HYDROLOGY STUDY FOR
Oak Grove Resources, LLC

Concord Prep. Plant

P-3233 R-24

Basin 017E Modification

Attachment III-B-2(a) Detailed Design Plans

Jefferson County, Alabama

BY

PERC ENGINEERING CO., INC.

P.O. BOX 1712

JASPER, ALABAMA 35502

January 12, 2016

PERC
ENGINEERING CO., INC.

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January 12, 2016

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

RE: Oak Grove Resources, LLC
Concord Prep. Plant
P-3233 R-24

Dear Stephen:

I hereby certify the attached Detailed Design Plans for Basin 017E Modification at 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 are true and correct to the best of my knowledge, information and belief.

If you have any questions or required additional information, please feel free to call me at 205-295-3127 or e-mail lstephens@percengineering.com

Sincerely,
PERC Engineering Co., Inc.

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

P.O. Box 1112 • Jasper, Alabama 35502 • 1606 Highway 78 West • Jasper, Alabama 35501

Attachment III-B-2-A

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 lv:lh, 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.

12. The combination primary and secondary decant system shall be designed to safely carry the expected peak flow from a 25 year - 6 hour storm. The entire emergency overflow spillway channel will be a stabilized channel and will be stabilized upon completion of construction as specified within the detailed design plans using prudent engineering measures. These measures may consist of lining the spillway with concrete or a durable rock riprap, or the spillway being constructed in consolidated non-erodible material and planted with a mixture or both annual and perennial grasses, or a combination of any or all of the above.

13. Sediment basins using a single spillway system shall be an open channel of non-erodible construction consisting of concrete, durable rock riprap or its being constructed in consolidated non-erodible material as specified in the detailed design plans.

14. The settled embankment for temporary impoundments shall be a minimum of 1.0 foot above the maximum water elevation for the runoff from a 25 year - 6 hour, or a 10 year - 24 hour precipitation event (whichever has the greatest runoff). The settled embankment for permanent impoundments shall be a minimum of 1.0 foot above the maximum water elevation for the runoff from a 25 year - 6 hour, or a 10 year - 24 hour precipitation event (whichever has the greatest runoff).

15. If basins are built in series, then the combined decant system for each shall be designed to accommodate the entire contributing drainage area.

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

17. The constructed height of the dam shall be increased a minimum of 5 percent over the design height to allow for settlement over the life of the embankment.

18. Final graded slopes of the entire permanent water impoundment area shall not exceed 2.5H-1.0V to provide for adequate safety and access for proposed water users.

19. Prior to Phase II bond release, additional data concerning water quality, water quantity, depth, size, configuration, postmining land use, etc., for each proposed permanent water impoundment, shall be submitted to the Regulatory Authority for permanent water impoundment approval.

20. All sediment basins will be inspected for stability, erosion, etc. two (2) times a month until removal of the structure or release of the reclamation bond.

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.

NOTES

1. The current primary spillway consist of a 18-inch diameter corrugated metal pipe laying on natural ground under the base of the embankment with a 18" Riser Pipe standing vertical in the Normal Pool Area. The Modification of the Primary Spillway will consist of replacing this pipe system with a Concrete Open Channel and Skimmerboard System.

2. The first step will be to Pump all water in the Normal Pool Area to Slurry Settling Ponds A & B and keep the Basin de-watered until the Modification is completed.

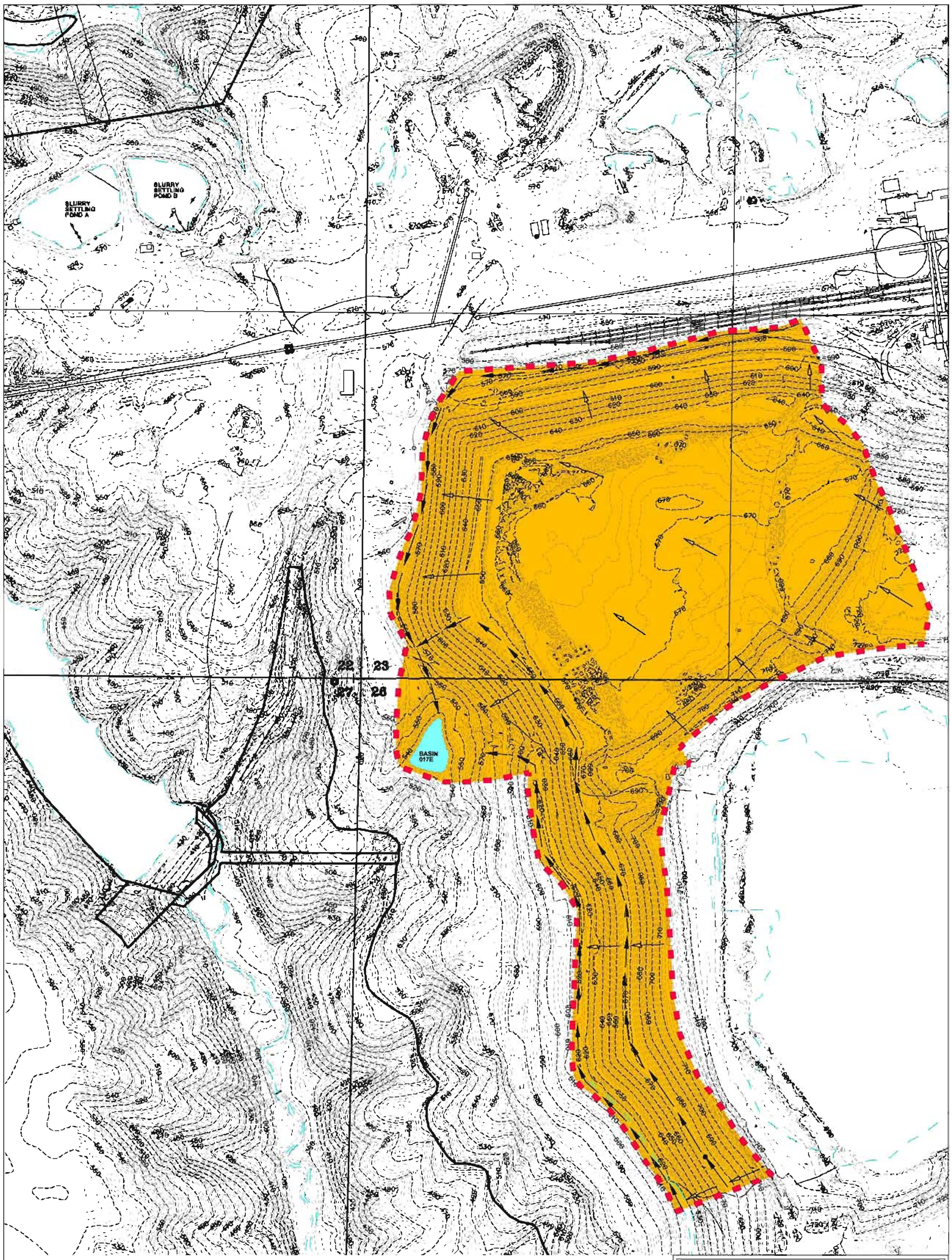
3. The next step is to cut off the Riser Pipe 1' above the current sediment level and fill the pipe with 3,000 psi concrete permanently closing the pipe. See cross section on Plan View Page.

4. The next step is to construct the Concrete Spillway System beginning with excavation of the Control Section, Intermediate Section and Tail Section consisting of a 35' wide Control Section, transition to a 20' wide Intermediate Section and a 20 ' wide Tail Section, all reinforced with 6x6 – W2.9 x W2.9 wire at an invert elevation of 539.9. See Signature drawing for transition details.

5. A 25' X 25' X 4" thick Concrete splash pad reinforced with 6x6 – W2.9 x W2.9 wire will be located at the discharge point of the primary spillway of Basin 017E Modified to prevent erosion.

6. The Current Top of Dam Elevation is 542.26, at the low point, based on the annual re-certification survey on 08/06/2015, therefore the Top of Dam will be raised 0.71' to Elevation 542.97.

7. Construction will be completed in 90 days or permission for additional time must be requested and received from the Director.



LEGEND

- PERMIT BOUNDARY
- 10' SURFACE CONTOUR INTERVAL
- 2' SURFACE CONTOUR INTERVAL
- WATERSHED BOUNDARY
- FLOW DIRECTION
- DIVERSION / SLOPE BENCH

LANDUSE AND CURVE NUMBER INFORMATION

- GRADED AND BARE, CURVE NUMBER, 91
- SEDIMENT BASIN, CURVE NUMBER, 100

0' 200' 400' 800'

Scale 1" = 200'

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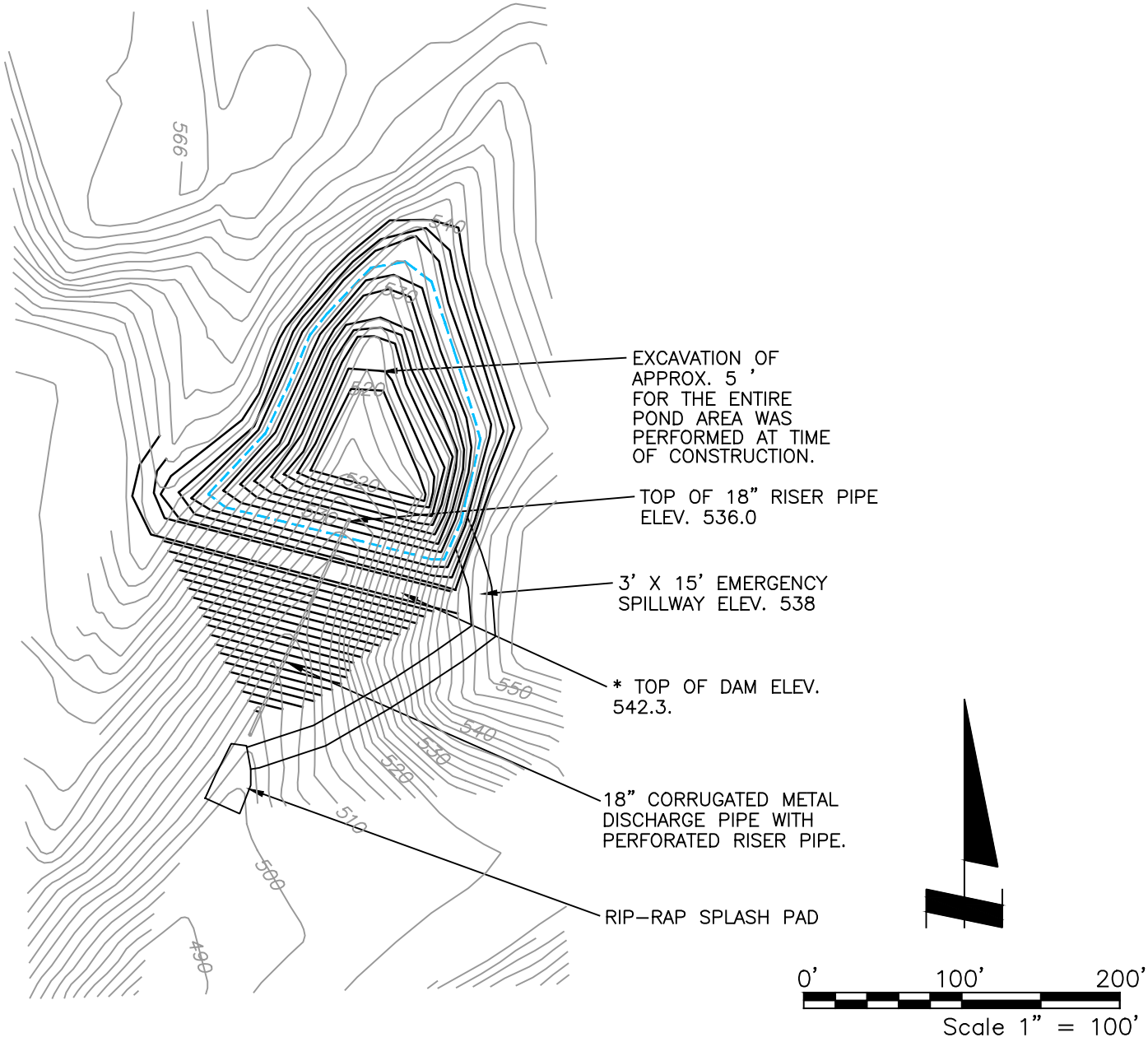
OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-24
ATTACHMENT III-B-2(a)
BASIN 017E MODIFICATION
WATERSHED MAP

DWG NAME:	[illegible]	DATE:	01/11/2016
DRAWN BY:	S.A.E.	SCALE:	1"=200'
APPROVED BY:	L.G.E.	JOB NUMBER:	15-03604-012



LEGEND

542 — EXISTING 2' CONTOURS AS PER 1996 CERTIFICATION

542 — EXISTING 2' CONTOURS PRIOR TO 1996 CONSTRUCTION

— · · — · · — NORMAL POOL 534.0

NOTES

* BASED ON SURVEY FROM TOP OF RISER PIPE TO LOW POINT ON TOP OF DAM

V:\Wilming\Oak Grove Resources LLC Mine\OakGroveConcord P-3233\R-24\OGCPPR24_BASIN 017 MOD.dwg 02/16/16 10:59

PERC
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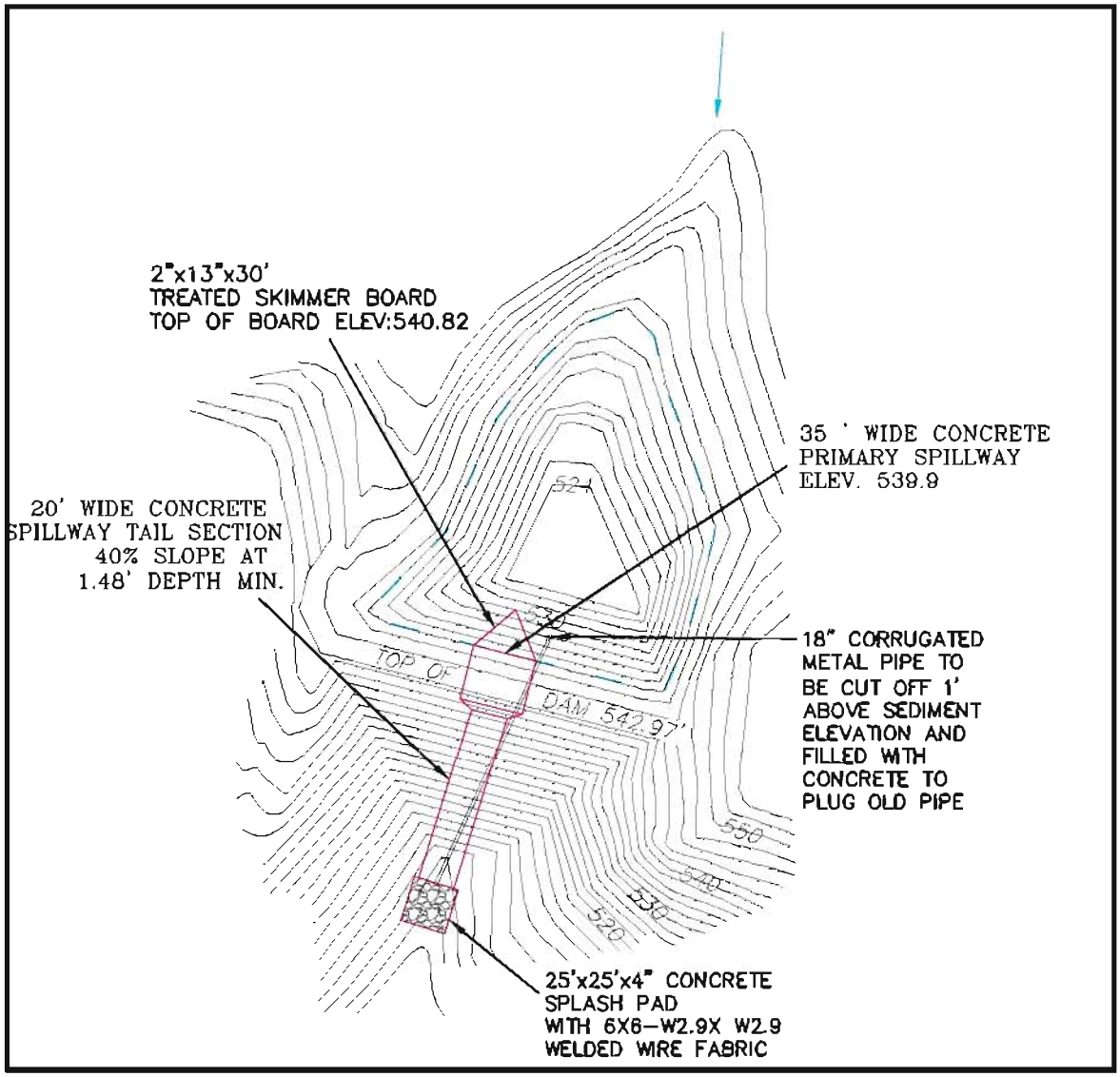
OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-24
ATTACHMENT III-B-2(a)
BASIN 017E EXISITING CONDITIONS

.DWG NAME:	OGCPPR24_BASIN 017 MOD	DATE:	01-08-2016
DRAWN BY:	S.A.E.	SCALE:	1"=50'
APPROVED BY:	L.G.S.	JOB NUMBER:	15-03901-012



0' 100' 200' 300'

Scale 1" = 100'

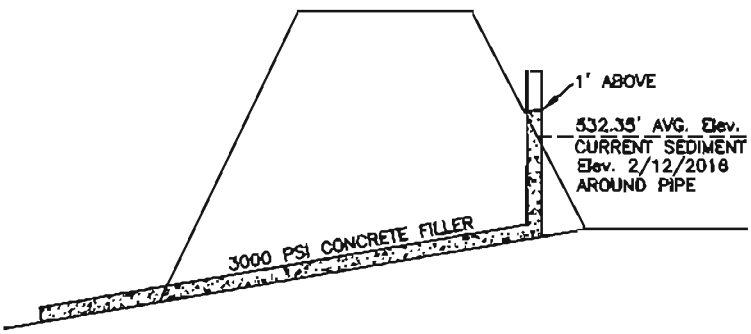
LEGEND

542 — EXISTING 2' CONTOURS AS PER 1996 CERTIFICATION

— — — PROPOSED NORMAL POOL 539.9

← MAJOR INFLOW

NOTES: 1) CURRENT SEDIMENT IN UPSTREAM END OF BASIN IS 529.4' AVG. Elev.
2) DETENTION VOLUME FROM CURRENT SEDIMENT LEVEL UP TO THE PROPOSED PRIMARY SPILLWAY = 4.7 AC-FT.



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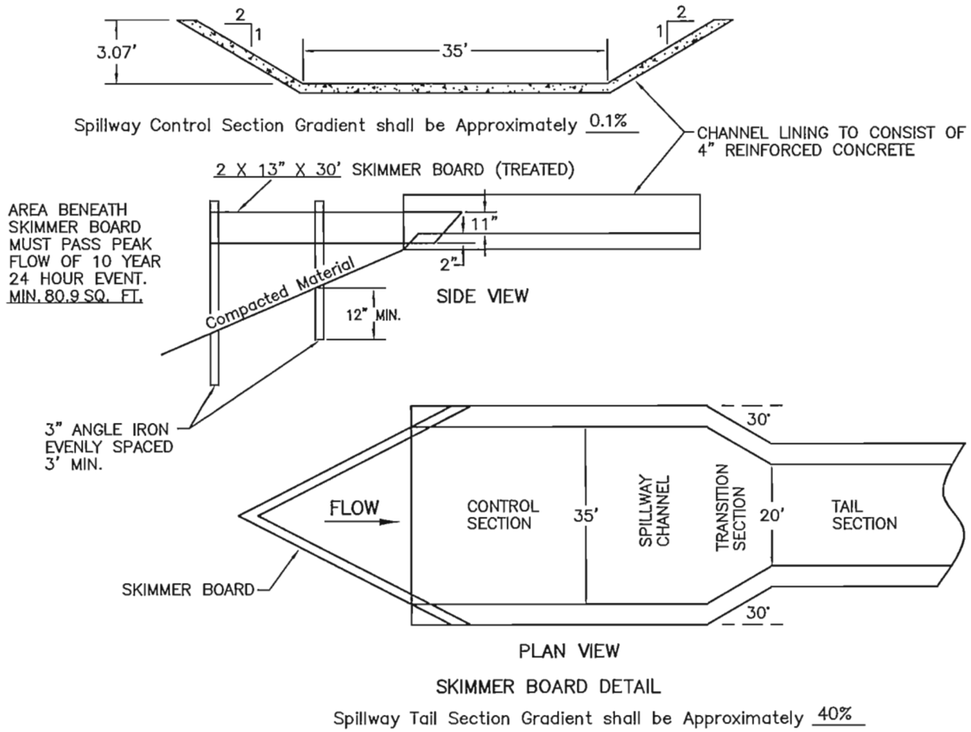
OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-24
ATTACHMENT III-B-2(a)
BASIN 17E MODIFICATION PLANVIEW

DWG NAME:	OGCPPR24_BASIN 017 MOD	DATE:	01-08-2016
DRAWN BY:	S.A.E.	SCALE:	1"=100'
APPROVED BY:	L.G.S.	JOB NUMBER:	15-03901-012

W:\Mining\Oak Grove Resources LLC Mine\Data\GroveConcord P-3233\R-24\OGCPPR24_BASIN 017 MOD.dwg 02/16/16 10:54

Skimmer Board Elev. 540.82
Spillway Elev. 539.9
Q Out 258.94 C.F.S.
V Out 3.20 FT/S



SKIMMER BOARD DETAIL

Spillway Tail Section Gradient shall be Approximately 40%

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.
9. Channel lining within the control section of the spillway channel will extend to the maximum water elevation.

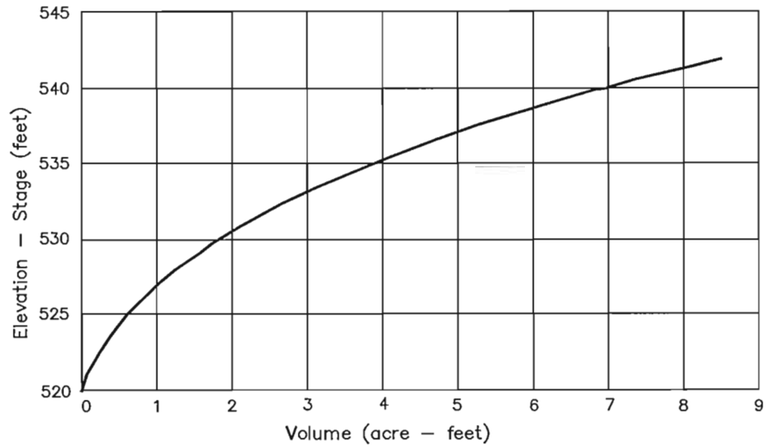
Storage Computation

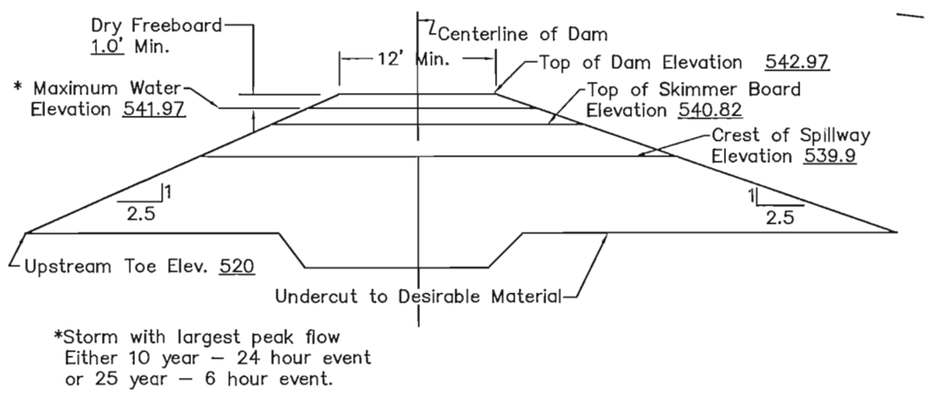
Elevation (feet)	Area (acres)	Avg. Area (acres)	Interval (feet)	Storage (ac.-ft.)	Acc. Storage (ac.-ft.)
520	0.070				0.000
		0.090	2	0.178	
522	0.110				0.178
		0.130	2	0.259	
524	0.150				0.437
		0.180	2	0.359	
526	0.210				0.796
		0.235	2	0.469	
528	0.260				1.265
		0.290	2	0.579	
530	0.320				1.844
		0.355	2	0.709	
532	0.390				2.553
		0.430	2	0.858	
534	0.470				3.411
		0.510	2	1.019	
536	0.550				4.430
		0.595	2	1.189	
538	0.640				5.619
		0.688	1.9	1.305	
539.90	0.735				6.924
		0.738	0.1	0.074	
540	0.740				6.998
		0.790	2	1.579	
542	0.840				8.577

Key Basin Parameters

Drainage Area	69.0 Acres
Disturbed Area	69.0 Acres
Sediment Storage	5.52 Ac. Ft.
Detention Storage	1.41 Ac. Ft.
Permanent Pool Capacity	6.93 Ac. Ft.
Total Basin Capacity	8.6 Ac. Ft.
Peak Inflow	263.35 C.F.S.
Peak Outflow	258.94 C.F.S.

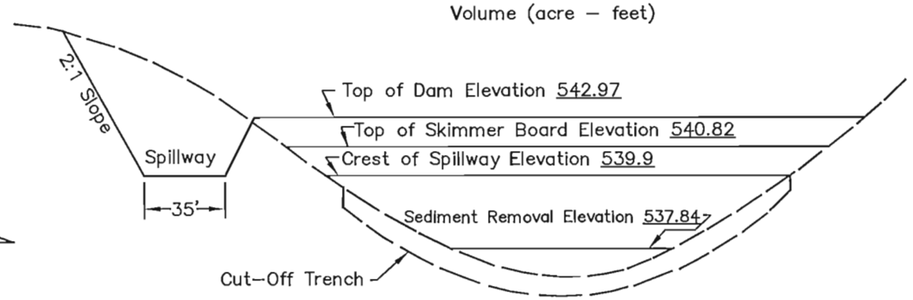
Stage vs. Storage Curve





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

Typical Cross Section Along Spillway



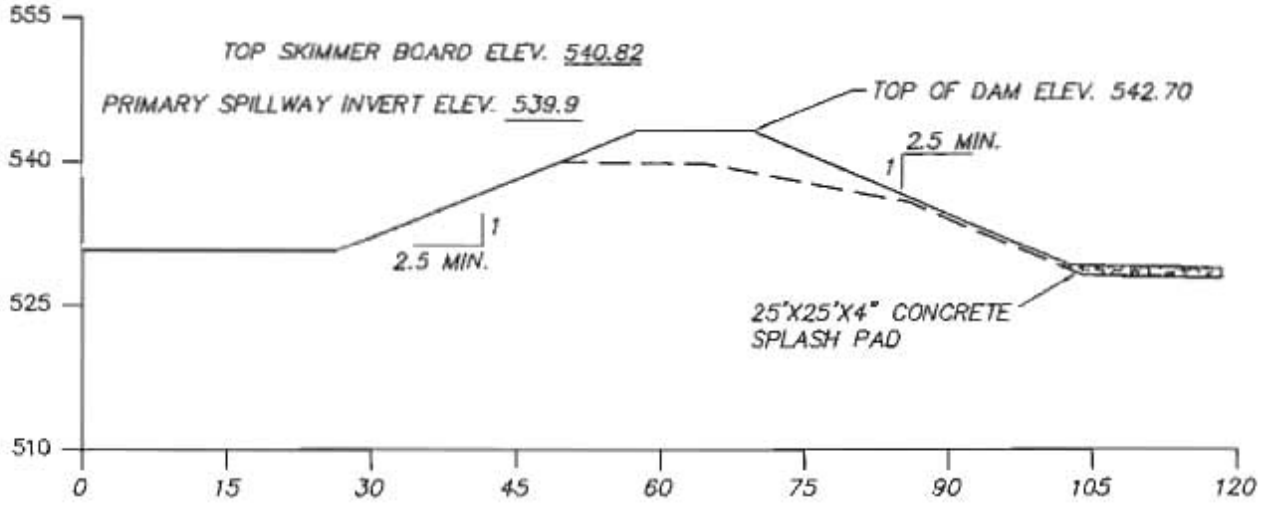
Typical Profile Looking Downstream

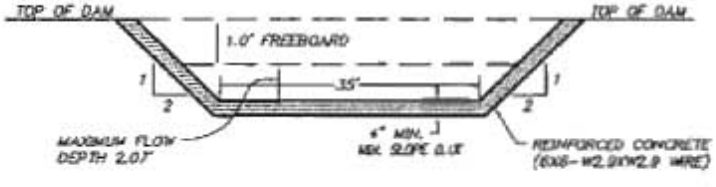
Leslie G. Stephens, P.E., P.L.S.
AL Registration. #14117-E
02/16/2016
Date

PERC ENGINEERING CO., INC.

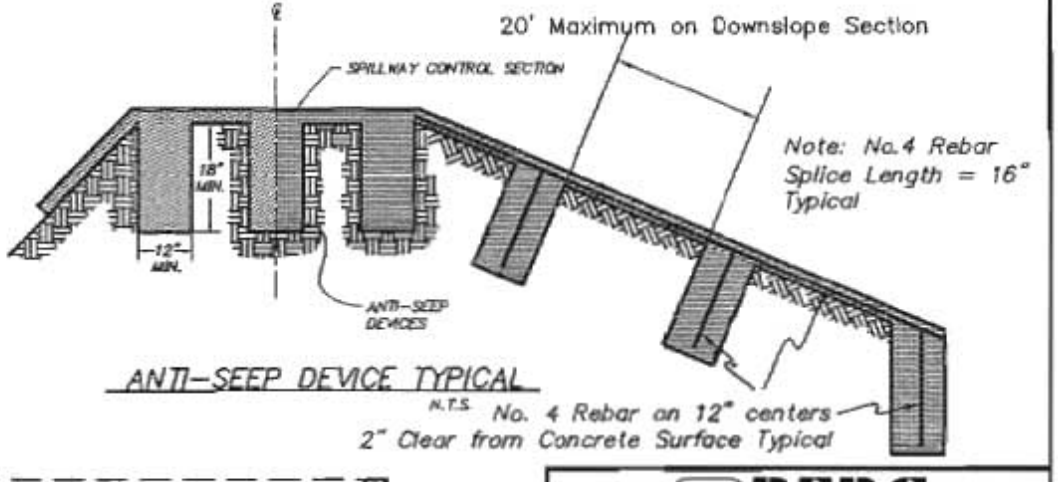
OAKGROVE RESOURCES, LLC
CONCORD PREP PLANT
P-3233 / R24
BASIN 017 MODIFY

DRAWN BY: S.W.L. DWG. NAME: OGCPPDetail Sheet	DATE: 01-12-16
APPROVED BY: L.G.S.	SCALE: NONE

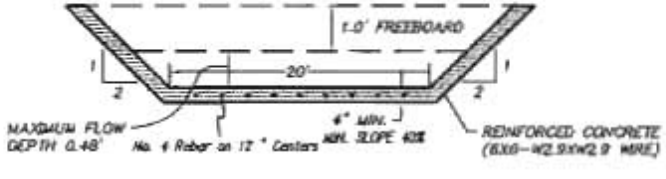




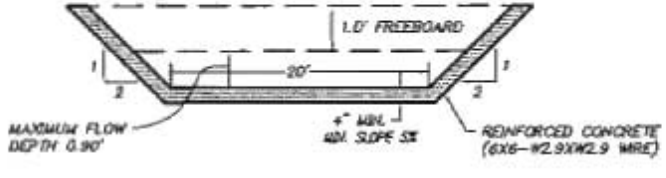
SPILLWAY CONTROL SECTION TYPICAL
N.T.S.



ANTI-SEEP DEVICE TYPICAL
N.T.S.



SPILLWAY TAIL SECTION TYPICAL
N.T.S.



SPILLWAY INTERMEDIATE SECTION TYPICAL
N.T.S.

PERC ENGINEERING CO. INC.

OAKGROVE RESOURCES, LLC
CONCORD PREP PLANT
P-3233 / R24
BASIN 017 MODIFY
DAM DETAILS

DRAWN BY: S.W.L. DWG. NAME: OGCPP01700	DATE: 01-12-16
APPROVED BY: L.G.S.	SCALE: AS NOTED

Oak Grove Resources LLC Concord Prep. Plant P-3233 R-24 Basin 017 Spillway Control Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
35.00	2.0:1	2.0:1	0.1	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	258.94 cfs	
Depth:	2.07 ft	3.07 ft
Top Width:	43.27 ft	47.27 ft
Velocity:	3.20 fps	
X-Section Area:	80.87 sq ft	
Hydraulic Radius:	1.828 ft	
Froude Number:	0.41	

Oak Grove Resources LLC Concord Prep.Plant P-3233 R-24 Spillway Intermediate Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	2.0:1	2.0:1	5.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	258.94 cfs	
Depth:	0.90 ft	1.90 ft
Top Width:	23.59 ft	27.59 ft
Velocity:	13.22 fps	
X-Section Area:	19.59 sq ft	
Hydraulic Radius:	0.816 ft	
Froude Number:	2.56	

Oak Grove Resources LLC Concord Prep.Plant P-3233 R-24 Spillway Tail Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	2.0:1	2.0:1	40.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	258.94 cfs	
Depth:	0.48 ft	1.48 ft
Top Width:	21.94 ft	25.94 ft
Velocity:	25.47 fps	
X-Section Area:	10.17 sq ft	
Hydraulic Radius:	0.459 ft	
Froude Number:	6.59	

Oak Grove Resources, LLC

Concord Prep. Plant

P-3233 R-24

Basin 017E Re-evaluation/Modification

6 Inches, 10 Year - 24 Hour

DRN 58

LGS

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1606 HIGHWAY 78 WEST
JASPER ALABAMA 35502

Phone: 205-384-5553
Email: LSTEPHENS@PERCENGINEERING.COM

General Information

Storm Information:

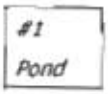
Storm Type:	DRN 58
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.000 Inches

Particle Size Distribution:

Size (mm)	Refuse	Reclaimed
9.5000	56.710%	100.000%
8.7500	37.430%	99.800%
2.0000	19.740%	96.100%
0.8500	9.670%	95.600%
0.4250	4.620%	94.000%
0.2500	2.490%	62.400%
0.1060	1.130%	38.900%
0.0750	0.970%	25.700%
0.0500	0.900%	15.100%
0.0300	0.800%	12.400%
0.0100	0.600%	10.300%
0.0050	0.400%	7.800%
0.0010	0.200%	2.200%
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 017E Re-evaluation 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)
#1	In	69.000	69.000	84.52	21.65	6,162.8	325,642	258.81	151.32
	Out			84.08	21.65	39.9	2,672	0.16	0.08

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
9.5000	58.458%	100.000%
8.7500	38.584%	100.000%
2.0000	20.348%	100.000%
0.8500	9.968%	100.000%
0.4250	4.762%	100.000%
0.2500	2.567%	100.000%
0.1060	1.165%	100.000%
0.0750	1.000%	100.000%
0.0500	0.928%	100.000%
0.0300	0.825%	100.000%
0.0100	0.618%	95.591%
0.0050	0.412%	63.727%
0.0010	0.206%	31.864%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

BASIN 017E Re-evaluation Modification

Pond Inputs:

Initial Pool Elev:	539.90 ft
Initial Pool:	1.41 ac-ft
*Sediment Storage:	5.52 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)
539.90	10.00	2.00:1	2.00:1	35.00

Pond Results:

Peak Elevation:	540.82 ft
H'graph Detention Time:	0.13 hrs
Pond Model:	CSTRS
Dewater Time:	0.53 days
Trap Efficiency:	99.35 %

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)	
537.84	0.633	0.000	0.000		Top of Sed. Storage
538.00	0.640	0.101	0.000		
538.50	0.664	0.427	0.000		
539.00	0.689	0.765	0.000		
539.50	0.714	1.116	0.000		
539.90	0.735	1.406	0.000		Spillway #1
540.00	0.740	1.479	6.295	1.10	
540.50	0.764	1.855	37.775	11.20	
540.82	0.780	2.106	84.082	0.40	Peak Stage
541.00	0.789	2.244	109.503		
541.50	0.814	2.645	210.056		
542.00	0.840	3.058	329.341		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
537.84	0.000	0.000
538.00	0.000	0.000
538.50	0.000	0.000
539.00	0.000	0.000
539.50	0.000	0.000
539.90	0.000	0.000
540.00	6.295	6.295
540.50	37.775	37.775
541.00	109.503	109.503
541.50	210.056	210.056
542.00	329.341	329.341

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	35.000	0.126	0.000	0.000	81.000	F	43.04	10.914
	2	33.300	0.137	0.000	0.000	81.000	F	40.95	10.384
	3	0.700	0.001	0.000	0.000	100.000	F	1.10	0.350
	Σ	**69.000**						**84.52**	**21.647**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	125.00	40.00	0.9000	1.0000	1	5,312.7	505,093	401.44	242.50
	2	0.240	200.00	8.00	0.9000	1.0000	1	850.1	102,123	81.17	46.46
	3	0.240	2.00	0.01	0.0010	1.0000	1	0.0	0	0.00	0.00
	Σ							**6,162.8**	**325,642**	**258.81**	**151.32**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	3.91	90.00	2,300.02	5.930	0.107
#1	**1**	**Time of Concentration:**					**0.126**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	130.00	2,770.02	6.490	0.118
#1	**2**	**Time of Concentration:**					**0.137**

Oak Grove Resources, LLC

Concord Prep. Plant

P-3233 R-24

Basin 017E Re-evaluation/Modification

5 Inches, 25 Year - 6 Hour

SCS Type II

LGS

PERC ENGINEERING CO., INC.
P. O. BOX 1712
1606 HIGHWAY 78 WEST
JASPER ALABAMA 35502

Phone: 205-384-5553
Email: LSTEPHENS@PERCENGINEERING.COM

General Information

Storm Information:

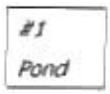
Storm Type:	NRCS Type II
Design Storm:	25 yr - 6 hr
Rainfall Depth:	5.000 Inches

Particle Size Distribution:

Size (mm)	Refuse	Reclaimed
9.5000	56.710%	100.000%
8.7500	37.430%	99.800%
2.0000	19.740%	96.100%
0.8500	9.670%	95.600%
0.4250	4.620%	94.000%
0.2500	2.490%	62.400%
0.1060	1.130%	38.900%
0.0750	0.970%	25.700%
0.0500	0.900%	15.100%
0.0300	0.800%	12.400%
0.0100	0.600%	10.300%
0.0050	0.400%	7.800%
0.0010	0.200%	2.200%
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 017E Re-evaluation 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)
#1	In	69.000	69.000	263.35	16.66	10,070.5	539,061	428.31	291.95
	Out			258.94	16.66	78.2	5,492	0.81	0.51

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
9.5000	61.095%	100.000%
8.7500	40.324%	100.000%
2.0000	21.266%	100.000%
0.8500	10.418%	100.000%
0.4250	4.977%	100.000%
0.2500	2.683%	100.000%
0.1060	1.217%	100.000%
0.0750	1.045%	100.000%
0.0500	0.970%	100.000%
0.0300	0.862%	100.000%
0.0100	0.646%	83.198%
0.0050	0.431%	55.465%
0.0010	0.215%	27.733%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

BASIN 017E Re-evaluation Modification

Pond Inputs:

Initial Pool Elev:	539.90 ft
Initial Pool:	1.41 ac-ft
*Sediment Storage:	5.52 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)
539.90	10.00	2.00:1	2.00:1	35.00

Pond Results:

Peak Elevation:	541.70 ft
H'graph Detention Time:	0.10 hrs
Pond Model:	CSTRS
Dewater Time:	0.18 days
Trap Efficiency:	99.22 %

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)	
537.84	0.633	0.000	0.000		Top of Sed. Storage
538.00	0.640	0.101	0.000		
538.50	0.664	0.427	0.000		
539.00	0.689	0.765	0.000		
539.50	0.714	1.116	0.000		
539.90	0.735	1.406	0.000		Spillway #1
540.00	0.740	1.479	6.295	1.05	
540.50	0.764	1.855	37.775	2.50	
541.00	0.789	2.244	109.503	0.50	
541.50	0.814	2.645	210.056	0.15	
541.70	0.825	2.814	258.945	0.05	Peak Stage
542.00	0.840	3.058	329.341		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
542.50	0.862	3.484	468.607	
543.00	0.884	3.920	627.008	
543.50	0.907	4.368	804.048	
544.00	0.930	4.828	999.436	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
537.84	0.000	0.000
538.00	0.000	0.000
538.50	0.000	0.000
539.00	0.000	0.000
539.50	0.000	0.000
539.90	0.000	0.000
540.00	6.295	6.295
540.50	37.775	37.775
541.00	109.503	109.503
541.50	210.056	210.056
542.00	329.341	329.341
542.50	468.607	468.607
543.00	627.008	627.008
543.50	804.048	804.048
544.00	999.436	999.436

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	35.000	0.126	0.000	0.000	81.000	F	134.59	8.389
	2	33.300	0.137	0.000	0.000	81.000	F	128.05	7.982
	3	0.700	0.001	0.000	0.000	100.000	F	3.79	0.291
	Σ	**69.000**						**263.35**	**16.662**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	125.00	40.00	0.9000	1.0000	1	8,681.4	791,935	629.23	446.83
	2	0.240	200.00	8.00	0.9000	1.0000	1	1,389.1	180,891	143.73	95.85
	3	0.240	2.00	0.01	0.0010	1.0000	1	0.0	1	0.00	0.00
	Σ							**10,070.5**	**539,061**	**428.31**	**291.95**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	3.91	90.00	2,300.02	5.930	0.107
#1	**1**	**Time of Concentration:**					**0.126**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	130.00	2,770.00	6.490	0.118
#1	**2**	**Time of Concentration:**					**0.137**

Oak Grove Resources LLC
Concord Prep. Plant
P-3233 R-24
Soil Classification

SUMMARY OF INPUTS TO COMPUTER MODELS

A brief description of the subwatersheds and other input parameters used in the (SEDCAD+) modeling of the ponds' drainage areas and performance are given below. The conditions assumed for modeling are worst case for sedimentation. The subwatersheds and pond locations are shown on the attached Drainage Map. The slope percent, slope length, and other input parameters are taken form the Plan View Drawings of the refuse embankment. These values are maximum for sedimentation.

Note that Pond 017 will be constructed initially - when Pond 016 is constructed, it will be upstream in series with Pond 017.

Pond 017

S2-SWS-1 - Embankment slope
S1-SWS-2 - Embankment - this SWS will be routed to Pond 016 as construction of the refuse disposal area progresses. This area will be flat during the 'worst case' for Pond 017.
S2-SWS-3 - Pond 017

Pond 016 & 017 Series

S1-SWS-1 - Flat area (top) of refuse pile
S1-SWS-2 - Embankment slope
S1-SWS-3 - Embankment slope
S1-SWS-4 - Pond 016
S2-SWS-1 - Embankment slope
S2-SWS-2 - Pond 017

Worst case conditions are graded and bare with soil - ready for planting. Particle size distribution (labeled 1) is from the operator via a report CONCORD COAL REFUSE DISPOSAL FACILITY. The other partical size (labeled 2 in SEDCAD runs) is of the proposed cover material for the refuse pile and is from Avatar.

SEDCAD+ runs are presented for each pond as described: PERFORMANCE RUN - 10 Year 24 Hour Storm models a 10 year 24 hour storm with 'worst case conditions'; and EMERGENCY SPILLWAY RUNS - 25 year 6 hour Storm.

STABILITY ANALYSIS - Computer aided stability analysis (REAME) was run on each pond. Analysis on the ponds was performed for a static case and with a seismic coefficient of 0.025, resulting in factors of safety greater than 1.5 for the static case and greater that 1.2 for the seismic case.

The dam construction material is soil classified SM. The Standard Proctor test results indicate the dry density of the construction material is 117 lbs/ft^3 with an optimum moisture content of 12.2% The foundation material is shale/sandstone.

Oak Grove Resources LLC
Concord Prep. Plant
P-3233 R-24
Basin 017E Modify
Stability Analysis

Oak Grove Resources, LLC
Concord Prep. Plant
P-3233 R-24

STABILITY ANALYSIS DATA

METHODOLOGY

The static and dynamic loading stability analyses were performed using the Simplified Bishop Method. The computer program used was the REAME Slope Stability Program as developed by Dr. Yang H. Haung, P.E. of the University of Kentucky.

SOIL CLASSIFICATION UNITS

The soil types (soil classifications) to be used in the evaluation of the embankment structure of Basin 017E Modify (SM) and the soil types (soil classification) of the material between the proposed embankment and stiff base of Basin 017E Modify (SM) were copied from the ASMC Permit file for Basin 017E and a copy is included in this report. The soil properties used in the stability analysis (SM) type soils, were taken from the U.S. Department of the Interior Bureau of Reclamation Design of Small Dams.*

SOIL PROPERTIES

	UNIFIED CLASS	COHESION (PSF)	ANGLE OF INT. FRC.	DESIGN DENSITY (PCF)
Dam Material Basin 017E	SM	273.6	33.0	132.1
Foundation Basin 017E	SM	273.6	33.0	132.1

*United States Department of Interior Bureau of Reclamation Design of Small Dams Second Edition 1973, Revised Reprint 1974 page 137 and United States Department of Interior Bureau of Reclamation Design of Small Dams Third Edition 1987 page 96 and 97.

STABILITY ANALYSIS DATA

(Continued)

DESIGN DATA

1) Design Density = 95% of the standard proctor maximum density.
2) Embankment top width: 12.0'.
3) Freeboard minimum = 10% of structure (from top of embankment to normal pool level).
4) Safety factors are for embankments with 2.5H:1V slopes, front and back.
5) Basin 017E Modified design height = *23..1 ft.
6) DMIN = 0.00
7) All design heights are measured from the top of the embankment to the toe of the upstream slope.

* Indicates the Primary Spillway to upstream toe height is 19.9' .

SAFETY FACTORS

BASIN NUMBER	STATIC SAFETY FACTOR
017E Modified	1.755

FOUNDATIONS AND ABUTMENTS

The foundation and abutments area will be inspected for visible structural deficiencies after clearing and grubbing, and if found they will be treated using sound engineering practices.

OGCOP017

REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Oak Grove Resources Concord Prep. Plan Basin 017E Modify

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4
Number of points on boundary lines are: 2 2 3
7

On boundary line no. 1 Point no. and coordinates are:
1 .000 42.500 2 500.000 .000

On boundary line no. 2 Point no. and coordinates are:
1 200.000 28.500 2 361.905 14.738

On boundary line no. 3 Point no. and coordinates are:
1 .000 45.500 2 200.000 28.500 3 249.750 48.400

On boundary line no. 4 Point no. and coordinates are:
1 .000 48.400 2 249.750 48.400 3 257.750 51.600 4
269.750 51.600 5 332.450 26.520
6 361.905 14.738 7 500.000 3.000

Line no. and slope of each segment are:
1 -.085
2 -.085
3 -.085 .400
4 .000 .400 .000 -.400 -.400 -.085

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

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

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles=
5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	273.600	33.000	132.100
2	273.600	33.000	132.100
3	.000	.000	62.400

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

```
     The factors of safety are determined by the SIMPLIFIED BISHOP method

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

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

     Under seepage condition 1point no. and            coordinates of water table
are:
    1      .000    48.400    2   249.750    48.400    3   283.638    39.648    4
332.450    26.520    5   361.905    14.738
    6   500.000     3.000

 point1=(   271.000,    73.000) point2=(   271.000,    53.000) point3=(   363.000,
 53.000) NJ=    2 NI=    2
     Automatic search will follow after grid with XINC=    10.000 and YINC=
10.000

 At point (   271.000,    73.000) under seepage    1,the radius and the
corresponding factor of safety are:
         53.343     8.072         46.961     8.272         40.580     8.416
34.199     8.867         27.818     9.682
     Lowest factor of safety=     8.072 and occurs at radius  =     53.343


 At point (   271.000,    63.000) under seepage    1,the radius and the
corresponding factor of safety are:
         43.379     8.349         36.997     8.265         30.614     8.197
24.232     8.051         17.850     8.746
         28.487     8.187         26.360     8.116         22.105     8.140
19.978     8.334
     Lowest factor of safety=     8.051 and occurs at radius  =     24.232


 At point (   271.000,    53.000) under seepage    1,the radius and the
corresponding factor of safety are:
         33.415     9.063         27.084     8.885         20.754     8.458
14.424     8.768         8.094     10.083
         24.974     8.923         22.864     8.797         18.644     8.397
16.534     8.361
     Lowest factor of safety=     8.361 and occurs at radius  =     16.534


 At point (   317.000,    73.000) under seepage    1,the radius and the
corresponding factor of safety are:
         57.239     1.976         53.274     2.059         49.310     2.250
45.346     2.697         41.382     3.997
     Lowest factor of safety=     1.976 and occurs at radius  =     57.239


 At point (   317.000,    63.000) under seepage    1,the radius and the
corresponding factor of safety are:
         47.275     2.083         43.446     2.171         39.618     2.361
35.790     2.806         31.961     4.129
     Lowest factor of safety=     2.083 and occurs at radius  =     47.275


 At point (   317.000,    53.000) under seepage    1,the radius and the
corresponding factor of safety are:
         37.310     2.273         33.618     2.373         29.926     2.563
26.233     2.990         22.541     4.333
     Lowest factor of safety=     2.273 and occurs at radius  =     37.310
```

At point (363.000, 73.000) under seepage 1,the radius and the corresponding factor of safety are:

61.135	2.624	59.808	2.851	58.481	3.155
57.155	4.064	55.828	7.158		

Lowest factor of safety= 2.624 and occurs at radius = 61.135

At point (363.000, 63.000) under seepage 1,the radius and the corresponding factor of safety are:

51.170	2.845	49.980	3.110	48.789	3.525
47.598	4.412	46.408	7.889		

Lowest factor of safety= 2.845 and occurs at radius = 51.170

At point (363.000, 53.000) under seepage 1,the radius and the corresponding factor of safety are:

41.206	3.173	40.152	3.490	39.097	4.037
38.042	4.903	36.987	8.831		

Lowest factor of safety= 3.173 and occurs at radius = 41.206

For piezometric line No. 1

At point (317.000, 73.000) ,RADIUS 57.239
the minimum factor of safety is 1.976

At point (317.000, 73.000) under seepage 1,the radius and the corresponding factor of safety are:

57.239	1.976	53.274	2.059	49.310	2.250
45.346	2.697	41.382	3.997		

Lowest factor of safety= 1.976 and occurs at radius = 57.239

At point (327.000, 73.000) under seepage 1,the radius and the corresponding factor of safety are:

58.086	1.903	54.695	2.014	51.304	2.227
47.913	2.708	44.522	4.191		

Lowest factor of safety= 1.903 and occurs at radius = 58.086

At point (337.000, 73.000) under seepage 1,the radius and the corresponding factor of safety are:

58.932	1.885	56.115	2.017	53.298	2.263
50.480	2.798	47.663	4.437		

Lowest factor of safety= 1.885 and occurs at radius = 58.932

At point (347.000, 73.000) under seepage 1,the radius and the corresponding factor of safety are:

59.779	1.926	57.535	2.091	55.291	2.388
53.047	3.011	50.803	4.916		

Lowest factor of safety= 1.926 and occurs at radius = 59.779

At point (337.000, 83.000) under seepage 1,the radius and the corresponding factor of safety are:

68.897	1.831	65.943	1.965	62.990	2.214
60.037	2.741	57.083	4.355		

Lowest factor of safety= 1.831 and occurs at radius = 68.897

At point (337.000, 93.000) under seepage 1,the radius and the corresponding factor of safety are:

78.861 1.789 75.771 1.927 72.682 2.179
69.593 2.696 66.504 4.293

Lowest factor of safety= 1.789 and occurs at radius = 78.861

At point (337.000, 103.000) under seepage 1,the radius and the corresponding factor of safety are:

88.825 1.767 85.600 1.897 82.375 2.152
79.150 2.663 75.925 4.228

Lowest factor of safety= 1.767 and occurs at radius = 88.825

At point (337.000, 113.000) under seepage 1,the radius and the corresponding factor of safety are:

98.789 1.765 95.428 1.882 92.067 2.121
88.706 2.635 85.345 4.163

Lowest factor of safety= 1.765 and occurs at radius = 98.789

At point (337.000, 123.000) under seepage 1,the radius and the corresponding factor of safety are:

108.753 1.781 105.256 1.888 101.759 2.106
98.263 2.607 94.766 4.093

Lowest factor of safety= 1.781 and occurs at radius = 108.753

At point (347.000, 113.000) under seepage 1,the radius and the corresponding factor of safety are:

99.636 1.775 96.848 1.932 94.061 2.215
91.273 2.782 88.486 4.494

Lowest factor of safety= 1.775 and occurs at radius = 99.636

At point (327.000, 113.000) under seepage 1,the radius and the corresponding factor of safety are:

97.942 1.858 94.008 1.943 90.073 2.119
86.139 2.551 82.205 3.891

Lowest factor of safety= 1.858 and occurs at radius = 97.942

At point (339.500, 113.000) under seepage 1,the radius and the corresponding factor of safety are:

99.001 1.755 95.783 1.884 92.565 2.142
89.348 2.663 86.130 4.239

Lowest factor of safety= 1.755 and occurs at radius = 99.001

At point (342.000, 113.000) under seepage 1,the radius and the corresponding factor of safety are:

99.212 1.755 96.138 1.895 93.064 2.162
89.990 2.696 86.916 4.314

Lowest factor of safety= 1.755 and occurs at radius = 99.212

At point (339.500, 115.500) under seepage 1,the radius and the corresponding factor of safety are:

101.492 1.756 98.240 1.882 94.989 2.133
91.737 2.657 88.486 4.224

Lowest factor of safety= 1.756 and occurs at radius = 101.492

At point (339.500, 110.500) under seepage 1,the radius and the corresponding factor of safety are:

96.509 1.756 93.326 1.888 90.142 2.149
86.959 2.670 83.775 4.253

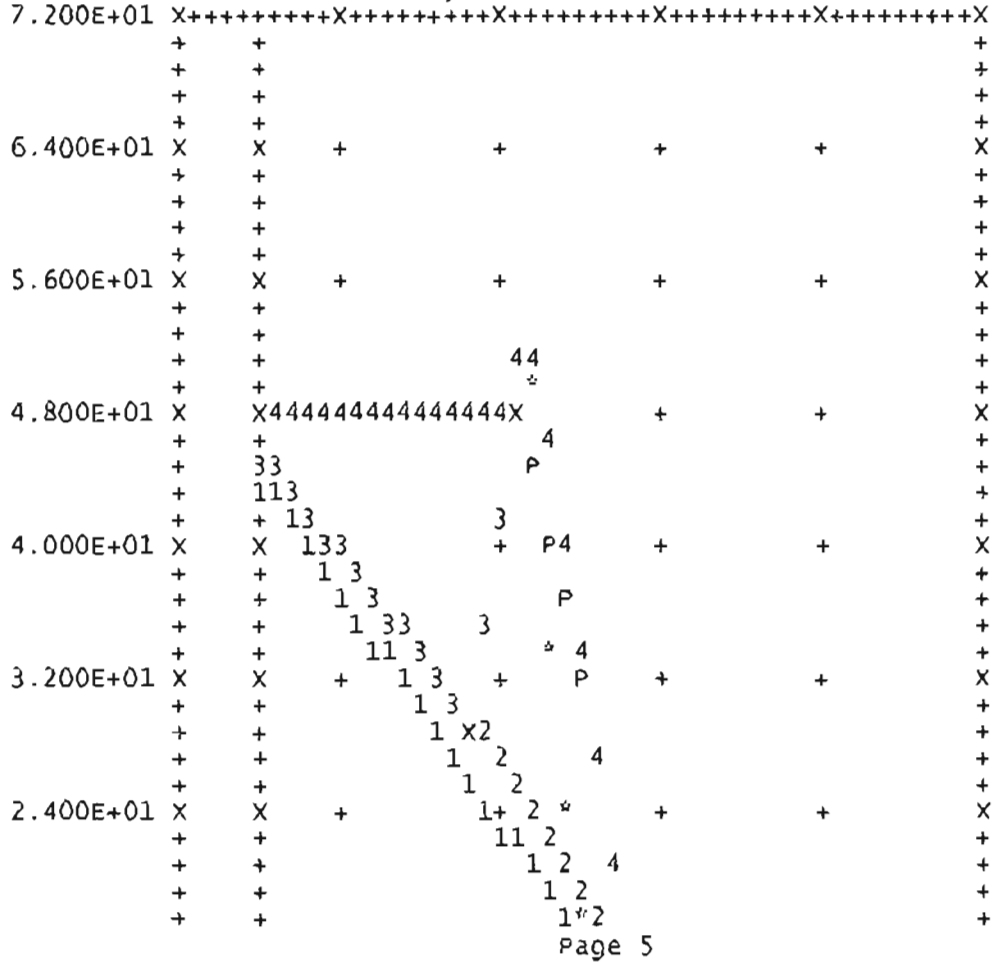
Lowest factor of safety= 1.756 and occurs at radius = 96.509

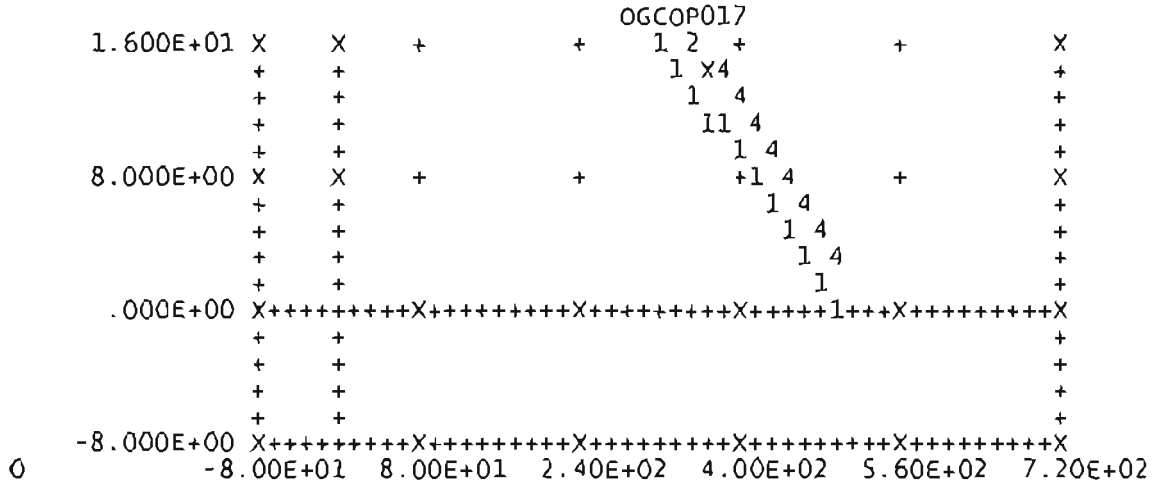
For piezometric line No. 1

At point (339.500, 113.000) ,RADIUS 99.001
the minimum factor of safety is 1.755

1

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 1.755




OGCOP017
1.600E+01
8.000E+00
.000E+00
-8.000E+00
0
-8.00E+01
8.00E+01
2.40E+02
4.00E+02
5.60E+02
7.20E+02