

**HYDROLOGY STUDY FOR
SHANNON, LLC**

**SHANNON MINE NO. 3
P-3948
JEFFERSON COUNTY, ALABAMA**

**BY
DRUMMOND COMPANY, INC.
POST OFFICE BOX 1549
JASPER, ALABAMA 35502**

AUGUST 8, 2012

Post Office Box 1549
Jasper, Alabama 35502-1549

Telephone: (205) 387-0501

**DRUMMOND
COMPANY, INC.**

August 8, 2012

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

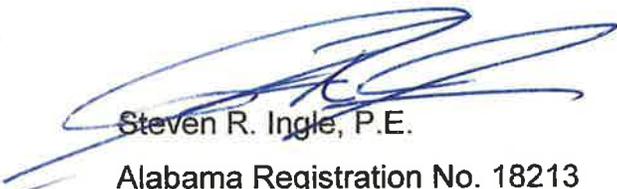
RE: Shannon, LLC
Shannon Mine No.3
P- 3948

Dear Michael:

I hereby certify the attached detailed modification design plans for Basins 027 and 029 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.


Steven R. Ingle, P.E.
Alabama Registration No. 18213

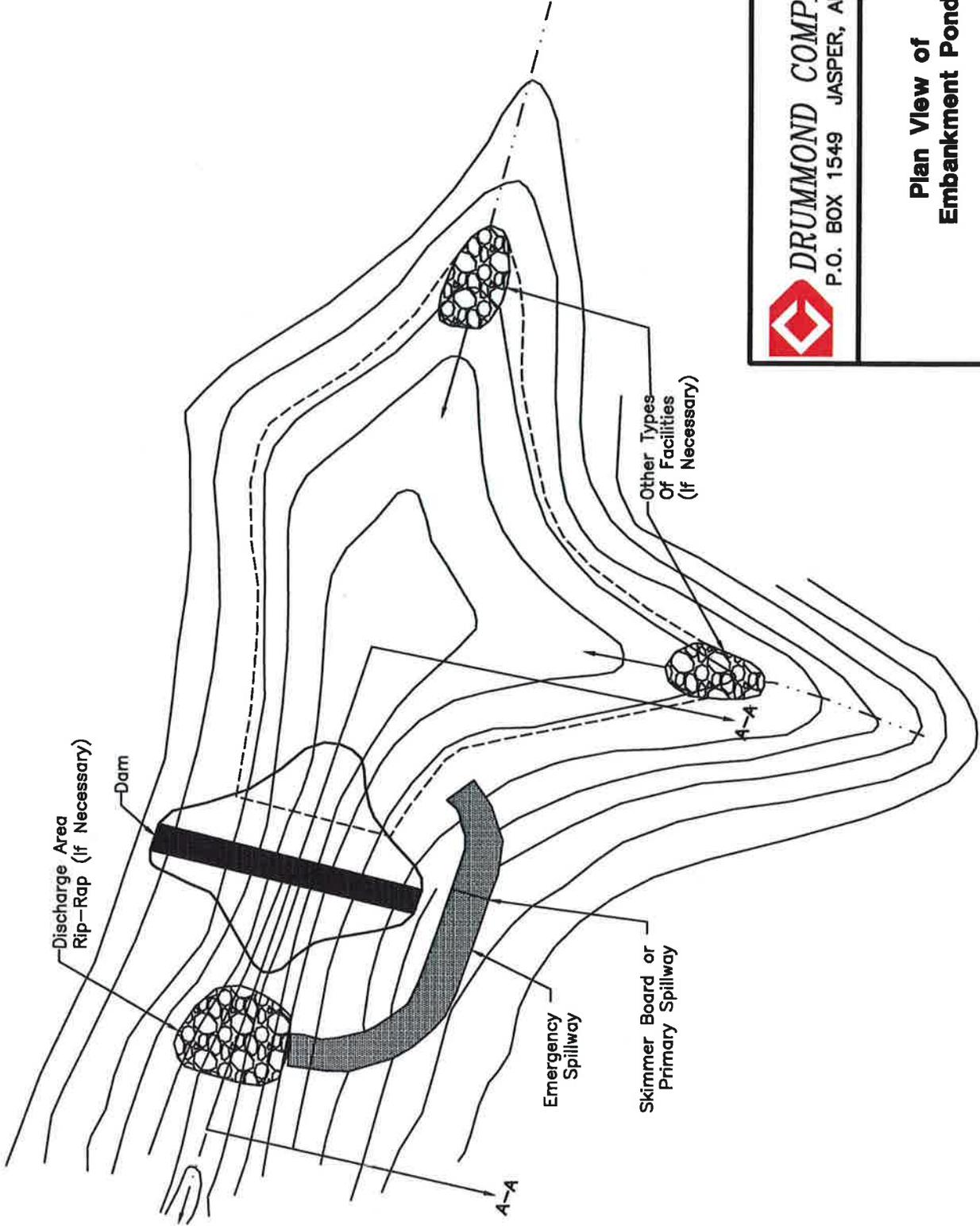


Pond Construction Criteria

The embankment for sediment basins (temporary and permanent) shall be designed and built using the following as minimum criteria:

1. The top of the dam shall be no less than 12 feet wide.
2. See design sheet for maximum and minimum embankment slopes.
3. The foundation and abutments for the impounding structure shall be designed to be stable under all conditions of construction and operation of the impoundments, with a minimum static safety factor of 1.5 for the normal pool with steady seepage saturation conditions, and a seismic safety factor of at least 1.20.
4. The dam shall be constructed with a cutoff trench based upon prudent engineering practices for the site. The cutoff shall be located on the dam centerline and be of sufficient depth to extend into a relatively impervious material from which the core of the dam shall also be constructed.
5. The embankment foundation area shall be cleared of all organic matter, all surfaces sloped to no steeper than 1v:1h, and the entire foundation surface scarified.
6. The entire embankment and cutoff trench shall be compacted to 95 percent density, based on standard proctor as outlined in ASTM.
7. The material placed in the embankment 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 that the moisture content of the fill material will permit satisfactory compaction in accordance with paragraph 5.
8. The pool area of the basin will be cleared of timber and large undergrowth.
9. The primary decant system when consisting of a pipe shall be installed according to Class C pipe installation for embankment bedding.
10. The primary decant system shall be equipped with a device, or constructed, such as to insure that subsurface withdrawal is accomplished to prevent discharge of floating solids. If a channel is used as the primary decant a skimmer shall be installed to prevent floating solids from discharging.
11. A splash pad or riprap may be required under the discharge of the primary decant system where necessary to insure that the discharge does not erode the embankment.

21. The embankment and spillway will be maintained by repairing any damage such as erosion, slope failure or spillway damage until removal of the structure or release of the performance bond.
22. All ponds shall be examined quarterly for structural weakness, instability, erosion, or other hazardous conditions and maintenance performed as necessary. Formal inspections shall be made on an annual basis, including any reports or modifications, in accordance with 880-X-10C-.20[1(j)] of the Alabama Surface Mining Commission Regulations.
23. Sediment will be removed from each pond when the accumulated sediment reaches the sediment storage volume as shown on the detailed design sheet.
24. Upon completion of mining, successful reclamation and effluent standards being met, each sediment basin not remaining as a permanent water impoundment will be dewatered in an environmentally safe manner (such as siphoning, pumping, etc.) and reclaimed to approximate original contours by the following procedure:
A permanent diversion channel (designed for a 10 year - 24 hour precipitation event) shall be cut along the outer edge of the basin to re-route drainage around the basin and back through the stabilized spillway to allow reclamation of the sediment basin. The diversion channel shall be designed and grassed as per enclosed information. (See permanent diversion for basin disposal). Upon completion of the diversion channel the back slope of the dam shall be graded to a minimum 3H to 1V slope. The dewatered sediment basin area shall be seeded with some combination of the following: Fescue, bermuda, rye grass, canary grass and willows. After seeding the area shall be mulched. Any additional sediment or embankment material not used to meet original contour, if non-toxic, shall be spread in thin layers within the permit area and vegetated as stated in the approved reclamation plan. All toxic material encountered in the basin disposal shall be buried and covered with 4 feet of non-toxic material and vegetated as stated in the approved reclamation plan.
25. A qualified registered professional engineer or other qualified professional specialist, under the direction of the professional engineer shall conduct regular inspections during construction and upon completion shall inspect each basin for certification purposes.
26. Point source discharge embankments shall be constructed and abutments keyed into desirable material if at all possible. In the event that undesirable material is encountered, addition design and construction criteria shall be submitted prior to certification.



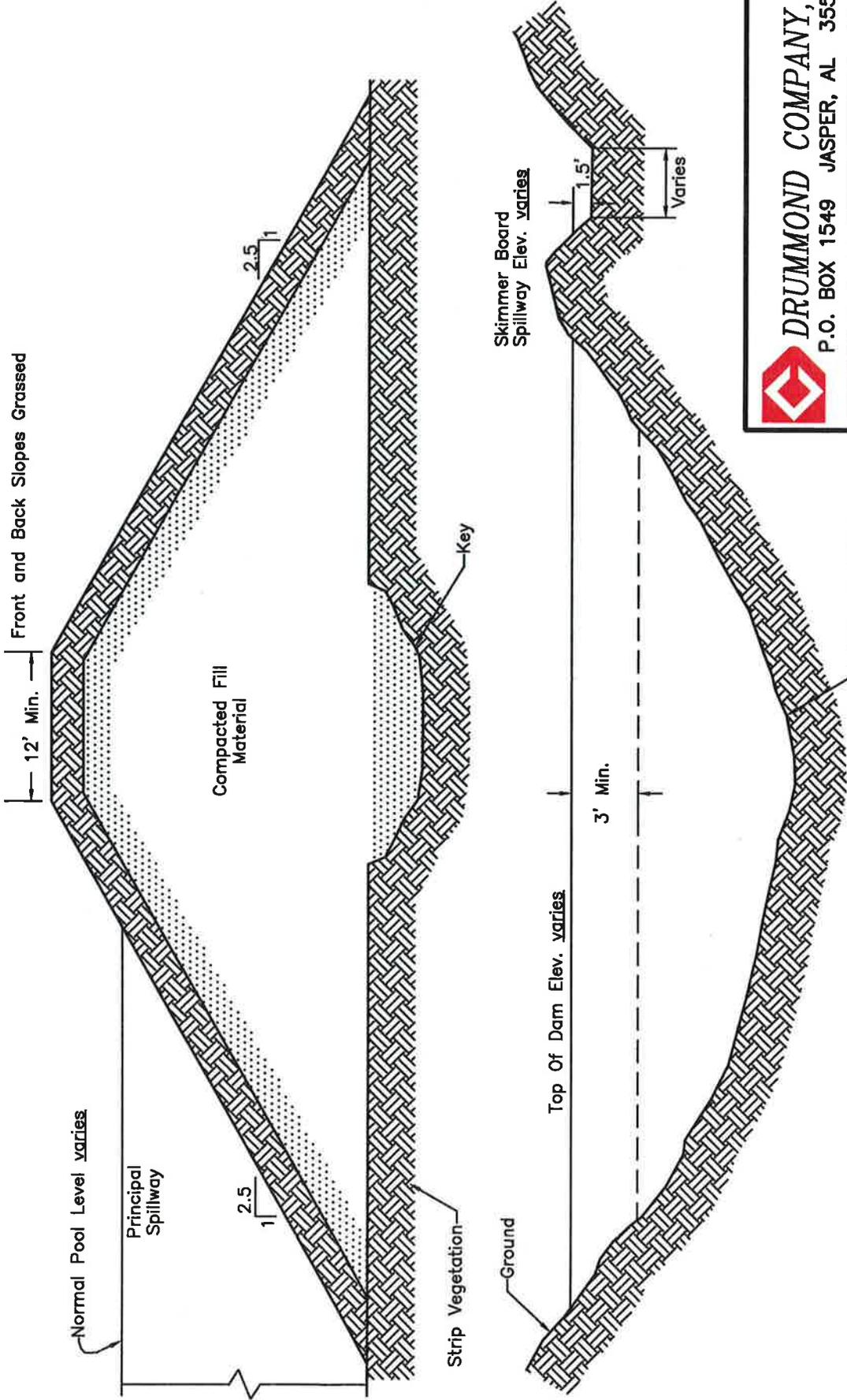
DRUMMOND COMPANY, INC.
P.O. BOX 1549 JASPER, AL 35502

Plan View of Embankment Pond

DRAWN BY: -	DATE: -
DWG. NAME: -	
APPROVED BY: -	SCALE: -

Plan View Of Embankment Pond

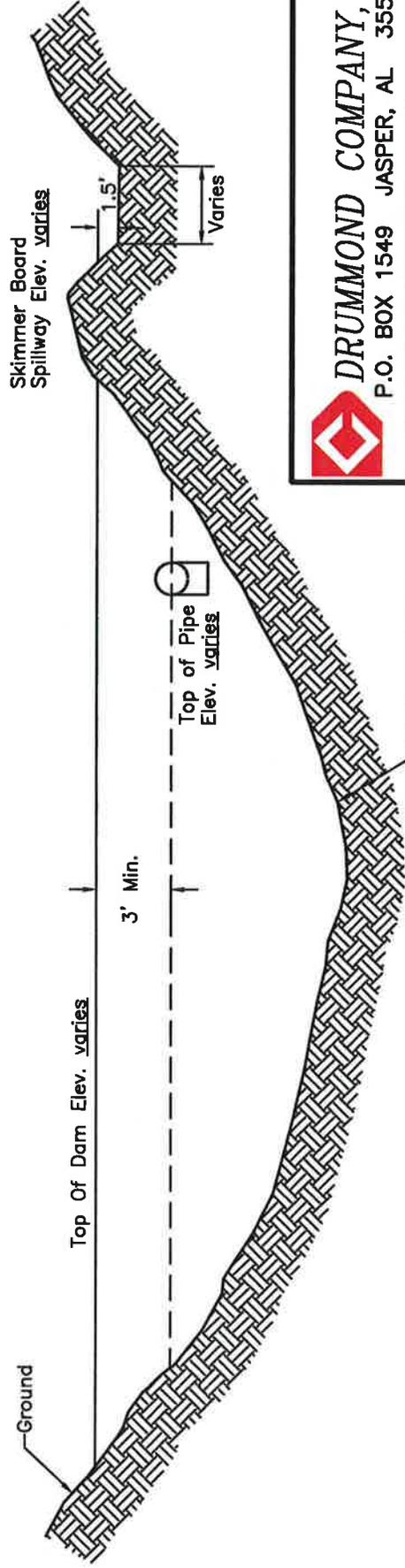
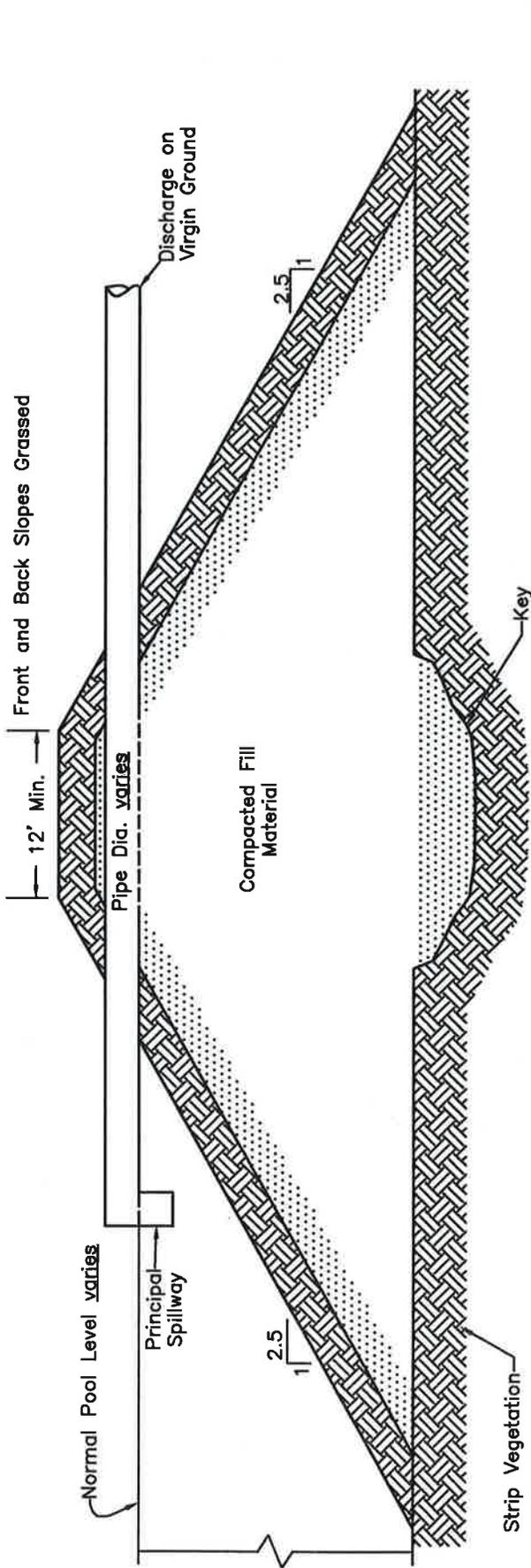
Attachment III-B-2(a)



Typical Dam Detail
No Scale

 **DRUMMOND COMPANY, INC.**
P.O. BOX 1549 JASPER, AL 35502

Typical Dam Detail	
DRAWN BY: -	DATE: -
DWG. NAME: -	
APPROVED BY: -	SCALE: -

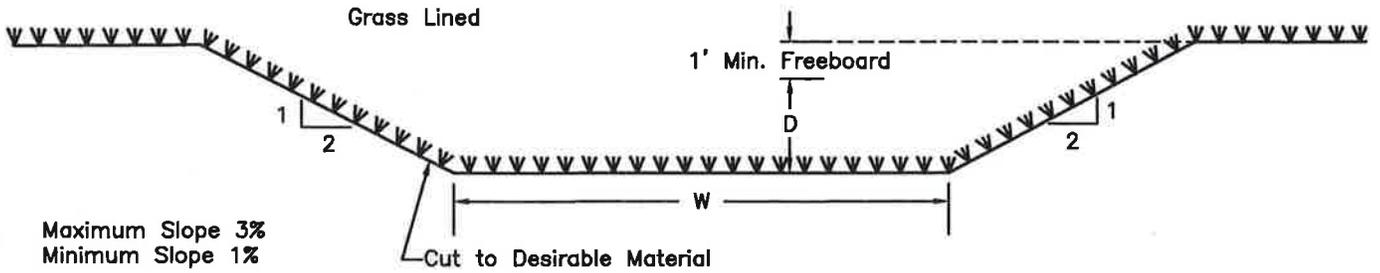


Typical Dam Detail
Typical Dam Detail
No Scale



DRUMMOND COMPANY, INC.
 P.O. BOX 1549 JASPER, AL 35502

DRAWN BY: -	DATE: -
DWG. NAME: -	SCALE: -
APPROVED BY: -	



$$Q = \frac{1.49}{N} A R^{2/3} S^{2/3}$$

N (loose stone or grass lined) = 0.035
 A = area
 R = area/wetted perimeter
 S = slope

* Grass Lining: fescue, bermuda, rye grass

Diversion Channel Depth (D) For Width (W) 8.0 Ft.	
Peak Flow Q (CFS)	Depth D (Ft.)
0-15	0.5
15-50	1.0
50-100	1.5
100-180	2.0
180-270	2.5

Diversion Channel Depth (D) For Width (W) 10.0 Ft.	
Peak Flow Q (CFS)	Depth D (Ft.)
0-15	0.5
15-60	1.0
60-120	1.5
120-210	2.0
210-320	2.5

Diversion Channel Depth (D) For Width (W) 12.0 Ft.	
Peak Flow Q (CFS)	Depth D (Ft.)
0-20	0.5
20-70	1.0
70-150	1.5
150-250	2.0
250-383	2.5

Diversion Channel Depth (D) For Width (W) 15.0 Ft.	
Peak Flow Q (CFS)	Depth D (Ft.)
0-25	0.5
25-90	1.0
90-180	1.5
180-300	2.0
300-450	2.5

C:\Temp\03081\03081.Drummond\ASAP_Tripoff\Draws\Drummond\Diversion_Channel_for_Basin_Disposal.dwg - 12/25/11 07:39

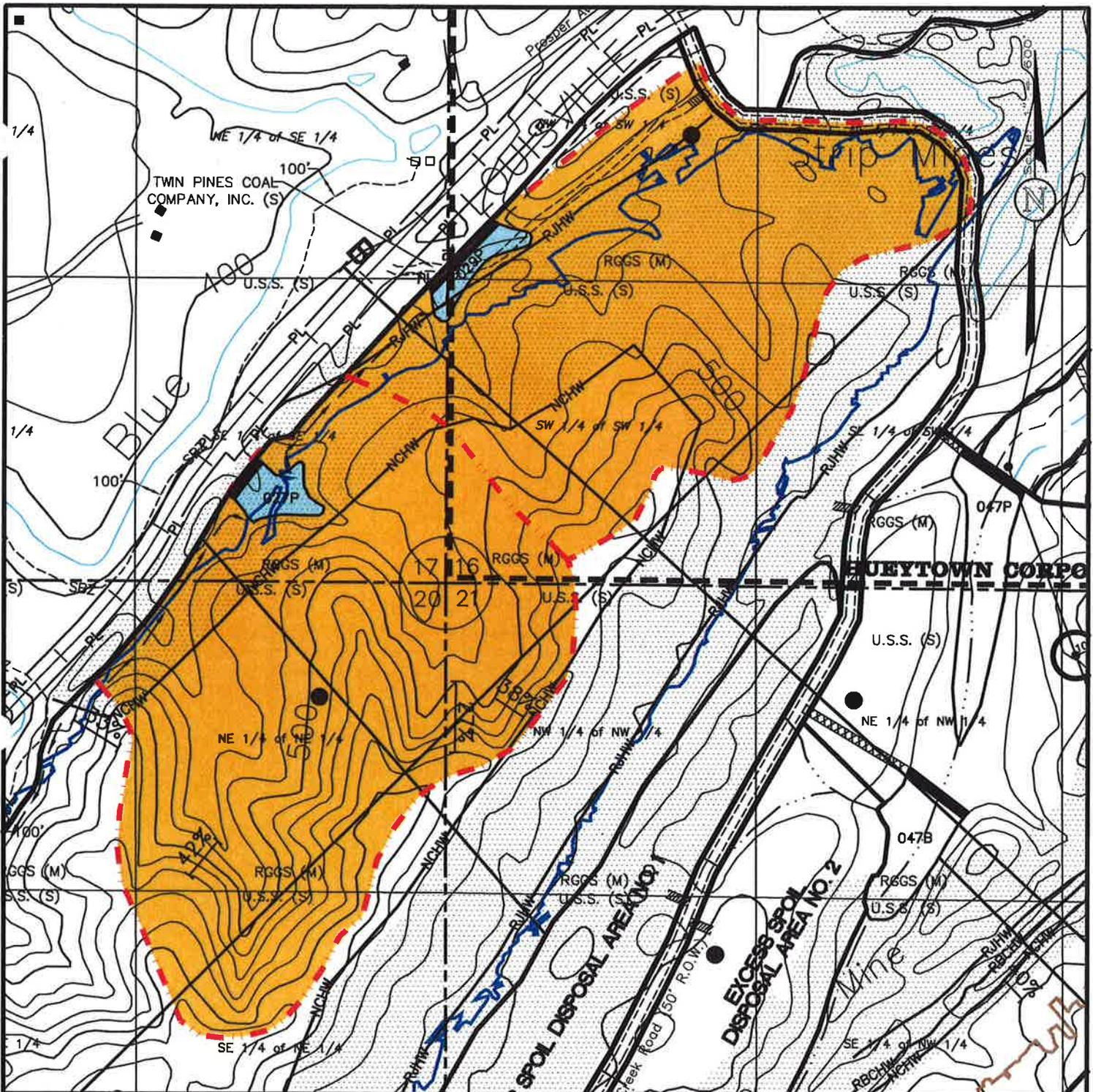


DRUMMOND COMPANY, INC.
P.O. BOX 1549 JASPER, AL 35502

**Permanent Diversion Channel
For Basin Disposal**

DRAWN BY: -	DATE: -
DWG. NAME: -	
APPROVED BY: -	SCALE: -

Attachment III-B-2(a)



LEGEND

-  Permit Boundary
-  Sediment Basin
-  Diversion
-  Drainage Divide

LANDUSE AND CURVE NUMBER INFORMATION

-  Graded & Bare, Curve Number, 81
-  Sediment Basin, Curve Number, 100



DRUMMOND COMPANY, INC.

P.O. BOX 1549 JASPER, AL 35502
205-387-0501 OFFICE

Shannon, LLC
Shannon Mine No. 3
P-3948
Basins 027 & 029 Modification
Watershed Map

DRAWN BY: P.T.O.
DWG. NAME: SM3027029MWS

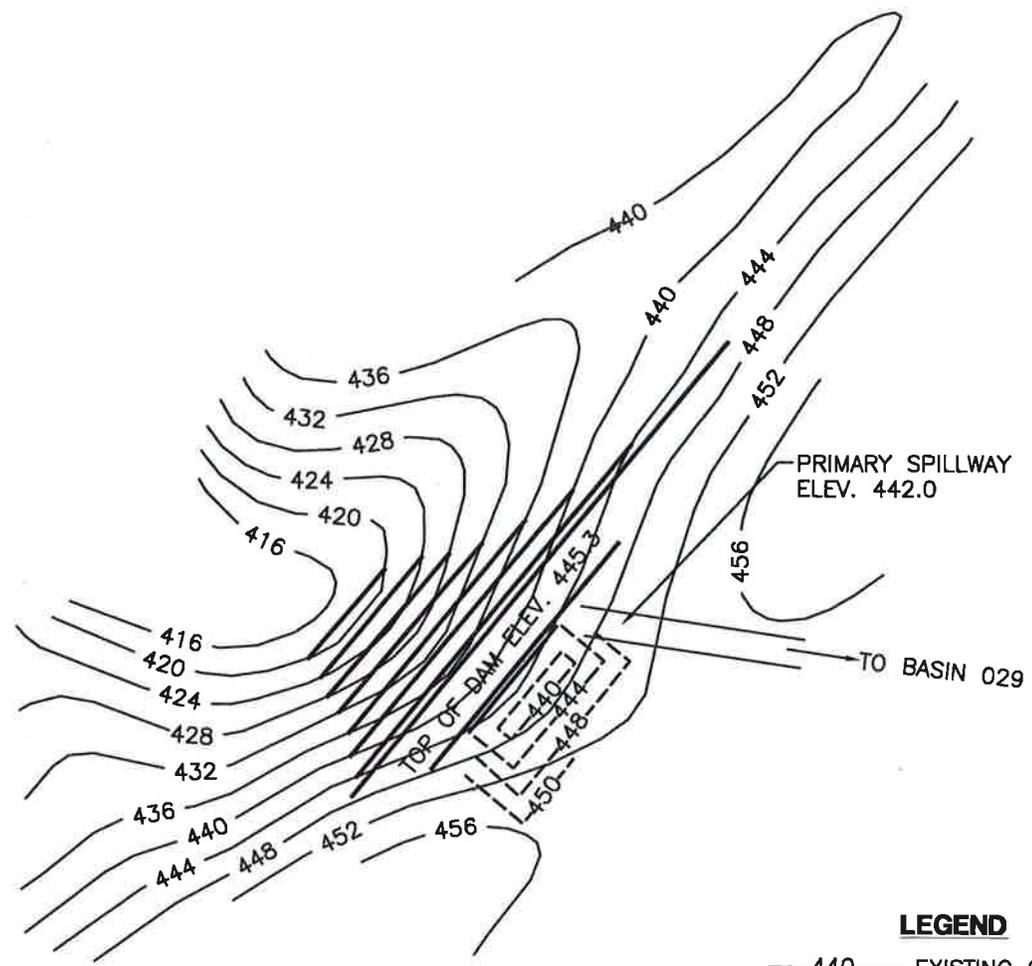
DATE: 8-10-12

APPROVED BY: S.R.I.

SCALE: 1"=600'

NOTES

- 1) The modifications of Basin 027 will consist of its relocation downstream approximately 50 feet from its existing location and its reconstruction the lines and grades as shown in these modification design plans. Basin 027 will be designed to function in series with Basin 029. During the initial phase of Basin 027, it will have a designated storage capacity and pool configuration as specified within its detailed modification design plans. The minimum storage capacity, pool configuration, embankment, and spillway channel will be maintained throughout the life of the basin, with certified inspection reports submitted to the regulatory authority as required. As mining operations progress within the vicinity of Basin 027, it will be filled with spoil material to a point where only the embankment, spillway, and an open channel along the upstream face of the impoundment remain. During this phase of the basin, an open channel will be retained along the face of the embankment to route drainage, entering the basin, to the existing primary spillway, then to Basin 029. During this phase, the embankment, routing channel, and spillway of Basin 027 will be maintained in good working order with certified inspection reports being submitted to the regulatory authority as required.
- 2) The modifications of Basin 027 also consist of the replacement of the existing primary and emergency spillways, 18 inch diameter corrugated plastic and metal pipes, with a 15 feet wide open channel spillway. The spillway channel lining will consists of a grass mixture of but not limited to Fescue, Bermuda, and, Sericea. The channel is seeded with the mixture, fertilized, and mulched.
- 3) The primary spillway of Basin 029 consists of a 18-inch diameter corrugated plastic pipe extending through and down the downstream slope of the embankment back to the original drainage course. The joints have a bell and spigot or bell-bell design and incorporate an ASTM F-477 elastomeric rubber gasket to form a watertight joint. To prevent the movement of the pipe along the grade of the back slope, screws, containing a rubber gasket, will be utilized at each joint for extra support. Also, to prevent the movement of the discharge pipe, the portions of the discharge pipe that are exposed along the downstream slope of the embankment will be covered with a minimum of 2 feet of cover as measured from the top of the pipe.
- 4) A splash pad consisting of durable, non-erodible sandstone or limestone riprap, concrete pad, or consolidated non-erodible bedrock will be located at the discharge point of the primary spillway of Basin 029 to prevent erosion.
- 5) The emergency spillway of Basin 029 consists of a 18-inch diameter corrugated metal pipe and will extend through the embankment back carried out past the downstream slope of the embankment.
- 6) Modifications to Basin 029 required as a result of these modification design plans consist of the increase in the top of dam elevation by 0.9 feet from 444.5 to 445.6. During the construction of Basin 027 the top of dam elevation was increased by 1.0 feet. With this in mind no field modifications to Basin 027 are required as a result of these modification design plans.
- 7) Due to Basins 027 and 029 being totally incised, no stability analysis is required.



LEGEND

- 440 — EXISTING CONTOURS
- 440 — FINISHED CONTOURS
- - 440 - - EXCAVATED CONTOURS
- ➔ MAJOR INFLOW



DRUMMOND COMPANY, INC.

P.O. BOX 1549 JASPER, AL 35502
205-387-0501 OFFICE

**Shannon, LLC
Shannon Mine No. 3
P-3948
Basin 027 Modification Planview**

DRAWN BY: P.T.O.
DWG. NAME: SM3027MPV

DATE: 8-10-12

APPROVED BY: S.R.I.

SCALE: 1"=100'

Shannon, LLC, Shannon Mine No. 3, P-3948, Basin 027

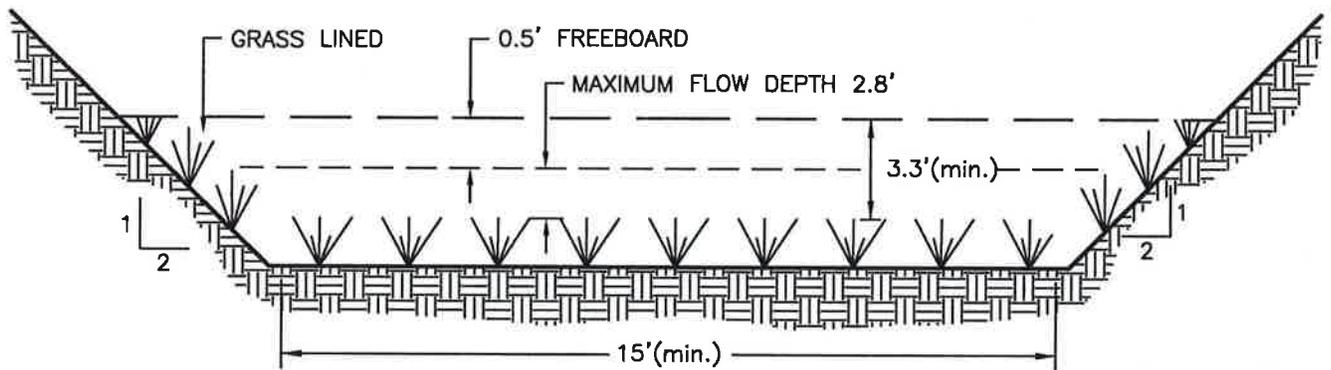
Spillway

Material: Grass mixture

Trapezoidal Channel

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)
15.00	2.0:1	2.0:1	0.5	D, B	0.50			5.0

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	180.50 cfs		180.50 cfs	
Depth:	2.05 ft	2.55 ft	2.83 ft	3.33 ft
Top Width:	23.20 ft	25.20 ft	26.34 ft	28.34 ft
Velocity:	4.61 fps		3.08 fps	
X-Section Area:	39.18 sq ft		58.57 sq ft	
Hydraulic Radius:	1.621 ft		2.117 ft	
Froude Number:	0.62		0.36	
Roughness Coefficient:	0.0316		0.0564	



GRASS LINING TO CONSIST OF A MIXTURE OF
FESCUE, BERMUDA AND SERICEA GRASSES.



DRUMMOND COMPANY, INC.

P.O. BOX 1549 JASPER, AL 35502
205-387-0501 OFFICE

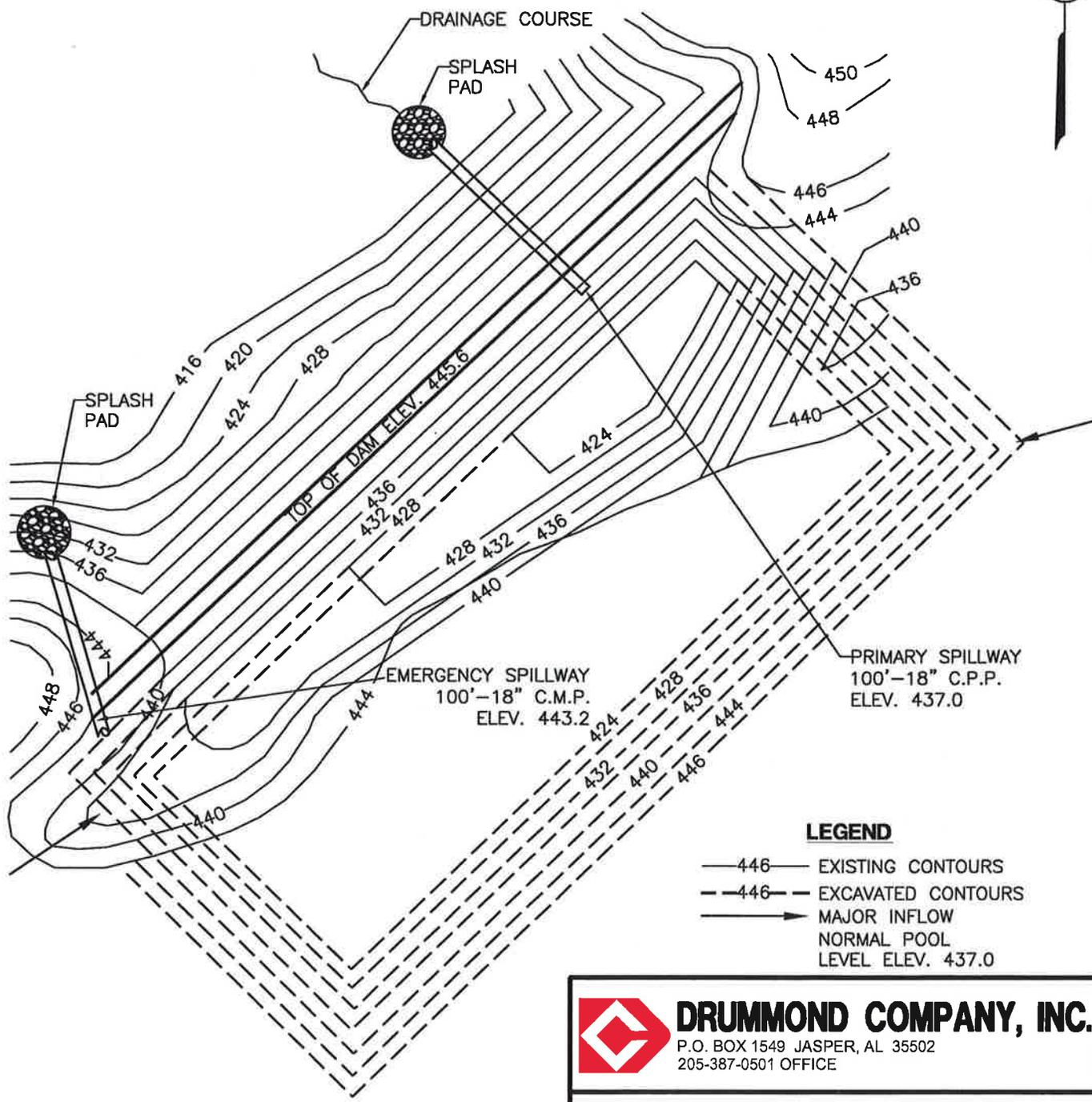
Shannon, LLC
Shannon Mine No. 3
P-3948
Basin 027 Spillway
Grass Lined

DRAWN BY: P.T.O.
DWG. NAME: SM3027MGLTY

DATE: 8-10-12

APPROVED BY: S.R.I.

SCALE: NONE



LEGEND

- 446 — EXISTING CONTOURS
- - 446 - - EXCAVATED CONTOURS
- ➔ MAJOR INFLOW
- ▭ NORMAL POOL
- LEVEL ELEV. 437.0

NOTE:
 MODIFICATIONS TO CONSIST OF THE INCREASE OF THE TOP OF DAM ELEVATION BY 0.9 FEET FROM 444.5 TO 445.6. DURING CONSTRUCTION OF BASIN 029 THE TOP OF DAM ELEVATION WAS INCREASED BY 1.0 FEET. WITH THIS IN MIND NO FIELD MODIFICATIONS TO BASIN 029 ARE REQUIRED.

DRUMMOND COMPANY, INC. P.O. BOX 1549 JASPER, AL 35502 205-387-0501 OFFICE	
DRAWN BY: HOCUTT DWG. NAME: SM3-B29MP	DATE: 4-12-12
APPROVED BY: S.R.I.	SCALE: 1"=100'

Notes:

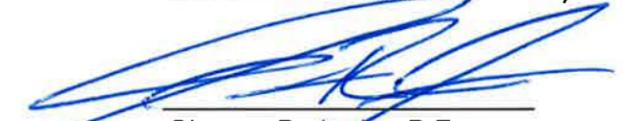
1. The sediment shall be removed from the basin when the accumulated sediment reaches the sediment storage volume.
2. Outer slopes of embankment shall be grassed.
3. Fill material shall be placed in 12" lifts and compacted to 95% of standard proctor.
4. The surface beneath the embankment shall be stripped of undesirable material.
5. Upon completion of mining, reclamation and maintenance of water quality standards the pond will be de-watered and reclaimed.
6. See the attached pond construction criteria.
7. See the attached drawings and specifications for diversions.
8. Elevations are based on assumed datum.

Storage Computation

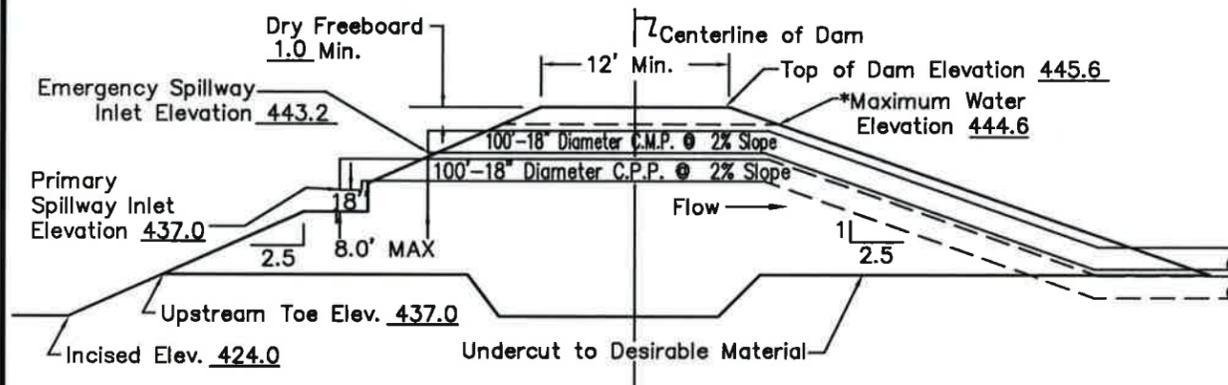
Elevation (feet)	Area (acres)	Avg. Area (acres)	Interval (feet)	Storage (ac.-ft.)	Acc. Storage (ac.-ft.)
424	2.025	2.184	4	8.734	.000
428	2.342	2.510	4	10.038	8.734
432	2.677	2.854	4	11.414	18.772
436	3.030	3.216	4	12.864	30.186
440	3.402	3.598	4	14.390	43.050
444	3.793	3.997	4	15.994	57.440
446	4.201		2	7.994	65.434

Key Basin Parameters

Drainage Area _____ 148.0 Acres
 Disturbed Area _____ 146.0 Acres
 Sediment Storage _____ 14.8 Ac. Ft.
 Detention Storage _____ 18.4 Ac. Ft.
 Permanent Pool Capacity _____ *33.2 Ac. Ft.
 Total Basin Capacity _____ *54.4 Ac. Ft.
 Peak Inflow _____ 277.1 C.F.S.
 Peak Outflow _____ 27.2 C.F.S.
 * Indicates Incised Volume of 28 Ac/Ft

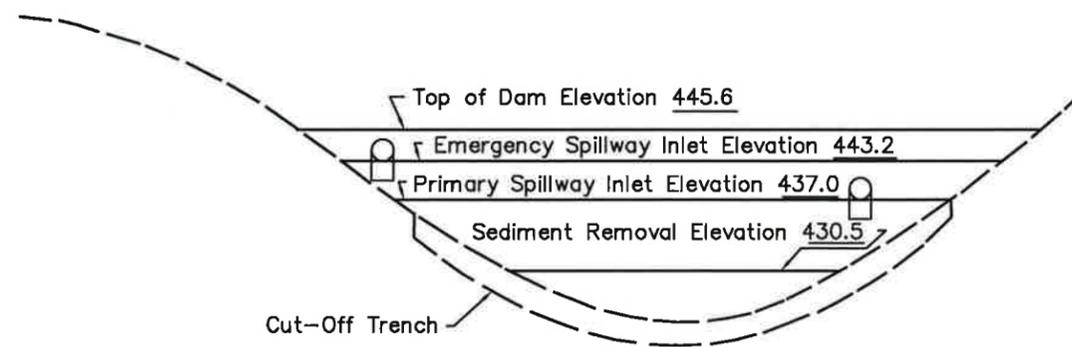
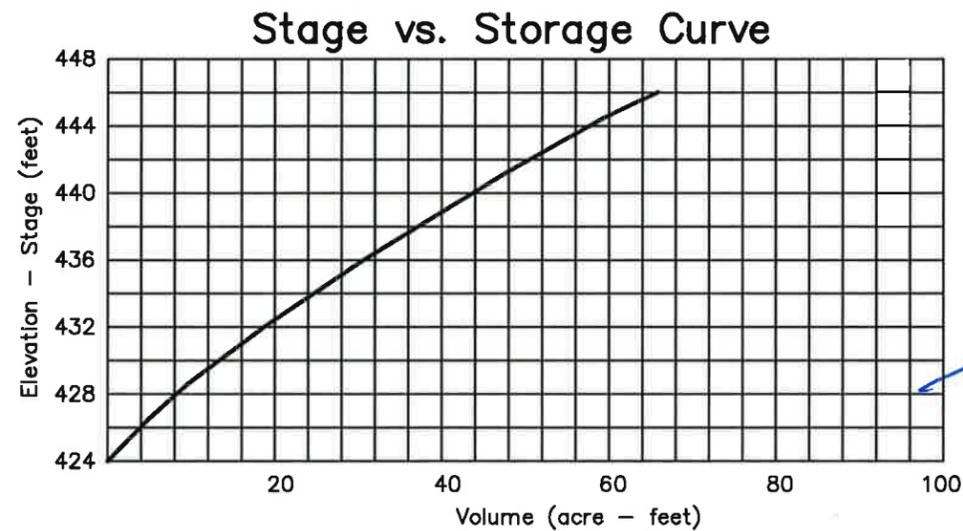


Steven R. Ingle, P.E.
 AL Registration #18213



*Storm with largest peak flow
 Either 10 year - 24 hour event
 or 25 year - 6 hour event.

**Typical Cross Section
 Along Primary Spillway**



Typical Profile Looking Downstream

DRUMMOND COMPANY, INC.
 P.O. BOX 1549 JASPER, AL 35502
 205-387-0501 OFFICE

**Shannon, LLC
 Shannon Mine No.3
 P-3948
 Basin 029 Modification**

DRAWN BY: HOCUTT
 DWG NAME: SM3-B29DET
 DATE: 4-12-12
 APPROVED BY: S.R.
 SCALE: NONE

Shannon, LLC
Shannon Mine No. 3
P-3948
Basins 027 and 029 Modification

*6.0 Inches, 10 Year-24 Hour,
DRN 58*

sri

General Information

Storm Information:

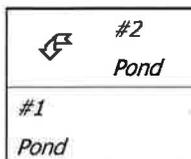
Storm Type:	DRN 58
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.000 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	100.000%
2.0000	96.000%	94.000%
1.0000	89.500%	74.500%
0.5000	82.500%	49.000%
0.3000	77.500%	39.000%
0.2000	71.500%	32.000%
0.1000	63.000%	24.500%
0.0500	41.000%	16.000%
0.0300	37.000%	13.000%
0.0200	11.000%	8.000%
0.0100	2.500%	3.000%
0.0050	2.500%	3.000%
0.0030	2.500%	3.000%
0.0010	2.500%	3.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Basin 029 Modification
Pond	#2	==>	#1	0.200	0.282	Basin 027 Modification



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#2	In			98.67	25.25	14,969.8	588,963	449.96	275.38
	Out	82.000	82.000	98.56	25.25	1,705.7	102,387	56.90	32.31
#1	In			180.69	46.93	9,394.3	313,665	224.06	97.85
	Out	66.000	148.000	25.65	44.82	533.7	14,936	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #2 (Basin 027 Modification):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	98.082%	100.000%
1.0000	77.735%	100.000%
0.5000	51.128%	100.000%
0.3000	40.694%	100.000%
0.2000	33.390%	100.000%
0.1000	25.564%	100.000%
0.0500	16.695%	100.000%
0.0300	13.565%	100.000%
0.0200	8.347%	73.262%
0.0100	3.130%	27.473%
0.0050	3.130%	27.473%
0.0030	3.130%	27.473%
0.0010	3.130%	27.473%
0.0001	0.000%	0.000%

Structure #1:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	95.088%	100.000%
1.0000	79.123%	100.000%
0.5000	58.247%	100.000%
0.3000	50.060%	100.000%
0.2000	44.329%	100.000%
0.1000	38.189%	100.000%
0.0500	31.230%	100.000%
0.0300	28.774%	100.000%
0.0200	19.851%	100.000%
0.0100	7.444%	100.000%
0.0050	7.444%	100.000%
0.0030	7.444%	100.000%

SEDCAD 4 for Windows

Copyright 1998-2002 Pamela I. Schwab

Size (mm)	In	Out
0.0010	7.444%	100.000%
0.0001	0.000%	0.000%

Structure Detail:

Structure #2 (Pond)

Basin 027 Modification

Pond Inputs:

Initial Pool Elev:	442.00 ft
Initial Pool:	0.02 ac-ft
*Sediment Storage:	0.01 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
442.00	10.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	443.61 ft
H'graph Detention Time:	0.02 hrs
Pond Model:	CSTRS
Dewater Time:	0.51 days
Trap Efficiency:	88.61 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
440.99	0.019	0.000	0.000	Top of Sed. Storage
441.00	0.019	0.000	0.000	
441.50	0.023	0.011	0.000	
442.00	0.027	0.023	0.000	Spillway #1
442.50	0.032	0.038	3.103	0.60
443.00	0.037	0.055	41.275	11.20
443.50	0.042	0.074	86.470	0.40
443.61	0.044	0.079	98.556	0.10 Peak Stage
444.00	0.048	0.097	142.306	
444.50	0.059	0.124	210.030	
445.00	0.072	0.156	289.670	
445.50	0.085	0.196	381.384	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
446.00	0.100	0.242	485.395	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
440.99	0.000	0.000
441.00	0.000	0.000
441.50	0.000	0.000
442.00	0.000	0.000
442.50	3.103	3.103
443.00	41.275	41.275
443.50	86.470	86.470
444.00	142.306	142.306
444.50	210.030	210.030
445.00	289.670	289.670
445.50	381.384	381.384
446.00	485.395	485.395

Structure #1 (Pond)

Basin 029 Modification

Pond Inputs:

Initial Pool Elev:	437.00 ft
Initial Pool:	18.40 ac-ft
*Sediment Storage:	14.84 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	100.00	2.00	0.0120	437.00	0.90	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	100.00	2.00	0.0240	443.20	0.90	0.00

Pond Results:

Peak Elevation:	444.36 ft
H'graph Detention Time:	10.02 hrs
Pond Model:	CSTRS
Dewater Time:	2.16 days
Trap Efficiency:	94.32 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
430.50	2.549	0.000	0.000	Top of Sed. Storage
431.00	2.591	1.285	0.000	
431.50	2.634	2.591	0.000	
432.00	2.677	3.919	0.000	
432.50	2.720	5.268	0.000	
433.00	2.763	6.639	0.000	
433.50	2.807	8.031	0.000	
434.00	2.851	9.446	0.000	
434.50	2.895	10.882	0.000	
435.00	2.940	12.341	0.000	
435.50	2.985	13.822	0.000	
436.00	3.030	15.326	0.000	
436.50	3.075	16.852	0.000	
437.00	3.121	18.401	0.000	Spillway #1
437.50	3.167	19.973	1.111	17.12*
438.00	3.213	21.568	3.142	6.14*
438.50	3.260	23.186	5.774	4.55
439.00	3.307	24.828	8.425	2.80
439.50	3.354	26.493	10.472	2.15
440.00	3.402	28.182	12.173	1.80
440.50	3.450	29.895	13.675	1.60
441.00	3.498	31.632	15.003	1.50
441.50	3.546	33.393	16.242	1.35
442.00	3.595	35.178	17.381	1.30
442.50	3.644	36.988	18.479	1.20

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
443.00	3.693	38.822	19.477	1.15	
443.20	3.713	39.563	19.872	0.50	Spillway #2
443.50	3.743	40.681	21.056	1.20	
444.00	3.793	42.565	23.432	3.55	
444.36	3.873	43.963	25.654	3.90	Peak Stage
444.50	3.893	44.487	26.486		
445.00	3.994	46.459	29.235		
445.50	4.097	48.481	31.809		
446.00	4.201	50.556	33.107		

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

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
430.50	0.000	0.000	0.000
431.00	0.000	0.000	0.000
431.50	0.000	0.000	0.000
432.00	0.000	0.000	0.000
432.50	0.000	0.000	0.000
433.00	0.000	0.000	0.000
433.50	0.000	0.000	0.000
434.00	0.000	0.000	0.000
434.50	0.000	0.000	0.000
435.00	0.000	0.000	0.000
435.50	0.000	0.000	0.000
436.00	0.000	0.000	0.000
436.50	0.000	0.000	0.000
437.00	0.000	0.000	0.000
437.50	(3)>1.111	0.000	1.111
438.00	(3)>3.142	0.000	3.142
438.50	(3)>5.774	0.000	5.774
439.00	(5)>8.425	0.000	8.425
439.50	(5)>10.472	0.000	10.472
440.00	(5)>12.173	0.000	12.173
440.50	(5)>13.675	0.000	13.675
441.00	(5)>15.003	0.000	15.003
441.50	(5)>16.242	0.000	16.242
442.00	(5)>17.381	0.000	17.381

Elevation (ft)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
442.50	(5)>18.479	0.000	18.479
443.00	(5)>19.477	0.000	19.477
443.20	(5)>19.872	0.000	19.872
443.50	(5)>20.463	(3)>0.593	21.056
444.00	(5)>21.181	(3)>2.251	23.432
444.50	(6)>21.856	(3)>4.630	26.486
445.00	(6)>22.531	(1)>6.703	29.235
445.50	(6)>23.154	(6)>8.655	31.809
446.00	(6)>23.770	(6)>9.336	33.107

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)
#2	1	82.000	0.235	0.000	0.000	81.000	F	98.67	25.251
		Σ						98.67	25.251
#1	1	64.000	0.117	0.000	0.000	81.000	F	83.09	20.684
	2	2.000	0.000	0.000	0.000	100.000	F	3.15	0.999
		Σ						180.69	46.934

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#2	1	0.240	200.00	33.00	0.9000	1.0000	2	14,969.8	588,963	449.96	275.38
		Σ						14,969.8	588,963	449.96	275.38
#1	1	0.240	200.00	22.00	0.9000	1.0000	2	7,691.0	404,004	309.26	184.59
	2	0.001	200.00	0.01	0.0010	1.0000	2	0.0	0	0.00	0.00
		Σ						9,394.3	313,665	224.06	97.85

Shannon, LLC
Shannon Mine No. 3
P-3948
Basins 027 and 029 Modification

*4.8 Inches, 25 Year-6 Hour,
SCS 6 Hour*

sri

General Information

Storm Information:

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

Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1680
1.00	0.3840
1.50	0.6480
2.00	1.1040
2.50	2.8800
3.00	3.3600
3.50	3.7440
4.00	4.0080
4.50	4.2480
5.00	4.4440
5.50	4.6320
6.00	4.8000

Peak 30-minute Intensity: 3.552 in/hr

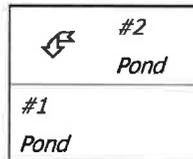
Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	100.000%
2.0000	96.000%	94.000%
1.0000	89.500%	74.500%
0.5000	82.500%	49.000%
0.3000	77.500%	39.000%
0.2000	71.500%	32.000%
0.1000	63.000%	24.500%
0.0500	41.000%	16.000%
0.0300	37.000%	13.000%
0.0200	11.000%	8.000%
0.0100	2.500%	3.000%
0.0050	2.500%	3.000%
0.0030	2.500%	3.000%

Size (mm)	Topsoil	Spoil
0.0010	2.500%	3.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Basin 029 Modification
Pond	#2	==>	#1	0.200	0.282	Basin 027 Modification



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VV (ml/l)
#2	In			180.85	18.27	17,530.5	776,653	591.44	409.11
	Out	82.000	82.000	180.50	18.27	2,546.0	167,516	100.67	59.01
#1	In			277.13	33.97	11,913.0	517,806	370.49	162.12
	Out	66.000	148.000	27.24	33.14	668.7	30,008	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #2 (Basin 027 Modification):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	100.000%	100.000%
1.0000	83.034%	100.000%
0.5000	54.613%	100.000%
0.3000	43.467%	100.000%
0.2000	35.666%	100.000%
0.1000	27.306%	100.000%
0.0500	17.833%	100.000%
0.0300	14.489%	99.766%
0.0200	8.916%	61.394%
0.0100	3.344%	23.023%
0.0050	3.344%	23.023%
0.0030	3.344%	23.023%
0.0010	3.344%	23.023%
0.0001	0.000%	0.000%

Structure #1:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	95.155%	100.000%
1.0000	79.407%	100.000%
0.5000	58.814%	100.000%
0.3000	50.739%	100.000%
0.2000	45.086%	100.000%
0.1000	39.029%	100.000%
0.0500	32.165%	100.000%
0.0300	29.742%	100.000%
0.0200	19.581%	100.000%
0.0100	7.343%	100.000%
0.0050	7.343%	100.000%
0.0030	7.343%	100.000%

Size (mm)	In	Out
0.0010	7.343%	100.000%
0.0001	0.000%	0.000%

Structure Detail:

Structure #2 (Pond)

Basin 027 Modification

Pond Inputs:

Initial Pool Elev:	442.00 ft
Initial Pool:	0.02 ac-ft
*Sediment Storage:	0.01 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
442.00	10.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	444.28 ft
H'graph Detention Time:	0.01 hrs
Pond Model:	CSTRS
Dewater Time:	0.18 days
Trap Efficiency:	85.48 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
440.99	0.019	0.000	0.000	Top of Sed. Storage
441.00	0.019	0.000	0.000	
441.50	0.023	0.011	0.000	
442.00	0.027	0.023	0.000	Spillway #1
442.50	0.032	0.038	3.103	0.55
443.00	0.037	0.055	41.275	2.60
443.50	0.042	0.074	86.470	0.95
444.00	0.048	0.097	142.306	0.10
444.28	0.056	0.112	180.501	0.10 Peak Stage
444.50	0.059	0.124	210.030	
445.00	0.072	0.156	289.670	
445.50	0.085	0.196	381.384	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
446.00	0.100	0.242	485.395	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
440.99	0.000	0.000
441.00	0.000	0.000
441.50	0.000	0.000
442.00	0.000	0.000
442.50	3.103	3.103
443.00	41.275	41.275
443.50	86.470	86.470
444.00	142.306	142.306
444.50	210.030	210.030
445.00	289.670	289.670
445.50	381.384	381.384
446.00	485.395	485.395

Structure #1 (Pond)

Basin 029 Modification

Pond Inputs:

Initial Pool Elev:	437.00 ft
Initial Pool:	18.40 ac-ft
*Sediment Storage:	14.84 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	100.00	2.00	0.0120	437.00	0.90	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	100.00	2.00	0.0240	443.20	0.90	0.00

Pond Results:

Peak Elevation:	444.64 ft
H'graph Detention Time:	10.45 hrs
Pond Model:	CSTRS
Dewater Time:	2.09 days
Trap Efficiency:	94.39 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
430.50	2.549	0.000	0.000	Top of Sed. Storage
431.00	2.591	1.285	0.000	
431.50	2.634	2.591	0.000	
432.00	2.677	3.919	0.000	
432.50	2.720	5.268	0.000	
433.00	2.763	6.639	0.000	
433.50	2.807	8.031	0.000	
434.00	2.851	9.446	0.000	
434.50	2.895	10.882	0.000	
435.00	2.940	12.341	0.000	
435.50	2.985	13.822	0.000	
436.00	3.030	15.326	0.000	
436.50	3.075	16.852	0.000	
437.00	3.121	18.401	0.000	Spillway #1
437.50	3.167	19.973	1.111	17.12*
438.00	3.213	21.568	3.142	9.85
438.50	3.260	23.186	5.774	4.55
439.00	3.307	24.828	8.425	2.80
439.50	3.354	26.493	10.472	2.15
440.00	3.402	28.182	12.173	1.80
440.50	3.450	29.895	13.675	1.65
441.00	3.498	31.632	15.003	1.45
441.50	3.546	33.393	16.242	1.35
442.00	3.595	35.178	17.381	1.30
442.50	3.644	36.988	18.479	1.20

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
443.00	3.693	38.822	19.477	1.20	
443.20	3.713	39.563	19.872	0.45	Spillway #2
443.50	3.743	40.681	21.056	0.65	
444.00	3.793	42.565	23.432	1.05	
444.50	3.893	44.487	26.486	0.95	
444.64	3.921	45.030	27.243	0.60	Peak Stage
445.00	3.994	46.459	29.235		
445.50	4.097	48.481	31.809		
446.00	4.201	50.556	33.107		

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

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
430.50	0.000	0.000	0.000
431.00	0.000	0.000	0.000
431.50	0.000	0.000	0.000
432.00	0.000	0.000	0.000
432.50	0.000	0.000	0.000
433.00	0.000	0.000	0.000
433.50	0.000	0.000	0.000
434.00	0.000	0.000	0.000
434.50	0.000	0.000	0.000
435.00	0.000	0.000	0.000
435.50	0.000	0.000	0.000
436.00	0.000	0.000	0.000
436.50	0.000	0.000	0.000
437.00	0.000	0.000	0.000
437.50	(3)>1.111	0.000	1.111
438.00	(3)>3.142	0.000	3.142
438.50	(3)>5.774	0.000	5.774
439.00	(5)>8.425	0.000	8.425
439.50	(5)>10.472	0.000	10.472
440.00	(5)>12.173	0.000	12.173
440.50	(5)>13.675	0.000	13.675
441.00	(5)>15.003	0.000	15.003
441.50	(5)>16.242	0.000	16.242
442.00	(5)>17.381	0.000	17.381

Elevation (ft)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
442.50	(5)>18.479	0.000	18.479
443.00	(5)>19.477	0.000	19.477
443.20	(5)>19.872	0.000	19.872
443.50	(5)>20.463	(3)>0.593	21.056
444.00	(5)>21.181	(3)>2.251	23.432
444.50	(6)>21.856	(3)>4.630	26.486
445.00	(6)>22.531	(1)>6.703	29.235
445.50	(6)>23.154	(6)>8.655	31.809
446.00	(6)>23.770	(6)>9.336	33.107

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)
#2	1	82.000	0.235	0.000	0.000	81.000	F	180.85	18.266
Σ		82.000						180.85	18.266
#1	1	64.000	0.117	0.000	0.000	81.000	F	171.31	14.904
	2	2.000	0.000	0.000	0.000	100.000	F	7.16	0.797
Σ		148.000						277.13	33.967

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#2	1	0.240	200.00	33.00	0.9000	1.0000	2	17,530.5	776,653	591.44	409.11
Σ								17,530.5	776,653	591.44	409.11
#1	1	0.240	200.00	22.00	0.9000	1.0000	2	9,620.5	590,714	452.18	298.42
	2	0.001	200.00	0.01	0.0010	1.0000	2	0.0	0	0.00	0.00
Σ								11,913.0	517,806	370.49	162.12