



August 4, 2015

Stephen Miles, P.E.
Alabama Surface Mining Commission
P. O. Box 2390
Jasper, AL 35502-2390

RE: **Black Warrior Minerals, Inc.**
Mine No. 2, P-39__

Dear Mr. Miles:

I hereby certify the enclosed detailed design plans for Sediment Basin 049 for the above referenced mine are in accordance with the Regulations of the Alabama Surface Mining Commission as adopted by Act 81-435 of December 18, 1981 and as amended to date and that the information used in the enclosed basin design plans is true and correct to the best of my knowledge and belief.

If you have any questions or need additional information, please do not hesitate to contact our office.

Sincerely,

McGehee Engineering Corp.

A handwritten signature in black ink, appearing to read "J.P. Johnsey", is written over the typed name and partially overlaps the circular professional seal.

Jared P. Johnsey, P.E.
Alabama Reg. No. 33239



SEDIMENT BASIN CONSTRUCTION SPECIFICATIONS

Sediment basins (temporary or permanent) will be designed and constructed using the following as minimum specifications:

1. EMBANKMENT REQUIREMENTS

- A) The minimum width of the top of the embankment will under no circumstance be less than twelve (12) feet.
- B) The embankment will have a minimum front and back slope no steeper than the slopes listed on the detailed design sheet.
- C) The foundation area of the embankment will be cleared and grubbed of all organic matter with no surface slope steeper than 1 horizontal to 1 vertical. The entire wet area, as measured from the upstream toe of the embankment to the normal pool level, will be cleared of trees and large brush.
- D) A core will be constructed in a cutoff trench along the centerline of the embankment. The cutoff trench will be of suitable depth and width to attain relatively impervious material.
- E) The embankment construction material will be free of sod, roots, stumps, rocks, etc., which exceed six (6") inches in diameter. The embankment material will be placed in layers of twelve (12") inches or less and compacted to ninety five (95%) percent of the standard proctor density, as set forth in ASTM.
- F) The embankment, foundation and abutments will be designed and constructed to be stable under normal construction and operating conditions, with a minimum static safety factor of 1.3 at normal pool level with steady seepage saturation conditions.
- G) The actual constructed height of the embankment will be a minimum of five (5%) percent higher than the design height to allow for settling over the life of the embankment.
- H) The design embankment height for temporary impoundments will be a minimum of one (1) foot above the maximum water level anticipated from a 10 Year - 24 Hour or a 25 Year - 6 Hour precipitation event (whichever is greater). The design embankment height for permanent impoundments will be a minimum of one (1) foot above the maximum water level anticipated from a 10 Year - 24 Hour or a 25 Year - 6 Hour precipitation event (whichever is greater).
- I) For embankments constructed as point source discharges, the embankment will be constructed and abutments keyed into undisturbed, virgin, ground if at all possible. In the event that this can not be achieved, additional design and construction specifications will be submitted in the detailed design plans.

- J) The embankment and all areas disturbed in the construction of the embankment will be seeded with a mixture of perennial and annual grasses, fertilized and mulched to prevent erosion and ensure restabilization. Hay dams, silt fences, rock check dams, etc. will be installed, where deemed necessary, as additional erosion prevention methods.

2. DISCHARGE STRUCTURE REQUIREMENTS

- A) The primary spillway will be designed to adequately carry the anticipated peak runoff from a 10 Year - 24 Hour precipitation event. The combination primary and secondary (emergency) spillway system will be designed to safely carry the anticipated peak runoff from a 25 Year - 6 Hour precipitation event. When sediment basins are proposed in the drainage course of a public water supply, the spillway system will be designed and constructed to adequately carry the runoff from a 50 Year - 24 Hour precipitation event.
- B) Channel linings, for secondary (emergency) spillways will be a trapezoidal open channel constructed in natural ground and planted with a mixture of both annual and perennial grasses being predominantly fescue and bermuda. In the event that the spillway can not be constructed in natural ground the spillway will be lined with riprap, concrete, asphalt or durable rock (See Detailed Design Plans for Spillway Lining).
- C) When consisting of pipe, the primary spillway will be installed according to Class "C" pipe installation for embankment bedding.
- D) Sediment basins with a single spillway system, such as a skimmer board, will be a trapezoidal open channel constructed in consolidated, nonerodible material and lined with rip-rap, concrete, asphalt or durable rock (See Detailed Design Plans for Spillway Lining).
- E) The primary spillway will be designed and constructed with device to eliminate floating solids from leaving the impoundment. This device will consist of a turned down elbow when using pipe or a skimmer system when using an open channel spillway.
- F) When necessary, to prevent erosion of the embankment or discharge area, a splash pad of rip-rap, durable rock, sacrete, etc. will be installed at the discharge end of the primary spillway.
- G) The combined spillway systems, for sediment basins constructed in series, will be designed to adequately accommodate the entire drainage area.

3. INSPECTION, MAINTENANCE AND CERTIFICATION REQUIREMENTS

- A) Inspections will be conducted regularly during construction of the sediment basin by a qualified registered professional engineer or other qualified person under the direction of a professional engineer. Upon completion of construction, the sediment basin will be certified, by a qualified registered professional engineer, to the Regulatory Authority as having been constructed in accordance with the approved detailed design plans.
- B) Sediment basins will be inspected semi-monthly for erosion, instability, etc., with maintenance performed as necessary, until the removal of the structure or until a Phase III Bond Release is granted.
- C) Sediment basins will be examined quarterly for structural weakness, instability, erosion, slope failure, or other hazardous conditions with maintenance performed as necessary.
- D) Formal inspections will be made annually, by a qualified registered professional engineer or other qualified person under the direction of a professional engineer, including any reports or modifications, in accordance with 880-X-10C-.20[1(j)] of the Alabama Surface Mining Regulations.
- E) Retained sediment will be removed from each sediment basin when the accumulated sediment reaches the maximum allowable sediment volume as set forth in the detailed design plans.

4. BASIN REMOVAL REQUIREMENTS

- A) Upon completion of mining, reclamation, restabilization and effluent standards being met, each sediment basin not proposed as a permanent water impoundment will be dewatered in a controlled manner by either pumping or siphoning. Upon successful dewatering, a determination will be made as to the retained sediment level in the basin. After determining the retained sediment level, a channel will be cut into the embankment down to the retained sediment level on the side of the embankment deemed most suitable to reach natural ground without encountering prohibiting rock. The embankment material removed from this newly constructed channel will be spread and compacted over the previous impoundment (wet area) area to prevent erosion and ensure restabilization. The newly constructed channel will be of adequate width (minimum 30 feet) and sloped to a grade (approximately 1% to 3%) which will cause all surface drainage to travel across this area in sheet flow, minimizing the possibility of erosion. Also, where necessary, hay dams will be installed in strategic locations across the width of the channel to retain sediment and slow the water velocity to a favorable rate. Upon removal of the embankment section, all disturbed areas will be graded in such a manner to ensure slope stability, successful restabilization and to minimize erosion. All disturbed areas will be seeded with a mixture of annual and perennial grasses, fertilized and mulched. No slope, existing or created in the removal of the sediment basin, will be left on a grade that will slip or slough.

5. PERMANENT WATER IMPOUNDMENT REQUIREMENTS

- A) Prior to a request for a Phase II Bond Release, all sediment basins being left as permanent water impoundments will have supplemental data submitted to the Regulatory Authority concerning water quality, water quantity, size, depth, configuration, postmining land use, etc.
- B) Final grading slopes of the entire permanent water impoundment area will not exceed a slope of 2 Horizontal to 1 Vertical to provide for safety and access for future water users.

RIPRAP CLASSIFICATION SPECIFICATIONS

CLASS 1 RIPRAP

No more than 10% of the stone will have a diameter greater than twelve (12) inches; no more than 50% of the stone will have a diameter of less than ten (10) inches; and, no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than twelve (12) inches.

CLASS 2 RIPRAP

No more than 10% of the stone will have a diameter greater than sixteen (16) inches; no more than 50% of the stone will have a diameter of less than twelve (12) inches; and, no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than sixteen (16) inches.

CLASS 3 RIPRAP

No more than 10% of the stone will have a diameter greater than twenty two (22) inches; no more than 50% of the stone will have a diameter of less than sixteen (16) inches; and, no more than 15% of the stone will have a diameter of less than eight (8) inches. The thickness of the rip-rap liner will be no less than twenty two (22) inches.

CLASS 4 RIPRAP

No more than 10% of the stone will have a diameter greater than twenty seven (27) inches; no more than 50% of the stone will have a diameter of less than twenty two (22) inches; and, no more than 25% of the stone will have a diameter of less than ten (10) inches. The thickness of the rip-rap liner will be no less than twenty seven (27) inches.

CLASS 5 RIPRAP

No more than 10% of the stone will have a diameter greater than thirty four (34) inches; no more than 50% of the stone will have a diameter of less than twenty seven (27) inches; and, no more than 25% of the stone will have a diameter of less than sixteen (16) inches. The thickness of the rip-rap liner will be no less than thirty four (34) inches.

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

DETAILED DESIGN PLANS
SEDIMENT BASIN 049

BLACK WARRIOR MINERALS, INC.

MINE NO. 2, P-39

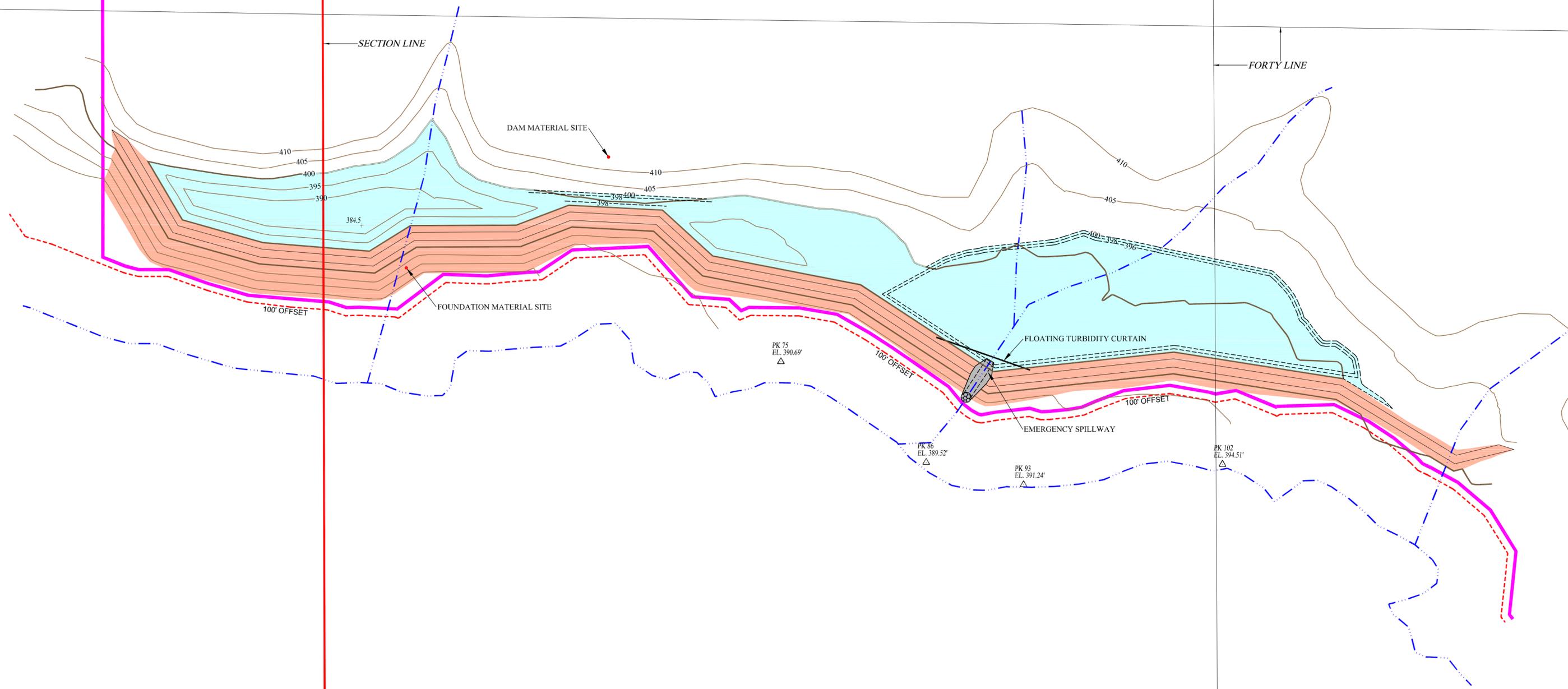
PLAN VIEW DRAWING

SCALE: 1" = 100'

SEDIMENT BASIN 049

SEDIMENT BASIN 049

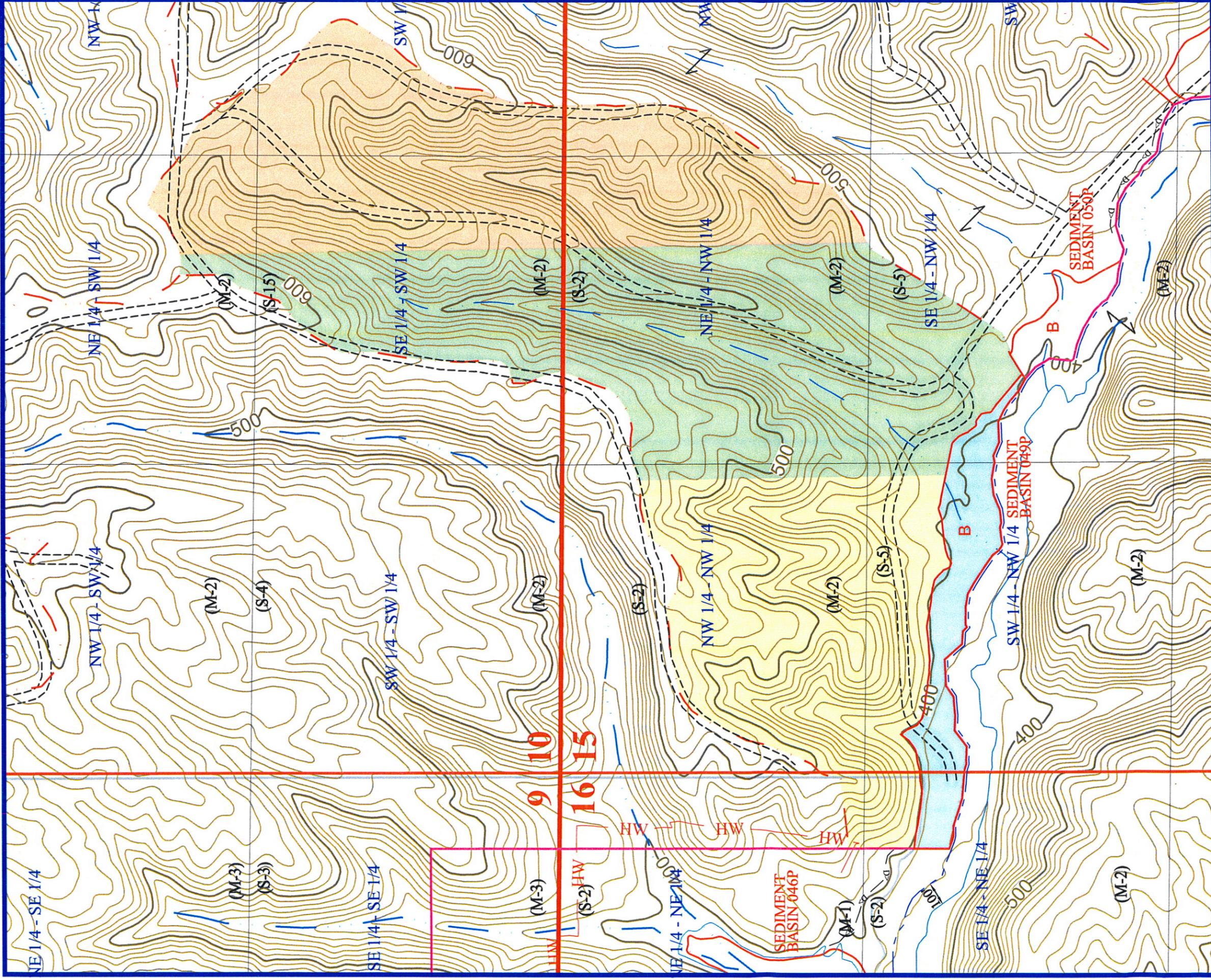
UPSTREAM TOE ELEV.: 384.50'
 SEDIMENT REMOVAL ELEV.: 397.48'
 PRIMARY SPILLWAY ELEV.: 399.50'
 EMERGENCY SPILLWAY ELEV.: 399.50'
 **MAXIMUM WATER ELEV.: 401.75'
 TOP OF DAM ELEV.: 402.75' DESIGN
 TOP OF DAM ELEV.: 404.0' CONSTRUCT.
 EMERGENCY SPILLWAY: 12' WIDE TRAPEZOIDAL
 CONCRETE LINED OPEN CHANNEL



- PERMIT BOUNDARY
- - - - - PROPOSED CONTOUR
- ORIGINAL CONTOUR INDEX
- ORIGINAL CONTOUR
- - - - - ORIGINAL DRAINAGE PATH
- - - - - 100' STREAM BUFFER ZONE
- NORMAL POOL AREA



ENERGY DISSIPATER (CLASS II SANDSTONE RIPRAP)
 ** 25 YEAR - 6 HOUR PRECIPITATION EVENT.



BLACK WARRIOR MINERALS, INC.

MINE NO. 2
ASMC PERMIT NO. P-39

WATERSHED MAP
SCALE: 1" = 400'
SEDIMENT BASIN 049

WATERSHED MAP LEGEND

-  PERMIT BOUNDARY
-  RE-VEGETATED 0-2 MO., C.N. 79
-  RE-VEGETATED 2-12 MO., C.N. 74
-  GRADED & BARE, C.N. 81
-  SEDIMENT BASIN, C.N. 100
-  DRAINAGE DIVIDE
-  100' STREAM BUFFER ZONE



mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: cw@mcgehee.org

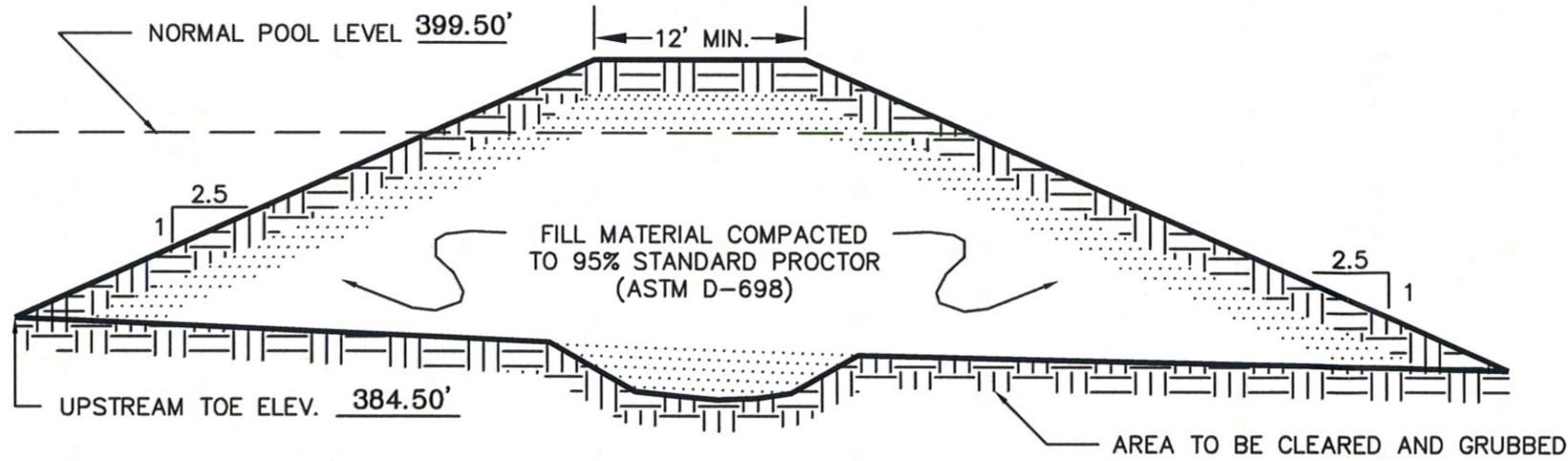
MINE NO. 2 BASIN 049

Elevation-Area-Capacity Table

Elevation (ft)	Area (ac)	Capacity (ac-ft)
384.50	0.000	0.000
385.00	0.014	0.002
385.50	0.050	0.017
386.00	0.110	0.057
386.50	0.132	0.117
387.00	0.156	0.189
387.50	0.182	0.273
388.00	0.210	0.371
388.50	0.242	0.484
389.00	0.276	0.613
389.50	0.312	0.760
390.00	0.350	0.925
390.50	0.389	1.110
391.00	0.431	1.315
391.50	0.474	1.541
392.00	0.520	1.790
392.50	0.571	2.062
393.00	0.625	2.361
393.50	0.681	2.688
394.00	0.740	3.043
394.50	1.170	3.517
395.00	1.699	4.230
395.50	2.325	5.232
396.00	3.050	6.571
396.50	3.197	8.133
397.00	3.348	9.769
397.50	3.502	11.482
398.00	3.660	13.272
398.50	3.813	15.140
399.00	3.969	17.086
399.50	4.128	19.110
400.00	4.290	21.214
400.50	4.441	23.396
401.00	4.595	25.655
401.50	4.751	27.992
402.00	4.910	30.407
402.50	5.266	32.950

Elevation (ft)	Area (ac)	Capacity (ac-ft)
403.00	5.635	35.675
403.50	6.016	38.588
404.00	6.410	41.694

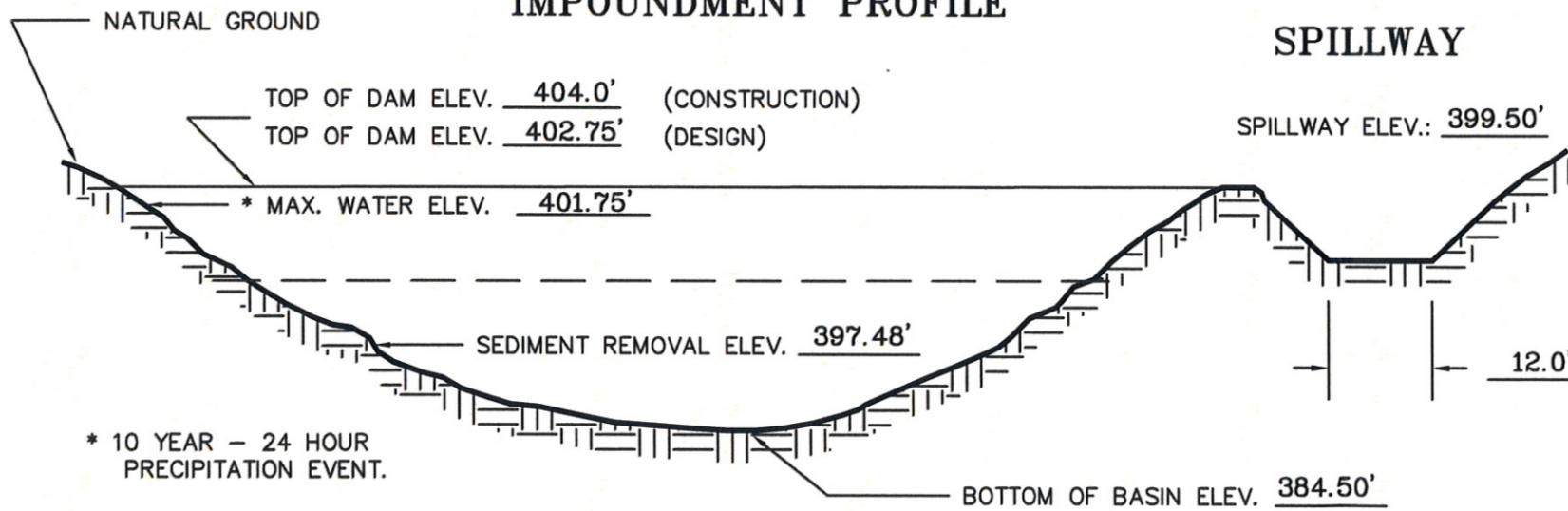
EMBANKMENT CROSS-SECTION



COMPANY: BLACK WARRIOR MINERALS, INC.
 MINE NAME: MINE NO. 2
 PERMIT #: P-39
 BASIN I.D. #: SEDIMENT BASIN 049

IMPOUNDMENT PROFILE

SPILLWAY



KEY BASIN PARAMETERS

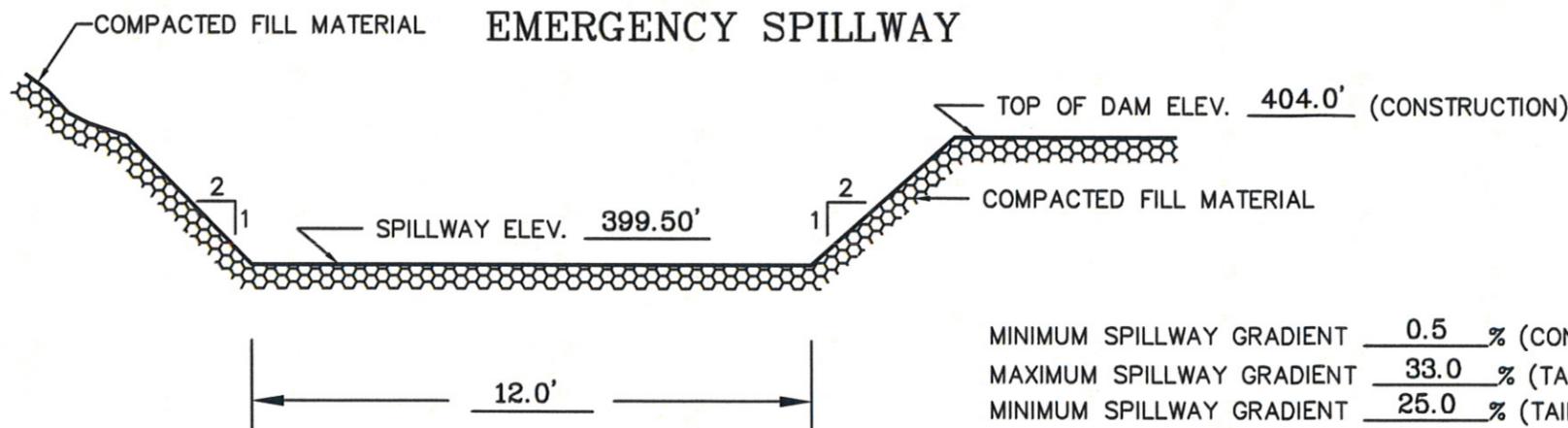
DRAINAGE AREA	<u>131.2</u>	ACRES
DISTURBED AREA	<u>126.9</u>	ACRES
SEDIMENT STORAGE	<u>11.42</u>	AC.FT.
DETENTION STORAGE	<u>7.69</u>	AC.FT.
PERMANENT POOL CAPACITY	<u>19.11</u>	AC.FT.
* TOTAL BASIN STORAGE CAPACITY	<u>27.92</u>	AC.FT.
** PEAK INFLOW	<u>269.79</u>	C.F.S.
** PEAK OUTFLOW	<u>135.54</u>	C.F.S.

NOTE: ALL ELEVATIONS ASSUMED.

* 10 YEAR - 24 HOUR PRECIPITATION EVENT.

** 25 YEAR - 6 HOUR PRECIPITATION EVENT.

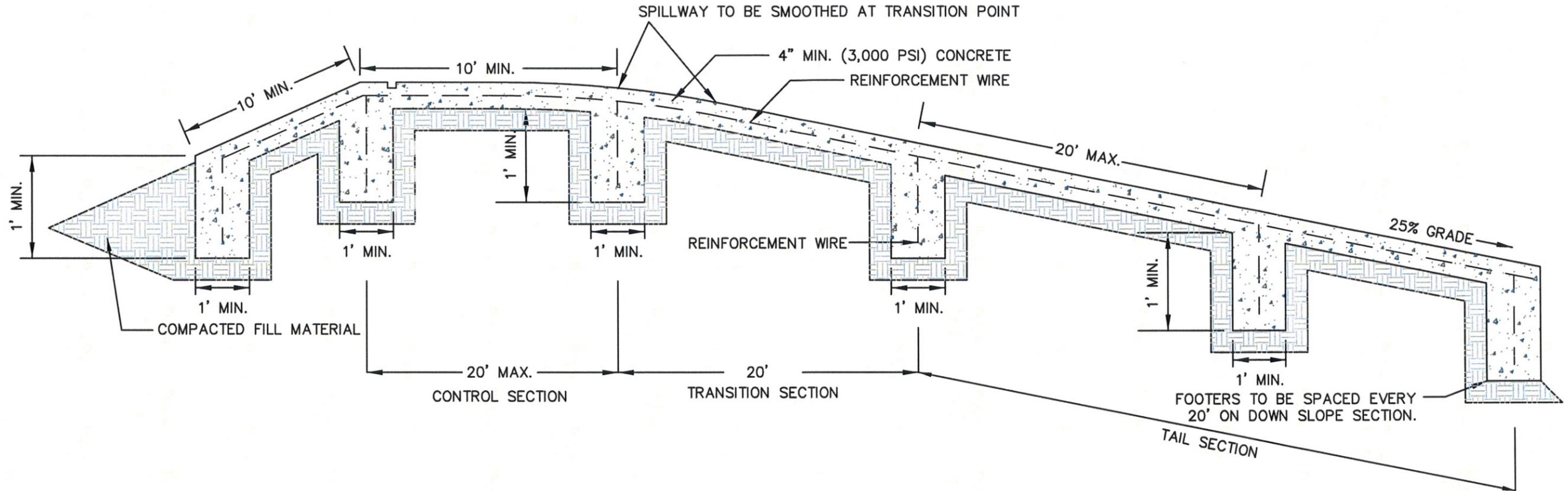
EMERGENCY SPILLWAY



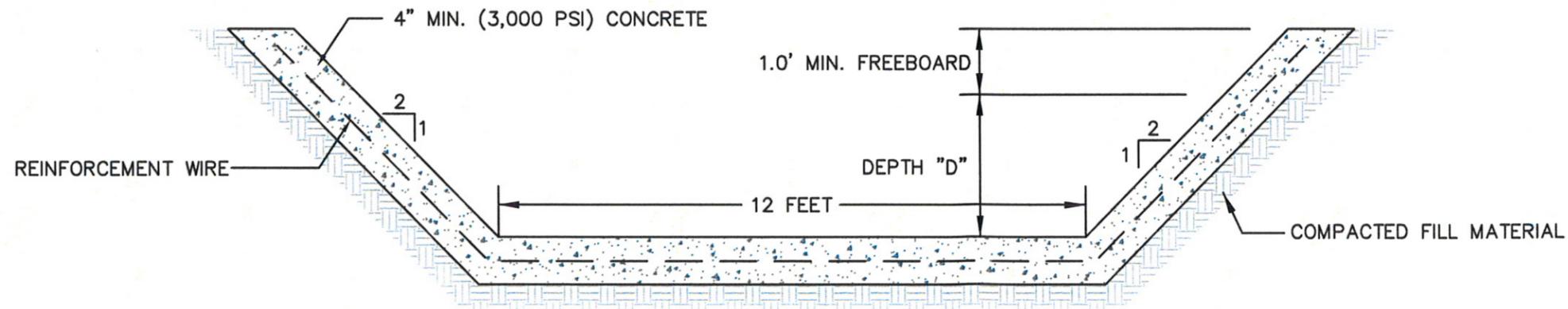
MINIMUM SPILLWAY GRADIENT 0.5 % (CONTROL SECTION)
 MAXIMUM SPILLWAY GRADIENT 33.0 % (TAIL DITCH SECTION)
 MINIMUM SPILLWAY GRADIENT 25.0 % (TAIL DITCH SECTION)

SEE SPILLWAY CONTROL SECTION AND TAIL DITCH DESIGN FOR CHANNEL LINING REQUIREMENTS.

SEDIMENT BASIN 049 SPILLWAY PROFILE



TYPICAL SPILLWAY CROSS-SECTION



SPILLWAY FLOW DEPTH "D" = 2.25 FEET (CONTROL SECTION)

SPILLWAY FLOW DEPTH "D" = 0.75 FEET (TAIL DITCH SECTION)

TOTAL SPILLWAY DEPTH "D+1" = 3.25 FEET (CONTROL SECTION)

TOTAL SPILLWAY DEPTH "D+1" = 1.75 FEET (TAIL DITCH SECTION)

NOTE: TOTAL SPILLWAY DEPTH IN TRANSITION SECTION VARIES FROM 3.25 FEET TO 1.75 FEET

SPILLWAY CHANNEL SPECIFICATIONS
SEDIMENT BASIN 049

The entire control section and tail ditch section of the emergency spillway will be cut into the compacted fill of the embankment and lined with a minimum of 4 inches of reinforced concrete. All concrete will be reinforced with 10 gauge, 6" x 6" welded wire mesh. Fibermesh may be added to the concrete for additional strength, however, the addition of fibermesh shall not be used in place of the required 6" x 6" welded wire.

The gradient of the control section of the emergency spillway will not exceed two (2%) percent. The gradient of the tail ditch section of the emergency spillway will not be less than twenty five (25%) percent and will not exceed thirty-three (33%) percent.

The control section and tail ditch section of the emergency spillway will extend from the inner face of the embankment, past the centerline of the embankment and be carried out beyond the downstream slope of the embankment.

The concrete liner of the control section of the emergency spillway will be a minimum of 3.25 feet as measured vertically, allowing 2.25 feet for the maximum anticipated flow and 1.0 feet of dry freeboard. The concrete liner of the tail ditch section of the emergency spillway will be a minimum of 1.75 feet as measured vertically, allowing 0.75 feet for the maximum anticipated flow and 1.0 foot of dry freeboard. There will be a transition zone of at least 20 feet in length between the control section and the tail section. The minimum depth at the beginning of the transition will be 3.25 feet and 1.75 feet at the end of the transition. The flow line of the spillway will be smoothed at the transition to avoid abrupt changes in the flow line slope.

See enclosed SEDCAD 4.0 spillway tail ditch section design and attached Plan Sheet cross-section for the minimum and maximum emergency spillway construction requirements.

A floating silt fence (lightweight turbidity curtain) will be installed near the entrance to the spillway to accomplish sub-surface withdrawal. The floating silt fence (lightweight turbidity curtain) will be set at normal pool and will be anchored at the 10 Year – 24 Hour Event peak stage with steel fence posts.

Black Warrior Minerals Mine No. 2 Sediment Basin 049

Spillway Control Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	2.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	135.54 cfs	
Depth:	1.07 ft	2.07 ft
Top Width:	16.29 ft	20.29 ft
Velocity:	8.94 fps	
X-Section Area:	15.15 sq ft	
Hydraulic Radius:	0.902 ft	
Froude Number:	1.63	

Black Warrior Minerals Mine No. 2 Sediment Basin 049

Spillway Tail Section

Material: Concrete, Rubble

Trapezoidal Channel

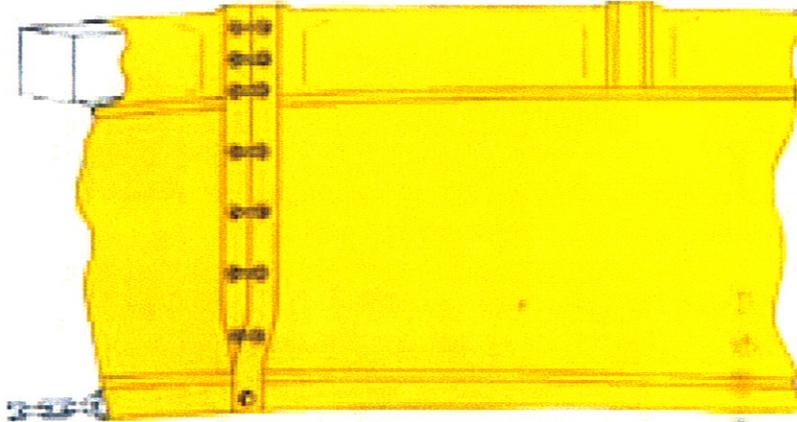
Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	25.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	135.54 cfs	
Depth:	0.51 ft	1.51 ft
Top Width:	14.05 ft	18.05 ft
Velocity:	20.36 fps	
X-Section Area:	6.66 sq ft	
Hydraulic Radius:	0.466 ft	
Froude Number:	5.21	

SUBSURFACE WITHDRAWAL DEVICE AND FLOATING SILT BOOM

Lightweight Turbidity Curtain

Application: Calm waters with little current, such as lakes, ponds, canals and shoreline areas.



Specifications

- Curtain to be anchored at the maximum anticipated peak stage elevation (10 Year – 24 Hour Precipitation Event).
- PVC coated floatations - ultraviolet resistant
- Geotextile fabric screens
- Chain ballast with connectors
- Double sewn seams with grommets
- Depths per requirements ' 50' sections = Minimum 24" deep
- Fabric - Polyester reinforced vinyl high visibility yellow
- Connector - Sections are laced together through grommets and load lines are bolted together.
- Flotation - 6" expanded polystyrene over 9 lbs./ft. buoyancy.
- Ballast - 1/4" galvanized chain (.7 lbs/ft).

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

HYDROLOGY AND SEDIMENTOLOGY PREDICTION
10 YEAR - 24 HOUR PRECIPITATION EVENT
SEDIMENT BASIN 049

Black Warrior Minerals, Inc.
Mine No. 2, P-39
Sediment Basin 049

10 Year - 24 Hour Precipitation Event

Jared P. Johnsey, P.E.

General Information

Storm Information:

Storm Type:	DRN 58
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.000 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	100.000%
2.0000	96.000%	91.000%
1.0000	89.000%	79.000%
0.5000	79.000%	68.000%
0.3000	68.000%	60.000%
0.2000	59.000%	51.000%
0.1000	50.000%	40.000%
0.0500	42.000%	32.000%
0.0300	31.000%	23.000%
0.0200	22.000%	15.000%
0.0100	18.000%	12.000%
0.0050	14.000%	9.000%
0.0030	7.000%	5.000%
0.0010	2.000%	1.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Sediment Basin 049

#1
Pond

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1 In	131.200	131.200	143.40	37.42	7,126.2	261,252	181.33	91.25
Out			105.85	37.16	607.4	17,885	0.01	0.01

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	94.332%	100.000%
1.0000	81.992%	100.000%
0.5000	70.576%	100.000%
0.3000	62.273%	100.000%
0.2000	52.932%	100.000%
0.1000	41.515%	100.000%
0.0500	33.212%	100.000%
0.0300	23.871%	100.000%
0.0200	15.568%	100.000%
0.0100	12.455%	100.000%
0.0050	9.341%	100.000%
0.0030	5.189%	60.881%
0.0010	1.038%	12.176%

Structure Detail:

Structure #1 (Pond)

Sediment Basin 049

Pond Inputs:

Initial Pool Elev:	399.50 ft
Initial Pool:	7.69 ac-ft
*Sediment Storage:	11.42 ac-ft
Dead Space:	20.00 %

**Sediment capacity calculated from 0.090 times disturbed area*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
399.50	20.00	2.00:1	2.00:1	12.00

Pond Results:

Peak Elevation:	401.48 ft
H'graph Detention Time:	2.13 hrs
Pond Model:	CSTRS
Dewater Time:	1.14 days
Trap Efficiency:	91.48 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
397.48	3.497	0.000	0.000	Top of Sed. Storage
397.50	3.502	0.062	0.000	
398.00	3.660	1.852	0.000	
398.50	3.813	3.721	0.000	
399.00	3.969	5.666	0.000	
399.50	4.128	7.690	0.000	Spillway #1
399.90	4.258	9.367	1.751	11.59*
400.00	4.290	9.795	2.189	2.65
400.50	4.441	11.977	30.064	10.45
401.00	4.595	14.236	63.036	1.85
401.48	4.744	16.466	105.847	0.90 Peak Stage
401.50	4.751	16.572	107.884	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
402.00	4.910	18.988	163.374	
402.50	5.266	21.531	229.657	
403.00	5.635	24.256	306.985	
403.50	6.016	27.168	395.659	
404.00	6.410	30.274	496.003	

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
397.48	0.000	0.000
397.50	0.000	0.000
398.00	0.000	0.000
398.50	0.000	0.000
399.00	0.000	0.000
399.50	0.000	0.000
399.90	1.751	1.751
400.00	2.189	2.189
400.50	30.064	30.064
401.00	63.036	63.036
401.50	107.884	107.884
402.00	163.374	163.374
402.50	229.657	229.657
403.00	306.985	306.985
403.50	395.659	395.659
404.00	496.003	496.003

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	42.700	0.170	0.265	0.256	81.000	F	52.59	13.338
	2	51.000	0.220	0.000	0.000	79.000	F	58.50	14.777
	3	33.200	0.150	0.000	0.000	74.000	M	29.06	7.160
	4	4.300	0.010	0.000	0.000	100.000	F	6.76	2.148
	Σ	131.200						143.40	37.423

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	200.00	25.00	0.9000	1.0000	2	5,464.0	437,338	303.90	182.71
	2	0.240	200.00	38.00	0.1400	1.0000	2	1,484.4	123,858	85.83	49.39
	3	0.240	200.00	27.00	0.0500	1.0000	2	183.8	32,985	22.53	12.77
	4	0.001	400.00	0.01	0.0001	1.0000	1	0.0	0	0.00	0.00
	Σ							7,126.2	261,252	181.33	91.25

Subwatershed Muskingum Routing 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	3.21	55.00	1,712.00	1.790	0.265
#1	1	Muskingum K:					0.265

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

HYDROLOGY AND SEDIMENTOLOGY PREDICTION
25 YEAR - 6 HOUR PRECIPITATION EVENT
SEDIMENT BASIN 049

Black Warrior Minerals, Inc.
Mine No. 2, P-39
Sediment Basin 049

25 Year - 6 Hour Precipitation Event

Jared P. Johnsey, P.E.

General Information

Storm Information:

Storm Type:	SCS 6 Hour
Design Storm:	25 yr - 6 hr
Rainfall Depth:	5.100 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	100.000%
2.0000	96.000%	91.000%
1.0000	89.000%	79.000%
0.5000	79.000%	68.000%
0.3000	68.000%	60.000%
0.2000	59.000%	51.000%
0.1000	50.000%	40.000%
0.0500	42.000%	32.000%
0.0300	31.000%	23.000%
0.0200	22.000%	15.000%
0.0100	18.000%	12.000%
0.0050	14.000%	9.000%
0.0030	7.000%	5.000%
0.0010	2.000%	1.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Sediment Basin 049

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In	131.200	131.200	269.79	29.47	9,654.3	395,080	272.35	149.84
	Out			135.54	29.41	920.0	27,674	0.02	0.02

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	98.164%	100.000%
1.0000	85.688%	100.000%
0.5000	73.756%	100.000%
0.3000	65.079%	100.000%
0.2000	55.317%	100.000%
0.1000	43.386%	100.000%
0.0500	34.709%	100.000%
0.0300	24.947%	100.000%
0.0200	16.270%	100.000%
0.0100	13.016%	100.000%
0.0050	9.762%	100.000%
0.0030	5.423%	56.912%
0.0010	1.085%	11.382%

Structure Detail:

Structure #1 (Pond)

Sediment Basin 049

Pond Inputs:

Initial Pool Elev:	399.50 ft
Initial Pool:	7.69 ac-ft
*Sediment Storage:	11.42 ac-ft
Dead Space:	20.00 %

**Sediment capacity calculated from 0.090 times disturbed area*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
399.50	20.00	2.00:1	2.00:1	12.00

Pond Results:

Peak Elevation:	401.75 ft
H'graph Detention Time:	1.92 hrs
Pond Model:	CSTRS
Dewater Time:	0.83 days
Trap Efficiency:	90.47 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
397.48	3.497	0.000	0.000		Top of Sed. Storage
397.50	3.502	0.062	0.000		
398.00	3.660	1.852	0.000		
398.50	3.813	3.721	0.000		
399.00	3.969	5.666	0.000		
399.50	4.128	7.690	0.000		Spillway #1
399.90	4.258	9.367	1.751	11.59*	
400.00	4.290	9.795	2.189	2.65	
400.50	4.441	11.977	30.064	2.50	
401.00	4.595	14.236	63.036	1.35	
401.50	4.751	16.572	107.884	1.25	
401.75	4.831	17.776	135.544	0.60	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
402.00	4.910	18.988	163.374	
402.50	5.266	21.531	229.657	
403.00	5.635	24.256	306.985	
403.50	6.016	27.168	395.659	
404.00	6.410	30.274	496.003	

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
397.48	0.000	0.000
397.50	0.000	0.000
398.00	0.000	0.000
398.50	0.000	0.000
399.00	0.000	0.000
399.50	0.000	0.000
399.90	1.751	1.751
400.00	2.189	2.189
400.50	30.064	30.064
401.00	63.036	63.036
401.50	107.884	107.884
402.00	163.374	163.374
402.50	229.657	229.657
403.00	306.985	306.985
403.50	395.659	395.659
404.00	496.003	496.003

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	42.700	0.170	0.265	0.256	81.000	F	115.85	10.556
	2	51.000	0.220	0.000	0.000	79.000	F	123.87	11.598
	3	33.200	0.150	0.000	0.000	74.000	M	56.40	5.495
	4	4.300	0.010	0.000	0.000	100.000	F	17.01	1.820
Σ		131.200						269.79	29.470

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	200.00	25.00	0.9000	1.0000	2	7,459.6	608,197	420.06	291.46
	2	0.240	200.00	38.00	0.1400	1.0000	2	1,972.7	181,741	124.82	81.30
	3	0.240	200.00	27.00	0.0500	1.0000	2	229.8	47,002	31.59	20.38
	4	0.001	400.00	0.01	0.0001	1.0000	1	0.0	0	0.00	0.00
Σ								9,654.3	395,081	272.35	149.84

Subwatershed Muskingum Routing 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	3.21	55.00	1,712.00	1.790	0.265
#1	1	Muskingum K:					0.265

STABILITY ANALYSIS

STABILITY ANALYSIS PROCEDURE

The computer program used to analyze the slope stability was the REAME Slope Stability Program as developed by Dr. Yang H. Huang, P.E. of the University of Kentucky.

The soil type of the foundation material beneath the proposed embankment structure of Sediment Basin 049 was sampled, analyzed and classified by personnel of McGehee Engineering Corp. The depth to the stiff base of Sediment Basin 049 (3.0') was measured by personnel of McGehee Engineering Corp.

A slope stability analysis was performed at two locations due to the length of the embankment. The results of the analysis shown below are for the location with smallest static factor of safety.

The soil type to be used in the construction of the proposed embankment structure of Sediment Basin 049 was sampled, analyzed and classified by personnel of McGehee Engineering Corp.

SOIL PROPERTIES

<u>USAGE</u>	<u>TYPE</u>	<u>COHESION (psf)</u>	<u>INTERNAL ANGLE OF FRICTION</u>	<u>EFFECTIVE DENSITY (pcf)</u>
049 FOUND.	CL-ML	460.00	29.00	123.90
049 DAM	SM	270.00	33.02	132.14

ANALYSIS RESULTS

<u>BASIN</u>	<u>STATIC SAFETY FACTOR</u>
049	2.442



SIEVE ANALYSIS

(ASTM C136-96a and C117)

Company Name: Black Warrior Minerals

Location: Mine #2

Sample I.D.: Basin 048

Description: Foundation

Sample Date: 6/19/15

Analyzed By: JWW

Date Analyzed: 6/23/15

Requested By: B Simmons

Weight of Oven Dry Sample (W):

1012.1 Grams

Sieve No.	Sieve + Sample Weight	Sieve Weight	Sample Weight Retained	Percent of Total Retained	Cumulative Weight Percent	Percent Retained	Percent Finer
1"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
3/4"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1/2"	537.9	537.9	0.0	0.0	0.0	0.0	100.0
4	520.8	512.4	8.4	0.8	0.8	0.8	99.2
10	485.4	460.5	24.9	2.5	3.3	3.3	96.7
40	456.6	382.0	74.6	7.4	10.7	10.7	89.3
200	584.2	332.2	252.0	25.0	35.6	35.6	64.4
Pan	1025.0	375.2	649.8	64.4	100.0	100.0	0.0
Total Weight (W1):			1009.7				

SOIL CLASSIFICATION

Unified System (ASTM D-2487)

Liquid Limit: 25.8

Plastic Limit: 20.5

Plasticity Index: 5.3

Effective Cohesion: 3.1944 psi

Total Cohesion: 6.670 psi

Permeability: 0.20 ft/yr

Maximum Dry Density: 111.0 pcf

Optimum Moisture: 17.5 %

Effective Cohesion: 460.0 psf

Angle of Internal Friction: 29.00 degrees

Mass Unit Weight: 123.90 pcf

Soil Classification: **CL-ML**

Fine Grained
Sandy silty clay



SIEVE ANALYSIS

(ASTM C136-96a and C117)

Company Name: Black Warrior Minerals

Location: Mine #2

Sample I.D.: Basin 048

Description: Dam Material

Sample Date: 6/19/15

Analyzed By: JWW

Date Analyzed: 6/23/15

Requested By: B Simmons

Weight of Oven Dry Sample (W):

1014.2 Grams

Sieve No.	Sieve + Sample Weight	Sieve Weight	Sample Weight Retained	Percent of Total Retained	Cumulative Weight Percent	Percent Retained	Percent Finer
1"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
3/4"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1/2"	543.2	537.9	5.3	0.5	0.5	0.5	99.5
4	557.0	512.4	44.6	4.4	4.9	4.9	95.1
10	624.8	460.5	164.3	16.2	21.1	21.1	78.9
40	588.3	382.0	206.3	20.4	41.5	41.5	58.5
200	419.5	332.2	87.3	8.6	50.1	50.1	49.9
Pan	880.7	375.2	505.5	49.9	100.0	100.0	0.0
Total Weight (W1):			1013.3				

SOIL CLASSIFICATION

Unified System (ASTM D-2487)

Liquid Limit: 36.6

Plastic Limit: 26.9

Plasticity Index: 9.7

Effective Cohesion: 1.8750 psi

Total Cohesion: 6.528 psi

Permeability: 12.30 ft/yr

Maximum Dry Density: 115.0 pcf

Optimum Moisture: 14.9 %

Effective Cohesion: 270.0 psf

Angle of Internal Friction: 33.02 degrees

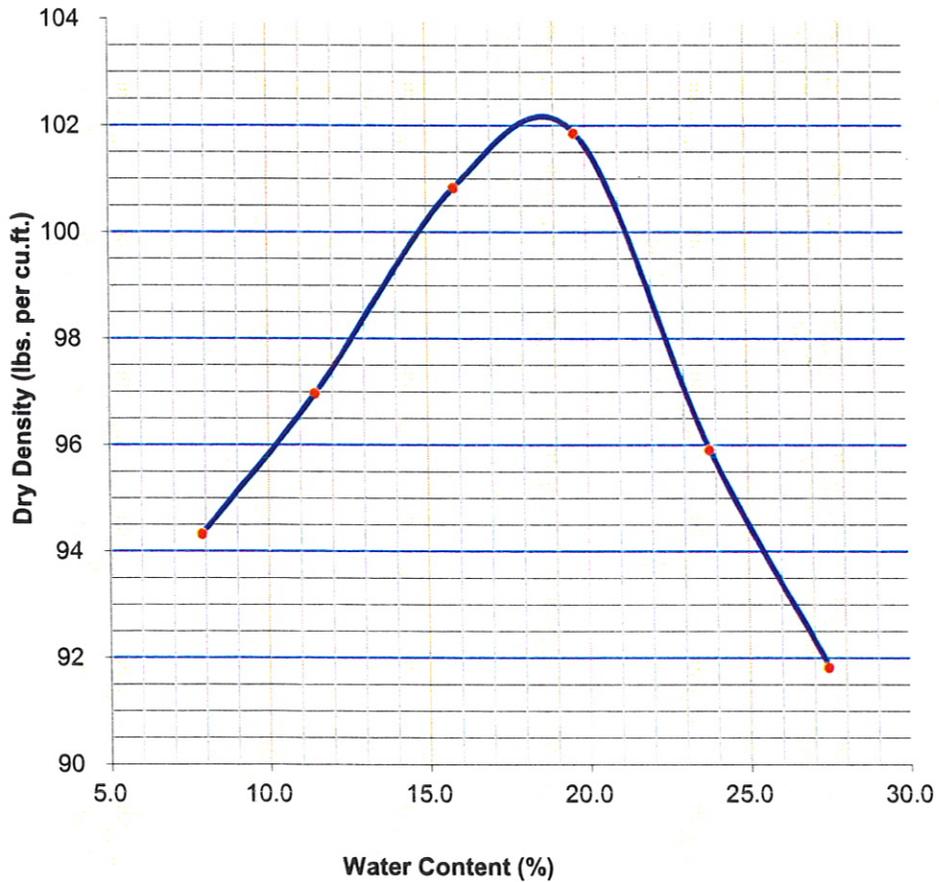
Mass Unit Weight: 132.14 pcf

Soil Classification: SM

Coarse Grained
Silty sand



Black Warrior Minerals
 Mine #2, Basin 048, Dam Material
 Moisture Density Relationship
 (Proctor Method)



ASTM D-698 Method A	Water Content %	Specific Gravity	%> No. 4	%< No. 200	LL %	PL %	PI %
			4.9	49.9	36.6	26.9	9.7
Sample Description, Classification and Location				Sample No.: Basin 048 Dam Material			
Coarse Grained Silty sand				Optimum Moisture Content=		18.8	
				Maximum Dry Density =		102.2	

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

STABILITY ANALYSIS - COMPUTER OUTPUT
SEDIMENT BASIN 049 - STATIC

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

REAME
(Rotational Equilibrium Analysis of Multilayered Embankments)

Black Warrior Minerals, Inc.
Mine No. 2, P-39__
Sediment Basin 049
Static Case

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4

Number of points on boundary lines are: 2 2 3 7

On boundary line no. 1 Point no. and coordinates are:

1 .000 9.000 2 500.000 .000

On boundary line no. 2 Point no. and coordinates are:

1 200.000 8.400 2 314.660 6.336

On boundary line no. 3 Point no. and coordinates are:

1 .000 12.000 2 200.000 8.400 3 237.500 23.400

On boundary line no. 4 Point no. and coordinates are:

1 .000 23.400 2 237.500 23.400 3 248.750 27.900 4 260.750 27.900 5 303.142 10.943
6 314.660 6.336 7 500.000 3.000

Line no. and slope of each segment are:

1 -.018

2 -.018

3 -.018 .400

4 .000 .400 .000 -.400 -.400 -.018

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1

Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no. Cohesion F. angle Unit wt.

1 460.000 29.000 123.900

2 270.000 33.020 132.140

3 .000 .000 62.400

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1 point no. and coordinates of water table are:

1 .000 23.400 2 237.500 23.400 3 264.696 18.622 4 303.142 10.943 5 314.660 6.336
6 500.000 3.000

point1=(262.000, 49.000) point2=(262.000, 29.000) point3=(316.000, 29.000) NJ= 2 NI= 2
Automatic search will follow after grid with XINC= 10.000 and YINC= 10.000

At point (262.000, 49.000) under seepage 1, the radius and the corresponding factor of safety are:
44.709 8.779 39.994 8.884 35.280 8.966 30.566 9.292 25.851 10.547
Lowest factor of safety= 8.779 and occurs at radius = 44.709

At point (262.000, 39.000) under seepage 1, the radius and the corresponding factor of safety are:
34.710 8.646 30.002 8.485 25.294 8.167 20.586 8.256 15.878 9.734
28.433 8.307 26.864 8.221 23.725 8.156 22.156 8.191
Lowest factor of safety= 8.156 and occurs at radius = 23.725

At point (262.000, 29.000) under seepage 1, the radius and the corresponding factor of safety are:
24.712 8.886 20.067 8.598 15.421 8.698 10.776 9.587 6.131 10.727
23.164 8.808 21.615 8.654 18.518 8.553 16.970 8.517
Lowest factor of safety= 8.517 and occurs at radius = 16.970

At point (289.000, 49.000) under seepage 1, the radius and the corresponding factor of safety are:
45.195 2.577 42.172 2.558 39.150 2.786 36.128 3.321 33.105 4.692
44.187 2.596 43.180 2.606 41.165 2.617 40.157 2.694
Lowest factor of safety= 2.558 and occurs at radius = 42.172

At point (289.000, 39.000) under seepage 1, the radius and the corresponding factor of safety are:
35.196 2.632 32.317 2.674 29.437 2.917 26.557 3.512 23.678 4.966
Lowest factor of safety= 2.632 and occurs at radius = 35.196

At point (289.000, 29.000) under seepage 1, the radius and the corresponding factor of safety are:
25.198 2.981 22.461 3.071 19.724 3.303 16.987 3.913 14.250 5.458
Lowest factor of safety= 2.981 and occurs at radius = 25.198

At point (316.000, 49.000) under seepage 1, the radius and the corresponding factor of safety are:
45.681 4.305 44.567 4.710 43.453 5.225 42.338 4.953 41.224 8.709
43.081 5.329 42.710 4.892 41.967 5.710 41.596 6.834
Lowest factor of safety= 4.305 and occurs at radius = 45.681

At point (316.000, 39.000) under seepage 1, the radius and the corresponding factor of safety are:
35.682 4.973 34.711 5.489 33.740 6.244 32.768 6.665 31.797 9.616

BLACK WARRIOR MINERALS, INC.
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Lowest factor of safety= 4.973 and occurs at radius = 35.682

At point (316.000, 29.000) under seepage 1, the radius and the corresponding factor of safety are:
25.684 6.107 24.855 6.810 24.027 7.905 23.198 9.749 22.369 10.997
Lowest factor of safety= 6.107 and occurs at radius = 25.684

For piezometric line No. 1

At point (289.000, 49.000), RADIUS 42.172
the minimum factor of safety is 2.558

At point (289.000, 49.000) under seepage 1, the radius and the corresponding factor of safety are:
45.195 2.577 42.172 2.558 39.150 2.786 36.128 3.321 33.105 4.692
44.187 2.596 43.180 2.606 41.165 2.617 40.157 2.694
Lowest factor of safety= 2.558 and occurs at radius = 42.172

At point (299.000, 49.000) under seepage 1, the radius and the corresponding factor of safety are:
45.375 2.485 43.059 2.614 40.743 2.796 38.428 3.513 36.112 5.457
Lowest factor of safety= 2.485 and occurs at radius = 45.375

At point (309.000, 49.000) under seepage 1, the radius and the corresponding factor of safety are:
45.555 3.061 43.946 3.212 42.337 3.104 40.728 4.028 39.119 6.779
43.410 3.229 42.873 3.200 41.801 3.334 41.264 3.634
Lowest factor of safety= 3.061 and occurs at radius = 45.555

At point (299.000, 59.000) under seepage 1, the radius and the corresponding factor of safety are:
55.373 2.447 52.915 2.523 50.456 2.706 47.998 3.411 45.540 5.195
Lowest factor of safety= 2.447 and occurs at radius = 55.373

At point (299.000, 69.000) under seepage 1, the radius and the corresponding factor of safety are:
65.371 2.488 62.770 2.525 60.169 2.693 57.568 3.314 54.967 4.975
Lowest factor of safety= 2.488 and occurs at radius = 65.371

At point (309.000, 59.000) under seepage 1, the radius and the corresponding factor of safety are:
55.553 2.897 53.801 3.017 52.050 2.992 50.298 3.868 48.547 6.450
53.218 3.014 52.634 2.937 51.466 3.213 50.882 3.492
Lowest factor of safety= 2.897 and occurs at radius = 55.553

At point (289.000, 59.000) under seepage 1, the radius and the corresponding factor of safety are:
55.193 2.633 52.028 2.606 48.863 2.841 45.698 3.318 42.533 4.462
54.138 2.654 53.083 2.654 50.973 2.668 49.918 2.749
Lowest factor of safety= 2.606 and occurs at radius = 52.028

BLACK WARRIOR MINERALS, INC.
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At point (301.500, 59.000) under seepage 1, the radius and the corresponding factor of safety are:
55.418 2.485 53.136 2.568 50.855 2.756 48.573 3.487 46.292 5.444
Lowest factor of safety= 2.485 and occurs at radius = 55.418

At point (296.500, 59.000) under seepage 1, the radius and the corresponding factor of safety are:
55.328 2.452 52.693 2.504 50.058 2.687 47.423 3.347 44.788 4.982
Lowest factor of safety= 2.452 and occurs at radius = 55.328

At point (299.000, 61.500) under seepage 1, the radius and the corresponding factor of safety are:
57.873 2.455 55.379 2.515 52.885 2.693 50.391 3.387 47.897 5.137
Lowest factor of safety= 2.455 and occurs at radius = 57.873

At point (299.000, 56.500) under seepage 1, the radius and the corresponding factor of safety are:
52.873 2.442 50.451 2.536 48.028 2.727 45.606 3.437 43.183 5.256
Lowest factor of safety= 2.442 and occurs at radius = 52.873

At point (299.000, 54.000) under seepage 1, the radius and the corresponding factor of safety are:
50.374 2.450 47.987 2.555 45.600 2.750 43.213 3.460 40.826 5.320
Lowest factor of safety= 2.450 and occurs at radius = 50.374

At point (301.500, 56.500) under seepage 1, the radius and the corresponding factor of safety are:
52.918 2.494 50.672 2.590 48.427 2.774 46.181 3.511 43.935 5.512
Lowest factor of safety= 2.494 and occurs at radius = 52.918

At point (296.500, 56.500) under seepage 1, the radius and the corresponding factor of safety are:
52.828 2.447 50.229 2.507 47.630 2.696 45.030 3.373 42.431 5.037
Lowest factor of safety= 2.447 and occurs at radius = 52.828

For piezometric line No. 1

At point (299.000, 56.500), RADIUS 52.873
the minimum factor of safety is 2.442

1

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 2.442

BLACK WARRIOR MINERALS, INC.
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