## CHAPTER 1 ADJUDICATION Table of Contents

- 1.1 IDENTIFICATION OF INTERESTS
- **1.2 VIOLATION INFORMATION**
- **1.3 RIGHT OF ENTRY INFORMATION**
- 1.4 STATUS OF UNSUITABILITY CLAIMS
- **1.5 PERMIT TERM**
- **1.6 INSURANCE**
- 1.7 NEWSPAPER ADVERTISEMENT AND PROOF OF PUBLICATION
- 1.8 PUBLIC OFFICE AND LOCATION FOR FILING APPLICATION -
- ADDRESS OF PUBLIC LOCATIONS
- **1.9 FACILITIES OR STRUCTURES USED IN COMMON**

#### LIST OF APPENDICES

- 1-A BHP Ownership and Control.
- 1-B Notice of Violations
- 1-B-A Navajo Mine, San Juan County, NM
- 1-B-B San Juan Mine, San Juan County, NM
- 1-B-C La Plata Mine, San Juan County, NM
- 1-B-D Black Diamond Mine Violations
- 1-C Legal description of the original Mining Lease and Amendments 2, 3, 4, and 4-A.
- 1-D Grants of Easement for Right of Way
- 1-E Certificate of Liability Insurance.
- 1-F Affidavit of Publication.

#### LIST OF TABLES

- 1-1 Information for Entities with Ownership and Control Interest in Navajo Mine
- 1-2 Other Permits maintained by Navajo Mine, Navajo Coal Company
- 1-3 Other Permits maintained by San Juan Mine, San Juan Coal Company
- 1-4 Other Permits maintained by La Plata Mine, San Juan Coal Company

#### LIST OF FIGURES

1-A BHP New Mexico Coal Operations Corporate Organizational Structure

- 1-1 Surface and Minerals Ownership Coal Leasehold Interest (Sheets 1 and 2)
- 1-2 Customary Use Area (Sheets 1 and 2)
- 1-3 Rights-of-Way and Easements (Sheets 1 and 2)

## CHAPTER 1 ADJUDICATION Table of Contents

- Area I Permit Areas Pre-Law, Interim, Permanent Program (Sheet 1)
  Area II Permit Areas Pre-Law, Interim, Permanent Program (Sheets 2 through 4)
  Area III Permit Areas Pre-Law, Interim, Permanent Program (Sheets 5 and 6)
  OPEN
- 1-6 Navajo Mine Lease Base Map (Sheets 1 through 9)

## CHAPTER 2 LAND USE Table of Contents

#### 2.1 PRE-MINING AND EXISTING LAND USE

- 2.2 **POSTMINING LAND USE**
- 2.3 SOCIOECONOMIC IMPACT ASSESSMENT
- 2.4 **REFERENCES**

### LIST OF APPENDICES

- 2-A Land Use Correspondence: IOC, A. King to A.F. Geiger. "Ref. Contract No. 14-20-603-2505 Mining Lease -Tribal Indian Lands". April 5, 1971. Letter J.W. Thomas, BIA, Shiprock, to W. Skeet, UII. "Ref. Clarify the land use status of the area presently under lease by UII...". March 4, 1983 Huskon, B., Presiding Chairmans, Resources Committee. Resolution of the Resources Committee of the Navaio Tribal Council "Adopting the Grazing Concept
  - Resources Committee of the Navajo Tribal Council "Adopting the Grazing Concept of the Holistic Resources Management or Other Adequate Practices on Strip Mine Lands and Other Disturbed Rangelands". October, 1983
- 2-B Navajo Mine Grazing Management Plan.
- 2-C Letter to OSMRE from BHP-UII, dated August 25, 1987, with respect to Navajo Mine being exempt from obtaining waivers to conduct coal mining and reclamation operations within 300 feet of an occupied dwelling or 100 feet of a public road.

## LIST OF TABLES

- 2-1 Recommended Nutrient Requirements for Cattle and Sheep Under Range Conditions During Gestation and Lactation On A Dry-Matter Basis.
- 2-2 Nutrient Content Nutrient Content At Various Stages of Growth For Forage Species in Revegetation Seed Mix.

## CHAPTER 3 CULTURAL RESOURCES Table of Contents

3.1	INTRODUCTION
3.1	INTRODUCTIO

- 3.2 CULTURAL/HISTORICAL BACKGROUND
- 3.3 PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES
- 3.4 **REFERENCES**

### LIST OF TABLES

3-1 Navajo Mine Archaeological Clearance

### LIST OF EXHIBITS

3-1 Archaeological Clearance Status Map

## CHAPTER 4 CLIMATE AND AIR QUALITY Table of Contents

# 4.1 CLIMATOLOGICAL CHARACTERISTICS

- 4.2 METEOROLOGICAL MONITORING
- 4.3 AIR POLLUTION CONTROL PLAN
- 4.4 **REFERENCES**

# LIST OF APPENDICES

4-A Met 1 and Met 2 Wind Direction vs. Wind Speed back-up data

# LIST OF TABLES

4-1	Navajo Mine Regional Precipitation Data
4-2	NMSU Temperature Extremes and Frost Free Periods
4-3	Navajo Mine 2003 Temperature Summary
4-4	Air Monitoring Stations and Locations
4-5	Air Monitoring Siting Information

# LIST OF FIGURES

4-1	Navajo Mine Met I – 10 Meter Tower Wind Rose
4-2	Navajo Mine Met 2 – 10 Meter Tower Wind Rose

# LIST OF EXHIBITS

4-1 Air Quality and Meteorological Monitoring Station

## CHAPTER 5 GEOLOGY Table of Contents

- 5.2 SEAM CHARACTERISTICS
- 5.3 GEOLOGIC HAZARDS
- 5.4 OVERBURDEN CHARACTERISTICS
- 5.5 **REFERENCES**

## LIST OF APPENDICES

- 5-A Drill Hole Core Logs
- 5-B Overburden Chemical and Physical Analyses
- 5-C 1987 Methods of Analysis
- 5-D 1989 Methods of Analysis

## LIST OF FIGURES

- 5-1 General Structural Features of the San Juan Basin of Northwestern New Mexico.
- 5-2 Stratigraphic Nomenclature and Generalized Stratigraphy of the Upper Cretaceous and Tertiary Sediments Found on the Navajo Mine Coal Lease.
- 5-3 Surface Expression of Geologic Units on and Surrounding the Navajo Mine Coal Lease.
- 5-4 Overburden Drill Hole Locations.

## LIST OF TABLES

- 5-1 Overburden Drill Site Locations.
- 5-2 Weighted Average of Overburden Analyses.

- 5-1 Area I drill hole data.
- 5-2 Area II drill hole data.
- 5-3 Area III drill hole data.
- 5-4 Area IV N drill hole data.
- 5-5 OPEN
- 5-5a Areas I, II, III cross section index map.
- 5-5b Areas I, II, III cross section index map.
- 5-5c Areas I, II, III cross section index map.
- 5-6 Area IV N cross section index map.
- 5-7 Areas I and II East-West drill hole correlation section A-A', B-B', C-C', D-D', E-E', F-F'.
- 5-7a Drill Hole Correlation Block "A".

### CHAPTER 5 GEOLOGY Table of Contents

#### LIST OF EXHIBITS (Continued)

Area III Cross Section T-T' Overburden Correlation. 5-7b 5-7c Drill Hole Correlation Block "C". 5-7d Area III Cross Section X-X' Overburden Correlation. Area III East-West drill hole correlation section G-G', H-H'. 5-8 Drill Hole Correlation Block "D". 5-8a 5-8b Drill Hole Correlation Block "D". Area III Cross Section U-U' Overburden Correlation. 5-8c 5-9 Areas III and IV N East-West drill hole correlation section I-I', J-J'. Areas II, III, and IV N North-South drill hole correlation section K-K', L-La'. 5 - 10Areas I and II North-South drill hole correlation section La'-L', M-M', N-N'. 5-11 5-12 Area IV N East-West, North-South correlation section O-O', P-P', Q-Q'. 5-13 Area III Seam 2A top of seam structure & iso-overburden map. 5-13a Area III Seam 2A thickness map. 5-14 Area IV N Seam 2A thickness map. Area IV N Seam 2A top of seam structure. 5-14a Area IV N Seam 2A iso-overburden map. 5-14b 5-15 Area III Seam 2B top of seam structure and iso-overburden map. 5-15a Area III Seam 2B thickness map. 5-16 Area IV N Seam 2B thickness map. 5-16a Area IV N Seam 2B top of seam structure. 5-16b Area IV N Seam 2B iso-overburden map. 5-17 Area III Seam 3 top of seam structure and iso-overburden map. 5-17a Area III Seam 3 thickness map. Area IV N Seam 3 thickness map. 5-18 Area IV N Seam 3 top of seam structure. 5-18a 5-18b Area IV N Seam 3 iso-overburden map. Area III Seam 4 top of seam structure and iso-overburden map. 5-19 5-19a Area III Seam 4 coal thickness map. 5-20 Area IV N Seam 4 thickness map. 5-20a Area IV N Seam 4 top of seam structure. 5-20b Area IV N Seam 4 iso-overburden map. 5-21 Area IV N Seam 5 thickness map. 5-21a Area IV N Seam 5 top of seam structure. 5-21b Area IV N Seam 5 iso-overburden map. Area II Seam 6A top structure and iso-overburden map. 5-22 5-22a Area II Seam 6A thickness map. 5-23 Area III Seam 6A top of structure and iso-overburden map. 5-23a Area III Seam 6A thickness map.

### CHAPTER 5 GEOLOGY Table of Contents

- 5-24 Area II Seam 6B top of seam structure and iso-overburden map.
- 5-24a Area II Seam 6B thickness map.
- 5-25 Area III Seam 6B top of seam structure and iso-overburden map.
- 5-25a Area III Seam 6B thickness map.
- 5-26 Area IV N Seam 6 thickness map.
- 5-26a Area IV N Seam 6 top of seam structure.
- 5-26b Area IV N Seam 6 iso-overburden map.
- 5-27 Area II Seam 7 top of seam structure and iso-overburden map.
- 5-27a Area II Seam 7 thickness map.
- 5-28 Area III Seam 7 top of seam structure and iso-overburden map.
- 5-28a Area III Seam 7 thickness map.
- 5-29 Area IV N Seam 7 thickness map.
- 5-29a Area IV N Seam 7 top of seam structure.
- 5-29b Area IV N Seam 7 iso-overburden map.
- 5-30 Area II Seam 8A top of seam structure and iso-overburden map.
- 5-30a Area II Seam 8A thickness map.
- 5-31 Area III Seam 8A top of seam structure and iso-overburden map.
- 5-31a Area III Seam 8A thickness map.
- 5-32 Area IV N Seam 8A thickness map.
- 5-32a Area IV N Seam 8A top of seam structure.
- 5-32b Area IV N Seam 8A iso-overburden map.
- 5-33 Area I Seam 8B top of seam structure and iso-overburden map.
- 5-33a Area I Seam 8B thickness map.
- 5-34 Area II Seam 8B top of seam structure and iso-overburden map.
- 5-34a Area II Seam 8B thickness map.
- 5-35 Area III Seam 8B top of seam structure and iso-overburden map.
- 5-35a Area III Seam 8B thickness map.
- 5-36 Area IV N Seam 8B thickness map.
- 5-36a Area IV N Seam 8B top of seam structure.
- 5-36b Area IV N Seam 8B iso-overburden map.
- 5-37 Area I Rider seam above Seam 8B top of seam structure and iso-overburden map.
- 5-37a Area I Rider seam above Seam 8B coal thickness.

### CHAPTER 6 GROUNDWATER HYDROLOGY Table of Contents

6.1	AQUIFER DELINEATION
-----	---------------------

- 6.2 **GROUNDWATER QUANTITY**
- 6.3 **GROUNDWATER QUALITY**
- 6.4 **GROUNDWATER USES**
- 6.5 ALLUVIAL VALLEY FLOOR ASSESSMENT
- 6.6 GROUNDWATER MONITORING PLAN
- 6.7 **REFERENCES**

## LIST OF APPENDICES

- 6-A Quality Assurance and Quality Control Water Quality
- 6-B Well Completion Records
- 6-C Pictured Cliff and Alluvial Water Quality Records
- 6-D Solutions to OSMRE Concerns and Deficiencies Related to the Groundwater Sections of the Navajo Mine Permit Application Package
- 6-E Water Supply Wells Within and Adjacent to the Navajo Mine Lease
- 6-F Special Condition (11/89)
- 6-G Baseline Groundwater Update for Navajo Mine Area IV North

## LIST OF FIGURES

- 6-1 Completion Diagram
- 6-2 Slug Test Well GM30
- 6-3 Recovery Test Well T4-1
- 6-4 Vertical Head No. 8 Seam
- 6-5 Vertical Head No. 7 Seam
- 6-6 Vertical Head No. 4 No. 6 Seams
- 6-7 Vertical Head No. 2 No. 3 Seams
- 6-8 Method of Calculation, Recovery Test SJKF-84-3, Seam 8
- 6-9 Method of Calculation, Recovery Test SJKF-84-4, Seam 8
- 6-10 Method of Calculation, Recovery Test SJKF-84-5, Seam 8
- 6-11 Method of Calculation, Recovery Test KF84-21(c), Seam 7
- 6-12 Method of Calculation, Recovery Test KF84-22 (b), Seam 7
- 6-13 Method of Calculation, Recovery Test KF84-20 (a), Seam 2
- 6-14 Method of Calculation, Recovery Test KF84-22(c), Seam 4
- 6-15 Method of Calculation, Recovery Test KF84-22 (d), Seam 3
- 6-16 Method of Calculation, Recovery Test KF84-22 (e), Seam 2
- 6-17 Method of Calculation, Recovery Test KF84-20 (d), Seam 7

## CHAPTER 6 GROUNDWATER HYDROLOGY Table of Contents

## LIST OF TABLES

- 6-1 Aquifer Discharge Characteristics
- 6-2 Groundwater Water Quality Summary
- 6-3 Navajo Mine Groundwater Wells
- 6-4 Groundwater Sampling Parameter List
- 6-4.1 Non-Navajo Mine Wells Adjacnet to Lease Boundary
- 6-5 Groundwater Monitoring Reference Criteria
- 6-6 Analytical Methods and Detection Limits

- 6-1 Well Location Map
- 6-2 No. 8 Potentiometric Surface
- 6-3 No. 7 Potentiometric Surface
- 6-4 No. 4-6 Potentiometric Surface
- 6-5 No. 2-3 Potentiometric Surface
- 6-6 Location of Well/Piezometer sites
- 6-7 Compliance Monitoring Well, NPDES Outfall and Surface Water Monitoring Stations Locations

### CHAPTER 7 SURFACE WATER HYDROLOGY Table of Contents

L DESCRIPTION
L DESCRIPTIO

- 7.2 SURFACE WATER DRAINAGES
- 7.3 SURFACE WATER QUALITY
- 7.4 SURFACE WATER MONITORING PLAN
- 7.5 **REFERENCES**

#### LIST OF APPENDICES

- 7-A Hosteen Wash Pre-Mine Hydrology and Sedimentology SEDCAD+ Files. 2-Yr., 6-Hr.; 10-Yr., 6-Hr.; 25-Yr., 6-Hr.; and 100-Yr., 6-Hr.
- 7-B Barber Wash Pre-Mine Hydrology and Sedimentology SEDCAD+ Files. 2-Yr., 6-Hr.; 10-Yr., 6-Hr.; 25-Yr., 6-Hr.; and 100-Yr., 6-Hr.
- 7-C Neck Arroyo Pre-Mine Hydrology and Sedimentology SEDCAD+ Files. 2-Yr., 6-Hr.; 10-Yr., 6-Hr.; 25-Yr., 6-Hr.; and 100-Yr., 6-Hr.
- 7-D Lowe Arroyo Pre-Mine Hydrology and Sedimentology SEDCAD+ Files. 2-Yr., 6-Hr.; 10-Yr., 6-Hr.; 25-Yr., 6-Hr.; and 100-Yr., 6-Hr.
- 7-E Geochemical Signature Summary
- 7-F Total Sediment Analysis Procedure
- 7-G Chinde Arroyo Pre-Mine Hydrology and Sedimentology SEDCAD+ Files. 2-Yr., 6-Hr.; 10-Yr., 6-Hr.; 25-Yr., 6-Hr.; and 100-Yr., 6-Hr.
- 7-H Cottonwood Arroyo Pre-mine Hydrology and Sedimentology SEDCAD<sup>+</sup> Files
- 7-I Cottonwood Arroyo Automated Samplers Total Sediment Laboratory Data
- 7-J Cottonwood Arroyo Automated Samplers Total Sediment Graphs, Particle Size Distribution Graphs, Texture Graphs
- 7-K Cottonwood Arroyo Automated Samplers Chemistry Data
- 7-L Cottonwood Arroyo Storm Hydrographs
- 7-M Surface Water Quality Monitoring Data Analysis For Stations CD-1 & CD-2 (1996-2003)
- 7-N South Barber Pre-Mine Hydrology & Sedimentology
- 7-O Chaco and Pinabete Tributaries Pre-Mining Hydrology and Sedimentology

## LIST OF FIGURES

- 7-1 Existing and Pre-Mine Longitudinal Profiles For Chinde Arroyos.
- 7-2 Location Map, Surface Water Monitoring Stations
- 7-3 OPEN
- 7-4 OPEN

### CHAPTER 7 SURFACE WATER HYDROLOGY Table of Contents

## LIST OF TABLES

- 7-1 Drainage Basin Characteristics San Juan River at Shiprock, NM.
- 7-2 Drainage Basin Characteristics Chaco River Near Waterflow, NM.
- 7-3 Precipitation Values (in inches) for Design Storms, Navajo Mine Drainage Basins.
- 7-4 Cottonwood Arroyo 1997 -1999 Monitoring Data
- 7-5 Cottonwood Arroyo 1997 -1999 Surface Water Data from Automated Stations
- 7-6 Cottonwood Sedcad Pre-mine Results Outlet at Chaco Wash Junction J4
- 7-7 Summary of Surface Water Monitoring Data Average Values
- 7-8 Navajo Mine Surface Water Monitoring
- 7-9 Watershed Areas Associated with Navajo Mine
- 7-10 Surface Water Quality Parameters

- 7-1 OPEN
- 7-2 OPEN
- 7-3 Chinde Arroyo Pre-Mining SEDCAD Drainage Subdivision
- 7-4 Lowe, Cottonwood, and Pinabete Arroyo Pre-mining Sedcad Drainage Subdivisions
- 7-4c Hosteen and Barber Pre-Mining SEDCAD Drainage Subdivision
- 7-5 OPEN
- 7-6 Cross-Sections Cottonwood Wash Surface Water Monitoring Stations CN-1, CS-1, CNS-1 June 1999 and January 2000 Surfaces

## CHAPTER 8 SOIL RESOURCES Table of Contents

#### 8.1 INTRODUCTION

- 8.2 GENERAL NATURE OF THE SURVEY AREA
- 8.3 SOIL SURVEY PROCEDURES
- 8.4 GENERAL SOILS MAP
- 8.5 DETAILED SOILS MAP
- 8.6 CLASSIFICATION OF THE SOILS
- 8.7 KEY TO SOILS
- 8.8 SOIL SERIES DESCRIPTIONS AND LABORATORY DATA
- 8.9 PRIME FARMLAND DETERMINATION
- 8.10 **REGOLITH SAMPLING PROGRAM**
- 8.11 **REFERENCES**

### LIST OF APPENDICES

lysis

- 8-B Soil Sample Characteristic by Mine Area
- 8-C Sample Characteristics of the Soil Series
- 8-D Availability of Topdressing Material by Mine Area
- 8-E Availability of Topdressing Material by Mapping Delineation of Each Mapping Unit
- 8-F Soil Series Descriptions and Laboratory Data.
- 8-G BIA-Land Operations letter and USDA-SCS letter.
- 8-H Soil Survey of the Lowe Boxcut Exchange Area

## LIST OF TABLES

- 8-1 Extent and Proportion of each Mapping Unit for the Total Survey Area.
- 8-2 Topsoil Suitability Rating Guide.
- 8-3 Available and Salvageable Topdressing for the Survey Areas.

## LIST OF EXHIBITS

8-1 Detailed Soils Map, Area I, II, III & IV, Navajo Mine (7 Sheets)

### CHAPTER 9 VEGETATION INFORMATION Table of Contents

- 9.1 INTRODUCTION
- 9.2 VEGETATION MAPPING AND SAMPLING
- 9.3 METHODOLOGY
- 9.4 **RESULTS AND DISCUSSION**
- 9.5 WILDLIFE HABITATS
- 9.6 THREATENED AND ENDANGERED PLANT SPECIES SURVEYS
- 9.7 **REFERENCES**

#### LIST OF TABLES

- 9-1 1985-86 Cover, Production and Shrub Density Data By Range Site For Navajo Mine (Area I III).
- 9-2 1987 Cover, Production and Shrub Density Data By Range Site For Navajo Mine Area IVN.

### LIST OF EXHIBITS

- 9-1a Navajo Mine Range Sites (sheet 1 of 6).
- 9-1b Navajo Mine Range Sites (sheet 2 of 6).
- 9-1c Navajo Mine Range Sites (sheet 3 of 6).
- 9-1d Navajo Mine Range Sites (sheet 4 of 6).
- 9-1e Navajo Mine Range Sites (sheet 5 of 6).
- 9-1f Navajo Mine Range Sites (sheet 6 of 6).

#### LIST OF APPENDICES

- 9-A A Survey for Threatened, Endangered and Sensitive Species Report for South Dixon Extension Area
- 9-B Threatened, and Endangered, and Sensitive (TES) Flora Survey Report, BHP Billiton – Navajo Mine; Area IV North San Juan County, New Mexico

## CHAPTER 10 WILDLIFE Table of Contents

### **10.1 INTRODUCTION**

- **10.2 SURVEY METHODS**
- 10.3 **RESULTS AND DISCUSSIONS**
- 10.4 SUMMARY AND CONCLUSIONS
- 10.5 ASSESSMENT OF IMPACTS TO WILDLIFE
- 10.6 FISH AND WILDLIFE MITIGATION PLAN
- 10.7 MONITORING PLAN
- **10.8 REFERENCES**

## LIST OF TABLES

- 10-1Sampling Intensities for Various Habitats Sampled During Small Mammal<br/>Trapping in the WESCO Study Area, Northwestern New Mexico, 1973 and 1974.
- 10-2 Summary of Black-footed Ferret Survey Effort on the Navajo Mine, Northwestern New Mexico, 1983-87.
- 10-3 Mammal Species Observed On and Adjacent to the Navajo Mine Lease, and Other Species that may occur in Northwestern, New Mexico.
- 10-4 Relative Abundance of Small Mammals (#/100 Trapnights) Trapped in Several Habitats on and near the Navajo Mine, Northwestern New Mexico, 1973 and 1974.
- 10-5 Birds Observed on or near the Navajo Mine Lease and Other Species that may occur in Northwestern New Mexico.
- 10-6 Summary of Roadside Breeding Birds Surveys Conducted on Areas IV and V of the Navajo Mine Lease and Adjacent Areas in Northwestern New Mexico.
- 10-7 Summary of Roadside Breeding Bird Surveys Conducted on Areas I, II, and III of the Navajo Mine Lease in Northwestern New Mexico.
- 10-8 Species of Birds Observed During General Reconnaissance Around Stock Ponds and Arroyos on the Navajo Mine Lease and Adjacent Habitats, Northwestern New Mexico.
- 10-9 Number and Relative Abundance of Non-Waterfowl Birds Observed on the Navajo Mine Lease and Adjacent Habitats, Northwestern New Mexico.
- 10-10 Summary of Waterfowl Observed on Natural or Man-made Stock Ponds on or Adjacent to the Navajo Mine Lease, Northwestern New Mexico.
- 10-11 Summary of Waterfowl Observed on Morgan Lake, Adjacent to the Navajo Mine Lease, Northwestern New Mexico.
- 10-12 Raptor Nests on the Navajo Mine Lease Within Approximately One-Quarter Mile of Adjacent Area, Northwestern New Mexico.
- 10-13 Relative Abundance of Amphibians and Reptiles Observed on and Adjacent to the Navajo Mine Lease and Other Species that may occur in Northwest New Mexico.
- 10-14 Water Sources Ponds

#### CHAPTER 10 WILDLIFE Table of Contents

#### LIST OF FIGURES

- 10-1 Matrix Used to Identify Relative Impacts for Wildlife on the Navajo Mine Permit Area, Northwestern New Mexico.
- 10-2 Impact on Wildlife Caused by the Navajo Mine, Northwestern New Mexico.

### LIST OF APPENDICES

10-A Wildlife Baseline Report (for Area IV North)

- 10-1 Wildlife Survey Areas 1973 1987
- 10-2 Important Wildlife Habitats
- 10-3 Stock Watering Pond Sites On and Near the Permit Area
- 10-4 Navajo Mine Permit and Buffer Zone Raptor Survey Area

- 11.1 LAND STATUS AND MARKERS
- 11.2 MINING PROCEDURES AND TECHNIQUES
- 11.3 ANNUAL COAL PRODUCTION
- 11.4 MAJOR MINING EQUIPMENT
- 11.5 MINE FACILITIES
- 11.6 PROBABLE HYDROLOGIC CONSEQUENCES
- 11.7 **REFERENCES**

## LIST OF APPENDICES

11-A	List of Residents
11-B	Public Blast Notice
11-C	Sample Blast Report and Scale Distance Factor Approvals, and Blast Reporting
11-D	Emma's Pond Design & As Built
11-E	Spur D Drainage/Sediment Control
11-F	Barber By-Pass Road
11-G	North Pinto Modification Design & As Built
11-H	Northeast Hosteen Outslopes Hydrology
11-I	Stability Analyses
11-J	NPDES Permit I.D. #NN0028193
11-K	Leach Study
11 <b>-</b> L	North Pond Expansion – Cell A2
11-M	Area III Main Access Road
11-N	Diversion Berm Design Data
11 <b>-</b> O	Lowe-Dixon Diversion Sediment Control
11-P	OPEN
11-Q	Lowe Railroad Embankments
11-R	OPEN
11-S	Lowe Boxcut Road Proposal, SEDCAD Calculations.
11 <b>-</b> T	South Dixon Ponds 1, 2 & 3 Hydrology
11 <b>-</b> U	Navajo Mine Railroad Sediment and Drainage Control Structures
11-V	Culverts Navajo Mine Hydrology Backup
11-W	Lowe/Dixon Temporary Diversion, Inlet Redesigns SEDCAD Backup
11-X	Lowe Arroyo Post-mining Hydrology & Sedimentology
11-X1	HEC-RAS Results for Lowe Reclaimed Drainage Channels
11-X2	HEC-RAS Results for Lowe Pre-mining Drainage Channels
11-X3	Area III Reclaimed Channels Rip-rapped Drop Structures
11-Y	Cottonwood Arroyo Post-mining Hydrology & Sedimentology
11-Y1	HEC-RAS Results for Cottonwood Reclaimed Drainage Channels
11-Y2	HEC-RAS Results for Cottonwood Pre-mining Drainage Channels
11-Z	Miscellaneous Hydrologic Structures

#### LIST OF APPENDICES (Continued)

11-AA	Sediment Ponds/Impoundments Hydrology Calculations
11-BB	Chinde Arroyo Post-Mining Hydrology and Sedimentology
11-CC	Hosteen Wash Post-Mining Hydrology and Sedimentology
11-DD	Barber Wash Post-Mining Hydrology and Sedimentology
11-EE	South Barber Channel Post-Mine Hydrology & Sedimentology
11-FF	Area I South Reclaimed Channels
11-GG	OPEN
11-HH	Landfarm Hydrology Data
11-II	Highwall Impoundment Design and As-Built Information
11 <b>-</b> JJ	Chinde Crossing-Design and As-Built Information
11-KK	Certificate of Registration for San Juan Regional Landfill
11 <b>-</b> LL	Navajo Mine RCRA Permit and Hazardous Waste Generator Status Permits
11-MM	Supplemental Groundwater Monitoring Study (November 1996 and Update Through
	March 1998)
11-NN	HEC-RAS Results for Area II Reclaimed Channels
11-00	Chinde Wash Surface Water Gain/Loss Report
11-PP	HEC-RAS Results for Area II Pre-Mine Channels
11-QQ	North Fork Diversion Channel
11-RR	Lowe/Dixon Diversion Channel Extension
11 <b>-</b> TT	Cottonwood Crossing Design by MWH Americas
11-UU	Doby North Channel Post-Mining Hydrology
11-VV	Navajo Mine: Mine Spoil Leachate Test Analyses
11-WW	Area IV Groundwater Modeling Report
11-XX	Neck Arroyo Post Mine SedCad

#### LIST OF FIGURES

- 11-1 Typical Operation-Navajo Mine
- 11-2 Typical Strip Layout
- 11-3 OPEN
- 11-4 North Fork Diversion Channel Drainage Control for Excess Material Dump
- 11-5 OPEN
- 11-6 OPEN
- 11-6b Typical Berm Reclamation Storage Yard
- 11-7 Coal Stockpile Area Typical Sections
- 11-8 Coal Stockpile Area Typical Plan
- 11-9 Topdressing/Regolith Berm Typical Section
- 11-10 OPEN
- 11-11 OPEN

# LIST OF FIGURES (Continued)

11-11.1 Drill Pad Typical Sections	
11-12 OPEN	
11-13 OPEN	
11-14 OPEN	
11-15 OPEN	
11-13 OPEN	
11-14 OPEN	
11-15 OPEN	
11-16 OPEN	
11-17 OPEN	
11-18 OPEN	
11-19 OPEN	
11-20 OPEN	
11-21 OPEN	
11-22 Railroad Culverts CP-14 and CP-13 Cross-section	
11-23 Railroad Culverts CP-8 and CP-9 Cross-section	
11-24 Area I Groundwater Models	
11-25 OPEN	
11-26 OPEN	
11-27 Typical Reclaimed Incised Pilot Channel Section N.T.S	
11-28 Area III Employee Coal Dump Access Road	
11-29 Typical Reclaimed Channel Section N.T.S.	
11-30 Water Elevations in Coal Monitoring Wells in the Vicinity of the Bitsui Pit	
11-31 Time Series of TDS and Sulfate in Coal Wells Located Near the Bitsui Pit	
11-32 Time Series of Boron Concentrations in Coal Wells Located Near the Bitsui Pit	
11-33 TDS Concentrations in Bitsui and Watson Wells	
11-34 Sulfate and Chloride Concentrations in Bitsui and Watson Wells	
11-35 Boron Concentrations in Bitsui and Watson Wells	
11-36 Predicted Sulfate Concentrations at well Bitsui-2	
11-37 Model Predicted Sulfate Concentrations at Specified Prediction Points	
11-38 Predicted Sensitivity of Sulfate Concentrations to Sulfate Decay Rate at Bitsui	ŧ2
11-39 Predicted Sensitivity of Sulfate Concentration to Sulfate Decay Rate at SKJF84	5
11-40 Mining Block Sequences for Proposed Mining in Area IV North	
11-41 Drawdown in the No. 8 Coal under Proposed Mining in Area IV North	
11-42 Drawdown in the No. 3 Coal under Proposed Mining in Area IV North	
11-43 Drawdown in the PCS under Proposed Mining in Area IV North	
11-44 Drawdown and Recovery in the PCS and Backfill with Area IV North Mining	
11-45 Drawdown and Recovery in the PCS, the No. 3 Coal and the No. 8 Coal at GM-	
11-46 Drawdown and Recovery in the PCS, the No. 3 Coal and the No. 8 Coal at GM-	-28

# LIST OF FIGURES (Continued)

11-47	PCS Steady-State Post-Mining Potentiometric Surface
11-48	Scenario 1 TDS Transport in the L1 after 500-years with Constant Source of 11,850 mg/l
11-49	Scenario 2 TDS Transport in the L1 after 500-years with Constant Source of 11,850
11.50	mg/l Secondia 2 TDS Transport in the L1 often 500 years with Constant Second of 11 850
11-50	Scenario 3 TDS Transport in the L1 after 500-years with Constant Source of 11,850 mg/l
11-51	Scenario 4 TDS Transport in the L1 after 500-years with Constant Source of 11,850 mg/l
11-52	Scenario 5 TDS Transport in the L1 after 500-years with Constant Source of 3,550 mg/l
11-53	Scenario 1 TDS Transport in the PCS after 500-years with Constant Source of 11,850 mg/l
11-54	Scenario 2 TDS Transport in the PCS after 500-years with Constant Source of 11,850 mg/l
11-55	Scenario 3 TDS Transport in the PCS after 500-years with Constant Source of 11,850 mg/l
11-56	Scenario 4 TDS Transport in the PCS after 500-years with Constant Source of 11,850
	mg/l
11-57	Scenario 5 TDS Transport in the PCS after 500-years with Constant Source of 3,550 mg/l
11-58	Scenario 1 TDS Transport in the No. 8 Coal after 500-years with Constant Source of 11,850 mg/l
11-59	Scenario 2 TDS Transport in the No. 8 Coal after 500-years with Constant Source of 11,850 mg/l
11-60	Scenario 3 TDS Transport in the No. 8 Coal after 500-years with Constant Source of 11,850 mg/l
11-61	Scenario 4 TDS Transport in the No. 8 Coal after 500-years with Constant Source of 11,850 mg/l
11-62	Scenario 5 TDS Transport in the No. 8 Coal after 500-years with Constant Source of 3,550 mg/l
11-63	Scenario 1 TDS Transport in the No. 3 Coal after 500-years with Constant Source of 11,850 mg/l
11-64	Scenario 2 TDS Transport in the No. 3 Coal after 500-years with Constant Source of 11,850 mg/l
11-65	Scenario 3 TDS Transport in the No. 3 Coal after 500-years with Constant Source of
	11,850 mg/l
11-66	Scenario 4 TDS Transport in the No. 3 Coal after 500-years with Constant Source of 11,850 mg/l

## LIST OF FIGURES (Continued)

11-67 Scenario 5 TDS Transport in the No. 3 Coal after 500-years with Constant Source of 3,550 mg/l

### LIST OF TABLES

11-1	Methods of Soil Analysis
11-2	Navajo Mine Topsoil and Topsoil Substitute Suitability Criteria
11-2a	Sediment Controls
11-3	Topdressing Stockpile Capacities, Regolith Stockpile Inventories
11-3A	Miscellaneous Mitigation Area Capacities
11-4A	Sewer and Loadout Facility Ponds
11-4B	Sewer and Loadout Ponds Hydrology Information
11-4C	Barber Loadout
11-4D	Lowe Loadout
11-4E	North Sewer Pond
11-5	Pond Cross Reference
11-5A – 11-5A	
11-6	Alternate Sediment Control Facilities
11-7	Highwall Impoundments and Impoundments Hazard Classification
11-8	Update of Structures Submitted for Permit Condition 1.B.
11-9	OPEN
11-10	OPEN
11-11	Primary Road Segments
11-11a	Ancillary Road Segments
11-12	OPEN
11-12a	Primary Road Culverts
11-12b	Ancillary Road Culverts
11-12c	Downdrains
11-13	Railroad Culverts
11-14	Comparison of Natural Groundwater Quality Before and After Leaching Through a
	Spoil Mixture
11-14a	Concentrations for Selected Constituents in Navajo Mine Monitoring Wells
11-14b	Selective Results of Batch Leach Tests
11-14c	Coal Combustion by Product Analysis Summary
11-14d	Spoils and Overburden Analysis Summary
11-14e	Trace Constituent Concentrations in Spoil and CCB Wells
11-14f	Batch Leaching Test Results
11-14g	Water Quality of the San Juan River Alluvium in Comparison with Mine Spoil Water

and Coal Water

#### LIST OF TABLES (Continued)

- 11-14h Recharge Rates and Hydraulic Properties of Mine Spoils for Groundwater Modeling
- 11-14i Estimated Source Concentrations in Mine Spoils
- 11-14j Summary of Transport Model Sensitivity Runs
- 11-14k Modeled Result for Alluvium at Mouth of Cottonwood
- 11-141 Estimated Post-Reclamation TDS in Cottonwood Alluvium
- 11-15 Topdressing Types and Quantities
- 11-16 Land Types and Curve Numbers
- 11-16a Topdressing Type, Quantities, and Curve Numbers for Area I
- 11-16b Topdressing Type, Quantities, and Curve Numbers for Area II
- 11-16c Topdressing Type, Quantities, and Curve Numbers for Area III
- 11-16d Topdressing Type, Quantities, and Curve Numbers for Area IV North
- 11-17 Comparison of Pre- & Postmining Areas, Peak Flows and Sediment Yields: Chinde Arroyo 10-year, 6-hour Precipitation Events
- 11-18 Comparison of Pre- and Postmining Peak Flow and Sediment Yields: Hosteen Wash, 10-Yr., 6-Hr. Precipitation Event
- 11-19 Comparison of Pre- and Postmining Areas Peak Flow and Sediment Yields: Barber Wash, 10-Yr., 6-Hr. Precipitation Event
- 11-20 Comparison of Pre- and Postmining Peak Flow and Sediment Yields: South Barber Drainage, 10-Yr., 6-Hr. Precipitation Event
- 11-21 Comparison of Pre- and Postmining Areas, Peak Flows and Sediment Yields: Neck Arroyo, 10-Yr., 6-Hr. Precipitation Event
- 11-22 Comparison of Pre- and Postmining Areas, Peak Flows and Sediment Yields: Lowe Arroyo, 10-Yr., 6-Hr Precipitation Event
- 11-23 Comparison of Pre- and Postmining Areas Peak Flow and Sediment Yields: Cottonwood Wash, 10-Yr., 6-Hr. Precipitation Event
- 11-24 Pre-mine and Post-mining Channel Velocities (Chinde, Hosteen, and Barber Washes)
- 11-24a HEC-RAS Results (Chinde, Hosteen, and Barber Washes)
- 11-25 Areas Mined by Year
- 11-26 Pre-mine and Post-mining Channel Velocities (Lowe and North Fork Drainages)
- 11-26a HEC-RAS Results (Lowe and North Fork Drainages)

11-1	Area 4 North Pond 401 As-Built
11-1D	Area 4 North Pond 401 Design
11-2	Area 4 North Pond 402 As-Built
11-2D	Area 4 North Pond 402 Design
11-3	OPEN
11-4	Area 4 North Pond 404 As-Built
11-4D	Area 4 North Pond 404 Design
11-5	Area 4 North Pond 405 As-Built
11-5D	Area 4 North Pond 405 Design11-6 Area 4 North Pond 413
11-6	Area 4 North Pond 413 As-Built
11-6D	Area 4 North Pond 413 Design
11-7	Yazzie Silos Site Plan and Access Road
11-7A	Yazzie Silos Access Road As-Built
11-8	Blasting Area Location Map (2 Exhibits)
11-9	Mine Structures Location Map
11-10	Mine Structures Location Map
11-11	Mine Structures Location Map
11-12	OPEN
11-12B	Area-I Culvert/Dropbox Structure Locations and Watershed Areas
11-12C	Area II Culvert/Down Drainage Structure Locations and Watershed Areas
11-12C-1	Area II Culvert/Down Drainage Structure Locations and Watershed Areas
11-12C-2	Area II Watershed Area Yazzie "Y" Culverts (CP-31, 32, 33, & 34)
11-12D	Area II Culvert/Down Drainage Structure Locations and Watershed Areas
11-12E	Area III Culvert/Down Drainage Structure Locations and Watershed Areas
11-12F	Area III/4N Culvert/Down Drainage Structure Locations and Watershed Areas
11-13	OPEN
11-13B	Area I Impoundment and Pond Locations/Watershed Areas
11-13C	Area II Impoundment and Pond Locations/Watershed Areas
11-13D	Area II Impoundment and Pond Locations/Watershed Areas
	Area III Impoundment and Pond Locations/Watershed Areas
11-13F	Area III/4N Impoundment and Pond Location/Watershed Areas
11-14	OPEN
11-14A-J	OPEN
11-14K-T	Navajo Mine Rail Road Erosion and Drainage Control Structures
11-15A	Coal Stockpile Runoff Control Plan As-Built
11-16	Phase 2 Layout As-Built
11-17	Phase 2 Wastewater Collection/Treatment Plot, Grading and Drainage Plan-Sheet No. 1
	As-Built

11-18	Phase 2 Wastewater Collection/Treatment Plot, Grading and Drainage Plan – Sheet No. 3 As-Built
11-19	OPEN
11-20	OPEN
11-21	Phase 2 Wastewater Collection/Treatment General Arrangement and Mechanical for
	Lift Stations No. 1, 2, 3, and 4 As-Built
11-22	Sanitary Sewage Treatment Pond and Pumping Facilities As-Built
11-23	Phase 2 Wastewater Collection/Treatment Electrical Installation As-Built
11-24	Phase 2 Wastewater Collection/Treatment Plot, Grading and Drainage Plan No. 3 As- Built
11-25	Phase 2 Wastewater Collection/Treatment Pond No. 1 Expansion & Channel Sections and Details As-Built
11-26	OPEN
11-27	OPEN
11-28	Barber Loadout Pond As-Built
11-29	OPEN
11-30	Mason Drainage Along Railroad "As-built"
11-31	OPEN
11-32	OPEN
11-33	Emma's Pond As-Built
11-34	Emma's Pond Hydrology and Pond Design
11-35	North Pinto Pond As-Built
11-36	OPEN
11-37	OPEN
11-38	OPEN
11-38A	OPEN
11-39	Hosteen Pond #1 As-Built
11-40	Hosteen Pond 2 As-Built
11-41	Hosteen Pond 3 As-Built
11-42	OPEN
11-43	As-Built Barber Coal Stockpile Sedimentation Pond #2
11-44	As-Built Baber Coal Stockpile Detention Pond #3
11-45	Lowe Stockpile Pond As-Built
11-46	Vinnel Hydrology Plan
11-46A	Vinnel Pond As-Built
11-47	As-Built Northwest Dixon Pond
11-48	As-Built Southwest Dixon Pond
11-49	Lowe Highwall Ponds 304 and 305 Design
11-49a	OPEN

11-50	South Barber Pond Design
11-50A	South Barber Pond As-Built
11-51	OPEN
11-51A	OPEN
11-51B	OPEN
11-51C	Area III As-Built South Dixon Pond #1
11-51D	Area III As-Built South Dixon Pond #3
11-52	OPEN
11-53	Spur D Watersheds
11-54	Area III Lowe Pit Lowe Ramp-1 Haulroad Design
11-55	Doby/Pinto Reroute Haulroad
11-55A	Doby/Pinto Reroute Haulroad As-built (Sheet 1 of 3)
11-55B	Doby/Pinto Reroute Haulroad As-built (Sheet 2 of 3)
11-55C	Doby/Pinto Reroute Haulroad As-built (Sheet 3 of 3)
11-56	Yazzie Skyline Road As-built (Sheet 1 of 3)
11-56A	Yazzie Skyline Road As-built (Sheet 2 of 3)
11-56B	Yazzie Skyline Road As-built (Sheet 3 of 3)
11-57	Lowe Silos Facilities Access Road Design Rev
11-58	North Industrial Area Pump House Site
11-59	Burnham Temp Re-Route
11-59A	Burnham Temp Re-route #1 Design
11-59B	Burnham Temp Reroute #1 As-Built
11-59C	Burnham Temp Reroute #1 As-Built
11-60, A - C	Burnham Road Temporary Reroute #2 Design (4 Sheets)
11-61	OPEN
11-62	Hosteen Road Design Location Map
11-62,A,B	Hosteen Road Design (2 Sheets)
11-62C	Hosteen Road As-Built
11-62D	Area II Hosteen Area Haulroad As-built Location Map (3 Sheets)
11-63,A,B	Block "B" Road Modification Design
11-63C, D, E	Block "B" Road Modification As-Built
11-64	Burns Pass Road Re-alignment Design
11-64A	Burns Pass Road As-Built
11-65	Railroad Side Ditch\Channel at CP-2 Culvert
11-65A	As-built CP-2 Channel
11-66	OPEN
11-67	Lowe Railroad Impoundment #1 As-Built Design
11-67A	Lowe Railroad Impoundment #2
11-67B	Lowe Railroad Impoundment #2 As-Built

11-67C	Area III Lowe RR Impoundment #1 Modified Pond Design
11-67C 11-68	OPEN
11-69	OPEN
11-02	OPEN
11-72A	OPEN
11-72B	OPEN
11-73	OPEN
11-75	Chinde Arroyo Post-mining Sedcad Drainage Subdivision
11-75A	Hosteen and Barber Post-mining Sedcad Drainage Subdivision.
11-76	Area II Reclaimed Channel Alignment
11-76A	Area II Reclaimed Channel Chinde Branch 1 (4 sheets)
11-76B	Area II Reclaimed Channel Hosteen Branch 1 (2 sheets)
11-76C	Area II Reclaimed Channel South Barber Channel (2 sheets)
11-76D	OPEN
11-76E	Area II Reclaimed AND Pre-Mine Channel
11-76F	Area II Pre-mining Channel Alignment
11-76G	Area II Pre-mining Channel Hosteen Branch 1 (2 sheets)
11-76H	Area II Pre-mining Channel South Barber Channel
11-77	Lowe, Cottonwood and Pinabete Arroyo Post-mining Sedcad Drainage Subdivisions
11-78	Area III Reclaimed Channel Alignment HEC-RAS X-Section Locations (4 sheets)
11-78A	Area III Pre-mine Channel Alignment HEC-RAS X-Section Locations (3 sheets)
11-78B	Area III Reclaimed and Pre-mining Channel Profiles (3 sheets)
11-78C	Area III Reclaimed Channels Typical Sections and Details
11-79 to 83	Roads and Railroads
11-84	Area 4-N Roads and Railroads
11-84A	Typical Cross Sections for Primary Roads and Culverts
11-84B	Ancillary Roads Typical Cross-Sections
11-85	Area-1 Doby North Channel and Drop Structure Plan and Typical X-Sections
11-85A	Doby Channel Design (4 Sheets)
11-86	Area 3 Facilities Sandy Hill Drainage Control Design Location Map
11-87	OPEN
11-87A	Gorman Road As-Built
11-88	OPEN
11-89	OPEN
11-90	Area III Bypass Road – General Layout, Surface Hydrology and Drainage
11-90A	OPEN
11-91	OPEN
11-91A	OPEN
11-91B	OPEN

11-92	OPEN
11-93	Area III Neck Haulroad As Built (3 sheets)
11-94	A4N East & West Perimeter Road Design (3 Sheets)
11-95	Yazzie Spoil Side Road Design
11-95A	Yazzie Spoil Side Road As-Built
11-96	OPEN
11-97	OPEN
11-98	OPEN
11-99	OPEN
11-100	Barber Bypass Road Design
11-100A&B	Barber Bypass Road Design – Plan, Profile, and Sections
11-100C	Barber By-pass Road As-Built
11-100D	Area II Barber Area Haulroad As-built Location Map (2 Sheets)
11-100E	Area II South Barber By-Pass Extension Road Plan/Profile Asbuilt
11-101	OPEN
11-102A	Lowe By-pass Road Modification Design
11-102B	Lowe By-pass Road Modification As-built
11-103A	Lowe Boxcut Road Plan/Profile Designs
11-103B	Lowe Boxcut Road Design Cross-Sections
11-103C	Lowe Boxcut Road Planned Watershed
11-103D-H	Lowe Boxcut Road Plan and Profile As-Builts
11-104	Typical Diversion Berm Plan and Sections
11-105	North Sewer Pond As-Built
11-105A	Pond 5 As-built
11-106	"As-Builts" North Pond 1 (North Cells)
11-107	As Built Area III Sewer Pond
11-108	Lowe Loadout Pond As-Builts
11-109	CR Pond 4 As-built (2 Sheets)
11-110	Area 4 North Pond 1 Design
11-111	Area 4 North Pond 412 As-Built
11-111D	Area 4 North Pond 412 Design
11-112	Index Sheet
11-112A-G	Shop/Office Access Road
11-113	Pre-Mining SEDCAD+ Drainage Subdivision for Area I
11-114	Post-Mining SEDCAD+ Drainage Subdivision for Area I
11-115	Area 4 North Pond 3 As-Built
11-115D	Area 4 North Pond 3 Design
11-116	Area III Shop Temporary Diversion Plan, Profile and Cross-Section
11-117	OPEN

11 1174	
11-117A	South Dixon Pond 2 Modification Design
11-117B	As-Built South Dixon Pond 2
11-118	Area 4 North Pond 4 As-Built
11-118D	Area 4 North Pond 4 Design
11-119	Ramp 7 Road Re-Alignment, Location and Watershed Map
11-119A	Ramp 7 Road Re-Alignment, Plan/Profile
11-119B	Ramp 7 Road Re-Alignment, Plan/Profile Typical Sections
11-119C	As-Built Ramp 7 Road Re-Alignment Location Map
11-119D,E	As-Built Ramp 7 Road Re-Alignment Plan/Profile
11-119F	As-Built Ramp 7 Road Re-Alignment Cross Sections
11-120	Area 4 North Pond 5 Design
11-121	Area 4 North Pond 6 Design
11-122	OPEN
11-122A-D	Area I As-Built Coal Plant Road
11-123	Culverts CP-103 & CP-104 Plans, Sections & Details
11-124	West Hosteen Landfarm Design – Location and Plan
11-124A	West Hosteen Landfarm Design – Section and Profile
11-124B	West Hosteen Landfarm As-Built
11-125	OPEN
11-126	OPEN
11-127	OPEN
11-127A	Area III Design, Lowe Hole 3 Pond 2
11-127B	Area III Design, Lowe Hole 3 Pond 3
11-127C	Lowe Hole 3 Pond 3 As-built
11-127D	Lowe Hole 3 Pond 2 As-built
11-128	OPEN
11-129	Area II Design Barber Haulroad Modification
11-129A-C	Barber Haulroad Modification As-Built
11-130	OPEN
11-131	OPEN
11-132	OPEN
11-132A	OPEN
11-132B	Employee Coal Dump Design
11-132C	Employee Coal Dump Modification As-built
11-133	Block C Pond 1 Design
11-133A	Block C Pond 1 As-Built
11-134	Block C Pond 2 Design
11-134A	Block C Pond 2 As-Built
11-135	Block C Pond 3 Design

11-135A Block C Pond 3 As-Built	
11-135B Block C Pond 3 Typical Section and Profile of Modified Surface Drainage As-Built	
11-136 Block C Pond 4 DesignDixon Haul Road Design	
11-136A Block C Pond 4 As-Built	
11-137 Mason Haulroad Location Map, Plan, Profile, and Sections	
11-137A & B Dixon Haulroad As-built	
11-137C A3 Dixon Ramp 4 Design	
11-138 Mason Haulroad As-Built (3 Sheets)	
11-139 Mason Pond Design	
11-139A Mason Pond As-Built	
11-140 Dixon Reclamation Area As-built Plan, Profile and Sections	
11-141 Hosteen Yazzie Haulroad Design, Location & Typical Cross Sections	
11-141A Hosteen Yazzie Haulroad Design, Plan & Profile	
11-141B OPEN	
11-141C OPEN	
11-141D OPEN	
11-141E OPEN	
11-142 North Fork Diversion Channel Location and Pit Layout Map	
11-142A North Fork Diversion Channel SEDCAD Watershed Subdivisions	
11-142B & C North Fork Diversion Channel Plan, Profile, and Sections	
11-142D & E North Fork Diversion Channel As-built	
11-143 Area III South Dixon Pit Extension Burnham Road Reroute Location Map	
11-147 Proposed BR Construction Yard Access Road Design	
11-149 Historic Coal Combustion Byproduct Placement on Interim and Permanent Program	
Lands	
11-150 OPEN	
11-151-A, B, C Lowe-Dixon Diversion Pond, Plan, Profile, and Sections (4 sheets)	
11-152 North Fork Pond Design	
11-152A North Fork Pond As-Built	
11-153 Lowe Ramp 2 Haulroad As-built – Plan, Profile and Section	
11-154 Dixon Ramp 2 Haulroad As-built – Plan, Profile and Section	
11-155 Area-I North Facilities Access Road As-built Location Map (3 Sheets)	
11-156 Area 4 North Pond 406 Design	
11-157 Area 4 North Pond 407 Design	
11-158 Area 4 North Pond 408 As-Built	
11-158D Area 4 North Pond 408 Design	
11-159 Area 4 North Pond 409 & 410 As-Built	
11-159D Area 4 North Pond 409 & 410 Design	
11-161Area 4 North Pond 411 As-Built	

- 11-161D Area 4 North Pond 411 Design
- 11-162 Area 3 Proposed South Dixon Ponds 301 and 302 Design
- 11-163 Doby North Channel (Sheets 1-4)
- 11-164 Dixon Ramp 1 Haulroad Design
- 11-165 Lowe Ramp 4 Haulroad Design
- 11-166 Navajo Mine Pits with Monitoring Wells and PCS Potentiometric Surface (Rev 1105)
- 11-167 Navajo Mine Monitoring Well Locations and Hydrologic Sections (Rev 1105)
- 11-168 Community Livestock tanks and Potable Water Sources

- 12.1 RECLAMATION OBJECTIVES
- **12.2 RECLAMATION TIMETABLE**
- **12.3 BACKFILLING AND GRADING**
- 12.4 DISPOSAL OF EXCESS SPOIL
- 12.5 TOPDRESSING
- 12.5 REVEGETATION PLAN
- 12.6 SUBSIDENCE PLAN
- 12.7 CASING AND SEALING OF DRILL HOLES
- **12.8 DETERMINATION OF BOND**
- 12.9 PRE-MINE TOPOGRAPHY
- 12.10 HYDROLOGIC RECLAMATION PLAN
- 12.11 REFERENCES

### LIST OF APPENDICES

- 12-A Quality Assurance and Quality Control (QA/QC) Program, Soil and Overburden Sample Analysis. (Special Condition 12/91, 26-I)
- 12-B Bond Calculation Worksheets, Worse Case Bond Scenario 2014
- 12-C Riprap Requirements for Bond Reclamation Topography Channel Stabilization Bond Scenario 2014
- 12-D Reclamation Bond Adjustment Worksheets
- 12-E Permanent Impoundments Hydrology Calculations
- 12-F Lowe Corner 3 East and North Drop Structures
- 12-G BHP Navajo Coal Company Noxious Weed Management Plan

## LIST OF TABLES

- 12-1 Annual Reclamation Timetable
- 12-2 Approximate Permit Area Regrade Schedule
- 12-3 OSMRE Root-Zone Suitability Criteria for Navajo Mine
- 12-4 Topdressing Resources at Navajo Mine March 2000
- 12-5 <u>Original Navajo Mine Reclamation Seed Mixture</u>
- 12-5A Cool Season Reclamation Seed Mixture
- 12-5B Warm Season Reclamation Seed Mixture
- 12-5C High Shrub Reclamation Seed Mixture
- 12-6 Range Site/Community Identification
- 12-7 Reclamation Bond Summary Sheet
- 12-7A Reclamation Bond Adjustment Summary Out for review
- 12-8 Slope Distribution by Area for Pre and Post-mining Topography
- 12-9 Mitigation Resources at Navajo Mine
- 12.3.4-1 Permanent Impoundments

#### LIST OF FIGURES

12-1	Spoil Sampling Layout
------	-----------------------

- 12-2 Composite Sampling Procedures
- 12.2-1 Reclamation Volume Available for Fill and Volume Regraded by Fiscal Year
- 12.2-2 Regrade Schedule by Year and Pit
- 12.2-3 Topsoil and Mitigation Schedule by Year and Pit
- 12.2-4 Revegetation by Year and Pit
- 12-3 Conceptual Design of North Block C Bluff
- 12.3-1 Area 1 (South of Ramp 7) Slope Histogram
- 12.3-2 Area 2 Slope Histogram
- 12.3-3 Area 3 Slope Histogram
- 12.3-4 Area 4 North Slope Histogram
- 12.8-1 Typical Drill Hole Seal/Plug
- 12.10-1 Open
- 12.10-2 Open
- 12.10-3 Open

12-1	OPEN
14 1	OI LI V

- 12-2 Area-II Permit Term Disturbance Schedule
- 12-3 Area-III & 4N Permit Term Disturbance Schedules
- 12-4 Area-I Final Surface Configuration
- 12-5 OPEN
- 12-5A Area 1 South Final Surface Configuration
- 12-6 OPEN
- 12-6A Area II Final Surface Configuration
- 12-6B Area II Final Surface Configuration
- 12-7 Area-III FSC (Final Surface Configuration)
- 12-7A Area 4N Final Surface Configuration
- 12-8 Area-1 Revegetated Areas
- 12-9 Area-2 Revegetated Areas
- 12-10 Area-3 Revegetated Areas
- 12-11 Area II (Hosteen and Yazzie Area) Post Mining Configuration Bond Scenario 9/2014
- 12-12 Area II (Mason and Barber Area) Post Mining Configuration Bond Scenario 9/2014
- 12-13 Area III Post Mining Configuration Bond Scenario 9/2014
- 12-14 Area II North Bond Surface Configuration Bond Scenario 9/2014
- 12-15 Area II South Bond Surface Configuration Bond Scenario 9/2014
- 12-16 Area III Bond Surface Configuration Bond Scenario 9/2014

12-17	Area II (Hosteen and Yazzie Area) Cut Fill Contours Bond Scenario 9/2014
12-18	Area II (Mason and Barber Area) Cut Fill Contours Bond Scenario 9/2014
12-19	Area III Cut Fill Contours Bond Scenario 9/2014
12-20	Area II (Hosteen and Yazzie Area) Cut Fill Blocks Bond Scenario 9/2014
12-20	Area II (Mason and Barber Area) Cut Fill Blocks Bond Scenario 9/2014
12-22	Area III Cut/Fill Blocks Bond Scenario 9/2014
12-23	Area II (Hosteen and Yazzie Area) Topdressing Replacement Bond Scenario
12 23	9/2014
12-24	Area II (Mason and Barber Area) Topdressing Replacement Bond Scenario
10.05	9/2014 Ame III Tendrossing Benlessment Band Seeneric 0/2014
12-25	Area III Topdressing Replacement Bond Scenario 9/2014
12-26	Area II (Hosteen and Yazzie Area) Bond Spoil Mitigation Bond Scenario 9/2014
12-27 12-28	Area II (Mason and Barber Area) Bond Spoil Mitigation Bond Scenario 9/2014 Area III Bond Spoil Mitigation Bond Scenario 9/2014
12-28	Navajo Mine Reference Areas
12-29	Area 4N Cut/Fill Contours Bond Scenario 9/2014
12-30 12-30A	
	Area 4N Post-Mine Configuration Bond Scenario 9/2014
12-30B 12-30C	Area 4N Bond Surface Configuration Bond Scenario 9/2014 Area 4N Cut/Fill Block Bond Scenario 9/2014
12-30C 12-30D	
12-30D 12-30E	Area 4N Topdressing Replacement Bond Scenario 9/2014 Area 4N Bond Spoil Mitigation Bond Scenario 9/2014
12-30E 12-31	Lowe Holes 1 & 2 Reclamation Stabilization Structures Plan View – Asbuilt
12-31 12-31A	Lowe Reclamation As-Built
12-31A 12-32	A3 Life of Mine Plan for Contemporaneous Reclamation
12-32 12-32A	Annual Regrade, Mitigation, and Topsoil Schedule
12-32R 12-32B	Annual Revegetation Schedule
12-32D 12-33	Lowe Corner 3, East Drop Structure Design
12-33 12-33A	Lowe Corner 3, East Drop Structure As-built
12-33R 12-33B	Lowe Corner 3, North Drop Structure As-built
12-33D 12-34	Area I Pre-mine Area
12-34 12-34A	Area II Pre-mine Area-A
12-34R 12-34B	Area II Pre-mine Area-B
12-34D 12-34C	Area III Pre-mine Area
12-34D	Area IV North Pre-mine Area
12-35	Area 1 Pre-Mining Surface and Post-Mining Surface Cross-Sections
12-35	Area I Cut Fill Blocks Bond Scenario 9/2014
12-30	Area I Topdressing Replacement Bond Scenario 9/2014
12-37	Area I Bond Spoil Mitigation Bond Scenario 9/2014
12-39	Area I Post Mining Configuration Bond Scenario 9/2014
12 37	The second

- 12-40 Area I Bond Surface Configuration Bond Scenario 9/2014
- 12-41 Area I Cut Fill Contours Bond Scenario 9/2014
- 12-42 Area II Permit Area Block C Pre Mine Bluffs
- 12-43 Lowe Permanent Impoundment 1
- 12-43A Lowe Permanent Impoundment 1 As-Built
- 12-44 As-Built Barber & Block C Reclamation
- 12-45 Doby Ramps 12, 13, and 14 Postmine Topography and Depicted Areas for RUSLE 1.06 Analysis
- 12-45A Doby Ramps 12, 13, and 14 Premine Topography and Depicted Areas for RUSLE 1.06 Analysis
- 12-46 Chinde Sub Drainage Location Map for 434 Standard Assessment