

HYDROLOGY STUDY

QUALITY COAL CO., INC.

DUTTON HILL MINE NO. 2

P-

WALKER COUNTY, ALABAMA

DIVERSIONS 1-2, 1-3, 4-5, 6-7 & 8-9

DETAILED DESIGN PLANS

ATTACHMENT III-B-3

AUGUST 20, 2014

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 landslides and no diversion shall be constructed on existing landslides.
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 dissipaters 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 1v:1h 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 1-2 shall consist of a 6 feet wide trapezoidal channel with 2H:1V side slopes.
 - 0+00 to 2+71 - Channel lining shall consist of a grass mixture with a depth of 2.5 feet which includes 1 foot of freeboard.
 - 2+71 to 9+77 - Channel lining shall consist of a grass mixture with a depth of 3.1 feet which includes 1 foot of freeboard.

- 2) Diversion 1-3 shall consist of a 6 feet wide trapezoidal channel with 2H:1V side slopes.
 - 0+00 to 2+58 - Channel lining shall consist of Bermuda grass with a depth of 2.2 feet which includes 1 foot of freeboard.
 - 2+58 to 9+50 - Channel lining shall consist of a grass mixture with a depth of 4.2 feet which includes 1 foot of freeboard.
 - 9+50 to 12+70 - Channel lining shall consist of a grass mixture with a depth of 3.2 feet which includes 1 foot of freeboard.

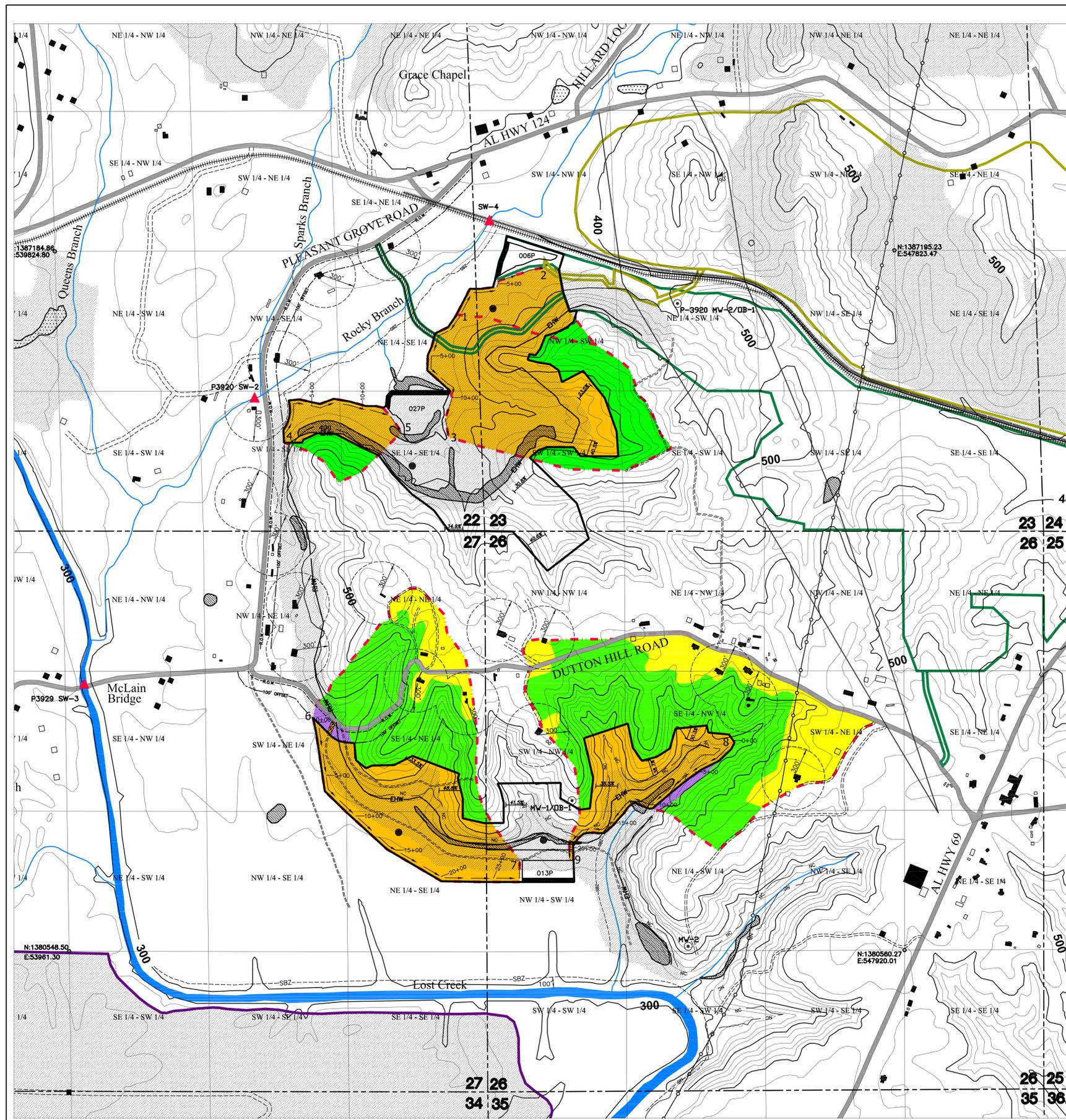
- 3) Diversion 4-5 shall consist of a 6 feet wide trapezoidal channel with 2H:1V side slopes.
 - 0+00 to 14+60 - Channel lining shall consist of a grass mixture with a depth of 3.2 feet which includes 1 foot of freeboard.

- 4) Diversion 6-7 shall consist of a 7.2 feet wide trapezoidal channel with 2H:1V side slopes.
 - 0+00 to 5+42 - Channel lining shall consist of Bermuda grass with a depth of 2.2 feet which includes 1 foot of freeboard.
 - 5+42 to 11+15 - Channel lining shall consist of Bermuda grass with a depth of 2.7 feet which includes 1 foot of freeboard.
 - 11+15 to 21+84 - Channel lining shall consist of Bermuda grass with a depth of 3.4 feet which includes 1 foot of freeboard.
 - 21+84 to 27+51 - Channel lining shall consist of a grass mixture with a depth of 4.2 feet which includes 1 foot of freeboard.

- 5) Diversion 8-9 shall consist of a 6 feet wide trapezoidal channel with 2H:1V side slopes.
 - 0+00 to 3+80 - Channel lining shall consist of a grass

mixture with a depth of 3.4 feet which includes 1 foot of freeboard.

- 3+80 to 12+31 - Channel lining shall consist of 16" of Class II limestone or sandstone riprap with a depth of 2.0 feet which includes 1 foot of freeboard.
- 12+31 to 21+28 - Channel lining shall consist of Bermuda grass with a depth of 3.7 feet which includes 1 foot of freeboard.



MAP LEGEND

- Permit Boundary
- Surface Contour
- Sediment Basin
- Land Slope Measurement
- Existing Highwall
- Reclaimed Highwall
- County Road (Paved unless otherwise designated)
- Road (Private unless otherwise shown)
- Area Previously Surface Mined
- Unoccupied Dwelling (Barn, Shed, Etc.)
- Occupied Dwelling
- Primary Road
- New Castle Coal Outcrop
- ASMC Permit P-3920
- ASMC Permit P-3793
- ASMC Permit P-3465
- Drainage Course
- Perennial Stream
- Stream Buffer Zone
- Monitoring Well
- P3929 SW-3 Surface Water Monitoring Site
- Impounded Water
- Coal Stockpile/Equipment Storage Area (Subject to Change)
- Power Lines
- Projected Fault
- Watershed Boundary
- Diversion Ditch
- Diversion Berm (Diversion 8-9 from 19+67 to 20+34)

CURVE NUMBER INFORMATION

- Previously Mined Area, Curve No. 68
- Unmanaged Timberland, Curve No. 70
- Open Spaces, Grassland, or Pastureland, Curve No. 75
- Graded & Bare, Curve No. 81
- Gravel Road, Curve No. 95

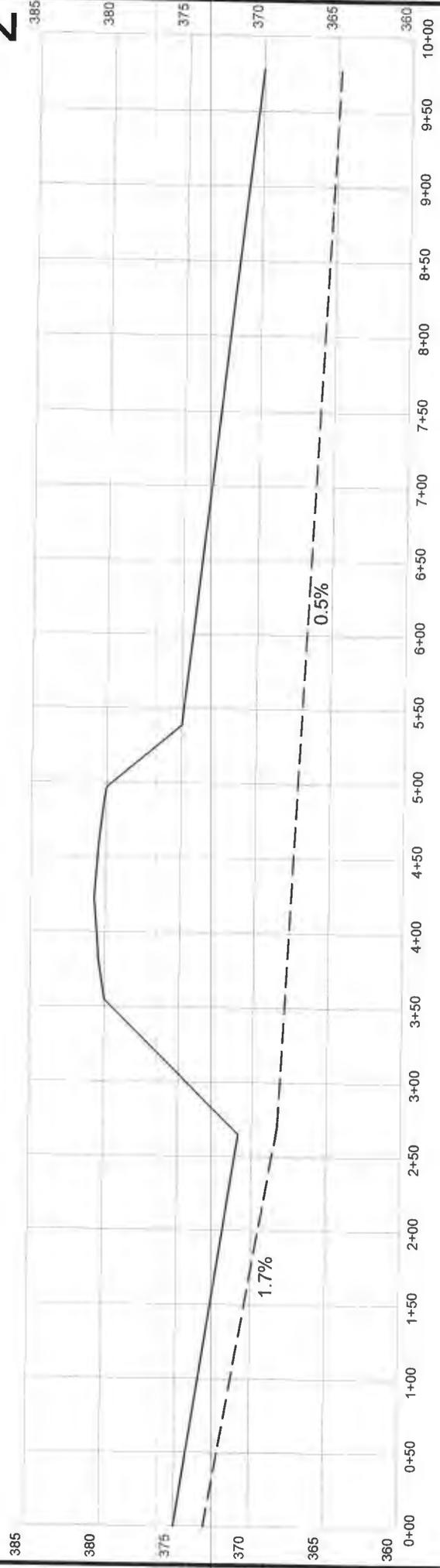
PERMIT AREA
Scale: 1" = 500'
Contour Interval = 20'

Base map - Jasper, Alabama
United States Geological Survey
Quadrangle Maps.

Attachment III-B-3
Diversion Ditch Watershed Map
Quality Coal Co., Inc.
Dutton Hill Mine No. 2
P-3980
Part of Sections 22, 23, 26 & 27
Township 14 South, Range 8 West
Walker County, Alabama

1

2



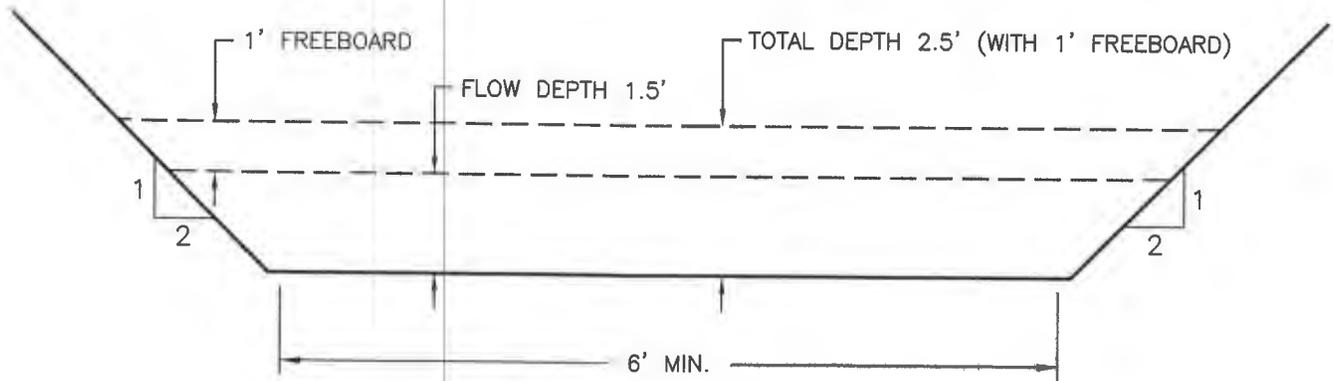
— EXISTING GRADE
 - - - PROPOSED GRADE

QUALITY COAL CO., INC.
 DUTTON HILL MINE NO. 2 P--
 DIVERSION 1-2 PROFILE

Date: 4/29/2014

Scale: H: 1" = 100'
 V: 1" = 10'

DIVERSION 1-2
0+00 TO 2+71



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 4/30/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 1-2
0+00 to 2+71

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

General Information

Storm Information:

Storm Type:	Rainfall Event
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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	0+00 to 2+71

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	11.200	11.200	24.00	2.06

Structure Detail:

Structure #1 (Vegetated Channel)

0+00 to 2+71

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

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	1.7	D, B	1.00			5.0

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:	24.00 cfs		24.00 cfs	
Depth:	0.90 ft	1.90 ft	1.45 ft	2.45 ft
Top Width:	9.60 ft	13.60 ft	11.82 ft	15.82 ft
Velocity:	3.42 fps		1.85 fps	
X-Section Area:	7.01 sq ft		12.95 sq ft	
Hydraulic Radius:	0.700 ft		1.036 ft	
Froude Number:	0.71		0.31	
Roughness Coefficient:	0.0447		0.1073	

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	1.000	0.064	0.017	0.441	70.000	M	1.46	0.121
	2	10.200	0.024	0.000	0.000	81.000	F	22.53	1.936
	Σ	11.200						24.00	2.058

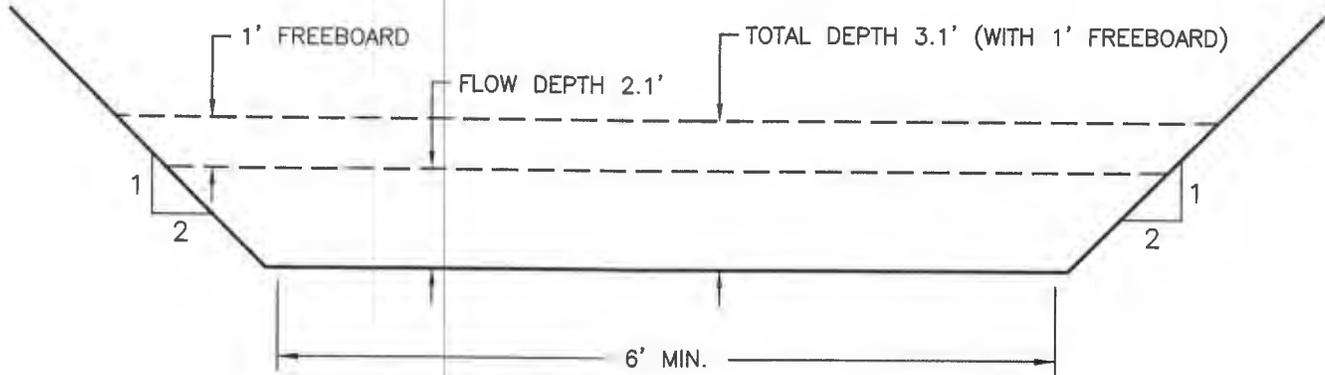
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	26.67	80.00	300.00	1.300	0.064
#1	1	Time of Concentration:					0.064
#1	2	5. Nearly bare and untilled, and alluvial valley fans	25.00	50.00	200.00	5.000	0.011
		8. Large gullies, diversions, and low flowing streams	15.52	90.00	580.00	11.810	0.013
#1	2	Time of Concentration:					0.024

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	17.95	140.00	780.00	12.700	0.017
#1	1	Muskingum K:					0.017

DIVERSION 1-2
2+71 TO 9+77



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 4/30/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 1-2
2+71 to 9+77

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

General Information

Storm Information:

Storm Type:	Rainfall Event
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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	2+71 to 9+77

#1
Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	11.200	11.200	24.00	2.06

Structure Detail:

Structure #1 (Vegetated Channel)

2+71 to 9+77

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

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	1.00			5.0

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:	24.00 cfs		24.00 cfs	
Depth:	1.30 ft	2.30 ft	2.13 ft	3.13 ft
Top Width:	11.18 ft	15.18 ft	14.51 ft	18.51 ft
Velocity:	2.16 fps		1.10 fps	
X-Section Area:	11.12 sq ft		21.81 sq ft	
Hydraulic Radius:	0.943 ft		1.406 ft	
Froude Number:	0.38		0.16	
Roughness Coefficient:	0.0469		0.1202	

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	1.000	0.064	0.017	0.441	70.000	M	1.46	0.121
	2	10.200	0.024	0.000	0.000	81.000	F	22.53	1.936
	Σ	11.200						24.00	2.058

Subwatershed Time of Concentration Details:

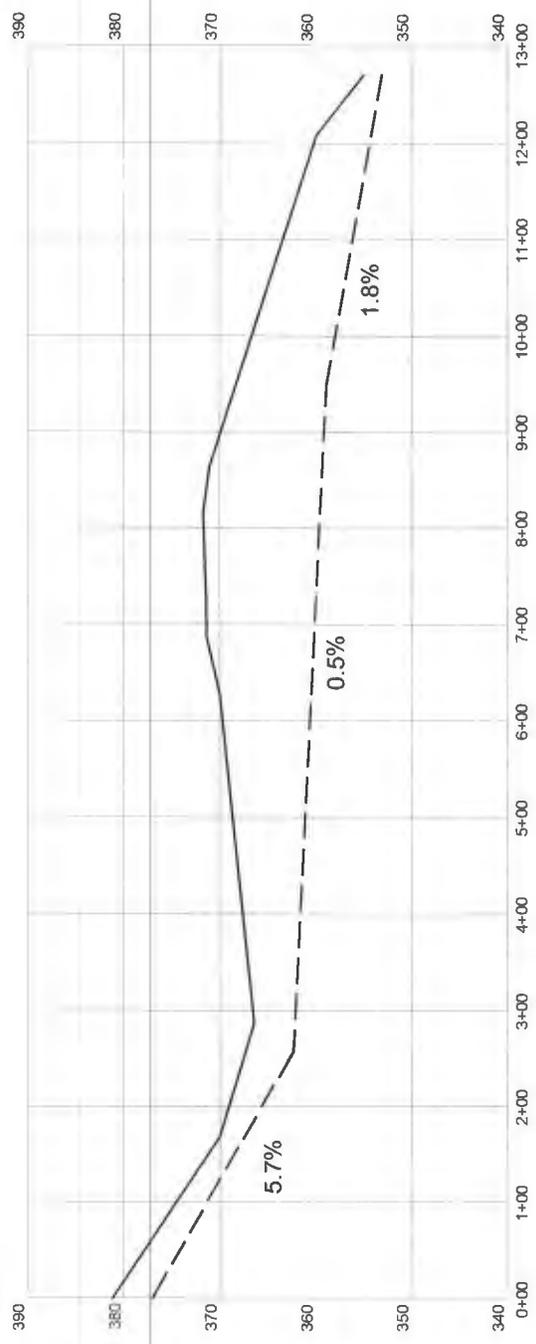
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	26.67	80.00	300.00	1.300	0.064
#1	1	Time of Concentration:					0.064
#1	2	5. Nearly bare and untilled, and alluvial valley fans	25.00	50.00	200.00	5.000	0.011
		8. Large gullies, diversions, and low flowing streams	15.52	90.00	580.00	11.810	0.013
#1	2	Time of Concentration:					0.024

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	17.95	140.00	780.00	12.700	0.017
#1	1	Muskingum K:					0.017

1

3



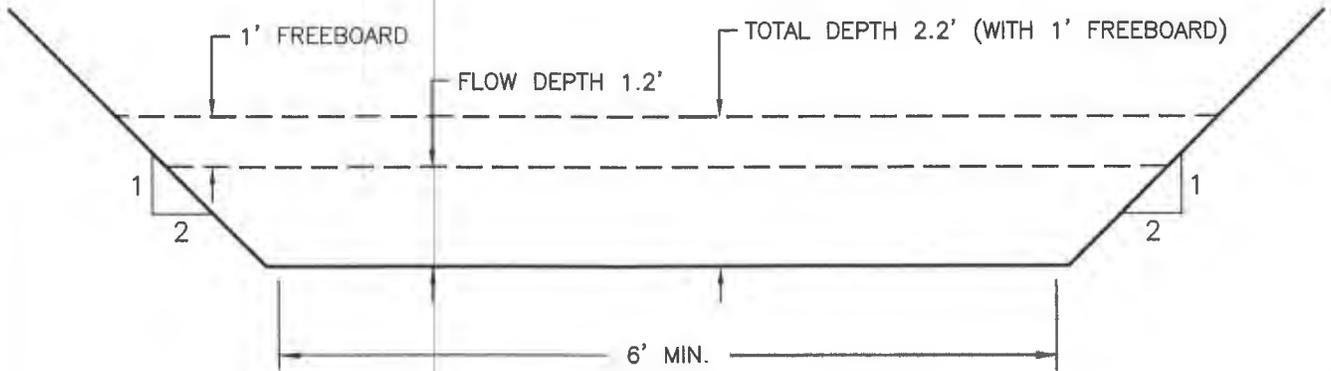
— EXISTING GRADE
 - - - PROPOSED GRADE

QUALITY COAL CO., INC.
 DUTTON HILL MINE NO. 2 P-
 DIVERSION 1-3 PROFILE

Date: 4/29/2014

Scale: H: 1" = 200'
 V: 1" = 20'

DIVERSION 1-3
0+00 TO 2+58



CHANNEL LINING TO CONSIST OF BURMUDA GRASS

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 4/30/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 1-3
0+00 to 2+58

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	0+00 to 2+58

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	20.600	20.600	41.18	3.51

Structure Detail:

Structure #1 (Vegetated Channel)

0+00 to 2+58

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	5.7	D, B	1.00			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:	41.18 cfs		41.18 cfs	
Depth:	0.78 ft	1.78 ft	1.17 ft	2.17 ft
Top Width:	9.13 ft	13.13 ft	10.66 ft	14.66 ft
Velocity:	6.96 fps		4.24 fps	
X-Section Area:	5.91 sq ft		9.72 sq ft	
Hydraulic Radius:	0.623 ft		0.866 ft	
Froude Number:	1.52		0.78	
Roughness Coefficient:	0.0372		0.0762	

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	5.800	0.067	0.023	0.432	70.000	M	8.49	0.703
	2	14.800	0.038	0.000	0.000	81.000	F	32.70	2.810
	Σ	20.600						41.18	3.513

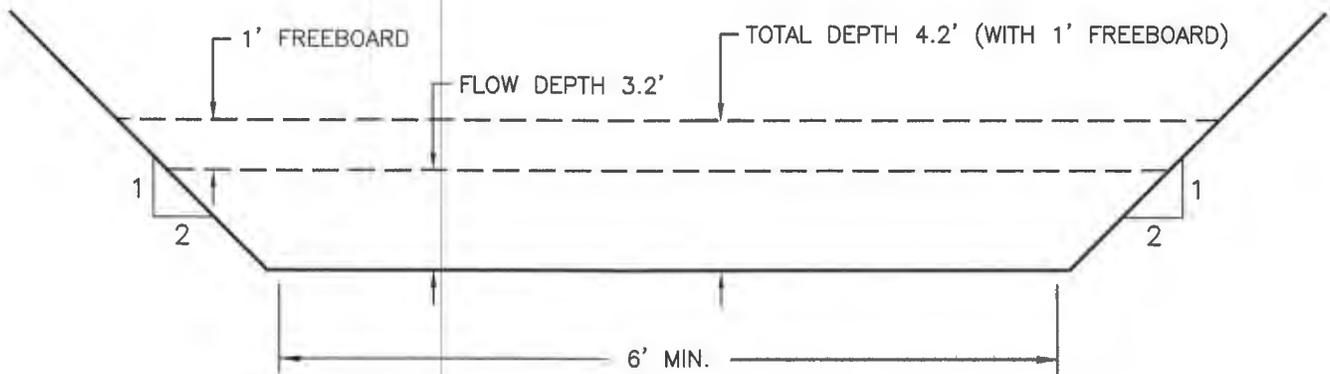
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	15.00	30.00	200.00	0.970	0.057
		8. Large gullies, diversions, and low flowing streams	15.22	70.00	460.00	11.700	0.010
#1	1	Time of Concentration:					0.067
#1	2	5. Nearly bare and untilled, and alluvial valley fans	30.00	60.00	200.00	5.470	0.010
		8. Large gullies, diversions, and low flowing streams	7.32	60.00	820.00	8.110	0.028
#1	2	Time of Concentration:					0.038

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	13.04	120.00	920.00	10.830	0.023
#1	1	Muskingum K:					0.023

DIVERSION 1-3
2+58 TO 9+50



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 4/30/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-

Diversion 1-3
2+58 to 9+50

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	2+58 to 9+50

#1
Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	52.800	52.800	103.24	8.94

Structure Detail:

Structure #1 (Vegetated Channel)

2+58 to 9+50

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

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	1.00			5.0

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:	103.24 cfs		103.24 cfs	
Depth:	2.33 ft	3.33 ft	3.23 ft	4.23 ft
Top Width:	15.30 ft	19.30 ft	18.92 ft	22.92 ft
Velocity:	4.17 fps		2.57 fps	
X-Section Area:	24.76 sq ft		40.24 sq ft	
Hydraulic Radius:	1.510 ft		1.968 ft	
Froude Number:	0.58		0.31	
Roughness Coefficient:	0.0332		0.0645	

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	15.800	0.056	0.055	0.415	70.000	M	23.12	1.915
	2	37.000	0.067	0.000	0.000	81.000	F	81.74	7.024
	Σ	52.800						103.24	8.940

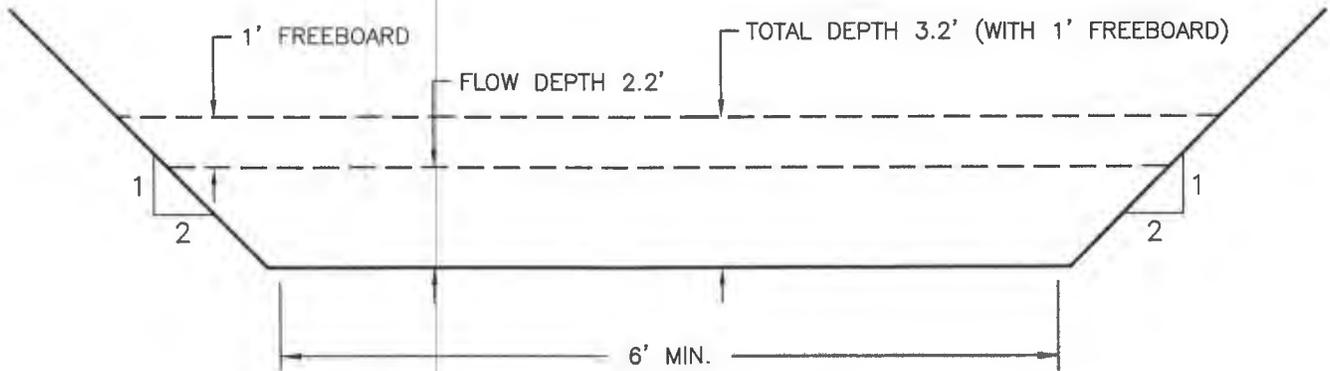
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	20.00	40.00	200.00	1.130	0.049
		8. Large gullies, diversions, and low flowing streams	15.63	50.00	320.00	11.850	0.007
#1	1	Time of Concentration:					0.056
#1	2	5. Nearly bare and untilled, and alluvial valley fans	10.00	20.00	200.00	3.160	0.017
		8. Large gullies, diversions, and low flowing streams	7.43	110.00	1,480.00	8.170	0.050
#1	2	Time of Concentration:					0.067

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	7.74	130.00	1,680.00	8.340	0.055
#1	1	Muskingum K:					0.055

DIVERSION 1-3
9+50 TO 12+70



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 4/30/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-

Diversion 1-3

9+50 to 12+70

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	9+50 to 12+70

#1
Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	52.800	52.800	103.24	8.94

Structure Detail:

Structure #1 (Vegetated Channel)

9+50 to 12+70

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	1.8	D, B	1.00			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:	103.24 cfs		103.24 cfs	
Depth:	1.61 ft	2.61 ft	2.20 ft	3.20 ft
Top Width:	12.44 ft	16.44 ft	14.78 ft	18.78 ft
Velocity:	6.95 fps		4.53 fps	
X-Section Area:	14.86 sq ft		22.81 sq ft	
Hydraulic Radius:	1.125 ft		1.442 ft	
Froude Number:	1.12		0.64	
Roughness Coefficient:	0.0311		0.0563	

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	15.800	0.056	0.055	0.415	70.000	M	23.12	1.915
	2	37.000	0.067	0.000	0.000	81.000	F	81.74	7.024
	Σ	52.800						103.24	8.940

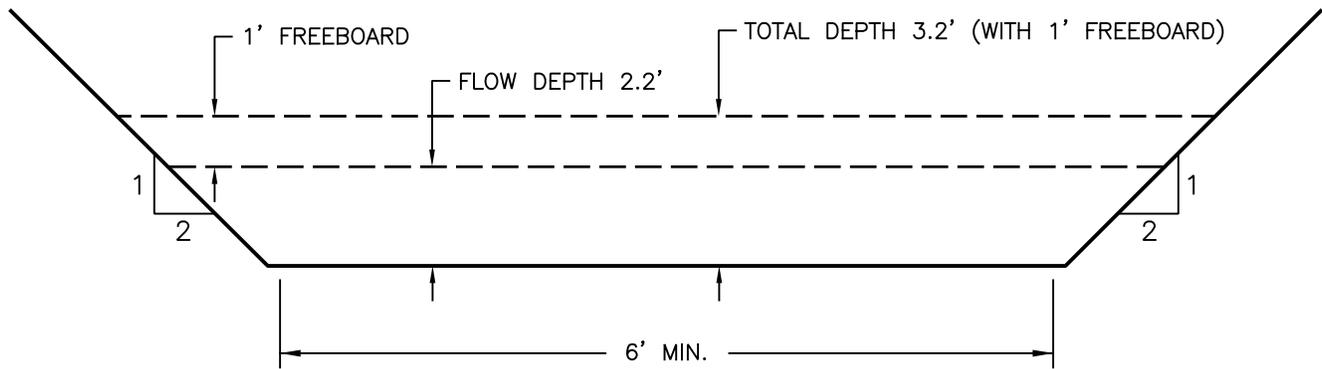
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	20.00	40.00	200.00	1.130	0.049
		8. Large gullies, diversions, and low flowing streams	15.63	50.00	320.00	11.850	0.007
#1	1	Time of Concentration:					0.056
#1	2	5. Nearly bare and untilled, and alluvial valley fans	10.00	20.00	200.00	3.160	0.017
		8. Large gullies, diversions, and low flowing streams	7.43	110.00	1,480.00	8.170	0.050
#1	2	Time of Concentration:					0.067

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	7.74	130.00	1,680.00	8.340	0.055
#1	1	Muskingum K:					0.055

DIVERSION 4-5
0+00 TO 14+60



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-3980
DIVERSION CROSS-SECTION

Date: 1/6/2015

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2
P-3980
Diversion 4-5
0+00 to 14+60

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	0+00 to 14+60

#1 Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	25.29	2.15

Structure Detail:

Structure #1 (Vegetated Channel)

0+00 to 14+60

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

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	1.00			5.0

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:	25.29 cfs		25.29 cfs	
Depth:	1.32 ft	2.32 ft	2.16 ft	3.16 ft
Top Width:	11.29 ft	15.29 ft	14.64 ft	18.64 ft
Velocity:	2.21 fps		1.13 fps	
X-Section Area:	11.44 sq ft		22.29 sq ft	
Hydraulic Radius:	0.960 ft		1.423 ft	
Froude Number:	0.39		0.16	
Roughness Coefficient:	0.0463		0.1175	

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	4.300	0.056	0.004	0.451	70.000	M	6.29	0.521
	2	8.600	0.013	0.000	0.000	81.000	F	19.00	1.633
	Σ	12.900						25.29	2.154

Subwatershed Time of Concentration Details:

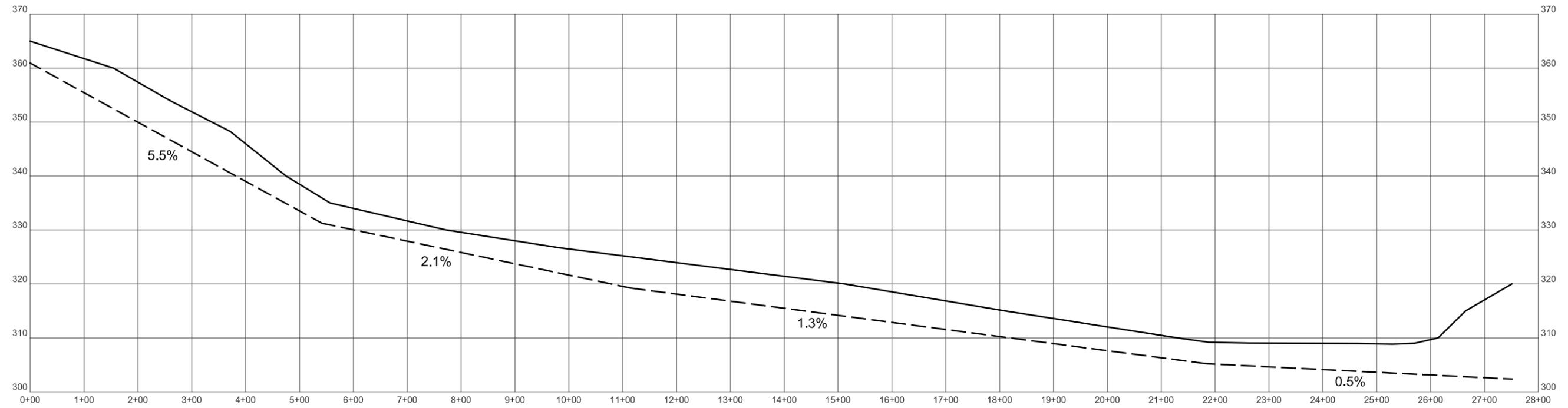
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	20.00	40.00	200.00	1.130	0.049
		8. Large gullies, diversions, and low flowing streams	22.50	90.00	400.00	14.230	0.007
#1	1	Time of Concentration:					0.056
#1	2	5. Nearly bare and untilled, and alluvial valley fans	26.92	70.00	260.00	5.180	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	26.92	70.00	260.00	15.560	0.004
#1	1	Muskingum K:					0.004

6

7



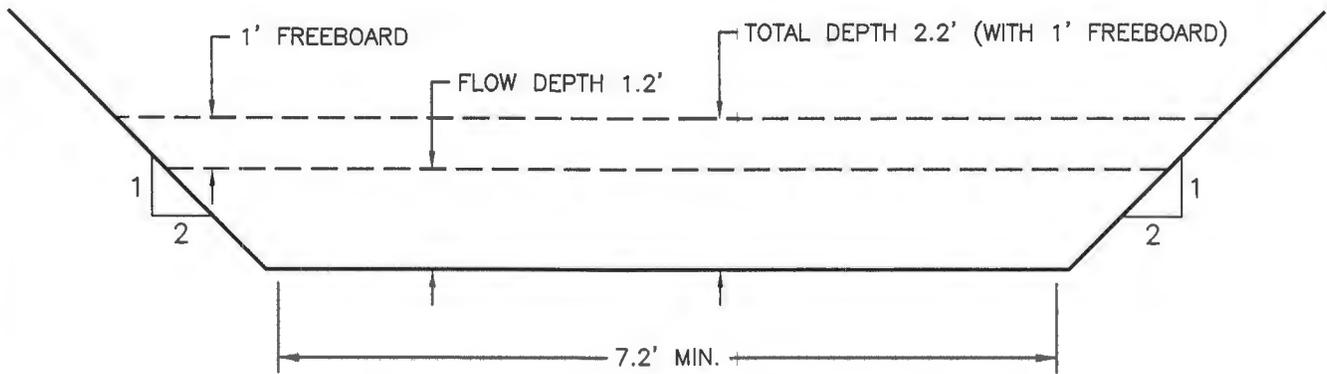
———— EXISTING GRADE
----- PROPOSED GRADE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION 6-7 PROFILE

Date: 8/11/2014

Scale: H: 1" = 200'
V: 1" = 20'

DIVERSION 6-7
0+00 TO 5+42



CHANNEL LINING TO CONSIST OF BERMUDA GRASS

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/13/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 6-7
0+00 to 5+42

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	0+00 to 5+42

#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	47.59	4.10

Structure Detail:

Structure #1 (Vegetated Channel)

0+00 to 5+42

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)
7.20	2.0:1	2.0:1	5.5	D, B	1.00			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:	47.59 cfs		47.59 cfs	
Depth:	0.78 ft	1.78 ft	1.15 ft	2.15 ft
Top Width:	10.31 ft	14.31 ft	11.82 ft	15.82 ft
Velocity:	7.00 fps		4.34 fps	
X-Section Area:	6.80 sq ft		10.97 sq ft	
Hydraulic Radius:	0.637 ft		0.888 ft	
Froude Number:	1.52		0.79	
Roughness Coefficient:	0.0369		0.0744	

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	1.000	0.026	0.021	0.402	68.000	M	1.33	0.110
	2	17.200	0.069	0.030	0.401	70.000	M	25.17	2.085
	3	4.900	0.039	0.053	0.427	75.000	M	8.82	0.738
	4	3.300	0.037	0.000	0.000	81.000	F	7.29	0.626
	5	1.800	0.040	0.059	0.427	95.000	F	5.45	0.542
	Σ	28.200						47.59	4.102

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	5.56	10.00	180.00	1.880	0.026
#1	1	Time of Concentration:					0.026
#1	2	1. Forest with heavy ground litter	25.00	50.00	200.00	1.260	0.044
		8. Large gullies, diversions, and low flowing streams	13.73	140.00	1,020.00	11.110	0.025
#1	2	Time of Concentration:					0.069
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	5.00	10.00	200.00	6.700	0.008
#1	3	Time of Concentration:					0.039
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	5.71	20.00	350.00	7.170	0.013
#1	4	Time of Concentration:					0.037
#1	5	7. Paved area and small upland gullies	1.43	5.00	350.00	2.400	0.040
#1	5	Time of Concentration:					0.040

Subwatershed Muskingum Routing Details:

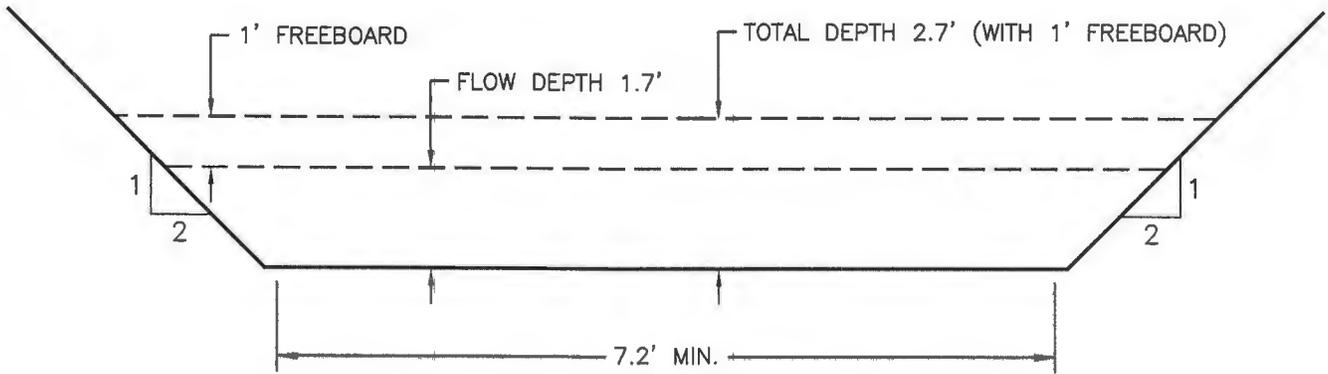
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	5.45	30.00	550.00	7.000	0.021
#1	1	Muskingum K:					0.021
#1	2	8. Large gullies, diversions, and low flowing streams	5.33	40.00	750.00	6.920	0.030

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	Muskingum K:					0.030
#1	3	8. Large gullies, diversions, and low flowing streams	10.94	210.00	1,920.00	9.920	0.053
#1	3	Muskingum K:					0.053
#1	5	8. Large gullies, diversions, and low flowing streams	10.85	230.00	2,120.00	9.880	0.059
#1	5	Muskingum K:					0.059

DIVERSION 6-7
5+42 TO 11+15



CHANNEL LINING TO CONSIST OF BERMUDA GRASS

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/13/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 6-7
5+42 to 11+15

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	5+42 to 11+15

#1
Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	33.500	33.500	56.27	5.06

Structure Detail:

Structure #1 (Vegetated Channel)

5+42 to 11+15

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)
7.20	2.0:1	2.0:1	2.1	D, B	1.00			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:	56.27 cfs		56.27 cfs	
Depth:	1.11 ft	2.11 ft	1.65 ft	2.65 ft
Top Width:	11.66 ft	15.66 ft	13.78 ft	17.78 ft
Velocity:	5.35 fps		3.26 fps	
X-Section Area:	10.51 sq ft		17.27 sq ft	
Hydraulic Radius:	0.863 ft		1.186 ft	
Froude Number:	0.99		0.51	
Roughness Coefficient:	0.0365		0.0742	

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	1.000	0.026	0.054	0.391	68.000	M	1.33	0.110
	2	18.000	0.069	0.062	0.393	70.000	M	26.34	2.182
	3	5.000	0.039	0.079	0.420	75.000	M	9.00	0.753
	4	7.600	0.070	0.000	0.000	81.000	F	16.79	1.443
	5	1.900	0.040	0.085	0.421	95.000	F	5.75	0.572
	Σ	33.500						56.27	5.060

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	5.56	10.00	180.00	1.880	0.026
#1	1	Time of Concentration:					0.026
#1	2	1. Forest with heavy ground litter	25.00	50.00	200.00	1.260	0.044
		8. Large gullies, diversions, and low flowing streams	13.73	140.00	1,020.00	11.110	0.025
#1	2	Time of Concentration:					0.069
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	5.00	10.00	200.00	6.700	0.008
#1	3	Time of Concentration:					0.039
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	4.00	40.00	1,000.00	6.000	0.046
#1	4	Time of Concentration:					0.070
#1	5	7. Paved area and small upland gullies	1.43	5.00	350.00	2.400	0.040
#1	5	Time of Concentration:					0.040

Subwatershed Muskingum Routing Details:

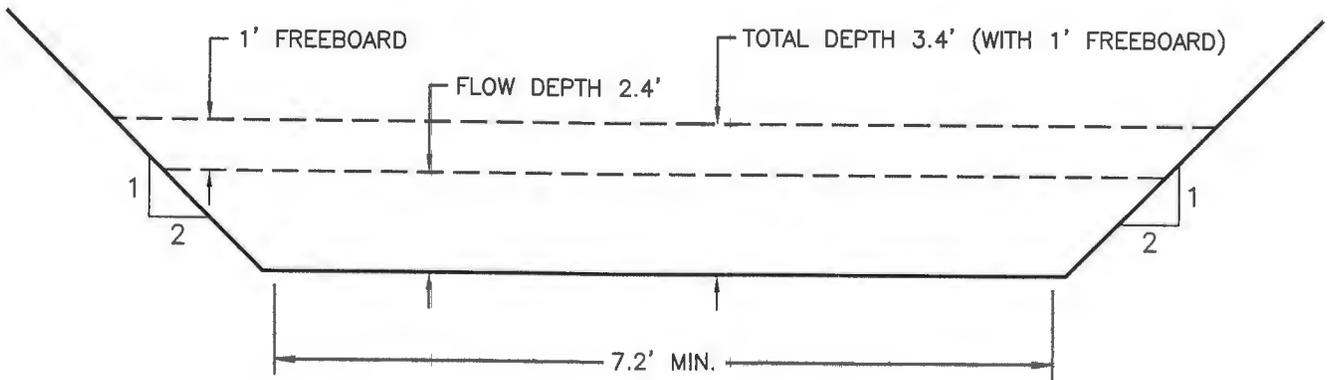
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	4.17	50.00	1,200.01	6.120	0.054
#1	1	Muskingum K:					0.054
#1	2	8. Large gullies, diversions, and low flowing streams	4.29	60.00	1,400.00	6.210	0.062

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	Muskingum K:					0.062
#1	3	8. Large gullies, diversions, and low flowing streams	8.95	230.00	2,570.00	8.970	0.079
#1	3	Muskingum K:					0.079
#1	5	8. Large gullies, diversions, and low flowing streams	9.03	250.00	2,770.00	9.010	0.085
#1	5	Muskingum K:					0.085

DIVERSION 6-7
11+15 TO 21+84



CHANNEL LINING TO CONSIST OF BERMUDA GRASS

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/13/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-

Diversion 6-7

11+15 to 21+84

4.2 Inch, 10 Year - 6 Hour

SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	11+15 to 21+84

#1 Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	68.000	68.000	114.86	10.49

Structure Detail:

Structure #1 (Vegetated Channel)

11+15 to 21+84

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)
7.20	2.0:1	2.0:1	1.3	D, B	1.00			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:	114.86 cfs		114.86 cfs	
Depth:	1.73 ft	2.73 ft	2.36 ft	3.36 ft
Top Width:	14.11 ft	18.11 ft	16.65 ft	20.65 ft
Velocity:	6.24 fps		4.08 fps	
X-Section Area:	18.40 sq ft		28.16 sq ft	
Hydraulic Radius:	1.233 ft		1.586 ft	
Froude Number:	0.96		0.55	
Roughness Coefficient:	0.0313		0.0566	

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	1.000	0.026	0.122	0.377	68.000	M	1.33	0.110
	2	30.100	0.069	0.129	0.380	70.000	M	44.05	3.649
	3	8.600	0.039	0.130	0.411	75.000	M	15.48	1.295
	4	26.300	0.139	0.000	0.000	81.000	F	50.15	4.837
	5	2.000	0.040	0.135	0.412	95.000	F	6.06	0.602
	Σ	68.000						114.86	10.494

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	5.56	10.00	180.00	1.880	0.026
#1	1	Time of Concentration:					0.026
#1	2	1. Forest with heavy ground litter	25.00	50.00	200.00	1.260	0.044
		8. Large gullies, diversions, and low flowing streams	13.73	140.00	1,020.00	11.110	0.025
#1	2	Time of Concentration:					0.069
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	5.00	10.00	200.00	6.700	0.008
#1	3	Time of Concentration:					0.039
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	2.86	60.00	2,100.00	5.070	0.115
#1	4	Time of Concentration:					0.139
#1	5	7. Paved area and small upland gullies	1.43	5.00	350.00	2.400	0.040
#1	5	Time of Concentration:					0.040

Subwatershed Muskingum Routing Details:

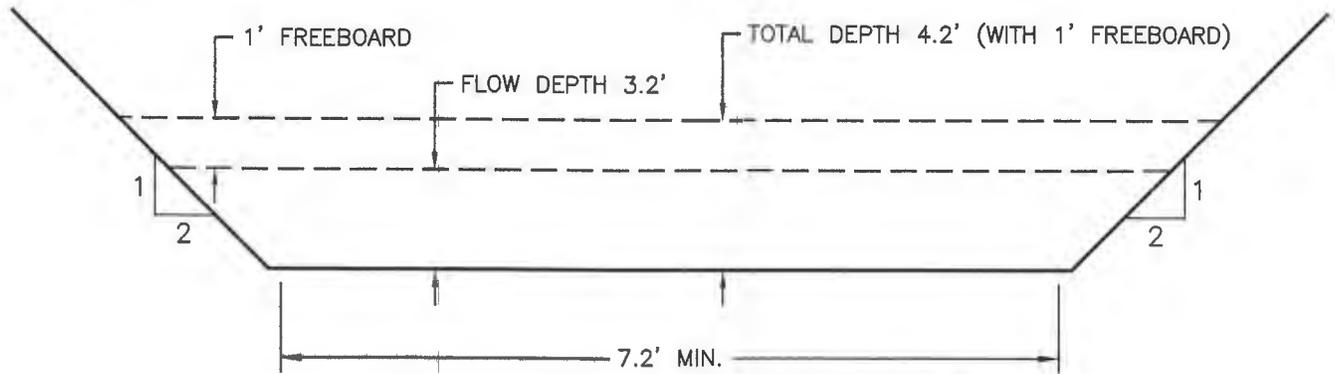
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	3.04	70.00	2,300.00	5.230	0.122
#1	1	Muskingum K:					0.122
#1	2	8. Large gullies, diversions, and low flowing streams	3.20	80.00	2,500.00	5.360	0.129

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	Muskingum K:					0.129
#1	3	8. Large gullies, diversions, and low flowing streams	6.81	250.00	3,670.00	7.820	0.130
#1	3	Muskingum K:					0.130
#1	5	8. Large gullies, diversions, and low flowing streams	6.98	270.00	3,870.00	7.920	0.135
#1	5	Muskingum K:					0.135

DIVERSION 6-7
21+84 TO 27+51



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/13/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-

Diversion 6-7
21+84 to 27+51

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	21+84 to 27+51

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	74.200	74.200	121.24	11.57

Structure Detail:

Structure #1 (Vegetated Channel)

21+84 to 27+51

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

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)
7.20	2.0:1	2.0:1	0.5	D, B	1.00			5.0

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:	121.24 cfs		121.24 cfs	
Depth:	2.33 ft	3.33 ft	3.21 ft	4.21 ft
Top Width:	16.51 ft	20.51 ft	20.05 ft	24.05 ft
Velocity:	4.39 fps		2.77 fps	
X-Section Area:	27.60 sq ft		43.76 sq ft	
Hydraulic Radius:	1.567 ft		2.029 ft	
Froude Number:	0.60		0.33	
Roughness Coefficient:	0.0323		0.0609	

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	1.000	0.026	0.164	0.370	68.000	M	1.33	0.110
	2	30.700	0.069	0.170	0.373	70.000	M	44.93	3.722
	3	8.600	0.039	0.160	0.406	75.000	M	15.48	1.295
	4	31.900	0.182	0.000	0.000	81.000	F	60.05	5.838
	5	2.000	0.040	0.165	0.407	95.000	F	6.06	0.602
	Σ	74.200						121.24	11.567

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	5.56	10.00	180.00	1.880	0.026
#1	1	Time of Concentration:					0.026
#1	2	1. Forest with heavy ground litter	25.00	50.00	200.00	1.260	0.044
		8. Large gullies, diversions, and low flowing streams	13.73	140.00	1,020.00	11.110	0.025
#1	2	Time of Concentration:					0.069
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	5.00	10.00	200.00	6.700	0.008
#1	3	Time of Concentration:					0.039
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.00	10.00	200.00	2.230	0.024
		8. Large gullies, diversions, and low flowing streams	2.43	65.00	2,670.00	4.680	0.158
#1	4	Time of Concentration:					0.182
#1	5	7. Paved area and small upland gullies	1.43	5.00	350.00	2.400	0.040
#1	5	Time of Concentration:					0.040

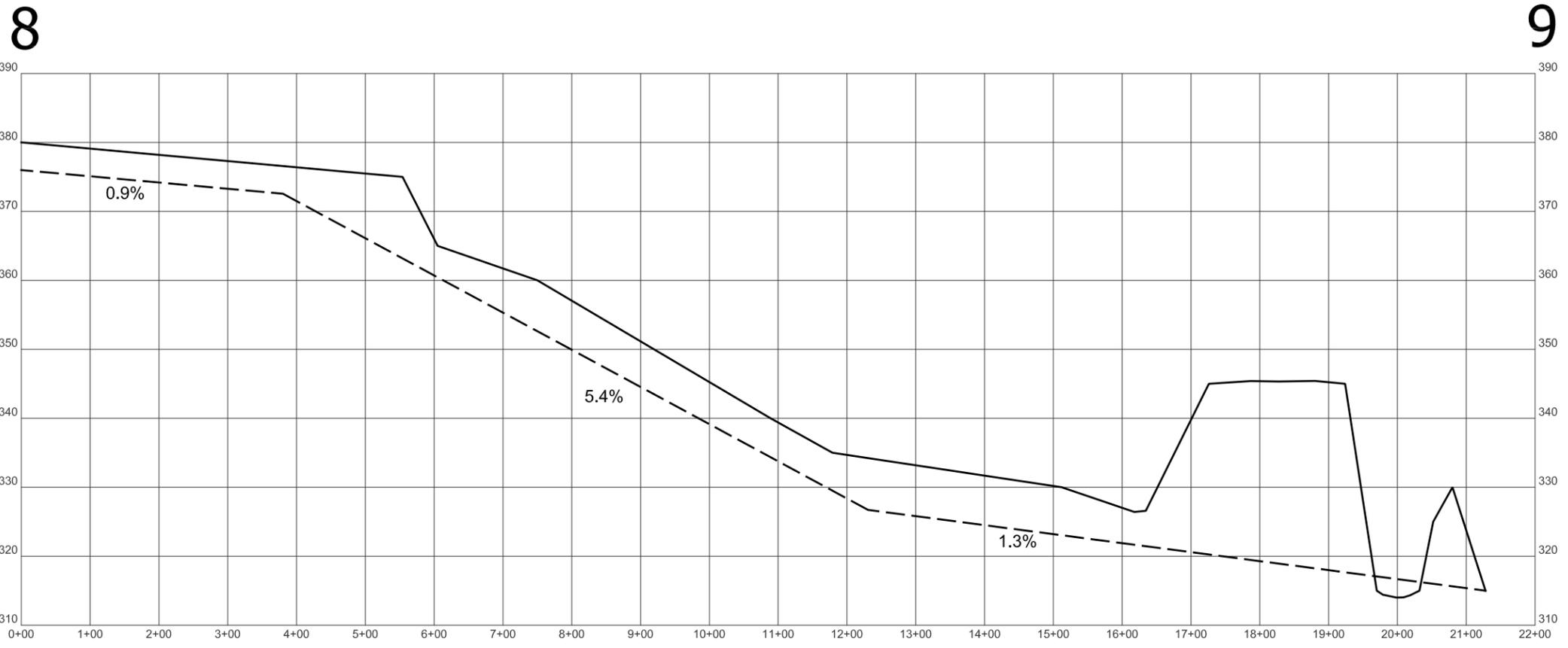
Subwatershed Muskingum Routing Details:

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	2.61	75.00	2,870.00	4.840	0.164
#1	1	Muskingum K:					0.164
#1	2	8. Large gullies, diversions, and low flowing streams	2.77	85.00	3,070.00	4.990	0.170

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	Muskingum K:					0.170
#1	3	8. Large gullies, diversions, and low flowing streams	6.01	255.00	4,240.00	7.350	0.160
#1	3	Muskingum K:					0.160
#1	5	8. Large gullies, diversions, and low flowing streams	6.19	275.00	4,440.00	7.460	0.165
#1	5	Muskingum K:					0.165

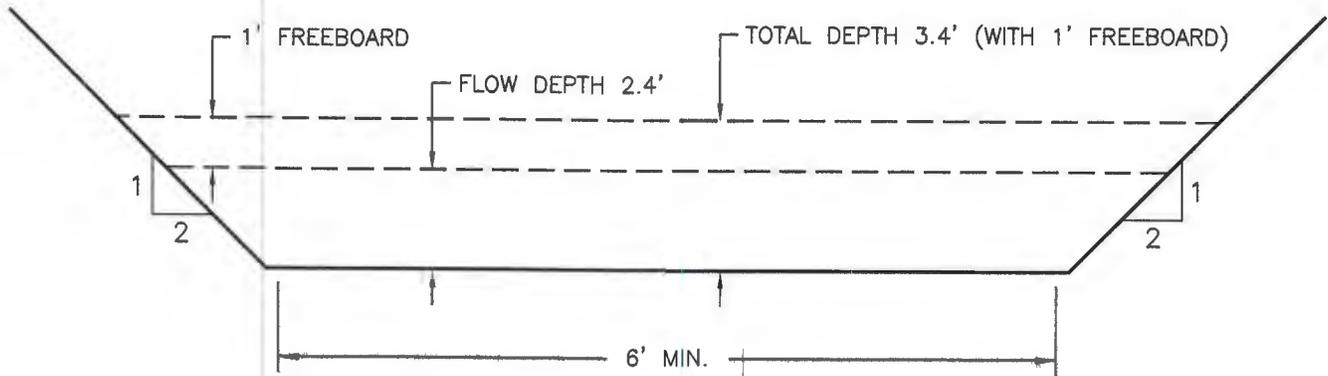


_____ EXISTING GRADE
 - - - - - PROPOSED GRADE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION 8-9 PROFILE

Date: 8/14/2014	Scale: H: 1" = 200' V: 1" = 20'
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DIVERSION 8-9
0+00 TO 3+80



CHANNEL LINING TO CONSIST OF A GRASS MIXTURE

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/20/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 8-9
0+00 to 3+80

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

General Information

Storm Information:

Storm Type:	Rainfall Event
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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	0+00 to 3+80

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	39.300	39.300	65.29	5.45

Structure Detail:

Structure #1 (Vegetated Channel)

0+00 to 3+80

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

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	1.00			5.0

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:	65.29 cfs		65.29 cfs	
Depth:	1.64 ft	2.64 ft	2.38 ft	3.38 ft
Top Width:	12.55 ft	16.55 ft	15.50 ft	19.50 ft
Velocity:	4.30 fps		2.56 fps	
X-Section Area:	15.19 sq ft		25.55 sq ft	
Hydraulic Radius:	1.140 ft		1.537 ft	
Froude Number:	0.69		0.35	
Roughness Coefficient:	0.0359		0.0736	

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	18,600	0.062	0.022	0.369	70.000	M	27.22	2.255
	2	18,700	0.046	0.031	0.420	75.000	M	33.65	2.816
	3	2,000	0.029	0.000	0.000	81.000	F	4.42	0.380
Σ		39,300						65.29	5.450

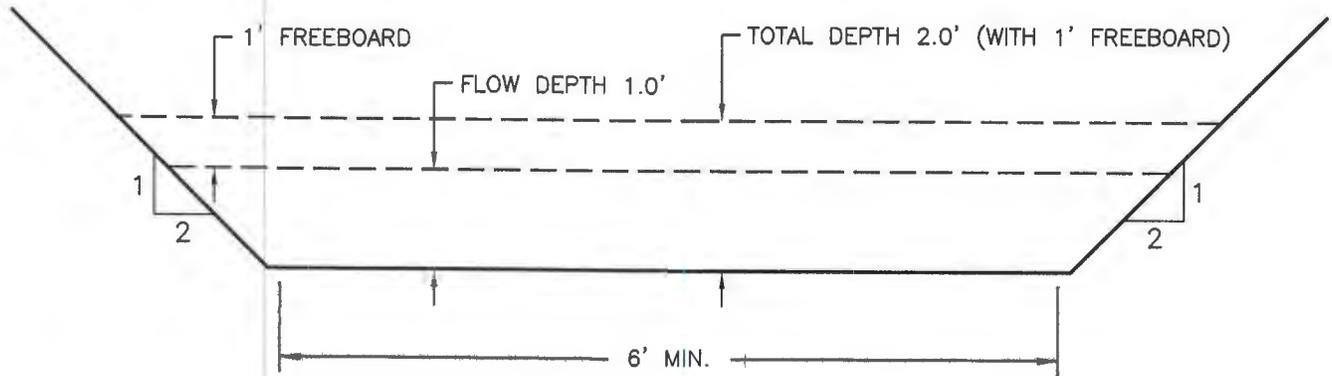
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)	
#1	1	1. Forest with heavy ground litter	20.00	40.00	200.00	1.130	0.049	
		8. Large gullies, diversions, and low flowing streams	9.09	40.00	440.00	9.040	0.013	
#1	1	Time of Concentration:						0.062
#1	2	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031	
		8. Large gullies, diversions, and low flowing streams	15.63	100.00	640.00	11.850	0.015	
#1	2	Time of Concentration:						0.046
#1	3	5. Nearly bare and untilled, and alluvial valley fans	10.00	20.00	200.00	3.160	0.017	
		8. Large gullies, diversions, and low flowing streams	7.89	30.00	380.00	8.420	0.012	
#1	3	Time of Concentration:						0.029

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	2.56	10.00	390.00	4.800	0.022	
#1	1	Muskingum K:						0.022
#1	2	8. Large gullies, diversions, and low flowing streams	8.82	90.00	1,020.00	8.910	0.031	
#1	2	Muskingum K:						0.031

DIVERSION 8-9
3+80 TO 12+31



CHANNEL LINING TO CONSIST OF 16" OF CLASS II LIMESTONE OR SANDSTONE RIPRAP

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/20/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-
Diversion 8-9
3+80 to 12+31

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

General Information

Storm Information:

Storm Type:	Rainfall Event
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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	3+80 to 12+31

#1
Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	61.300	61.300	97.40	8.63

Structure Detail:

Structure #1 (Riprap Channel)

3+80 to 12+31

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	5.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	97.40 cfs	
Depth:	0.99 ft	1.99 ft
Top Width:	9.97 ft	13.97 ft
Velocity*:		
X-Section Area:	7.92 sq ft	
Hydraulic Radius:	0.759 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 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	30.400	0.062	0.057	0.390	70.000	M	44.49	3.685
	2	21.300	0.046	0.065	0.412	75.000	M	38.33	3.207
	3	8.500	0.061	0.000	0.000	81.000	F	18.78	1.614
	4	1.100	0.014	0.031	0.400	68.000	M	1.47	0.121
	Σ	61.300						97.40	8.628

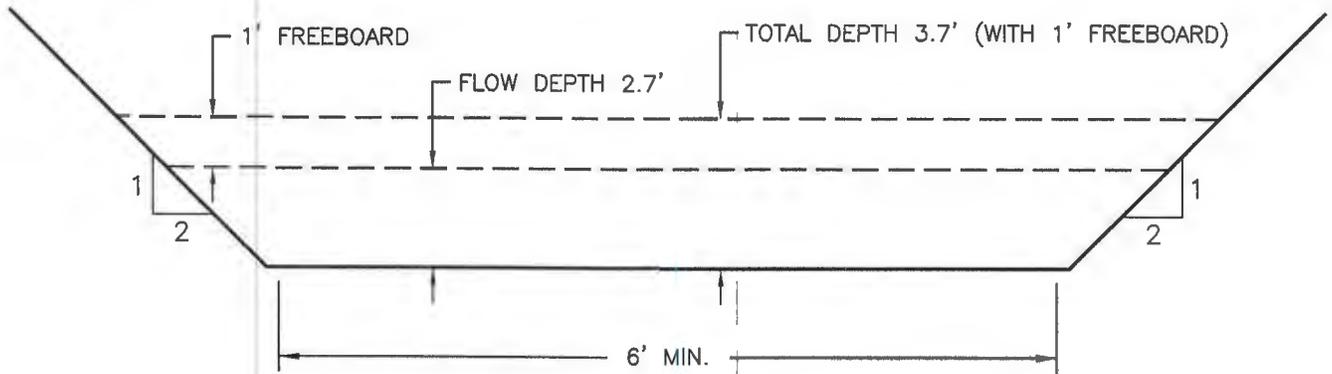
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	20.00	40.00	200.00	1.130	0.049
		8. Large gullies, diversions, and low flowing streams	9.09	40.00	440.00	9.040	0.013
#1	1	Time of Concentration:					0.062
#1	2	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	15.63	100.00	640.00	11.850	0.015
#1	2	Time of Concentration:					0.046
#1	3	5. Nearly bare and untilled, and alluvial valley fans	10.00	20.00	200.00	3.160	0.017
		8. Large gullies, diversions, and low flowing streams	5.93	70.00	1,180.00	7.300	0.044
#1	3	Time of Concentration:					0.061
#1	4	3. Short grass pasture	13.33	20.00	150.00	2.920	0.014
#1	4	Time of Concentration:					0.014

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	4.03	50.00	1,240.00	6.020	0.057
#1	1	Muskingum K:					0.057
#1	2	8. Large gullies, diversions, and low flowing streams	6.99	130.00	1,860.00	7.930	0.065
#1	2	Muskingum K:					0.065
#1	4	8. Large gullies, diversions, and low flowing streams	5.13	40.00	780.00	6.790	0.031
#1	4	Muskingum K:					0.031

DIVERSION 8-9
12+31 TO 21+28



CHANNEL LINING TO CONSIST OF BERMUDA GRASS

QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2 P-
DIVERSION CROSS-SECTION

Date: 8/20/2014

Scale: Not to Scale

Quality Coal Co., Inc.
Dutton Hill Mine No. 2

P-

Diversion 8-9
12+31 to 21+28

4.2 Inch, 10 Year - 6 Hour
SCS 6 Hour Event

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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	12+31 to 21+28

#1
Chan'

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	97.600	97.600	144.85	13.73

Structure Detail:

Structure #1 (Vegetated Channel)

12+31 to 21+28

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	1.3	D, B	1.00			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:	144.85 cfs		144.85 cfs	
Depth:	2.03 ft	3.03 ft	2.67 ft	3.67 ft
Top Width:	14.10 ft	18.10 ft	16.69 ft	20.69 ft
Velocity:	7.11 fps		4.78 fps	
X-Section Area:	20.37 sq ft		30.31 sq ft	
Hydraulic Radius:	1.352 ft		1.689 ft	
Froude Number:	1.04		0.62	
Roughness Coefficient:	0.0292		0.0504	

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	53.100	0.062	0.109	0.381	70.000	M	77.72	6.437
	2	24.400	0.046	0.109	0.402	75.000	M	43.91	3.674
	3	18.200	0.294	0.000	0.000	81.000	F	30.54	3.261
	4	1.100	0.014	0.082	0.385	68.000	M	1.47	0.121
	5	0.800	0.033	0.067	0.426	95.000	F	2.42	0.241
	Σ	97.600						144.85	13.735

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	20.00	40.00	200.00	1.130	0.049
		8. Large gullies, diversions, and low flowing streams	9.09	40.00	440.00	9.040	0.013
#1	1	Time of Concentration:					0.062
#1	2	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	15.63	100.00	640.00	11.850	0.015
#1	2	Time of Concentration:					0.046
#1	3	5. Nearly bare and untilled, and alluvial valley fans	10.00	20.00	200.00	3.160	0.017
		5. Nearly bare and untilled, and alluvial valley fans	4.33	90.00	2,080.00	2.080	0.277
#1	3	Time of Concentration:					0.294
#1	4	3. Short grass pasture	13.33	20.00	150.00	2.920	0.014
#1	4	Time of Concentration:					0.014
#1	5	7. Paved area and small upland gullies	2.50	5.00	200.00	3.180	0.017
		8. Large gullies, diversions, and low flowing streams	2.00	5.00	250.00	4.240	0.016
#1	5	Time of Concentration:					0.033

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	3.27	70.00	2,140.00	5.420	0.109
#1	1	Muskingum K:					0.109

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Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	5.43	150.00	2,760.00	6.990	0.109
#1	2	Muskingum K:					0.109
#1	4	8. Large gullies, diversions, and low flowing streams	3.57	60.00	1,680.00	5.660	0.082
#1	4	Muskingum K:					0.082
#1	5	8. Large gullies, diversions, and low flowing streams	10.59	250.00	2,360.00	9.760	0.067
#1	5	Muskingum K:					0.067