S. over the past 50 years.

Although the overall population size of this species remains large, western populations in many areas have decreased dramatically. Major declines among western populations in the 20th century are attributed to habitat loss and fragmentation. Although once considered a common nester in Arizona river bottoms, fewer than 50 pairs were estimated present in the state in the early 1990s. The greatest declines have been in California, from an estimated 15,000 pairs in the late 19th century to a few dozen pairs by the mid-1980s (New Mexico Partners in Flight 2014).

Based on historic accounts, the species was widespread and locally common in California and Arizona, locally common in a few river reaches in New Mexico, locally common in Oregon and Washington, generally local and uncommon in scattered drainages of the arid and semiarid portions of western Colorado, western Wyoming, Idaho, Nevada, and Utah, and probably uncommon and local in British Columbia (USFWS 2011b). The largest remaining breeding areas are in southern and central California, Arizona, along the Rio Grande in New Mexico, and in northwestern Mexico (USFWS 2010e). The current breeding population is low, with estimates of approximately 350 to 495 pairs north of the Mexican border and another 330 to 530 pairs in Mexico for a total of 680 to 1,025 breeding pairs (USFWS 2010e).

In New Mexico, the species was historically rare statewide, but common in riparian areas along the Pecos River and Rio Grande, as well as uncommon to common locally along portions of the Gila, San Francisco, and San Juan Rivers. A review on the status of the species in New Mexico concluded that the species would likely decline in the future due to loss of riparian woodlands (USFWS 2011b). In the eastern third of the state, non-native salt cedar has provided habitat for approximately 1,000 pairs of yellow-billed cuckoos in historically unforested areas (USFWS 2011b). Few cuckoo surveys have been conducted on the San Juan River (Reclamation 2006; OSMRE 2014b; USFWS 2013, 2014).

No habitat capable of supporting cuckoo is present within the Navajo Mine Lease Area or Pinabete Permit Area due to lack of riparian woodland habitats and perennial water resources (BNCC 2012b). Some marginally suitable habitat for yellow-billed cuckoo occurs in the FCPP Lease Area along the riparian vegetation around Morgan Lake and within the salt cedar vegetation within the DFADA (AECOM 2013d). Along the PNM transmission line ROWs, areas identified as potentially capable of supporting yellow-billed cuckoo habitat were identified near the Rio Puerco, San Juan River, and at Morgan Lake. Each of these areas were considered to be marginal habitat as it occurs immediately adjacent to area affected by noise and disturbance and consisted of a dense, low-growing Russian olive trees or salt cedar. After timbering, these areas lack the overstory structure that cuckoo usually prefers. Suitable habitat along the San Juan River and Morgan Lake were subject to protocol surveys in June and July 2012 (Marron 2012b). No yellow-billed cuckoos were identified during those surveys.

However, cuckoos have been documented as occurring along the San Juan River from Navajo Reservoir to the Arizona state line (New Mexico Partners in Flight 2014). Staff from the BLM, Farmington Field Office, have documented this species at five of their San Juan River parcels during 2002 and 2003 surveys between the Hogback and Bloomfield, New Mexico. The closest potential habitat for this species was documented along the San Juan River (Ecosphere 2011). Approximately 6,726 acres of potentially suitable cuckoo habitat was identified within the Deposition Area (AECOM 2013b, 2014).

ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the effects of the action on federally listed species, the Service is required to take into consideration the environmental baseline. Regulations implementing the ESA (50 CFR 402.02) define environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area; the anticipated impacts of all proposed Federal actions in the action area that have already undergone formal or early section 7 consultation; and the impact of State and private actions that are contemporaneous with the consultation in process. All projects previously built or consulted on, and those State, Tribal, or private projects presently being built or considered that deplete water from the San Juan River basin are in the Environmental Baseline for this proposed action. The environmental baseline does not include the effects of the action under review, only actions that have occurred previously.

Federally authorized (or unauthorized) Hg-emitting activities were difficult to categorize as either part of the environmental baseline or part of cumulative effects. Therefore, we aggregated those into the environmental baseline. Numerous activities, natural sources, and legacy sources have emitted Hg in the past or currently and some of that Hg has variously deposited in the San Juan River Basin over time (EPRI 2014). Since the surface area of water is low in the San Juan River Basin, almost all Hg deposition falls on land, primarily as elemental or ionic mercury. The deposited Hg either evades back to the atmosphere or sequesters to soil. Over time, when overland flow takes place, soil is eroded from the catchment surface and carries adsorbed Hg (e.g., Hg ions; EPRI 2014) with it to the river. About 0.1 percent of ionic deposited in the watershed enters surface waters (EPRI 2014). Because of the relatively large amount of Hg deposited to San Juan River Basin soils from local, regional and global sources, Hg in water and fish are slow to respond to changes in Hg deposition, including reductions (EPRI 2014). Thus, Hg emission and deposition in the San Juan River Basin that may have occurred in the past, and may continue to affect the listed species and critical habitat today, or will affect the listed species and habitat in the future are considered as part of the environmental baseline.

The EPRI (2014) model predicts gradually rising Hg concentrations in water and fish tissue because the watershed has not yet reached equilibrium with the rate of atmospheric deposition the watershed has been receiving. Modeled reductions in Hg emissions (with concordant changes in Hg deposition, transport, methylation, and bioaccumulation) also never exceeded a 0.2 percent reduction in Colorado pikeminnow tissue burdens within the 85-year model simulation period (EPRI 2014). Therefore, except for Hg deposition associated with the proposed action, we characterize Hg deposition from past and current activities and Hg deposition from non-USA sources (e.g., East Asia) in the San Juan River Basin all as part of the environmental baseline (and do not separate it further into cumulative effects). In preparing this BO, we evaluated the direct and indirect effects of the proposed action and added those effects to the environmental baseline (see 50 CFR 402.02).

FACTORS AFFECTING LISTED SPECIES AND CRITICAL HABITAT IN ACTION AREA

The San Juan River is a tributary to the Colorado River and drains a basin of approximately 25,000 mi^2 (65,000 km^2) located in Colorado, New Mexico, Utah, and Arizona (BOR 2002).

From its origins in the San Juan Mountains of southwestern Colorado (at an elevation exceeding 13,943 ft; 4,250 m), the river flows westward through New Mexico, Colorado, and into Lake Powell, Utah. The majority of water that feeds the 345 mi (570 km) of river is from the mountains of Colorado. From a water resources perspective, the area of influence for the proposed action begins at the inflow areas of Navajo Reservoir and extends west from Navajo Dam approximately 224 mi (359 km) along the San Juan River to Lake Powell. Reclamation operates and maintains Navajo Dam (BOR 2002). Navajo Dam regulates river flows, provides flood control, and contributes to recreational and fishery activities (BOR 2002). The major perennial tributaries below Navajo Dam are the Animas, La Plata, and Mancos Rivers, and McElmo Creek (Figure 6). In addition, numerous ephemeral arroyos and washes that contribute little flow but large sediment loads to the San Juan River occur. The Chaco River is an intermittent tributary to the San Juan River that passes just to the west of Navajo Mine and FCPP.

Reclamation (BOR 2006) described, in its Final Environmental Impact Statement for Navajo Reservoir Operations, changes in biodiversity associated with the historical San Juan River that occurred after installation of Navajo Dam (1957-1962). The reservoir physically altered the San Juan River and surrounding terrain and modified the pattern and quality of flows downstream (Holden 1999; BOR 2002, 2006, 2008; USFWS 2006). Similar to rivers downstream of other dam operations in the southwestern United States, the San Juan River below the dam became clearer due to sediment retention, and downstream water became colder, because water was released from deep in the reservoir. All species of plants and animals that existed along the river channel were affected to varying degrees (BOR 2006?). The disruption of natural patterns of flow caused changes to the vegetation along the riverbanks by altering the previously established conditions under which the plants reproduced and survived. Compounding these changes has been the intentional and non-intentional introduction of non-native species of fish that compete with and prey on native species (BOR 2002).

Platania and Young (1989) summarized historic fish collections in the San Juan River drainage that indicate that Colorado pikeminnow once inhabited reaches above what is now Navajo Dam and Reservoir near Rosa, New Mexico (now inundated by Navajo Reservoir). The creation of Lake Powell and Navajo Reservoir resulted in the direct loss of approximately 161 km (100 mi) of San Juan River habitat for the Colorado pikeminnow and razorback sucker (Holden 2000). Since closure of Navajo Dam in 1963, the accompanying fish eradication program, physical changes associated with the dam, and barriers to movement, wild Colorado pikeminnow have been eliminated from the upper San Juan River upstream of Navajo Dam. In addition to the changes caused to the river by dam operations, there were changes to how nearby lands were used (BOR 2002). Irrigation water provided by Navajo Dam contributed to large agricultural developments in this arid region (Abell 1990; Blanchard et al. 1993; Thomas et al. 2008).

Navajo Reservoir stores water for the Navajo Indian Irrigation Project (NIIP), the Hammond Irrigation Project, and various municipal and industrial uses making it possible to nearly double the amount of irrigation in the basin. At present, the NIIP diverts an annual average of approximately 160,000 AFY from the reservoir for irrigation south of Farmington (BOR 2002). In the future, the use of San Juan River water is expected to approximately double (BOR 2002). These demands will further affect the river and the native species dependent on the river both directly, through flow diversions, and indirectly, through changes in water quality, as a result of the transportation of sediment, metals, salts, pesticides, and nutrients from irrigated lands through seepage and return flows (Blanchard et al. 1993; BOR 2002; Thomas et al. 2008). In addition to the effects of Navajo Dam and Reservoir, over the last century the San Juan River has been diverted for a variety of uses, resulting in a variety of return flows to the river, including variously-treated municipal wastewater, industrial wastewater, and urban and natural stormwater runoff and seepage (Abell 1990; BIA 1999; USFWS 2009).

Although there are impacts to the river ecosystem from dam construction itself, dams have many impacts that continue after the structure is complete. Dams affect the physical, chemical, and biological components of a stream ecosystem (Williams and Wolman 1984; USFWS 1998, 2002; Collier et al. 2000; Mueller and Marsh 2002). Some of these effects include a change in water temperature, a reduction in lateral channel migration, channel scouring, blockage of fish passage, transformation of riverine habitat into lake habitat, channel narrowing, changes in the riparian community, diminished peak flows, changes in the timing of high and low flows, and a loss of connectivity between the river and its flood plain (e.g., Sherrard and Erskine 1991; Power et al. 1996; Kondolf 1997; Collier et al. 2000; Polzin and Rood 2000; Shields et al. 2000). Of these, changes in water temperature, water depletions, blockage of fish passage, transformation of riverine habitat, changes in the timing and magnitude of high and low flows, and changes in channel morphology, and water quality are discussed in greater detail below. The conditions below, plus nonnative species predation and competition adversely affect both endangered fishes and their critical habitat in the San Juan River.

Water temperature

Below Navajo Dam, summer water temperatures are colder and winter water temperatures are warmer than the pre-dam condition. The first 10 km (6.2 mi) below the dam have substantially reduced suspended sediment concentrations, resulting in the clearest water of any reach (Miller and Ptacek 2000). Colorado pikeminnow are currently found from near the confluence of the Animas River downstream to Lake Powell, although temperatures in the upper reach of this area may be colder than the species prefers (Durst and Franssen 2014).

The cold water released from Navajo Reservoir limits the potential spawning habitat of the endangered fishes in the San Juan River (Holden 1999; Cutler 2006; Lamarra 2007). Prior to dam construction, water temperatures at Archuleta (approximately 10 km [6.1 mi] below the dam) were above the threshold spawning temperature of 20º C (68º F) for approximately two months (Holden 1999). Based on cumulative degree-days, spawning could have occurred at Archuleta by July 11 each year prior to dam closure (Lamarra 2007). Since dam construction, water temperature at that site is rarely over 15º C (59º F) and is too cold for successful Colorado pikeminnow spawning (Holden 1999, Cutler 2006, Lamarra 2007). The threshold temperatures for spawning at Shiprock (approximately 125 km [78 mi] below the dam) occur about two weeks later on average than prior to dam construction (Holden 1999, Lamarra 2007). Spawning is unlikely to occur from Navajo Dam to the confluence of the Animas River (approximately 72 km [45 mi] below the dam) and may also be delayed for two weeks or more from the confluence with the Animas River down to Shiprock, New Mexico (Lamarra 2007).

Water temperatures near Shiprock before the construction of Navajo Dam were above 20º C (68º F) from approximately mid-June until mid-September (Holden 1999). Projected temperatures at Shiprock from 1993-1996 were above 20º C (68º F) for more than one month (August) (Holden 1999). Because fish are cold-blooded, their metabolism and growth are dependent upon water temperature. The amount of food eaten, assimilation efficiency, and time to sexual maturity are largely governed by water temperature (Lagler et al. 1977). Cold water typically decreases food consumption, assimilation efficiency, and growth rate, and increases the time to sexual maturity (Lagler et al. 1977).

Development time of Colorado pikeminnow and razorback sucker embryos is inversely related to temperature, and survival is reduced at temperatures that depart from 20º C (68ºF) (Bulkley et al. 1981, Hamman 1982, Bestgen 2008). Marsh (1985) found that for razorback suckers, time to peak hatch was nine days at 15ºC (59ºF) and 3.5 days at 25ºC (77ºF) and that the percent of eggs hatched was highest at 20ºC (68ºF). Bestgen (2008) found that fastest growth of razorback sucker occurred at 25.5ºC (77.9ºF). Fast larval growth may be linked to higher survival rates because the faster the larval fish grow, the less time they are highly susceptible to predation.

All Colorado pikeminnow eggs tested died at incubation temperatures of 15ºC (59ºF) or lower, and survival and hatching success were maximized near 20º C (68º F) (Marsh 1985). Bestgen and Williams (1994) found a relatively wide range of acceptable incubation temperatures above 18ºC (64.4 ºF). In addition, Bestgen et al. (2006) found that early hatching Colorado pikeminnow larvae in the Green River were almost twice the size of late hatching ones because they had more time to grow.

Because the combination of a suitable spawning bar (an area of sediment-free cobbles) and suitable temperatures occur low on the San Juan River at the Mixer, there is a greater chance that larval fish will drift into Lake Powell and be lost from the population. Dudley and Platania (2000) found that drifting larval Colorado pikeminnow would be transported from the Mixer Area to Lake Powell in as little as three days. For those larval fish not carried into Lake Powell, a delay in spawning (which reduces the amount of time YOY have to grow before winter) and overall colder water temperatures (resulting in slower growth) could lead to smaller, less fit YOY and reduce survival. There is speculation that the large volume of cold water in the upper Green River may be a major reason why larval Colorado pikeminnow drift so far downstream (Holden 2000). The same pattern may also occur on the San Juan River.

Cold water released from Navajo Dam has affected razorback sucker and Colorado pikeminnow in a number of ways. Water temperatures that were once suitable for spawning for Colorado pikeminnow near Archuleta are no longer suitable, and, if spawning were to occur near Shiprock, it would be delayed by approximately two weeks compared to pre-dam conditions and thereby desyncing the phenology of their emergence during periods of appropriate food resources. A delay in spawning reduces the amount of time that larval fish have to grow before winter, and colder temperatures reduce growth rate, increasing the amount of time that the larval fish are highly susceptible to predation.

Blockage of fish passage

Like other major dams on the Colorado River and its tributaries, Navajo Dam blocked all fish passage. While native fish once could move unimpeded from the San Juan River into the Colorado River and its tributaries, they are now confined to a relatively short reach of 362 km (225 mi) between Lake Powell and Navajo Dam. Razorback sucker and Colorado pikeminnow that may have been trapped above the reservoir have all died or were killed during treatment with rotenone (Olson 1962, Holden 1999). In addition to the major dams, the diversion structures constructed in the San Juan River have also created barriers to fish passage.

Dams have fragmented razorback sucker and Colorado pikeminnow habitat throughout the Colorado River system. Within the San Juan River, fish passage was once impeded by five instream structures. One of these structures has been removed, two have been equipped with fish passage structures, and two remain as impediments to fish passage for part of the year depending on flow. However, no remaining structures are complete barriers within critical habitat.

The five identified diversion structures (Cudei, Hogback, FCPP, SJGS [PNM weir], and Fruitland Irrigation Canal diversions) between Farmington, New Mexico, and the Utah state line were barriers to fish passage at certain flows. When radio telemetry studies were initiated on the San Juan River in 1991, only one radio-tagged Colorado pikeminnow was recorded moving upstream past one of the diversions. In 1995, an adult Colorado pikeminnow moved above the Cudei Diversion and then returned back downstream (Miller and Ptacek 2000). Other native fish had been found to move either upstream or downstream over all five of the weirs (Buntjer and Brooks 1997, Ryden 2000a). In 2001, Cudei Diversion (RM 142) was removed from the river and Hogback Diversion (previously an earth and gravel berm structure), which had to be rebuilt every year, was made into a permanent structure with non-selective fish passage. It is likely that Colorado pikeminnow, razorback sucker, and other native fishes can negotiate the ladder. The removal of Cudei Diversion and installation of the fish ladder at Hogback Diversion improved access for native fishes over a 24.5 mi (39.4 km) reach of river.

Until 2003, the PNM Weir (RM 166) was also a barrier to fish passage. Because of funding and technical assistance from the SJRRIP and operation and maintenance by the Navajo Nation, the PNM selective fish ladder was completed and has been operational since 2003. This has allowed passage past that structure by Colorado pikeminnow and razorback suckers. From 2003 – 2007, 65,596 native fish used the passage including 27 Colorado pikeminnow and 21 razorback suckers (LaPahie 2007 in litt). However, the FCPP Diversion at RM 163.3 can act as a fish barrier when the control gate for the structure is closed (Masslich and Holden 1996). Above the PNM weir, at the Fruitland Irrigation Canal Diversion (RM 178.5), model results suggest that the rock dam structure does not significantly hinder fish passage, expect perhaps at very high discharges (8,000 cubic feet per second [cfs] and greater) (Stamp and Golden 2005).

Colorado pikeminnow and razorback sucker can potentially navigate from Lake Powell, past the Animas River, and up to Hammond Diversion Dam, a total of approximately 338 km (210 mi).

An additional passage barrier exists where the San Juan River enters Lake Powell (Schleicher and Ryden 2013). When Lake Powell is not full, the San Juan River has changed course and enters Lake Powell over a sandstone ledge and creates an approximately 30-foot-high waterfall, which prevents fish from moving upstream into the San Juan River. This barrier is not absolute as the waterfall is occasionally inundated by Lake Powell level fluctuations during wetter periods (approximately one in ten years, on average), temporarily allowing fish access. Pikeminnow and razorback sucker that pass over this waterfall cannot return to the San Juan River to contribute to the population. Additionally, larval fish could be transported from the Mixer Area to Lake Powell in as little as 3 days (Dudley and Platania 2000). Surveys conducted in 2011 in the San Juan arm of Lake Powell documented both Colorado pikeminnow and razorback sucker (Schleicher and Ryden 2013. Razorback sucker are able to reproduce within the lake, but Colorado pikeminnow likely cannot. Razorback sucker tagged on the San Juan River have been documented in the upper Colorado River, indicating that some exchange of individuals from the San Juan River to the upper Colorado River through Lake Powell can occur.

Water Diversion and Withdrawal

As discussed previously, natural flow regimes are essential to the ecological integrity of large western rivers (USFWS 1998) and for the maintenance or restoration of native aquatic communities (Lytle and Poff 2004, Propst and Gido 2004, Propst et al. 2008). The flow regime works in concert with the geomorphology of the basin to establish and maintain the physical, chemical, and biological components of a stream ecosystem (Williams and Wolman 1984, Allan 1995, USFWS 1998, Collier et al. 2000, Mueller and Marsh 2002). Depletions play a major role in limiting the amount of water available as potential fish habitat as well as for achieving the Flow Recommendations (Holden 1999; BOR 2006).

Significant depletions and redistribution of flows of the San Juan River have occurred because of other major water development projects, including the NIIP and the San Juan-Chama Project. At the current level of development, average annual flows at Bluff, Utah, already have been depleted by 30 percent (Holden 1999). By comparison, the Green and Colorado Rivers have been depleted approximately 20 percent (at Green River) and 32 percent (at Cisco), respectively (Holden 1999). These depletions have likely contributed to the decline in Colorado pikeminnow and razorback sucker populations (USFWS 1994, 1998). To the extent that water is exported out of the basin (San Juan-Chama Project) or consumptively used (e.g., evaporation from fields, irrigation canals, reservoir surface) it is not available to maintain flows within the river.
Water depletion projects, including Project diversions that were in existence prior to November 1, 1992, are considered to be historic depletions because they occurred before the initiation of the SJRRIP. The depletions associated with the FCPP and Navajo Mine are considered historic depletions as diversion and consumptive use associated with Permit 2838 have been part of the basin depletions since the 1960s. However, the effects of those depletions are fully considered in this consultation. Projects that began after this date are considered new projects. On May 21, 1999 the Service determined through section 7 consultation that new depletions of 100 af or less, up to a cumulative total of 3,000 AFY, would not: 1) limit the provision of flows identified for the recovery of the Colorado pikeminnow and razorback sucker, 2) be likely to jeopardize the endangered fish species, or 3) result in the destruction or adverse modification of their critical habitat. Consequently, any new depletions under 100 AFY, up to a cumulative total of 3,000 AFY, may be incorporated under the 1999 BO but would still require ESA consultation.

Consultations contributing to the baseline depletions used reoperation of Navajo Reservoir in accordance with the Flow Recommendations as part of their section 7 compliance. Some of these projects have been completed (e.g., PNM Water Contract with Jicarilla Apache Nation), some are partially complete (e.g., NIIP), and some have not been fully implemented (e.g., Animas-La Plata Project).

As discussed under "Changes in the Timing and Magnitude of Flow" it is anticipated that climate change will create additional depletions to the San Juan River. The magnitude and timing of the depletions cannot be predicted with certainty at this time. Several studies project a decrease in stream flow from eight to 45 percent depending on the model used, the time frame, and the methods (Christensen and Lettenmeier 2006, Hoerling 2007, Seager et al. 2007, Udall 2007, Ray et al. 2008). Although the San Juan River was not modeled independent of the entire Colorado River basin in these studies, based on the projections of the IPCC (in Christensen et al. 2007) for warmer temperatures and an increase in the frequency of hot extremes and heat waves, it is reasonable to expect that there will be a decrease in stream flow in the future.

Transformation of Riverine Habitat into Lake Habitat

Lake Powell inundated the lower 54 miles of the San Juan River and Navajo Reservoir inundated about 27 miles. This inundation reduced the total amount of available habitat by over 30 percent and reduced the amount of endangered fish habitat in the lower end of the river (USFWS 2002a, 2006). Lake Powell is also home to several nonnative predators and competitors. In years when the falls are inundated, these fish may travel up the San Juan and prey upon and compete with endangered fishes.

Flow Changes

Prior to the construction of Navajo Dam, mean monthly flows in the San Juan River ranged from less than 50 cfs during the late summer/early fall to nearly 20,000 cfs in May (USFWS 2006). Spring peak flows of more than 15,000 cfs occurred 25 percent of the time, and the highest peak flow recorded was 52,000 cfs. Construction of the dam decreased peak discharges by more than half and elevated base flows by 168 percent on average. The USFWS (2006) estimated that average annual flows in the San Juan River at Bluff, Utah, had been depleted by 30 percent, and that these depletions likely contributed to the decline in Colorado pikeminnow and razorback sucker populations. The Navajo Reservoir BO cited total New Mexico diversions of 617,128 af/yr and total basin diversions of 854,376 af/yr.

Surface water drawn from the San Juan River into Morgan Lake for use at the FCPP is obtained according to water rights for 51,600 af/yr diversion, 39,000 af/yr consumptive held by BBNMC under New Mexico Office of the State Engineer Permit 2838. No changes to the water rights or water use would occur under the Proposed Action, and the ability to draw as much water as the rights allow for the Project life is maintained. However, future operations at FCPP are expected to have reduced quantity of both diversions and consumptive use from historical operations (see above).

Flow Recommendations were developed through the SJRRIP during the 1990s to better support populations of native fish, including the Colorado pikeminnow and razorback sucker (Holden 1999). Navajo Dam has been operated to meet these flow recommendations since they were published and completed an EIS in support of these modified operations in 2006 (BOR 2006) the USFWS issued a BO for those operations (USFWS 2006). The BO indicates that the reoperation of the dam provides native fish with the proper cues at the proper times to trigger spawning and appropriate habitat at the appropriate time to support young fish. Therefore, the operation of Navajo Dam and the water rights considered would not adversely affect listed species, provided sufficient progress is made toward endangered fish recovery.

Channel Morphology

The timing and magnitude of flows and the amount of sediment input into the system influences channel form and morphology, which creates habitat for fish and other aquatic organisms. The channel of the San Juan River has narrowed considerably since the 1930s because of upland habitat degradation and erosion (Holden 1999) and may also be associated with climate changes. These changes to the active river channel have been exacerbated by the reduction of high spring peak flows following the closure of Navajo Dam. The lack of flood flows has allowed nonnative riparian vegetation, such as tamarisk and Russian olive, to encroach on the river channel. These nonnative plants are very resistant to erosion, resulting in channel narrowing and a subsequent increase in water velocity. Narrow channels have few backwater habitats or active secondary channels that are important for some life stages of the endangered fishes. Narrowing of the channel increases water velocity and decreases the amount of low-velocity habitat important to young Colorado pikeminnow and razorback sucker (USFWS 2006).

Channel complexity increased between 1960 and 1988 to near historical levels, due in part to a number of wet years and despite the closure of Navajo Dam near the beginning of this period. Channel narrowing appears to have stopped or been substantially reduced by 1988 (Holder 1999), which may be due in part to higher flows implemented in 1992 to mimic natural flows. The amount of backwater habitat decreased since 1992, relative to the period prior to 1991, but this may have been due to an unusually large amount of backwater habitat prior to 1991 as a result of several wet years. The amount of other low-velocity habitats did not change significantly after 1992 (Holden 1999) and channel complexity has remained stable (USFWS 2006).

Navajo Dam’s operations have been modified to include flows that may continue to support geomorphic processes, the formation of backwaters, and promote channel complexity. However, because of the various droughts in the basin, not all of the flow recommendation targets have been met in recent years. The last time all of the flow targets were met was in 2005. The goal of 10,000 cfs for 5 or more days has not been met since 2005, with the exception of 4 days of high flows that were provided in 2008. The last time the target number of days of flow of 8,000 and 5,000 cfs were met was in 2008. The 2,500-cfs flow target has been met consistently since 2003 (BOR 2012).

Water of Sufficient Quality

Water quality is of concern in the San Juan River Basin with many water bodies, including the San Juan River, being impaired for one or more factors, including metals, sediment, salinity, temperature, fecal matter, and dissolved oxygen (USFWS 2006). Land uses within the basin contribute metals, salts, fossil fuel residuals (e.g., polycyclic aromatic hydrocarbons (PAHs)), and pesticides to the San Juan River and its tributaries. The USEPA (1979), Abell (1994), and Reclamation (2002) and Thomas et al. (1998, 1999) conducted comprehensive contaminants reviews of the San Juan River Basin water quality and identified irrigation and mineral extraction, processing, and utilization as major sources of pollution.

Fish consumption advisories for mercury in fish tissue have been issued for Navajo Reservoir and other smaller reservoirs in the basin (NMED 2012; fishadvisoryonline.epa.gov/Advisories.aspx). The Nature Conservancy (2013) along with others, reported that aquatic integrity of the San Juan River Basin was generally fair. A summary of their ranking of aquatic integrity based partially on water quality is in Figure 13.

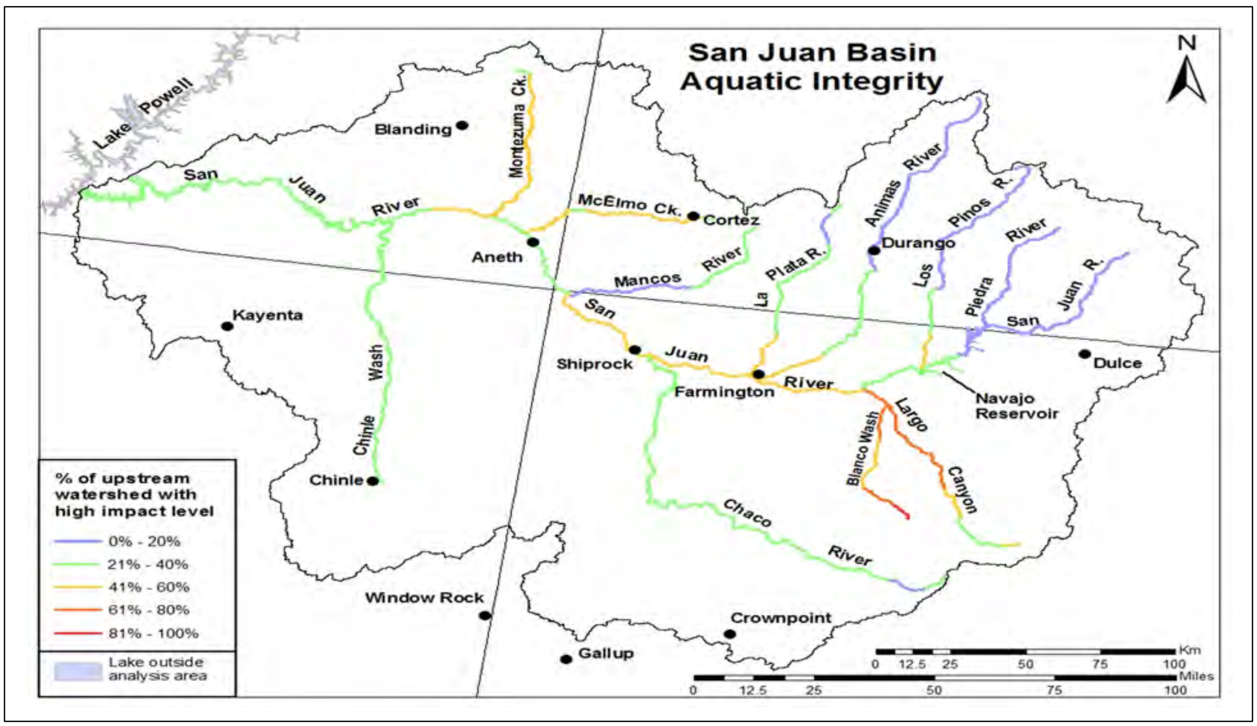


Figure 13. San Juan River Basin aquatic integrity ranking by the Nature Conservancy (2013).

Service (USFWS 2011a, 2012c) reviews of threats to endangered fishes identify potential contaminants, including pesticides and other pollutants as potentially affecting Colorado pikeminnow and razorback sucker critical habitat. Pesticide concentrations generally were low and varied seasonally and across land uses (Blanchard et al. 1993; Thomas et al. 1998,1999). Thomas et al. (1998, 1999); Simpson and Lusk (1999); Hinck et al. (2006); Osmundson and Lusk (2011); AECOM 2013; and EPRI (2014) identified mercury or selenium as moderately elevated contaminants of concern in biota and fish tissues collected from the San Juan River Basin.

The concentrations of Hg and Se in fish and wildlife tissues are the most relevant to the understanding of effects to endangered fishes or birds (Hamilton and Lemly; USEPA 2014). We used tissue and dietary concentrations as the foundation of our effects analysis below, rather than focusing entirely upon Hg and Se concentrations in air or water. However, Hg and Se in water are discussed as they are part of the PCEs of critical habitat ("water of sufficient quality). Concentrations of Hg and Se in different type of tissues (e.g., muscle, whole body, eggs) are relevant to different types and magnitudes of physiological effects. We begin with a discussion of various conversions of Hg and Se concentrations in one type of tissue to other types of tissues provided below.

Conversion of Hg or Se in Fish or Wildlife Tissues from a Dry Weight to a Wet Weight Basis

Biologists and chemists often measure, quantitate, and interpret environmental contaminants (e.g., Hg, Se, pesticides, etc.) in fish and wildlife tissues (Keith 1996). Because the main component of fish tissue is water, the moisture content of fish tissues is often determined from samples that are analyzed for environmental contaminants. Samples are weighed fresh, oven or freeze dried and weighed again. Moisture content as a percent is calculated from the wet and dry weights of the samples. Thereafter, contaminant data in fish tissues can be reported in either dry weight (DW) or wet weight (WW) concentrations and are so indicated in this BO. Using Equation (1), DW concentrations of contaminants in fish and wildlife tissues were converted into WW concentrations using Equation 1 (or solved for DW to convert to WW concentrations):

$$WW = DW \times [1 - (\text{percent sample moisture}/100)] \qquad \text{Equation (1)}$$

Conversion of Hg in Fish Muscle Tissue to Hg in Whole Body Fish

Since Hg accumulates in fish muscle, rather than fat, skin, or organs, the manner in which fish samples are analyzed may affect the reported concentrations (USEPA 2000). Using whole fish samples will generally give a reduced Hg concentration, relative to muscle tissues (fillets), due to a dilution effect from lower concentrations in non-fillet portions of the fish (Peterson et al. 2005). Sampling of fish to determine Hg concentration is a routine part of many environmental studies and traditionally requires that numerous fish be killed to acquire sufficient tissue volume for analysis (Baker et al. 2004). Methods of Hg detection in fish tissue have improved over time (Cizdzeil et al. 2002). As regulatory authorities are reluctant to permit destructive sampling of numerous rare or endangered fish species, there was a need for wide-scale application of nonlethal techniques that could reliably measure Hg concentrations in fish muscle over time (Waddell and May 1995; Baker et al. 2004; Osmundson et al. 2010).

Several studies have reported relationships between concentrations of Hg or Se measured in biopsied muscle plugs (and fillets) collected from fish and concentrations in similar whole body fish (Waddell and May 1995; Buhl and Hamilton 2000; Osmundson et al. 2000; Baker et al. 2004; Hamilton et al. 2005; Peterson et al. 2005; GEI Inc. et al. 2008; Osmundson and Skorupa 2011; USEPA 2004, 2014). After review, we used the following equations to extrapolate between Hg or Se in muscle (MP), in egg/ovary (EO) tissues, or in whole body (WB) fish.

Colorado Pikeminnow Tissue Conversions:

$$WB\ Hg\ WW = 10^{\wedge}(-0.2387+(0.9048*Log_{10}(MP\ Hg\ WW))) \qquad \text{Equation (2)}$$
(Source: Peterson et al. 2005 for Northern Pikeminnow (*Ptychocheilus oregonensis*)

$$EO\ Se\ DW = \exp(0.8150 + (0.9384*Ln(MP\ Se\ DW))) \qquad \text{Equation (3)}$$
(Osmundson and Skorupa 2011 for prespawn Roundtail Chub (*Gila robusta*)

$$EO\ Se\ DW = 2.04* (MP\ Se\ DW) \qquad \text{Alternate Equation (4)}$$
(USEPA 2014 for all Roundtail Chub)

$$EO\ Se\ DW = -3.412 + (5.049*(MP\ Se\ DW)) \qquad \text{Alternate Equation (5)}$$
(Buhl and Hamilton 2000 for Colorado pikeminnow)

Razorback Sucker Tissue Conversions:

$$WB\ Hg\ WW = 10^{\wedge}(-0.3203+(0.9048*Log_{10}(MP\ Hg\ WW))) \qquad \text{Equation (6)}$$
(Source: Peterson et al. 2005 for White Sucker)

$$EO\ Se\ DW = -1.51 + (2.66*(MP\ Se\ DW)) \qquad \text{Equation (7)}$$
(Hamilton et al. 2005 for Razorback sucker)

$$EO\ Se\ DW = 1.12* (MP\ Se\ DW) \qquad \text{Alternate Equation (8)}$$
(USEPA 2014 for Razorback sucker)

Conversions Used For All Fishes:

$$WB\ Se\ DW = \exp(0.1331 + (0.8937*\ln(MP\ Se\ DW))) \qquad \text{Equation (9)}$$
(Source: USEPA 2004 for all fishes)

$$\text{Percent Egg/Early Life Stage Survival} = 100*(0.8981 - (0.011*(EO\ Se\ DW)) \qquad \text{Equation (10)}$$
(Source: derived for this BO, see below and Lusk 2015)

$$\text{Dietary selenium toxicity to larval fish} = (e^{\wedge}(10.0768+(-7.5758)*Ln(\text{dietary Se DW}) / (1+ e^{\wedge}(10.0768 +(-7.5758)*Ln(\text{dietary Se DW})))*100 \qquad \text{Equation (11)}$$
(Source: derived for this BO, see below and Lusk 2015)

Mercury

Once atmospheric Hg is deposited to land or water, it can be converted into a biologically available form, methylmercury (MeHg), through a methylation process by bacteria mostly in wetlands and anoxic conditions (USEPA 1997, Lorey 2001, Wiener et al. 2007; EPRI 2014). The biological uptake of Hg is also exceedingly complex, but generally, MeHg enters an aquatic food chain involving plants, zooplankton and benthos, herbivorous fish, and then carnivorous fish (Potter et al. 1975, Grieb et al. 1990, EPA 1997, UNEP 2002). Uptake of MeHg by aquatic organisms is both more rapid and more extensive than uptake of inorganic Hg (Biesinger et al. 1982, EPA 1997), and uptake of MeHg differs from inorganic Hg. Toxicologically, MeHg bioaccumulates in food chains, and particularly in aquatic food chains, meaning that organisms exposed to MeHg in their food can build up concentrations that are many times higher than ambient concentrations in the environment. Atmospheric Hg deposition, and subsequent overland transport, is the predominant pathway delivering Hg to aquatic systems and into fish tissues (Downs et al. 1998; Cocca 2001; Bullock 2005; USEPA 2005; Engstrom 2007; Harris et al. 2007), including into the endangered fish tissues of the San Juan River Basin (EPRI 2014).

Current Hg Deposition in the San Juan River Basin

Sather et al. (2013) measured the atmospheric deposition of Hg at various stations within San Juan River Basin. Sather et al. (2013) reported Hg deposition at Mesa Verde National Park to range from 14.6 to 19.2 Hg g/m^2, which comports with modeled estimates of EPRI (2014) of ~20.3 Hg g/m^2. Sather et al. (2013) described the regional data pattern of Hg deposition recorded at five other sites within the San Juan River Basin and found them strongly correlated suggesting that many locations within the basin are similarly impacted by the same regional/natural/global Hg emission sources. Results of the National Atmospheric Deposition Program - Mercury Deposition Network show total mercury concentrations in dry deposition and/or precipitation at Mesa Verde National Park in the San Juan River Basin are among the highest measured in the United States (Weidner 2007; Sather et al. 2013). Weidner (2007) identified a majority high deposition samples measured at Mesa Verde National Park have trajectories that trace back to within 50 km of the FCPP and SJGS, which supports the theory that air masses passing from near these coal-fired power plants are contributing to Hg deposition in the San Juan River Basin. Sather et al. (2013) also used back trajectory analysis and reported fewer air masses passing near the FCPP during 2009 to 2011.

The USEPA (through contractor ISC, International 2008) reported that in 2001, 712 kilograms (kg) (~1,569 lbs) per year of Hg were deposited into the San Juan River Basin. Sources of that Hg deposition in the basin were attributed to the global pool of Hg (95.8 percent), followed by other sources (1.8 percent), the SJGS (1.8 percent), FCPP (1.0 percent), and Mexico (0.6 percent). Recently, two local coal-fired power plants (SJGS and FCPP) have reduced their Hg emissions approximately 66 percent, while other sources have or are likely to increase (EPRI 2014, p 9-7) (OSMRE 2014a,b). Deposition of Hg into the San Juan River Basin currently ranges from 13.9 to 16.5 ug/m2 at various locations within the basin (Figure 14). Source contributions to Hg Deposition at Shiprock, New Mexico, is approximately 16.5 ug/m2-yr, with 78 percent coming from the global pool, 15 percent coming from sources in China, 2 percent coming from other sources in the USA, and up to 5 percent coming from the three local coal-fired power plants (SJGS, FCPP, and NGS) combined (EPRI 2014).

The EPRI (2014) model predicts gradually rising Hg concentrations in water and fish tissue because the San Juan River Basin has not yet reached equilibrium with the rate of atmospheric Hg deposition the Basin will continue to receive in the foreseeable future. Modeled reductions in Hg emissions (with concordant changes in Hg deposition, transport, methylation, and bioaccumulation) never exceed a 0.2 percent reduction in adult Colorado pikeminnow tissue burdens within the 85-year model simulation period (EPRI 2014).

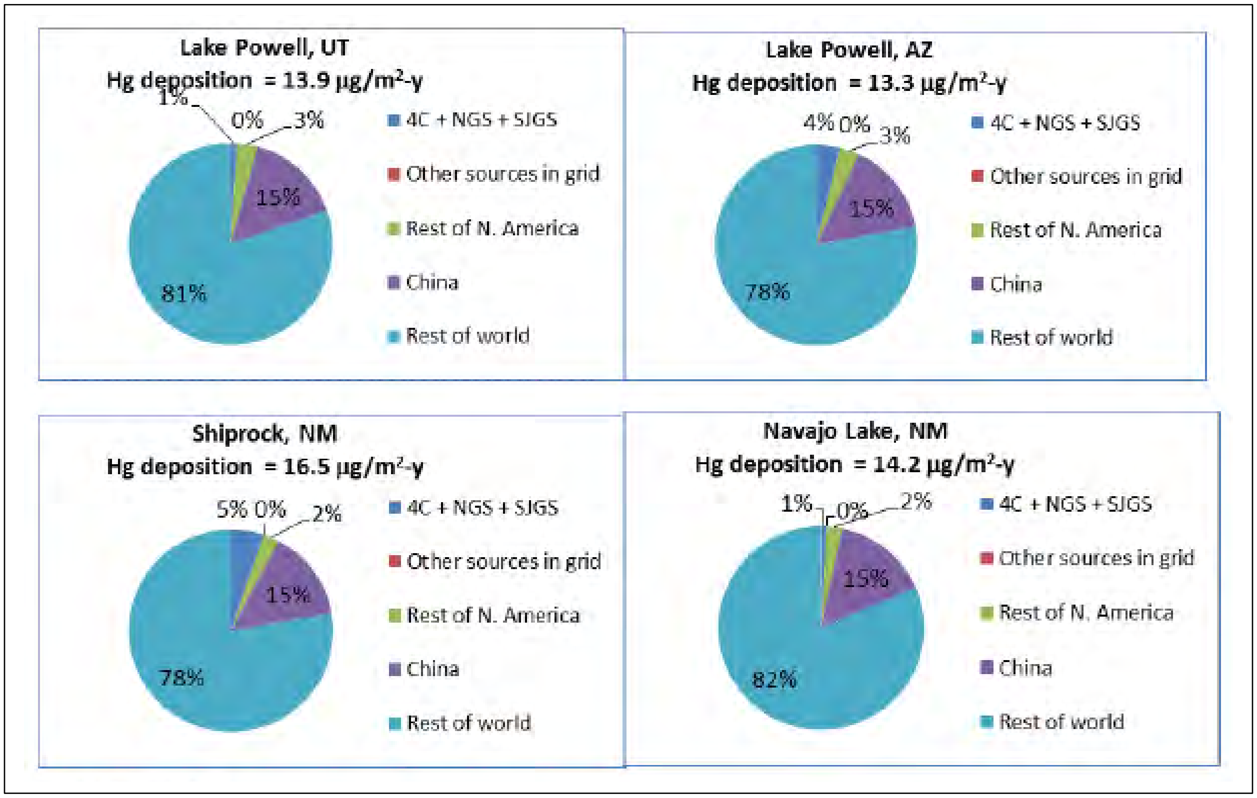


Figure 14. Source contributions to current Hg deposition at selected location in the San Juan River Basin and at Glen Canyon Dam at Lake Powell in Arizona (EPRI 2014).

Mercury Concentrations in Surface Waters, Sediments, and Invertebrates

The available in-stream Hg concentration data were of questionable integrity for the San Juan River Basin during the time period of this study (EPRI 2014). A search of the literature, the USEPA STORET database, and the USGS NWIS database resulted in data that were either unverifiable, unreasonably high, or non-existent (EPRI 2014). Additionally, because the San Juan River Basin is so large, Hg loading endpoints were based on flow, other water quality data at various USGS gages: (potentially Archuleta, Farmington, Shiprock, Bluff near Mexican Hat, UT) and fish tissue data (EPRI 2014). Using modeling, EPRI (2014) estimated Hg concentrations ranging from 0.0005 to 0.012 ug/L in San Juan River Basin (Figure 15). Using an alternative modeling approach, AECOM (2014) estimated that maximum Hg (as HgCl) concentration in water at 0.4 ug/L.

The average Hg concentration in (converted) whole body Colorado pikeminnow greater than 400 mm in TL was 0.26 mg/kg WW (n=5; 0.2 to 0.4 mg/kg WW). Using the Bioaccumulation Factors (BAFs) for trophic level 4 fish of 3,530 (described in the BA, OSMRE 2014b) or 53,000 (described by USEPA 1997, 2002) we back calculate the total Hg concentration of (0.07 ug/L using OSMRE 2014b BAF) or 0.005 ug/L (using USEPA 1997, 2002 BAF) and therefore, find the EPRI (2014) model estimated total Hg concentration in water is reasonable and would be approximated by the orange-colored line category (~5 ng/L) in Figure 15.

AECOM (2014) estimated a maximum Hg concentration of 0.02 mg/kg DW in San Juan River Basin sediment. Nydick (2008) reported Hg concentrations in sediment collected from the Los Pinos River Basin (in Colorado) ranging from less than 0.010 to 0.08 mg/kg DW. Nydick and Wright (2008) also collected sediment cores from several lake bottoms in southwestern Colorado to demonstrate a clear increase in mercury deposition in the 1960s and 1970s and then some lakes sediment Hg declined in the 1990s. Nydick (2008) attributed that decline partly to reduced erosion and sedimentation rates as Hg concentrations appeared relatively stable in the 1990s.

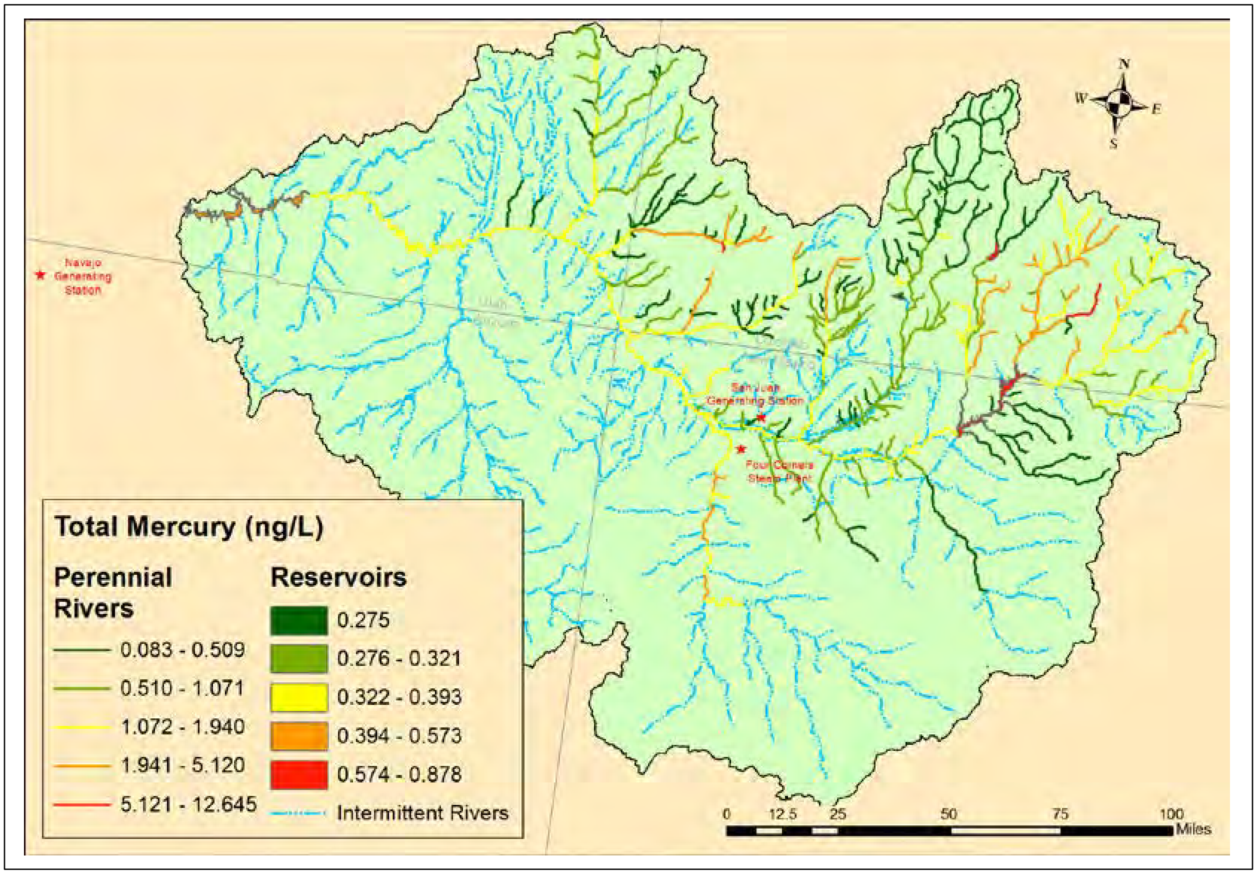


Figure 15. Estimated total Hg concentrations in San Juan River Basin waters (EPRI 2014).

Simpson and Lusk (1999) reported a geometric mean Hg concentration 0.06 mg/kg DW in 86 invertebrate samples collected in the San Juan River Basin. AECOM (2014) using similar data reported a maximum concentration in benthic and aquatic invertebrates ranging from 0.03 to 0.04 mg/kg DW. Invertebrates accumulate and partition Hg in tissues similar to the trends exhibited by fish (Fowler 1978; Riisgard and Famme 1986; Saouter et al. 1991; Saouter et al. 1993. This wide variation of Hg content in invertebrates is most likely a function of different feeding strategies (and trophic levels) and different environmental exposures.

Mercury concentrations in Endangered Fish and Listed Birds

Osmundson and Lusk (2011) reported on the collection, locations, methods, chemical analyses, laboratory quality assurance and quality control, and interpretation of Hg and Se in Colorado pikeminnow from Upper Colorado River Basins, including from the San Juan River during 2008-2009. Similarly, the collection, analysis of Se, and results for razorback sucker from the San Juan River were also evaluated from 2008-2009. The Hg and Se in Colorado pikeminnow muscle tissues collected from the San Juan, Green, Upper Colorado, White, and Yampa Rivers are summarized in Table 4. Mercury and Se in Razorback sucker muscle tissues collected from the San Juan River are also provided in Table 4. As piscivorous fish size is strongly related to Hg levels (Hope 2003; Peterson et al. 2007), we assumed that the lower average Hg concentrations in Colorado pikeminnow from San Juan River were related to the small sizes of the fish collected (Osmundson and Lusk 2011).

Table 3. Average and range of mercury (Hg mg/kg WW) and selenium (Se mg/kg WW) in Colorado pikeminnow and Razorback sucker muscle tissues from San Juan River and from other Upper Colorado River Basins 2008-2009 (Osmundson and Lusk 2011).

River Basin and Species	Average Hg in Muscle Tissue (min - max)	Average Se in Muscle Tissue (min - max)
San Juan River Colorado pikeminnow > 400 mm TL	0.37 (0.31 - 0.43)	0.8 (0.6 – 0.9)
San Juan River Razorback sucker > 400 mm TL	0.12 (0.04 – 0.24)	0.8 (0.4 – 1.4)
Middle Green River Colorado pikeminnow	0.77 (0.68 - 0.87)	1.0 (0.9 – 1.1)
Upper Colorado River Colorado pikeminnow	0.60 (0.31 – 1.04)	1.9 (0.9 – 2.2)
White River Colorado pikeminnow	0.95 (0.43 – 1.83)	0.9 (0.6 – 1.2)
Yampa River Colorado pikeminnow	0.49 (0.44 – 0.53)	0.6 (0.4 – 0.7)

Estimation of Hg in Muscle Tissue and Whole Body fish by Age and Size (Total Length)

Although there was variation in Hg in Colorado pikeminnow muscle tissues collected from different rivers within the Upper Colorado River Basin, based on Peterson et al. (2005, 2007) we assumed that the majority of the variation was strongly related to pikeminnow size. We used all Colorado pikeminnow Hg in muscle tissue data from all the Upper Colorado River Basins to describe the relationship between Hg in (converted) whole body by total length (TL) using a sigmoidal (fitted) model (Figure 16). The equation for the sigmoidal model of Colorado pikeminnow whole body Hg (mg/kg WW) by their size (TL in millimeters (mm)) is:

$$\text{WB Hg WW} = e^{(-6.5 + 5.6/(1+10^{((226.5 - TL)*0.00415)}))} \qquad \text{Equation (11)}$$

(Sources: Miller 2014, Attachment A; ERM 2014a; Osmundson and Lusk 2011)

Therefore, Hg concentrations (Hg mg/kg WW) in Colorado pikeminnow whole body and muscle tissue expected in the San Juan River Basin by their size (in increments), are provided in Table 4. Actual Hg concentrations in muscle tissues collected from Colorado pikeminnow are equivalent (Osmundson and Lusk 2011).

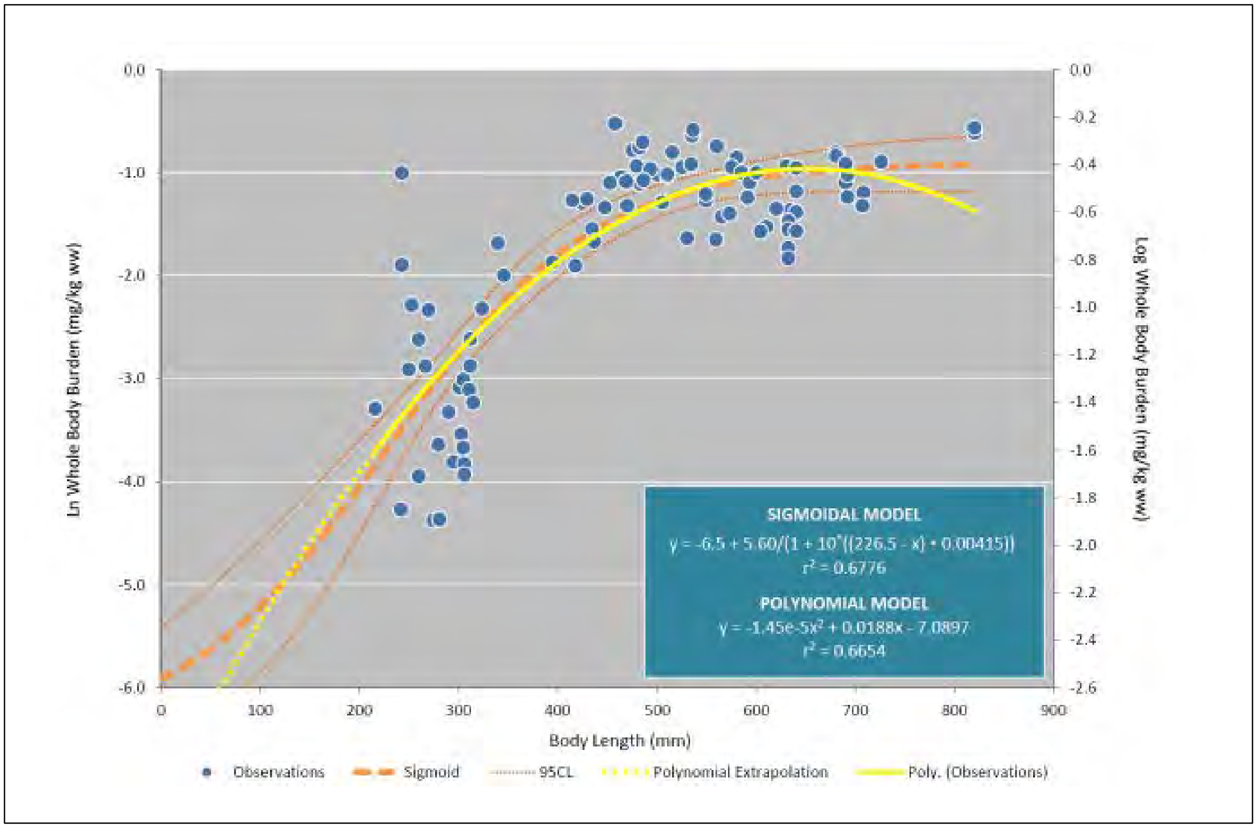


Figure 16. Relationship of Colorado pikeminnow total length and whole body Hg (mg/kg WW). (Source: ERM 2014).

Table 4. Modeled Mercury (Hg mg/kg WW) in Muscle and Whole Body (WB) in San Juan River Colorado Pikeminnow (CPM) by Total Length (TL in mm) using Equations 2 and 11.

CPM TL >	50	150	200	250	300	350	400	450	550	650	750	850	950
Muscle (mg/kg WW)	0.006	0.011	0.028	0.038	0.08	0.16	0.26	0.35	0.52	0.61	0.65	0.67	0.68
WB Hg mg/kg WW	0.004	0.01	0.02	0.03	0.06	0.11	0.17	0.22	0.32	0.37	0.39	0.40	0.40

EPRI (2014) also spatially modeled the current, whole body Hg concentrations (mg/kg WW) in smaller (less than 400 mm TL; Figure 17) and larger (greater than 400 mm TL; Figure 18) Colorado pikeminnows and in larger razorback suckers (greater than 400 mm TL) in the San Juan River Basin. Hg concentrations in Colorado pikeminnow muscle tissues were used to calibrate the EPRI (2014) modeled concentrations.

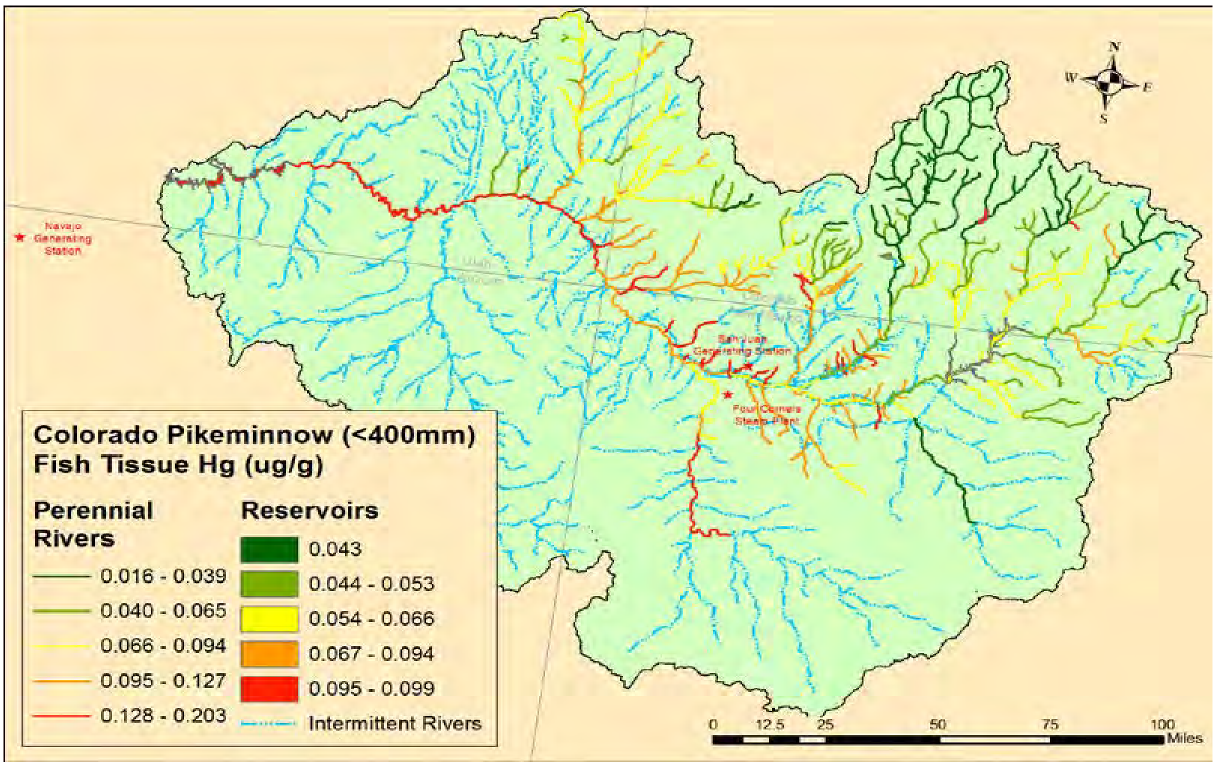


Figure 17. Current Hg concentrations (mg/kg WW) in small whole body Colorado pikeminnow in the action area as modeled by EPRI (2014) (Note change in color scale in Figures 17 and 18).

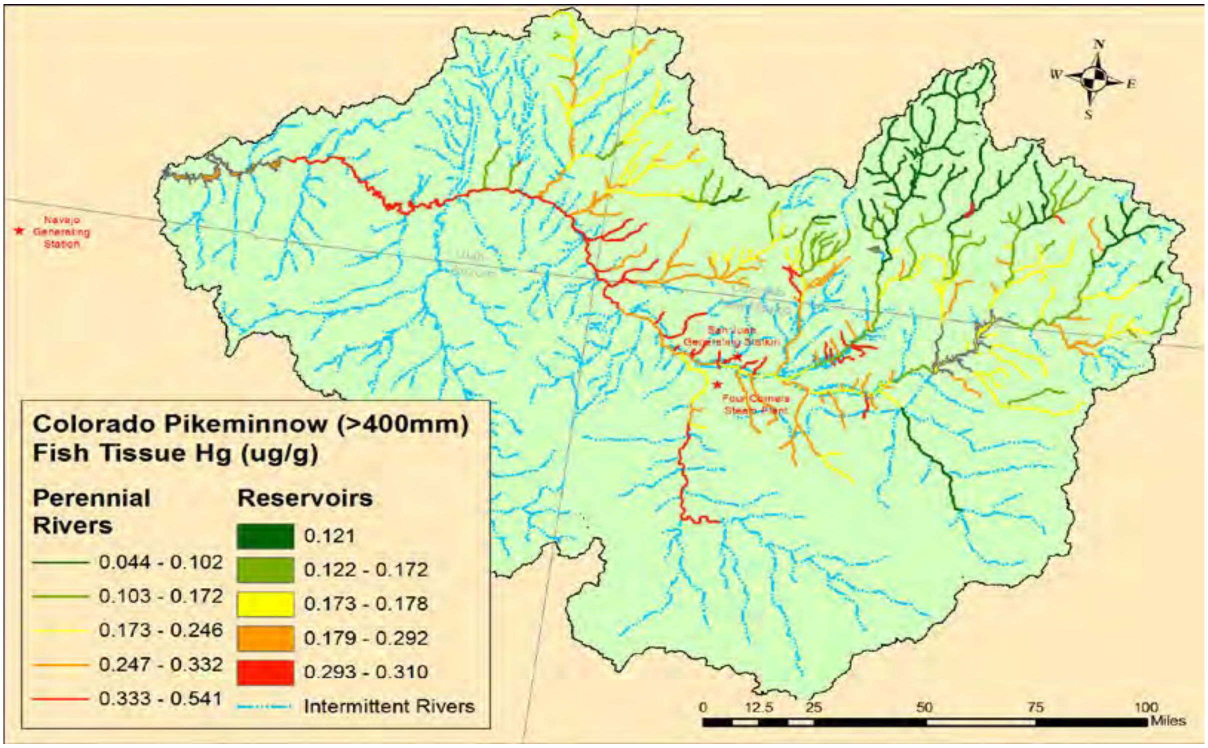


Figure 18. Current Hg concentrations (mg/kg WW) in large whole body Colorado pikeminnow in the action area as modeled by EPRI (2014) (Note change in color scale in Figures 17-18).

Estimation of Hg in Whole Body Colorado Pikeminnow by Size an Over Time

EPRI (2014; including subcontractors ENVIRON and Systech Water Resources, Inc.) assessed the trace metal atmospheric emissions and their aquatic impacts in the San Juan River Basin. Three coal-fired power plants, FCPP, the Navajo Generating Station (NGS), and San Juan Generating Station (SJGS), are located in the San Juan River Basin. EPRI (2014) specifically modeled their Hg deposition within the San Juan River Basin. EPRI's (2014) modeling study tracked the contributions of Hg and Se (and arsenic) emissions from the three coal-fired power plants as well as other sources to model the atmospheric Hg deposition in the basin, near the facilities, as well as model their long-term impact on Hg and Se in surface water and fish tissue. EPRI's (2014) modeling assessment was critical to the understanding of Hg and Se cycling in the San Juan River Basin, and the results are summarized here, but it and all assumptions and uncertainty associated with this analysis is incorporated here by reference.

EPRI (2014) used a meteorological model to produce five years of meteorological outputs to drive the regional/local-scale air quality modeling at a four km horizontal grid resolution. The five-year period was modeled to address inter-annual variability of meteorological fields, such as winds, temperature, and precipitation that affect the deposition of atmospheric pollutants. The worldwide emissions, chemical transformations, dispersion and wet and dry deposition of atmospheric Hg was simulated using an advanced multi-scale modeling system comprising the

GEOS-Chem model (applied globally), the continental CMAQ model (applied over the United States) and regional/local CMAQ-APT model (applied over the approximate extent of the San Juan River Basin). Atmospheric model simulations were conducted over the basin for each of the five years of meteorology for four emissions scenarios: a baseline scenario reflecting the status quo, a 2016 scenario (reflecting a post-MATS scenario), a 2050 case with a lower bound on China Hg emissions and a 2050 case with a higher bound on China Hg emissions. Model simulations included the tagging of Hg from various worldwide source categories to identify relative contributions of these categories.

For the baseline scenario (that is, the current conditions), the FCPP contributions to total Hg deposition near the facility ranged from 2 percent to a maximum of 28 percent southeast of the FCPP. Over the remainder of the San Juan River Basin, FCPP contributions are less than 2 percent. Baseline contributions of Hg emissions from sources outside the United States to Hg deposition in the San Juan River Basin range from 70 percent to 98 percent. Hg emissions from China contribute from 13 to 16 percent to Hg deposition in the San Juan River Basin in the post-2016 baseline (i.e., the baseline 2050 scenario with a medium estimate of China Hg emissions). In the high estimate of China emissions scenario, the range of China Hg contributions to total Hg deposition ranged from 16 percent to 19 percent. In the low estimate of China emissions scenario, in which emissions of elemental Hg decrease compared to the baseline case, the China Hg contributions to Hg deposition in the San Juan River Basin range from 9 percent to 12 percent, a reduction of about 4 percent compared to the medium China, post-2016 scenario.

Hg deposition contributions were calculated at selected receptor locations: including Lake Powell below the San Juan River in Utah, the San Juan River at Shiprock, New Mexico, and Navajo Lake near the Colorado-New Mexico border. At the Lake Powell location, the three coal-fired power plants contribute about 4 percent to total Hg deposition in the baseline case, and other North American emissions contribute about 3 percent. The remainder is attributed to sources outside North America, with 15 percent coming from China sources and 78 percent from the global pool. At the Shiprock location, contributions to Hg deposition from China Hg emissions and other sources outside North America were the similar. The contribution of the three coal-fired power plants is about 5 percent, while Hg emissions from the rest of North America contribute about 2 percent.

The wet and dry Hg deposition predictions from the atmospheric modeling in various model scenarios were linked with the watershed modeling system through various temporal and spatial transformations. The results of the tagged Hg and Se simulations were used to construct past, present and future deposition records for the watershed scenarios from 1990 to 2074. The model WARMF (Watershed Analysis Risk Management Framework) was used by EPRI (2014) to simulate Hg and Se concentrations in each catchment, river segment, and reservoir in the San Juan River Basin for each day of the simulation period. By combining other outputs of WARMF, the model provided useful information about the origin of pollutants to augment the understanding of the watershed system and assisted development of management alternatives.

The atmospheric model was linked to the WARMF model that provided Hg and Se inputs to the San Juan River Basin including atmospheric deposition, mineral weathering, irrigation, inflow from the land, inflow from upstream rivers and reservoirs, point sources, production by chemical

reaction, and re-suspension from riverbeds (EPRI 2014). Outputs of Hg and Se by outflow to surface water via surface or subsurface flow, settling to the river/reservoir beds, diversion, and decay by chemical reactions were also estimated by EPRI (2104
EPRI (2014) used a plume-in-grid approach to represent the behavior of reactive plumes in the atmosphere from point and other sources as well as meteorology as model inputs to produce spatially detailed atmospheric deposition to the land surface of the San Juan River Basin as an output. The atmospheric model to watershed analysis linkage was upgraded to allow the atmospheric output to be modeled as deposition amounts within grid points rather than concentrations and deposition velocities. The grid cells are lined up with the WARMF catchment and lake boundaries to determine the area of overlap. Deposition to each river catchment and at area lakes was calculated with an area-weighted average.

For EPRI (2014) modeled Hg deposition in the San Juan River Basin, the effect of high and low Chinese emissions clearly had the largest impact, altering the deposition by 3.5 and 5 percent respectively. The removal of FCPP had a clear but lesser effect, reducing Hg deposition by 0.68 percent before 2014 and about 0.35 percent after 2016 (after 3 units are shut down, with 2 units remaining active and emitting approximately 102 lbs Hg/year). WARMF scenario simulations generated time series outputs of fish tissue Hg concentrations and water column concentrations for Se and a wide range of chemical species. Examples of these output time series plotted and depicted in Figures 5, 17 through 20, and 22, for locations within the San Juan River Basin. AECOM (2014) identified pathways of Hg and Se accumulation in endangered fish, listed birds and their prey (Figure 21).

EPRI (2014) generated daily average Hg concentrations in large (>400 mm TL) and small (<400 mm TL) Colorado pikeminnow with large seasonal variations, including maximum Hg accumulation during fall and winter at several locations within the San Juan River Basin (Figure 22). For this BO, we averaged the maximum annual Hg concentrations in whole fish from model runs from two locations on the San Juan River (above Lake Powell in Utah and near Shiprock, New Mexico) in order to characterize annual Hg concentrations in endangered fish over time. The Hg concentrations in whole body Colorado pikeminnow by different sizes and over time are summarized in Tables 5 and 6. We used information on annual Hg accumulation in whole body Colorado pikeminnow by size and time to estimate age- and size-specific Hg body burdens that are associated with adverse effects, based on toxicological studies, and to compare EPRI's different APS scenarios over time (Figure 23; Table 7). Note that because Colorado pikeminnow were collected and analyzed in 2009 (Osmundson and Lusk 201) the year 2009 established the baseline to which additional Hg deposition accumulation in fish tissue was added or compared.

Estimation of the Type and Magnitude of Effects based on Hg in Whole Body Fish

Colorado pikeminnow and razorback sucker would be exposed to Hg deposition from the rest of the world, particularly sources in China and the global pool of Hg (as well as the proposed action by FCPP) through Hg deposition, runoff into downstream aquatic habitats, and subsequent bioaccumulation through the food chain. Mercury bioaccumulates in endangered fish in the San Juan River and is a potent neurotoxin that affects their fitness and reproductive health (Crump and Trudeau 2009). Once Hg enters the body, it poses the highest threats of toxicity because it can be absorbed into living tissues and blood. Once in the blood it crosses into the brain and accumulates, there is no known way to be expelled from the brain (Gonzalez et al. 2005).

The accumulation of Hg from water occurs via the gill membranes as well as through ingestion (Beckvar 1996; USEPA 1997). MeHg is eventually transferred from the gills to muscle and other tissues where it is retained for long periods of time (Julshamn et al. 1982; Riisgård and Hansen 1990). Probably less than 10 percent of the Hg in fish tissue residues is obtained by direct (gill) uptake from water (Francesconi and Lenanton 1992; Spry and Wiener 1991). Hg taken up with food initially accumulates in the tissues of the posterior intestine of fish (Boudou et al. 1991). Hg ingested in food is transferred from the intestine to other organs including muscle tissues (Boudou et al. 1991). MeHg has been reported to constitute from 70 to 95 percent of the total mercury in skeletal muscle in fish (Huckabee et al. 1979; EPA 1985; Riisgård and Famme 1988; Greib et al. 1990; Spry and Wiener 1991). MeHg accounted for almost all of the Hg in muscle tissue in a wide variety of both freshwater and saltwater fish (Bloom 1992).

Hg in fish tissues can be transferred to ovary and eggs (Beckvar 1996; Wiener and Spry 1996; McKim et al. 1976). Exposure of the parent population to Hg concentrations of 0.03 to 2.93 ug/l in the laboratory resulted in Hg concentrations as high as 2 mg/kg in their embryos (McKim et al. 1976). Other studies reported a maternal burden transfer to eggs ranging from 0.2 to 36 percent (Hammerschmidt et al. 1999; Hammerschmidt and Sandheinrich 2005; Alvarez et al. 2006; Nye et al. 2007). Hatching success and embryonic survival in fish are inversely correlated with Hg concentrations in the egg (Whitney 1991; Dillon et al. 2010; ERM 2014b). Without additional information about the maternal transfer rate of Hg from the adult female to Colorado pikeminnow eggs, we assumed a transfer of 0.2 percent of the adult female whole body burden Hg concentration. Total mercury concentrations in eggs of several species of adult fish from Swedish lakes are much lower than concentrations in other tissues (Lindqvist 1991). Fish (including eggs and larvae) continue take up Hg from the water column and their prey (McKim et al. 1976; Pentreath 1976a; 1976b).

The toxicity of Hg to aquatic organisms is affected by both abiotic and biotic factors including the form of Hg (inorganic versus organic), environmental conditions (e.g., temperature, salinity, and pH), the sensitivity of individual species and life history stages, and the tolerance of individual organisms. Toxicological effects include neurological damage, reproductive impairment, growth inhibition, developmental abnormalities, mortality, and altered behavioral responses (Beckvar 1996, Beckvar et al. 2005, Dillon et al. 2010, ERM 2010a,b). Wiener and Spry (1996) concluded that neurotoxicity seems to be the most probable chronic response of wild adult fishes to Hg exposure, based on observed effects such as incoordination, inability to feed, diminished responsiveness, abnormal movements, lethargy, and brain lesions. In laboratory studies, reproductive endpoints are generally more sensitive than growth or survival, with embryos and the early developmental stages being the most sensitive (Hansen 1989).

Beckvar et al. (2005) reviewed 10 Hg residue-effects publications for fish to identify whole body tissue concentrations of Hg that were of concern to fish. Laboratory dosing studies with fish indicate that ecologically relevant methylmercury exposures can cause significant behavioral, physiological, reproductive, histological changes as well as mortality. Beckvar et al. (2005) associated adverse effects to survival, growth, reproduction, and behavior with whole body Hg concentrations and recommended that greater than 0.2 mg/kg WW Hg. Beckvar et al. (2005) noted that attempts to derive protective tissue residues for fish continue to be hampered by a paucity of high quality, toxicological studies specifically designed to link residues and biological effects and encouraged investigators to conduct studies designed specifically to produce technically sound residue-effect information.

Dillon et al. (2010) reviewed 11 laboratory toxicity studies involving fish. The test endpoints were distilled to a control-normalized response and extrapolated to a percent injury for both early life stages of fish, and juveniles and adult fish. Recently ERM (2014a,b) reviewed 14 Hg residue-effects publications, selected dose-responsive data, and calculated control-normalized response for different life stages of fish and types of injury (e.g., reproductive injury, behavioral injury, and survivorship injury).

A comparison of the types of injury identified by Dillon et al. (2010) and by ERM (2014a,b) is also provided in Figure 23. Using Dillon et al (2010), there is comparatively more injury estimated for adults, but the type of injury to adults is not readily identified as to mortality, behavioral injury, or injury to growth. Using ERM (2014a,b), there is comparatively more injury estimated for early life stages and less expected mortality for subadults and adults, but the type of injury to subadults and adults is readily identified as to mortality (survivorship injury), behavioral injury, or reproductive injury. Therefore, we used the effects relationships described by ERM (2014a,b) to estimate the type and magnitude of adverse effects associated with whole body Hg in modeled Colorado pikeminnow and razorback suckers in the San Juan River Basin.

Based on these studies we used:

a. The ERM (2014a, b) injury relationships to estimate magnitude and type of adverse effects to eggs, early life stages, subadult and adult Colorado pikeminnows in the San Juan River based on EPRI (2014) modeled whole body Hg concentrations over time and estimated in eggs as well as estimated mortality associated with behavioral injury (Table 7, Table 8).

b. ERM (2014a, b) estimate the type and magnitude of adverse effects associated with whole body Hg in modeled Colorado pikeminnow and razorback suckers in the San Juan River Basin.

We found that ERM (2014a, b) description of behavioral injury associated with Hg whole body was particularly important. The brain and central nervous system are very sensitive to Hg (ATSDR 1999; USEPA 2001, 2005; Krey et al. 2014). The effects of Hg on the nervous system are primarily the consequence of the reaction of Hg with sulfur atoms of brain proteins, enzymes, and other macromolecules, which detrimentally affects a fish brain's normal function (Rabenstein 1978, Eccles and Annau 1987, Wiener and Spry 1996, ATSDR 1999, Clarkson and Magos 2006, Crump and Trudeau 2009; Berg et al. 2010). MeHg in the brain causes death of cells of the central nervous system (Rabenstein 1978). Because nervous system cells are replenished only during an organism's development, cell death by MeHg in fish may result in permanent brain damage. Thus, nerve cell damage is irreversible and cumulative (Rabenstein 1978, Eccles and Annau 1987, Clarkson and Magos 2006, Crump and Trudeau 2009).

In five studies, trout, striped bass, and walleye were fed methylmercury, and after accumulation and observations for effect, both muscle and brain tissues were analyzed (Scherer et al. 1975, McKim et al. 1976, Niimi and Kissoon 1994, Mason et al. 2000, Cizdziel et al. 2003). Berntssen et al. (2003) identified lesions and impairment of locomotor and feeding activity of Atlantic salmon when brain concentrations were measured at 0.68 mg/kg WW. Using the muscle-to-brain ratio of 0.9, the concentration of Hg in muscle would be approximately 0.75 mg/kg WW, whole body concentration would be 0.45 mg/kg WW, would be associated with brain injuries. MeHg is lipid soluble, allowing rapid penetration of the blood-brain barrier (Feltier et al. 1972, Giblin and Massaro 1973; McKim et al. 1976; Olson et al. 1978; Beijer and Jernelov 1979). Injury to the central nervous system results from accumulation of Hg in the cerebellum and cerebral cortex where it binds tightly to sulfhydryl groups resulting in pathological changes (Sastry and Sharma 1980). Inside the cell, Hg inhibits protein synthesis/RNA synthesis and affects other brain proteins (Yoshino et al. 1966; Chang et al. 1972; Basu et al. 2014).

Furthermore, recent studies have clearly indicated adverse effects of Hg on fish migration and spawning behavior (Basu et al. 2014). Fish have likely provided the most evidence of Hg toxicant-associated neurochemical change (Basu et al. 2014). Many researchers (Fjed et al. 1998; Tanan et al. 2006; Crump and Trudeau 2009; Berg et al. 2010; Farina et al. 2010; Mela et al. 2010; Richetti et al. 2010; and Le Page et al. 2011; Xu et al. 2012) outline associations between Hg exposures and neurochemical changes in fish brains, and also make linkages to adverse effects on fish behavior, endocrine function, visual systems, and reproduction.

Numerous studies have reported on the behavioral effects of mercury exposure to fish. A study by Webber and Haines (2003) provides quantitative estimates of behavioral effects in golden shiner exposed to dietary MeHg at concentrations of 0.012 (control), 0.455, and 0.959 mg/kg mercury under standard laboratory conditions for 90 days. At the end of the exposure period, whole body fish tissue mercury concentrations were 0.041 (control), 0.230, and 0.536 mg/kg WW. No mortality or effects on growth were observed at any dose. Predator-avoidance behavior to a model belted kingfisher was evaluated for multiple behavioral responses. The authors reported statistically significant behavioral impairment for shoal vertical dispersal, time to return to pre-exposure activity, and greater shoal area after return to pre-exposure activity levels for fish with 0.54 mg/kg WW whole body fish tissue Hg concentrations. The authors referred to these responses as hyperactive responses, which can make the prey more easily detected and more easily fatigued. Hyperactive behavioral responses from Hg exposure to fish have also been observed in rainbow trout and largemouth bass (Hartmann 1978; Morgan 1979). Fjeld et al. (1998) reported impaired feeding efficiencies and reduced competitive abilities in 13-day old graylings fed a diet containing MeHg. The resulting whole body concentrations ranged from 0.09 to 3.8 mg/kg WW for the lowest and highest exposure groups. The authors reported statistically significant behavioral effects at concentrations of 0.27 mg/kg WW and higher.

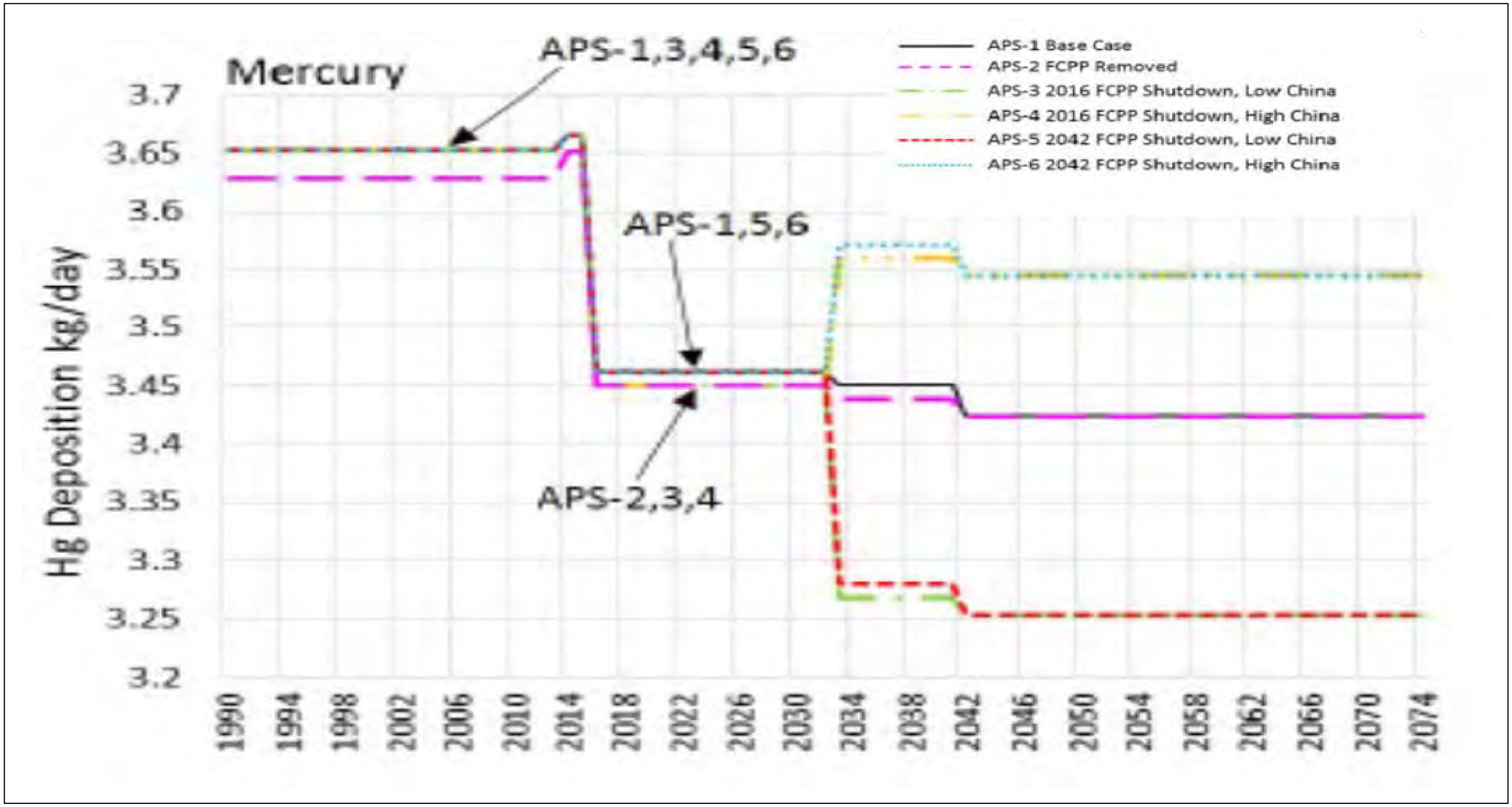


Figure 19. Average atmospheric Hg deposition in the San Juan River Basin over time for various scenarios including with or without the FCPP and low, medium, and high Hg deposition amounts from sources in China (EPRI 2014). (Scenario APS-1; baseline with FCPP operating until 2042 and medium China Hg deposition. Scenario APS-2; baseline with medium China Hg deposition and all FCPP Hg deposition removed. Scenario APS-3; FCPP shutdown in 2016 and low China Hg deposition. Scenario APS-4; FCPP shutdown in 2016 and high China Hg deposition. Scenario APS-5; FCPP shutdown in 2042 and low China Hg deposition. Scenario APS-6; FCPP shutdown in 2042 and high China Hg deposition.).

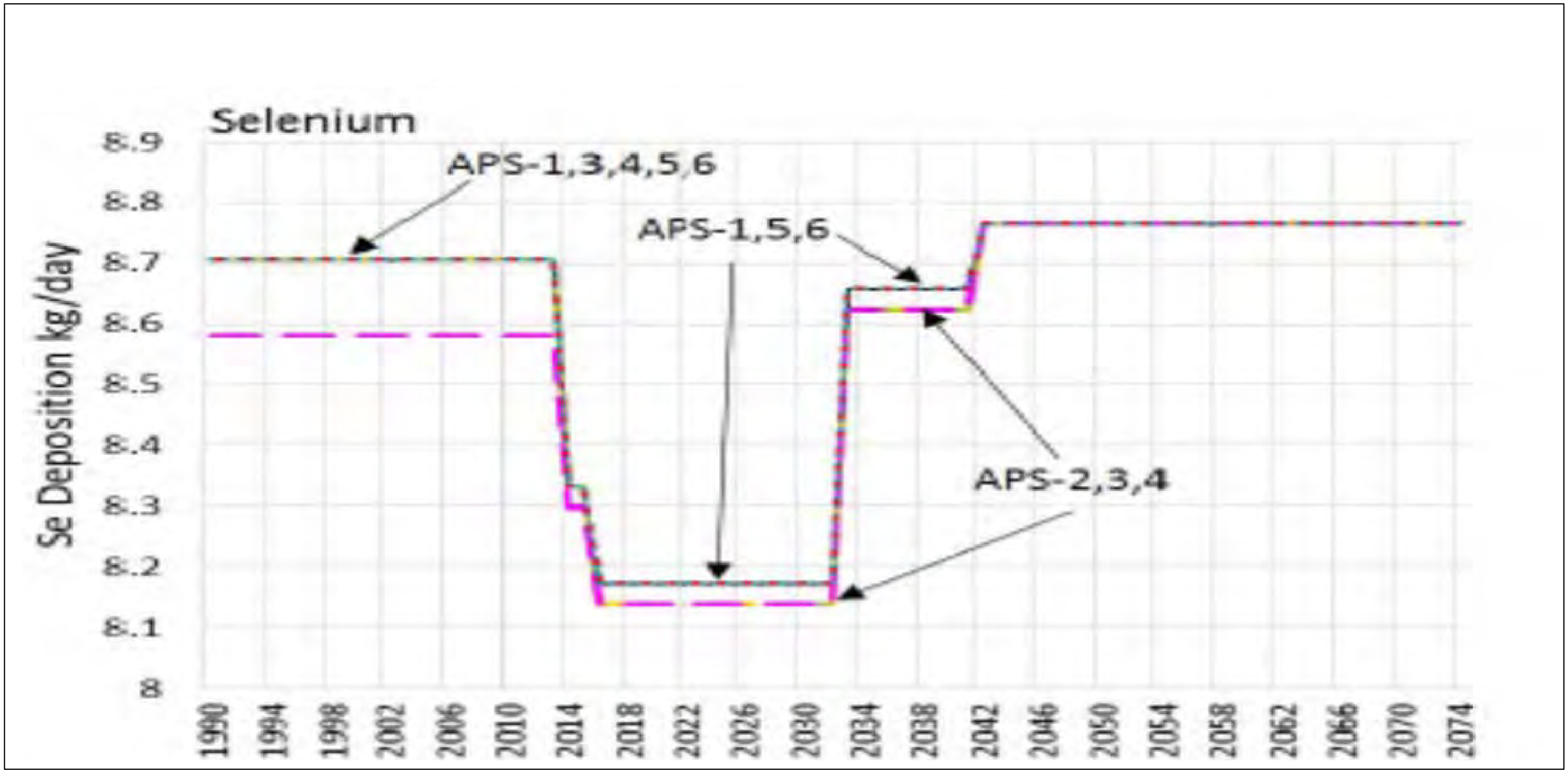


Figure 20. Average atmospheric Se deposition (kg/day) in the San Juan River Basin over time for various scenarios including with or without the FCPP and with low, medium, and high Se deposition amounts from sources in China (EPRI 2014). (Scenario APS-1; baseline with FCPP operating until 2042 and medium China Se deposition. Scenario APS-2; baseline with medium China Se deposition and all FCPP Se deposition removed. Scenario APS-3; FCPP shutdown in 2016 and low China Se deposition. Scenario APS-4; FCPP shutdown in 2016 and high China Se deposition. Scenario APS-5; FCPP shutdown in 2042 and low China Se deposition. Scenario APS-6; FCPP shutdown in 2042 and high China Se deposition. However, note that Se deposition from China was always assumed low and therefore did not change by scenario). (See footnotes in Figure 19 for description of lines).

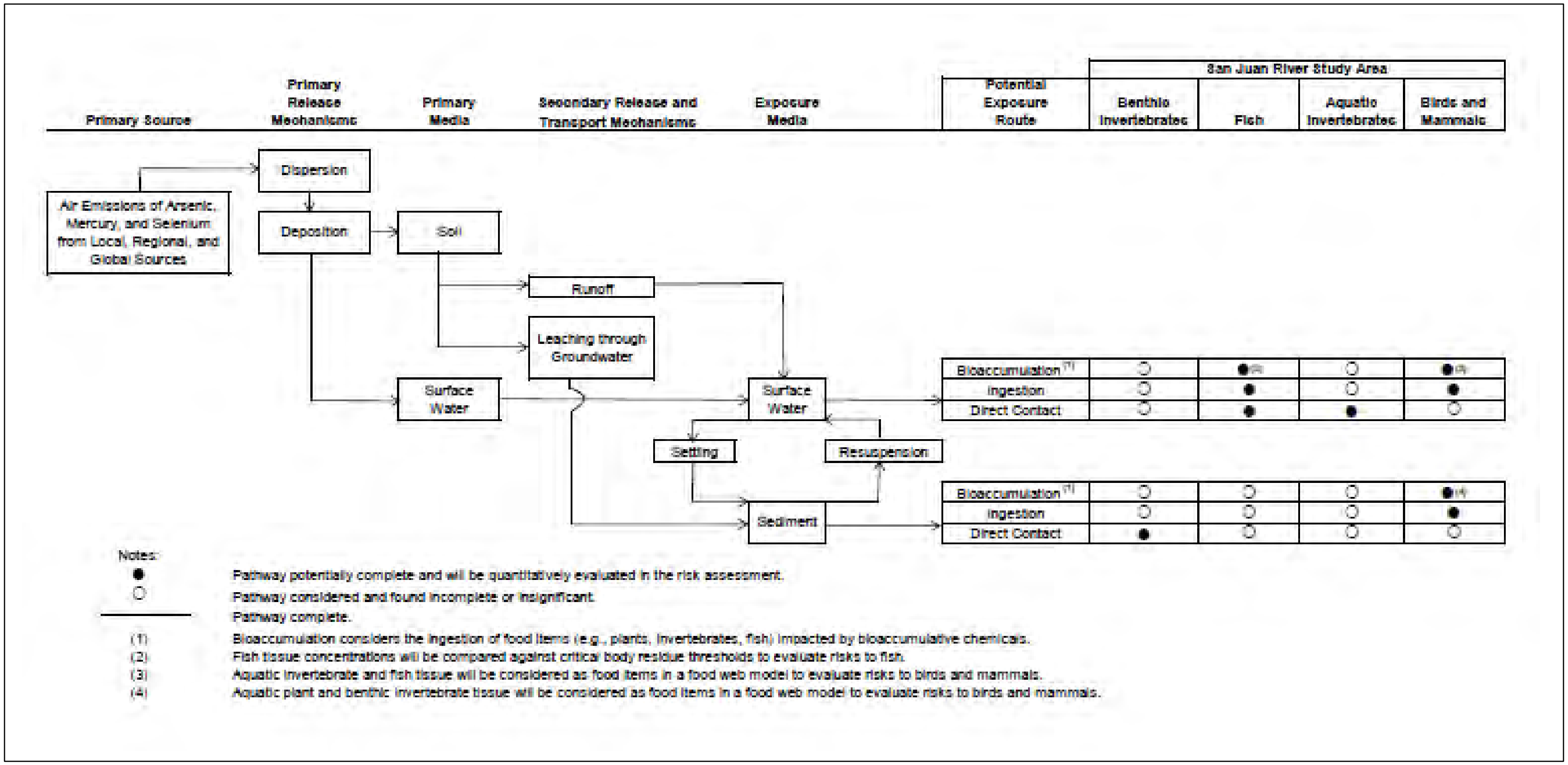


Figure 21. Conceptual exposure model for Hg and Se in the San Juan River Basin and ecological risk assessment (AECOMM 2013).

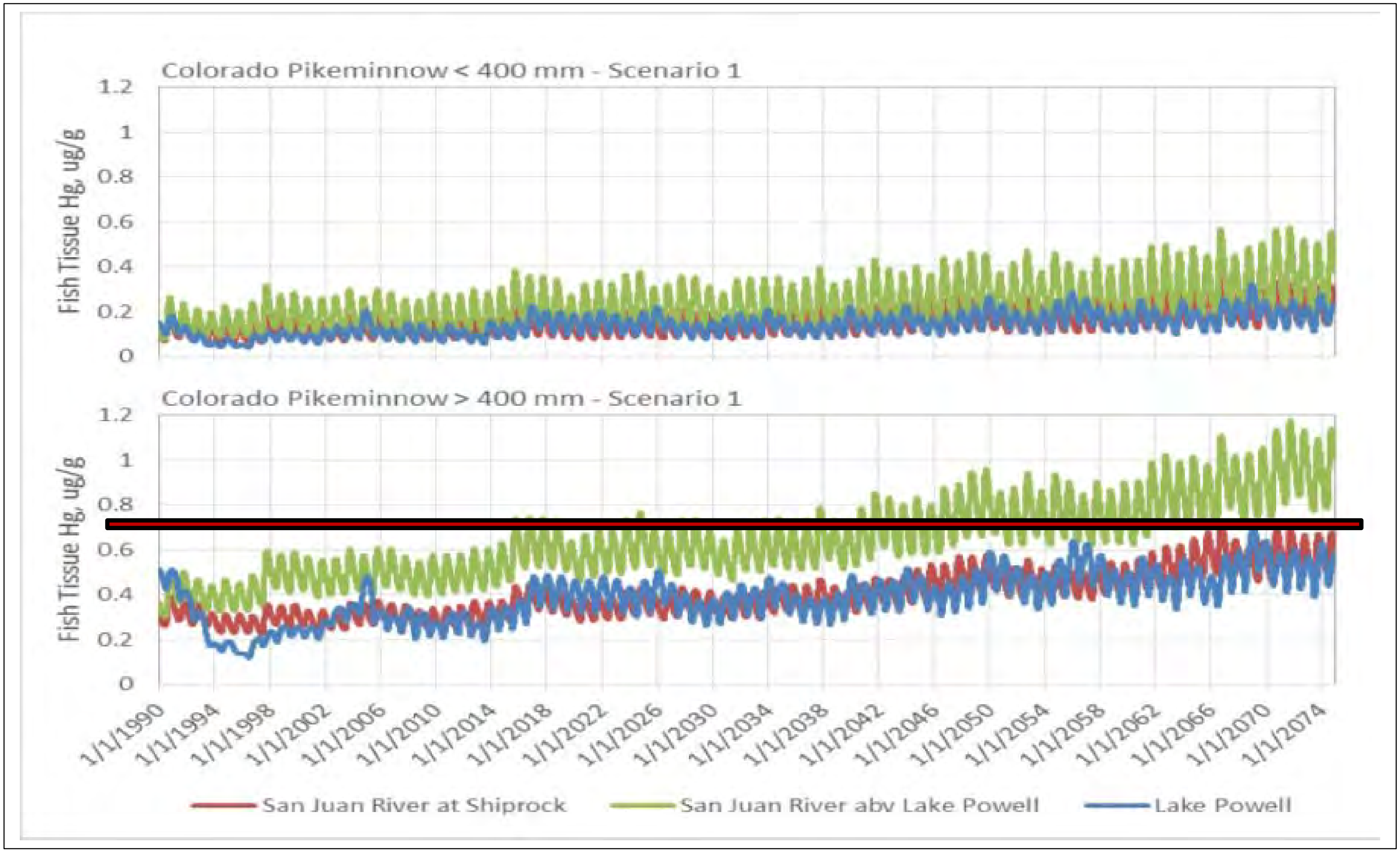


Figure 22. EPRI (2104) modeled annual average mercury concentrations (ug/g WW) in smaller (< 400 mm TL) and larger (>400 mm TL) Colorado pikeminnow at three locations on the San Juan River showing seasonal fluctuation and accumulation in mercury whole body burdens for Scenario 1 (included an estimate of medium range Hg deposition from China and FCPP operation until 2042). (Note black and red line at 0.7 mg/kg WW in whole body Colorado pikeminnow represents Service determination of adverse modification of critical habitat in San Juan River Basin)

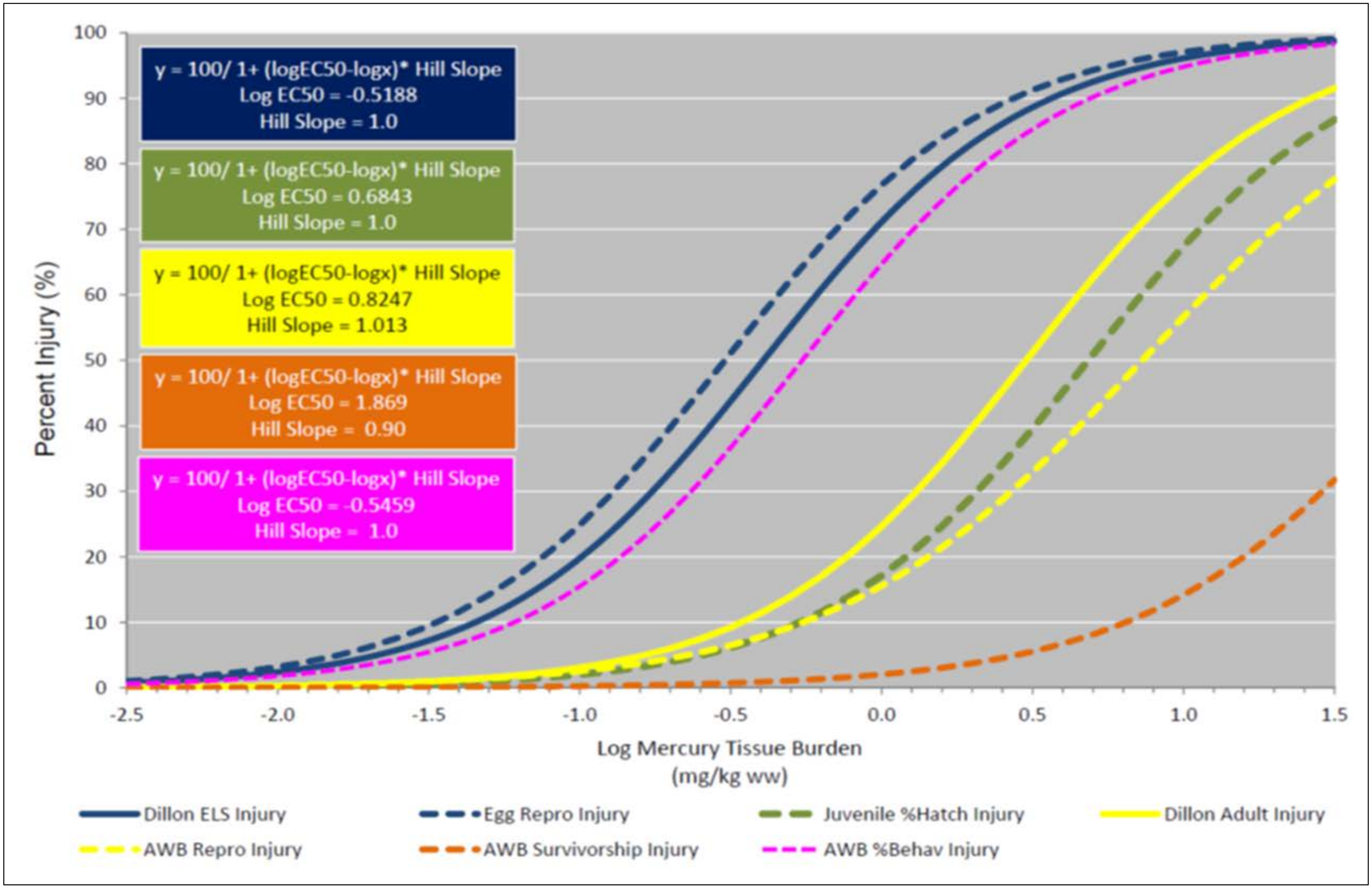


Figure 23. Comparison of Dillon et al. (2010) and ERM (2014b) percent injury relationships with base-10 logarithm of Hg burden (mg/kg WW) in whole body fish.

Table 5. Estimate of Hg concentrations (mg/kg WW) in large, whole body adult (>400 mm TL), smaller (<400 mm TL), and early life stages of Colorado pikeminnow (CPM) in the San Juan River Basin as modeled by EPRI (2014) and extrapolated by the Service to Age Classes based on TL at age. Note: some year's data were omitted for clarity. Egg Hg estimated using 0.2 percent of adult Hg.

	Average of EPRI (2014) SJR sites		Hg in Eggs and Early Stages		Juvenile CPM	Hg in subadult CPM (< 400 mm TL)					Hg in adult CPM (> 400 mm TL)			
Modeled Deposition Year	Max Annual Average Hg in SJR CPM <400 mm whole body based on EPRI 2014 and APS Scenario 1	Max Annual Average Hg in SJR CPM >400 mm whole body based on EPRI 2014 and APS Scenario 1	Est Hg in Eggs = 0.2 % Avg Adult Female	Est Hg in Age 0 CPM	Est Hg in Age 1 CPM	Est Hg in Age 2 CPM	Est Hg in Age 3 CPM	Est Hg in Age 4 CPM	Est Hg in Age 5 CPM	Est Hg in Age 6 CPM	Est Hg in Age 7 CPM	Est Hg in Age 8 CPM	Est Hg in Age 9 CPM	Est Hg in Age 10+ CPM
2009	0.22	0.46	0.0008	0.004	0.008	0.024	0.073	0.169	0.287	0.391	0.36	0.40	0.43	0.44
2010	0.22	0.46	0.0008	0.004	0.008	0.023	0.071	0.166	0.282	0.384	0.36	0.40	0.43	0.44
2015	0.30	0.59	0.0011	0.006	0.011	0.033	0.100	0.233	0.397	0.540	0.47	0.52	0.55	0.57
2016	0.29	0.60	0.0011	0.006	0.011	0.031	0.094	0.220	0.374	0.508	0.48	0.53	0.56	0.58
2019	0.22	0.51	0.0009	0.004	0.008	0.024	0.072	0.167	0.283	0.385	0.41	0.45	0.48	0.50
2020	0.25	0.52	0.0009	0.005	0.009	0.027	0.082	0.191	0.324	0.441	0.42	0.46	0.49	0.51
2025	0.24	0.54	0.0010	0.005	0.009	0.026	0.078	0.182	0.310	0.422	0.43	0.48	0.51	0.53
2029	0.25	0.55	0.0010	0.005	0.009	0.027	0.083	0.193	0.328	0.445	0.44	0.49	0.52	0.54
2030	0.22	0.51	0.0009	0.004	0.008	0.024	0.074	0.173	0.294	0.399	0.41	0.45	0.48	0.50
2035	0.26	0.58	0.0010	0.005	0.010	0.029	0.087	0.203	0.345	0.469	0.46	0.51	0.54	0.56
2039	0.26	0.57	0.0010	0.005	0.010	0.028	0.086	0.201	0.342	0.465	0.45	0.50	0.53	0.55
2040	0.30	0.62	0.0011	0.006	0.011	0.033	0.099	0.231	0.394	0.535	0.49	0.54	0.58	0.60
2041	0.33	0.67	0.0012	0.006	0.012	0.036	0.109	0.254	0.432	0.587	0.53	0.59	0.62	0.64
2042	0.30	0.65	0.0012	0.006	0.011	0.033	0.099	0.230	0.392	0.533	0.52	0.57	0.61	0.63
2043	0.30	0.64	0.0011	0.006	0.011	0.033	0.099	0.231	0.392	0.533	0.51	0.57	0.60	0.62
2044	0.32	0.67	0.0012	0.006	0.012	0.035	0.107	0.248	0.422	0.574	0.53	0.59	0.63	0.65
2045	0.31	0.67	0.0012	0.006	0.011	0.034	0.103	0.239	0.407	0.553	0.53	0.59	0.63	0.65
2049	0.36	0.77	0.0014	0.007	0.013	0.039	0.120	0.280	0.476	0.647	0.61	0.68	0.72	0.74
2050	0.30	0.69	0.0012	0.006	0.011	0.032	0.098	0.229	0.389	0.529	0.55	0.61	0.65	0.67
2055	0.32	0.71	0.0013	0.006	0.012	0.035	0.106	0.247	0.420	0.572	0.56	0.62	0.66	0.68
2059	0.34	0.72	0.0013	0.007	0.013	0.037	0.112	0.262	0.445	0.605	0.57	0.63	0.67	0.70
2060	0.35	0.73	0.0013	0.007	0.013	0.038	0.115	0.268	0.457	0.621	0.58	0.64	0.68	0.71
2065	0.39	0.83	0.0015	0.007	0.014	0.042	0.128	0.297	0.506	0.687	0.66	0.73	0.77	0.80
2069	0.40	0.84	0.0015	0.008	0.015	0.043	0.132	0.308	0.524	0.712	0.67	0.74	0.79	0.82
2070	0.45	0.91	0.0016	0.009	0.017	0.049	0.148	0.345	0.587	0.798	0.72	0.80	0.85	0.88
2074	0.43	0.91	0.0016	0.008	0.016	0.047	0.144	0.334	0.568	0.772	0.72	0.80	0.85	0.88

Table 6. Estimate of the magnitude and types of adverse effects using ERM (2014a,b) and based on Hg concentrations (mg/kg WW) in large, whole body adult (>400 mm TL), smaller subadult (<400 mm TL), and early life stages of Colorado pikeminnow (CPM) in the San Juan River Basin as modeled by EPRI (2014) and extrapolated to Age Class based on TL at age. Note: some year's data were omitted for clarity. Egg Hg concentrations (mg/kg W) were estimated using 0.2 percent of female whole body Hg burden.

Modeled Deposition Year	Max Annual Average Hg in SJR CPM <400 mm whole body based on EPRI 2014 and APS Scenario 1	Max Annual Average Hg in SJR CPM >400 mm whole body based on EPRI 2014 and APS Scenario 1	ERM 2014 % Egg Reproductive Injury using Estimated Egg Hg burden	ERM 2014 % Egg Reproductive Injury using Age 0 Hg burden	ERM 2014 % Adult Reproductive Injury using Avg Adult Hg burden	ERM 2014 % Behavioral Injury using average subadult CPM Hg burden	ERM 2014 % Behavioral Injury using average adult CPM Hg burden	ERM 2014 % Juv&Adult Survivorship Injury applied using Age 1 Hg burden	ERM 2014 % Juvenile/Adult Survivorship Injury averaged for all subadult Age Classes	ERM 2014 % Juvenile/Adult Survivorship Injury averaged for all adult Age Classes
2009	0.22	0.46	0.3	1.4	5.7	25.7	42.9	0.03	0.4	0.9
2010	0.22	0.46	0.3	1.4	5.7	25.4	42.9	0.03	0.4	0.9
2015	0.30	0.59	0.3	1.9	7.2	32.3	49.1	0.04	0.6	1.2
2016	0.29	0.60	0.4	1.8	7.3	31.0	49.5	0.03	0.6	1.2
2019	0.22	0.51	0.3	1.4	6.4	25.4	45.7	0.03	0.4	1.0
2020	0.25	0.52	0.3	1.6	6.5	28.1	46.2	0.03	0.5	1.0
2025	0.24	0.54	0.3	1.5	6.7	27.2	47.1	0.03	0.5	1.1
2029	0.25	0.55	0.3	1.6	6.8	28.3	47.6	0.03	0.5	1.1
2030	0.22	0.51	0.3	1.4	6.4	26.1	45.8	0.03	0.5	1.0
2035	0.26	0.58	0.3	1.7	7.1	29.3	48.5	0.03	0.5	1.1
2039	0.26	0.57	0.3	1.6	7.0	29.1	48.4	0.03	0.5	1.1
2040	0.30	0.62	0.4	1.9	7.5	32.1	50.3	0.04	0.6	1.2
2041	0.33	0.67	0.4	2.1	8.1	34.2	52.2	0.04	0.6	1.3
2042	0.30	0.65	0.4	1.9	7.9	32.0	51.5	0.04	0.6	1.3
2043	0.30	0.64	0.4	1.9	7.8	32.1	51.3	0.04	0.6	1.2
2044	0.32	0.67	0.4	2.0	8.1	33.7	52.3	0.04	0.6	1.3
2045	0.31	0.67	0.4	1.9	8.1	32.9	52.3	0.04	0.6	1.3
2049	0.36	0.77	0.5	2.3	9.2	36.4	55.7	0.04	0.7	1.5
2050	0.30	0.69	0.4	1.9	8.4	31.9	53.2	0.04	0.6	1.3
2055	0.32	0.71	0.4	2.0	8.5	33.6	53.7	0.04	0.6	1.4
2059	0.34	0.72	0.4	2.1	8.7	34.8	54.1	0.04	0.7	1.4
2060	0.35	0.73	0.4	2.2	8.8	35.4	54.6	0.04	0.7	1.4
2065	0.39	0.83	0.5	2.4	9.9	37.8	57.6	0.05	0.7	1.6
2069	0.40	0.84	0.5	2.5	10.0	38.6	58.0	0.05	0.8	1.6
2070	0.45	0.91	0.5	2.8	10.7	41.4	59.8	0.05	0.8	1.7
2074	0.43	0.91	0.5	2.7	10.7	40.6	59.9	0.05	0.8	1.7

Table 7. Estimates of the type and magnitude of injuries to endangered fish in the San Juan River Basin using Dillon et al. (2010) or ERM (2014), and with Service estimates of mortality associated with maladaptive behavioral injury for whole body Hg (mg/kg WW). The red-colored cells at 0.7 mg/kg WW in whole body that is associated with 9.2 percent reproductive injury and 1.5 percent survivorship injury was used to identify Hg concentrations associated with impaired endangered fish population fitness (Miller 2014).

Fish WB Hg Burden (mg/kg ww)	Log10(Hg burden)	Dillon % ELS Injury	Dillon % Juvenile/Adult Injury	ERM % Behavioral Injury	ERM % Egg Reproductive Injury	ERM % Adult Reproductive Injury	ERM % Survivorship Injury	USFWS = Estimated % Mortality due to Maladaptive Behaviors = 0.0012*[WB Hg] + 0.01
0.0000000001	-10.0	0.00000002	0.000000002	0.00000002	0.000000033	0.0000000011	0.000000002	n/a
0.000000001	-9.0	0.0000002	0.00000002	0.0000002	0.00000033	0.00000001	0.00000002	n/a
0.00000001	-8.0	0.000002	0.0000003	0.000002	0.0000033	0.0000001	0.0000001	n/a
0.0000001	-7.0	0.00002	0.000003	0.00002	0.000033	0.000001	0.000001	n/a
0.000001	-6.0	0.0002	0.00003	0.0002	0.00033	0.00001	0.00001	n/a
0.00001	-5.0	0.002	0.0003	0.002	0.0033	0.0001	0.0001	n/a
0.0001	-4.0	0.02	0.003	0.02	0.033	0.001	0.001	n/a
0.001	-3.0	0.2	0.03	0.2	0.33	0.01	0.004	n/a
0.01	-2.0	2.4	0.3	1.8	3.2	0.1	0.03	n/a
0.05	-1.3	11.0	1.5	8.4	14.2	0.7	0.1	1%
0.1	-1.0	19.8	3.1	15.5	24.8	1.4	0.3	1%
0.2	-0.7	33.0	6.0	26.8	39.8	2.8	0.5	1%
0.3	-0.5	42.5	8.8	35.5	49.8	4.1	0.7	1%
0.4	-0.4	49.6	11.5	42.3	56.9	5.5	0.9	1%
0.5	-0.3	55.2	14.0	47.8	62.3	6.7	1.1	1%
0.6	-0.2	59.6	16.3	52.4	66.5	8.0	1.3	1%
0.7	-0.2	63.3	18.6	56.2	69.8	9.2	1.5	1%
0.8	-0.1	66.3	20.7	59.4	72.5	10.4	1.7	1%
0.9	0.0	68.9	22.7	62.2	74.8	11.6	1.9	1%
1.0	0.0	71.1	24.7	64.7	76.8	12.7	2.0	1%
1.1	0.0	73.0	26.5	66.8	78.4	13.9	2.2	1%
1.2	0.1	74.7	28.2	68.7	79.8	14.9	2.4	1%
1.3	0.1	76.2	29.9	70.4	81.1	16.0	2.6	1%
1.4	0.1	77.5	31.5	71.9	82.2	17.0	2.7	1%
1.5	0.2	78.7	33.0	73.3	83.2	18.1	2.9	1%
1.6	0.2	79.8	34.5	74.6	84.1	19.0	3.1	1%
1.7	0.2	80.7	35.9	75.7	84.9	20.0	3.2	1%
1.8	0.3	81.6	37.2	76.7	85.6	20.9	3.4	1%
1.9	0.3	82.4	38.5	77.7	86.3	21.9	3.6	1%
2.0	0.3	83.1	39.8	78.6	86.8	22.8	3.7	1%
2.1	0.3	83.8	41.0	79.4	87.4	23.6	3.9	1%
2.2	0.3	84.4	42.1	80.1	87.9	24.5	4.1	1%
2.3	0.4	85.0	43.2	80.8	88.4	25.4	4.2	1%
2.4	0.4	85.5	44.3	81.5	88.8	26.2	4.4	1%
2.5	0.4	86.0	45.3	82.1	89.2	27.0	4.5	1%
2.6	0.4	86.5	46.3	82.6	89.6	27.8	4.7	1%
2.7	0.4	86.9	47.2	83.2	89.9	28.5	4.8	1%
2.8	0.4	87.3	48.1	83.7	90.2	29.3	5.0	1%
2.9	0.5	87.7	49.0	84.2	90.5	30.0	5.1	1%
3.0	0.5	88.1	49.9	84.6	90.8	30.8	5.3	1%

Crump and Trudeau (2009) found that accumulation of Hg in the fish brain has resulted in reduced hormone secretion, hypothalamic neuron degeneration, and alterations in neurotransmission. The inhibitory effect of Hg on reproduction in fish has been suggested to occur at multiple sites within the reproductive system, including the hypothalamus, pituitary, and gonads (Crump and Trudeau 2009). At the level of the pituitary, Hg exposure would reduce and/or inactivate gonadotropin-secreting cells necessary for reproduction. Studies that have examined the effects of Hg on the reproductive organs demonstrated a range of effects, including reductions in gonad size, circulating reproductive steroids, gamete production, and spawning success. Laboratory experiments have shown diminished reproduction and endocrine impairment in fish exposed to dietary Hg at environmentally relevant concentrations, with documented effects on production of sex hormones, gonadal development, egg production, spawning behavior, and spawning success. Field studies have found declining levels of sex hormones with increased Hg exposure (Crump and Trudeau 2009). Compared to pairs of fish raised on normal diets, of those that ate contaminated diets, fewer spawned, and those that did spawned later and produced fewer eggs. Currently, not all females do spawn (Valdez 2014).

Condition of Water Quality PCE of Colorado Pikeminnow Critical Habitat

Water of sufficient quality is a primary constituent element (PCE) of Colorado pikeminnow physical critical habitat. We used the rates of Hg-related impairments associated with a modeled long-term population decline of Colorado pikeminnow in the San Juan River Basin (AECOM 2013; Miller 2014; ERM 2014a,b) to characterize when those conditions would be associated with adverse modification of critical habitat. That is, critical habitat would be adversely modified when Hg concentrations in water are associated with fish whole body concentrations of 0.7 mg/kg WW (which are related to a greater than 8 percent reproductive injury and above 1.5 percent adult mortality). The PCEs of critical habitat likely occur associated with 0.7 mg/kg WW in whole body Colorado pikeminnow and using Bioaccumulation Factors provided in the BA (OSMRE 2014, p 6-18), would be from 0.002 ug/L MeHg in water or 0.2 ug/L total Hg in water.

We used models (with various assumptions) to assess, describe, evaluate, and estimate what is happening now and what will happen in the San Juan River Basin and to the endangered species that reside there over time (Osmundson and Lusk 2011; ERM 2014a,b; Miller 2014; OSMRE2014; and the administrative record supporting the BA and BO).

There remain issues with the accuracy and precision of measurement-based estimates that depend on the validity of extrapolating measurements made at infrequent intervals to longer periods, or measurements made at one place to other areas. However, the best available scientific and commercial information supports the following regarding Hg in the San Juan River Basin:

1. Currently, anthropogenic Hg emissions far surpass those derived from natural processes Mason and Sheu, 2002; Fitzgerald et al., 2005; Pacnya 2010; UNEP 2013; EPRI 2014). Much of the Hg in the environment originates from combustion of coal and can travel long distances in the atmosphere before being deposited (Landis and Keeler 2002; Hammerschmidt and Fitzgerald 2006; EPRI 2014). The global pool and sources in Asia

account for the majority all anthropogenic Hg emissions (Pacyna et al. 2010, Pirrone, et al. 2010; EPRI 2014). However, local sources also contribute dry Hg deposition or to locally elevated concentrations within the San Juan River Basin (Lyman et al. 2007; Mountain Studies Institute 2010; USEPA 2011a; Huang and Gustin 2012; Sather et al. 2013; EPRI 2014). Without improved pollution controls or other actions taken to reduce Hg deposition, Hg concentrations are likely to remain at the levels they are today.

2. In the San Juan River Basin, some amount of the Hg deposited is converted to MeHg, which ultimately bioaccumulates in the endangered fish. The rate of Hg methylation, varies greatly in time and space, and depends on numerous environmental factors, including temperature, and amounts of oxygen, organic matter, and sulfate that are present, but few actions can be taken that significantly alter those natural watershed processes (Gilmour and Henry 1991). Hg enters aquatic food webs where it is taken up from water by algae and other microorganisms and increases in concentrations with fish at the top of the food web. The native, top predator fish is the endangered Colorado pikeminnow, which consumes other fish and tends to accumulate high Hg concentrations in their tissues.

3. Mercury is a persistent toxic element. It is becoming increasingly evident that the scope and severity of the Hg problem for wildlife has been substantially underestimated (Wentz et al. 2014). Recent findings show that at high concentrations, Hg impairs the health and reproduction of fish and birds at much lower dietary or tissue concentrations than previously recognized (Evers et al. 2011; Sandheinrich and Wiener 2011; Depew et al. 2012a). For example, concentrations of Hg in adult Colorado pikeminnow frequently will exceed threshold levels of concern (0.2 mg/kg WW in whole fish) that are associated with altered biochemical processes, altered behaviors, damage to cells and tissues, mortality, and diminished reproduction (Beckvar 1996; USEPA 1997; Crump and Trudeau 2009; Dillon et al 2010; Sandheinrich and Wiener 2011; ERM 2014a,b)

Estimation of Hg in Whole Body Razorback Sucker

EPRI (2014) modeled the spatial distribution of Hg in larger, adult whole body razorback suckers in the San Juan River Basin (Figure 24). Concentrations of Hg in Razorback sucker are much lower as (converted) whole body ranged from 0.03 to 0.13 mg/kg WW and averaged 0.07 mg/kg WW (Table 5). This level of whole body Hg was similar to that in an Age 3 Colorado pikeminnow, and therefore, we used a similar method to estimate the number of Razorback suckers that could be adversely affected by the proposed action.

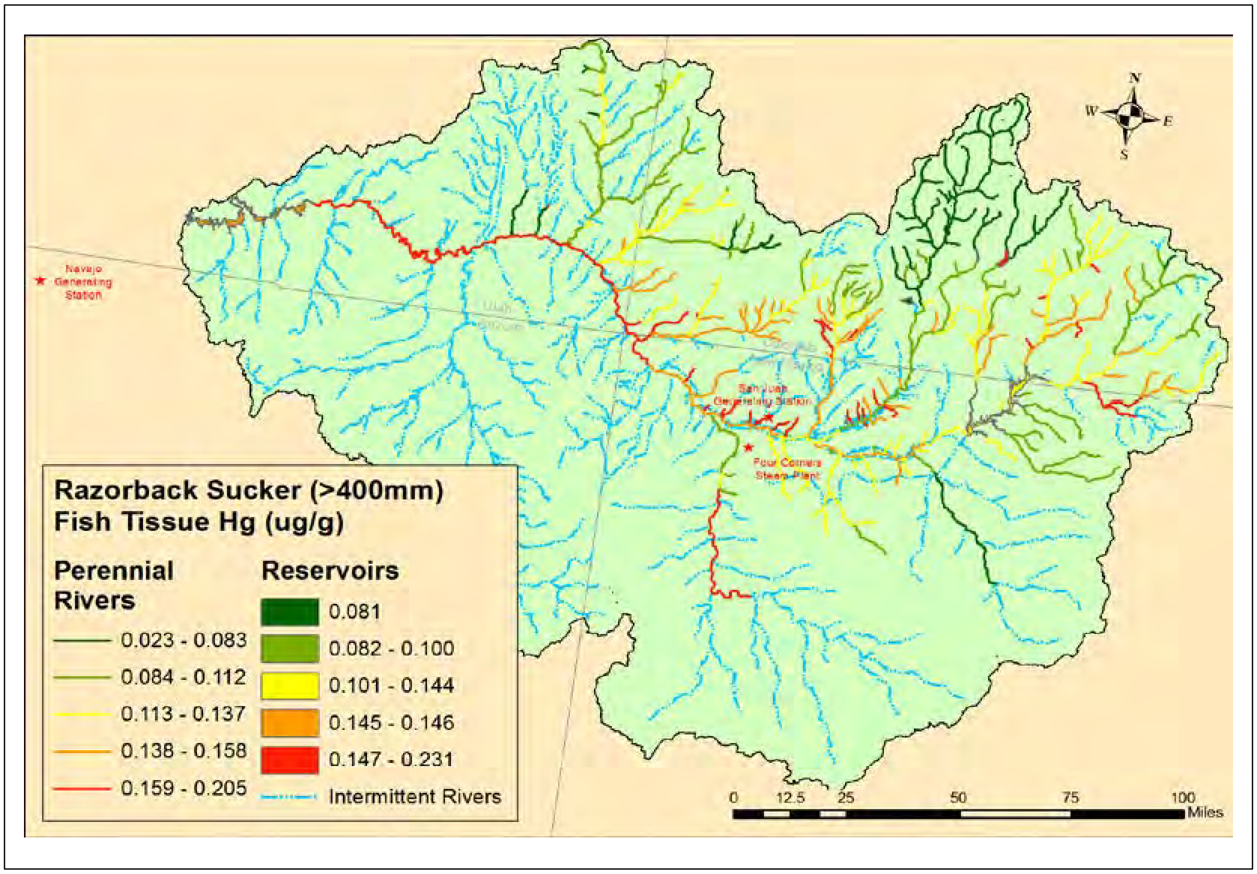


Figure 24. Current Hg concentrations (mg/kg WW) in whole body razorback sucker in the action area as modeled by EPRI (2014) (Note change in color scale in Figures 17, 18, and 24).

<u>Effects of Hg deposition on Southwestern Willow Flycatcher and Yellow-billed Cuckoo</u>

AECOM (2013) prepared an ecological risk assessment (ERA) to support the EIS and OSMRE's BA. A conceptual site model was developed to describe the exposure pathways linking Hg (and Se and other pollutant) releases to the environment and then to ecological receptors such as federally listed birds (Figure 21). The ERA focused on San Juan River habitat from the Deposition Area downstream into the San Juan River arm of Lake Powell. The ERA was intended to evaluate the risks posed by exposure of federally listed birds to pollutants associated with the environmental baseline, cumulative effects and the future FCPP stack emissions from 2016 to 2041 (AECOMM 2013). Federally listed bird exposures were evaluated using a traditional daily dose approach where dose was expressed in units of mg/kg per day (mg/kg-day) of the pollutants ingested. Toxicity reference values (TRVs) were developed, in units of mg/kg-day, which are doses below which adverse ecological effects are not expected. The risks were characterized in terms of a hazard quotient (HQ) where values greater than 1 indicate a potential for adverse ecological effects to individual birds. Hazard quotients for riparian birds in the San Juan River including southwestern willow flycatchers and yellow-billed cuckoos were less than 6.7 for methylmercury and less than 5.9 for selenium indicating potential adverse effects to federally listed birds (AECOMM 2013). The proposed action was only a very small portion of these effects and those were removed and discussed below.

Habitat modeling by AECOM (2013d, 2014) identified approximately 6,726 acres of potentially suitable southwest willow flycatcher habitat within the Deposition Area. The ratio of flycatcher nesting habitat (632 acres; BOR 2012) to flycatcher critical habitat in the Middle Rio Grande (47,844 acres) was (632/47844=) 0.013. If we assume a similar ratio of flycatcher nesting habitat to suitable flycatcher habitat within the Deposition Area, we estimate that as many as (6726 acres x 0.013=) 87.4 acres of nesting habitat could occur within any year. In a recovered flycatcher population, the average suitable nesting habitat size is 5.4 acres (USFWS 2013). The total maximum number of nesting flycatchers that could occupy the Deposition Area in any year would be (87.4 acres/5.4 acres =) 16 nesting pairs. However, not all flycatcher habitats in the Deposition Area are currently suitable nesting habitat nor would they be expected to remain suitable nesting habitats over time.

Hg is an environmental contaminant that can also have adverse effects on riparian wildlife (Scheuhammer et al. 2012; Wentz et al. 2014). For riparian birds such as flycatchers and cuckoos, mercury is accumulated via ingestion of aerial insects emerging from benthic life stages in aquatic environments containing mercury or from associated predatory spiders (Cristol et al. 2008; Edmonds et al. 2012; Evers et al. 2012; Buckland-Nicks et al. 2014; Gann et al. 2014). Dietary total Hg concentrations associated with adverse effects to birds are generally greater than 0.1 mg/kg WW (DOI 1998). Once ingested, MeHg rapidly moves into the bird's central nervous system, resulting in behavioral and neuromotor disorders (Tan et al. 2009; Scheuhammer et al. 2007, 2012). The developing central nervous system in avian embryos is especially sensitive to this effect, and permanent brain lesions and spinal cord degeneration are common (DOI 1998, Young 1998; Bryan et al. 2003; Scheuhammer et al. 2007; Heinz et al. 2009). Therefore, adverse effects are described for the eggs, embryos, nestlings and/or fledglings associated with elevated Hg burdens in the female parent and due to foraging.

Hg concentrations in invertebrates from the San Juan River Basin are generally (0.03 to 0.04 mg/kg WW) less than this threshold concentration (AECOM 2013). No modeling of Hg in invertebrates over time was conducted. Therefore, we expected that no more than one third of invertebrate Hg concentrations would be greater than the 0.1 mg/kg WW threshold. Therefore, we applied the average annual flycatcher-nesting rate from 20 years of survey results in the San Juan River Basin to estimate the likelihood of that suitable nesting habitat within the Deposition Area would be occupied by nesting flycatchers (16 nesting pairs x 1.25 percent flycatcher nesting rate per year = 0.2) to be 20 percent during any one year.

Selenium

Selenium, a trace element, is a natural component of coal and soils in the area and can be released to the environment by the irrigation of selenium-rich soils and the burning of coal in power plants with subsequent emissions to air and deposition to land and surface water (EPRI 2014). Sources of selenium, both anthropogenic and natural, in the San Juan River have been reported by O'Brien (1987), Abell (1994), Blanchard et al. (1993), and Thomas et al. (1997, 1998). Selenium, although required in the diet of fish at very low concentrations (<0.5 micrograms per gram [ug/g] on a dry weight [DW] basis), is toxic at higher levels (>3 ug/g) and may be adversely affecting endangered fish in the upper Colorado River basin (Hamilton 1999, Hamilton et al. 2005). Excess dietary selenium causes elevated concentrations of selenium to be deposited into developing eggs, particularly the yolk (Buhl and Hamilton 2000, Lemly 2002). If concentrations in the egg are sufficiently high, developing proteins and enzymes become dysfunctional or result in oxidative stress, conditions that may lead to embryo mortality, deformed embryos or embryos that may be at higher risk for mortality (Lemly 2002). Additional selenium risks are associated with dietary toxicity.

Selenium in water

Selenium concentrations can be elevated in areas where irrigation occurs on soils which are derived from or overlie Upper Cretaceous marine sediments. Thomas et al. (1998) found that water samples from DOI project irrigation-drainage sites developed on Cretaceous soils contained a mean selenium concentration about 10 times greater than those in samples from DOI project sites developed on non-Cretaceous soils. Percolation of irrigation water through these soils and sediments leaches selenium into receiving waters. Other sources of selenium likely include power plant fly ash and oil refineries in the basin (Abell 1994). Water depletions, by reducing dilution effects, can increase the concentrations of selenium and other contaminants in water, sediments, and biota (Osmundson et al. 2000).

Some tributaries to the San Juan River carry higher selenium concentrations than found in the mainstem of the river (Thomas et al. 1998; EPRI 2014; Figure 25). Increased selenium concentrations may also result from the introduction of groundwater to the mainstem of the river along its course (BIA 1999). Although these levels are diluted by the San Juan River flow, the net effect is a gradual accumulation of the element in the river as it travels downstream. For example, selenium concentrations in water samples collected from the mainstem of the San Juan River exhibited a general increase in maximum recorded values with distance downstream from Archuleta, New Mexico, to Bluff, Utah (<1 microgram per liter [ug/L] to 4 ug/L) (Wilson et al. 1995). The safe level of selenium concentrations for protection of fish and wildlife in water is considered to be less than 2 ug/L, and chronically toxic levels are considered to be greater than2.7 ug/L (Lemly 1993; Maier and Knight 1994; Wilson et al. 1995). Dietary selenium is the primary source for selenium in fish (Lemly 1993). Thus, sediment and biotic analyses are necessary to further elucidate the risk of selenium in water to fish and wildlife.
Estimations of selenium concentrations in the San Juan River include the contributions of the Navajo Indian Irrigation Project (NIIP) and other irrigated agricultural projects. Irrigation return flows from irrigation projects result in increased selenium concentrations in the San Juan River (Blanchard et al. 1993; Thomas et al. 1999).

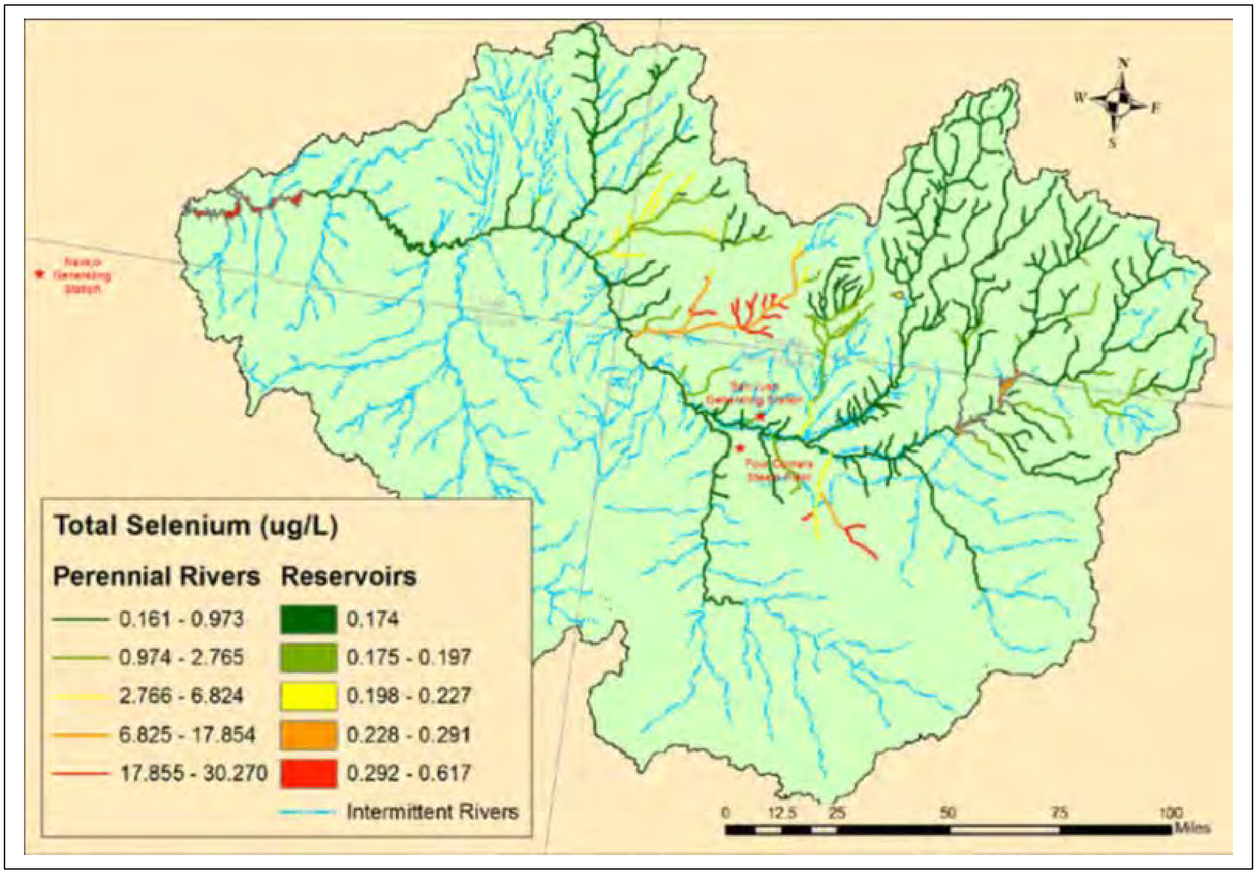


Figure 25. Total selenium concentrations in San Juan River Basin waters (EPRI 2014).

Evaluation of Selenium Effects in Endangered Fish, Critical Habitat, and Listed Birds
Selenium in water may be less important than dietary exposure when determining the potential for chronic effects to a species (USEPA 1998). A number of studies have recommended tissue-based selenium tissue benchmarks for fish and birds (Lemly 1993a, 1996b; USDOI 1998; DeForest et al. 1999; Hamilton 2003; Ohlendorf 2003; Adams et al. 2003; Chapman 2007; USEPA 2014). Although there is not always consensus on the recommended tissue benchmarks, there is consensus that tissue-based selenium benchmarks are the most appropriate medium for evaluating selenium toxicity. Therefore, in this BO, estimates of effects from selenium are based on concentrations of selenium in fish tissues and their estimated dietary concentrations.

Selenium in Invertebrates

Thomas et al. (1998) reported that selenium concentrations in algae, odonates (dragonflies and damselflies), and western mosquitofish (Gambusia affinis) collected from aquatic habitats underlain by Cretaceous soils were significantly greater than in those collected from similar habitats underlain by non-Cretaceous soils. Median selenium concentrations were less than 2 ug/g DW for plant samples, less than 7 ug/g DW for invertebrate samples, and less than 6 ug/g DW for whole-fish samples collected from aquatic habitats underlain by non-Cretaceous soils. Similar samples collected from aquatic habitats underlain by Cretaceous soils contained median selenium concentrations two to five times greater. Blanchard et al. (1993) and Thomas et al.

(1997) reported the concentrations of selenium in biota from aquatic habitats away from the river mainstem including biota collected from irrigation drains and ponds, which had much higher concentrations of selenium in plants (20 ug/g DW), in invertebrates (32.5 ug/g DW), and in whole fish (41.7 ug/g DW) than those found in the mainstem.

Selenium in Fish

Simpson and Lusk (1999) reported on selenium concentrations in biota collected from the San Juan River mainstem (only) using data from Thomas et al. (1997, 1998) and others (Blanchard et al. 1993, O'Brien 1987, Wilson et al. 1995). Simpson and Lusk (1999) and Osmundson and Lusk (2011) reported on the concentrations of selenium in muscle tissues collected from Colorado pikeminnow and razorback suckers from the San Juan River mainstem. Selenium concentrations in razorback sucker muscle plugs collected from the San Juan River ranged from 1.1 – 5.4 mg/kg DW and averaged 3.5 mg/kg DW. Selenium concentrations in Colorado pikeminnow muscle plugs collected from the San Juan River ranged from 1.6 – 4.6 mg/kg DW and averaged 3.0 mg/kg DW (Table 5). There were no statistically significant spatial differences found using razorback sucker or the Colorado pikeminnow muscle plug selenium concentrations. Concentrations of Se in endangered fish tissues would be expected to reflect changes in decreasing atmospheric deposition after FCPP shut down of Units 1-3 in December 2013 (EPRI 2014), and then would be expected to increase slightly after 2031.

Mechanisms of Selenium Toxicity

Selenium has been shown to elicit a wide range of adverse effects in fish including mortality, reproductive impairment, effects on growth, and developmental and teratogenic effects including edema and finfold, craniofacial, and skeletal deformities (Hamilton 2004; Holm et al. 2005). Excessive selenium concentrations in fish tissues can cause a wide variety of toxic effects at the biochemical, cellular, organ, and tissue levels (Sorensen 1991). Selenium is beneficial in small amounts but can be toxic to animals at slightly higher concentrations (Sharma and Singh 1984). Maier et al. (1987) suggest the safety margin between recommended and toxic dietary concentrations may only be 10-fold. Selenium is generally one of the most toxic elements to fish, and researchers (Hilton et al. 1980; Hodson and Hilton 1983; Sorenson 1991) have reported selenium toxicity to occur at dietary concentrations only 7 to 30 times greater than those considered essential for proper nutrition (i.e., > 3 mg Se/kg DW). However, toxicity varies with fish species, temperature, life stage, exposure concentration, chemical form, the presence of pathogens, and other factors (Sorenson 1991).

<u>Selenium Effects to Fish Ovaries and Eggs</u>

Lemly (1998) reported that one of the outward manifestations of selenium toxicities in fish is teratogenic deformity. Teratogenic deformities (or terata) are permanent congenital malformations that have been attributed to excessive selenium in eggs (Lemly 1998). Excess dietary selenium of the female is deposited into the developing egg, particularly in the yolk (Lemly 1993b, 1998). In fish, yolk precursors (vitellogenin) are synthesized in the maternal liver, exported via blood, and incorporated into the developing ovarian follicle and become yolk proteins (Arukwe and Goksøyr 2003). When eggs hatch, larval fish use the selenium-contaminated yolk, both as an energy supply and as a source of protein for building new body tissues. During this life stage (fry), permanent developmental anomalies (e.g., spinal curvatures, missing or deformed fins, and craniofacial deformities) and other effects (e.g., edema) in fish can be related to elevated selenium in eggs (Hodson and Hilton 1983; Lemly 1993a; Maier and Knight 1994; Hamilton 2003). While hatchability is not affected, Lemly (1996) reported an increase in the incidences of teratogenic deformities when selenium concentrations in egg exceed 10 µg/g DW.

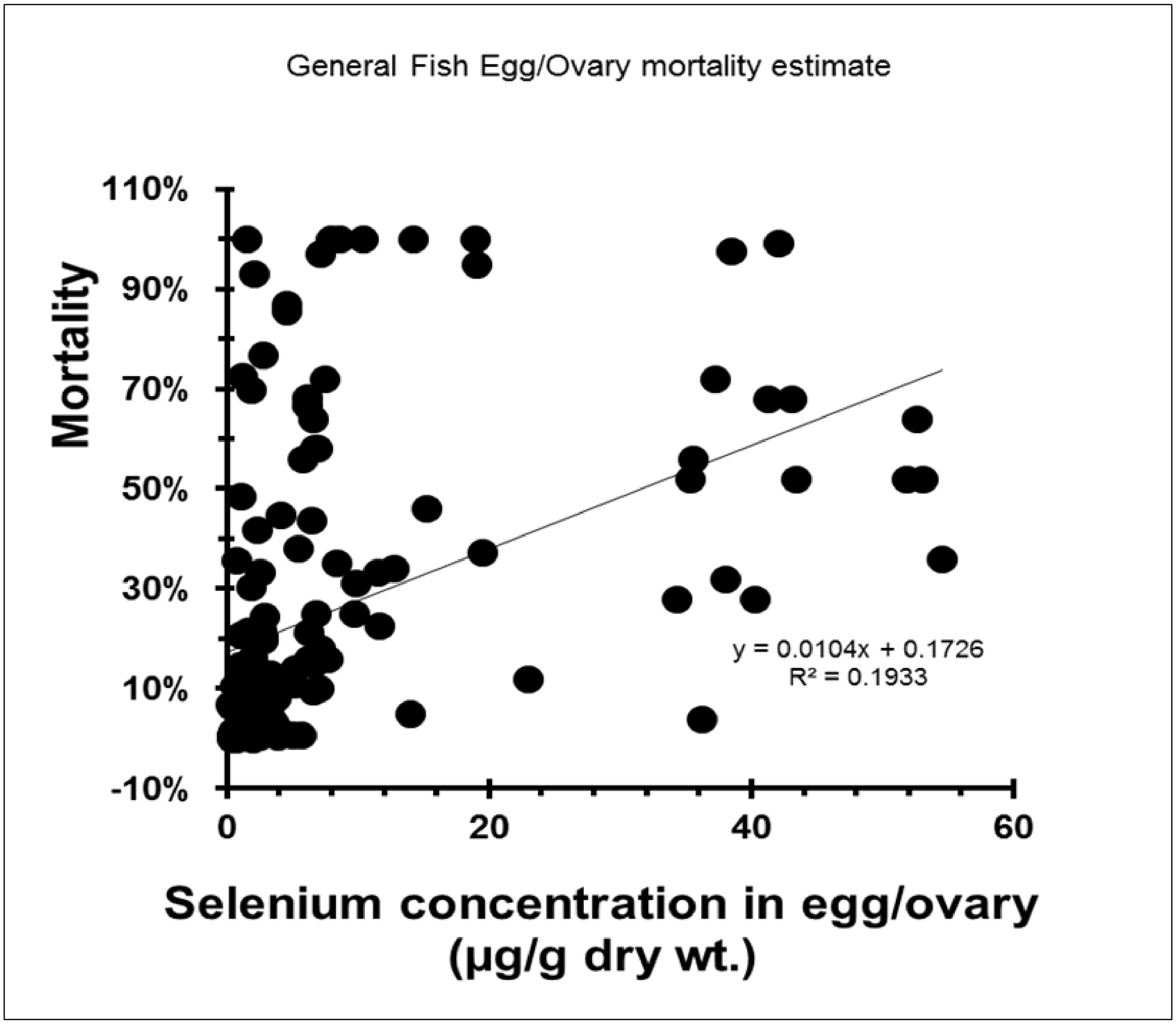


Figure 26. Selenium concentration (mg/kg DW) in fish eggs and relationship with associated mortality, deformity, or failure to hatch from a variety of toxicity studies (see text; Lusk 2015).

<u>Dietary Selenium Toxicity to Fish</u>

Studies have shown that diet is the primary route of exposure that controls chronic toxicity to certain fish (Coyle et al. 1993, Hamilton et al. 1990, Hermanutz et al. 1996, EPA 1998d, 2004. 2014). Selenium is required in the diet of fish at very low concentrations (< 0.5 mg/kg DW) (Hilton et al. 1980, Hodson and Hilton 1983, Doroshov et al. 1992). Threshold and concern levels encompass a range of dietary selenium of 2 to 10 mg/kg DW, with adverse effects a certainty as the upper limit is exceeded (Presser and Luoma 2006, Skorupa 1998a). Selenium concentrations in diets greater than 10 mg/kg DW have been consistently implicated in adverse effects on reproduction in a variety of avian, fish, and mammalian predators (Hodson and Hilton 1983; Woock et al. 1987; Heinz et al. 1989; Doroshov et al. 1992; Coyle et al. 1993; Lemly 1996a, 1997a; Hamilton et al. 1990, 2005b; Heinz 1996; Hamilton 2003, 2004). Reproductive failure in adults has been associated with their dietary concentration of 30 to 35 mg/kg DW (Skorupa 1998a, Woock et al. 1987, Coyle et al. 1993). Feeding excessive Se to larvae, fry, or adults does not directly cause malformations in the recipient, but survival of larvae fed elevated Se and can be severely compromised (Lemly 1998; Hamilton et al. 1990, 2001a, 2001b). Dietary Se toxicity to larval survival can occur at the same time that adult fish appear healthy.

McAda and Wydowski (1980) and Bestgen (1990) suggested that the diet of razorback sucker was composed primarily of "ooze," (e.g., plant detritus with associated bacteria, fungus and zooplankton) as well as insect larvae, such as found in low-velocity habitats of the San Juan River. Potential dietary items of larval razorback sucker would likely be small invertebrates (such as zooplankton) found in the mainstem or at the mouths of tributaries, in irrigation drains, and in associated wetlands. Papoulias and Minckley (1992) found that razorback sucker larvae exhibited prey-size selection, based on body width, and consumed prey from 0.1 to 0.4 mm. Selenium concentrations in zooplankton from the San Juan River Basin have not been reported.

From a caloric standpoint, zooplankton have similar energy content to invertebrate brine shrimp (Hamilton et al. 2001a). Chironomid worms have been identified as having elevated Se concentrations in comparison to other invertebrates (Hamilton et al. 2001). Chironomids have also been identified as an important dietary item for both Colorado pikeminnow and razorback sucker (USFWS 2002a,b). Because the caloric contents of zooplankton and aquatic invertebrates are similar (even though concentrations in zooplankton may be higher than in invertebrates), it seemed appropriate to estimate dietary concentrations to larval razorback sucker and Colorado pikeminnow based on the selenium concentrations reported in both plants (25 percent) and invertebrates (75 percent) by Simpson and Lusk (1999) and AECOM (2014). Average dietary Se concentrations in diets containing this ratio (25:75) of plants and invertebrates would be expected to have Se concentrations ranging from 2.7 to 2.9 mg/kg DW in the environmental baseline condition.

For larval razorback sucker, the range of dietary concern is approximately 2 to 5 mg/kg DW because of studies involving sensitive species, life stages, and endpoints (Beyers and Sodergren 1999; Hamilton et al. 2001a, 2001b, 2002, 2005b). Using these and other data, we developed a larval (12 to 45 days) fish survival relationship to larval dietary Se concentrations based on the assumed diet of both larval razorback sucker and larval Colorado pikeminnow in the San Juan River Basin (Equation 11).

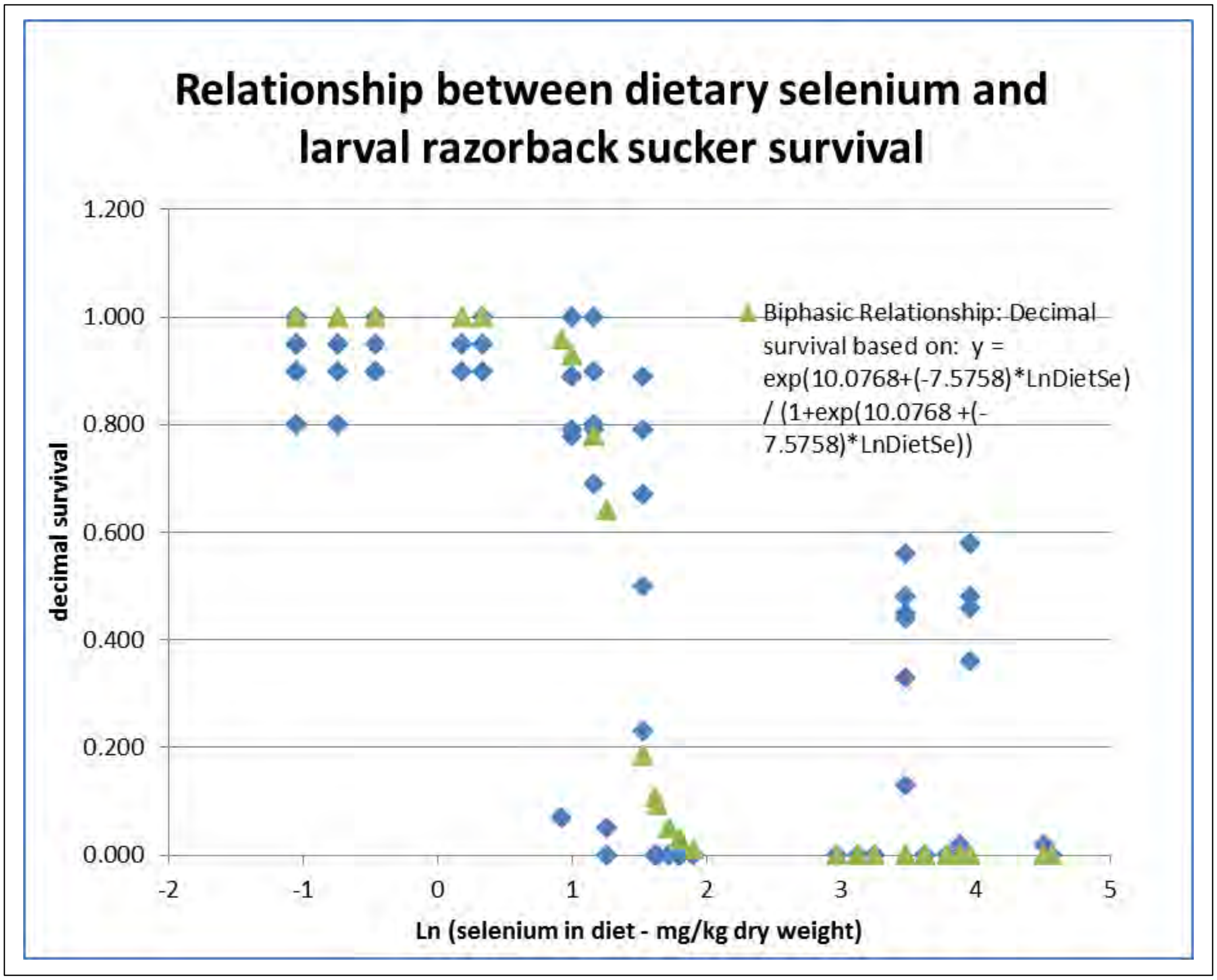


Figure 27. Biphasic relationship between dietary selenium in fish diets (in mg/kg DW) and larval survival (as a decimal) based on studies involving razorback sucker (see text; Lusk 2015).

Effects of Se to listed birds are discussed in the Hg effects section, above, and as described by AECOM (2014), and incorporated here by reference.

<u>Population Impacts of Selenium in the Environmental Baseline</u>

Quarterone and Young (1995) suggested that irrigation and pollution were contributing factors to razorback sucker and Colorado pikeminnow population declines. Hamilton (1999) hypothesized that historic selenium contamination of the upper and lower Colorado River basins contributed to the decline of these endangered fish by affecting their overall reproductive success, including loss of eggs and larvae. These fish can live over 40 years (Behnke and Benson 1983), increasing their frequency of exposure to both dietary and waterborne selenium. In addition, they often stage at tributary mouths such as the Mancos River before spawning, increasing their exposure to elevated levels of dietary selenium (Wilson et al. 1995).

Interactions of selenium and other elements

Many different compounds interact with selenium. Selenium does not aid the excretion of Hg; instead, it increases the accumulation of an inert form, including mercury-selenide (Himeno and Imura 2002), although conflicting studies exist; Huckabee and Griffith (1974) reported selenium increased the toxicity of mercury. Interactions between Se and Hg are known to be concentration-dependent (Kim et al. 1977). Interactions between Se and Hg can be synergistic at low mercury concentrations (<0.07 ppm) and antagonistic at high concentrations (>0.10 ppm) in water (Kim et al. 1977). Cuvin and Furness (1988) reported that Se protected minnows against Hg toxicity as a molar ratio of 2.5:1 Hg:Se. However, a 1.3:1 molar ratio caused increased mortality compared with 0.3 ppm Hg only. Therefore, the studies of Cuvin and Funess (1988) and Kim et al. (1977) demonstrated that antagonistic and synergistic toxic interactions between selenium and mercury are possible and are a function of the concentrations of the two elements and the molar ratio of one to the other (Sorensen 1991). The underlying mechanisms regarding the interactions between Se and Hg, the compounds that are formed in tissues and the conditions that are responsible for Hg:Se antagonism remain unclear (Kahn and Wang 2009).

Numerous pollutants are often released into the environment and result in a mixture of elements that is unique to each aquatic system. Categorization of various elemental mixtures in the environment or in the fish as synergistic or antagonistic can depend on the concentrations, their bioavailability, water temperature, the molar ratios of Se and Hg, the fish species, and other factors (Sorensen 1991). The available data also do not show whether the various inorganic and organic compounds and oxidation states of selenium are equally effective sources of selenium as a trace nutrient, or as reducing the toxic effects of various pollutants (EPA 2004). As some of the accumulations of Se and Hg will result in irreversible injury, and the optimal antagonistic molar ratios for Se and Hg in the environment (along with other elements and environmental stressors) have not been determined for the Colorado pikeminnow, razorback sucker, or their prey sufficiently to address the antagonistic interactions between Se and Hg, they were not further addressed by this analysis.

Environmental Baseline Conditions of Flycatcher and Cuckoo Riparian Habitat
Past and present federal, state, and private activities have affected flycatcher and cuckoo habitats within the Action Area including urbanization, agricultural conversion, irrigated agriculture, pollution impacts to prey density, river maintenance, flood control, dam operation, and water diversions (TNC 2013). There are efforts underway to restore riparian habitat in the San Juan River Basin (TNC 2013). Restoration efforts are aimed at developing suitable nesting and foraging habitat for flycatcher and cuckoo along the San Juan River over the next 25 years. Because of disturbance, infestation of Tamarisk Leaf Beetle, and riparian management, it is not anticipated that quality nesting habitat for flycatcher or cuckoo will improve near Morgan Lake.

Climate Change

Climate change has and will occur and affect endangered species and their habitat over the duration of the Proposed Action and beyond, whether or not the Proposed Action occurs. Climate change over the coming decades and centuries has the potential to affect many organisms, including freshwater fish. Climate change has the potential to change precipitation patterns, including the timing, intensity, and type of precipitation received; runoff patterns based on the amount of precipitation falling as snow and when snowmelt occurs; and atmospheric temperatures, which exhibit a strong influence on water temperatures.

According to the NRC (2007), air temperature has increased by 1.4°C in the last century. The Colorado River Basin has warmed more than any other part of the U.S. Warmer air temperatures will lead to increased evaporation from Navajo Reservoir. This increase is expected to reduce water availability, operational flexibility, and the quality and quantity of fish habitat, which are important elements to native fish in the river downstream.

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

Climate change models agree that the southwest will get drier in the next century, with runoff decreasing 8 to 25 percent (Seager et al. 2007), resulting in decreased water availability. This reduction in precipitation will make it increasingly challenging to meet the Flow Recommendations for the San Juan River, established to protect listed fish and other native fish species, especially the high-flow requirements that provide for channel maintenance and create or renew habitat for listed fish. In the current drought, Reclamation has not been able to provide the required number of days of flow over 10,000 cfs since 2005 (BOR 2012).

Reduced flow levels may also exacerbate contaminant issues, as less dilution of contaminants in the river would occur.

EFFECTS OF THE PROPOSED ACTION

Effects of the action means the direct and indirect effects of an action on the species or designated critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by a proposed action and are contemporaneous or later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification; ‘interdependent actions’ are those that have no independent utility apart from the action under consideration (50 CFR 402.02). If the proposed action includes offsite conservation measures to reduce net adverse impacts by improving habitat conditions and survival, the Service will evaluate the net combined effects of the proposed action and the offsite conservation measures as interrelated actions. Future Federal actions that are not a direct effect of the proposed action and not included in the environmental baseline or as indirect or interrelated effects are not considered in this BO.

The proposed action, including the specific operations of FCPP and NMEP are described above and in the EIS (OSMRE 2014a) and the BA (OSMRE 2014b); (OSMRE 2015). Types of effects were categorized by activity or by project element (Navajo Mine operations or FCPP operations):

1. Effects of Navajo Mine Operations;
2. Effects of Noise and Vibration;
3. Effects on Surface Water Hydrology;
4. Effects of Stormwater Runoff, Point source, and Other Authorized Discharges;
5. Effects of Entrainment at Cooling Water Intakes above APS Weir;
6. Effects of Operation of APS Weir on Endangered Fishes;
7. Effects of Nonnative Species Release from Morgan Lake; and
8. Effects of Atmospheric Emissions, Deposition, and Bioaccumulation;

COLORADO PIKEMINNOW AND RAZORBACK SUCKER

Effects of Navajo Mine Operations

Navajo Mine Operations will not have an adverse effect on the Colorado pikeminnow and razorback sucker.

Effects of NMEP and FCPP Operations on Surface Water Hydrology

All of the water supply for Navajo Mine (and FCPP) Operations is obtained from the San Juan River by diversion through cooling water intakes at the APS Weir. It is then pumped into Morgan Lake, and transported to various locales for various uses (BA, pages 2-19 to 2-60). An average of 27,682 AFY of San Juan River water (ranging from 25,327 to 28,981 AFY) is used by the FCPP and Navajo Mine annually. All water supply at Navajo Mine and FCPP is supported by a water right owned by BHP Billiton New Mexico Coal Company. (BA, Section 2). The surface water right includes up to 51,600 AFY diversion and allows 39,000 AFY to be consumed.

Navajo Mine Operations in the Pinabete Permit Area are within the Chaco River Watershed (Hydrologic Unit Code 14080106), which drains 4,563 square miles of the San Juan River Basin (Hydrologic Unit Code 1408). The Navajo Mine lies on the eastern side of the Chaco River Watershed. Navajo Mine Operations would affect some portions of Cottonwood Arroyo and Pinabete Arroyo, which are the primary drainage pathways for runoff through the Pinabete Permit Area. Cottonwood and Pinabete Arroyos are ephemeral sand bed, tributary drainages that pass through the northern portion of the Pinabete Permit Area. Cottonwood Arroyo is one of the largest of the Chaco River tributaries with a drainage area of approximately 80.1 square miles (1.8 percent of the Chaco River Basin), though only approximately 6 percent of the Cottonwood Arroyo drainage area is within the permit area. Pinabete Arroyo has a drainage area of about 60 square miles (1.4 percent of the Chaco River Basin). Approximately 16 percent of the Pinabete Arroyo watershed is within the Pinabete Permit Area. Together the area of the mine drained by these arroyos is about 0.3 percent of the total area of the Chaco River watershed.

Natural runoff in these (and other) tributaries may be intercepted or diverted around mining activities or during other Navajo Mine Operations. The interception of surface water may diminish the volume of runoff from these areas that enters into the Chaco River Basin. Navajo Mine Operations conducted hydrologic modeling that indicated that intercepted flows would be approximately 757 acre feet per year (AFY) in the Pinabete Arroyo drainage, and 403 AFY in Cottonwood Arroyo drainage, assuming the entire drainage was mined in a year. In actuality, these areas would be likely mined variously over 25 years, so the potential impact would be smaller; on average about 46 AFY (757 AFY + 403 AFY = 1,160 AFY/25 years = 46.4 AFY). We compared this average intercepted water volume to the average annual flow of the Chaco River near Waterflow, New Mexico (USGS Gage 09367950) for the 18 year period of record (1977-1995), which was 35,133 AFY. The average annual volume of intercepted flows from these arroyos to that of the Chaco River was approximately 0.13 percent (=46.4 AFY/35,133 AFY=0.00132) and could range from 0.1 to 0.6 percent even if the annual rate of intercepted water were doubled in any particular year as compared to range of reported Chaco River flow). The Chaco River drains to the San Juan River near Shiprock. Average annual flow at Shiprock, approximately 2 miles downstream of the Chaco River confluence from the 2000 to 2014 water years was 415,484 cfs (USGS gaging Station 09368000), so this interception of flow represents approximately 0.05 percent of the flow of the San Juan River. After these areas are mined or modified, these drainages would be reconnected to restore their natural flow patterns (OSMRE 2014), which would be anticipated to restore surface runoff flow.

Similarly, the FCPP Operations intercept surface water flows to protect against the entry of contaminants from the Dry Fly Ash Disposal Area. This could affect flows in downstream water bodies including the Chaco and San Juan Rivers (BA, page 7-6). Because of extensive and existing water depletions from the San Juan River there is no minimum amount of water depletion that is considered insignificant in its effects to the Colorado pikeminnow and razorback sucker. This is because the Service determined that any depletion is likely to have adverse effects on the Colorado pikeminnow and razorback sucker, as well as their designated critical habitat.

Effects of Stormwater Runoff, Point Source, and Other USEPA Authorized Discharges

The proposed action includes the present and future issuance of National Pollutant Discharge Elimination System (NPDES) permits by USEPA for discharges associated with various activities such as coal mining, stormwater runoff, and other discharges (BA, Section 2). Under these permits, the Navajo Mine Operators are required to control all surface runoff water with the potential of being contaminated from contact with mining activities. Various polluted effluents are permitted to be discharged through conveyance facilities (e.g., pipes, ditches, etc.) that end in "outfalls" to the environment. Outfalls 1 and 2 discharge to Morgan Lake and which then eventually discharges to the Chaco River that is a tributary to the San Juan River. Outfalls 003 to Outfall 019 discharge to the Chaco River. Outfall 020 discharges to the San Juan River (USEPA 2008). There are currently 14 outfall locations on Navajo Mine Lease Areas 1, 2, and 3, and the proposed action may enable USEPA to authorize up to 26 more discharge outfalls in Areas 3, 4, and 5 (USEPA 2013). The USEPA has required monitoring at selected outfalls for arsenic, boron, cadmium, lead, Se, sulfate, and total dissolved solids. The USEPA has also established requirements that a Sediment Control Plan be designed, implemented, and maintained using BMPs at the Navajo Mine so that the Operators demonstrate that stormwater discharges will result in average, annual, sediment yields that will not be greater than similar sediment yields determined for from pre-mined or undisturbed conditions.

Effluent discharges from FCPP operations are also being authorized by NPDES permits issued by USEPA (Figure 28). The cooling water discharges will occur through an outfall to Morgan Lake, which discharges to No Name Wash (a 2.5 mile-long tributary to the Chaco River), which in turn drains approximately 7 miles of the Chaco River then to the San Juan River. These discharges are intermittent with an average of 2.5 days per week of discharge for about 6 months in a year. The rest evaporates. The average flow rate for the discharge is 4.2 million gallons a day (6.5 cfs). Discharges are mostly conducted to regulate the accumulation of salts (total dissolved solids) in Morgan Lake. Stormwater discharges associated with the electric steam generation boilers and other related facilities flows to the Combined Waste Treatment Pond for treatment and is discharged to the Condenser Cooling Water Discharge Canal. Parking lots, switchyards and other open areas are discharged to the Condenser Cooling Water Intake Canal through permitted discharge points. Stormwater in the ash disposal area is discharged to Chaco Wash after BMP treatment in accordance with a storm water construction permit. FCPP Operations also include road and vegetation maintenance activities conducted at Transmission Line crossings authorized under a General Construction Permit.

USEPA authorizes the use of a Practical Quantification Level (PQL) of a pollutant as part of the effluent limits, which is the numerical result considered accurate. In cases where the PQL exceeds the effluent limitation in a NPDES permit, an analytical result at or below the PQL is deemed by USEPA to constitute compliance with the NPDES permit effluent limitation. This practice can result in PQLs that are greater than concentrations expressed in the applicable water quality standard. We therefore expect that NPDES permits identifying outfalls with the potential to discharge Hg will provide monitoring data for Hg using Method 1631E or another sufficiently sensitive EPA-approved method. For purposes of permit applications, a method for Hg is "sufficiently sensitive" when (1) its method quantitation level is at or below the level of the applicable water quality criterion for Hg or Se (2) its method quantitation level is above the applicable water quality criterion, but the amount of Hg or Se in facility's discharge is high enough that the method detects and quantifies the level of Hg or Se in the discharge.

NO.	TITLE	AVG. RATE (MGPD)
1	RIVER MAKE-UP; COOLING WATER INTAKE	17-28
2	RECIRCULATED COOLING WATER POND DISCHARGE/BLOW-DOWN	3-14.6
	SYSTEM EVAPORATION	13.3
4	SERVICE & RECIRCULATED COOLING WATER INTAKE*	1000-1726.7
5	RECIRCULATED COOLING WATER RETURN	1000-1713.6
6	COMBINED WASTE STREAMS *	13.0
7	CWTP (L.V.W.) DISCHARGE	13.0
8	SANITARY SEWAGE	.027-.04
9	CHEMICAL METAL CLEANING WASTES	.100
10	FLUE GAS DESULFURIZATION WASTEWATER	0.8-1.4

* INCLUDES IN PLANT STORM WATER RUNOFF

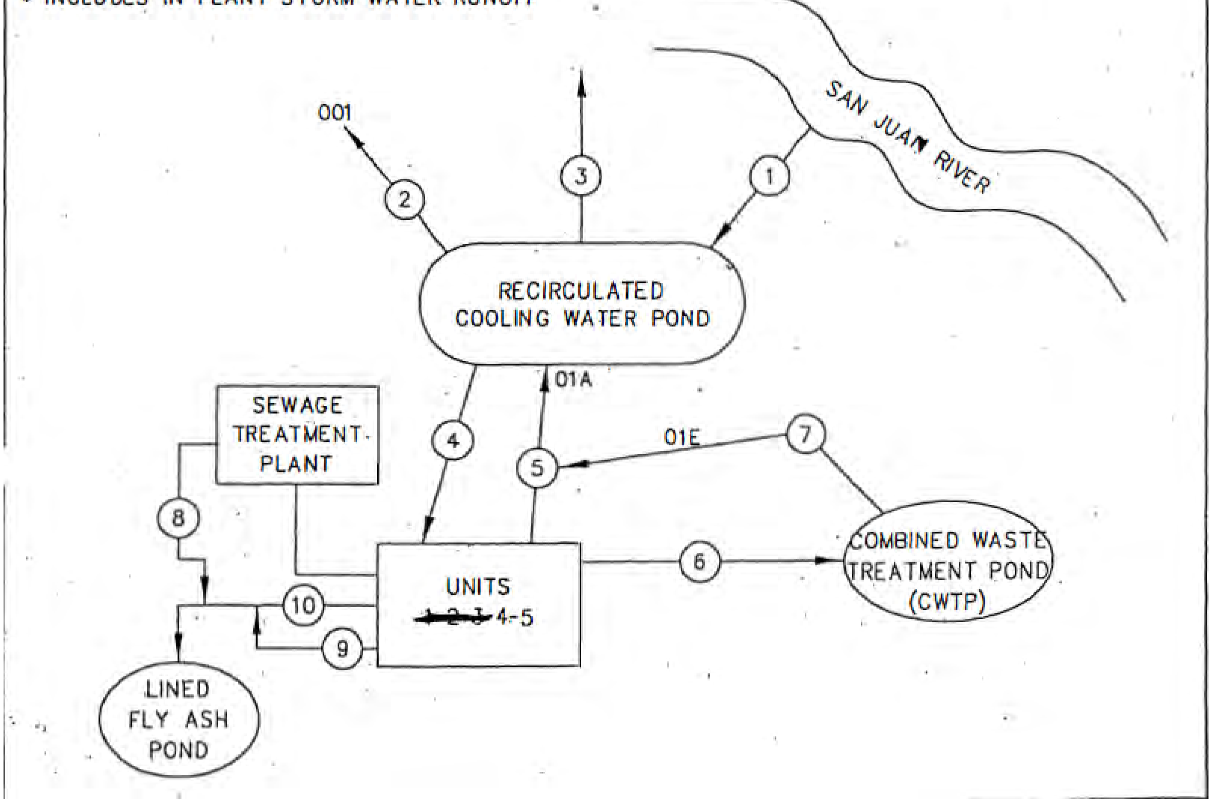


Figure 28. Effluent wastewater pathways associated with Four Corners Power Plant operations.

However, for all NPDES permit actions, we anticipate that a PQL for Se of 1 ug/L and a PQL for total Hg of 0.0002 ug/L will be used. Using the PQLs and the bioaccumulation factors (BAF) provided in the BA (OSMRE 2014, page 6-18) for Se (BAF = 485 L/mg), we expect Se in whole body razorback suckers and Colorado pikeminnow to increase to approximately 2.4 mg/kg wet weight and their egg Se concentrations would increase to 13.6 to 19.4 mg/kg DW resulting in an increase in egg mortality ranging from 4 to 5 percent. Using the PQL for Hg and the BAF provided in the BA (OSMRE 2014, page 6-18) for total Hg (BAF = 3,520), we expect Hg in whole body razorback suckers and Colorado pikeminnow to be approximately 0.1 mg/kg wet weight and therefore, associate a 2.8 percent reproductive injury and a 0.5 percent survivorship injury (Table 8). We conclude that in both cases, the PQLs used in the NPDES permits or discharges of Hg and Se would be associated with a wide range of adverse effects to the Colorado Pikeminnow and razorback sucker and their designated critical habitat.

Discharges from the Ash Disposal Areas authorized by USEPA and OSMRE

The DEIS reported two areas of groundwater seepage at the Ash Disposal Area known as the "north seep" and "south seepage area", which have identified contaminated groundwater (p. 4.5-57). Se concentrations beneath the Ash Disposal Area have exceeded USEPA drinking water quality standards (APS 2013). However, APS has installed extraction wells and finished a two part seepage intercept project. This project serves to intercept and prevent water seepage from both the north seep and south seepage area into the Chaco River, west of the plant in the ash disposal area. The intercept project consists of two French drains running approximately 2 miles. The trenches for the French drains were constructed down to an impermeable shale layer to ensure maximum water capture. Water is collected from the French drains and pumped to a lined pond. The operation of the intercept trenches, as well as the monitoring of groundwater by monitoring wells as well as inspection and monitoring to ensuring that any pollutant sources present in ground water that re-surfaces via seeps can be traced so that corrective actions can be undertaken. According to the BA, with the operation of intercept trenches and water extraction wells, continued operation of the ash disposal ponds should have little potential to contaminate water quality in Chaco Wash.

There are inactive ash disposal areas that previously received flue gas emission control residuals, boiler acid cleaning waste, treated sewage, chemical metal cleaning wastes, air preheater wash, co-disposal waste, and turbine foam cleaning waste. The Lined Decant Water Pond has a capacity of 517 acre-feet, although this liquid is continually pumped back to the power plant to be used in its operations, and so generally contains 135 to 435 acre feet of water (APS 2011b). These facilities are lined and all dikes are constructed in accordance with specifications approved by the New Mexico Office of the State Engineer, Dam Safety Bureau. A safety inspection, performed in 2009, found the dams and dikes associated with the ash disposal to be satisfactory.

The Ecological Risk Assessments (ERA) conducted under the EIS could not rule out risks to Colorado pikeminnow, razorback sucker, (and flycatcher, and cuckoo) in the San Juan River Basin, due to their exposure to Hg and Se. . Based on this and the factors above, the effects of the effluent discharges, likely have an adverse effect on the listed species by increasing the Hg and Se in the body burdens of Colorado pikeminnow, razorback sucker, flycatcher, and cuckoo in the action area.

Effects of Entrainment at the Cooling Water Intakes above APS Weir

The intakes that supply water to Morgan Lake from the San Juan River likely result in the entrainment of endangered fish from the San Juan River (BA, Section 7). These river intakes consist of two 8 by 8.5-foot intake structures that occur just upstream of the APS Weir. The west intake volume was measured at 18,250 gallons per minute (40.7 cfs) and the east intake was measured at 16,000 gpm (35.7 cfs) (R. Grimes, FCPP, pers. comm., December 16, 2014). Both intakes are fully screened with 1- by 3-inch mesh screens to keep out debris and some fish. The minimum approach velocity at the west intake is approximately 0.64 feet per second (fps) and that at the east intake is approximately 0.56 fps. During low flows, when the screens are often not fully submerged, approach velocity increases (at 6 feet of depth) to ~0.85 fps at the west intake and to ~0.74 fps at the east intake. The river intakes are operated at any time of day, as needed, with increased need during high summer temperatures. The west intake (40.7 cfs) is generally used during the October to May timeframe, when average monthly flows in the river at Farmington are between 784 to 3,490 cfs (USGS Gaging Station 09365000, 2004 to 2013 water years). Both intakes (76.4 cfs) are generally used during the May through October timeframe, when average monthly flows in the river are between 913 to 3,316 cfs. Thus, the maximum seasonal proportion of flow diverted to Morgan Lake ranges from (=40.7/3490) 1.2 to (=40.7/784) 5.2 percent during the October to May timeframe, and (=76.4/3316) 2.3 to (=76.4/913) 8.4 percent of the flow in the June to September timeframe, when larval native fishes are known to drift within the water column and be subject to currents and flow.

The maximum diversion allowed pursuant to New Mexico Office of the State Engineer Permit 2838 is 51,600 AFY and depletion is 39,000 AFY. As noted in the BA, the full amount of the consumptive water rights under Permit 2838 has been accounted for in the SJRRIP's water accounting and factored into the flow recommendations for the San Juan River. While the FCPP and Navajo Mine would maintain the ability to divert and consumptively use as much water as the rights allow for the Project life, annual water use is expected to be reduced by 5,000 to 7,000 AFY with the closure of Units 1, 2, and 3 at the end of2013. Average consumptive use has been 27,682 AFY. Assuming a reduction of 5,000 AFY, this would equate to average consumptive use of ~22,682 AFY. The reduction in diversion would be accomplished by running the diversions in the same manner as they have been operated historically, but for shorter periods of time. Therefore, depending on the operational mode of the two intakes, approach velocities could range from 0.56 to 0.85 fps, and may depend on the mode of diversion (one intake or two) and the amount each screen is submerged. There may be time periods at which one of these intakes are on, but the range of approach velocities are expected to remain the same, even with possible reduced diversions.

No entrainment studies have been conducted at this diversion. Fish species, life stage, period of movement or migration, timing, other fish species, predator presence, human activity, fish behaviors, light and acoustic conditions, water quality, and swimming performance of the endangered fish life stages may affect the number and types of endangered fish that are entrained (drawn into the pumps, pipes, and into Morgan Lake, injured by barotrauma, or are killed).

On August 15, 2014, EPA promulgated revised regulations on the design and operation of electric steam plant intake structures, in order to minimize adverse environmental impacts. Because the facility intakes greater than two million gallons per day (mgd) of cooling water from the San Juan River, it must meet requirements under CWA Section 316(b), regulating the design and operations of intake structures for cooling water operations. APS operates a closed-cycle recirculating system, circulating from around 1,000 up to about 1,700 million gallons a day (MGD) through Morgan Lake, a man-made cooling water impoundment.

APS will be required to undertake all appropriate measures to reduce impacts from impingement and entrainment at the river intakes (40 CFR Parts 122 and 125, EPA 2014b) , as determined by

EPA. When EPA imposes any applicable requirements, EPA will determine the specific action(s) to be taken in accordance with the regulations. All such future actions would be expected to either maintain (in the event that current operations meet USEPA standards) or reduce entrainment risk over existing levels.

Effects of Entrainment at Cooling Water Intakes on Colorado Pikeminnow

The maximum approach velocity of 0.85 fps in the summer would be exceeded to entrain nearly all the Age 0 Colorado pikeminnow in the vicinity of the intakes that are less than approximately 93 mm in total length (at 10C, 91 mm TL at 14C, and 87 mm TL at 20C) that have a sustained swimming ability of less than 0.85 fps (depending on water temperature, see Childs and Clarkson 1996 and Figure 29, below). For fish with planktonic larvae, such as Colorado pikeminnow, these larvae are often assumed to be entrained in proportion to the amount of flow diverted, as they tend to drift with the current. Older pikeminnow life stages are generally capable of directing their movements independently from the current. For the larger life stages, the proportion of flow diverted is less likely indicative of impingement risk. Also, Colorado pikeminnow eggs are demersal and would rarely drift and therefore, are unlikely to be entrained, and were not estimated.

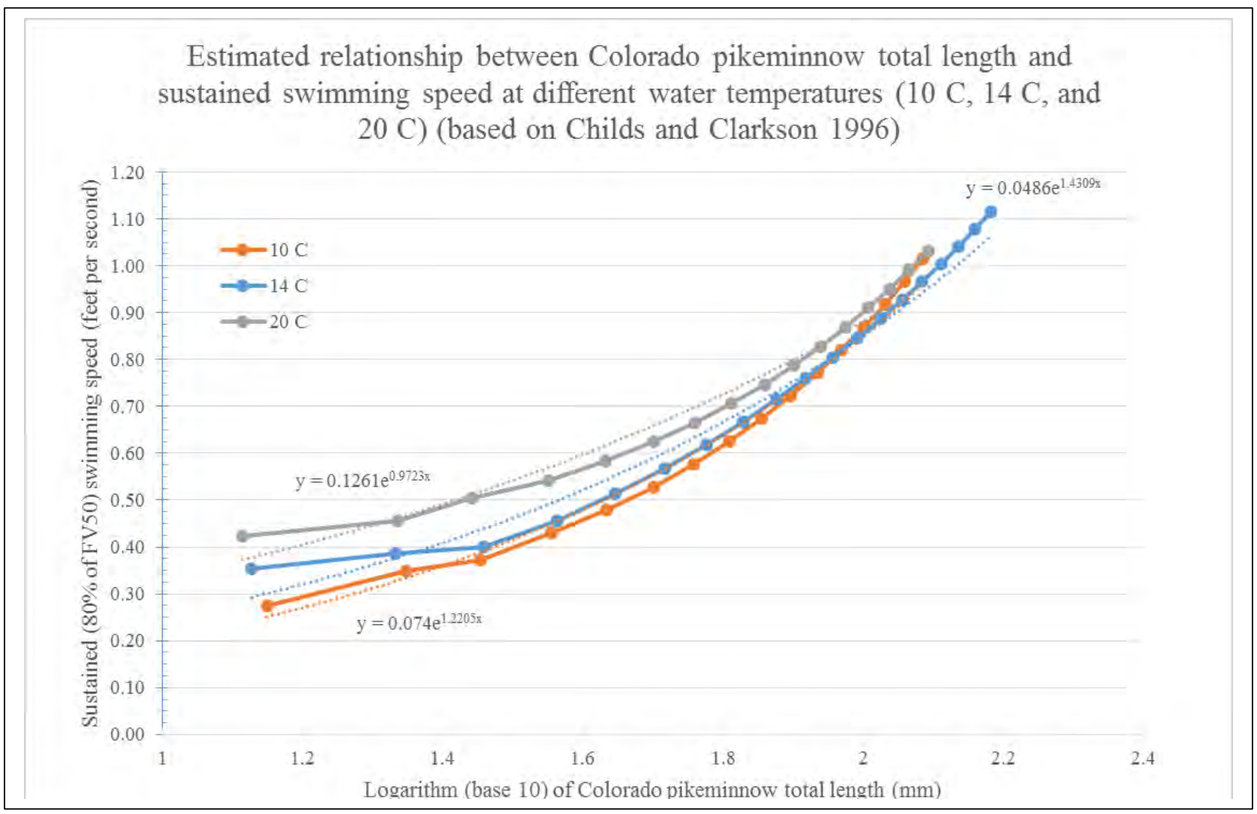


Figure 29. Estimate of swimming speed of Colorado pikeminnow by size (TL in mm) and temperature (extrapolated from three early life stages based on Childs and Clarkson 1996).

The USFWS (2009) estimated that Colorado pikeminnow spawning could potentially occur between River Miles (RM) 128 and 180. The cooling water intakes are located at APS Weir at

RM 163.3, therefore, about 26 percent of the available spawning habitat is upstream of the weir. The SJRRIP has proposed to implement fish passage around APS Weir, thereby opening up this upper reach to more spawning adults in the near future (~6 to 10 years). Lacking information on the actual distribution of spawning Colorado pikeminnow, an assumption of equal distribution within the available spawning habitat was reasonable for that minority of fish (30 percent) that do not use the preferred Mixer Area to spawn (70 percent). When Colorado pikeminnow attains recovery, as many as 203 female pikeminnow could occupy the San Juan River and as many as 30 percent of them (~61) could spawn upstream or away from the Mixer Area. We assumed that only one third of that minority population would actually spawn upstream of the APS Weir, or approximately 20 females.

The Colorado pikeminnow spawning above the APS Weir could be as many as 20 females (USFWS 2006). With each of those females producing an average of 50,000 eggs, the total produced could be as many as 1,000,000 eggs upstream of APS Weir. Valdez (2014) estimated that survivorship of eggs was approximately 30 percent and then survival of Age 0 fish was approximately 54 percent. Therefore, of the total eggs expected, as many as 300,000 eggs might hatch, and then as many as 162,000 pikeminnow larvae could be produced upstream of APS Weir. Of those, up to 8.4 percent (13,608) would be potentially entrained, assuming these fish are entrained in proportion to the amount of flow entrained. Water temperatures currently upstream of APS Weir are often likely too cool to support robust spawning and rearing of Colorado pikeminnow (Durst and Franssen 2014), which may result in a smaller proportion of adults spawning in the area above APS Weir.

We also evaluated the number of Age 0 pikeminnow entrained by other similar diversions in the San Juan River. Prior to installation of fish screens and passage at Hogback Diversion, it seasonally diverted up to 22 percent of the flow, and loss of pikeminnow larvae was estimated at 9 to 12 percent (USBR 2009). Compared to 56,000 AFY at APS Weir, the total diversion at Hogback was much less (12,100 AFY, but the daily diversion rate was more (<200 cfs versus 74.6 cfs at APS Weir) to meet seasonal agricultural demand. Diversions for the Navajo Gallup Water Supply may divert up to 59 cfs per day, or about 4 percent of flow, and is expected to entrain between 1 to 4 percent of pikeminnow larvae (5,400). Finally, estimates of loss of Age 0 pikeminnow larvae due to cold water temperatures and drift into Lake Powell was estimated at 48.3 percent of the entire Age 0 pikeminnow population (USFWS 2006).

The SJRRIP currently augments the San Juan River with hatchery-reared Colorado pikeminnow. Approximately 400,000 Colorado pikeminnow, approximately 6 months of age (50 to 65 mm total length (TL)), are stocked each year. Since 2007, nearly all of these fish have been stocked above the APS Weir and they are vulnerable to entrainment at FCPP's river station intakes. These fish are stocked in October and November when flows in the San Juan River are 728 to 1,530 cfs (USGS Gage 09365000). The diversion is typically operating only the west intake at this time and anywhere from (=40.7/1,530) 2.7 to (=40.7/728) 5.6 percent of the flow is being diverted. With a sustained swimming speed of between 0.5 to 0.6 fps, and cooling water intake velocity at approximately 0.65 fps, it is likely that some portion of the stocked pikeminnow will also be entrained. These fish swim actively so they would not be entrained in proportion to the amount of flow diverted. However, up to 5.6 percent of the pikeminnow stocked could also be entrained in the cooling water intakes. We consider 13,608 the maximum estimated number of

Age 0 pikeminnow entrained by the river station intakes per year as it also includes entrainment of some of the fish stocked in autumn .

Colorado pikeminnow may remain vulnerable to entrainment for some time after the initial stocking. The exact size of a pikeminnow vulnerable to entrainment at the 1 by 3 inch screens (an ellipse of 1,520 mm^2 would fit inside each square) at the intake may be related to the size of its girth. The girth of Colorado pikeminnow has not been reported, therefore, we assumed that its shape was similar to flannelmouth sucker, whose body depth has been reported (Portz and Tyus 2004). Using the dimensions for body depth, and an estimate of 2/3rds of body depth for its width, we estimated that a Colorado pikeminnow of 385 mm TL, approximately 54 mm in depth, and about 28 mm wide, could pass through the 1 by 3 inch openings in the screens covering both cooling water intakes. In September 2012, there were 45 Colorado pikeminnow within 10 river miles of APS Weir less than 385 mm TL. In four months in 2013, there were 99 individuals less than 385 mm TL, or about 25 per month. Therefore, in any month as many as 25 pikeminnow less 385 mm TL near the cooling water intakes are entrained.

Based on entrainment, adverse effects to Colorado pikeminnow will occur.

Effects of Entrainment at Cooling Water Intakes on Razorback Sucker

The APS cooling water intakes might entrain some larval and older razorback suckers too. Razorback suckers spawn on the ascending limb of the hydrograph during the spring. Their larvae are found in the drift from late March to early July. Spawning is assumed to occur between RM 100 and 180, with the effort spread evenly throughout the reach (USFWS 2009). The intakes are about 16 miles below the top of the spawning reach and thus may affect about 20 percent of the potential spawning and nursery habitat. Average flow during their spawning season between 2003 and 2007 ranged from 717 to 6,455 cfs (USFWS 2009). During the spawning season, the Proposed Action would divert 37 cfs in March and April and 71 cfs in May and June. Thus the Proposed Action would divert between 0.6 percent of the flow in low diversion operations at high flows and 9.9 percent of the flow at high diversion operations during lower flows. Based on the distribution of spawning and the proportion of flow diverted, it is anticipated that between 0.1 and 2 percent of recently spawned razorback sucker may be entrained.

1.

A study of entrainment at Hogback, Farmers Mutual, Jewitt Valley and Fruitland Irrigation diversions conducted in 2004 and 2005 indicates that the proportion of native sucker species entrained in the canals is considerably lower than what would be predicted based on the proportion of flow diverted (Renfro et al. 2006).

Adverse effects to razorback sucker will occur as a result of entrainment.

Effects of Operation of APS Weir to Endangered Fishes

The APS Weir at RM 163.3 lies within designated critical habitat for Colorado pikeminnow and upstream of designated critical habitat for razorback sucker. It impedes fish passage during some times of the year (Bio-West 2005). Some Colorado pikeminnow and razorback sucker have been observed to occur upstream (after detection downstream) and pass APS Weir under certain conditions (Bio-West 2005). Based on the conditions observed during their study, Bio-West (2005) found that both species could possibly move across the weir near its right side (looking down; north side of weir) when flows (measured at Farmington Gage) are higher than 5,000 cfs. However, for flows between 500 and 5,000 cfs, Bio-West noted that flow velocity and depth conditions are not ideal for fish passage (i.e., they do not match criteria used to design passable fishways for native species). Flows in July are typically less than 5,000 cfs, so the potential to impede spawning migrations of Colorado pikeminnow may occur in most years (Bio-West 2005). In years with low spring runoff volume, APS Weir may also impede spawning movements of razorback sucker.

The impairment of fish passage at the weir could limit the ability of Colorado pikeminnow and razorback sucker to move within the river to different areas in response to changing needs and environmental conditions. This could reduce the amount of accessible spawning and rearing habitat under some conditions, and may reduce the physical habitat quantity and quality for these species by altering depth and velocities (Bio-West 2005). The alteration of physical habitat by operation of APS Weir and sluiceway gates adversely affects the feeding, spawning and movement behavior of Colorado pikeminnow and razorback sucker.

The full extent of this blockage of movement is not known because the sustained swimming performances of larger Colorado pikeminnow and razorback sucker are not well known. Additionally, water temperatures currently upstream of APS Weir are often likely too cool to support robust spawning and rearing of Colorado pikeminnow (Durst and Franssen 2014).

However, APS Weir lies within the critical habitat for Colorado pikeminnow and its operations will adverse effects to the function and physical qualities (depth and velocity) of its critical habitat within 50 feet on either side of the weir, and prevent movement, feeding, and spawning behavior to as many as 18 miles of critical habitat upstream. The APS Weir is outside of critical habitat for razorback sucker.

Effects of Nonnative Species Release from Morgan Lake on Colorado pikeminnow and razorback sucker

Morgan Lake supports several species of nonnative fish, including bluegill, green sunfish, largemouth bass, white crappie, gizzard shad, common carp, plains killifish, mosquitofish, and channel catfish, as well as a novel species, such as tropical suckerfish (*Hypostomus plecostomus*) (OSMRE 2014; J.Cole, Wildlife Manager, Navajo Nation Department of Fish and Wildlife, August 28, 2014, pers. comm.). A single red pacu (subfamily Serrasalminae) was reported to inhabit Morgan Lake for over 4 years (“Toothy Fish”, Associated Press, February 28, 2004). An extensive biological survey of the type, number, and distribution of nonnative species in Morgan Lake was not available or reported.

Operations of Morgan Lake discharge water into No Name Wash, which drains to the Chaco River and from there into the San Juan River. Potential discharges from Morgan Lake could result in release of nonnative species into the San Juan River. Such discharges could be facilitated by optimal conditions for transporting live fish eggs, larvae, or fish downstream, any unauthorized or incidental transport associated with recreational fishing, or during evacuation or decommissioning of Morgan Lake, should such activities ever occur. Gustaveson (2010) presents a compelling narrative that gizzard shad, likely associated with largemouth bass stocking in Morgan Lake during 1998, had escaped into the San Juan River and by 2001 had entered Lake Powell and adversely affected the fishery there. Recent invaders, such as the gizzard shad, northern pike, and smallmouth bass, have demonstrated how quickly nonnative species can increase and expand to the detriment of native fish assemblages. No studies were available that evaluated the exposure pathways and the relative risks of nonnative fish release from Morgan Lake. Therefore, we assumed that such events could occur, and we therefore identify adverse effects associated with nonnative species releases including adverse effects to critical habitat.

While the San Juan River currently supports populations of several of these nonnative fish, release of additional individuals of these species or any new species of nonnative fish or other nonnative organisms from Morgan Lake could help support these populations or introduce novel species. Many of these nonnative fish also occur in Navajo Reservoir, which may also support populations of these species in the San Juan River. In addition, some of the nonnative fish in Morgan Lake (e.g., gizzard shad) do not have populations in the San Juan River, and if such populations became established, they could exacerbate the existing nonnative fish problem, as they may prey on eggs, fish larvae, or compete with native fish.

The likelihood of nonnative species release or escape from Morgan Lake is high. Their potential to survive, become established, and spread is high. Impacts on wildlife resources or ecosystems through hybridization and competition for food and habitats, habitat degradation and destruction, predation, and pathogen transfer are high. Impact to threatened and endangered species and their habitats is extreme and persistent. The adequacy or ability of regulations to prevent escape and establishment is low. The potential to extirpate or manage established populations is low. Nonnative species invasions can outstrip resources available to combat them, precluding complete eradication, and instead result in a long-term battle for control (Van Driesche et al. 2008; Green et al. 2014). The knowledge about the types and abundance of nonnative species in Morgan Lake, a body of water with unique biological, chemical, and physical properties is unknown, which creates one of the greatest uncertainties in the estimate of the risks.

Introduction of any nonnative species from Morgan Lake into the San Juan River will have an adverse effect simply by becoming integrated into the native riverine system, impacts will be negative, vary in magnitude, and can be compared through time and across space. Therefore, release of nonnative fish (or other nonnative aquatic species) from Morgan Lake will adversely affect to Colorado pikeminnow and razorback sucker.

Effects of Nonnative Species Release from Morgan Lake on Critical Habitat

The biological features of critical habitat include food supply, predation, and competition (Maddux et al. 1993; USFWS 2002a,b). Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, may be out of balance due to nonnative species in some areas. This may also be true of competition, particularly from nonnative fish species. Any release of nonnative species would adversely affect the endangered fishes' food, shelter from predators, competition for resources and space, movement and dispersal, and physical space to carry out normal behaviors. The duration of impacts from the nonnative species release until those species are eradicated, their impacts reduced, or they die is not known. Nonnative species introductions from Morgan Lake would adversely modify the biological features of critical habitat of these endangered fish by reducing its ability to support their recovery.

Introduction of nonnative species from Morgan Lake would preclude or significantly delay the eradication and management of nonnative species and adversely affect the biological features of the entirety of critical habitats of the Colorado pikeminnow and the Razorback sucker necessary for their recovery in the San Juan River.

Therefore, we conclude the release of nonnative species from Morgan Lake could significantly delay the development or restoration of the biological features needed to achieve recovery of Colorado pikeminnow and razorback sucker in the San Juan River relative to that which would occur without the action undergoing consultation, and therefore, is likely to result in adverse effects to their critical habitat.

Effects of FCPP Atmospheric Emissions, Deposition, and Bioaccumulation

In order to estimate the effects associated with the proposed action, we determined that the percentage of Hg accumulation in whole body Colorado pikeminnow associated with the proposed action was 0.3 percent from scenario APS- 1 as compared to Scenario APS-2, without FCPP having ever existed. Similarly, EPRI (2014) also estimated that the proposed action was associated with 0.35 percent of the baseline Hg deposition in the San Juan River Basin. Therefore, to estimate the effects of the proposed action, all Hg effects associated with the environmental baseline were multiplied by 0.3 percent; afterwards the environmental baseline was reduced this same amount.

Based on an annual reproductive injury from mercury accumulation from all sources of up to 8 percent and an adult mortality of up to 2 percent, there is a measurable population-level impact in Colorado pikeminnow demographic parameters. Under the conditions of an increasing Hg load, the combination of a reduction of recruitment and the loss of adults appears to result in long-term population decline as recruitment of new adults cannot keep up with adult mortality (Miller 2014). Under the assumption of an increasing environmental Hg burden in the San Juan River, the estimated injuries to both reproductive success and age-specific survival led to observable decreases in simulated Colorado pikeminnow population growth.

When Hg deposition contributes to an annual reproductive injury above 8 percent and an adult mortality above 1.5 percent, Colorado pikeminnow survival in the San Juan River is adversely affected and the function of designated critical habitat is compromised. Based on the ERM (2014a, b) analysis for adult reproductive injury, adult survivorship injury, and for the analysis conducted for this BO, those conditions occur when average adult Colorado Pikeminnow whole body Hg concentrations are at or above 0.7 mg/kg WW in the San Juan River Basin.

The Colorado pikeminnow and razorback sucker would be exposed to Hg from baseline conditions, as well as 0.3 percent from the proposed action by FCPP, through Hg deposition, runoff through into downstream aquatic habitats, and subsequent bioaccumulation through the food chain. Mercury bioaccumulates in endangered fish in the San Juan River and is a potent neurotoxin that affects their fitness and reproductive health (Crump and Trudeau 2009). Once Hg enters the body, it poses the highest threats of toxicity because it can be absorbed into living tissues and blood. Once in the blood it crosses into the brain and accumulates, there is no known way to be expelled from the brain (Gonzalez et al. 2005).

The accumulation of Hg from water occurs via the gill membranes as well as through ingestion (Beckvar 1996; USEPA 1997). MeHg is eventually transferred from the gills to muscle and other tissues where it is retained for long periods of time (Julshamn et al. 1982; Riisgård and Hansen 1990). Probably less than 10 percent of the Hg in fish tissue residues is obtained by direct (gill) uptake from water (Francesconi and Lenanton 1992; Spry and Wiener 1991). Hg taken up with food initially accumulates in the tissues of the posterior intestine of fish (Boudou et al. 1991). Hg ingested in food is transferred from the intestine to other organs including muscle tissues (Boudou et al. 1991). MeHg has been reported to constitute from 70 to 95 percent of the total mercury in skeletal muscle in fish (Huckabee et al. 1979; EPA 1985; Riisgård and Famme 1988; Greib et al. 1990; Spry and Wiener 1991). MeHg accounted for almost all of the Hg in muscle tissue in a wide variety of both freshwater and saltwater fish (Bloom 1992).

Hg in fish tissues can be transferred to ovary and eggs (Beckvar 1996; Wiener and Spry 1996; McKim et al. 1976). Exposure of the parent population to Hg concentrations of 0.03 to 2.93 ug/l in the laboratory resulted in Hg concentrations as high as 2 mg/kg in their embryos (McKim et al. 1976). Other studies reported a maternal burden transfer to eggs ranging from 0.2 to 36 percent (Hammerschmidt et al. 1999; Hammerschmidt and Sandheinrich 2005; Alvarez et al. 2006; Nye et al. 2007). Hatching success and embryonic survival in fish are inversely correlated with Hg concentrations in the egg (Whitney 1991; Dillon et al. 2010; ERM 2014b). Without additional information about the maternal transfer rate of Hg from the adult female to Colorado pikeminnow eggs, we assumed a transfer of 0.2 percent of the adult female whole body burden Hg concentration to eggs. Total mercury concentrations in eggs of several species of adult fish from Swedish lakes are much lower than concentrations in other tissues (Lindqvist 1991). Fish (including eggs and larvae) continue take up Hg from the water column and their prey (McKim et al. 1976; Pentreath 1976a; 1976b).

The toxicity of Hg to aquatic organisms is affected by both abiotic and biotic factors including the form of Hg (inorganic versus organic), environmental conditions (e.g., temperature, salinity, and pH), the sensitivity of individual species and life history stages, and the tolerance of individual organisms. Toxicological effects include neurological damage, reproductive impairment, growth inhibition, developmental abnormalities, mortality, and altered behavioral responses (Beckvar 1996, Beckvar et al. 2005, Dillon et al. 2010, ERM 2010a,b). Wiener and Spry (1996) concluded that neurotoxicity seems to be the most probable chronic response of wild adult fishes to Hg exposure, based on observed effects such as incoordination, inability to feed, diminished responsiveness, abnormal movements, lethargy, and brain lesions. Mercury exposure can affect Colorado pikeminnow populations through reproductive impairments. In laboratory studies, reproductive endpoints are generally more sensitive than growth or survival, with embryos and the early developmental stages being the most sensitive (Hansen 1989).

Of the 43 to 60 percent of Colorado pikeminnow that experience behavioral injury, some percentage of those may experience brain lesions and thus impairment of essential feeding, breeding, migrations or sheltering behaviors. We based this relationship on the ratio of survivorship injury to behavioral injury using ERM (2014a,b), and estimated that approximately 1.1 percent of adult Colorado pikeminnow annually that experience behavioral injury will also exhibit extreme maladaptive behaviors and will subsequently die, fail to spawn, or fail to migrate to appropriate areas in time for spawning. Therefore, we conclude that Colorado pikeminnow will be adversely affected by the proposed action.

Effects of Hg deposition on Colorado Pikeminnow Critical Habitat

Average concentrations in whole body adult Colorado pikeminnow associated with the environmental baseline, cumulative effects, and residuals associated with proposed action may equal or exceed 0.7 mg/kg WW by the year 2046, after the cessation of the proposed action Hg deposition have ceased. Therefore, the proposed action Hg deposition contributes to the adverse effects to Colorado pikeminnow critical habitat. However, Hg contributions to the San Juan River Basin are largely associated with the degraded environmental baseline and cumulative effects would be expected to adversely affect Colorado Pikeminnow critical habitat by the year 2046. There could be reductions in amount of Hg deposited in the San Juan River Basin over time, but modeling indicates Hg in whole body fish were not significantly different over the 85-year modeled simulation period (EPRI 2014).

Estimation of Hg in Muscle Tissue and Whole Body Razorback Sucker by Size (Total Length)

Concentrations of Hg in Razorback sucker are much lower as (converted) whole body ranged from 0.03 to 0.13 mg/kg WW and averaged 0.07 mg/kg WW (Table 5). This level of whole body Hg was similar to that in an Age 3 Colorado pikeminnow, and therefore, we used a similar method to estimate the number of razorback suckers that would be adversely affected by the proposed action.

Effects of Hg deposition on Razorback Sucker Critical Habitat

No information was available to determine the Hg-related impairments associated with a long-term population decline of razorback suckers necessary to characterize Hg concentrations associated with adverse modification of their critical habitat. Similar to Colorado pikeminnow, we assumed that razorback sucker critical habitat would also be adversely modified when Hg concentrations in water bioaccumulate to whole body concentrations that were are associated with at least 8 percent reproductive injury and with at least 1.5 adult mortality. Those conditions occur with 3.5 Hg mg/kg WW in whole body razorback sucker. Using Bioaccumulation Factors provided in the BA, a water concentration associated with 3.5 mg/kg WW could result from 0.05 ug/L methylmercury in water or 1.0 ug/L total Hg in water for razorback sucker. Concentrations associated with the proposed action do not increase concentrations of methylmercury or total Hg to those levels. Therefore, Hg deposition from the proposed action adversely affects the razorback sucker, but does not adversely affect its critical habitat.

Effects of Se Deposition on Listed Species and Critical Habitat

Using the same analyses as described in the environmental baseline, the effects to Colorado pikeminnow and razorback sucker was estimated for the proposed action. We expect as many as 25,503 Colorado pikeminnow eggs/ovaries and 291,510 razorback sucker eggs/ovaries to be harmed by the proposed action from 2016-2074. We expect as many as 42 Colorado pikeminnow larvae and 301 razorback sucker larvae to be harmed by the proposed action from 2016-2074. For the duration of Se deposition from the FCPP, we would expect as many as (58 years x 0.2 per year x 0.33 = 4) four nesting pairs to be exposed to the Hg deposited pollutants in their habitat and Hg burdens may adversely affect up to 12 eggs, nestlings, or fledglings of either the flycatcher or the cuckoo. We conclude critical habitat will be adversely affected by additional Se deposition.

SOUTHWESTERN WILLOW FLYCATCHER

Effects of Navajo Mine Operations

No flycatcher nesting habitat occurs on the Navajo Mine Lease area (BA). However, within the Navajo Mine Lease Area suitable migratory flycatcher stopover habitat occurs in widely scattered patches of tamarisk in Cottonwood Arroyo, Chinde Wash, Pinabete Arroyo and at a small stock pond in the southern portion of the and Pinabete Permit Area (BA, page 6-4; Ecosphere 2012, p. 6). This suitable migratory flycatcher stopover habitat is subject to removal, disturbance, and reclamation under the proposed action.

For a variety of reasons, the proposed action cannot avoid removal or disturbance of these areas during May through August, when migrant flycatchers could likely occur. Therefore, during seasonal presence periods, when these suitable habitats are scheduled for removal, flycatcher protocol surveys will need to be conducted to identify when migrant flycatchers occupy these areas, and to the extent possible, activities and disturbances should be minimized until flycatchers leave of their own volition (or are possibly harassed by noise). Measures to protect other nesting migratory birds may also be necessary during habitat removal. Although likely a rare occurrence, and based on the observation of one migrant flycatcher at the DFADA in 18 years, we expect as many as 1.5 migrant flycatchers could be disturbed or harassed per habitat while these habitats are disturbed, removed, or remediated (that is, 3 habitats lost x 1.5 flycatchers per 25 years = 5 possible migrant flycatchers that may be subject to harassment by Navajo Mine Operations) and therefore adversely affected through 2041.

Effects of Noise and Vibration

The level at which fish and wildlife can detect sound depends upon the level of ambient noise. We assume that ambient noise near the San Juan River (and near other water bodies in the action area) would have characteristic noise similar to that in nearby unaffected sites with ambient background noise levels (average 35 dB, peak noise 55 dB; EIS page 4.14-8). There is no information available on sound and vibration frequencies in the San Juan River as systematic measurement of sounds underwater have not taken place, or any such records are incomplete or unpublished. We assumed the ambient underwater ambient acoustic habitat range of sound of 10 to 30 decibels with respect to 1 micropascal pressure (dB re 1 uPa), but it could depend on many factors including frequencies, and ambient noise levels affected by waterfalls, wind, rain, and reflectance off the water surface (Cavanaugh and Tocci 1998; Popper et al. 2014). These factors are used in complex numerical models to estimate the conductance of noise over distance in air and during transfer to the water column. As sound pressure (amplitude) falls inversely proportional to the distance (1/r) from the sound source, we identified that the peak noise levels travel approximately 3.5 additional miles to the San Juan River and would be 65 dB. We then used a 62 dB correction factor (developed by the US Navy) to estimate the sound levels in water column (conversions made using website at http://www.sengpielaudio.com/Calculations03.htm). At Station 1, at the southern edge of Morgan Lake, the maximum noise measured was 78 dBlmax. Therefore, at a distance 3.5 miles further to the San Juan River, the noise level would be 65 dB.

Migrant flycatchers may have the potential to occur in the Action Area from May through August, but autumn flycatcher migration may vary from year to year, from site to site, and in response to environmental conditions (Finch et al. 2000). Migratory flycatchers have been documented occasionally near Morgan Lake, San Juan River, Rio Puerco, and once near the DFADA (~15 miles away from the Pinabete Permit Area arroyos) during previous 16 years of surveys (BA, page 6-4; Ecosphere 2012a; Marron 2012a, b). Although there is uncertainty regarding detection frequency, this is about 0.06 flycatchers per year, or 1.5 flycatchers per 25 years. Modification and loss of migratory “stopover” habitat used by flycatchers to replenish energy reserves during their long-distance migration may also contribute to the decline of flycatcher survival and reproduction.

Because flycatchers have been documented in the Action Area and migratory stopover habitat occurs in Cottonwood Arroyo, Chinde Wash, Pinabete Arroyo, and at the small stock pond (and unlike the cuckoo), the presence of migrant flycatchers in these habitats is possible. Should flycatchers be using these migratory stopover habitats when they are disturbed, then adverse effects (in the form of harassment) could occur. Flycatchers disturbed from their migratory stopover habitats might not replenish their fat and protein stores, which may affect their flight performance and ability to overcome obstacles (inclement weather, landscape barriers, predators, and discontinuity of stopover habitats) or migrate successfully (Finch et al. 2000, citing Moore 2000).

For a variety of reasons, the proposed action cannot avoid removal or blasting disturbance of these areas during May through August, when migrant flycatchers could likely occur. Based on the observation of one migrant flycatcher at the DFADA observed since 1998 (~0.06/year), we expect as many as 1.5 migrant flycatchers could be disturbed or harassed per suitable habitat while these habitats are removed or when blasting occurs nearby (estimated as 3 habitats with 1.5 migrant flycatchers per year over 25 years = 5 migrant flycatcher harassments or temporary hearing loss due to noise associated with Navajo Mine Operations).

Therefore, during seasonal presence periods, when these suitable habitats are scheduled for removal or prior to loud blasting noise disturbances, flycatchers are likely to be adversely affected and protocol surveys will need to be conducted to identify when migrant flycatchers occupy these stopover habitats, and to the extent possible, activities and disturbances should be minimized until any flycatchers leave of their own volition.

Effects of Stormwater Runoff, Point Source, and Other USEPA Authorized Discharges

The proposed action includes the present and future issuance of National Pollutant Discharge Elimination System (NPDES) permits by USEPA for discharges associated with various activities such as coal mining, cooling plant water, stormwater runoff, and other discharges (BA, Section 2). Under these permits, the Navajo Mine Operators are required to control all surface runoff water with the potential of being contaminated from contact with mining activities. Various polluted effluents are permitted to be discharged through conveyance facilities (e.g., pipes, ditches, etc.) that end in "outfalls" to the environment. Outfalls 1 and 2 discharge to Morgan Lake and which intermittently discharges to the Chaco River that is a tributary to the San Juan River. Outfalls 003 to Outfall 019 discharge to the Chaco River. Outfall 020 discharges to the San Juan River (USEPA 2008). There are currently 14 outfall locations on Navajo Mine Lease Areas 1, 2, and 3, and the proposed action may enable USEPA to authorize up to 26 more discharge outfalls in Areas 3, 4, and 5 (USEPA 2013). The USEPA has required monitoring at selected outfalls for arsenic, boron, cadmium, lead, Se, sulfate, and total dissolved solids. The USEPA has also established requirements that a Sediment Control Plan be designed, implement, and maintained using BMPs at the Navajo Mine so that the Operators demonstrate that stormwater discharges will result in average, annual, sediment yields that will not be greater than similar sediment yields determined for from pre-mined or undisturbed conditions.

Effluent discharges from FCPP operations are also being authorized by NPDES permits issued by USEPA (Figure 28). The cooling water discharges will occur through an outfall to Morgan Lake, which discharges to No Name Wash (a 2.5 mile-long tributary to the Chaco River), which in turn drains approximately 7 miles of the Chaco River then to the San Juan River. These discharges are intermittent with an average of 2.5 days per week of discharge for about 6 months in a year. The rest evaporates. The average flow rate for the discharge is 4.2 million gallons a day (6.5 cfs). Discharges are mostly conducted to regulate the accumulation of salts (total dissolved solids) in Morgan Lake. Stormwater discharges associated with the FCPP operations, associated with the electric steam generation boilers and other related facilities flows to the Combined Waste Treatment Pond and is discharged to the Condenser Cooling Water Discharge Canal. Parking lots, switchyards, and other open areas are discharged to the Condenser Cooling Water Intake Canal through permitted discharge points. Stormwater in the ash disposal area is discharged to Chaco Wash after BMP treatment in accordance with a storm water construction permit.

USEPA authorizes the use of a Practical Quantification Level (PQL) of a pollutant as part of the effluent limits, which is the numerical result considered accurate. In cases where the PQL exceeds the effluent limitation in a NPDES permit, an analytical result at or below the PQL is deemed by USEPA to constitute compliance with the NPDES permit effluent limitation. This practice can result in PQLs that are greater than concentrations expressed in the applicable water quality standard. We therefore expect that future NPDES permits will be issued in accordance with evaluation methods developed through RPM 5.

Discharges from the Ash Disposal Areas authorized by USEPA and OSMRE

The DEIS reported two areas of groundwater seepage at the Ash Disposal Area known as the "north seep" and "south seepage area", which have identified contaminated groundwater (p. 4.5-57). APS has installed extraction wells and finished a two part seepage intercept project. This project serves to intercept and prevent water seepage from both the north seep and south seepage area into the Chaco River, west of the plant in the ash disposal area. The intercept project consists of two French drains running approximately 2 miles. The trenches for the French drains were constructed down to an impermeable shale layer to ensure maximum water capture. Water is collected from the French drains and pumped to a lined pond. . The operation of the intercept trenches, as well as the monitoring of groundwater by monitoring wells as well as inspection and monitoring to ensuring that any pollutant sources present in ground water that re-surfaces via seeps can be traced so that corrective actions can be undertaken. With the operation of intercept trenches and water extraction wells, continued operation of the ash disposal ponds should have little potential to contaminate water quality in Chaco Wash.

The Ecological Risk Assessments (ERA) conducted under the EIS could not rule out risks to flycatcher (and cuckoo) in the San Juan River Basin, due to their exposure to Hg and Se. Therefore, the effects of the effluent discharges likely have an adverse effect on the listed species by increasing the Hg and Se in the body burdens of flycatcher (and cuckoo) in the action area.

Effects of FCPP Atmospheric Emissions, Deposition, and Bioaccumulation

Effects of Hg of Se deposition on Flycatcher and Cuckoo in the Deposition Area

AECOM (2013) prepared an ecological risk assessment (ERA) to support the EIS and OSMRE's BA. A conceptual site model was developed to describe the exposure pathways linking Hg (and Se and other pollutant) releases to the environment and then to ecological receptors such as federally listed birds (Figure 21). The ERA focused on San Juan River habitat from the Deposition Area downstream into the San Juan River arm of Lake Powell. The ERA was intended to evaluate the risks posed by exposure of federally listed birds to pollutants associated with the environmental baseline, cumulative effects and the future FCPP stack emissions from 2016 to 2041 (AECOMM 2013). Federally listed bird exposures were evaluated using a traditional daily dose approach where dose was expressed in units of mg/kg per day (mg/kg-day) of the pollutants ingested. Toxicity reference values (TRVs) were developed, in units of mg/kg-day, which are doses below which adverse ecological effects are not expected. The risks were characterized in terms of a hazard quotient (HQ) where values greater than 1 indicate a potential for adverse ecological effects to individual birds. Hazard quotients for riparian birds in the San Juan River including flycatchers (and cuckoos) were less than 6.7 for MeHg and less than 5.9 for selenium indicating the potential for adverse effects to federally listed birds (AECOMM 2013).

Habitat modeling by AECOM (2013d, 2014) identified approximately 6,726 acres of potentially suitable southwest willow flycatcher habitat within the Deposition Area. The ratio of flycatcher nesting habitat (632 acres; BOR 2012) to flycatcher critical habitat in the Middle Rio Grande (47,844 acres) was (632/47844=) 0.013. If we assume a similar ratio of flycatcher nesting habitat to suitable flycatcher habitat within the Deposition Area, we estimate that as many as (6726 acres x 0.013=) 87.4 acres of nesting habitat could occur within any year. In a recovered flycatcher population, the average suitable nesting habitat size is 5.4 acres (USFWS 2013). The total maximum number of nesting flycatchers that could occupy the Deposition Area in any year would be (87.4 acres/5.4 acres =) 16 nesting pairs. However, not all flycatcher habitats in the Deposition Area are currently suitable nesting habitat nor would they be expected to remain suitable nesting habitats over time.

Hg is an environmental contaminant that can also have adverse effects on riparian wildlife (Scheuhammer et al. 2012; Wentz et al. 2014). For riparian birds such as flycatchers and cuckoos, Hg is accumulated via ingestion of aerial insects emerging from benthic life stages in aquatic environments containing Hg or from associated predatory spiders (Cristol et al. 2008; Edmonds et al. 2012; Evers et al. 2012; Buckland-Nicks et al. 2014; Gann et al. 2014). Dietary total Hg concentrations associated with adverse effects to birds are generally greater than 0.1 mg/kg WW (DOI 1998). Once ingested, MeHg rapidly moves into the bird's central nervous system, resulting in behavioral and neuromotor disorders (Tan et al. 2009; Scheuhammer et al. 2007, 2012). The developing central nervous system in avian embryos is especially sensitive to this effect, and permanent brain lesions and spinal cord degeneration are common (DOI 1998, Young 1998; Bryan et al. 2003; Scheuhammer et al. 2007; Heinz et al. 2009). Therefore, adverse effects are described for the eggs, embryos, nestlings and/or fledglings associated with elevated Hg burdens in the female parent and due to foraging.

Hg concentrations in invertebrates from the San Juan River Basin are generally (0.03 to 0.04 mg/kg WW) less than this threshold concentration (AECOM 2013). No modeling of Hg in invertebrates over time was conducted. We expected that no more than one third of invertebrate Hg concentrations would be greater than the 0.1 mg/kg WW threshold. Therefore, we applied the average annual flycatcher-nesting rate from 20 years of survey results in the San Juan River Basin to estimate the likelihood that suitable nesting habitat within the Deposition Area would be occupied by nesting flycatchers (16 nesting pairs x 1.25 percent flycatcher nesting rate per year = 0.2) to be 20 percent probability during any one year.

In a recovered flycatcher population, the average suitable nesting habitat size is 5.4 acres (USFWS 2013). Additionally, as many as 25 territories, or at most 25 nesting pairs would occur within the San Juan Management Unit. Therefore, in a recovered population, we would expect as many 25 nesting pairs at 0.2 per year for a duration of over 50 years or 250 pairs to form territories of nest within the entire San Juan Management Unit and approximately one-third of them (82) might be at risk of Hg toxicity, with the majority of these occurring beyond 2050 where there is greater uncertainty. There are no PCEs including Hg or water of sufficient quality for either flycatcher critical habitat or for cuckoo proposed critical habitat and therefore, none is affected.

Therefore, the proposed action will have adverse effects on nesting flycatchers (including their eggs, embryos, nestling, and/or fledglings) through Hg and Se deposition, transport, and bioaccumulation to levels associated with delayed or impaired development, and/or mortality.

YELLOW-BILLED CUCKOO

Effects of Noise and Vibration

Operations of Navajo Mine and Four Corners Power Plant will generate noise and vibration and the effects of noise to wildlife were described in the EIS (OSMRE 2014 PFEIS, pages 4.14-1 to 4.14-28). Noise levels associated with the proposed action included an average of 54 dBleq and maximum of 78 dBlmax measured at the southern portion of Morgan Lake (EIS, page 4.14-13) (the noise monitoring stations closest to the San Juan River. Noise levels at the pump house or at APS Weir along the San Juan River were not reported). During Navajo Mine Operations, including habitat removal activities range from an average of 82 dBleq and maximum of 110 dBlmax (EIS< page 4.14-19). Blasting activities can range from an average of 94 dBlmax to 113 dBlmax (EIS< pages 4.14-11 to 4.14-19) with a maximum ground-borne vibration of 0.18 inches per second). Noise levels associated with transmission lines ranged from an average of 40 to 60 dBleq and up to 65 dB during maintenance activities (EIS page 4.14-13).

Similarly, the effect of noise on avian wildlife are also highly varied and is dependent on noise intensity, frequency, duration of exposure and the sensitivity of the species affected (USBOR 2008). Based on reviews by Goudie and Jones (2004) and Dooling and Popper (2007), we surmise that hearing injury to birds can occur at noise levels > 125 dB, with recoverable injury occurring at > 93 dB, and the masking of song and behavioral changes associated with continuous noise sources would occur above ambient noise levels (that is, >50 to 60 dB). Yellow-billed cuckoos appear to be more sensitive to noise than flycatchers and tend to abandon habitats at sound levels > 55 dB when exposed to traffic noise over 10 weeks (Goodwin and Shriver 2011). Ambient noise near the San Juan River (and near other riparian areas near perennial surface water bodies in the action area) may have characteristic noise similar to that measured in nearby unaffected areas with ambient noise levels reported in the EIS (EIS page 4.14-8; average 35 dB, and maximum peak noise was 55 dB).

Noise levels associated with the proposed action included an average of 54 dBleq and maximum of 78 dBlmax measured at the southern portion of Morgan Lake (EIS, page 4.14-13). Using the 3.5-mile distance to the San Juan River, we expect noise levels there would average about 41 dB and maximum noise levels would be about 65 dB. When peak noise levels occur, we would expect that the cuckoo would experience minor behavioral changes such as a startle response, but would not have adversely effects because peak noise would be low and the average noise levels expected (41 dB) are below levels of concern (50 to 60 dB) near the San Juan River.

Effects of Stormwater Runoff, Point Source, and Other USEPA Authorized Discharges

There is insufficient information to estimate nesting habitat or potential nesting rates of cuckoos within the San Juan River Basin at this time. Therefore, the analysis for the flycatcher served as a proxy for the cuckoo Hg and Se effects analysis, estimation of potential habitat, and estimation of incidental take. Cuckoo surveys will be required within the same or similar riparian habitats within the Deposition Area as are conducted for flycatchers.

Effects of FCPP Atmospheric Emissions, Deposition, and Bioaccumulation

Effects of Hg of Se deposition on Flycatcher and Cuckoo in the Deposition Area

There is insufficient information to estimate nesting habitat or potential nesting rates of cuckoos within the San Juan River Basin at this time. Therefore, the analysis for the flycatcher served as a proxy for the cuckoo Hg and Se effects analysis, estimation of potential habitat, and estimation of incidental take. Cuckoo surveys will be required within the same or similar riparian habitats within the Deposition Area as are conducted for flycatchers.

Table 8. Summary of Effects of Hg Deposition from the Proposed Action and associated with the Environmental Baseline and Cumulative Effects to endangered fishes, critical habitat and birds. (Note: Hg burden, mercury and/or methylmercury in fish or bird tissues; dph, days post hatch; FCPP and NMEP, Four Corners Power Plant and Navajo Mine Energy Project operations are proposed to cease by 2042, but residual Hg in San Juan River Basin will continue to affect listed species until 2074).

Table 8. Species or Habitat	Life stage or Habitat Effected	Type of Adverse Effect to Species or Critical Habitat	Estimated Take or Critical Habitat Affected by Proposed Action (FCPP and NMEP for 2016-2074)	Estimated Loss or Critical Habitat Affected in the Environmental Baseline and/or by Cumulative Effects
Colorado pikeminnow	egg/ovary/embryo/larvae <6dph	Adverse Effect	250,340	66,978,395
Colorado pikeminnow	larvae > 5 dph /Age 0	Adverse Effect	2,975	796,688
Colorado pikeminnow	subadult / Age 1 through Age 6	Adverse Effect	1,118	301,154
Colorado pikeminnow	adult / greater than Age 6	Adverse Effect	47	1,940
Colorado pikeminnow	subadult / Age 2 through Age 6	Adverse Effect	25	6,861
Colorado pikeminnow	adult / greater than Age 6	Adverse Effect	2	419
Colorado pikeminnow	adult / greater than Age 6	Adverse Effect	7	All adults after 2046
Colorado pikeminnow critical habitat	Physical features of critical habitat	Adverse Effect	All Critical Habitat in San Juan River	N/A
Colorado pikeminnow critical habitat	Physical features of critical habitat	Adverse Effect	N/A	All Critical Habitat in San Juan River in ~2046
Razorback sucker	egg/ovary/embryo/larvae <6dph	Adverse Effect	34,694	9,282,671
Razorback sucker	larvae greater than 5dph/Age 0	Adverse Effect	552	148,042
Razorback sucker	subadult / Age 2 through Age 4	Adverse Effect	34	9,137

Table 8. Species or Habitat	Life stage or Habitat Effected	Type of Adverse Effect to Species or Critical Habitat	Estimated Take or Critical Habitat Affected by Proposed Action (FCPP and NMEP for 2016-2074)	Estimated Loss or Critical Habitat Affected in the Environmental Baseline and/or by Cumulative Effects
Razorback sucker	adult / greater than Age 1	Adverse Effect	12	3,085
Razorback sucker	subadult / Age 2 through Age 4	Adverse Effect	1	224
Razorback sucker	adult / greater than Age 4	Adverse Effect	4	1,084
Razorback sucker	adult / greater than Age 1	Adverse Effect	1	286
Razorback sucker critical habitat	Physical features of critical habitat	Adverse Effect	None	All Critical Habitat in San Juan River
Southwestern willow flycatcher	egg/embryo/nestling/fledgling	Adverse Effect	4 nests of up to 12	25 nests and up to 89
Yellow-billed cuckoo	egg/embryo/nestling/fledgling	Adverse Effect	4 nests of up to 12	25 nests and up to 89

Table 9. Summary of Effects of Se Deposition from the Proposed Action and associated with the Environmental Baseline and Cumulative Effects to endangered fishes, critical habitat and birds. (Note: Se burden, mercury and/or methylmercury in fish or bird tissues; dph, days post hatch; FCPP and NMEP, Four Corners Power Plant and Navajo Mine Energy Project operations are proposed to cease by 2042, but residual Se in San Juan River Basin will continue to affect listed species until 2074).

Table 9. Species or Habitat	Life stage or Habitat Effected	Type of Adverse Effect to Species or Critical Habitat	Estimated Take or Critical Habitat Affected by Proposed Action (FCPP and NMEP for 2016-2074)	Estimated Loss or Critical Habitat Affected in the Environmental Baseline and/or by Cumulative Effects
Colorado pikeminnow	egg/ovary/embryo/larvae	Adverse Effect	25,503	66,978,395
Colorado pikeminnow	larvae > 5dph/Age 0	Adverse Effect	42	547,751
Colorado pikeminnow	adult / greater than Age 6	Adverse Effect	~1	2,594
Colorado pikeminnow critical habitat	Physical features of critical habitat	Adverse Effect	All Critical Habitat in San Juan River	all Critical Habitat in San Juan River
Razorback sucker	egg/ovary/embryo/larvae	Adverse Effect	291,510	1,361,956,116
Razorback sucker	larvae > 5dph/Age 0	Adverse Effect	301	3,881,323
Razorback sucker	adult / greater than Age 1	Adverse Effect	6	29,139
Razorback sucker critical habitat	Physical features of critical habitat	Adverse Effect	All Critical Habitat in San Juan River	All Critical Habitat in San Juan River
Southwestern willow flycatcher	egg/embryo/nestling/fledgling	Adverse Effect	4 nests, or up to 12	25 nests, or up to 89
Yellow-billed cuckoo	egg/embryo/nestling/fledgling	Adverse Effect	4 nests, or up to 12	25 nests, or up to 89

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions on endangered or threatened species or critical habitat that are reasonably certain to occur in the foreseeable future in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects analysis as stated here applies to section 7 of the ESA and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.

COLORADO PIKEMINNOW AND RAZORBACK SUCKER AND CRITICAL HABITAT

Coalbed methane development

The San Juan basin in southwestern Colorado and northwestern New Mexico is rich in coalbed methane, and development of this resource has increased rapidly in the last ten years. There are currently more than 3,000 coalbed methane wells in the San Juan basin in the Fruitland Coal Formation. Historically, one well per 320 acres was allowed in this area; however, the Colorado Oil and Gas Commission approved an increase of the well spacing to one well per 160 acres. Potentially more than 700 additional wells may be drilled and approximately 250 of these could occur on private or State land. Coalbed methane development requires the extraction of groundwater to induce gas flow. It was estimated that the wells would be drilled by 2013, but because of slow groundwater movement water depletion effects would not be incurred until at least 2025.

A study was initiated in 1998 to determine the effects of groundwater extraction from the Fruitland Formation. The study is called the 3M Project (mapping, modeling, and monitoring) and was being conducted by the Colorado Oil and Gas Conservation Commission in cooperation with the Southern Ute Indian Tribe, BLM, the Forest Service, and the industry. The mapping and modeling studies were completed in 2000. A follow-up project was funded by the Ground Water Protection Research Foundation (GWPRF).

The Fruitland Formation and the underlying Pictured Cliffs Sandstone were shown to be an aquifer system. In general terms, the groundwater produced from near-outcrop coalbed methane wells is recent recharge water that would, under predevelopment conditions, discharge to the Animas, Pine, Florida and Piedra Rivers. These rivers provide flow to the San Juan River. Coalbed methane wells occur on Federal, State, Tribal and private lands. Future section 7 consultations are not expected for coalbed methane development on private or State lands; therefore, these water depletions are considered a cumulative effect that is reasonably certain to occur within the action area.

The GWPRF used a groundwater model and a reservoir model to determine water budgets and depletions associated with coalbed methane development. Three areas around the Animas, Pine, and Florida Rivers were modeled using three-dimensional multi-layer models to account for aquifer-river interactions and the effects of coalbed methane development. Baseline conditions were simulated with a single-phase ground water flow model (MODFLOW), and predictive runs were made using two-phase flow models (EXODUS and COALGAS). The predictive model run results are summarized in Table 11.

Table 10. Surface Water Depletions: Model Summaries

River	Pre-CBM Discharge (AFY)	Current Depletion (AFY)	Maximum Depletion (AFY)	Year when Max Depletions Begin
Animas	66	41	66	2045
Pine	61	31	61	2025
Florida	17.5	2	12.5	2050
Piedra*	60	0	60	**
Total	204.5	74	199.5	

*Piedra River depletions are estimated based on discharges simulated from the 3M Project and the depletions modeled in the GWPRF at other rivers.
**Maximum depletions at the Piedra River will depend on the rate of coalbed methane development in the northeastern portion of the San Juan basin.

The model results show that prior to coalbed methane development, the Fruitland Formation discharged approximately 205 AFY to the San Juan River. Modeling shows approximately 74 AFY is currently being depleted with existing wells and predicts the maximum depletions to be approximately 200 AFY.

The RiverWare Model, which is used to evaluate hydrologic conditions in the San Juan River and its tributaries, requires a defined project to determine project compatibility with the San Juan River Flow Recommendations (Holden 2000). Because future coalbed methane development on State and private land is not a defined project and the depletions associated with it are relatively small and not specifically quantified, the RiverWare Model is not an appropriate tool to assess these effects.

Other depletions and diversions from the San Juan River basin

We believe most of these depletions, including the FCPP diversions to Morgan Lake, are accounted for in the environmental baseline depletions .. Irrigation ditches and canals below Navajo Dam could entrain Colorado pikeminnow and razorback sucker, including Citizens, Hammond, Fruitland, San Juan Generating Station, Jewett Ditch, and Hogback. Increased urban and suburban use of water, including municipal and private uses, will increase demands for water. Further use of surface water from the San Juan River will reduce river flow and decrease available habitat for the razorback sucker and Colorado pikeminnow. Livestock grazing may adversely impact razorback sucker and Colorado pikeminnow by removal of water for drinking and the reduction in soil water holding capacity in the floodplain, and resulting reduction in base flows.

Increases in development and urbanization in the historic floodplain result in reduced peak flows because of the flooding threat. Development in the floodplain makes it more difficult to transport large quantities of water that would overbank and create low velocity habitats that the razorback sucker and Colorado pikeminnow need for their various life history stages.

NON-NATIVE FISH SPECIES IN LAKE POWELL

The presence of striped bass, walleye and channel catfish in Lake Powell constitutes a future threat to Colorado pikeminnow and razorback sucker in the San Juan River. When the water elevation of Lake Powell is high enough to inundate a barrier created by a waterfall, striped bass, walleye, channel catfish, and other non-native fish species can enter the San Juan River.

Increased boating, fishing, ORV use, and camping in the San Juan River basin is expected to increase as the human population increases.

Potential impacts include angling pressure, non-point source pollution, increased fire threat, the introduction of additional non-native species, and the potential for harassment of native fishes.

CUMULATIVE EFFECTS TO FLYCATCHER AND CUCKOO IN THE ACTION AREA

Cumulative effects to the flycatcher would result from human activities, wildfire, and global warming.

Increases in development and urbanization

Increases in development and urbanization in the historic floodplain would affect the flycatcher by reducing peak flows because of the flooding threat. Development in the floodplain makes it more difficult, if not impossible, to transport large quantities of water that will overbank and create low velocity habitats and contribute to the riparian successional processes that create habitat for flycatchers.

Increased urban use of water

Increased urban use of water, including municipal and private uses, would affect the flycatcher by reducing river flow and decreasing available habitat for the flycatcher.

Water contamination

Contamination of the water from sources such as sewage treatment plants, runoff from small feed lots and dairies, and residential, industrial, and commercial development could adversely affect the flycatcher. A decrease in water quality and gradual changes in floodplain vegetation could adversely affect the flycatcher, its prey base and its habitat.

Other human activities

Human activities may adversely impact the flycatcher by decreasing the amount and suitability of habitat. These activities include dewatering the river for irrigation, increasing water pollution from non-point sources; habitat disturbance from recreational use, suburban development, and removal of large woody debris.

Wildfire

Wildfires and wildfire suppression in riparian areas may have an adverse effect on flycatchers. Wildfires are a fairly common occurrence in riparian areas. The spread of the highly flammable saltcedar and drying of river areas due to river flow regulation, water diversion, lowering of groundwater tables, and other land practices are largely responsible for the increase in fuel loading along riparian areas. Wildfires have the potential to destroy flycatcher habitat.

Non-native vegetation removal

The removal of non-native vegetation, such as saltcedar and Russian olive, can adversely affect the amount of available flycatcher habitat in the short term. In areas where non-native trees are removed and replaced with native vegetation as part of a restoration project, habitat may be created. Where phreatophyte removal is not followed by restoration, habitat for the flycatcher is lost.

Climate change

The effect climate change may have on the flycatcher is still unpredictable. However, mean annual temperature in Arizona increased by one degree per decade beginning in 1970 and 0.6 degrees per decade in New Mexico (Lenart 2005). In both New Mexico and Arizona the warming is greatest in the spring (Lenart 2005). Higher temperatures lead to higher evaporation rates which may reduce the amount of runoff, groundwater recharge, and lateral extent of rivers such as the Rio Grande. Increased temperatures may also increase the extent of area influenced by drought (Lenart 2003).

The Service anticipates that these conditions and types of activities will continue to threaten the survival and recovery of the flycatcher by reducing the quantity and quality of habitat through the continuation and expansion of habitat degrading actions. Future restoration activities along the San Juan River have the potential to increase flycatcher habitat, and the effects described above may limit habitat expansion.

CONCLUSION

The SJRRIP was created to offset jeopardy resulting from hydrologic modifications to the San Juan River Basin associated with the Animas LaPlata project. The SJRRIP provides a suite of recovery actions to ensure recovery of the endangered fish in the San Juan River Basin. These recovery actions include addressing habitat loss, population augmentation, nonnative fish removal, and population monitoring. Miller (2014) suggested that the Colorado pikeminnow would likely be extirpated without the measures provided through the SJRRIP, especially augmentation. The historic and ongoing recovery benefits provided by the actions taken by the SJRRIP, plus the Conservation Measures provided by the action agencies and FCPP and NMEP proponents as part of the proposed action subject to this consultation create a package of cumulative beneficial actions that offset the adverse effects which would otherwise occur as a result of the proposed action when considered in relation to the environmental baseline, and cumulative effects. The Service has the authority and discretion to view the balance of the effects of the action, when added to environmental baseline, along with cumulative effects, and conclude whether the Conservation Measures, and the historic and future recovery benefits provided by the SJRRIP, are adequate to offset the magnitude and duration of the effects of the proposed action and provide sufficient certainty for the continued existence and recovery of the Colorado pikeminnow and razorback sucker. Additionally, there is a greater range of uncertainty associated with Hg deposition in future years (EPRI 2014). The cumulative Hg deposition to the San Juan River Basin, associated with levels of adverse modification of critical habitat, would not be expected to occur until 2046, well past the duration of the proposed action and the reasonably foreseeable future, in addition those future conditions are subject to great uncertainty associated with level of Hg emissions outside USA.

Colorado Pikeminnow and Razorback Sucker

After reviewing the current status of both endangered fish, the environmental baseline for the action area, the effects of the proposed action which includes the Conservation Measures, and the cumulative effects, it is our biological opinion that implementation of the FCPP and NMEP, as proposed, is not likely to jeopardize the continued existence of the Colorado pikeminnow and the razorback sucker.

Mercury in the environment accumulates in watercourses through emissions, deposition, and runoff into the waterbody. Fish are exposed to mercury through diet; mercury in the water column accumulates up the food chain and primarily affects top predators, such as the Colorado pikeminnow. Mercury is a potent neurotoxin that affects the reproductive health of fish through affecting the portions of the brain that regulate the production and timing of sex steroids; therefore, it primarily impacts fecundity rather than directly killing individuals exposed to it. Once ingested and absorbed into the blood, there is no known way for an organism to excrete it. A threshold for adverse effects has been shown to be 0.2 mg/kg WW in a number of species of fish; in the absence of data specific to the Colorado pikeminnow and razorback sucker, we employ this threshold. Colorado pikeminnow is the top predatory of the San Juan River that accumulates mercury over their long life span. Chronic exposure to mercury is thought to compromise survival rates and long-term reproductive outputs of this long-lived organism, thus inducing population decline in combination with other physical and biological threat factors. Using the results of various population modeling (EPRI 2014, BO analysis), we projected demographic decline in response to an increase in Hg concentrations in Colorado pikeminnow whole body burden. This decline in population growth rate would be exacerbated by other anthropogenic perturbations, such as nonnative species invasion, hydrologic alterations, water withdrawal, and other mortality factors in the San Juan River Basin.

The FCPP contributions to total Hg deposition near the facility ranged from 2 percent to a maximum of 28 percent southeast of the FCPP. Over the remainder of the San Juan River Basin, FCPP contributions are less than 2 percent. In contrast, baseline contributions of Hg emissions from sources outside the United States to Hg deposition in the San Juan River Basin range from 70 percent to 98 percent. Hg emissions from China contribute from 13 to 16 percent to Hg deposition in the San Juan River Basin in the post-2016 baseline (i.e., the baseline 2050 scenario with a medium estimate of China Hg emissions).

By comparison, the removal of FCPP had a clear but lesser effect, reducing Hg deposition by 0.68 percent before 2014 and about 0.35 percent after 2016 (after 3 units are shut down, with 2 units remaining active and emitting approximately 102 lbs Hg/year).

In order to estimate the effects associated with the proposed action, we determined that the ratio of Hg accumulation in whole body Colorado pikeminnow associated with the proposed action was 0.3 percent from Scenario APS- 1 (proposed action) as compared to Scenario APS-2 (FCPP never existed). Similarly, EPRI (2014) also estimated that the proposed action was associated with 0.35 percent of the baseline Hg deposition in the San Juan River Basin. Therefore, to estimate the effects of the proposed action, all Hg effects associated with the environmental baseline were multiplied by 0.3 percent; afterwards the environmental baseline was reduced this same amount.

The San Juan River Basin is one of only three subbasins inhabited by the Colorado pikeminnow. In the Recovery Goals for the Colorado Pikeminnow in the San Juan River Recovery Area (USWFS 2002a), criteria for downlisting and delisting the species are identified. In order to downlist the species, the San Juan River population of Colorado pikeminnow must reach at least 1,000 Age 5 (or greater) fish. Given the baseline levels of Hg and Se in the system as well as the amounts added to the system due to the proposed action, when added to the environmental baseline and cumulative effects, 6 to 11 percent of adults will experience reproductive injury, and 26 to 60 percent will experience behavioral injury in the foreseeable future. Of those that successfully reproduce, as many as 6 to 11 percent of eggs and 7 to 13 percent of Age 0 larvae would die due to Hg burdens. As many as 1.7 to 3.0 percent subadults and 1.7 to 9.1 percent of adults (summed across age classes) could also die due to all Hg burden. Additionally, 13 percent of eggs and ovaries of Colorado pikeminnow would perish, fail to hatch, or produce deformed embryos due to their Se burden. Those larvae that survive would also experience up 7 to 9 percent loss of Age 0 larvae due to dietary selenium toxicity. These factors, combined with the 7 to 15 percent loss due to entrainment, and the indeterminate losses due to negative nonnative species interactions, loss of habitat, alteration of hydrology, and water withdrawal from the proposed action, the environmental baseline, and cumulative effects decrease their population viability.

These numbers specifically express the outcome of the total accumulation of Hg in the system from all sources. However, in a Population Viability Analysis (PVA) (Miller 2014) the results showed that because of the actions taken by the SJRRIP the population of Colorado pikeminnow was stable to increasing. To the extent any additional Hg is contributed by the proposed action, those contributions represent a very small proportion of Hg deposition in the Action Area overall and any increases in Hg deposition are due, not to the proposed action, but attributable to global sources. The interplay of the degraded baseline and the contribution of global sources to Hg deposition creates significant uncertainty with regard to Hg deposition in the basin. However, to the extent a degraded baseline exists, the proposed action does not contribute to the deepening of such degradation, and the significant Conservation Measures proposed will contribute to the recovery of the endangered fish in the basin.

In the Recovery Goals for the Razorback Sucker (USFWS 2002b) for the San Juan River Recovery Area, the San Juan River system is one of two that must show stable or increasing trends in order to achieve downlisting or delisting. Given the baseline levels of Hg and Se in the system as well as the amounts added to the system due to proposed action, when added to the environmental baseline and cumulative effects, 0.9 to 1.8 percent of adults will experience reproductive injury, and 1.0 to 18 percent will experience behavioral injury in the foreseeable future. Of those that successfully reproduce, as many as 0.04 to 0.08 percent of eggs and 0.9 to 1.9 percent of Age 0 larvae would die due to Hg burdens. As many as 1.0 percent subadults and 1.8 percent of adults (summed across age classes) could also die due to Hg burden. Additionally, 16 percent eggs and ovaries of razorback sucker would perish, fail to hatch, or produce deformed embryos due to their Se burden. Those larvae that survive would also experience up 16 percent loss of Age 0 larvae due to dietary selenium toxicity. It should be noted that these numbers are a result of total deposition within the San Juan basin and are not specifically attributable to the Four Corners project's proposed action.

The environmental baseline is clearly degraded due to historic contributions of Hg to the San Juan Basin. Future projections predict an increasing global contribution of Hg to the San Juan Basin. However the actions of the SJRRIP are clearly offsetting those effects and, in combination with the Conservation Measures, will continue to do so. The Conservation Measures address all of the other project specific effects. As a whole, we find that the proposed action is not anticipated to appreciably reduce the likelihood of both the survival and recovery of the species. In conclusion, we find that proposed action will not jeopardize the continued existence of the Colorado pikeminnow and razorback sucker.

Colorado Pikeminnow and Razorback Sucker Critical Habitat

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat (50 CFR 402.02); instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of razorback sucker and Colorado pikeminnow critical habitat to determine whether the current proposal destroys or adversely modifies critical habitat for these species.

After reviewing the current status of both fish, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that implementation of the proposed action, as proposed, is not likely to adversely modify critical habitat for the Colorado pikeminnow. We reached this conclusion based on the following findings, the basis for which is presented in the preceding Environmental Baseline, Effects of the Action, and Cumulative Effects sections of this document. Based on the PVA of Colorado pikeminnow in the San Juan River Basin (Miller 2014), there is a significant decline in the population associated with Hg concentrations in whole body pikeminnow over 0.7 mg/kg WW if the actions of the SJRRIP were to cease. However, the Conservation Measures will continue to offset any projected decline. These Hg concentrations (that is, the average Hg in the population) are projected to occur sometime after 2046, if the rate of Hg deposition, transport, and bioaccumulation in these Colorado pikeminnow continues as expected. However, the Service's regulation (USFWS 1986), only allow cumulative assessment analysis until the end of the project which is 2041. Therefore, Critical Habitat is not adversely modified by this project's actions.

Additionally, there is a reasonable potential that a nonnative species could be released into the critical habitat of both the Colorado pikeminnow and razorback sucker in the San Juan River Basin. The ecological damages and injuries to these endangered fishes were not calculable, but would be extensive and persistent. However, the Conservation Measures include actions to prevent nonnative species release and to fund nonnative species removal. These measures will offset nonnative species impacts.

The conservation role of Colorado pikeminnow and razorback sucker critical habitat is to provide spawning and rearing habitat conditions necessary for successful pikeminnow and sucker recruitment at levels that will provide for the conservation of the species. Appropriate water (PCE 1), physical habitat (PCE 2), biological environment (PCE 3) are essential for successful Colorado pikeminnow and razorback sucker spawning and survival. Past and present activities within the San Juan River basin have degraded these habitat elements to the extent that their co-occurrence at the appropriate places and times is insufficient to support successful Colorado pikeminnow and razorback sucker recruitment at levels that will provide for the species' conservation. While implementation of the proposed action is expected to exacerbate the very limited co-occurrence of PCEs at appropriate places and times, the implementation of the Conservation Measures will offset that impact. The increased Hg deposition in the basin, the contamination of the physical properties of the water, and the prey of Colorado pikeminnow could lead to an irreversible loss of reproductive success and adult survival necessary to sustain the species beyond the proposed action. As previously noted, these effects are attributable to the degraded environmental baseline, the proposed action and future predicted increased global contributions of Hg to the basin. However the actions of the SJRRIP are clearly offsetting those effects and, in combination with the Conservation Measures, will continue to do so.

Therefore, the proposed action is not anticipated to appreciably reduce the likelihood of both the survival and recovery of the species, and we find that proposed action will not appreciably diminish the value of designated critical habitat to satisfy the function and conservation role of critical habitat during the time frame of the proposed action. Therefore, we find that the proposed action will not result in destruction or adverse modification of designated critical habitat.

Southwestern Willow Flycatcher and Yellow-billed Cuckoo

After reviewing the current status of the flycatcher, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that implementation of the proposed action, is not likely to jeopardize the continued existence of the southwestern willow flycatcher. Flycatchers are currently found to nest in the San Juan River Basin only rarely and even fewer nesting attempts have occurred within the Deposition Area. While some loss of nesting attempts, eggs, or young may be expected due occur due to the proposed action and the environmental baseline, the recovery goals for the San Juan Management Unit can still be met. Additionally, proposed action will not affect critical habitat.

After reviewing the current status of the cuckoo, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that implementation of the proposed action, is not likely to jeopardize the continued existence of the yellow-billed cuckoo. Cuckoos have been found to nest in the San Juan River Basin only extremely rarely and no nesting attempts have been reported to occur in the Deposition Area. While some future loss of nesting attempts, eggs, or young may be expected to occur due to the proposed action, and the environmental baseline, contributions of recovery support by habitat of cuckoo in the San Juan River can still be met. Additionally, the proposed action is not anticipated to affect their critical habitat.

We find that implementation of the proposed action is not likely to jeopardize the continued existence of the southwestern willow flycatcher or the yellow-billed cuckoo because it is not expected to result in high levels of mortality in the future. No nesting flycatchers or cuckoos are known to inhabit the Deposition Area at this time, and the Project proposes continued surveys within the San Juan River basin for flycatchers and cuckoos. Therefore, the Service will be able to monitor presence of the species in the action area as habitat increases.

The regulations (50 CFR 402.02) implementing section 7 of the ESA define reasonable and prudent measure (RPM) as alternative measures, identified during formal consultation, that: 1) can be implemented in a manner consistent with the intended purpose of the action; 2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; 3) are economically and technologically feasible; and, 4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

The Service has developed the following elements of an RPM to actions proposed in the OSMRE (2014b,c,d) BA, as amended (OSMRE 2015). Where the SJRRIP is implementing the Conservation Measures, they should be implemented using an adaptive management approach within specific constraints. The elements of the Conservation Measure are incorporated into the following RPMs and are based on the best scientific information available regarding what is necessary to avoid adverse to Colorado pikeminnow, razorback sucker, and adverse modification of Colorado pikeminnow and razorback sucker critical habitat. Elements 1 through 3 of the RPM will be monitored by the New Mexico Ecological Services Field Office (NMESFO); and Element 4 will be funded by the Project Proponents and implemented by the San Juan River Recovery Implementation Program (SJRRIP). As new information becomes available, the RPMs may be modified by the Service consistent with the need to avoid adverse effects and adverse modification of critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), take that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such take is in compliance with the terms and conditions of an incidental take statement.

The Reasonable and Prudent Measures described below are non-discretionary and must be undertaken by OSMRE or delegated to the other federal action agencies, so that they become binding conditions of any grant or permit issued to any applicants, as appropriate, for the exemption in section 7(o)(2) to apply. OSMRE has a continuing duty to regulate the activity covered by this incidental take statement. If OSMRE (1) fails to assume and implement the terms and conditions, or (2) fails to require applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, OSMRE must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Proposed actions will result in the increased likelihood of noise and disturbance, water withdrawal, effluent discharges either pursuant to NPDES permits or in the unlikely event of ash pond failure, entrainment, APS Weir operations, nonnative species release, and the emission, subsequent deposition, and bioaccumulation of Hg and Se. These conditions will adversely affect the Colorado pikeminnow, razorback sucker, flycatcher, and cuckoo as described below (Table 12). Note that only activities that adversely affect listed species are provided in Table 12.

Table 11. Incidental takes of endangered fishes and listed birds authorized for the action proposed with implementation of the Conservation Measures and Reasonable and Prudent Measures, by activity, species, species life stage, number authorized, time period of ITS estimate, and injury type.

(Table 11) Activity	Species	Life stage	Number ITS authorized	ITS Time Period	Injury Type
Disturbances at the NMEP	flycatcher	Migrants	5	2016-2041	harass or harm
Water withdrawal	Colorado pikeminnow	All	indeterminate	2016-2041	harm, harass or kill
Water withdrawal	razorback sucker	All	indeterminate	2016-2041	harm, harass or kill
effluent discharges	Colorado pikeminnow	All	indeterminate	2016-2041	harm, harass or kill
effluent discharges	razorback sucker	All	indeterminate	2016-2041	harm, harass or kill
effluent discharges	flycatcher	All	indeterminate	2016-2041	harm, harass or kill
effluent discharges	cuckoo	All	indeterminate	2016-2041	harm, harass or kill
entrainment or impingement	Colorado pikeminnow	Larvae	2, up to 4 percent	annually 2016-2041	harm, harass or kill
entrainment or impingement	Colorado pikeminnow	juveniles & subadults	less than or equal to 3	annually 2016-2041	harm, harass or kill
entrainment or impingement	razorback sucker	Larvae	1, up to 2 percent	annually 2016-2041	harm, harass or kill
entrainment or impingement	razorback sucker	juveniles & subadults	less than or equal to 10	annually 2016-2041	harm, harass or kill
APS Weir operations	Colorado pikeminnow	All	indeterminate	2016-2021	harm or harass
APS Weir operations	razorback sucker	All	indeterminate	2016-2021	harm or harass
nonnative species release	Colorado pikeminnow	All	indeterminate	2016-2041	harm, harass or kill
nonnative species release	razorback sucker	All	indeterminate	2016-2041	harm, harass or kill
Hg emission & deposition	Colorado pikeminnow	egg, ovary, embryo, fry	up to 250,340	2016-2074	harm or kill
Hg emission & deposition	Colorado pikeminnow	Age 0, larvae	up to 2,975	2016-2074	harm or kill
Hg emission & deposition	Colorado pikeminnow	subadult (Age 1 to 6)	up to 1,118	2016-2074	harass or harm
Hg emission & deposition	Colorado pikeminnow	adult (Age 7 to Age10+)	up to 47	2016-2074	harass or harm
Hg emission & deposition	Colorado pikeminnow	adult (Age 7 to Age10+)	up to 7	2016-2074	reproductive harm
Hg emission & deposition	Colorado pikeminnow	subadult (Age 1 to 6)	up to 25	2016-2074	harm or kill

(Table 11) Activity	Species	Life stage	Number ITS authorized	ITS Time Period	Injury Type
Hg emission & deposition	Colorado pikeminnow	adult (Age 7 to Age10+)	up to 2	2016-2074	harm or kill
Hg emission & deposition	razorback sucker	egg, ovary, embryo, fry	up to 34,694	2016-2074	harm or kill
Hg emission & deposition	razorback sucker	Age 0, larvae	up to 552	2016-2074	harm or kill
Hg emission & deposition	razorback sucker	subadult (Age 1 to 6)	up to 34	2016-2074	harass or harm
Hg emission & deposition	razorback sucker	adult (Age 7 to Age10+)	up to 12	2016-2074	harass or harm
Hg emission & deposition	razorback sucker	adult (Age 7 to Age10+)	up to 1	2016-2074	reproductive harm
Hg emission & deposition	razorback sucker	subadult (Age 1 to 6)	up to 1	2016-2074	harm or kill
Hg emission & deposition	razorback sucker	adult (Age 7 to Age10+)	up to 4	2016-2074	harm or kill
Hg emission & deposition	flycatcher	eggs to fledglings	up to 12	2016-2074	harm or kill
Hg emission & deposition	cuckoo	eggs to fledglings	up to 12	2016-2074	harm or kill
Se emission & deposition	Colorado pikeminnow	egg, ovary, embryo, fry	up to 25,503	2016-2074	harm or kill
Se emission & deposition	Colorado pikeminnow	Age 0, larvae	up to 42	2016-2074	reproductive harm
Se emission & deposition	Colorado pikeminnow	adult (Age 7 to Age10+)	up to 1	2016-2074	reproductive harm
Se emission & deposition	razorback sucker	egg, ovary, embryo, fry	up to 291,510	2016-2074	harm or kill
Se emission & deposition	razorback sucker	Age 0, larvae	up to 301	2016-2074	reproductive harm
Se emission & deposition	razorback sucker	adult (Age 7 to Age10+)	up to 6	2016-2074	reproductive harm
Se emission & deposition	flycatcher	eggs to fledglings	up to 12	2016-2074	harm or kill
Se emission & deposition	cuckoo	eggs to fledglings	up to 12	2016-2074	harm or kill

There are several activities that are associated with indeterminate take estimates. This is either due to the nature of the activity, such as with programmatic consultations on effluent discharges, or the nature of the effects, such as with nonnative species release. NPDES permits subject to this consultation will be subject to the indeterminate take estimate in the table above. Take estimates for any subsequent individually issued NPDES permits will be estimated on a site specific basis using guidelines developed in conjunction with the Project Proponents, the federal agencies and the Service.

Take estimates due to blockage of fish passage and modification of the depth and velocity of habitat are indeterminate at this time, but likely would not exceed up to 500 individual Colorado pikeminnow or razorback sucker in any one year. The incidental take estimate is authorized for a period prior to implementation of fish passage at APS Weir, however, the Project Proponents are not lead for that action. Therefore, the Service reserves its ability to modify and adjust the incidental take associated with any blockage of fish passage after 2021, if fish passage is not provided by the SJRRIP. Take estimates for the potential release of nonnative species from Morgan Lake were indeterminate and would be persistent. However, with implementation of the RPMs, the estimated take is reduced, but still indeterminate. Take estimates for nonnative species releases from Morgan Lake that are not novel are subject to the indeterminate take estimate in the table above. However, the Service notes that the demonstrative introduction of *a single*, novel, nonnative species from Morgan Lake to the San Juan River that occurs through the Project Facilities and that is adverse to endangered fishes would exceed the incidental take for this activity.

The Service notes that this represents a best estimate of the extent of take that is likely during the proposed action along with implementation of the RPMs. In several cases, for actions associated with Hg or Se deposition, the incidental take was estimated using a fish population modeled at its recovery potential. Therefore, actual estimates of incidental takes may be less than those authorized above. Incidental takes associated with Hg and Se deposition will be verified by monitoring endangered fishes (or suitable surrogates) and compared with those estimated by EPRI (2014) or the Service. Should the average Hg or Se burdens in endangered fish be significantly greater than was estimated, then additional information collection may be necessary to verify these conditions, and if attributable to the proposed action, reinitation of ESA consultation may be warranted. Thus, estimated incidental take may be modified from the above should population monitoring information or other research indicate substantial deviations from the estimated extent of incidental take, or if it allows for a calculation of the amount of take that will occur. In this case further consultation may be necessary. If any actual incidental take is found to meet or exceed the predicted incidental take levels, consultation must be reinitiated.

REASONABLE AND PRUDENT MEASURES

While the proposed Conservation Measures are substantial in helping to reduce impacts to listed species and their critical habitats, the Service nonetheless believes that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize impacts of incidental take of the Colorado pikeminnows, razorback suckers, flycatchers, and cuckoos resulting from the Project:

1. RPM 1) Federal agencies shall use all available authorities and agency discretion to reduce atmospheric Hg deposition (and Se loading) in the San Juan River Basin to ameliorate adverse effects to Colorado pikeminnow and adverse effects to its critical habitat.

    a. As the lead federal agency conducting consultation under Section 7 of ESA for FCPP/NMEP, and acting under the provisions of the Surface Mining Control & Reclamation Act, OSMRE will evaluate and consult with the Service on all discretionary OSMRE permitting actions within OSMRE's authority that have the potential to deposit mercury (Hg) in the San Juan River. OSMRE will conduct this evaluation every two years and consult with USFWS upon completion of the evaluation. In evaluating and consulting on such actions, if adverse Hg effects to the Colorado pikeminnow, or adverse modification of its critical habitat due to Hg deposition, are determined likely, OSMRE will initiate formal ESA consultation to reduce these likely effects; and will ensure implementation of any subsequently developed measures to offset Hg effects to this species.

    b. As a key cooperating agency coordinating with OSMRE in the ESA consultation process, BIA will obligate funding in fiscal year 2015 for the purposes of a Razorback sucker Selenium Effects Study. This study is expected to assist with clarifying what level of selenium causes adverse impacts to razorback sucker in the San Juan Basin.

Rationale. Because Colorado pikeminnow is a top predator, it has bioaccumulated high levels of Hg in its tissues that are known to be associated with reproductive injury, behavioral injury, and mortality (based on surrogate fish toxicity studies). When the populations' average Hg concentration in its whole body achieves 0.7 mg/kg WW, the breeding adult population will lose approximately 1 percent of its population every year, the majority of breeding adults will experience reproductive and behavioral injuries, and the recruitment of eggs and larvae to older life stages will be reduced by as much as 8 to 10 percent. These injuries are multiplicative given the Colorado pikeminnow life history and therefore, there is an Hg-mediated demographic impact to the Colorado pikeminnow population that results in the loss of individuals, a reduction of reproductive success, an increased probability of population decline, an increased probability of extinction, and inability to achieve recovery in the San Juan River Basin without additional action taken by the federal agencies.

Water of sufficient quality is a necessary primary constituent element for all Colorado pikeminnow history stages as it reduces Hg in water, soils, and Hg bioaccumulation in the food web and provides for adequate food to maintain reduced body burdens of Hg in Colorado pikeminnow adults, subadults, larvae and eggs. Elements 1a and 1b will provide the primary constituent elements needed to sustain the Colorado pikeminnow, which include water in sufficient quality as well as a cleaner food supply; prevent water quality degradation as a result of Hg deposition or Se loading to the San Juan River Basin and therefore benefit all life stages. Reducing the deposition of Hg, particularly ionic Hg, into the San Juan River Basin will improve the quality of soils, sediments, plants, invertebrates, and fish prey necessary for Colorado pikeminnow to provide for increased survival of breeding adults and recruitment. The concentrations of Hg and Se in Colorado pikeminnow, or other appropriate surrogates, will be routinely monitored so that achievements in the reduction of Hg in their critical habitat, prey, or body burdens can be quantified and further evaluated. Future mercury controls on mercury contributors to deposition in the San Juan River Basin are expected to have additional benefits and alleviate adverse modification of critical habitat.

We recognize that Hg pollution is a global problem that requires global action because it moves with air and water, transcends political borders, and can be transported thousands of miles in the atmosphere. Mercury pollution is more extensive than previously thought. Past mercury controls have been successful. In the United States, we are significantly reducing our use and emissions of mercury, but these efforts alone may not be sufficient to address the effects of mercury pollution in the San Juan River Basin. The effects of probable long-term Hg deposition in the San Juan River Basin create significant challenges to management of Colorado pikeminnow and critical habitat. Without creative, intensive, and focused management by the federal agencies on reducing Hg deposition, these impacts could contribute to the extinction of the Colorado pikeminnow and adverse modification of its critical habitat in the San Juan River Basin.

While there is uncertainty about the Hg reductions necessary to reverse the trend of bioaccumulation in Colorado pikeminnow and critical habitat, there is a strong likelihood that federal action agencies have available authorities, discretion, and a duty to work towards the reduction of local, regional, national and international sources of Hg deposition to the San Juan River Basin and thereby improve the physical and biological factors of Colorado pikeminnow critical habitat The long-term goal for federal agencies would be to take action at the regional, national, or international level to identify exposed Colorado pikeminnow populations, minimize exposures, and appropriately reduce anthropogenic Hg emissions and deposition into the San Juan River Basin.

The Service recognizes that the involved federal agencies (OSMRE, USEPA, BIA, BLM) each have different authorities and agency discretion that will be necessary to insure that any action it authorizes, funds, or carries out, is not likely to jeopardize the continued existence of Colorado pikeminnow or results in the destruction or adverse modification of critical habitat. Therefore, the role of the lead federal agency, OSMRE, is to collect those periodic agency reviews and provide them as part of their report to the Service identifying which actions they or other federal agencies have taken to improve critical habitat. No failure to report will be considered a trigger for reinitiation as it is a mandatory duty of federal agencies to insure that any action it *authorizes, funds, or carries out, is not likely to result in the destruction or adverse modification of critical habitat and their actions must be maintained until adverse modification of critical habitat is alleviated.*

2. RPM 2) Project Proponents will develop and implement a Pumping Plan to reduce the magnitude and types of entrainment of Colorado pikeminnow and razorback sucker. The Pumping Plan will optimize avoidance of entrainment of larvae and impingement of larger fishes through measures that are deemed feasible without altering the current operating configuration at the river pump station.

    a. The Pumping Plan measures shall be developed with the oversight of OSMRE and the approval of the Service.

    b. The final Pumping Plan shall be implemented within 2 years of issuance of a Record of Decision.

Rationale. As proposed, we estimate up to 340,200 larval Colorado pikeminnow or approximately 15 percent of the maximum estimated Colorado pikeminnow larval population and up to 426,975 razorback sucker larvae or 10 percent of the maximum razorback sucker larval population above APS Weir could be injured or entrained by the high velocities of water being pumped into and through the APS cooling water intakes for 25 years. Additional injuries and mortalities to as many as 375 subadult Colorado pikeminnows and 725 subadult razorback suckers could also occur should these fishes approach the cooling water intakes and be unable to swim away or be impinged.

Therefore, the Project Proponents shall develop a Pumping Plan that optimizes when cooling water pumps can be reasonably and prudently halted or reduced that are during times at which there is a seasonal abundance of either larval Colorado pikeminnow or larval razorback suckers drifting near the APS cooling water intakes. The Pumping Plan shall also evaluate and implement management practices or options for finer screen mesh or other reasonable and prudent technological solutions that reduce the number of subadult endangered fishes that may be impinged or entrained at the APS cooling water intakes. Similar pumping plans and water intake modifications have resulted in the reduction of endangered fish larvae and subadults elsewhere in the Upper Colorado River Basin. We have confidence that development and implementation of a Pumping Plan for APS cooling water intakes will reduce the number and types endangered fish larval losses to between 2 to 5 percent. Individual larvae and subadults that survive will contribute to population numbers, help alleviate adverse effects, and contribute towards self-sustaining populations of Colorado pikeminnow and razorback suckers in the San Juan River Basin. Survivability of endangered larval fish will be investigated so that appropriate reduction of entrainment can be achieved.

3. RPM 3) Project Proponents will develop and implement a Non-native Species Escapement Prevention Plan, which will include the following measures to minimize: (a) the risk of non-native species (plants, invertebrates, and fish) that inhabit Morgan Lake invading San Juan River; and (b) the introduction of additional nonnative species into Morgan Lake.

a. Project Proponents will develop and disseminate public education materials regarding the threat of non-native species targeted to recreational users of Morgan Lake. The materials will recommend practices to prevent the introduction of new nonnative species to Morgan Lake or the transfer of existing nonnative species from Morgan Lake to the San Juan River.

b. Project Proponents will install and operate a device designed to prevent the transfer of nonnative fish species from Morgan Lake to the San Juan River.

Rationale: Colorado pikeminnow and razorback sucker are threatened with extinction due to the cumulative effects of environmental impacts that have resulted in habitat loss, proliferation of nonnative introduced fish, and other man-induced disturbances. Because of the extreme and persistent threat posed by nonnative species, their eradication and management is the first priority in the endangered fish recovery plans (USFWS 2002a,b, 2014). Even nonnative species that already exist in the San Juan River pose a risk because they will likely displace, compete, or prey, or transmit diseases or parasites upon endangered fishes for many years after their potential release, thereby reducing the numbers, distribution, fitness, and population viability of endangered fishes in the San Juan River Basin. Predation and competition, although considered normal components of this environment, are out of balance due to introduced nonnative fish species in many areas including the San Juan River.

Morgan Lake provides a unique aquatic habitat in this arid region with a direct hydrological connection to the San Juan River. The environmental (e.g., warm, deep, clear) and societal conditions (e.g., recreational fishing and boating) there have resulted in novel, nonnative species such as tropical suckerfish and pacu that inhabit Morgan Lake and that have never been reported anywhere else in the San Juan River.

Allegations are that novel, nonnative species such as gizzard shad from Morgan Lake have escaped and colonized the San Juan River and Lake Powell to the detriment of the fisheries there. Ease of access, lack of comprehensive knowledge of nonnative species in Morgan Lake and lack of appropriate containment exacerbates the risks of nonnative species escapement and their potential ecological and societal impacts to the San Juan River and effects to endangered fish, and their critical habitat. As Morgan Lake is an industrial water supply that is managed by the Navajo Nation Department of Fish and Wildlife as a recreational fishery, APS is encouraged to coordinate with this agency. Implementation of a Nonnative Species Escapement Prevention Plan (in addition to funding nonnative removal efforts, see below) will reduce the number of nonnative fish in a particular area, including in Colorado pikeminnow and razorback sucker critical habitats.

4. RPM 4) Project Proponents shall fund implementation of the following Recovery Actions to continue working towards endangered fish survival and recovery in the San Juan River Basin and create, maintain, or improve habitat for Colorado Pikeminnow and Razorback Sucker through the SJRRIP.

   a. Funding will be provided to the SJRRIP through the National Fish and Wildlife Foundation (NFWF) on an initial one time and annual basis. Annual funding will be subject to annual adjustments determined by the Consumer Price Index (CPI).

   b. Funding will be managed and administered by the SJRIP Program Office according to the terms and conditions set forth in a contract with NFWF which shall conform to the obligations of this BO.

   c. The following Recovery Actions shall be funded (Table 12).

Table 12. The following Recovery Actions shall be implemented by the SJRRIP.

Funded Recovery Action	One-time Costs	Annual Costs
Propagate endangered fish		$40,600
Remove nonnative species		$50,361
Protect, manage and augment fish habitat		$153,045
Monitor fish habitat		$103,463
Partial funding of fish passage at APS Weir	$620,000	
Conduct monitoring of Hg and Se in endangered fish or their surrogates		$60,000
Conduct studies of Hg in Colorado pikeminnow	$600,000	
Contribute towards SJRRIP staff biologist to conduct these and other Recovery Actions		$126,000
Conduct a Navajo Dam Temperature Modification Feasibility Study	$100,000	0
Total	$1,320,000	$533,469

Rationale: The Project Proponents, federal agencies, and the Service identified that the project poses direct and indirect adverse effects and injuries to Colorado pikeminnow and its critical habitat, razorback sucker and its critical habitat, and to a lesser extent, the cuckoo and the flycatcher, through Hg and Se deposition, nonnative species escapement and entrainment. Colorado pikeminnow and razorback sucker are threatened with extinction due to the cumulative effects of environmental impacts that have resulted in habitat loss, proliferation of nonnative introduced fish, and other man-induced disturbances.

Recognizing the long-term need for recovery, the federal agencies and Project Proponents have agreed to fund these substantial actions to help remove the adverse effects to the endangered species and their critical habitats including:

Propagation of endangered fishes to offset of losses associated with the proposed action.

Nonnative fish removal, combined with the Nonnative Species Escapement Prevention Plan (RPM 3), to alleviate adverse effects to endangered fishes and adverse modification of their critical habitats.

Protection, management, and augmentation of fish habitat, including aquatic and floodplain habitats, to contribute towards the offset of losses to endangered fishes listed birds by increasing areas for their recovery.

Monitoring of habitat is required to track implementation of the RPM and contribute scientific information to support adaptive management by the SJRRIP. Fish passage at APS Weir will allow endangered fish increased access of up to 18 miles of fish habitat, including portions of Colorado pikeminnow critical habitat.

Monitoring of Hg and Se in endangered fish (or suitable surrogates) will be conducted by the Service every 5 years and is required to track implementation of the RPM and contribute scientific information to allow adaptive management by the SJRRIP.

Conducting Hg Studies in Colorado pikeminnow to address uncertainty will assist the tracking of implementation of the RPM and contribute scientific information to support adaptive management by the SJRRIP.

Funding a SJRRIP staff biologist will facilitate Hg and Se reviews, investigation, and monitoring, and contribute towards implementation of these and other Recovery Actions.

Funding a Navajo Dam Temperature Modification Feasibility Study was an additional effort identified by federal agencies and Project Proponents. This could benefit the recovery of Colorado pikeminnow in the San Juan River by determining whether or not temperature modifications to the outflow from Navajo Dam would increase survival of larval Colorado pikeminnow downstream.

The conservation needs of the Colorado pikeminnow and razorback sucker at this time are primarily associated with: 1) reduction of mercury and selenium loading to the San Juan River Basin; 2) reducing the entrainment or impingement of larval, juvenile, and larger Colorado pikeminnow and razorback sucker into the APS cooling water intakes; 3) detection, prevention, and removal of nonnative species from the San Juan River; 4) increased access to endangered fish habitat above APS Weir; 5) improving fish habitat conditions for Colorado pikeminnow and razorback sucker to improve recruitment, growth, survival, and recovery. Additional measures funded through RPM 4 will result in scientific information necessary to track incidental takes, track sufficient progress *towards recovery, and allow for an adaptive management by the SJRRIP. The first four RPMs specifically address the Hg and Se threats identified in the Environmental Baseline and address the threats posed by the proposed action. Implementation of these RPMs will minimize the effect of incidental take associated with the proposed action and increase the likelihood that Colorado Pikeminnow and Razorback Suckers will survive and the conditions of their habitat including attributes for migration, spawning, recruitment, growth, survival, and recovery will be improved. For these reasons, the Service finds that implementation of the RPMs described above is likely to avoid adverse effects to the Colorado pikeminnow and razorback sucker and their critical habitats in the San Juan River Basin.*

5. RPM 5) OSMRE will work with USEPA and the Project Proponents to minimize the effects of the Proposed Action on Colorado pikeminnow, razorback sucker, southwestern willow flycatcher, or yellow-billed cuckoo, by coordinating with the Service in developing the analytical methods and conduct an analysis of duration, magnitude, concentration and contribution of discharges associated with NPDES permitting actions that will be used to conduct ESA review prior to development of future USEPA-issued NPDES permits for the Project.
    a. In developing methods to evaluate the potential for effects of the future NPDES permits for the Project, OSMRE will coordinate with USEPA and the Project Proponents to identify how available water column and fish tissue Hg and Se data, including data collected as part of the monitoring program funded in Conservation Measure 7, will be evaluated to ensure protection of listed species and their suitable habitats.
    b. OSMRE will work with USEPA and the Project Proponents to ensure that Se and Hg water column data collected pursuant to NPDES permit requirements will be analyzed using test methods that are sufficiently sensitive to enable measurement below the applicable water quality standards or associated review thresholds for purposes of evaluating reasonable potential effects and setting water quality based effluent limitations, if required. For example, we will require use of method 1631 or any similarly sensitive method to conduct Hg monitoring under the NPDES permits.

c. Pending completion of the coordination steps identified in RPM 5.a. above, customary ESA review will occur for future proposed NPDES permit or renewal for the Project.

6. RPM 6) FCPP Project Proponents will minimize potential takes of Colorado pikeminnows, razorback suckers, flycatchers, or cuckoos by providing a Spill Contingency Countermeasures Plan which addresses potential Ash Pond Failure impacts on suitable habitat.
    a. All necessary equipment, training, and materials will be made available for emergency response to a potential Ash Pond Failure as soon as feasible.
    b. A practice response table top drill with appropriate authorities will be conducted every 10 years for the duration of the Project.

7. RPM 7) Project Proponents will minimize takes of flycatchers and cuckoos by conducting standard protocol surveys within the Deposition Areas and contribute to improved riparian or floodplain habitat conditions along the San Juan River Basin (as identified in RPM 3 (f)) or as described by the Project conservation measures).

    a. FCPP Project Proponents will conduct flycatcher and cuckoo protocol surveys within at least 85 acres of the Deposition Area from 2016-2042 or until the Project ceases operation to monitor the effects of Hg and Se deposition to flycatchers and cuckoos.

    b. NMEP Project Proponents will conduct flycatcher protocol surveys within at least one optimal location of suitable flycatcher habitat within the Navajo Mine Lease Area during the spring migration period from 2016-2042 or until the Project ceases operation to monitor the potential effects of noise and disturbance to migrant flycatchers.

    c. RPM 8) OSMRE will coordinate the provision of data and an annual report to the Service at a frequency that is specifically identified by the RPMs on implementation of the proposed action, and their implementing terms and conditions.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the agencies must comply with the following terms and conditions. These terms and conditions implement the Reasonable and Prudent Measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM 1 (Federal agencies shall use all available authorities and agency discretion to reduce atmospheric Hg deposition (and Se loading) in the San Juan River Basin).

    a. Federal action agencies shall review their authorities and determine whether there is agency discretion to reduce Hg deposition (or Se loading) to the San Juan River Basin;

    b. If there is agency discretion under existing authorities to reduce Hg within the San Juan River Basin, then ESA consultation with the Service shall be initiated;

    c. For Se loading, BIA will obligate funding in fiscal year 2015 for the purposes of a Razorback Sucker Selenium Effects study. This study is expected to assist with clarifying what level of selenium causes adverse impacts to razorback sucker in the San Juan River Basin.

   d. The lead federal agency shall report on any of their agency reviews and ESA consultation involving Hg deposition to the San Juan River Basin that may adversely affect Colorado pikeminnow or their critical habitat prior to the next OSMRE permit issuance, or by October 1, 2020, whichever comes first.

   e. Failure to report will not be considered a trigger for reinitiation as it is a mandatory duty of federal agencies to insure that any action it authorizes, funds, or carries out, is not likely to result in the destruction or adverse modification of critical habitat and their actions must be maintained until adverse modification of critical habitat is alleviated.

2. To implement RPM 2 (Project Proponents shall minimize entrainment and impingement losses of Colorado pikeminnow and razorback sucker through measures taken at the APS cooling water intakes above APS Weir).

   a. Project Proponents, in consultation with the Service, will develop a Pumping Plan that will identify optimal times to restrict pumping, provided the restrictions are reasonable and prudent and, that will minimize the entrainment injury of endangered fish larvae; and, that will use screening technology to minimize injury to endangered fishes

   b. Project Proponents will implement the Pumping Plan within two years of issuance of a Record of Decision.

3. To implement RPM 3 (Federal agencies and Project Proponents shall develop and implement a Nonnative Species Escapement Prevention Plan).

   a. Federal agencies and Project Proponents will work with others to develop and implement a Nonnative Species Escapement Prevention Plan.

   b. A risk management approach will be used to identify, evaluate, treat, monitor, and prevent existing or novel nonnative species in Morgan Lake from invading the San Juan River

   c. The Project Proponents will contribute information to the Navajo Nation Department of Fish and Wildlife for the comprehensive inventory of nonnative species that occur in Morgan Lake that may pose a threat to endangered fishes in the San Juan River. . This may include, but are not limited, invasive plants, invertebrates including mollusks, and especially nonnative fish.

   d. Educational materials and the device installed to prevent nonnative fish release will be developed and designed based on risk posed by the nonnative species detected, their life histories and any potential for those species to transport or disperse through the FCPP facilities, the risks of escapement, and the consequences of such escapement to endangered fishes in the San Juan River.

e. Working with the federal agencies, the Proponents will select and implement those reasonable and prudent educational measures and device design necessary to contain, treat, or manage nonnative species that pose the greatest risks of escapement into the San Juan River and to the endangered fishes or their critical habitat

f. Monitor the containment or treatment implemented and report on nonnative species in Morgan Lake, their risks of escapement, and the measures implemented to contain or treat those risks, and any educational and outreach efforts within three years of issuance of a Record of Decision.

4. To implement RPM 4 (fund implementation of the following Recovery Actions to continue working towards endangered fish survival and recovery in the San Juan River Basin, create, maintain, or improve habitat for Colorado Pikeminnow and Razorback Sucker through the SJRRIP).

    a. Funding will be provided to the SJRRIP through the National Fish and Wildlife Foundation (NFWF) on an initial and triannual basis;

    b. Funding will be managed and administered by the SJRIP Program Office according to the terms and conditions set forth in a contract with NFWF consistent with the terms and obligations of this BO;

    c. The Recovery Actions identified in Table 13 shall be implemented during the proposed project (2016 to 2041 or for the life of the project).

    d. The Service and the SJRRIP shall be responsible for implementation of any and all Funded Recovery Actions and any adaptive management necessary to appropriately continue to ensure the recovery of the endangered fish. In no event shall any adaptive management by the Service or the SJRRIP result in any further or increased financial obligations to the project proponents than as otherwise set forth in this BO.

5. To implement RPM 5 (Develop Evaluation Methods for future NPDES reviews) USEPA and OSMRE shall consider the following factors:

    a. USEPA will consider how the effluent limits, if any, are expressed in the NPDES permit and evaluate whether a water column translation to an endangered fish tissue guideline concentration is available at the time of permit issuance. USEPA will consider guidance and scientific information available at the time of permit issuance in selecting an appropriate method for translating fish tissue guidelines to water column values used to evaluate reasonable potential effects and calculate effluent limitations if needed.

b. In evaluating potential effects of NPDES discharges in future permitting actions for the Project, USEPA will use the Navajo Nation's fish tissue criterion of methylmercury in fish of 0.3 mg/kg wet weight and the USEPA (2014) draft freshwater selenium ambient chronic water quality criterion for protection of aquatic life of 15.2 mg/kg dry weight in fish egg/ovaries (or water column equivalent), or other appropriate and scientifically defensible values, for purposes of evaluating the relationship between water discharges and potential species effects. As necessary these current endangered fish tissue evaluation thresholds may be modified to reflect new information, monitoring data, and in coordination with the Service.

c. USEPA will, in association with future NPDES permitting actions for the Project, provide an analysis of the duration, magnitude, concentration and contribution of the flows in the vicinity downstream from the NPDES permitted discharges to clarify the potential contribution of such flows to the overall impacts from Hg and Se to threatened and endangered species and critical habitat in the project area.

d. If the fish tissue guideline of Hg or Se in the receiving water is below and not close to the endangered fish tissue guidelines, depending on the particular facts, the permitting authority may reasonably conclude that the discharge does not have reasonable potential, but tier 2 antidegradation provisions should be considered.

e. If the review of available Hg and Se data collected in the vicinity downstream from the NPDES permitted discharges indicates that permitted discharges cause or contribute to exceedances of applicable water quality standards, as evaluated based on the best available water column, translator, and fish tissue threshold values, water quality based effluent limitations will be included in the NPDES permit.

f. NPDES permits shall contain a special condition requiring the permittee to monitor effluents for Se and Hg using a sufficiently sensitive EPA-approved method. The selection of a sufficiently sensitive method relates method quantitation levels to the water column criterion value. If a water column criterion or a water column translation of an endangered fish tissue guideline is not available to allow for selecting an alternate sufficiently sensitive method, use of the most recent approved version of method 1631, where feasible, to characterize effluent discharges will be required. The frequency of such monitoring shall be quarterly or once per discharge in the case of intermittent discharge for a sufficient period of time to accurately assess the long-term concentration levels of Se and Hg in the effluent regulated under the NPDES permits.

6. To implement RPM 6 (Provide Spill Contingency Countermeasures Plan for Ash Pond Failure) the federal action agencies shall:

   a. Direct Project Proponents to submit for review and approval. a Spill Contingency Countermeasures Plan which addresses potential Ash Pond Failure impacts on suitable habitat, including plans to make available all necessary equipment, training;

   b. Promptly submit the final amended Spill Contingency Countermeasures Plan to the federal action agencies and the Service's NMESFO

   c. Direct Project Proponents to conduct an initial practice response (table-top) drill with appropriate authorities within ten years of issuance of a record of decision

7. To implement RPM 7 (Conduct flycatcher and cuckoo protocol surveys) the federal action agencies shall require flycatcher and cuckoo protocol surveys conducted by the Project Proponents as follows:

   a. All flycatcher and cuckoo protocol surveys shall be conducted by persons in possession of a valid Federal Fish and Wildlife Permit (note Federal Fish and Wildlife Permits are only valid with possession of an appropriate state and/or tribal permit).

      i. As appropriate, have assigned staff or contractors submit an application for a Federal Fish and Wildlife Permit, Native Endangered and Threatened Species -Scientific Purposes, Enhancement of Propagation or Survival Permits (i.e., Recovery Permits that is available online at http://www.fws.gov/forms/3-200-55.pdf) as soon as possible to insure enough time to allow for attendance of flycatcher and cuckoo protocol survey training and application reviews of methods and expertise.

      ii. All flycatcher and cuckoo protocol surveys conducted must provide all data and reports as required by the Federal Fish and Wildlife Permit.

   b. Federal agencies shall require appropriate Project Proponents to conduct flycatcher and cuckoo protocol surveys within at least 85 acres of the Deposition Area from 2016-2042 or until the Project ceases operation to monitor the effects of Hg and Se deposition to nesting flycatchers and cuckoos.

      i. Selection of 85 acres of flycatcher and cuckoo protocol survey sites can be done considering riparian habitat qualities within suitable habitat described by AECOM (2014), land ownership, and other legal, practical, or logistic factors.

      ii. Flycatcher and cuckoo protocol surveys done by any others (e.g., BIA, BLM, NNDFW, Reclamation, etc.) in possession of a valid Federal Fish and Wildlife Permit can be substituted or used to meet the requirement for these surveys, however, responsibility for completion of all protocol surveys rests with federal action agencies and the Project Proponents.

c. Federal agencies shall require appropriate Project Proponents to conduct presence/absence flycatcher and cuckoo surveys within at least one optimal or suitable habitat (AECOM 2014) on the Navajo Mine Lease Area during the spring migration period to monitor the potential effects of noise and disturbance to migrant flycatchers from 2016-2042 or until the Project ceases operation.

    i. The specific survey design, location, and evaluation of the data necessary to quantify the potential effects of noise and disturbance to migrant flycatchers on the Pinabete Mine Lease Area may be modified over time based on new information, successful efforts, and other emerging needs.

d. Summaries of these flycatcher and cuckoo surveys shall be provided in the annual reports to the Service described in RPM 9.

8. To implement RPM 8 (Reporting Requirements) the OSMRE shall prepare and submit a report summarizing the status of all RPMs, and the Terms and Conditions and any additional data or relevant information to the Service's NMESFO annually, no later than May 30 for the previous calendar year's activities.

    a. Ensure that the Service receives electronic copies of all reports and plans related to implementation of these RPMs and terms and conditions, including but not limited to, the progress or completion of the Project that identifies any significant modifications to the proposed action; any anticipated outcomes to actual outcomes; any anticipated level of incidental take or any actual observations or quantification of take associated with the proposed action, any summaries of species monitoring and protocol surveys, a summary of the annual estimated atmospheric emissions of Hg and Se (as submitted to any federal agency or publically and with any confidential business information removed), any habitat mapping and monitoring, any relevant water quality monitoring associated with NPDES permits and that exceeds any permit limits, any Spill Contingency Countermeasure plans or drills conducted, and any relevant information and status of the Recovery Actions taken.

    b. Reports should reference the appropriate consultation number: Consultation # 02ENNM00-2014-F-0064 and should be sent to the email address nmesfo@fws.gov (or individual email addresses affirmed through discussion) or by mail to the Service's New Mexico Ecological Services Field Office, Attn: San Juan River Recovery Implementation Program Office, 2105 Osuna Road NE, Albuquerque, New Mexico 87113. (And note that the NMESFO will relocate within 4 years).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibility for these species. In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species and their habitats; we request notification of the implementation of the conservation recommendations. We suggest the following conservation recommendations be implemented:

1. OSMRE could work with Bureau of Reclamation and other agencies to further quantify the effects of cold water releases and minimize cold water impacts to Colorado Pikeminnow and its critical habitat in the San Juan River.
2. USEPA could work with states and tribes to develop a Total Maximum Daily Load or Mercury Minimization Plan for the San Juan River that reduces all inputs of Hg so as to protect piscivorous fish and wildlife.
3. BLM could evaluate the Hg emission and deposition associated with fossil fuel extraction, and any ozone or particulates that may affect Hg dynamics in the San Juan River Basin;
4. USEPA could draft Hg ambient freshwater water criterion guidelines that include fish tissue guidelines that protect top level predators and wildlife, particularly for any watersheds that contain Colorado pikeminnow or its critical habitat.
5. BIA could post signage and provide educational materials (using symbols and all major languages used in the region) that alert people who might dispose of aquarium fish into Morgan Lake about the hazards such disposal would pose to native fish and wildlife.
6. BIA, BLM and OSMRE should report any collection of Mesa Verde cacti within the action area to the Service.
7. BIA could survey populations of Mesa Verde cactus in Colorado on the Ute Mountain Ute Reservation.
8. OSMRE, BIA, and BLM could continue to participate in the development, approval, and management of the Mesa Verde Cactus Conservation Areas.
9. Determine how water savings from water conservation and water use efficiency improvements or water acquired through purchase or lease can be used directly for in-stream flow and other direct benefits to the species.
10. Research the effects and benefits of turbidity and suspended sediment on Colorado pikeminnow, razorback sucker, and their critical habitat to identify thresholds of concern.
11. Conduct studies of razorback sucker and Colorado pikeminnow diets.
12. Reduce risks of catastrophic hazardous material or petroleum spills as they are likely to remain even if annual risks are low. Hazard assessments, pollution prevention, and Area Contingency Plans should be developed and refined over time to address potential oil spills and leaks of hazardous materials into the San Juan River Basin. Spill response

drills specific to the likely hazards posed to critical habitats in the San Juan River should be conducted.

13. Develop a contingency plan in the event of wildfire in flycatcher and cuckoo habitat that would reduce impacts to these listed species.
14. Transplant Mancos Milk vetch and Mesa Verde cactus to establish new populations.
15. Develop and implement a plan to limit encroachment of permanent dwellings into areas that could be flooded on the San Juan River.
16. Implement ecosystem restoration on a broad watershed scale.
17. Research razorback sucker predation and competition relationships.
18. Trap Brown-headed cowbirds and control feral hogs as needed.
19. Manage livestock grazing to avoid impacts to flycatchers, cuckoos and their habitats.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REPORTING REQUIREMENTS

Documentation and reporting on the implementation of the RPMs and terms and conditions will occur within 1 year following the completion of the Record of Decision for the Project and annually thereafter for a period of up to twenty five years or until the Project ceases operation. The nearest Service Law Enforcement Office must be notified within 24 hours in writing should any listed species be found dead, injured, or sick. Notification must include the date, time, and location of the carcass, cause of injury or death (if known), and any pertinent information. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. If necessary, the Service will provide a protocol for the handling of dead or injured listed animals. In the event that OSMRE suspects that a listed species has been taken in violation of Federal, State, or local law, all relevant information should be reported in writing within 24 hours to the Service's New Mexico Law Enforcement Office (505) 883-7814 and/or the New Mexico Ecological Services Field Office (505) 346-2525.

REINITIATION NOTICE

This concludes formal consultation on the Four Corners Power Plant and Navajo Mine Energy Project. As required by 50 FR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded (see section on Amount or Extent of Take), 2) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not considered in the BA or this BO, 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, 4) a new species is listed or critical habitat designated that may be affected by the action, 5) if the Project Proponents elect to cease the Project, they will notify the Service as soon as possible, they will fund Recovery Actions per the NFWF agreement, and this BO will become invalid by the end of the notification year, and a final report must be submitted, as required.

In future communications regarding this project please refer to consultation number 02ENNM00-2014-F-0064. If you have any questions or would like to discuss any part of this BO, please contact David Campbell of my staff at (505) 761-4745.

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ATTACHMENT G

Programmatic Agreement
between
Office of Surface Mining Reclamation and Enforcement,
Bureau of Indian Affairs,
Bureau of Land Management,
U.S. Environmental Protection Agency,
National Park Service,
Navajo Nation Tribal Historic Preservation Officer,
Hopi Cultural Preservation Office,
Zia Pueblo,
Advisory Council on Historic Preservation,
New Mexico State Historic Preservation Officer,
Arizona State Historic Preservation Officer,
New Mexico State Land Office,
Arizona Public Service Company, and
Public Service Company of New Mexico
regarding
Management of Historic Properties Associated with the
Four Corners Power Plant, Ancillary Facilities, and Transmission Lines

Errata Sheet

"**Programmatic Agreement between Office of Surface Mining Reclamation and Enforcement, Bureau of Indian Affairs, Bureau of Land Management, U.S. Environmental Protection Agency, National Park Service, Navajo Nation Tribal Historic Preservation Officer, Hopi Cultural Preservation Office, Zia Pueblo, Advisory Council on Historic Preservation, New Mexico State Historic Preservation Office, Arizona State Historic Preservation Office, New Mexico State Land Office, Arizona Public Service Company, and Public Service Company of New Mexico regarding Management of Historic Properties Associated with the Four Corners Power Plant, Ancillary Facilities, and Transmission Lines**" (FCPP PA)

March 4, 2015

The seventeenth "WHEREAS" recital statement, located on page 4 of the Programmatic Agreement does not accurately describe all of the land ownership affected by the APS ancillary facilities and Transmission Lines. The original "WHEREAS" recital statement provides: "**WHEREAS,** the FCPP and associated APS ancillary facilities and Transmission Lines are located on Navajo Indian and Hopi Indian Reservation lands held in trust by the United States; and" is therefore changed to "**WHEREAS,** the FCPP and associated APS ancillary facilities and Transmission Lines are located on Navajo Indian Reservation lands held in trust by the United States and allotment(s) within the exterior boundaries of the Navajo Indian Reservation owned by individual Navajo members and Hopi Indian Reservation lands held in trust by the United States; and". Please see the updated seventeenth recital statement on page 4 included with this errata sheet.

On pages 1, 5, 7 and F-1, references to the United States Code (U.S.C.) for the National Historic Preservation Act have changed. On page 1, line 23, change "(16 U.S. Code [USC] 470f, as amended)" to "(54 U.S. Code [USC] 306108, as amended)". On page 5, line 28, change "(16 USC 470f)" to "(54 USC 306108)". On page 7, line 27, change "(16 USC 470w3)" to "(54 USC 307103)". In Attachment F, page F-1, line 10, change "16 USC 470 et seq." to "54 USC 300101 et seq." Please see the updated pages 1, 5, 7, and F-1 included with this errata sheet.

On page 39, Stipulation XV. At the end of the sentence "This Agreement shall take effect upon its execution and issuance of the ROD for the Project by OSMRE", remove "by OSMRE" from the statement. Please see the updated page 39 included with this errata sheet.

On pages C-8 and C-9, NRHP Determination by OSMRE and SHPO Concurrence with OSMRE Findings are not current to the status of the consultations between OSMRE and Arizona SHPO. Arizona SHPO concurred with amended OSMRE NRHP determinations for 29 sites prior to the date of release of the final Programmatic Agreement, but these concurrences are not updated in the Appendix C table. On page C-8, column NRHP Determination by OSMRE, change rows 010-2009, 013-2009, 015-2009 and 016-2009 from "Unevaluated" to "Eligible". On pages C-8 and C-9, column SHPO Concurrence with OSMRE findings, change rows 001-2009 through 006-2009 and 008-2009 through 29-2009 from "Pending" to "Eligible". Please see the updated pages C-8 and C-9 included with this errata sheet.

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Attachments

ATTACHMENT A: Project Maps

ATTACHMENT B: List of Tribes Invited to Participate and Consultation Record

ATTACHMENT C: List of National Register Properties

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ATTACHMENT H: Unanticipated Discovery Procedures and Protocols

RECITALS

WHEREAS, Arizona Public Service Company (APS) and Navajo Transitional Energy Company, LLC (NTEC) are proponents of the Four Corners Power Plant and Navajo Mine Energy Project (the Project) whose purpose is to facilitate ongoing operations at the Four Corners Power Plant (FCPP) and on NTEC's Navajo Mine lease to provide for long-term, reliable, continuous, and uninterrupted base load electrical power to customers in the southwestern United States, using a reliable and readily available fuel source; and

WHEREAS, the Bureau of Indian Affairs (BIA) (Navajo Region Office and Western Region Office), Bureau of Land Management (BLM), U.S. Environmental Protection Agency (EPA), and National Park Service (NPS) have designated the Office of Surface Mining Reclamation and Enforcement (OSMRE) as the lead federal agency for purposes of compliance with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA) in accordance with 36 Code of Federal Regulations (CFR) § 800.2(a)(2), until this Programmatic Agreement (the Agreement) is executed and then, if a Record of Decision (ROD) is issued, the BIA will become the lead federal agency for purposes of NHPA implementation; and

WHEREAS, NTEC is seeking a Surface Mining Control and Reclamation Act (SMCRA) permit for a new 5,600-acre permit area at Navajo Mine within its existing lease and is also seeking to renew its permit on the Navajo Mine in 2014 for up to 25 years in increments of 5-year permit renewals from OSMRE and to re-align Burnham Road; and

WHEREAS, OSMRE receives and considers applications for and renewals of SMCRA permits and has determined the issuance of a SMCRA permit for the Navajo Mine includes review under Section 106 of the NHPA (54 U.S. Code [USC] 306108, as amended) and its implementing regulations, "Protection of Historic Properties" (36 CFR Part 800) and is therefore a Signatory to this Agreement; and

WHEREAS, APS operates the FCPP, which receives coal solely from the Navajo Mine, and executed a lease amendment with the Navajo Nation (Amendment and Supplement No. 3 to *Supplemental and Additional Indenture of Lease Between the Navajo Nation and Arizona Public Service Company, El Paso Electric Company, Public Service Company of New Mexico, Salt River Project Agricultural Improvement and Power District, and Tucson Electric Power Company*) on March 7, 2011, which provides Navajo Nation consent to extend the term of the FCPP lease for an additional 25 years, beginning on July 7, 2016, until 2041, and also provides Navajo Nation consent to renew rights-of-way (ROWs) for both the plant site and certain transmission lines and related facilities until 2041; and

WHEREAS, APS has also received the consent of the Hopi Tribe to extend the term of the ROW for a Transmission Line across the Hopi Indian Reservation until 2041 and that Release and Consent Agreement between the Hopi Tribe and APS became effective November 1, 2013; and

WHEREAS, Public Service Company of New Mexico (PNM) and the Navajo Nation have executed a ROW Extension/Renewal Agreement, which was approved by the Navajo Nation in October 2010 and expires April 7, 2030; and

WHEREAS, the Project requires federal approvals for portions of four Transmission Lines, including the Moenkopi switchyard and ancillary facilities (hereinafter "Transmission Lines") (Attachment A) that are owned and operated by either APS or PNM and that interconnect with the FCPP and its ancillary facilities and transmit FCPP power and thus are part of the Undertaking:

- APS FCPP to Cholla 345-kilovolt (kV) Transmission Lines, terminating at the Navajo Indian Reservation southern boundary,
- APS FCPP to El Dorado 500-kV Transmission Line through and including Moenkopi and 14-mile segment from Moenkopi to the Navajo Indian Reservation western boundary,
- PNM FCPP to San Juan Generating Station FC 345-kV Transmission Line, and
- PNM FCPP to West Mesa FW 345-kV Transmission Line; and

WHEREAS, Section 106 of the NHPA and its implementing regulations require a federal agency with direct or indirect jurisdiction over a federal, federally assisted, or federally permitted or approved Undertaking to take into account the effects of the Undertaking on historic properties included in or eligible for the National Register of Historic Places (NRHP), afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on the Undertaking and consult with applicable Tribal and State Historic Preservation Offices and Indian tribes; and

WHEREAS, OSMRE has determined that the Project approvals constitute an "Undertaking" as defined at 36 CFR § 800.16(y) and that the operation and maintenance of the Project components may have an adverse effect on properties listed in or eligible for listing in the NRHP, and OSMRE has consulted with the Navajo Nation Tribal Historic Preservation Officer (NNTHPO), Hopi Cultural Preservation Office (HCPO), Zia Pueblo, New Mexico and Arizona State Historic Preservation Officers (SHPOs), BLM, NPS, EPA, BIA, and the ACHP for the Project, pursuant to 36 CFR Part 800; and

WHEREAS, OSMRE, in consultation with the NNTHPO, HCPO, Zia Pueblo, New Mexico SHPO, Arizona SHPO, BLM, NPS, EPA, BIA, and the ACHP, has determined that an Agreement is appropriate to govern the implementation of the Undertaking because all effects of the Undertaking on historic properties cannot be known prior to the approval of the Project and there is the potential to encounter unanticipated historic properties during the life of the Project, and thus final identification and evaluation of certain historic properties may be deferred to a later point in time as provided for in this Agreement; and

WHEREAS, pursuant to 36 CFR § 800.14(b), OSMRE has elected to execute two Agreements for the FCPP and the Project (one for the Navajo Mine and one for the FCPP, ancillary facilities, and Transmission Lines), given the different aspects of the Undertaking, the jurisdiction of various federal agencies, and the separate Project Proponents and their respective responsibilities; and

WHEREAS, OSMRE intends to amend the existing Agreement for the Navajo Mine and has prepared this Agreement to address the FCPP, ancillary facilities, and Transmission Lines, and associated responsibilities related to continued operation of those facilities ("FCPP Programmatic Agreement" or "Agreement"); and

WHEREAS, OSMRE, in consultation with the NNTHPO, HCPO, Zia Pueblo, New Mexico SHPO, Arizona SHPO, BLM, NPS, EPA, BIA, and the ACHP, has determined and documented the FCPP, ancillary facilities, and Transmission Lines Project Area of Potential Effect (APE) as depicted in Attachment A including:

- All areas within the power plant lease and ROW boundaries, including proposed new ash disposal areas, as well as Morgan Lake and the existing lease areas or corridors for a water pipeline from the power plant area to the San Juan River, the water pipeline access road from the pumping plant to Morgan Lake, a pumping plant on the southern side of the San Juan River, a 69-kV Transmission Line from the power plant to the pumping station, County Road 6675 from the FCPP to the San Juan River, and
- The four existing Transmission Line ROW corridors, including PNM FCPP to West Mesa FW 345-kV (100-foot ROW), PNM FCPP to San Juan Generating Station FC 345-kV (100-foot ROW), APS FCPP to Cholla 345-kV (315-foot ROW for approximately 96 miles and two separate 195-foot corridors for approximately 40 miles), APS FCPP to El Dorado 500-kV (225-foot ROW and expanded to 328 feet (100 meters) on either side of the ROW on the Hopi Indian Reservation), the Moenkopi switchyard, and other ancillary facilities; and

WHEREAS, OSMRE has determined that federal actions associated with APS's lease extensions and renewal of plant site and Transmission Line ROWs are part of the Undertaking, and that APS will have continuing obligations with respect to operation and maintenance of these existing facilities and under this Agreement, and OSMRE has therefore invited APS to be an Invited Signatory to this Agreement; and

WHEREAS, OSMRE has determined that federal actions associated with PNM's renewal of Transmission Line ROWs are part of the Undertaking, and that PNM will have continuing obligations with respect to operation and maintenance of these existing facilities and under this PA, and OSMRE has therefore invited PNM to be an Invited Signatory to this Agreement; and

WHEREAS, the FCPP and associated APS ancillary facilities and Transmission Lines are located on Navajo Indian Reservation lands held in trust by the United States and allotment(s) within the exterior boundaries of the Navajo Indian Reservation owned by individual Navajo members and Hopi Indian Reservation lands held in trust by the United States; and

WHEREAS, PNM Transmission Lines are located on the Navajo Nation and Zia Pueblo lands held in trust by the United States and portions of such Transmission Lines are also located on federal lands administered by the BLM and NPS, as well as New Mexico State Trust Lands, private lands, and allotments owned by individual Navajo members within the exterior boundaries or constitute dependent Indian communities; and

WHEREAS, the BIA has determined that reauthorization of the FCPP lease and plant site ROWs and ancillary facility and Transmission Line ROWs on Indian Trust lands is a federal action and an Undertaking that requires the BIA to comply with Section 106 and 36 CFR Part 800 and the BIA Navajo Nation Region Office serving Navajo Nation, BIA Western Region Office serving Hopi Tribe, and BIA Southwest Region Office, which serves the Zia Pueblo, are therefore Signatories to this Agreement; and

WHEREAS, the NNTHPO performs selected historic preservation functions for the BIA pursuant to the Indian Self-Determination and Education Assistance Act (Public Law 93-638, as amended) within the Navajo Nation; and

WHEREAS, the BLM has determined that approving any Transmission Line ROW reauthorization crossing BLM lands is a federal action and part of the Undertaking that requires the BLM to comply with Section 106 of the NHPA and 36 CFR Part 800 and is therefore a Signatory to this Agreement; and

WHEREAS, the EPA Region 9 Water Division has been invited to sign this Agreement as a Signatory; and

WHEREAS, the reauthorization of the FCPP lease and plant site ROWs and ancillary facility and Transmission Line ROWs on the Navajo Indian Reservation require approval by the Navajo Nation and the tribe is therefore a Signatory to this Agreement, by and through the NNTHPO, who has assumed the responsibilities of the SHPO for Section 106 on Navajo Nation land pursuant to 36 CFR § 800.6(c); and

WHEREAS, the renewal of the Transmission Line crossing the Hopi Indian Reservation requires approval by the Hopi Tribe and the tribe is therefore a Signatory to this Agreement; and

WHEREAS, the renewal of the FW Transmission Line crossing Zia Pueblo requires approval by Zia Pueblo and the tribe is therefore a Signatory Party to this Agreement; and

WHEREAS, the renewal of the FW Transmission Line crossing New Mexico State Trust Lands is a connected action and a state action under the jurisdiction of the New Mexico State Land Office (NM SLO). OSMRE has consulted with and invited the NM SLO to sign this Agreement as an Invited Signatory; and

WHEREAS, NPS has assumed a pre-existing, perpetual ROW for the PNM FCPP to West Mesa FW 345-kV Transmission Line crossing the Petroglyph National Monument, and has been invited to sign this Agreement as a Signatory; and

WHEREAS, PNM's FCPP to West Mesa FW 345-kV Transmission Line and FCPP to San Juan Generating Station FC 345-kV Transmission Line cross New Mexico State Trust and private lands and the New Mexico SHPO is charged with responsibilities to preserve, protect, and enhance the prehistoric, historic, and cultural heritage of New Mexico for the benefit of present and future generations under the New Mexico Cultural Properties Act § 18-6-1 et seq., New Mexico Statutes Annotated (NMSA) 1978; the New Mexico Prehistoric and Historic Sites Protection Act § 18-8-1 et seq., NMSA 1978; and the New Mexico Cultural Properties Protection Act § 18-6A-1, et seq., NMSA 1978, and is therefore a Signatory to this Agreement; and

WHEREAS, OSMRE has made diligent efforts to involve the public, property owners, and other interested parties early in the federal decision-making process by notifying them of the Project and its impacts through the NEPA process and providing them with information on the Project and opportunities to comment, including at several public meetings, as required by the Council on Environmental Quality's regulations implementing NEPA (40 CFR § 1506.6) and the NHPA's implementing regulations (36 CFR §§ 800.2(d); 800.6(1)(4));

WHEREAS, pursuant to the Arizona State Historic Preservation Act of 1982 including Arizona Revised Statutes 41-862 through 41-864, the Arizona SHPO provides advice for the protection, preservation, and interpretation of historic properties within the State of Arizona and is therefore a Signatory to this Agreement; and

WHEREAS, OSMRE has consulted with the New Mexico SHPO and the Arizona SHPO pursuant to Section 800.6 of the regulations (36 CFR Part 800) implementing Section 106 of the NHPA (54 USC 306108) and they are Signatories to this Agreement; and

WHEREAS, pursuant to 36 CFR § 800.2(c)(2)(i)(B), the BIA must also consult with the Arizona SHPO, in addition to the Hopi Tribe, regarding undertakings occurring on or affecting historic properties on Hopi tribal lands because the Hopi Tribe has not assumed SHPO functions; and

WHEREAS, should the Hopi Tribe assume the function of the Arizona SHPO under Section 101(d)(2) of the NHPA with respect to the Hopi Indian Reservation, the roles of the Arizona SHPO will be replaced by the Hopi THPO; and

WHEREAS, OSMRE has invited the Indian tribes listed in Attachment B via letter dated September 13, 2012, to participate in consultation; and

WHEREAS, the ACHP has participated in consultation and has been invited by OSMRE under 36 CFR § 800.6(c)(2) to sign this Agreement as a Signatory; and

WHEREAS, Attachment C includes summary information on the identification, evaluation, and effect assessment updates on historic properties within the APE; and

WHEREAS, Attachment D summarizes consultation with Indian tribes and nations, SHPOs, and other agencies; and

WHEREAS, the Consulting Parties recognize that the Navajo Nation has granted APS a "covenant not to regulate" in the Navajo Nation's lease agreements with APS, including Lease Amendment #3; and

WHEREAS, a proposed draft of this Agreement has been circulated for public comment as an attachment to the draft Environmental Impact Statement for the Project, and OSMRE and Consulting Parties to this agreement have taken into consideration applicable public comments received regarding the draft Agreement in preparing this final Agreement; and

NOW, THEREFORE, OSMRE, BIA, BLM, EPA, NPS, NNTHPO, the HCPO, Zia Pueblo, New Mexico SHPO, Arizona SHPO, NM SLO, ACHP, APS, and PNM agree that the following stipulations and procedures will be implemented to take into account the effect of the Undertaking on historic properties and to satisfy all responsibilities under Section 106 of the NHPA.

STIPULATIONS

Stipulation I. Definitions

The definitions found at 36 CFR § 800.16 apply throughout this Agreement except where another definition is provided in Attachment E.

Stipulation II. Standards

1. Identification and evaluation studies and treatment measures required under the terms of this Agreement will be carried out by or performed under the direct on-site supervision of a professional(s) who meets, at a minimum, the Secretary of the Interior's Historic Preservation Professional Qualification Standards (48 *Federal Register* 44716, September 29, 1983).
2. In addition, on all state land in New Mexico, all activities and documentation concerning cultural resources shall be carried out under the appropriate permit and by or under the direct supervision of individuals who are listed on the SHPO Directory of Qualified Supervisory Personnel in the appropriate discipline.
3. In developing scopes of work for identification and evaluation, studies, and treatment measures required under the terms of this Agreement, APS and PNM will take into account the regulations and guidelines listed in Attachment F, as applicable. OSMRE, BIA, and appropriate consulting parties (as defined in Attachment E) based on their jurisdiction will review any scopes of work developed by APS and/or PNM for the identification, evaluation, study, and treatment of historic properties.

Stipulation III. Confidentiality

The distribution of sensitive information about the locations and nature of inventoried historic properties and properties of religious and cultural significance to Indian tribes, including information provided by Indian tribes to assist in the identification of such properties, shall be limited as provided for by Section 304 of NHPA (54 USC 307103), Section 9 of the ARPA (16 USC 470hh) and its implementing regulations (43 CFR § 7.18), Navajo Nation Cultural Resources Protection Act (CRPA), the Navajo Nation Privacy Act at 2 Navajo Nation Code (NNC) Section 85, and SMCRA (Public Law 95-87), as applicable, in addition to other applicable laws. Pursuant to this stipulation, the Consulting Parties agree to appropriately safeguard and control the distribution of any confidential information they may receive as a result of their participation in this Agreement. Such safeguarded information is exempt from disclosure under the Freedom of Information Act (5 USC 552).

Stipulation IV. Responsibilities of Federal Agencies with Land Management and Other Permitting Authorities

1. OSMRE will comply with and ensure the requirements of Section 106 and its implementing regulations (36 CFR Part 800) are met for the completion of the Section 106 activities undertaken prior to the finalization of the Agreement. On the effective date of this agreement, established in Stipulation XV, the BIA Navajo Regional Office will assume lead responsibility for the performance of the Agreement over the life of the undertaking. OSMRE will remain a Signatory to the Agreement.
2. Consultation for this Project will be coordinated through OSMRE until BIA assumes this responsibility.

Stipulation V. General Consultation Process for FCPP Site and Transmission Lines

A. Consultation

OSMRE is providing the Consulting Parties with an opportunity to provide their views on the identification and evaluation of historic properties as defined in 36 CFR § 800.16(1), including properties of religious and cultural significance to Indian tribes, and the treatment of affected historic properties, in connection with the FCPP Lease Amendment/Plant Site ROW Renewals/and Transmission Line ROW Renewals.

B. Identification and Evaluation of Historic Properties Conducted to Date

1. APS and PNM, through qualified outside cultural resources consultants, have conducted extensive inventory work for the identification of cultural resources within the APE, including archaeological, architectural/engineering, and ethnographic investigations and surveys, as of the date of this Agreement. This work was reviewed by or completed under the direction of OSMRE, in consultation with the Consulting Parties.
2. OSMRE, in consultation with the Consulting Parties, has made determinations of eligibility for listing on the NRHP for sites that were identified through the inventory work undertaken to identify cultural resources. The determinations of eligibility made to date are summarized in Attachment C to this Agreement.
3. OSMRE, in consultation with the Consulting Parties, has assessed the potential effects of the Project in accordance with 36 CFR § 800.4(d) and, where historic properties may be affected, has applied the criteria of adverse effect (as outlined in 36 CFR § 800.5) to NRHP-listed or NRHP-eligible properties located within the APE to assess whether the properties may be

adversely affected by the Undertaking consistent with the process outlined in the stipulations below.

C. Ongoing Identification and Evaluation of Historic Properties

The Consulting Parties agree that additional determinations of eligibility or effects determinations are ongoing for those resources for which OSMRE is finalizing determinations and/or that are part of current inventories listed in Attachment G to this Agreement. These additional determinations are listed as “pending” in Attachment C and will be completed as necessary prior to land-disturbing activities in those areas. The determinations will be included in the summary matrix provided in Stipulation XII. The protocols for ongoing identification and evaluation of historic properties are provided for the Navajo Nation in Stipulation VI, the Hopi Indian Reservation in Stipulation VII, and federal, state, private, and Zia Pueblo lands in Stipulation VIII.

D. Treatment of Historic Properties and Resolution of Adverse Effects

1. Whenever feasible and practicable, avoidance of adverse effects to historic properties will be the preferred treatment. Cultural resources that are unevaluated will be treated as eligible for the NRHP and will be avoided, where practicable. Any resources that cannot be avoided will be subject to the provisions of Stipulation V(E) below. The BIA will provide information regarding development of measures to reduce or mitigate adverse effects on historic properties to the Consulting Parties as outlined in Stipulations VI, VII, and VIII.
2. When historic properties are identified in the APE on Navajo Nation lands and allotments owned by individual Navajo members, the BIA will apply the criteria of adverse effect in accordance with 36 CFR § 800.5(a) and consult with the NNTHPO consistent with the protocols established in Stipulation VI.
3. When historic properties are identified in the APE on Hopi Tribe lands, the BIA will apply the criteria of adverse effect in accordance with 36 CFR § 800.5(a) and consult with the HCPO and Arizona SHPO consistent with the protocols established in Stipulation VII.
4. When historic properties are identified in the APE on Zia Pueblo lands, the BIA will apply the criteria of adverse effect in accordance with 36 CFR § 800.5(a) and consult with the Zia Pueblo and New Mexico SHPO consistent with the protocols established in Stipulation VIII.
5. When historic properties are identified in the APE on federal, State Trust, or private lands, the BIA will apply the criteria of adverse effect in accordance with 36 CFR § 800.5(a) and consult with the applicable federal land manager

(BLM or NPS) and New Mexico SHPO consistent with the protocols established in Stipulation VIII.

6. The New Mexico SHPO will be consulted when determining effects for any properties within the State of New Mexico excluding Navajo Nation lands and allotted lands owned by individual Navajo members.

E. Historic Properties Treatment Plan(s)

Historic Properties Treatment Plan(s) will be developed, consistent with Stipulations VI, VII, and VIII, to set forth the appropriate process for treatment of historic properties that may be adversely affected by activities covered by this Agreement within the APE, with specific consideration for both the type of historic property and the relevant jurisdiction. The nature of the treatment may vary for the various types of affected historic properties, and separate Historic Properties Treatment Plans may be developed for different portions of the APE or for different types of historic properties. Emergencies will be handled as set forth in Stipulations VI, VII, and VIII.

Historic Properties Treatment Plan(s) shall:

1. Take into account any applicable federal, tribal, and/or state standards for the treatment of historic properties;
2. Describe the properties to be affected by the Undertaking and the nature of those effects;
3. Identify the significant values of the properties within relevant historic contexts and describe how those values would be affected;
4. Specify any measures to avoid, reduce, or mitigate adverse effects on those significant values; and
5. List methods and procedures for addressing any human remains and cultural objects, consistent with Stipulation X and Attachment H.

The Historic Properties Treatment Plan(s) shall include the following topics for the treatment of adverse effects to historic properties:

1. A summary of previous research and findings;
2. A description of the historic property and its significance in relation to the NRHP;
3. Short-term and long-term strategies for the protection of the historic property that are appropriate to the resource type;
4. Mitigation measures based on resource type, including but not limited to data recovery, interpretive materials, Historic American Building Survey/Historic American Engineering Record (HABS/HAER) or agreed-upon equivalent, relocation, and/or consideration of loss of use or access;

5. Schedule to complete mitigation; and
6. Strategies for distributing and/or archiving collected information, as appropriate, consistent with curation procedures in Stipulation XI.
7. Schedule for completion of reports.

Potential adverse effects on historic properties include (33 CFR § 800.5(a)(2)):

- Physical destruction of or damage to all or part of the property;
- Removal of the property from its historical location;
- Change of character within the property's setting;
- Introduction of visual, atmospheric, or audible elements that diminish integrity; or
- Neglect of a property that causes its deterioration.

The Historic Properties Treatment Plan(s) will be developed, reviewed, and finalized consistent with the processes outlined in Stipulations VI, VII, and VIII.

Stipulation VI. Navajo Protocols for the APE on Navajo Lands and Allotments Owned by Individual Navajo Members

A. Coordination with the BIA and Navajo Nation THPO

The BIA Navajo Regional Office and the Navajo Nation have entered into a contract pursuant to the Indian Self-determination and Education Act (Public Law 93-638, as amended) under which the Navajo Nation Historic Preservation Department (HPD) performs selected historic preservation functions for the BIA. Pursuant to that contract, the NNTHPO makes recommendations to the BIA regarding determinations of eligibility and determinations of effects and any necessary measures that may be needed to avoid, mitigate, or minimize effects of an undertaking on historic properties within the Navajo Indian Reservation to satisfy historic preservation responsibilities and to facilitate the BIA's compliance with its Section 106 responsibilities.

The NNTHPO will oversee the identification by the Proponent or its contractor and complete evaluations of historic properties within APEs under the jurisdiction of the Navajo Nation and on allotments owned by individual Navajo members, and make recommendations to the BIA on the assessment of effects and resolution of any adverse effects to those historic properties (including appropriate treatment measures) consistent with the terms of this Agreement and in accordance with Navajo Nation policies, procedures, and guidelines for the preservation and protection of cultural resources; traditional cultural properties (TCPs); cemeteries, gravesites, and human remains; and historic, modern, and contemporary abandoned sites, as appropriate.

The BIA will review the information provided by the NNTHPO, consult with the NNTHPO under Section 106, and make final determinations regarding the identification and evaluation of historic properties and resolution of adverse effects.

B. Operation and Maintenance

1. Procedures that have been Determined not to Affect Historic Properties

The Consulting Parties agree that most activities related to operation and maintenance of the FCPP, ancillary facilities, and both APS's and PNM's Transmission Lines are not likely to affect historic properties. In general, these activities occur largely on the surface in areas that are already disturbed, do not introduce new structural or visual elements, and require only nominal ground disturbance or alterations to existing structures. Therefore, the Consulting Parties agree that the following Project operations and maintenance activities will not affect historic properties and are exempt from further review/consultation:

a) Aerial Maintenance and Non-Earth-Disturbing Operation and Maintenance Activities

The Consulting Parties agree that routine aerial maintenance and non-earth-disturbing activities will not affect historic properties. When the routine maintenance consists solely of aerial maintenance or non-earth-disturbing activities, the activity does not require prior notification, review, assessments, or consultation with the NNTHPO or BIA, and no notice will be given. Additionally, no review by the Project Proponents will be required for these activities.

Examples include but are not limited to:

- Maintenance, retrofit, or replacement of above-ground electric Transmission Line structure components including insulators, hardware, cross-braces, cross-members, static cable lines, or switches, and conductors;
- Filling voids or cavities in the wood of utility poles;
- Repair, replacement, or installation of transmission pole numbers;
- Repair, replacement, or installation of pole-mounted components such as insulators, conductors, cross arms, bracing, and associated hardware;
- Transmission and distribution electric line patrols;
- Remote or manual electrical switching work, including turning electric services on or off;
- Electric line spotting;
- Vegetation management within the ROW using means that do not cause ground disturbance, including crews with chainsaws and the application of

approved herbicides by backpack-mounted sprayers or quad-mounted sprayer, which shall occur during dry conditions when through historic properties;

- Annual maintenance inspection with truck, maintenance with bucket truck, and access to ROW by dirt access road for 69-kV Transmission Line, which shall occur during dry conditions when through historic properties; and/or
- Biannual inspection and as-needed paving repairs and replacement of paving, chip sealing, relining, and Botts' dots replacements for roads.

b) Earth-Disturbing Activities in Areas of Previous Disturbance that have been Surveyed

The Consulting Parties agree that when the routine maintenance consists solely of earth-disturbing activities in areas of previous disturbance that have been surveyed, the activity does not require prior notification, review, assessments, or consultation with NNTHPO or the BIA, and no notice will be given. Additionally, no review by the Project Proponent will be required for these activities. However, if during the course of preparing for the work activity it is discovered that a known historic property exists within 50 feet of the activity, procedures for areas previously surveyed and cultural resources within 50 feet of the activity described in Stipulation VI (B)(2)(a)(ii) will be followed. If there are no known historic properties within 50 feet of the activity, no further review is required for these activities.

Examples of earth-disturbing activities in areas of previous disturbance include but are not limited to:

- Anchor repair and maintenance (involves digging 1 to 3 feet in diameter and up to 1 to 2 feet in depth around an existing anchor to remove wind-blown deposits and expose the anchor rod and buried guy wires);
- Road blading on existing, previously bladed access roads;
- Erosion control work to protect the ROW from erosion in areas of previous disturbance;
- Excavations to repair or replace ground wires;
- Excavations immediately around the base of transmission poles;
- Re-grading previously established, mechanically leveled pads around transmission structures to permit safe equipment set-up;
- Work within existing fenced/walled perimeters of electric substations or switching stations;

- Remedial treatment of poles (involves disturbing approximately 1 to 2 feet in diameter and up to 3 feet in depth around the base of an existing pole to examine pole condition and possibly apply a treatment);
- Maintenance, repair, replacement, and installation of poles;
- Maintenance, repair, installation, or replacement of certain ancillary facilities including, but not limited to, gates, fences, and signs;
- Repair of existing access roads that do not traverse historic properties using in-kind materials with all work conducted within the existing footprint of the road;
- Ground patrols within the ROW with all-terrain vehicles (ATVs), provided no new trails or roadways are created;
- Application of approved herbicides by ATV-mounted sprayers on existing trails or roadways;
- Annual inspection of pipeline, concrete vaults and works, excavation of water course at end of piping to Morgan Lake, and repairs of joint to joint and pipe wall erosion.

2. Procedures for which Additional Evaluation is Required

For activities that may affect historic properties, the Project Proponent will first conduct the following internal review process, as appropriate to the activity, and in conformance with applicable standards in Stipulation II:

- Determine if the work is within the Project APE;
- If the work is within the Project APE, review existing information on historic properties (including historic properties identified in Attachment C);
- Assess the potential existence of historic properties by reviewing existing field survey and other research; and
- Determine the degree of existing disturbance by performing a field inspection, as appropriate.

a) Earth-Disturbing Activities in Non-Disturbed Areas

The Consulting Parties agree that when routine maintenance activities result in earth-disturbing activities in areas that may not have been previously disturbed, the activity is subject to the following additional processes.

(i) Area Previously Surveyed and No Cultural Resources

If the area has been previously surveyed and no cultural resources were identified, the Project Proponent will proceed with the routine maintenance. No notification or approval will be required before work begins. The Project Proponent will maintain records of activities that proceed under these circumstances for a period of six (6) years. During that time, records will be made available to the NNTHPO and the BIA.

(ii) Area Previously Surveyed and Cultural Resources Identified within 50 feet of the Activity

If the area has been previously surveyed and cultural resources were identified within 50 feet of the activity, a permitted contractor will evaluate the anticipated effect of the routine maintenance activity on the known resource prior to commencement of the activity.

No Effect. If the results of the internal evaluation process indicate that any identified cultural resources can and will be avoided, the Project Proponent will submit a Maintenance Evaluation Report via email or as hard copy within ten (10) calendar days of conducting the review to the NNTHPO and the BIA. This report will confirm that the resources can and will be avoided and the Project Proponent may proceed with the maintenance. No response or approval will be required before work begins.

Adverse Effects. If the results of the internal evaluation process indicate that cultural resources that have been determined to be NRHP-eligible will not be avoided and will be impacted, the BIA, in consultation with the NNTHPO, shall ensure the Project Proponents develop a Historic Properties Treatment Plan(s) to resolve the adverse effects of the activity. The Project Proponent will submit the Historic Properties Treatment Plan(s) via email or as hard copy to the NNTHPO and the BIA. The NNTHPO and BIA will review the Historic Properties Treatment Plan(s) and provide comments within thirty (30) calendar days. Project Proponents will address any comments provided by the BIA or NNTHPO in preparing the final Historic Properties Treatment Plan(s). If no response from the NNTHPO or BIA is received by the Project Proponent within thirty (30) calendar days, the Project Proponent must continue to contact the NNTHPO and the BIA in order to obtain an ARPA permit, as applicable.

The Project Proponent will send a copy of the final Historic Properties Treatment Plan(s) to NNTHPO and the BIA. The records documenting the internal evaluation process will be provided to the NNTHPO and the BIA by the Project Proponent within thirty (30) calendar days of their receipt.

(iii) Area has not been Previously Surveyed

A permitted contractor will conduct a survey of the area by systematically walking over the ground surface, including those areas listed in Attachment G of this Agreement, and in any areas later added to the APE in the event of future potential Project modifications including new access routes into the ROW after issuance of any ROD, provided they follow the NNTHPO permitting process, as applicable. This survey is designed to gather information about potential cultural resources prior to the commencement of the maintenance activity and will determine whether cultural resources are likely to be present. The following procedures will be implemented depending on the findings of the cultural resources survey.

Negative Survey. If the survey results indicate no cultural resources are present, the Project Proponent will submit a negative survey report via email or as hard copy within ten (10) calendar days of conducting the survey to the NNTHPO and BIA, and may proceed with the activity. No response or approval from the NNTHPO and BIA will be required before work begins.

Positive Survey. If cultural resources sites are identified during the survey, they will be recorded on applicable forms. The Project Proponent will submit a written report via email or as hard copy following applicable guidelines to the NNTHPO and BIA. The NNTHPO will review the report and provide a recommendation to the BIA on the NRHP eligibility of any newly recorded cultural resources in the APE in accordance with 36 CFR § 800.4(c), the potential effects of the Project in accordance with 36 CFR § 800.4(d), if historic properties may be affected, and the determination of any impacts of the proposed activity (as outlined in 36 CFR § 800.5) within thirty (30) calendar days of the receipt of the report. The BIA will review the NNTHPO recommendation and make a final determination of eligibility and project effects within thirty (30) calendar days. If the determination is that NRHP-eligible historic properties will not be avoided and will be impacted, the BIA, in consultation with the NNTHPO, shall ensure the Project Proponents develop a Historic Properties Treatment Plan(s) to resolve the adverse effects of the activity, following the procedure outline in Stipulations V(E) and VI(B)(2)(a)(ii), above. If no response from the NNTHPO or BIA is received by the Project Proponent within thirty (30) calendar days, the Project Proponent must continue to contact NNTHPO and BIA in order to obtain an ARPA permit, as applicable.

Attachment H (Unanticipated Discovery Procedures and Protocols) should be followed if an unanticipated discovery occurs.

b) Actions Involving Historic Buildings or Structures

The Consulting Parties agree that any adverse effect to NRHP-eligible or listed historic buildings or structures within Navajo Nation jurisdiction resulting from other actions related to the Undertaking shall be resolved through preparation of appropriate: (1) inventory; (2) evaluation of adverse effects; and (3) mitigation.

3. Emergency Maintenance and Response

A number of events can occur within the Project APE that require a rapid response in order to safeguard facilities, provide for protection of wildlife habitat, protect public and private property, and prevent serious injury or loss of human life. These include, but are not limited to: structural or mechanical failure; transmission outages due to maintenance conditions; fire; wind and electrical storms; flood; and earthquake. The emergency maintenance and response procedure is designed to be implemented if such events occur.

Emergency maintenance typically commences within 24 hours of discovery and may occur immediately with notification to the NNTHPO and BIA. When an emergency maintenance activity results in potential impacts to cultural resources, the Project Proponent will follow the expedited procedures outlined below, after the emergency work is completed.

An APS or PNM archaeologist will be notified of the need for emergency maintenance work within twenty-four (24) hours. After the emergency maintenance is conducted, the APS or PNM archaeologist will evaluate the potential impacts to cultural resources and will prepare a report that outlines the emergency work conducted, the impacts, and any proposed mitigation measures within twenty (20) calendar days. The NNTHPO and BIA will review the report within ten (10) calendar days. This provision is applicable to all emergency situations on land within Navajo Nation jurisdiction including allotments owned by individual Navajo members.

Stipulation VII. Hopi Protocols for APS Transmission Line ROW APE on Hopi Indian Reservation

A. Hopi Cultural Preservation Office Authority

The HCPO is the official branch of the Hopi tribal government that oversees cultural resources management on the Hopi Indian Reservation. The HCPO reviews and issues permits for all outside researchers and contractors seeking to conduct cultural resources work on the Hopi Indian Reservation. In addition, the HCPO has the right of first refusal to conduct any cultural resources projects, including those related to compliance with Section 106 of the NHPA, on the Hopi Indian Reservation. Therefore, the HCPO will serve as the initial contractor for APS for any work conducted on the Hopi Indian Reservation under this Agreement.

B. Coordination with the BIA, HCPO, and Arizona SHPO

BIA Western Region will oversee the identification and complete evaluations of historic properties by Project Proponents within the APE located on the Hopi Indian Reservation, assess effects, and resolve any adverse effects to those historic properties (including appropriate treatment measures) in consultation with the HCPO and Arizona SHPO consistent with the terms of this Agreement.

1. APS will convene an annual meeting with the HCPO, BIA, and Arizona SHPO to discuss anticipated activities for the coming year. At this time, an assessment will be made as to which activities may require further consultation or notification of the HCPO when they are implemented. Activities that are identified as needing no further consultation can be considered as having no potential to impact historic properties and are discussed under Stipulation VII(C)(1) for the purposes of this Agreement. APS will submit a written summary of the annual meeting to the BIA, who will distribute the summary to the HCPO and Arizona SHPO upon receipt.
2. APS will inform the BIA and HCPO immediately as new activities are added or substantial changes occur to previously discussed activities. The BIA will inform Arizona SHPO immediately. The BIA will consult with the HCPO and Arizona SHPO in regard to determination of eligibility and project effects for these new activities, as needed, following the protocols outlined in Stipulation VII(C) and 36 CFR Part 800.
3. Some information regarding historic properties, including TCPs, may be deemed sensitive and should not be released to consulting parties other than the BIA and Arizona SHPO beyond what is necessary for the specific implementation of activities covered under this Agreement. The release of sensitive information is subject to the laws listed in Stipulation III, as applicable. Any use of information regarding historic properties on the Hopi Indian Reservation other than for the purpose of implementing the activities covered under this Agreement requires consultation and concurrence by the HCPO.
4. The HCPO may request to monitor any activities occurring under this Agreement on the Hopi Indian Reservation.

C. Routine Maintenance

Routine maintenance is defined as those activities required in order to maintain existing infrastructure in a safe, operational status. It includes activities that do not result in ground disturbance and those that have the potential to cause ground disturbance.

1. Activities with No Potential to Effect Historic Properties

The Consulting Parties agree that activities that do not have the potential to affect historic properties will require no further review or consultation beyond that identified under Stipulation VII(B). APS will concurrently notify the BIA and HCPO when work crews will be conducting these activities. The BIA will notify Arizona SHPO upon receipt of notification. These types of activities include, but are not limited to, aerial maintenance and non-earth-disturbing operation and maintenance activities.

Examples of aerial maintenance include but are not limited to:

- Maintenance, retrofit, or replacement of above-ground electric Transmission Line structure components including insulators, hardware, cross-braces, cross-members, static cable lines, or switches, and conductors.

Examples of non-earth-disturbing activities include but are not limited to:

- Transmission Line patrols on existing roads,
- Repair, replacement, or installation of transmission pole numbers,
- Repair, replacement, or installation of pole-mounted components such as insulators, conductors, cross arm, bracing, and associated hardware,
- Electric line spotting,
- Vegetation management within the ROW using non-mechanical means including crews with chainsaws and the application of approved herbicides by backpack-mounted sprayers or light mechanical means including quad-mounted sprayers, during dry conditions, and
- Annual maintenance inspection with truck, maintenance with bucket truck, and access to ROW by dirt access road, during dry conditions.

Should any previously unidentified or undocumented historic properties be encountered during the performance of an activity with no potential to impact historic properties, the procedures provided in Attachment H (Unanticipated Discovery Procedures and Protocols) should be followed.

2. Activities with Potential to Effect Historic Properties

Any activity that may cause surface or subsurface ground disturbance is considered to have the potential to impact historic properties. This includes, but is not limited to:

- Repair of existing access roads, including blading, and the development of new access roads,
- Erosion control work to protect the ROW from erosion,
- Excavations to repair or replace ground wires,
- Excavations immediately around the base of transmission poles,
- Maintenance, repair, installation, or replacement of certain ancillary facilities including, but not limited to, gates, fences, and signs, or
- Vegetation management within the ROW using mechanical means, which include but are not limited to mowers.

For these types of activities, APS will first conduct an internal review process in collaboration with HCPO to determine if the activity is within the Project ROW or previously inventoried APE.

a. If the activity is within the Project ROW or previously inventoried APE, APS, in collaboration with the HCPO, will assess the potential existence of historic properties, including TCPs, through a review of existing field surveys and other information on historic properties (including historic properties identified in Attachment C). Prior to the commencement of the activity, an APS archaeologist will confirm with the HCPO the results of the findings and the presence or absence of historic properties.

(i) No Historic Properties Present

If the review process identifies that there are no historic properties present, APS will record the collaborative determination and report the activity and determination in a summarized annual comment matrix to the BIA and Arizona SHPO as specified in Stipulation XII.

(ii) Historic Properties Present

If the review process determines that historic properties are present, APS and HCPO will assess whether the planned activity will affect the historic properties present and make either of the following determinations:

- **No Historic Properties Affected**. If APS and HCPO collaboratively agree on measures that will avoid effects to historic properties, which may include adequate avoidance distance and/or the presence of an

HCPO monitor, then the activity will have a finding of no historic properties affected. When APS and HCPO implement such measures that will have no effect to historic properties, APS will record the collaborative decision and report the activity and decision in a summarized annual comment matrix to the BIA and Arizona SHPO as specified in Stipulation XII.

- **Adverse Effects**. If the results of the evaluation process indicate that cultural resources will be impacted, APS will develop a Historic Properties Treatment Plan(s) with measures to reduce or mitigate those impacts. Any cultural resource work on Hopi land will be conducted by the HCPO, pursuant to the right of first refusal in Stipulation VII(A) or by a consultant or independent researcher who is licensed to carry out the work in a manner consistent with Section 5 of Hopi Ordinance 26.

  APS will submit the Historic Properties Treatment Plan(s) to the BIA and HCPO for concurrent thirty (30) day review. The BIA will forward the Historic Properties Treatment Plan(s) to the Arizona SHPO after incorporation of HCPO review comments. The Arizona SHPO will conduct an thirty (30) calendar day review and comment period. Comments from the BIA, HCPO, and Arizona SHPO will be incorporated into the Historic Properties Treatment Plan by APS. APS shall conduct the mitigation work upon approval of the Historic Properties Treatment Plan and submit the preliminary report. Work on the planned activity can commence after the preliminary report is reviewed and commented on by the BIA, in consultation with the HCPO and Arizona SHPO.

  A Treatment Plan(s) for historic properties may include data recovery. Stipulation VII(D) outlines the development and review of a Data Recovery Plan(s) and review of findings, subject to applicable ARPA permit requirements.

b. Activities in any areas not previously inventoried, including new access routes into the ROW, and any areas added to the APE in the event of future potential Project modifications, shall be subject to Section 106 compliance consistent with the process established in this Agreement. The HCPO will be provided the first right of refusal to conduct the necessary research and identify and evaluate the historic properties. Should the HCPO decide not to conduct the work, an outside permitted contractor may be employed by APS provided the outside contractor follows the HCPO permitting process. APS will provide funding to complete any additional identification and evaluation under this section.

Preliminary technical documentation completed under this section will be provided to APS and the BIA. Upon receipt, the BIA will provide the documentation to the HCPO (if documentation is completed by an outside entity) for a concurrent thirty (30) day review period. The BIA will forward the preliminary documentation to Arizona SHPO once HCPO comments have been incorporated for a thirty (30) day review period. Once the inventory process has been completed, the procedures outlined in Stipulation VII(C) will be followed.

D. Historic Property Treatment Plan(s) for Mitigation of Adverse Effects to Archaeological Sites

1. Development of a Data Recovery Plan(s) as Treatment of Adverse Effects

Consistent with Stipulation VII(A), APS will develop a Data Recovery Plan(s), in cooperation with the HCPO, for data recovery of historic properties and archaeological sites that cannot be avoided by activities, if agreed upon by the HCPO, BIA, and Arizona SHPO. The Data Recovery Plan will be consistent with the Secretary of the Interior's Standards and Guidelines for Archaeological Documentation (48 *Federal Register* 44734-37), the ACHP's *Handbook for Treatment of Archaeological Properties*, and the ACHP's *Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites* (May 18, 1999). Data Recovery Plans will recognize the cultural values of archaeological sites and will incorporate tribal insights and resources to elucidate site context and meaning.

The Data Recovery Plan will specify:

a. The properties or portion of properties where data recovery is to be carried out. The Data Recovery Plan will also specify any property or portion of property that would be destroyed or altered without treatment along with the rationale for not treating the property or portion of property.
b. The results of previous research relevant to the Undertaking on the Hopi Indian Reservation including archaeological and ethnographic works.
c. The research questions to be addressed through data recovery, with an explanation of their relevance and importance within an appropriate tribal and historical context.
d. The field and laboratory analysis methods to be used, consistent with Stipulation VII(A), with an explanation of their relevance to the research questions. Analyses

shall incorporate information held by elders and ethnographic research in addition to standard archaeological methods.

e. The methods to be used for disseminating data to the professional community and the public, taking into account that some information may be deemed sensitive and should be protected, consistent with Stipulation III.
f. A proposed schedule for project tasks, and a schedule for the submission of draft and final reports to the Consulting Parties.
g. The proposed disposition and curation of recovered materials and records in accordance with Stipulation XI, consistent with ARPA (Section 4.b.3) and the Antiquities Act of 1906 (16 USC 432[3]).
h. A Monitoring and Discovery Plan outlining the procedures for monitoring and ensuring compliance with Attachment H and governing unexpected discoveries or newly identified properties during geotechnical investigations or construction of the Project.
i. A protocol for ensuring compliance with Attachment H, governing discovery of human remains, funerary objects, sacred ceremonial objects, or objects of cultural patrimony.

2. Review and Comment on the Data Recovery Plan(s)

a. APS or the HCPO, as appropriate, will distribute the draft Data Recovery Plan to the BIA and HCPO (if documentation is completed by an outside entity) for thirty (30) calendar day review. The BIA will submit the draft Data Recovery Plan after incorporation of HCPO comments to Arizona SHPO for thirty (30) calendar day review. All comments shall be in writing (electronic mail is acceptable) and provided to the BIA, who will forward the comments on to APS. If a response is not received during the review period, the BIA will contact the appropriate consulting parties.
b. If revisions to the Data Recovery Plan are made, APS or the HCPO will distribute the revised Data Recovery Plan to the BIA and HCPO (if documentation is completed by an outside entity) for concurrent thirty (30) calendar day review. The BIA will submit the revised Data Recovery Plan after incorporation of HCPO comments to Arizona SHPO for a thirty (30) calendar day review. All comments will be in writing (electronic mail is acceptable) and provided to the BIA, who will forward the comments onto APS. If a response is not received during the review period, the BIA will contact the appropriate consulting parties.
c. APS will provide the final Data Recovery Plan to the BIA and HCPO. The BIA will forward the final Data Recovery Plan to the Arizona SHPO.

3. Review and Comment on the Preliminary Report of Findings

a. If necessary, an in-field meeting will be held upon completion of Phase I fieldwork to apprise the BIA, HCPO, and Arizona SHPO of the methods employed and the preliminary results of the field effort. If appropriate, Phase II data recovery will begin immediately upon in-field approval by the BIA, HCPO, and Arizona SHPO of the results of Phase I fieldwork. APS shall provide a written summary via letter or email to the BIA, HCPO, and Arizona SHPO summarizing the in-field meeting.

b. Within fourteen (14) calendar days after the completion of all fieldwork, the party responsible for the work will prepare a brief Preliminary Report of Findings. This report shall contain, at a minimum:
   - A discussion of the methods and treatments applied to each property, with an assessment of the degree to which these methods and treatments followed the direction provided by the Data Recovery Plan along with a justification of all deviations, if any, from the approved Data Recovery Plan;
   - Topographic site plans for the properties depicting all features and treatment areas;
   - General description of recovered artifacts and other data classes, including features excavated or sampled; and
   - Discussion of other analyses to be conducted for the Data Recovery Report, including any proposed changes in the methods or levels of effort from those proposed in the Data Recovery Plan.

c. APS or the HCPO, as appropriate, will distribute the draft Preliminary Report of Findings to the BIA and HCPO for concurrent thirty (30) day review. The BIA will distribute the draft Preliminary Report of Findings after incorporation of HCPO comments to the Arizona SHPO for thirty (30) day review. All comments shall be in writing (electronic mail is acceptable) and provided to the BIA, who will forward the comments on to APS. If a response is not received during the review period, the BIA will contact the appropriate consulting parties.

d. If revisions to the Preliminary Report of Findings are made, APS will provide the report to the BIA and HCPO for a concurrent thirty (30) calendar day review. The BIA will forward the revised Preliminary Report of Findings after incorporation of HCPO comments to the Arizona SHPO for thirty (30) calendar day review. All comments shall be in writing (electronic mail is acceptable) and provided to the BIA, who will forward the comments on to APS. If a response is not received during the review period, the BIA will contact the appropriate consulting parties.

e. APS or the HCPO, as appropriate, shall ensure that any written comments received are taken into account during the preparation of the final document.

f. If the BIA, HCPO, or Arizona SHPO objects to any aspect of the report, the BIA shall resolve the objection according to Stipulation XIV.
g. Once the Preliminary Report of Findings has been accepted as a final document, data recovery efforts will be deemed complete and in compliance with the agreed-upon goals, and APS can commence the activity.

4. Review and Comment on Data Recovery Report

a. Within 180 calendar days of completion of data recovery, a report will be prepared incorporating all appropriate data analyses and interpretations;
b. APS or the HCPO, as appropriate, will distribute the draft Data Recovery Report to the BIA and HCPO (if documentation is completed by an outside entity) for concurrent thirty (30) calendar day review. The BIA will distribute the draft Data Recovery Report after incorporation of HCPO comments to the Arizona SHPO for thirty (30) calendar day review. All comments shall be in writing (electronic mail is acceptable) and provided to the BIA, who will forward the comments on to APS. If a response is not received during the review period, the BIA will contact the appropriate consulting parties.
c. If revisions to the Data Recovery Report are made, APS will forward the report to the BIA and HCPO for concurrent twenty (20) calendar day review. The BIA will forward the revised Data Recovery Report after incorporation of HCPO comments to the Arizona SHPO for twenty (20) calendar day review. All comments shall be in writing (electronic mail is acceptable) and provided to the BIA, who will forward the comments on to APS. If a response is not received during the review period, the BIA will contact the appropriate consulting parties.
d. APS or the HCPO, as appropriate, shall ensure that any written comments received are taken into account during the preparation of the final document.
e. If the BIA, HCPO, and Arizona SHPO continue to object to any aspect of the report, the BIA shall resolve the objection according to Stipulation XIV, governing dispute resolution.

E. Historic Property Treatment Plan(s) for Mitigation of Adverse Effects to Non-Archaeological Sites

Consistent with Stipulation VII(A), APS will develop Historic Property Treatment Plan(s), in cooperation with the HCPO, for alternative mitigation measures concerning types of historic properties that are significant due solely to cultural values (non-archaeological TCPs) when these historic properties cannot be avoided by activities. BIA, in consultation with HCPO, will consult with Arizona SHPO for concurrence on the proposed treatment plans, as specified in Stipulation VII(C)(2)(a)(ii). Treatment plans shall include any timelines for completion, reporting and subsequent commencement of the activity.

F. Emergencies

A number of events can occur within the Project APE that require a rapid response to safeguard facilities, provide for protection of wildlife habitat, protect public and private property, and prevent serious injury or loss of human life. These include, but are not limited to:

- Structural or mechanical failure;
- Transmission outages due to maintenance conditions;
- Fire;
- Wind and electrical storms;
- Flood; and
- Earthquake.

Emergency maintenance typically commences within twenty-four (24) hours of discovery. APS will notify the HCPO and BIA by email or phone with written confirmation as soon as reasonably practicable after an emergency activity. Upon receipt of this confirmation, the BIA will notify the Arizona SHPO via email and phone. APS will take all reasonable measures to conduct an expedited review for the potential presence of historic properties in the area of the emergency as outlined in Stipulation VII(C)(2) above and notify the HCPO and BIA of the results as soon as completed, where practicable.

If the emergency maintenance activity is likely to result in potential impacts to known cultural resources or if there has not been a historic properties inventory of the area, then APS will enable APS cultural program staff and HCPO staff to conduct monitoring of the emergency maintenance. APS will provide for expedited documentation of any historic properties that are encountered, where practicable. Efforts will be made to avoid or minimize impacts to any historic properties identified during the emergency maintenance activities. APS will submit a report detailing the activities that occurred during the emergency maintenance within fifteen (15) calendar days of the incident to the HCPO and BIA. If historic properties are affected, the BIA will forward the documentation after incorporation of HCPO comments to the Arizona SHPO for a fifteen (15) day review period. This provision is applicable to all emergency situations on Hopi lands.

G. Replacement of SHPO by Hopi THPO

At the current time, the Hopi Tribe has not assumed the role of the Arizona SHPO. Should that occur during the duration of this Agreement, the roles of the Arizona SHPO will be replaced by the Hopi THPO. The replacement of the Arizona SHPO by Hopi THPO would require an amendment to this Agreement pursuant to Stipulation XVII.

Stipulation VIII. Protocols for Federal, State, and Private Lands, and Zia Pueblo Lands, in APE for PNM Transmission Lines

A. Coordination with the BIA, Applicable Federal Land Manager, Zia Pueblo, NM SLO and/or New Mexico SHPO

The BIA, as lead federal agency, will coordinate with applicable federal land managers, Zia Pueblo, and the New Mexico SHPO as follows:

- The BIA Navajo Region will oversee the identification and completion of evaluations of historic properties by Project Proponents within the APE located on BLM land, assess effects, and resolve any adverse effects to those historic properties (including appropriate treatment measures) in consultation with BLM, New Mexico SHPO, and other consulting parties consistent with the terms of this Agreement.
- The BIA Navajo Region will oversee the identification and completion of evaluations of historic properties by Project Proponents within the APE located on NPS land, assess effects, and resolve any adverse effects to those historic properties (including appropriate treatment measures) in consultation with the NPS and New Mexico SHPO consistent with the terms of this Agreement.
- BIA Southwest Region will oversee the identification and complete evaluations of historic properties by Project Proponents within the APE located on Zia Pueblo land, assess effects, and resolve any adverse effects to those historic properties (including appropriate treatment measures) in consultation with Zia Pueblo and New Mexico SHPO consistent with the terms of this Agreement.
- The BIA Navajo Region will oversee the identification and completion of evaluations of historic properties by Project Proponents within the APE located on New Mexico State Trust Land, assess effects, and resolve any adverse effects to those historic properties (including appropriate treatment measures) in consultation with the NM SLO and the New Mexico SHPO consistent with the terms of this Agreement.

- The BIA Navajo Region will oversee the identification and completion of evaluations of historic properties by Project Proponents within the APE located on private property, assess effects, and resolve any adverse effects to those historic properties (including appropriate treatment measures) in consultation with the New Mexico SHPO consistent with the terms of this Agreement.

B. Operation and Maintenance

1. Procedures that have been Determined not to Affect Historic Properties

The Consulting Parties to this Agreement agree that most activities related to operation and maintenance of the Transmission Lines are not likely to affect historic properties. In general, these activities occur largely on the surface in areas that are already disturbed, do not introduce new structural or visual elements, and require only nominal ground disturbance or alterations to existing structures. Therefore, the Consulting Parties agree that the following Project operations and maintenance activities will not affect historic properties and are exempt from further review/consultation:

a) Aerial Maintenance and Non-Earth-Disturbing Operation and Maintenance Activities

The Consulting Parties agree that routine aerial maintenance and non-earth-disturbing activities will not affect historic properties. When the routine maintenance consists solely of aerial maintenance or non-earth-disturbing activities, the activity does not require prior notification, review, assessments, or consultation with federal agencies or Consulting Parties and no notice will be given. Additionally, no review by PNM will be required for these activities.

Examples include but are not limited to:

- Maintenance, retrofit, or replacement of above-ground electric Transmission Line structure components including insulators, hardware, cross-braces, cross-members, static cable lines, or switches, and conductors;
- Filling voids or cavities in the wood of utility poles;
- Transmission and distribution electric line patrols;
- Repair, replacement, or installation of transmission pole numbers;
- Repair, replacement, or installation of pole-mounted components such as insulators, conductors, cross-arm, bracing, and associated hardware;
- Transmission and distribution electric line patrols;
- Remote or manual electrical switching work, including turning electric services on or off;

- Electric line spotting;
- Vegetation management within the ROW using means that do not cause ground disturbance including crews with chainsaws and the application of approved herbicides by backpack-mounted sprayers or quad-mounted sprayers, which shall occur during dry conditions when through historic properties; and
- Annual maintenance inspection with truck, maintenance with bucket truck, and access to ROW by dirt access road, which shall occur during dry conditions when through historic properties.

b) Earth-Disturbing Activities in Areas of Previous Disturbance that have been Surveyed and have no Historic Properties within 50 Feet

The Consulting Parties agree that when the routine maintenance consists solely of earth-disturbing activities in areas of previous disturbance that have been surveyed and have had no historic properties identified within 50 feet, the activity does not require prior notification, review, assessments, or consultation with federal agencies or Consulting Parties and no notice will be given. A PNM archaeologist will review and confirm that there are no historic properties within 50 feet. If while preparing for the work activity, it is discovered that a known historic property exists within 50 feet of the activity, procedures for areas previously surveyed and containing cultural resources within 50 feet of the activity described in Stipulation VIII(B)(2)(a)(ii) will be followed. If there are no known historic properties within 50 feet of the activity, no further review is required for these activities.

Examples of earth-disturbing activities in areas of previous disturbance that have been surveyed and have had no historic properties identified within 50 feet include but are not limited to:

- Anchor repair and maintenance (involves digging 1 to 3 feet in diameter and up to 1 to 2 feet in depth around an existing anchor to remove wind-blown deposits and expose the anchor rod and buried guy wires);
- Road blading on existing, previously bladed access roads where blading would be confined to the existing road prism and erosion control work;
- Erosion control work to protect the ROW from erosion in areas of previous disturbance;
- Excavations to repair or replace ground wires;
- Excavations immediately around the base of transmission poles;
- Re-grading previously established, mechanically leveled pads around transmission structures to permit safe equipment set-up;

- Work within existing fenced/walled perimeters of electric substations or switching stations;
- Remedial treatment of poles (involves disturbing approximately 1 to 2 feet in diameter and up to 3 feet in depth around the base of an existing pole to examine pole condition and possibly apply a treatment);
- Maintenance, repair, replacement, and installation of poles;
- Maintenance, repair, installation, or replacement of certain ancillary facilities including, but not limited to, gates, fences, and signs; and/or
- Repair of existing access roads that do not traverse historic properties using in-kind materials with all work conducted within the existing footprint of the road.

c) Actions Involving Historic Buildings or Structures

The Consulting Parties agree that any adverse effect to NRHP-eligible or listed historic buildings or structures resulting from other actions related to the Undertaking shall be resolved through preparation of appropriate: (1) inventory; (2) evaluation of adverse effects; and (3) mitigation.

2. Procedures for which Additional Evaluation is Required

For activities that may affect historic properties, PNM and PNM's archaeologist will first conduct the following internal review process, as appropriate to the activity, and in conformance with applicable standards in Stipulation II:

- Determine if the work is within the Project APE;
- If the work is within the Project APE, review existing information on historic properties (including historic properties identified in Attachment C);
- Assess the potential existence of historic properties by reviewing existing field survey and other research;
- Determine the degree of existing disturbance by performing a field inspection as appropriate and then follow Stipulation VIII(B)(2)(a) as appropriate.

a) Earth-Disturbing Activities in Non-Disturbed Areas

The Consulting Parties agree that when the routine maintenance activities result in earth-disturbing activities in areas that may have not been previously disturbed, the activity is subject to the following additional processes:

(i) Area Previously Surveyed and Found to have No Historic Properties

If the area has been previously surveyed and no historic properties have been identified, PNM will proceed with the routine maintenance. No notification or approval will be required before work begins. PNM will maintain records of activities that proceed under these circumstances for a period of three (3) years. During that time, records will be made available to the BIA and Consulting Parties.

(ii) Area Previously Surveyed and Containing Cultural Resources within 50 Feet of the Activity

If the area has been previously surveyed and cultural resources have been identified within 50 feet of the activity, a permitted cultural resources contractor will evaluate the anticipated effect of the routine maintenance activity on the known resource prior to commencement of the activity in consultation with the BIA.

No Historic Properties Affected. If the results of the internal evaluation process indicate that any identified cultural resources can and will be avoided, PNM will submit a Maintenance Evaluation Report via email or as hard copy to the BIA and Consulting Parties. This report will confirm that the resources can and will be avoided and PNM may proceed with the activity. No response or approval will be required before work begins.

No Adverse Effect. If the results of the internal evaluation process indicate that identified cultural resources exist in the activity area, but adverse effects can be avoided, PNM will submit a Maintenance Evaluation Report via email or as a hard copy to the BIA and the applicable federal land manager and New Mexico SHPO for federal lands or New Mexico State Trust Lands for a thirty (30) calendar day review and comment period. Work on the planned activity can commence after review and concurrence with the No Adverse Effect determination. If no response from the applicable federal land manager, the New Mexico SHPO or the BIA is received by PNM within thirty (30) calendar days, PNM may proceed with the activity.

Adverse Effects. If the results of the internal evaluation process indicate that cultural resources will be impacted, PNM will submit a Historic Properties Treatment Plan(s) via email or as hard copy to the BIA and the applicable federal land manager and New Mexico SHPO for federal lands or New Mexico State Trust Lands for a thirty (30) calendar day review and comment period. Work on the planned activity can commence after review and written approval of the Historic Properties Treatment Plan by the BIA, in consultation with the applicable federal land manager and New Mexico SHPO, and after the plan's execution by PNM. If treatment entails avoidance and no response from the applicable federal land manager and/or New Mexico SHPO and/or the BIA is received by PNM within thirty (30) calendar days, PNM may proceed with the activity provided PNM follows the resource management recommendations outlined in the Historic Properties Treatment Plan(s).

(iii) Area has not been Previously Surveyed

A permitted cultural resources contractor will conduct a survey of the area by systematically walking over the ground surface, including those areas listed in Attachment G of this Agreement, and in any areas later added to the APE in the event of future potential modifications after issuance of any ROD including new access into the ROW, provided the agency permitting processes are followed. This survey is designed to gather information about potential cultural resources prior to the commencement of the maintenance activity and will determine whether cultural resources are likely to be present. The following procedures will be implemented depending on the findings of the cultural resources survey:

Negative Survey. If the survey results indicate no cultural resources are present, PNM will submit a negative survey report via email or as hard copy within ten (10) calendar days of conducting the survey to the BIA. The BIA will review and submit the report to the applicable federal land manager and New Mexico SHPO for federal lands or New Mexico SHPO for New Mexico State Trust Lands for an expedited 15 calendar day review and comment period. Work may commence upon written authorization by BIA, in consultation with the applicable federal land manager and New Mexico SHPO. In the event that no response is received from the BIA after 15 days, PNM may assume that the BIA concurs with the survey results and proceed with the activity.

Positive Survey. If cultural resources are identified during the survey, they will be recorded on applicable forms. PNM will submit a written report via email or as hard copy, following applicable guidelines, to the BIA and the applicable federal land manager for federal lands for review. The BIA will send the report to the New Mexico SHPO for a thirty (30) calendar day review and comment period. The BIA, in consultation with the applicable federal land manager and New Mexico SHPO, will determine the NRHP eligibility of any newly recorded cultural resources in the APE in accordance with 36 CFR § 800.4 (c), the potential effects of the activity in accordance with 36 CFR § 800.4 (d), where historic properties may be affected, and the determinations of any impacts of the proposed activity (as outlined in 36 CFR § 800.5) within thirty (30) calendar days of receipt of the report. The BIA, in consultation with applicable federal land manager and New Mexico SHPO, will also decide any necessary mitigation measures, the implementation of which will be required prior to work proceeding at the activity location. The Project Proponent may proceed with the activity upon written approval by BIA, in consultation with the federal land manager and New Mexico SHPO. If no response from the applicable federal land manager and/or New Mexico SHPO is received within thirty (30) calendar days, PNM may proceed with the activity provided PNM follows the management recommendations outlined in the report.

C. Emergency Maintenance and Response

A number of events can occur within the Project APE that require a rapid response in order to safeguard facilities, provide for protection of wildlife habitat, protect public and private property, and prevent serious injury or loss of human life. These include, but are not limited to: structural or mechanical failure; transmission outages due to maintenance conditions; fire; wind and electrical storms; flood; and earthquake. The emergency maintenance and response procedure is designed to be implemented in the event such events occur.

Emergency maintenance typically commences within twenty-four (24) hours of discovery. After the emergency work is completed, if the activity results in impacts to cultural resources, PNM will follow the record-keeping and reporting procedures for areas previously surveyed and found to have cultural resources within 50 feet of the activity, as outlined in Stipulation VIII(B)(2)(a)(ii). PNM's archaeologist will be notified of the need for emergency maintenance work within twenty-four (24) hours.

Stipulation IX. Cultural Resources Awareness Training

APS and PNM will develop cultural resources awareness training and ensure that appropriate APS and PNM personnel complete that training. APS will consult with the BIA, NNTHPO, HCPO, and Arizona SHPO in developing the training. PNM will consult with the BIA, NNTHPO, BLM, NPS, Zia Pueblo, and New Mexico SHPO in developing the training.

Stipulation X. Unanticipated Discoveries During Operation and Maintenance of the Project

A. Unanticipated Discoveries of Archaeological Resources

1. If the discovery occurs within the Navajo Nation jurisdiction or on allotments owned by individual Navajo members, the *Navajo Nation Guidelines for Discovery Situations*, as listed in Attachment H pages H-1 through H-6, will

be followed by the NNTHPO, BIA Navajo Region, and APS or PNM, as appropriate.

2. If the discovery occurs within the Hopi Indian Reservation, guidance in Attachment H, page H-8, will be followed by the HCPO, BIA Western Region, Arizona SHPO, and APS.
3. If the discovery occurs within Zia Pueblo lands, guidance from Section 106 of the NHPA and ARPA, as listed in Attachment H pages H-10 and H-11, will be followed by the Zia Pueblo, BIA Southwest Region, New Mexico SHPO, and PNM.
4. If the discovery occurs within federal lands, guidance from Section 106 of the NHPA and ARPA, as listed in Attachment H pages H-12 and H-13, will be followed by the federal land manager, BIA, New Mexico SHPO, and PNM.
5. If the discovery occurs within New Mexico State or private lands, the New Mexico Cultural Properties Act (New Mexico Statute Part 18-6-1 through 18-6-17, as amended through 2005) and implementing regulation 4.10.8, New Mexico Administrative Code (NMAC), as listed in Attachment H pages H-15 and H-16, will be followed by the New Mexico SHPO, BIA, and PNM.

B. Unanticipated Discovery of Human Remains, Funerary Objects, Sacred Objects, or Objects of Cultural Patrimony

When an unmarked human burial or unregistered grave is encountered during operation and maintenance activities, the Project Proponent will ensure that any and all human remains, sacred objects, and objects of cultural patrimony will be treated with dignity and respect.

1. Discovery of Human Remains, Funerary Objects, and Objects of Cultural Patrimony Within the Jurisdiction of the Navajo Nation and on Allotments Owned by Individual Navajo members

   Upon discovery, APS or PNM will comply with applicable laws and regulations, including, but not limited to, Navajo Nation Policy for the Protection of Jishchaa’, Navajo Nation CRPA (CMY-19-88), Navajo Nation Policy for the Disposition of Cultural Resource Collections, and Navajo Nation Guidelines for Discovery Situations, as summarized in Attachment H pages H-6 and H-7.

2. Hopi Indian Reservation

   Upon discovery, APS will comply with applicable laws and regulations including NAGPRA (25 USC 3001[3]; 43 CFR § 10), ACHP Policy

Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007), and any guidance provided by the HCPO. Policies and guidelines are provided in Attachment H page H-9.

3. Zia Pueblo Lands

Upon discovery, PNM will comply with applicable laws and regulations including NAGPRA (25 USC 3001[3]; 43 CFR § 10), ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007), and any guidance provided by the Zia Pueblo. Policies and guidelines are provided in Attachment H page H-11.

4. Federal Lands

Upon discovery, PNM will comply with applicable laws, regulations, and guidelines including NAGPRA (25 USC 3001[3]; 43 CFR § 10), and ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007). Policies and guidelines are provided in Attachment H page H-13 and H-14.

5. New Mexico State or Private Lands

Upon discovery, PNM will comply with the New Mexico Cultural Properties Act (N.M. Stat. Part 18-6-11.2, as amended through 2005) and implementing regulation 4.10.11, NMAC. The ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007) shall also be followed. Policies and guidelines are provided in Attachment H pages H-16 and H-17.

Stipulation XI. Curation

1. The BLM and NPS may curate any artifacts, materials, and records resulting from archaeological identification and mitigation conducted on federal lands under their jurisdiction in accordance with 36 CFR Part 79 and NAGPRA (25 USC 3001[3]; 43 CFR Part 10). Human remains and associated funerary objects shall not be curated.
2. On land controlled or owned by the BLM and NPS, those agencies will determine the disposition of human burials, human remains, and funerary objects in accordance with applicable federal law and in consultation with affected tribes and New Mexico SHPO, if discovery is within an archaeological site.

3. Any artifacts, materials, and records recovered from BLM jurisdiction will be curated at the expense of PNM.
4. PNM will return all artifacts recovered from private lands, except human remains and associated funerary objects, to the respective landowner after analysis is complete. For collections from private lands, PNM will encourage the private landowner to donate collections to an approved curation facility. PNM shall pay all required curation fees associated with the donation.
5. All artifacts recovered from lands owned, controlled, or operated by the State of New Mexico, including associated records and documentation, shall be curated at the Museum of New Mexico, Museum of Indian Arts and Culture, at the expense of PNM.
6. On Tribal Trust Land, the tribe, as owner of the artifacts, shall determine the final deposition of the artifacts and records. Should the tribe prefer that the artifacts be curated at a museum or repository, APS or PNM, as appropriate, shall ensure these items are transported and accessioned at the selected institution.
7. On BIA lands acquired by Public Land Order 2198, which are sometimes referred to as BIA Administrative Lands, the artifacts become the property of the U.S. Government (BIA) and shall be curated in accordance with 36 CFR Part 79 at the expense of APS.
8. NNTHPO may curate any artifacts, materials, and records resulting from archaeological identification and mitigation conducted within Navajo Nation jurisdiction in accordance with applicable laws and regulations, including Navajo Nation Policy for the Protection of Jishchaa', Navajo Nation CRPA (CMY-19-88), and Navajo Nation Policy for the Disposition of Cultural Resource Collections.
9. The HCPO may curate any artifacts, materials, and records resulting from archaeological identification and mitigation conducted within Hopi Indian Reservation under their jurisdiction in accordance with applicable laws and regulations at the expense of APS.
10. If the work is on Allotted Indian Land held in trust for the allottee and their heirs or otherwise subject to a restraint on alienation (Allotted Indian Land) and the owner(s) wants the artifacts, the artifacts (except for human remains, funerary objects, sacred objects, and objects of cultural patrimony) will be given to the owner(s) after a reasonable study time.
11. If the work is on Allotted Indian Land and the owner(s) wants the artifacts in order to sell them, BIA will not give the artifacts to the allotted land owner, and instead will ask the Navajo Nation as to disposition of the artifacts after any study is completed. 25 CFR § 262.8(c) gives authority to withhold artifacts if an agency believes the landowners will sell them.

12. If the work is on Allotted Indian Land and the owner(s) does not want the artifacts, the Navajo Nation will be consulted as to disposition of artifacts after study.
13. If artifacts are recovered on Allotted Indian Land that is located outside the jurisdiction of the Navajo Nation and the owner(s) does not want the artifacts, the BIA will consult with various tribes and the applicable SHPO/THPO as to the disposition after study. In New Mexico, if the tribe declines, the artifacts, materials, and records shall be curated at the Museum of Indian Arts and Culture, at the expense of APS or PNM, as appropriate.

Stipulation XII. Reporting

1. The Project Proponents will prepare a summary matrix of activities related to the Undertaking within the APE, including activities associated with identification, evaluation, mitigation, and emergency maintenance of historic properties as listed in Attachment C. The summary matrix will be completed yearly by January 25 in each year (until termination of this Agreement as outlined in Stipulation XVIII) and submitted to the BIA. The BIA will forward the summary matrix to the Consulting Parties for review and comment. Consulting Parties will have thirty (30) days to comment on the summary matrix and respond to the BIA. APS or PNM will address comments and will submit a final summary matrix to the BIA. The BIA will forward the final summary matrix to Consulting Parties.
2. APS will provide a summary matrix of all activities related to the Undertaking within the Hopi Indian Reservation for which consultation was not conducted. The summary matrix will be completed yearly by January 25 in each year (until termination of this Agreement as outlined in Stipulation XVIII) and submitted to the BIA and HCPO for concurrent thirty (30) day review. The BIA will forward the summary matrix to the Arizona SHPO for thirty (30) day review. APS will address comments and will submit a final summary matrix to the BIA and HCPO. The BIA will forward the final summary matrix to the Arizona SHPO.
3. Every two years following the execution of this Agreement until it expires or is terminated, BIA with the assistance of the Project Proponents, BLM, EPA, OSMRE, and ACHP, as necessary, will provide the SHPOs, consulting Indian tribes, and other Consulting Parties a Progress Report summarizing the work carried out pursuant to its terms. The Progress Report will be submitted by March 1 of each bi-annum. Such report will include any scheduling changes proposed, any issues encountered, and any disputes and objections received in the efforts to carry out the terms of this Agreement. The BIA will maintain and update a list of current contact information for the SHPOs, consulting

Indian tribes, and other Consulting Parties and will be distributed in each report. The Consulting Parties will have thirty (30) calendar days to review and comment on the report unless otherwise extended by the BIA. The BIA will address comments and will submit a final Progress Report to the Consulting Parties within thirty (30) calendar days of comments received.

4. Every two years, with assistance by APS and PNM, the BIA will also organize a meeting for all Consulting Parties after the comment period has ended and prior to the completion of the final report.
5. APS and PNM shall address timely comments and recommendations submitted by the BIA and other consulting parties on the Progress Report and will submit a final report. Upon acceptance by the BIA, the final report will be submitted by the BIA to the NNTHPO, HCPO, SHPOs, and other consulting parties.
6. Other reports associated with the operations and maintenance of the power plant and Transmission Lines will follow the protocols set forth in Stipulations V, VI, VII, and VIII.

Stipulation XIII. No Waiver of Rights or Obligations between APS and Navajo Nation

1. This Agreement is intended strictly to satisfy the federal agencies' Section 106 responsibilities for this Undertaking. Nothing in this Agreement shall be deemed a waiver of any rights or obligations of any Party under any existing leases or ROWs, including but not limited to the covenant not to regulate granted to APS. APS, through this Agreement, voluntarily agrees to work with the NNTHPO to determine protocols for the identification, evaluation, and treatment of historic properties that are mutually acceptable to the NNTHPO and APS, and is intended to establish a practical substitute for Navajo Nation jurisdiction.
2. The Consulting Parties agree that the acts or omissions of the Consulting Parties pursuant to this Agreement have no effect on the scope, validity, or effect of the "covenant not to regulate", and do not constitute a waiver, abandonment, forfeiture, or relinquishment of APS's rights to invoke the "covenant not to regulate" either during pendency of or upon expiration or termination of this Agreement.
3. The Consulting Parties further agree that this Agreement and any actions taken pursuant to this Agreement may not be used, or offered or entered into evidence, in any proceeding relating to the jurisdictional authority or lack of jurisdictional authority of the Navajo Nation over APS, including without limitation any proceeding concerning the scope, validity, or effect of the covenant not to regulate.

Stipulation XIV. Dispute Resolution

1. Should any Signatory or Invited Signatory to the Agreement object at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, that party shall promptly notify BIA with written notice and a recommended resolution. The BIA will consult with such party to resolve the objection within thirty (30) calendar days. If the BIA determines that such objection cannot be resolved, the BIA will:

   a. Forward all documentation relevant to the dispute, including the BIA’s proposed resolution, to the ACHP. The ACHP will provide the BIA with its advice on the resolution of the objection within thirty (30) calendar days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the BIA will prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, Signatories and Invited Signatories received within thirty (30) calendar days of BIA forwarding the documentation relevant to the dispute, and provide them with a copy of this written response. The BIA will then proceed according to its final decision.
   b. If the ACHP does not provide its advice regarding the dispute within the thirty (30) calendar day time period, the BIA is responsible for making a final decision on the dispute and proceeding accordingly. Prior to reaching such a final decision, the BIA will prepare a written response that takes into account any timely comments regarding the dispute from the Signatories, Invited Signatories, and Concurring Parties, and provide them and the ACHP with a copy of such written response.

2. Any dispute pertaining to the NRHP eligibility of historic properties or cultural resources covered by this Agreement will be addressed by the BIA per 36 CFR § 800.4(c)(2).
3. The appropriate lead federal agencies are responsible for carrying out all other actions subject to the terms of this Agreement that are not the subject of the dispute.

Stipulation XV. Effective Date

This Agreement shall take effect upon its execution and issuance of the ROD for the Project.

Stipulation XVI. Duration

1. This Agreement expires twenty-five (25) years from its effective date unless extended by written agreement of the Signatories and Invited Signatories prior to expiration.
2. One year prior to expiration of this Agreement, the BIA shall consult with the other Signatories and Invited Signatories to reconsider the terms of the Agreement and, if applicable, have the Signatories extend the term of the originally executed Agreement. Extensions are treated as amendments in accordance with Stipulation XVII. Signatories will notify the Invited Signatories and Concurring parties as to the course of action they will pursue.

Stipulation XVII. Amendment

1. Any Signatory or Invited Signatory to this Agreement may propose in writing to the other Signatories and Invited Signatories that it be amended. The Signatories and Invited Signatories will consult for no more than thirty (30) calendar days in an effort to reach agreement on an amendment. Any amendment will be effective on the date it is signed by all of the Signatories.
2. Modifications, additions or deletions to the Historic Properties Treatment Plan(s) shall not require an amendment to this Agreement.

Stipulation XVIII. Termination

1. Only Signatories and Invited Signatories may terminate this Agreement in its entirety. If any Signatory or Invited Signatory to this Agreement determines that its terms will not or cannot be carried out, that party will immediately consult with the other parties to attempt to develop an amendment per Stipulation XVII. If within thirty (30) calendar days an amendment cannot be reached, any Signatory, Invited Signatory or Concurring Party may terminate its participation in the Agreement upon written notification to the other Signatories, Invited Signatories, and Concurring Parties.
2. Termination by the NNTHPO, HCPO, Zia Pueblo, or an individual SHPO shall only terminate the application of this Agreement within the jurisdiction of that party.
3. If the Agreement is terminated in its entirety, the BIA shall either seek to negotiate a memorandum of agreement under 36 CFR § 800.6(c) or request, take into account, and respond to the comments of the ACHP in accordance with 36 CFR § 800.7(a). Following consultation with the ACHP, the BIA will notify the Signatories, Invited Signatories, and Concurring Parties as to the course of action it will pursue.

4. If the Agreement is terminated, each federal agency will be responsible for completion of Section 106 for any undertaking within their jurisdiction.

Stipulation XIX. Coordination with Other Federal Reviews

In the event that APS or PNM applies for federal funding or approvals and the Undertaking remains unchanged, such funding or approving agency may comply with Section 106 of the NHPA by agreeing in writing to the terms of this Agreement and notifying and consulting with the applicable federal or state agency and consulting party. Any necessary amendments will be considered in accordance with Stipulation XVII.

Stipulation XX. Scope of the Agreement

This Agreement is limited in scope to actions that will facilitate the operation and maintenance of the FCPP, ancillary facilities, and Transmission Lines and is entered into solely for the purpose of taking into account the effects of those aspects of the Undertaking on historic properties.

EXECUTION of this Agreement by OSMRE, BIA, BLM, EPA, NPS, NNTHPO, HCPO, Zia Pueblo, ACHP, New Mexico SHPO, Arizona SHPO, APS, and PNM and implementation of its terms evidence that OSMRE, BIA, BLM, EPA, and NPS have taken into account the effects of continued operations at the FCPP, associated Transmission Lines, and ancillary facilities on historic properties and afforded the ACHP an opportunity to comment.

SIGNATORY PARTY

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

By Irwin J. Barchenger Date 01/26/2015

Regional Director, Western Region

FCPP-NMEP Project: FCPP PA
OSMRE Received 26JAN2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

BUREAU OF INDIAN AFFAIRS

By ______________________ Date 2/17/2015

Sharon A. Pinto, Regional Director, Navajo Region

FCPP-NMEP Project: FCPP PA
OSMRE Received 17FEB2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

BUREAU OF INDIAN AFFAIRS

By ______________________ Date 1/7/15

Bryan Bowker, Regional Director, Western Region

FCPP-NMEP Project: FCPP PA
OSMRE Received 12 Jan 2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

BUREAU OF INDIAN AFFAIRS

By ________________________ Date 22 Jan 2015

William T. Walker, Regional Director, Southwest Region

FCPP-NMEP Project: FCPP PA
OSMRE Received 27JAN2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

NAVAJO NATION TRIBAL HISTORIC PRESERVATION OFFICER

By_______________________ Date 12-22-14

Ron Maldonado, Acting Tribal Historic Preservation Officer

FCPP NMEP Project: FCPP PA
OSMRE Received 22 DEC 2014
OSMRE Received by
Mychal Yellowman

SIGNATORY PARTY

HOPI TRIBE

By Herman G. Honanie Date 1/22/15

Herman G. Honanie, Chairman

FCPP-NMEP Project : FCPP PA
OSMRE Received 28JAN2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

PUEBLO OF ZIA

By ______________________ Date 12-19-14

David Pino, Governor

FCPP-NMEP Project: FCPP PA
OSMRE Received 19DEC2014
OSMRE Received by Jeremy Iliff
Page should read "48" but reads "51" due to table of contents page numbers added when printed

SIGNATORY PARTY

BUREAU OF LAND MANAGEMENT

By ______________________________ Date 01/09/15

for Victoria Barr, District Manager, Farmington District

FCPP-NMEP Project: FCPP PA
OSMRE Received 12JAN2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

BUREAU OF LAND MANAGEMENT

By ______________________ Date 12/23/2014

Danita Burns, District Manager, Albuquerque District

FCPP-NMEP Project: FCPP PA
OSMRE Received 24DEC2014
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

NATIONAL PARK SERVICE

By Dennis A. Vásquez Date 1/7/2015

Superintendent, Petroglyph National Monument

FCPP-NMEP Project: FCPP PA
OSMRE Received 7 JAN 2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

U.S. ENVIRONMENTAL PROTECTION AGENCY

By ______________________________ Date 1/7/2015

Jane Diamond, Director, Water Division, Pacific Southwest Office

FCPP-NMEP Project: FCPP PA
OSMRE Received 15JAN2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

By ______________________________ Date 12/23/14

Jeff Pappas, New Mexico State Historic Preservation Officer

FCPP-NMEP Project: FCPP PA
OSMRE Received 23DEC2014
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

ARIZONA STATE HISTORIC PRESERVATION OFFICER

By James W. Garrison. Date 2/2/15

James W. Garrison, Arizona State Historic Preservation Officer

FCPP-NMEP Project: FCPP PA
OSMRE Received 2FEB2015
OSMRE Received by
Jeremy Iliff

SIGNATORY PARTY

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By ____________________ Date 2/23/15

for John M. Fowler, Executive Director

FCPP-NMEP Project: FCPP PA
OSMRE Received 25FEB2015
OSMRE Received by
Jeremy Iliff

INVITED SIGNATORY PARTY

ARIZONA PUBLIC SERVICE COMPANY

By Ann C. Becker Date 1-16-2015

Ann Becker, Vice President, Environment and Sustainability

FCPP-NMEP Project: FCPP PA
OSMRE Received 18 JAN 2015
OSMRE Received by
Jeremy Iliff

INVITED SIGNATORY PARTY

PUBLIC SERVICE COMPANY OF NEW MEXICO

By Maureen Gannon Date 1/08/2015

Maureen Gannon, Executive Director, Environmental Services, PNM Resources

FCPP-NMEP Project: FCPP PA
OSMRE Received 9JAN2015
OSMRE Received by
Jeremy Iliff

INVITED SIGNATORY PARTY

NEW MEXICO STATE LAND OFFICE

By Ray Powell Date 12/29/14

Ray Powell, M.S., D.V.M., Commissioner of Public Lands

FCPP-NMEP Project: FCPP PA
OSMRE Received 29DEC2014
OSMRE Received by
Jeremy Iliff

ATTACHMENTS

Attachment A: Project Maps

Attachment B: List of Indian Tribes Invited by Lead Federal Agency to Participate in Consultation and Consultation Record

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

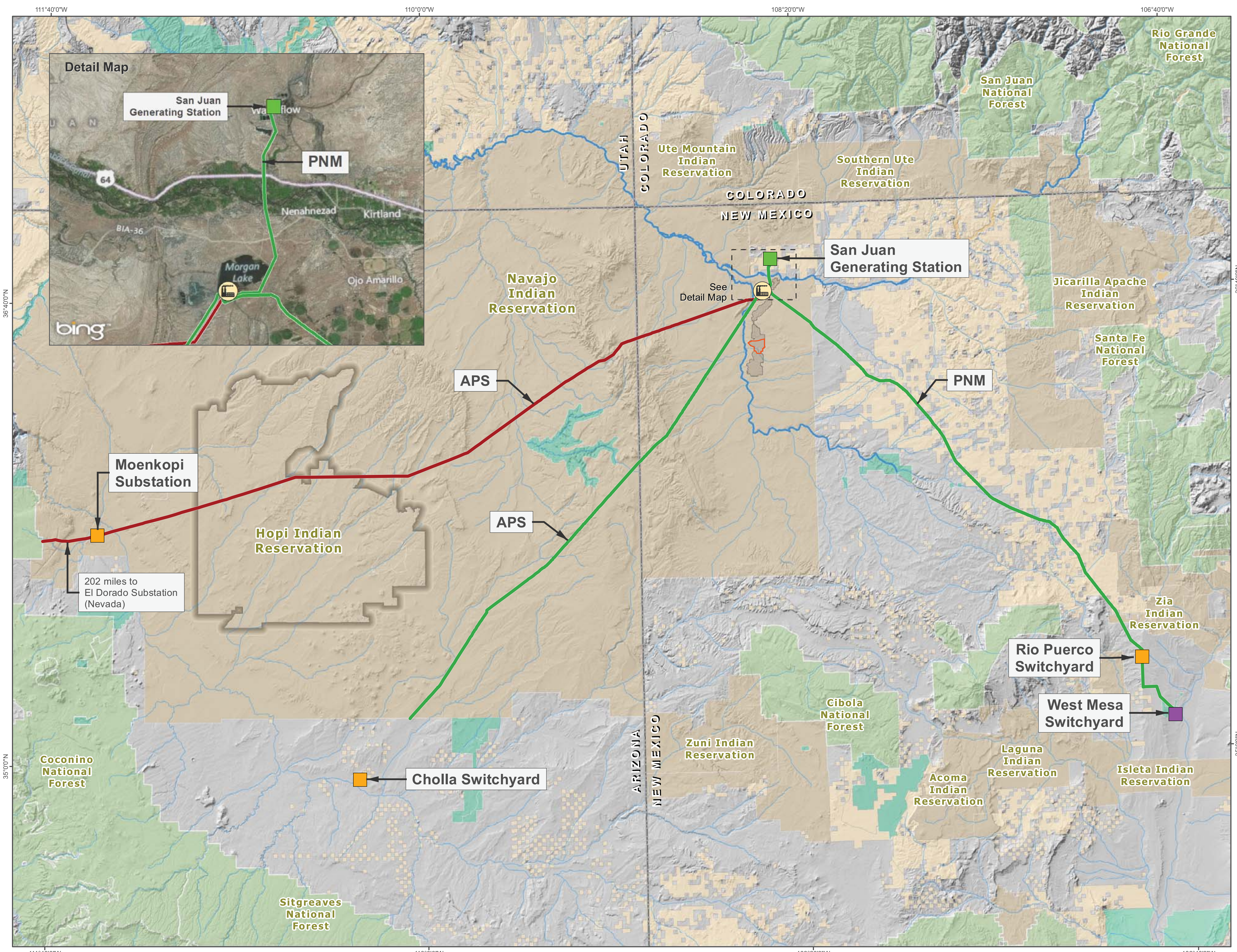
Attachment D: Agency, Consulting Tribes, and Proponent Contact List

Attachment E: Definitions

Attachment F: Regulations and Guidelines Referenced

Attachment G: List of Areas to be Surveyed under the PA

Attachment H: Unanticipated Discovery of Archaeological Materials and Human Remains: Procedures and Protocols



Four Corners Power Plant and Navajo Mine Energy Project

SECTION 106

Project Location

PROJECT FACILITIES

- Four Corners Power Plant
- Generating Station
- Substation
- Switchyard

PROJECT BOUNDARIES

- Pinabete Mine Permit Boundary
- Navajo Mine Lease Areas

TRANSMISSION LINES

- 345kV
- 500kV

FEDERAL MANAGING GROUP

- Forest Service
- Bureau of Land Management
- Fish and Wildlife Service
- National Park Service
- Bureau of Indian Affairs
- Bureau of Reclamation

Note: The FCPP to Cholla Switchyard transmission line consists of two parallel transmission lines that occupy the same right-of-way for approximately 85 miles before separating into two rights-of-way for another 40 miles and converging into a single right-of-way for 10 miles before leaving the Navajo Nation.

N

Cardno Shaping the Future

0 12.5 25 50

Scale in Miles

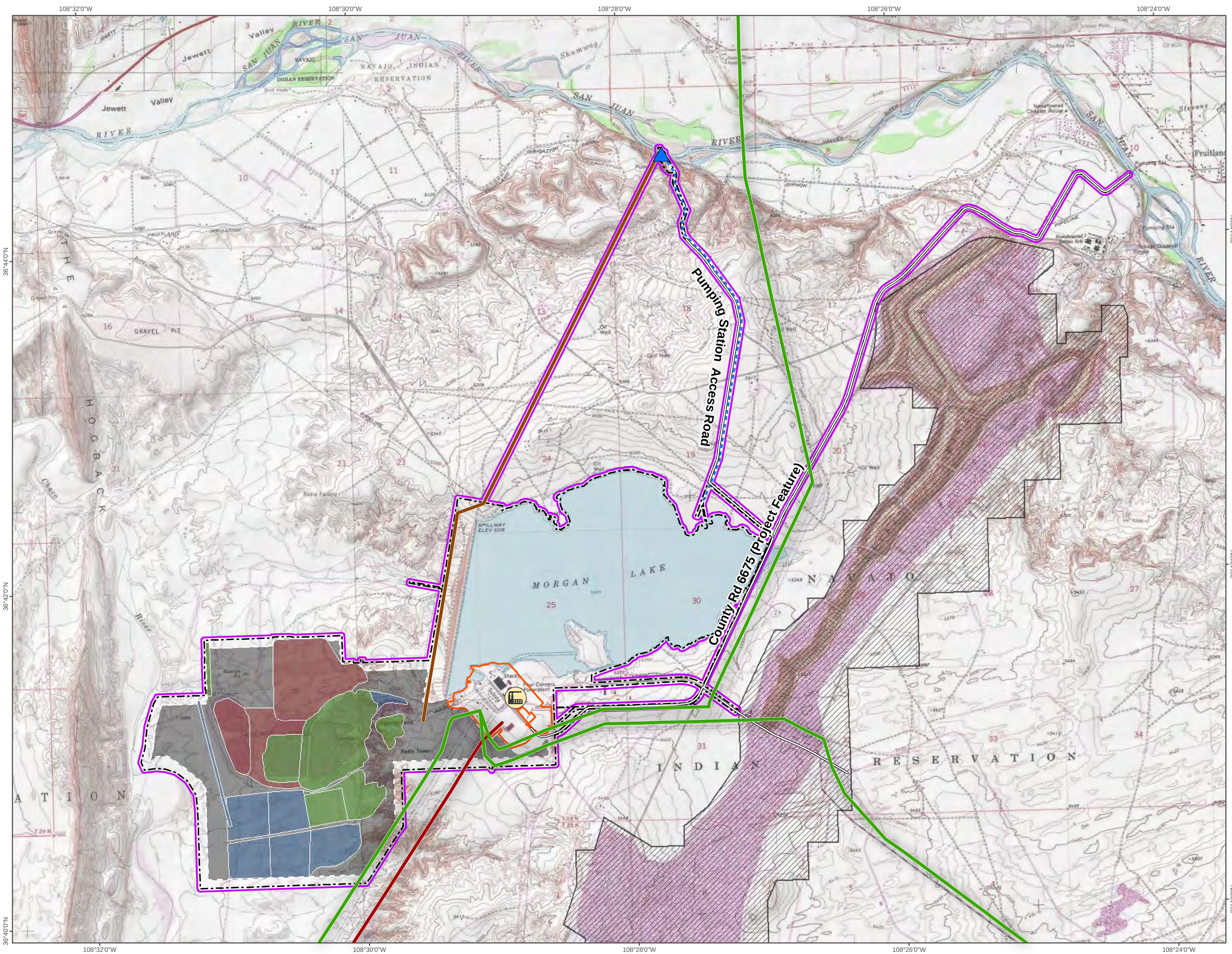


Figure 4.4-2
Area of Potential Effect
Four Corners Power Plant

PROJECT FACILITIES

Four Corners Power Plant
Pumping Station
Pumping Station Pipeline

PROJECT BOUNDARIES

Four Corners Lease Boundary
Navajo Mine Lease Area
Power Plant Fence Line

TRANSMISSION LINES

345kV
500kV
69kV - Pumping Station to Power Plant

AREAS OF POTENTIAL EFFECT

Area of Potential Effect

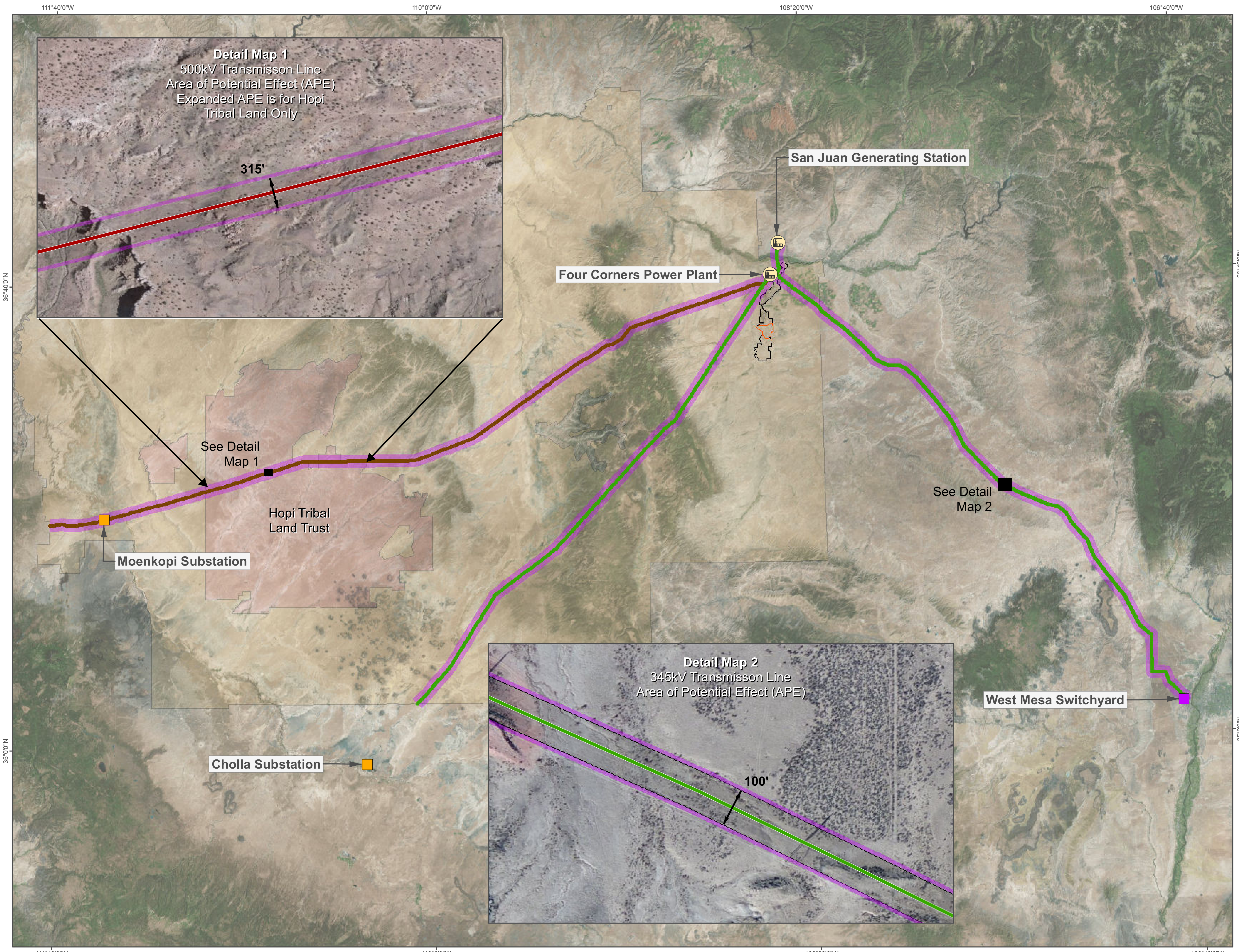
ASH FACILITIES

Existing Active Facility
Existing Inactive Facility
Future Facility
Future Ash Disturbance Area

N

0 0.25 0.5 1
Scale in Miles

Cardno ENTRIX



Four Corners Power Plant
and Navajo Mine Energy Project

SECTION 106

Area of Potential Effect
Transmission Lines

PROJECT FACILITIES

Four Corners Power Plant

Substation

Switchyard

PROJECT BOUNDARIES

Navajo Mine Lease Area

Proposed Pinabete Permit Boundary

Area of Potential Effect

TRANSMISSION LINES

345kV

500kV

OTHER FEATURES

County Boundaries

Hopi Tribal Trust Lands

Navajo Nation Tribal Trust Lands

N

Cardno ENTRIX

0 20 40

Scale in Miles

Attachment B: List of Indian Tribes Invited by Lead Federal Agency to Participate in Consultation

INDIAN TRIBES INVITED TO PARTICIPATE IN CONSULTATION	
1	Comanche Nation
2	Fort McDowell Yavapai Nation
3	Havasupai Tribe
4	Hopi Tribe
5	Hualapai Indian Tribe
6	Jicarilla Apache Nation
7	Kaibab of Paiute Indians
8	Kewa Pueblo, formerly Santo Domingo Pueblo
9	Kiowa Tribe of Oklahoma
10	Las Vegas Tribe of Paiute Indians
11	Moapa Band of Paiute Indians
12	Navajo Nation
13	Ohkay Owingeh, formerly Pueblo of San Juan
14	Paiute Indian Tribe of Utah (Cedar, Kanosh, Koosharem, Indian Peaks, and Shivwits Bands)
15	Pueblo of Acoma
16	Pueblo of Cochiti
17	Pueblo of San Ildefonso
18	Pueblo of Isleta
19	Pueblo of Jemez
20	Pueblo of Laguna
21	Pueblo of Nambe
22	Pueblo of San Felipe
23	Pueblo of Sandia
24	Pueblo of Santa Ana
25	Pueblo of Santa Clara
26	Pueblo of Tesuque
27	Pueblo of Zia
28	Ramah Navajo Chapter
29	San Carlos Apache Tribe
30	San Juan Southern Paiute Tribe of Arizona
31	Southern Ute Indian Tribe
32	Ute Mountain Tribe of the Ute Mountain Indian Reservation
33	White Mountain Apache Tribe of the Fort Apache Reservation
34	Ysleta Del Sur Pueblo
35	Zuni Pueblo

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Table C-1. Archaeological Historic Properties Identified in FCPP Area

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
NM-H-20-12	Navajo Nation	Previously recorded structural site	Anasazi	Eligible	Pending
NM-H-20-13	Navajo Nation	Previously recorded sherd and lithic scatter	Anasazi	Unevaluated	Pending
NM-H-20-14	Navajo Nation	Previously recorded artifact scatter	Anasazi	Eligible	Pending
NM-H-20-15	Navajo Nation	Previously recorded sheepherding camp	Navajo	Eligible	Pending
NM-H-20-16	Navajo Nation	Previously recorded habitation	Anasazi	Eligible	Pending
NM-H-20-17	Navajo Nation	Previously recorded feature	Anasazi	Eligible	Pending
NM-H-20-18	Navajo Nation	Previously recorded field house	Anasazi	Eligible	Pending
NM-H-20-19	Navajo Nation	Previously recorded field house	Anasazi	Eligible	Pending
NM-H-20-21	Navajo Nation	Previously recorded structural site and cairns	Anasazi/ Late Historic/ Navajo	Eligible	Pending
NM-H-20-62	Navajo Nation	Previously recorded multiple residence	Anasazi	Eligible	Pending
NM-H-20-128	Navajo Nation	Artifact scatter	Anasazi	Unevaluated	Pending
NM-H-20-152	Navajo Nation	Hogan	Navajo	Eligible	Pending
NM-H-20-154	Navajo Nation	Previously recorded multiple residence	Anasazi	Eligible	Pending
NM-H-20-155	Navajo Nation	Previously recorded residence	Anasazi	Eligible	Pending
NM-H-21-156	Navajo Nation	Previously recorded possible hearth	Unknown	Unevaluated	Pending

*Table to be updated based on ongoing consultation with NNTHPO.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-2. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW FOR APS 500-KV TO MOENKOPI SUBSTATION

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	THPO CONCURRENCE WITH OSMRE FINDINGS
AZ-I-25-121	Navajo Nation	Artifact scatter with feature	Anasazi	Eligible	Pending
AZ-I-25-124	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-38-46	Navajo Nation	Previously Recorded Habitation	Anasazi/ Navajo	Eligible	Pending
AZ-I-38-47	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-38-50	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-38-51	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-38-52	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-I-39-137	Navajo Nation	Artifact scatter	Anasazi	Unevaluated	Pending
AZ-I-39-138	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-39-139	Navajo Nation	Artifact scatter with features	Anasazi	Eligible	Pending
AZ-I-39-140	Navajo Nation	Artifact scatter with features	Navajo	Eligible	Pending
AZ-I-39-141	Navajo Nation	Artifact scatter	Basketmaker/ Navajo	Unevaluated	Pending
AZ-I-44-48	Navajo Nation	Sweat lodge with features and artifact scatter	Unknown/ Navajo	Eligible	Pending
AZ-I-44-49	Navajo Nation	Artifact scatter with features	Anasazi	Eligible	Pending
AZ-I-44-50	Navajo Nation	Artifact scatter with features	Anasazi/ Navajo	Eligible	Pending
AZ-I-44-52	Navajo Nation	Sweat lodge and artifact scatter with features	Anasazi/ Navajo	Eligible	Pending
AZ-I-44-53	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending
AZ-I-44-54	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-I-44-55	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
AZ-I-44-56	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending
AZ-I-44-58	Navajo Nation	Lithic scatter	Unknown	Unevaluated	Pending
AZ-I-44-59	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-44-60	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-44-62	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending
AZ-I-44-63	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-I-44-64	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-44-65	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-44-66	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-I-44-67	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-I-44-68	Navajo Nation	Habitation	Navajo/ Unknown	Eligible	Pending
AZ-I-45-101	Navajo Nation	Artifact scatter with features	Anasazi/ Navajo	Unevaluated	Pending
AZ-I-45-102	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-45-103	Navajo Nation	Artifact scatter with feature	Unknown	Unevaluated	Pending
AZ-I-45-104	Navajo Nation	Artifact scatter with feature	Archaic/ Anasazi	Unevaluated	Pending
AZ-I-45-105	Navajo Nation	Flaked stone quarry with features	Unknown/ Navajo	Unevaluated	Pending
AZ-I-45-106	Navajo Nation	Artifact scatter with features	Anasazi	Eligible	Pending
AZ-I-45-107	Navajo Nation	Artifact scatter	Anasazi	Unevaluated	Pending
AZ-I-51-1	Navajo Nation	Habitation	Navajo/ Anasazi	Eligible	Pending
AZ-I-52-78	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-63-66	Navajo Nation	Artifact scatter with features	Anasazi	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
AZ-I-64-67	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-I-64-68	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-J-57-100	Navajo Nation	Artifact scatter with feature	Anasazi	Unevaluated	Pending
AZ-J-57-101	Navajo Nation	Habitation and sweat lodge	Anasazi/ Navajo	Eligible	Pending
AZ-J-57-91	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-J-57-92	Navajo Nation	Artifact scatter with features	Basketmaker/ Anasazi/ Navajo	Eligible	Pending
AZ-J-57-93	Navajo Nation	Artifact scatter with features and sweat lodge	Navajo	Eligible	Pending
AZ-J-57-94	Navajo Nation	Artifact scatter with features	Anasazi/ Navajo	Eligible	Pending
AZ-J-57-95	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending
AZ-J-57-96	Navajo Nation	Artifact scatter with feature	Basketmaker/ Anasazi/ Navajo	Eligible	Pending
AZ-J-57-98	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-J-57-99	Navajo Nation	Artifact scatter with features	Navajo	Unevaluated	Pending
AZ-J-58-125	Navajo Nation	Habitation and sweat lodge	Anasazi/ Navajo/ Unknown	Eligible	Pending
AZ-J-58-126	Navajo Nation	Artifact scatter	Navajo	Unevaluated	Pending
AZ-J-58-127	Navajo Nation	Habitation and sweat lodge	Anasazi/ Navajo	Eligible	Pending
AZ-J-58-128	Navajo Nation	Habitation	Anasazi/ Navajo/ Historic	Eligible	Pending
AZ-J-58-129	Navajo Nation	Sweat lodge	Navajo/ Unknown	Eligible	Pending
AZ-J-58-130	Navajo Nation	Sweat lodge	Navajo/ Unknown	Eligible	Pending
AZ-J-58-131	Navajo Nation	Sweat lodge	Navajo/ Unknown	Eligible	Pending
AZ-J-59-107	Navajo Nation	Artifact scatter with features and sweat lodges	Anasazi/ Navajo/ protohistoric-historic	Eligible	Pending
AZ-J-59-108	Navajo Nation	Artifact scatter	Anasazi	Unevaluated	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
AZ-J-59-109	Navajo Nation	Sweat lodge	Navajo/ Unknown	Eligible	Pending
AZ-K-53-4	Navajo Nation	Previously Recorded Road	Euro-American	Eligible	Pending
AZ-M-17-1	Navajo Nation	Lithic scatter	Unknown/ Prehistoric	Unevaluated	Pending
AZ-M-17-2	Navajo Nation	Flaked stone scatter	Unknown/ Prehistoric	Unevaluated	Pending
AZ-M-17-3	Navajo Nation	Flaked stone scatter	Unknown/ Prehistoric	Unevaluated	Pending
AZ-M-17-4	Navajo Nation	Lithic scatter	Early Archaic	Unevaluated	Pending
AZ-M-17-5	Navajo Nation	Artifact scatter with features	Early Archaic/ Patayan	Eligible	Pending
AZ-M-18-1	Navajo Nation	Artifact scatter	Archaic/ Patayan	Eligible	Pending
AZ-M-18-10	Navajo Nation	Lithic scatter	Unknown/ Prehistoric	Eligible	Pending
AZ-M-18-11	Navajo Nation	Artifact scatter	Patayan	Unevaluated	Pending
AZ-M-18-12	Navajo Nation	Artifact scatter	Patayan	Unevaluated	Pending
AZ-M-18-13	Navajo Nation	Flaked stone scatter	Unknown/ Prehistoric	Unevaluated	Pending
AZ-M-18-14	Navajo Nation	Artifact scatter	Patayan	Unevaluated	Pending
AZ-M-18-2	Navajo Nation	Lithic scatter	Unknown/ Prehistoric	Eligible	Pending
AZ-M-18-5	Navajo Nation	Artifact scatter	Unknown/ Prehistoric	Eligible	Pending
AZ-M-18-6	Navajo Nation	Artifact scatter	Archaic/ Patayan	Eligible	Pending
AZ-M-18-7	Navajo Nation	Flaked stone scatter	Archaic	Unevaluated	Pending
AZ-M-18-8	Navajo Nation	Lithic scatter	Unknown/ Prehistoric	Unevaluated	Pending
AZ-M-18-9	Navajo Nation	Artifact scatter	Late Archaic/ Patayan	Eligible	Pending
AZ-M-19-2	Navajo Nation	Flaked stone scatter	Archaic	Unevaluated	Pending
AZ-M-19-3	Navajo Nation	Flaked stone scatter	Unknown	Unevaluated	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
AZ-N-11-18	Navajo Nation	Artifact scatter	Unknown	Unevaluated	Pending
AZ-N-12-47	Navajo Nation	Artifact scatter	Anasazi	Unevaluated	Pending
AZ-N-12-58	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-N-12-60	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-N-12-61	Navajo Nation	Habitation	Anasazi	Eligible	Pending
AZ-N-12-62	Navajo Nation	Artifact scatter with features	Navajo	Unevaluated	Pending
AZ-N-12-64	Navajo Nation	Flaked stone scatter with features	Unknown/ Navajo	Unevaluated	Pending
AZ-N-13-16	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-N-13-17	Navajo Nation	Artifact scatter	Cohonina	Eligible	Pending
AZ-N-14-12	Navajo Nation	Artifact scatter with feature	Unknown	Eligible	Pending
AZ-N-14-13	Navajo Nation	Sweat lodge and corral	Navajo	Eligible	Pending
AZ-N-7-1	Navajo Nation	Artifact scatter	Anasazi	Unevaluated	Pending
AZ-Z-25-1	Navajo Nation	Lithic scatter	Unknown	Unevaluated	Pending
AZ-Z-25-2	Navajo Nation	Artifact scatter	Patayan	Eligible	Pending
AZ-Z-25-3	Navajo Nation	Flaked stone scatter	Unknown	Unevaluated	Pending
AZ-Z-25-4	Navajo Nation	Flaked stone scatter	Unknown	Unevaluated	Pending
NM-H-20-146	Navajo Nation	Sherd scatter with features	Anasazi	Eligible	Pending
NM-H-20-147	Navajo Nation	Previously Recorded Chacoan Great House Community	Anasazi/Navajo	Eligible	Pending
NM-H-20-148	Navajo Nation	Habitation	Anasazi	Eligible	Pending
NM-H-20-153	Navajo Nation	Artifact scatter with features	Anasazi	Eligible	Pending
NM-H-20-77	Navajo Nation	Previous Recorded Artifact scatter with feature	Anasazi	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	THPO CONCURRENCE WITH OSMRE FINDINGS
NM-H-20-84	Navajo Nation	Previously Recorded Habitation	Navajo	Eligible	Pending
NM-H-20-90	Navajo Nation	Previously Recorded Artifact scatter with features	Anasazi	Eligible	Pending
NM-H-30-24	Navajo Nation	Artifact scatter with features	Archaic/ Anasazi/ Navajo	Unevaluated	Pending
NM-H-32-103	Navajo Nation	Habitation	Navajo	Eligible	Pending
NM-H-32-104	Navajo Nation	Rock art	Anasazi/ Navajo	Eligible	Pending
NM-H-32-105	Navajo Nation	Previously Recorded Habitation	Anasazi	Eligible	Pending
NM-I-25-122	Navajo Nation	Habitation	Navajo	Eligible	Pending
NM-I-25-123	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending

*Table to be updated based on ongoing consultation with NNTHPO.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-3. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW OF APS 500-KV TO MOENKOPI SUBSTATION ON HOPI TRIBAL LANDS

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	SHPO CONCURRENCE WITH OSMRE FINDINGS
001-2009[1]	Hopi	Habitation	Hisatsinom	Eligible	Eligible
002-2009[1]	Hopi	Habitation	Hisatsinom/ Navajo	Eligible	Eligible
003-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
004-2009[1]	Hopi	Developed spring	Hopi	Eligible	Eligible
005-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
006-2009[1]	Hopi	Hogan	Navajo	Eligible	Eligible
007-2009[1]	Hopi	Artifact scatter and feature	Navajo	Unevaluated	Pending
008-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
009-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
010-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
011-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
012-2009[1]	Hopi	Artifact scatter and feature	Hisatsinom	Eligible	Eligible
013-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
014-2009[1]	Hopi	Habitation	Hisatsinom/ Navajo	Eligible	Eligible
015-2009[1]	Hopi	Artifact scatter and feature	Hisatsinom	Eligible	Eligible
016-2009[1]	Hopi	Artifact scatter and feature	Hisatsinom	Eligible	Eligible
017-2009[1]	Hopi	Artifact scatter and feature	Basketmaker	Eligible	Eligible
018-2009[1]	Hopi	Rock art and feature	Unknown	Eligible	Eligible
019-2009[1]	Hopi	Rock art, features, and artifact scatter	Hisatsinom/ Hopi	Eligible	Eligible
020-2009[1]	Hopi	Artifact scatter and feature	Hisatsinom	Eligible	Eligible

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	SHPO Concurrence with OSMRE Findings
021-2009[1]	Hopi	Habitation	Hisatsinom	Eligible	Eligible
022-2009[1]	Hopi	Rock shelter	Hisatsinom	Eligible	Eligible
023-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
024-2009[1]	Hopi	Artifact scatter and feature	Hisatsinom	Eligible	Eligible
025-2009[1]	Hopi	Artifact scatter and habitation	Hisatsinom/ Navajo	Eligible	Eligible
026-2009[1]	Hopi	Rock art and artifact scatter	Hisatsinom	Eligible	Eligible
027-2009[1]	Hopi	Artifact scatter and feature	Hisatsinom	Eligible	Eligible
028-2009[1]	Hopi	Artifact scatter	Hisatsinom	Eligible	Eligible
029-2009[1]	Hopi	Habitation	Hisatsinom/ Navajo	Eligible	Eligible

*Table to be updated based on ongoing consultation with HCPO and Arizona SHPO.

[1] Identified in Hopkins et al. 2014 as a TCP.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-4. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW OF APS 345-KV TO CHOLLA SWITCHYARD

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	THPO CONCURRENCE WITH OSMRE FINDINGS
AZ-I-57-32	Navajo Nation	Flaked stone scatter and features	Navajo	Eligible	Pending
AZ-I-57-33	Navajo Nation	Flaked stone scatter	Unknown	Eligible	Pending
AZ-O-56-8	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-O-56-9	Navajo Nation	Artifact scatter and feature	Anasazi	Eligible	Pending
AZ-P-07-60	Navajo Nation	Previously recorded habitation	Navajo	Eligible	Pending
AZ-P-11-45	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-P-12-68	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-P-12-69	Navajo Nation	Previously recorded multiple room blocks and kivas	Anasazi	Eligible	Pending
AZ-P-20-160	Navajo Nation	Sherd scatter	Anasazi	Eligible	Pending
AZ-P-20-161	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-20-162	Navajo Nation	Artifact scatter and feature	Anasazi	Eligible	Pending
AZ-P-20-163	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-21-79	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-P-21-80	Navajo Nation	Flaked stone scatter	Unknown	Eligible	Pending
AZ-P-29-65	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-30-16	Navajo Nation	Previously recorded artifact scatter and feature	Anasazi	Eligible	Pending
AZ-P-30-45	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
AZ-P-30-46	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-30-47	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
AZ-P-30-48	Navajo Nation	Artifact scatter and feature	Anasazi	Eligible	Pending
AZ-P-30-49	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-30-50	Navajo Nation	Artifact scatter and features	Anasazi	Eligible	Pending
AZ-P-34-10	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-34-9	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-47-1	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-48-10	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-48-11	Navajo Nation	Structure	Anasazi	Eligible	Pending
AZ-P-48-7	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
AZ-P-48-8	Navajo Nation	Habitation	Navajo	Eligible	Pending
AZ-P-48-9	Navajo Nation	Habitation	Navajo	Eligible	Pending
NM-H-143	Navajo Nation	Previously Recorded Habitation	Anasazi	Eligible	Pending
NM-H-20-98	Navajo Nation	Previously recorded artifact scatter	Anasazi	Eligible	Pending
NM-H-20-99	Navajo Nation	Previously recorded artifact scatter	Anasazi	Eligible	Pending
NM-H-21-209	Navajo Nation	Bread oven	Navajo	Eligible	Pending
NM-H-29-139	Navajo Nation	Previously recorded habitation with multiple room blocks, kivas, and artifact scatter	Anasazi	Eligible	Pending
NM-H-35-20	Navajo Nation	Habitation	Navajo	Eligible	Pending
NM-H-35-21	Navajo Nation	Artifact scatter and features	Anasazi/Navajo	Eligible	Pending
NM-H-35-22	Navajo Nation	Artifact scatter and features	Anasazi	Eligible	Pending
NM-H-35-23	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
NM-H-35-24	Navajo Nation	Previously recorded artifact scatter and features	Anasazi	Eligible	Pending
NM-H-35-26	Navajo Nation	Habitation	Navajo	Eligible	Pending
NM-H-35-27	Navajo Nation	Artifact scatter and features	Anasazi/ Navajo	Eligible	Pending
NM-H-35-28	Navajo Nation	Artifact scatter and feature	Anasazi/ Navajo	Eligible	Pending
NM-H-35-29	Navajo Nation	Rock art, artifact scatter, and features	Anasazi/ Navajo	Eligible	Pending
NM-H-35-30	Navajo Nation	Artifact scatter and features	Anasazi/ Navajo	Eligible	Pending
NM-H-47-125	Navajo Nation	Previously recorded habitation and artifact scatter	Anasazi	Eligible	Pending
NM-H-47-126	Navajo Nation	Artifact scatter	Anasazi	Eligible	Pending
NM-H-47-127	Navajo Nation	Habitation	Anasazi/ Navajo	Eligible	Pending
NM-H-47-128	Navajo Nation	Previously recorded habitation	Anasazi/ Navajo	Eligible	Pending
NM-H-47-129	Navajo Nation	Artifact scatter and features	Anasazi	Eligible	Pending
NM-H-47-130	Navajo Nation	Artifact scatter and feature	Anasazi	Eligible	Pending
NM-H-47-132	Navajo Nation	Sherd scatter	Anasazi	Eligible	Pending
NM-H-47-133	Navajo Nation	Artifact scatter and features	Anasazi/ Navajo	Eligible	Pending
NM-H-47-134	Navajo Nation	Previously recorded habitation	Anasazi/ Navajo	Eligible	Pending
NM-H-47-135	Navajo Nation	Artifact scatter and feature	Anasazi/ Navajo	Eligible	Pending
NM-H-47-32	Navajo Nation	Previously recorded artifact scatter and feature	Anasazi	Eligible	Pending
NM-H-47-94	Navajo Nation	Previously recorded habitation	Anasazi/ Navajo	Eligible	Pending
NM-H-49-116	Navajo Nation	Artifact scatter and features	Anasazi/ Navajo	Eligible	Pending
NM-H-49-117	Navajo Nation	Previously recorded hogan	Navajo	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Site #	Land Ownership	Description	Affiliation	NRHP Determination by OSMRE	THPO Concurrence with OSMRE Findings
NM-H-49-2	Navajo Nation	Previously recorded flaked stone scatter	Anasazi	Eligible	Pending
NM-H-50-180	Navajo Nation	Previously recorded room block, pit house, and trash mound	Anasazi	Eligible	Pending
NM-H-50-181	Navajo Nation	Artifact scatter and feature	Navajo	Eligible	Pending
NM-H-50-182	Navajo Nation	Sweat lodge	Navajo	Eligible	Pending
NM-H-50-183	Navajo Nation	Artifact scatter	Anasazi/ Navajo	Eligible	Pending
NM-H-50-184	Navajo Nation	Previously recorded habitation	Anasazi	Eligible	Pending
NM-I-57-35	Navajo Nation	Previously recorded habitation	Unknown/ Navajo	Eligible	Pending

*Table to be updated based on ongoing consultation with NNTHPO.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-5. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FC TRANSMISSION LINE ON NAVAJO LANDS

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	THPO CONCURRENCE WITH OSMRE FINDINGS
NM-H-21-213	Navajo Nation	Residence	Navajo	Eligible	Pending
NM-H-21-214	Navajo Nation	Residence	Navajo	Eligible	Pending

*Table to be updated based on ongoing consultation with NNTHPO.

TABLE C-6. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FC TRANSMISSION LINE ON BLM, STATE, AND PRIVATE LANDS*

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	SHPO CONCURRENCE WITH OSMRE FINDINGS
LA 68213	Private (continues onto BLM and State)	Previously recorded Farmer's Mutual Ditch	Anglo	Eligible[1, 2]	Concur[1]
LA 83965	Private (continues onto BLM and Navajo)	Previously recorded Jewett Valley Ditch	Anglo/Euro-American and Navajo	Eligible[1, 2]	Concur[1]

*Table to be updated based on ongoing consultation with BLM, NM SHPO, and NNTHPO.

[1] Site previously determined eligible by SHPO.

[2] Site revisit conducted in 2012 to confirm NRHP eligibility. OSMRE consulting with SHPO and BLM for this resource.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-7. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FW TRANSMISSION LINE ON NAVAJO LANDS

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	THPO CONCURRENCE WITH OSMRE FINDINGS
NM-G-48-68	Navajo Nation	Previously recorded artifact scatter with features	Unknown	Eligible	Pending
NM-R-4-41	Navajo Nation	Previously recorded artifact scatter	Unknown	Unevaluated	Pending
NM-R-4-42	Navajo Nation	Previously recorded artifact scatter	Unknown	Unevaluated	Pending
NM-R-5-13	Navajo Nation	Previously recorded artifact scatter	Anasazi	Eligible	Pending
NM-G-50-37	Navajo Nation	Artifact scatter	Unknown	Unevaluated	Pending
NM-G-50-38 (LA 173647)	Navajo Nation and BLM	Artifact scatter	Unknown	Unevaluated	Pending
NM-G-50-39	Navajo Nation	Artifact scatter with feature	Unknown	Eligible	Pending
NM-G-51-76	Navajo Nation	Artifact scatter with features	Unknown/ Navajo	Eligible	Pending
NM-G-51-77	Navajo Nation	Artifact scatter with features	Unknown	Eligible	Pending
NM-G-62-200	Navajo Nation	Artifact scatter	Unknown	Unevaluated	Pending
NM-H-21-212	Navajo Nation	Artifact scatter with features	Anasazi	Unevaluated	Pending
NM-R-5-14	Navajo Nation	Artifact scatter	Unknown	Unevaluated	Pending
NM-R-5-15	Navajo Nation	Artifact scatter	Archaic	Unevaluated	Pending
NM-R-10-19	Navajo Nation	Multiple residences	Navajo	Eligible	Pending
NM-R-10-20	Navajo Nation	Residence	Navajo	Eligible	Pending
NM-R-11-17	Navajo Nation	Residence	Navajo	Eligible	Pending
NM-R-12-6	Navajo Nation	Residence, commercial	Navajo	Eligible	Pending
NM-R-12-7	Navajo Nation	Artifact scatter with feature	Unknown	Unevaluated	Pending

*Table to be updated based on ongoing consultation with NNTHPO.

TABLE C-8. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FW TRANSMISSION LINE ON BLM, STATE, ZIA PUEBLO, AND PRIVATE LANDS*.

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	SHPO CONCURRENCE WITH OSMRE FINDINGS
LA 9176	State	Previously recorded multiple residence	Navajo	Eligible	Concur
LA 9177	BLM	Previously recorded artifact scatter with features	Navajo	Unevaluated	Pending
LA 13943	Private	Previously recorded artifact scatter	Ancestral Pueblo	Unevaluated	Pending
LA 28997	BLM	Previously recorded artifact scatter with features	Unknown/ Navajo	Unevaluated	Pending
LA 157254	BLM	Previously recorded artifact scatter with features	Unknown/ Navajo	Eligible	Concur
LA 169527	State and BLM	Previously recorded antelope trap	Unknown/ Navajo	Eligible	Concur
LA 173639	BLM	Residence	Navajo	Not Eligible	Pending
LA 173641	BLM	Artifact scatter	Unknown	Unevaluated	Pending
LA 173642	BLM, Navajo Nation*	Artifact scatter	Unknown	Unevaluated	Pending
LA 173646	BLM	Artifact scatter with features	Ancestral Pueblo	Eligible	Concur
LA 173647	BLM and Navajo	Artifact scatter	Unknown	Unevaluated	Pending
LA 173648	BLM	Artifact scatter	Unknown	Unevaluated	Pending
LA 173649	BLM RPFO	Artifact scatter	Unknown	Unevaluated	Pending
LA 173651	BLM	Artifact scatter with features	Unknown	Unevaluated	Pending
LA 173652/ LA 173803	BLM FFO	Historic dump	Unknown/ historic	Unevaluated	Pending
LA 173653	BLM RPFO	Artifact scatter	Unknown	Unevaluated	Pending
LA 173796	Private	Artifact scatter	Unknown	Unevaluated	Pending

*Table to be updated based on ongoing consultation with BLM, New Mexico SHPO, and NNTHPO.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-9. ARCHAEOLOGICAL HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FW 345-KV RIO PUERCO TO WEST MESA.

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	SHPO CONCURRENCE WITH OSMRE FINDINGS
LA 52100[1]	Petroglyph National Monument	Previously recorded petroglyphs	Unknown	Eligible	Concur
LA 54635	Private	Previously recorded artifact scatter	Basketmaker II	Unevaluated	Pending
LA 54642	Private	Previously recorded artifact scatter	Basketmaker II/ Anasazi	Eligible	Concur
LA 54643	Private	Previously recorded artifact scatter	Ancestral Pueblo	Unevaluated	Pending
LA 111622	Private	Previously recorded artifact scatter with features	Middle to Late Archaic/ Developmental Pueblo	Eligible	Concur
LA 137833	Private	Previously recorded artifact scatter with features	Late Archaic	Eligible	Concur
LA 146431	Private	Previously recorded artifact scatter with features	Early to Late Archaic	Eligible	Concur
LA 146432	Private	Previously recorded artifact scatter	Early to Late Archaic/ Ancestral Pueblo	Eligible	Concur
LA 146435	Private	Previously recorded artifact scatter	Early to Late Archaic	Unevaluated	Pending
LA 162292	Private	Previously recorded artifact scatter	Unknown	Unevaluated	Pending
LA 175230	State Trust	Artifact scatter with features	Unknown	Eligible	Concur
LA 175232	Private	Artifact scatter	Unknown	Eligible	Concur
LA 175233	Private	Artifact scatter	Late Archaic	Eligible	Concur
LA 175234	Private	Artifact scatter with features	Unknown	Eligible	Concur

*Table to be updated based on ongoing consultation with NPS and New Mexico SHPO.

[1] Site LA 52100 includes LA 8750, at the request of Petroglyph National Monument.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-10. HISTORIC RESOURCES/IN-USE AREAS HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FC TRANSMISSION LINE.

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	THPO CONCURRENCE WITH OSMRE FINDINGS
AC HPL 1	Navajo Nation	Water Conveyance AD 1870-present	Anglo/Euro-American and Navajo	Unevaluated	Pending

*Table to be updated based on ongoing consultation with NNTHPO.

TABLE C-11. HISTORIC RESOURCES HISTORIC PROPERTIES IDENTIFIED IN ROW FOR PNM FC AND FW TRANSMISSION LINES.

SITE #	LAND OWNERSHIP	DESCRIPTION	AFFILIATION	NRHP DETERMINATION BY OSMRE	SHPO CONCURRENCE WITH OSMRE FINDINGS
LA 176088	BLM, State, Private	Structural/ transmission line	Historic/ recent	Not Eligible/Pending[1]	Pending
LA 176089	BLM, State, Private	Structural/ transmission line	Historic/ recent	Not Eligible/Pending[1]	Pending

[1] Site originally recorded as archaeological site and determined not eligible as an archaeological site. Additional recordation as historic resource forthcoming.

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

TABLE C-12. PROPERTIES OF RELIGIOUS AND CULTURAL SIGNIFICANCE (INCLUDING TCPS) IDENTIFIED IN APE ON HOPI RESERVATION.

HCPO SITE #	LAND OWNERSHIP	DESCRIPTION	NAME	NRHP DETERMINATION BY OSMRE	SHPO CONCURRENCE WITH OSMRE FINDINGS
001-2009[1]	Hopi	Ancestral habitation	N/A	Eligible	Pending
002-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
003-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
004-2009[1]	Hopi	Spring	Tuqayva Spring (Listening Spring)	Eligible	Pending
005-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
006-2009[1]	Hopi	Ancestral artifact scatter, possible historic sheepherding features or hogan foundation	N/A	Unevaluated; Additional Ethnographic Work Required (Eligible as Archaeological Site)	Pending
007-2009[1]	Hopi	Possible historic sheepherding features or hogan foundation	N/A	Unevaluated; Ethnographic Work Required (Testing also Required)	Pending
008-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
009-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
010-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
011-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
012-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending
013-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
014-2009[1]	Hopi	Ancestral artifact scatter and feature	Tawa'ovi (Place of the Sun)	Eligible	Pending
015-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending
016-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending
017-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

HCPO Site #	Land Ownership	Description	Name	NRHP Determination by OSMRE	SHPO Concurrence with OSMRE Findings
018-2009[1]	Hopi	Historic or modern petroglyphs and feature	N/A	Eligible	Pending
019-2009[1]	Hopi	Unknown, historic, or modern petroglyphs, artifact scatter, and features	N/A	Eligible	Pending
020-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending
021-2009[1]	Hopi	Ancestral habitation	N/A	Eligible	Pending
022-2009[1]	Hopi	Rock shelter	N/A	Eligible	Pending
023-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
024-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending
025-2009[1]	Hopi	Ancestral artifact scatter, trail segment, offering place, and possible historic sheepherding features	N/A	Eligible	Pending
026-2009[1]	Hopi	Ancestral habitation; petroglyphs	N/A	Eligible	Pending
027-2009[1]	Hopi	Ancestral artifact scatter and feature	N/A	Eligible	Pending
028-2009[1]	Hopi	Ancestral artifact scatter	N/A	Eligible	Pending
029-2009[1]	Hopi	Ancestral habitation	N/A	Eligible	Pending
Isolated Feature 4[2]	Hopi	Stone trail marker and offering place	N/A	Eligible	Pending
001-2014	Hopi	Ancestral habitation with stone pillars	N/A	Eligible	Pending
N/A	Hopi	Trail	Third Mesa Kìisiw Pilgrimage Route (Indian Route 22)	Eligible	Pending
N/A	Hopi	Trail	Hopi Salt Trail	Eligible	Pending
N/A	Hopi	Eagle collection site	Hotvela Piikyasngyam Eagle Collection Area	Eligible	Pending

Attachment C: Current List of National Register Eligible Properties (Historic Properties) and Unevaluated Properties within the APE (as of December 2, 2014)

HCPO Site #	Land Ownership	Description	Name	NRHP Determination by OSMRE	SHPO Concurrence with OSMRE Findings
N/A	Hopi	Eagle collection site	Hotvela Tepngyam Eagle Collection Area	Eligible	Pending
N/A	Hopi	Eagle collection site	Hotvela Kòokyangwngyam Eagle Collection Area	Eligible	Pending
N/A	Hopi	Mineral collection site	Qöya'owa	Eligible	Pending
N/A	Hopi	Mineral collection site	Sikya'owa	Eligible	Pending

[1] Identified in Laurila et al. 2011 as archaeological site.

[2] Identified in Laurila et al. 2011 as archaeological isolated feature.

Attachment D: Agency, Consulting Tribes, and Proponent Contact List

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Attachment D: Agency, Consulting Tribes, and Proponent Contact List

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Attachment D: Agency, Consulting Tribes, and Proponent Contact List

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Attachment E: Definitions

Appropriate Federal Lead Agency: This refers to OSMRE before execution of the Agreement and issuance of a Record of Decision for the Navajo Mine and refers to the BIA thereafter.

Concurring Parties: An invited Consulting Party to this Agreement that agrees with the content of the Agreement. The refusal of a concurring party to sign the Agreement does not invalidate this Agreement as noted in 36 CFR Part 800.6(c) (3). Concurring parties may not terminate the Agreement.

Consulting Parties: Parties that have consultative roles in the Section 106 process, as defined in 36 CFR Part 800.2(c). Consulting Parties include OSMRE, BIA, BLM, U.S. EPA, NPS, Navajo Nation, Hopi Tribe, Zia Pueblo, ACHP, New Mexico SHPO, Arizona SHPO, APS, and PNM.

Determination of Effect: A determination made by the lead federal agency in consultation with the SHPO/THPO, ACHP, and other consulting parties in regard to a project's effect upon a historic property as defined in 36 CFR Part 800.

Determination of Eligibility: A determination made by the lead federal agency in consultation with the SHPO/THPO and other consulting parties in regard to a cultural resource's eligibility for inclusion in the NRHP and more fully described in 36 CFR Part 60 and 36 CFR Part 800.16(1)(2).

Earth-Disturbing Activity: Work conducted by APS, PNM, or their contractors that results in any subsurface disturbance.

Effect: An alteration to the characteristics of a property qualifying it for inclusion in or eligibility for the NRHP (see 36 CFR Part 800.16 9i).

Historic Property: Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural significance to an Indian tribe or Native Hawaiian organization and that meet the NRHP criteria (see 36 CFR Part 800.16(1)(a)).

Historic Property Treatment Plan: A plan developed in consultation with the parties to this Agreement that identifies minimization and mitigation measures for historic properties located within the APE that will be adversely affected by the Project.

Invited Signatory: OSMRE has invited PNM, APS, and BIA Southwest Region Office to be signatories to this Agreement pursuant to 36 CFR Part 800.6(c) (2). Invited Signatories have the right to seek amendment or termination of the Agreement. The refusal of any invited signatory to sign the Agreement does not invalidate the Agreement.

Maintenance Evaluation Report: Report to be written by PNM or APS, as appropriate, outlining the results of the internal evaluation process for maintenance activities that require additional evaluation. The report will include management recommendations and confirm impacts to identified cultural resources. It will be submitted to the land managing agency.

Permitted Cultural Resources Contractor: An archaeologist who meets the Secretary of Interior's Professional Qualification Standards for Archaeology, as well as other professional standards set forth by the New Mexico SHPO and federal land managing agencies.

Project Proponent: For the purposes of this Agreement, Project Proponent means either APS or PNM, as appropriate.

Attachment E: Definitions

Public Land Order 2198: This was an order issued on Aug. 26, 1960, and provided for a land consolidation program to adjust Navajo Indian Land use and non-Indian use in areas outside of and in the vicinity of the Navajo Reservation in New Mexico. Much of the 2198 land was later transferred into Trust Land status per a land exchange agreement between Navajo Tribe and US Dept. of Interior BLM and the BIA, on May 1, 1991 [authorized by Indian Land Consolidation Act of 1983, Public Law 97-459 (96 Stat. 2517)]. The remaining 2198 Lands are BIA Administrative Lands.

Signatory Parties: All signatories to this Agreement, which includes OSMRE, BLM, BIA, EPA, NPS, ACHP, Navajo Nation THPO, the Hopi CPO, Zia Pueblo, and the SHPOs of New Mexico and Arizona. (Signatory parties include the federal agency[ies], SHPOs, THPOs [or designee] if the undertaking is carried out on tribal land or affects historic properties on tribal land, and also any OSMRE invited signatories [not including invited concurring parties]).

Undertaking: Any project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency (36 CFR Part 301(7)). The term Undertaking is used in this Agreement to refer to all federal permits and approvals for the Four Corners Power Plant and Navajo Mine Energy Project.

Attachment F: Regulations and Guidelines Referenced

American Indian Religious Freedom Act (ARPA; 42 USC 1996 and 1996a)

Archaeological Resources Protection Act (ARPA; 16 USC 470, 43 CFR 7)

Arizona State Historic Preservation Act of 1982 including Arizona Revised Statutes 41-862 through 41-864

BLM 8110 Manual: Identifying and Evaluating Cultural Resources

BLM H-8100-1: Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities (BLM 2005)

Hopi Ordinance 26: Ordinance for the Protection of Places and Objects of Sacred, Historical and Scientific Interest on the Hopi Reservation

Hopi Preservation procedures/guidelines

National Historic Preservation Act (NHPA; 54 USC 300101 et seq.)

National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (NPS 1990; Revised 1992; 1998)

Native American Graves Protection Act (NAGPRA; 25 USC 3001; 43 CFR 10)

Navajo Nation Cultural Resources Protection Act

Navajo Nation Policy for the Disposition of Cultural Resource Collections

New Mexico Cultural Properties Act (Section 18-6 through 18-6-23; New Mexico Statutes Annotated 1978)

New Mexico Cultural Properties Act (Section 18-6A through 18-6A-6; New Mexico Statutes Annotated 1978)

New Mexico Prehistoric and Historic Sites Preservation Act of 1989 (Sections 18-8-1 through 18-8-8; New Mexico Statutes Annotated 1978)

New Mexico Permits to Conduct Archaeological Investigations on State Land (4.10.8 NMAC)

New Mexico Issuance of Permits to Excavate Unmarked Human Burials in the State of New Mexico (4.10.11 NMAC)

New Mexico Standards for Survey and Inventory (4.10.15 NMAC)

New Mexico Standards for Excavation and Test Excavation (4.10.16 NMAC)

New Mexico Standards for Monitoring (4.10.17 NMAC)

Section 28 of the Mineral Leasing Act of 1920 (30 USC 185)

Section 106 of the NHPA (36 CFR Part 800)

The ACHP's guidance on conducting archaeology under Section 106 (2007)

Attachment F: Regulations and Guidelines Referenced

The ACHP's *Policy Statement Regarding the Treatment of Burial Sites, Human Remains and Funerary Objects* (February 23, 2007)

The Arizona Antiquities Act of 1960, including Arizona Revised Statutes 41-841 through 41-845

The Navajo Nation Policy for the Protection of Jishchaa'

The Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-42, September 29, 1983)

The Secretary of the Interior's Standards for the Rehabilitation (36 CFR 67)

The "*Treatment of Archaeological Properties*" (ACHP 1983)

Title V of the Federal Land Policy and Management Act of 1976 (43 USC 1701)

Attachment G: List of Areas to be Surveyed under the PA

TABLE G-1. AREAS NOT SURVEYED AND ADDITIONAL WORK REQUIRED AS OF DRAFT PA

PROJECT AREA	LOCATION	STATUS
FCPP	Morgan Lake, including dam and 100-foot buffer around the lake	Approval of report pending
FCPP	Pumping plant area, including 100-foot buffer around the plant	Approval of report pending
FCPP	69-kV transmission line from FCPP to pumping plant, including 100-foot corridor centered on the transmission line	Approval of report pending
FCPP	Water pipeline from San Juan River to Morgan Lake, including 100-foot corridor centered on the pipeline, and water pipeline access road from pumping plant to Morgan Lake, including 100-foot corridor centered on the road	Approval of report pending
FCPP	County Road 6675 from FCPP to San Juan River, including 150-foot corridor centered on the road	Approval of report pending

Attachment H: Unanticipated Discovery of Archaeological Materials and Human Remains: Procedures and Protocols

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Attachment H: Unanticipated Discovery of Archaeological Materials and Human Remains: Procedures and Protocols

NAVAJO NATION PROCEDURES AND PROTOCOLS

I. Unanticipated Discoveries within the Jurisdiction of the Navajo Nation and on Allotments owned by Individual Navajo Members

In the event of an unanticipated discovery within the Navajo Nation, the Navajo Nation Historic Preservation Department (HPD) Guidelines for the Treatment of Discovery Situations will be followed, as outlined below.

Protocol

A. These guidelines must be followed in any situation involving the discovery of any kind of cultural or historic property, including historical and prehistoric archaeological sites and traditional cultural properties, and human remains, whether previously identified or unknown.

B. In the event of a discovery, the project sponsor will inform the project contractor to temporarily cease work within 50 feet of the site. A 100-foot-radius avoidance zone will be maintained around discoveries containing human remains.

C. HPD will be contacted within one (1) working day at (928) 871-7147 or -7148 to arrange for proper evaluation of any discovery. The BIA Navajo Region will also be contacted within twenty-four (24) hours of the discovery via email or phone.

D. When a cultural or historic property is discovered:

   a. HPD will make a recommendation of effect and significance of the cultural or historic property(ies) by the most efficient and expeditious means and notify the BIA of these recommendations.

   b. HPD will consult with interested parties, including other Indian tribes, during development of a scope of work and will take into account comments from interested parties in developing the scope-of-work.

   c. In the event of a dispute concerning the disposition of human remains discovered on the Navajo Nation, the Navajo Nation Historic Preservation Officer will make all final decisions regarding resolution of disputes in accordance with Navajo Nation policies.

Administrative Procedures

For discovery situations where a scope-of-work has been approved:

A. HPD will define a 50-foot-radius avoidance zone around the discovery (100-foot-radius if the discovery contains human remains) to remain in effect for the duration of investigations at the site.

B. HPD will make recommendations regarding significance and eligibility for nomination to the National Register of Historic Places for each discovered property.

C. If the property is eligible, HPD will establish a schedule to complete treatment.

D. HPD will implement or direct its contractor to implement the scope-of-work at each discovery consistent with the approved scope-of-work for the undertaking.

E. The methods of excavation, recordation, conservation, analysis, preservation, storage, interviewing or consultation with knowledgeable individuals and interested parties, and reporting of discoveries shall be consistent with the scope-of-work, the general and specific methods of treatment outlined below, and stipulations of any existing memorandum of agreement or programmatic agreement applicable to the undertaking.

F. HPD will simultaneously notify the BIA and all declared interested parties upon the completion of treatment.

G. The HPD, in consultation with BIA, will wait three (3) working days after work is completed at the discovery before letting the project contractor continue work in the avoidance zone, except in cases of emergency. This period will enable consulting and interested parties to submit comments.

H. The results of the investigations at a discovery will be incorporated into the draft technical report. Confidential data resulting from the ethnographic assessment and provenience data for all cultural and historic sites will be provided in one or more detachable appendices. Confidential appendices will only be distributed to appropriate parties.

I. The contractor will finalize the technical report, incorporating or addressing comments received from HPD.

For discoveries situations where a scope-of-work has not been approved:

A. HPD will define a 50-foot-radius avoidance zone around the discovery (100-foot-radius if the discovery contains human remains) to remain in effect for the duration of investigations at the discovery.

B. HPD will make recommendations regarding significance and eligibility for nomination to the National Register of Historic Places for each discovered property.

C. If the property is eligible, HPD will establish a schedule to complete treatment.

D. HPD will direct the Project Proponent to provide a scope-of-work within five (5) working days of the request, except in cases of emergency.

E. The methods of excavation, recordation, conservation, analysis, preservation, storage, consultation, and reporting of discoveries shall be consistent with the scope-of-work, the general and specific methods of treatment outlined below, and stipulations of any existing memorandum of agreement or programmatic agreement applicable to the undertaking.

F. Upon approval of the scope-of-work by HPD, HPD will direct the Project Proponent to implement the plan.

G. HPD will simultaneously notify the BIA and all declared interested parties upon the completion of treatment.

H. HPD, in consultation with BIA, will wait three (3) working days after work is completed at the discovery before letting the project contractor continue work in the avoidance zone, except in cases of emergency.

I. The results of investigations at a discovery will be incorporated into a draft technical report. Confidential data resulting from the ethnographic assessment and provenience data for all cultural and historic sites will be provided in one or more detachable appendices. Confidential appendices will only be distributed to appropriate parties.

J. The contractor will finalize the technical report, incorporating or addressing comments received from HPD.

General Methods of Treatment

In all discovery situations the existing ground surface in the vicinity of the discovery will be mapped to show the relationship of the discovery to the project area, topographic features, cultural features, and surface artifacts. The map will be prepared using, at a minimum, a compass and measuring tape.

Archaeological Methods:

Assessment and treatment of cultural resources may be accomplished using archaeological methods. Data recovery strategies for historic properties may include in situ preservation, scientific testing and excavation, and documentation. This information will be used to develop a scope-of-work for treatment of affected properties. The plan will be implemented after approval of HPD.

The general process for treatment of archaeological components of historic properties is as follows:

1. Assessment of situation by a qualified archaeologist.
2. Development of a strategy to determine the significance of the property if significance is not explicit from visible evidence. Initiate a testing program if necessary.
3. Development of a strategy for data recovery and implementation of the plan for data recovery.

Ethnographic Methods:

Assessment and treatment of cultural resources and burials may be accomplished using ethnographic methods. Methods include conducting interviews with chapter officials, local and customary land users, and other knowledgeable individuals to elicit information regarding these surface features. This information will be used to develop a scope-of-work for treatment of affected properties. The plan will be implemented after approval of HPD.

The general process for treatment of traditional cultural properties, historical sites, and burials (not found in the context of a historic property) is as follows:

1. Assessment of situation by a qualified anthropologist and/or cultural specialist.
2. Consultation with chapter officials, local and customary land users, and other knowledgeable individuals.
3. In the case of unclaimed human remains, consultation with interested parties, including officials from other Indian tribes.
4. Development of a scope-of-work, in consultation with HPD.

5. Implementation of the scope-of-work upon approval by HPD.
6. Preparation of a technical report; confidentiality of information will be ensured.

Burials not found in the context of a historic property will be treated in accordance with the Navajo Nation Policies and Procedures Concerning the Protection of Cemeteries, Gravesites and Human Remains and the Native American Graves Protection and Repatriation Act.

Specific Method of Treatment:

The following methods of treatment are offered for situations in which a researchdesign or scope-of-work has not been approved for the undertaking. If a research design or scope-of-work has been approved for a specific undertaking, discovered historic and cultural properties, and human remains, shall be treated in a manner consistent with the research design or scope-of-work, using the following treatment methods as a guideline.

<u>Ash Stains, Hearths, and Other Thermal Features:</u>

The location will be mapped and the feature will be profiled and photographed. Excavated fill will be screened through quarter-inch or smaller mesh. If it appears that the feature can be dated through association of artifacts or stratigraphy, appropriate samples may be taken, including charcoal fragments for radiocarbon dating. Should the feature appear likely to yield botanical remains, pollen and flotation samples may be collected. HPD must be consulted before any samples are analyzed.

<u>Storage Pits:</u>

The location will be mapped and the feature will be profiled and photographed. The feature will be fully excavated, and the fill must be screened through quarter-inch or smaller mesh screen. If it appears that the feature can be dated through association of artifacts or stratigraphy appropriate samples may be taken. Should the feature appear likely to yield botanical remains, pollen and flotation samples may be collected. All artifacts will be collected. HPD must be consulted before any samples are analyzed.

<u>Buried or Partially Buried Structures, Middens, and Other Features:</u>

Examples of buried or partially buried features include pit structures, pithouses, and kivas. The location will be mapped and the feature will be profiled and photographed. Treatment of buried or partially buried features is a two-stage process involving (1) nature and extent testing within the area of effect to define the boundary of the feature and detect the presence of additional features and (2) data recovery within the area of effect. Systematic trenching in conjunction with 1 by 1 m test units, or other subsurface investigative techniques, may be used within the area of effect. Consultation with HPD is required after the initial recording has been completed for review of the data recovery plan.

Excavated fill will be screened through quarter-inch or smaller mesh. If it appears that the feature can be dated through association of artifacts or stratigraphy, or by radiographic or archeomagnetic dating, appropriate samples may be taken. Should the feature appear likely to yield botanical remains, pollen and flotation samples may be collected. HPD must be consulted before any samples are analyzed.

Miscellaneous Prehistoric Features:

Examples of miscellaneous features include buried cultural horizons and agricultural features. The location will be mapped and the feature will be profiled and photographed. The strategy for treatment of miscellaneous prehistoric features is the same as that for buried or partially buried features.

Surface Features:

Examples of surface features include field houses, jacal structures, ramadas, masonry structures, historical, contemporary, and modern structures, and various types of historic landscapes. The location will be mapped and the feature(s) will be photographed. Treatment of surface features may be a multistage process involving (1) intensive and extensive documentation of the property to define the boundary of the feature and detect the presence of additional features, (2) consultation with local and customary users, and other knowledgeable individuals, in order to determine the nature of the site, place, property, or feature and recommend a Treatment Plan, and (3) implementation of data recovery or the Treatment Plan within the area of effect.

The strategy discussed above for treatment of buried or partially buried features may be the appropriate way to treat some surface features and should be used as a guideline for data recovery. Alternatively, the strategy espoused below for traditional cultural properties and historical sites may be more appropriate and should be used as a guideline for treatment.

Traditional Cultural Properties (TCPs) and Historical Sites:

Examples of traditional or historical features include named landscape features, mineral or herb gathering areas, offering areas, hogans, trail markers, cairns, sheep corrals, ceremonial sites (e.g., Enemy Way sites), sweathouses, and tepee grounds. If a TCP or historical site is encountered, or information about a possible site is provided to the project sponsor or their agent by any knowledgeable or concerned individual, the project sponsor must ensure that work is discontinued within a 50-foot-radius of the property and contact HPD within one (1) day of the discovery. Treatment of TCPs or historical sites is a two-stage process involving (1) consultation with HPD along with local and customary users, and other knowledgeable individuals, in order to determine the nature of the site, place, property, or feature and recommend a scope-of-work and (2) implementation of the scope-of-work. Examples of treatment include, but are not limited to, the following:

1. Avoiding the remaining portion of the property through use of protective fencing or redesign of the undertaking or project.
2. Monitoring the remaining portion of the property during construction and/or erection of protective fencing to ensure protection.
3. Moving material remains of the TCP. This activity may include participation of local medicine men or women for ceremonial blessings.
4. Restricting construction activities to certain seasons or times of the day.
5. Conducting ceremonies for the well-being of properties that have been affected.

HPD will recommend the best possible treatment as guided by interviews and consultation.

II. Discovery of Human Remains Within the Jurisdiction of the Navajo Nation and on Allotments owned by Individual Navajo Members

A. Upon encountering an unmarked grave or unregistered grave during operations and/or maintenance activities, APS or PNM, as appropriate, will immediately stop work within a one-hundred (100) foot radius of the point of discovery. APS or PNM, as appropriate, will implement interim measures to protect the discovery in situ and from vandalism and looting, but must not remove or otherwise disturb any human remains or other items in the immediate vicinity of the discovery. *Under no circumstances* shall APS or PNM further disturb human remains except under the formal direction of Navajo Nation THPO.

B. APS or PNM, as appropriate, will notify the Navajo Nation THPO and BIA Navajo Region within twenty-four (24) hours of the discovery.

C. The Navajo Nation THPO will determine the treatment, including mitigation and disposition of the unmarked human burial or unregistered grave in consultation with the BIA Navajo Region.

D. APS or PNM, as appropriate, will implement the treatment and disposition measures deemed appropriate by the Navajo Nation THPO, which will be in accordance with the laws of the Navajo Nation, as applicable. Claimed human remains shall not be disturbed without the consent of the next-of-kin. Unclaimed human remains shall be treated according to the provisions of the Navajo Nation Policies and Procedures Concerning the Protection of Cemeteries, Gravesites and Human Remains and the Native American Graves Protection and Repatriation Act.

E. APS or PNM, as appropriate, will resume operations and/or maintenance in the area of discovery upon receipt of written authorization from the Navajo Nation THPO.

HOPI TRIBE PROCEDURES AND PROTOCOLS

I. Unanticipated Discoveries within the Hopi Tribe Reservation

In the event of an unanticipated discovery within the Hopi Tribe Reservation, the following guidelines will be followed.

A. APS shall cease all activity within a 50-foot radius surrounding the location of the discovery and shall immediately notify the HCPO and BIA Western Region within twenty-four (24) hours of the discovery. Notification can be made by email, phone, or in person at the HCPO office. BIA will be notified by email or phone. APS will follow up with written confirmation of the discovery.

B. APS in consultation with the HCPO and BIA Western Region will arrange for an archaeologist with appropriate expertise or Hopi cultural specialist to document and preliminarily assess the finding and formulate a recommendation regarding whether the discovery is eligible for the NRHP and merits further consideration. Any archaeologist working on the Hopi Tribal Lands shall at all times be in compliance with permitting requirements, as may be applicable. The assessment shall address the following factors:

   a. The nature of the resource, such as the number and kinds of artifacts, and presence or absence of archaeological features. This may require screening of already disturbed deposits, photographs of the discovery, and collection of other information.

   b. The spatial extent of the resource. This may require additional testing, mapping, or inspection to delineate the boundaries of the site. Boundary delineation should not take the place of formal site testing.

   c. The nature of the deposits in which the discovery was made. This may require additional testing, inspection, or interviews with persons involved in the discovery. Any testing activities that impact archaeological deposits will need concurrence from the HCPO before being implemented, subject, as appropriate, to applicable ARPA requirements.

   d. The contextual integrity of the resource, damage related to the initial discovery, and potential impacts of the continued activity that resulted in the discovery.

C. Except in cases of emergency, HCPO will make a NRHP eligibility determination within seven (7) calendar days following discovery and will provide the relevant assessment documentation to the BIA Western Region. BIA Western Region will forward the determination to the Arizona SHPO for concurrence.

   a. Where a property is evaluated as not being eligible, the BIA Western Region and Arizona SHPO will have a seven (7) calendar-day comment period. If there is concurrence with the evaluation or no response within the comment period, activities that led to the discovery may resume under the protocols of Stipulation VII(C).

b. For properties evaluated as eligible or potentially eligible, BIA Western Region will make a determination of eligibility and seek concurrence from the Arizona SHPO. The Arizona SHPO will review and comment within an expedited period of fifteen (15) calendar days. APS will then follow procedures under Stipulation VII(C)(2) before the activity can be resumed in the area of discovery.

II. Discovery of Human Remains Within the Hopi Tribe Reservation

A. Compliance with applicable laws and regulations including Native American Graves Protection Act (NAGPRA)(25 USC 3001[3]; 43 CFR § 10), ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007), and any guidance provided by the HCPO including Ordinance 26, will be followed as appropriate.

B. When encountering an unmarked grave or unregistered grave during operations and/or maintenance activities, APS will cease the activity within a one-hundred (100) foot radius surrounding the location of discovery and will immediately notify the HCPO and BIA of the discovery within twenty-four (24) hours. Notification can be made by email, phone, or in person at the HCPO office. APS will follow up with written confirmation of the discovery. BIA Western Region will be notified by email or phone. The HCPO will respond immediately and will keep BIA Western Region apprised of the discovery.

C. During this time, APS will ensure that any and all human remains, sacred objects, and objects of cultural patrimony will be protected from looting or vandalism and treated with dignity and respect. Human remains, sacred objects, and objects of cultural patrimony should not be removed or further disturbed without concurrence from the HCPO.

D. The BIA Western Region will notify the Arizona SHPO within forty-eight (48) hours, if the remains occur within an archaeological site and will follow protocols set forth in Attachment H.I.

E. APS will facilitate the implementation of the treatment and the disposition for human remains, sacred items, and objects of cultural patrimony that are deemed appropriate by the HCPO.

F. APS will resume operations and/or maintenance in the area of discovery upon receipt of written authorization from the BIA Western Region, in consultation with the HCPO.

Attachment H: Unanticipated Discovery of Archaeological Materials and Human Remains: Procedures and Protocols

ZIA TRIBE PROCEDURES AND PROTOCOLS

I. Discoveries within Zia Pueblo Lands

In the event of an unanticipated discovery within Zia Pueblo Lands, the following guidelines will be followed.

A. PNM shall cease all activity within a 50-foot radius surrounding the location of the discovery and shall immediately notify the Zia Pueblo and BIA Southwest Region within twenty-four (24) hours of the discovery. Notification can be made by email or phone.

B. BIA Southwest Region will notify the New Mexico SHPO of the discovery within twenty-four (24) hours by email or phone.

C. PNM, in consultation with the Zia Pueblo, BIA Southwest Region, and New Mexico SHPO, will arrange for an archaeologist with appropriate expertise to document and preliminarily assess the finding and formulate a recommendation regarding whether the discovery is eligible for the NRHP and merits further consideration. The archaeologist shall prepare the documentation and conduct the assessment in accordance with any permits that may be required, as applicable. The assessment shall address the following factors:

   a. The nature of the resource, such as the number and kinds of artifacts, and presence or absence of archaeological features. This may require screening of already disturbed deposits, photographs of the discovery, and collection of other information.

   b. The spatial extent of the resource. This may require additional testing, mapping, or inspection to delineate the boundaries of the site. Boundary delineation should not take the place of formal site testing.

   c. The nature of the deposits in which the discovery was made. This may require additional testing, inspection, or interviews with persons involved in the discovery.

   d. The contextual integrity of the resource, damage related to the initial discovery, and potential impacts of the continued activity that resulted in the discovery.

D. The BIA Southwest Region shall notify the Consulting Parties within forty-eight (48) hours that it will take comments concerning the unanticipated discovery. BIA, in consultation with Zia Pueblo, will make an NRHP eligibility determination within seven (7) calendar days following notification, after considering the timely filed views of the appropriate Consulting Parties. Where a property is determined not to be eligible, records of this assessment will be made available to the New Mexico SHPO. The New Mexico SHPO will have seven (7) calendar days to review and provide comment on the determination. Activities that led to the discovery may resume under the protocols of Stipulation VIII(B)(1).

E. For properties determined eligible or potentially eligible, protocols outlined in a Historic Properties Treatment Plan will be followed by the BIA Southwest Region, in consultation with the Zia Pueblo. The BIA Southwest Region will request an expedited 15 day review and comment period by the New Mexico SHPO and Zia Pueblo for determinations of eligibility.

F. If it was an activity that originally led to the unanticipated discovery, the activity may proceed after a Treatment Plan is developed and implemented as outlined in the Treatment Plan and after written authorization by the BIA Southwest Region.

II. Discovery of Human Remains Within Zia Pueblo Lands

A. Upon discovery, PNM will comply with applicable laws and regulations including Native American Graves Protection Act (NAGPRA)(25 USC 3001[3]; 43 CFR 10), ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007), and any guidance provided by the Zia Pueblo, BIA Southwest Region, and New Mexico SHPO.

B. Upon encountering an unmarked grave or unregistered grave during operations and/or maintenance activities, PNM will immediately stop work within a one-hundred (100) foot radius of the point of discovery. PNM will implement interim measures to protect the discovery from vandalism and looting, but must not remove or otherwise disturb any human remains or other items in the immediate vicinity of the discovery.

C. PNM will notify the Zia Pueblo and BIA Southwest Region within twenty-four (24) hours of the discovery via phone or email. The BIA Southwest Region will notify the New Mexico SHPO if the discovery is associated within a precontact archaeological site, and local law enforcement within twenty-four (24) hours of notification. The local law enforcement will notify the Medical Examiner, if necessary.

D. The BIA Southwest Region, in consultation with the Zia Pueblo, will determine the treatment, including mitigation and disposition of the unmarked human burial or unregistered grave.

E. PNM will implement the treatment and disposition measures deemed appropriate by the Zia Pueblo and BIA Southwest Region. PNM will resume operations and/or maintenance in the area of discovery upon receipt of written authorization from the BIA Southwest Region.

Attachment H: Unanticipated Discovery of Archaeological Materials and Human Remains: Procedures and Protocols

FEDERAL LAND PROCEDURES AND PROTOCOLS

I. Unanticipated Discoveries within Federal Lands

In the event of an unanticipated discovery within federal lands, Section 106 of the NHPA and ARPA will be followed and the following guidelines will apply.

A. PNM shall cease all activity within a 50 foot radius surrounding the location of the discovery and shall immediately notify the federal land manager and BIA within twenty-four (24) hours of the discovery. Notification can be made by email or phone.

B. BIA will notify the New Mexico SHPO of the discovery within twenty-four (24) hours by email or phone.

C. PNM, in consultation with the federal land manager, New Mexico SHPO, and BIA, will arrange for an archaeologist with appropriate expertise to document and preliminarily assess the finding and formulate a recommendation regarding whether the discovery is eligible for the NRHP and merits further consideration. The archaeologist shall prepare the documentation and conduct the assessment in accordance with any permits that may be required pursuant to ARPA, as applicable. The assessment shall address the following factors:

   a. The nature of the resource, such as the number and kinds of artifacts, and presence or absence of archaeological features. This may require screening of already disturbed deposits, photographs of the discovery, and collection of other information.

   b. The spatial extent of the resource. This may require additional testing, mapping, or inspection to delineate the boundaries of the site. Boundary delineation should not take the place of formal site testing.

   c. The nature of the deposits in which the discovery was made. This may require additional testing, inspection, or interviews with persons involved in the discovery.

   d. The contextual integrity of the resource, damage related to the initial discovery, and potential impacts of the continued activity that resulted in the discovery.

D. The BIA shall notify the Consulting Parties within forty-eight (48) hours that it will take comments concerning the unanticipated discovery. A NRHP eligibility determination will be made within seven (7) calendar days following notification, after considering the timely filed views of the Consulting Parties, as defined in Attachment E. Where a property is determined not to be eligible by the BIA, in consultation with the federal land manager and New Mexico SHPO, PNM may resume the activity that resulted in the discovery upon written authorization by the BIA.

E. For properties determined eligible or potentially eligible, the BIA, in consultation with the federal land manager and New Mexico SHPO, will review the Treatment

Plan to identify applicable actions to resolve adverse effects and will notify Consulting Parties.

a. The Consulting Parties will have forty-eight (48) hours to provide their views on the proposed actions.

b. The BIA, in consultation with the federal land manager, will ensure that the timely filed recommendations of the Consulting Parties are taken into account prior to granting approval of the measures that PNM will implement to resolve adverse effects.

c. Consistent with the terms of this Agreement, PNM will carry out the approved measures prior to resuming operations and/or maintenance activities in the location of the discovery.

F. If it was an activity that originally led to the unanticipated discovery, the activity may proceed upon written authorization by the BIA.

II. Discovery of Human Remains, Funerary Objects, Sacred Objects, or Objects of Cultural Patrimony Within Federal Lands

A. Upon discovery, PNM will comply with applicable laws, regulations, and guidelines including Native American Graves Protection Act (NAGPRA)(25 USC 3001[3]; 43 CFR 10), and ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007).

B. Upon encountering an unmarked grave or unregistered grave during operations and/or maintenance activities, PNM will immediately stop work within a one-hundred (100) foot radius of the point of discovery. PNM will implement interim measures to protect the discovery from vandalism and looting, but must not remove or otherwise disturb any human remains or other items in the immediate vicinity of the discovery.

C. PNM will notify the BIA and federal land manager within twenty-four (24) hours of the discovery. The BIA will notify the New Mexico SHPO if the discovery is associated within a precontact archaeological site, and local law enforcement, if applicable, within twenty-four (24) hours of notification.

D. The federal land manager archaeologist or if delegated, permitted cultural resources contractor, will conduct an initial assessment of the discovery and will notify the Medical Examiner, if necessary.

E. The federal land manager, in consultation with BIA and the affected tribes, and New Mexico SHPO (if involved and as applicable), will determine the treatment, including mitigation and disposition of the unmarked human burial or unregistered grave.

F. PNM will implement the treatment and disposition measures deemed appropriate by the BIA, in agreement with the federal land manager, affected tribes, and New Mexico SHPO (if involved and as applicable). All necessary permits will be issued by the federal land manager in consultation with BIA and the affected tribes and SHPO, if involved.

G. PNM will resume operations and/or maintenance in the area of discovery upon receipt of written authorization from the BIA.

NEW MEXICO STATE OR PRIVATE LANDS PROCEDURES AND PROTOCOLS

I. Unanticipated Discoveries within New Mexico State or Private Lands

In the event of an unanticipated discovery within New Mexico state or private lands, New Mexico Cultural Properties Act (N.M. Stat. Part 18-6-1 through 18-6-17, as amended through 2005) and implementing regulation 4.10.8 New Mexico Administrative Code (NMAC) will be followed and the following guidelines will apply.

A. PNM shall cease all activity within a 50 foot radius surrounding the location of the discovery and shall immediately notify the New Mexico SHPO and BIA within twenty-four (24) hours of the discovery. If the discovery occurs on state land, NMSLO will also be contacted within 24 hours of the discovery. Notification can be made by email or phone.

B. PNM, in consultation with the New Mexico SHPO, NMSLO as appropriate, and BIA, will arrange for an archaeologist with appropriate expertise to document and preliminarily assess the finding and formulate a recommendation regarding whether the discovery is eligible for the NRHP and merits further consideration. The archaeologist shall prepare the documentation and conduct the assessment in accordance with any permits that may be required pursuant to the New Mexico Cultural Properties Act. The assessment shall address the following factors:

   a. The nature of the resource, such as the number and kinds of artifacts, and presence or absence of archaeological features. This may require screening of already disturbed deposits, photographs of the discovery, and collection of other information.

   b. The spatial extent of the resource. This may require additional testing, mapping, or inspection to delineate the boundaries of the site. Boundary delineation will not be substituted for formal site testing.

   c. The nature of the deposits in which the discovery was made. This may require additional testing, inspection, or interviews with persons involved in the discovery.

   d. The contextual integrity of the resource, damage related to the initial discovery, and potential impacts of the continued activity that resulted in the discovery.

C. BIA shall notify the New Mexico SHPO, NMSLO as appropriate, and Consulting Parties within forty-eight (48) hours that it will take comments concerning the unanticipated discovery. A NRHP eligibility determination will be made within seven (7) calendar days following notification, after considering the timely filed views of the New Mexico SHPO, NMSLO as appropriate, and Consulting Parties, as defined in Attachment E. Where a property is determined not to be eligible, PNM may resume the activity that resulted in the discovery with written authorization by the BIA.

D. For properties determined eligible or potentially eligible, the BIA, in consultation with the New Mexico SHPO and NMSLO as appropriate, will review a Historic Properties Treatment Plan to identify applicable actions to resolve adverse effects and will notify the Consulting Parties.

   a. The New Mexico SHPO, NMSLO as appropriate, and Consulting Parties will have forty-eight (48) hours to provide their views on the proposed actions.

   b. The BIA will ensure that the timely filed recommendations of the New Mexico SHPO, NMSLO as appropriate, and Consulting Parties are taken into account prior to granting approval of the measures that PNM will implement to resolve adverse effects.

   c. Consistent with the terms of this Agreement, PNM will carry out the approved measures prior to resuming operations and/or maintenance activities in the location of the discovery.

E. If it was an activity that originally led to the unanticipated discovery, the activity may proceed upon written authorization by the BIA.

II. Discovery of Human Remains within New Mexico State or Private Lands

A. Upon discovery, PNM will comply with the New Mexico Cultural Properties Act (N.M. Stat. Part 18-6-11.2, as amended through 2005) and implementing regulation 4.10.11 New Mexico Administrative Code (NMAC). The ACHP Policy Statement Regarding the Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007) shall also be followed as appropriate.

B. Upon encountering an unmarked burial or unregistered grave during operations and/or maintenance activities, PNM will immediately stop work within a one-hundred (100) foot radius of the point of discovery. PNM will implement interim measures to protect the discovery from vandalism and looting, but must not remove or otherwise disturb any human remains or other items in the immediate vicinity of the discovery.

C. PNM will notify the BIA and local law enforcement within twenty-four (24) hours of the discovery. The local law enforcement will notify the Medical Investigator. BIA will notify the New Mexico SHPO, NMSLO as appropriate, and Consulting Parties within twenty-four (24) hours of notification.

D. The Medical Investigatorshall determine whether the discovery is of medicolegal significance.

E. If the discovery has medicolegal significance, the Medical Investigator may, consistent with the statues governing medical investigations (e.g., 42-11-5 NMSA 1978), have authority over or take possession of the discovery, in which case the provisions of Subsections F and G of this section shall not apply.

F. If the discovery is determined to be without medicolegal significance, the New Mexico SHPO and NMSLO, as appropriate, in consultation with the BIA, PNM, and Permitted Cultural Resources Contractor, and in accordance with 4.10.11 NMAC, will determine the treatment, including mitigation of the unmarked human burial or unregistered grave.

G. PNM will implement the treatment measures deemed appropriate by the BIA, New Mexico SHPO, and NMSLO, as appropriate. If excavation is planned, a consultant holding an Annual Unmarked Human Burial Excavation Permit will conduct the excavations.

H. At the conclusion of excavation, PNM will submit a recommended plan for disposition to the New Mexico SHPO for review and comment in accordance with 4.10.11 NMAC. Once accepted by the New Mexico SHPO, PNM will implement the approved disposition plan.

PNM will resume operations and/or maintenance in the area of discovery upon receipt of written authorization from the BIA, in consultation with either the Medical Examiner or the New Mexico SHPO, whoever has jurisdiction under state law.

ATTACHMENT H

I, Jeffrey W. Jenkins, give authorization to the Environmental Section Leader, to sign changes to the SWPPP and other compliance documentation required under the permit, including the Annual Report, Discharge Monitoring Reports (DMRs), inspection reports, and corrective action reports for the Storm Water Programs. This is in accordance with signatory requirements in the NPDES Citations of the General Permit for Storm Water Discharge from Construction Activities, Appendix G – Standard Permit Conditions, Section 11 and NPDES Multi-Sector General Permit (MSGP) for Stormwater Discharges Associated with Industrial Activities, Appendix B, Section B.11.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Jeffrey W Jenkins

Signature: Jeffrey W. Jenkins
Plant Manager
Arizona Public Service Company
Four Corners Power Plant

01/29/19

Date: