HYDROLOGY STUDY FOR
BIRMINGHAM COAL & COKE CO., INC.

BEAR CREEK MINE

P-3831 / REVISION R-7

FRANKLIN COUNTY, ALABAMA

BY

PERC ENGINEERING CO., INC.

P.O. BOX 1712

JASPER, ALABAMA 35502

DETAILED DESIGN PLANS

DIVERSION 3-4

ATTACHMENT III-B-3

SEPTEMBER 6, 2011

PERC
ENGINEERING CO., INC.

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Facsimile: (205) 295-3114 - Main Building
(205) 295-3115 - Water Lab
Web Address: www.percengineering.com

September 6, 2011

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

RE: Birmingham Coal & Coke Co., Inc.
Bear Creek Mine
P- 3831 / Revision R-7

Dear Gary:

I hereby certify the attached detailed design plans for Diversion 3-4 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 amended to date, 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.

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

ALABAMA PROFESSIONAL ENGINEER AND LAND SURVEYOR REGISTERED No. 14117 LESLIE G. STEPHENS

SPECIFICATIONS FOR DIVERSION CHANNELS AND DIVERSION BERMS

1. Temporary diversions shall be constructed to pass safely the peak runoff from a 2-year, 6-hour precipitation event.

2. To protect fills and property and to avoid danger to public health and safety, permanent diversions shall be constructed to pass safely the peak runoff from a 10-year, 6-hour precipitation event. Permanent diversions shall be constructed with gently sloping banks that are stabilized by vegetation.

3. Diversions shall be designed, constructed, and maintained in a manner which prevents additional contributions of suspended solids to stream flow and to runoff outside the permit area, to the extent possible, using the best technology currently available. Appropriate sediment control measures for these diversions may include, but not be limited to, maintenance of appropriate gradients, channel lining, revegetation, roughness structures, and detention basins.

4. No diversion shall be located so as to increase the potential for land slides and no diversion shall be constructed on existing land slides.

5. When no longer needed, each temporary diversion shall be removed and the affected land regraded, topsoiled, and revegetated in accordance with Rules 880-X-10C-.10, 880-X-10C-.11, 880-X-10C-.52 - 880-X-10C-.58, 880-X-10C-.60, and 880-X-10C-.62.

6. Channel linings, when slopes are between 1-3 percent shall consist of both perennial and annual grasses and when slopes are greater than 3 percent, shall consist of riprap or be cut into non-erodible material.

7. Freeboard shall provide protection for transition of flows and for critical areas such as swales and curves along the entire channel length.

8. Energy dissipators shall be installed, when necessary, at discharge points where natural streams and exit velocity of the diversion ditch flow is greater than that of the receiving stream.

9. Excess excavated material not necessary for diversion channel geometry or regrading of the channel shall be disposed of in accordance with Rule 880-X-10C-.36.

10. Topsoil removed from the diversion excavations shall be handled in accordance with Rule 880-X-10C-.07 through 880-X-10C-.11.

11. Diversions shall not be constructed or operated to divert water into underground mines.

12. The embankment or berm foundation area shall be cleared of all organic matter, all surfaces sloped to no steeper than lv:lh and the entire foundation surface scarified.

13. The entire embankment or berm shall be compacted to 95% density, based on standard proctor as outlined in ASTM.

14. The material placed in the berm shall be free of sod, roots, stones over 6 inches in diameter, and other objectionable materials. The fill material shall be placed and spread over the entire fill area, starting at the lowest point of the foundation, in layers not to exceed 12 inches in thickness. Construction of the fill shall be undertaken only at such times as the moisture content of the fill material will permit satisfactory compaction in accordance with paragraph 13.

15. The berm and all disturbed areas shall be seeded with both perennial and annual grasses in order to insure that erosion is minimized. Hay bales or riprap may be placed at the toe of the berm immediately upon completion of construction.

16. All berms shall be examined quarterly for structural weakness, instability, erosion, or other hazardous conditions and maintenance performed as necessary.

NOTES

1) Diversion 3-4 will be a 6' open channel consisting of varying channel linings. From station 0+00 to station 19+96 and station 21+15 to station 23+65 the channel lining will consist of Bermuda Grasses. From station 19+96 to station 21+15 the channel lining will consist of Class II sandstone or limestone rip-rap.

2) The construction of Basin 019P and Diversion 3-4 will commence upon issuance of Revision R-7 as to the following construction sequence:

    - Basin 019P will be constructed and certified to the Regulatory Authority.
    - Construct and certify Diversion 3-4 as required beginning from the end point at Basin 019P at station 23+65 with construction progressing up gradient to station 12+00 at the time of Basin 019P construction certification to the Regulatory Authority. Then station 12+00 to station 4+00 will be constructed and certified to the Regulatory Authority prior to disturbance within this watershed. Finally station 4+00 to station 0+00 will be constructed and certified to the Regulatory Authority prior to disturbance within this watershed.

RIP-RAP CLASSIFICATION SPECIFICATIONS

CLASS 1 RIP-RAP

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 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 RIP-RAP

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 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 RIP-RAP

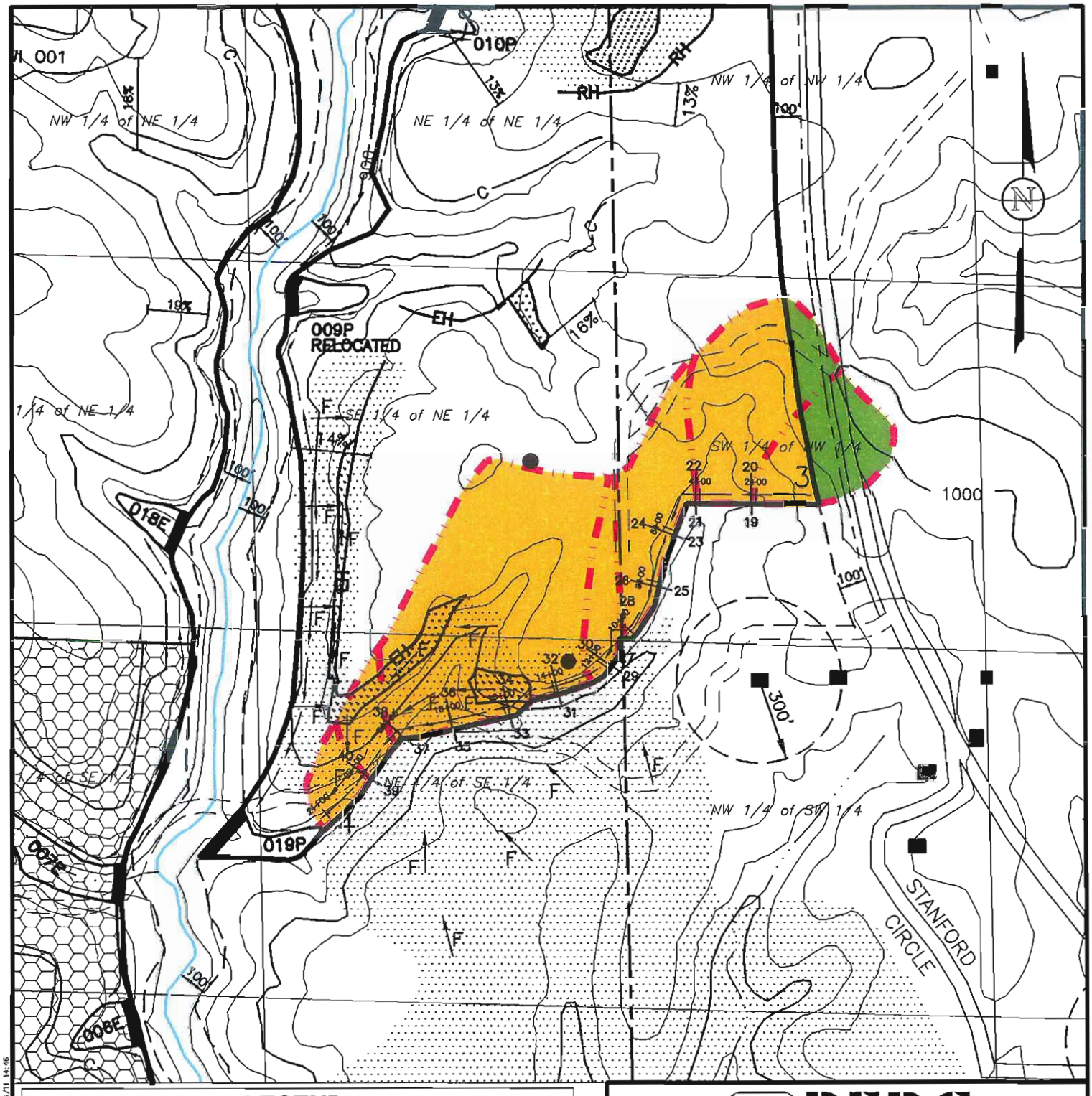
No more than 10% of the stone will have a diameter greater than twenty two (22) inches; no more than 50% of the stone will have a diameter less than sixteen (16) inches; and no more than 10% of the stone will have a diameter of less than eight (8) inches. The thickness of the rip-rap liner will be no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

CLASS 4 RIP-RAP

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 less than twenty two (22) inches; and no more than 10% 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 RIP-RAP

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 less than twenty seven (27) inches; and no more than 10% 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.



LEGEND

- Permit Boundary
- Drainage Divide
- Diversion
- Perennial Stream
- 018E Sediment Basin
- F Flow Direction on Previously Mined Area

LANDUSE & CURVE NUMBER INFORMATION

- Unmanaged Timberland, Curve Number, 70
- Graded & Bare, Curve Number, 81

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ATTACHMENT III-B-3
BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION DITCH 3-4
WATERSHED MAP

DRAWN BY:	S.D.M.	DATE:	9/6/2011
DWG. NAME:	BCCBCDIVWS		
APPROVED BY:	L.G.S.	SCALE:	1"=500'

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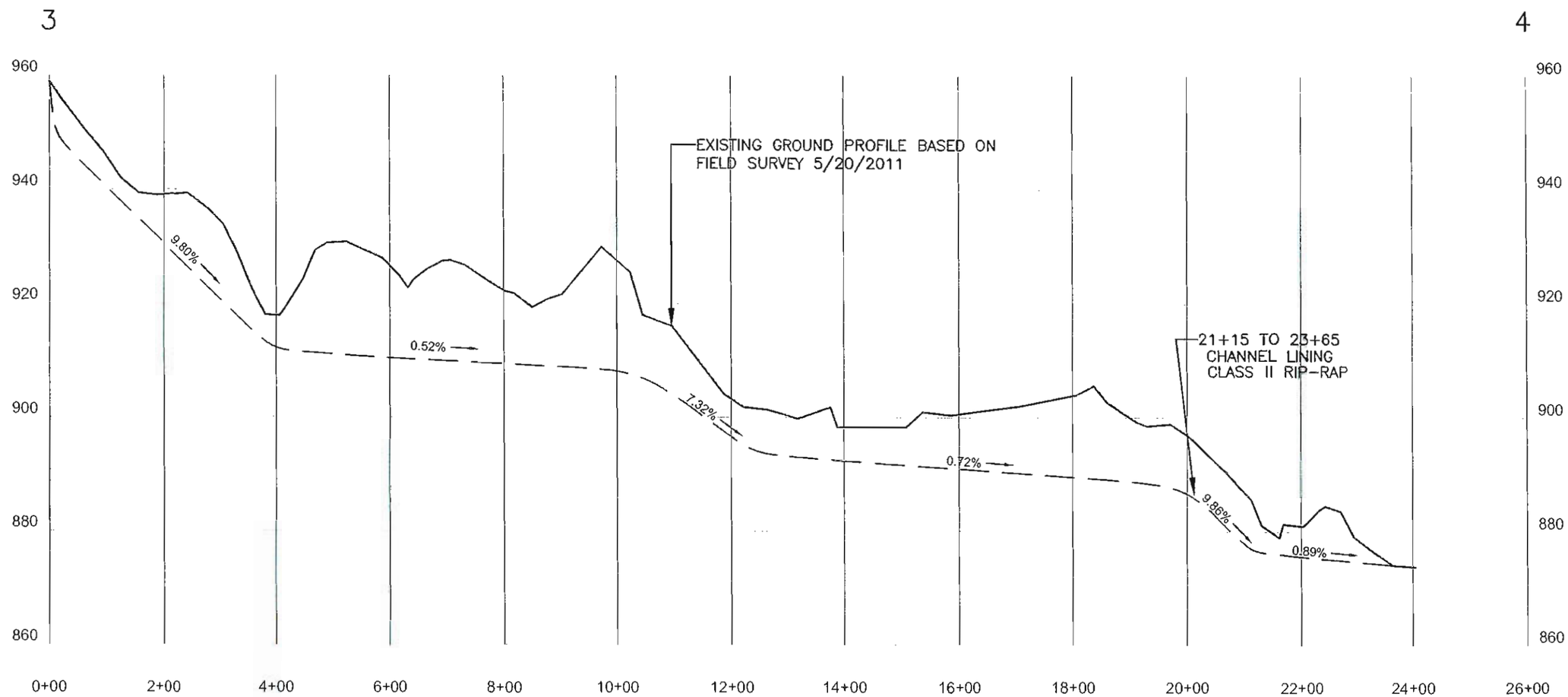


DIVERSION 3–4

NOTES: 1) 0+00 TO 19+96 AND 21+15 TO 23+65, BOTTOM CHANNEL WIDTH 6.0 FEET, CHANNEL LINING TO CONSIST OF BERMUDA GRASSES.

2) 21+15 TO 23+65, BOTTOM CHANNEL WIDTH 6.0 FEET CHANNEL LINING TO CONSIST OF CLASS II RIP–RAP.

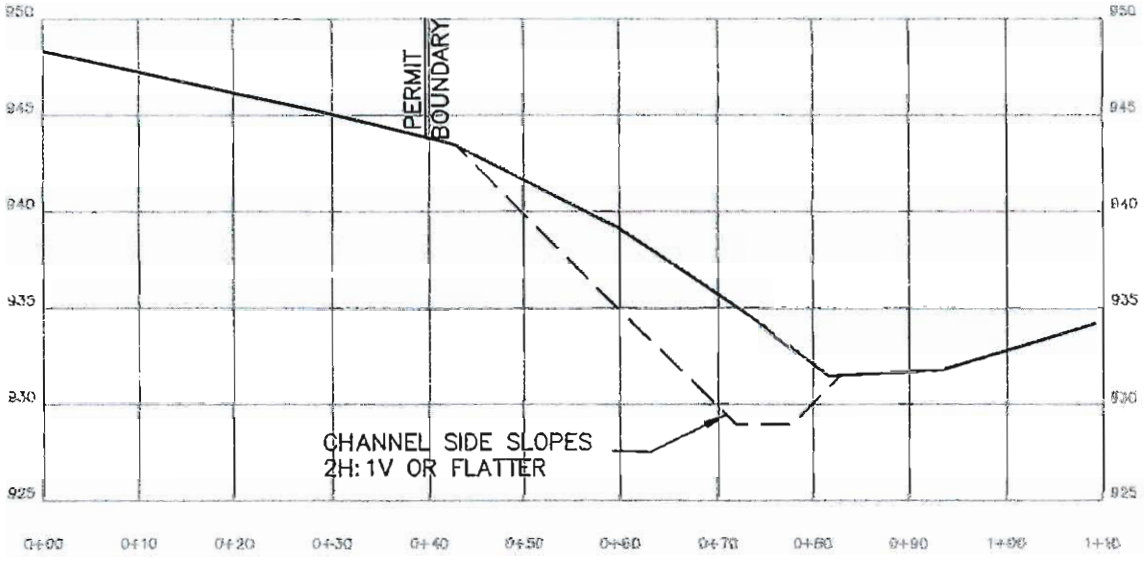
——— EXISTING GRADE

– – – – – PROPOSED GRADE

PERC ENGINEERING CO., INC.

BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION PROFILE

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3–4P	DATE: 6/14/2011
APPROVED BY: L.G.S.	SCALE: H: 1"=200' V: 1"=20'



EXISTING GRADE

FINISHED GRADE

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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 19-20 AT STATION 2+16

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
APPROVED BY: L.G.S.	SCALE: 1"=10' 1"=20'

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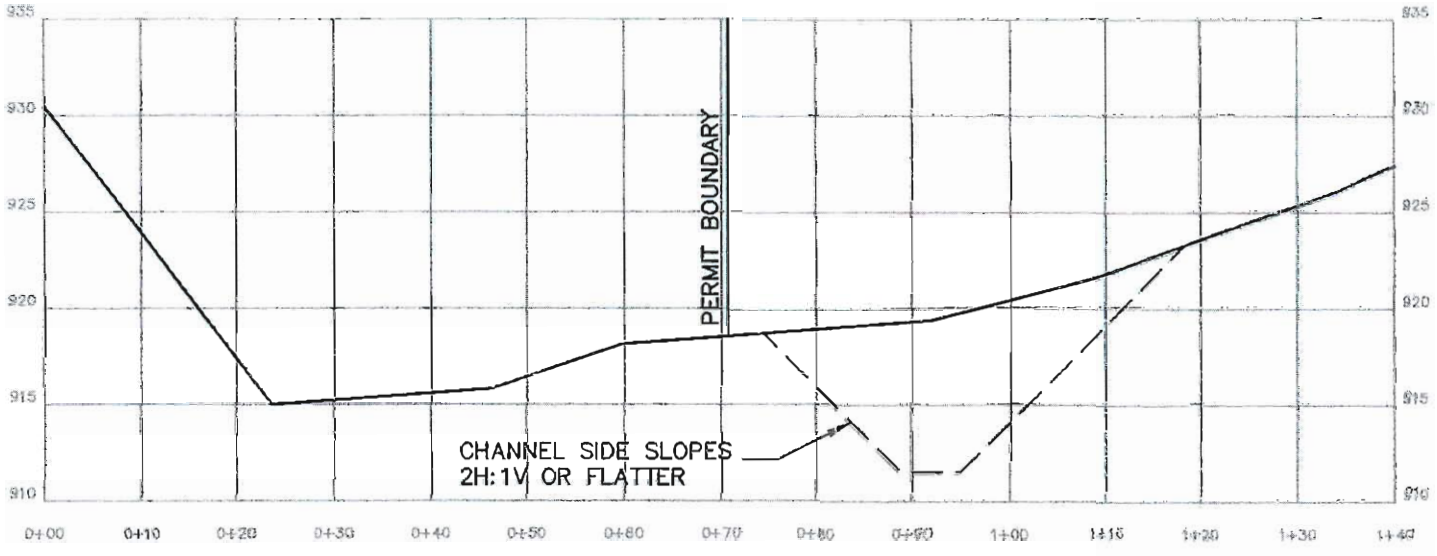

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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 21-22 AT STATION 4+16

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
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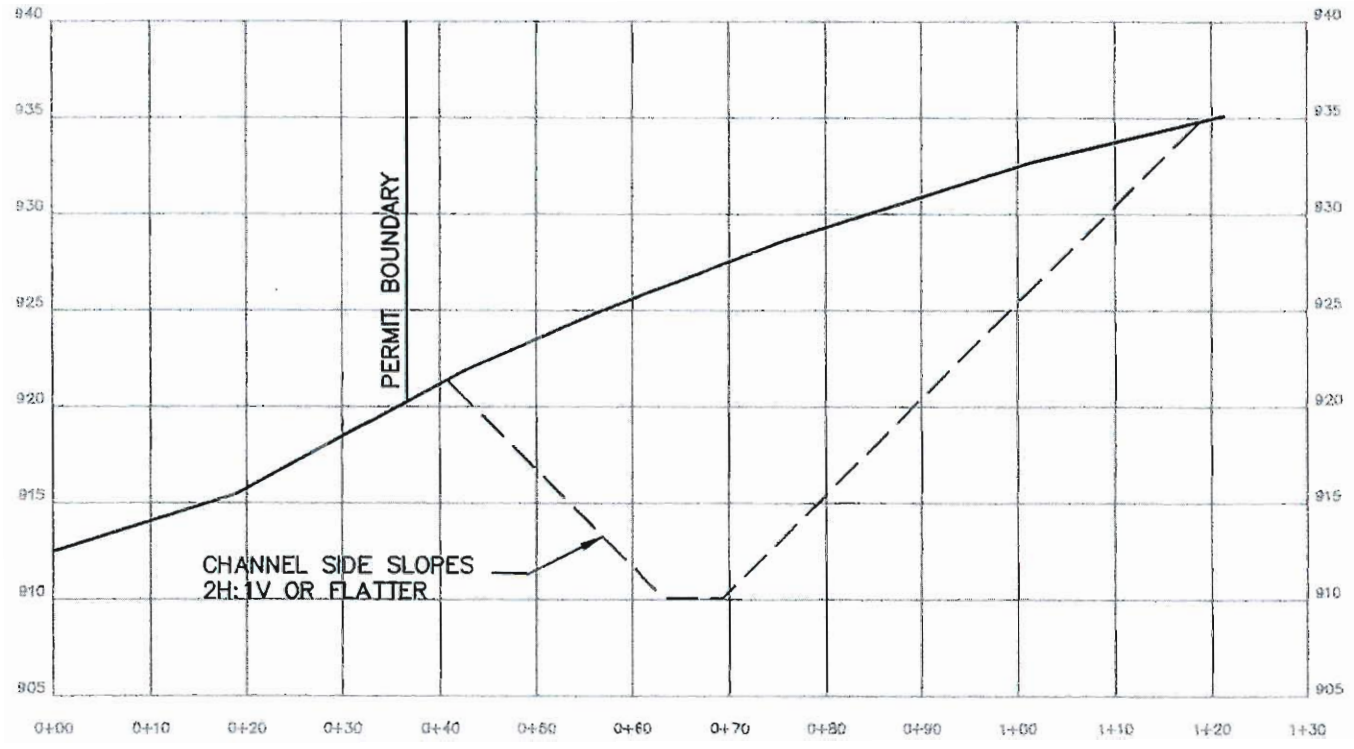

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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 23-24 AT STATION 6+17

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
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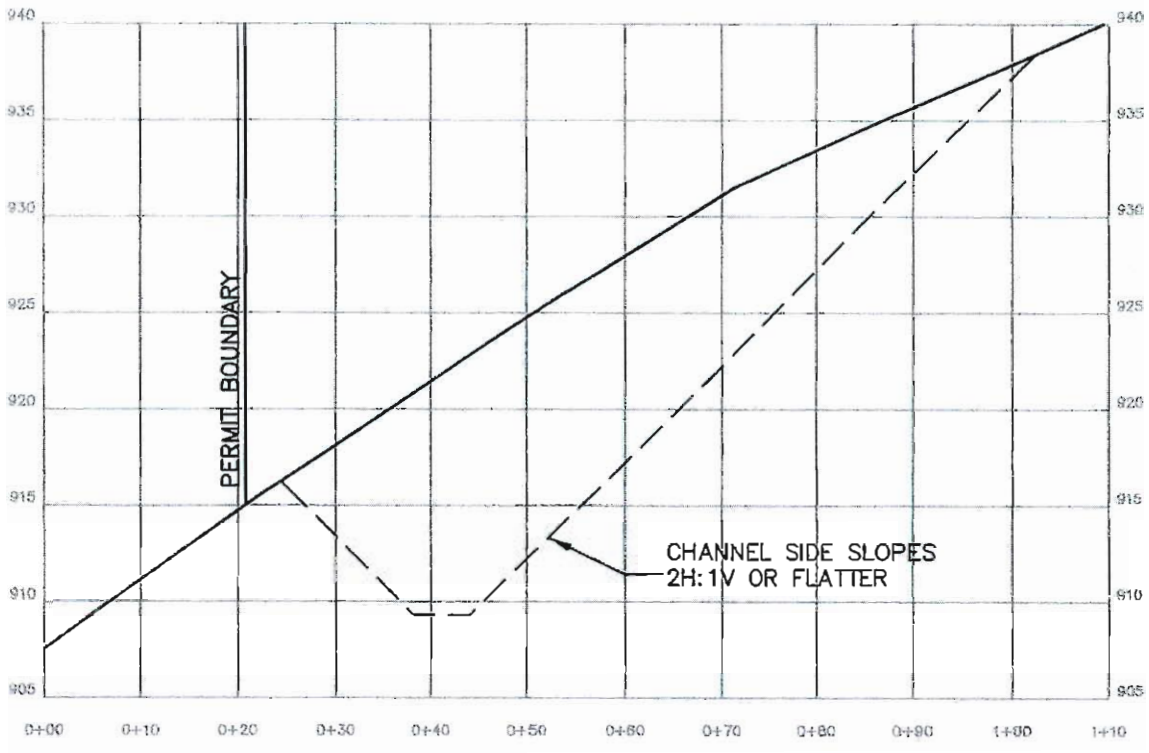

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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 25-26 AT STATION 8+17

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
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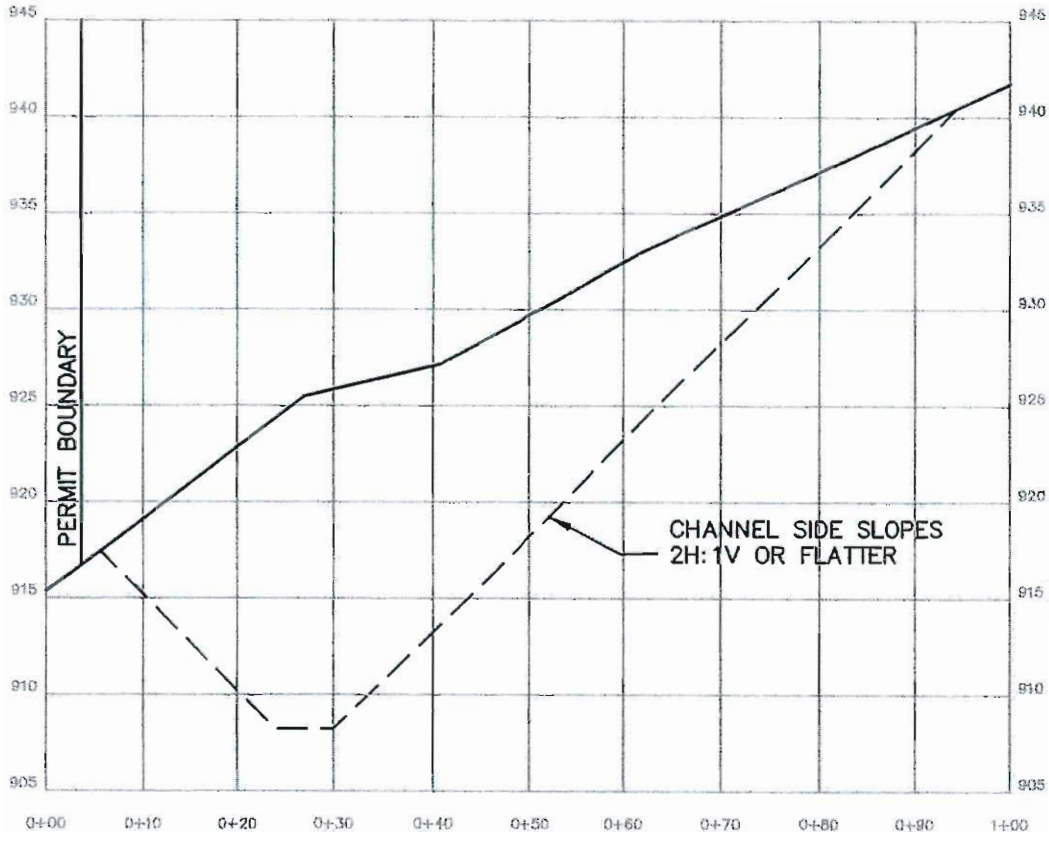

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PERC ENGINEERING CO., INC.

BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 27-28 AT STATION 10+24

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
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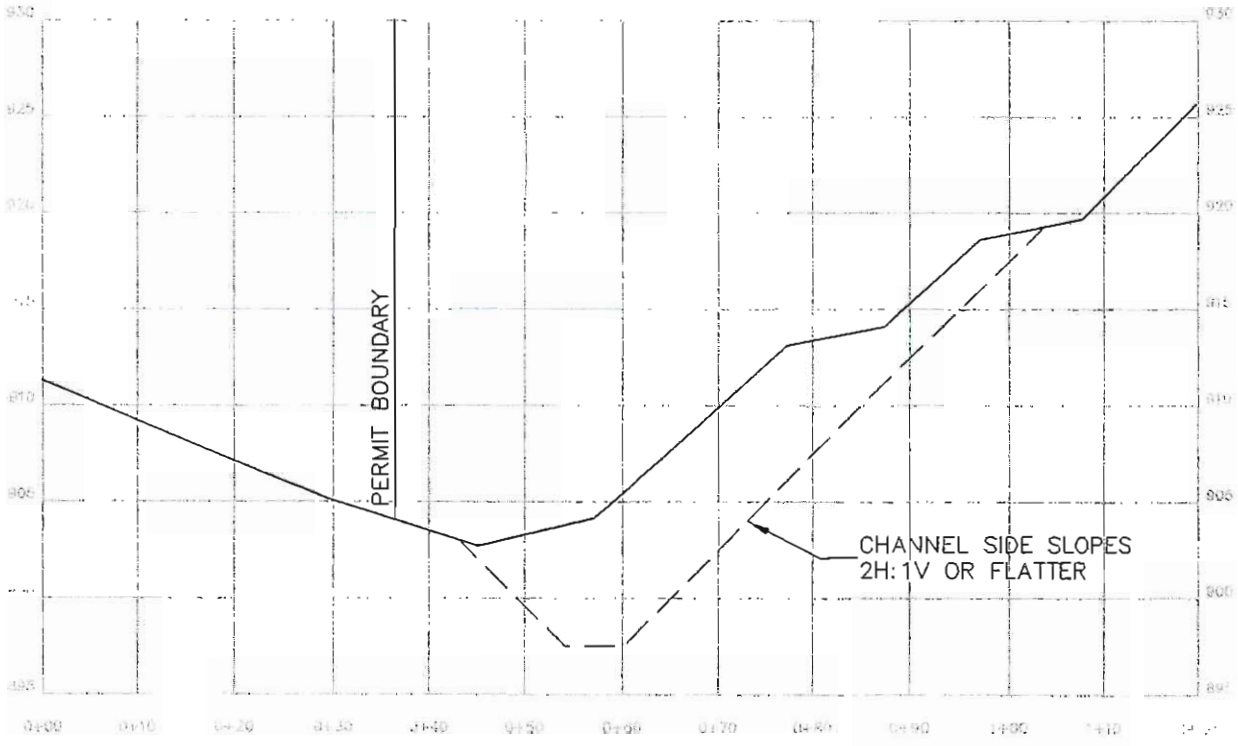

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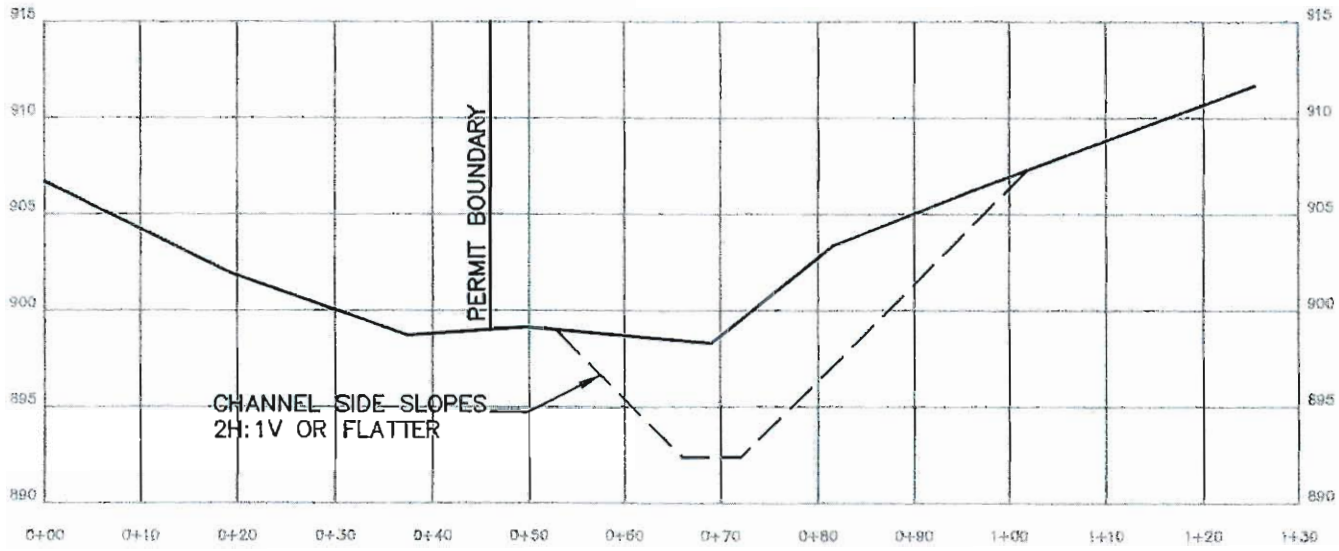
BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 29-30 AT STATION 11+87

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
APPROVED BY: L.G.S.	SCALE: 1"=10' 1"=20'



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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 31-32 AT STATION 13+88

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
APPROVED BY: L.G.S.	SCALE: 1"=10' 1"=20'

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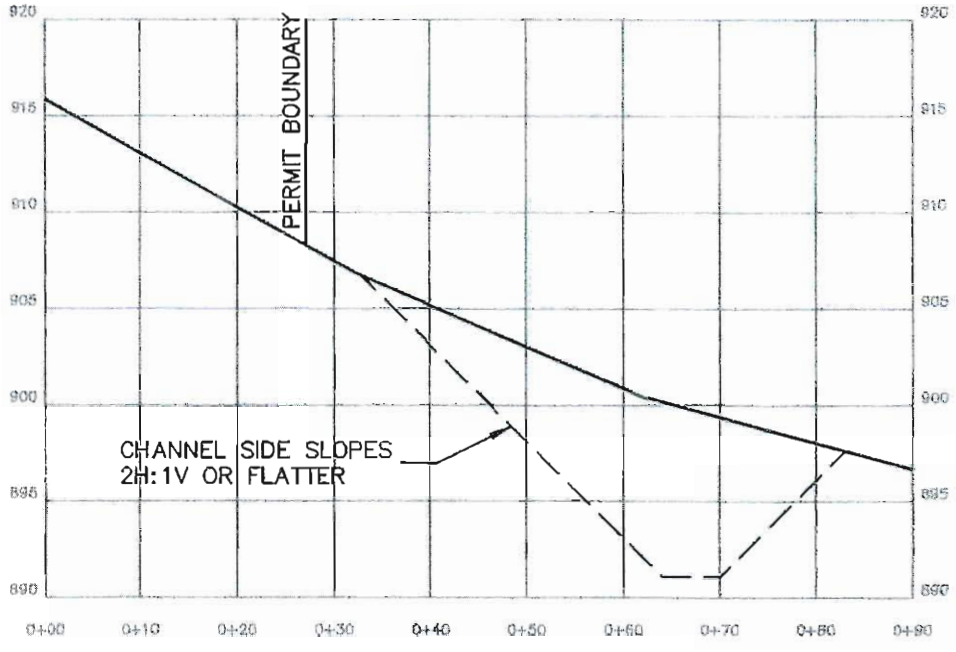

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PERC ENGINEERING CO., INC.

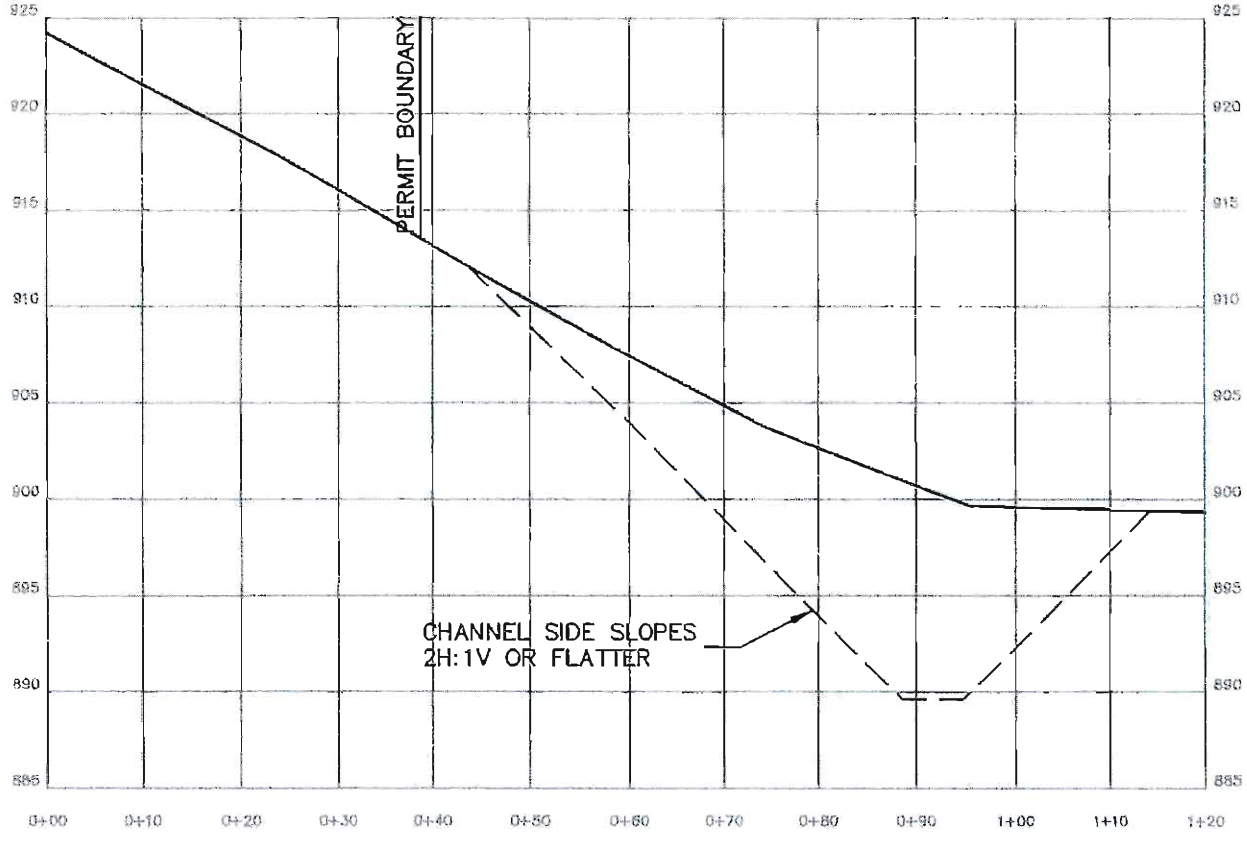
BIRMINGHAM COAL & COKE CO., INC.

BEAR CREEK MINE

P-3831 / REVISION R-7

CROSS-SECTION 33-34 AT STATION 15+86

DRAWN BY: J.W.T. DWG. NAME: BCCBCOIV3-4CS	DATE: 6/14/2011
APPROVED BY: L.G.S.	SCALE: 1"=10' 1"=20'



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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 35-36 AT STATION 17+98

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3--4CS	DATE: 6/14/2011
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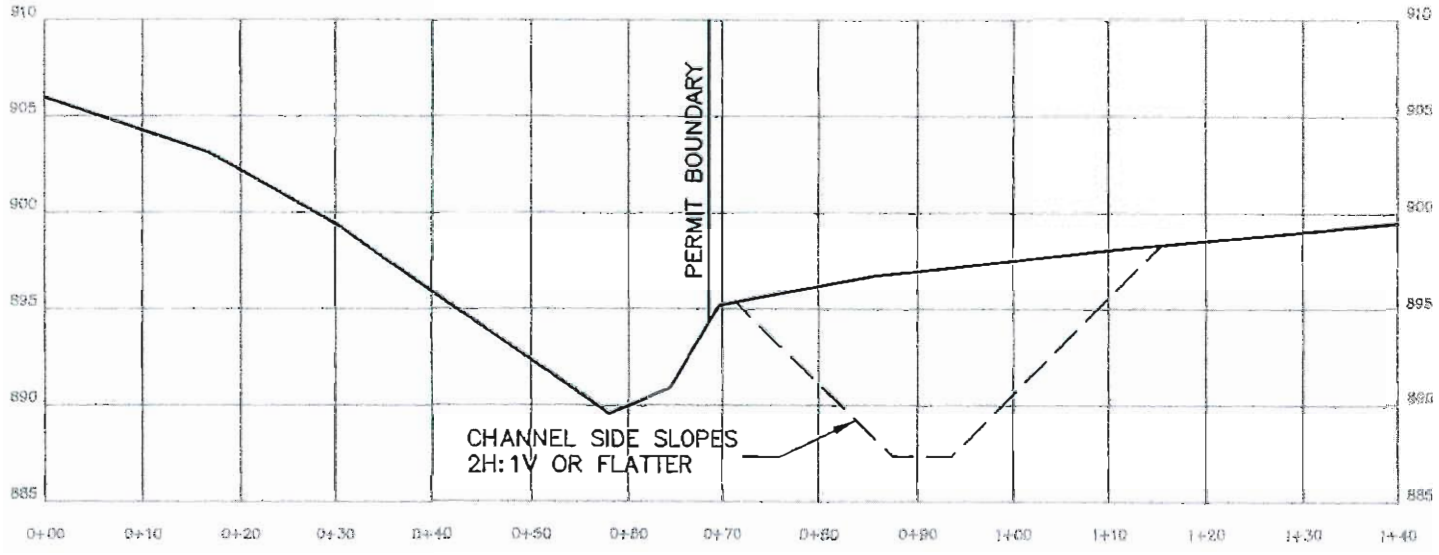

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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 37-38 AT STATION 20+03

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
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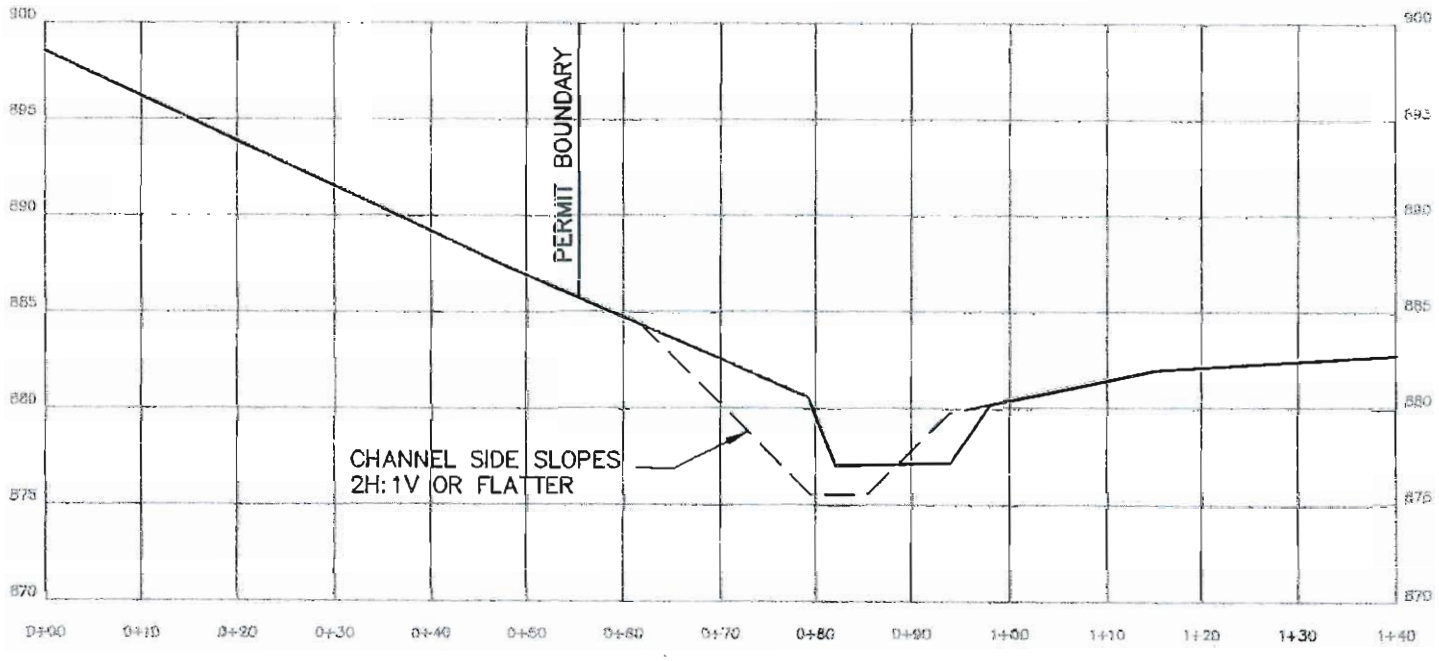

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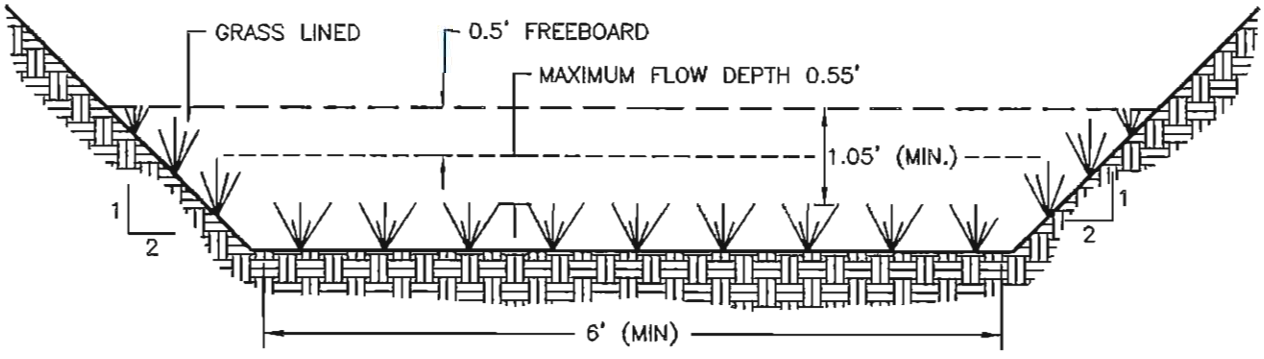
BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
CROSS-SECTION 39-40 AT STATION 22+00

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4CS	DATE: 6/14/2011
APPROVED BY: L.G.S.	SCALE: 1"=10' 1"=20'



GRASS LINING TO CONSIST OF BERMUDA GRASSES.

PERC ENGINEERING CO., INC.
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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION 3-4 0+00 TO 3+94

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4	DATE: 6/10/2011
APPROVED BY: L.G.S.	SCALE: NONE

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Birmingham Coal & Coke Co., Inc.

Bear Creek Mine

P-3831 Revision R-7

Diversion Ditch 3-4 9.80%

Stations 0+00 to 3+94

4.2 Inch, 10 Year-6 Hour

SCS 6 Hour

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@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
Channel	#1	==>	End	0.000	0.000	Diversion Ditch 3-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	3.600	3.600	6.09	0.51

Structure Detail:

Structure #1 (Vegetated Channel)

Diversion Ditch 3-4

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	2.0:1	2.0:1	9.8	D, B	0.50			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	6.09 cfs		6.09 cfs	
Depth:	0.30 ft	0.80 ft	0.55 ft	1.05 ft
Top Width:	7.18 ft	9.18 ft	8.21 ft	10.21 ft
Velocity:	3.12 fps		1.55 fps	
X-Section Area:	1.95 sq ft		3.93 sq ft	
Hydraulic Radius:	0.266 ft		0.464 ft	
Froude Number:	1.06		0.39	
Roughness Coefficient:	0.0617		0.1799	

Subwatershed Hydrology Detail:

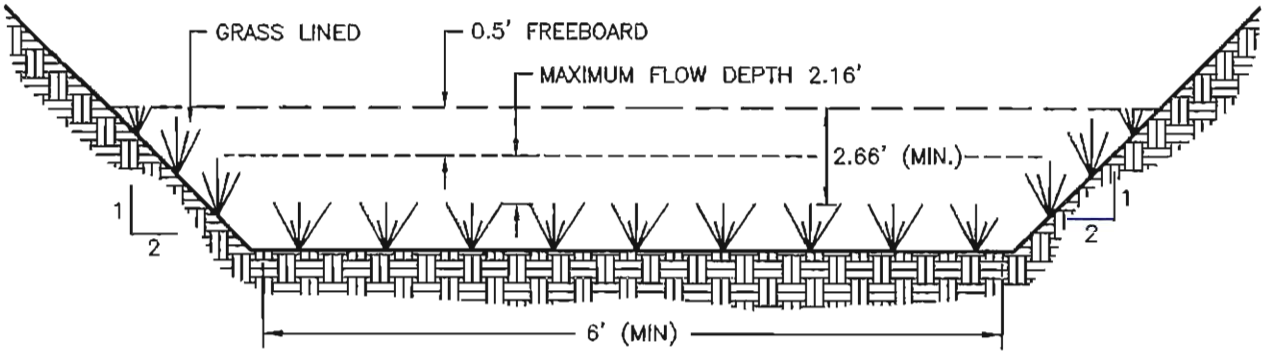
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.500	0.081	0.010	0.432	70.000	M	3.66	0.303
	2	1.100	0.013	0.000	0.000	81.000	F	2.43	0.209
	$\sum$	**3.600**						**6.09**	**0.512**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	7.50	15.00	199.99	0.690	0.080
		9. Small streams flowing bankfull	11.24	20.00	178.00	30.160	0.001
#1	**1**	**Time of Concentration:**					**0.081**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	17.50	35.00	200.00	4.180	0.013
#1	**2**	**Time of Concentration:**					**0.013**

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	12.74	52.00	408.00	10.710	0.010
#1	**1**	**Muskingum K:**					**0.010**



GRASS LINING TO CONSIST OF BERMUDA GRASSES.

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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION 3-4 3+94 TO 10+42

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4	DATE: 6/10/2011
APPROVED BY: L.G.S.	SCALE: NONE

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Birmingham Coal & Coke Co., Inc.

Bear Creek Mine

P-3831 Revision R-7

Diversion Ditch 3-4 0.52%

Stations 3+94 to 10+42

4.2 Inch, 10 Year-6 Hour

SCS 6 Hour

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@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
Channel	#1	==>	End	0.000	0.000	Diversion Ditch 3-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	13.400	13.400	26.17	2.30

Structure Detail:

Structure #1 (Vegetated Channel)

Diversion Ditch 3-4

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	2.0:1	2.0:1	0.5	D, B	0.50			8.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	26.17 cfs		26.17 cfs	
Depth:	1.33 ft	1.83 ft	2.16 ft	2.66 ft
Top Width:	11.30 ft	13.30 ft	14.62 ft	16.62 ft
Velocity:	2.28 fps		1.18 fps	
X-Section Area:	11.47 sq ft		22.23 sq ft	
Hydraulic Radius:	0.962 ft		1.421 ft	
Froude Number:	0.40		0.17	
Roughness Coefficient:	0.0459		0.1153	

Subwatershed Hydrology Detail:

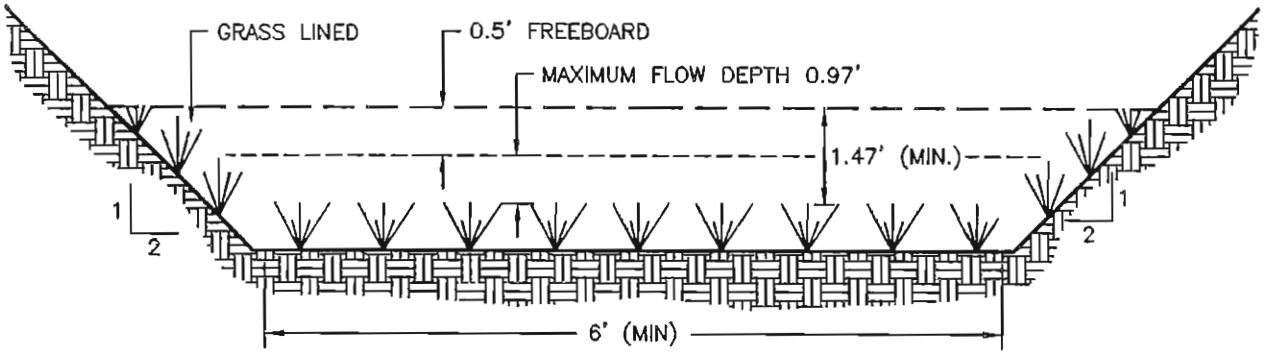
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.500	0.080	0.119	0.365	70.000	M	5.12	0.424
	2	9.900	0.096	0.000	0.000	81.000	F	21.87	1.879
	$\sum$	**13.400**						**26.17**	**2.304**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	7.50	15.00	200.00	0.690	0.080
#1	**1**	**Time of Concentration:**					**0.080**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.00	200.00	1.410	0.039
		8. Large gullies, diversions, and low flowing streams	3.81	46.00	1,207.00	5.850	0.057
#1	**2**	**Time of Concentration:**					**0.096**

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	2.34	46.00	1,966.06	4.580	0.119
#1	**1**	**Muskingum K:**					**0.119**



GRASS LINING TO CONSIST OF BERMUDA GRASSES.

PERC ENGINEERING CO., INC.
1600 Highway 78 West Jasper, Alabama 35301
P.O. Box 1712 Jasper, Alabama 35502
(205) 384-5553 Office (205) 384-9461 Fax

BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION 3-4 10+42 TO 12+42

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4	DATE: 6/10/2011
APPROVED BY: L.G.S.	SCALE: NONE

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Birmingham Coal & Coke Co., Inc.
Bear Creek Mine
P-3831 Revision R-7
Diversion Ditch 3-4 7.32%
Stations 10+42 to 12+42

4.2 Inch, 10 Year-6 Hour

SCS 6 Hour

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@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
Channel	#1	==>	End	0.000	0.000	Diversion Ditch 3-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	15.000	15.000	29.57	2.61

Structure Detail:

Structure #1 (Vegetated Channel)

Diversion Ditch 3-4

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	2.0:1	2.0:1	7.3	D, B	0.50			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	29.57 cfs		29.57 cfs	
Depth:	0.63 ft	1.13 ft	0.97 ft	1.47 ft
Top Width:	8.52 ft	10.52 ft	9.90 ft	11.90 ft
Velocity:	6.45 fps		3.81 fps	
X-Section Area:	4.58 sq ft		7.75 sq ft	
Hydraulic Radius:	0.519 ft		0.748 ft	
Froude Number:	1.55		0.76	
Roughness Coefficient:	0.0403		0.0871	

Subwatershed Hydrology Detail:

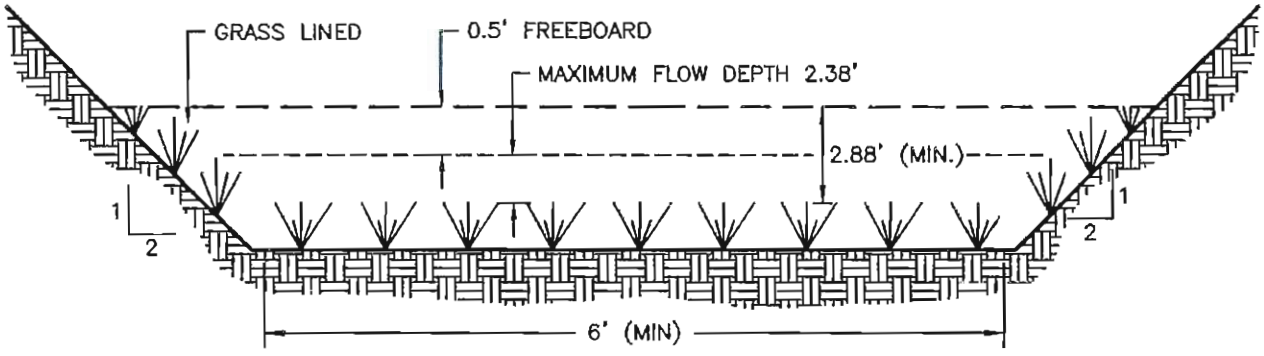
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.500	0.080	0.136	0.361	70.000	M	5.12	0.424
	2	11.500	0.110	0.000	0.000	81.000	F	25.41	2.183
	Σ	**15.000**						**29.57**	**2.608**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	7.50	15.00	199.99	0.690	0.080
#1	**1**	**Time of Concentration:**					**0.080**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.00	200.00	1.410	0.039
		8. Large gullies, diversions, and low flowing streams	3.37	48.00	1,425.00	5.500	0.071
#1	**2**	**Time of Concentration:**					**0.110**

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	2.16	47.00	2,174.01	4.410	0.136
#1	**1**	**Muskingum K:**					**0.136**



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1606 Highway 78 West Jasper, Alabama 35501
P.O. Box 1712 Jasper, Alabama 35502
(205) 384-3553 Office (205) 384-8491 Fax

BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION 3-4 12+42 TO 19+96

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4	DATE: 6/10/2011
APPROVED BY: L.G.S.	SCALE: NONE

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Birmingham Coal & Coke Co., Inc.

Bear Creek Mine

P-3831 Revision R-7

Diversion Ditch 3-4 0.72%

Stations 12+42 to 19+96

4.2 Inch, 10 Year-6 Hour

SCS 6 Hour

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@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
Channel	#1	==>	End	0.000	0.000	Diversion Ditch 3-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	28.200	28.200	51.80	4.97

Structure Detail:

Structure #1 (Vegetated Channel)

Diversion Ditch 3-4

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	2.0:1	2.0:1	0.7	D, B	0.50			8.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	51.80 cfs		51.80 cfs	
Depth:	1.59 ft	2.09 ft	2.38 ft	2.88 ft
Top Width:	12.37 ft	14.37 ft	15.51 ft	17.51 ft
Velocity:	3.54 fps		2.02 fps	
X-Section Area:	14.62 sq ft		25.58 sq ft	
Hydraulic Radius:	1.114 ft		1.538 ft	
Froude Number:	0.57		0.28	
Roughness Coefficient:	0.0383		0.0832	

Subwatershed Hydrology Detail:

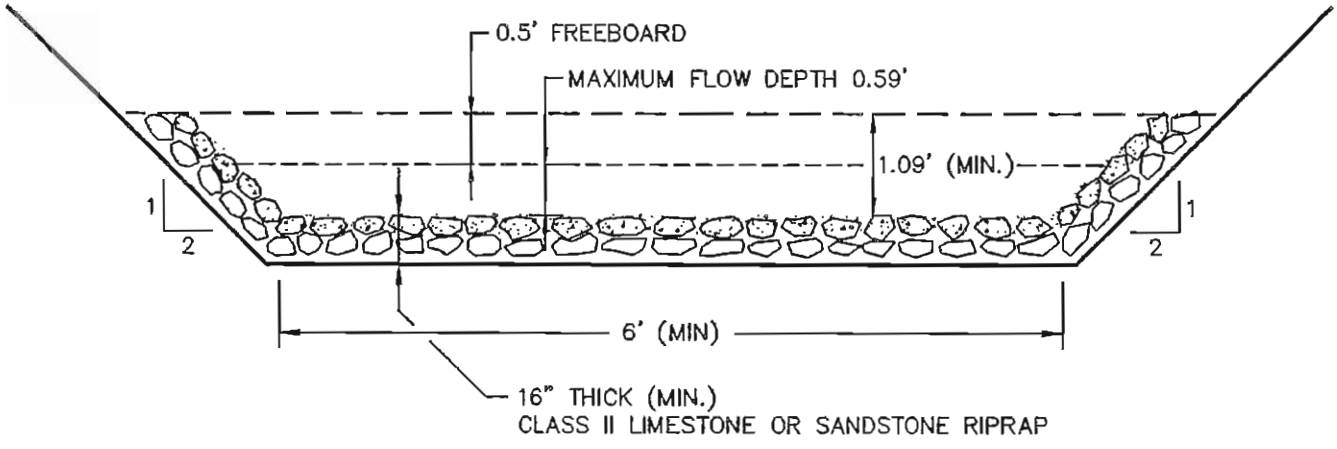
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.500	0.080	0.144	0.385	70.000	M	5.12	0.424
	2	24.700	0.129	0.000	0.000	81.000	F	47.10	4.543
	$\sum$	**28.200**						**51.80**	**4.967**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	7.50	15.00	199.99	0.690	0.080
#1	**1**	**Time of Concentration:**					**0.080**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.00	200.00	1.410	0.039
		8. Large gullies, diversions, and low flowing streams	5.02	110.00	2,192.00	6.720	0.090
#1	**2**	**Time of Concentration:**					**0.129**

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	3.57	105.00	2,941.00	5.660	0.144
#1	**1**	**Muskingum K:**					**0.144**



PERC ENGINEERING CO., INC.
1006 Highway 78 West Jasper, Alabama 35501
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BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION 3-4 19+96 TO 21+15

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4	DATE: 6/10/2011
APPROVED BY: L.G.S.	SCALE: NONE

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Birmingham Coal & Coke Co., Inc.

Bear Creek Mine

P-3831 Revision R-7

Diversion Ditch 3-4 9.86%

Stations 19+96 to 21+15

4.2 Inch, 10 Year-6 Hour

SCS 6 Hour

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@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
Channel	#1	==>	End	0.000	0.000	Diversion Ditch 3-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	29.500	29.500	53.99	5.21

Structure Detail:

Structure #1 (Riprap Channel)

Diversion Ditch 3-4

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)
6.00	2.0:1	2.0:1	9.9	0.50		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	53.99 cfs	
Depth:	0.59 ft	1.09 ft
Top Width:	8.37 ft	10.37 ft
Velocity*:		
X-Section Area:	4.26 sq ft	
Hydraulic Radius:	0.492 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

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

Subwatershed Hydrology Detail:

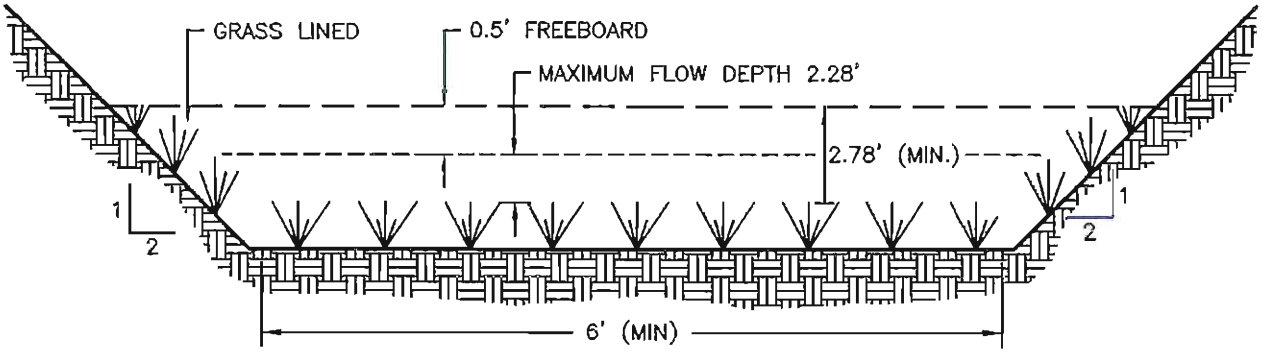
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	3.500	0.080	0.154	0.384	70.000	M	5.12	0.424
	2	26.000	0.138	0.000	0.000	81.000	F	49.58	4.782
	Σ	**29.500**						**53.99**	**5.206**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	7.50	15.00	199.99	0.690	0.080
#1	**1**	**Time of Concentration:**					**0.080**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.00	200.00	1.410	0.039
		8. Large gullies, diversions, and low flowing streams	4.82	114.00	2,367.00	6.580	0.099
#1	**2**	**Time of Concentration:**					**0.138**

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	3.50	109.00	3,114.00	5.610	0.154
#1	**1**	**Muskingum K:**					**0.154**



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P.O. Box 1712 Jasper, Alabama 35502
(205) 384-5563 Office (205) 384-9481 Fax

BIRMINGHAM COAL & COKE CO., INC.
BEAR CREEK MINE
P-3831 / REVISION R-7
DIVERSION 3-4 21+15 TO 23+65

DRAWN BY: J.W.T. DWG. NAME: BCCBCDIV3-4	DATE: 6/10/2011
APPROVED BY: L.G.S.	SCALE: NONE

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Birmingham Coal & Coke Co., Inc.

Bear Creek Mine

P-3831 Revision R-7

Diversion Ditch 3-4 0.89%

Stations 21+15 to 23+65

4.2 Inch, 10 Year-6 Hour

SCS 6 Hour

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@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
Channel	#1	==>	End	0.000	0.000	Diversion Ditch 3-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	30.600	30.600	56.04	5.41

Structure Detail:

Structure #1 (Vegetated Channel)

Diversion Ditch 3-4

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	2.0:1	2.0:1	0.9	D, B	0.50			8.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	56.04 cfs		56.04 cfs	
Depth:	1.55 ft	2.05 ft	2.28 ft	2.78 ft
Top Width:	12.18 ft	14.18 ft	15.12 ft	17.12 ft
Velocity:	3.99 fps		2.33 fps	
X-Section Area:	14.04 sq ft		24.09 sq ft	
Hydraulic Radius:	1.088 ft		1.487 ft	
Froude Number:	0.65		0.32	
Roughness Coefficient:	0.0372		0.0787	

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	3.500	0.080	0.160	0.387	70.000	M	5.12	0.424
	2	27.100	0.146	0.000	0.000	81.000	F	51.68	4.984
	Σ	**30.600**						**56.04**	**5.408**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	7.50	15.00	199.99	0.690	0.080
#1	**1**	**Time of Concentration:**					**0.080**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	4.00	200.00	1.410	0.039
		8. Large gullies, diversions, and low flowing streams	5.04	131.00	2,600.00	6.730	0.107
#1	**2**	**Time of Concentration:**					**0.146**

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	3.76	126.00	3,350.00	5.810	0.160
#1	**1**	**Muskingum K:**					**0.160**