

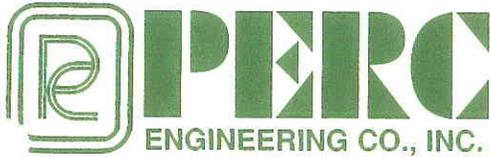
**HYDROLOGY STUDY FOR  
BLACK WARRIOR MINERALS, INC.**

**MANCHESTER EAST MINE  
P-3922 / REVISION R-3  
WALKER COUNTY, ALABAMA**

**BY  
PERC ENGINEERING CO., INC.  
P.O. BOX 1712  
JASPER, ALABAMA 35502**

**PRIMARY ROAD DESIGN PLANS  
HAULROAD 2E EXTENSION  
ATTACHMENT III-B-5**

**JANUARY 25, 2012**



Telephone: (205) 384-5553  
Facsimile: (205) 295-3114 - Main Building  
(205) 295-3115 - Water Lab  
Web Address: [www.percengineering.com](http://www.percengineering.com)

January 25, 2012

Mr. Michael Harrison, P.E.  
Alabama Surface Mining Commission  
Post Office Box 2390  
Jasper, Alabama 35502-2390

RE: Black Warrior Minerals, Inc.  
Manchester East Mine  
P-3922

Dear Michael:

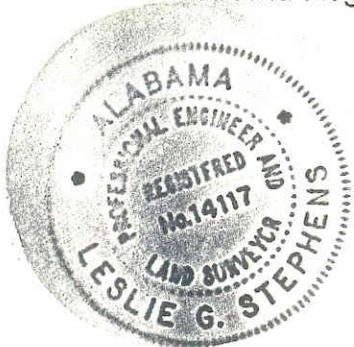
I hereby certify the attached detailed design plans for Primary Road 2E Extension for the above referenced mine are in accordance with current prudent engineering practices and the Regulations of the Alabama Surface Mining Commission and are true and correct to the best of my knowledge and belief.

If you have any questions or required additional information, please feel free to call.

Sincerely,  
PERC Engineering Co., Inc.

A handwritten signature in brown ink that reads "Leslie G. Stephens".

Leslie G. Stephens, P.E., P.L.S.  
Alabama Registration No. 14117-E



SPECIFICATIONS FOR THE CONSTRUCTION, MAINTENANCE  
AND RECLAMATION OF PRIMARY ROADS

1. Primary roads shall be designed by or under the direction of a registered professional engineer in accordance with the Alabama Surface Mining Commission rules and regulations and prudent engineering practice.
2. Each roadway embankment will be designed and constructed so as to have a minimum static safety factor of 1.3.
3. To the extent possible, roads will be located on ridges or on the most stable available slopes to prevent or minimize erosion, downstream sedimentation and flooding in an effort to prevent adverse effects to fish, wildlife and related environmental values.
4. To the extent possible, roads will be located above the sediment basins to be constructed for the mining operation in an effort to control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area and to comply with State and Federal water quality standards applicable to receiving waters and avoid the alteration of the normal flow of water in streambeds or drainage channels while preventing or controlling damage to public or private property. Where it is not possible or is impractical to locate roads in this manner, sediment control devices such as silt fencing, hay bale check dams and rock filter check dams will be used as necessary to maintain water quality. No fording of intermittent or perennial streams will be conducted unless specifically approved by the Alabama Surface Mining Commission as temporary routes to be used during road construction.
5. Prior to construction, the roadway will be cleared, grubbed and will have the topsoil removed. The clearing limits will be kept to the minimum necessary to accommodate the roadbed and associated ditch construction.
6. Roads will be constructed of suitable compacted subgrade material. The material will be free of sod, roots, stones over 12 inches in diameter, and other objectionable materials. The material will be placed and spread over the entire fill area, starting at the lowest point in layers not to exceed 12 inches in thickness. The material will be compacted to 95 percent of the density, based on standard proctor as outlined in ASTM.

7. Primary roads will have a minimum width of eighteen feet and a maximum width necessary to accommodate the largest equipment traveling the road.
8. Roadbeds will be cut to consolidated non-erodible material or will be surfaced with durable non-toxic, non-acid forming substances. The wearing surface will consist of durable sandstone, chert, crushed limestone, crushed concrete, crushed asphalt, red rock, ironore refuse, gravel, or other durable non-toxic, non-acid forming material approved by the Regulatory Authority. The wearing surface will be placed on the roadbed to a depth of four inches.
9. No sustained grades will exceed ten percent unless deemed necessary, in which case appropriate sediment control facilities will be constructed. If grades in excess of fifteen percent are required, cross drains, ditch relief drains and road drainways will be located at a minimum distance of three-hundred feet.
10. Roads will be constructed so as to have adequate drainage utilizing ditches, culverts, cross drains and ditch relief drains designed to safely pass the peak runoff from a ten year, six hour precipitation event. Drainage pipes and culverts shall be installed as designed and will be maintained in a free and operating condition to prevent and control erosion at inlets and outlets. Culverts have been designed to support the load of the heaviest equipment to travel the road and are based on the Handbook of Steel Drainage and Highway Construction Products by the American Iron and Steel Institute and the equipment specifications. Drainage ditches will be constructed and maintained in accordance with the approved design to prevent uncontrolled drainage over the road surface and embankment. Roads will not be located in the channel of an intermittent or perennial stream unless specifically approved by the Alabama Surface Mining Commission. Additionally, no relocation and/or alteration of an intermittent or perennial stream will be done unless specifically approved by the Alabama Surface Mining Commission. In the event that it becomes evident that any drainage structures including culverts, bridges and/or low water crossings will be required in order to cross an intermittent or perennial stream, the structure will be designed and constructed in accordance with Alabama Surface Mining Commission requirements and prudent engineering practice and the approval of the design(s) will be acquired prior to the commencement of construction. Hay bale check

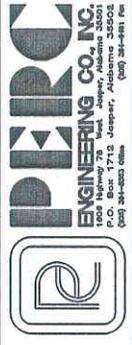
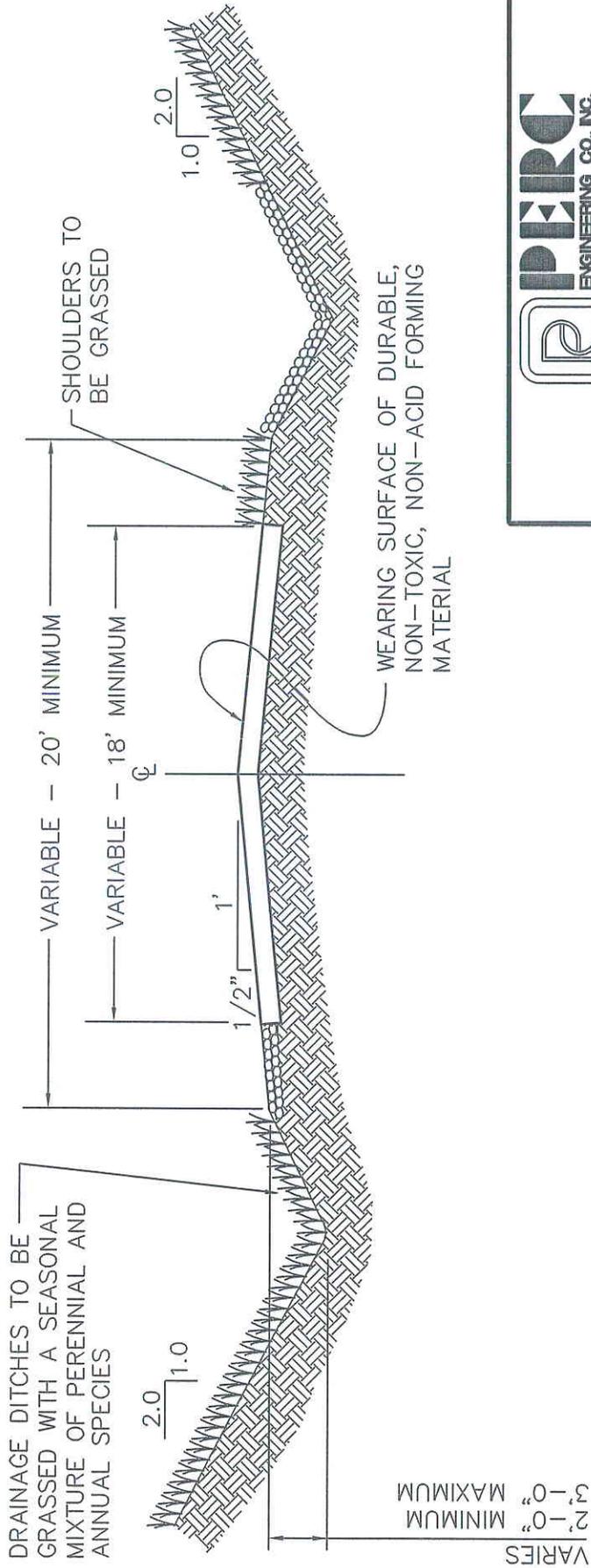
dams and silt fences will be used at strategic locations when necessary to control sediment runoff. Immediately upon completion of construction, the side slopes of the road embankments and/or cuts will be fertilized, seeded with annual and perennial grasses and mulch will be added to aid in the prevention of erosion and to enhance seed germination. The seed mix will consist of, but is not limited to, some combination of the following species: bermuda grass, fescue, lespedeza, rye grass, brown top millet, clover and vetch. The particular species to be planted will vary with the planting season at the time of seed application. Upon completion of construction of each phase of the roadway the construction will be certified to the Alabama Surface Mining Commission as having been done in accordance with the approved plans for the roadway and associated facilities.

11. Routine maintenance will be required to assure that the road continually meets performance standards and will consist of periodic grading, resurfacing, dust suppression and maintenance of sediment control facilities. Dust suppression will consist of the application of water, chemical binders and/or other dust suppressants. No oil will be utilized in this process. Spot seeding, fertilizing and mulching will be performed as necessary to improve vegetative cover on roadway slopes. A road damaged by a catastrophic event shall be repaired as soon as practicable after the damage has occurred.
12. Roads not to be retained as part of the post mine land use shall be reclaimed in accordance with the approved reclamation plan for this permit as soon as practicable after they are no longer needed as part of the mining and reclamation operation, using the following procedures:
  - a. The road will be closed to traffic.
  - b. All bridges, culverts and other drainage structures not approved as part of the post mine land use will be removed.
  - c. All road surfacing materials that are not compatible with the post mine land use or revegetation requirements will be properly disposed of on-site or removed from the site for re-use.
  - d. Roadway cut and fill slopes shall be regraded and reshaped to be compatible with the post mine land use and to compliment the natural drainage pattern of the surrounding terrain.
  - e. The natural drainage patterns shall be protected from surface runoff and erosion utilizing the installation of dikes and/or cross drains as necessary.

- f. The roadbed shall be ripped or scarified as necessary, the topsoil or substitute or approved growing medium shall be replaced and revegetated in accordance with the approved reclamation plan for this permit.
13. The drawings and data contained in the specific design plans illustrate typical roadbed configurations for primary roads as well as site specific design of drainage structures, stability analysis and ditch sections.

# TYPICAL HAUL ROAD CUT SECTION

NO SCALE



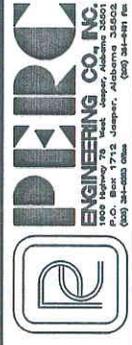
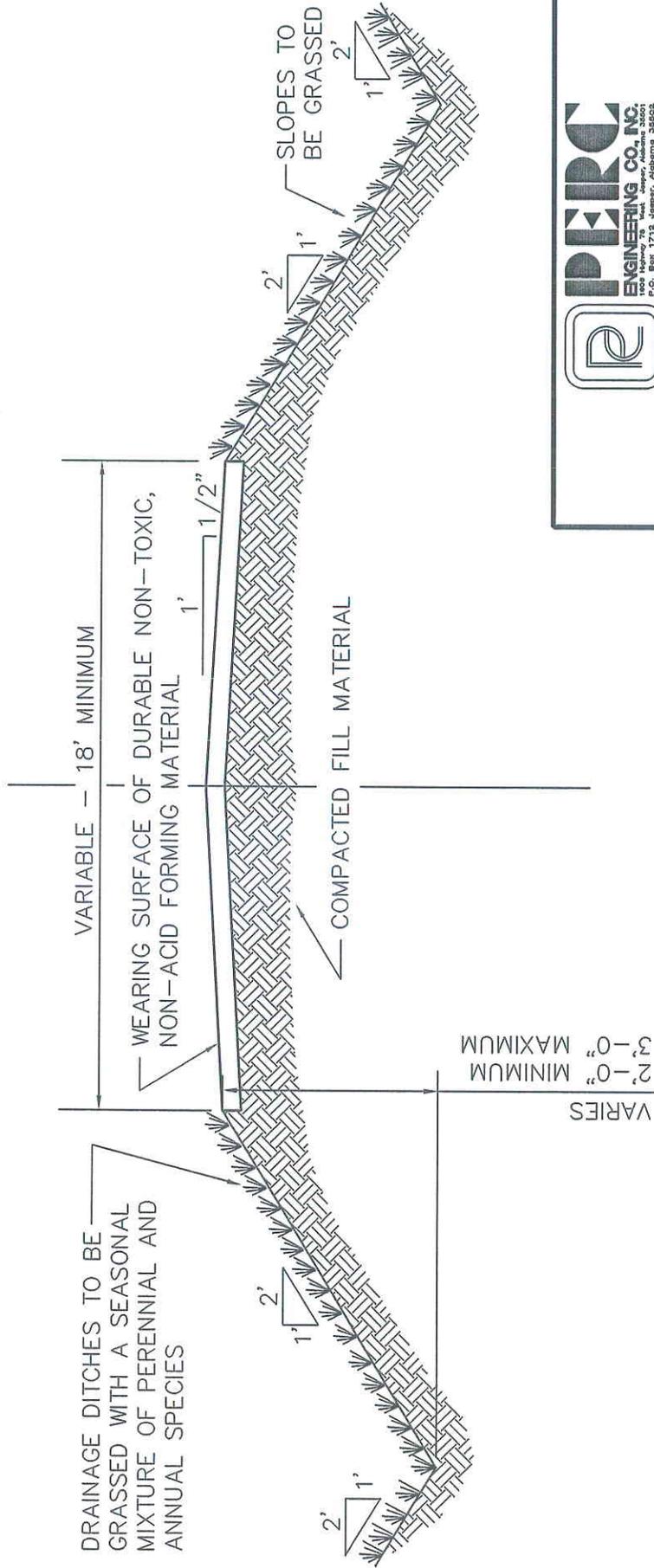
TYPICAL CUT SECTION  
PRIMARY HAUL ROAD

DRAWN BY: K.D.P.	DATE: 2-3-97
DWG. NAME: TYPHAULC	
APPROVED BY: S.R.I.	SCALE: NONE

ATTACHMENT III - B - 5.

# TYPICAL HAUL ROAD FILL SECTION

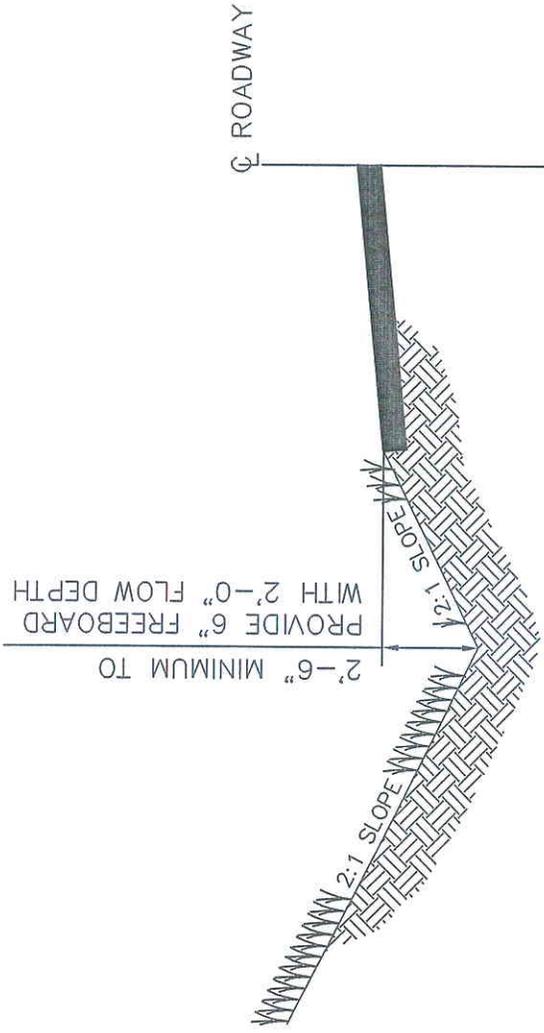
NO SCALE



TYPICAL FILL SECTION  
PRIMARY HAUL ROAD

DRAWN BY: K.D.P.	DATE: 2-3-97
DWG. NAME: TYPHAULF	
APPROVED BY: S.R.I.	SCALE: NONE

ATTACHMENT III - B - 5.



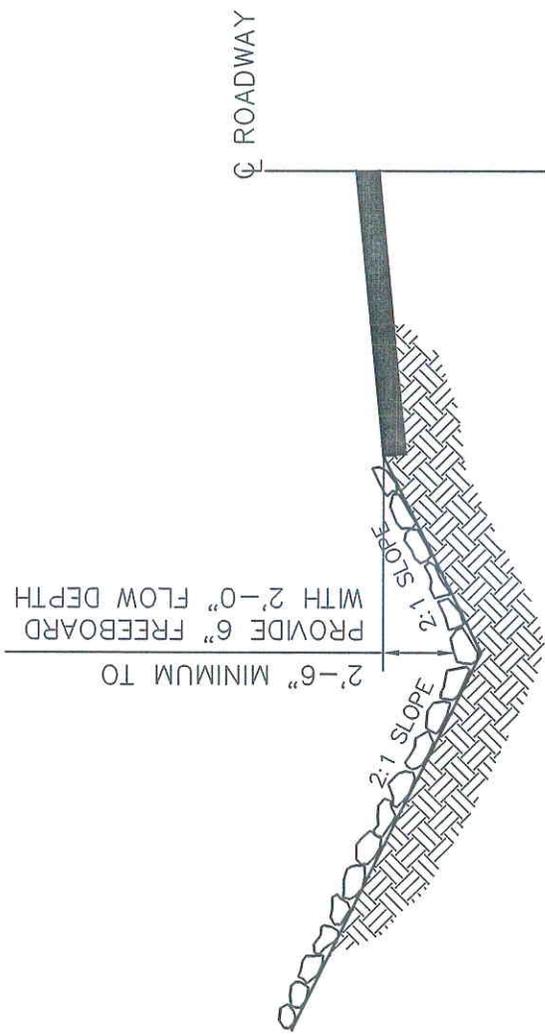
MINIMUM DITCH GRADIENT = 1%  
 MAXIMUM DITCH GRADIENT = 5%

DITCH CHANNEL TO BE VEGETATED WITH  
 A MIXTURE OF BERMUDA GRASS, FESCUE,  
 AND LESPEDEZA TO CONFORM TO CLASS  
 "D" RETARDANT CLASS.



TYPICAL PRIMARY ROADWAY DITCH  
 CROSS SECTION

DRAWN BY: K.D.P.	DATE: 2-4-97
DWG. NAME: PRIMROAD	
APPROVED BY: R.E.P.	SCALE: NONE



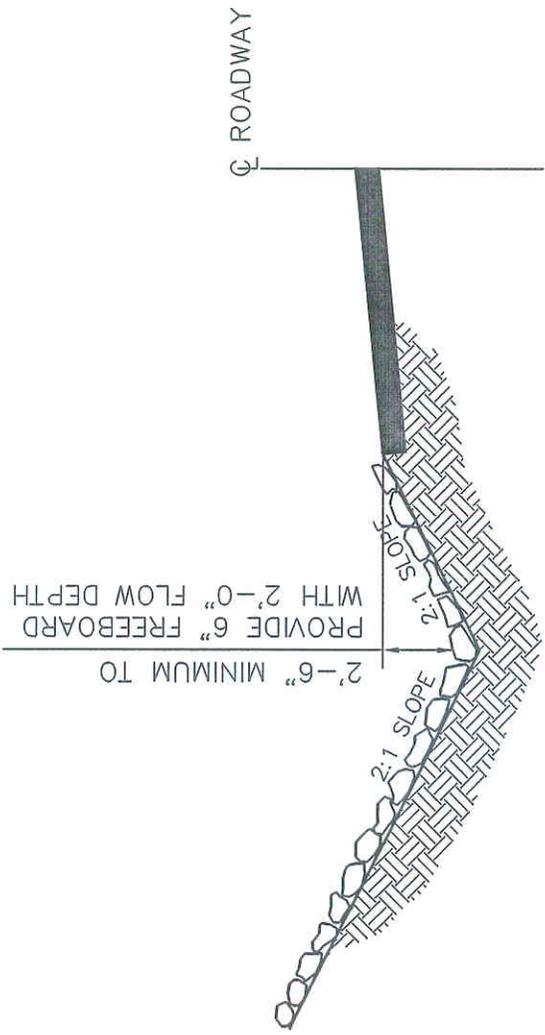
DITCH GRADIENT 5% TO 10%

DITCH CHANNEL TO BE LINED WITH NON-ERODIBLE  
NON-TOXIC, NON-ACID FORMING SANDSTONE OR  
LIMESTONE RIP-RAP. THE RIP-RAP WILL BE "CLASS 1"  
RIP-RAP AND HAVE A MINIMUM THICKNESS OF 12".



TYPICAL PRIMARY ROADWAY DITCH  
CROSS SECTION

DRAWN BY: DWG. NAME:	S.D.M. PRIMRD1	DATE:	11/8/2011
APPROVED BY:	L.G.S.	SCALE:	NONE



DITCH CHANNEL TO BE LINED WITH NON-ERODIBLE NON-TOXIC, NON-ACID FORMING SANDSTONE OR LIMESTONE RIP-RAP. THE RIP-RAP WILL BE "CLASS 2" RIP-RAP AND HAVE A MINIMUM THICKNESS OF 16".



TYPICAL PRIMARY ROADWAY DITCH  
CROSS SECTION

DRAWN BY: S.D.M.	DATE: 11/8/2011
DWG. NAME: PRIMRD2	
APPROVED BY: L.G.S.	SCALE: NONE

## NOTES

- 1) Primary Road 2E was certified on 11/24/2009 from station 0+00 to 24+50.
- 2) Primary Road 2E shall be extended to station 52+46.
- 3) Drainage structure DS1 shall consist of 8-36" CMP.
- 4) The maximum water elevation at drainage structure DS1 during a 10 year – 6 hour storm event will be elevation 491.8 and the constructed roadway bed above drainage structure DS1 will be constructed to elevation 490.9. Due to a temporary overtopping of the roadway, the roadway section above drainage structure DS1 will consist of 8 inches of reinforced concrete and the outer slopes will consist of 4" of reinforced concrete.
- 5) The roadway at DS1 will consist of 8 inches of 3000 psi concrete reinforced with two mats of #5 - 60 ksi rebar each way on 10" centers. The top mat will be located 2 inches from the top of the concrete and the bottom mat will be located 3 inches from the bottom of the concrete.
- 6) The outer slopes at DS1 will be lined with 4 inches of concrete reinforced with 6x6-W2.9xW2.9 concrete reinforcement.
- 7) See attached "1993 AASHTO Pavement Design" – DARWin Design and Analysis System for roadway concrete buildup and reinforcement within these design plans.
- 8) During the peak flow when the roadway is being overtopped, no traffic will travel on the low water crossing at DS1.
- 9) Due to there being no significant cut or fill, no stability analysis is required.

# 1993 AASHTO Pavement Design

## DARWin Pavement Design and Analysis System

### A Proprietary AASHTOWare Computer Software Product

PERC Engineering Co., Inc.  
1606 Hwy 78 West  
Jasper Alabama 35501  
Walker

### Rigid Structural Design Module

Black Warrior Minerals Inc.  
Manchester East  
Primary Road 2E Extension DS1 34+22  
ASMC Permit P-3922 Revision R-3

### Rigid Structural Design

Pavement Type	CRCP
18-kip ESALs Over Initial Performance Period	601,110
Initial Serviceability	4.2
Terminal Serviceability	2.5
28-day Mean PCC Modulus of Rupture	650 psi
28-day Mean Elastic Modulus of Slab	3,605,000 psi
Mean Effective k-value	100 psi/in
Reliability Level	90 %
Overall Standard Deviation	0.39
Load Transfer Coefficient, J	3
Overall Drainage Coefficient, Cd	1.15
Calculated Design Thickness	5.76 in <i>6" minimum SLAB</i>

### Simple ESAL Calculation

Performance Period (years)	10
Two-Way Traffic (ADT)	100
Number of Lanes in Design Direction	1
Percent of All Trucks in Design Lane	100 %
Percent Trucks in Design Direction	100 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	100 %
Average Initial Truck Factor (ESALs/truck)	1.45
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	3 %
Growth	Simple
Total Calculated Cumulative ESALs	601,110

### CRCP Longitudinal Steel Design

28-day Concrete Indirect Tensile Strength	650 psi
Concrete Shrinkage at 28 Days	0.0003 in/in

Thermal Coefficient of Concrete	6 (10 <sup>-6</sup> in/in)/F
Thermal Coefficient of Reinforced Steel	5 (10 <sup>-6</sup> in/in)/F
Design Temperature Drop	80 F
Tensile Stress Due to Wheel Load	300 psi
Allowable Steel Stress	60 ksi
Allowable Crack Width	0.03 in
Bar Diameter	0.625 in

<u>Lane</u>	<u>Width (ft)</u>
1	20
2	-
3	-
4	-
5	-

Lane

1

**Calculated Results**

Calculated Minimum % Steel	0.51 %
Calculated Maximum % Steel	0.55 %
Calculated Actual % Steel	0.53 %
Calculated Minimum # of Bars	23.1
Calculated Maximum # of Bars	24.7
Calculated Actual # of Bars	24

*10" c/c*

**CRCP Transverse Steel Design**

Friction Factor (F)	1.2
Steel Working Stress	60
Bar or Wire Diameter	0.625

<u>Lane</u>	<u>Width (ft)</u>	<u>Tied to Next Lane</u>	<u>Percent Steel</u>	<u>Area of Steel (sq in/ft)</u>	<u>Bar Spacing (in)</u>
1	-	-	-	-	-
2	20	-	0.020	0.014	266.51
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-

**Tie Bar Steel Design**

Steel Grade	60 ksi
Distance to Free Edge	3 ft
Slab Thickness	6 in
Friction Factor (F)	1.2
Percent of Yield Strength	60
Bar Diameter	0.625 in

**Calculated Results**

Calculated Maximum Tie Bar Spacing	511.3 in
Recommended Maximum Tie Bar Spacing	48.0 in
Calculated Tie Bar Length	35.1 in
Calculated Area of Steel	0.007 sq in/ft

**Layer Information**

Layer  
1  
Total

Material Description  
CRCP  
-

Thickness  
(in)  
5.7557676  
5.76

One Dir  
Width  
(ft)  
20  
-

*Minimum 6" SLAB*

### Inner Shoulder Design

Layer  
Total

Material Description  
-

Inner  
Thickness  
(in)  
0.00

Outer  
Thickness  
(in)  
0.00

One Dir  
Width  
(ft)  
-

### Outer Shoulder Design

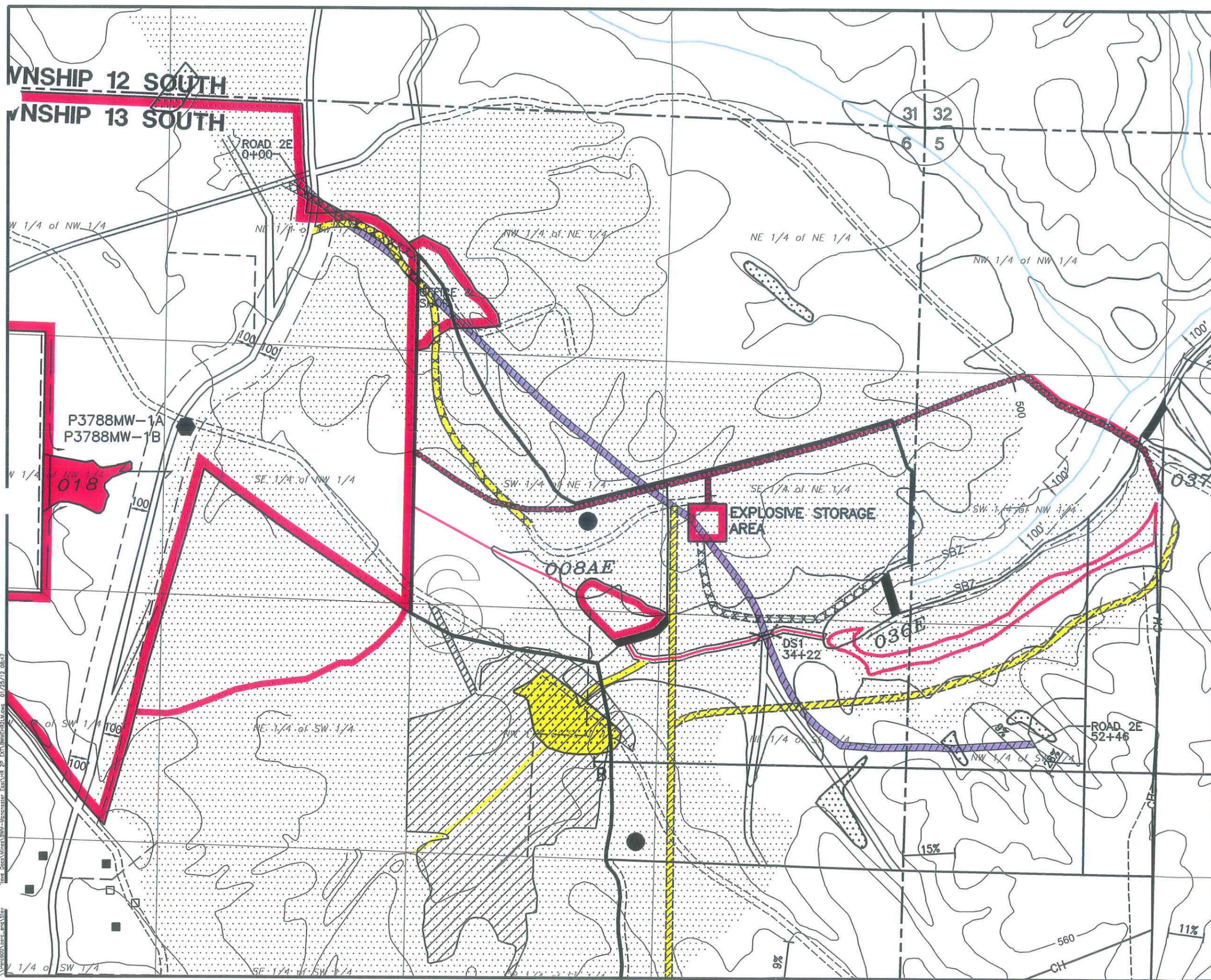
Layer  
Total

Material Description  
-

Inner  
Thickness  
(in)  
-

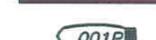
Outer  
Thickness  
(in)  
-

One Dir  
Width  
(ft)  
-



Scale: 1" = 500'

**MAP LEGEND**

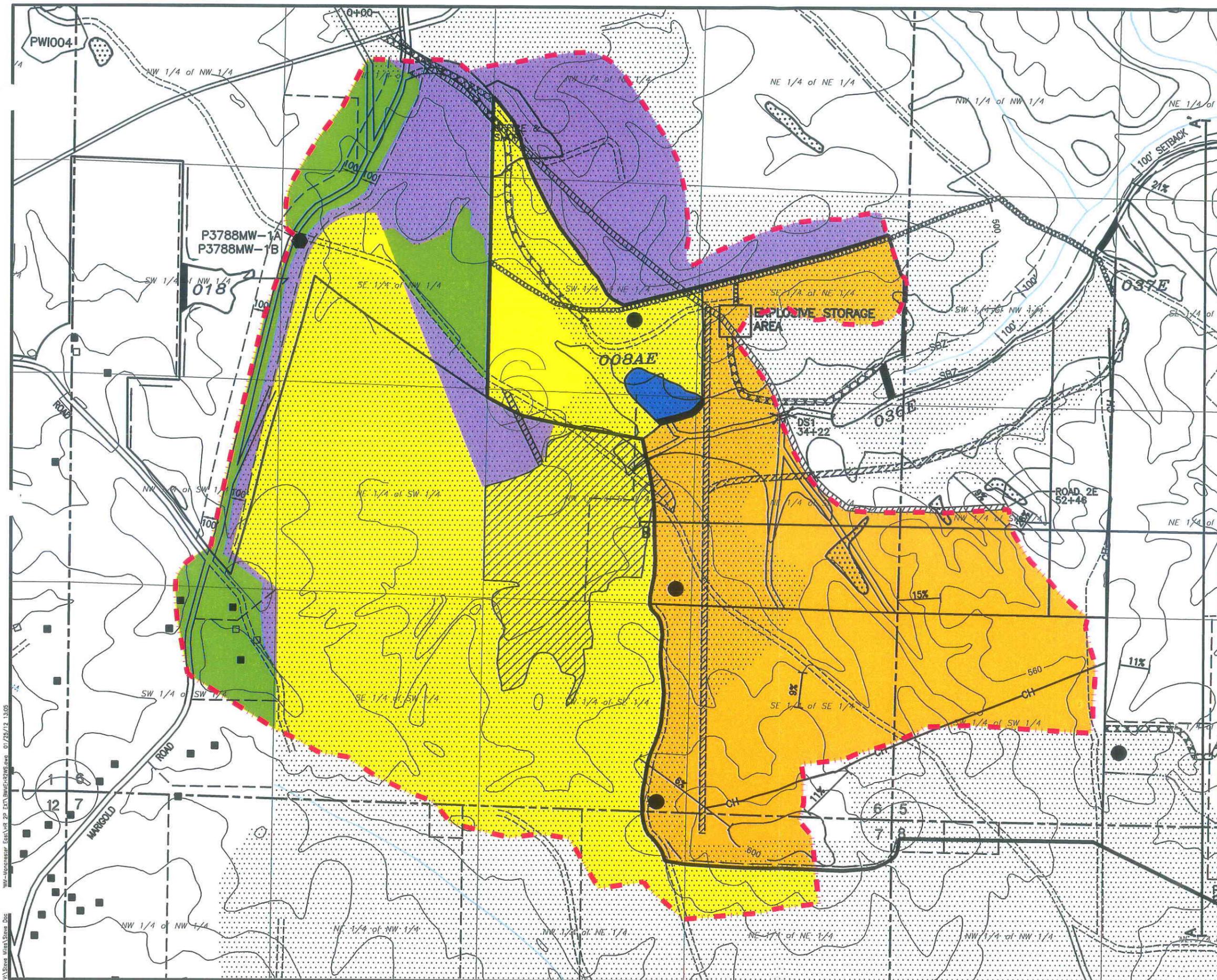
-  Permit Boundary
-  ASMC Permit P-3788
-  ASMC Permit P-3830
-  Sediment Basin
-  Primary Road
-  Drainage Structure
-  Diversion Ditch
-  Perennial Stream



Attachment III-B-5  
 Haulroad Location Map  
 Black Warrior Minerals, inc.  
 Manchester East Mine  
 P-3922 / Revision R-3

DRAWN BY: S.D.M.	DATE: 1/25/2012
DWG. NAME: BWMEHR2LM	
APPROVED BY: L.G.S.	SCALE: 1"=500'

File: D:\Data\Mining\Black Warrior\BWM\DWG\BWMHR2LM.dwg 01/25/12 08:47  
 P:\Perdco\BWM\BWMHR2LM.dwg



Scale: 1" = 600'

N

**MAP LEGEND**

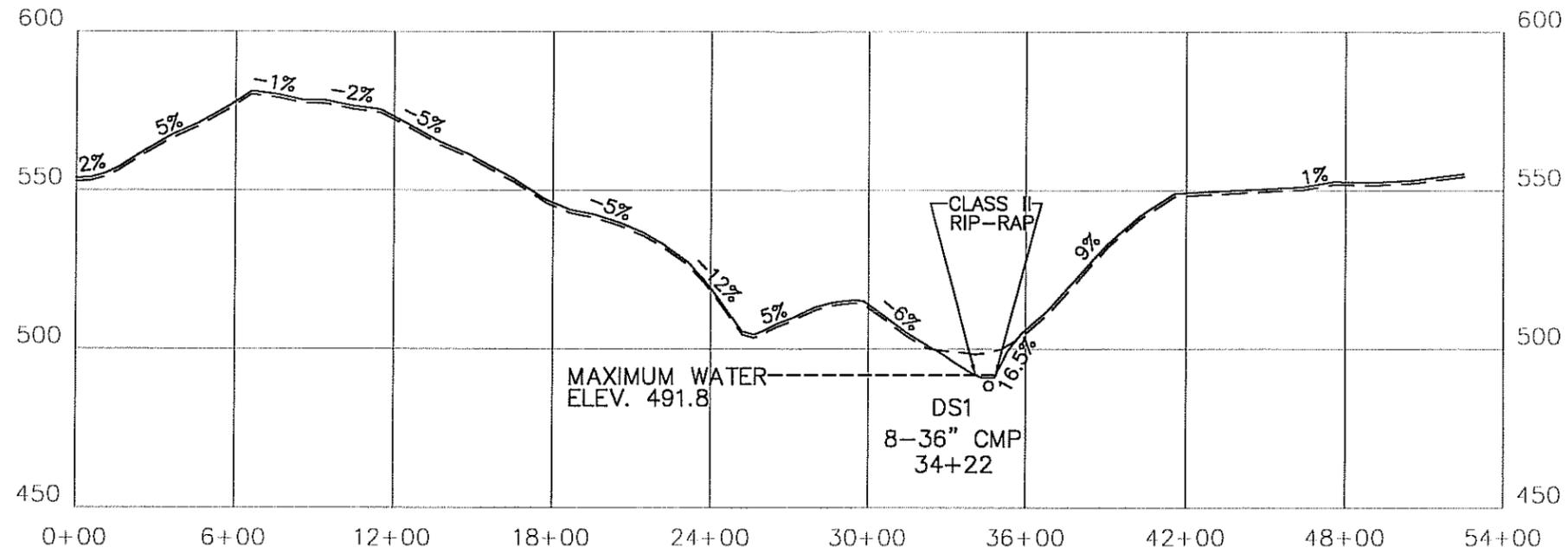
- Permit Boundary
- Sediment Basin
- Primary Road
- Drainage Structure
- Diversion Ditch
- Perennial Stream
- Drainage Divide
- Previously Mined, Curve Number, 68
- Unmanaged Timberland, Curve Number, 70
- Revegetated, Curve Number, 74
- Graded & Bare, Curve Number, 81
- Sediment Basins, Curve Number, 100



Attachment III-B-5  
 Watershed Map  
 Black Warrior Minerals, inc.  
 Manchester East Mine  
 P-3922 / Revision R-3

DRAWN BY: S.D.M.	DATE: 1/25/2012
DWG. NAME: BWMEHR2WS	
APPROVED BY: L.G.S.	SCALE: 1"=600'

W:\Mine\Manchester East\LR 2P EXT\BWMEHR2WS.dwg 01/25/12 13:05  
 VA:Shore Mines\Steve.Dog



SCALE: 1"=600' HORIZONTAL  
1"=50' VERTICAL

### PRIMARY ROAD 2E EXTENSION

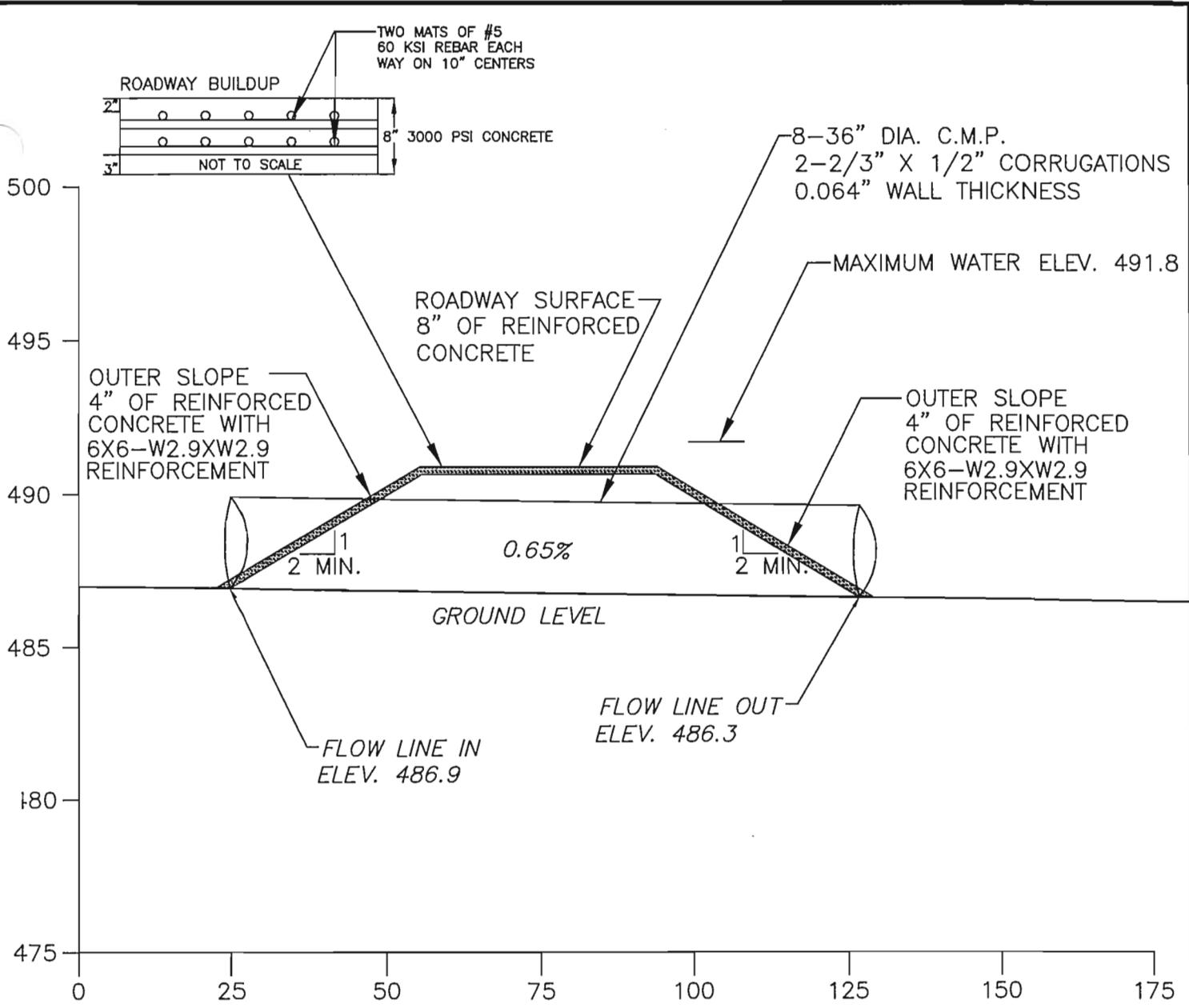
----- EXISTING GRADE  
————— PROPOSED GRADE

NOTE:  
FINISHED GRADES SHOWN HEREON MAY  
VARY FROM BETWEEN 0% AND 17%.



**BLACK WARRIOR MINERALS, INC.**  
**MANCHESTER EAST MINE**  
**P-3922 / REVISION R-3**  
**HAULROAD 2E EXTENSION PROFILE**

DRAWN BY: S.D.M.	DATE: 4/5/2012
DWG. NAME: BWMEHRD2	
APPROVED BY: L.G.S.	SCALE: AS NOTED



Hydraulics Information

Drainage Area = 432.7 Acres  
 10 YR.-6 HR., Q = 496.4 C.F.S.  
 Maximum Water Elev. = 491.8  
 Minimum Fill Elev. = 490.9  
 Maximum Allowable Cover 36" C.M.P. = 83'  
 Minimum Allowable Cover 36" C.M.P. = 1'  
 Wall Thickness = 0.064"  
 Minimum Freeboard = 1'



**BLACK WARRIOR MINERALS, INC.**  
**MANCHESTER EAST MINE**  
**P-3922 / REVISION R-3**  
**PRIMARY ROAD 2E CROSS SECTION**  
**DS1 34+22**

DRAWN BY: S.D.M  
 DWG. NAME: BWMMEHR2RCS

DATE: 4/19/2012

APPROVED BY: L.G.S.

SCALE: AS NOTED

**Black Warrior Minerals, Inc.**  
**Manchester East Mine**  
**P-3922 / Revision R-3**  
**Primary Road 2E Extension**  
**Drainage Structure DS1 34+22**

*4.2 Inches, 10 Year - 6 Hour*

*SCS 6 Hour Event*

SDM

PERC Engineering Co., Inc.  
1606 Highway 78 West  
Jasper, AL 35501

Phone: (205) 384-5553  
Email: smiles@percengineering.com

## General Information

### Storm Information:

Storm Type:	Rainfall Event
-------------	----------------

Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1470
1.00	0.3360
1.50	0.5670
2.00	0.9660
2.50	2.5200
3.00	2.9400
3.50	3.2760
4.00	3.5070
4.50	3.7170
5.00	3.8850
5.50	4.0530
6.00	4.2000

*Peak 30-minute Intensity: 3.108 in/hr*

***Structure Networking:***

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Drainage Structure DS1

#1  
Culvert

***Structure Summary:***

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1*	432.700	432.700	496.43	58.52

*\*Denotes structures with incomplete design parameters. Results for these structures have not been evaluated, and may affect downstream structures.*

## ***Structure Detail:***

### ***Structure #1 (Culvert)***

#### ***Drainage Structure DS1***

Structure design parameters are not specified. No results to show.

### 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	64.200	0.133	0.090	0.360	68.000	M	52.00	5.797
	2	33.800	0.555	0.225	0.369	70.000	M	19.64	3.287
	3	199.300	0.184	0.079	0.325	74.000	M	215.82	23.392
	4	133.100	0.085	0.000	0.000	81.000	F	294.04	25.269
	5	2.300	0.183	0.000	0.000	100.000	F	6.87	0.771
	<b>Σ</b>	<b>432.700</b>						<b>496.43</b>	<b>58.516</b>

### Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	3.41	70.00	2,050.00	5.540	0.102
<b>#1</b>	<b>1</b>	<b>Time of Concentration:</b>					<b>0.133</b>
#1	2	1. Forest with heavy ground litter	1.00	5.00	500.00	0.250	0.555
<b>#1</b>	<b>2</b>	<b>Time of Concentration:</b>					<b>0.555</b>
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	2.86	80.00	2,800.04	5.070	0.153
<b>#1</b>	<b>3</b>	<b>Time of Concentration:</b>					<b>0.184</b>
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		9. Small streams flowing bankfull	2.94	100.00	3,400.00	15.430	0.061
<b>#1</b>	<b>4</b>	<b>Time of Concentration:</b>					<b>0.085</b>
#1	5	8. Large gullies, diversions, and low flowing streams	0.40	5.00	1,250.00	1.890	0.183
<b>#1</b>	<b>5</b>	<b>Time of Concentration:</b>					<b>0.183</b>

### Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.11	30.00	1,420.00	4.360	0.090
<b>#1</b>	<b>1</b>	<b>Muskingum K:</b>					<b>0.090</b>
#1	2	8. Large gullies, diversions, and low flowing streams	2.56	100.00	3,900.00	4.800	0.225
<b>#1</b>	<b>2</b>	<b>Muskingum K:</b>					<b>0.225</b>

# SEDCAD 4 for Windows

Copyright 1998-2006 Pamela J. Schwab

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	3	8. Large gullies, diversions, and low flowing streams	1.11	10.00	900.00	3.160	0.079
<b>#1</b>	<b>3</b>	<b>Muskingum K:</b>					<b>0.079</b>



CURRENT DATE: 04-03-2012  
CURRENT TIME: 17:45:48

FILE DATE: 04-03-2012  
FILE NAME: BWMMEAST

PERFORMANCE CURVE FOR CULVERT 1 - 8( 3.00 (ft) BY 3.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD- WATER ELEV. (ft)	INLET DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	CONTROL TYPE	FLOW NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	488.70	0.00	1.80	0-NF	0.00	0.00	0.00	2.40	0.00	0.00
55.00	488.84	1.22	1.94	3-M1t	1.00	0.81	2.40	2.40	1.13	0.00
110.00	489.11	1.78	2.21	3-M1t	1.48	1.18	2.40	2.40	2.27	0.00
165.00	489.48	2.26	2.58	3-M1t	1.92	1.45	2.40	2.40	3.40	0.00
220.00	489.91	2.74	3.01	3-M2t	2.41	1.69	2.40	2.40	4.54	0.00
275.00	490.39	3.23	3.49	3-M2t	3.00	1.90	2.40	2.40	5.67	0.00
328.90	490.89	3.77	3.99	3-M2t	3.00	2.09	2.40	2.40	6.78	0.00
349.80	491.30	4.00	4.40	3-M2t	3.00	2.15	2.40	2.40	7.21	0.00
362.87	491.55	4.15	4.65	3-M2t	3.00	2.19	2.40	2.40	7.48	0.00
373.22	491.75	4.28	4.85	3-M2t	3.00	2.22	2.40	2.40	7.70	0.00
373.38	491.76	4.28	4.86	3-M2t	3.00	2.22	2.40	2.40	7.70	0.00

El. inlet face invert 486.90 ft El. outlet invert 486.30 ft  
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

\*\*\*\*\* SITE DATA \*\*\*\*\* CULVERT INVERT \*\*\*\*\*  
INLET STATION 0.00 ft  
INLET ELEVATION 486.90 ft  
OUTLET STATION 100.00 ft  
OUTLET ELEVATION 486.30 ft  
NUMBER OF BARRELS 8  
SLOPE (V/H) 0.0060  
CULVERT LENGTH ALONG SLOPE 100.00 ft

\*\*\*\*\* CULVERT DATA SUMMARY \*\*\*\*\*  
BARREL SHAPE CIRCULAR  
BARREL DIAMETER 3.00 ft  
BARREL MATERIAL CORRUGATED STEEL  
BARREL MANNING'S n 0.024  
INLET TYPE CONVENTIONAL  
INLET EDGE AND WALL THIN EDGE PROJECTING  
INLET DEPRESSION NONE

\*\*\*\*\*

