

# 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 all permit applications to conduct surface coal mining operations within the boundaries of the Navajo Nation Reservation. On April 29, 2013, the Navajo Nation Council passed legislation to form Navajo Transitional Energy Company (NTEC), a Navajo Nation owned Limited Liability Company (LLC) organized under the Navajo Nation's Limited Liability Company Act. The Navajo Nation informed OSMRE that they are seeking to purchase all interests in BHP Navajo Coal Company (BNCC) from BHP Billiton New Mexico Coal, Inc. OSMRE has received and is reviewing a Permit Application Package (PAP) submitted by Navajo Transitional Energy Company (NTEC) to develop an approximately 5,600 acre new permit area to continue surface coal mining and reclamation operations post July 6, 2016 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The new permit area, referred to as the Pinabete Permit (NM-0042A), consists of portions of the current Navajo mine permit area (NM-0003F) and unpermitted areas of NTEC's mining lease, located immediately south of the Navajo Mine permit area. NTEC's Navajo Mine and Pinabete permit areas are located on Navajo Nation lands and within the Navajo Tribal Coal Lease. By regulation, OSMRE must prepare a Cumulative Hydrologic Impact Assessment (CHIA) for these permit areas. The CHIA determines 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 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 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 and certified by the Navajo Nation and Hopi Tribe 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 was written in February, 1984 (Kaman Temp 1984), and addendum to the 1984 CHIA in 1989 (OSMRE 1989), and significantly updated in 2012. This 2015 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, and the Pinabete Permit Area. Findings with regard to material damage of these operations are summarized below (Table 1).

**Table 1: Navajo Mine and Pinabete Permit Area – Material Damage Summary**

<b>Water Resource</b>	<b>Assessment Approach</b>	<b>Hydrologic Balance Threshold Reached</b>	<b>Material Damage Limit Reached</b>	<b>Measures to Minimize Impact</b>	<b>Adequate Monitoring Program</b>
<b>Fruitland &amp; PCS Quantity</b>	Evaluation of potentiometric surface contour maps	No	No	Contemporaneous Reclamation	Yes
<b>Alluvial Quantity</b>	Comparison of water levels at individual wells over-time	No	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Yes
<b>Surface Water Quantity</b>	SEDCAD modeling-assessment of pre- and post-mining impacts; Percent of HUC12 Watersheds controlled with impoundments	Yes	No		Yes
<b>Fruitland &amp; PCS Quality</b>	Comparison of baseline water quality to potentially impacted or non-baseline wells, including spoil and CCB wells	No	No	Contemporaneous Reclamation; mixing of overburden/ backfill materials	Yes
<b>Alluvial Quality</b>	Comparison baseline (upstream/pre-mining) water quality to non-baseline (post-mining/downstream) water quality	Yes	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Yes
<b>Surface Water Quality</b>		No	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones; Sedimentation Ponds	Yes

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 NTEC operation on surface and groundwater quantity and quality, and includes a determination of:
  - The minimization of impacts within the lease area; and,
  - The adequacy of the monitoring program to assess potential impacts.
- Chapter 6
  - Establishes hydrologic balance thresholds and material damage limits; and,
  - Contains the summary CHIA findings statement.

## 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. Regulatory agencies that may have a permitting action on the Navajo Tribal Coal Lease include:

- OSMRE (regulatory authority for coal mining operations within the Navajo Nation)
- Bureau of Indian Affairs (protect and improve trust assets of the Tribes)
- Navajo Nation Environmental Protection Agency (NNEPA) (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)
- USEPA (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)

The 2012 Navajo Mine CHIA was peer reviewed by the Bureau of Indian Affairs (BIA), Navajo Nation Environmental Protection Agency (NNEPA), Navajo Nation Minerals Department (NNMD), U.S. Army Corps of Engineers (USACE), and OSMRE technical staff. Additionally, separate face-to-face discussions were conducted with the aforementioned organizations to review the assessment approach, and to identify any potential major concerns prior to finalization of the assessment. BIA, NNMD, and USACE concurred that the assessment approach for the 2012 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.

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. OSMRE did not use NNEPA guidance for assessing the quality of Navajo Nation surface waters to determine impairment because OSMRE has no authority to implement 303d impaired stream listing protocols. For this reason NNEPA cannot concur with OSMRE's conclusions without first assessing water quality impairment using NNEPA guidance. NNEPA has expressed future plans to conduct analysis on the available data set using NNEPA guidance.

The 2015 CHIA update is 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.

### 1.1.1 CHIA Revision Rationale

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 3, 2013, OSMRE received an application from BNCC, to transfer Federal Permit NM0003F to NTEC. OSMRE provided conditional approval in letter to BNCC dated November 1, 2013. Additionally, OSMRE received a Permit Application Package (PAP) on March 30, 2012 to develop an approximately 5,600 acre new permit area to continue surface coal mining and reclamation operations post July 6, 2016 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The application has since been updated by NTEC’s mine manager BHP Mine Management Company (MMCo.) in response to OSMRE’s ongoing technical evaluation. The application was updated on: December 13, 2013, January 27, 2014, March 6, 2014 and March 17, 2014. A Final FCPP and Navajo Mine Energy Project EIS is anticipated for publication May 2015. The factors below describe the major differences from the 2012 CHIA to the 2015 CHIA.

The 2015 CHIA for NTEC operations:

- Changes the permittee of Federal Permit NM0003F from BNCC to NTEC in text and PAP references,
- Clarifies the assessment of two active permit areas (Navajo Mine Permit NM-0003F and The Proposed Pinabete Permit NM-0042A) within the Navajo Tribal Coal Lease, which was completed during the 2012 CHIA update in anticipation of the Pinabete PAP,
- Updates illustrations, tables, and text to reflect the Navajo Mine and Pinabete Permit Areas,
- Updates ongoing revisions to the hydrologic monitoring program described at Section 5.2 and Appendix H of this document, and
- Updates references to locations in the electronic permit application packaged approved on June 30, 2014.

### 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, one surface water CIA and one groundwater CIA 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 if 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 permanent adverse impact from surface coal mining and reclamation operations on the quality or quantity of surface water or groundwater that exceeds the identified material damage limits and that would preclude any existing or reasonably foreseeable use of surface water or groundwater outside the permit area.

SMCRA recognizes that coal mining will have some hydrologic impacts; therefore, differentiates between impacts within the permit area and 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). The 2015 CHIA evaluates the entire lease area (Figure 1). The lease area includes NTEC coal mining areas prior to the enactment of SMCRA north of the permit area, and includes lease areas IV south and V. In an effort to evaluate historical CCB disposal north of the permit area, and to include baseline information from areas IV south and V, the assessment includes the entire lease area.

#### 1.1.4 Material Damage Criteria

Except for water quality standards and effluent limitations established 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 quality should be related to existing standards that generally 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 can include material damage standards for parameters of local significance to water use (OSMRE, 1998). The 2015CHIA includes hydrologic balance thresholds and material damage limits (Ch. 6).

## 1.2 Background

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-0003(A-F). Permit NM-0003 was renewed in 1991, 1993, 1994, 1999, 2004, and 2010; pursuant to 30 CFR 774.15(c). On May 3, 2013, OSMRE received an application from BNCC, to transfer Federal Permit NM0003F to NTEC. OSMRE provided conditional approval in letter to BNCC dated November 1, 2013. Additionally, OSMRE received a Permit Application Package (PAP) on March 30, 2012 to develop an approximately 5,600 acre new permit area to continue surface coal mining and reclamation operations post July 6, 2016 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The application has since been updated by NTEC's mine manager BHP Mine Management Company (MMCo.) in response to OSMRE's ongoing technical evaluation. The application was updated on: December 13, 2013, January 27, 2014, March 6, 2014 and March 17, 2014.

The Navajo Tribal Coal Lease is located 18.6 miles southwest of Farmington, New Mexico, on a contiguous lease within the northeastern portion of the Navajo Nation (Figure 2). The Navajo Tribal Coal Lease area is divided into five areas (I-V) (Figure 1) (USEPA n.d.). These lands are divided into Pre-Law, Interim, Termination of jurisdiction (TOJ), and Permanent Program land classifications (Figure 1) (NTEC 2013, Part 6 Sect. 40). NTEC is currently conducting surface coal mining operations in Areas III and IV North, and anticipates conducting surface coal mining operations in the Pinabete Permit Area, south of Area IV North, beginning in 2016.

The NTEC operations currently supply coal from the Navajo Mine 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 Navajo Mine will be used to support operation of the FCPP until July 2016. After July 2016, coal resources in the Pinabete Permit Area will be available to support operation of the FCPP until 2041. The Proposed Pinabete PAP indicates that 5.38 million tons will be produced annually, on average, for the 25-year life-of-mine (NTEC 2014, Sect. 20). MMCo. relies on strip mining as the primary 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 5,000 feet to 5,600 feet above sea level. The climate at Navajo Tribal Coal Lease varies from arid to semi-arid based on Navajo Mine precipitation records. Navajo Mine has collected climatological data from two onsite meteorological monitoring stations since 1991, designated Met Station I and II. Met Station I is located in Area I, and Met Station II is located at an area referred to as “the Neck” between Area II and Area III (NTEC 2013, Part 2 Sect. 12).

Temperatures at the Navajo Tribal Coal Lease 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 Tribal Coal Lease 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 area of interest for this CHIA 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 (mi<sup>2</sup>) and includes parts of Arizona, Colorado, New Mexico, and Utah (Hereford, Webb and Graham 2005). 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 3). 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.



## Legend

### Mine Lease Boundary

-  Pre-Law
-  Interim Program
-  Permanent Program
-  TOJ Lands

### Meteorological Station

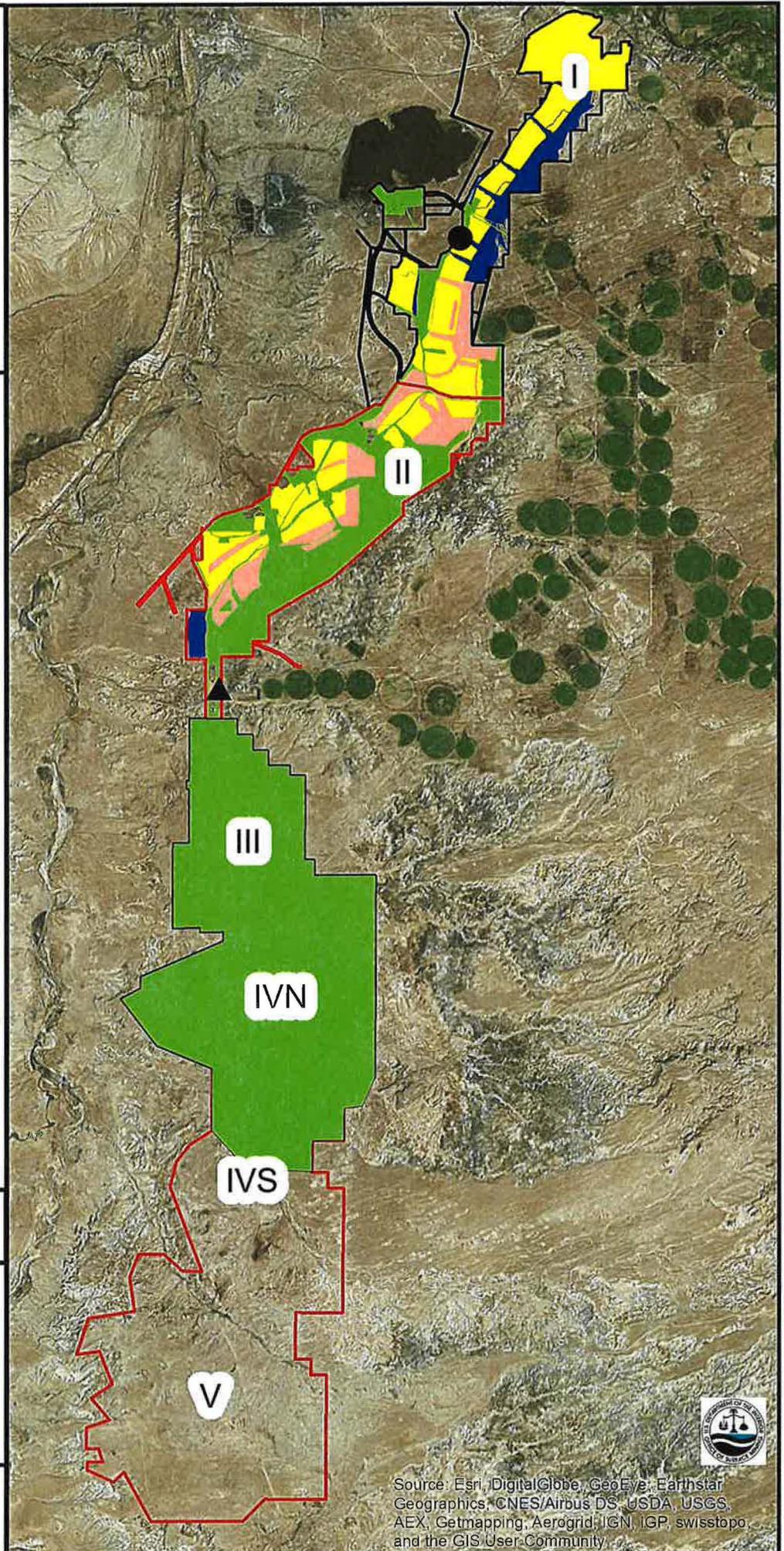
-  1
-  2

1 0.5 0  
Miles



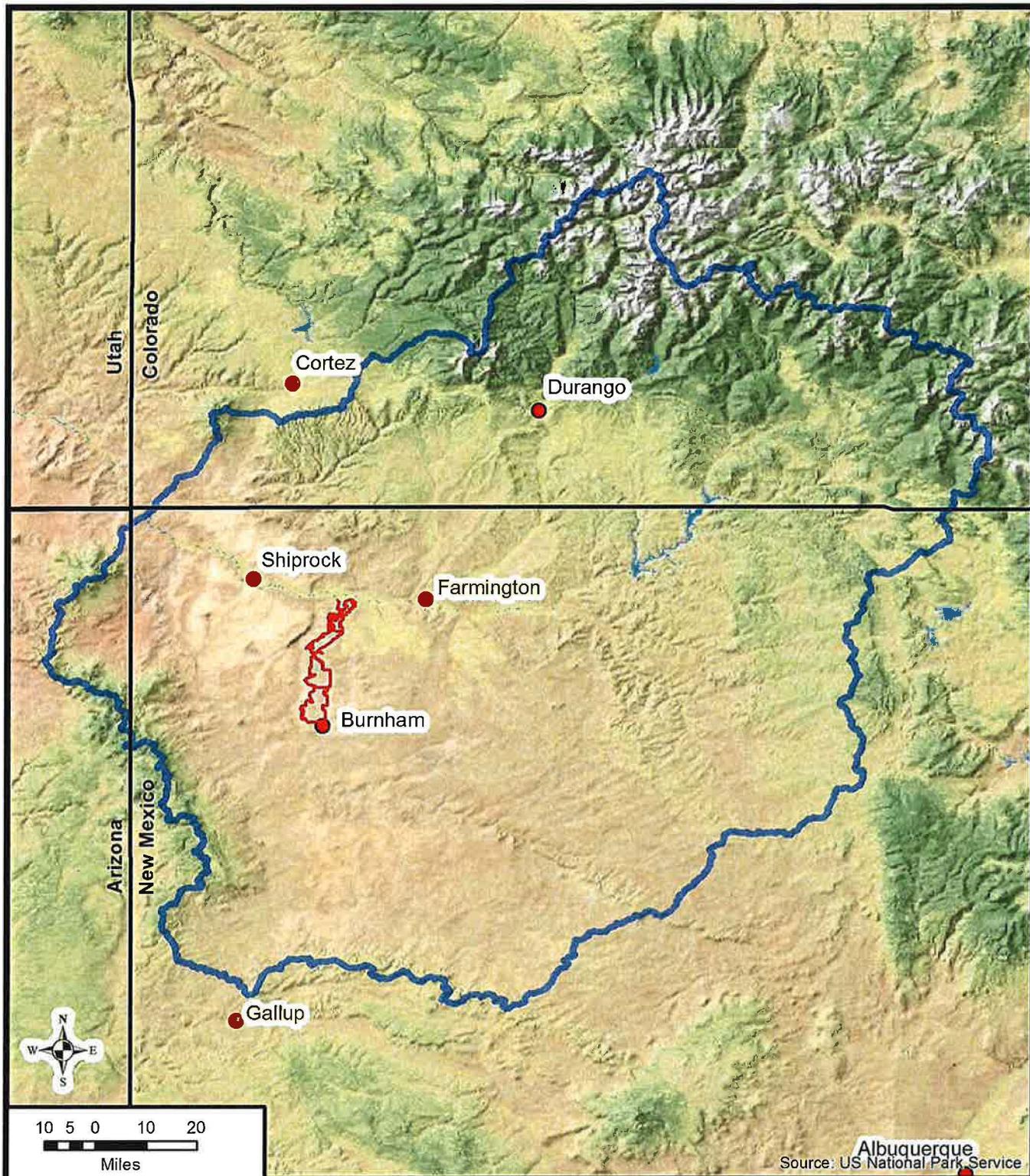
**NTEC Navajo Mine and  
Pinabete Permit Areas**

**Figure 1**



Source: Esri, DigitalGlobe, GeoEye, Earthstar  
Geographics, CNES/Airbus DS, USDA, USGS,  
AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,  
and the GIS User-Community





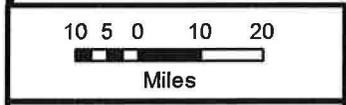
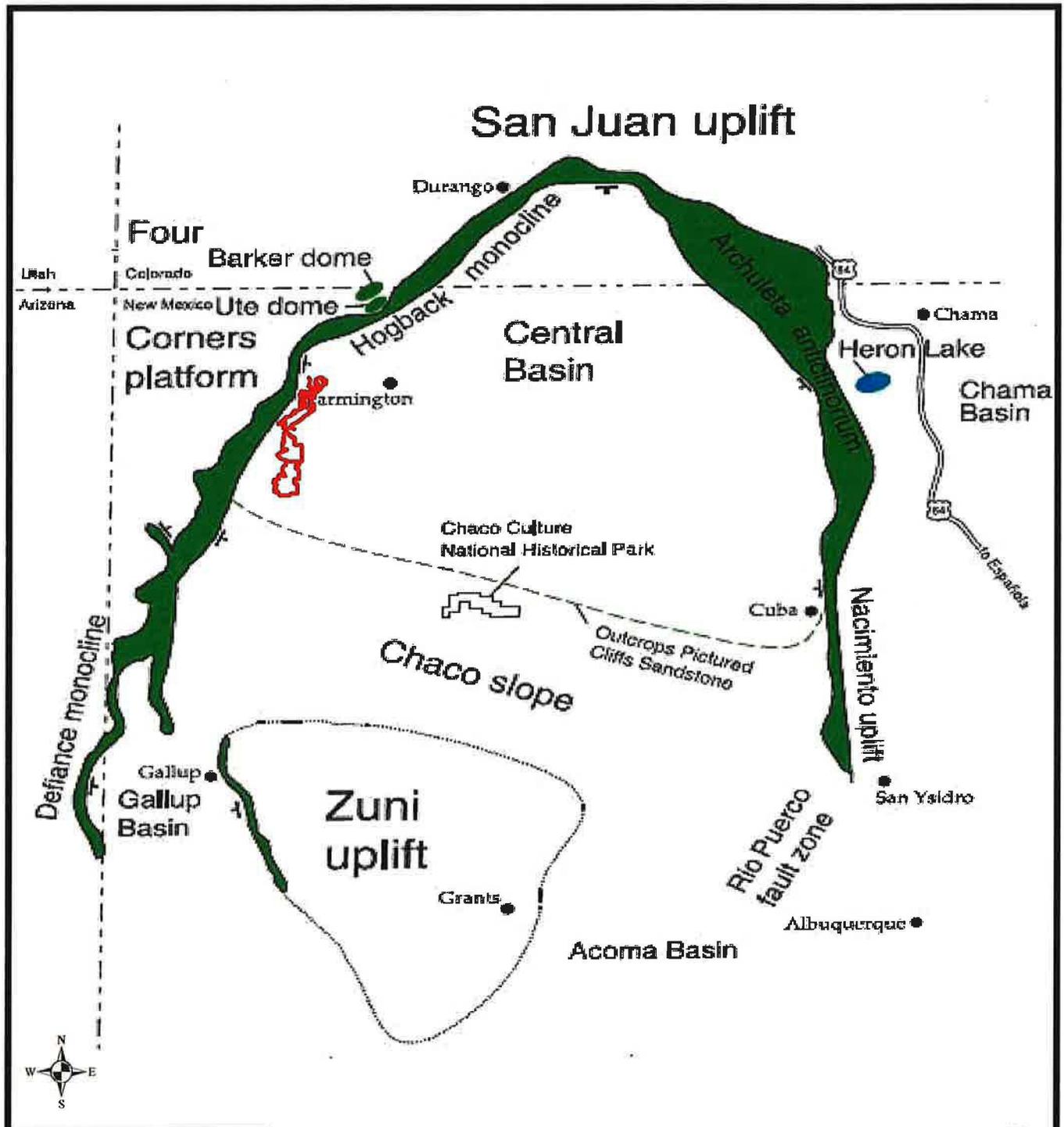
**Legend**

-  Navajo Tribal Coal Lease
-  San Juan Watershed
-  Communities



**Navajo Tribal Coal Lease Location Map**

**Figure 2**



Modified from Lorenz, J.C. and Cooper, S.P., 2003

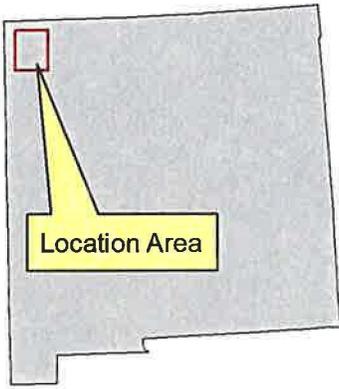


**Legend**

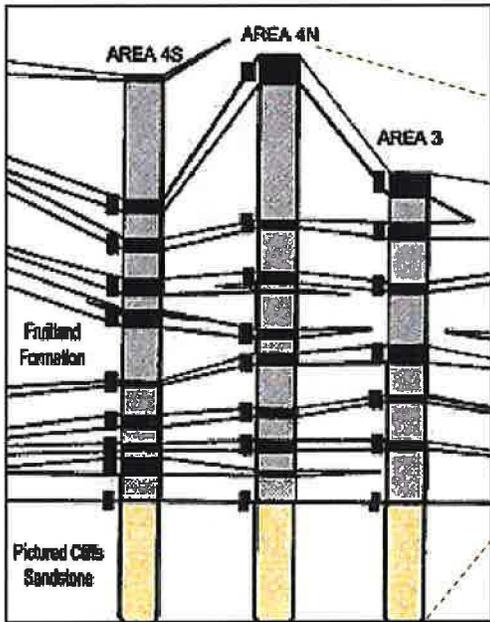
- Navajo Tribal Coal Lease
- Areas of steep dip; strike and dip symbols show direction of dip

**San Juan Watershed  
Structural Geology**

**Figure 3**



### Navajo Lease Area Lithology



Modified from  
Fassett, J. E. (1977),  
USGS Prof. Paper 1625-B

### Navajo Tribal Coal Lease & Surrounding Area Stratigraphy

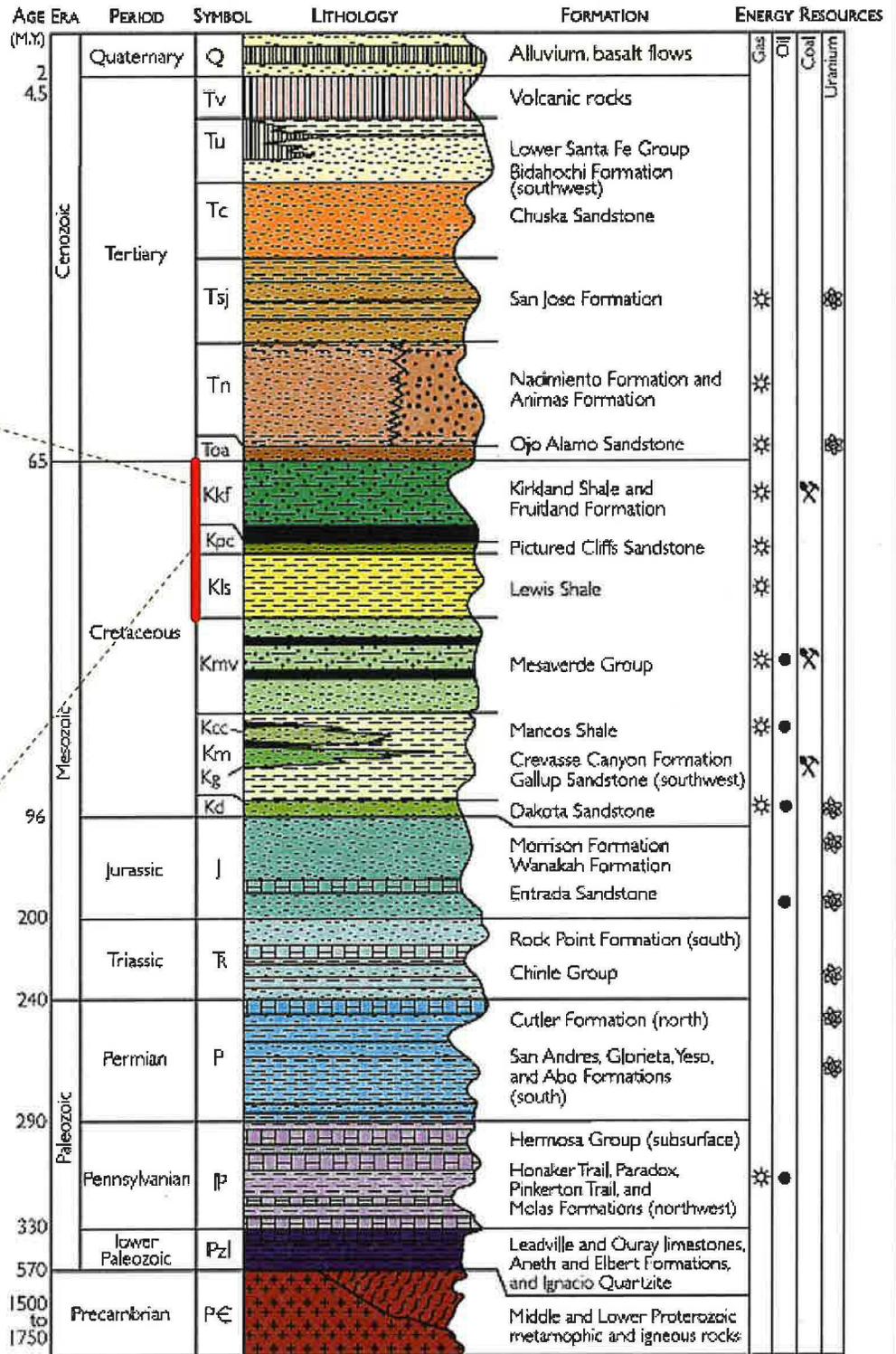
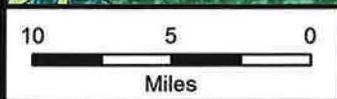
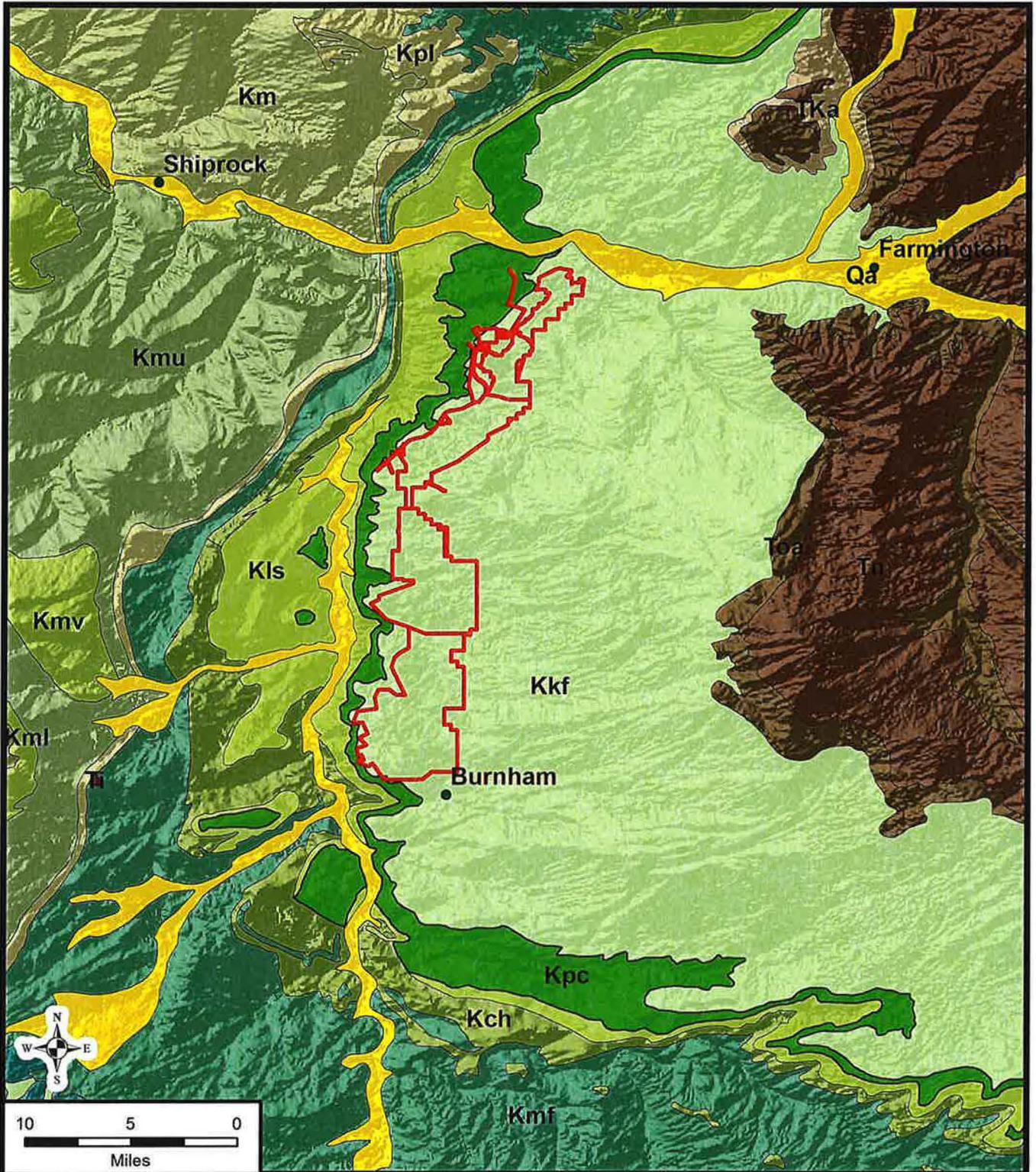


Figure 4

From: Brister, B. S. and Price, L. G., 2002





**Legend**

Navajo Coal Lease Boundary

**Area Geology**

- Qa - Quaternary Alluvium
- Kkf - Kirtland Shale - Fruitland fm.
- Kpc - Pictured Cliffs Sandstone
- Kls - Lewis Shale



**Surface Geology Map  
NW New Mexico**

---

**Figure 5**