

**SECTION 26**

**DRAINAGE CONTROL PLAN**

**TABLE OF CONTENTS**

<b>SECTION</b>	<b>SECTION TITLE</b>	<b>PAGE NUMBER</b>
SECTION 26	DRAINAGE CONTROL PLAN .....	1
26.1	Drainage Control Watersheds .....	1
26.2	Drainage Control Structures .....	1
26.2.1	Existing Drainage Control Structures .....	1
26.2.2	Impoundments and Siltation Structures General Plans .....	1
26.3	Drainage Control Structures Design Plans .....	2
26.3.1	Perennial and Intermittent Stream Diversions .....	2
26.3.2	Miscellaneous Flow Diversions Design Plans .....	2
26.3.3	Sedimentation Ponds .....	2
26.3.4	Siltation Structures Design Plans .....	4
26.3.5	Impoundments Design Plans .....	4
26.3.5.1	Highwall Impoundments .....	4
26.3.6	Other Drainage Control Structures Design Plans .....	6
26.4	Discharges to Underground Mines .....	6
26.5	Information Collection and Analysis .....	6
	Personnel .....	6
	References .....	7

**SECTION 26**

**DRAINAGE CONTROL PLAN**

**LIST OF TABLES**

**TABLE  
NUMBER      TABLE TITLE**

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[26.2-1](#)      Drainage Control Structures

**SECTION 26**

**DRAINAGE CONTROL PLAN**

**LIST OF EXHIBITS**

**EXHIBIT  
NUMBER      EXHIBIT TITLE**

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- [26.1-1](#)      Drainage Control Plan - Control Structures and Watersheds
- [26.3-1](#)      Pond 415 Design
- [26.3-2](#)      Pond 416 Design

**SECTION 26**

**DRAINAGE CONTROL PLAN**

**LIST OF APPENDICES**

**APPENDIX**

**NUMBER      APPENDIX TITLE**

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[26.A](#)              Pond 415 Hydrologic Analysis and Design

[26.B](#)              Pond 416 Hydrologic Analysis and Design

**SECTION 26**

**DRAINAGE CONTROL PLAN**

**LIST OF REVISIONS DURING PERMIT TERM**

<b>REV.</b>		<b>DATE</b>
<b>NUMBER</b>	<b>REVISION DESCRIPTION</b>	<b>APPROVED</b>

---

## **SECTION 26 DRAINAGE CONTROL PLAN**

Drainage control structures will be designed to meet the applicable performance standards of 30 CFR Subchapter K and the Mine Safety and Health Administration (MSHA) standards and requirements for impoundments.

### **26.1 Drainage Control Watersheds**

The watersheds for drainage control structures were delineated using aerial mapping on 10-ft contours inside the permit area and U.S. Geologic Survey (USGS) quadrangle sheets on 10- or 20-foot contours outside the Pinabete Mine Plan permit area (permit area). The watersheds are presented on [Exhibit 26.1-1](#). The curve numbers were determined using data from a detailed soil survey conducted inside the permit area, presented in Section 14 (Soil), and data from the Natural Resources Conservation Service (NRCS) soil surveys, *Soil Survey of San Juan County New Mexico, Eastern Part* (Keetch 1980), for areas outside the permit area. The soil mapping units were classified into four groups based on the surface texture; fine, fine loamy, coarse loamy, and sandy. The four groups have a combination of different hydrologic groups: fine 100% hydrologic group D; fine loamy 3.9% hydrologic group B and 96.1% hydrologic group D; coarse loamy 65.4% hydrologic group B, 18.6% hydrologic group C, and 16.0% hydrologic group D; sandy 96.0% hydrologic group A, 3.5% hydrologic group B, and 0.5% hydrologic group D. The curve numbers assigned to the hydrologic groups are: A 65, B 78, C 87, and D 93. Using this data, a weighted curve number was determined for each soil texture group. The weighted curve numbers for the four soil texture groups are: fine 93, fine loamy 92.4, coarse loamy 81.9, and sandy 65.6. Using this data, a weighted curve number was calculated for the watersheds.

### **26.2 Drainage Control Structures**

The locations of the drainage control structures and their associated watersheds are presented on [Exhibit 26.1-1](#). [Table 26.2-1](#) identifies each structure and provides references for locating the supporting design data, design drawing, and the as-built drawing. The data referenced in the table for each respective structure provide the information required for demonstrating that the structures comply with applicable performance standards of 30 CFR Subchapter K and MSHA standards and requirements.

#### *26.2.1 Existing Drainage Control Structures*

Existing Area 4 North drainage structures will be utilized to facilitate the mining and reclamation operations along the northern permit boundary. These drainage control structures are identified on Exhibit 11-13F in the Navajo Mine Permit-0004F (BNCC 2009).

#### *26.2.2 Impoundments and Siltation Structures General Plans*

There will be no general plans for impoundments and siltation structures; a site-specific design will be developed for each structure.

### **26.3 Drainage Control Structures Design Plans**

#### *26.3.1 Perennial and Intermittent Stream Diversions*

Currently there is no plan to construct any diversions of perennial or intermittent stream diversions to facilitate mining operations in permit area. Should a need arise in the future; this section will be revised accordingly.

#### *26.3.2 Miscellaneous Flow Diversions Design Plans*

All miscellaneous flow diversion will meet the applicable performance standards described in 30 CFR Subchapter K and, in particular, §816.43.

The drainage plan associated with a site-specific design may require miscellaneous flow diversions to control drainage. These structures are an integral part of a site-specific design, thus, their design will be incorporated into the site-specific design package of the diversions that they are associated with.

All miscellaneous flow diversions will be classified as temporary diversions and will be designed to safely pass the peak flow from the 2 year 6 hour (2yr-6hr) storm event or greater. The watersheds for the diversion channels will be delineated, soil curve numbers determined, and precipitation values for the design storm obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas IV-New Mexico (NOAA 2006). The watersheds and channel or ditch will be modeled in SEDCAD to determine the peak flow and the required channel size. If the results from the hydraulic analysis indicate potential for erosion to occur, riprap rock or other forms of protective lining will be installed.

#### *26.3.3 Sedimentation Ponds*

The sediment ponds required to retain the runoff and sediment from a disturbed area will be constructed prior to commencing any type of surface disturbance upstream of the pond. They will be located as close as possible to the upstream area that will be disturbed. Construction of a pond will not commence until the engineering drawings and supporting design data have been reviewed and approved by OSM. After completion of construction, an as-built drawing of the pond will be developed and kept on file at the mine site; it will be made available upon request. A registered professional engineer will certify both the design and as-built drawings.

[Table 26.2-1](#) identifies each sediment pond and provides references for locating the supporting design data, design drawing, and the as-built drawing for each pond. The data referenced in the table for each respective pond provides the information required to demonstrate that the ponds comply with 30 CFR Sections 816.46, 816.47, and 816.49. The hazard classification for each pond is also specified on the table. The locations of the ponds are shown on [Exhibit 26.1-1](#).

A site-specific design will be developed for each sediment pond. They will be designed to meet the applicable performance standards of 30 CFR Subchapter K. The design criteria for the sediment ponds will be as follows:

- The design storm will be 10yr-24hr or the 100yr-6hr precipitation event.
- The design capacity will be the design storm runoff volume plus at least 15% to ensure there is adequate storage volume for sediment.
- Ponds designed to retain the 10yr-24hr runoff will have a spillway.
- Ponds designed to retain the 100yr-6hr runoff will not have a spillway.
- The spillway will safely pass the peak discharge from the 25yr-6hr storm event.
- The pond is assumed to be full when sizing the spillway.
- The pond will have a 1-foot freeboard with the spillway flowing.
- The design capacity will be less than 20 acre-feet (ac-ft).
- Riprap will be placed at the pond inlets and spillways if hydraulic analysis indicates that a protective lining is required to minimize and control erosion.
- Embankments will have a minimum static safety factor of 1.3.

The capacity of all sediment ponds will be less than 20 ac-ft. These are small ponds located in a rural area and in the event of a failure they will not constitute a hazard to the general public, mine employees, mine equipment, and public transportation or utilities. The potential for loss of life and property damage is very low. They will all be classified as low-hazard-potential dams.

To demonstrate that the pond embankments will have a minimum static safety factor of 1.3, a slope stability analysis has been performed on a worst-case scenario, i.e., maximum embankment height. Because the embankments are to be constructed with similar type soils, a worst-case analysis should be sufficient. The slope stability analysis is presented in Appendix 23.A.

To ensure that the design storm runoff volume is maintained, the maximum permissible gauge reading for the water or sediment level is provided. The volume above the maximum permissible water or sediment level is equal to the design storm runoff volume, and the volume below it is the excess volume. If the water or sediment level should exceed the maximum permissible gauge reading, then the impoundment will be either pumped or cleaned out down to an acceptable level. This will ensure that the design storm runoff volume is maintained at all times. The maximum permissible gauge reading for the water or sediment level is provided for each impoundment, except for the sewer ponds, raw water storage ponds, and highwall impoundments. The maximum permissible gauge reading for each pond is provided on [Table 26.2-1](#).



The watershed sizes and curve numbers can change due to areas being mined and reclaimed. This can result in changes in the volume of surface runoff that needs to be retained by the ponds. The supporting hydrology data and the maximum permissible gauge reading will be updated annually to account for these changes.

After a runoff event, 90% of the design capacity will be restored within 10 days, provided the ponds are accessible. Weather and ground conditions may limit access to some ponds, particularly those in the reclaimed and undisturbed areas. Accessing these ponds with dewatering equipment during muddy conditions can cause excessive damage to adjacent undisturbed or reclaimed lands. In such a case, dewatering will occur as soon as conditions improve.

Prior to commencing construction of the ponds, the topsoil will be removed and placed in a stockpile. To prevent excessive settlement, the pond will be located on stable ground and the embankment will be adequately compacted. The fill area will be cleared of trees, stumps, roots, boulders, vegetation, and rubbish prior to beginning placement of fill material. Only suitable fill material free of debris, organic material, frozen matter, and excessive moisture or dryness will be used to construct the embankments. The fill material will be properly compacted. To keep surface disturbance to a minimum, excavation and placement of fill will be limited to the lines and grades indicated on the design drawings.

Inspection and maintenance will be conducted on a periodic basis to ensure that ponds are functional and in good condition. Inspections will be performed on a quarterly basis; the fourth quarter inspection will be an annual inspection, the results of which will be submitted to OSM. The quarterly inspections will be kept on file at the mine site. Any maintenance items identified from the inspections will be promptly repaired or corrected. Further discussion on the inspection and maintenance of ponds is provided in Section 42 (Monitoring, Maintenance, Inspections, and Examinations).

#### *26.3.4 Siltation Structures Design Plans*

Currently there is no plan to construct any siltation structures that do not impound water. Should the need arise in the future; this section will be revised accordingly.

#### *26.3.5 Impoundments Design Plans*

There will be no typical design or general plans for impoundments; a site-specific design will be developed of each impoundment.

##### 26.3.5.1 Highwall Impoundments

When the mining pit is advancing in the upstream direction this may create a need to construct highwall impoundments to minimize the inflows into the pit and the immediate mining area (IMA). Impoundments

will be located upstream of the IMA on the highwall side of the pit. The primary intent is to retain all or a portion of the smaller intensity but more frequently occurring precipitation events, thereby enhancing the safety of work areas in the IMA (e.g., topsoil removal, truck/loader operation, blasting, and mining operations).

These highwall impoundments, although not intended to comply with surface runoff standards, will retain some sediment. In the event of a discharge or failure, the water released along with any sediment generated will be retained in the pit downstream. Discharges from these impoundments will not leave the permit area. Discharge through the spillways would be very infrequent since the annual rainfall for the area is approximately 6 in and generates infrequent surface runoff. These impoundments would be dry and empty a majority of the time.

[Table 26.2-1](#) identifies each highwall impoundment and provides references for locating the supporting design data, design drawing, and as-built drawing. The hazard classification for each impoundment is also specified on the table. The locations of the impoundments are shown on [Exhibit 26.1-1](#).

A site-specific design will be developed for each impoundment and submitted to OSM for approval. Construction will not commence until approval has been obtained. After completion of construction, an as-built drawing will be developed and kept on file at the mine site; it will be made available upon request. A registered professional engineer will certify both the design and as-built drawings.

The design criteria for the impoundments will be as follows:

- They will not be designed for a specific storm event, but will be capable of retaining the more frequently occurring storm events, i.e., between the 2yr-6hr and 5yr-6hr storm event.
- The spillway will safely pass the peak discharge from the 25yr-6hr storm event.
- The impoundment is assumed to be full when sizing the spillway.
- The impoundment will have a 1-foot freeboard with the spillway flowing.
- Capacity will be less than 20 ac-ft.
- A protective lining will be installed in the spillway if the hydraulic analysis indicates that it is required to control erosion.
- Embankments will have a minimum static safety factor of 1.3 (see Appendix 23.A).

The capacity of highwall impoundments will be less than 20 ac-ft. These are small impoundments located in a rural area and in the event of a failure they will not constitute a hazard to the general public, mine employees, mine equipment, and public transportation or utilities. The potential for loss of life and property damage is very low. They will all be classified as low-hazard-potential dams.

Prior to commencing construction of the pond, the topsoil will be removed and placed in a stockpile. To prevent excessive settlement, the impoundment will be located on stable ground and the embankment will be adequately compacted. The fill area will be cleared of trees, stumps, roots, boulders, vegetation, and rubbish prior to beginning placement of fill material. Only suitable fill material free of debris, organic material, frozen matter, and excessive moisture or dryness will be used to construct the embankments. The fill material will be properly compacted. To keep surface disturbance to a minimum, excavation and placement of fill will be limited to the lines and grades indicated on design drawings.

Inspection and maintenance will be conducted on a periodic basis to ensure that impoundments are functional and in good condition. Inspections will be performed on a quarterly basis; the fourth quarter inspection will be an annual inspection, the results of which will be submitted to OSM. The quarterly inspections will be kept on file at the mine site. Any maintenance items identified from the inspections will be promptly repaired or corrected. Further discussion on the inspection and maintenance of high wall impoundments is provided in Section 42 (Monitoring, Maintenance, Inspections, and Examinations).

#### *26.3.6 Other Drainage Control Structures Design Plans*

Refer to Section 25 (Sediment Control Plan) for diversion berms and other structures or methods utilized to control drainage, erosion, and sediment.

### **26.4 Discharges to Underground Mines**

There will be no discharge of water, coal-mine waste, coal combustion by-products, or other wastes into underground mine workings.

### **26.5 Information Collection and Analysis**

Certified exhibits for Section 26 are available for review upon request at either the BNCC offices or the OSM, Western Region, technical office in Denver, Colorado. Certified as-built drawings will be kept on file at the mine site and made available upon request.

#### *Personnel*

Persons or organizations responsible for data collection, analysis, and preparation of this permit application package section:

Ron Van Valkenburg

Kent Applegate

BHP Navajo Coal Company

GEOMAT, Inc.

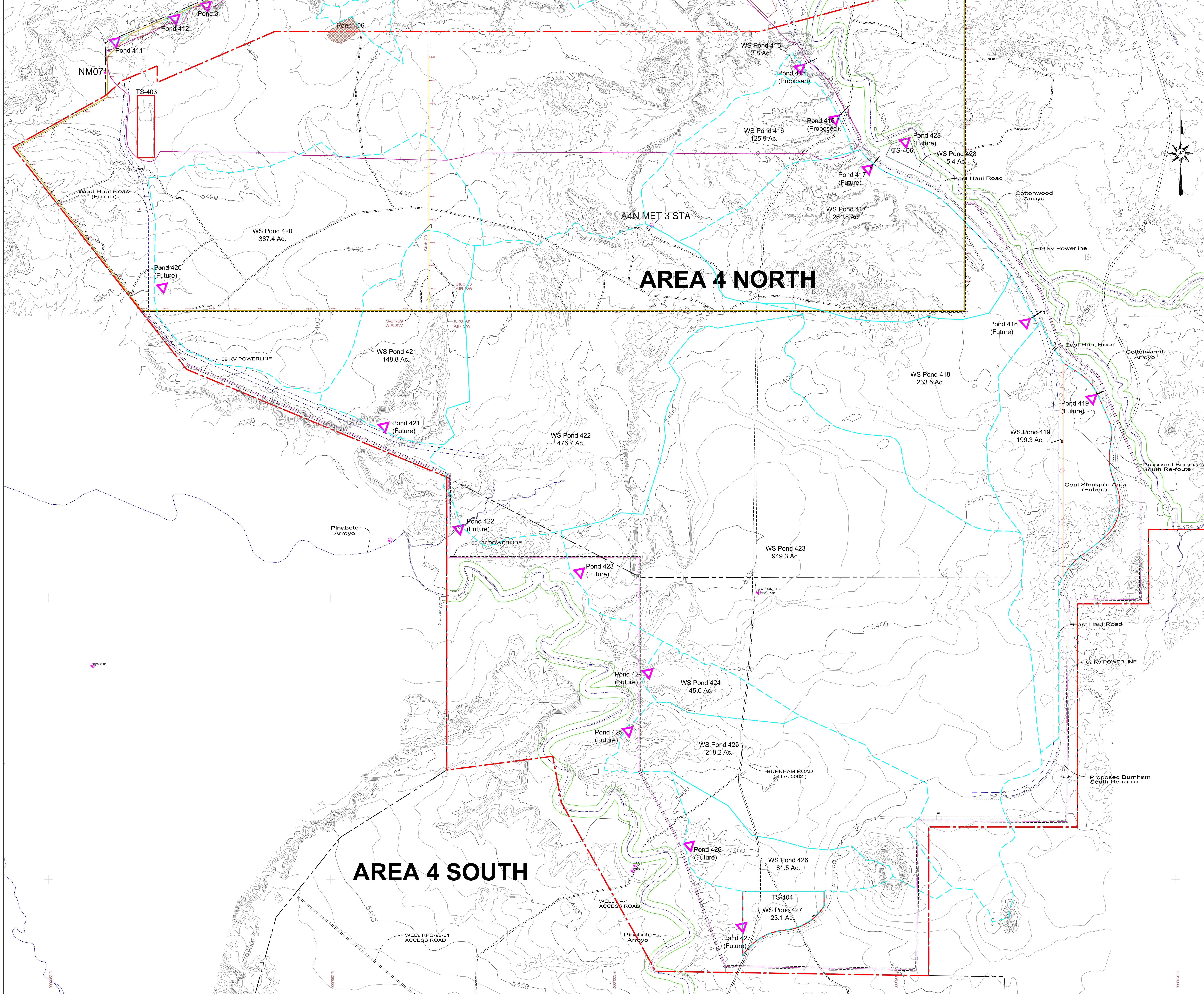
Farmington, NM

*References*

- BHP Navajo Coal Company (BNCC). 2009. Navajo Mine Permit Application Package. OSM Permit No. NM-0003F. On file at Office of Surface Mining Reclamation and Enforcement- Western Region Technical Office. Denver, Colorado.
- Keetch, C. Wesley. 1980. Soil Survey of San Juan County, New Mexico, Eastern Part. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.
- National Oceanic and Atmospheric Administration (NOAA). 2006. Precipitation-Frequency Atlas of the United States. Volume 1, Version 4.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah). NOAA Atlas 14. U.S. Department of Commerce, Washington D.C.

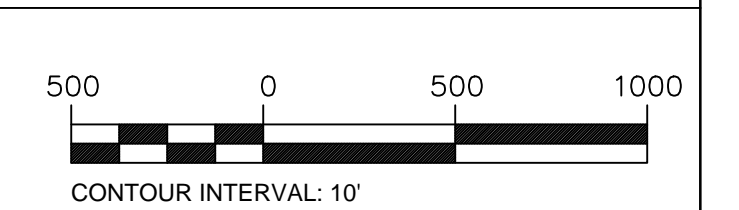
Table 26.2-1 Drainage Control Structures

Structure type	Structure identification	Hazard class	Watershed (ac)	Curve number	Design slope (%)	Maximum permissible gauge reading	Purpose	Design and as-built data	Const. date	Removal or recl. date	Reclamation plan
Sediment pond	Pond 415	Low	3.8	See <a href="#">Appendix 26.A</a>	NA	4.7 ft or El. 5310.7	Retains runoff and sediment from disturbed area	<a href="#">Exhibit 26.3-1</a> and <a href="#">Appendix 26.A</a>	2017	2036	Section 35.1
Sediment pond	Pond 416	Low	125.9	See <a href="#">Appendix 25.B</a>	NA	5.2 or El. 5303.2	Retains runoff and sediment from disturbed area	<a href="#">Exhibit 26.3-2</a> and <a href="#">Appendix 26.B</a>	2017	2036	Section 35.1
Sediment pond	Pond 417	Low	261.8	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 418	Low	233.5	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 419	Low	199.3	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 420	Low	387.4	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 421	Low	148.8	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 422	Low	476.7	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 423	Low	949.3	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 424	Low	45.0	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 425	Low	218.2	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 426	Low	81.5	NA	NA	NA	Retains runoff and sediment from disturbed area	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 427	Low	23.1	NA	NA	NA	Retains runoff and sediment from topdressing stockpile	To be designed prior to the end of first 5-year permit term	NA	NA	NA
Sediment pond	Pond 428	Low	5.4	NA	NA	NA	Retains runoff and sediment from topdressing stockpile	To be designed prior to the end of first 5-year permit term	NA	NA	NA



**LEGEND**

- PAVED ROAD
- DIRT ROAD
- HAUL ROAD
- TRAIL
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- STEAM BUFFER ZONE
- POWERLINE
- SPOT ELEVATION
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- 218
- 5422.45
- L-30
- LEASE CORNER
- LEASE BOUNDARY
- PERMIT BOUNDARY
- MONITORING SITES
- WATERSHED BOUNDARY
- POND LOCATION POINTS



Topo Revised by  
 Aero-Graphics, Inc.  
 2930 South West Temple  
 Salt Lake City, Utah 84115

Notes:  
 1. The design data for the mine support facilities are referenced on Tables 22.1-1, 23.2-1 and 26.2-1.  
 2. The hydrology and supporting design data for the drainage control structures are referenced on Table 26.2-1.

Original certified signed exhibits are maintained at the mine site and at O&M.

REV	DATE	BY	DESCRIPTION	APP'D	DATE

**CERTIFICATION STATEMENT**  
 I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

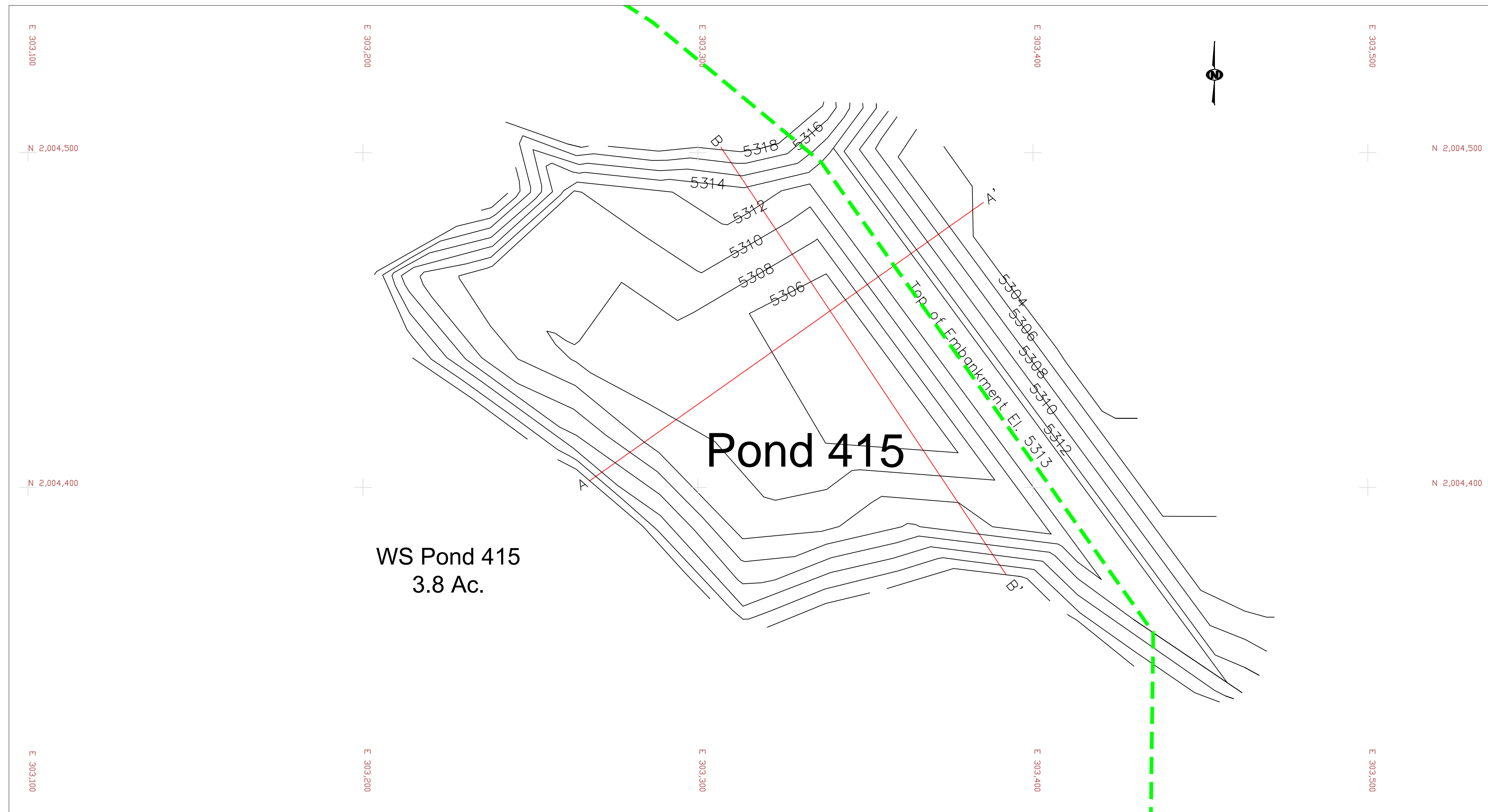


**EXHIBIT 26.1-1**  
**BHP NAVAJO COAL COMPANY**



**PINABETE PERMIT**  
**Drainage Control Plan**  
**Control Structures**  
**and Watersheds**

PREPARED BY: [Signature] DRAWN BY: [Signature] SCALE: 1"=500'  
 APPROVED BY: [Signature] DATE: Feb 2012 SHEET 1 of 1



PLAN 1"=20'

STAGE STORAGE  
Pinabete Permit POND 415

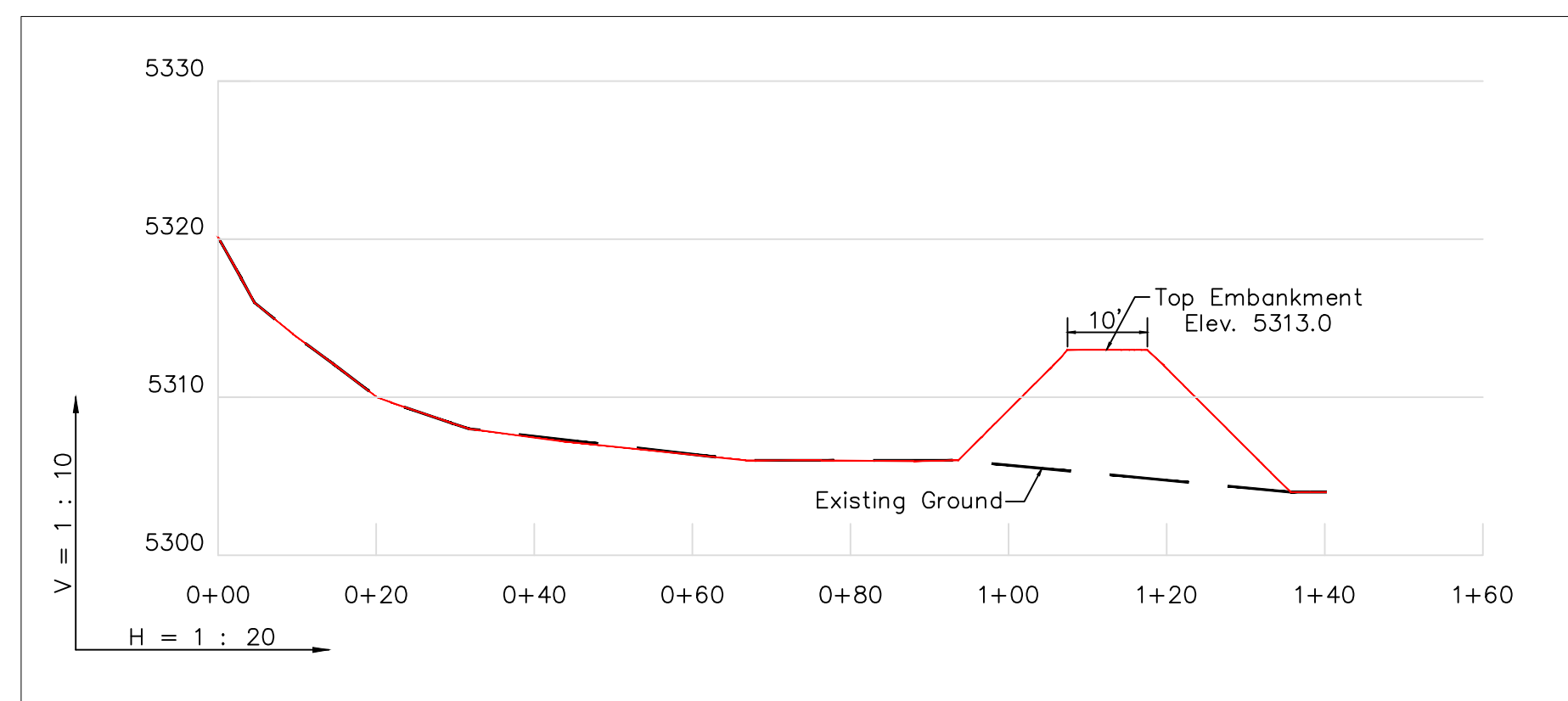
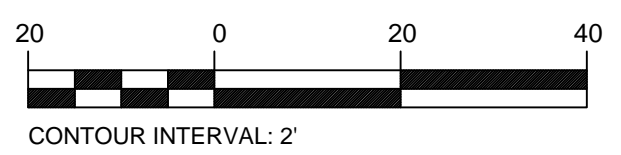
Elev. (ft)	AREA (AC)	Inc Volume (AC-FT)	Accum Volume (AC-FT)
5,306.0	0.04	0.00	0.00
5,308.0	0.11	0.15	0.15
5,310.0	0.21	0.33	0.48
5,312.0	0.28	0.49	0.97
5,314.0	0.32	0.60	1.57

LEGEND

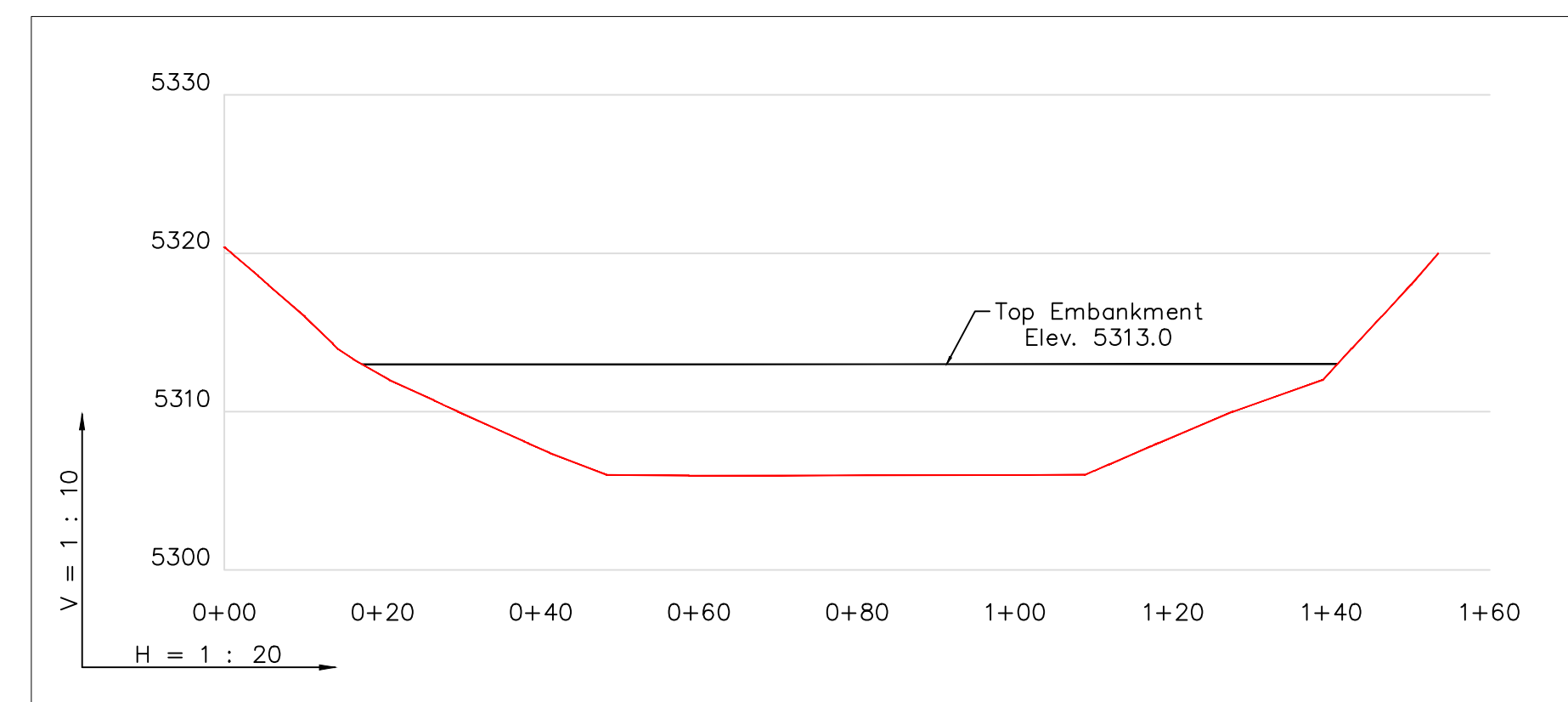
- ROAD
- WATERSHED
- CULVERT
- DRAINAGE
- SPOT ELEVATION
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- LEASE BOUNDARY
- PERMIT BOUNDARY

NOTES

- For location of drainage control structures and watersheds, refer to Exhibit 26.1-1
- The hydrology and supporting design data for the drainage control structures are referenced on Table 26.2-1 of the Pinabete Permit.



Profile A - A'



Profile B - B'

REV	DATE	BY	DESCRIPTION	REV	MO	RY
11-A	Feb-2012	RJV	Initial Submittal			

**CERTIFICATION STATEMENT**  
I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.



EXHIBIT 26.3-1

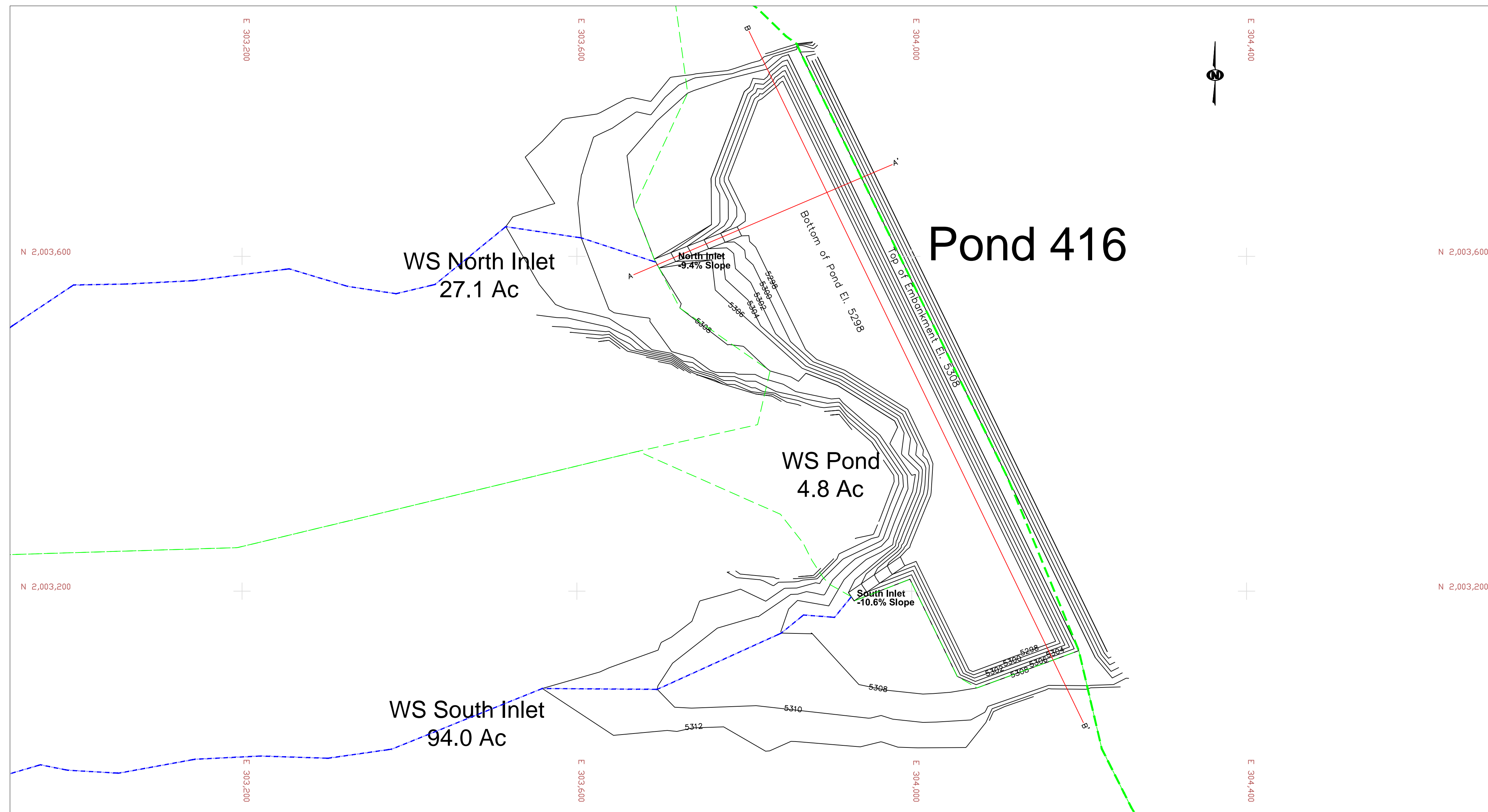


**BHP Navajo Coal Company**

P.O. Box 1717, Panguitch, New Mexico, 87416 Phone: 505-698-6200 Fax: 505-698-3911

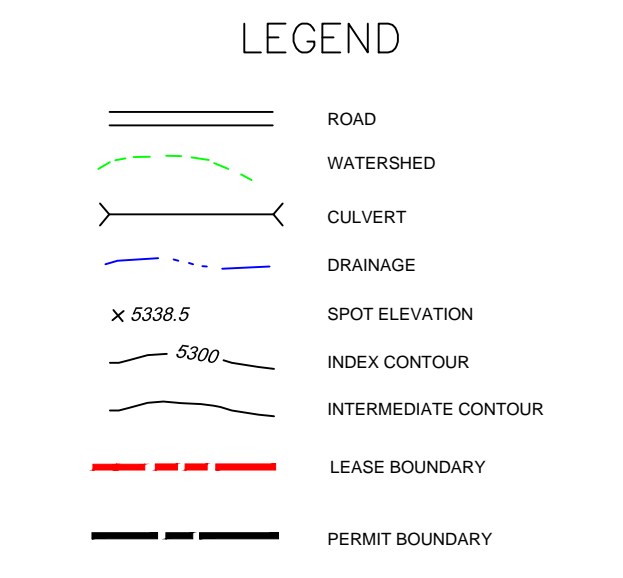
**Pond 415 Design**

PREPARED BY RCV	DRAWN BY RCV	SCALE 1"= 20'
APPROVED BY RCV	DATE Feb 2012	(SHEET 1 OF 1)

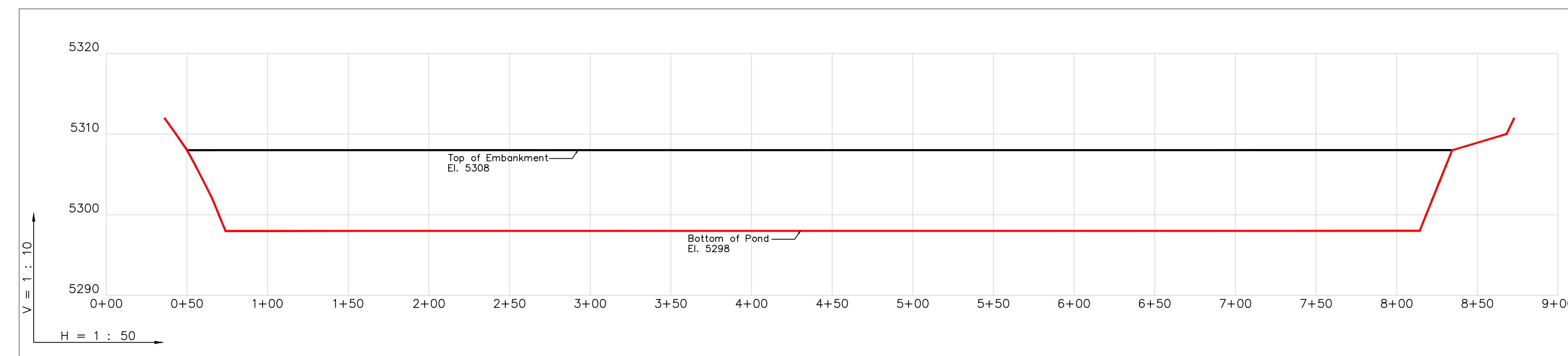
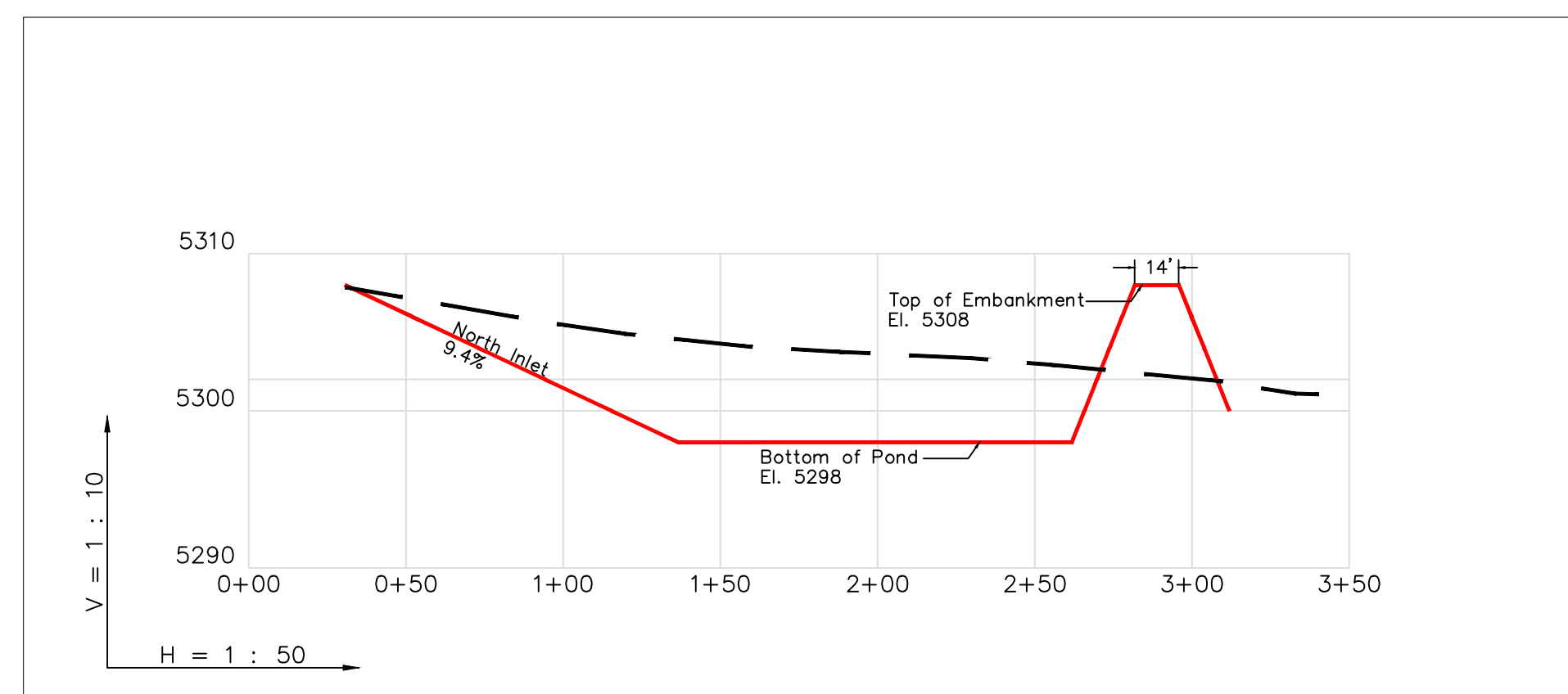
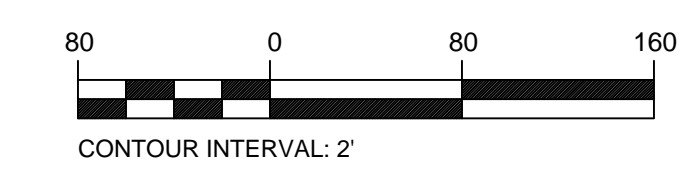


**STAGE STORAGE**  
Pinabete Permit POND 416

Elev. (ft)	AREA (AC)	Inc Volume (AC-FT)	Accum Volume (AC-FT)
5,298.0	1.53	0.00	0.00
5,300.0	1.74	3.27	3.27
5,302.0	1.96	3.70	6.97
5,304.0	2.18	4.14	11.11
5,306.0	2.42	4.60	15.71
5,308.0	3.53	5.95	21.67

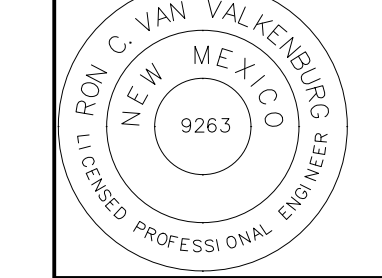


- NOTES**
- For location of drainage control structures and watersheds, refer to Exhibit 26.1-1
  - The hydrology and supporting design data for the drainage control structures are referenced on Table 26.2-1 of the Pinabete Permit.



**CERTIFICATION STATEMENT**

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.



**EXHIBIT 26.3-2**



**BHP Navajo Coal Company**  
P.O. Box 1717  
Fruitland, New Mexico, 87416  
Phone: 505-598-4200  
Fax: 505-568-3361

**Pond 416 Design**

PREPARED BY RCV DRAWN BY RCV SCALE 1" = 80'



## **Appendix 26.A**

Pond 415

Hydrologic Analysis and Design

---

# NAVAJO MINE PINABETE PERMIT POND 415

*The location of the pond and the associated watershed are  
presented on Exhibit 26.1-1.*

Ron Van Valkenburg, PE

BHP Billiton  
Navajo Mine  
PO Box 1717  
Fruitland, NM 87416

Phone: 505 598 2007

*General Information*

*Storm Information:*

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

## Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 415

#1
Null

*Structure Summary:*

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	3.800	3.800	8.68	0.32

*Structure Detail:*

*Structure #1 (Null)*

*POND 415*

*Subwatershed Hydrology Detail:*

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.800	0.018	0.000	0.000	89.000	M	8.68	0.325
	<b>Σ</b>	3.800						8.68	0.325

*Subwatershed Time of Concentration Details:*

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	9.90	20.00	202.00	3.140	0.017
		8. Large gullies, diversions, and low flowing streams	42.11	40.00	95.00	19.460	0.001
#1	1	Time of Concentration:					0.018

# **Appendix 26.B**

Pond 416

Hydrologic Analysis and Design



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# NAVAJO MINE PINABETE PERMIT POND 416

*The location of the pond and the associated watershed are  
presented on Exhibit 26.1-1.*

Ron Van Valkenburg, PE

BHP Billiton  
Navajo Mine  
PO Box 1717  
Fruitland, NM 87416

Phone: 505 598 2007

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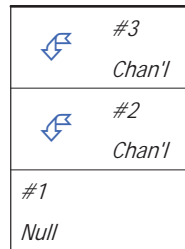
*General Information*

*Storm Information:*

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

*Structure Networking:*

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 416
Channel	#2	==>	#1	0.002	0.422	North Inlet
Channel	#3	==>	#1	0.002	0.426	South Inlet



*Structure Routing Details:*

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	9.41	8.00	85.00	9.20	0.002
#2	Muskingum K:					0.002
#3	8. Large gullies, diversions, and low flowing streams	10.67	8.00	75.00	9.79	0.002
#3	Muskingum K:					0.002

*Structure Summary:*

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	94.000	94.000	115.00	6.43
#2	27.100	27.100	61.93	2.32
#1	4.800	125.900	156.21	9.16

*Structure Detail:*

*Structure #3 (Riprap Channel)*

*South Inlet*

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
16.00	2.0:1	2.0:1	10.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	115.00 cfs	
Depth:	0.62 ft	1.62 ft
Top Width:	18.49 ft	22.49 ft
Velocity*:		
X-Section Area:	10.71 sq ft	
Hydraulic Radius:	0.570 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

*Structure #2 (Riprap Channel)*

*North Inlet*

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	9.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	61.93 cfs	
Depth:	0.46 ft	1.46 ft
Top Width:	13.85 ft	17.85 ft
Velocity*:		
X-Section Area:	5.97 sq ft	
Hydraulic Radius:	0.425 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 416

*Subwatershed Hydrology Detail:*

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	94.000	0.301	0.000	0.000	89.000	M	115.00	6.435
	$\Sigma$	94.000						115.00	6.435
#2	1	27.100	0.114	0.000	0.000	89.000	M	61.93	2.318
	$\Sigma$	27.100						61.93	2.318
#1	1	4.800	0.026	0.000	0.000	89.000	M	10.97	0.411
	$\Sigma$	125.900						156.21	9.163

*Subwatershed Time of Concentration Details:*

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	32.31	42.00	130.00	17.050	0.002
#1	1	Time of Concentration:					0.026
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	10.00	300.00	1.820	0.045
		8. Large gullies, diversions, and low flowing streams	3.62	52.00	1,435.00	5.710	0.069
#2	1	Time of Concentration:					0.114
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.25	20.00	616.00	1.800	0.095
		8. Large gullies, diversions, and low flowing streams	2.57	92.00	3,576.00	4.810	0.206
#3	1	Time of Concentration:					0.301

# NAVAJO MINE PINABETE PERMIT POND 416

*The location of the pond and the associated watershed are  
presented on Exhibit 26.1-1.*

Ron Van Valkenburg, PE

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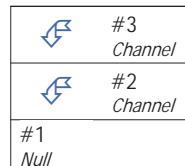
*General Information*

*Storm Information:*

Storm Type:	NM TYPE II 70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

*Structure Networking:*

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 416
Channel	#2	==>	#1	0.002	0.422	North Inlet
Channel	#3	==>	#1	0.002	0.426	South Inlet



*Structure Routing Details:*

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	9.41	8.00	85.00	9.20	0.002
#2	Muskingum K:					0.002
#3	8. Large gullies, diversions, and low flowing streams	10.67	8.00	75.00	9.79	0.002
#3	Muskingum K:					0.002

## Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	94.000	94.000	79.72	5.54
#2	27.100	27.100	45.10	1.60
#1	4.800	125.900	106.82	7.42

*Structure Detail:*

Structure #3 (Riprap Channel)

*South Inlet*

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
16.00	2.0:1	2.0:1	10.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.46 ft	1.46 ft
Top Width:	17.86 ft	21.86 ft
Velocity*:		
X-Section Area:	7.86 sq ft	
Hydraulic Radius:	0.435	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Riprap Channel)

*North Inlet*

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	9.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.36 ft	1.36 ft
Top Width:	13.43 ft	17.43 ft
Velocity*:		
X-Section Area:	4.56 sq ft	
Hydraulic Radius:	0.335	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

## Structure #1 (Null)

POND 416

*Subwatershed Hydrology Detail:*

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	94.000	0.301	0.000	0.000	89.000	M	79.72	5.54
	<b>S</b>	94.000						79.72	5.54
#2	1	27.100	0.114	0.000	0.000	89.000	M	45.10	1.60
	<b>S</b>	27.100						45.10	1.60
#1	1	4.800	0.026	0.000	0.000	89.000	M	7.99	0.28
	<b>S</b>	125.900						106.82	7.42

*Subwatershed Time of Concentration Details:*

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	32.31	42.00	130.00	17.050	0.002
#1	1	Time of Concentration:					0.026
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	10.00	300.00	1.820	0.045
		8. Large gullies, diversions, and low flowing streams	3.62	52.00	1,435.00	5.710	0.069
#2	1	Time of Concentration:					0.114
#3	1	5. Nearly bare and untilled, and alluvial valley fans	3.25	20.00	616.00	1.800	0.095
		8. Large gullies, diversions, and low flowing streams	2.57	92.00	3,576.00	4.810	0.206
#3	1	Time of Concentration:					0.301