

# 1 INTRODUCTION

The Office of Surface Mining Reclamation and Enforcement (OSMRE) is the regulatory authority for coal mining and reclamation operations under the Surface Mining Reclamation and Control Act of 1977 that occur on Hopi Tribe and Navajo Nation surface. As such, OSMRE is responsible for the review and decisions on all permit applications to conduct surface coal mining and reclamation operations. The Peabody Western Coal Company (PWCC) permit area, located on both Navajo Nation and Hopi Tribe surface area, is required to have a cumulative hydrologic impact assessment (CHIA), prepared by the regulatory authority, which assesses whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area (30 Code of Federal Regulations (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. Congress identified in the Surface Mining Coal and Reclamation Act (SMCRA) (U.S. Congress, 1977) that there is “a balance between protection of the environment and agricultural productivity and the Nation’s need for coal as an essential source of energy” (SMCRA, 1977 Sec 102(f)). The hydrologic reclamation plan required by the rules at 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 “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 the effluent limitations for coal mining promulgated by the United States Environmental Protection Agency (USEPA) set forth in 40 CFR part 434.” Discharges of disturbed area runoff at the Kayenta Mine Complex are conducted in accordance with the terms and conditions of National Pollutant Discharge Elimination System (NPDES) permits issued by the USEPA and certified by the Navajo Nation and Hopi Tribe under the Clean Water Act (CWA).

OSMRE considered USEPA approved water quality standards for the Hopi Tribe (effective August 24, 2011) and Navajo Nation (effective March 26, 2009) as part of the impact assessment. Additionally, protection of existing and reasonably foreseeable water uses within the various delineated cumulative impact areas was a focus of this assessment. The following summary table identifies water resources evaluated and approach for impact assessment (Table 1). Table 1 indicates that; (1) the hydrologic monitoring program is adequate for OSMRE’s CHIA, (2) impacts within the permit area have been minimized, and (3) material damage outside the permit area has been prevented. This CHIA supersedes the previous Black Mesa Kayenta Mine Complex CHIA’s (OSMRE, 2011a), (OSMRE, 2008), (OSMRE, 1989).

<b>Kayenta Mine Complex Material Damage Summary</b>			
<b>Water Resource</b>	<b>Impact Minimization</b>	<b>Adequate Monitoring Program</b>	<b>Designed to Prevent Material Damage Outside the Permit Area</b>
<b>Surface Water Quality</b>	Sediment Control Structures	YES: Historical Upstream Data and Active Downstream Monitoring	YES (see Chapter 5)
<b>Surface Water Quantity</b>	Western Alkaline Rule Implementation	YES: Historical Upstream Data and Active Downstream Monitoring	YES (see Chapter 5)
<b>Alluvial Quality</b>	Sediment Control Structures	YES: Historical Upstream Data and Active Downstream Monitoring	YES (see Chapter 5)
<b>Alluvial Quantity</b>	Western Alkaline Rule Implementation	YES: Historical Upstream Data and Active Downstream Monitoring	YES (see Chapter 5)
<b>Wepo Quality</b>	Water Rights and Replacement in Accordance with 30 CFR 816(h)	YES: Active Spoil Backfill and Adjacent Pit Monitoring	YES (see Chapter 5)
<b>Wepo Quantity</b>	Water Rights and Replacement in Accordance with 30 CFR 816(h)	YES: Active Spoil Backfill and Adjacent Pit Monitoring	YES (see Chapter 5)
<b>N-Aquifer Quality</b>	PWCC wellfield modified to only pump N aquifer water in 2016	YES: Accordance with PAP and Settlement No. DV-2012-3-R	YES (see Chapter 5)
<b>N-Aquifer Water Levels</b>	Negotiated Rate Royalty (per acre foot) with Hopi and Navajo Nation	YES: Accordance with PAP and USGS Monitoring Program	YES (see Chapter 5)
<b>N-Aquifer Discharge</b>	Negotiated Rate Royalty (per acre foot) with Hopi and Navajo Nation	YES: Accordance with PAP and USGS Monitoring Program	YES (see Chapter 5)

Table 1. Kayenta Mine Complex Material Damage Assessment Summary

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.
  - Describes general background of the Kayenta Mine Complex.
- Chapter 2
  - Assesses cumulative impact potential with active coal mines.
  - Delineates the surface water CIAs.
  - Delineates the groundwater CIAs.
- Chapter 3 identifies water resource uses and designations in 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 Kayenta Mine Complex on surface water and groundwater quantity and quality, and includes a determination of:
  - The adequacy of the monitoring program to assess potential impacts;
  - The minimization of impacts within the permit area; and
  - The prevention of material damage outside the permit area.

## 1.1 Regulatory Environment

Surface coal operations on Hopi Tribe and Navajo Nation surface are managed through the coordination of several regulatory agencies. Depending on the permitting action, multiple regulatory agencies may be involved in the review, comment, and public participation process. Regulatory agencies that may have a permitting action or compliance interest on the PWCC permit include:

- OSMRE (regulatory authority for coal operations on Hopi Tribe and Navajo Nation surface)
- Bureau of Indian Affairs (protect and improve trust assets of the Tribes)
- Hopi Tribe Water Resources Program (develop and administer water quality standards)
- Navajo Nation EPA (develop and administer water quality standards)
- Navajo Nation Minerals Department (represent Tribal mineral interests)
- Navajo Nation Water Management Branch (implement Navajo Nation's Water Code)
- U.S. Environmental Protection Agency (issue and administer NPDES permits)
- U.S. Fish and Wildlife Service (ensure protection of threatened and endangered species)
- Bureau of Land Management (ensures maximum resource recovery)
- U.S. Army Corps of Engineers (issue permits and associated impact assessments for the discharge of fill material into waters of the United States, including wetlands under section 404 of the CWA)

### 1.1.1 CHIA Revision Purpose

The CHIA is not updated at a specified interval. 30 CFR § 780.21(g)(2) states “an application for permit revision shall be reviewed by the regulatory authority to determine whether a new or updated CHIA shall be required.” On May 1, 2012, OSMRE received a Life of Mine (LOM) significant permit revision application from Peabody Western Coal Company (PWCC) for the Kayenta Mine Complex (KMC). The May 1, 2012, permit revision application was updated by PWCC on December 18, 2013, February 10, 2014, and May 2, 2014. The revision application includes adding support facilities located on the Black Mesa Mine to the Kayenta Mine permanent program permit area, mining of new coal resource areas (J21 West, N10, and N11 Extension), and updating the N-aquifer groundwater flow model used for impact assessment and the associated protection of the hydrologic balance information included in the PAP at Chapter 18.

The 2016 Kayenta Mine Complex CHIA is also updated to comply with Settlement Conditions associated with Docket No. DV-2012-3-R. Specific to hydrology, Settlement Conditions state:

(1) OSM shall update the Kayenta Mine Complex CHIA in conjunction with its disposition of the 2013 Significant Permit Revision application. If PWCC withdraws that application, OSM shall update the Kayenta Mine Complex CHIA in conjunction with PWCC's next significant permit revision application or in conjunction with the next minor permit revision that affects the Probable Hydrologic Consequences determination of the permit, whichever occurs first.

Response: OSMRE's disposition of the 2013 Significant Permit Revision application requires an Environmental Impact Statement (EIS), which is anticipated for Record of Decision (ROD) in the Fall of 2017.

(2) In the updated Kayenta Mine Complex CHIA, OSM shall identify and adopt, as material damage criteria for the Navajo Sandstone Aquifer (“N-aquifer”), numeric water levels that will be physically measured for all wells screened in the confined area of the N-aquifer that are monitored by the U.S. Geological Survey (USGS).

Response: OSMRE has identified numeric water levels as material damage criteria at windmills and community supply wells monitored by the USGS and screened in the confined N aquifer. Material damage water levels for community supply wells are based on economic and lift cost considerations. Material damage water levels for windmills are based on the depth of the drop pipe intake on the windmill. Graphical illustration of the measured water levels and material damage criteria are provided in Appendix A.

(3) OSM shall produce a written assessment of the need and potential for increased N aquifer spring monitoring. This written evaluation will be documented in the CHIA update and developed in consultation with the Hopi Tribe, Navajo Nation, PWCC, and USGS.

Response: During the development of the NGS-KMC EIS, several spring inventories were evaluated and discussed in collaboration with the Hopi Tribe, Navajo Nation, PWCC, USGS, Bureau of Reclamation (BOR), and BOR's consultant AECOM (Leake and others, 2016) BOR, 2016). The NGS-KMC EIS and OSMRE Kayenta Mine Complex CHIA have similar purpose and needs for evaluation of impacts. As such, OSMRE coordinated a field evaluation of regional D and N aquifer baseflow and spring discharge. The written evaluation of the need and potential for increase N aquifer spring monitoring is provided as Appendix B.

(4) In the updated Kayenta Mine Complex CHIA, OSM will consider formulating material damage criteria for N aquifer discharge that is not based on the PWCC 3D Model.

Response: The PWCC 3D Model was updated in 2014 (Tetra Tech, 2014). The 2014 updated model was peer reviewed by the USGS (Leake and others, 2016). The following statements are provided in the USGS review Summary and Conclusions (Leake and others, 2016):

- The PWCC (Tetra Tech, 2014) model is a recently calibrated model that can simulate the effects of past groundwater development in the D and N aquifers in the Black Mesa Area.
- The combination of MODFLOW packages used in the PWCC model to represent real hydrologic features leads to improved simulation capabilities in comparison to previous models including the original PWCC (1999) model, the USGS model (Brown and Eychaner, 1988), and the WNHN model (HDR Engineering Inc., 2003).
- This evaluation found no problems with the PWCC model that would preclude its use by the NGS-KMC EIS team. Given the complexity of the N and D aquifer system in the study area and the amounts and types of data available, the calibration of the PWCC model described in Tetra Tech (2014) seems to be reasonable. Observed streamflow in most of the major washes is simulated reasonably well.

Based on the summary and conclusions provided in the USGS review, the updated 2014 PWCC groundwater flow model is the best tool available to evaluate PWCC effects on N aquifer discharge, and will be used for formulating material damage criteria.

(5) In the updated Kayenta Mine Complex CHIA, OSM shall add, as part of the N aquifer water quality material damage criteria at PWCC N aquifer wells, numeric water quality parameters including but not limited to arsenic, selenium, and boron that will be evaluated through laboratory analysis. OSM shall modify the monitoring plan to require monitoring for such parameters at the PWCC N aquifer wells and with the same frequency as other N aquifer water quality material damage parameters. OSM shall not establish material damage criteria for any parameter in excess of U.S. Safe Drinking Water Act standards or current concentration of that parameter, whichever is higher, at the PWCC N aquifer wells. If the U.S. Safe Drinking Water Act does not establish a standard for a particular parameter, OSM shall not establish a material damage criterion in excess of Hopi or Navajo Nation livestock watering standards or the current concentration of that parameter, whichever is higher.

Response: PWCC N aquifer wells are monitored for a suite of water quality parameters at a frequency provided in the approved permit Hydrologic Monitoring Program (PWCC, v.11, ch.16, Table 12). The following describes the U.S. Safe Drinking Water Act standards for arsenic, selenium, and boron.

Effective January 23, 2006, the arsenic drinking water standard is 10 µg/L. Arsenic concentrations are evaluated through laboratory analysis and monitored at the same frequency as other N-aquifer water quality material damage parameters as described in the approved permit (PWCC, v.11, ch.16, 2016).

Selenium drinking water standard is 0.05 mg/L. Selenium concentrations are evaluated through laboratory analysis and monitored at the same frequency as other N-aquifer water quality material damage parameters as described in the approved permit (PWCC, v.11, ch.16, 2016).

Boron was identified on the second published EPA contaminant candidate list (CCL 2) in 2005. In May 2007, the Agency published a Federal Register (FR) notice announcing and requesting comment on its preliminary determinations for 11 of the 51 CCL 2 contaminants. In July 2008, EPA published its final determination that no regulatory action is appropriate or necessary for boron. Hopi Tribe drinking water standard for total recoverable boron is 1400 µg/L. Navajo Nation domestic water supply boron standard is 630 µg/L. Boron concentrations are evaluated through laboratory analysis and monitored at the same frequency as other N-aquifer water quality material damage parameters as described in the approved permit (PWCC, v.11, ch.16, 2016).

(6) OSM will accept information from Appellants prior to or during preparation of the updated Kayenta Mine Complex CHIA. OSM will make the CHIA update publicly available in conjunction with the public release of the NGS-Kayenta Mine Complex Draft EIS.

Response: OSMRE did not receive information from Appellants related to the CHIA since the execution of the settlement agreement. The updated Kayenta Complex CHIA will be publicly available September 2016 in conjunction with the public release of the NGS-KMC Draft EIS.

Compared to the 2011 CHIA, the 2016 CHIA for PWCC operations:

- 1) Implements Settlement Conditions associated with Docket No. DV-2012-3-R.
- 2) Utilizes 2014 PWCC Groundwater Flow Model for predictive impacts. The 2014 PWCC Model underwent a technical review by the USGS (Leake and others, 2016).
- 3) Utilizes results from the Draft NGS-KMC EIS.
- 4) Evaluates surface water resources using the Median Absolute Deviation (MAD) and relates to the effective 2011 Hopi Tribe Water Quality Standards (HTWQS), and the effective 2009 Navajo Nation Surface Water Quality Standards (NNSWQS).

### **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 is an area where impacts from the coal mining operation, in combination with additional coal mining operations, may cause material damage (OSMRE, 2002). The size and location of a given CIA will depend on the surface water and groundwater system characteristics, the hydrologic resources of concern, and projected impacts from the operations included in the assessment (OSMRE, 2007). For this CHIA, two surface water CIAs and two groundwater CIAs are delineated to assess impacts associated within these distinct hydrologic resource areas.

### 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 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 for “material damage to the hydrologic balance” was to provide the regulatory authority the ability to develop a definition based on regional environmental and regulatory conditions. Therefore, for the purpose of this CHIA;

Material damage to the hydrologic balance outside the permit area means any quantifiable 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.

### 1.1.4 Material Damage Criteria

Except for water quality standards and effluent limitations required at 30 CFR § 816.42, the determination of material damage criteria is the discretion of the regulatory authority (48 FR 43972-43973, 1983 and 48 FR 43956, 1983). Material damage criteria for both groundwater and surface water are related to existing standards, and based on the protection of water uses. The material damage criteria are reviewed after submittal of the PWCC annual reclamation status report to OSMRE.

## 1.2 Kayenta Mine Complex Background

The Kayenta Complex Mine is located within the boundaries of the Hopi Tribe and Navajo Nation reservations and has operated since 1973. The Black Mesa Mine operated in a permit area adjacent to the Kayenta Mine and was active from 1970 through 2005. The two (2) surface mine operations are collectively considered the Kayenta Mine Complex. The Black Mesa Mine operated under Initial Program and Administrative Delay pursuant to 30 CFR 750.11(c). The Kayenta Mine permanent program permit was issued on July 6, 1990. The permanent program permit is AZ-0001E and was renewed four times; on July 6, 1995, on July 6, 2000, on July 6, 2005, and lastly on July 6, 2010. Since technical updates to the PAP are ongoing, reference to specific chapters in the PAP use the year 2016 as reference since the permit is complete and up to date at the publishing of this CHIA document.

The Kayenta Mine Complex encompasses an area of 65,387 acres and is located in northeastern Arizona on Black Mesa, southwest of Kayenta, Arizona (Figure 1). The Navajo Nation has exclusive surface and mineral interests for 24,858 acres in the northern portion of the Kayenta Mine Complex. In the remaining 40,529 acres of the Kayenta Mine Complex, the Hopi Tribe and Navajo Nation have joint and equal interests in the mineral resources that underlie the land surface. Navajo Nation coal resource areas are identified as “N” areas, and joint coal resource interest areas are identified as “J” area (Figure 2). Active coal mining occurs in the N-9, J-19, and J-21 coal resource areas. Coal royalties are based on surface area, and water royalties for PWCC’s wellfield pumping are paid equally to the Hopi Tribe and Navajo Nation based on metered wellfield production.

From 1970 to 2005, coal mined at the Black Mesa mine was transported 273 miles to the Mohave Generating Station near Laughlin, Nevada via a coal slurry pipeline. The Mohave Generating Station consumed approximately four to five million tons of coal annually (PWCC, v.1, ch.2, 2016). Coal

produced at Kayenta Mine is currently transported 83 miles to the Navajo Generating Station near Page, Arizona via an electric railroad. The Navajo Generating Station consumes seven to eight million tons of coal annually (PWCC, v.1, ch.2, 2016).

PWCC uses the strip mining method to recover the coal resources at the Kayenta Mine Complex. Strip mining involves the removal of overburden material covering the coal using blasting and draglines. The coal is then removed by shovels or front-end loaders and transported to coal preparation facilities using haulage trucks. After the coal removal, the overburden material is regraded to the approximate original topographic contours, conforming to topography to support the approved post-mining land uses. Stockpiled topsoil and other suitable material are then spread on top of the graded overburden material to support the re-establishment of approved post-mining vegetation. PWCC must then demonstrate the persistence of re-established vegetative cover sufficient to support post-mining land use.

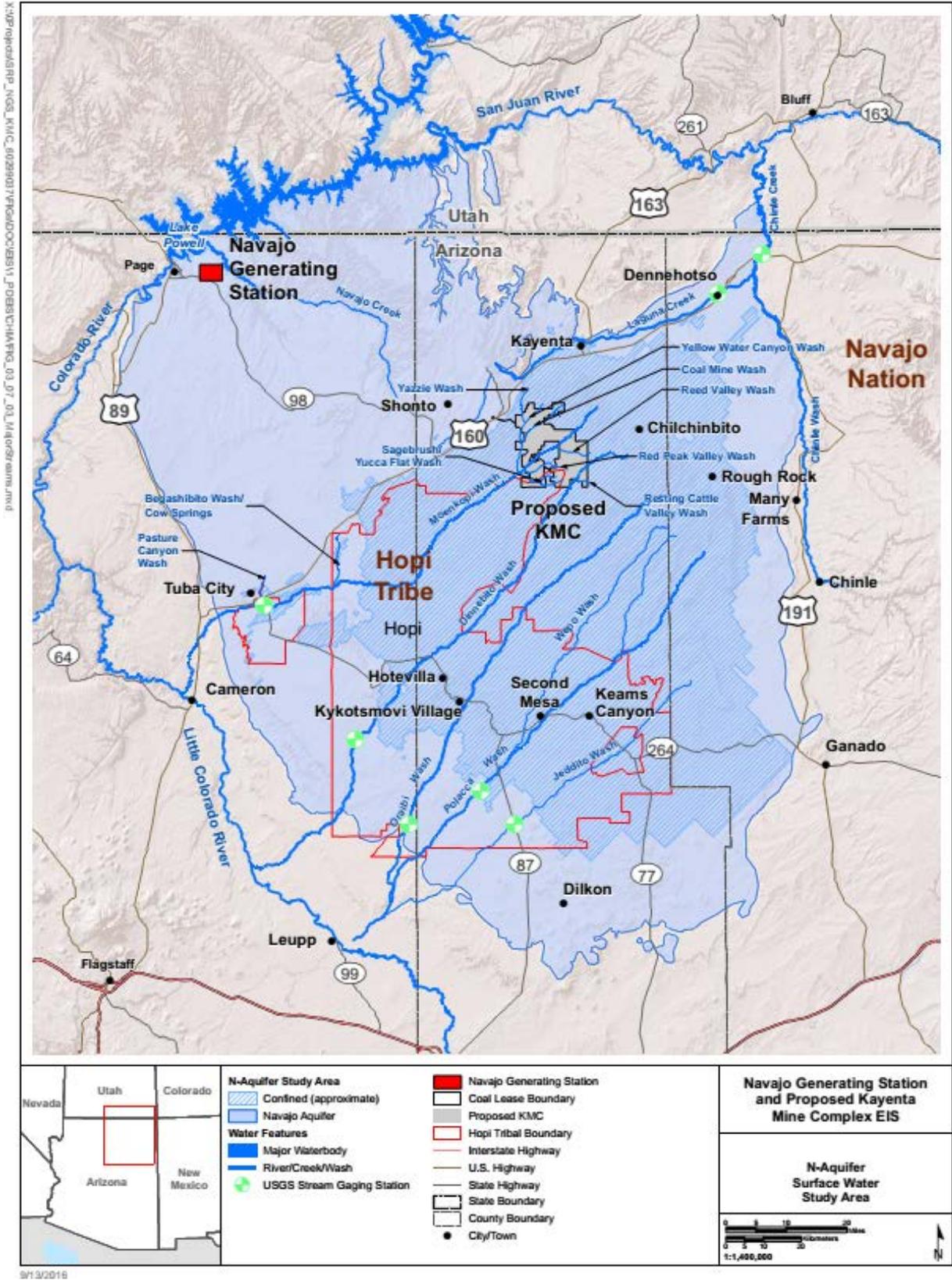


Figure 1: Kayenta Mine Complex Location Map (BOR, 2016, Figure 3.7-3).

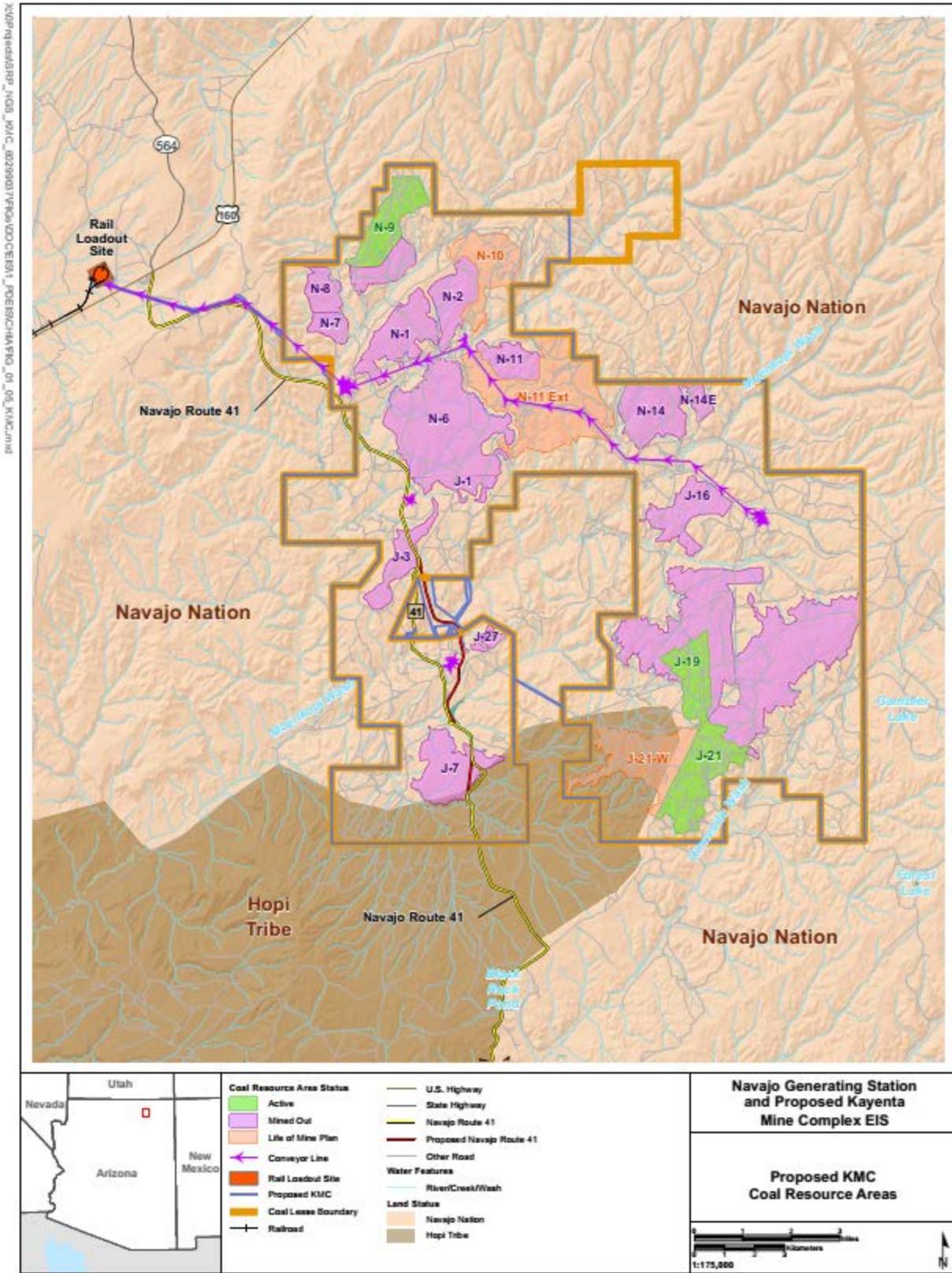


Figure 2: Kayenta Mine Complex Coal Resource Areas (BOR, 2016, Figure 1-5).