HYDROLOGY STUDY FOR
OAK GROVE RESOURCES , LLC

CONCORD PREP. PLANT

Basin 018E Modification

Attachment III-B-2(a)

P-3233 R-21

JEFFERSON COUNTY, ALABAMA

BY

PERC ENGINEERING CO., INC.

P.O. BOX 1712

JASPER, ALABAMA 35502

MAY 14, 2015

PERC
ENGINEERING CO., INC.

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(205) 295-3115 - Water Lab
Web Address: www.percengineering.com

May 14, 2015

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

RE: Oak grove Resources, LLC
Concord Prep. Plan
P- 3233 Revision R-21

Dear Stephen:

I hereby certify the attached Detailed Design Plans for the Modification of Basin 018E 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-P

P.O. Box 1712 • Jasper, Alabama 35502 • 1606 Highway 78 West • Jasper, Alabama 35501

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 1.3 for the normal pool with steady seepage saturation conditions.

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 all basins 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 or greater event as specified by the Regulatory Authority.(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.

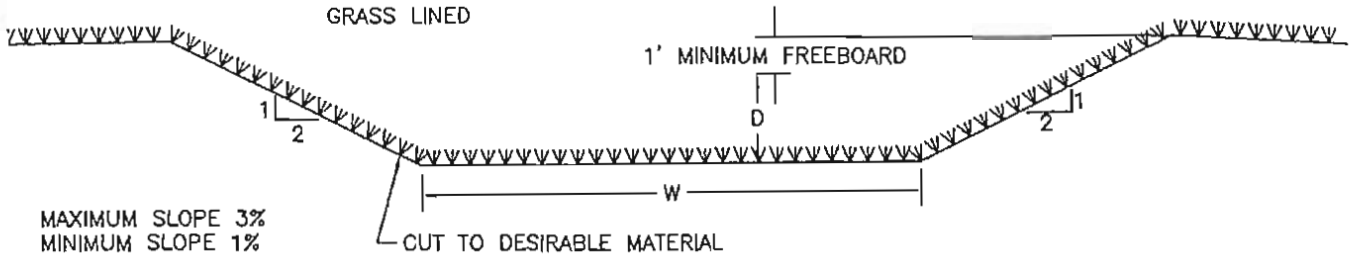
22. All ponds shall be examined quarterly for structural weakness, instability, erosion, or other hazardous conditions and maintenance performed as necessary. Formal inspections shall be made on an annual basis, including any reports or modifications, in accordance with 880-X-10C-.20[l(j)] of the Alabama 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.



$$Q = \frac{1.486}{N} A R^{2/3} S^{1/2}$$

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

PERC ENGINEERING CO. INC.

TYPICAL PERMANENT DIVERSION FOR BASIN DISPOSAL

DRAWN BY: L.G.S. DWG. NAME: TYPICALS	DATE: 4/13/2015
APPROVED BY: L.G.S.	SCALE: NONE

ATTACHMENT III–B–2–A

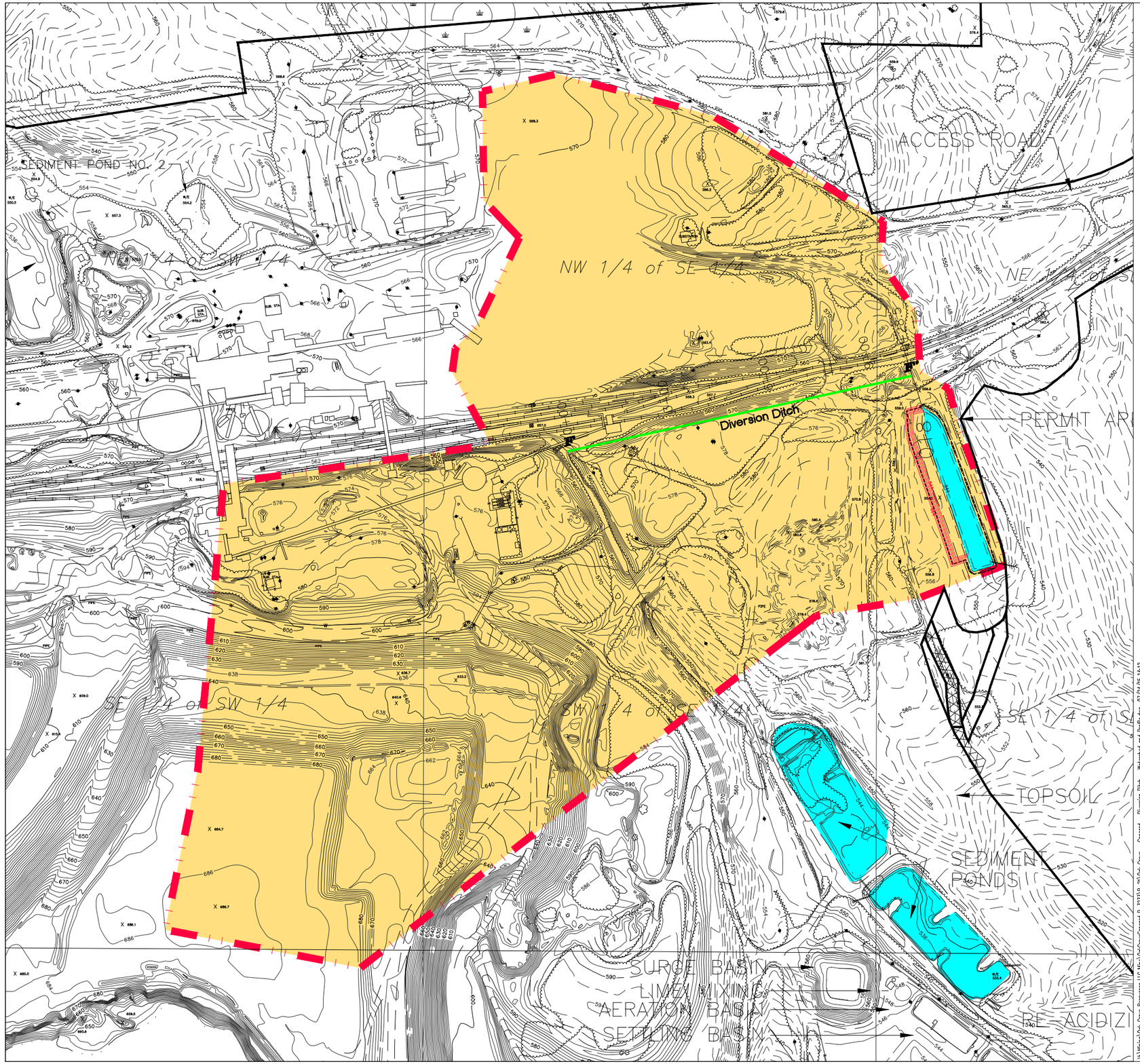
NOTES

1) The modification for Basin 018E will consist of removing the primary spillway Pipe and replace with compacted fill up to the Top of Dam elevation. Erosion will be controlled with silt fence & hay bales down grade of the construction site.

2) Excavating the West side of the Normal Pool area North of the existing building up to the North end of the Pond a width of 40 feet down to the 544.0 Elevation to form a Normal Pool area slope of 2 Horz. To 1 Vert. or flatter. Erosion will be controlled by drainage back into the basin pool and pumping water to Basin 003AE or the Slurry Impoundment.

3) The emergency spillway channel will be excavated down to an elevation such that the flow line of the Shotcrete overlayed rip-rap spillway elevation will be 551.0. The 2" X 18" Skimmer Board will be placed as shown on the Detailed Design sheet later in theses plans. Erosion will be controlled with silt fence & hay bales down grade of the construction site.

4) No stability analysis was required since the Basin is incised up to elevation 547.7 and the new primary spillway elevation is 551.0.



0' 300' 600' 900'

Scale 1" = 300'

LEGEND

- 700 — SURFACE CONTOUR
- PERMIT BOUNDARY
- WATERSHED BOUNDARY
- F — F' PROPOSED DIVERSION DITCH

LANDUSE AND CURVE NUMBER INFORMATION

- GRADED AND BARE, CURVE NUMBER, 81
- SEDIMENT BASIN, CURVE NUMBER, 100

PERC ENGINEERING CO., INC.

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OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-21
ATTACHMENT III-B-2(a)
POND 18E WATERSHED MAP

.DWG NAME: Oak Grove - Concord - Diversion Ditch - Watershed and Profile.		DATE:	05-14-2015
DRAWN BY:	S.A.E.	SCALE:	1"=300'
APPROVED BY:	L.G.S.	JOB NUMBER:	15-03904-008

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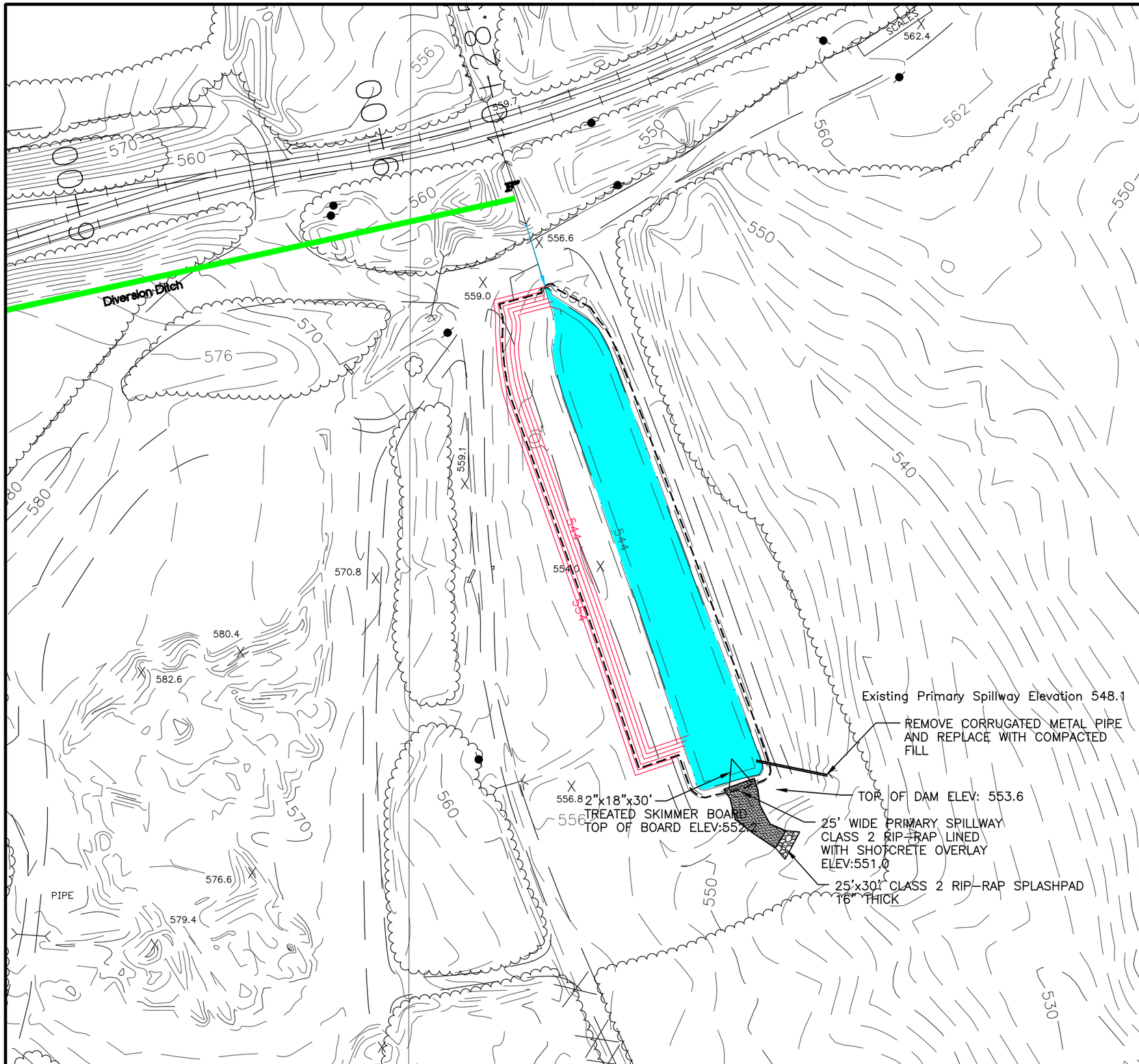

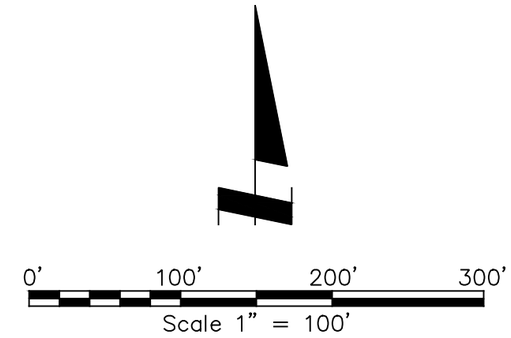

LEGEND

- 700 — EXISTING SURFACE CONTOUR
- 540 — PROPOSED SURFACE CONTOUR
- MAJOR INFLOW
- PROPOSED NORMAL POOL ELEV: 551.0
- F F — PROPOSED DIVERSION DITCH

Note: Elevations derived from RTK GPS Survey, NAVD 88, Geoid 2012A Datum

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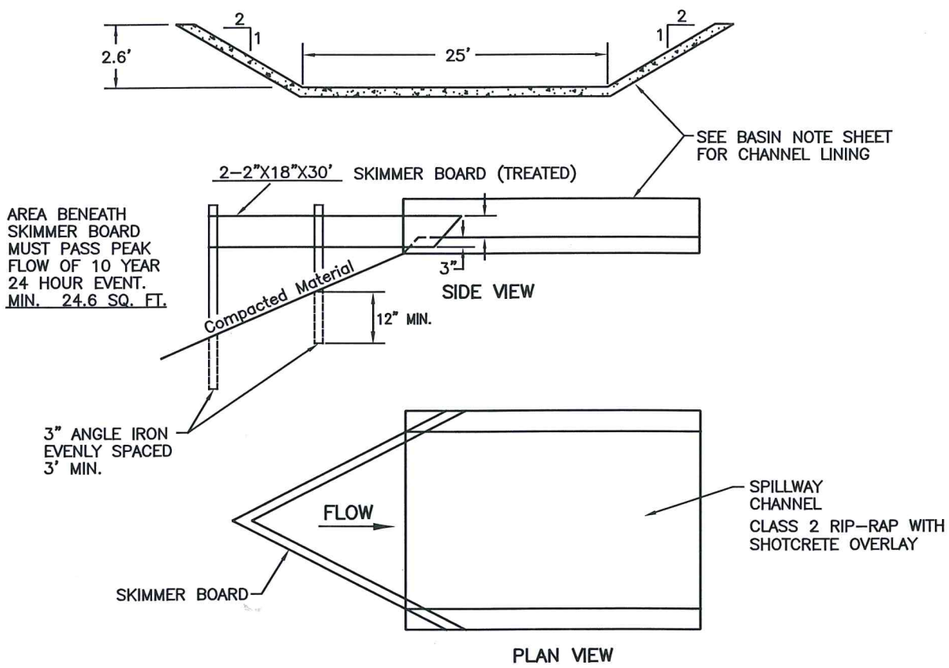
OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-21
ATTACHMENT III-B-2(a)
POND 18E MODIFICATION PLANVIEW

.DWG NAME: Oak Grove – Concord – Diversion Ditch – Watershed and Profile.		DATE:	06–03–2015
DRAWN BY:	S.A.E.	SCALE:	1"=100'
APPROVED BY:	L.G.S.	JOB NUMBER:	15–03904–008

K:\Mining\Oak Grove Resources LLC Mine\OakGrove\Concord P-3233\R-21\Oak Grove – Concord – Diversion Ditch – Watershed and Profile.dwg 07/24/15 14:06

Skimmer Board Elev. 552.2
Spillway Elev. 551.0
Q Out 149.2 C.F.S.
V Out 4.3 F.P.S.



SKIMMER BOARD DETAIL

SPILLWAY GRADIENT SHALL BE APPROXIMATELY 1%. WITHIN THE CONTROL SECTION AND 40% WITHIN THE TAIL SECTION.

Notes:

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

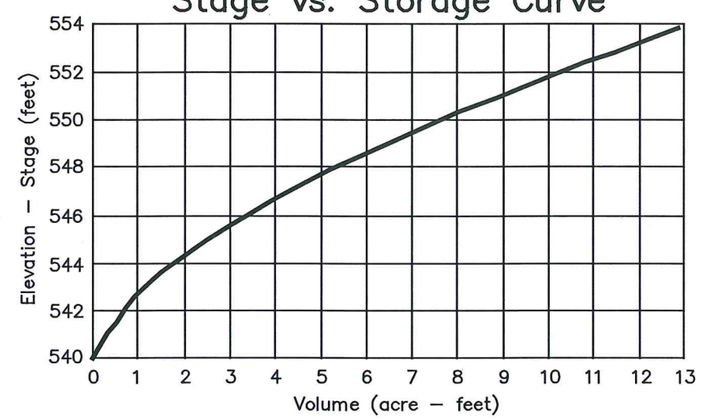
Storage Computation

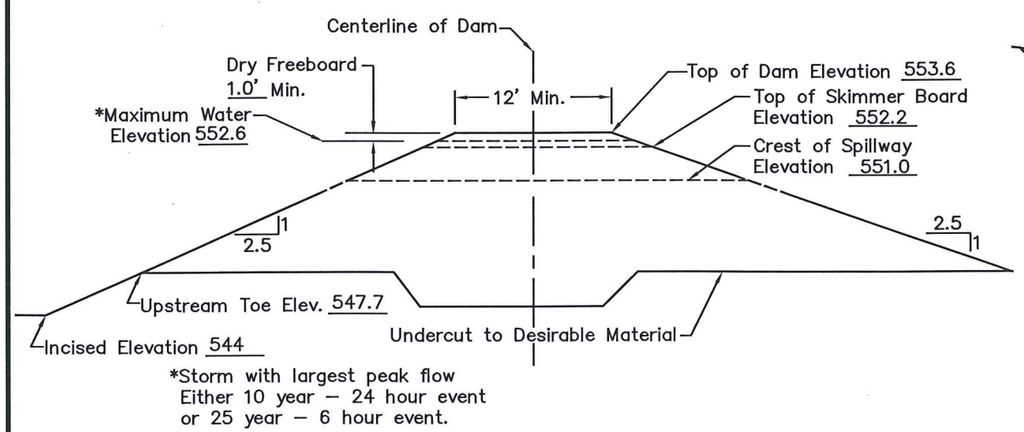
Elevation (feet)	Area (acres)	Avg. Area (acres)	Interval (feet)	Storage (ac.–ft.)	Acc. Storage (ac.–ft.)
540	.301				.000
		.346	2	.689	
542	.390				.689
		.565	2	1.111	
544	.739				1.800
		.787	2	1.572	
546	.834				3.372
		.963	2	1.919	
548	1.091				5.291
		1.150	2	2.299	
550	1.209				7.590
		1.269	2	2.536	
552	1.328				10.126
		1.388	2	2.774	
554	1.447				12.900

Key Basin Parameters

Drainage Area 77.7 Acres
Disturbed Area 77.7 Acres
Sediment Storage 6.3 Ac. Ft.
Detention Storage 2.53 Ac. Ft.
Permanent Pool Capacity 8.83 Ac. Ft.
Total Basin Capacity 10.9 Ac. Ft.
Peak Inflow 173.6 C.F.S.
Peak Outflow 149.2 C.F.S.

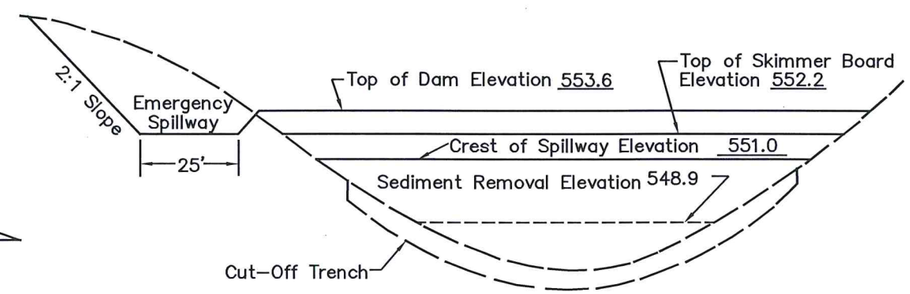
Stage vs. Storage Curve





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

Typical Cross Section Along Primary Spillway



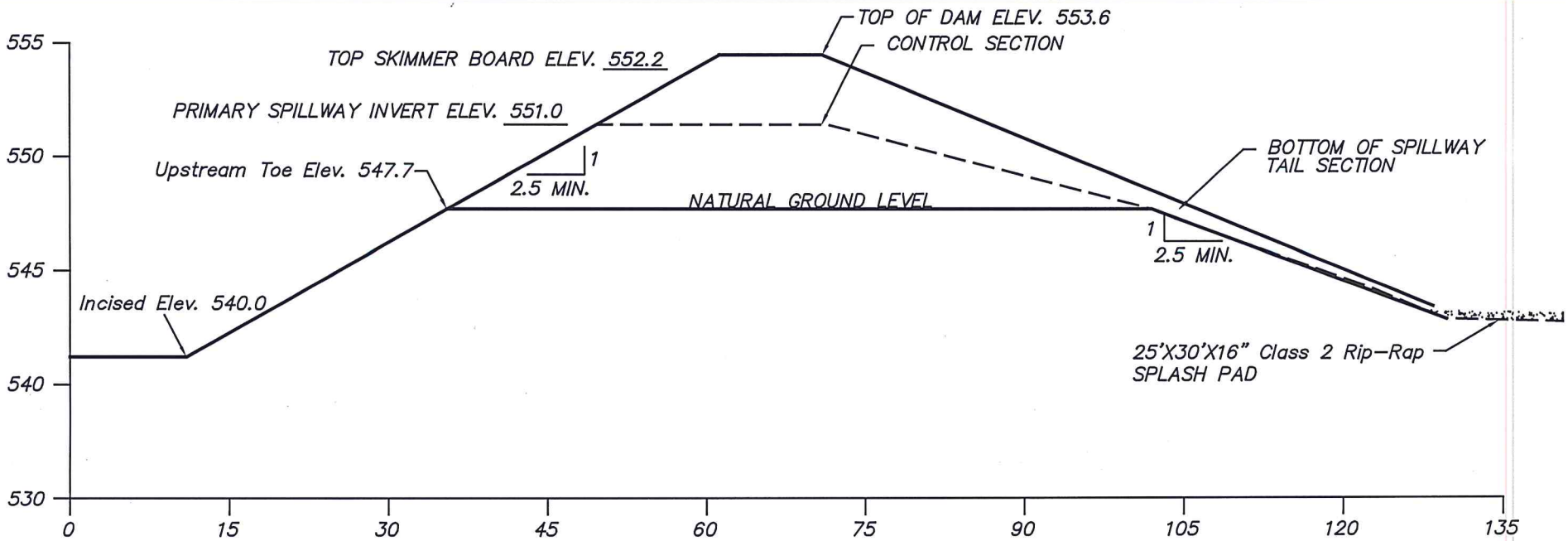
Typical Profile Looking Downstream

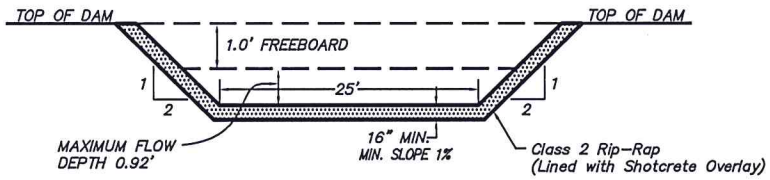
Leslie G. Stephens, P.L.S. & P.E.
AL Reg. No. 14117–E
07/24/2015
Date

PERC ENGINEERING CO., INC.

Oak Grove Resources, LLC.
Concord Prep Plant
P-3233 / R-21
Sediment Pond No. 18 Modification

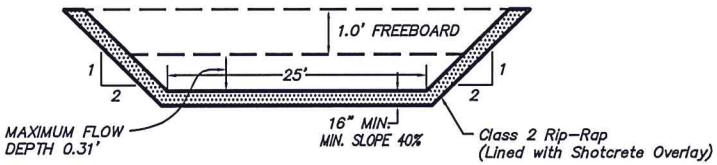
DRAWN BY: S.A.E DWG. NAME: OGRCPP18TY	DATE: 06–03–15
APPROVED BY: L.G.S.	SCALE: NONE





SPILLWAY CONTROL SECTION TYPICAL

N.T.S.



SPILLWAY TAIL SECTION TYPICAL

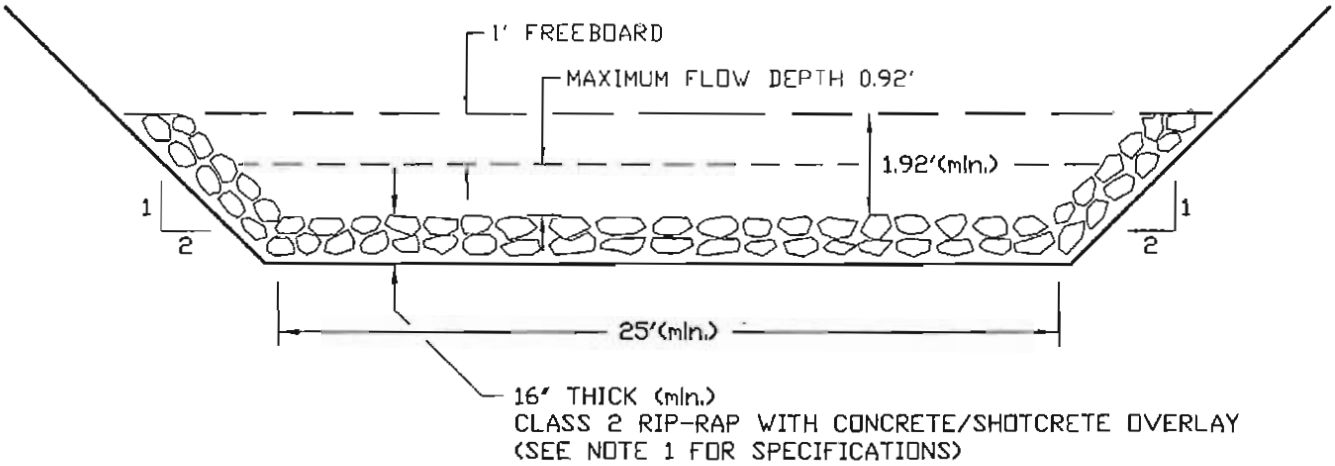
N.T.S.

PERC ENGINEERING CO. INC.

OAK GROVE RESOURCES, LLC
CONCORD PREP. PLANT
P-3233 / REVISION R-21
BASIN 018E MODIFICATION
DAM DETAILS

DRAWN BY: JLR DWG. NAME: OGRCPP18DD	DATE: 06/25/2015
APPROVED BY: L.G.S.	SCALE: AS NOTED

\\Perc600\perc_eng\Mining\Oak Grove Resources LLC Mine\OakGroveConcord P-3233\R-21\OGRCPP18DD.dwg 06/25/15 13:20



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(205) 384-5553 Office (205) 285-3114 Fax

OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-21
BASIN 018E SPILLWAY CONTROL SECTION
CROSS SECTION

DWG NAME: 01 Oak - Concord - Diversion Ditch - Watershed and Public		DATE:	06-03-2015
DRAWN BY:	S.A.E.	SCALE:	As Shown
APPROVED BY:	L.G.S.	JOB NUMBER:	15-03904-008

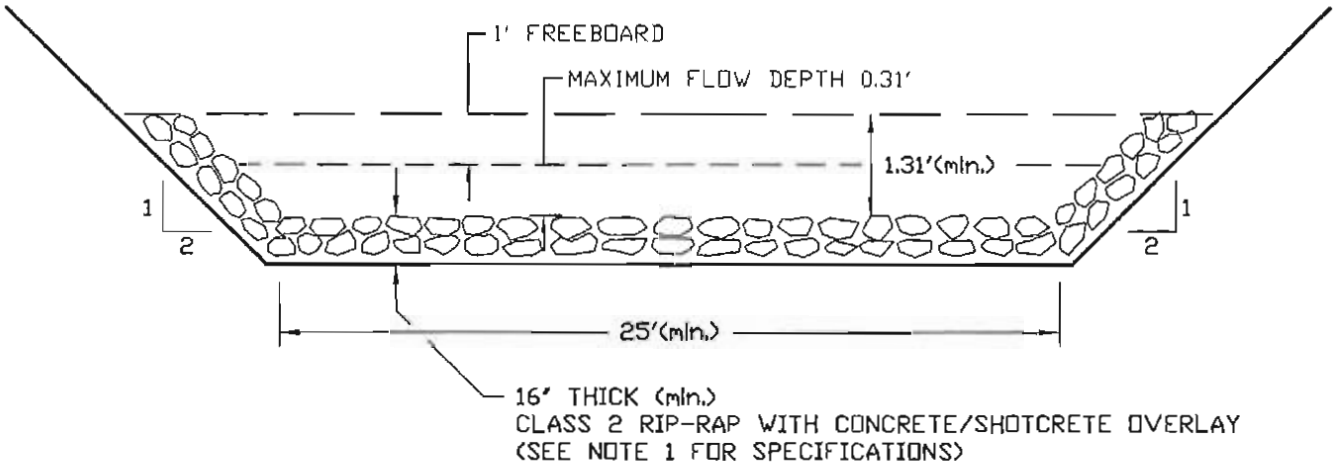
Oak Grove Resources LLC Concord Prep. Plant P-3233 R-21 Basin 018 Modified Spillway Control Section

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)
25.00	2.0:1	2.0:1	1.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	149.16 cfs	
Depth:	0.92 ft	1.92 ft
Top Width:	28.67 ft	32.67 ft
Velocity:	6.06 fps	
X-Section Area:	24.62 sq ft	
Hydraulic Radius:	0.846 ft	
Froude Number:	1.15	



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OAK GROVE RESOURCES, LLC.
CONCORD PREP PLANT / P-3233 R-21
BASIN 018E SPILLWAY TAIL SECTION
CROSS SECTION

DWG NAME:	[illegible]	DATE:	08–03–2015
DRAWN BY:	S.A.E.	SCALE:	As Shown
APPROVED BY:	L.G.S.	JOB NUMBER:	15–03904–008

Oak Grove Resources LLC Concord Prep. Plant P-3233 R-21 Basin 018 Modified 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)
25.00	2.0:1	2.0:1	40.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	149.16 cfs	
Depth:	0.31 ft	1.31 ft
Top Width:	26.22 ft	30.22 ft
Velocity:	19.06 fps	
X-Section Area:	7.83 sq ft	
Hydraulic Radius:	0.297 ft	
Froude Number:	6.15	

RIP-RAP CLASSIFICATION SPECIFICATIONS

CLASS 1 RIP-RAP

No more than 10% of the stone will have a diameter greater than twelve (12) inches; no more than 50% of the stone will have a diameter less than ten (10) inches; and no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than twelve (12) inches.

CLASS 2 RIP-RAP

No more than 10% of the stone will have a diameter greater than sixteen (16) inches; no more than 50% of the stone will have a diameter less than twelve (12) inches; and no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than sixteen (16) inches.

CLASS 3 RIP-RAP

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

CLASS 4 RIP-RAP

No more than 10% of the stone will have a diameter greater than twenty seven (27) inches; no more than 50% of the stone will have a diameter less than twenty two (22) inches; and no more than 10% of the stone will have a diameter of less than ten (10) inches. The thickness of the rip-rap liner will be no less than twenty seven (27) inches.

CLASS 5 RIP-RAP

No more than 10% of the stone will have a diameter greater than thirty four (34) inches; no more than 50% of the stone will have a diameter less than twenty seven (27) inches; and no more than 10% of the stone will have a diameter of less than sixteen (16) inches. The thickness of the rip-rap liner will be no less than thirty four (34) inches.

Oak Grove Resources, LLC
Concord Prep. Plant
P-3233 R-21
Basin 018E Re-evaluation/Modification

6 Inches, 10 Year - 24 Hour

DRN 58

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:	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%	96.000%
0.8500	9.670%	95.000%
0.4250	4.620%	94.000%
0.2500	2.490%	92.000%
0.1060	1.130%	71.000%
0.0750	0.970%	46.000%
0.0500	0.900%	42.000%
0.0300	0.800%	31.000%
0.0100	0.600%	12.000%
0.0050	0.400%	7.000%
0.0010	0.200%	2.000%
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 018E Re-evaluation Modification

#1
Pond

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	77.690	77.690	95.82	24.60	10,779.3	538,740	426.15	221.32
	Out			93.97	24.60	63.3	3,759	0.09	0.05

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
9.5000	59.073%	100.000%
8.7500	38.990%	100.000%
2.0000	20.563%	100.000%
0.8500	10.073%	100.000%
0.4250	4.813%	100.000%
0.2500	2.594%	100.000%
0.1060	1.177%	100.000%
0.0750	1.010%	100.000%
0.0500	0.938%	100.000%
0.0300	0.833%	100.000%
0.0100	0.625%	100.000%
0.0050	0.417%	70.943%
0.0010	0.208%	35.471%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

BASIN 018E Re-evaluation Modification

Pond Inputs:

Initial Pool Elev:	551.00 ft
Initial Pool:	2.53 ac-ft
*Sediment Storage:	6.30 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)
551.00	10.00	2.00:1	2.00:1	25.00

Pond Results:

Peak Elevation:	552.19 ft
H'graph Detention Time:	0.57 hrs
Pond Model:	CSTRS
Dewater Time:	0.93 days
Trap Efficiency:	99.41 %

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)	
548.90	1.144	0.000	0.000		Top of Sed. Storage
549.00	1.149	0.112	0.000		
549.50	1.179	0.694	0.000		
550.00	1.209	1.291	0.000		
550.50	1.238	1.903	0.000		
551.00	1.268	2.529	0.000		Spillway #1
551.50	1.298	3.171	5.142	10.55	
552.00	1.328	3.827	66.760	11.45	
552.19	1.339	4.085	93.969	0.25	Peak Stage
552.50	1.357	4.498	137.574		
553.00	1.387	5.184	223.036		
553.50	1.417	5.885	324.530		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
554.00	1.447	6.601	441.596	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
548.90	0.000	0.000
549.00	0.000	0.000
549.50	0.000	0.000
550.00	0.000	0.000
550.50	0.000	0.000
551.00	0.000	0.000
551.50	5.142	5.142
552.00	66.760	66.760
552.50	137.574	137.574
553.00	223.036	223.036
553.50	324.530	324.530
554.00	441.596	441.596

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	53.000	0.240	0.018	0.319	81.000	F	63.77	16.321
	2	23.000	0.122	0.000	0.000	81.000	F	29.86	7.433
	3	1.690	0.001	0.000	0.000	100.000	F	2.66	0.844
	Σ	**77.690**						**95.82**	**24.599**

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	0.280	135.00	40.00	0.9000	1.0000	1	10,205.9	613,394	487.47	299.39
	2	0.240	200.00	8.00	0.9000	1.0000	1	579.0	97,031	77.13	44.26
	3	0.240	2.00	0.01	0.0010	1.0000	1	0.0	1	0.00	0.00
	Σ							**10,779.3**	**538,740**	**428.15**	**221.32**

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	13.64	150.00	1,100.00	11.070	0.027
		8. Large gullies, diversions, and low flowing streams	0.24	2.45	1,020.83	1.460	0.194
#1	**1**	**Time of Concentration:**					**0.240**
#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	1.57	22.00	1,400.02	3.760	0.103
#1	**2**	**Time of Concentration:**					**0.122**

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	1.00	2.00	200.00	3.000	0.018

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**1**	**Muskingum K:**					**0.018**

Oak Grove Resources, LLC
Concord Prep. Plant
P-3233 R-21
Basin 018E Revaluation/Modification

4.8 Inches, 25 Year - 6 Hour

SCS 6 Hour

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:	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	4.4400
5.50	4.6320
6.00	4.8000

Peak 30-minute Intensity: 3.552 in/hr

Particle Size Distribution:

Size (mm)	Refuse	Reclaimed
9.5000	56.710%	100.000%
8.7500	37.430%	99.800%
2.0000	19.740%	96.000%
0.8500	9.670%	95.000%
0.4250	4.620%	94.000%
0.2500	2.490%	92.000%
0.1060	1.130%	71.000%
0.0750	0.970%	46.000%
0.0500	0.900%	42.000%
0.0300	0.800%	31.000%
0.0100	0.600%	12.000%
0.0050	0.400%	7.000%
0.0010	0.200%	2.000%

Size (mm)	Refuse	Reclaimed
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 018E Re-evaluation Modification

#1
Pond

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	77.690	77.690	173.58	17.84	12,640.4	728,444	578.65	332.84
	Out			149.16	17.84	83.7	5,610	0.16	0.10

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
9.5000	63.014%	100.000%
8.7500	41.591%	100.000%
2.0000	21.934%	100.000%
0.8500	10.745%	100.000%
0.4250	5.134%	100.000%
0.2500	2.767%	100.000%
0.1060	1.256%	100.000%
0.0750	1.078%	100.000%
0.0500	1.000%	100.000%
0.0300	0.889%	100.000%
0.0100	0.667%	100.000%
0.0050	0.444%	67.100%
0.0010	0.222%	33.550%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

BASIN 018E Re-evaluation Modification

Pond Inputs:

Initial Pool Elev:	551.00 ft
Initial Pool:	2.53 ac-ft
*Sediment Storage:	6.30 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)
551.00	10.00	2.00:1	2.00:1	25.00

Pond Results:

Peak Elevation:	552.57 ft
H'graph Detention Time:	0.33 hrs
Pond Model:	CSTRS
Dewater Time:	0.60 days
Trap Efficiency:	99.34 %

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)	
548.90	1.144	0.000	0.000		Top of Sed. Storage
549.00	1.149	0.112	0.000		
549.50	1.179	0.694	0.000		
550.00	1.209	1.291	0.000		
550.50	1.238	1.903	0.000		
551.00	1.268	2.529	0.000		Spillway #1
551.50	1.298	3.171	5.142	10.50	
552.00	1.328	3.827	66.760	3.35	
552.50	1.357	4.498	137.574	0.40	
552.57	1.361	4.591	149.156	0.10	Peak Stage
553.00	1.387	5.184	223.036		
553.50	1.417	5.885	324.530		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
554.00	1.447	6.601	441.596	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
548.90	0.000	0.000
549.00	0.000	0.000
549.50	0.000	0.000
550.00	0.000	0.000
550.50	0.000	0.000
551.00	0.000	0.000
551.50	5.142	5.142
552.00	66.760	66.760
552.50	137.574	137.574
553.00	223.036	223.036
553.50	324.530	324.530
554.00	441.596	441.596

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	53.000	0.240	0.018	0.319	81.000	F	116.38	11.806
	2	23.000	0.122	0.000	0.000	81.000	F	61.57	5.356
	3	1.690	0.001	0.000	0.000	100.000	F	6.05	0.674
	Σ	**77.690**						**173.58**	**17.836**

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	0.280	135.00	40.00	0.9000	1.0000	1	11,922.7	803,419	638.19	443.66
	2	0.240	200.00	8.00	0.9000	1.0000	1	724.2	152,185	120.98	75.52
	3	0.240	2.00	0.01	0.0010	1.0000	1	0.0	1	0.00	0.00
	Σ							**12,640.4**	**728,444**	**578.65**	**332.84**

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	13.64	150.00	1,100.00	11.070	0.027
		8. Large gullies, diversions, and low flowing streams	0.24	2.45	1,020.83	1.460	0.194
#1	**1**	**Time of Concentration:**					**0.240**
#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	1.57	22.00	1,400.02	3.760	0.103
#1	**2**	**Time of Concentration:**					**0.122**

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	1.00	2.00	200.00	3.000	0.018

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**1**	**Muskingum K:**					**0.018**