

**Cumulative Hydrologic Impact Assessment
of the
Navajo Mine, Pinabete Mine, and No Name Permit Areas**

Prepared By



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TABLE OF CONTENTS

LIST OF FIGURES	6
LIST OF TABLES	7
LIST OF APPENDICES	8
LIST OF ACRONYMS	9
1 INTRODUCTION	10
1.1 Regulatory Environment.....	13
1.1.1 CHIA Revision Rationale	13
1.1.2 Cumulative Impact Area	14
1.1.3 Material Damage to the Hydrologic Balance.....	14
1.1.4 Material Damage Criteria.....	15
1.2 Background.....	15
1.2.1 Climate.....	16
1.2.2 Regional Geology	16
2 DELINEATION OF CUMULATIVE IMPACT AREA.....	23
2.1 Surface Water Cumulative Impact Area	23
2.1.1 Cumulative Surface Water Impact Potential.....	23
2.1.2 Impact Potential to the San Juan River	28
2.1.3 Impact Potential to the Chaco River	32
2.1.4 Surface Water Impact Area.....	33
2.2 Ground Water Cumulative Impact Area	33
2.2.1 Ground Water Impact Area.....	34
3 WATER RESOURCE USES AND DESIGNATIONS	38
3.1 Direct Human Use.....	38
3.2 Industrial Supply Water	39
3.3 Irrigation Supply Water	40
3.4 Livestock Supply Water.....	41
3.5 Aquatic and Wildlife Habitat Water Supply	43
4 BASELINE HYDROLOGIC CONDITIONS.....	47
4.1 Surface Water.....	47
4.1.1 Surface Water Regulatory Requirements.....	48
4.1.2 Surface Water Regime	48
4.1.3 El Segundo Mine.....	48
4.1.4 Morgan Lake	49

4.1.5	Chaco River	51
4.1.5.1	Surface Water Quantity.....	51
4.1.5.2	Surface Water Quality.....	51
4.1.5.2.1	Methodology	51
4.1.5.2.2	Analysis	52
4.1.6	Historic Mining Area North of the Navajo and No Name Permit Areas	53
4.1.7	No Name Permit Area and Associated Drainages	54
4.1.7.1	Surface Water Baseline Quantity	54
4.1.7.1.1	Morgan Lake-Chaco River Watershed.....	57
4.1.7.1.2	Chinde Wash Watershed	57
4.1.7.1.3	Chinde Wash-Chaco River Watershed.....	57
4.1.7.1.4	Coal Creek-Chaco River Watershed.....	58
4.1.7.1.5	Cottonwood Arroyo Watershed.....	58
4.1.7.1.6	Pinabete Arroyo Watershed.....	59
4.1.7.1.7	No Name Wash Watershed	59
4.1.7.2	Surface Water Baseline Quality	60
4.1.7.2.1	Baseline with NAPI.....	61
4.1.7.2.1.1	Chinde Wash	61
4.1.7.2.1.2	Cottonwood Arroyo	62
4.1.7.2.2	Pinabete Arroyo and No Name Wash.....	63
4.2	Ground Water.....	64
4.2.1	Ground Water Regulatory Requirements.....	64
4.2.2	Chaco River Alluvium	64
4.2.3	Historic Mining Area North of Navajo Mine and No Name Permit Areas.....	65
4.2.4	Navajo Mine, No Name Mine, and Pinabete Mine Permit Areas	68
4.2.4.1	Alluvial Baseline Quantity.....	68
4.2.4.2	Alluvial Baseline Quality.....	69
4.2.4.3	Fruitland Formation Baseline Quantity.....	70
4.2.4.4	Fruitland Formation Baseline Quality.....	71
4.2.4.5	Pictured Cliffs Sandstone Aquifer Baseline Quantity.....	72
4.2.4.6	Pictured Cliffs Sandstone Aquifer Baseline Quality.....	72
5	HYDROLOGIC IMPACT ASSESSMENTS.....	76
5.1	Minimization of Impact	76
5.2	Monitoring Program.....	76
5.2.1.1	Monitoring Program Updates.....	77
5.3	Impact Assessment.....	79

5.3.1	Potential Cumulative Impact between NTEC operations and El Segundo Mine.....	83
5.3.2	Chaco River	83
5.3.2.1	Surface Water Quantity.....	83
5.3.2.2	Surface Water Quality.....	84
5.3.2.3	Chaco River Alluvium	85
5.3.3	Historic Mining Area North of the No Name Permit Area	86
5.3.3.1	Surface Water.....	86
5.3.3.2	Alluvium	86
5.3.3.3	Fruitland Formation and PCS	87
5.3.3.3.1	CCB Disposal	88
5.3.4	Navajo Mine, No Name, and Pinabete Permit Areas	91
5.3.4.1	Surface Water Quantity.....	91
5.3.4.1.1	Morgan Lake-Chaco River Watershed.....	92
5.3.4.1.2	Pinabete Arroyo Watershed.....	92
5.3.4.1.3	No Name Wash Watershed	94
5.3.4.1.4	Miscellaneous Watersheds	94
5.3.4.1.5	Chinde Wash Watershed	95
5.3.4.1.6	Chinde-Chaco River Watershed.....	96
5.3.4.1.7	Coal Creek-Chaco River Watershed.....	97
5.3.4.1.8	Cottonwood Arroyo Watershed.....	98
5.3.4.2	Surface Water Quality.....	99
5.3.4.2.1	Chinde Wash	99
5.3.4.2.2	Cottonwood Wash	100
5.3.4.3	Pinabete and No Name Arroyo	100
5.3.5	Groundwater	101
5.3.5.1	Alluvium	102
5.3.5.1.1	Alluvial Quantity	102
5.3.5.1.1.1	Chaco River Alluvium	105
5.3.5.1.2	Alluvial Quality	105
5.3.5.1.2.1	Bighan Alluvium.....	105
5.3.5.1.2.2	Chinde Wash Alluvium.....	106
5.3.5.1.2.3	Cottonwood Arroyo Alluvium	109
5.3.5.1.2.4	Pinabete Arroyo Alluvium	109
5.3.5.2	Fruitland Formation Quantity	110
5.3.5.3	Fruitland Formation Quality	111
5.3.5.4	Pictured Cliffs Sandstone Quantity.....	112

5.3.5.5	Pictured Cliffs Sandstone Quality	113
6	MATERIAL DAMAGE	115
6.1	Cumulative Impact of NTEC Operations and El Segundo Mine	115
6.2	NTEC Operations Impact to Morgan Lake and APS	115
6.3	Chaco River	115
6.4	Historic Mining North of the Navajo Mine and No Name Permit Area	116
6.5	Navajo Mine, No Name Mine, and Pinabete Mine Permit Areas	116
6.5.1	Material Damage Assessment	118
6.5.1.1	Surface Water	118
6.5.1.2	Groundwater	118
6.5.1.2.1	Alluvium	119
6.5.1.2.2	Fruitland Formation and Pictured Cliffs Sandstone	119
6.5.2	Conclusion	120
7	WORKS CITED	121

LIST OF FIGURES

Figure 1: NTEC Navajo Mine and No Name Permit Area	18
Figure 2: Navajo Tribal Coal Lease Location Map	19
Figure 3: San Juan Basin Structural Geology	20
Figure 4: Navajo Tribal Coal Lease Area and Surrounding Area Stratigraphy	21
Figure 5: Surface Geology Map, NW New Mexico	22
Figure 6: Navajo Tribal Coal Lease Primary Drainages and HUC 12 and Pinabete and No Name Watersheds	25
Figure 7: Historical and Existing Coal Mining, San Juan Watershed.....	26
Figure 8: USGS Active and Historical Gaging Stations, San Juan Watershed.....	30
Figure 9: San Juan River Discharge and Mine Operational Period Comparison (1931-2010).....	31
Figure 10: San Juan River TDS and Mine Operational Period Comparison (1957-2010).....	31
Figure 11: Surface Water CIA and Non-NTEC Surface Water Impoundments	36
Figure 12: Groundwater CIA and Non-NTEC use Wells	37
Figure 13: Non-NTEC Surface Water Impoundments within the vicinity of the Navajo Tribal Coal Lease	45
Figure 14: Select Tributary Irrigation Project Lands	46
Figure 15: PCS Potentiometric Surface and Outcrop Location	50
Figure 16: Baseline Monthly Flow along the Chaco River.....	51
Figure 17: Surface Water Monitoring Locations	55
Figure 18: SEDCAD Routing Subwatersheds for the Chinde-Chaco River and Coal Creek Watersheds..	56
Figure 19: Groundwater Monitoring Locations	67
Figure 20: No. 3 Coal Seam Potentiometric Surface	74
Figure 21: No 8 Coal Seam Potentiometric Surface	75
Figure 22: Chinde Diversion and Monitoring Locations	80
Figure 23: Monthly Flow along the Chaco River	84
Figure 24: Custer Water Elevations	87
Figure 25: Approximate Historic CCB Disposal	90
Figure 26: Chinde and Bighan Alluvial Water Elevations.....	104
Figure 27: Chinde Alluvium Concentrations over Time.....	108
Figure 28: Post-Mining Potentiometric Surface in the PCS Aquifer (Barr 2025)	114

LIST OF TABLES

Table 1: Navajo Mine (including No Name permit component) – Material-Damage Summary (At-a-Glance)	12
Table 2: Mining History in the San Juan Watershed	27
Table 3: Surface Water Criteria	52
Table 4: Chinde-Wash Chaco River Sub-Watershed Details	58
Table 5: Coal Creek Sub-Watershed Details	58
Table 6: Chinde Alluvium Monitoring Approach	78
Table 7: Hydrologic Impact Designation Assessment Methodology	81
Table 8: SEDCAD™ 4 Estimated Peak Discharge and Sediment Yield at Surface Water Monitoring Stations	93
Table 9: Comparison of Pre-Mine and Post-Mine Peak Flows in the Chinde Wash Watershed (NTEC 2013)	96
Table 10: Comparison of Pre-Mine and Post-Mine Peak Flows in Chinde-Chaco River Watershed	97
Table 11: Comparison of Pre-Mine and Post-Mine Peak Flows in Coal Creek-Chaco River Watershed	98
Table 12: Comparison of Pre-mine and Post-Mine Peak Flows in the Cottonwood Arroyo Watershed (NTEC 2013)	98
Table 13: Short and Long Term Impact Interpretive Framework	117
Table 14: Assessment of Material Damage for the Waters of the Navajo Mine and No Name Permit Areas	117

LIST OF APPENDICES

SUPPORTING TECHNICAL RECORD (No Name Permit Component)

Section 18: Water Resources (No Name Permit Application Package)

Appendix 18-A: Channel Morphology Inventories (No Name Permit Application Package)

Appendix 18-B: SEDCAD Modeling Report (No Name Permit Application Package)

Section 26: Drainage Control Plan (No Name Permit Application Package)

Appendix 26-A: Drainage Control Plan Figures/Details (No Name Permit Application Package)

Section 41: Probable Hydrologic Consequences (No Name Permit Application Package)

Appendix 41-E: Groundwater Model Report (No Name Permit Application Package)

LIST OF ACRONYMS

%RSD	Percent Relative Standard Deviation
AOC	Approximate Original Contour
APS	Arizona Public Service
AST	Above-Ground Storage Tank
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
BNCC	BHP Navajo Coal Company
CCB	Coal Combustion Byproduct
CFR	Code of Federal Regulations
CHIA	Cumulative Hydrologic Impact Assessment
CIA	Cumulative Impact Area
CWA	Clean Water Act
FCPP	Four Corners Power Plant
HUC	Hydrologic Unit Code
LOM	Life-of-Mine
MAD	Median Absolute Deviation
MSL	Mean Sea Level
NAPI	Navajo Agricultural Products Industry
NHD	National Hydrologic Database
NIST	National Institute of Standards and Technology
NMEMNRD	New Mexico Energy Minerals and Natural Resource Division
NNEPA	Navajo Nation Environmental Protection Agency
NTEC	Navajo Transitional Energy Company, LLC
NPDES	National Pollution Discharge Elimination System
OSMRE	Office of Surface Mining Reclamation and Enforcement
PAP	Permit Application Package
PCS	Pictured Cliff Sandstone
PHC	Probable Hydrologic Consequences
SMCRA	Surface Mining Control and Reclamation Act of 1977
TDS	Total Dissolved Solids
TOJ	Termination of Jurisdiction
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VWP	Vibrating Wire Piezometer

1 INTRODUCTION

The Office of Surface Mining Reclamation and Enforcement (OSMRE) is the regulatory authority for coal mining operations on Indian Lands under the Surface Mining Reclamation and Control Act of 1977 (SMCRA) (U.S. Congress, 1977). As such, OSMRE is responsible for the review and decisions on permit applications to conduct surface coal mining operations within the boundaries of the Navajo Nation Reservation, including the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). OSMRE has received and is reviewing a Permit Application Package (PAP) submitted by Navajo Transitional Energy Company (NTEC) to develop an approximately 11,526 acre new permit area to continue surface coal mining and reclamation operations past 2031 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The new permit area, referred to as the No Name Permit (NM-0043A), consists of portions of unpermitted areas of NTEC's mining lease, located immediately south of the Pinabete Mine permit area. This 2026 CHIA updates the 2015 Navajo Mine Cumulative Hydrologic Impact Assessment (CHIA) to address a new permit component within the larger Navajo Mine complex, the No Name permit area. By regulation, OSMRE prepares a CHIA to determine whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area (30 CFR § 780.21(g)).

A CHIA is an assessment of the probable hydrologic consequences (PHC) of the proposed operation and all anticipated coal mining upon surface- and groundwater systems in the cumulative impact area (CIA). The PHC is prepared by the applicant, as required by 30 CFR § 780.21(f), and approved by the regulatory authority. The hydrologic reclamation plan required by 30 CFR § 780.21(h) recognizes that disturbances to the hydrologic balance within the permit and adjacent area should be minimized; material damage outside the permit area should be prevented; applicable Federal, Tribal, and State water quality laws should be met; and the rights of present water users protected. Additionally, 30 CFR § 816.42 states that discharges of water from areas disturbed by surface mining activities shall be made in compliance with all applicable State and Federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the United States Environmental Protection Agency (USEPA) at 40 CFR part 434. Discharges of disturbed area runoff at the Navajo Tribal Coal Lease are conducted in accordance with the terms and conditions of a National Pollutant Discharge Elimination System (NPDES) permit issued by the USEPA under the Clean Water Act (CWA).

OSMRE considered USEPA approved surface water quality standards for the Navajo Nation Environmental Protection Agency (NNEPA) as part of this assessment. Protection of existing and foreseeable water uses within the various delineated cumulative impact areas was a focus of this assessment. Additionally, potential impacts associated with the historic disposal of coal combustion by-products (CCB) at the Navajo Mine were specifically evaluated. Additional data and analysis of CCB impacts associated with the Four Corners Power Plant (FCPP) are available in the FCPP and Navajo Mine Energy Project Environmental Impact Statement (EIS) (OSMRE 2015, Sect. 4.15). The original CHIA for the Navajo Mine was written in February, 1984 (Kaman Temp 1984), and addendum to the 1984 CHIA in 1989 (OSMRE 1989), and significantly updated in 2012 and subsequently in 2015.

This 2026 CHIA supersedes the previous CHIA's and continues to evaluate all mining activities in the lease area, which are currently the Navajo Mine Permit Area, the Pinabete Permit Area, and the No Name Permit Area (collectively, the Navajo Mine). This 2026 update integrates (1) the 2015 CHIA framework and record; (2) updated applicant technical materials for the No Name permit area, including updated PHC documentation and supporting modeling; and (3) updated baseline and monitoring information available through 2025 (including groundwater and surface water quality summaries and related QA/QC documentation). Where historic issues (e.g., CCB) remain relevant to cumulative impacts or receptor protection, those pathways are carried forward and updated as appropriate using reasonably available

information. Findings with regard to material damage for the Navajo Mine operation (including the No Name permit component evaluated herein) are summarized below (Table 1).

The finding that the mining operation is designed to prevent material damage to the hydrologic balance outside the permit area is supported by the following chapters. The CHIA is organized as follows:

- Chapter 1 describes the regulatory environment and general background of the assessment area.
- Chapter 2
 - Assesses the cumulative impact potential with historical and active coal mines.
 - Delineates the surface water CIA.
 - Delineates the groundwater CIA.
- Chapter 3 identifies water resource uses and water use designations within the CIAs.
- Chapter 4 provides a description of baseline surface- and groundwater quantity and quality within the CIAs.
- Chapter 5 contains an impact assessment of the mining operation on surface- and groundwater quantity and quality, and includes a determination of:
 - The minimization of impacts within the permit/lease area; and,
 - The adequacy of the monitoring program to assess potential impacts.
- Chapter 6 Analyzes potential changes with respect to material damage designations and presents the CHIA findings statement.

Table 1: Navajo Mine (including No Name permit component) – Material-Damage Summary (At-a-Glance)

Water Resource	Assessment Approach (summary)	Evidence of Adverse Change Outside Permit Area?	Material Damage to Hydrologic Balance Outside Permit Area?	Measures to Minimize Impacts	Monitoring Program Adequate to Detect/Assess Impacts?
Fruitland & Pictured Cliffs Sandstone (PCS) – Quantity	Evaluation of potentiometric surface maps and water modeling provided in the respective PAPs	No	No	Contemporaneous reclamation	Yes
Alluvial – Quantity	Comparison of water levels at individual wells over time	No	No	Contemporaneous reclamation; geomorphic stream restoration; stream buffer zones	Yes
Surface Water – Quantity	SEDCAD modeling assessment of pre versus post -mining impact	Yes (localized/managed changes)	No	Contemporaneous reclamation; geomorphic stream restoration; stream buffer zones	Yes
Fruitland & PCS – Quality	Comparison of baseline water quality to potentially impacted wells; evaluation of spoil wells	No	No	Contemporaneous reclamation; mixing/management of overburden and backfill materials	Yes
Alluvial – Quality	Comparison of baseline (upstream or pre-mining) water quality to non-baseline (post-mining or downstream) water quality	Yes (localized/managed changes)	No	Contemporaneous reclamation; geomorphic stream restorations; stream buffer zones	Yes
Surface Water – Quality	Comparison of baseline to downstream/non-baseline water quality; evaluation of sediment control performance and compliance-related monitoring	No	No	Contemporaneous reclamation; geomorphic restoration; stream buffer zones; sedimentation ponds	Yes

Notes:

1. “Adverse change” in this table is a screening-level summary of observed/model-predicted changes in hydrologic conditions; the CHIA finding on material damage is supported by the detailed analyses in Chapters 2–6.
2. Where changes are indicated as “localized/managed,” those changes are addressed through engineered controls, reclamation sequencing, and monitoring/permit compliance programs.

1.1 Regulatory Environment

Surface coal operations within the Navajo Nation are managed through the coordinated collaboration of several regulatory agencies. Depending on the permitting action, several regulatory agencies may be involved in the review, comment, and public participation process including:

- OSMRE (regulatory authority for coal mining operations within the Navajo Nation)
- Bureau of Indian Affairs (BIA; protect and improve trust assets of the Tribes)
- Navajo Nation Minerals Department (NNMD; represent Tribal mineral interests)
- USEPA (issue and administer NPDES permits; administers the filing process for Environmental Impact Statements)
- U.S. Fish and Wildlife Service (ensure protection of threatened and endangered species)
- Bureau of Land Management (BLM; ensures maximum resource recovery)
- U.S. Army Corps of Engineers (USACE; issue permits and associated impact assessments for the discharge of fill material into waters of the United States under section 404 of the CWA).

The 2015 Navajo Mine CHIA was peer reviewed by the BIA, NNEPA, NNMD, USACE, and OSMRE technical staff. BIA, NNMD, and USACE concurred that the assessment approach for the 2015 Navajo Mine CHIA was reasonable, and the conclusions were appropriate. NNEPA found that the process used to determine water quantity impact was appropriate and that comparison between baseline and post-mining results was acceptable. The 2015 CHIA update was administrative in nature to reflect a change in permittee from BNCC to NTEC, and to clarify the assessment of two active mining areas (Navajo Mine Permit and Pinabete Permit) within the Navajo Tribal Coal Lease, which was completed during the 2012 CHIA update.

OSMRE developed a use impact assessment approach, specific to the evaluation of potential impacts from NTEC operations. This approach developed by OSMRE in part referenced and used NNEPA water quality standards for comparison and also considered baseline (background) water quality as well as research supported water quality criteria for livestock.

The 2026 CHIA update addresses a new permit application (No Name permit area) within the Navajo Mine and updates the 2015 CHIA to reflect current permit review needs, updated technical inputs, and updated baseline/monitoring information relevant to the CIA, and the material-damage determination.

1.1.1 CHIA Revision Rationale

The CHIA is not updated at a specified interval. 30 CFR § 780.21(g)(2) states that an application for permit revision shall be reviewed by the regulatory authority to determine whether a new or updated CHIA is required. OSMRE prepared the 2015 Navajo Mine CHIA to support prior permitting actions within the Navajo Mine complex. Since that time, OSMRE has received and is reviewing permit application materials for an additional permit application within the Navajo Mine (the No Name permit area) and has determined that an updated CHIA is required to evaluate cumulative impacts for that permit action.

- The major differences from the 2015 CHIA to this 2026 CHIA update include the following:
- Updates the assessment focus to include the No Name permit area within the broader Navajo Mine operation and associated CIA(s).
- Updates illustrations, tables, and text as needed to reflect the current permit configuration and current mine planning assumptions relevant to No Name permit area.

- Incorporates updated PHC documentation and supporting modeling for No Name permit area (including updated groundwater and surface water/sediment analyses).
- Updates baseline and monitoring summaries (including water quantity and water quality information) through the most recent available reporting period (e.g., through 2025), and updates monitoring-program descriptions as applicable.
- Updates references and appendix citations to the current technical record supporting the 2026 CHIA.

1.1.2 Cumulative Impact Area

A CIA is defined at 30 CFR § 701.5 as “the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface- and ground-water systems.” The CIA delineation provides the geographic framework for evaluating whether the proposed operation, considered together with all anticipated mining, could contribute to material damage to the hydrologic balance outside the permit area. The size and location of a CIA depend on surface water and groundwater system characteristics, the hydrologic resources of concern, and the magnitude and extent of projected impacts from the operations included in the assessment. For this CHIA update, OSMRE delineates one surface water CIA and one groundwater CIA to assess cumulative impacts within these distinct hydrologic resource areas for the Navajo Mine operation, including the No Name permit area evaluated herein.

1.1.3 Material Damage to the Hydrologic Balance

Sections 507(b)(11) and 510(b)(3) of SMCRA and 30 CFR § 780.21(g) require OSMRE to determine whether a mining and reclamation operation has been designed to prevent material damage to the hydrologic balance outside the permit area. “Hydrologic balance” is defined at 30 CFR § 701.5 as “the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage.”

“Material damage to the hydrologic balance” is not defined in SMCRA or at 30 CFR § 701.5. The intent of not developing a programmatic definition is to provide the regulatory authority the ability to apply a definition based on regional environmental and regulatory conditions and the hydrologic resources of concern. Therefore, for the purpose of this CHIA:

Material damage to the hydrologic balance outside the permit area means any quantifiable permanent adverse impact from surface coal mining and reclamation operations on the quality or quantity of surface water or groundwater that would preclude any existing or reasonably foreseeable use of surface water or groundwater outside the permit area.

SMCRA recognizes that surface coal mining and reclamation operations will have some hydrologic impacts; therefore, the statute and implementing regulations differentiate between impacts within the permit area and impacts outside the permit area. Disturbances to the hydrologic balance within the permit and adjacent area should be minimized, and material damage outside the permit area should be prevented (30 CFR § 780.21). This CHIA update evaluates the Navajo Mine operation within the Navajo Tribal Coal Lease, including the No Name permit area evaluated herein, and considers cumulative impacts from the proposed operation together with all anticipated mining within the delineated CIAs (Chapters 2 through 6). Where historic issues (e.g., past CCB disposal) remain relevant to cumulative effects or

protection of water uses, those pathways are carried forward and updated based on reasonably available information.

1.1.4 Material Damage Criteria

Except for water quality standards and effluent limitations established at 30 CFR § 816.42, the selection and application of material damage criteria is at the discretion of the regulatory authority (48 FR 43972–43973, 1983; 48 FR 43956, 1983). Material damage criteria for groundwater and surface water quality are generally related to applicable standards or criteria that are based on the maintenance and protection of specified water uses such as public and domestic water supply, agriculture, industry, aquatic life, and recreation (OSMRE, 1998). A CHIA also may consider parameters of local significance to water use (OSMRE, 1998), as well as baseline water-quality conditions and other relevant, scientifically supported criteria where appropriate.

In this CHIA update, OSMRE evaluates whether observed or predicted changes in surface water and groundwater quantity and quality, considered in the context of applicable standards, baseline conditions, and protection of existing and reasonably foreseeable uses, support the finding that the operation is designed to prevent material damage to the hydrologic balance outside the permit area. The basis for this determination is developed in Chapters 2 through 6 and summarized in Chapter 6.

1.2 Background

The Navajo Mine is located within the Navajo Nation on lands subject to Navajo Tribal Coal Lease 14-20-603-2505. Mining and reclamation activities have occurred under successive operators; the mine is currently operated by Navajo Transitional Energy Company (NTEC), a Navajo Nation owned limited liability company.

The Navajo Mine is located in San Juan County, New Mexico, 22 miles southwest of Farmington, New Mexico. Surface coal mining and reclamation operations are conducted within permit areas that lie within the broader lease boundary. This 2026 CHIA update addresses a new permit area (the No Name permit area) within the overall Navajo Mine operation and evaluates cumulative hydrologic impacts within the delineated cumulative impact areas.

The Navajo Tribal Lease Area was originally under the operation of Utah International, beginning operation in 1963. Utah International was acquired by GE in 1977, and then by BHP in 1984. Navajo Mine operation became part of BHP Billiton with the merger of BHP and Billiton in 2001. Navajo Mine operates under Permit NM-0003I. OSMRE received a Permit Application Package (PAP) to develop an approximately 10,000 acre new permit area to continue surface coal mining and reclamation operations past 2031 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505).

Coal produced from the Navajo Mine has historically supported regional power generation, principally at the Four Corners Power Plant. Reclamation is conducted contemporaneously where practicable and is designed to restore the land to a condition capable of supporting the approved post-mining land use in accordance with applicable SMCRA performance standards, including 30 CFR 816.116. NTEC mining operations currently supply coal from the Navajo and Pinabete Mines to support the operations of Units 4 and 5 at the Four Corners Power Plant (FCPP). The operation of Units 1, 2, and 3 were discontinued after 2013, reducing FCPP coal consumption from approximately 8.5 million tons of coal per year to 5-6 million tons of coal per year. As such, FCPP has two operational units, producing approximately 1,500

megawatts of power annually. Coal from the Navajo and Pinabete Mines will be used to support operation of the FCPP until 2031, when the majority of reserves in those permit areas will be exhausted.

The Proposed No Name PAP indicates that between 5 and 15 million tons will be produced annually, on average, for the 50 to 110-year life-of-mine. NTEC relies on strip mining as the mining method in the Navajo Tribal Coal Lease area for multiple coal seam mining. Strip mining involves the removal of overburden material covering the coal using blasting and large draglines. The coal is then removed by truck shovels or front-end loaders and transported to coal preparation facilities using haulage trucks. Coal seams are exposed in pits ranging in depth from 5 feet to 240 feet, mine pit lengths vary from 1,000 feet to 15,000 feet. After the coal is removed, the overburden material is regraded to the approved topography and drainages to support the approved post-mining land uses. Stockpiled topsoil and other suitable material are spread on top of the graded overburden material to support the re-establishment of approved post-mining vegetation (NTEC 2013, Part 3 Sect. 20). NTEC must then demonstrate the persistence of reestablished vegetative cover sufficient to support post-mining land use in accordance with 30 CFR 816.116.

1.2.1 Climate

The lease area ranges in elevation from approximately 5,000 to 5,600 feet above mean sea level. The climate varies from arid to semi-arid based on precipitation records collected at the Navajo Mine. NTEC has collected climatological data from two onsite meteorological monitoring stations since 1991, designated Meteorological Station I and Meteorological Station II. Meteorological Station I is located in Area I, and Meteorological Station II is located at an area referred to as the Neck between Area II and Area III. Temperatures at the Navajo Mine are characterized by cold winters and warm summers, with wide variations in diurnal and annual temperature (URS 2009). Summer days are typically warm (90-95°F) and dry, while nights are cool (55-60°F). During the winter months of December and January, air temperatures commonly fall below 20°F in early morning, while daytime highs typically range from 35 to 45°F. The frost-free period averages 162 days from early May to mid-October (Smeal, et al. 2006).

The average relative humidity at the Navajo Mine ranges from 33 percent in July to 65 percent in January, with an annual average of 45 percent relative humidity (NTEC 2013, Part 2 Sect. 12). The area receives precipitation during the summer months, when afternoon showers form as a result of moist air from the Gulf of Mexico moving over the area, and in the fall and winter, when cold fronts moving to the east and southeast from the Pacific Ocean create steady, usually light rain and snow showers across the area (URS 2009). The majority of precipitation occurs during monsoon season (July-October), when prevailing winds shift to the southwest and carry sub-tropical moisture into the area, resulting in localized, high intensity, short duration thunderstorms (NTEC 2013, Part 2 Sect. 12, Smeal, et al. 2006, URS 2009). However, considering the entire year, most precipitation events are of short duration and deposit less than 0.10 inch of rain per event (Smeal, et al. 2006). During the winter, snows are infrequent and light. Snow accumulations melt or sublimate within a few days, and snow depths greater than 6 inches are uncommon (Smeal, et al. 2006, URS 2009).

1.2.2 Regional Geology

The assessment area for this CHIA update, including the Navajo Mine operation and the No Name permit component evaluated herein, is within the Colorado Plateau physiographic province of the western United States, geographically west of the 100th meridian west longitude (NTEC 2013, Part 2 Sect. 12). The Colorado Plateau covers approximately 130,000 square miles (mi²) and includes parts of Arizona, Colorado, New Mexico, and Utah (Hereford, Webb and Graham 2005). The Navajo and Pinabete Permit

areas, and the proposed No Name Permit area, are shown in Figure 1. The Navajo Tribal Coal lease is located on the western flank of the San Juan Structural Basin in northwestern San Juan County approximately 15 miles southwest of Farmington, New Mexico (Figure 2). This basin is an asymmetric, structural basin with a northwest trending axis parallel to the Hogback Monocline in northwest New Mexico. The basin is bounded on the northwest by the Hogback Monocline and on the north by the San Juan Uplift. The eastern rim is formed by the Brazos Uplift and the Nacimiento Uplift. The Zuni Uplift and the Chaco Slope form the southern margin of the basin while the Defiance Uplift and Four Corners Platform complete the northwestern basin rim (Figure 3) (NTEC 2013, Part 2 Sect. 17). The San Juan Watershed lies on the eastern edge of the Colorado Plateau and extends from northwestern New Mexico into portions of northeastern Arizona along the New Mexico/Arizona border, southwestern Colorado, and the southeastern most corner of Utah. The San Juan Watershed is approximately 140 miles wide by 200 miles long and covers a total area of 21,600 square miles (URS 2009).

The rock strata in the southern part of the lease area strike north-south while the strata in the northern part strike northeast-southwest (NTEC 2013, Part 2 Sect. 17). The geologic formation dips gently to the east toward the center of the San Juan Basin at an angle of one to two degrees, and steepens toward the outcrop areas where the fairly abrupt monocline (Hogback) can be observed (NTEC 2013, Part 2 Sect. 18). The stratigraphic section in the lease area reflects the Late Cretaceous transition of shallow marine depositional environment to a terrestrial fluvial depositional environment (NTEC 2013, Part 2 Sect. 17). During the late Cretaceous geologic period, the shoreline of a vast shallow inland sea shifted back and forth across the basin and ultimately receded, depositing alternating marine and nonmarine sediments (NTEC 2013, Appendix 18.O). The strata in the lease area have not been intensively folded, and faults in the strata have limited displacement and extent (NTEC 2013, Part 6 Sect. 41). The mine lease area surface, and adjacent areas, are comprised of the Lewis Shale, Pictured Cliffs Sandstone Formation, Fruitland Formation, Kirtland Shale and unconsolidated alluvial deposits in the valleys of the San Juan River, Chaco River, and the Chaco River tributaries (NTEC 2013, Part 2 Sect. 18). A generalized stratigraphic section and geologic map of the lease area are presented in Figures 4 and 5.

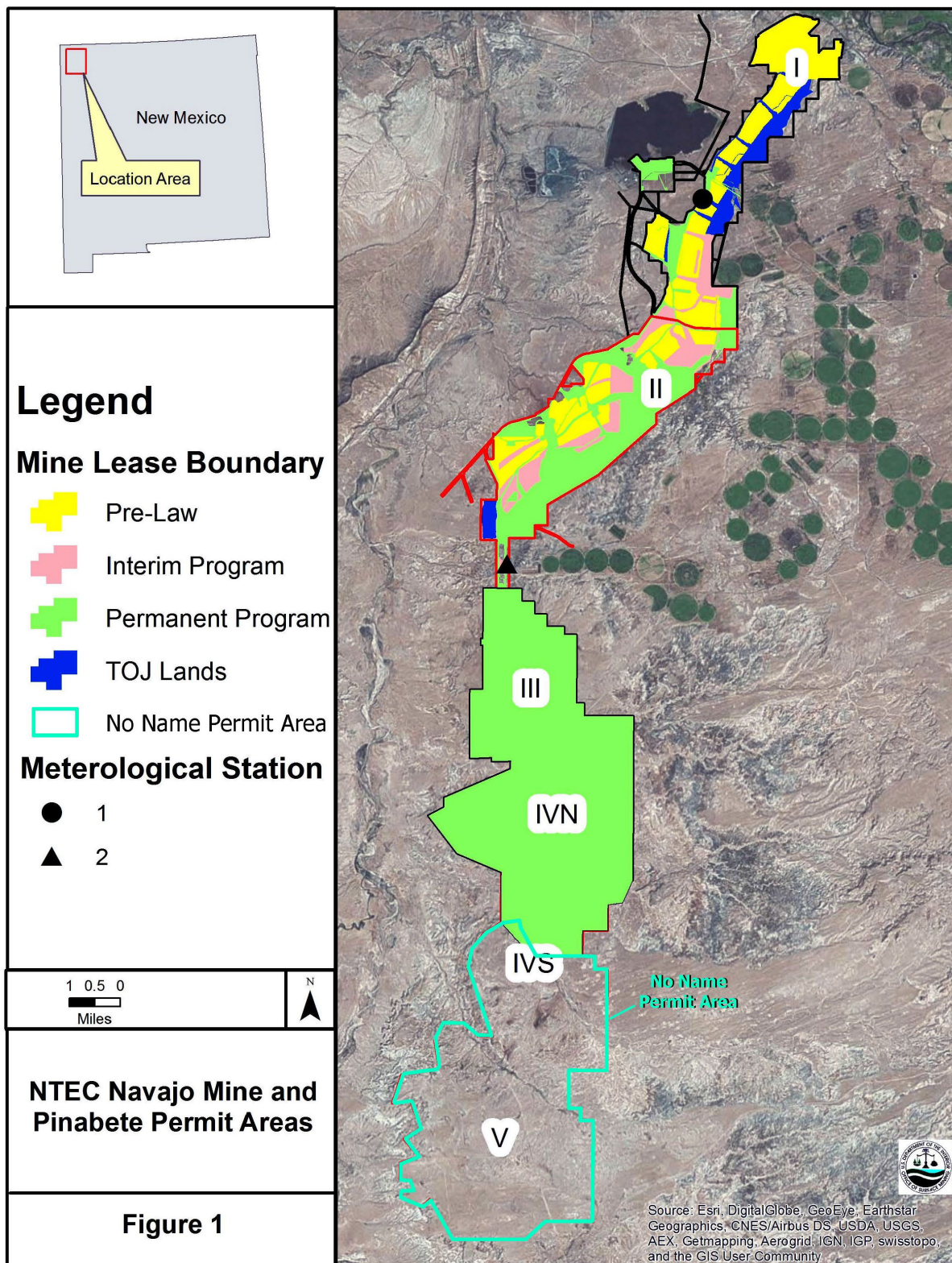


Figure 1: NTEC Navajo Mine and No Name Permit Area

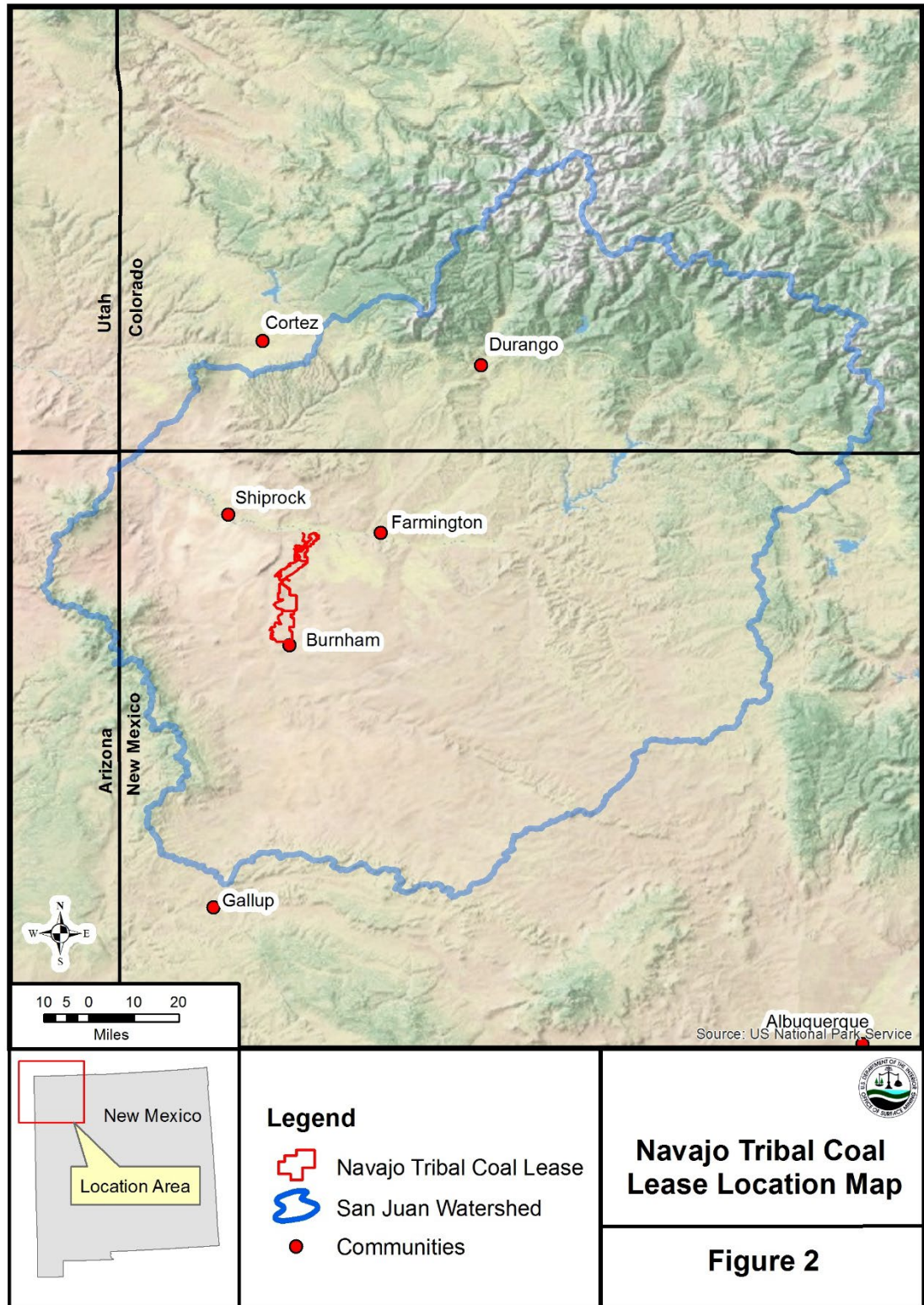


Figure 2: Navajo Tribal Coal Lease Location Map

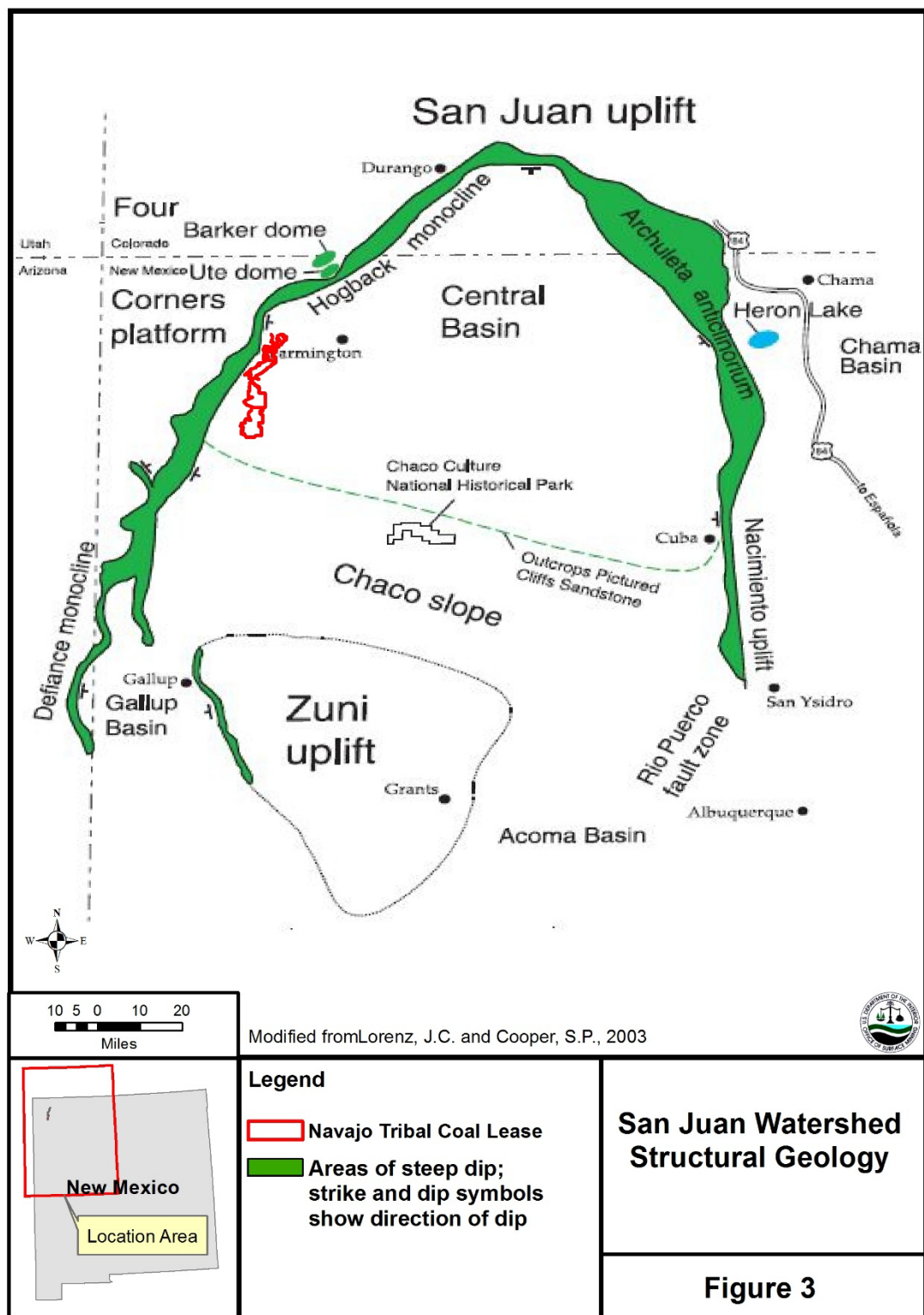


Figure 3: San Juan Basin Structural Geology

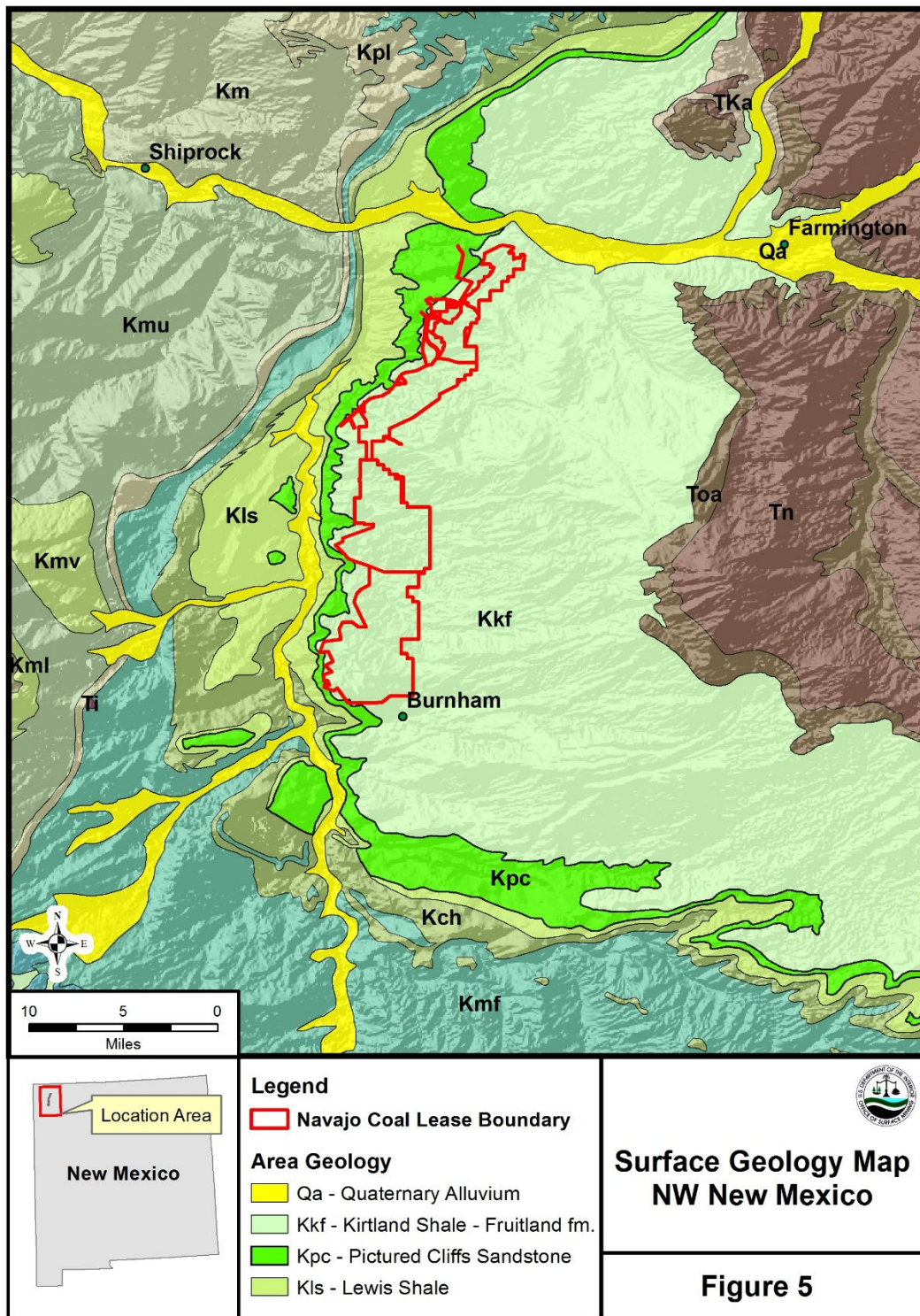


Figure 5: Surface Geology Map, NW New Mexico

2 DELINEATION OF CUMULATIVE IMPACT AREA

A CIA is defined in 30 CFR 701.5 as the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface- and groundwater systems. For the Navajo Tribal Coal Lease, CIA delineation consists of both surface water and groundwater components. Within each component, specific impact areas are delineated based on the extent of the hydrologic resource, the hydrologic pathways of concern, and the potential for impacts to affect existing and reasonably foreseeable water uses.

2.1 Surface Water Cumulative Impact Area

The Navajo Tribal Coal Lease covers all or part of the drainage areas of the Bitsui, Chinde, Hosteen, No Name, and Barber Washes, and the Neck, Lowe, Cottonwood, No Name, and Pinabete Arroyos (Figure 6). Since mining operations at the Navajo Tribal Coal Lease are the only SMCRA regulated operations in the drainage basins identified above, surface water impacts cannot be cumulative with other SMCRA operations unless the impacts extend farther downstream within the receiving watersheds. Bitsui Wash discharges directly to the San Juan River. All other washes and arroyos discharge to the Chaco River, which in turn discharges to the San Juan River. The San Juan River and Chaco River channels and flood plains will not be directly disturbed by active mining activities. Therefore, potential coal mining impacts on these rivers would occur through mine-related discharges, runoff, or groundwater influences originating within the lease area or from reclaimed surface and backfill areas. OSMRE will assess (1) the cumulative surface water impact potential of all local NTEC mining operations within the Chaco and San Juan watersheds, and (2) the potential for cumulative surface water quality and quantity impacts of the Navajo Mine operation, including the No Name permit area evaluated in this CHIA update, on the Chaco River and San Juan River systems.

2.1.1 Cumulative Surface Water Impact Potential

Surface coal mining and reclamation activities are required to minimize disturbance to the hydrologic balance within the permit and adjacent areas, prevent material damage to the hydrologic balance outside the permit area, assure the protection or replacement of water rights, and support approved post-mining land uses and conditions (30 CFR 816.41(a)). Surface water quality protection of the hydrologic balance is accomplished, to the extent possible, by using the best technology currently available to minimize acidic or toxic drainage and additional contribution of suspended solids to streamflow outside the permit area (30 CFR 816.41(d)(1)). The 1984 Navajo Mine CHIA (with addendum in 1989) was prepared considering the San Juan Watershed as the CIA (Kaman Temp 1984; OSMRE 1989). Consistent with that approach, this CHIA considers the cumulative surface water impact potential of SMCRA regulated mining activities within the San Juan Watershed for context. The San Juan Watershed contains the following historical or existing coal mines: Chimney Rock Mine, Coal Gulch Mine, Carbon Junction Mine, Peacock Mine, National King Coal Mine, La Plata No. 1 Mine, Blue Flame Mine, La Plata Mine, Black Diamond Mine, San Juan Mine, Navajo Mine, Burnham Mine, De-Na-Zin Mine, Gateway Mine, El Segundo Mine, Pinabete Mine, and the No Name Mine (Figure 7). Lee Ranch Mine, which began surface coal operations in 1984, is identified on Figure 7 for illustration purposes only. Existing and planned operations border but are not within the San Juan Watershed; therefore, Lee Ranch Mine is not included in the potential cumulative impacts discussion. The Chimney Rock, Coal Gulch, Gateway, De-Na-Zin, and Black Diamond Mines were surface coal mines (Table 2). Mining was completed at each of these mines, as well as final bond release. The Blue Flame and La Plata No. 1 Mines were underground mines, which began operation in 1950 and 1905 respectively. Mining was completed at each in 1991 and 1988,

respectively; final bond release occurred in 2008 and 2004, respectively. The Peacock Mine was an underground coal mine, which began mining in 1905, and reclamation was completed in 1996.

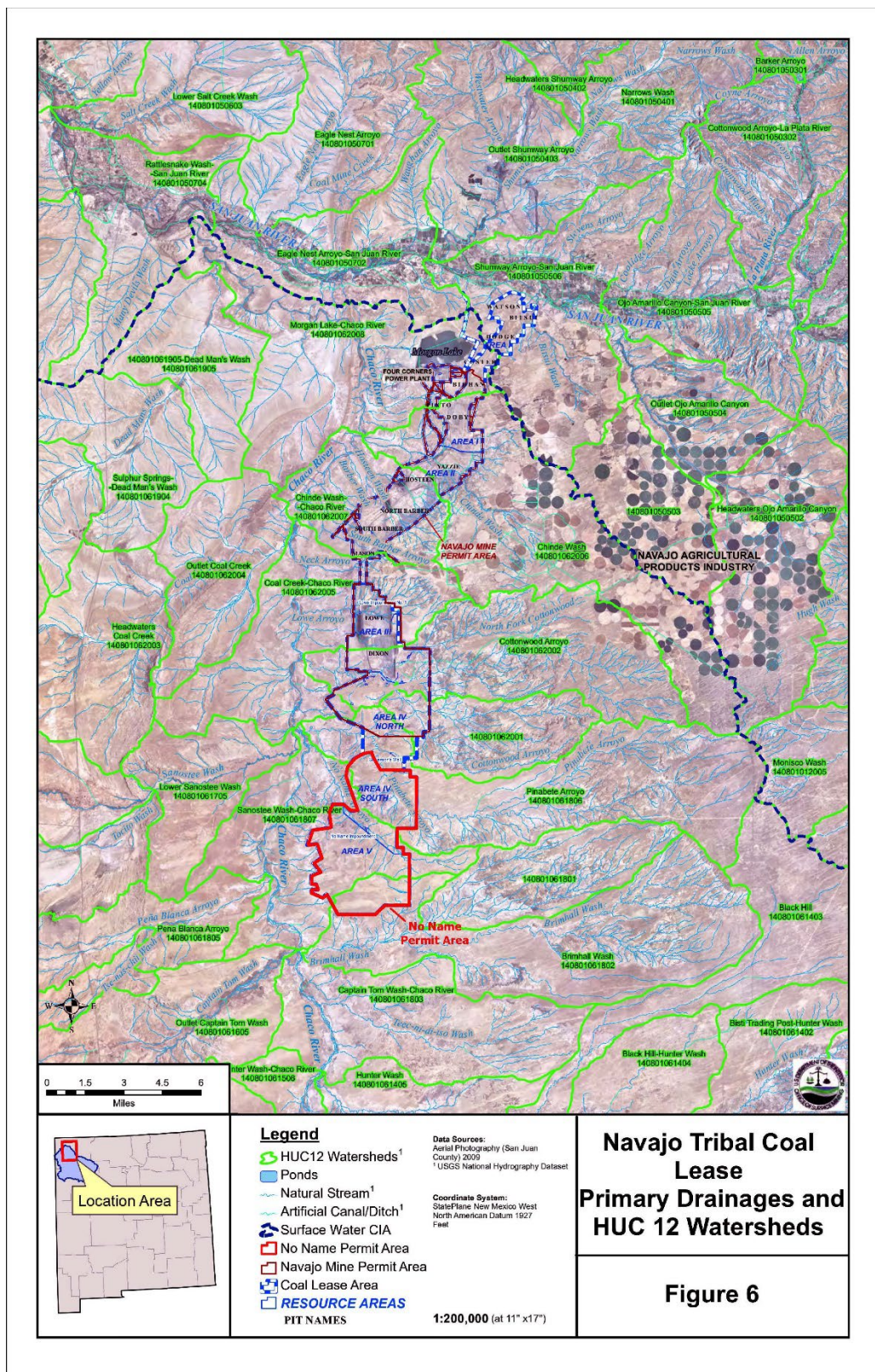


Figure 6: Navajo Tribal Coal Lease Primary Drainages and HUC 12 and Pinabete and No Name Watersheds

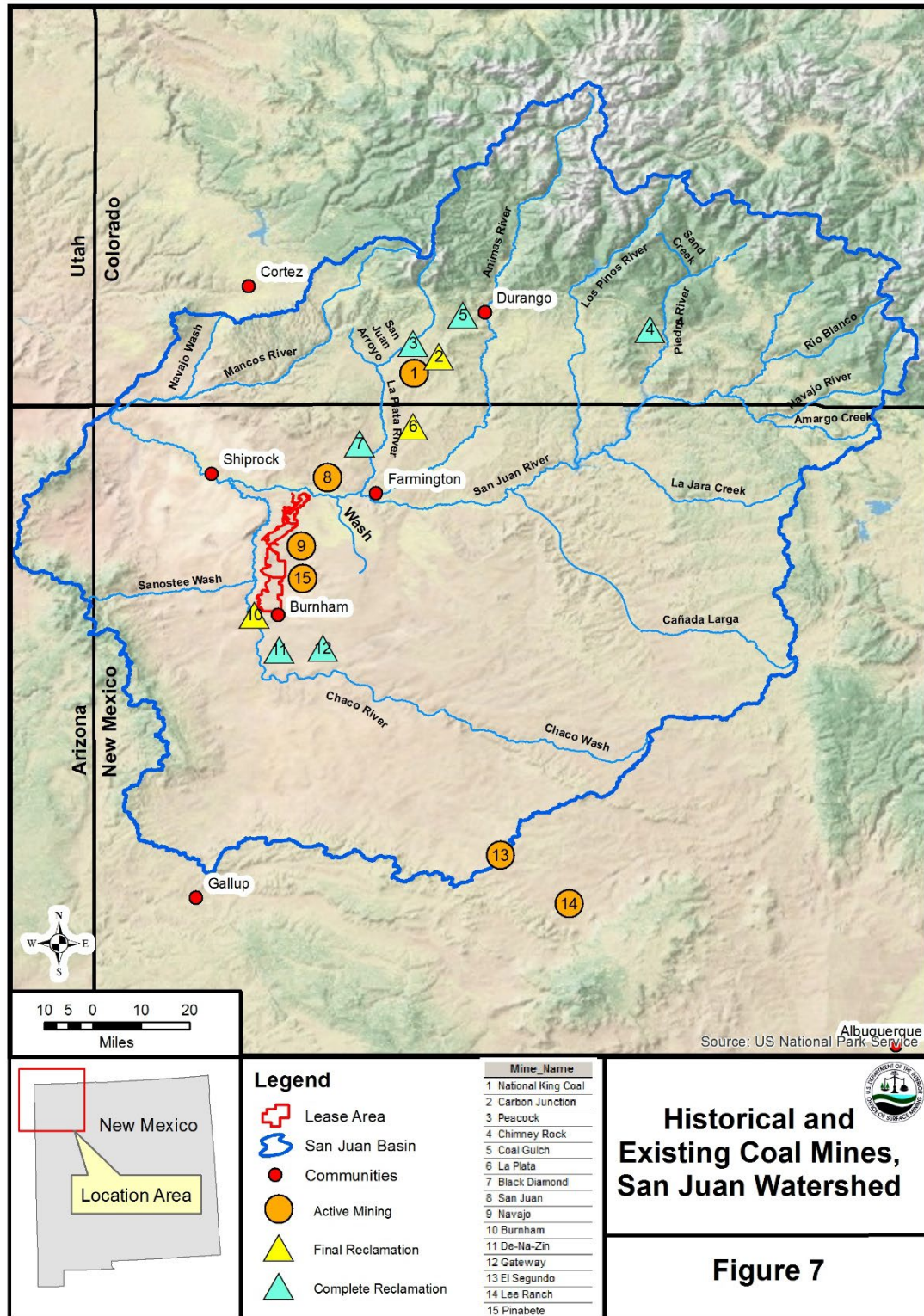


Figure 7: Historical and Existing Coal Mining, San Juan Watershed

The Carbon Junction, La Plata, and Burnham Mines are surface mines that have not achieved final bond release. The Carbon Junction Mine achieved final reclamation in 2008. Phase II bond release was achieved for the entire La Plata Mine site, and the site is in final reclamation. The Burnham Mine was conditionally approved for the initial seven years of operation but was never issued a permit under the Permanent Program. The location is currently fully reclaimed and OSMRE's jurisdiction has been terminated. The King Coal Mine (also known as the King II Mine) is an underground operation that began in 1941 and is currently active. The San Juan Mine includes both surface and underground operations, which began in 1973 and 2000, respectively, and both are currently active. The El Segundo Mine is a surface mine that began in 2008 and is currently active. The Navajo Mine has operated since 1963 and is the subject of this assessment.

Table 2: Mining History in the San Juan Watershed

Mine	Type	Start of Mining	End of Mining	Status
Chimney Rock	Surface	1976	1985	Reclamation completed 2005
Coal Gulch	Surface	1978	1998	Reclamation completed 2010
Gateway	Surface	1982	1990	Reclamation completed 2004
De-Na-zin	Surface	1980	1992	Reclamation completed 2003
Black Diamond	Surface	1983	1993	Reclamation completed 2007
Blue Flame	Underground	1950	1991	Reclamation completed 2008
La Plata No. 1	Underground	1905	1988	Reclamation completed 2004
Peacock	Underground	1905	1981	Reclamation completed 1996
Carbon Junction	Surface	1983	1990	Reclamation completed 2008
La Plata	Surface	1986	2003	Reclamation completed
Burnham	Surface	1980	1984	Reclamation completed
King Coal Mine	Underground	1941	NA	Active
San Juan Mine	Surface/Underground	1973/2000	2022	Inactive, under reclamation
El Segundo	Surface	2008	NA	Active
Navajo	Surface	1963	NA	Active

Generally, Phase I bond release requires submission and approval of documentation for permanent drainage control structures. Phase II bond release generally requires documentation that the permittee or the landowner has provided for future maintenance of all approved permanent impoundments in accordance with 30 CFR 800.40(c)(2). Phase III bond release requires a demonstration in accordance with 30 CFR 816.41 that surface mining and reclamation activities have been conducted to minimize disturbance of the hydrologic balance within the permit and adjacent areas, prevent material damage to the hydrologic balance outside the permit area, assure that water quantity and quality are suitable to support approved postmining land uses, and that the water rights of other users have been protected or replaced, in accordance with the terms and conditions of the approved permit.

Mines that have achieved final bond release are generally eliminated from the potential cumulative impact discussion because a regulatory authority determination has been made that material damage to the hydrologic balance has been prevented for those operations. The Peacock Mine is also excluded from the potential impact discussion because reclamation has been completed to the satisfaction of the Colorado Department of Mining and Safety. Inactive operations and permit areas currently under reclamation, especially those further along in the bond release process, are less likely to contribute to cumulative impacts; however, they are considered in the potential impacts discussion for completeness. All currently active mines are also considered in the potential impact discussion. Therefore, the mines considered in the potential impact discussion are Carbon Junction, La Plata, Burnham, King Coal, San Juan, El Segundo, Pinabete, and Navajo Mine, including the No Name permit area evaluated in this CHIA update.

2.1.2 Impact Potential to the San Juan River

The San Juan River is a major tributary to the Colorado River and drains a large, multi-state watershed. In the vicinity of the Navajo Mine, the USGS maintains streamflow monitoring locations on the San Juan River, including gages near Farmington, near Fruitland, and near Shiprock (Figure 8). These gages provide long-term context for evaluating whether hydrologic conditions at the scale of the San Juan River are measurably influenced by mining-related activities within the Navajo Tribal Coal Lease.

Figure 9 illustrates discharge data collected by the USGS at three stations San Juan River gaging stations from 1931 to 2010. The data demonstrates there has been consistent flow variability along the San Juan, with a general decreasing flow trend for the period of record. Although flows initially increased upstream to downstream along the San Juan during the monitoring period, this trend reversed, such that downstream flows were less than upstream flows. Based on linear trend lines, the tipping point at which this occurred was around 1972. However, the general trend of decreasing flows, and the difference in the rate of decrease between the downstream and upstream stations, was apparent before mining, and appears unrelated to the changing mining activity in the San Juan Watershed.

The San Juan River is perennial, and a portion of its flow originates from groundwater discharge. Surface water withdrawals from the San Juan River have historically supported regional industrial uses, including the power generation and mining complex. Recent diversion volumes for mine-related uses are small relative to San Juan River flows at the relevant gaging locations. Therefore, diversion from the San Juan River for use at the Navajo Mine operation, including the No Name permit area evaluated in this CHIA update, is not expected to result in material impacts to San Juan River surface water quantity.

Potential mining-related influence on the San Juan River would occur indirectly through tributary drainages (principally through the Chaco River system) or through groundwater discharge from reclaimed mine areas. Available analyses and monitoring data indicate that mine-related discharge estimates to the San Juan River are small compared to river flows, and that water quality trends in long-term USGS datasets along the San Juan River show variability but do not indicate a consistent mining-related signal distinguishable from baseline variability at the river scale. Historic water quality data evaluated along the San Juan River similarly indicate that trends in constituents of interest are variable and do not show correlation with changing mining activity in the watershed.

All surface water drainages that traverse the Navajo Tribal Coal Lease discharge to the Chaco River, which in turn discharges to the San Juan River, except Bitsui Wash. Bitsui Wash drains the northern portion of the lease area and discharges directly to the San Juan River (Figure 6). Disturbance in the Bitsui watershed largely predates SMCRA jurisdiction (pre-law), and available information indicates that Bitsui Wash does not receive drainage from the reclaimed areas of the Navajo Mine permanent program permit areas. Based on these considerations, and because discharge from Bitsui Wash is not expected to result in material damage to San Juan River uses, Bitsui Wash is excluded from the surface water CIA.

In addition, CHIAs prepared by the New Mexico Mining and Minerals Division for other mines in the San Juan watershed have delineated CIAs that do not extend to the San Juan River for the La Plata and San Juan Mines. Considered in conjunction with available hydrologic assessments for the watershed, these findings support the conclusion that cumulative surface water impacts from other regional mines have a negligible potential to interact with the Navajo Mine operation at the scale of the San Juan River.

For instance, the measured Total Dissolved Solids (TDS) concentrations indicate variability in concentrations along the San Juan River, with a general trend of decreasing concentration throughout the

duration of monitoring. TDS increases from upstream to downstream along the San Juan River and is consistently higher at downstream monitoring stations. Based on linear trend lines, TDS concentrations are decreasing at downstream locations, and the general trend appears to be unrelated to the changing mining activity in the San Juan Watershed (Figure 10).

Based on the watershed-scale context, available quantity and quality data along the San Juan River, and relevant CHIA analyses completed by other regulatory authorities, the San Juan River is not included in the Navajo Mine surface water CIA.

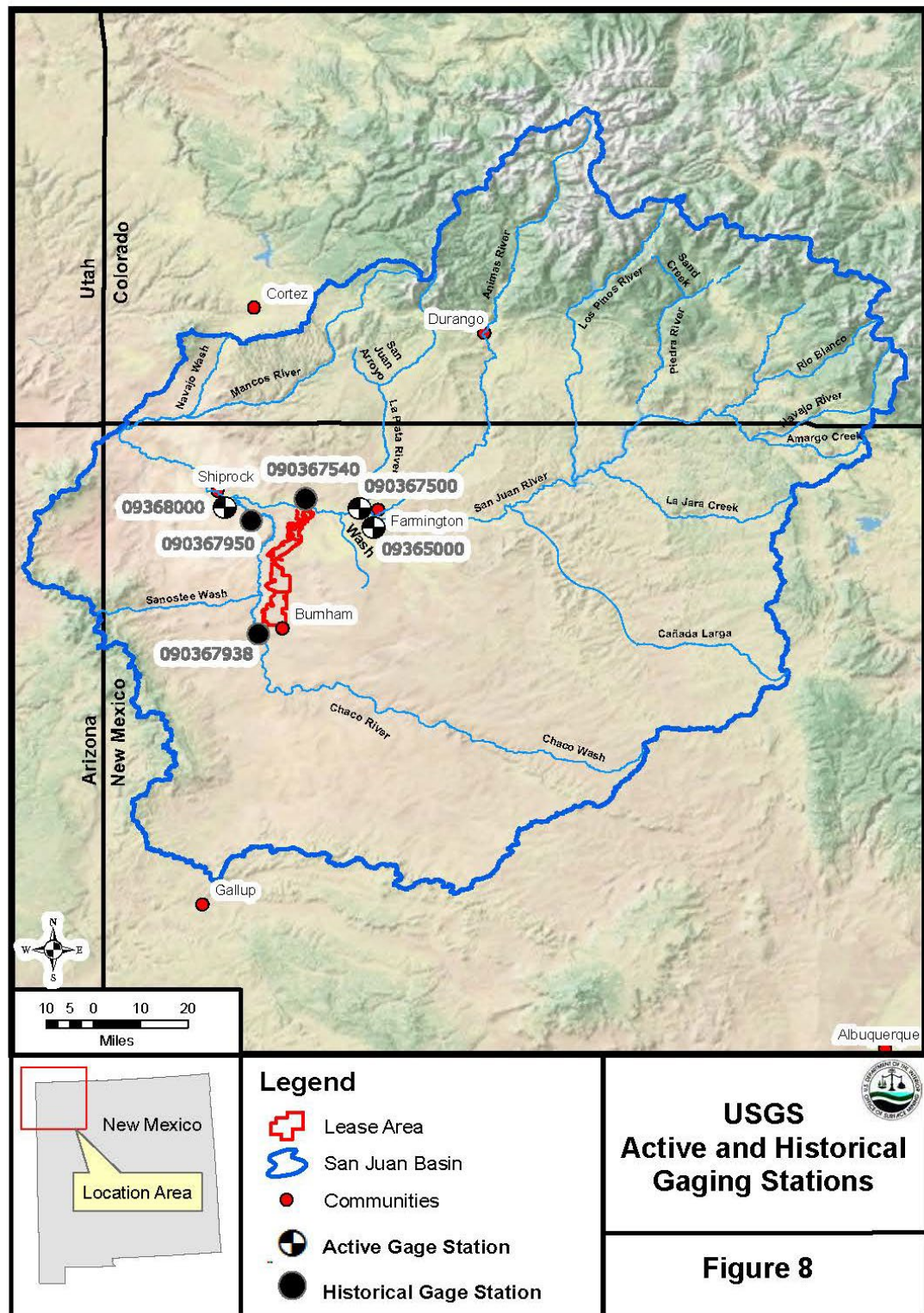


Figure 8: USGS Active and Historical Gaging Stations, San Juan Watershed

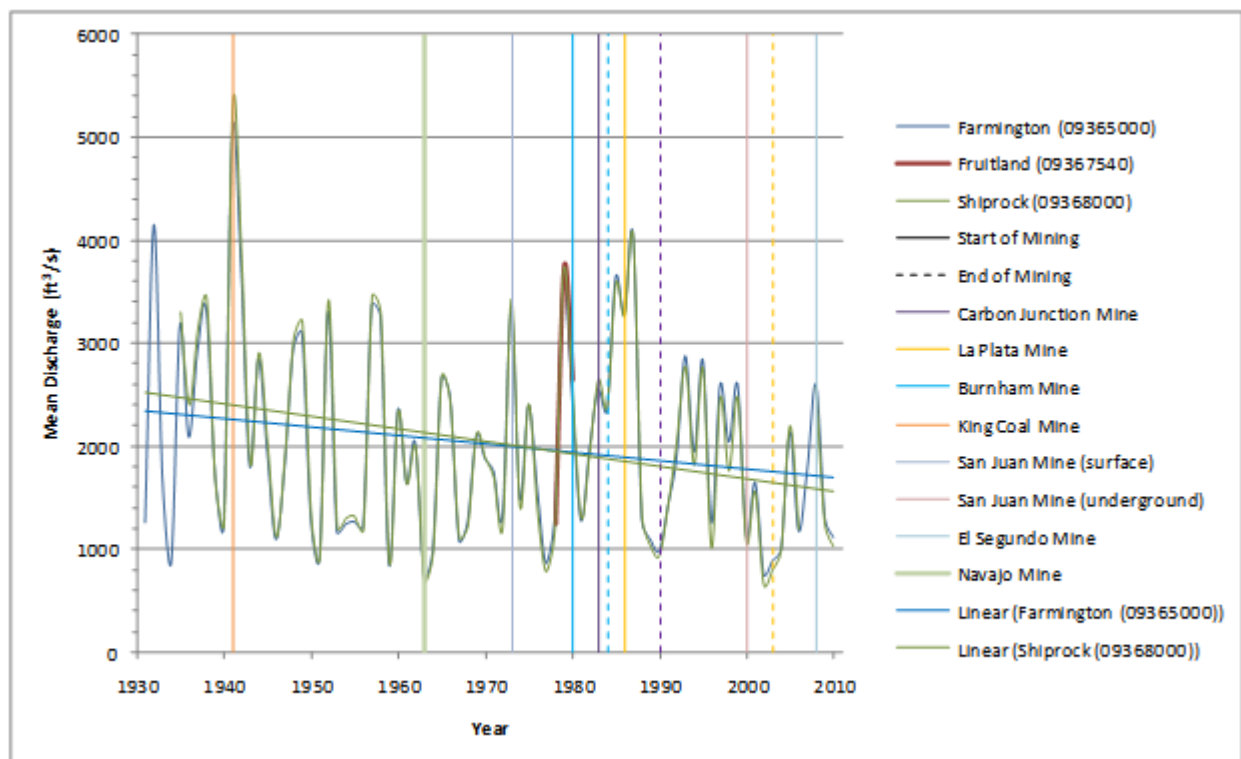


Figure 9: San Juan River Discharge and Mine Operational Period Comparison (1931-2010)

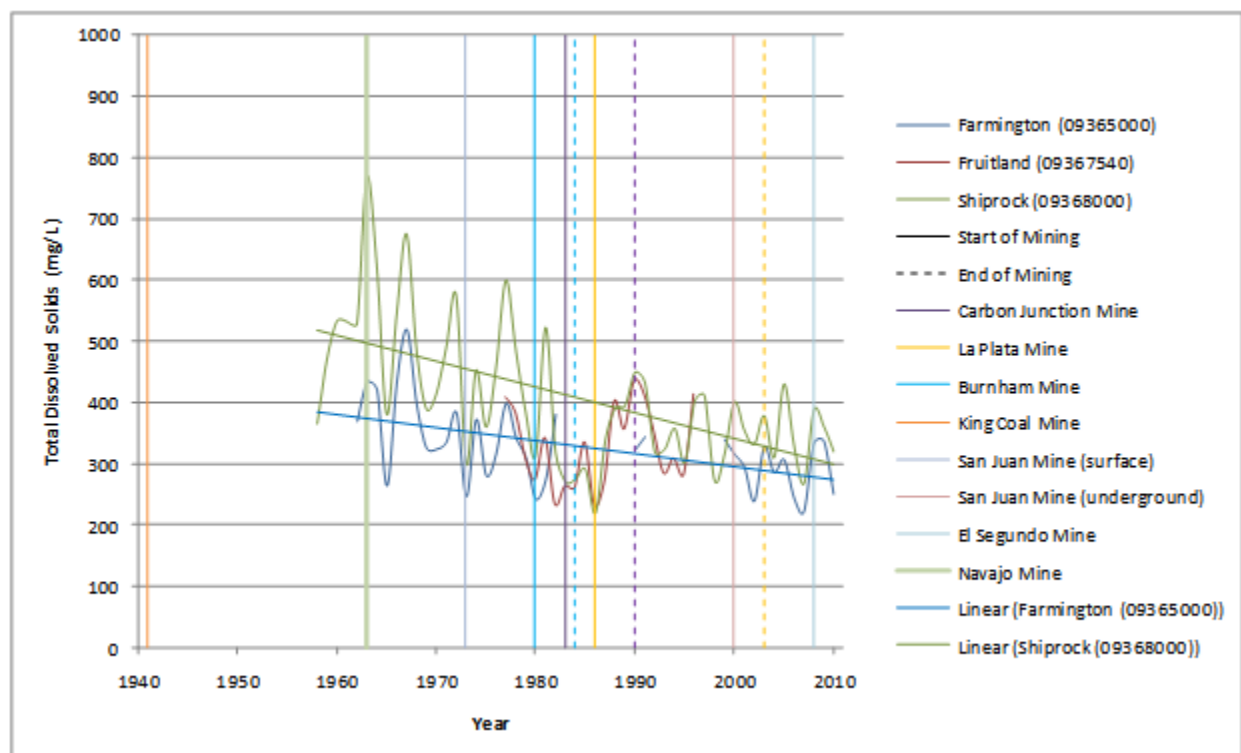


Figure 10: San Juan River TDS and Mine Operational Period Comparison (1957-2010)

2.1.3 Impact Potential to the Chaco River

The Chaco River has a watershed area of approximately 4,350 square miles, of which the Navajo Tribal Coal Lease area occupies approximately 0.6 percent. The Chaco River lies to the west of the lease area and flows north to the San Juan River downstream of the lease area. Flow in the Chaco River is ephemeral except for the last approximately 12.5 miles near the confluence of the Chaco and San Juan Rivers. The surface expression of the Chaco River is approximately 0.1 mile wide, and the river is subject to high sediment loadings. The BLM Farmington Field Office estimated an average sediment yield from the Chaco watershed at 5.8 tons per acre per year (URS 2009). Within the Chaco watershed, the only coal mining activities that have not achieved final bond release, other than the Navajo Mine operation evaluated in this CHIA update, is the El Segundo Mine, which is approximately 110 miles away.

The Burnham Mine is located near Burnham, New Mexico, approximately 15 miles east of U.S. Highway 491 on BIA Road 5 in San Juan County, New Mexico (Golder Associates Inc. 2008). In 1978, Consol proposed mining approximately 6,831 acres at the Burnham Mine. OSMRE conditionally approved Burnham Mine for seven years, and mining operations commenced in 1980; however, production ceased in 1984. Consol submitted an application under the permanent program following approval of the Federal Program for Indian Lands (30 CFR 750) in 1984. Prior to OSMRE completing review of the application, lease negotiations between Consol and the Navajo Nation failed, resulting in lease termination in 1990. In 1991, OSMRE rejected the permanent program application and requested reclamation of the disturbed lands, approximately 140 acres. Consol submitted the Plan for the Reclamation of the Burnham Mine to OSMRE, and it was approved in 1994 (Blake 1994).

The existing Burnham Mine site encompasses approximately 203 acres, including a former pit area, reclamation areas, and the main facility. A diesel fuel release was confirmed in 1992 from an aboveground storage tank system that provided fuel to a generator. The release affected subsurface soil and shallow groundwater, with the majority of soil contamination present at the air-water interface between approximately 16 and 26 feet below ground surface (Golder Associates Inc. 2008; Golder Associates Inc. 2013). In an August 26, 2014 letter from NNEPA to Consol Energy, NNEPA stated that downgradient groundwater monitoring wells sampled in April 2013 showed no diesel hydrocarbons detected, and that excavation, landfarming, and backfilling operations were successful; the local chapter resolved that remediation was completed to their satisfaction, and the site no longer posed a current threat to human health and the environment (NNEPA 2014). The nearest major surface water is the Chaco River, located approximately seven miles west of the site, with Brimhall Wash a tributary feature located approximately 0.5 mile south of the site. Based on the site history, its full reclamation status, remedial actions completed, and distance to the Chaco River, the hydrologic impacts associated with the Burnham Mine are not considered further in the surface water CIA evaluation.

There are two historic USGS stations along the Chaco River with limited discharge and water quality records (09367950 and 09367938). Discharge data were collected from 1977 to 1994, and water quality data were collected from 1969 to 1989. The period of record does not sufficiently cover more recent mining activity in the watershed; therefore, these datasets alone are not sufficient to evaluate cumulative SMCRA related surface water impacts along the Chaco River.

In addition to the USGS data, the Mining and Minerals Division of the NMEMNRD has completed a CHIA assessment for the El Segundo Mine. El Segundo coal mine is located in the eastern end of the Standing Rock Cleary Coal area, which is located in the southern part of the San Juan Watershed in an area known as the Chaco Slope. The Chaco Slope is a broad, gently dipping part of the San Juan Watershed extending from the edge of the Zuni uplift on the south, northward to the central area of the basin. The proposed lease area straddles the continental divide at elevations approximating 7,000 feet

above mean sea level (MSL) in an area that is crossed by several unnamed ephemeral arroyos. The continental divide separates the lease area into two surface watersheds; only the western section is included as part of the Chaco watershed. There are no named drainages to the west of the continental divide within the proposed lease area. The main drainage through the western mine area has the National Hydrologic Database (NHD) reach code of (14080106000944) and is identified as ephemeral as it leaves the lease area. The drainage area for the main western drainage as it leaves the lease area is approximately 24.7 square miles of which about 6.1 square miles (25%) of the total watershed are proposed to be disturbed by mining (NMEMNRD 2005).

Based on the watershed-scale setting and the limited temporal coverage of historic Chaco River monitoring data, cumulative surface water quantity and quality impacts to the Chaco River cannot be evaluated solely using the historic USGS record. Accordingly, this CHIA addresses potential cumulative impacts to the Chaco River through delineation of the surface water CIA and through the use of the current technical record, including updated baseline and monitoring information and the approved hydrologic and sediment modeling analyses for the Navajo Mine operation, including the No Name permit area evaluated in this update.

2.1.4 Surface Water Impact Area

The surface water CIA for assessing cumulative impacts of the Navajo Mine operation, including the No Name permit area evaluated in this CHIA update, and other mining operations in the Chaco River watershed is the Chaco River watershed (Figure 11). The Navajo Tribal Coal Lease occupies a relatively small percentage of the Chaco River watershed. Therefore, to ensure adequate protection of water uses adjacent to the lease area, impacts are also assessed using smaller evaluation areas that focus on the primary washes and arroyos traversing the lease area.

Impacts to surface water quality are assessed for the Chaco River in the vicinity of the Navajo Mine, and for the primary washes and arroyos traversing the lease area, including Pinabete Arroyo, No Name Wash, Cottonwood Arroyo, and Chinde Wash. These drainages provide representative coverage of surface water quality conditions and potential mine-influenced pathways within and immediately downstream of the lease area.

Impacts to surface water quantity are assessed using a combination of Hydrologic Unit Code (HUC) 12 watersheds and total watersheds for certain areas. The USGS has subdivided the United States into successively smaller hydrologic units and assigned each a HUC number. HUC 12 and Pinabete and No Name watersheds represent one of the smaller hydrologic unit scales used for watershed-based analyses and provide a standardized basis for comparing runoff and flow-response metrics across drainage areas that vary in size. Impacts to surface water quantity are analyzed using the following HUC 12 and Pinabete and No Name watersheds: Morgan Lake-Chaco River (140801062008), Chinde Wash (140801062006), Chinde Wash-Chaco River (140801062007), Coal Creek-Chaco River (140801062005), and Cottonwood Arroyo (140801062002). Impacts were also analyzed on the entirety of the Pinabete Arroyo and No Name watersheds.

2.2 Ground Water Cumulative Impact Area

Based on drilling and excavation activities, quaternary alluvium, the coal seams and interbedded lithologic units of the Fruitland Formation, and the Pictured Cliffs Sandstone (PCS) bear appreciable amounts of water within and adjacent to the mine area. Coal seams mined at the Navajo Mine, including within the No Name permit area evaluated in this CHIA update, occur within the Fruitland Formation,

and the majority of water within the Fruitland Formation is concentrated within these lenticular coal strata. Therefore, the Fruitland Formation is assessed in this CHIA with an emphasis on the coal strata.

The Kirtland Shale is relatively impermeable, contains no coal seams, and is not identified as bearing appreciable amounts of water within the assessment area; therefore, the Kirtland Shale is not considered for impact assessment in this CHIA. Potentiometric gradients in the Fruitland coal strata and in the PCS generally trend north to northwest toward the San Juan River, with localized gradients toward topographic lows along tributaries to the Chaco system. Ground water in the Fruitland coal strata and PCS may discharge at very low rates in some locations along topographic lows where it is removed by evapotranspiration. These discharges are insufficient to sustain baseflow, although they may enhance localized vegetation growth.

Alluvial groundwater is included in the groundwater CIA. Ground water recharge to bedrock units is thought to be enhanced along select channels and at pond locations where storm runoff or ponded water is available for infiltration. Recharge water is expected to move predominantly downward through overburden and coal units of the Fruitland Formation and into the PCS. For this reason, the PCS is also assessed in this CHIA. The Lewis Shale underlies the PCS; however, it is relatively impermeable and is not expected to receive significant discharge from the PCS and is not considered for impact assessment in this CHIA. Therefore, potential groundwater quantity and quality effects on the Fruitland Formation coal strata, the PCS, and valley alluvium within the permit area and adjacent area are evaluated in this CHIA.

2.2.1 Ground Water Impact Area

A single groundwater CIA is used to encompass the three principal groundwater resources evaluated in this CHIA update, including the Fruitland Formation coal strata, the PCS, and alluvium (Figure 12). The CIA is bounded on the north by the San Juan River. Both the PCS and Fruitland Formation outcrop in the vicinity of the San Juan River, and because the San Juan River is perennial and receives groundwater discharge, groundwater potentiometric elevations near the river are expected to be closely related to river elevations. The San Juan River therefore functions as a practical hydrologic boundary for the groundwater CIA.

Regional alluvial groundwater flow in the San Juan River alluvium is large relative to mine-related contributions from reclaimed areas. Available analyses indicate that groundwater discharge from reclaimed mine areas to the San Juan River alluvium is small relative to alluvial groundwater throughflow, and that backfill leachate chemistry is expected to be similar to baseline coal seam water quality. Consequently, groundwater discharge from the mine area is not expected to result in material impacts to the quantity or quality of the San Juan River alluvium. Both the PCS and Lewis Shale outcrop west of the lease area and provide a practical boundary for PCS groundwater impacts. In this area, PCS potentiometric elevations and the regional stratigraphic configuration also provide a reasonable western boundary for potential impacts to the Fruitland Formation coal strata. However, to address potential impacts to the alluvial system, the western boundary of the groundwater CIA is extended to the western boundary of the Chaco River alluvium.

The southern and eastern boundaries of the groundwater CIA are supported by the groundwater modeling framework developed for the Navajo Mine operation and documented in the current PHC technical record, including the updated MODFLOW 6 model provided by NTEC for the No Name permit area. Current and historic water-level monitoring data, hydrogeologic mapping, and previously conducted studies were used to develop and calibrate a conceptual and numerical representation of the groundwater system. The groundwater CIA boundaries are delineated at sufficient distance from the lease area such

that assumptions at the model boundaries are expected to have minimal influence on predicted changes within the area of potential impact. The model documentation and associated analyses represent a comprehensive compilation and evaluation of geologic and hydrologic data in the area and provide an appropriate technical basis for assessing hydrologic impacts and for delineating the groundwater CIA (Figure 12).

It should be noted that this groundwater CIA extends south of the Burnham Mine. The depth to groundwater at the Burnham Mine ranges from approximately 16 to 30 feet below ground surface. Hydrologic monitoring at the Burnham Mine indicates groundwater movement to the southeast, away from the Navajo Tribal Coal Lease (Golder Associates Inc. 2008). In addition, the area has a low hydraulic gradient and reclamation has been completed (Golder Associates Inc. 2013). Therefore, groundwater conditions at Burnham are not expected to result in cumulative groundwater effects with the Navajo Mine operation, and groundwater impacts associated with the Burnham Mine are not considered further in this CHIA.

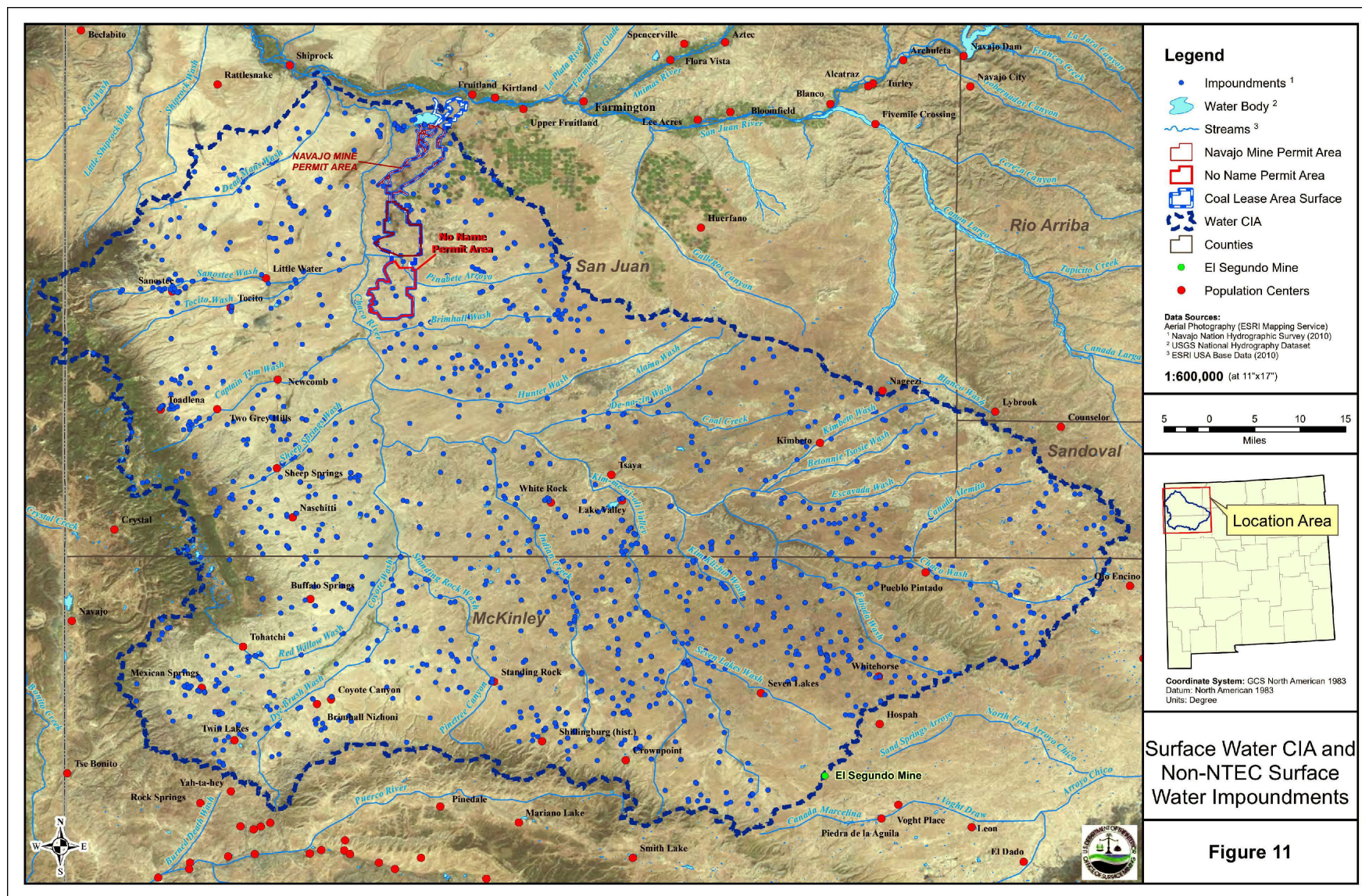


Figure 11: Surface Water CIA and Non-NTEC Surface Water Impoundments

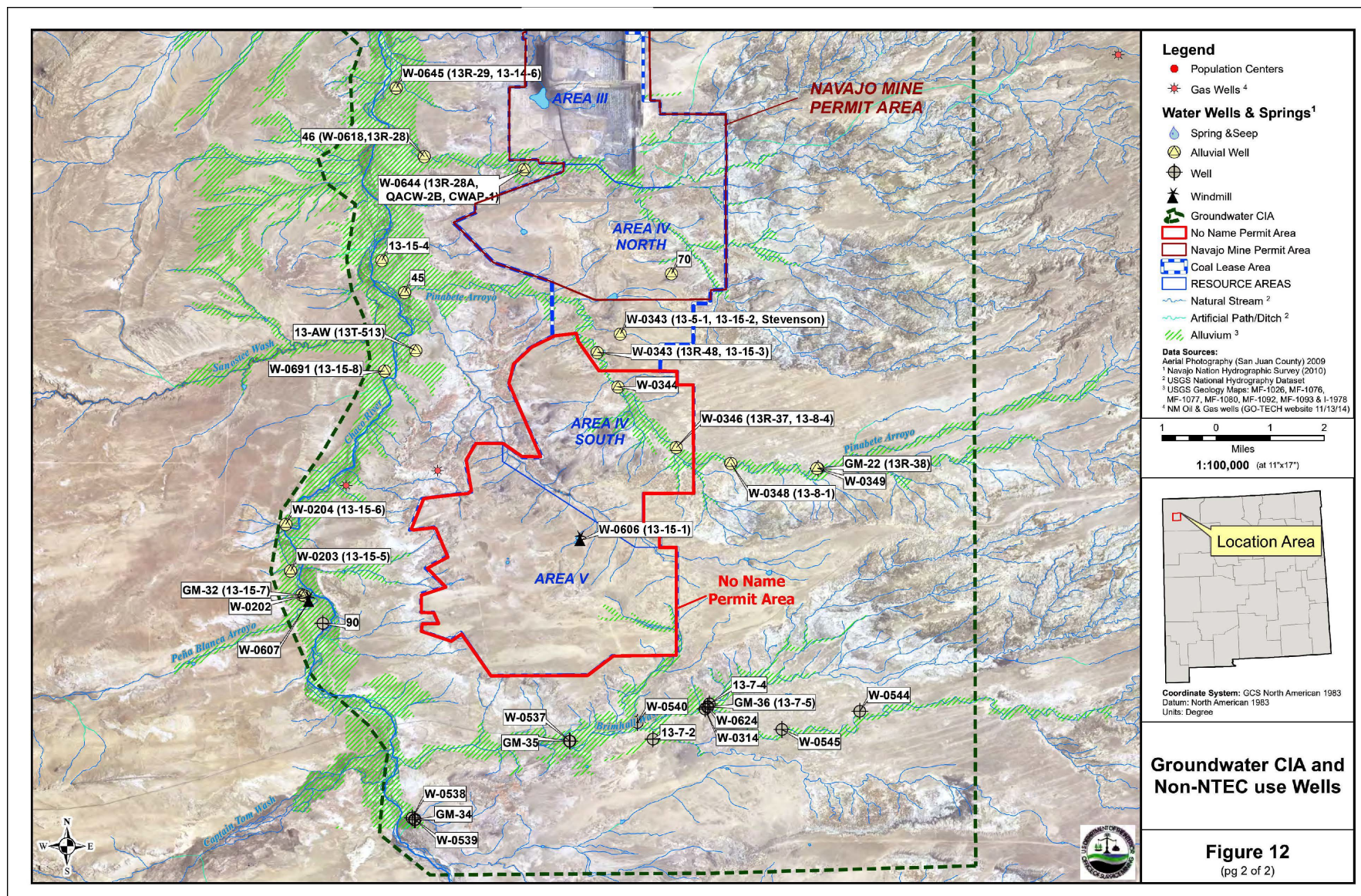


Figure 12: Groundwater CIA and Non-NTEC use Wells

3 WATER RESOURCE USES AND DESIGNATIONS

OSMRE, as the regulatory authority, is responsible for assessing the potential effects of the proposed mining operation on the hydrologic balance and for determining whether the operation has been designed to prevent adverse impacts to surface water and groundwater resources outside the permit areas. Therefore, it is necessary to identify the existing and reasonably foreseeable water uses within the CIAs evaluated for the No Name permit area.

Surface water and groundwater within the CIAs are evaluated for the following existing and reasonably foreseeable uses:

- Direct human use (including domestic and municipal water supply)
- Industrial water supply
- Irrigation supply water
- Livestock watering
- Aquatic and wildlife habitat

Multiple uses may be present at some locations. Figure 12 shows groundwater wells identified within the groundwater CIA, and Figure 11 shows surface water impoundments identified within the surface water CIA. The last known hydrographic survey conducted in the Navajo Mine and surrounding area was in 2011 and was conducted by the United States in response to a court order by the State of New Mexico San Juan County Eleventh Judicial district. Information from this report is utilized in part for the following discussions of water use in the CIAs, and the report is incorporated by reference.

3.1 Direct Human Use

Within the surface water CIA, surface water uses and associated water-quality standards are established under the Navajo Nation Surface Water Quality Standards (NNEPA 2015). These standards apply to all waters of the Navajo Nation, including ephemeral, intermittent, and perennial streams; springs and wetlands; and natural or man-made depressions or basins that impound water. The standards associate specific uses with specific stream reaches, including Brimhall Wash and the Chaco River. Specific uses have not been identified for No Name and Pinabete Arroyos; however, both are non-perennial tributaries of the Chaco River (a tributary of the San Juan River), and standards have been set for non-perennial tributaries of the San Juan River. Designated uses for Brimhall Wash and the Chaco River include livestock watering, aquatic and wildlife habitat, fish consumption, and secondary human contact (NNEPA 2015). Based on available information, no cultural-use waters have been identified within the vicinity of the Navajo Tribal Coal Lease.

Fish Consumption means the use of water by humans for harvesting aquatic organisms for consumption. The lease does not contain streams or ponds with fish, and Morgan Lake is the closest water body within the surface water CIA that provides fishing habitat.

The closest surface water body to the mine designated by NNEPA for domestic water supply is the San Juan River, which is outside the surface water CIA. There are no surface water sources for municipal supply water within the CIA; however, the San Juan River downstream of the Navajo Tribal Coal Lease is used as a municipal water source for Shiprock, New Mexico. A hydrographic survey conducted as part of an ongoing water rights settlement agreement between the State of New Mexico, the United States Federal Government, and the Navajo Nation identified impoundments within the surface water CIA used for municipal wastewater treatment. These impoundments are supplied by local sewer systems and used

for waste settling. Of the 59 identified impoundments, 56 are west and/or south of the Chaco River, and 3 are north of the Chaco River and east of the permit area (United States of America 2011).

Within the groundwater CIA, the Burnham Chapter was identified as a community whose water supply may be considered for groundwater impact assessment. However, the Burnham Chapter formerly used a local well and currently has water piped in from the Carson/Huerfano area to the east, outside of the groundwater CIA. In addition, water withdrawn from the Carson/Huerfano area is from the Ojo Alamo aquifer, which is stratigraphically above the Fruitland Formation. Therefore, while the Burnham Chapter lies within the groundwater CIA, a specific water quantity assessment related to Burnham community water use is not warranted because the current water supply source is outside the CIA.

An updated inventory in the No Name PAP identifies three water wells indicated to be within the permit area from one or more information sources: (1) Well 13R-37, a dug alluvial well on Pinabete Arroyo (upstream of well 13R-48) equipped with a windmill and tank and used for livestock watering; (2) Well 13-5-2, an alluvial well on a tributary to Pinabete Arroyo adjacent to Burnham Road, reportedly recharged by an adjacent man-made pond and equipped with a hand pump (also referred to as the Stevenson Well or 13-5-1); and (3) Well 13-15-1, located adjacent to Burnham Road within Area 5, with an unknown completion zone and capped/welded shut, and which may be completed within the PCS based on reported depth (No Name Permit Application Package, Section 18).

Additional wells and water supply sources identified within the groundwater CIA include Well No. 90, completed in the PCS west of Area 5 and the Chaco River (Figure 12), and wells identified in the hydrographic survey, including W-0312 east of the permit area south of the San Juan River and W-0349 east of Area 4 South along Pinabete Arroyo (United States of America 2011). New Mexico Office of the State Engineer records and the USGS have identified SJ 00248 (G7, No. 6) in the alluvium of the San Juan River northwest of the Navajo Tribal Coal Lease (Thorn 1993). NTEC also provides community potable water at two locations, one near the Navajo North facilities and the other near the Area 4 facilities.

3.2 Industrial Supply Water

The Arizona Public Service (APS) Four Corners Power Plant (FCPP) and NTEC are the primary industrial water users within the CIAs. In addition to APS and NTEC, significant oil and gas extraction occurs within the San Juan Basin, including the Chaco watershed. Oil and gas extraction wells use groundwater resources within the vicinity of the permit area. A few gas wells were identified within the groundwater CIA just north and east of the NTEC permit areas. Gas extraction is the only industrial use of groundwater within the groundwater CIA beyond water required for operation of the FCPP and NTEC mining and reclamation activities.

San Juan River surface water is used at the FCPP and by NTEC through Surface Water Permit Number 2838, issued by the New Mexico Office of the State Engineer in October 1958. This permit provides a total diversionary right of 51,600 acre-feet annually (approximately 71 ft³/second), with a consumptive right of 39,000 acre-feet annually (approximately 54 ft³/second), for waters drawn from the San Juan River (United States of America 2011, Table L-1).

Water diverted from the San Juan River is conveyed to Morgan Lake [P-0016], which is the primary source of industrial water in the area and is used by both NTEC and APS. NNEPA has designated Morgan Lake for primary and secondary human contact, fish consumption, aquatic and wildlife habitat, and livestock watering. Morgan Lake is a manmade reservoir approximately 1.2 miles wide and 2.2 miles

long. It has a maximum depth of about 100 feet and a surface area of 1,260 acres at maximum storage. Built in 1961 and operated by APS, Morgan Lake holds approximately 39,200 acre-feet of water at normal storage and 42,800 acre-feet of water at maximum storage. Water from Morgan Lake is used as cooling water at the FCPP and also for dust suppression and reclamation irrigation activities associated with the NTEC permit area. APS uses an ultrafiltration system to purify the water before using it to cool the turbines and diverts a small portion for drinking water within the plant.

APS manages 11 impoundments northwest of the Navajo Tribal Coal Lease area that are supplied by industrial water from the power plant and used for industrial purposes [P-0430 through P-0440]. There are an additional 3 impoundments supplied by industrial sources just south of Morgan Lake [P-0022 through P-0024] (United States of America 2011, Table K-1). NTEC manages several impoundments on the lease area from which water is extracted for use in dust suppression. In addition to impoundments operated by APS and NTEC, 6 impoundments supported by the Navajo Indian Irrigation Project (NIIP) irrigation channel are used as a fish hatchery east of the Neck section of Area II of the Navajo Mine permit area [P-1430 through P-1435] (United States of America 2011, Table K-1). Although the El Segundo Mine is partially within the surface water CIA, the water supply for that mine is from a groundwater well outside of the groundwater CIA. All of these impoundments within the immediate vicinity of the Navajo Tribal Coal Lease area are shown on Figure 13.

For the No Name permit area, the No Name PAP indicates there are no lakes or reservoirs within the permit area; only a few stock watering ponds constructed to catch surface flows from tributary drainages, which are often dry and are not used for irrigation, human consumption, or industrial purposes. The No Name Permit Application Package also indicates there are no springs, seeps, or man-made discharges into surface water bodies within or adjacent to the permit area (No Name PAP, Section 18).

3.3 Irrigation Supply Water

Groundwater is not used for irrigation within the groundwater CIA. However, there is significant use of surface water for irrigation within the surface water CIA. Under the Navajo Nation Surface Water Quality Standards, the closest surface water body to the Navajo Tribal Coal Lease designated for agricultural water supply is the San Juan River, which is outside of the surface water CIA (NNEPA 2015). Water from the San Juan River is used for irrigation by the Navajo Agricultural Products Industry (NAPI), NTEC, and the Navajo Nation Fruitland–Cambridge irrigation projects within the vicinity of the lease area. The Fruitland–Cambridge project is just north of the lease area and has a diversion right of 18,180 acre-feet per year and a depletion right of 7,970 acre-feet per year; however, fields on the southern edge of the San Juan River drain into the San Juan River and do not extend south into the Chaco watershed. Therefore, this project does not extend into the surface water CIA. NTEC operates an irrigation pipeline, initiated in 1975, which provides water from Morgan Lake for irrigation of revegetation plots as part of the approved reclamation plan. NAPI withdraws water from Navajo Reservoir. Navajo Reservoir is approximately 33 miles east of Farmington, New Mexico, and is outside of the surface water CIA.

NAPI is part of the Navajo Indian Irrigation Project (NIIP). On June 13, 1962, Congress authorized the NIIP to furnish irrigation water to 110,630 acres of land with an average annual diversion of 508,000 acre-feet of water. The initial 1962 project authorization allowed for development of 77,543 acres of land east and 33,087 acres west of the Chaco River. On September 25, 1970, following a reevaluation of the project, the site descriptions authorized by the original 1962 Act were amended to exclude the proposed irrigated lands west of the Chaco River and include additional townships east of the river such that all proposed irrigated 110,630 acres were east of the Chaco River (United States of America 2011). NAPI was created by the Navajo Tribal Council on April 16, 1970 (Moore 2006). NAPI has developed in stages

and by blocks; eleven blocks of approximately 10,000 acres each were created (United States of America 2011). On April 10, 1976, Farm Block I received its first release of water (Moore 2006).

Blocks 1 through 8 and the first six fields of Block 9 of NIIP have been completed and are operational. Since 1962, of the acres authorized for development, 79,760 acres have been developed and are subject to project irrigation. Blocks 1, 2, and 4 are east of Gallegos Canyon and outside of the surface water CIA. Block 3 is east of Areas I and II and is within the surface water CIA. Block 2 is north and east of Block 3, and while part of it drains into the Bitsui watershed it is outside of the Chaco watershed (surface water CIA). Block 7 is east of Block 3 and is partially contained within the CIA. Blocks 8 and 9 are south of Block 7 and are also partially contained within the CIA (United States of America 2011).

In addition to NAPI and NTEC impoundments, 77 impoundments supplied by surface water sources other than the San Juan River are used for irrigation within the surface water CIA. These impoundments include diversions, in-channel impoundments, and off-channel impoundments. All 77 impoundments drain into the Chaco River from the opposite side of the basin from the NTEC permit area and are located either west or south of the Chaco River. In addition, 15 impoundments used for irrigation within the surface water CIA are supplied by groundwater or spring sources. These impoundments also drain into the Chaco River from the opposite side of the basin from the NTEC permit areas and are located either west or south of the Chaco River (United States of America 2011).

The hydrographic survey also identifies acreage associated with tributary irrigation project lands that utilize water from sources other than the mainstem of the San Juan River (Figure 14). One project irrigates by diversion of surface flows from No Name Wash and is located south of Area 4 North and east of the Chaco River. Two projects irrigate by diversion of surface flows from Teec-ni-di-tso Wash and are located southwest of Area V and east of the Chaco River. None of these tributary irrigation projects have associated impoundments. The fourth tributary irrigation project is the R.L. Tanner project located north of the Chaco River and southeast of the NTEC lease area in the Lower De-na-zin Wash HUC-12 watershed. The project has an associated reservoir and irrigates by diversion of surface flows from De-na-zin Wash. All other tributary irrigation project lands are located either west or south of the Chaco River on the opposite side of the basin from the NTEC permit area (United States of America 2011).

For the No Name permit area, the No Name PAP indicates that irrigation water is not a use of surface water resources within the permit area; only a few stock watering ponds constructed to catch surface flows from tributary drainages are present within the permit area and are often dry (No Name PAP, Section 18).

3.4 Livestock Supply Water

Livestock grazing has been and is currently the largest land use on Navajo lands. Within the San Juan watershed, a variety of water sources exist to meet the demands of livestock. Surface water from the mainstem San Juan River and its tributaries has been, and continues to be, used for livestock purposes. In addition, groundwater sources are also utilized to meet livestock demands. On Navajo lands within the San Juan watershed, 650 wells and 138 springs have been identified as serving livestock purposes. Stock impoundments have also been built or maintained to create an additional source of water for livestock. These stock impoundments are supplied with water and are filled and refilled annually to the extent that water is available. The United States has identified that the reserved water right associated with livestock grazed on the lands held in trust for the Navajo Nation is 304 acre-feet per year of depletion (486 acre-feet per year diversion). In addition, Navajo Nation water rights associated with stock impoundments on

trust lands amount to 12,693 acre-feet of storage with the associated right to fill and refill these stock impoundments as water is available (United States of America 2011).

NTEC has completed an inventory of wells and springs within the No Name permit and adjacent area. The inventory was extended beyond the three permit areas and includes wells completed in the alluvium of the Chaco River and the San Juan River. A separate hydrographic survey conducted as part of the ongoing water rights settlement agreement also identified wells and springs used for livestock watering within the groundwater CIA (United States of America 2011).

In total, 39 wells used for stock watering were identified within the groundwater CIA. Three wells are located along the San Juan River north of the Navajo Tribal Coal Lease. Two of these are identified as alluvial wells [W-0695 (G-2), SJ 00264 (No. 7)], and the other well [W-0593] does not have an identified completion interval. There are fifteen wells along the Chaco River. Nine are identified as alluvial [W-0202, W-0607, W-0203, W-0204, W-0519, W-0645, 13-AW, GM-32], one is completed in the PCS [No. 90], and the other four [W-0342, W-0520, W-0538, W-0539] have unidentified completion intervals. Two wells are located along Bitsui Wash, one east [W-0313] and one north [W-0603] of the lease area, and both have unidentified completion intervals. One improved spring [S-0767] is located adjacent to Chinde Wash east of the lease area. Two wells used for stock watering are located west of the lease area within the Cottonwood Arroyo alluvium [W-0618, W-0644]. Seven wells are identified along Pinabete Arroyo, four within the lease area [W-0343, W-0345, W-0344, W-0346] and three west of the lease boundary [W-0348, W-0349, GM-22]. Six are identified as alluvial wells, and one has no identified completion interval. One well within the lease area along No Name Wash has no identified completion interval [W-0606]. Six wells used for stock watering were identified along Brimhall Wash, none of which have identified completion intervals [W-0314, W-0537, W-0540, W-0544, W-0545, W-0624]. There are an additional 17 wells identified within the groundwater CIA with no identified use. Livestock watering is the primary use of groundwater within the CIA. The locations of the referenced wells are provided in Figure 12.

All surface waters within the CIA are designated by NNEPA for livestock watering use, including Morgan Lake. Surface water flows are used opportunistically by sheep or other livestock when channels are carrying water. However, livestock normally use stock watering ponds constructed to capture surface flows. Surface water use adjacent to the El Segundo Mine is confined to opportunistic use by ranchers for livestock watering (NMEMNRD 2008).

NTEC has conducted an inventory of stock watering ponds within the No Name permit and adjacent area. The inventory identified 11 pre-mine stock ponds that have been disturbed, or will be disturbed, by mining. NTEC also identified 4 ponds west of Area 2, 3 east of Area 2, 2 west of Area 3, and 11 east of Area 3.

The hydrographic survey conducted as part of the ongoing water rights settlement agreement also identified stock ponds within and adjacent to the lease area (United States of America 2011). One in-channel impoundment [P-5378] was identified east of Area II slightly south of Area I. Five impoundments were identified east of the Chaco River west of Areas 2 and 3, including three in Chaco tributaries north of Cottonwood Arroyo [P-5358, P-5354, P-5305], one in a Cottonwood tributary south of the main fork [P-5294], and one in a Chaco tributary south of Cottonwood [P-0384]. Fourteen in-channel stock impoundments were identified east of Areas 2 and 3, including six in Chinde Wash [P-0365, P-1769, P-0366, P-5352, P-0367, P-0354], two in the north fork of Cottonwood [P-5306, P-5318], one in the South Barber Arroyo [P-5344], and five in Lowe Arroyo [P-5325, P-5324, P-5323, P-5320, P-5316].

In addition, 12 in-channel impoundments were identified east of Areas 3 and 4 North in Cottonwood Arroyo and Cottonwood Arroyo tributaries [P-5318, P-0382, P-0355, P-0356, P-5311, P-0695, P-0691, P-0690, P-5280, P-5357, P-0700, P-0692]. South of Area IV North, 41 stock impoundments were identified, including sixteen in-channel impoundments in Pinabete Arroyo and Pinabete Arroyo tributaries [P-5274, P-5261, P-5233, P-5232, P-0350, P-0349, P-0348, P-5241, P-0346, P-0345, P-5262, P-0685, P-0688, P-0687, P-5250, P-0689], two in No Name Wash [P-0332, P-0342], and 23 in Brimhall Wash and Brimhall Wash tributaries [P-0337, P-0339, P-5192, P-5184, P-0341, P-5187, P-5190, P-5209, P-0343, P-5213, P-0344, P-0813, P-5180, P-0608, P-5183, P-0610, P-0611, P-0594, P-0593, P-5195, P-5189, P-0593, P-0591] (United States of America 2011). All referenced impoundment locations are provided in Figure 13.

Outside of the permit and adjacent area, 242 stock impoundments were identified northeast of the Chaco River on the same side of the watershed as the Navajo Tribal Coal Lease. Of these, 205 are in-channel, 2 are off-channel, 3 are NIIP supplied, and 1 is a diversion. A total of 791 stock impoundments were identified southwest of the Chaco River. Of these, 767 are in-channel, 0 are off-channel, and 15 are diversions (United States of America 2011). In addition, NTEC provides water to local permittees in tanks for livestock use in areas around the lease area when requested. Given the number of stock impoundments and identified uses, livestock watering is the primary use of surface water within the CIA.

For the No Name permit area, the No Name PAP identifies a stock watering pond/impoundment within the permit area (No Name Impoundment) that is used for livestock watering when water is available. The No Name Impoundment has an estimated storage capacity of approximately 12.8 acre-feet when full and an estimated high-water area of approximately 5.8 acres based on a 2008 survey. The No Name Impoundment is generally seasonal, and vegetation along the shoreline suggests seepage and/or interaction with shallow groundwater. Water quality sampling reported for this impoundment indicates that, even under concentrated conditions, the water appears acceptable for livestock watering based on available information (No Name PAP, Section 18; Table 18-17). As noted elsewhere in the CHIA, livestock wells completed in the Pinabete alluvium within the permit area will be removed by mining, and the Hydrologic Reclamation Plan provides alternate water supply during mining and replacement supply after reclamation.

3.5 Aquatic and Wildlife Habitat Water Supply

The Chaco River and tributaries within the surface water CIA are associated with Aquatic and Wildlife Habitat as a designated use under the Navajo Nation Surface Water Quality Standards (NNEPA 2015). The Aquatic and Wildlife Habitat designated use indicates that the water body supports use by animals, plants, or other organisms for habitation, growth, or propagation. Specific designated uses have not been identified for No Name and Pinabete Arroyos; however, both are non-perennial tributaries of the Chaco River (a tributary of the San Juan River), and standards have been set for non-perennial tributaries of the San Juan River. Designated uses for Brimhall Wash and the Chaco River include livestock watering, aquatic and wildlife habitat, fish consumption, and secondary human contact (NNEPA 2015).

All water sources are considered wildlife habitats, particularly in the arid region within which the Navajo Tribal Coal Lease occurs. Vegetation around water sources may be more vigorous or comprised of different species than found in the surrounding area. The predominant wildlife water sources are ponds and impoundments on the lease and nearby areas. Wildlife and their habitats on and adjacent to the Navajo Tribal Coal Lease have been surveyed during several studies conducted at various times between 1973 and 1989. The lease does not contain streams or ponds with fish, and Morgan Lake is the closest water body within the surface water CIA that provides fishing habitat. The scarcity of suitable water

sources on the lease limits the potential habitat for amphibians. The lesser earless lizard, western whiptail, and sagebrush lizard were among the most frequently observed reptiles on the lease.

Waterfowl in the area use water sources such as stock ponds and impoundments on the lease opportunistically as they migrate through the area. Morgan Lake, which is located off lease but within the surface water CIA, provides more suitable waterfowl habitat than is available on the lease. Horned larks are abundant passerine bird species throughout the year. Other common breeding birds include mourning doves and rough-winged swallows. Mourning doves were frequently observed game birds, and mourning dove and waterfowl hunting occurs at Morgan Lake. Blue-winged or cinnamon teal were common species observed using small ponds. White-faced ibis migrate through the region and are occasionally observed at stock ponds or other water sources. Raptors nesting within the lease and adjacent buffer zone during prior surveys included ferruginous hawk, red-tailed hawk, American kestrel, and burrowing owl. Active ferruginous hawk nests were located on the lease and within approximately one-quarter mile of the lease boundary. Red-tailed hawk nests were also located on the lease. Burrowing owls nested on active and abandoned prairie dog colonies on the lease. Additional raptors nesting beyond the one-quarter mile buffer include ferruginous hawk, red-tailed hawk, golden eagle, prairie falcon, and barn owl.

Mule deer are the only big game animals reported on the lease, though they are infrequently observed. Deer mice and silky pocket mice are abundant small mammals throughout most of the habitats on the lease. Prairie dogs and kangaroo rats are relatively common on upland habitats. Black-tailed jackrabbits and cottontails are common medium-sized mammals. Common predators include red fox, kit fox, coyote, and badger. Prairie dog colonies on the lease provide potential habitat for the endangered black-footed ferret; however, no black-footed ferret was observed during prior night spotlight surveys conducted on the lease. Other endangered species that may use the area include bald eagle and peregrine falcon. Neither species nests on the lease and no suitable nesting habitat for either occurs on the lease. Both species may occasionally use the area during migration or winter periods. Other species of interest that breed on the lease include ferruginous hawk and mountain plover.

For the No Name permit area, the No Name PAP reports that no lakes or reservoirs occur within the permit area; only a few stock watering ponds constructed to catch surface flows from tributary drainages, which are often dry, are present. The No Name PAP also indicates there are no springs, seeps, or man-made discharges into surface water bodies within or adjacent to the permit area (No Name P PAP, Section 18).

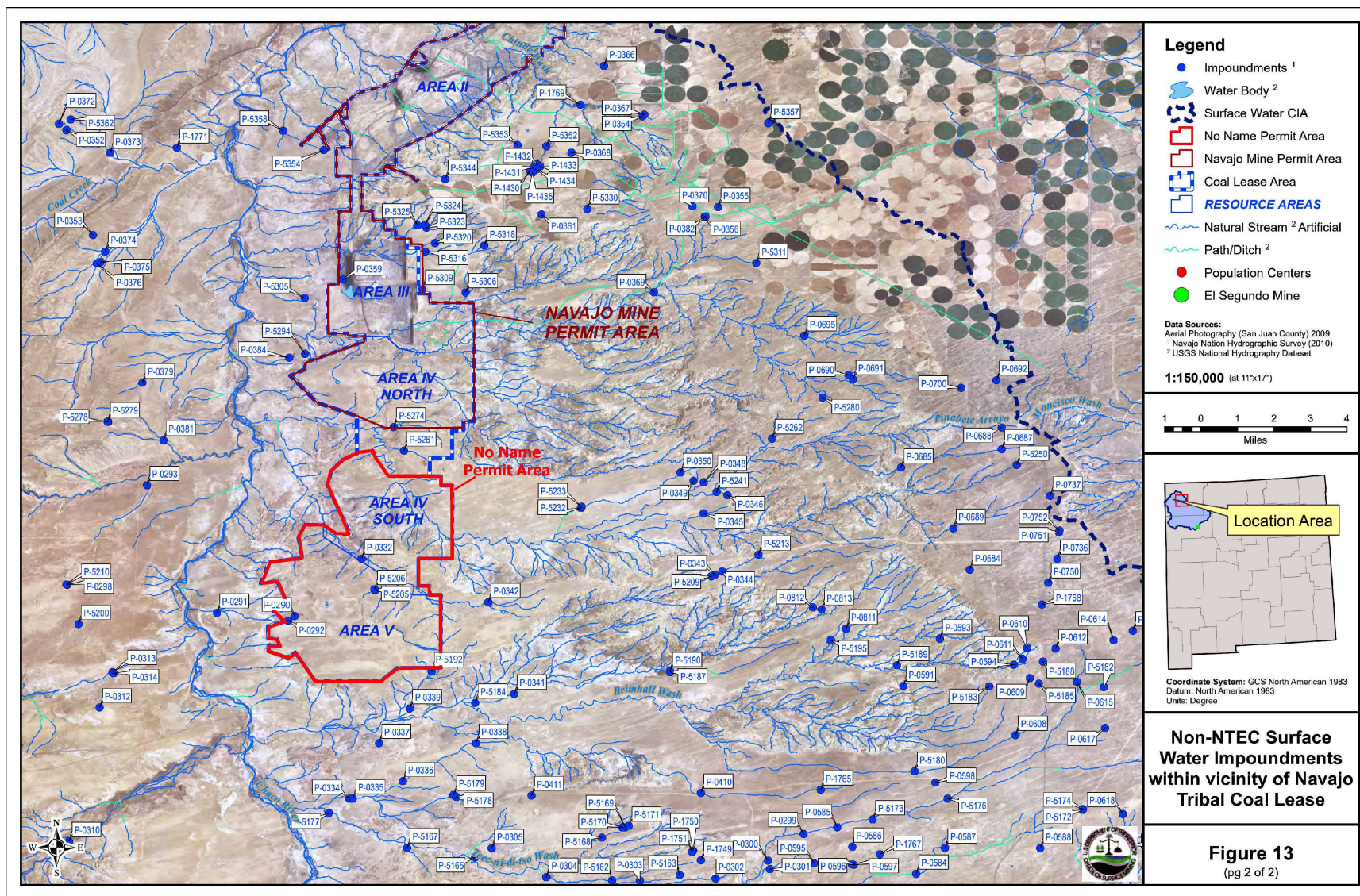


Figure 13: Non-NTEC Surface Water Impoundments within the vicinity of the Navajo Tribal Coal Lease

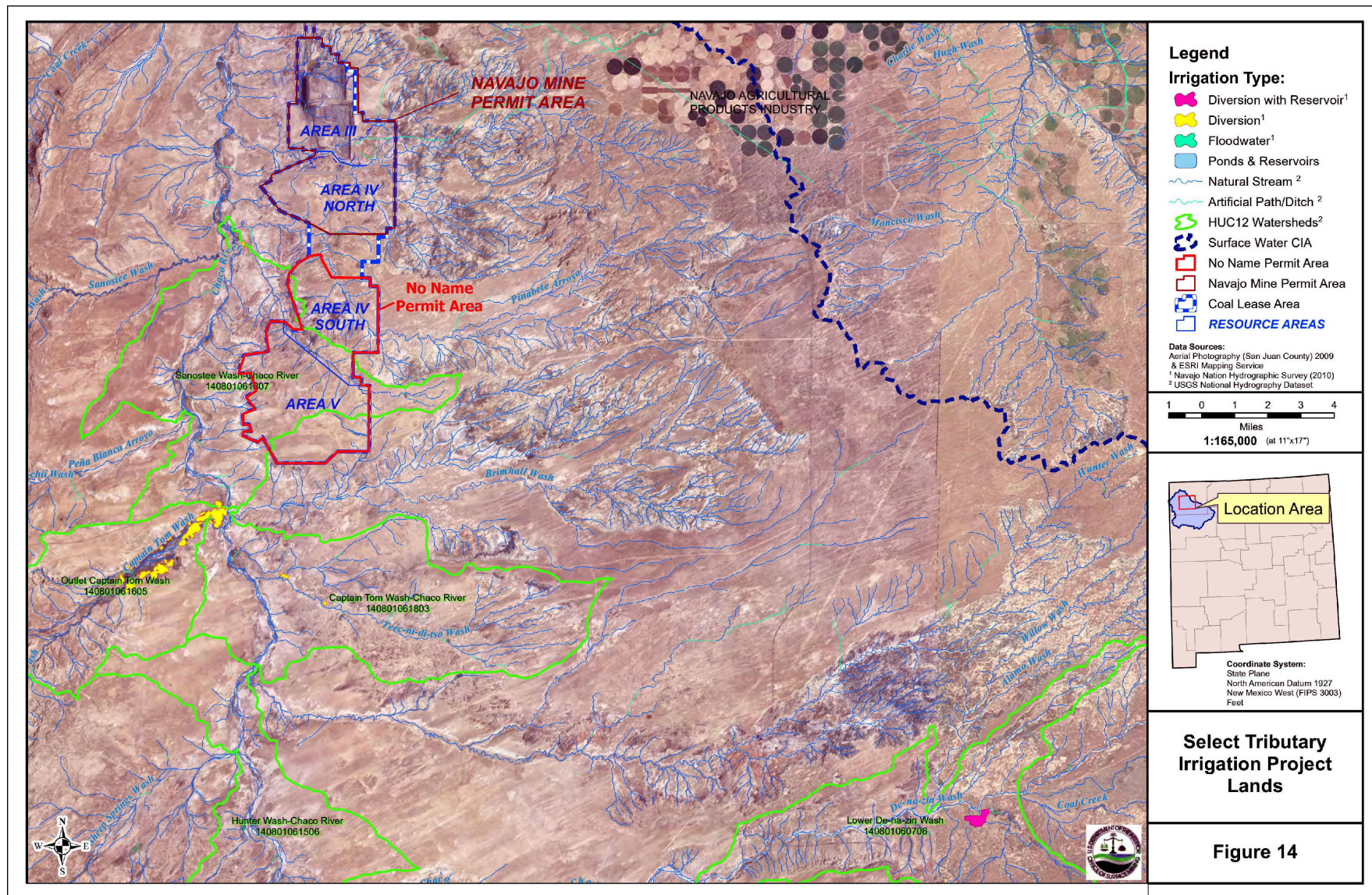


Figure 14: Select Tributary Irrigation Project Lands

4 BASELINE HYDROLOGIC CONDITIONS

SMCRA established that surface coal mining operations are to be conducted to protect the environment and to assure that a balance between protection of the environment and the production of coal as a source of energy is maintained (SMCRA, Section 102(d) and 102(f), 1977). The goals in establishing baseline hydrologic conditions are to characterize local hydrology, understand the regional hydrologic balance, and identify any water resource or water use that could be affected by the mining operation. This guidance is consistent with the requirements of 30 CFR 780.21, Hydrologic Information.

Because mining operations at the Navajo Mine commenced prior to SMCRA, quantification of pre-mining baseline conditions is limited for some hydrologic resources, particularly where pre-1977 monitoring was not required. In response to SMCRA, an extensive hydrologic monitoring program was initiated in the late 1970s and has been expanded and refined over time. For this CHIA update, baseline characterization relies primarily on the current technical record developed for the No Name permit area, including Section 18 Water Resources and associated appendices, which compile surface water and groundwater quantity and quality information and monitoring results through the most recent available period. Data analysis from the previous 2015 CHIA is incorporated into this document, and updates to tables, figures, discussions, etc., where necessary, are based primarily on new information available through the No Name Mine PAP and collected through the approved water monitoring program.

Chapter 3 identified water resource uses and designations within the surface water and groundwater cumulative impact areas delineated in Chapter 2. The following discussion of baseline hydrologic conditions uses the current monitoring record to characterize regional and local hydrologic quantity and quality in the assessment areas. Chapter 5 uses this characterization to support hydrologic impact analysis related to existing and reasonably foreseeable water uses, and Chapter 6 presents the basis for the material damage determination outside the permit areas.

4.1 Surface Water

Drainages within the surface water CIA are classified as ephemeral, intermittent, or perennial based on OSMRE definitions at 30 CFR 701.5. An ephemeral stream is a stream that flows only in direct response to precipitation in the immediate watershed or in response to melting of a cover of snow and ice, and has a channel bottom that is always above the local water table. An intermittent stream is a stream, or reach of a stream, that is below the water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge. OSMRE further defines intermittent at 30 CFR 701.5 as a stream, or reach of a stream, that drains a watershed of at least one square mile. A perennial stream is a stream, or part of a stream, that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff.

For this CHIA update, baseline surface water characterization is based on the monitoring and analyses documented in Section 18 Water Resources and its supporting appendices. This record includes baseline and ongoing monitoring on No Name and Pinabete Arroyos, channel morphology investigations, QA/QC documentation, and compiled surface water quality datasets through the most recent available reporting periods. Where appropriate, the CHIA summarizes results directly from the current record tables and figures and uses those summaries to support the cumulative impact evaluation in Chapters 5 and 6.

4.1.1 Surface Water Regulatory Requirements

Water Quality

Surface water runoff from areas disturbed by mining operations is required to be managed in a manner that prevents additional contribution of suspended solids to streamflow outside the permit area to the extent possible using the best technology currently available and otherwise prevents surface water pollution (30 CFR 816.41(d)). NTEC implements surface water protection measures by designing, constructing, and maintaining siltation structures, impoundments, and diversions, and by designating stream buffer zones within the permit area.

NTEC is required to submit monthly reports to USEPA for NPDES Permit No. NN0028193. The monthly reports document the water quality and quantity of discharges to receiving washes during events when runoff exceeds the design storage capacity of a structure and discharge occurs. This happens very rarely given the dry conditions in the area, and the fact that water is preferentially pumped to onsite storage or in the mine pits in response to runoff events. In addition, NTEC may dewater ponds to maintain storage capacity by transferring water to nearby ponds with available capacity or by discharging water to downstream washes in accordance with the NPDES permit.

Water Quantity

NTEC is required to reclaim lands disturbed by mining so the lands may be returned to the appropriate land management agency in a condition compatible with and capable of supporting the approved postmining land use. The approved postmining land use is livestock grazing, which is consistent with the pre-mine land use.

4.1.2 Surface Water Regime

The surface water CIA flow regime is influenced by the duration, intensity, and extent of precipitation events and by transmission losses to alluvium along channels. NTEC has conducted field investigations to better understand these influences on the surface water regime within and adjacent to the lease area. In addition, the surface water monitoring program provides information necessary for hydrologic evaluation and compliance with SMCRA requirements. Continued collection and analysis of hydrologic data are used to assess and update the probable hydrologic consequences to the surface water regime as part of ongoing permit compliance and technical evaluation.

4.1.3 El Segundo Mine

El Segundo coal mine is located approximately 70 miles southeast of the southern boundary of the Navajo Tribal Coal Lease. The mine is divided into two subwatersheds by the continental divide and is crossed by several unnamed ephemeral arroyos. The western portion of the lease area drains into the Chaco River through an unnamed ephemeral channel that drains to Laguna Castillo before flowing into a named drainage, Kim-me-ni-oli Wash, and then to the Chaco River. The USGS maintained a gaging station on Kim-me-ni-oli Wash from October 1981 to September 1983. The utility of this station is questionable due to baseflow discharge to the wash from the proposed Phillips Petroleum Nose Rock Uranium Mine during that period. The two-year dataset indicates that surface flows in the ephemeral channel are highly variable, ranging from zero to 1,060 cubic feet per second. The ephemeral arroyos passing through the lease area flow only in direct response to storm events and have channel bottoms above the local water table. The drainage area for the main western drainage as it leaves the lease area is approximately 24.7

square miles, of which about 6.1 square miles (25 percent) of the total watershed are proposed to be disturbed by mining (NMEMNRD 2008). In the western unnamed arroyo drainages, bicarbonate is the dominant anion and calcium is the major cation followed by sodium. In addition, total suspended solids and possibly aluminum concentrations exceed various New Mexico water quality standards under baseline conditions (NMEMNRD 2008). This information provides regional context for baseline conditions within the Chaco watershed for purposes of the surface water CIA evaluation.

4.1.4 Morgan Lake

Built in 1961, Morgan Lake is a manmade reservoir and perennial surface water body west of Area I. It was constructed to supply water to mining and power generation activities in the area. Morgan Lake is approximately 1.2 miles wide and 2.2 miles long with a maximum depth of about 100 feet and a surface area of 1,260 acres at maximum storage. Morgan Lake has a volume of approximately 39,200 acre-feet of water at normal storage and 42,800 acre-feet of water at maximum storage.

Morgan Lake influences hydrologic conditions in Navajo Mine Areas I, II, and III, including both surface water and groundwater conditions. One principal surface water influence is the outflow point where Morgan Lake discharges to the Chaco River. Flow in the Chaco River is generally ephemeral except for the last approximately 12.5 miles near the confluence with the San Juan River, where perennial flow occurs in response to spillway overflows from Morgan Lake. Morgan Lake also influences the groundwater regime in the area, particularly within the PCS. The PCS potentiometric surface shown on Figure 15 indicates that Morgan Lake has likely affected groundwater levels in the vicinity of the reservoir and within portions of the Navajo Lease area.

Water from the San Juan River is pumped to Morgan Lake for use as cooling water at the APS Four Corners Generating Station and also for dust suppression and reclamation irrigation activities associated with the NTEC permit areas. Baseline surface water quality for Morgan Lake is characterized using the monitoring record compiled in Section 18 Water Resources, including the applicable surface water quality datasets and associated QA/QC documentation. Morgan Lake is designated by NNEPA for livestock watering, aquatic and wildlife habitat, secondary and primary human contact, and fish consumption (NNEPA 2015).

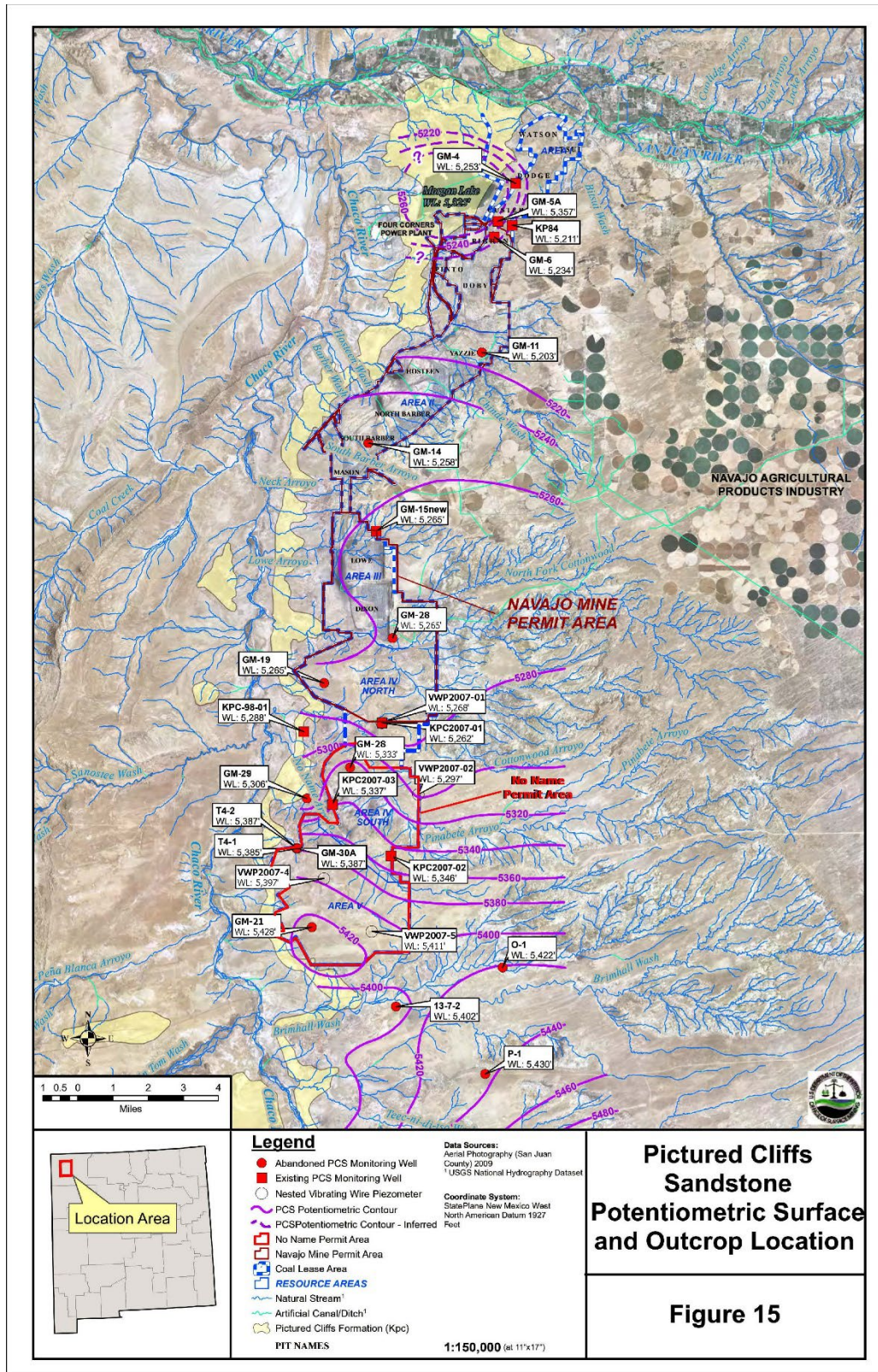


Figure 15: PCS Potentiometric Surface and Outcrop Location

4.1.5 Chaco River

4.1.5.1 Surface Water Quantity

The Chaco River is an ephemeral drainage except for the last approximately 12.5 miles near its confluence with the San Juan River, where spillway overflows from Morgan Lake have resulted in perennial flow. All of the primary drainages of interest at the Navajo Tribal Coal Lease, except for Bitsui Wash, drain to the Chaco River. Historic monitoring occurred at two USGS stations along the Chaco River, station 09367950 near Waterflow, New Mexico, and station 09367938 near Burnham, New Mexico. These stations were monitored for streamflow and select water quality parameters during limited periods of record, including discharge data collected from 1977 to 1994 and water quality data collected from 1969 to 1989. Station 09367938 exhibits the ephemeral flow characteristics of the Chaco River upstream of the Navajo Mine and is used as representative of baseline conditions for the Chaco River relative to mining impacts because it is upstream of the Navajo Mine permit areas. Flow at USGS station 09367938 is shown on Figure 16, and large flow events occur in response to precipitation and there is no baseflow in the channel at this location. Baseline surface water quality characterization for the Chaco River for this CHIA update is based on the monitoring and analyses compiled in Section 18 Water Resources and associated appendices.

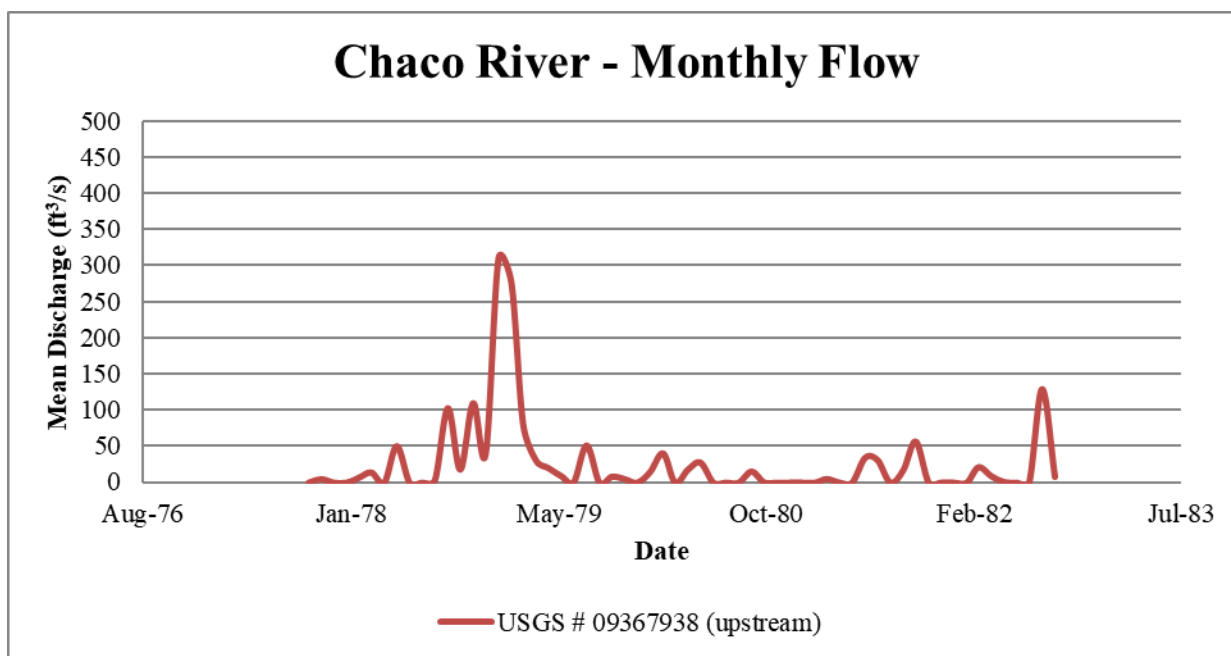


Figure 16: Baseline Monthly Flow along the Chaco River

4.1.5.2 Surface Water Quality

The Chaco River in the vicinity of the Navajo Lease is designated by NNEPA for livestock watering, aquatic and wildlife habitat, secondary human contact, and fish consumption. In addition, the Chaco River from its mouth to the mouth of Dead Man's Wash is designated by NNEPA for Primary Human Contact (NNEPA 2015). The principal use of surface water near the lease area is for stock watering ponds.

4.1.5.2.1 Methodology

Surface water quality analysis, where data were available, was conducted for all constituents for which NNEPA criteria are available, as these constituents have been identified by NNEPA to have potential impacts on designated uses (NNEPA 2015). In addition, analysis was conducted for TDS, sulfate, chloride, and fluoride, as these constituents are generally considered to be harmful to livestock at elevated concentrations (Lardy, Stoltenow and Johnson 2008). Select surface water use criteria are presented in Table 3. Analysis was also conducted for dissolved iron based on the water quality definition referenced in SMCRA at 30 CFR 816.42, which for western alkaline mining is defined in 40 CFR 434.81 as a drainage effluent maximum of 10 mg/L. No manganese criterion is defined for western alkaline mining in 40 CFR 434.81.

Several statistical parameters were used during the analysis of surface water quality, including average and standard deviation, median and median absolute deviation (MAD), third quartile (Q3), and ninety-fifth percentile. Variability of surface water quality data in the area was high, with percent relative standard deviation values across parameters and sites ranging from 44 percent to 126 percent, with a median of 85 percent. Given this variability, the median and MAD were used for characterization because they are more robust measures of central tendency and variability and are less sensitive to outliers (NIST 2010). The median and MAD are used throughout baseline characterization in this CHIA.

Table 3: Surface Water Criteria

Constituent	Livestock	Aquatic & Wildlife Habitat (Acute)	Aquatic & Wildlife Habitat (Chronic)	Secondary Human Contact	Fish Consumption
Aluminum	NNS	0.75	0.087	NNS	NNS
Arsenic	0.2	0.34	0.15	0.28	0.08
Barium	NNS	NNS	NNS	98	NNS
Boron	5	NNS	NNS	126	NNS
Cadmium ¹	0.05	.0041	.00041	0.47	0.008
Chloride	600**	NNS	NNS	NNS	NNS
Chromium (III+IV)	1	NNS	NNS	NNS	NNS
Chromium III	NNS	.00061	.035	1400	75
Chromium IV	NNS	.016	.011	2.8	0.15
Copper ¹	0.5	.027	.017	9.33	NNS
Fluoride	2*	NNS	NNS	56	NNS
Lead ¹	0.1	.14	.0056	0.015	NNS
Mercury	NNS	0.0024	0.000001	0.28	0.00015
Nitrate	500*	NNS	NNS	1493.33	NNS
pH	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	NNS
Radium 226+228	30	NNS	NNS	NNS	NNS
Selenium	0.05	0.033	0.002	4.67	0.67
Silver ¹	NNS	.012	NNS	4.67	8
Sulfate	1000*	NNS	NNS	NNS	NNS
TDS	3000*	NNS	NNS	NNS	NNS
Zinc ¹	25	.0375	.0378	280	5.1

Note all values are NNEPA 2015 criterion unless otherwise specified.

NNS = No Numeric Standard

1 Aquatic & Wildlife Criterion are hardness dependent and calculated for a hardness of 210 mg/L as CaCO₃, which is the median across all surface water samples

*Lardy, Stoltenow and Johnson 2008

**NNEPA 2004 Criterion

4.1.5.2.2 Analysis

Surface water quality information for the Chaco River includes historic USGS monitoring stations located in the lower Chaco River corridor in the general vicinity of the Navajo Tribal Coal Lease, including station 09367950 downstream of the Morgan Lake discharge point and station 09367938 upstream of the lease area (Figure 8). USGS station 09367938 is upstream of the Navajo Tribal Coal Lease and provides context for baseline conditions in the lower Chaco River. Water quality data were collected by the USGS at this site during a limited period of record.

For this CHIA update, baseline surface water quality characterization for the Chaco River and its tributary drainages is based primarily on the monitoring datasets compiled in Section 18 Water Resources, including the Surface Water Site Quality Data summaries for the applicable monitoring period and associated QA/QC documentation. These datasets are used to evaluate variability and to compare observed concentrations to NNEPA designated-use criteria and other relevant criteria used for livestock watering and human contact. Consistent with the statistical approach described in Section 4.1.5.2.1, median and median absolute deviation are used to characterize central tendency and variability where appropriate.

Baseline surface water quality in the Chaco River corridor, relative to NNEPA criteria and other relevant criteria, is compatible with the designated postmining land use of livestock grazing. Constituents associated with aquatic and wildlife habitat and fish consumption criteria may exhibit exceedances under baseline conditions. There were no exceedances of the USEPA dissolved iron effluent limitation for coal mining in the datasets evaluated for this CHIA update.

4.1.6 Historic Mining Area North of the Navajo and No Name Permit Areas

Channels traversing the historic mining area north of the Navajo Mine and No Name permit areas are predominantly ephemeral and can carry high sediment loads during runoff events. Upgradient agricultural development associated with the Navajo Indian Irrigation Project/Navajo Agricultural Products Industry (NIIP/NAPI) has the potential to influence local hydrology and water quality through indirect discharges associated with irrigation return flows. These indirect discharges may result from infiltration of applied irrigation water and return flow to channels and may be expressed as variable increases in flow and discharge. Irrigation return flows may also result in leaching of shallow geologic formations and soils. These factors contribute to baseline hydrologic variability in the broader area and provide context for evaluating potential mining-related changes.

Historic mining areas north of the NTEC permit areas include the Watson, Bitsui, Dodge, and Custer pits. Of these, only the Custer pit area lies within the surface water CIA. The Custer pit area is within the Morgan Lake–Chaco River HUC-12 watershed along with the Bighan pit area. The Bighan pit area is within the Navajo Mine permit area; therefore, characterization of baseline surface water quantity for the Morgan Lake–Chaco River HUC-12 watershed is addressed in Section 4.1.2.1.5.1. There are no major tributaries to the Chaco River that traverse this historic north mining area, and baseline surface water monitoring data within this portion of the surface water CIA are limited. In addition, mining has continued in portions of the lease area since the 2015 CHIA, including in areas south of this historic north

mining area (i.e., in the vicinity of the Pinabete drainage/Area 4 South). Therefore, baseline hydrologic conditions used for the 2026 update for the No Name permit area are characterized primarily using No Name–focused surface water and groundwater information and updated modeling presented elsewhere in this CHIA, including the Section 18 of the No Name PAP (Section 18) and the groundwater model report in the No Name PAP (Appendix 41.E).

4.1.7 No Name Permit Area and Associated Drainages

4.1.7.1 Surface Water Baseline Quantity

Baseline surface water flows in the arroyos draining the No Name permit area occur in response to short duration, high intensity precipitation events, primarily during the seasonal thunderstorm months. Runoff events may be localized and may not extend throughout a drainage area; therefore, consistency between upstream and downstream responses and between adjacent drainages is limited. Baseline monitoring stations were established on No Name Arroyo and Pinabete Arroyo in 1998, upstream and downstream of the mining lease. The monitoring stations were installed on relatively uniform straight channel segments and consist of single-stage samplers and crest-stage gages. An additional upstream and downstream station pair was established on No Name Arroyo within the mine permit area near the eastern permit boundary where channel geometry allowed installation.

Peak flows were estimated at monitoring locations using Manning’s equation with site-specific roughness coefficients and measured water-surface slopes from crest-stage gages. Monitoring results demonstrate prolonged periods of zero flow punctuated by storm-driven peaks. During the 1997 to 1998 baseline period, summer monsoonal events produced peak storm flows on the order of tens of cubic feet per second at upstream sites and up to thousands of cubic feet per second at downstream locations on Pinabete Arroyo. Peak flows observed on No Name Arroyo were smaller overall but included storm peaks ranging from less than one cubic foot per second to on the order of tens of cubic feet per second, with the largest observed peak at the downstream No Name station in 1998. During the 2007 to 2008 baseline period, peak flows measured at upstream and downstream sites generally ranged from fractions of a cubic foot per second to tens of cubic feet per second, with higher peaks observed at downstream locations on No Name Arroyo.

SEDCAD 4 modeling was performed for No Name Arroyo, Pinabete Arroyo, Brimhall Wash tributaries, and the Chaco River to better characterize baseline flow and sediment regimes. Modeling inputs and results are provided in No Name Permit Application Package (PAP) Appendix 18-B, including baseline runs that account for attenuation of flood flows associated with the No Name Impoundment. A summary of modeled peak flows and sediment yields for selected storm frequency events at monitoring station locations is provided in the No Name PAP, Section 18 (Table 18-4). Channel morphology context that affects flow and sediment response, including localized incision downstream of the No Name Impoundment and braided, high sediment transport conditions on Pinabete Arroyo, is summarized in No Name PAP Section 18, with detailed inventories provided in Appendix 18-A.

Mining has continued in portions of the lease area since the 2015 CHIA, including in the vicinity of the Pinabete drainage/Area 4 South; therefore, Pinabete baseline monitoring/modeling results are retained in this chapter as regional context and for comparison, while baseline characterization for the 2026 No Name permit component relies primarily on No Name–focused monitoring and analyses documented in the No Name PAP (Section 18).

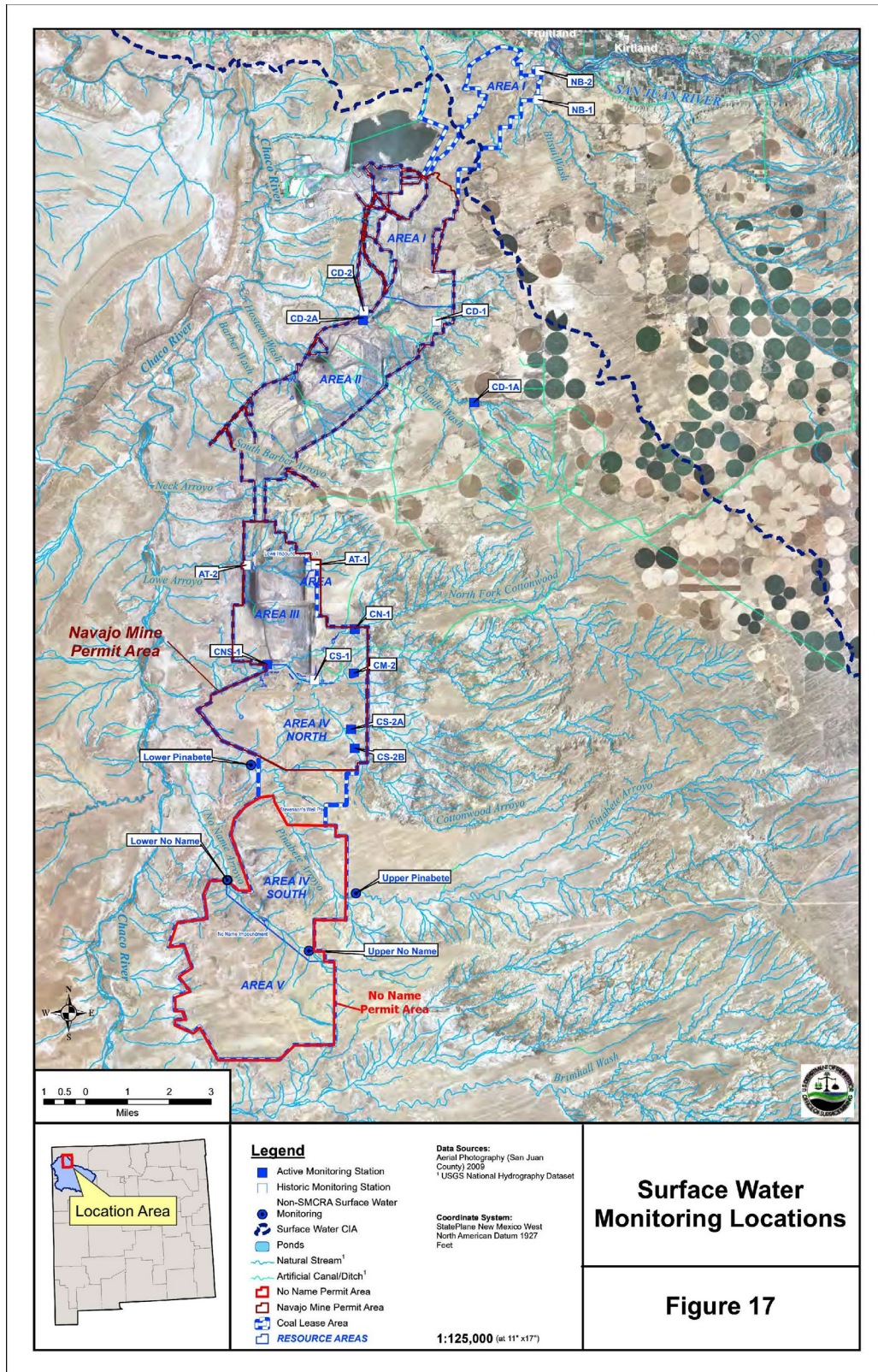


Figure 17: Surface Water Monitoring Locations

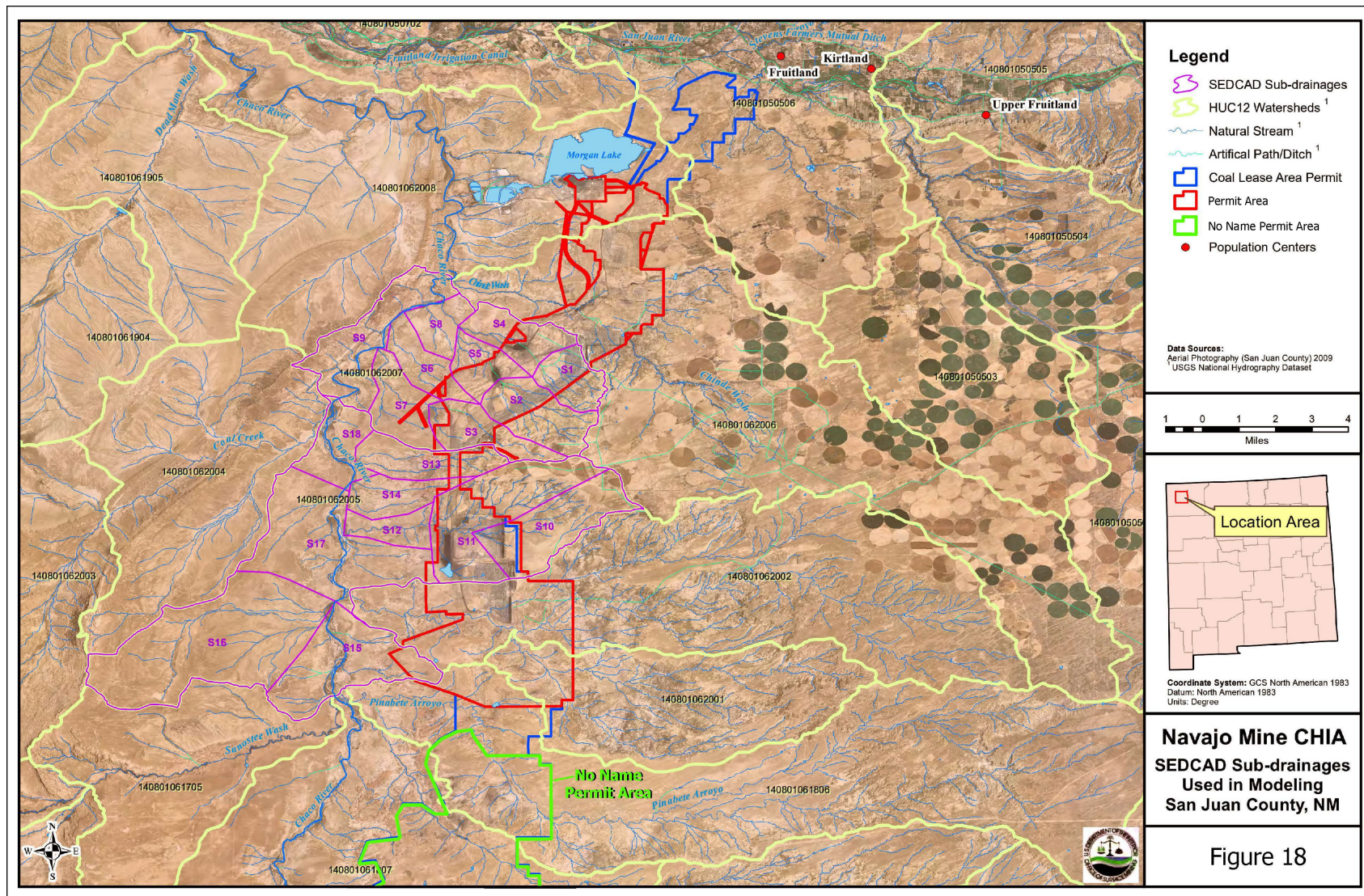


Figure 18: SEDCAD Routing Subwatersheds for the Chinde-Chaco River and Coal Creek Watersheds

4.1.7.1.1 Morgan Lake-Chaco River Watershed

The Morgan Lake–Chaco River watershed (HUC-12 140801062008) is located north of the Chinde Wash and Chinde Wash–Chaco River watersheds and includes portions of the northern section of the Navajo Mine. The surface area of the watershed is approximately 32,600 acres, and approximately 1,400 acres of the Navajo Mine permit area lies within this watershed. The portion of the Navajo Mine permit area within this watershed is located in the Area I section of the mine. Hydrologic conditions within this watershed are dominated by the presence of Morgan Lake, which has substantially altered baseline conditions relative to pre-lake conditions.

For the 2026 CHIA update focused on the No Name permit area, this watershed is retained for cumulative impact area context; however, SEDCAD modeling was not implemented for this watershed because activities within the permit area represent a small portion of the total watershed area, because perennial flow contributions associated with Morgan Lake complicate interpretation of design-storm peak flow modeling at the watershed outlet, and because much of the permit area within this watershed predates SMCRA monitoring requirements or is otherwise outside the scope of the current baseline evaluation framework.

4.1.7.1.2 Chinde Wash Watershed

Chinde Wash (HUC-12 140801062006) has been disturbed by mining since before SMCRA was enacted in 1977; therefore, it is difficult to estimate pre-mining conditions along portions of the drainage using direct pre-mine monitoring data. Limited data were collected prior to 1977 to characterize predevelopment conditions along Chinde Wash. As a result, modeling methods documented in the current technical record have been used to develop baseline estimates for peak runoff and related hydrologic parameters.

The present watershed area of Chinde Wash is approximately 27,130 acres. An additional area of approximately 7,000 acres historically contributed to the Chinde watershed but was diverted by the NAPI Ojo Amarillo canal to Cottonwood Arroyo. Baseline peak runoff for the 10-year, 6-hour precipitation event for the drainage is estimated at 715 cubic feet per second. Modeling details and supporting information are provided in the current PHC documentation and Appendix 18-B.

4.1.7.1.3 Chinde Wash-Chaco River Watershed

The Chinde Wash-Chaco River watershed (HUC-12 140801062007) is approximately 14,225 acres, of which approximately 4,200 acres are within the Navajo Mine permit area. The watershed includes three principal subwatersheds, Hosteen Wash, Barber Arroyo, and South Barber Arroyo. Hydrologic modeling was used to develop baseline estimates of peak flow for the 10-year, 6-hour storm event for the watershed. Figure 18 and Table 4 summarize the modeled sub-watersheds and related inputs.

In the model, Hosteen Wash is represented by sub-watersheds S1, S2, S4, and S5 and comprises a total of approximately 5,860 acres. South Barber Arroyo is represented by sub-watersheds S3 and S7, and Barber Arroyo is represented by sub-watershed S6. These sub-watersheds drain to the Chaco River. Runoff is attenuated to some extent as it moves through stream reaches toward the watershed outlet. The baseline estimate of peak discharge for the 10-year, 6-hour storm event for the watershed is approximately 2,100 cubic feet per second. Modeling details, including sub-watershed definitions and routing assumptions, are provided in No Name PAP Appendix 18-B and the current PHC technical record.

Table 4: Chinde-Wash Chaco River Sub-Watershed Details

Subwatershed	Area (acres)
S1	1210
S2	2010
S3	1565
S4	1540
S5	1100
S6	1235
S7	1650
S8	980
S9	2930
Total	14220

4.1.7.1.4 Coal Creek-Chaco River Watershed

The total watershed area for the Coal Creek–Chaco River watershed (HUC-12 140801062005) is approximately 28,235 acres, of which approximately 2,900 acres are within the Navajo Mine permit and lease area. The portion of the watershed within the lease area includes two principal tributary sub-watersheds, Neck Arroyo and Lowe Arroyo. Lowe Arroyo is the larger of the two, approximately 7,700 acres, and is represented in the SEDCAD model as sub-watersheds S10, S11, and S12. Neck Arroyo is smaller, approximately 1,700 acres, and relatively little of this area is disturbed by mining-related activities. Both Lowe Arroyo and Neck Arroyo drain to the Chaco River, which exits the watershed to the northwest.

Hydrologic modeling was used to estimate peak flows for the baseline surface configuration for the 10-year, 6-hour storm event. Sub-watershed areas and related model inputs are summarized in Table 5, and modeling inputs and results are provided in the No Name PAP, including Section 18 and Appendix 18-B. Although the watershed area is large, the baseline peak flow for the 10-year, 6-hour storm event at the watershed outlet is estimated to be approximately 1,720 cubic feet per second.

Table 5: Coal Creek Sub-Watershed Details

Subwatershed	Area (acres)
S10	2860
S11	3930
S12	940
S13	1740
S14	1280
S15	3530
S16	7300
S17	5060
S18	1590
Total	28230

4.1.7.1.5 Cottonwood Arroyo Watershed

Cottonwood Arroyo is a major sand bed ephemeral drainage that passes through the southern portion of the Navajo Mine permit area. The Cottonwood Arroyo HUC-12 watershed (140801062002) is

approximately 29,845 acres, and the watershed outlet occurs along Cottonwood Arroyo immediately upstream of its confluence with the Chaco River. Approximately 10 percent of the Cottonwood Arroyo watershed lies within the Navajo Tribal Coal Lease area. The total drainage area includes approximately 7,000 acres of the Chinde Wash drainage that is diverted by the NAPI Ojo Amarillo canal into the Cottonwood drainage. Approximately 49 percent of the Cottonwood Arroyo watershed consists of badlands, which contribute to higher discharge and flow intensities observed in this drainage.

The hydrologic modeling framework for Cottonwood Arroyo includes the Cottonwood Arroyo HUC-12 watershed, the approximately 7,000 acres diverted from the Chinde drainage, and an additional adjacent watershed south of Cottonwood Arroyo (HUC-12 140801062001), as documented in the current PHC technical record. The total area represented in the modeling framework is 51,269 acres.

Modeled flow response in Cottonwood Arroyo is characterized by a rapid increase in discharge from a dry channel to a peak discharge followed by recession to low discharge over several hours. The baseline estimate of peak flow in response to the 10-year, 6-hour storm event is approximately 1,551 cubic feet per second. Modeling details, including SEDCAD subwatersheds and assumptions, are provided in the No Name PAP technical record (Section 18) and Appendix 18-B, and are summarized in the PHC documentation (No Name PAP Section 41).

4.1.7.1.6 Pinabete Arroyo Watershed

Pinabete Arroyo is a major ephemeral drainage that crosses the lease area in the vicinity of Area IV South and drains directly to the Chaco River. Pinabete Arroyo has a total drainage area of approximately 60.3 square miles, with approximately 43.9 square miles upgradient of the No Name permit component (No Name PAP, Appendix 26.A). Baseline flow in Pinabete Arroyo is flashy and storm-driven, and the channel exhibits high sediment transport conditions characteristic of sand-bed arroyos in this setting.

Surface-water management for mining and reclamation includes diversion of Pinabete runoff around/through disturbed areas. The primary engineered conveyance for Pinabete flow is the planned Pinabete Diversion, which will be constructed along the south side of Area IV South to divert runoff and route it to No Name Arroyo (No Name PAP, Section 26; Appendix 26.A). In addition, the East Diversion will collect storm runoff from an area of approximately 2.74 square miles located east of Area IV South and route it to the managed drainage network (No Name PAP, Appendix 26.A). SEDCAD modeling for baseline conditions and for operational and post-reclamation configurations is documented in the No Name technical record (No Name PAP, Section 18; Appendix 18-B; and PHC appendices addressing mining-operation and post-reclamation modeling). SEDCAD modeling indicates a flashy response in Pinabete Arroyo, characterized by a rapid increase from a dry channel to a short-duration peak discharge followed by recession to low discharge over several hours (No Name PAP Appendix 18-B; Section 18).

The most recently collected data from Pinabete Arroyo is a sample from the upstream monitoring station collected in October 2025. Previous to that, data is available from 2015 to 2022 on both the upstream and downstream monitoring stations. The data collected from the approved monitoring program validates the data previously collected and presented in Sections 18 and 41 of the No Name PAP and the predictions made in the PHC.

4.1.7.1.7 No Name Wash Watershed

No Name Arroyo (No Name Wash) is an ephemeral drainage that traverses the No Name permit component (Area V) and drains directly to the Chaco River. No Name Arroyo has a total drainage area of

approximately 11.5 square miles, and the drainage area above the confluence of the proposed Pinabete Diversion and No Name Arroyo is approximately 7.50 square miles (No Name PAP, Appendix 26.A). Baseline flow in No Name Arroyo is flashy and storm-driven, with extended periods of zero flow punctuated by short-duration runoff events.

Surface-water management and baseline characterization for No Name Arroyo are influenced by the presence of the No Name Impoundment, which attenuates storm flows when water is present. Baseline SEDCAD modeling includes runs that account for attenuation of flood flows associated with the No Name Impoundment, and the channel morphology context for No Name Arroyo (including localized incision and related stability considerations downstream of the impoundment) is documented in the No Name technical record (No Name PAP, Section 18; Appendix 18-A; Appendix 18-B). Diversion design and routing details (including the Pinabete Diversion tie-in and discharge to No Name Arroyo) are provided in the Drainage Control Plan record (No Name PAP, Section 26; Appendix 26.A). SEDCAD modeling for operational and post-reclamation configurations affecting contributing area and routing is documented in the PHC technical record appendices. SEDCAD modeling indicates a similarly flashy storm-response in No Name Arroyo, with peak discharges that are attenuated where routing includes the No Name Impoundment under baseline conditions, followed by recession to low discharge over several hours (No Name PAP Appendix 18-B; Section 18).

The most recently collected data from No Name Arroyo is a sample from the upstream monitoring station collected in September 2025. Although there was not enough water available during the runoff event to allow for a complete suite of water quality parameters, the data supports the analyses conducted in the No Name PAP and validates the data previously collected.

4.1.7.2 Surface Water Baseline Quality

Surface waters that traverse the Navajo Tribal Coal Lease are designated by NNEPA for livestock watering, aquatic and wildlife habitat, secondary human contact, and fish consumption (NNEPA 2015). The principal use of surface waters on or near the lease area is for stock watering ponds. Surface water quality analysis, where data are available, was conducted using the methodology described in Section 4.1.5.2.1.

Baseline surface water flows in tributary channels traversing the lease area are predominantly ephemeral and occur in response to storm runoff. Under baseline conditions, these channels can carry high concentrations of suspended solids and bed load during runoff events. Baseline water quality varies among drainages due to differences in watershed conditions, soils, and upstream land and water management activities.

Baseline surface water quality characterization for tributaries to the Chaco River that traverse the lease area is based on the monitoring record compiled in No Name PAP Section 18 Water Resources and supporting appendices, including station descriptions, QA/QC documentation, and compiled surface water quality datasets through the most recent available reporting periods. Monitoring stations have been established on drainages that traverse the lease area, including stations on Chinde Wash, No Name Wash, Cottonwood Arroyo, Pinabete Arroyo, and other tributaries. Monitoring results from these stations are used to characterize baseline conditions and to provide representative coverage for similar drainages where monitoring is limited.

In portions of the northern lease area, irrigation and return flow influences associated with NAPI and related irrigation activities may affect surface water quantity and quality at monitoring locations. For

purposes of baseline characterization in this CHIA update, observed conditions at monitoring locations that reflect these influences are described as part of the baseline condition context for those drainages. Baseline water quality for the Chaco River tributaries crossing the lease area is described in the following sections, including discussion of drainages influenced by irrigation return flows and drainages where such influences are limited. Summary tables and figures supporting baseline surface water quality characterization are provided in No Name PAP Section 18 Water Resources and associated appendices.

4.1.7.2.1 Baseline with NAPI

NAPI influences include direct discharges of water from irrigation canals and indirect discharges from irrigation return flows. Direct discharge events are variable and can occur over short durations, resulting in episodic increases in flow and potential channel erosion and sediment transport. Indirect irrigation return flows may contribute to leaching of shallow geologic formations and soils and can influence water quality in affected drainages. Quantitative data to characterize irrigation-related influences are collected as part of the surface water monitoring program. For purposes of baseline characterization in this CHIA update, irrigation-related influences are considered in evaluating baseline surface water conditions for drainages that may be affected by these sources, including Chinde Wash and Cottonwood Arroyo.

Comparison of median baseline values at monitoring locations influenced by irrigation-related discharges to median baseline values at locations without such influence indicates that some constituents are relatively consistent among drainages, while others differ. Median values for aluminum, pH, and selenium were relatively consistent between irrigation-influenced and non-influenced locations. Aluminum and total iron values were relatively higher at non-influenced locations. Median values were higher at irrigation-influenced locations for barium, boron, cadmium, chloride, chromium, fluoride, lead, nitrate, silver, sulfate, TDS, zinc, conductivity, and manganese. Total suspended solids values were highest along Cottonwood Arroyo and lowest along Chinde Wash.

4.1.7.2.1.1 Chinde Wash

Surface water quality data are available for Chinde Wash at four monitoring stations that bracket the lease area, including CD-2 and CD-2A downstream of the mine and CD-1 and CD-1A upstream of the mine (Figure 17). Water quality data were collected at CD-1 and CD-2 from 1986 to 1997 and at CD-1A and CD-2A from 1996 to the most recent available reporting period. There are no pre-mining water quality data for Chinde Wash. For purposes of baseline characterization, CD-1 and CD-1A provide upstream baseline context relative to mining because they are upstream of mine disturbances. It is important to note that although upstream of mining, CD-1 and CD-1A are downstream of NAPI-related irrigation influences, and there are no pre-NAPI baseline data for Chinde Wash. Chinde Wash is subject to both direct and indirect irrigation-related influences, including canal releases and irrigation return flows, which may contribute to baseflow conditions and influence dissolved solids concentrations. Total suspended solids values may be lower along Chinde Wash relative to other drainages because some samples may be collected during baseflow, whereas samples in other drainages may be more commonly associated with storm runoff events.

Downstream water quality data (CD-2 and CD-2A) exhibit slightly higher variability relative to baseline conditions, with median percent relative standard deviation values of approximately 100 percent compared to 85 percent for the upstream baseline stations. The NNEPA fish consumption criterion was not exceeded in any samples. NNEPA acute aquatic and wildlife habitat criteria were exceeded for cadmium, chromium, selenium, silver, and zinc (4 percent, 100 percent, 1 percent, 2 percent, and 60 percent of samples, respectively), and NNEPA chronic aquatic and wildlife habitat criteria were exceeded

for aluminum, cadmium, chromium, lead, selenium, and zinc (46 percent, 100 percent, 3 percent, 57 percent, 70 percent, and 60 percent of samples, respectively). Lead exceeded the NNEPA secondary human contact criterion in 4 percent of samples. Livestock criteria for boron, chloride, selenium, sulfate, and TDS were exceeded in 0.5 percent, 5 percent, 23 percent, 0.5 percent, and 6 percent of samples, respectively. One sample (approximately 6 percent) exceeded the SMCRA dissolved iron standard; the median dissolved iron concentration was 0.1 mg/L, which is substantially lower than the 10 mg/L criterion.

Baseline water quality within Chinde Wash is characterized using the monitoring datasets compiled in Section 18 Water Resources and associated appendices, including summary statistics and comparisons to NNEPA designated-use criteria and other relevant livestock watering criteria. The Chinde Wash dataset exhibits high variability. Baseline surface water quality in Chinde Wash, relative to applicable criteria, is generally compatible with the designated postmining land use of livestock grazing. However, certain constituents may exhibit exceedances relative to aquatic and wildlife habitat and fish consumption criteria under baseline conditions. Compliance-related parameters, including dissolved iron, are also evaluated using the criteria and methodology described in Section 4.1.5.2.1, with detailed results and summary tables provided in No Name PAP Section 18 and associated appendices.

4.1.7.2.1.2 Cottonwood Arroyo

Surface water quality data were collected on Cottonwood Arroyo from 1990 to 1999 at three monitoring stations: CN-1 along the North Fork upstream of the mine, CNS-1 downstream of mining, and CS-1 along the main stem within the mine lease area (Figure 17). These data were collected prior to mining in this portion of the drainage. It is important to note that while the dataset is premining, there are no pre-NAPI baseline data for Cottonwood Arroyo. Cottonwood Arroyo is not subject to indirect NAPI irrigation return flows; however, NAPI canal releases may directly discharge to the North Fork. Therefore, monitoring station CN-1 and downstream station CNS-1 may be influenced by NAPI canal releases, whereas station CS-1 is not. Direct discharge events are variable and can occur over short durations, resulting in episodic increases in flow and potential channel erosion and sediment transport. These recurrent higher-flow discharges may contribute to elevated suspended solids and increased variability in water quality parameters. Mineralization observed on stream banks and seep-related conditions in upper reaches may also contribute to variability and increased dissolved constituents.

Baseline water quality within Cottonwood Arroyo is characterized using the monitoring datasets compiled in Section 18 Water Resources and associated appendices, including summary statistics and comparisons to NNEPA designated-use criteria and other relevant livestock watering criteria. The Cottonwood Arroyo dataset exhibits high variability. Baseline surface water quality in Cottonwood Arroyo, relative to applicable criteria, is generally compatible with the designated postmining land use of livestock grazing. However, certain constituents may exhibit exceedances relative to aquatic and wildlife habitat and fish consumption criteria under baseline conditions. Compliance-related parameters, including dissolved iron, are evaluated using the criteria and methodology described in Section 4.1.5.2.1, with detailed results and summary tables provided in Section 18 and associated appendices.

Baseline pH within Cottonwood Arroyo fell below the NNEPA criteria range in one sample at CN-1 and one sample at CNS-1. Livestock criteria were exceeded for nitrate (38 percent of samples), sulfate (3 percent), and TDS (4 percent). Lead exceeded livestock and secondary human contact criteria in 0.3 percent and 20 percent of samples, respectively. NNEPA acute aquatic and wildlife habitat criteria were exceeded for arsenic, cadmium, chromium, lead, silver, and zinc (0.5 percent, 2 percent, 100 percent, 1 percent, 1 percent, and 77 percent of samples, respectively). NNEPA chronic aquatic and wildlife habitat criteria were exceeded for arsenic, cadmium, chromium, lead, selenium, and zinc (0.5 percent, 100

percent, 5 percent, 78 percent, 64 percent, and 77 percent of samples, respectively). Thirty samples (approximately 15 percent) exceeded the SMCRA dissolved iron standard; the median dissolved iron concentration was 0.5 mg/L, which is substantially lower than the 10 mg/L criterion.

Comparison of concentrations among stations may be used to evaluate relative differences between the North Fork, the main stem, and downstream locations. Station-to-station comparisons and constituent patterns are summarized in the current technical record to support baseline characterization and subsequent impact evaluation.

4.1.7.2.2 Pinabete Arroyo and No Name Wash

Surface water quality data were collected on Pinabete Arroyo and No Name Wash at upper and lower monitoring stations in 1998 and during 2007 to 2008 (Figure 17). These datasets represent baseline conditions for the monitoring locations evaluated and are not influenced by NAPI/NIIP irrigation return flows. Baseline data for Pinabete Arroyo and No Name Wash exhibit relatively high variability, consistent with storm-driven, ephemeral arroyos in this setting. The median percent relative standard deviation for all constituents was 86 percent for Pinabete Arroyo and 77 percent for No Name Wash. This places Pinabete Arroyo at roughly the same variability as Chinde Wash and No Name Wash at a relatively lower variability. Both Pinabete Arroyo and No Name Wash exhibit less variability in water quality than Cottonwood Arroyo.

There were no exceedances of NNEPA secondary human contact criteria. Aluminum, cadmium, copper, lead, mercury, selenium, and zinc exceeded NNEPA chronic aquatic and wildlife habitat criteria for 41 percent, 23 percent, 7 percent, 3 percent, 100 percent, 56 percent, and 7 percent of samples, respectively. Aluminum, cadmium, chromium, and zinc exceeded NNEPA acute aquatic and wildlife habitat criteria for 7 percent, 8 percent, 46 percent, and 7 percent of samples, respectively. Cadmium and zinc fish consumption criteria were exceeded for 8 percent and 3 percent of samples, respectively. Cadmium exceeded livestock criteria in 4 percent of samples, and TDS exceeded criteria in 7 percent of samples. Median concentrations for mercury and selenium were 100 and 1.25 times greater than the NNEPA chronic aquatic and wildlife habitat criteria, respectively. All other median values were below criteria, indicating that exceedances for those parameters are generally more characteristic of high variability than general baseline water quality. Therefore, baseline surface water quality within Pinabete Arroyo and No Name Wash, relative to NNEPA and other relevant criteria, is generally compatible with the designated postmining land use of livestock grazing; however, elevated levels of mercury and selenium were found relative to NNEPA aquatic and wildlife habitat criteria.

There were no exceedances of the USEPA coal mining related dissolved iron standard along No Name Wash. One sample along Pinabete Arroyo (approximately 4 percent of samples) exceeded the dissolved iron standard; the median dissolved iron concentration was 0.12 mg/L, which is substantially lower than the 10 mg/L criterion.

Cadmium, pH, and selenium median values were relatively consistent across Pinabete Arroyo monitoring locations. Chloride and pH median values were relatively consistent across No Name Wash monitoring locations. Aluminum and copper median values were higher at upper stations, whereas barium, boron, lead, and manganese median values were higher at lower stations for both Pinabete Arroyo and No Name Wash. Along Pinabete Arroyo, arsenic, chloride, fluoride, nitrate, sulfate, TDS, TSS, and conductivity median values were higher at upper stations, whereas chromium, silver, zinc, and iron median values were higher at lower stations. Along No Name Wash, cadmium, chromium, silver, zinc, and iron median

values were higher at upper stations, whereas arsenic, fluoride, nitrate, selenium, sulfate, TDS, TSS, and conductivity median values were higher at lower stations.

For the 2026 update focused on the No Name permit component, these Pinabete and No Name baseline water-quality results are retained as representative of storm-driven, ephemeral drainage conditions in the vicinity of the permit area. Where available, additional No Name-specific water resources information and more recent technical record updates are documented in the No Name Permit Application Package (Section 18) and associated appendices.

4.2 Ground Water

Since mining at the Navajo Tribal Coal Lease began in 1963, prior to enactment of SMCRA in 1977, premine baseline groundwater monitoring data are limited for Area I and portions of Area II of the Navajo Mine. However, monitoring wells installed in the late 1970s (including the GM-series wells) provide baseline and early post-SMCRA information for Areas III, IV, V, and portions of Area II. Many GM-series wells have been mined through, reclaimed, or replaced over time, and additional monitoring wells were installed during the mid-1980s. Monitoring wells were also installed in 1998 and in 2007 to support baseline characterization for portions of Areas IV South and V. Groundwater monitoring locations are shown on Figure 19.

For this CHIA update for the No Name permit area, baseline groundwater characterization and potentiometric-surface interpretation are supported by the groundwater modeling documented in No Name PAP Appendix 41.E (MODFLOW 6) and the associated monitoring record.

4.2.1 Ground Water Regulatory Requirements

30 CFR 816.41(h) states that a water supply of an owner of an interest that is used for domestic, agricultural, industrial, or other legitimate purposes and is adversely impacted by contamination, diminution, or interruption proximately resulting from surface mining activities shall be replaced. The Fruitland Formation and PCS are utilized for oil production west of the lease area, and the alluvial aquifer has limited use as a livestock watering supply.

4.2.2 Chaco River Alluvium

Data were collected along the Chaco River alluvium from 1974 to 1977 at GM-24 located between the No Name and Pinabete confluences, GM-25 located upstream of No Name Wash, and GM-34 located upstream of the Navajo Tribal Coal Lease. The Chaco River alluvium is mostly saturated across the length of the lease area and provides limited stock water supply at several dug wells. The Chaco River alluvium had water for all sampling events at GM-34 upstream of the lease area, for 67 percent of all sampling events downstream of No Name Wash, and for 87.5 percent of sampling events at GM-24 between No Name Wash and Pinabete Arroyo. Characterization of Chaco River alluvial quantity was limited to the percent of dry sampling events because water elevation data were not available.

Groundwater discharge rates in the vicinity of the No Name permit area are low and are insufficient to sustain base flow in any drainages, including the Chaco River. The alluvium of the Chaco River contains groundwater as indicated by the dug wells located adjacent to the river.

Groundwater use within the groundwater CIA is limited in extent and is mostly derived from wells completed within surficial valley-fill deposits of Quaternary age, or alluvium. Water derived from alluvial

wells is predominantly used for livestock watering. Given the predominant use of alluvial waters for livestock watering and the designated postmining land use of livestock grazing, alluvial baseline quality is evaluated in part by comparison to applicable livestock watering criteria (Table 3). The criteria are not enforceable standards with respect to groundwater and are included only as a reference for suitability of groundwater quality for livestock use.

Baseline alluvial quality data exhibit high variability. Arsenic, lead, selenium, chloride, fluoride, sulfate, and TDS exceeded livestock criteria for the Chaco River alluvium for 21 percent, 5 percent, 16 percent, 11 percent, 6 percent, 67 percent, and 72 percent of samples, respectively. Median values for arsenic, lead, selenium, chloride, and fluoride were below criteria, indicating that exceedances for these constituents are generally characteristic of high variability rather than general baseline water quality. Median sulfate and TDS values exceeded livestock criteria. Based on these relevant use criteria, the water in the Chaco River alluvium is a poor source of supply for livestock watering use, particularly with respect to sulfate and TDS.

Limited baseline groundwater quality data are also available for the Chaco River alluvium near the mouth of Cottonwood Arroyo. Results from two alluvial wells indicate TDS concentrations ranging from 740 to 1,070 mg/L, sulfate concentrations from 350 to 610 mg/L, and fluoride concentrations ranging from 0.4 to 1.0 mg/L.

4.2.3 Historic Mining Area North of Navajo Mine and No Name Permit Areas

Two alluvial wells exist along drainages tributary to Morgan Lake. Data were collected from 1996 to 2000 at Custer-1 located along the western lease boundary and at Custer-4 located within the Navajo Tribal Coal Lease area near the eastern lease boundary. The Custer wells were not monitored prior to mining impacts in the area and therefore are not used for baseline characterization.

Two additional alluvial wells exist along Bitsui Wash. Data were collected at GM-7 from 1975 to 1976, and no data are available at GM-37. GM-7 is located upstream of mining and is used for baseline characterization. The Bitsui Wash alluvium had water for all sampling events at GM-7 upstream of the lease area. No water elevation data were available for characterization of Bitsui Wash alluvial quantity.

Only four samples were collected at GM-7 from 1975 to 1976. Baseline alluvial quality data exhibited lower variability compared to surface water quality, with a median percent relative standard deviation for constituents that was approximately 70 percent lower than the surface water dataset. All pH values were within the appropriate range. Arsenic, selenium, chloride, fluoride, sulfate, and TDS exceeded livestock criteria for 25 percent, 25 percent, 25 percent, 100 percent, 75 percent, and 25 percent of samples, respectively. Median values for arsenic, selenium, chloride, and TDS were below criteria, indicating that exceedances for these constituents are generally characteristic of variability rather than general baseline water quality. Median fluoride and sulfate values exceeded livestock criteria. Based on these relevant use criteria, water in the alluvial system is a poor source of supply for livestock watering use, particularly with respect to fluoride and sulfate, although the alluvium has historically been used for this purpose.

No pre-mine Fruitland Formation data are available in this area. However, postmining data are available for the No. 8 coal seam. The Fruitland Formation outcrop is located to the north of this area, and groundwater discharge at the outcrop may contribute to the San Juan River alluvium. No pre-mine PCS data are available in this area; however, limited postmining PCS data are available. Postmining monitoring data, together with modeling and related analyses, have been used by the operator and

OSMRE to assess postmining conditions and impact potential for this area. This analysis is addressed in Section 5.3.5.

4.2.4 Navajo Mine, No Name Mine, and Pinabete Mine Permit Areas

4.2.4.1 Alluvial Baseline Quantity

Alluvial quantity was assessed using two methods: the percent of sampling events that were dry and water elevation in feet above mean sea level (MSL). Water elevation was not collected for all sampling events; however, inference of water presence was based on the presence of water quality data. Therefore, the total number of samples used to calculate the percent of dry sampling events is often higher than the number of samples used for water elevation comparisons. Given data availability, baseline quantity could be characterized for the Chaco River, No Name Wash, Pinabete Arroyo, and Cottonwood Arroyo.

One alluvial well, Bighan-1, exists along drainages tributary to Morgan Lake within the permit area. Data were collected from 1995 to 2001 at this location along the eastern lease boundary just south of the permit boundary. The location of Bighan-1 along the eastern permit boundary suggests it could be representative of baseline conditions; however, the well was installed after mining impacts occurred in the area. For these reasons, it is unclear whether this well should be treated as baseline, and it is evaluated in Chapter 5.

Along Chinde Wash, alluvial data were collected from 1979 to 1980 at GM-9 within the Navajo Tribal Coal Lease, from 1985 to the most recent available reporting period at QAC-1 at the western lease boundary, and from 1975 to 1982 at GM-10 just downstream of QAC-1. Wells along Chinde Wash were not monitored prior to mining impacts in the area and therefore are not used for baseline characterization.

Alluvial data were collected along Cottonwood Arroyo from 1975 to 1982 at GM-17 along the North Fork at the eastern lease boundary; from 1985 to 1998 at QAC-1 along the North Fork downstream of GM-17 in Area III; during 1975 at GM-16 along the North Fork just upstream of the confluence with the main fork; from 1986 to 1999 at QACW-2B just downstream of the western lease boundary; and from 1974 to 2008 at QACW-2 downstream of QACW-2B. Cottonwood Arroyo alluvium is variably saturated and provides limited stock water supply at wells shown on Figure 12, including W-0644 (QACW-2B), which is not owned by NTEC and has been used for stock watering supply. QACW-2B and GM-17 had water for all sampling events. QACW-2, QACW-1, and GM-16 had water for 66 percent, 54 percent, and 50 percent of sampling events, respectively.

Alluvial data were collected along No Name Wash during 1975 at GM-23 located just upstream of the Chaco River confluence, and during 1998, 2007, and 2008 at NNA-1 and NNA-2 located within the lease area, where NNA-1 is downstream of NNA-2. No Name Wash alluvium was mostly dry. NNA-2 was dry for all sampling events; NNA-1 had water for 27 percent of sampling events.

Along Pinabete Arroyo, alluvial data were collected from 1974 to 1977 at GM-22 located upstream of the lease area, and during 1998, 2004, 2007, and 2008 at PA-2 located just west of the eastern lease boundary and PA-1 located within the lease area downstream of PA-2. Pinabete alluvium was mostly saturated and provides limited stock water supply at wells shown on Figure 12. PA-2 and GM-22 had water for all sampling events, and PA-1 had water for 96 percent of sampling events. Estimated hydraulic conductivities based on aquifer test results for the Pinabete Arroyo alluvium are 51.3 feet per day at PA-1 and 10.7 feet per day at PA-2. Both are within the range expected for clean sand and higher than bedrock values in the area. Well yields from the alluvium are limited by low saturated thickness, approximately 5 feet or less.

Water elevation data were available for Cottonwood Arroyo, Pinabete Arroyo, and No Name Wash, although not at the historic GM-series monitoring locations. Percent relative standard deviation for water elevation data indicates that Cottonwood Arroyo had the highest variability. Under baseline conditions,

the alluvial systems of Cottonwood Arroyo and Pinabete Arroyo exhibit decreasing water levels in the downstream direction. No Name Wash had no water during sampling events at the upstream alluvial well but had water for 27 percent of sampling events at the downstream well. This may reflect contributions from tributary drainages between the two wells. Both the upstream (PA-2) and downstream (PA-1) alluvial monitoring wells for Pinabete Arroyo have been primarily dry since 2015: only one sample was produced for the downstream well and four were taken for the upstream well because the wells were too dry to produce enough water for samples otherwise. Sampling at the NNA-1 and NNA-2 alluvial wells on No Name Arroyo was re-initiated in 2025. Both No Name wells have been too dry to produce samples since that time, and were also too dry to produce samples during both the 1998 and 2007-2008 sampling regime. These data support the finding that the Pinabete Arroyo and No Name Arroyo alluvium are a marginal water resource at best.

4.2.4.2 Alluvial Baseline Quality

Groundwater use in the vicinity of the Navajo Tribal Coal Lease is limited in extent and is mostly derived from wells completed within surficial valley-fill deposits of Quaternary age, or alluvium. Water derived from alluvial wells is predominantly used for livestock watering. Given the predominant use of alluvial waters for livestock watering and the designated postmining land use of livestock grazing, alluvial baseline quality is evaluated in part by comparison to applicable livestock watering criteria (Table 3). These criteria are not enforceable standards with respect to groundwater and are included only as a reference for the suitability of groundwater quality for livestock use. Alluvial quality data were not collected at GM-23 and NNA-2 along No Name Wash and at GM-16 and QACW-1 along Cottonwood Arroyo because these locations were either dry or had insufficient water for sampling during baseline monitoring. In general, alluvial waters are of sodium-sulfate type with variable TDS concentrations.

Baseline alluvial quality data exhibit high variability for all drainages except No Name Wash. Median percent relative standard deviation values for constituents were 142 for Pinabete Arroyo and 121 for Cottonwood Arroyo, approximately 1.7 and 1.1 times greater than their respective surface water datasets. The median percent relative standard deviation for No Name Wash alluvium was 68, approximately 10 percent lower than the respective surface water dataset. Comparison of median concentrations among wells indicates the following patterns. Pinabete Arroyo alluvial pH was relatively consistent across sites. Moving downstream along Pinabete Arroyo, iron and mercury tended to increase while arsenic, boron, cadmium, copper, lead, selenium, zinc, and nitrate tended to decrease; other constituents did not show an apparent trend. Moving downstream along Cottonwood Arroyo alluvium, pH, selenium, and fluoride tended to increase while boron, manganese, mercury, nitrate, sulfate, and TDS tended to decrease; other constituents did not show an apparent trend. No station-to-station comparison was made along No Name Wash alluvium because only one well had sufficient water for sampling.

Baseline pH within Cottonwood Arroyo alluvium dropped below the livestock criteria range once at GM-17; all other pH values were within the appropriate range. Arsenic, selenium, chloride, fluoride, sulfate, and TDS exceeded livestock criteria for the Cottonwood Arroyo alluvium in 6 percent, 4 percent, 3 percent, 26 percent, 91 percent, and 55 percent of samples, respectively. Median values for arsenic, selenium, chloride, and fluoride were below criteria, indicating that exceedances for these constituents are generally characteristic of high variability rather than general baseline water quality. Median sulfate and TDS values exceeded livestock criteria. Based on these use criteria, water in the Cottonwood Arroyo alluvium system is a poor source of supply for livestock watering use, particularly with respect to sulfate and TDS, although the alluvium has historically and is currently used for this purpose.

All pH values for samples within Pinabete Arroyo alluvium were within the appropriate range. Arsenic, selenium, chloride, fluoride, sulfate, and TDS exceeded livestock criteria for the Pinabete Arroyo

alluvium in 5 percent, 4 percent, 4 percent, 86 percent, 75 percent, and 46 percent of samples, respectively. Median values for arsenic, selenium, and chloride were below criteria, indicating that exceedances for these constituents are generally characteristic of high variability rather than general baseline water quality. Median fluoride, sulfate, and TDS values exceeded livestock criteria. Based on these use criteria, water in the Pinabete Arroyo alluvium system is a poor source of supply for livestock watering use, particularly with respect to fluoride, sulfate, and TDS, although the alluvium has historically and is currently used for this purpose.

All pH values for samples within No Name Wash alluvium were within the appropriate range. Sulfate and TDS exceeded livestock criteria for the No Name Wash alluvium in 100 percent and 100 percent of samples, respectively. Median sulfate and TDS values exceeded livestock criteria. Based on these use criteria, water in the No Name Wash alluvium system is a poor source of supply for livestock watering use, particularly with respect to sulfate and TDS, although the alluvium has historically and is currently used for this purpose.

4.2.4.3 Fruitland Formation Baseline Quantity

Only a small amount of groundwater occurs in the coal units of the Fruitland Formation and in the PCS, which underlies the Fruitland Formation at the Navajo Mine. Geologic strata within the permit and adjacent area dip gently to the east toward the center of the San Juan Basin at approximately 1 to 2 degrees. Based on regional and site-specific information, the Fruitland Formation coal units and the PCS are unsaturated or partially saturated near their outcrops on the western side of the Navajo Tribal Coal Lease area but become saturated to the east and downdip of the outcrop.

The Fruitland Formation has been mined extensively throughout the history of the Navajo Mine. Many wells that existed historically have been mined through, abandoned, or replaced, which complicates interpretation of groundwater system responses at the mine site. Modeling efforts and other estimates have been developed by the operator to evaluate premining groundwater flow conditions in the Fruitland Formation and to assess likely postmining conditions.

Based on baseline water level information from wells and piezometers, general groundwater flow directions in the Fruitland Formation within Areas 3, 4, and 5 include vertical downward flow through interbedded shale and coal units into the PCS, and lateral flow within individual coal seams toward the north-northeast, with localized gradients toward topographic lows along Cottonwood and Pinabete Arroyos.

Direct recharge rates measured using chloride mass balance methods on undisturbed areas of the lease area ranged from 0.002 to 0.09 inches per year (Stone, Phase III Recharge Study at the Navajo Mine, Impact of Mining on Recharge, 1987). The highest recharge rate of 0.09 inches per year was measured for valley terraces, while the lowest recharge rate of 0.002 inches per year was measured for badland areas. Recharge from upland flats averaged 0.03 inches per year. Recharge is expected to be higher from saturated alluvium and surface water impoundments. Although Stone's studies did not include recharge estimates for surface impoundments, they provide an estimate of an average recharge rate of 0.16 inches per year from depressions within reclaimed mine areas at the Navajo Mine.

Baseline potentiometric elevations measured in wells in Areas 4 and 5 were recorded by NTEC. The potentiometric surface for the No. 3 coal seam is shown on Figure 20. This potentiometric surface was constructed using baseline potentiometric elevations for the No. 3 coal seam documented in the permit application materials and July 1989 baseline potentiometric elevations measured in No. 3 coal wells

located within Area 3. Modeled baseline potentiometric conditions were used to estimate potentiometric contours beyond the limits of monitoring data. The potentiometric gradient in the No. 3 coal seam indicates groundwater flow components toward the north-northeast with local gradients toward Pinabete Arroyo and Cottonwood Arroyo. Lower coal seams pinch out and do not extend north of Area 3. Groundwater flowing perpendicular to potentiometric gradients to the northeast moves through undifferentiated Fruitland Formation toward upper coal units or into the underlying PCS.

Potentiometric gradients in other coal seams within Areas 3, 4, and 5 are expected to be generally toward the northeast, similar to gradients shown for the No. 3 coal seam. However, the upper coal seams (No. 6, No. 7, and No. 8) outcrop more extensively within the valleys of Pinabete Arroyo, No Name Wash, and Cottonwood Arroyo within the lease area. Groundwater associated with these upper coal seams is expected to show greater local influence from lower topographic elevations along the arroyos. Local topographic influence on potentiometric gradients was greatest for the shallowest coal seam, the No. 8 seam. Field observations of salt deposits and enhanced vegetation also indicate that local discharge may occur from the No. 8 coal at the coal outcrop along Pinabete Arroyo. Baseline groundwater model simulations and potentiometric elevations at wells within the No. 8 coal seam were used to prepare the potentiometric surface shown on Figure 21. Modeled baseline potentiometric conditions were used to estimate potentiometric contours beyond the limits of monitoring data. Higher hydraulic conductivities are characteristic of the higher coal units (No. 7 and No. 8) relative to lower coal units.

4.2.4.4 Fruitland Formation Baseline Quality

Groundwater use within the groundwater CIA is limited in extent, and water derived from the Fruitland Formation has no known use within the vicinity of the coal lease area other than for oil and gas extraction west of the lease area. This is due in part to low well yields within the Fruitland system in the vicinity of the mine, which generally do not support beneficial use. However, given the designated postmining land use of livestock grazing, Fruitland baseline quality is evaluated in part by comparison to livestock watering criteria (Table 3). These criteria are not enforceable standards with respect to groundwater and are included only as a reference for suitability of groundwater quality for livestock use. Fruitland water quality is evaluated for pH, conductivity, boron, total iron, manganese, selenium, chloride, fluoride, sulfate, and TDS because these parameters generally define water quality and tend to be of concern within the region. Monitoring data from Fruitland Formation coal wells indicate that baseline groundwater in the coals is saline.

Fruitland water quality data have been collected at historic and current locations shown on Figure 19. Data collected from Areas IV and V and data collected prior to 2001 within Areas II and III are considered baseline relative to quality because during mining, gradients within the Fruitland were toward the mine pits and potential impacts to water quality were expected to be minimal. The dataset used to characterize baseline Fruitland quality within the lease area includes samples collected at 12 well locations from 1984 to 2008, including KF2007-01 (2007 to 2008), KF98-02 (1998 to 2008), KF84-21A, KF84-22B, and KF84-20A (1984 to 2001), KF84-21C, KF84-22D, and KF84-22E (1984), KF84-22A (1991 to 2001), KF84-20C and KF84-18A (1985 to 2001), and KF84-18B (1984 to 2000).

Baseline Fruitland quality data exhibit lower variability compared to alluvial water quality. Median percent relative standard deviation for constituents was 58 for baseline coal wells within the lease area. Comparison of median concentrations across baseline Fruitland wells indicates a general trend moving northeast from Area 6 to Area 2, where conductivity, TDS, chloride, manganese, and iron tended to increase, while sulfate, fluoride, selenium, and pH tended to decrease. TDS concentrations in the coal units at the Navajo Tribal Coal Lease typically increase with depth, while sulfate tends to decrease with depth, potentially reflecting sulfate reduction processes in groundwater.

Baseline Fruitland water quality within the lease area indicates that pH, fluoride, and sulfate were outside livestock criteria ranges for 4 percent, 16 percent, and 11 percent of samples, respectively. Chloride and TDS exceeded livestock criteria for 85 percent and 88 percent of samples, respectively. Median chloride and TDS concentrations were 6 times and 2.5 times greater than the criteria, respectively. Based on comparison to livestock criteria, water in the Fruitland system would be a very poor source of supply for livestock watering use, primarily due to elevated chloride and TDS concentrations.

4.2.4.5 Pictured Cliffs Sandstone Aquifer Baseline Quantity

PCS is a well-cemented, low-permeability marine sandstone and is the first water-bearing unit below the Fruitland Formation. The PCS is approximately 110 to 120 feet thick and generally follows the structure of the Fruitland Formation, dipping to the east at approximately 2 degrees, although structure varies locally. The PCS conformably overlies the Lewis Shale, with the contact marked by a zone of interbedded sandstones and mudstones in the lower part of the PCS (Stone, Hydrogeology and Water Resources of the San Juan Basin, New Mexico, 1983). The PCS outcrops west of the mine lease area and east of the Chaco River. The PCS is a marginal water resource due to low permeability, generally poor water quality, gas production, and low yields. The PCS is also a natural gas reservoir in the San Juan Basin. Stone et al. (1983) noted that the PCS cannot be considered a major aquifer and is important primarily because it is the water-bearing horizon immediately underlying the coals in the Fruitland Formation.

The PCS has not been used as a groundwater supply source and has not been extensively affected by mining activities at the Navajo Mine. Modeling and potentiometric surface interpretation have been used to evaluate baseline and mine-influenced conditions within the PCS. Although some modeling and monitoring work was developed in support of specific permit components, baseline PCS quantity information provides useful characterization of prevailing conditions for the Navajo Mine operation, including the No Name permit area evaluated in this CHIA update.

Well KPC-98-01 was installed in 1998 near the PCS outcrop at the location shown on Figure 19. In 2007, wells KPC2007-01, KPC2007-02, and KPC2007-03 were completed in the PCS at locations around the perimeter of Area IV South. Vibrating wire piezometers were installed in the PCS at four of the five locations shown on Figure 19. A vibrating wire piezometer was not installed in the PCS at the VWP2007-03 location because monitoring well KPC2007-02 was installed in the PCS at that location.

The modeled baseline potentiometric surface for the PCS, together with baseline potentiometric elevations from PCS wells and vibrating wire piezometers, were used to prepare the PCS potentiometric surface shown on Figure 15. Baseline potentiometric elevations for abandoned GM wells were measured in June 1989. The potentiometric surface for the PCS indicates overall gradients to the north. The highest potentiometric elevations correspond with a structural high in the PCS located within the southeast portion of Area V of the Navajo Tribal Coal Lease. Local gradients also occur toward topographic lows along No Name Wash, Pinabete Arroyo, and Cottonwood Arroyo.

Water yields from PCS monitoring wells completed around Navajo Tribal Coal Lease Area IV South are low. Two PCS wells were quickly pumped or bailed dry during conventional sampling. One PCS well yielded sufficient water to sustain a rate of approximately 0.4 gallons per minute during a constant-rate pumping test. A fourth PCS monitoring well was pumped dry after approximately 140 minutes during a constant-rate pumping test at a rate of approximately 1 gallon per minute.

4.2.4.6 Pictured Cliffs Sandstone Aquifer Baseline Quality

Groundwater use in the vicinity of the Navajo Tribal Coal Lease area is limited in extent, and water derived from the PCS has no known use within the vicinity of the mine lease other than for oil and gas extraction to the north and west of the lease area. This is due in part to low well yields within the PCS system in the vicinity of the mine, which generally do not support beneficial use. However, given the designated postmining land use of livestock grazing, PCS baseline quality is evaluated in part by comparison to livestock watering criteria (Table 3). These criteria are not enforceable standards with respect to groundwater and are included only as a reference for suitability of groundwater quality for livestock use. PCS water quality is evaluated for pH, conductivity, boron, total iron, manganese, selenium, chloride, fluoride, sulfate, and TDS because these parameters generally define water quality and tend to be of concern within the region. Monitoring data from PCS wells indicate that baseline groundwater is typically sodium-sulfate type with high TDS concentrations.

PCS water quality data have been collected at historic and current locations shown on Figure 19. Data collected from Areas 4 and 5 and data collected during the mid-1970s from GM-series wells are considered baseline relative to quality. The dataset used to characterize baseline PCS quality within the lease area includes samples collected at 13 well locations from 1974 to 2008, including KPC-2007-01 (2007 to 2008), KPC-98-01 (1998, 2007, and 2008), GM-14, GM-15, and GM-8 (1975 to 1976), GM-19, GM-20, and GM-21 (1974 to 1979), GM-11 and GM-5 (1975 to 1977), GM-6 (1976 to 1977), GM-28 (1974 to 1976), and GM-30A (1976 to 1979). Baseline PCS quality data exhibit lower variability compared to alluvial water quality and higher variability compared to Fruitland water quality. Median percent relative standard deviation for constituents was 76.

Comparison of median concentrations across baseline PCS wells indicates that pH and TDS were relatively consistent across the lease area, while other constituents were more variable. Fluoride and boron tended to increase moving toward the northeast from Area III to Area I. Baseline PCS water quality indicates that pH, boron, selenium, chloride, fluoride, sulfate, and TDS were outside livestock criteria ranges for 19 percent, 2 percent, 12 percent, 61 percent, 23 percent, 82 percent, and 98 percent of samples, respectively. Median chloride, sulfate, and TDS concentrations were 1.6, 2.5, and 2 times greater than the criteria, respectively. Based on comparison to livestock criteria, water in the PCS would be a very poor source of supply for livestock watering use, primarily due to elevated chloride, sulfate, and TDS concentrations.

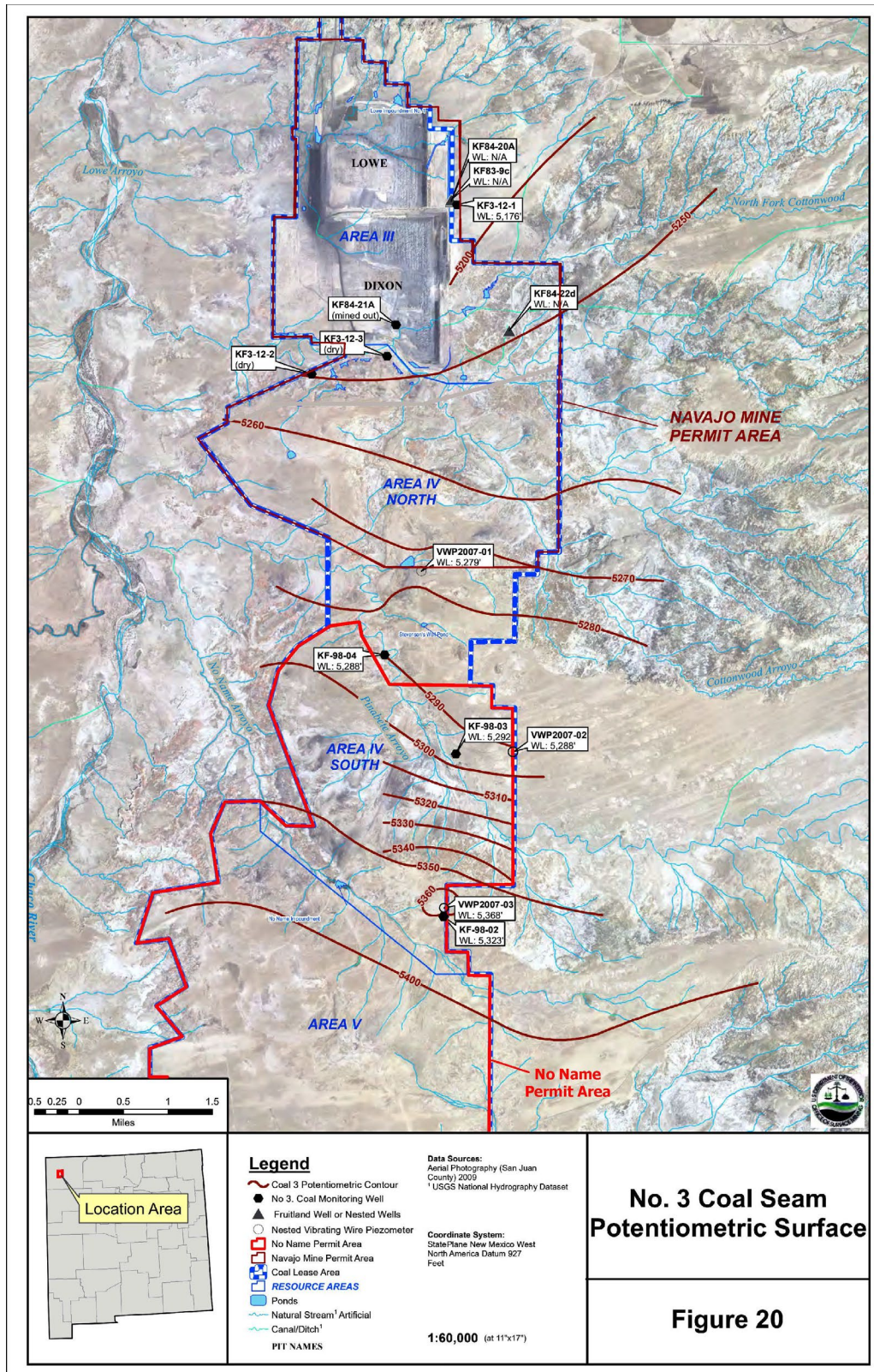


Figure 20: No. 3 Coal Seam Potentiometric Surface

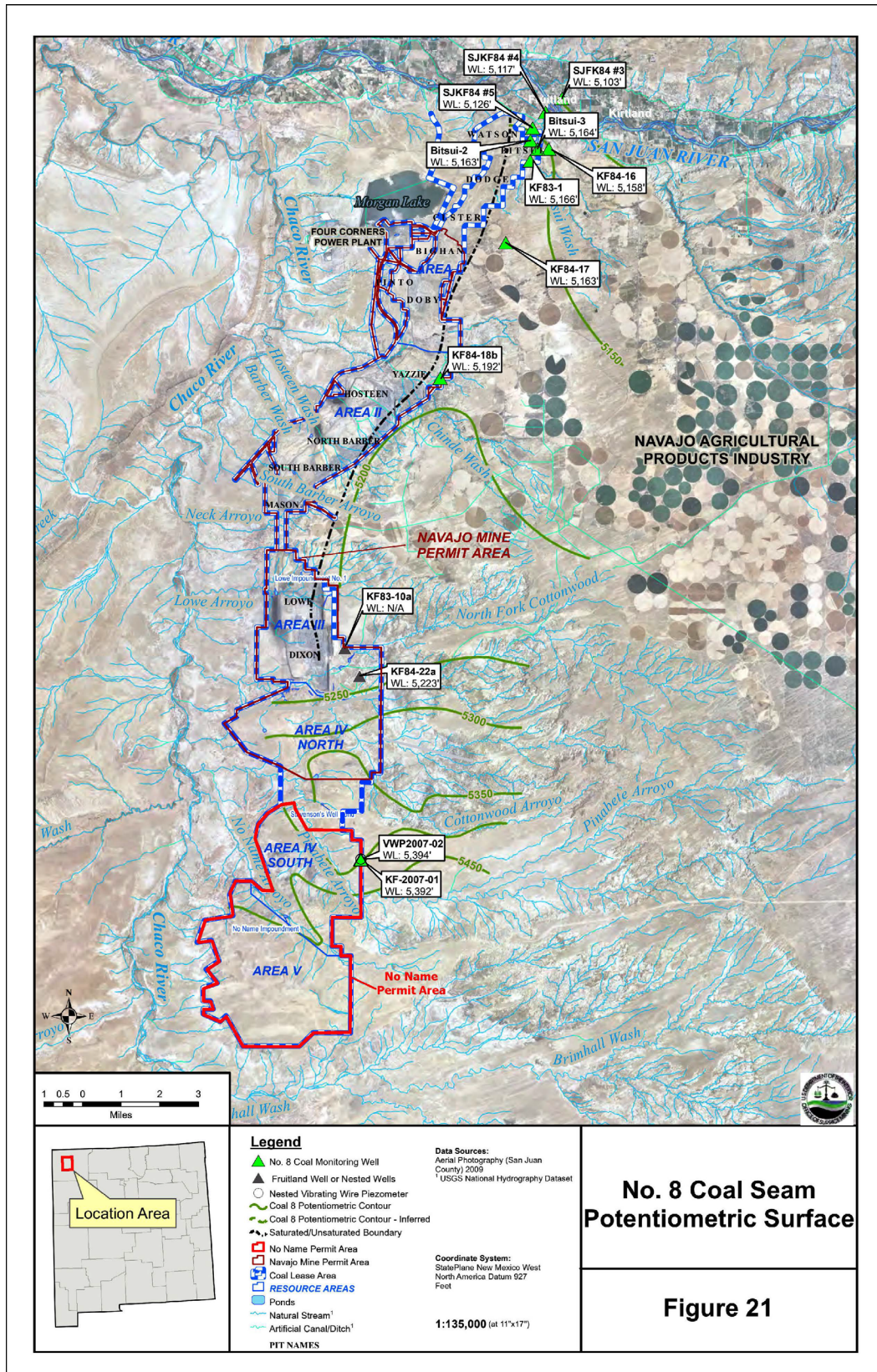


Figure 21: No 8 Coal Seam Potentiometric Surface

5 HYDROLOGIC IMPACT ASSESSMENTS

Required by 30 CFR 780.21(g), as the regulatory authority, OSMRE provides an assessment of the probable cumulative hydrologic impacts of the mining operation on surface water and groundwater systems within the cumulative impact areas. OSMRE must determine that the NTEC operation has been designed to minimize impacts within the permit area and prevent material damage to the hydrologic balance outside the permit area. OSMRE also evaluates whether the monitoring program has been designed to provide the surface water and groundwater quantity and quality information necessary to assess potential impacts in accordance with 30 CFR 780.21(g).

5.1 Minimization of Impact

NTEC describes impact minimization procedures in the Hydrologic Reclamation Plan and related No Name PAP materials. Minimization of impacts to the hydrologic balance is focused on reducing the disturbance footprint to the extent practicable through contemporaneous reclamation. In addition, potentially acid-forming or otherwise problematic materials are managed through chemical characterization and appropriate handling and placement, including blending and mixing of overburden materials as needed. The amount of upgradient surface water commingled with disturbed area drainage is limited using best management practices to contain or divert upgradient flows. Upgradient flows may be diverted around active mining areas and routed to natural channels or impoundments as appropriate to manage runoff. Sediment migration during storm events is limited using best management practices to contain or treat flows, including the use of impoundments and sediment control structures downgradient of disturbed areas. NTEC also minimizes potential effects to surface water and alluvial groundwater quantity by implementing stream buffer zones where practicable to limit disturbances in channel reaches not directly affected by mining. In addition, reclamation incorporates geomorphic methods, where practicable, to re-establish stable drainage forms and grades that are consistent with surrounding landforms and that promote appropriate infiltration and conveyance. These geomorphic approaches are intended to reduce long-term erosive potential, limit sediment delivery, and support functional postmining drainage networks.

These measures are reviewed and approved during the permit application and revision process and are intended to provide a high degree of water management and treatment practicable to maintain designated uses and existing water quality. Discharges of water from areas disturbed by surface mining activities are required to comply with applicable water quality requirements, including water quality-based effluent limitations administered through NPDES Permit No. NN0028193. Based on the approved design features and operational controls described in the current technical record, OSMRE finds that the mining operation, including the No Name permit area evaluated in this CHIA update, is designed to minimize impacts within the permit area.

Detailed impact minimization measures for the No Name permit area are documented in the No Name PAP, including the Hydrologic Reclamation Plan, Section 26 (Drainage Control Plan), and Section 18 (Water Resources), and are incorporated here by reference.

5.2 Monitoring Program

A surface water monitoring plan is provided in the permit application materials. NTEC's surface water monitoring program is established to monitor surface water quantity and quality at locations where major watercourses enter and leave the permit areas. The monitoring program provides a basis for assessment of mining impacts on surface water resources and is designed to collect water quantity and quality

information for use in identifying potential impacts to the prevailing hydrologic regime. The plan identifies parameters to be monitored, sampling frequency, and monitoring site locations. The permit application also includes compliance requirements for NPDES Permit No. NN0028193. Current surface water monitoring locations are shown on Figure 17.

Surface water sampling parameters are identified in the permit application materials and include pH, TDS, TSS, conductivity, settleable solids, total sediment, aluminum, arsenic, boron, calcium, cadmium, chloride, fluoride, total and dissolved iron, lead, total and dissolved manganese, nitrate, potassium, selenium, sulfate, sodium, bicarbonate, and carbonate. Each sample is accompanied by a cation and anion balance for quality assurance. Based on the monitoring record and the baseline and trend information summarized in Chapter 4 and No Name PAP Section 18 Water Resources, OSMRE finds that the surface water monitoring program has supplied sufficient information to support evaluation of potential material damage in this CHIA.

A groundwater monitoring plan is also provided in the permit application materials. The groundwater monitoring program is established to monitor groundwater quantity and quality in alluvial systems, the Fruitland Formation coal units, and the PCS. The monitoring program provides a basis for assessment of mining impacts on groundwater resources and is designed to collect water quantity and quality information for use in identifying potential impacts to the prevailing hydrologic regime. The plan identifies parameters to be monitored, sampling frequency, and monitoring site locations. Current groundwater monitoring locations in the southern part of the lease are shown on Figure 19.

Groundwater sampling parameters include TDS, conductivity, pH, water level, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, fluoride, and selenium. Each sample is accompanied by a cation and anion balance for quality assurance. Additional monitoring parameters are included if reference criteria are exceeded and include iron, manganese, nitrate, and boron, as identified in the permit application materials. Based on the monitoring record and the baseline and trend information summarized in Chapter 4 and No Name PAP Section 18 Water Resources, OSMRE finds that the groundwater monitoring program has supplied sufficient information to support evaluation of potential material damage in this CHIA.

5.2.1 Monitoring Program Updates

Monitoring programs are periodically updated to enhance available datasets for baseline characterization and predictive analysis. Monitoring program enhancements implemented over time have included additions and modifications to surface water monitoring locations, groundwater monitoring wells, and monitoring frequency and parameters to address site-specific hydrologic pathways and potential receptors. For this CHIA update, baseline and trend evaluation relies on the monitoring record compiled in No Name PAP Section 18 Water Resources and associated appendices, which summarize monitoring locations, sampling parameters, QA/QC procedures, and the periods of record used in the Chapter 4 baseline characterization.

No Name—area surface-water monitoring updates include establishment of baseline monitoring stations on No Name Arroyo and Pinabete Arroyo in 1998 at upstream and downstream locations near the lease, consisting of single-stage sediment samplers and crest-stage gages installed on relatively uniform channel segments (No Name PAP Section 18). NTEC implemented a baseline hydrologic monitoring program in 2007–2008 to supplement the earlier baseline dataset, including collection of surface-water samples and field parameters (e.g., pH, temperature, specific conductance) and laboratory analyses for sediment and water-quality constituents; QA/QC information for the 2007–2008 surface-water dataset is provided in

Appendix 18-D. Channel profiles and cross sections at crest gage locations were surveyed in 2007 and compared to the 1998 survey to evaluate midterm morphological change and channel stability (Appendix 18-A). NTEC has continued sampling at the Pinabete Arroyo surface-water sites since 2011 (Table 18-41), and No Name Arroyo surface-water site sampling has been resumed, with results to be provided as supplemental information prior to permit approval or as directed by OSMRE (No Name PAP Section 18).

No Name–area groundwater monitoring updates include baseline groundwater monitoring programs implemented in 1998 and 2007–2008 to obtain site-specific information on groundwater levels, aquifer characteristics, and groundwater quality at well locations within and adjacent to the No Name permit area (No Name PAP Section 18). Alluvial monitoring wells PA-1 and PA-2 (Pinabete Arroyo alluvium) and NNA-1 and NNA-2 (No Name Arroyo alluvium) were installed in 1998, and water levels were measured monthly; the No Name Arroyo alluvial wells were specifically intended to support evaluation of potential alluvial groundwater interaction with the No Name Impoundment (No Name PAP Section 18). QA/QC information for the 2007–2008 groundwater dataset is provided in Appendix 18-G, and laboratory QA documentation is provided in Appendix 18-H. In 2025, NTEC conducted an additional inventory of springs and wells within and adjacent to the permit area and updated the inventory based on the recent survey. In addition, No Name alluvial well sampling has resumed in 2025, although the wells have been dry; sampling will continue and results will be provided as supplemental information prior to permit approval or as requested by OSMRE (No Name PAP Section 18).

The Chinde alluvial monitoring program is particularly important in light of potential mining-related pathways evaluated in this CHIA. The objective of these monitoring locations is to characterize and monitor hydrogeologic conditions of the Chinde alluvium as follows:

- The first monitoring location is a drive point well installed downgradient of the NAPI fields and upgradient of the wetland east of the mine lease. The purpose of this location is to assess groundwater quality immediately downgradient of NAPI.
- The second monitoring location is a well installed adjacent to the wetland east and upgradient of mining activities. The purpose of this well is to monitor water quality immediately upgradient of mining activities.
- The third monitoring location is a well installed in Chinde Wash downgradient of existing well QAC-1. The purpose of this well is to monitor water quality downgradient of the mine.
- Three monitoring locations have been installed in the wetland immediately upgradient of the Big Fill. The purpose of these locations is to monitor potential wetland influences on alluvial water quality, monitor groundwater elevations, and support determination of groundwater flow direction.

These monitoring points are outlined in Table 6 and approximate locations are shown in Figure 22.

Table 6: Chinde Alluvium Monitoring Approach

Target Unit	Well Designation	General Location	Monitoring Type	Screen Interval	Sampling Frequency
Top of competent bedrock	CA-1	Chinde Wash — drive point installed downgradient of NAPI fields and upgradient of the wetland east of the mine lease	Drive Point	Dependent on refusal	Quarterly
Alluvium	CA-2	Chinde Wash — monitoring well adjacent to wetland east	Monitoring Well	Varies — 5 ft above water table plus	Quarterly

Target Unit	Well Designation	General Location	Monitoring Type	Screen Interval	Sampling Frequency
		of mine lease (upgradient of mining activities)		thickness of aquifer	
Alluvium	CA-3*	Wetland on lease — monitoring location immediately upgradient of the Big Fill	Water level measurements only	NA	Water level measurements only
Alluvium	CA-4*	Wetland on lease — monitoring location immediately upgradient of the Big Fill	Water level measurements only	NA	Water level measurements only
Alluvium	CA-5*	Wetland on lease — monitoring location immediately upgradient of the Big Fill	Water level measurements only	NA	Water level measurements only
Alluvium	CA-6	Chinde Wash — downgradient of mine lease	Drive Point / Monitoring Well	Dependent on refusal / Varies — 5 ft above water table plus thickness of aquifer	Quarterly

*Water level measurements only

Note: Existing monitoring locations (including QAC-1 and other legacy alluvial points) are described in the baseline technical record; Table 6 summarizes the Chinde alluvium monitoring approach elements implemented to evaluate key pathways for this CHIA update.

5.3 Impact Assessment

The assessment presented in Chapter 5 considers available surface water and groundwater quantity and quality information potentially affected by NTEC operations within the CIAs. The assessment approach for each resource is summarized in Table 7. Impact assessment relies on analysis of monitoring data, applicable modeling results, relevant reports and studies, experience from past mining and reclamation operations at the Navajo Tribal Coal Lease and other mines in the region, and observations made by mine personnel and OSMRE staff during mine operations and regulatory oversight. For purposes of communication, impacts are designated as negligible, minor, moderate, or major using the methodology described in Table 7. Table 7 also summarizes mitigation measures and monitoring program updates relevant to each resource. The impact designations in Table 7 are used as a screening and communication tool for this CHIA and do not represent regulatory thresholds for the material-damage determination.

Additionally, impact assessment associated with the No Name Permit is not exclusively based on Table 7 and is estimated using existing evaluations available in the No Name PAP.

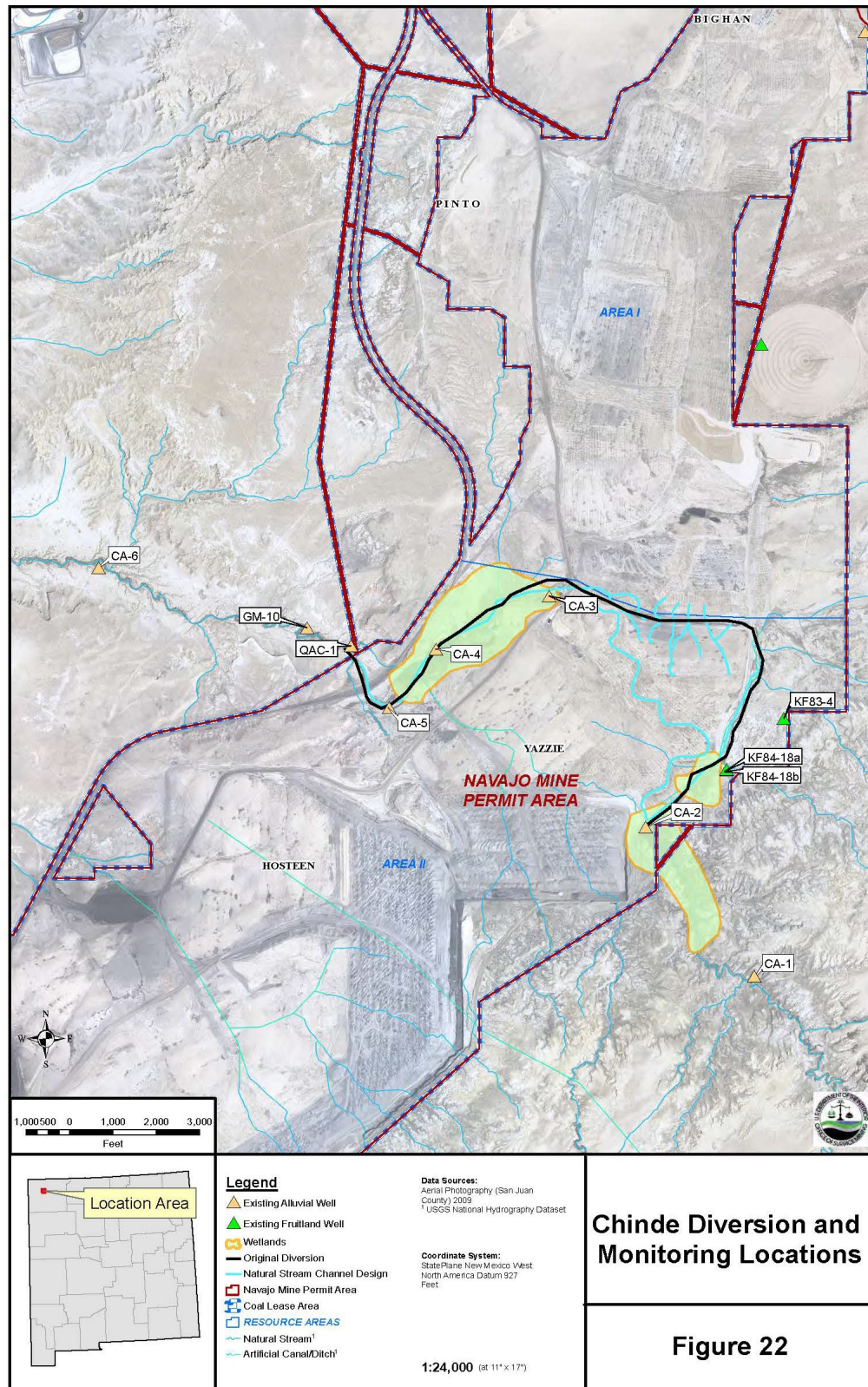


Figure 22: Chinde Diversion and Monitoring Locations

Table 7: Hydrologic Impact Designation Assessment Methodology

Water Resource	Fruitland & PCS Quantity	Alluvial Quantity	Surface Water Quantity	Fruitland & PCS Quality	Alluvial Quality	Surface Water Quality
Assessment Approach	Evaluation of potentiometric surface contour maps	Comparison of water levels at individual wells over-time	SEDCAD modeling- pre- and post-mining	Comparison of baseline water quality to potentially impacted or non-baseline wells, including spoil and CCB wells	Comparison baseline (upstream/pre-mining) water quality to non-baseline (during and post-mining/downstream) water quality and comparison to applicable Water Quality Standards	Comparison baseline (upstream/pre-mining) water quality to non-baseline (during and post-mining/downstream) water quality and comparison to applicable Water Quality Standards
Impact Designation: Major	Changes in water level contours that are significantly less than baseline levels	Changes in water levels that are consistently (>60% of the time) below baseline fluctuations as Characterized by the Median minus 2 MAD and attributable to mining	Change in peak flows relative to baseline are >60% and attributable to mining	Changes in water quality that consistently (>60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining	Changes in water quality that consistently (>60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining	Changes in water quality that consistently (>60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining
Impact Designation: Moderate	Changes in water level contours that are moderately less than baseline levels	Changes in water levels that are regularly (30%-60%) below baseline fluctuations as Characterized by the Median minus 2 MAD and attributable to mining	Change in peak flows relative to baseline are between 30% and 60% and attributable to mining	Changes in water quality that regularly (30-60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining	Changes in water quality that regularly (30-60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining	Changes in water quality that regularly (30-60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining
Impact Designation: Minor	Changes in water level contours that are slightly less than baseline levels	Changes in water levels that are occasionally (10%-30%) below baseline fluctuations as Characterized by the Median minus 2 MAD and attributable to mining	Change in peak flows relative to baseline are between 10% and 30% and attributable to mining	Changes in water quality that occasionally (10%-30%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining	Changes in water quality that occasionally (10%-30%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining	Changes in water quality that occasionally (10%-30%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD and attributable to mining

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Water Resource	Fruitland & PCS Quantity	Alluvial Quantity	Surface Water Quantity	Fruitland & PCS Quality	Alluvial Quality	Surface Water Quality
Impact Determination: Negligible	Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations	Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations	Change in peak flows are <10% (considered within baseline)	Impacts to water quality that are within baseline fluctuations (<10%) as Characterized by the Median plus 2 MAD or Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations	Impacts to water quality that are within baseline fluctuations (<10%) as Characterized by the Median plus 2 MAD or Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations	Impacts to water quality that are within baseline fluctuations (<10%) as Characterized by the Median plus 2 MAD or Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations
Impact Mitigation	Contemporaneous Reclamation	Contemporaneous Reclamation; reclamation of approximate original contour (AOC); stream buffer zones	Contemporaneous Reclamation; reclamation of approximate original contour (AOC); stream buffer zones	Contemporaneous Reclamation; mixing of overburden/ backfill materials; material classification and handling procedures	Contemporaneous Reclamation; stream buffer zones	Contemporaneous Reclamation; stream buffer zones; Sedimentation Ponds

5.3.1 Potential Cumulative Impact between NTEC operations and El Segundo Mine

El Segundo coal mine is located approximately 70 miles southeast of the southern boundary of the Navajo Mine lease area. The proposed lease area is divided into two subwatersheds by the continental divide and is crossed by several unnamed ephemeral arroyos. The western portion of the lease area drains toward the Chaco River through an unnamed ephemeral channel that drains to Laguna Castillo before flowing to Kim-me-ni-oli Wash and then to the Chaco River. The ephemeral arroyos passing through the lease area flow primarily in direct response to storm events. The drainage area for the main western drainage as it leaves the lease area is approximately 24.7 square miles, of which about 6.1 square miles (25 percent) of the total watershed are proposed to be disturbed by mining. The effects of mining relative to surface water quantity are limited to interception and alteration of ephemeral surface flows, which has potential to affect the stock watering capability of rangelands (NMEMNRD 2008).

Given the distance between the El Segundo Mine and the Navajo Tribal Coal Lease, and given that the Chaco River is predominantly ephemeral and losing along much of its course, it is unlikely that runoff generated at the El Segundo Mine would reach the Chaco River in the vicinity of the Navajo Tribal Coal Lease and come in line with surface waters traversing the NTEC permit areas except under uncommon, watershed-scale storm conditions. The El Segundo Mine also occupies a small portion of the overall Chaco watershed. Therefore, any surface water runoff contribution from the El Segundo Mine is small relative to runoff generated from the Chaco watershed as a whole. OSMRE concludes that cumulative surface water impacts to the Chaco River from the El Segundo Mine, in combination with NTEC operations, are negligible.

5.3.2 Chaco River

There are periods when precipitation runoff from drainages that would normally flow across areas intersected by mining will not reach the Chaco River during active operations because it may be intercepted by mine pits or captured in temporary pit protection ponds and other control structures located upgradient of mining. Following reclamation, precipitation runoff from reclaimed areas is routed through channels in the reconstructed topography and then toward the Chaco River.

5.3.2.1 Surface Water Quantity

The Chaco River is an ephemeral drainage except for the last approximately 12.5 miles near its confluence with the San Juan River, where spillway overflows from Morgan Lake have resulted in perennial conditions. All primary drainages crossing the Navajo Tribal Coal Lease, except Bitsui Wash (which drains to the San Juan River), drain to the Chaco River. Historic monitoring occurred at two USGS stations along the Chaco River, station 09367950 near Waterflow, New Mexico, and station 09367938 near Burnham, New Mexico (Figure 8). Station 09367938 represents an upstream, predominantly ephemeral reach and is used as baseline context for the Chaco River because it is upstream of the Navajo Tribal Coal Lease.

Precipitation runoff from reclaimed areas may be reduced relative to some pre-mine conditions due to a combination of factors, including lower slopes, enhanced vegetative growth, engineered drainage designs, and sediment control best management practices that retain water and reduce stormwater runoff. Although perennial flow occurs in the lower Chaco River reach associated with Morgan Lake overflow, large flow events occur in response to precipitation. Available information indicates that storm response increases in magnitude moving downstream, and there is not a substantial loss in surface water flows attributable to

mining operations at the scale of the Chaco River (Figure 23). Therefore, impacts of NTEC mining operations on Chaco River surface water quantity are considered negligible.

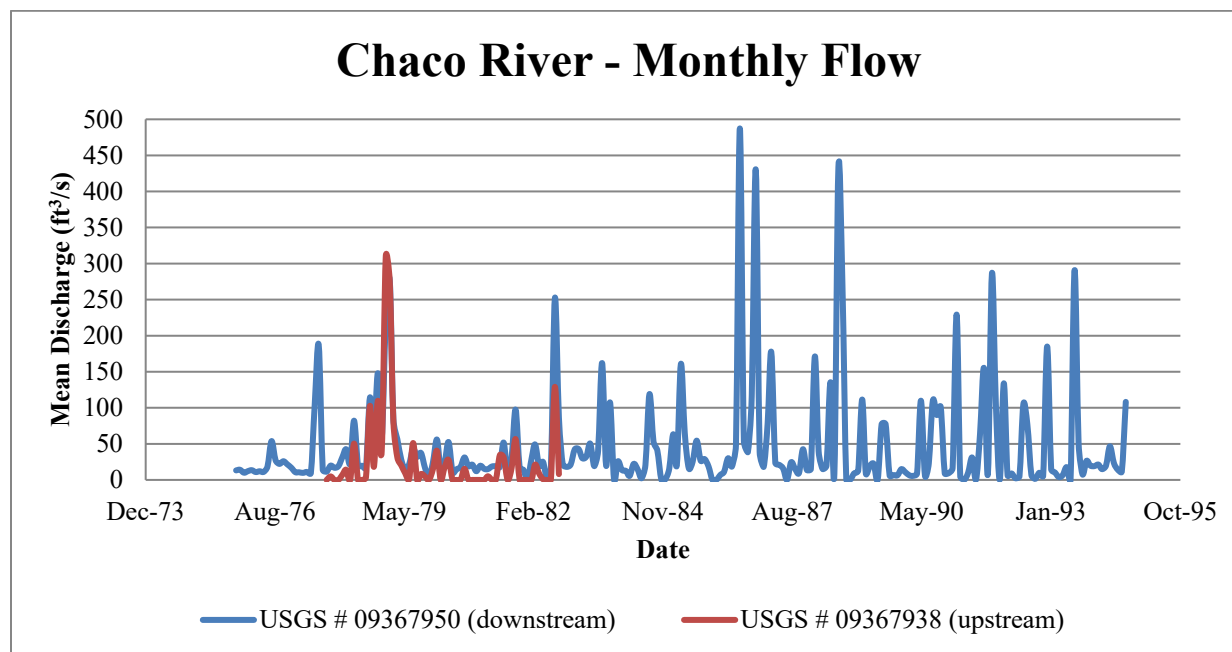


Figure 23: Monthly Flow along the Chaco River

5.3.2.2 Surface Water Quality

Historic surface water quality data are available for the Chaco River at two USGS stations in the lower Chaco River corridor, station 09367938 upstream of the Navajo Tribal Coal Lease and station 09367950 downstream of the lease area and downstream of the Morgan Lake discharge point (Figure 8). Water quality data were collected at station 09367938 from July 1977 to August 1982, and at station 09367950 from October 1969 to August 1989. Station 09367950 is used to assess downstream conditions; however, interpretation of differences between stations is limited because the downstream station is also influenced by Morgan Lake discharge and other upstream factors, and the Chaco River changes geologic setting between the two stations.

Given the lack of a monitoring station upstream of the Morgan Lake discharge point, it is not possible to fully differentiate mining-related effects from other influences using the historic USGS record. Nevertheless, downstream data from station 09367950 indicate high variability and show that some constituents exceed applicable criteria. Mercury exceeded fish consumption criteria in a large proportion of samples, and a suite of constituents, including cadmium, chromium, mercury, selenium, and zinc, exceeded aquatic and wildlife habitat criteria in varying proportions of samples. Livestock criteria exceedances occurred for some constituents, while dissolved iron did not exceed the SMCRA dissolved iron effluent limitation in the dataset evaluated. Overall, surface water quality in the Chaco River is considered compatible with the designated postmining land use of livestock grazing; however, constituents of concern relative to aquatic and wildlife habitat and fish consumption criteria are present under some conditions, and evaluation of those constituents is addressed in the context of cumulative effects and monitoring program adequacy.

Comparison of downstream results to baseline variability using the median plus 2 median absolute deviation approach indicates the following impact designations for selected constituents: minor impacts for manganese (15 percent of samples exceeding baseline), moderate impacts for barium, cadmium, fluoride, radium, and selenium (35 percent, 31 percent, 54 percent, 1 percent, and 58 percent of samples exceeding baseline, respectively), and major impacts for boron, sulfate, TDS, and conductivity (96 percent, 94 percent, 100 percent, and 96 percent of samples exceeding baseline, respectively). For these constituents, median concentrations exceeded the baseline median plus 2 median absolute deviations. However, for most constituents, median concentrations were below relevant use criteria, indicating that while impact designation can be elevated for certain parameters, it does not necessarily translate to impairment of designated uses for the primary postmining land use. Potential concerns remain for selenium relative to aquatic and wildlife habitat use and for nitrate where applicable.

Review of downstream data indicates high variability relative to baseline data, where the median percent relative standard deviation for constituents was 96 percent compared to 44 percent for baseline data. The NNEPA pH criterion was exceeded in one sample (pH 11.3). Mercury exceeded NNEPA fish consumption criteria in 85 percent of samples. Cadmium exceeded NNEPA secondary human contact, fish consumption, and livestock criteria in 8 percent of samples. NNEPA acute aquatic and wildlife habitat criteria were exceeded for cadmium, chromium, copper, mercury, selenium, and zinc in 8 percent, 100 percent, 25 percent, 17 percent, 8 percent, and 8 percent of samples, respectively. NNEPA chronic aquatic and wildlife habitat criteria were exceeded for cadmium, copper, mercury, selenium, and zinc in 100 percent, 25 percent, 100 percent, 85 percent, and 8 percent of samples, respectively. Livestock criteria for boron, chloride, fluoride, sulfate, and TDS were exceeded in 23 percent, 1 percent, 46 percent, 24 percent, and 5 percent of samples, respectively. Median cadmium, mercury, and selenium concentrations were 1.2, 300, and 3 times greater than the NNEPA chronic aquatic and wildlife habitat standards, respectively. The median chromium concentration was 1.6 times greater than the NNEPA acute aquatic and wildlife habitat standard. The median mercury value also exceeded the NNEPA fish consumption criterion. All other median values were below criteria, indicating that many exceedances are characteristic of the high variability in the dataset rather than general baseline water quality. However, elevated levels of cadmium, chromium, mercury, and selenium were found relative to NNEPA aquatic and wildlife habitat and fish consumption criteria.

Comparison to baseline conditions using the upstream station median plus 2 median absolute deviations indicates minor impacts for manganese (15 percent of samples exceeding baseline), moderate impacts for barium, cadmium, fluoride, radium, and selenium (35 percent, 31 percent, 54 percent, 1 percent, and 58 percent of samples exceeding baseline, respectively), and major impacts for boron, sulfate, TDS, and conductivity (96 percent, 94 percent, 100 percent, and 96 percent of samples exceeding baseline, respectively). Median concentrations of boron, chloride, fluoride, nitrate, selenium, sulfate, TDS, and conductivity exceeded the baseline median plus 2 median absolute deviations. Median concentrations for these constituents, except selenium and nitrate, were below relevant use criteria. Impacts for other constituents were determined to be negligible. Therefore, while the impact designation can be considerable for certain constituents, it does not necessarily translate to significant impairment of use.

5.3.2.3 Chaco River Alluvium

Groundwater use in the groundwater CIA is limited in extent and is mostly derived from wells completed within Quaternary alluvium. Water derived from alluvial wells is predominantly used for livestock watering. Baseline alluvial water quality indicates that sulfate and TDS frequently exceed livestock watering reference criteria and alluvial water quality is generally a poor source for livestock watering use. No downstream alluvial data are available for comparison.

5.3.3 Historic Mining Area North of the No Name Permit Area

Mining has continued in portions of the lease area since the 2015 CHIA (including in the vicinity of the Pinabete drainage/Area 4 South); therefore, this section is retained as regional context, while No Name permit area impact findings rely primarily on updated monitoring and analyses documented in the No Name PAP and Appendix 41.E.

5.3.3.1 Surface Water

The application of surface water for agriculture by NAPI has influenced hydrologic conditions and water quality in portions of the northern lease area through indirect discharges associated with irrigation return flows. These return flows result from infiltration of irrigation water and return flow to channels and may be expressed as variable increases in flow and discharge. Irrigation return flows may also mobilize chemical constituents from shallow geologic formations and soils. These factors contribute to baseline hydrologic variability and provide context for evaluating potential mining-related changes.

Historic coal mining areas north of the NTEC permit area include the Watson, Bitsui, Dodge, and Custer pits. Only the Custer pit area lies within the surface water CIA and is within the Morgan Lake-Chaco River HUC-12 watershed along with the Bingham pit area. The Bingham pit area is within the NTEC permit area; therefore, characterization of impacts to water quantity for the Morgan Lake-Chaco River HUC-12 watershed is addressed in Section 5.3.7.1.1. There are no major tributaries to the Chaco River that traverse this area, and surface water monitoring data within this portion of the surface water CIA are limited.

5.3.3.2 Alluvium

There are no current identified uses of alluvium in this area; however, historic use of alluvium for livestock watering has been attempted. Two alluvial wells exist along drainages tributary to Morgan Lake. Water quantity data were collected from 1996 to 2000 at Custer-1 located along the western lease boundary and at Custer-4 located within the Navajo Tribal Coal Lease near the eastern lease boundary. Two additional alluvial wells exist along Bitsui Wash; data were collected at GM-7 from 1975 to 1976, and no data are available at GM-37. Data collected at GM-7 represent the only alluvial quality data available for this area; however, GM-7 is located upstream of mining and was used for baseline characterization, and no postmining comparison dataset is available. Therefore, no assessment of alluvial quality is presented for this area in the impact discussion.

The Custer wells were not monitored prior to mining impacts in the area and are not used for baseline characterization. Therefore, alluvial quantity assessment at these locations cannot rely on a direct comparison of premine and postmine conditions. Alluvial quantity was assessed using two metrics: the percent of sampling events that were dry and water elevation in feet above MSL. Water elevation was not collected for all sampling events; inference of water presence was based on the presence of water quality data. Therefore, the total number of samples used to calculate the percent of dry sampling events is often higher than the number of samples used for water elevation comparisons. Alluvium at Custer-1 and Custer-4 was dry for 75 percent of sampling events, and only two water elevation measurements are available for each well as shown on Figure 24. Although data are limited, hydrologic, geologic, and climatological information indicates that changes in groundwater levels at these locations are not expected to preclude livestock watering use, and potential mining-related impacts are considered negligible.

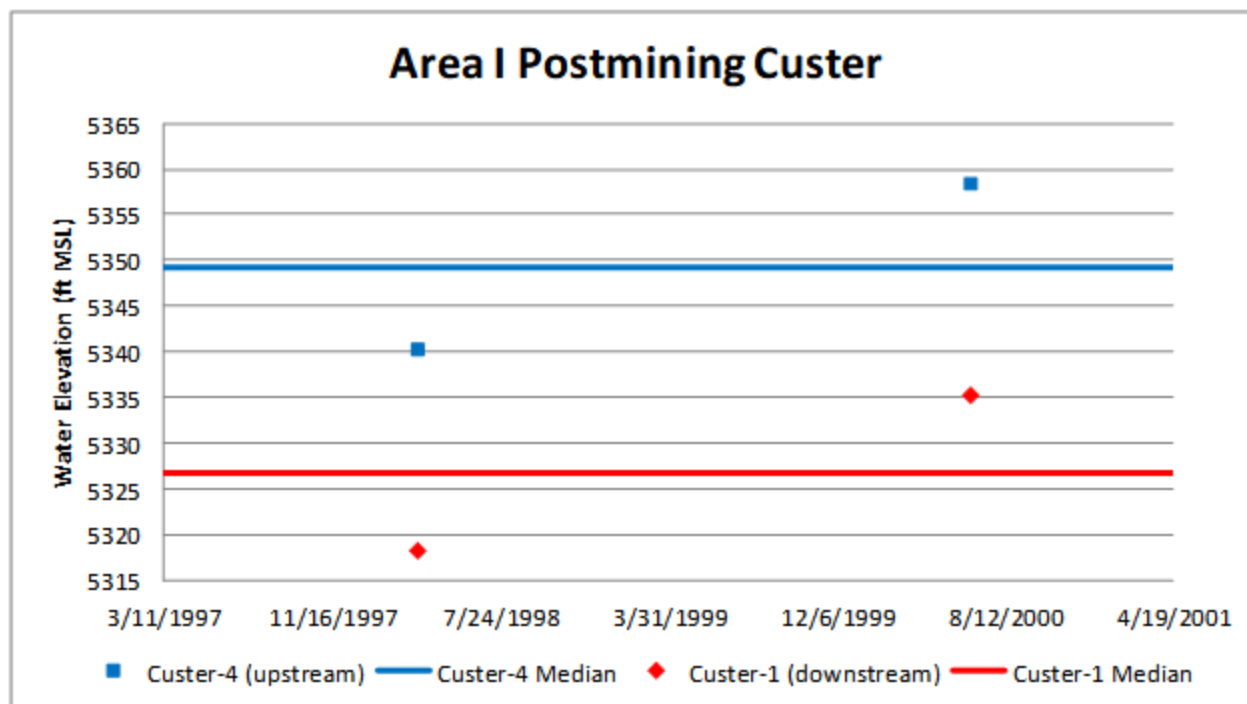


Figure 24: Custer Water Elevations

5.3.3.3 Fruitland Formation and PCS

Mine pits generally remain dry except during occasions when precipitation runoff is captured. Groundwater seeps observed along highwalls, Fruitland overburden, and coal seams are typically consumed by evaporation. The few seeps observed during mining were generally at locations where highwalls were near NAPI irrigation plots. Projected and observed impacts to Fruitland Formation water quantity associated with historic mining activities have been minimal to date. There are no current known uses for Fruitland Formation groundwater in or adjacent to this historic mining area, and no reasonably foreseeable uses other than oil and gas extraction. Observed impacts do not extend beyond areas immediately surrounding the historic mine pits and reclaimed areas, and the unit is generally not capable of providing a sustainable water supply for use. Therefore, for purposes of this assessment, impacts to Fruitland Formation groundwater quantity in the historic mining area are considered negligible.

Laboratory spoil leaching tests were performed in support of the PHC assessment for the mine. Spoil leaching test results indicate a range of concentrations for TDS and sulfate, which are constituents of concern with respect to spoil leachate. The leaching test results are generally consistent with results for the Bitsui No. 5 spoil well completed in mine spoils in the Bitsui Pit located in the pre-SMCRA mining areas. The Bitsui Pit was backfilled in the 1980s and is the only pit where saturation of mine spoils has been observed to date. Arsenic and selenium were below detection in most leaching test results and in the Bitsui No. 5 spoil well. Fluoride is also lower in spoil water leachate than in coal water and appears to be attenuated during flow through mine spoil. Boron and manganese concentrations are elevated in mine spoil water. A post-reclamation increase in TDS and sulfate concentrations in mine spoil backfill may result in increased TDS and sulfate concentrations in coal seams adjacent to historic mining areas. Spoil leaching test results indicate TDS concentrations in spoil water leachate ranging from 400 to 2,700 mg/L and sulfate concentrations ranging from 630 to 2,580 mg/L. Spoil data in this historic area are generally

consistent with spoil data within the permit area. For a detailed assessment of spoil data relative to baseline within the permit area, see Section 5.3.7.2.2.

The PCS is a well-cemented, low-permeability marine sandstone and is the first water-bearing unit below the Fruitland Formation. The PCS is approximately 110 to 120 feet thick and generally follows the structure of the Fruitland Formation, dipping to the east at approximately 2 degrees, although structure varies locally. The PCS conformably overlies the Lewis Shale, with the contact marked by a zone of interbedded sandstones and mudstones in the lower part of the PCS (Stone, Hydrogeology and Water Resources of the San Juan Basin, New Mexico, 1983). The PCS outcrops west of the Navajo Tribal Coal Lease area and east of the Chaco River. The PCS is a marginal water resource due to low permeability, generally poor water quality, gas production, and low yields. The PCS is also a natural gas reservoir in the San Juan Basin. Stone et al. (1983) noted that the PCS cannot be considered a major aquifer and is important primarily because it is the water-bearing horizon immediately underlying the Fruitland Formation coals. Because non-baseline PCS data are limited in the historic mining area, comparison of baseline and non-baseline PCS quality is limited.

Because there are no current known uses for Fruitland Formation or PCS groundwater in or adjacent to this historic mining area and no reasonably foreseeable uses other than oil and gas extraction, mining-related impacts are not anticipated to interrupt existing or foreseeable water uses. Potential impacts are localized and are not anticipated to extend beyond areas immediately surrounding the historic pits and reclaimed areas. These units are generally not capable of providing a sustainable water supply for use in the vicinity of the historic mining area. Therefore, for the purpose of this assessment, the impacts to the Fruitland groundwater quantity are considered to be negligible.

5.3.3.3.1 CCB Disposal

Navajo Mine accepted coal combustion by-products (CCBs) from Four Corners Power Plant Units 4 and 5 for disposal in final pits and ramps from 1971 to 2008. CCBs disposed of at Navajo Mine included fly ash, scrubber sludge, and bottom ash. CCBs were placed in mined-out pits and ramps to help achieve approximate original contour (AOC). CCB disposal designs considered natural conditions in the area and targeted placement above the water table to limit mobility of dissolved constituents.

CCB disposal predominantly occurred within the historic mining area north of the active permit areas and is shown on Figure 25. The only saturated CCB area (Bitsui) is located within this pre-SMCRA historic area. Baseline Fruitland coal data are not available for this historic area; however, baseline Fruitland data from upgradient wells within the permit areas are available for comparison.

CCB well data exhibit variability that is generally comparable to baseline Fruitland coal data within the lease area. Comparison of CCB well results to the baseline median plus 2 median absolute deviations for Fruitland coal within the lease area indicates negligible impacts for chloride; minor impacts for conductivity and manganese (20 percent and 26 percent of samples exceeding baseline, respectively); moderate impacts for total iron and TDS (40 percent and 59 percent of samples exceeding baseline, respectively); and major impacts for pH, boron, selenium, fluoride, and sulfate (70 percent, 100 percent, 82 percent, 63 percent, and 100 percent of samples exceeding baseline, respectively). Median concentrations for boron, selenium, fluoride, sulfate, and TDS exceeded the baseline median plus 2 median absolute deviations, with ratios of 13, 4, 1.1, 150, and 1.25 times, respectively. Median pH was within the livestock criteria range and no individual sample was below 6.5; however, 16 percent of pH samples were above 9. Median selenium concentrations were below livestock criteria; however, median concentrations for boron, fluoride, sulfate, and TDS exceeded livestock criteria by factors of 2, 1.3, 6, and

5, respectively. Therefore, within CCB disposal areas, boron, fluoride, sulfate, and TDS are of concern relative to baseline and livestock criteria.

Although elevated levels of constituents of concern occur in CCB wells in the historic mining area, there are no current known uses for Fruitland Formation groundwater in or adjacent to this area and no reasonably foreseeable uses other than oil and gas extraction. For historic CCB disposal to significantly impact use, leachate would need sufficient mobility to reach alluvial users near disposal sites at concentrations of concern. Modeling was conducted to evaluate potential impacts of historic CCB placement relative to nearby alluvial systems. Modeling results indicate slow groundwater movement and attenuation of constituents of concern during subsurface migration. OSMRE concludes that potential impacts to water users from historic CCB disposal at the Navajo Mine are negligible.

Placement of CCBs is not proposed as part of the No Name permit area operations evaluated in this CHIA update.

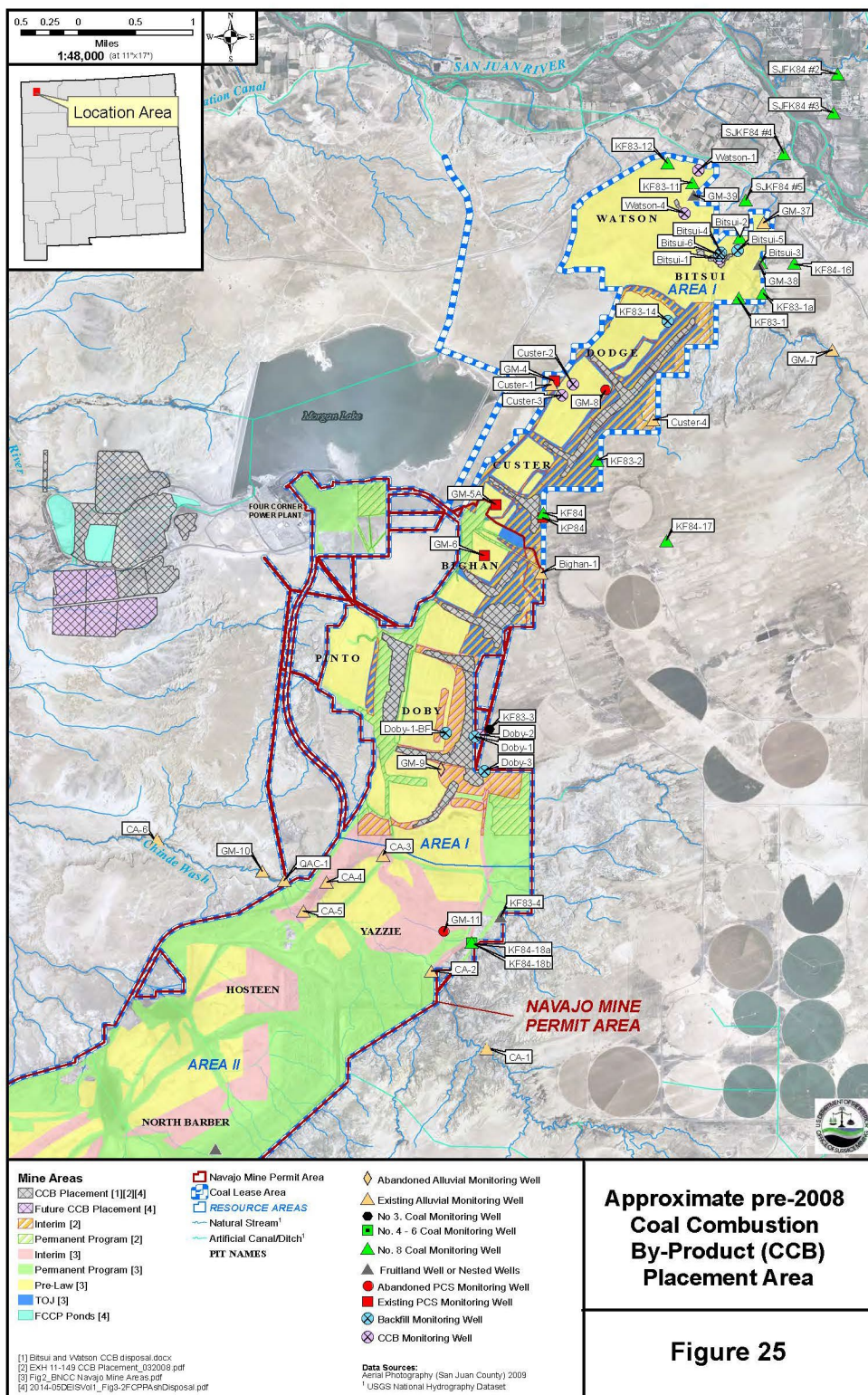


Figure 25: Approximate Historic CCB Disposal

5.3.4 Navajo Mine, No Name, and Pinabete Permit Areas

Drainage control features and diversion design criteria used in the surface water quantity assessment are provided in the No Name PAP Section 26 and Appendix 26.A, and watershed hydrologic response was evaluated using SEDCAD modeling documented in No Name PAP Appendix 18-B.

5.3.4.1 Surface Water Quantity

During operations, surface water management measures including containment berms, diversions, highwall impoundments, temporary pit protection ponds, and downgradient sediment ponds intercept and retain runoff and can reduce peak flows downgradient of active mine areas. As areas are reclaimed, surface water runoff within reclaimed areas is expected to be retained to a greater extent than under some pre-mine conditions due to a combination of factors, including lower slopes, enhanced vegetative growth, engineered drainage designs, and placement of reclamation soil materials that can increase infiltration and reduce direct runoff.

Postmining flows in drainages within the No Name permit area and associated drainages are expected to remain predominantly ephemeral due to the limited precipitation regime, except where sustained flow may occur due to upgradient irrigation-related influences. Irrigation influences have resulted in perennial and intermittent flows in some drainages in the region, including Chinde Wash. Future changes in irrigation practices could influence flow conditions in headwater areas; however, such influences are separate from mining-related impacts and are addressed in this CHIA as baseline condition context for affected drainages.

Precipitation runoff from drainages that would normally flow across active mine permit areas may be intercepted by mine pits or captured in temporary pit protection ponds located upgradient of active mining. Runoff collected in pits or in pit protection ponds may be used for dust suppression or may diminish through evaporation and seepage. Once reclamation is completed, precipitation runoff from reclaimed areas is routed through reconstructed channels and conveyed toward receiving drainages, including the Chaco River system.

Surface water and sediment modeling was performed using SEDCAD to evaluate peak flows and related hydrologic response for design storm events. The No Name permit area and associated drainages are within HUC-12 watersheds that intersect or contain portions of the lease area, including the Morgan Lake–Chaco River, Chinde Wash–Chaco River, Coal Creek–Chaco River, and Cottonwood Arroyo watersheds. Each major tributary to the Chaco River is evaluated by watershed in the following sections.

Surface water quantity impacts from the permit area are evaluated by the extent to which water management within the lease area affects peak flows within each watershed, including comparison of pre-mining and postmining peak flows.

The No Name PAP provides detailed information on surface water management structures and the removal plan for temporary structures, including drainage control features described in Section 26 (Drainage Control Plan) and related appendices (Appendix 26.A). Summary information on impoundments and related hydrologic management structures are also provided.

5.3.4.1.1 Morgan Lake-Chaco River Watershed

As discussed previously, the impact assessment for the Morgan Lake-Chaco River watershed does not include modeling of peak flow changes because activities within the permit area represent a small portion of the total watershed, because perennial flow contributions associated with Morgan Lake complicate interpretation of design-storm modeling at the watershed outlet, and because much of the permit area within this watershed is pre-SMCRA or otherwise outside the scope of the current baseline evaluation framework.

5.3.4.1.2 Pinabete Arroyo Watershed

SEDCAD modeling was conducted as part of the No Name permit-component technical record to evaluate storm-driven runoff response and storm volumes under pre-mining, operational, and post-reclamation surface configurations for Pinabete Arroyo and related drainages, including No Name Arroyo, Brimhall Wash, select unnamed tributaries, and the Chaco River reaches used to summarize watershed-scale response. The SEDCAD approach subdivides the drainage area into sub-watersheds and defines a linked routing network between sub-watersheds and channel segments. Sub-watersheds are delineated to represent relatively uniform surface conditions so that model assumptions can be applied consistently. Runoff response for specified design storm events is computed using standard hydrologic methods based on topography, soils, and vegetative cover; curve numbers and channel routing parameters are assigned accordingly. A consistent hydrologic response class was applied across model runs, and the 10-year 24-hour storm and multiple 6-hour events (2-, 10-, 25-, 50-, and 100-year) were evaluated (Table 8; No Name PAP Section 18; Appendix 18-B).

Model results indicate that surface-water management and mining progression within the Pinabete drainage (including diversion routing and temporary storage/retention within disturbed areas) reduce routed peak flows from portions of the Pinabete watershed to the Chaco River during operations relative to pre-mining conditions. The portion of Pinabete Arroyo contributing to the Chaco River along the Pinabete channel will initially decline from 59.1 sq mi to 11.6 sq mi after construction of the Pinabete and East diversions, and then to 3.6 sq mi once mining begins within the Pinabete drainage. During operations, a portion of runoff that would otherwise contribute to downstream peak flow may be intercepted by the mine pit or controlled by temporary protection ponds and utilized for mine operations (e.g., dust suppression) consistent with the approved water management approach. A flood attenuation feature is incorporated into the Pinabete Diversion design to attenuate diverted peak flows routed to No Name Arroyo; model results indicate that No Name Arroyo peak flows downstream of the diversion increase relative to pre-mining conditions, with the attenuation feature reducing (but not eliminating) the magnitude of peak-flow increases during larger storm events (No Name PAP Section 18; Section 26; Appendix 18-B; Appendix 26.A).

Peak flows from Pinabete Arroyo to the Chaco River from storm events of various return periods will initially be reduced by 40% to 55% following construction of the Pinabete Diversion and East Diversion, and by 70% to 73% once mining begins in the Pinabete drainage within Area 4 South (No Name PAP Section 41.2.4).

Peak flows post-mining are predicted to be similar to the pre-mining volumes and rates, and reclamation will restore much of the flow in the Pinabete Arroyo. Precipitation runoff from reclaimed areas might be reduced somewhat from pre-mine levels due to lower slopes, enhanced vegetative growth from the use of quality soils, engineered geomorphic drainage designs, and the use of other sediment-control BMPs that operate to retain water in the reclaimed areas, reducing storm-water runoff to the channel.

Table 8: SEDCAD™ 4 Estimated Peak Discharge and Sediment Yield at Surface Water Monitoring Stations

Watershed location	SEDCAD designation	2yr-6hr event (0.85 inches) Peak discharge (cfs)	2yr-6hr event (0.85 inches) Sediment yield (tons)	10yr-6hr event (1.28 inches) Peak discharge (cfs)	10yr-6hr event (1.28 inches) Sediment yield (tons)	10yr-24hr event (1.7 inches) Peak discharge (cfs)	10yr-24hr event (1.7 inches) Sediment yield (tons)	25yr-6hr event (1.56 inches) Peak discharge (cfs)	25yr-6hr event (1.56 inches) Sediment yield (tons)	50yr-6hr event (1.79 inches) Peak discharge (cfs)	50yr-6hr event (1.79 inches) Sediment yield (tons)	100yr-6hr event (2.04 inches) Peak discharge (cfs)	100yr-6hr event (2.04 inches) Sediment yield (tons)
Pinabete upstream	Structure 6	406.0	2,250.6	1,124.3	8,093.3	1,694.1	15,104.2	1,714.7	13,702.7	2,252.5	19,063.8	2,879.3	25,543.8
Pinabete downstream	Structure 8	395.7	2,146.9	1,099.2	7,808.1	1,701.5	14,698.1	1,677.5	13,103.4	2,203.7	18,151.3	2,816.9	24,239.3
No Name upstream	Structure 2	54.18	68.8	231.18	302.1	280.33	494.6	297.02	461	400.79	644.6	522.95	868.3
No Name downstream	Structure 5	113.85	290	563.64	1543.5	624.8	1875.5	660.92	1781.2	870.11	2427.5	1021.67	3091.3
Brimhall tributaries downgradient of Area 5	Structure 7	113.92	122.6	293.41	367.8	416.52	618.9	434.97	578.9	560.86	775.8	705.27	1009.6
Brimhall tributaries draining NMEP	Structure 9	132.12	237.7	350.41	751.6	501.77	1283.5	525	1199.1	681.42	1619.1	862.62	2120
Brimhall at the Confluence	Structure 12	424.62	4305	1197.76	14286.1	1866.78	24877.7	1824.37	23161.2	2390.53	31496.6	3047.08	41272.4
Chaco trib 1, pre-mine	Structure 3	74.91	289.6	216.06	988.4	315	1723.8	330.44	1609.3	433.26	2195.4	553.7	2902.5
Chaco trib 2, pre-mine	Structure 3	131.44	425.7	355.9	1271.9	509.61	2063.4	537.85	1999	701.94	2660.8	891.87	3364.8
Chaco trib 3, pre-mine	Structure 3	71.05	132.5	247.39	554.1	376.22	1023.6	396.85	949.1	535.69	1334.9	698.88	1803.4

cfs - cubic feet per second

5.3.4.1.3 No Name Wash Watershed

During mining within Area 5, while the Pinabete Diversion remains in place, some drainages that historically contributed flow to No Name Arroyo from the southwest will be mined through or otherwise altered by the disturbed-area configuration. As a result, modeled flows in No Name Arroyo during Area 5 operations differ from modeled No Name Arroyo flows during Area IV South operations, and the operational configuration reflects both direct disturbed-area effects and diversion-routing effects documented in the modeling record (No Name PAP Section 18; Appendix 18-B).

SEDCAD modeling results indicate that total sediment yields from No Name Arroyo can increase under certain operational configurations because contributing area and routing change; however, when evaluated at the receiving-water scale, the combined sediment yield from No Name Arroyo and diverted Pinabete contributions is not projected to result in an adverse effect on sediment yield or water quality in the Chaco River from overland flow and storm-runoff sources. The SEDCAD model represents event-based surface erosion and storm-driven sediment transport and provides predictions of expected sediment yields for disturbed areas and watersheds. Conventional SEDCAD-type surface erosion modeling does not estimate sediment yield associated with channel incision or bank erosion; therefore, potential sediment contributions associated with channel adjustment processes in No Name Arroyo downstream of the Pinabete diversion are addressed through geomorphic baseline characterization and reclamation/mitigation design rather than through the event-based sediment-yield tables alone (Table 8; No Name PAP Section 18; Appendix 18-A; Appendix 18-B; Section 26).

The estimated peak flows on No Name Wash downstream of the Pinabete Diversion are projected to increase by only 18% for the 2yr-6hr storm event and by 37% for the 10yr-6hr storm event during mining operations. Peak flows post-mining are likely to be similar to the pre-mining volumes and rates once the Pinabete Diversion is removed.

Baseline channel inventory and observations indicate that No Name Arroyo downstream (west) of the Burnham Road crossing includes an unstable reach with a headcut and incised channel conditions near the diversion influence area. Increased magnitude and/or frequency of storm-driven flows could increase headcut migration rates and associated sediment production through episodic mass failure and plunge-pool undercutting mechanisms. The diversion design therefore includes headcut mitigation to stabilize this reach and minimize sediment production associated with headcut migration, consistent with the Hydrologic Reclamation Plan and drainage control plan design (No Name PAP Section 18; Appendix 18-A; Section 26; Hydrologic Reclamation Plan).

5.3.4.1.4 Miscellaneous Watersheds

Several smaller drainages are also influenced during mining of Area 5. Three unnamed tributaries along the western side of the permit area (numbered from north [#1] to south [#3]) drain to the Chaco River. In addition, an approximately 2.81-square-mile portion of the Area 5 mine drains toward Brimhall Wash. Consistent with the surface-water management approach described for other watersheds, runoff from disturbed areas is retained and managed on-site using berms and/or ponds, which reduces the amount of runoff routed to Brimhall Wash. SEDCAD modeling indicates only minor operational-period changes in peak flow for these miscellaneous drainages, with projected changes ranging from a slight increase (approximately 0.15 percent) to a slight decrease (approximately 1.9 percent), depending on the storm event and modeled configuration (Table 8; No Name PAP Section 18; Appendix 18-B).

Flow from the disturbed areas during mining will be retained on-site by berms and/or ponds and will result in less runoff reaching Brimhall Wash. SEDCAD flow projections show very slight changes during operations, with flows ranging from a decrease of 8% to 12%.

Mining is anticipated to remove certain small ponds within the active disturbance footprint, including Stevenson's Well Pond during mining in Area IV South and several ponds within Area 5 (C#1, C#2, C#3, NN#1, NN#2, NN#3, and NN#4). The B#1 pond immediately southeast of Area 5 is not expected to be disturbed by mining, although local hydrology and contributing runoff conditions could be affected by nearby operations. The No Name Impoundment is not planned to be mined through; however, absent periodic maintenance, storage capacity would be expected to decline over the life of mine due to sedimentation from natural flows. Therefore, the Hydrologic Reclamation Plan includes a maintenance approach for the No Name Impoundment during mining operations in Area IV South and Area 5 to maintain capacity and support reduction of storm-water runoff to the No Name Arroyo reach downstream of the Pinabete Diversion (No Name PAP Section 18; Section 26; Hydrologic Reclamation Plan).

5.3.4.1.5 Chinde Wash Watershed

Approximately 3,100 acres of the Chinde Wash drainage basin are disturbed by mining activities. The postmining Chinde Wash watershed increases in size by 1,124 acres within the lease area, primarily due to changes in the drainage divide between Hosten Wash and Chinde Wash and the drainage divide between Dodge Diversion and Chinde Wash.

The largest hydrologic change to Chinde Wash is in the Doby reclamation area to the north, where westward drainage from off-lease undisturbed areas is diverted toward the south via a post-mine channel (Doby North Channel) that runs north to south along the eastern lease boundary. The pre-mine topography had no major channel; the surface sloped down toward the west with predominantly sheet flow and some small channels. The post-mine channel also collects surface runoff from a portion of the reclaimed surface to the west and diverts flow into a tributary of the Chinde Diversion.

The peak flow resulting from the 10-year, 6-hour precipitation event is predicted to decrease from a pre-mine estimate of 715 cubic feet per second to a post-mine estimate of 705 cubic feet per second for Chinde Wash at the watershed outlet (Table 9). For purposes of this assessment, this decrease in peak flow constitutes a negligible impact. Therefore, surface water quantity impacts to Chinde Wash at the watershed outlet are considered negligible.

There are no impoundments within the Chinde Wash watershed; therefore, impacts to the hydrologic balance related to the percentage of the watershed managed by impoundments are negligible. Significant activity occurred on Chinde Wash prior to SMCRA in 1977, which resulted in areas of sediment accumulation in the channel within the lease area. In 1973, the Big Fill was constructed for the rail crossing of Chinde Wash. Sediment accumulation associated with the rail crossing has developed into productive wetland habitat, and surface water and groundwater monitoring are in place to evaluate water conditions at the wetland.

The Chinde Wash watershed is also influenced by non-mining sources. In 1976, NAPI initiated commercial scale irrigation on lands adjacent to the Navajo Tribal Coal Lease (Moore 2006), and irrigation return flows and canal releases influence hydrologic conditions in Chinde Wash. Once an ephemeral arroyo, Chinde Wash now exhibits perennial conditions in portions of the drainage due to irrigation-related inputs. Irregular flow conditions are managed in part by development of wetlands along Chinde Wash, including one wetland located upgradient of the mine lease and a second located on the

mine lease upgradient of the Big Fill. The Chinde Diversion and the natural channel regrade are shown on Figure 22.

Table 9: Comparison of Pre-Mine and Post-Mine Peak Flows in the Chinde Wash Watershed (NTEC 2013)

Sedcad 4.0 Watershed Designation		Pre-Mine		Post Mine		Difference From Pre-Mine	
Pre	Post	Area	Peak Flow (cfs)	Area	Peak Flow (cfs)	Area	Peak Flow (cfs)
S24	S24	27,130	715	28,254	705	1,124	-10
S17 SW1	S17 SW1	1,100	34	824	40	-276	6
S15 SW1	S15 SW1	595	43	600	26	5	-17
S11	S27	446	172	1,726	332	1,280	160
S18 SW1	S18 SW1	146	10	120	10	-26	0

5.3.4.1.6 Chinde-Chaco River Watershed

Notable changes from the pre-mining to the postmining scenario occur along Hosteen Wash, Barber Wash, and South Barber Wash. The surface area within Hosteen Wash decreases by approximately 1,300 acres from the pre-mining to the postmining scenario due to diversion of surface water into the adjacent Chinde watershed. Curve numbers used in SEDCAD modeling for certain areas within Hosteen Wash were reduced to reflect the influence of mining water management structures and higher infiltration rates. Peak flow reductions along Hosteen Wash and associated tributaries were incorporated into the watershed-scale assessment. Impacts along North and South Barber Wash were also incorporated. South Barber Wash decreases by approximately 850 acres in its sub-watershed, and the decreased area is added to the North Barber sub-watershed through a diversion.

Detailed assessment and modeling of individual drainages are provided in the current PHC technical record and No Name PAP, including Section 18 (Water Resources), Section 26 (Drainage Control Plan), Appendix 18-B (SEDCAD modeling), and Appendix 26.A (drainage control plan details). Although peak flow to South Barber Wash is estimated to be reduced following reclamation, the net effect on the HUC-12 watershed is captured in the watershed-scale modeling results summarized in Table 10.

The peak flow resulting from the 10-year, 6-hour precipitation event at the watershed outlet is simulated to decrease from a pre-mine estimate of 2,096 cubic feet per second to a post-mine estimate of 1,331 cubic feet per second. The total peak flow reduction for the HUC-12 watershed from pre-mine to post-mine is approximately 36 percent. For purposes of this assessment, this decrease in peak flow represents a moderate impact. Therefore, surface water quantity impacts at the Chinde Wash–Chaco River watershed outlet are designated moderate under the impact assessment methodology.

Table 10: Comparison of Pre-Mine and Post-Mine Peak Flows in Chinde-Chaco River Watershed

Sedcad Watershed Designation	Pre-Mine		Post-Mine		Decrease in Peak Flow (percent)
	Total Contributing Area (acres)	Peak Discharge (cfs)	Total Contributing Area (acres)	Peak Discharge (cfs)	
#2	2,010	680.13	1,650	81.38	88
#5	3,110	929.94	2,400	262.42	72
#1	1,210	298.3	850	32.21	89
#4	2,750	609.87	2,100	307.04	50
#8	6,840	1,408.08	5,480	575.42	59
#3	1,565	221.37	1,140	161.25	27
#7	3,215	444.33	2,365	326.8	26
#6	1,235	253.21	1,985	406.98	-61
#9 (Outlet)	14,220.	2,096.39	12,760	1,331.61	36

5.3.4.1.7 Coal Creek-Chaco River Watershed

Peak flow reduction for the Coal Creek–Chaco River watershed is lower, as a percentage, than for the Chinde Wash–Chaco River watershed. Although much of the runoff within the watershed is generated in Lowe Arroyo due to steeper slopes in that area, overall impacts at the watershed scale are moderated by the large watershed area. Curve numbers used in SEDCAD modeling were reduced to reflect postmining conditions along Lowe Arroyo. Detailed assessment and modeling of individual drainages are provided in the current technical record, including the No Name Permit Application Package (PAP) (Section 18) and Appendix 18-B (SEDCAD modeling).

The estimated pre-mine peak flow for the watershed, in response to the 10-year, 6-hour precipitation event, is 1,719 cubic feet per second, and the post-mine peak flow is 1,335 cubic feet per second. The total peak flow reduction for the HUC-12 watershed from pre-mine to post-mine is approximately 22 percent (Table 11). For purposes of this assessment, this decrease in peak flow represents a minor impact. Therefore, surface water quantity impacts at the Coal Creek-Chaco River watershed outlet are designated minor under the impact assessment methodology.

Table 11: Comparison of Pre-Mine and Post-Mine Peak Flows in Coal Creek-Chaco River Watershed

Sedcad Watershed Designation	Pre-Mine		Post-Mine		Decrease in Peak Flow (percent)
	Total Contributing Area (acres)	Peak Discharge (cfs)	Total Contributing Area (acres)	Peak Discharge (cfs)	
#16	7300	467.26	7300	467.26	0
#15	3530	388.14	3530	388.14	0
#10	2860	370.9	2860	240.25	35
#11	6790	898.5	6790	500.47	44
#12	7730	933.82	7730	523.35	44
#17	23620	1827.86	23620	1471.57	19
#14	1280	261.33	1280	261.33	0
#13	1762	250.23	1762	250.23	0
#18	28252	1757.7	28252	1383.23	21
#19 (Outlet)	28252	1719.96	28252	1335.69	22

5.3.4.1.8 Cottonwood Arroyo Watershed

The primary hydrologic change to the Cottonwood Arroyo watershed is disturbance and reconstruction of portions of the North Fork of Cottonwood Arroyo. Approximately 10,662 feet of the North Fork will be permanently realigned from pre-mine orientation due to reclamation. As noted in the discussion of Lowe Arroyo, the Cottonwood Arroyo watershed will slightly increase in area between pre-mine and post-mine scenarios; however, this increase is not expected to result in appreciable hydrologic effects with respect to the evaluation method used in this CHIA.

Table 12 compares peak flow for the 10-year, 6-hour precipitation event for portions of Cottonwood tributaries that drain the Area IV North mine area. These results reflect disturbance conditions for the modeled sub-watershed even though proposed mining affects only a portion of the sub-watershed. The differences in peak flow are negligible between pre-mine and post-mine conditions at the lease boundary. The small change in peak flow reflects the small acreage of mining disturbance relative to the total Cottonwood watershed. Peak flow resulting from the 10-year, 6-hour precipitation event at the lease boundary is predicted to increase slightly from a pre-mine estimate of 2,879 cubic feet per second to a post-mine estimate of 2,903 cubic feet per second. For purposes of this assessment, this represents a negligible impact. Therefore, surface water quantity impacts at the Cottonwood Arroyo watershed boundary are considered negligible.

Table 12: Comparison of Pre-mine and Post-Mine Peak Flows in the Cottonwood Arroyo Watershed (NTEC 2013)

Watershed Designation		Pre-Mine		Post-Mine		Difference From Pre-Mine	
Pre	Post	Area (acres)	Peak Flow (cfs)	Area (acres)	Peak Flow (cfs)	Area (acres)	Peak Flow (cfs)
S21	S21	13,492	1,551	13,532	1,546	40	-5
S34	S34	18,191	674	18,279	665	88	-9
S36	S36	49,060	2,879	49,184	2,903	124	24
S37	S37	51,269	2,842	51,477	2,855	208	13

5.3.4.2 Surface Water Quality

Several mechanisms influence surface water quality within the permit and adjacent area. Precipitation events and NAPI-related discharges can generate runoff in ephemeral washes, entraining sands, silts, and clays and producing elevated concentrations of total suspended solids. Elevated suspended solids can influence geochemical conditions, including sorption and exchange processes, and may affect observed surface water chemistry. Recharge and hydrologic communication may also occur in areas where NAPI influences have resulted in intermittent or perennial flow conditions and associated changes in shallow groundwater levels, which can increase interactions among alluvial systems and underlying units. Surface water quality may also be influenced by contact with spoil materials. During mining and through bond release, surface water impoundments capture runoff that may have been in contact with disturbed materials. Impounded water may discharge over spillways during events exceeding design capacity or may infiltrate through impoundment bottoms and contribute to subsurface flow paths.

Surface water quality impact assessment is conducted by comparison of upstream or baseline water quality to downstream or non-baseline water quality where such datasets exist. This assessment focuses on primary drainages that traverse the NTEC permit areas. As part of the ongoing surface water monitoring program, water quality has been assessed along Chinde Wash, Cottonwood Arroyo, Pinabete Arroyo, and No Name Wash at locations shown on Figure 17. Non-baseline surface water quality data are limited, and the primary drainage with downstream non-baseline surface water quality data for direct comparison is Chinde Wash.

Surface water quality impact assessment is also conducted by comparison to applicable water quality criteria and standards, including NNEPA designated-use criteria (Table 3) and the SMCRA dissolved iron effluent limitation of 10 mg/L. NNEPA's water quality program is an integral component in protection of the hydrologic balance and surface water quality. NNEPA develops and implements water quality-based effluent limitations and provides input on technology-based effluent limitations for inclusion in permits issued to dischargers. Discharges are reported to USEPA under NPDES Permit No. NN0028193. If the appropriate Clean Water Act authority determines that a water quality violation exists, OSMRE will use applicable permitting and enforcement procedures to ensure compliance with NPDES Permit No. NN0028193 and protection of the hydrologic balance.

5.3.4.2.1 Chinde Wash

Surface water quality data are available for Chinde Wash at monitoring stations that bracket the lease area, including CD-2 and CD-2A downstream of the mine and CD-1 and CD-1A upstream of the mine (Figure 17). Water quality data were collected at CD-1 and CD-2 from 1986 to 1997 and at CD-1A and CD-2A from 1996 to the most recent available reporting period. There are no pre-mine data for Chinde Wash; however, CD-1 and CD-1A are used as baseline stations because they are upstream of mining. It is important to note that although upstream of mining, CD-1 and CD-1A are downstream of NAPI activities, and there are no pre-NAPI data for Chinde Wash. Chinde Wash is subject to both direct and indirect NAPI influences. Direct discharge events are variable and can occur over short durations and may contribute to erosion and sediment transport. Indirect irrigation return flows may contribute to baseflow conditions within Chinde Wash. Data from CD-2 and CD-2A are used for downstream, non-baseline comparison.

Downstream data exhibit slightly higher variability relative to baseline data, where the median percent relative standard deviation for constituents was 100 percent compared to 85 percent for baseline data. The NNEPA fish consumption criterion was not exceeded in any samples. NNEPA acute aquatic and wildlife

habitat criteria were exceeded for cadmium, chromium, selenium, silver, and zinc in 4 percent, 100 percent, 1 percent, 2 percent, and 60 percent of samples, respectively. NNEPA chronic aquatic and wildlife habitat criteria were exceeded for aluminum, cadmium, chromium, lead, selenium, and zinc in 46 percent, 100 percent, 3 percent, 57 percent, 70 percent, and 60 percent of samples, respectively. Lead exceeded the NNEPA secondary human contact criterion in 4 percent of samples. Livestock criteria for boron, chloride, selenium, sulfate, and TDS were exceeded in 0.5 percent, 5 percent, 23 percent, 0.5 percent, and 6 percent of samples, respectively. Median cadmium, lead, selenium, and zinc concentrations were 6, 2, 1.25, and 1.3 times greater than NNEPA chronic aquatic and wildlife habitat standards, respectively. Median chromium and zinc concentrations were 16 and 1.3 times greater than NNEPA acute aquatic and wildlife habitat standards, respectively. All other median values were below criteria, indicating that many exceedances are characteristic of high variability rather than general baseline water quality. Surface water quality in Chinde Wash, relative to NNEPA and other relevant criteria, is compatible with the designated postmining land use of livestock grazing. However, elevated selenium levels are present relative to NNEPA chronic aquatic and wildlife habitat criteria. One sample (approximately 6 percent of samples) exceeded the SMCRA dissolved iron standard; the median dissolved iron concentration was 0.1 mg/L, which is substantially lower than the 10 mg/L criterion.

Comparison to baseline conditions using the upstream station median plus 2 median absolute deviations indicates minor impacts for boron, selenium, sulfate, TDS, conductivity, and manganese (15 percent, 24 percent, 21 percent, 22 percent, 22 percent, and 10 percent of samples exceeding baseline, respectively) and moderate impacts for aluminum, arsenic, chloride, nitrate, TSS, and total iron (50 percent, 50 percent, 39 percent, 35 percent, 32 percent, and 32 percent of samples exceeding baseline, respectively). Median concentrations of aluminum and arsenic exceeded the baseline median plus 2 median absolute deviations. Median concentrations for these constituents, except selenium, were below relevant use criteria. Impacts for other constituents were determined to be negligible. Therefore, no major impacts are identified for Chinde Wash, and water quality is generally compatible with the designated postmining land use of livestock grazing. Selenium concentrations relative to aquatic and wildlife habitat use are not being met at upstream and downstream locations.

5.3.4.2.2 Cottonwood Wash

Cottonwood Wash flows from east to west and joins Chaco Wash approximately three miles west of the Navajo Tribal Coal Lease. Surface water monitoring location CNS-1 is located near the mine access bridge crossing Cottonwood Wash (Figure 17). Location CNS-1 is used to assess downstream water quantity and quality conditions for Cottonwood Wash and to characterize passing flow for a large portion of the Cottonwood Wash watershed.

Cottonwood Wash branches into several tributaries east of the lease area. Surface water monitoring locations CN-2, CM-2, CS-2A, and CS-2B (Figure 17) were installed during 2012 to 2013 during the Burnham Road realignment. These locations are upstream of current and proposed mining activities and are used to assess water quantity and water quality conditions. The Cottonwood Wash monitoring locations include flow measurement equipment and water quality sampling, and quarterly water quality monitoring is ongoing.

5.3.4.3 Pinabete and No Name Arroyo

NTEC has designed the mine plan in No Name Permit to minimize impacts to the hydrologic balance and surface water quality by routing upland flows from Pinabete Arroyo around Area 4 South and by not mining through No Name Arroyo in the Area 5 mine plan. The mine plan for the No Name permit

component incorporates surface-water management features intended to minimize potential effects on the hydrologic balance and surface-water quality by routing upland flows from Pinabete Arroyo around Area IV South and by avoiding mining through No Name Arroyo under the Area 5 mine plan. Where storm runoff occurs on disturbed areas, contact with newly exposed overburden, interburden, coal, and spoil materials may increase concentrations of dissolved constituents (e.g., TDS and sulfate) and certain metals (e.g., iron and manganese) in surface runoff relative to baseline stormwater quality.

Potential leaching behavior of spoil materials is characterized using SPLP leaching test results. SPLP results summarized in the No Name PAP technical record indicate TDS and sulfate concentrations on the order of 1,200 mg/L and 670 mg/L, respectively, which are above typical median concentrations observed in baseline surface-water samples but are within the overall range of baseline variability observed during storm-driven sampling events. In addition, runoff from disturbed areas is managed using BMPs (e.g., berms, impoundments, and sediment control structures) such that stormwater is retained and treated on-site and is unlikely to reach Pinabete Arroyo or No Name Arroyo except possibly during extreme precipitation events that exceed the design basis of the structures (No Name PAP Section 26; Appendix 26.A). There will be little-to-no contribution of sediment to surface waters outside the permit area from No Name Permit, as the sediment and runoff from all but the occasional extreme event (much larger than the 10yr-24hr event) are retained within the mine pit and sediment ponds. No NPDES outfalls are anticipated in the NNP at this time however, should outfalls be added at a later date, discharges will be further managed under applicable provisions of NPDES regulations (No Name PAP Section 41).

Because there of the plan to divert Pinabete Arroyo into the No Name Arroyo, when the diversions are in place, the total sediment yield from No Name Arroyo increases at the confluence with Chaco by 180% to 320%, depending upon the storm event because the watershed increased by 415% (No Name PAP Section 41; Table 41.2-6). However, the combined sediment yield reaching the Chaco River from Pinabete Arroyo and No Name Arroyo is lower under both operational scenarios in comparison with the pre-mine baseline yields.

Post-mining surface water quality in Pinabete Arroyo and No Name Arroyo is predicted to be improved from pre-mine water quality. Sediment contributions from reclaimed areas are likely to decrease relative to baseline due to the overall reduction in slopes and improvement in the permanent vegetation cover. Poor quality and sodic soils will be buried within the backfill, and overland flow from the reclaimed areas is expected to exhibit lower concentrations of sodium and TDS than the pre-mining conditions (No Name PAP Section 41).

5.3.5 Groundwater

OSMRE evaluates groundwater quantity and quality related to overall hydrologic balance and the potential impacts of mining operations on groundwater uses within the groundwater CIA. Groundwater use within the CIA is primarily livestock watering; therefore, evaluation considers livestock water quality criteria as a reference for suitability. OSMRE has made the determination that the operation has provided the groundwater quantity and quality information necessary to assess potential impacts in accordance with 30 CFR 780.21(g). Minimization of impacts to the hydrologic balance related to groundwater focuses on reducing the disturbance footprint to the extent practicable through contemporaneous reclamation, water supply replacement where warranted, and protection of groundwater resources in high value areas through the use of stream buffer zones and other methods. In addition, localized areas of potentially acid-forming material are managed through characterization and appropriate handling, including blending and mixing of overburden materials.

5.3.5.1 Alluvium

Non-baseline (downstream or postmining) alluvial wells exist within Areas I and II. Alluvial data were collected from 1979 to 1980 at GM-9 on Chinde Wash within the Navajo Tribal Coal Lease, from 1985 to the most recent available reporting period at QAC-1 at the western lease boundary, and from 1975 to 1982 at GM-10 downstream of QAC-1. In addition, four alluvial wells were installed on Chinde Wash during 2012 to 2013: CA-2, CA-3, CA-4, and CA-5. CA-2 is located upgradient of the Navajo Tribal Coal Lease in an artificially created wetland developed to manage discharges associated with NAPI. CA-3, CA-4, and CA-5 are within the lease area on Chinde Wash and within a second wetland developed through sediment accumulation during flow events, which also contributes to management of irregular flow conditions associated with NAPI discharge events.

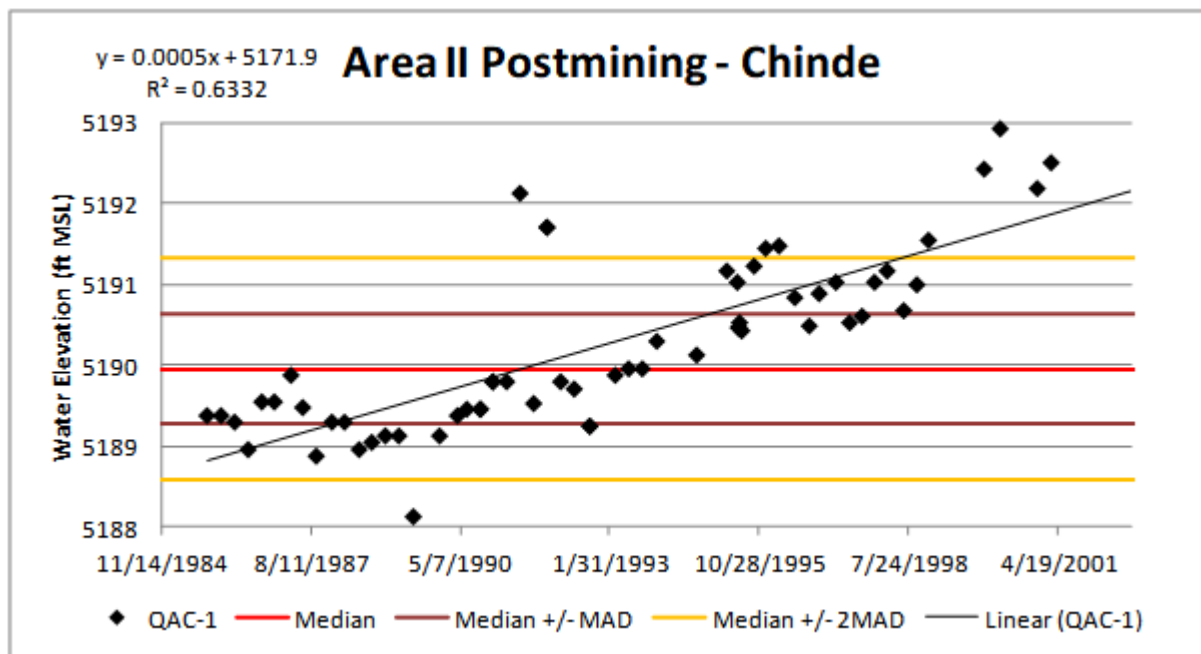
Two additional alluvial wells on Chinde Wash were proposed: CA-1 (upgradient) and CA-6 (downgradient). One alluvial well, Bighan-1, exists along drainages tributary to Morgan Lake within the permit area. Data were collected from 1995 to 2001 at this location along the eastern lease boundary just south of the permit boundary. The location of Bighan-1 along the eastern permit boundary suggests it could represent baseline conditions; however, it was installed after mining impacts occurred in the area and is therefore evaluated as a non-baseline monitoring location rather than as baseline. Monitoring well locations are shown on Figure 19.

5.3.5.1.1 Alluvial Quantity

Currently, there are no uses of the alluvium as a developed water supply resource in Area I or II of the Navajo Tribal Coal Lease; however, there have been historic uses of alluvium for livestock watering. Wells along Chinde Wash and Morgan Lake tributaries were not monitored prior to mining impacts in the area and therefore are not used for baseline characterization. Accordingly, alluvial quantity assessment at these locations does not rely on direct comparison of pre-mine and post-mine conditions. The potential for impacts to alluvial groundwater quantity was assessed using two metrics: the percent of sampling events that were dry and water elevation in feet above mean sea level (MSL). Water elevation was not collected for all sampling events; inference of water presence was based on the presence of water quality data. Therefore, the total number of samples used to calculate percent dry sampling events is often higher than the number of samples used for water elevation comparisons.

Alluvial groundwater monitoring locations GM-9 and GM-10 are no longer utilized in the hydrologic monitoring program, but the data are considered for hydrologic assessment. Alluvial data reviewed indicate that Chinde Wash alluvium is mostly saturated across the length of the lease area based on water present for all sampling events at GM-9, GM-10, and QAC-1. Alluvium at Custer-1 and Custer-4 was dry for 75 percent of sampling events, whereas Bighan-1 had water for all sampling events. Water elevation data were available at QAC-1 along Chinde Wash and at Custer-1, Custer-4, and Bighan-1. Variability in water elevation, characterized by percent relative standard deviation, indicates that the Custer wells have the highest variability, where median percent relative standard deviation is 14 times greater than that of Bighan-1 and 11 times greater than that of QAC-1 on Chinde Wash. Lower variability of water levels in Chinde Wash may be related to sustained flow conditions associated with NAPI agricultural irrigation discharges. Water levels at QAC-1 and Bighan-1 have been increasing over time (Figure 26), likely reflecting infiltration of NAPI runoff and agricultural irrigation discharges. Therefore, because water levels are steadily increasing in alluvial systems in Areas I and II, it is reasonable to conclude that groundwater levels are not below baseline fluctuations, and potential impacts to alluvial quantity in this area are negligible.

Alluvial groundwater downstream of the Area IV North permit boundary has been monitored at QACW-2 since 2005 after mining began in the North Fork of Cottonwood Arroyo and has been recorded as dry for all monitoring events. Dry periods of this duration are not outside the variability observed in baseline quantity data at this location; therefore, this dry period is characterized as a negligible impact. Groundwater modeling conducted as part of the PHC assessment was used to evaluate the approximate magnitude of changes in alluvial groundwater flow in the Cottonwood alluvium that might occur as a result of mining in Area IV North. The model simulated a steady-state post reclamation alluvial groundwater flow at the mouth of Cottonwood Arroyo of approximately 4.6 gallons per minute compared to a pre-mine alluvial groundwater flow estimate of approximately 4.3 gallons per minute. However, baseline groundwater flows in Cottonwood alluvium are not steady state and vary seasonally and from year to year and will continue to vary during mining and after reclamation. The model-predicted 0.3 gallons per minute increase in alluvial groundwater flow is small relative to baseline variability in Cottonwood alluvial groundwater. Therefore, mining and reclamation within Area IV North are not expected to result in a long-term measurable change in alluvial groundwater quantities or potential well yield from the alluvium. Groundwater quantities in Cottonwood alluvium have historically been insufficient to sustain a reliable water supply at two of the three wells monitored for baseline conditions, and those conditions are not expected to change with a modeled flow increase of 0.3 gallons per minute. Therefore, impacts to Cottonwood alluvial quantity are considered negligible because they are consistent with fluctuations caused by natural processes (Ecosphere Associates Inc. 2011).



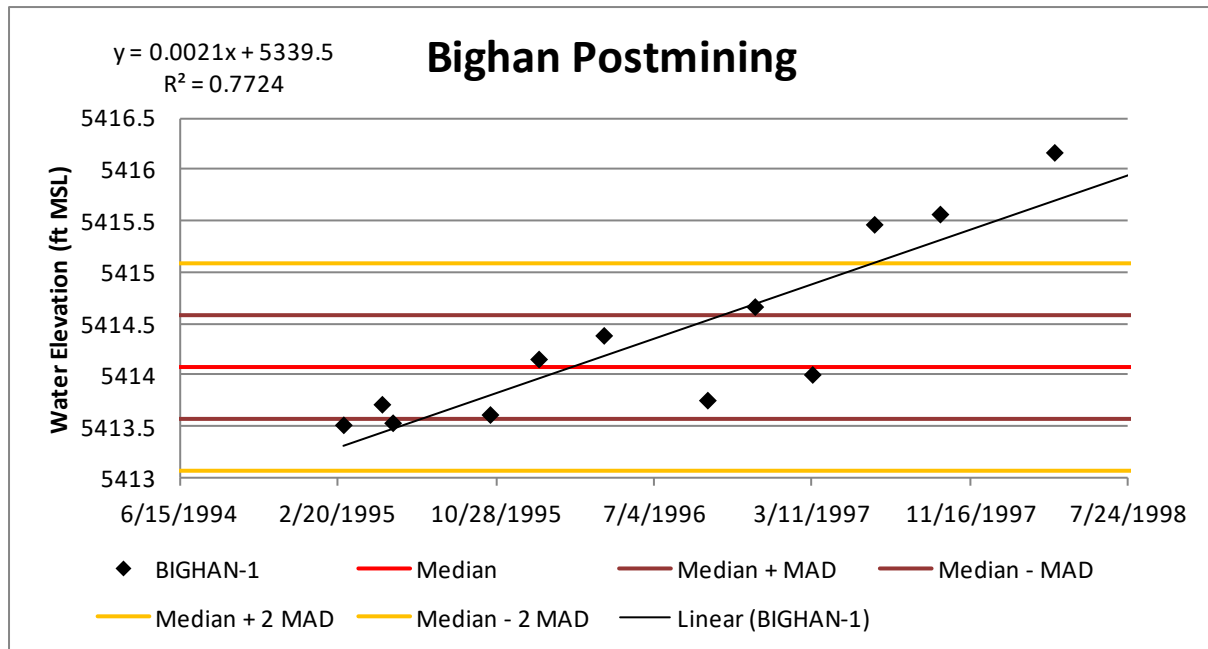


Figure 26: Chinde and Bighan Alluvial Water Elevations

The principal alluvial groundwater quantity effect associated with mining in the vicinity of Pinabete Arroyo is related to (1) diversion and routing of surface flows (including construction and operation of the Pinabete Diversion) and (2) physical removal of alluvial materials where mining advances through portions of the Pinabete alluvial valley within the permit area. Alluvial conditions upstream of the permit area are not expected to be affected by mining.

Baseline observations indicate that shallow saturation can occur within portions of the Pinabete alluvium; however, groundwater levels are generally insufficient to support perennial or baseflow conditions in the Pinabete channel. Recharge to the Pinabete alluvium occurs primarily from direct precipitation and infiltration of ephemeral surface-water flows. A minor component of groundwater contribution from shallow bedrock units (including coal seams and the Pictured Cliffs Sandstone) may occur locally, but indicators of sustained discharge to the alluvium are limited. In some locations, thin saturated intervals within the alluvium appear perched above unsaturated bedrock.

Groundwater stored in the Pinabete alluvium supports limited livestock-watering use. Several livestock wells completed in the Pinabete alluvium (including dug alluvial wells) occur within areas that will be removed by mining, and an additional livestock well completed in the alluvium of a tributary to Pinabete Arroyo adjacent to Burnham Road (recharged in part by a nearby man-made pond and equipped with a hand pump) is also anticipated to be removed by mining. Yields from these alluvial sources are typically low and water levels vary with precipitation patterns; during very dry periods, water levels may be too low to supply dug wells. As described elsewhere in this CHIA, livestock water supply wells in the Pinabete alluvium within the permit area will be removed by mining; the Hydrologic Reclamation Plan provides for alternate supply during mining and replacement following reclamation.

Alluvial wells located east/upgradient of the permit area are not expected to be affected by mining where they are topographically and hydraulically upgradient and where the groundwater source is perched water in the alluvium that is not hydraulically connected to the disturbed-area configuration. Downstream of

mining, alluvial groundwater flow along Pinabete Arroyo within and immediately downgradient of mined reaches is expected to diminish where the alluvial valley is removed or disrupted by mining. Conversely, recharge to the alluvium of No Name Arroyo could increase temporarily downstream of the Pinabete Diversion if diversion routing results in increased frequency and/or duration of ephemeral flows in No Name Arroyo relative to baseline conditions; enhanced recharge could result in more frequent or more extensive shallow saturation in reaches where baseline monitoring indicates the alluvium is often dry.

5.3.5.1.1 Chaco River Alluvium

Alluvial groundwater in the Chaco River valley is expected to be beyond the direct influence of mine-related drawdown in deeper bedrock aquifers and is not anticipated to be directly affected by mining. During periods when mining interrupts shallow alluvial flow within Pinabete Arroyo, any contribution of Pinabete alluvial groundwater to downstream alluvial systems could be temporarily reduced. Baseline alluvial groundwater flow rates in the Pinabete and Chaco valley alluvium are expected to vary seasonally and from year to year in response to precipitation and ephemeral runoff patterns. To the extent that shallow alluvial flow from the Pinabete watershed contributes to groundwater conditions near the Pinabete–Chaco confluence, mining-related interruption of Pinabete alluvial flow could result in a temporary reduction in that contribution during active mining of the Pinabete alluvial valley. Baseline observations and monitoring relevant to alluvial groundwater quantity are summarized in the No Name Permit Application Package (PAP) Section 18 (Water Resources), and groundwater impact context for the CHIA update is supported by the groundwater modeling documented in Appendix 41.E.

5.3.5.1.2 Alluvial Quality

Water quality data were evaluated at three wells along Chinde Wash (GM-9, GM-10, and QAC-1) and at Bighan-1 along drainages tributary to Morgan Lake. Wells along Chinde Wash and Morgan Lake tributaries were not monitored prior to mining impacts in the area and therefore were not used for baseline characterization. Instead, baseline alluvial data collected along Cottonwood Arroyo were used as an analog for this area. Cottonwood Arroyo was selected because hydrologic conditions in Areas I and II are influenced by NAPI. However, this analog is imperfect because Cottonwood Arroyo is primarily subject to NAPI direct discharges and not to NAPI irrigation return flows, which can leach water soluble constituents from shallow formations and soils. This difference in source water type suggests that Cottonwood Arroyo baseline alluvial dissolved constituent concentrations may be lower than baseline concentrations along Chinde Wash and in portions of Area I. Therefore, impacts assessed using Cottonwood Arroyo as an analog baseline may be overestimated.

5.3.5.1.2.1 Bighan Alluvium

The location of Bighan-1 along the eastern mine permit boundary suggests that the well could be representative of baseline conditions; however, it was installed after mining impacts occurred in the area and is therefore evaluated as a non-baseline location. There is ambiguity in representation of baseline conditions at this location.

Variability of Bighan-1 data is relatively low, with a median percent relative standard deviation of 31, which is significantly lower than that of the Cottonwood baseline alluvium dataset (median percent relative standard deviation of 121). At Bighan-1, arsenic, selenium, chloride, sulfate, TDS, and fluoride exceeded livestock criteria in 4 percent, 4 percent, 4 percent, 13 percent, 6 percent, and 100 percent of samples, respectively. Median fluoride concentration exceeded livestock criteria, and the median fluoride concentration was 5 times greater than the criterion.

Comparison to the Cottonwood baseline median plus 2 median absolute deviations indicates moderate impacts for total iron (50 percent of samples exceeding baseline) and major impacts for arsenic, fluoride, selenium, and nitrate (95 percent, 100 percent, 100 percent, and 100 percent of samples exceeding baseline, respectively). Impacts for other constituents were determined to be negligible. Median concentrations of arsenic, boron, selenium, fluoride, and nitrate exceeded the Cottonwood baseline median plus 2 median absolute deviations by factors of 5, 6, 3, 4, and 21, respectively. Median concentrations for these constituents, except fluoride, were below relevant livestock criteria. Therefore, while the impact designation can be considerable for certain constituents, it does not necessarily translate to significant impairment of use. Alluvial water quality at Bighan-1 is generally compatible with the designated postmining land use of livestock grazing; however, potential concerns exist for fluoride concentrations.

The fluoride exceedance may indicate impacts to the alluvial system or may also reflect general alluvial quality in the area, because Cottonwood Arroyo is not a perfect analog baseline. Cottonwood alluvium is primarily influenced by NAPI direct discharges, whereas the Bighan area may be influenced by indirect NAPI irrigation return flows that can leach constituents from shallow formations and soils. In addition, spoil leachate data and observations in spoil wells in the historic mining area indicate that fluoride is lower in spoil water leachate than in coal water and is attenuated during flow through mine spoil. There are no apparent trends over time in Bighan-1 fluoride concentrations.

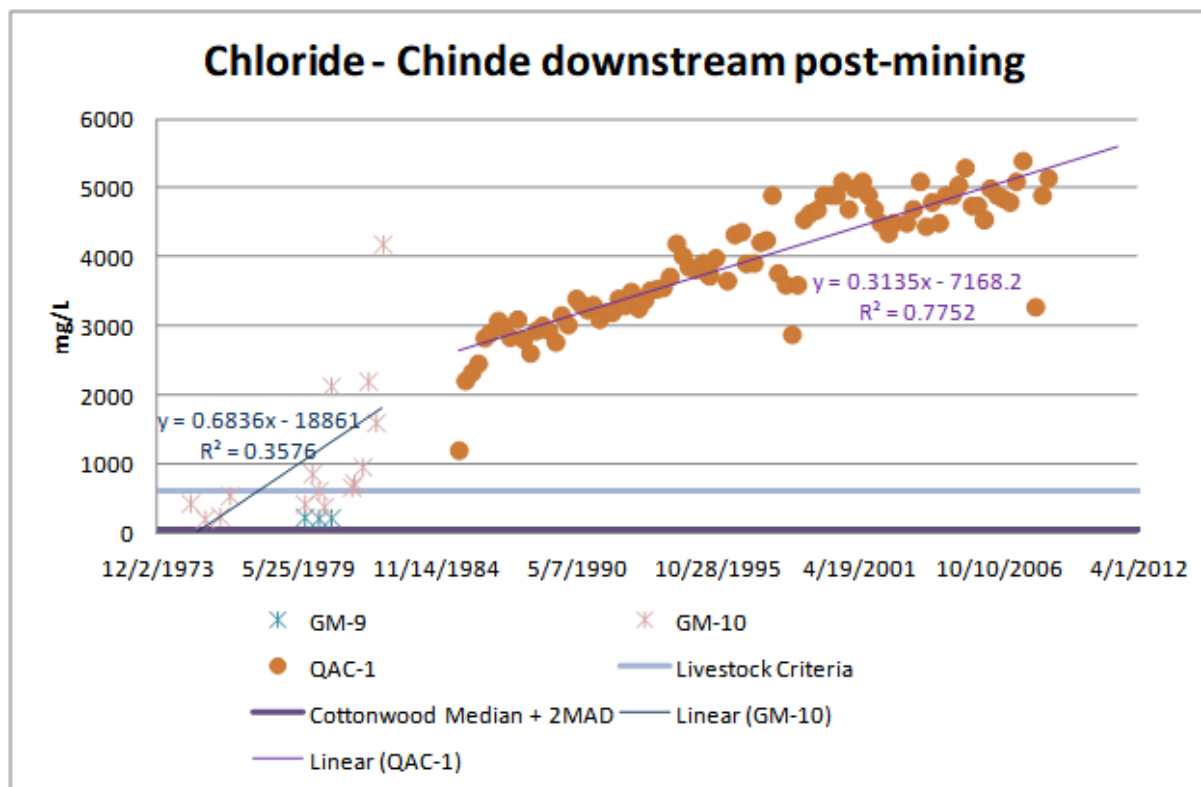
5.3.5.1.2.2 Chinde Wash Alluvium

Variability of Chinde Wash alluvium water quality is greater than at Bighan-1, where median percent relative standard deviation values were 114 and 31, respectively. Both exhibit lower variability than Cottonwood Arroyo baseline alluvium water quality, which had a median percent relative standard deviation of 121. Chinde Wash alluvium water quality is also more variable than Chinde surface water quality, which had a median percent relative standard deviation of 100.

Along Chinde Wash, pH was below the NNEPA standard range for one sample (pH 6.45). Arsenic, cadmium, lead, selenium, chloride, fluoride, nitrate, sulfate, and TDS exceeded livestock criteria in 1 percent, 1 percent, 8 percent, 7 percent, 92 percent, 11 percent, 3 percent, 98 percent, and 98 percent of samples, respectively. Median concentrations for chloride, sulfate, and TDS exceeded livestock criteria and were 6, 4, and 4 times greater than the applicable criteria, respectively.

Comparison to the Cottonwood baseline median plus 2 median absolute deviations indicates moderate impacts for total iron (50 percent of samples exceeding baseline), minor impacts for pH, cadmium, copper, selenium, fluoride, and nitrate (24 percent, 16 percent, 19 percent, 25 percent, 11 percent, and 18 percent of samples exceeding baseline, respectively), moderate impacts for arsenic, chromium, lead, and radium (43 percent, 51 percent, 52 percent, and 47 percent of samples exceeding baseline, respectively), and major impacts for conductivity, boron, total iron, manganese, chloride, sulfate, and TDS (94 percent, 98 percent, 74 percent, 88 percent, 100 percent, 95 percent, and 97 percent of samples exceeding baseline, respectively). Impacts for other constituents were determined to be negligible. Median concentrations of conductivity, boron, chromium, total iron, lead, manganese, chloride, sulfate, and TDS exceeded the Cottonwood baseline median plus 2 median absolute deviations by factors of 4, 6, 2, 2, 2, 15, 22, 2, and 3, respectively. Median concentrations for these constituents, except chloride, sulfate, and TDS, were below relevant livestock criteria. Therefore, while the impact designation can be considerable for certain constituents, it does not necessarily translate to significant impairment of use. Alluvial water quality along Chinde Wash is generally compatible with the designated postmining land use of livestock grazing, except for concerns related to chloride, sulfate, and TDS concentrations.

These exceedances relative to baseline may indicate mining-related impacts to the alluvial system or may reflect general alluvial quality in the area, because Cottonwood Arroyo is not a perfect analog baseline. Cottonwood alluvium is primarily influenced by NAPI direct discharges, whereas Chinde Wash is influenced by both NAPI direct discharges and indirect irrigation return flows that can leach water soluble constituents from shallow formations and soils. In addition, elevated sulfate and TDS concentrations at the Navajo Tribal Coal Lease are associated with water quality from backfilled spoil and CCB disposal areas as characterized elsewhere in this CHIA. Concentrations of chloride, sulfate, and TDS have been steadily increasing in Chinde Wash alluvium over time, as shown on Figure 27.



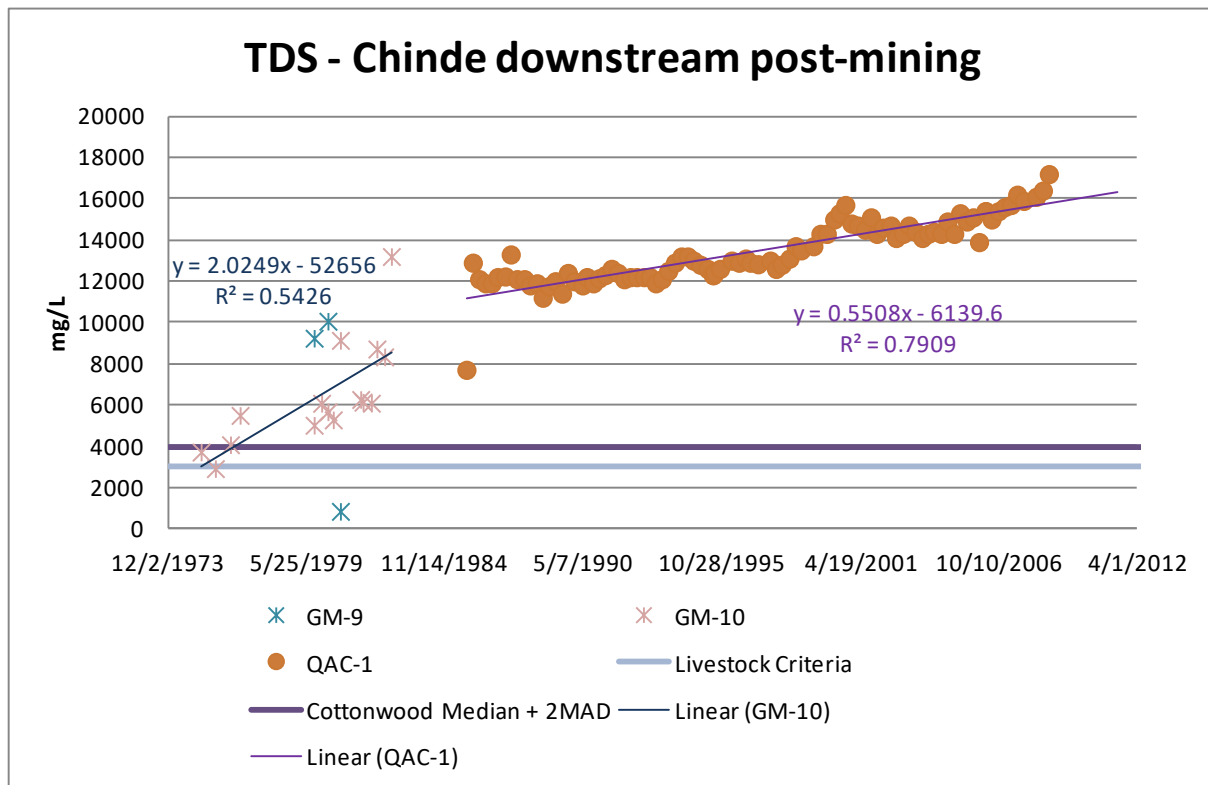
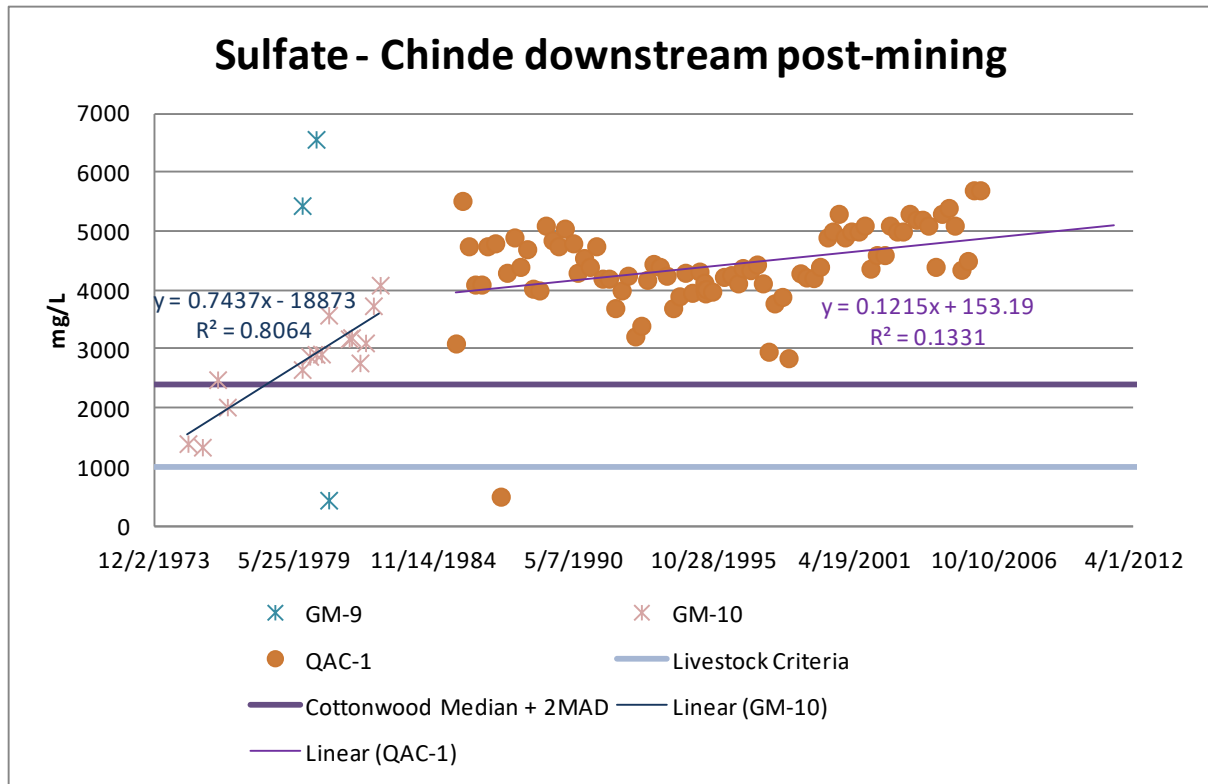


Figure 27: Chinde Alluvium Concentrations over Time

5.3.5.1.2.3 Cottonwood Arroyo Alluvium

Although QACW-2 has been monitored since 2005 after mining began in the North Fork of Cottonwood Arroyo, it has been dry for all monitoring events; therefore, no water quality data have been collected at this location for comparison to baseline. Impacts to the Cottonwood alluvium in Area IV North are not expected to be significant because a stream buffer zone is maintained around the main stem of Cottonwood Arroyo, including the alluvial deposit.

Long-term TDS transport modeling simulations for Area IV North were performed using a lower bound source TDS concentration of 3,550 mg/L and an upper bound source TDS concentration of 11,850 mg/L. Based on these results, long-term post reclamation TDS concentrations in Cottonwood alluvium groundwater may increase downgradient of the Area IV North mine area. Modeling results indicate a delayed long-term increase in TDS concentrations in the Cottonwood alluvium near the mouth of Cottonwood of approximately 0 to 22 percent after more than 500 years. A 22 percent increase corresponds to a predicted TDS concentration of 3,687 mg/L.

Natural variability in baseline TDS concentrations in Cottonwood alluvium is comparable to, or greater than, the magnitude of model-predicted changes. For example, the median plus one median absolute deviation of TDS concentrations measured in baseline samples at Cottonwood alluvial wells QACW-2 and QACW-2B are 22 percent and 10 percent higher than the median, respectively, indicating substantial variability. Cottonwood Arroyo alluvial monitoring at QACW-1 had insufficient water for sampling; therefore, variability in TDS concentrations at this location cannot be assessed. The median plus one median absolute deviation of TDS concentrations measured in baseline samples at alluvial well GM-17 on the North Fork of Cottonwood was 3 percent higher than the median. However, the median TDS concentration at this location was 15,210 mg/L, indicating that alluvial groundwater at this location is unsuitable for use. In summary, baseline median plus one median absolute deviation ranges from approximately 3 to 22 percent higher than the median values.

Although the predicted TDS change of 0 to 22 percent could result in TDS concentrations above livestock criteria, the predicted change is within the 3 to 22 percent variability observed in baseline fluctuations. Therefore, impacts of the modeled long-term changes in TDS concentrations in the Cottonwood alluvium are considered negligible because predicted changes are within baseline variability. In addition, changes unrelated to mining could result in greater changes in TDS concentrations over the modeled timeframe. Any changes in alluvial groundwater quality are not expected to affect surface water quality or ecological receptors because alluvial groundwater is not a source of baseflow and generally does not discharge to the surface.

5.3.5.1.2.4 Pinabete Arroyo Alluvium

Baseline groundwater quality in the Pinabete Arroyo alluvium is characterized by elevated dissolved solids typical of shallow, intermittently recharged alluvial systems in this setting. The Pinabete alluvial groundwater resource supports limited livestock-watering use; however, baseline data indicate that total dissolved solids (TDS) and sulfate concentrations can exceed livestock guideline values at some locations, and fluoride concentrations are variable and may exceed criteria relevant to livestock, wildlife, and drinking-water uses. Baseline selenium concentrations in the Pinabete alluvial groundwater meet livestock criteria, but selenium values fluctuate and may exceed criteria relevant to wildlife use. Baseline water-quality results for the Pinabete alluvial monitoring wells are summarized in the No Name PAP technical record (Section 18; Tables 18-28 and 18-29).

Mining within the Pinabete drainage will remove portions of the shallow alluvial aquifer within the permit area, including certain livestock water-supply wells completed in the Pinabete alluvium that are anticipated to be removed by mining. As described in the Hydrologic Reclamation Plan, alternate supply during mining and replacement supply following reclamation will be provided for livestock water sources removed by mining. Because the Pinabete alluvium does not support baseflow and generally does not discharge to surface water, potential alluvial quality effects are expected to be localized. Groundwater quality change mechanisms associated with mining and reclamation (including mine backfill leachate and transport behavior) are addressed in the PHC groundwater modeling record (Appendix 41.E) and are not expected to result in long-term off-site transport that would permanently preclude existing or reasonably foreseeable uses outside the permit area.

5.3.5.2 Fruitland Formation Quantity

Based on mining experience at the Navajo Tribal Coal Lease, the Fruitland Formation coal units, overburden, and interburden are not expected to yield appreciable water during mining in the No Name permit component, and mine pits typically remain dry except on occasions when surface flows are captured. Groundwater seeps along highwalls are uncommon and, where present, are typically removed by evaporation. Observations indicate that seeps have most commonly been associated with localized conditions near upgradient irrigation influences rather than widespread groundwater inflow.

The open mine pit acts as a drain for drawdown of any groundwater in the overburden/interburden, in the coal seams as the backfill spoil material re-saturates. Model simulations of the advance of open pit mining in Area IV North, Area 4 South, and Area 5 have been performed to provide estimates of drawdown and recovery in the Fruitland coals during mining and reclamation. It is estimated that mining in Area IV North will cause around 5 feet of drawdown by the time of completion of mining in both the No.3 and the No. 8 coal seams (NTEC 2013). The groundwater models developed for the PHC's were also applied to simulate the rate of recovery of water levels in mine backfill and in the Fruitland coals adjacent to the mining block. Maximum drawdown is less than 17 feet, occurring approximately 30 years following the start of mining (NTEC 2013). Upward gradients of groundwater movement from the PCS to the mine backfill do not occur until about 85 years after the start of mining. After that time, the recovery of the potentiometric surface in the backfill is complete and gradients are vertically downward from the backfill to the PCS.

The numerical groundwater model developed for the No Name permit area evaluates drawdown and recovery of groundwater levels in the alluvial aquifers, Fruitland coals, and PCS in response to mining and reclamation. Model results indicate that groundwater levels experience localized drawdown during mining with gradual recovery projected during postmining conditions. The model also indicates that saturation of mine backfill is slow due to low permeability and limited recharge, and that mine-related changes to groundwater flow are geographically confined. The modeled drawdown in Fruitland coal units is presented for multiple simulation years in the current PHC technical record and supporting appendices. No Name PAP Appendix 41.E concludes that modeled mining effects remain largely contained near the permit boundaries over operational and postmining timeframes, with no significant off-site transport.

Within the Fruitland Formation coal units, baseline potentiometric gradients are generally toward the northeast with localized gradients toward topographic lows along Pinabete Arroyo, No Name Wash, and Cottonwood Arroyo associated with outcrop conditions in the upper coal seams. The No. 8 coal seam is representative of the upper coal units and the No. 3 coal seam is representative of lower coal units in the modeling framework. Modeling results indicate that drawdown and recovery patterns are localized to the mine area and adjacent zones of influence and do not extend as widespread regional effects.

There are no water supply wells completed in the Fruitland Formation within the No Name permit area, and there are no current known uses for Fruitland Formation groundwater in or adjacent to this area other than oil and gas extraction in portions of the basin. Therefore, the expected drawdown in Fruitland coal units during mining is not anticipated to interrupt existing or reasonably foreseeable uses. In addition, predicted impacts are localized and do not extend beyond areas immediately surrounding the mine pits, backfill, and adjacent reclaimed areas, and the Fruitland Formation is generally not capable of providing a sustainable water supply in the vicinity of the mine. Therefore, for purposes of this assessment, impacts to Fruitland Formation groundwater quantity are considered negligible.

5.3.5.3 Fruitland Formation Quality

Spoil leaching tests were performed in support of the PHC assessment for the Navajo Mine operation. Leaching test results show a range in TDS and sulfate concentrations, which are primary constituents of concern with respect to spoil leachate. Spoil leaching test results indicate TDS concentrations in spoil water leachate ranging from 400 to 2,700 mg/L and sulfate concentrations ranging from 630 to 2,580 mg/L (No Name PAP Appendix 41.B). Leaching test results are generally consistent with results for the Bitsui No. 5 spoil well completed in mine spoils in the Bitsui Pit at the north end of the Navajo Tribal Coal Lease. The Bitsui Pit was backfilled in the 1980s and is the only pit at Navajo Mine where saturation of mine spoils has been observed. Arsenic and selenium were below detection in most leaching test results and in the Bitsui No. 5 spoil well. Fluoride is lower in spoil water leachate than in coal water and is attenuated during flow through mine spoil. Boron and manganese concentrations are elevated in mine spoil water.

During active mining, hydraulic gradients and groundwater flow directions in the Fruitland Formation are generally toward mine pits and backfill areas. Therefore, it is anticipated that there would be limited change in groundwater quality beyond the limits of mine pits and mine backfill during mining and reclamation operations. These results indicate that, in addition to increases in TDS and sulfate, concentrations of boron and manganese may also increase relative to baseline coal water.

Comparison of baseline Fruitland Formation water quality to livestock criteria indicates that Fruitland groundwater is a very poor source of supply for livestock watering use, primarily due to elevated chloride and TDS concentrations. There are no livestock watering wells completed in the Fruitland Formation that would be impacted, and the unit is generally not capable of providing a sustainable water supply for this use. The documented use of Fruitland Formation groundwater in the vicinity of the lease area is primarily associated with oil and gas extraction. Therefore, evaluation of postmining groundwater quality in the Fruitland Formation, including adjacent Fruitland coal aquifers, CCB disposal areas, and backfilled spoil, is presented relative to baseline Fruitland Formation groundwater quality and livestock use criteria. A comparison to livestock use criteria is provided in Appendix F. An analysis of constituents commonly associated with backfill spoil and CCB leachate, including pH, conductivity, boron, total iron, manganese, selenium, chloride, fluoride, sulfate, and TDS, is summarized below.

Variability of groundwater quality data from backfill spoil and non-baseline Fruitland Formation coal aquifer wells is similar to that of the corresponding baseline groundwater quality data within the lease area, where median percent relative standard deviation values are 68 and 67, respectively. Comparison of spoil wells to the baseline median plus 2 median absolute deviations for Fruitland coals within the lease area indicates negligible impacts for conductivity, chloride, and fluoride; minor impacts for total iron (27 percent of samples exceeding baseline); moderate impacts for selenium (33 percent of samples exceeding baseline); and major impacts for pH, boron, manganese, sulfate, and TDS (64 percent, 98 percent, 64 percent, 100 percent, and 93 percent of samples exceeding baseline, respectively). Median concentrations for boron, manganese, sulfate, and TDS exceeded the baseline median plus 2 median absolute deviations

by factors of 2, 10, 187, and 1.3, respectively. No pH values were outside the livestock criteria range. There is no livestock criterion for manganese, and median boron concentrations were below the livestock criterion; however, median sulfate and TDS concentrations exceeded livestock criteria by factors of 8 and 5, respectively. Therefore, in spoil wells, sulfate and TDS are constituents of concern relative to baseline and livestock criteria. It is also noted that impacts to boron and fluoride concentrations are lower in spoil wells relative to CCB wells.

Comparison of non-baseline Fruitland Formation coal aquifer wells to the baseline median plus 2 median absolute deviations for baseline Fruitland coal aquifer wells within the lease area indicates negligible impacts for pH, conductivity, total iron, manganese, chloride, and TDS; minor impacts for selenium and fluoride (20 percent and 13 percent of samples exceeding baseline, respectively); and major impacts for boron and sulfate (92 percent and 64 percent of samples exceeding baseline, respectively). Median concentrations for boron and sulfate exceeded the baseline median plus 2 median absolute deviations by factors of 1.3 and 6, respectively. When compared to livestock water quality criteria, median boron and sulfate concentrations were below livestock criteria. Therefore, in non-baseline Fruitland coal wells, no constituents are identified as of concern relative to baseline and livestock criteria, although boron and sulfate exhibit major impacts relative to baseline. Impacts in non-baseline Fruitland coal wells within the lease area are lower than impacts observed in CCB and spoil wells.

Because there are no current known uses for Fruitland Formation groundwater in or adjacent to the Navajo Tribal Coal Lease and no reasonably foreseeable uses other than oil and gas extraction, changes in Fruitland Formation groundwater quality are not expected to preclude existing or reasonably foreseeable water uses. Predicted and observed impacts are localized and do not extend beyond areas immediately surrounding mine pits, backfill, and reclaimed areas, and the unit is generally not capable of providing a sustainable water supply. Therefore, for purposes of this assessment, impacts to Fruitland Formation groundwater quality are considered negligible with respect to existing and reasonably foreseeable uses.

5.3.5.4 Pictured Cliffs Sandstone Quantity

Groundwater flow within the PCS is expected to be generally toward the northeast based on regional potentiometric patterns, with localized components of flow toward outcrop areas where the PCS is exposed. Groundwater flow rates through the PCS are low due to low hydraulic conductivity, and discharge along PCS outcrops is expected to be limited and largely removed by evapotranspiration. Based on observations in PCS outcrop areas near the mine, PCS flow rates are not expected to be sufficient to sustain persistent seep flow or substantial discharge to alluvial systems.

Modeling and potentiometric surface interpretation indicate that mining-related effects on PCS groundwater levels are localized and primarily associated with areas of mine backfill and adjacent zones of influence (Figure 28). Postmining potentiometric conditions in the PCS are expected to be similar to baseline conditions away from mine backfill, with only limited change in heads at distances removed from mine pits and reclaimed areas. Where changes occur, they are expected to be localized and to diminish with distance from mine backfill and reclaimed areas.

There is one identified livestock watering well completed in the PCS located west of Area V along the Chaco River that may be influenced by alluvial waters of the Chaco River, and it is not known whether the well is actively used. The PCS is known to have low yields in the vicinity of the Navajo Tribal Coal Lease and is generally not capable of providing a sustainable water supply for livestock watering use. The primary documented current and historic use of the PCS in the area is for oil and gas extraction, which is not particularly sensitive to small changes in groundwater quantity. Predicted and observed impacts to the

PCS are localized and are not anticipated to extend beyond areas immediately surrounding mine pits, mine backfill, and reclaimed areas. Therefore, for purposes of this assessment, impacts to PCS groundwater quantity are considered negligible.

5.3.5.5 Pictured Cliffs Sandstone Quality

Comparison of baseline PCS water quality to livestock criteria indicates that PCS groundwater is a very poor source of supply for livestock watering use, primarily due to elevated chloride, sulfate, and TDS concentrations that exceed livestock criteria. There is one identified livestock watering well completed in the PCS located west of Area V along the western side of the Chaco River that may be influenced by alluvial waters of the Chaco River, and it is uncertain whether the well is actively used. The PCS is known to have low yields in the vicinity of the Navajo Tribal Coal Lease and is generally not capable of providing a sustainable water supply for livestock watering use. The primary documented current and historic use of the PCS in the area is for oil and gas extraction, for which water quality criteria are not typically controlling. Therefore, impacts to PCS groundwater quality are not expected to affect existing or reasonably foreseeable water users.

Non-baseline PCS water quality data suitable for direct comparison to baseline conditions are limited. The non-baseline PCS monitoring well KP-84 did not have sufficient water for sampling during the historic monitoring period from 1990 to 1998; therefore, direct comparison of non-baseline PCS quality to baseline conditions is limited.

Direct intermediate-term impacts to PCS groundwater quality beyond the active mine area are not anticipated during mining and reclamation operations. During active mining, hydraulic gradients and groundwater flow directions in the PCS are expected to be toward mine pits and backfill areas, and therefore little change in groundwater quality is expected beyond the limits of mine pits and mine backfill during mining and reclamation. Over the long term following reclamation, as gradients reverse, increased TDS and sulfate concentrations in mine spoil backfill may contribute to increased TDS and sulfate concentrations in the PCS adjacent to mining. Predicted and observed impacts to the PCS are localized and are not anticipated to extend beyond areas immediately surrounding mine pits, mine backfill, and reclaimed areas. Therefore, for purposes of this assessment, impacts to PCS groundwater quality are considered negligible with respect to existing and reasonably foreseeable uses.

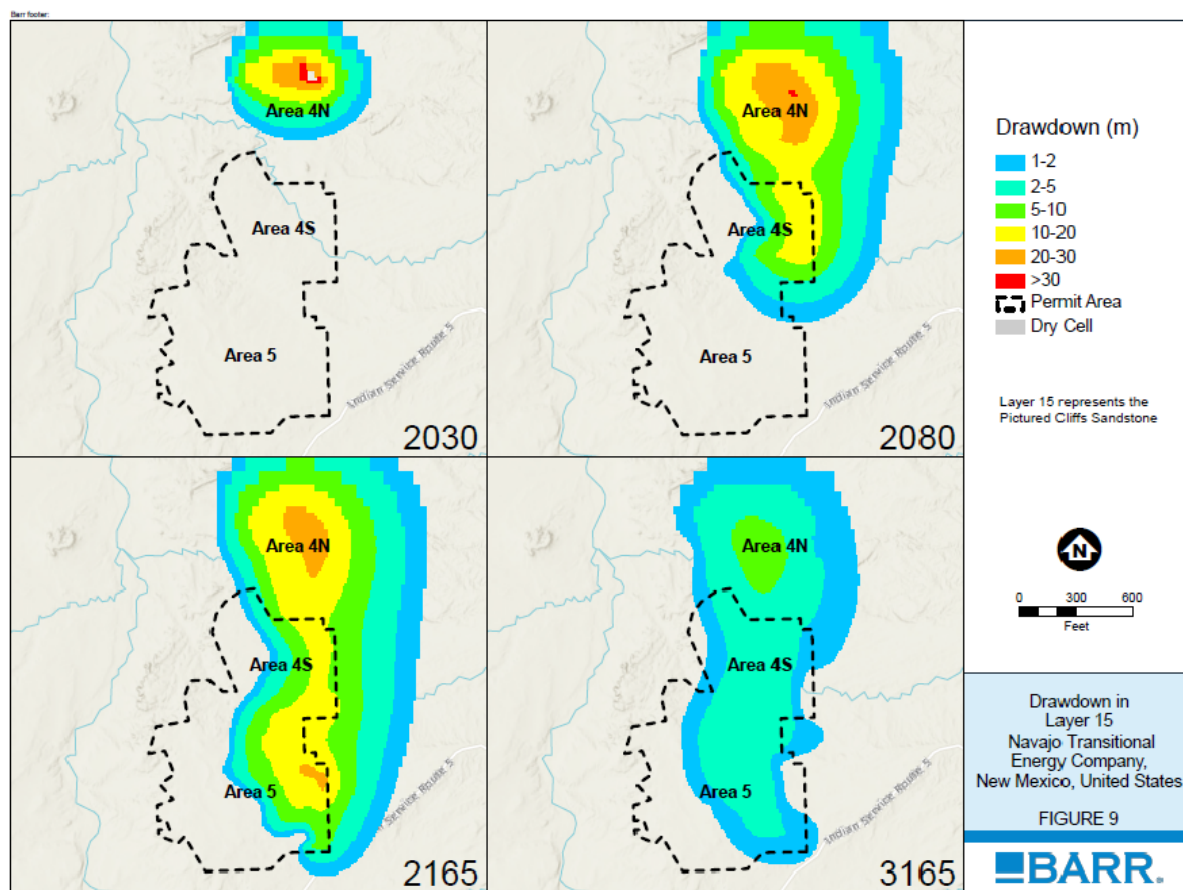


Figure 28: Post-Mining Potentiometric Surface in the PCS Aquifer (Barr 2025)

6 MATERIAL DAMAGE

Sections 507(b)(11) and 510(b)(3) of SMCRA, and 30 CFR 780.21(g), require OSMRE to determine that a mining and reclamation operation has been designed to prevent material damage to the hydrologic balance outside the permit area. “Hydrologic balance” is defined at 30 CFR 701.5 as “the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage.”

“Material damage to the hydrologic balance” is not defined in SMCRA or at 30 CFR 701.5. The intent of not developing a programmatic definition is to provide the regulatory authority the ability to apply a definition based on regional environmental and regulatory conditions and the hydrologic resources of concern. Therefore, for purposes of this CHIA:

Material damage to the hydrologic balance outside the permit area means any quantifiable permanent adverse impact from surface coal mining and reclamation operations on the quality or quantity of surface water or groundwater that would preclude any existing or reasonably foreseeable use of surface water or groundwater outside the permit area.

The hydrologic impact assessment presented in Chapter 5 considers available quantity and quality information related to surface water and groundwater resources potentially affected by the Navajo Mine operation, including the No Name permit component evaluated in this CHIA update. Chapter 5 includes definitions for impact designation of negligible, minor, moderate, and major (Table 7) and provides discussion of monitoring, impact minimization, and impact designation determinations. The material damage assessment in this chapter determines whether material damage to the hydrologic balance has occurred or has the potential to occur due to the mining operation.

6.1 Cumulative Impact of NTEC Operations and El Segundo Mine

OSMRE concludes that cumulative surface water quantity and quality impacts to the Chaco River associated with the El Segundo Mine, in combination with NTEC operations, are negligible. In addition, the New Mexico Mining and Minerals Division determined that anticipated mining at the El Segundo Mine has been designed to prevent material damage to the hydrologic regime outside the permit area (NMEMNRD 2008).

6.2 NTEC Operations Impact to Morgan Lake and APS

OSMRE concludes that flow contributions to Morgan Lake from tributaries that traverse the Navajo Mine are negligible, and water quality impacts associated with these tributaries are also negligible. Surface mining and reclamation operations are not anticipated to adversely affect the water quantity or quality necessary for power plant operations. Therefore, OSMRE concludes that NTEC operations will have a negligible impact on power plant operations.

6.3 Chaco River

OSMRE concludes that impacts of the NTEC mining operation on Chaco River surface water quantity are negligible. For Chaco River surface water quality, although the hydrologic impact designation may be considerable for certain constituents, it does not translate to significant impairment of use.

6.4 Historic Mining North of the Navajo Mine and No Name Permit Area

OSMRE finds that changes in alluvial groundwater quantity will not preclude any designated or beneficial use; therefore, the hydrologic impact is designated negligible. For Fruitland Formation and PCS groundwater quantity and quality, the hydrologic impact designation is negligible because observed and predicted impacts are localized and do not extend beyond areas immediately surrounding mine pits, backfill, and reclaimed areas, and these units are generally not capable of providing a sustainable water supply in the vicinity of the mine. OSMRE concludes that potential impacts to water users from historic CCB disposal are negligible.

6.5 Navajo Mine, No Name Mine, and Pinabete Mine Permit Areas

OSMRE uses the baseline characterization, impact assessment, and monitoring record in this CHIA to distinguish between short-term changes in hydrologic conditions during mining and longer-term conditions that could persist after reclamation. Short-term impacts are impacts to the hydrologic balance that occur during mining but are not projected to persist beyond the reclamation liability period. Long-term impacts are impacts projected to persist beyond the reclamation liability period. The reclamation liability period extends through completion of all applicable reclamation requirements and the associated bond release process, including final (Phase III) bond release. At final bond release, OSMRE must determine that material damage to the hydrologic balance outside the permit area has been prevented, and final bond release shall not be granted until such a determination is made.

For purposes of mine management and regulatory oversight, the monitoring program and impact assessment framework described in Chapters 4 and 5 are intended to provide early identification of changes that warrant attention. Early identification allows NTEC and OSMRE to take appropriate actions, including operational adjustments, reclamation measures, drainage-control restoration, and, where applicable, water supply replacement, to prevent conditions that could preclude existing or reasonably foreseeable uses outside the permit area.

The distinction between shorter-term and longer-term effects is supported by published research indicating that appropriate reclamation, regrading, revegetation, and restoration of drainage controls can improve hydrologic response and water quality over time. Studies have documented restoration of seasonal rainfall–runoff processes following reclamation (Bonta et al. 1997), water-quality improvement associated with reclamation measures (Bonta and Dick 2003), and decreases in suspended sediment concentrations and yields following reclamation (Bonta 2000).

Table 13 provides a synopsis of the general designations for what would constitute a short or long term impact which is applied to numerous water resources at Navajo Mine. A resource-specific summary of OSMRE’s material damage assessment and findings is presented in Table 14 and further discussed below.

Table 13: Short and Long Term Impact Interpretive Framework

General Quantity	Irretrievable loss of the water resource to support existing or reasonably foreseeable uses outside of the lease area that cannot be provided by alternate water supplies
General Quality	Long-term changes in water quality outside the lease area that preclude existing or reasonably foreseeable uses that cannot be provided by alternate water supplies
Criteria Applied to the Navajo Mine	Long-term (impact remains after final reclamation and bond-release) Impact Designation of Major as defined in Table 7, and which Preclude Existing or Reasonably Foreseeable Uses Outside of the Lease area that Cannot be Mitigated by Reclamation or Provision of Alternate Water Supplies

Table 14: Assessment of Material Damage for the Waters of the Navajo Mine and No Name Permit Areas

Water Resource	Assessment Approach	Material Damage Reached	Impact Mitigation	Adequate Monitoring Program
Fruitland & PCS Quantity	Evaluation of potentiometric surface contour maps	No	Contemporaneous Reclamation	Yes
Alluvial Quantity	Comparison of water levels at individual wells over-time	No	Contemporaneous Reclamation	Yes
Surface Water Quantity	SEDCAD modeling-assessment of pre- and post-mining impacts	No	Contemporaneous Reclamation	Yes
Fruitland & PCS Quality	Comparison of baseline water quality to potentially impacted or non-baseline wells, including spoil and CCB wells	No	Contemporaneous Reclamation; mixing of overburden/ backfill materials	Yes
Alluvial Quality	Comparison of baseline (upstream/pre-mining) water quality to non-baseline (post-mining/downstream) water quality	No	Contemporaneous Reclamation	Yes
Surface Water Quality	Comparison of baseline (upstream/pre-mining) water quality to non-baseline (post-mining/downstream) water quality	No	Contemporaneous Reclamation; Sedimentation Ponds	Yes

6.5.1 Material Damage Assessment

6.5.1.1 Surface Water

Surface-water quantity impacts are assessed using watershed-scale metrics, including comparison of modeled pre-mining peak flows to postmining peak flows. Impacts are generally designated as negligible, minor, moderate, or major primarily based on the impact assessment presented in Chapter 5. For the Chinde Wash watershed, Coal Creek–Chaco River watershed, and Cottonwood Arroyo watershed, comparison of modeled pre-mining and postmining peak flows indicates negligible to minor impacts, and existing and reasonably foreseeable designated uses are not expected to be precluded.

For the Chinde Wash–Chaco River watershed, a long-term impact designation of moderate is identified outside the permit boundary due to a reduction in postmining peak flow. This impact designation indicates a measurable change in surface-water quantity at the watershed outlet; however, it does not equate to material damage because existing and reasonably foreseeable uses are not expected to be permanently precluded.

For Chinde Wash surface-water quality, impacts identified in Chapter 5 do not indicate that existing or reasonably foreseeable designated uses will be permanently precluded. Surface-water quality impacts associated with the Chinde Wash do not constitute material damage to the hydrologic balance because existing and reasonably foreseeable uses are not expected to be permanently precluded outside the permit area.

The No Name Permit outlines potentially different mining rates, from 5 to 15 million tons per year, respectively. At 5 million tons per year, the annual rate of disturbance and associated exposure of erodible surfaces would generally be lower than 15 million tons per year but would occur over a longer duration. The overall impacts from the potentially different mining rates do not result in a different material damage finding associated with each respective water resource, as the overall impacts are expected to be similar under each scenario.

Impacts associated with the No Name Permit in the Pinabete Arroyo, No Name Arroyo, and Brimhall Wash are expected to be moderate and long-term with respect to surface water quality and quantity. The impacts will primarily be limited to the timeframes associated with active mining operations, and reclamation operations will attenuate nearly all post-mining impacts to these resources. Sediment ponds and temporary diversions would attenuate the peak flows from disturbed areas and reduce sediment delivery to downstream reaches during operations. Therefore, surface water quantity and drainage impacts would be moderate and long-term during active mining because runoff would be rerouted and retained in ponds. Erosion and sediment impacts would be moderate and long-term, driven by storm events during disturbance, but potential adverse impacts would be minimized through the implementation of sediment controls and reclamation activities. Surface water quality impacts would be minor to moderate and long-term due to episodic storm-event TSS/TDS variability and localized dissolved-constituent changes in disturbed or re-routed drainage segments. Post-mining impacts are expected to diminish as reclamation stabilizes drainage features and disturbed areas are revegetated. Impacts to surface water quality and quantity for these resources do not constitute material damage to the hydrologic balance outside the permit area.

6.5.1.2 Groundwater

Groundwater modeling predicts it may take as long as 500 years for the mine backfill to reach a final steady-state potentiometric level. Impacts to groundwater levels would be moderate and long-term within

localized drawdown areas near active pits, with long-term recovery post-closure as dewatering ceases and groundwater levels rebound. The post-mining recovery of potentiometric levels is expected to be gradual in deeper bedrock units under arid recharge conditions.

With respect to groundwater quality, the results of modeling conducted in the No Name PAP indicate that potential increases in dissolved constituents associated with mining/backfill conditions can occur as localized changes near the backfill mass (i.e., near the source area) with limited lateral migration under modeled conditions. The impacts of mining activity on groundwater quality would be minor to moderate and long-term with monitoring and water quality regulatory compliance designed to prevent adverse trends outside the permit areas. Following reclamation of individual mining pits, groundwater quality is anticipated to return to near-baseline conditions.

For alluvial groundwater resources, the evaluation indicates that potential increases in TDS, if they occur, would be localized, short-reach changes within the specific alluvial segments where flow regimes are altered, rather than as broad downstream changes.

Impacts to groundwater quality and quantity from the No Name Permit do not constitute material damage to the hydrologic balance outside the permit area.

6.5.1.2.1 Alluvium

The material damage assessment for alluvial groundwater quantity indicates that impacts are designated negligible and are not expected to permanently preclude existing or reasonably foreseeable uses. Within the permit area, livestock water supply wells in the Pinabete alluvium will be removed by mining; the Hydrologic Reclamation Plan provides for alternate supply during mining and replacement following reclamation. Therefore, alluvial groundwater quantity impacts do not constitute material damage to the hydrologic balance outside the permit area.

For alluvial groundwater quality in the Chinde Wash alluvium, a short-term major impact designation has been identified in Chapter 5, indicating a change that warrants attention and could affect suitability for certain uses if sustained. However, impacts are not projected to be long term and are not expected to permanently preclude existing or reasonably foreseeable uses outside the permit area. Therefore, alluvial groundwater quality impacts in the Chinde Wash alluvium do not constitute material damage to the hydrologic balance outside the permit area. The alluvial monitoring program in this area was augmented in 2012 to 2013 to further assess conditions and to verify the duration and extent of impacts in the Chinde Wash alluvium outside the permit area.

For Cottonwood alluvial groundwater quality, impact designations are negligible, and impacts are not expected to permanently preclude existing or reasonably foreseeable uses. Therefore, Cottonwood alluvial groundwater quality impacts do not constitute material damage to the hydrologic balance outside the permit area.

6.5.1.2.2 Fruitland Formation and Pictured Cliffs Sandstone

Relative to Fruitland Formation and Pictured Cliffs Sandstone quantity and quality, impact designations and material damage findings are not indicated because predicted impacts are localized, the formations have low yields in the vicinity of the lease area, and designated uses are not expected to be permanently precluded outside the permit area.

6.5.2 Conclusion

OSMRE finds that NTEC's Navajo Mine water monitoring program and the No Name permit component monitoring and modeling record have supplied sufficient information in the approved permit application materials for this CHIA and finding. OSMRE finds that operations have been designed to minimize impacts within the permit area and to prevent material damage to the hydrologic balance outside of the permit area, including for drainages associated with the No Name permit component (Pinabete Arroyo, Brimhall Wash, and No Name Wash).

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