CONSTRUCTION PLANS
BOTTOM ASH POND 2

Sherburne County (Sherco) Generating Station
Becker, Minnesota
Carlson McCain Project No.: 3404-19

Prepared for:

Xcel Energy, Inc.

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15650 36TH AVENUE N, SUITE 110
PLYMOUTH, MN 55446

TEL 952.346.3900
FAX 952.346.3901

CARLSONMCCAIN.COM

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1.0 INTRODUCTION

This report presents the information required for the construction plans for Bottom Ash Pond No. 2 (BAP2) at the Sherburne County Generating Plant (Sherco) in Becker, Minnesota. The Bottom Ash Pond No. 2 is a "new coal combustion residual (CCR) surface impoundment" according to 40 CFR §257.53. This document addresses the requirements of 40 CFR §257.74(c), i.e. Construction Plans for new CCR surface impoundments, and demonstrates compliance with the requirements for the Bottom Ash Pond No. 2.

1.1 Requirements of Construction Plans

40 CFR §257.74(c) states the following:

(c)…The owner or operator unit must compile the design and construction plans for the CCR unit, which must include, to the extent feasible, the information specified in paragraphs (c)(1)(i) through (xi) of this section:

(i) The name and address of the person(s) owning or operating the CCR unit;

BAP2 is owned and operated by Xcel Energy and located at 13999 Industrial Blvd, Becker, MN 55308.

(ii) The location of the CCR unit identified on the most recent USGS 7 ½ minute or 15-minute topographic quadrangle map.

A USGS Map is attached as Figure 1

(iii) A statement of the purpose for which the CCR unit is being used.

BAP2 is designed to hold bottom ash and ash transport water generated by the operation of Generating Units 1, 2, and 3. Bottom ash and ash transport water will be discharged to the pond through four sluice pipes located on the west side of the BAP2. Ash contact water decants through the primary discharge pipe controlled by a motor-operated valve in the Unit 3 control room. Water from BAP2 outlets to the Recycle Basin where water is returned to the plant for re-use.

(iv) The name and size in acres of the watershed within which the CCR unit is located.

BAP2 is located in Mississippi River – St. Cloud watershed, which is 691,200 Acres

(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

The BAP2 is located in the Anoka sand plain region and the native soils consist of coarse sand with some gravel near the surface and intermittent glacial till approximately 20 to 30 feet below ground. This surficial geology provides a stable foundation and good source of dike construction materials.

Foundation material for BAP was obtained from within the pond base and surrounding borrow areas. This material, referred to as common fill, was excavated, hauled, spread in to 12-inch thick maximum loose lifts, watered (from a nearby fill station that discharges river water), and compacted using a smooth-drum roller. In-place moisture-density tests were performed on the compacted foundation material at a rate of once per 3,000 cubic yards by an independent contractor to verify the material was placed at or above the 95% standard proctor density specification. Any tests that did not meet the minimum density were watered and/or re-compacted and re-tested until all tests passed. A summary of all the standard proctor and in-place moisture density tests is attached as Appendix A.

(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of the site preparation and construction of each successive stage of construction of the CCR unit

The entire dike is constructed out of compacted native sandy soils, and does not contain separate zones. The soils used for this project are fairly uniform and are classified as poorly graded sand (SP) or poorly graded sand and silty sand (SP-SM) by the Unified Soil Classification System (USCS). The the exterior is stabilized by topsoil and vegetation, and the interior protected by composite liner covered that will be covered by hydraulically sluiced bottom ash once in operation.

(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation

Signed Plans for Construction of BAP2 are attached as Appendix B and contain all the pertinent items listed in §257.74(c)(1)(vii). The normal operating pool surface will vary from an elevation of 965 feet mean sea level (MSL) to approximately 980 feet (MSL). The maximum pool surface elevation following peak discharge from the inflow design flood will be 0.92 feet above the operating elevation at that time. The maximum operational elevation will be 989 feet MSL, which is the elevation of the secondary outlet pipe (spillway). The depth of CCR from maximum operation level to the lowest elevation of the pond would be 53.8 feet.

(viii) A description of the type, purpose, and location of existing instrumentation.

Two redundant level transmitters are used to monitor and control pond water level. The transmitters measure pond head pressure on the 24-inch primary discharge pipe located in the pond vault. The level readings are connected to the Sherco Data Control System (DCS), and are used to monitor and automatically control pond water levels by opening and closing the motor-operated control valve. They also will alarm whenever the level is too high or too low, letting plant operators know that corrective actions need to be taken. The high-level alarm will be used when the level is approaching the secondary outlet pipe (elevation 989 feet MSL). The low-level alarm will be used to warn of insufficient water volume in the pond (less than 965 feet MSL), which could plug the outlet pipe with ash carryover, or winter ice formation.

An ultrasonic level transmitter is installed in the wet well of the vault where the pond outlet pipe discharges. It will be used by the DCS to monitor the water level in the 30-inch pipe that drains into the Recycle Basin. A high-level alarm will indicate that there may be a restriction in the pipe to the Recycle Basin. A low-level alarm will be used to warn of a possible restriction in the BAP outlet pipe or a control valve problem.

There are other DCS alarms located in the vault for the HVAC system, electrical power, control valve and for a high-water level in the basement sump.

(ix) Area-Capacity Curves for the CCR unit.

An Area-Capacity Curve for BAP2 is attached as Appendix C.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

BAP2 was designed and constructed with two outlet pipes, a primary discharge pipe that will be used to control the water level in the pond, and secondary outlet pipe that serves as a spillway should the primary pipe become inoperable. The primary pipe is constructed out of 24-inch SDR 11 high density polyethylene (HDPE), with an inlet invert elevation at 964.5 feet mean sea level (MSL). The water level in the BAP2 will be controlled using a motor-operated valve (MOV) in the vault located at the outlet of the pipe. Water level in the BAP2 will be raised and lowered by the plant using the MOV to control CCR deposition. The secondary pipe, also constructed of 24-inch SDR 11 HDPE, has an invert elevation of 989 feet MSL (5 feet below crest), and outlets to the vault. The secondary pipe does not feature any valves and was designed as an overflow pipe.

Bottom ash and transport water is sluiced from the plant to BAP2 by four pipes, two primary and two backup pipes. Each primary pipe runs in a 6-hour on, 6-hour off rotation, 24-hours a day. In general, the start and stop times of the pipes are staggered so only one pipe is running at a time, discharging either 5,000 gallons per minute (gpm) or 6,000 gpm (depending on the pipe), for an

average of 5,500 gpm per day. However, during some hours of the day both pipes will run and discharge 11,000 gpm in to the pond. As shown in Appendix D the secondary outlet pipe can flow 29,264 gpm at full capacity. If BAP2 water level was at the secondary pipe outlet elevation of 989 feet MSL *and* experienced a 1,000-year, 24-hour storm event (design event for significant hazard), the pond would be able to safely pass the water to the Recycle Basin.

A worksheet showing the flow calculation using Manning's equation and a HydroCAD stormwater model using a 1000-year, 24-hour storm event and 5,500 gpm base flow can be found in Appendix D.

(xi) The construction specifications and provisions for surveillance, maintenance and repair of the CCR unit

The construction specifications for BAP2 area attached as Appendix E. BAP2 lies within a barbed wire perimeter fence with monitored entry and exit points. Maintenance and repair of BAP2 will be performed, as needed, by the Laborers and Operators retained by Sherco.

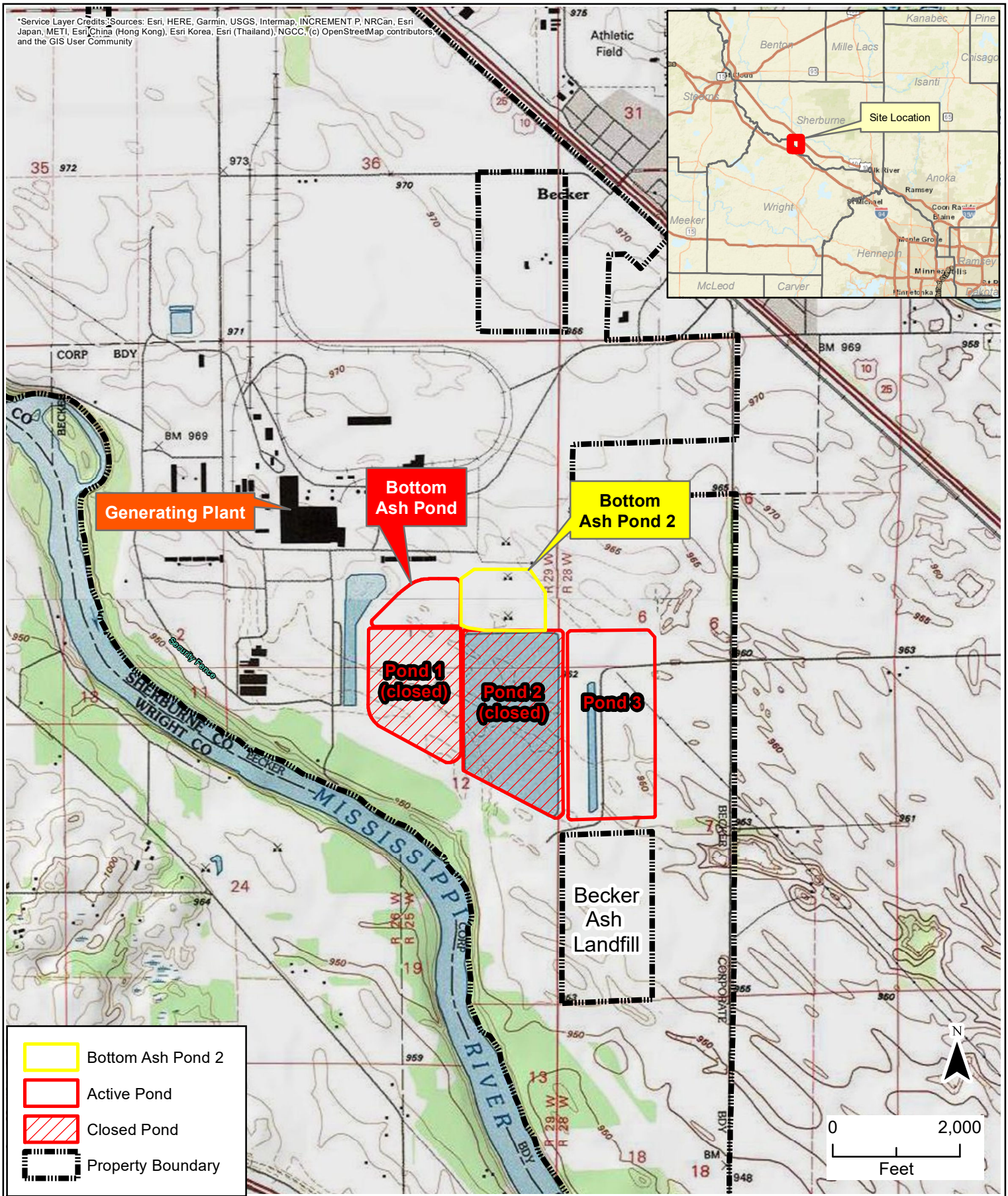
(xii) Any record or knowledge of structural instability of the CCR unit.

There has been no record or knowledge of structural instability of BAP2.

2.0 CONCLUSION

As demonstrated by the information in this report, Sherco Bottom Ash Pond 2 was designed and constructed in accordance with the requirements of §257.74(c).

FIGURE



Document Path: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\GIS\Figure 1 - Site LocationMap Construction.mxd

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CONSTRUCTION PLAN
BOTTOM ASH POND 2

Xcel Energy®

Sherburne County Generating Plant
Becker, Minnesota

FIGURE 1

SITE LOCATION MAP

APPENDIX A – SUMMARY OF FOUNDATION MATERIAL IN-PLACE MOISTURE-DENSITY TESTING

Common Fill In-Place Moisture-Density Testing Summary
2020 Bottom Ash Pond No. 2 Construction

ITT SAMPLE NO.	SAMPLE COLL. DATE	SOIL CLASSIFICATION	SAMPLE COLLECTION TEST LOCATION			NUCLEAR IN-PLACE DRY DENSITY (PCF)	NUCLEAR IN-PLACE MOISTURE (%)	SOIL PROCTOR ID	PROCTOR MAX DRY DENSITY (PCF)	PROCTOR OPTIMUM MOISTURE (%)	REL. COMP. (%)	SPEC. COMP. (%)	TEST RESULT (PASS/FAIL)	# OF PASSING TESTS	Comment
			NORTHING	EASTING	ELEVATION										
P-1	9/26/19	SP	-	-	-	-	-	P-1	112.2	12.7	-	-	-	-	Common Fill Proctor (tested by ITT)
P-2	9/26/19	SP	-	-	-	-	-	P-2	115.2	13.0	-	-	-	-	Common Fill Proctor (tested by ITT)
P-3	9/26/19	SP	-	-	-	-	-	P-3	114.3	12.8	-	-	-	-	Common Fill Proctor (tested by ITT)
P-4	10/8/19	SP-SM	-	-	-	-	-	P-4	119.8	10.6	-	-	-	-	Common Fill Proctor (tested by ITT)
1	9/27/19	SP	866177.11	2029323.25	965.80	112.3	5.8	P-3	114.3	12.8	98%	95%	PASS	1	
2	9/27/19	SP	866135.65	2029463.55	967.60	115.9	6.3	P-2	115.2	13.0	101%	95%	PASS	2	
3	10/1/19	SP	866216.65	2029290.50	967.50	112.1	5.9	P-2	115.2	13.0	97%	95%	PASS	3	
4	10/1/19	SP	866213.45	2029426.55	969.20	113.7	7.1	P-2	115.2	13.0	99%	95%	PASS	4	
5	10/1/19	SP	866200.20	2029574.85	971.15	114.8	8.2	P-2	115.2	13.0	100%	95%	PASS	5	
6	10/2/19	SP	866163.00	2029226.15	970.25	115.3	2.8	P-2	115.2	13.0	100%	95%	PASS	6	
7	10/2/19	SP	866115.00	2029377.35	972.50	114.0	4.7	P-2	115.2	13.0	99%	95%	PASS	7	
8	10/2/19	SP	866146.80	2029543.70	968.00	115.1	5.7	P-2	115.2	13.0	100%	95%	PASS	8	
9	10/8/19	SP-SM	866181.70	2029639.10	973.00	113.7	5.6	P-4	119.8	10.6	95%	95%	PASS	9	
10	10/8/19	SP-SM	866165.60	2029568.80	978.65	113.9	7.9	P-4	119.8	10.6	95%	95%	PASS	10	
11	10/8/19	SP-SM	866165.50	2029404.60	980.40	114.8	5.7	P-4	119.8	10.6	96%	95%	PASS	11	
12	10/11/19	SP-SM	866172.00	2029048.90	987.00	118.0	7.2	P-4	119.8	10.6	98%	95%	PASS	12	
13	10/11/19	SP-SM	866180.25	2029323.12	988.00	119.7	6.3	P-4	119.8	10.6	100%	95%	PASS	13	
14	10/11/19	SP-SM	866188.05	2029445.20	986.00	119.9	5.2	P-4	119.8	10.6	100%	95%	PASS	14	
15	10/14/19	SP-SM	865907.70	2029037.90	993.00	118.1	6.0	P-4	119.8	10.6	99%	95%	PASS	15	
16	10/14/19	SP-SM	866042.40	2029056.70	990.00	120.3	7.1	P-4	119.8	10.6	100%	95%	PASS	16	
17	10/14/19	SP-SM	866122.60	2029048.60	991.00	119.2	5.2	P-4	119.8	10.6	99%	95%	PASS	17	
18	10/14/19	SP-SM	866180.10	2029437.40	989.00	120.5	4.0	P-4	119.8	10.6	101%	95%	PASS	18	
19	10/14/19	SP-SM	866192.40	2029505.70	985.00	119.2	3.9	P-4	119.8	10.6	99%	95%	PASS	19	
20	10/14/19	SP-SM	866199.30	2029539.40	983.00	120.6	4.4	P-4	119.8	10.6	101%	95%	PASS	20	
21	10/14/19	SP-SM	866204.50	2029566.00	981.00	121.0	4.0	P-4	119.8	10.6	101%	95%	PASS	21	
22	10/16/19	SP	866300.00	2029970.00	958.00	109.9	2.1	P-1	112.2	12.7	98%	98%	PASS	22	Vault Building, center of pad
23	10/16/19	SP-SM	866141.80	2029132.80	998.75	119.7	3.5	P-4	119.8	10.6	100%	95%	PASS	23	
24	10/16/19	SP-SM	866119.00	2029578.85	984.00	120.7	2.9	P-4	119.8	10.6	101%	95%	PASS	24	
25	10/16/19	SP-SM	866078.20	2029949.50	964.00	120.6	4.5	P-4	119.8	10.6	101%	95%	PASS	25	
26	10/16/19	SP-SM	866091.00	2029748.25	974.00	118.4	5.0	P-4	119.8	10.6	99%	95%	PASS	26	
27	10/22/19	SP-SM	865976.30	2030131.50	956.25	117.2	6.7	P-4	119.8	10.6	98%	95%	PASS	27	
28	10/22/19	SP-SM	865844.90	2030095.60	954.35	116.3	6.8	P-4	119.8	10.6	97%	95%	PASS	28	
29	10/22/19	SP-SM	865735.20	2030033.40	953.00	114.8	8.2	P-4	119.8	10.6	96%	95%	PASS	29	
30	10/22/19	SP-SM	866142.20	2029964.10	965.00	116.4	7.3	P-4	119.8	10.6	97%	95%	PASS	30	
31	10/25/19	SP	865942.60	2030276.50	962.00	114.1	2.5	P-2	115.2	13.0	99%	95%	PASS	31	
32	10/25/19	SP	865799.10	2030114.00	960.30	110.0	4.3	P-2	115.2	13.0	95%	95%	PASS	32	
33	10/25/19	SP	865621.80	2030090.00	961.00	112.8	2.7	P-2	115.2	13.0	98%	95%	PASS	33	
34	10/25/19	SP	865609.60	2030010.60	958.00	111.0	2.9	P-2	115.2	13.0	96%	95%	PASS	34	
35	11/1/19	SP	865980.20	2030092.60	961.00	114.7	2.3	P-2	115.2	13.0	100%	95%	PASS	35	
36	11/1/19	SP	865924.10	2030039.20	960.00	113.2	2.8	P-2	115.2	13.0	98%	95%	PASS	36	
37	11/1/19	SP	865815.20	2030028.10	963.00	109.5	2.5	P-2	115.2	13.0	95%	95%	PASS	37	

Common Fill In-Place Moisture-Density Testing Summary
2020 Bottom Ash Pond No. 2 Construction

ITT SAMPLE NO.	SAMPLE COLL. DATE	SOIL CLASSIFICATION	SAMPLE COLLECTION TEST LOCATION			NUCLEAR IN-PLACE DRY DENSITY (PCF)	NUCLEAR IN-PLACE MOISTURE (%)	SOIL PROCTOR ID	PROCTOR MAX DRY DENSITY (PCF)	PROCTOR OPTIMUM MOISTURE (%)	REL. COMP. (%)	SPEC. COMP. (%)	TEST RESULT (PASS/FAIL)	# OF PASSING TESTS	Comment
			NORTHING	EASTING	ELEVATION										
38	11/1/19	SP-SM	865692.90	2030028.70	964.00	118.3	6.9	P-4	119.8	10.6	99%	95%	PASS	38	
39	11/1/19	SP-SM	865555.30	2030032.50	962.00	117.5	2.4	P-4	119.8	10.6	98%	95%	PASS	39	
40	11/1/19	SP-SM	865608.90	2030131.10	965.00	120.1	6.1	P-4	119.8	10.6	100%	95%	PASS	40	
41	11/1/19	SP	865992.10	2030151.40	962.00	111.6	1.9	P-2	115.2	13.0	97%	95%	PASS	41	
42	11/1/19	SP	866187.50	2029981.70	966.00	112.4	3.2	P-2	115.2	13.0	98%	95%	PASS	42	
43	11/1/19	SP	866187.00	2029837.50	975.00	114.0	3.4	P-2	115.2	13.0	99%	95%	PASS	43	
44	11/1/19	SP-SM	866183.30	2029746.60	978.00	117.7	4.1	P-4	119.8	10.6	98%	95%	PASS	44	
45	11/1/19	SP-SM	866170.00	2029634.90	982.00	119.5	3.4	P-4	119.8	10.6	100%	95%	PASS	45	
46	11/1/19	SP-SM	866100.60	2029694.30	980.00	118.0	3.9	P-4	119.8	10.6	98%	95%	PASS	46	
47	11/1/19	SP-SM	866088.50	2029789.20	976.00	117.4	2.1	P-4	119.8	10.6	98%	95%	PASS	47	
48	11/1/19	SP-SM	865403.30	2029498.00	997.00	116.5	3.1	P-4	119.8	10.6	97%	95%	PASS	48	
49	11/1/19	SP	865475.90	2029380.20	977.00	109.3	5.5	P-2	115.2	13.0	95%	95%	PASS	49	
50	11/1/19	SP	865411.40	2029205.80	999.00	110.7	3.3	P-2	115.2	13.0	96%	95%	PASS	50	
51	11/1/19	SP	865484.20	2029051.90	991.00	113.1	3.4	P-2	115.2	13.0	98%	95%	PASS	51	
52	11/8/19	SP-SM	865863.10	2030234.50	965.00	113.7	4.7	P-4	119.8	10.6	95%	95%	PASS	52	
53	11/8/19	SP-SM	865693.20	2030231.70	967.00	118.9	3.7	P-4	119.8	10.6	99%	95%	PASS	53	
54	11/8/19	SP-SM	865527.80	2030242.40	966.00	117.6	2.2	P-4	119.8	10.6	98%	95%	PASS	54	
55	11/8/19	SP-SM	865576.30	2030032.10	964.00	114.2	2.0	P-4	119.8	10.6	95%	95%	PASS	55	
56	11/8/19	SP-SM	865717.60	2030108.70	967.00	115.1	4.8	P-4	119.8	10.6	96%	95%	PASS	56	
57	11/8/19	SP-SM	865835.80	2030045.20	967.00	114.6	2.8	P-4	119.8	10.6	96%	95%	PASS	57	
58	11/8/19	SP-SM	865905.70	2030029.90	962.00	115.3	2.1	P-4	119.8	10.6	96%	95%	PASS	58	
59	11/8/19	SP-SM	865967.90	2030002.80	960.00	114.7	1.8	P-4	119.8	10.6	96%	95%	PASS	59	
60	11/8/19	SP-SM	866044.50	2029983.60	960.00	114.9	2.5	P-4	119.8	10.6	96%	95%	PASS	60	
61	11/8/19	SP-SM	866079.20	2030065.90	961.00	117.2	3.6	P-4	119.8	10.6	98%	95%	PASS	61	
62	11/13/19	SP	866208.30	2029977.20	968.00	112.1	2.3	P-1	112.2	12.7	100%	100%	PASS	62	Backfill to pipe spring line
63	11/13/19	SP	866097.90	2029984.20	969.00	112.2	2.3	P-1	112.2	12.7	100%	100%	PASS	63	Backfill to pipe spring line
64	11/13/19	SP	866147.20	2029984.30	967.50	112.2	2.0	P-1	112.2	12.7	100%	100%	PASS	64	Backfill to pipe spring line
65	11/18/19	SP-SM	866303.50	2029988.10	963.40	116.2	1.9	P-4	119.8	10.6	97%	95%	PASS	65	
66	11/18/19	SP	866260.50	2029973.60	966.50	103.6	3.2	P-1	112.2	12.7	92%	100%	FAIL	65	Backfill to pipe spring line
67	11/18/19	SP	866190.60	2029972.50	969.00	106.2	2.1	P-1	112.2	12.7	95%	100%	FAIL	65	Backfill to pipe spring line
68	11/18/19	SM	866059.90	2030207.40	969.00	129.4	3.2	P-5	133.6	8.3	97%	95%	PASS	66	
69	11/18/19	SM	865915.20	2030228.30	972.00	128.9	3.1	P-5	133.6	8.3	96%	95%	PASS	67	
70	11/18/19	SM	865765.80	2030227.90	973.00	126.9	2.9	P-5	133.6	8.3	95%	95%	PASS	68	
71	11/18/19	SM	865595.20	2030222.80	971.00	129.7	5.4	P-5	133.6	8.3	97%	95%	PASS	69	
72	11/18/19	SM	865504.80	2030147.80	970.00	127.3	2.6	P-5	133.6	8.3	95%	95%	PASS	70	
73	11/18/19	SP-SM	865582.10	2030045.90	968.00	115.7	2.0	P-4	119.8	10.6	97%	95%	PASS	71	
74	11/18/19	SP-SM	865764.20	2030111.60	973.00	117.9	4.0	P-4	119.8	10.6	98%	95%	PASS	72	
75	11/18/19	SM	865806.20	2030182.30	969.50	127.6	2.2	P-5	133.6	8.3	96%	95%	PASS	73	
76	11/18/19	SM	865939.70	2030161.70	968.00	128.2	3.2	P-5	133.6	8.3	96%	95%	PASS	74	
77	11/18/19	SP	866164.60	2029975.30	968.50	106.6	2.5	P-1	112.2	12.7	95%	100%	FAIL	74	Retest of 67; backfill to pipe spring line
78	11/18/19	SP	866160.20	2029975.30	967.80	109.1	2.8	P-1	112.2	12.7	97%	100%	FAIL	74	Retest of 67 & 77; backfill to pipe spring line

Common Fill In-Place Moisture-Density Testing Summary
2020 Bottom Ash Pond No. 2 Construction

ITT SAMPLE NO.	SAMPLE COLL. DATE	SOIL CLASSIFICATION	SAMPLE COLLECTION TEST LOCATION			NUCLEAR IN-PLACE DRY DENSITY (PCF)	NUCLEAR IN-PLACE MOISTURE (%)	SOIL PROCTOR ID	PROCTOR MAX DRY DENSITY (PCF)	PROCTOR OPTIMUM MOISTURE (%)	REL. COMP. (%)	SPEC. COMP. (%)	TEST RESULT (PASS/FAIL)	# OF PASSING TESTS	Comment
			NORTHING	EASTING	ELEVATION										
79	11/18/19	SP	866255.90	2029974.60	965.00	102.4	3.3	P-1	112.2	12.7	91%	100%	FAIL	74	Retest of 66; backfill to pipe spring line
79A	11/18/19	SP	866255.90	2029974.60	965.00	111.9	10.4	P-1	112.2	12.7	100%	100%	PASS	75	Retest of 66 & 79; backfill to pipe spring line
80	11/18/19	SP	866165.80	2029983.80	966.90	114.3	10.9	P-1	112.2	12.7	102%	100%	PASS	76	Retest of 67, 77, & 78; backfill to pipe spring line
81	11/19/19	SM	866233.90	2029979.90	967.80	134.9	4.9	P-5	133.6	8.3	101%	100%	PASS	77	Backfill to pipe spring line
82	11/19/19	SM	866232.60	2029940.90	968.00	133.5	5.6	P-5	133.6	8.3	100%	95%	PASS	78	
83	11/19/19	SM	866135.40	2030069.50	967.00	129.6	4.6	P-5	133.6	8.3	97%	95%	PASS	79	
84	11/19/19	SP-SM	865969.70	2030175.40	971.00	117.4	2.4	P-4	119.8	10.6	98%	95%	PASS	80	
85	11/19/19	SP-SM	865858.80	2030179.70	974.00	118.7	4.8	P-4	119.8	10.6	99%	95%	PASS	81	
86	11/25/19	SP	865476.50	2029037.50	994.60	109.5	8.9	P-2	115.2	13.0	95%	95%	PASS	82	
87	11/25/19	SP	865533.90	2029036.50	994.00	109.6	6.1	P-2	115.2	13.0	95%	95%	PASS	83	
88	11/25/19	SM	866181.30	2030143.20	971.00	128.6	4.3	P-5	133.6	8.3	96%	95%	PASS	84	
89	11/25/19	SM	866210.20	2030039.70	970.00	131.9	2.3	P-5	133.6	8.3	99%	95%	PASS	85	
90	11/25/19	SM	866037.50	2030151.50	972.00	127.7	4.2	P-5	133.6	8.3	96%	95%	PASS	86	
91	11/25/19	SM	865902.70	2030139.90	974.00	127.1	2.8	P-5	133.6	8.3	95%	95%	PASS	87	
92	11/25/19	SM	865671.60	2030180.80	977.00	128.2	2.8	P-5	133.6	8.3	96%	95%	PASS	88	
93	11/25/19	SM	865552.90	2030153.60	973.00	133.3	5.9	P-5	133.6	8.3	100%	95%	PASS	89	
94	11/25/19	SP	865656.10	2029037.30	994.40	115.4	4.0	P-2	115.2	13.0	100%	95%	PASS	90	
95	12/4/19	SP	866154.00	2030023.00	978.60	116.0	7.0	P-2	115.2	13.0	101%	95%	PASS	91	
96	12/4/19	SP	866239.00	2029813.00	983.00	112.4	6.7	P-2	115.2	13.0	98%	95%	PASS	92	
97	12/4/19	SP	866194.00	2029649.00	983.30	110.6	8.1	P-2	115.2	13.0	96%	95%	PASS	93	
98	12/6/19	SP	866147.00	2029800.00	991.00	111.1	6.9	P-2	115.2	13.0	96%	95%	PASS	94	
99	12/6/19	SP	866157.00	2029646.00	911.60	129.6	7.2	P-5	133.6	8.3	97%	95%	PASS	95	
100	4/1/20	SP-SM	866084.80	2030136.70	977.00	120.0	4.9	P-4	119.8	10.6	100%	95%	PASS	96	
101	4/1/20	SP-SM	865995.20	2030182.10	980.30	117.2	3.9	P-4	119.8	10.6	98%	95%	PASS	97	
102	4/1/20	SP-SM	865900.90	2030122.30	979.80	117.9	5.8	P-4	119.8	10.6	98%	95%	PASS	98	
103	4/1/20	SP-SM	865659.70	2030159.30	979.10	113.9	4.3	P-4	119.8	10.6	95%	95%	PASS	99	
104	4/1/20	SM	865455.10	2030177.80	986.00	123.9	6.5	P-5	133.6	8.3	93%	95%	FAIL	99	
104A	4/1/20	SP-SM	865455.10	2030177.80	986.00	113.8	5.8	P-4	119.8	10.6	95%	95%	PASS	100	Retest of 104
105	4/1/20	SP-SM	865371.20	2030350.50	1008.10	115.5	5.3	P-4	119.8	10.6	96%	95%	PASS	101	
106	4/1/20	SP-SM	865402.60	2030360.70	1001.60	116.1	6.0	P-4	119.8	10.6	97%	95%	PASS	102	
107	4/6/20	SP-SM	865463.50	2030000.80	985.50	129.4	4.2	P-6	136.2	7.9	95%	95%	PASS	103	
108	4/6/20	SP-SM	865427.20	2029976.20	989.40	120.9	3.8	P-4	119.8	10.6	101%	95%	PASS	104	
109	4/6/20	SP-SM	865521.60	2030129.10	979.20	132.7	3.2	P-6	136.2	7.9	97%	95%	PASS	105	
110	4/8/20	SP	865420.20	2030234.50	997.45	112.5	6.9	P-2	115.2	13.0	95%	95%	PASS	106	
111	4/8/20	SP	865468.10	2030113.00	988.60	113.6	4.6	P-2	115.2	13.0	99%	95%	PASS	107	
112	4/8/20	SP	865414.00	2030003.30	994.20	113.4	5.0	P-2	115.2	13.0	98%	95%	PASS	108	
113	4/8/20	SP	866312.70	2029933.70	961.50	112.4	9.4	P-1	112.2	12.7	100%	100%	PASS	109	Backfill to pipe spring line
114	4/8/20	SP	866306.60	2029448.40	960.60	112.6	11.1	P-1	112.2	12.7	100%	100%	PASS	110	Backfill to pipe spring line
115	4/9/20	SP	866293.00	2028946.00	959.70	112.7	10.7	P-1	112.2	12.7	95%	95%	PASS	111	Backfill over pipe
116	4/9/20	SP	866312.00	2028516.00	958.10	112.7	12.2	P-1	112.2	12.7	100%	95%	PASS	112	Backfill over pipe
117	4/9/20	SP-SM	866016.00	2030142.00	981.80	117.3	3.2	P-4	119.8	10.6	98%	95%	PASS	113	

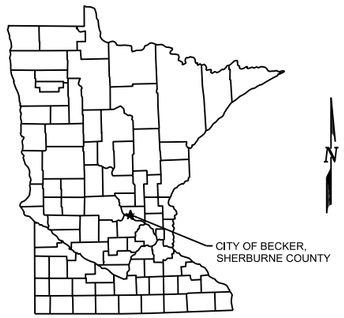
Common Fill In-Place Moisture-Density Testing Summary
2020 Bottom Ash Pond No. 2 Construction

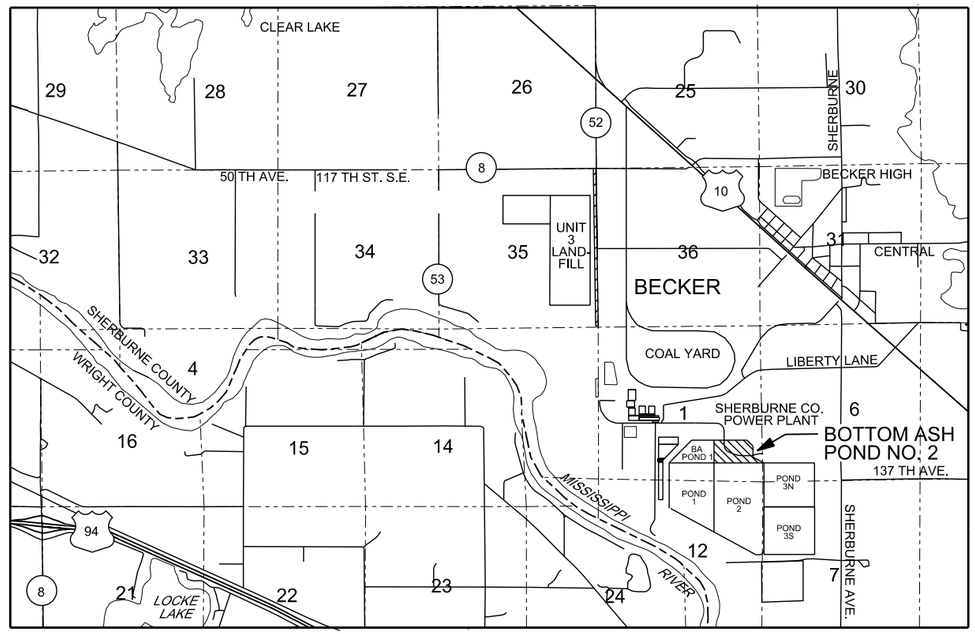
ITT SAMPLE NO.	SAMPLE COLL. DATE	SOIL CLASSIFICATION	SAMPLE COLLECTION TEST LOCATION			NUCLEAR IN-PLACE DRY DENSITY (PCF)	NUCLEAR IN-PLACE MOISTURE (%)	SOIL PROCTOR ID	PROCTOR MAX DRY DENSITY (PCF)	PROCTOR OPTIMUM MOISTURE (%)	REL. COMP. (%)	SPEC. COMP. (%)	TEST RESULT (PASS/FAIL)	# OF PASSING TESTS	Comment
			NORTHING	EASTING	ELEVATION										
118	4/9/20	SP-SM	865828.00	2030143.00	985.90	122.0	2.9	P-4	119.8	10.6	102%	95%	PASS	114	
119	4/14/20	SP	865580.00	2030173.00	988.60	112.2	2.7	P-2	115.2	13.0	97%	95%	PASS	115	
120	4/14/20	SP	865711.00	2030177.00	989.00	112.8	3.2	P-2	115.2	13.0	98%	95%	PASS	116	
121	4/14/20	SP	865823.00	2030173.00	989.00	112.2	3.0	P-2	115.2	13.0	97%	95%	PASS	117	
122	4/14/20	SP	866218.00	2029840.00	986.00	111.7	3.4	P-2	115.2	13.0	97%	95%	PASS	118	
123	4/14/20	SP-SM	866162.00	2029828.00	995.00	115.8	3.7	P-4	119.8	10.6	97%	95%	PASS	119	
124	4/14/20	SP	866264.00	2028299.00	957.00	112.3	6.8	P-1	112.2	12.7	100%	100%	PASS	120	Backfill to pipe spring line
125	4/15/20	SP	866170.00	2029969.00	982.00	115.2	4.2	P-2	115.2	13.0	100%	100%	PASS	121	Backfill to pipe spring line
126	4/15/20	SP	866229.00	2029970.00	972.00	115.6	6.2	P-2	115.2	13.0	100%	100%	PASS	122	Backfill to pipe spring line
127	4/15/20	SP-SM	865947.00	2030175.00	987.00	116.9	5.1	P-4	119.8	10.6	98%	95%	PASS	123	
128	4/17/20	SP-SM	865907.00	2030152.00	994.00	121.5	3.9	P-4	119.8	10.6	101%	95%	PASS	124	
129	4/17/20	SP-SM	865737.00	2030146.00	994.00	115.4	3.0	P-4	119.8	10.6	96%	95%	PASS	125	
130	4/22/20	SP-SM	866107.10	2030097.65	993.85	115.5	4.2	P-4	119.8	10.6	96%	95%	PASS	126	
131	4/22/20	SP-SM	866052.20	2030147.65	993.70	117.7	4.0	P-4	119.8	10.6	98%	95%	PASS	127	
132	5/18/20	SP-SM	865577.64	2030137.10	992.40	114.4	4.6	P-4	119.8	10.6	95%	95%	PASS	128	Anchor Trench
133	5/18/20	SP-SM	865731.00	2030140.00	993.00	114.9	4.0	P-4	119.8	10.6	96%	95%	PASS	129	Anchor Trench
134	5/18/20	SP-SM	865969.00	2030139.00	993.00	117.8	2.3	P-4	119.8	10.6	98%	95%	PASS	130	Anchor Trench
135	5/18/20	SP-SM	866151.00	2029972.00	993.40	116.2	3.1	P-4	119.8	10.6	97%	95%	PASS	131	Anchor Trench
136	5/18/20	SP-SM	866144.00	2029743.00	994.40	113.9	3.1	P-4	119.8	10.6	95%	95%	PASS	132	Anchor Trench
137	5/18/20	SP-SM	866137.00	2029369.00	996.00	117.7	3.6	P-4	119.8	10.6	98%	95%	PASS	133	Anchor Trench
138	5/18/20	SP-SM	866130.00	2029082.00	997.80	118.6	2.7	P-4	119.8	10.6	99%	95%	PASS	134	Anchor Trench
139	5/18/20	SP-SM	865471.90	2029020.00	1000.70	113.8	4.8	P-4	119.8	10.6	95%	95%	PASS	135	Anchor Trench
140	5/18/20	SP-SM	865429.00	2029168.00	996.70	118.8	3.5	P-4	119.8	10.6	99%	95%	PASS	136	Anchor Trench
141	5/18/20	SP-SM	865417.00	2029513.00	995.60	114.8	3.8	P-4	119.8	10.6	96%	95%	PASS	137	Anchor Trench
142	5/18/20	SP-SM	865421.00	2029901.00	994.00	113.9	3.7	P-4	119.8	10.6	95%	95%	PASS	138	Anchor Trench

APPENDIX B –CONSTRUCTION PLANS

CONSTRUCTION DRAWINGS
SHERBURNE COUNTY (SHERCO) GENERATING PLANT
BOTTOM ASH POND NO. 2

POND PROJECT NO: SHC11380
& PERMIT: NPDES No. MN0002186
BECKER, MINNESOTA
NORTHERN STATES POWER COMPANY
dba XCEL ENERGY, INC.





SITE LOCATION MAP

SHEET	DRAWING TITLE
	GENERAL
G1	INDEX SHEET
G2	PLANT LAYOUT
G3	POND AREA AND STOCKPILE LAYOUT
	BOTTOM ASH POND NO. 2
BA1	EXISTING CONDITIONS
BA2	LINER AND INTERIOR GRADING PLAN
BA3	STORMWATER MANAGEMENT PLAN
BA4	BA SLUICE LINE PLAN
BA4-MW	WEST EMBANKMENT MONITORING WELL PADS
BA5	VAULT GRADING PLAN
BA6	DISCHARGE OUTLET PIPE PLAN AND PROFILE
BA7	SITE RESTORATION PLAN
BA7A	ACCESS ROAD GRADING PLAN
BA8	DISCHARGE PIPE AND SECONDARY PIPE SECTIONS
BA9	DISCHARGE STRUCTURE SECTIONS
BA10	RECYCLE BASIN OUTLET PIPE AND PIPE PENETRATION DETAIL
BA11	NORTH AND EAST EMBANKMENT SECTIONS
BA12	SOUTH EMBANKMENT SECTIONS
BA13	WEST EMBANKMENT SECTIONS
BA14	WEST EMBANKMENT CONCRETE CHANNEL SECTIONS
BA15	COMPOSITE LINER AND EMBANKMENT DETAILS
BA16	DEWATERING SUMP PLAN AND SECTIONS
BA17	DEWATERING SYSTEM DETAILS
BA18	SOUTHWEST CORNER GRADING PLAN
BA19	SLUICE LINE TRANSITION FROM BAP1
BA20	BOTTOM ASH LINES #2 AND #1 SLUICE PIPE OUTLET PLAN AND SECTION
BA21	BOTTOM ASH LINES #32 AND #31 SLUICE PIPE OUTLET PLAN AND SECTION

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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR
4	SLUICE LINE REV: REVISED BA4, ADDED BA18 - BA21		5/20/20	DJR	XCEL	DJR

Carlson McCain
• ENVIRONMENTAL
• ENGINEERING
• SURVEYING
15650 36th Ave N, Suite 110, Plymouth, MN 55446
Tel | (952) 346-3900 Fax | (952) 346-3901
www.CarlsonMcCain.com

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA
FIRST NAME: DANIEL J. RIGGS
SIGNATURE:
DATE: 5/20/2020 LICENSE# 49559

Xcel Energy®
NORTHERN STATES POWER COMPANY
SHERCO GENERATING PLANT
BECKER, MINNESOTA

DWN: BLP	DATE:	CHK:	DATE:
ENG: DJR	DATE:	CHK:	DATE:
PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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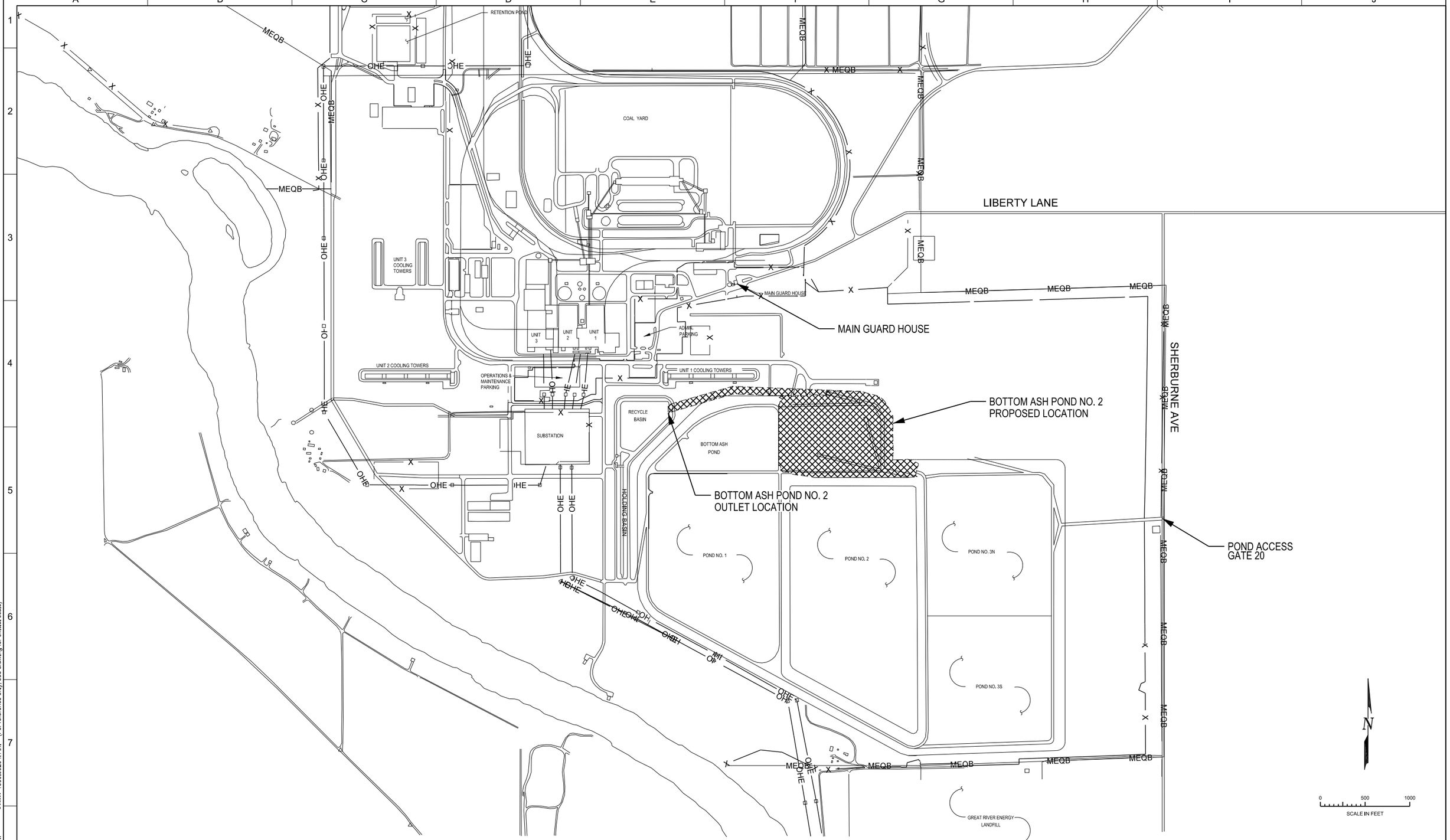
BOTTOM ASH POND NO. 2 NPDES CONSTRUCTION DRAWINGS

INDEX SHEET

G1

REV 4



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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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DATE: 9/16/2019 LICENSE# 49559

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ENG: DJR	DATE:	CHK:	DATE:		
PM: DJR	DATE:	PROJ. NO: SHC11380			
APVD:	DATE:	SCALE: SEE DRAWING			

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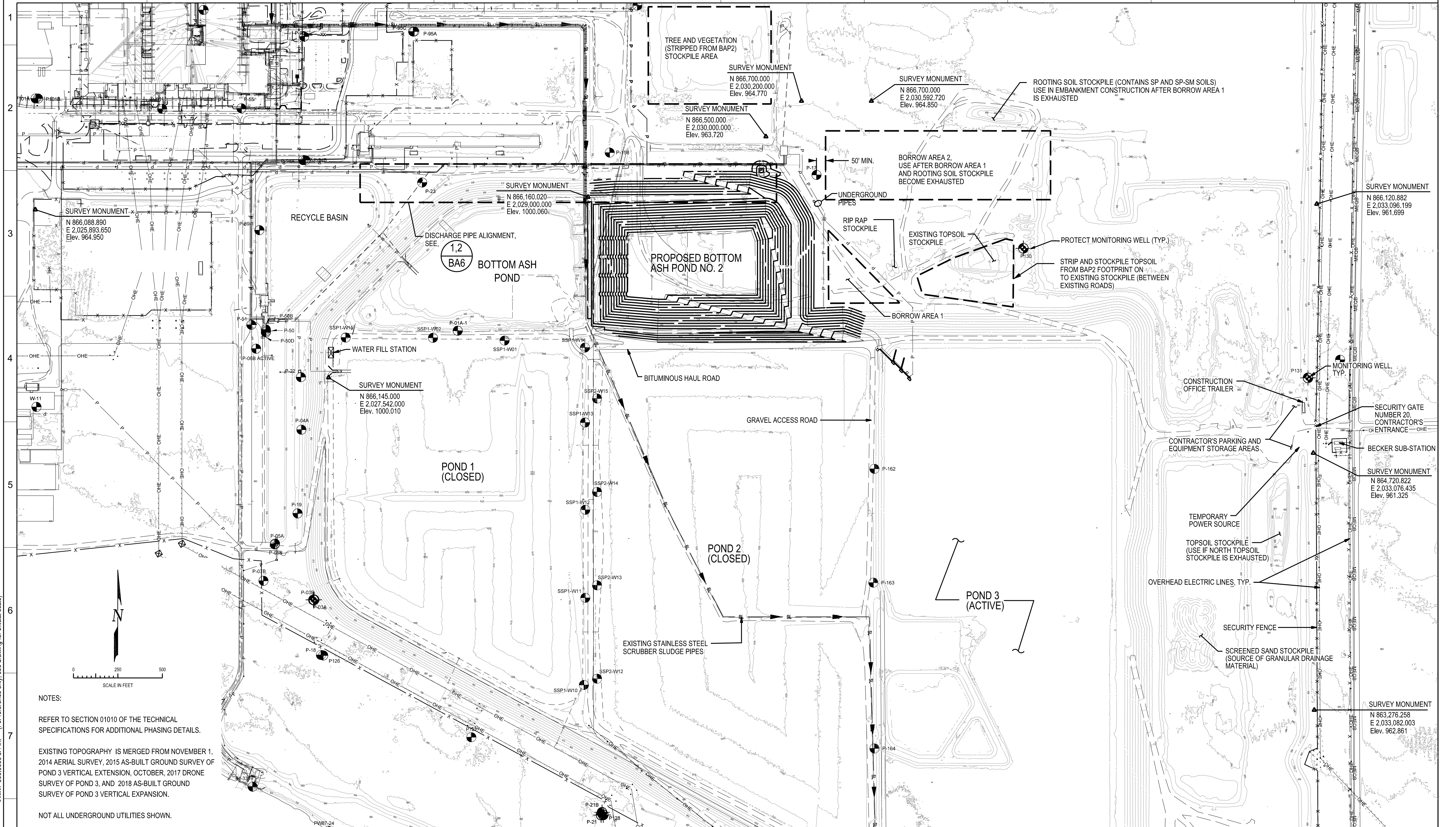
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

PLANT LAYOUT AND PROJECT AREAS

G2

REV 1



NOTES:

REFER TO SECTION 01010 OF THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL PHASING DETAILS.

EXISTING TOPOGRAPHY IS MERGED FROM NOVEMBER 1, 2014 AERIAL SURVEY, 2015 AS-BUILT GROUND SURVEY OF POND 3 VERTICAL EXTENSION, OCTOBER, 2017 DRONE SURVEY OF POND 3, AND 2018 AS-BUILT GROUND SURVEY OF POND 3 VERTICAL EXPANSION.

NOT ALL UNDERGROUND UTILITIES SHOWN.

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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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ENG:	DJR	DATE:	CHK:	DATE:
PM:	DJR	DATE:	PROJ. NO: SHC11380	
APVD:		DATE:	SCALE: SEE DRAWING	

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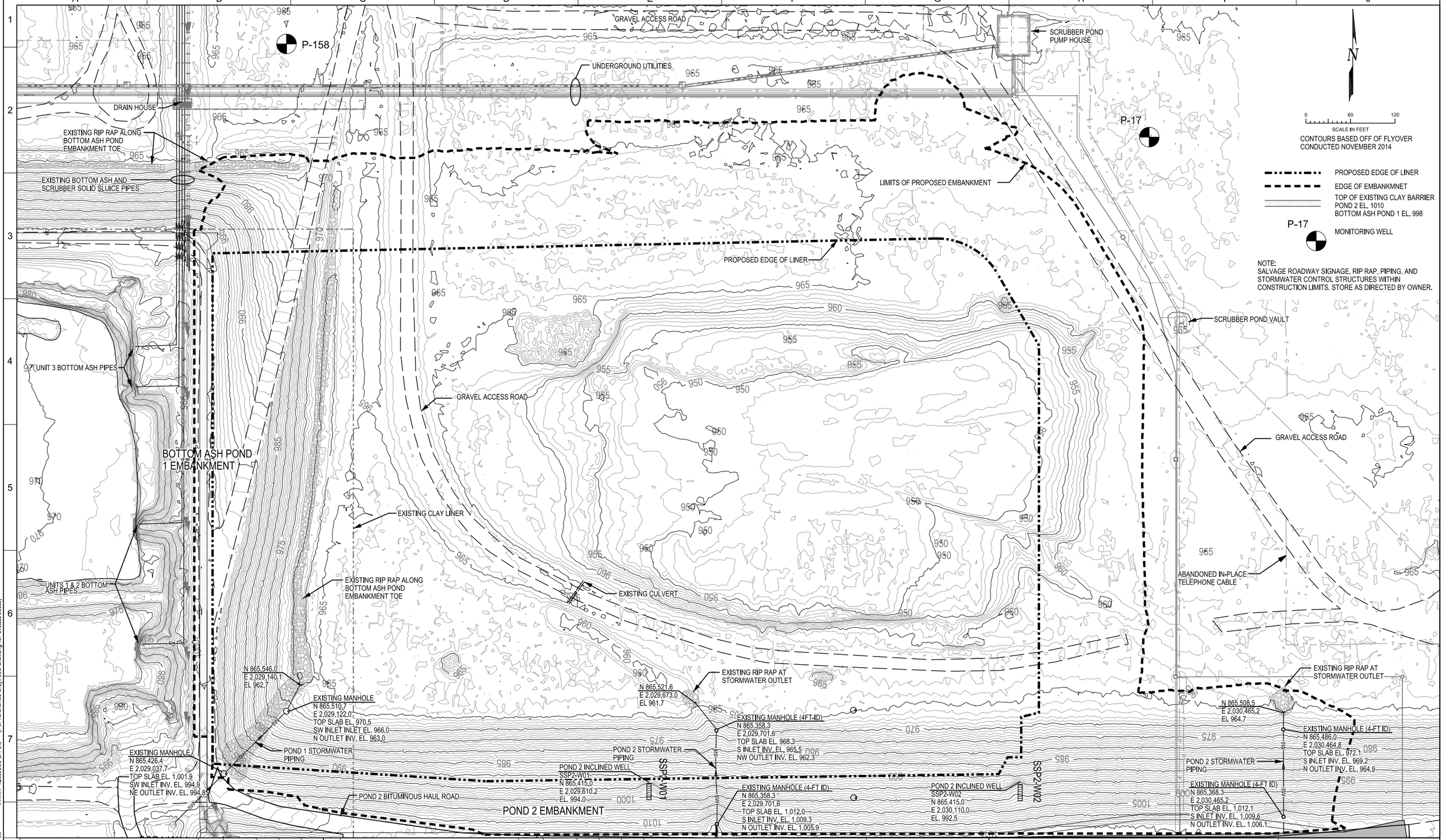
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

POND LAYOUT AND PROJECT AREAS

G3

REV 1



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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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DWN: BLP	DATE: 9/6/2019	CHK: JRM	DATE:
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BOTTOM ASH POND NO. 2 NPDES CONSTRUCTION DRAWINGS

EXISTING CONDITIONS

BA1

REV 1

BOTTOM ASH SLUICE LINES, SEE 1/BA4

TRANSITION FROM 3H:1V (BAP2) TO 2.5H:1 (BAP1)

PROTECT SURVEY MONUMENT

VAULT GRADING PLAN, SEE BA5

30' WIDE RAMP

SECONDARY PIPE (INLET COORDS SHOWN ON BA5)

DISCHARGE STRUCTURE AND PIPE (INLET COORDS SHOWN ON BA5)

DEWATERING SUMP, SEE 1/BA16

GEOMEMBRANE FLAP

25' WIDE ACCESS RAMP

UPPER ACCESS ROAD

40' WIDE RAMP

EXISTING CONCRETE TRENCHES

ABANDONED IN-PLACE TELEPHONE CABLE, IF ENCOUNTERED REMOVE AND DISCARD

BORROW AREA

SLOPE

LEGEND

- 995 — EXISTING MAJOR CONTOUR (5' INTERVAL)
- EXISTING MINOR CONTOUR (1' INTERVAL)
- PROPOSED LINER EDGE (EL. VARIES)
- PROPOSED BREAKLINE
- 950 — PROPOSED MAJOR CONTOUR (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- P — EXISTING PIPE
- P — PROPOSED LARGE DIAMETER PIPE (VARIES FROM 24 TO 30 INCH)
- DW — PROPOSED PERFORATED DEWATERING PIPE, 8 INCH SDR 17
- CO — PROPOSED SOLID CLEAN-OUT PIPE, 8 INCH SDR 17
- TOP OF EXISTING CLAY BARRIER POND 2 EL. 1010
  BOTTOM ASH POND 1 EL. 998

0 60 120
SCALE IN FEET

N

NOTE: CONTOURS INSIDE PROPOSED LINER EDGE REPRESENT LINER GRADES AND CONTOURS OUTSIDE PROPOSED LINER EDGE REPRESENT FINAL GRADE.

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA2 Liner and interior piping plan.dgn
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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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FIRST NAME: DANIEL J. RIGGS

SIGNATURE:

DATE: 9/16/2019 LICENSE# 49559

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DWN: BLP	DATE: 9/6/2019	CHK: JRM	DATE:
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PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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BOTTOM ASH POND NO. 2 NPDES CONSTRUCTION DRAWINGS

LINER AND INTERIOR PIPING PLAN

BA2 REV 1

INSTALL RIP RAP UNDERLAIN BY 12 oz. NON-WOVEN GEOTEXTILE

INSTALL SALVAGED 24-INCH CMP W/FES OUTLET INV. EL. 963.4

PROPOSED STORMWATER POND

INSTALL SALVAGED 4-FOOT I.D. CONCRETE MANHOLE, MOUND TOPSOIL 2 FEET OVER MANHOLE

N 866,242.3
E 2,029,042.7
TOP SLAB EL. 971.2
S INLET INV. EL. 966.7
N OUTLET INV. EL. 963.7

12-INCH SDR 17 PE DROP-PIPE

4-FOOT I.D. CONCRETE MANHOLE, INSTALL NEENAH R4342 OR APPROVED EQUAL GRATE ON TOP SLAB
N 866,172.8
E 2,029,030.83
TOP SLAB EL. 990.5
S INLET INV. EL. 986.7
N OUTLET INV. EL. 984.7

SALVAGE EXISTING RIP RAP AT TOE OF BOTTOM ASH POND EMBANKMENT WITHIN CONSTRUCTION LIMITS

12-INCH SDR 17 PEP, 742 LF MIN 1% SLOPE TO MEET FLOW DEMAND

SALVAGE MANHOLE AND CULVERT

SALVAGE EXISTING DROP PIPE (146 LF OF 12-INCH SDR 17 PE PIPE)

SALVAGE MANHOLE, CUVLERT AND RIP RAP

SALVAGE EXISTING DROP PIPE (120 LF OF 12-INCH SDR 17 PE PIPE)

PROPOSED EDGE OF LINER

MANHOLE, I.E.
N 865,430.400
E 2,029,037.700
Elev. 994.26

GROUT ABONDONED PIPE PENETRATION ON NORTHEAST SIDE OF MANHOLE

EXISTING 0.75% SLOPE 10-INCH CORRUGATED PE PIPE

CORE DRILL 12-INCH HOLE INTO NORTH SIDE OF EXISTING MANHOLE, MATCH INVERT EL. OF EXISTING NORTHEAST OUTLET. INSTALL 12-INCH SDR 17 PEP AND CONNECT WATER TIGHT SEAL. INSPECT AND VERIFY MANHOLE BASE SLAB EL. PRIOR TO CORE-DRILLING

EXISTING POND 2 BITUMINOUS HAUL ROAD

GROUT ABONDONED PIPE PENETRATION ON NORTH SIDE OF MANHOLE

CORE DRILL 12-INCH HOLE INTO EAST SIDE OF EXISTING MANHOLE, MATCH INVERT EL. OF EXISTING EAST OUTLET. INSTALL 12-INCH SDR 17 PEP AND CONNECT WATER TIGHT SEAL

INSTALL 473LF OF NEW AND SALVAGED 12-INCH SDR 17 PEP TO RE-ROUTE STORMWATER. MAINTAIN 3-FEET OF SOIL COVER OR EQUIVALENT R-VALUE OVER PIPE. DO NOT INSTALL AT ELEVATION BELOW LINER GRADES.

EXISTING 0.5% SLOPE 10-INCH CORRUGATED PE PIPE

PROPOSED STORMWATER POND

INSTALL SALVAGED 24-INCH CMP W/FES OUTLET INV. EL. 962.9

INSTALL SALVAGED 4-FOOT I.D. MANHOLE MOUND TOPSOIL 2' OVER MANHOLE

CUT MANHOLE INLET AS NECESSARY TO FIT 14-INCH PEP, GROUT ANNULUS

14-INCH SDR 17 PE DROP-PIPE, 145 LF

4-FOOT I.D. MANHOLE, INSTALL NEENAH R4342 OR APPROVED EQUAL GRATE ON TOP SLAB
N 865,400.5
E 2,030,178.1
TOP SLAB EL. 993
W INLET INV. EL. 989
NE OUTLET INV. EL. 987

EXISTING 12-INCH PEP TO REMAIN IN-TACT UNDER ROAD

PROPOSED STORMWATER POND

BORROW AREA

INSTALL RIP RAP UNDERLAIN BY 12 oz. NON-WOVEN GEOTEXTILE

SALVAGE AND RE-INSTALL 24-INCH CMP OUTLET

SALVAGE AND RE-INSTALL 4-FT ID MANHOLE
N 865,519.03
E 2,030,465.53
TOP SLAB: 971.2
S INV: 969.25
N INV: 964.3

SALVAGE EXISTING 12-INCH SDR 17 PEP DROP-PIPE (120 LF). RE-INSTALL 3 FEET BELOW PROPOSED BAP2 GRADE (MEASURED FROM CROWN OF PIPE)

RE-INSTALL SALVAGED 4FT-ID MANHOLE
N 865,393.76
E 2,030,465.25
TOP SLAB, EL: 1011.28
N INV: 1008.2
S INV: 1004.3

SALVAGE EXISTING MANHOLE AND EXTEND EXISTING 12-INCH SDR 17 PEP 20 LF. EXTENSION CAN BE CONDUCTED VIA ELECTROFUSION OR BUTT-FUSION.

LEGEND

- 995 — EXISTING MAJOR CONTOUR (5' INTERVAL)
- EXISTING MINOR CONTOUR (1' INTERVAL)
- PROPOSED LINER EDGE (EL. VARIES)
- PROPOSED BREAKLINE
- 950 — PROPOSED MAJOR CONTOUR (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- EXISTING PIPE
- EXISTING STORMWATER PIPE
- PROPOSED STORMWATER PIPE

0 60 120
SCALE IN FEET

N

NOTES:
CONTOURS INSIDE PROPOSED LINER EDGE REPRESENT LINER GRADES AND CONTOURS OUTSIDE PROPOSED LINER EDGE REPRESENT FINAL GRADE.
COORDINATES FOR EXISTING STRUCTURES SHOWN ON BA1.

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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR

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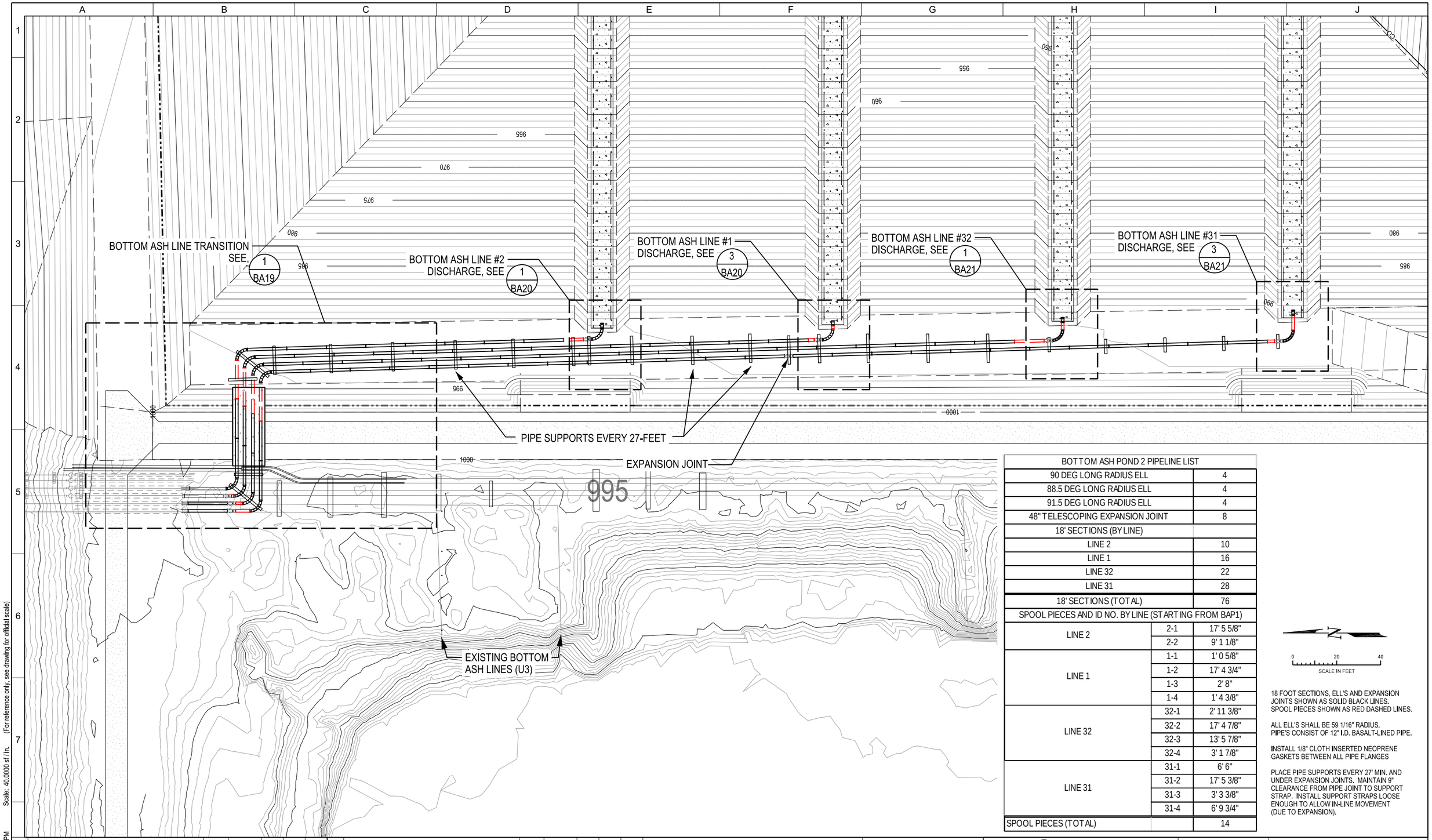
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

STORMWATER MANAGEMENT PLAN

BA3

REV 3



BOTTOM ASH POND 2 PIPELINE LIST		
90 DEG LONG RADIUS ELL		4
88.5 DEG LONG RADIUS ELL		4
91.5 DEG LONG RADIUS ELL		4
48" TELESCOPING EXPANSION JOINT		8
18' SECTIONS (BY LINE)		
LINE 2		10
LINE 1		16
LINE 32		22
LINE 31		28
18' SECTIONS (TOTAL)		76
SPOOL PIECES AND ID NO. BY LINE (STARTING FROM BAP1)		
LINE 2	2-1	17' 5 5/8"
	2-2	9' 1 1/8"
LINE 1	1-1	1' 0 5/8"
	1-2	17' 4 3/4"
	1-3	2' 8"
	1-4	1' 4 3/8"
LINE 32	32-1	2' 11 3/8"
	32-2	17' 4 7/8"
	32-3	13' 5 7/8"
	32-4	3' 1 7/8"
LINE 31	31-1	6' 6"
	31-2	17' 5 3/8"
	31-3	3' 3 3/8"
	31-4	6' 9 3/4"
SPOOL PIECES (TOTAL)		14

0 20 40
SCALE IN FEET

18 FOOT SECTIONS, ELL'S AND EXPANSION JOINTS SHOWN AS SOLID BLACK LINES.
SPOOL PIECES SHOWN AS RED DASHED LINES.

ALL ELL'S SHALL BE 59 1/16" RADIUS.
PIPE'S CONSIST OF 12" I.D. BASALT-LINED PIPE.

INSTALL 1/8" CLOTH INSERTED NEOPRENE GASKETS BETWEEN ALL PIPE FLANGES

PLACE PIPE SUPPORTS EVERY 27' MIN. AND UNDER EXPANSION JOINTS. MAINTAIN 9" CLEARANCE FROM PIPE JOINT TO SUPPORT STRAP. INSTALL SUPPORT STRAPS LOOSE ENOUGH TO ALLOW IN-LINE MOVEMENT (DUE TO EXPANSION).

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR
4	SLUICE LINE REV; REVISED BA4, ADDED BA19 - BA21		5/20/20	DJR	XCEL	DJR

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

BA SLUICE PIPE PLAN

BA4

REV 4

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA4 BA sluice pipe plan_REV4.dgn
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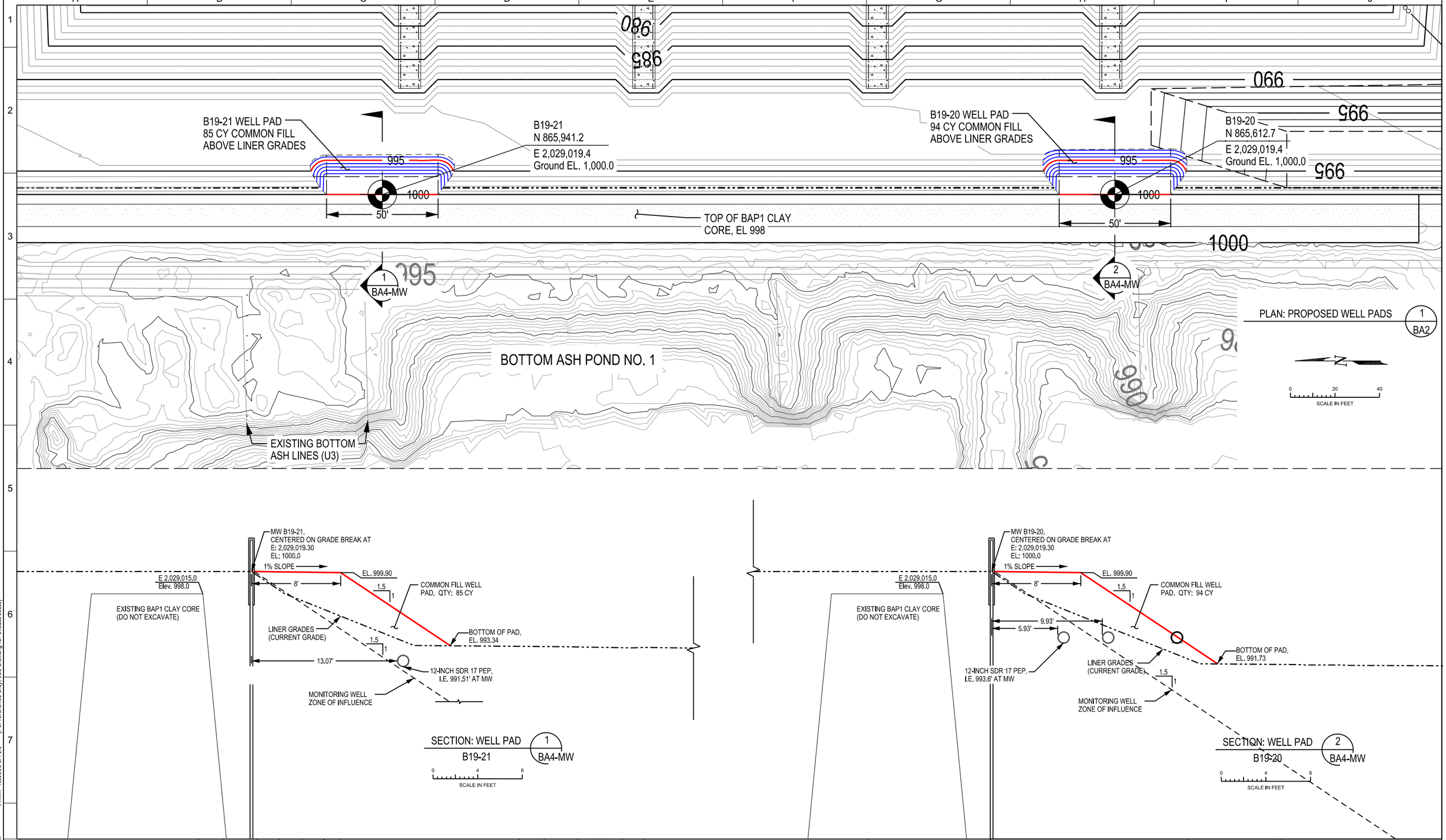

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1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
WEST EMBANKMENT MONITORING WELL PADS

BA4-MW

REV 2

SCRUBBER BUILDING

EXISTING CLASS 5 ROAD

BURIED UTILITIES

965

970

5H:1V

VAULT OUTLET PIPE
30-INCH SDR 11, IE
N 866,314.88
E 2,029,965.65
Elev. 960.50

VAULT OUTLET PIPE AND
PROPOSED TRENCH EXCAVATION.
FOR PLAN AND PROFILE SEE 1/BA6

972

VAULT WALKWAY,
5 FEET WIDE, 2% SLOPE

960

960

5H:1V

5H:1V

SECONDARY PIPE, IE
N 866,298.01
E 2,029,967.65
Elev. 963.00

DISCHARGE PIPE, IE
N 866,298.01
E 2,029,972.65
Elev. 963.00

RAMP 8% SLOPE
15-FT WIDE

RAMP SLOPE AT 2% (SOUTH)
15-FT WIDE

EMBANKMENT
(3H:1V SLOPE)

RE-ROUTE CLASS 5 ROAD
(SEE RESTORATION PLAN)

SECONDARY PIPE,
24-INCH SDR 11

DISCHARGE PIPE (PRIMARY OUTLET),
24-INCH SDR 11

965

970

975

980

985

SECONDARY PIPE INLET IE (NOT SHOWN)
N 866,126.51
E 2,029,973.78
Elev. 989.00

DISCHARGE PIPE INLET IE (NOT SHOWN)
N 866,041.15
E 2,029,988.82
Elev. 964.25

LEGEND

- 955 — EXISTING MAJOR CONTOUR (5' INTERVAL)
- EXISTING MINOR CONTOUR (1' INTERVAL)
- PROPOSED BREAKLINE
- 950 — PROPOSED MAJOR CONTOUR (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- P — EXISTING PIPE
- P — PROPOSED LARGE DIAMETER PIPE (VARIES FROM 24 TO 30 INCH)

N

0 10 20
SCALE IN FEET

NOTES:
CONTOURS REPRESENT FINAL GRADE.
PLACE 6-INCHES OF CLASS 5 ON ALL RAMP SURFACES.

SEE VAULT DRAWINGS (V SERIES SHEETS)
FOR TIE-DOWN COORDINATE, AND STRUCTURAL,
PIPING, AND ELECTRICAL DETAILS OF VAULT CONSTRUCTION

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

VAULT GRADING PLAN

BA5

REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA5 Vault Grading Plan.dgn
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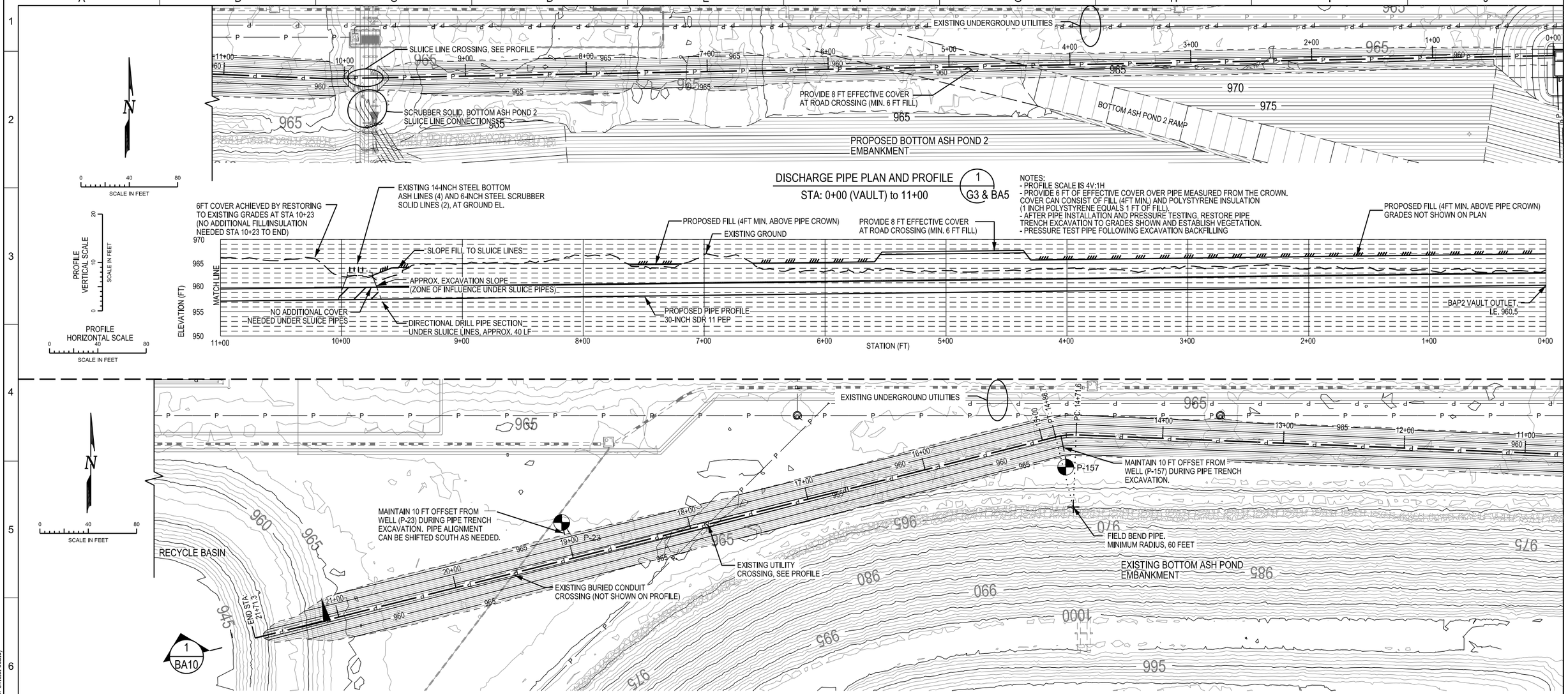
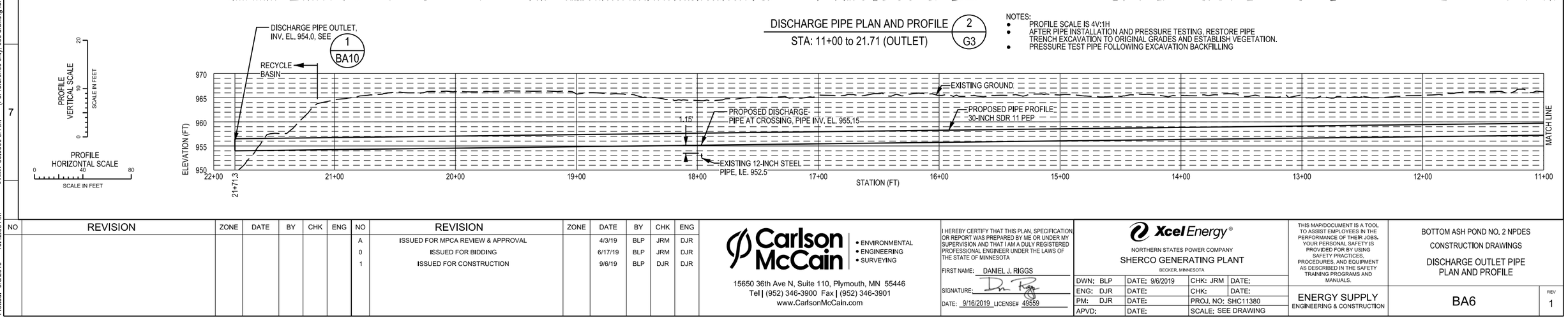


DISCHARGE PIPE PLAN AND PROFILE (1 / G3 & BA5)

STA: 0+00 (VAULT) to 11+00

NOTES:
- PROFILE SCALE IS 4V:1H
- PROVIDE 6 FT OF EFFECTIVE COVER OVER PIPE MEASURED FROM THE CROWN. COVER CAN CONSIST OF FILL (4FT MIN.) AND POLYSTYRENE INSULATION (1 INCH POLYSTYRENE EQUALS 1 FT OF FILL).
- AFTER PIPE INSTALLATION AND PRESSURE TESTING, RESTORE PIPE TRENCH EXCAVATION TO GRADES SHOWN AND ESTABLISH VEGETATION.
- PRESSURE TEST PIPE FOLLOWING EXCAVATION BACKFILLING



DISCHARGE PIPE PLAN AND PROFILE (2 / G3)

STA: 11+00 to 21.71 (OUTLET)

NOTES:
- PROFILE SCALE IS 4V:1H
- AFTER PIPE INSTALLATION AND PRESSURE TESTING, RESTORE PIPE TRENCH EXCAVATION TO ORIGINAL GRADES AND ESTABLISH VEGETATION.
- PRESSURE TEST PIPE FOLLOWING EXCAVATION BACKFILLING

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
DISCHARGE OUTLET PIPE PLAN AND PROFILE

BA6 REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA6 BAP2 to RB discharge pipe plan.dgn
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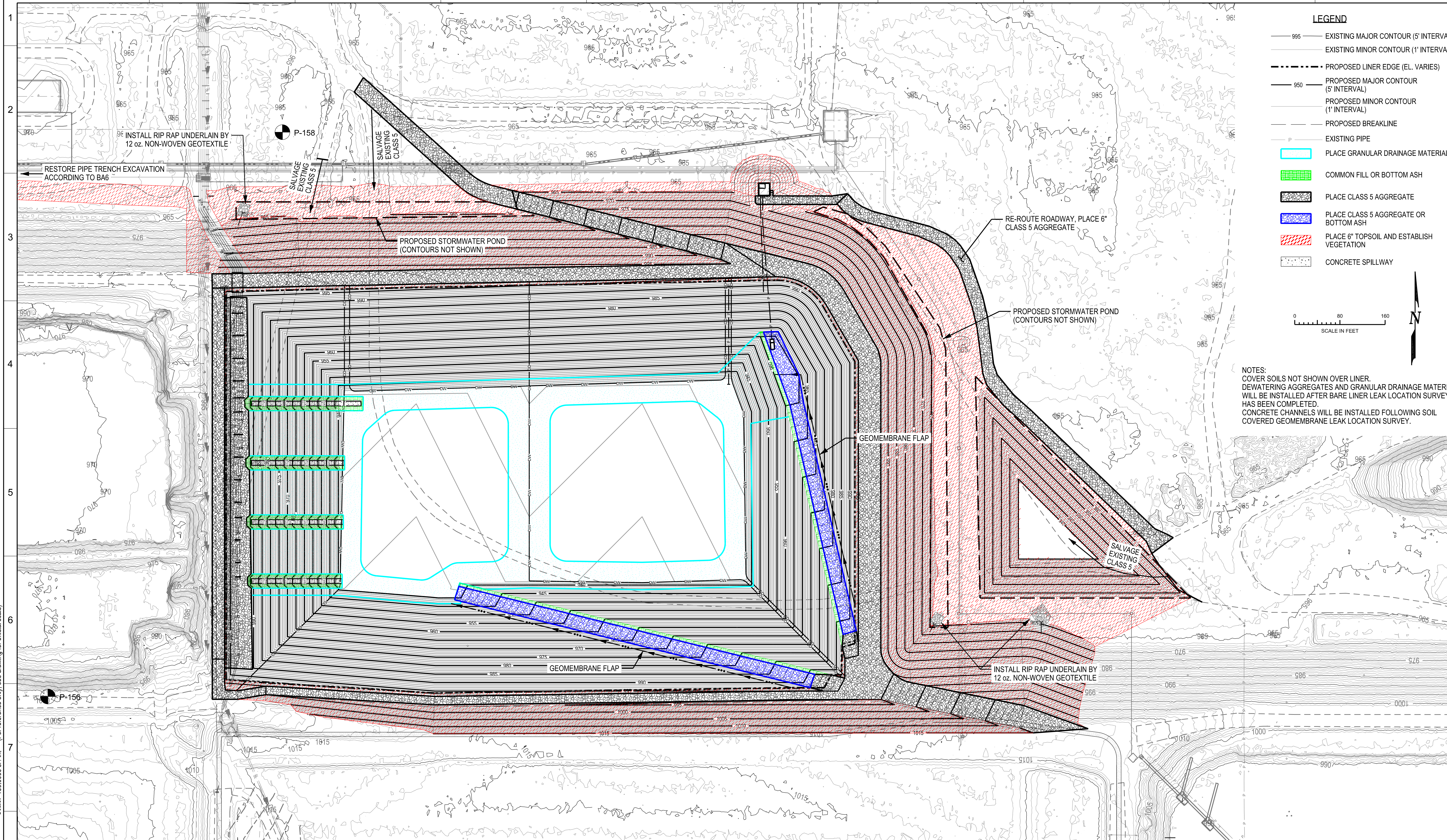

LEGEND

- 995 — EXISTING MAJOR CONTOUR (5' INTERVAL)
- EXISTING MINOR CONTOUR (1' INTERVAL)
- PROPOSED LINER EDGE (EL. VARIES)
- 950 — PROPOSED MAJOR CONTOUR (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- PROPOSED BREAKLINE
- P — EXISTING PIPE
- PLACE GRANULAR DRAINAGE MATERIAL
- COMMON FILL OR BOTTOM ASH
- PLACE CLASS 5 AGGREGATE
- PLACE CLASS 5 AGGREGATE OR BOTTOM ASH
- PLACE 6" TOPSOIL AND ESTABLISH VEGETATION
- CONCRETE SPILLWAY

NOTES:
COVER SOILS NOT SHOWN OVER LINER.
DEWATERING AGGREGATES AND GRANULAR DRAINAGE MATERIAL WILL BE INSTALLED AFTER BARE LINER LEAK LOCATION SURVEY HAS BEEN COMPLETED.
CONCRETE CHANNELS WILL BE INSTALLED FOLLOWING SOIL COVERED GEOMEMBRANE LEAK LOCATION SURVEY.

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA7 Restoration plan.dgn
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Plotted: 9/6/2019 10:40:55 AM

NO	REVISION	ZONE	DATE	BY	CHK	ENG

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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FIRST NAME: DANIEL J. RIGGS
SIGNATURE:
DATE: 9/16/2019 LICENSE# 49559

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BECKER, MINNESOTA

DWN: BLP	DATE: 9/6/2019	CHK: JRM	DATE:
ENG: DJR	DATE:	CHK:	DATE:
PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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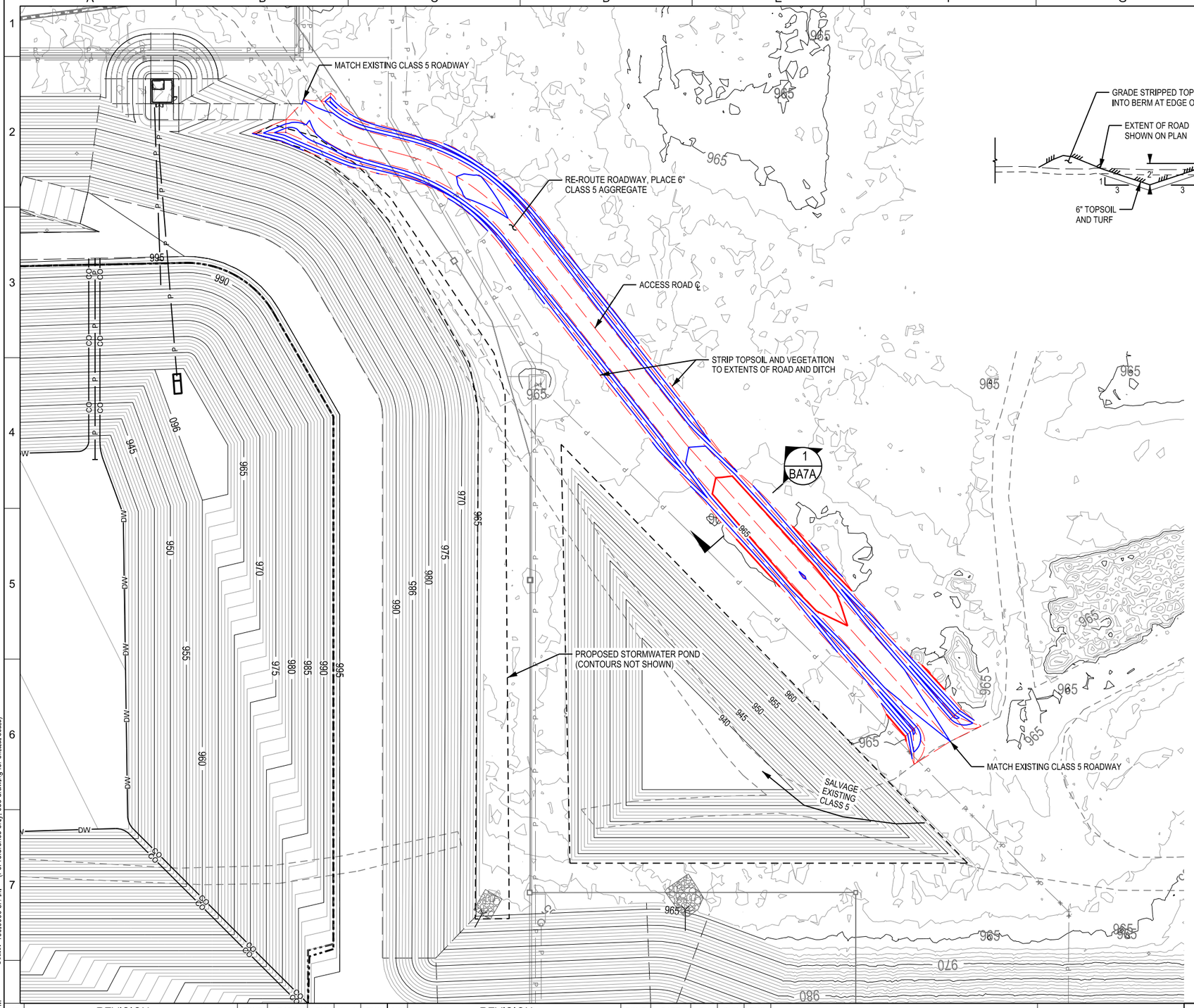
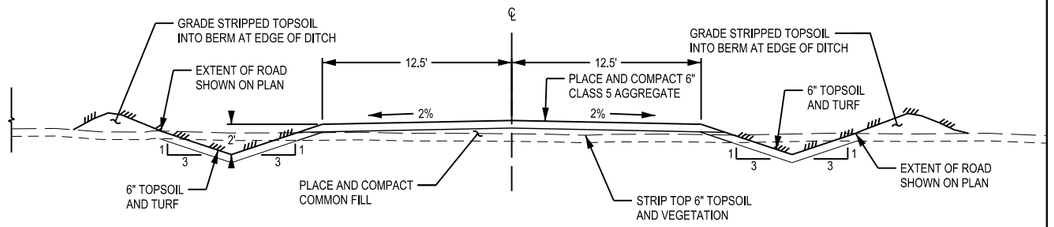
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
SITE RESTORATION PLAN

BA7
REV 1





SECTION: ACCESS ROAD 1 BA7A
TYP

0 5 10
SCALE IN FEET

ESTIMATED EARTHWORK

STRIP TOPSOIL: 595 CY

CUT TO ROAD SUBGRADE: 765 CY
FILL TO ROAD SUBGRADE: 480 CY
FILL w/COMPACTION LOSS: 565 CY (ASSUME 15% OF FILL)
NET: +200 CY COMMON FILL

PLACE CLASS 5 TO FINAL GRADE: 407 CY
PLACE TOPSOIL TO FINAL GRADE: 366 CY

LEGEND

- 995 — EXISTING MAJOR CONTOUR (5' INTERVAL)
- EXISTING MINOR CONTOUR (1' INTERVAL)
- ACCESS ROAD PROPOSED BREAKLINE
- 995 — ACCESS ROAD PROPOSED MAJOR CONTOUR (5' INTERVAL)
- ACCESS ROAD PROPOSED MINOR CONTOUR (1' INTERVAL)
- PROPOSED LINER EDGE (EL. VARIES)
- 950 — PROPOSED MAJOR CONTOUR (5' INTERVAL)
- PROPOSED MINOR CONTOUR (1' INTERVAL)
- PROPOSED BREAKLINE
- P — EXISTING PIPE

N

0 50 100
SCALE IN FEET

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	DRAFT - ISSUED FOR REVIEW		10/16/19	BLP	DJR	DJR

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PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

ACCESS ROAD GRADING PLAN

BA7A

REV 2

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA7A Access Road Grading Plan.dgn
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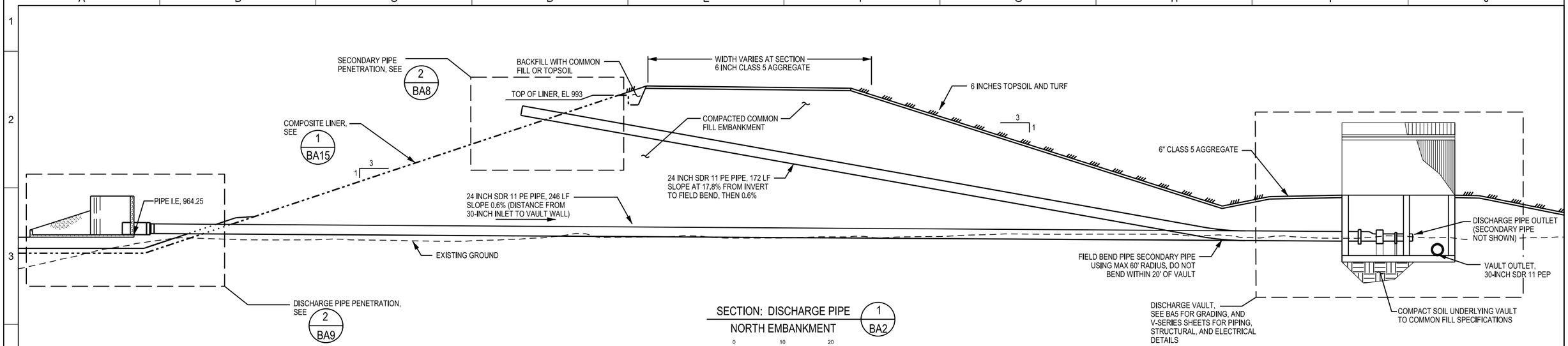
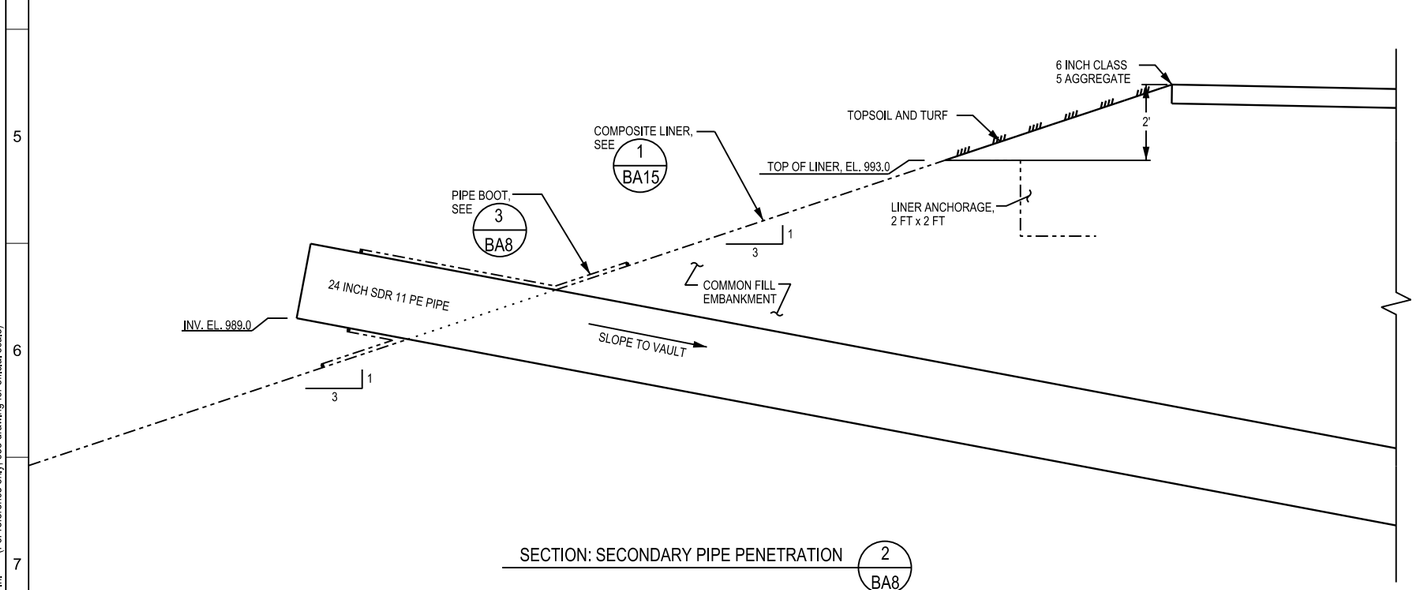


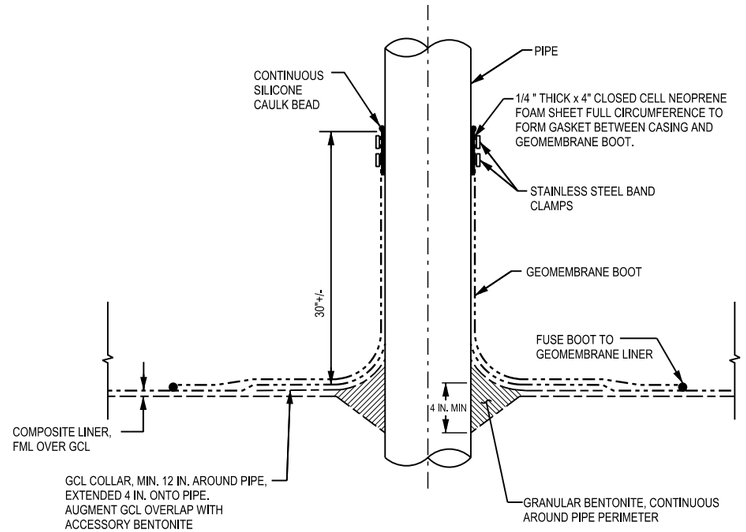
SECTION: DISCHARGE PIPE NORTH EMBANKMENT 1 BA2

0 10 20
SCALE IN FEET



SECTION: SECONDARY PIPE PENETRATION 2 BA8

0 2 4
SCALE IN FEET



DETAIL: PIPE BOOT 3 BA8
TYP

NOT TO SCALE

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA8 discharge and secondary pipe sections.dgn
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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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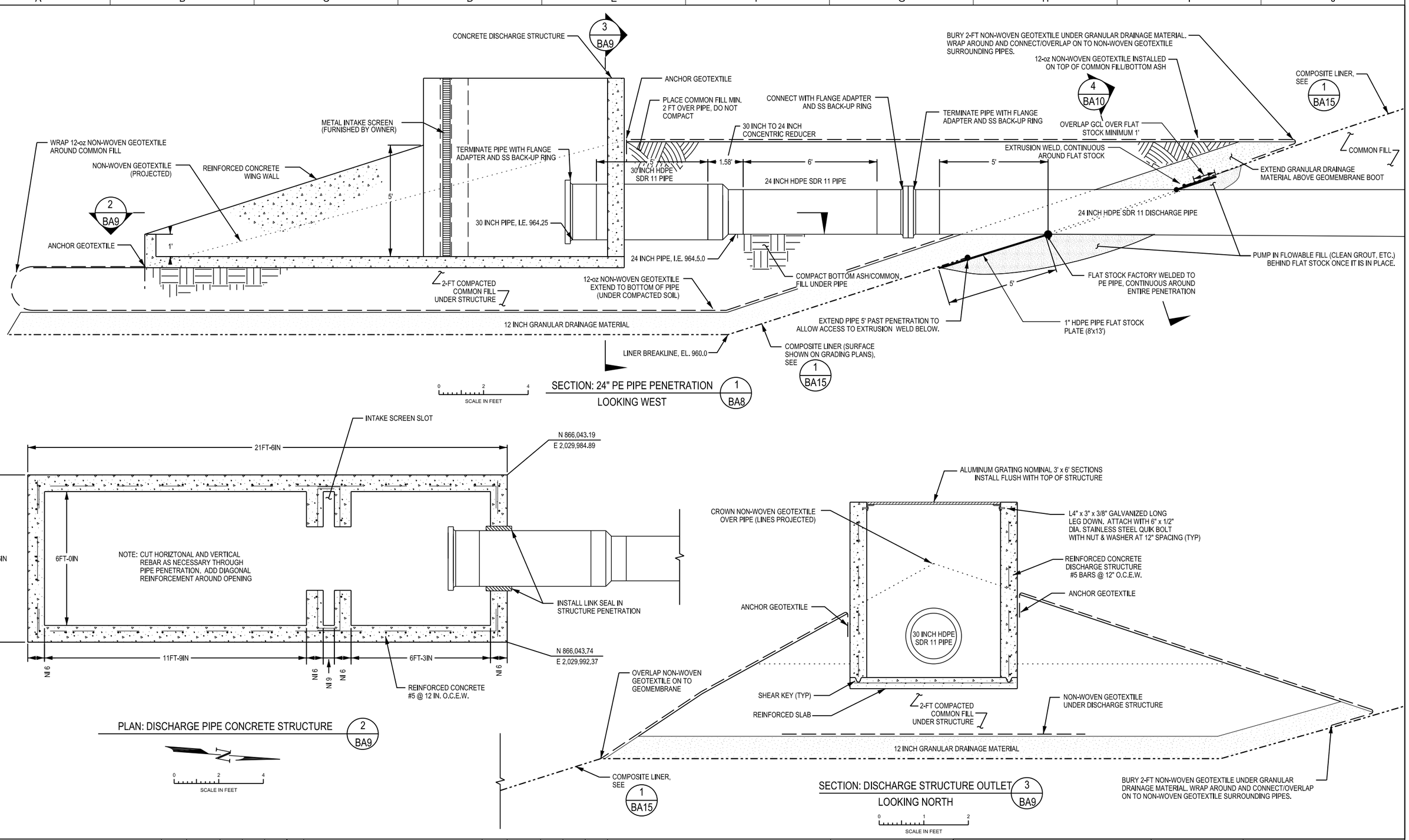
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
DISCHARGE PIPE AND SECONDARY PIPE SECTIONS

BA8 REV 1



NO	REVISION	ZONE	DATE	BY	CHK	ENG
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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

DISCHARGE STRUCTURE SECTIONS

BA9 REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA9 discharge pipe penetration.dgn
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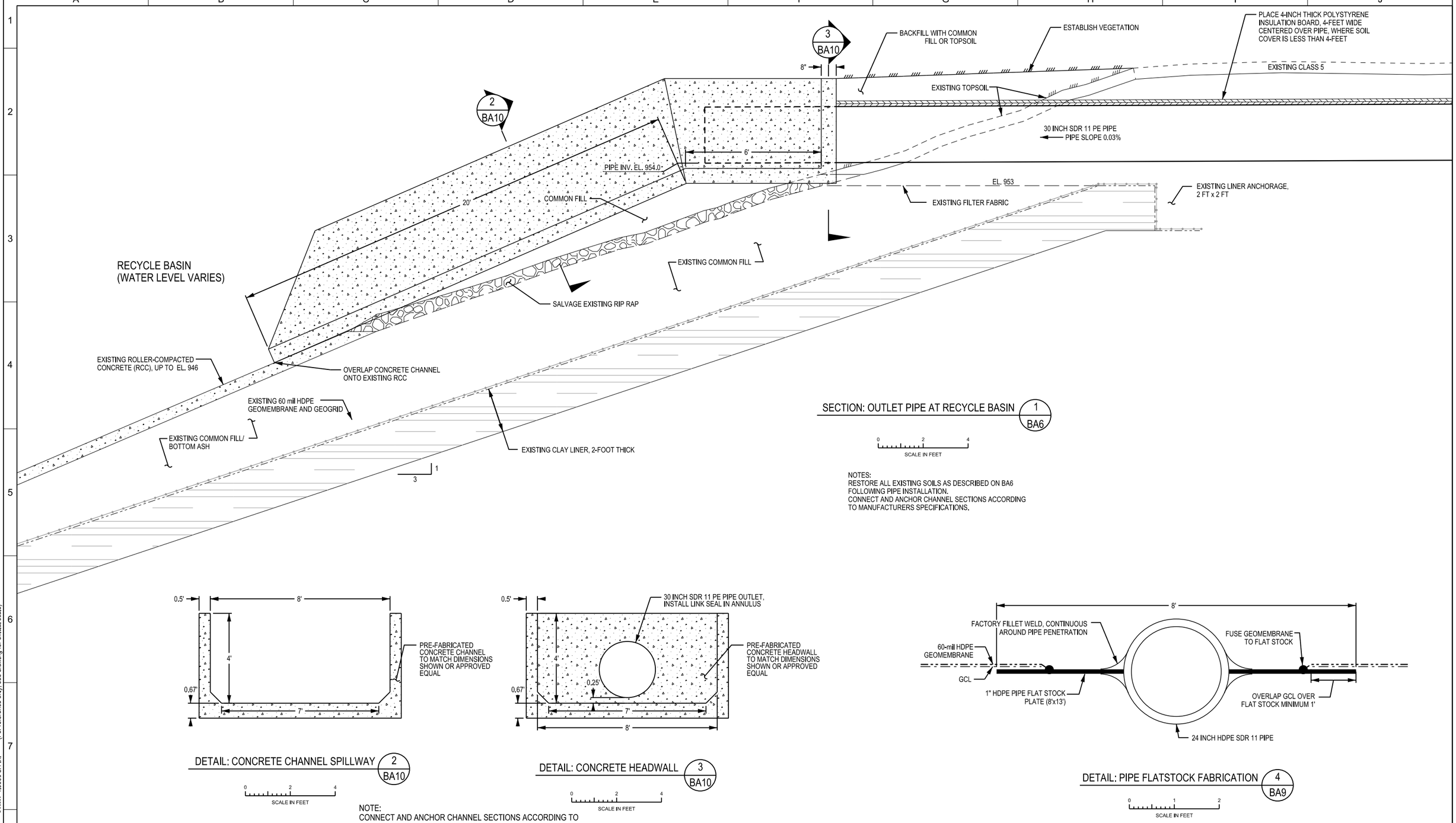

SECTION: OUTLET PIPE AT RECYCLE BASIN (1 / BA6)

0 2 4
SCALE IN FEET

NOTES:
RESTORE ALL EXISTING SOILS AS DESCRIBED ON BA6 FOLLOWING PIPE INSTALLATION.
CONNECT AND ANCHOR CHANNEL SECTIONS ACCORDING TO MANUFACTURERS SPECIFICATIONS.

DETAIL: CONCRETE CHANNEL SPILLWAY (2 / BA10)

0 2 4
SCALE IN FEET

DETAIL: CONCRETE HEADWALL (3 / BA10)

0 2 4
SCALE IN FEET

NOTE:
CONNECT AND ANCHOR CHANNEL SECTIONS ACCORDING TO MANUFACTURER'S SPECIFICATIONS.

DETAIL: PIPE FLATSTOCK FABRICATION (4 / BA9)

0 1 2
SCALE IN FEET

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A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
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1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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PM: DJR	DATE:	PROJ. NO: SHC11380	
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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
RECYCLE BASIN OUTLET PIPE AND PIPE PENETRATION DETAIL

BA10 | REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA10 pipe.dgn
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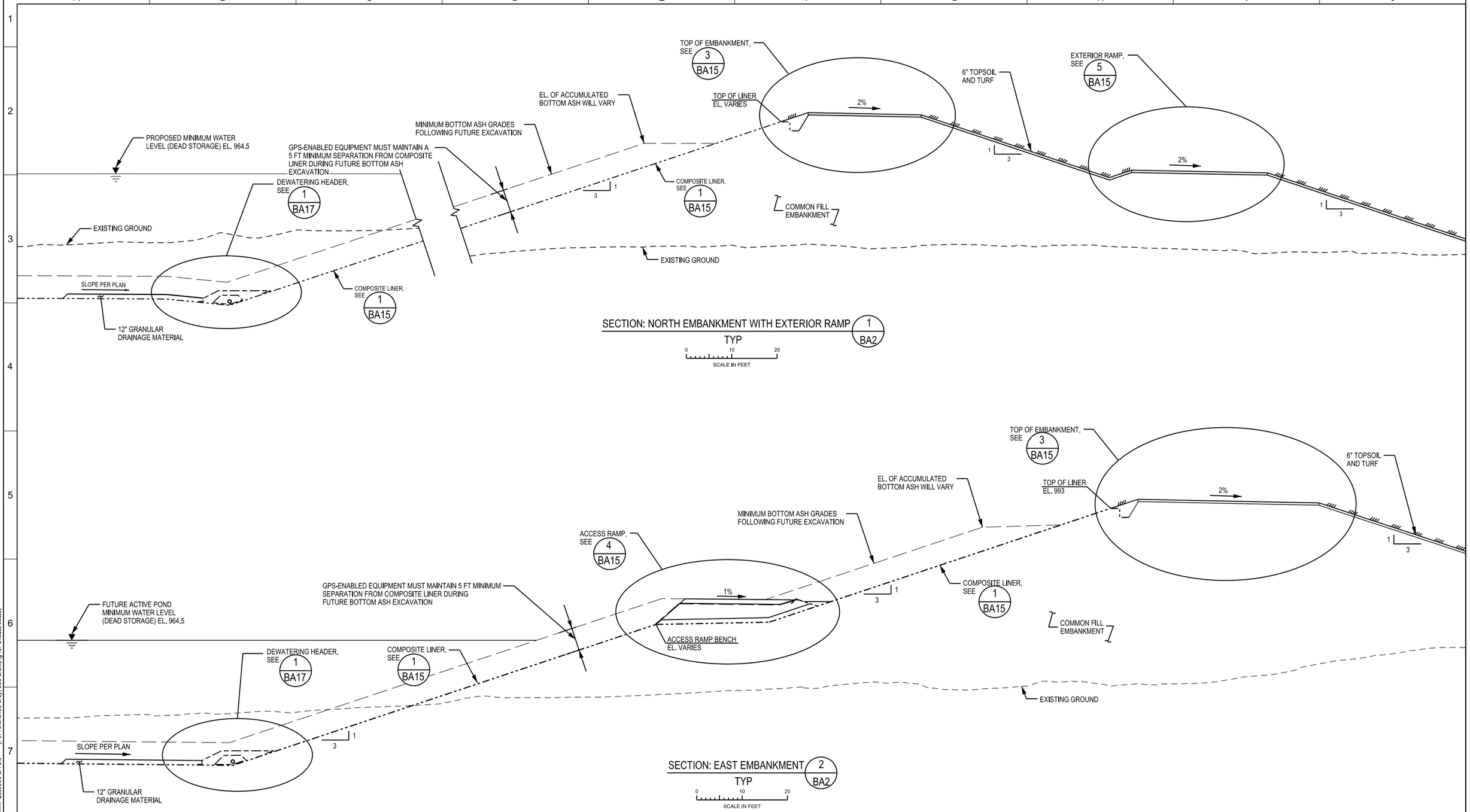

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NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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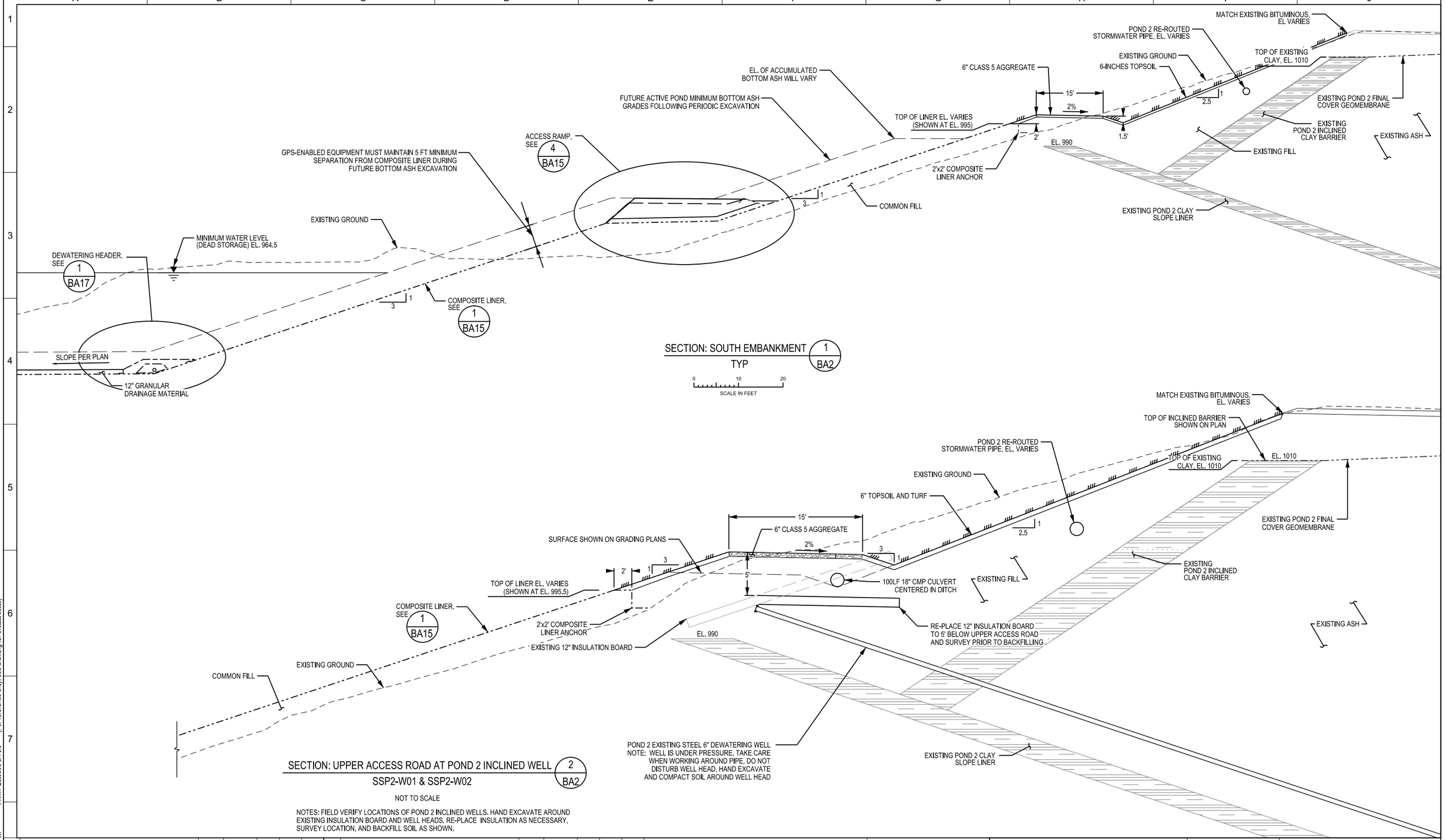
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
NORTH AND EAST EMBANKMENT SECTIONS

BA11 REV 1



SECTION: UPPER ACCESS ROAD AT POND 2 INCLINED WELL SSP2-W01 & SSP2-W02 — 2 BA2

NOT TO SCALE

NOTES: FIELD VERIFY LOCATIONS OF POND 2 INCLINED WELLS. HAND EXCAVATE AROUND EXISTING INSULATION BOARD AND WELL HEADS. RE-PLACE INSULATION AS NECESSARY, SURVEY LOCATION, AND BACKFILL SOIL AS SHOWN.

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
SOUTH EMBANKMENT SECTIONS

BA12 REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA12 South Embankment Sections.dgn
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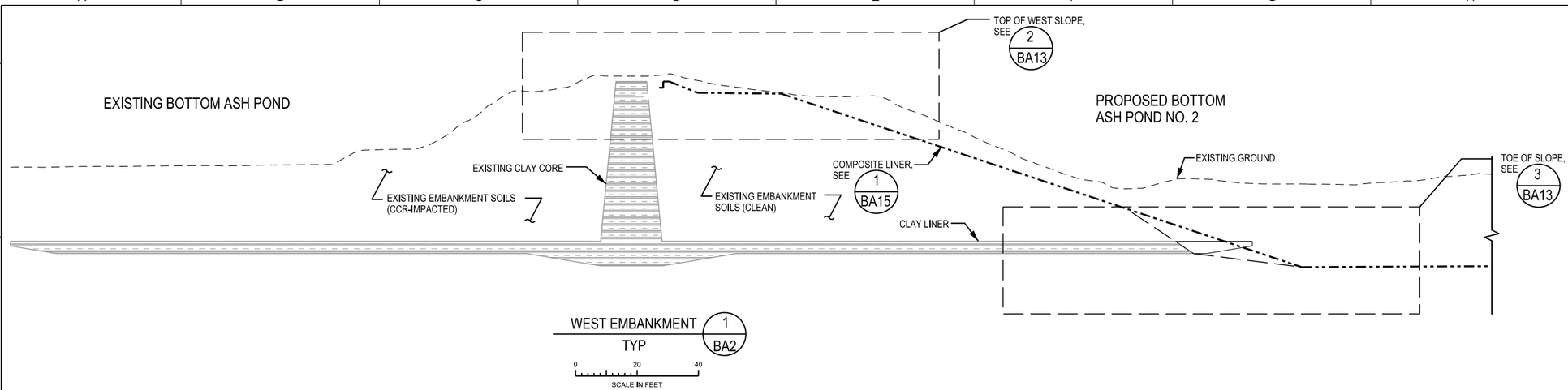

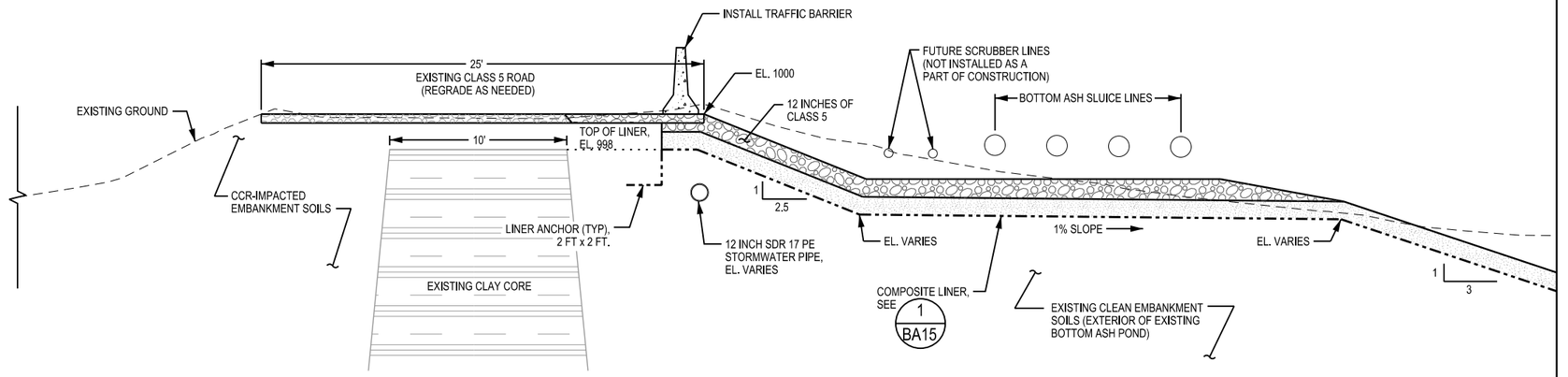

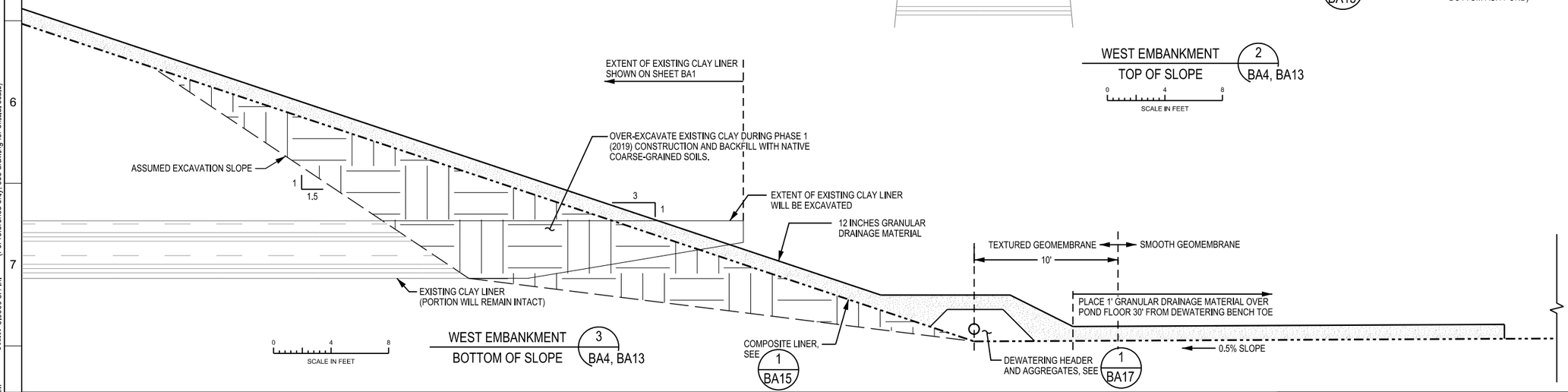

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

WEST EMBANKMENT SECTIONS

BA13 REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA13 West Emb TYP.dgn
Plotter, Driver: P:\IMAI Standards\Microstation\Misc Standard\Plot Drivers\Ricoh6000_MAIstyle_DJR VPN printing.pltcfg
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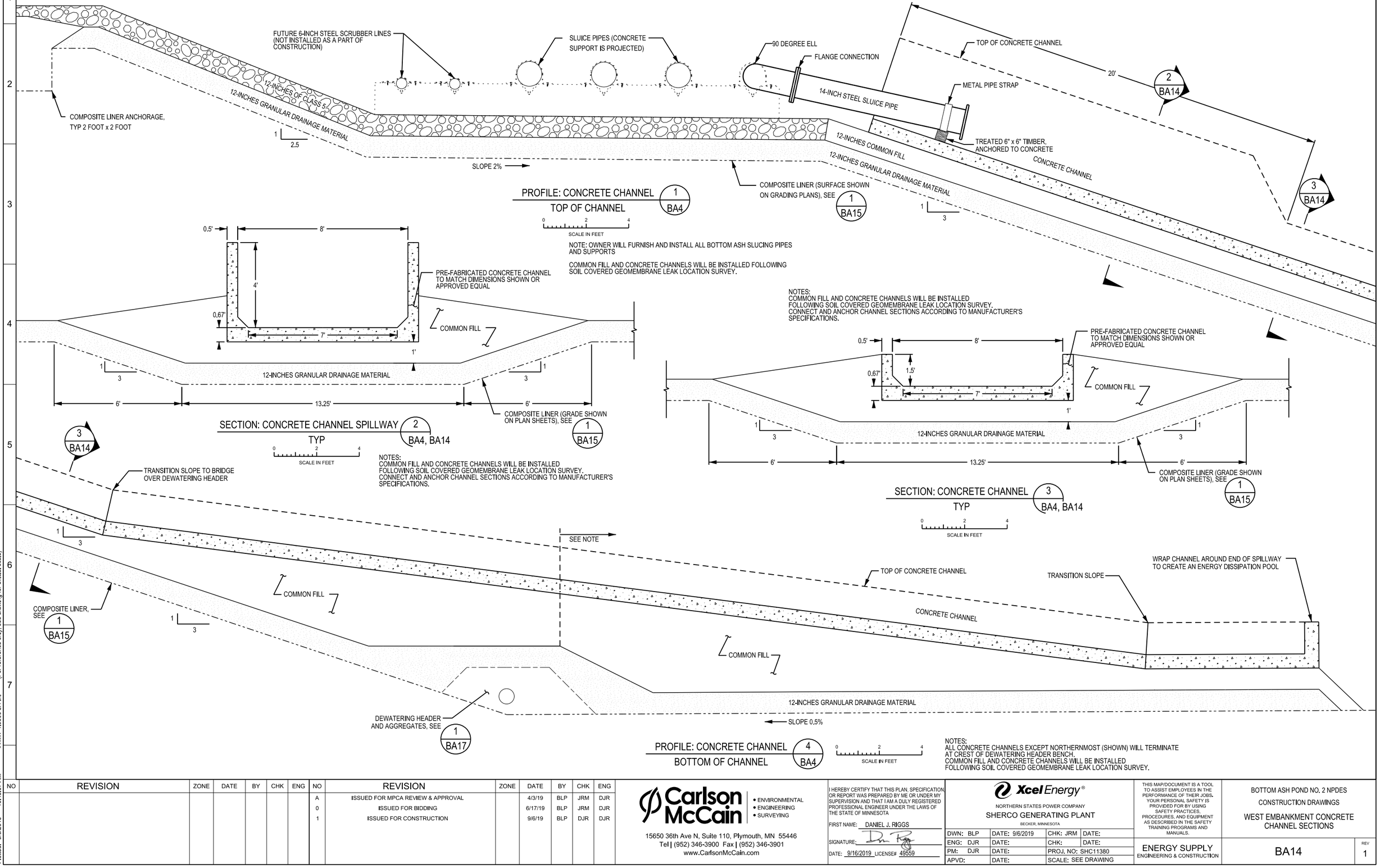

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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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FIRST NAME: DANIEL J. RIGGS
SIGNATURE:
DATE: 9/16/2019 LICENSE# 49559

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BECKER, MINNESOTA

DWN: BLP	DATE: 9/6/2019	CHK: JRM	DATE:
ENG: DJR	DATE:	CHK:	DATE:
PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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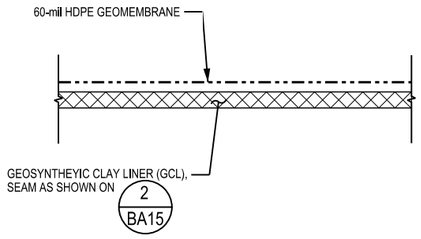
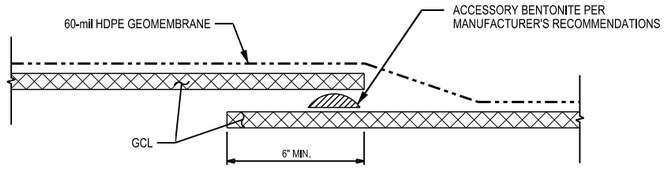
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
WEST EMBANKMENT CONCRETE CHANNEL SECTIONS

BA14 REV 1



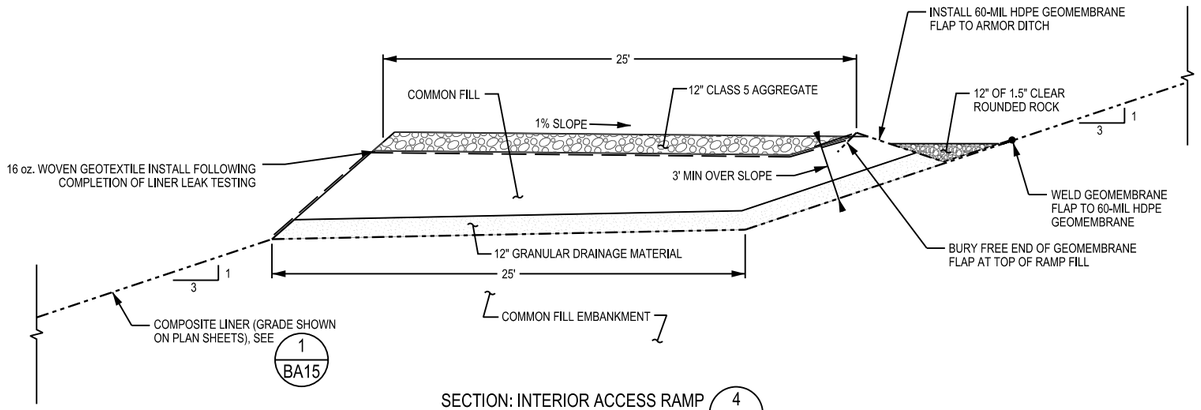
DETAIL: COMPOSITE LINER 1 TYP. BA8-17

NOT TO SCALE



DETAIL: GCL CONNECTION 2 TYP. BA15

NOT TO SCALE

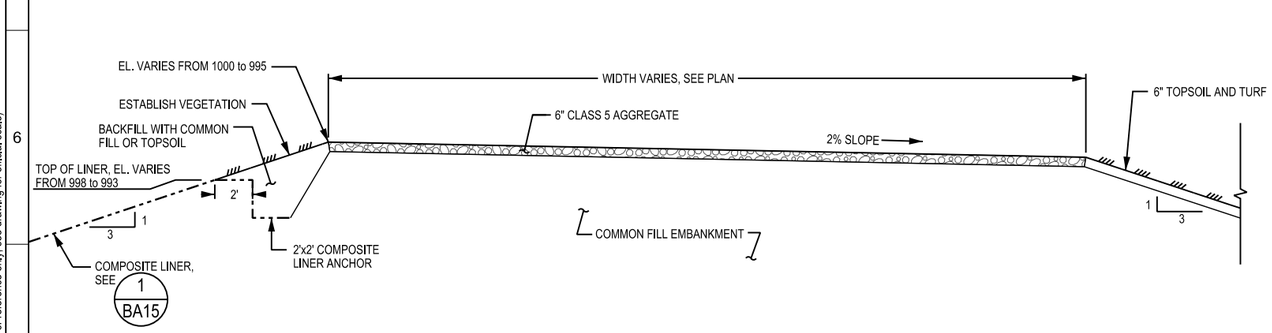


SECTION: INTERIOR ACCESS RAMP 4 EAST AND SOUTH EMBANKMENT BA11&12

0 4 8

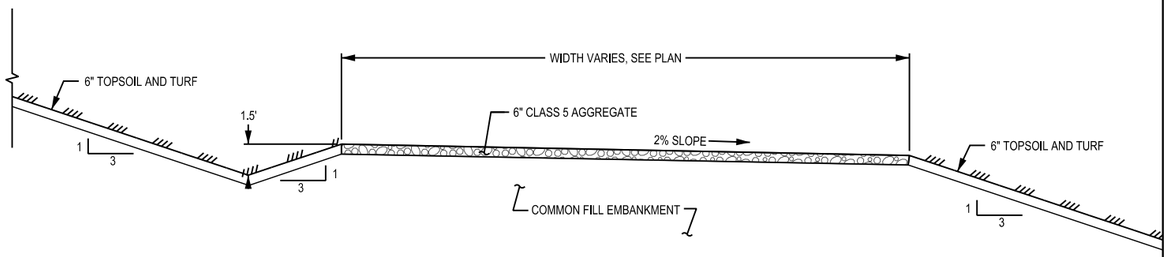
SCALE IN FEET

NOTE: CONTRACTOR SHALL MAINTAIN MOISTURE IN DRAINAGE AND COVER AGGREGATES UNTIL LEAK LOCATION TESTING HAS BEEN COMPLETED.



SECTION: TOP OF EMBANKMENT AND LINER ANCHOR 3 TYP BA11

NOT TO SCALE



SECTION: EXTERIOR ACCESS RAMP 5 TYP. BA2&11

NOT TO SCALE

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA15 Embankment Details.dgn
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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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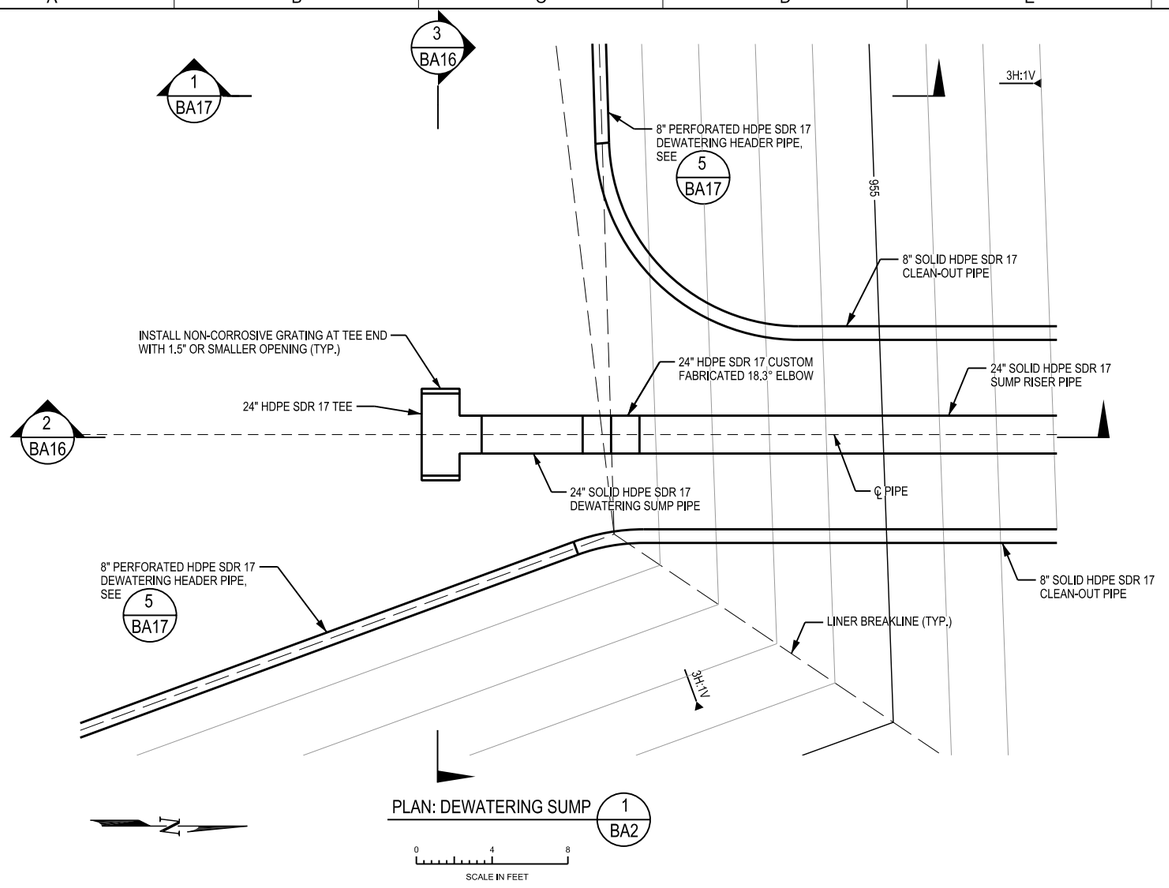
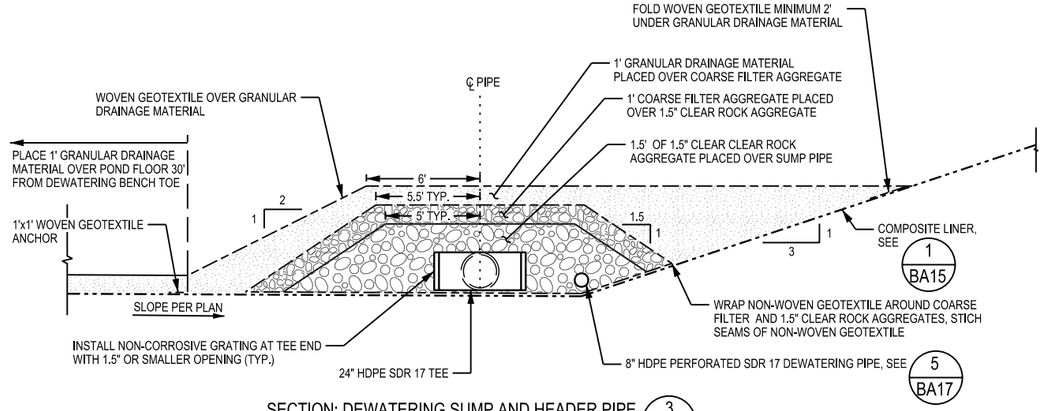
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
COMPOSITE LINER AND EMBANKMENT DETAILS

BA15 REV 1



PLAN: DEWATERING SUMP (1 BA2)

0 4 8
SCALE IN FEET



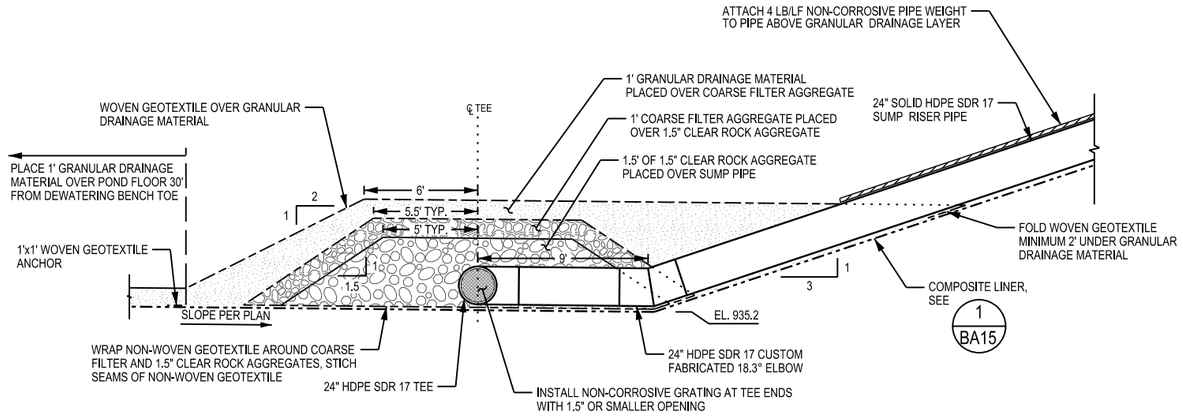
SECTION: DEWATERING SUMP AND HEADER PIPE (3 BA16)

0 4 8
SCALE IN FEET

NOTE: LEAK TESTING WILL BE CONDUCTED IN A MINIMUM OF TWO PHASES.

PHASE 1 WILL CONSIST OF TESTING ALL BARE GEOMEMBRANE ONCE INSTALLATION IS COMPLETE.

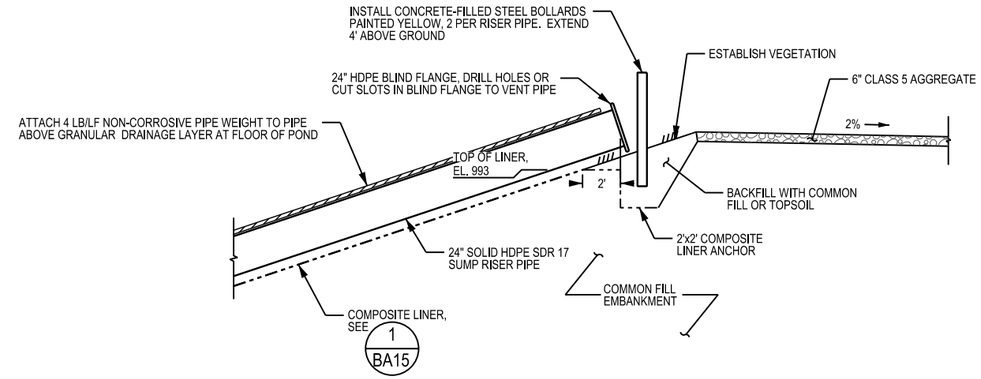
PHASE 2 WILL BE CONDUCTED OVER THE INSTALLED DRAINAGE AGGREGATES. CONTRACTOR SHALL MAINTAIN MOISTURE IN DRAINAGE AGGREGATES UNTIL SECOND PHASE OF LEAK TESTING HAS BEEN COMPLETED.



SECTION: DEWATERING SUMP AND RISER PIPE (2 BA16)

0 4 8
SCALE IN FEET

SEE NOTE ON SECTION 3 OF THIS SHEET



SECTION: DEWATERING SUMP RISER PIPE AT TOP OF EMBANKMENT (4 BA2)

0 4 8
SCALE IN FEET

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
DEWATERING SUMP PLAN AND SECTIONS

BA16 REV 1

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA16 DW Sump plan and sections.dgn
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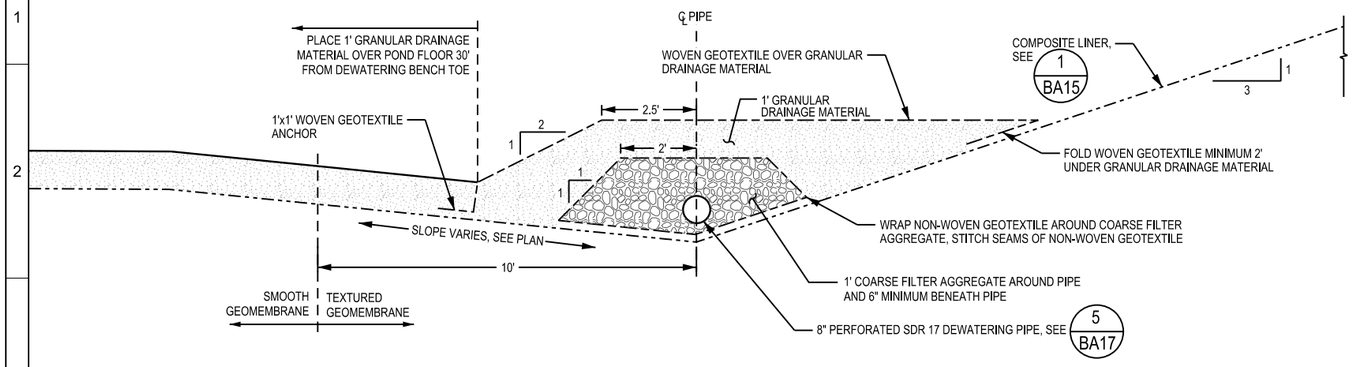
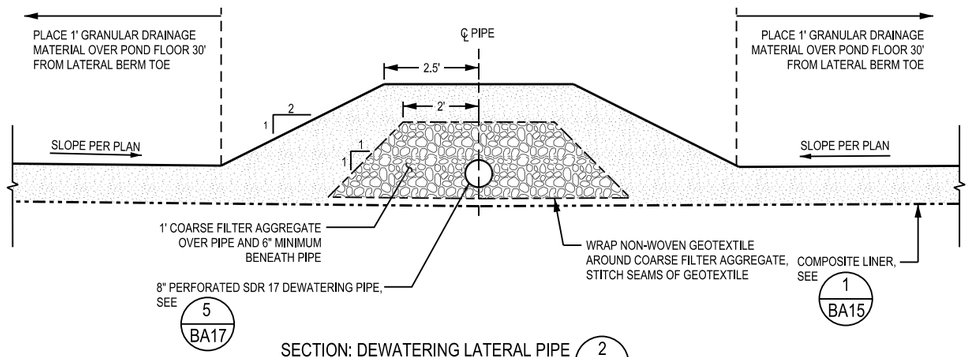


SECTION: DEWATERING HEADER PIPE 1 BA11-14,16

TYP.

SCALE IN FEET

NOTE: LEAK TESTING WILL BE CONDUCTED IN A MINIMUM OF TWO PHASES.
-PHASE 1 WILL CONSIST OF TESTING ALL BARE GEOMEMBRANE ONCE INSTALLATION IS COMPLETE.
-PHASE 2 WILL BE CONDUCTED OVER THE INSTALLED DRAINAGE AGGREGATES. CONTRACTOR SHALL MAINTAIN MOISTURE IN DRAINAGE AGGREGATES UNTIL SECOND PHASE OF LEAK TESTING HAS BEEN COMPLETED.

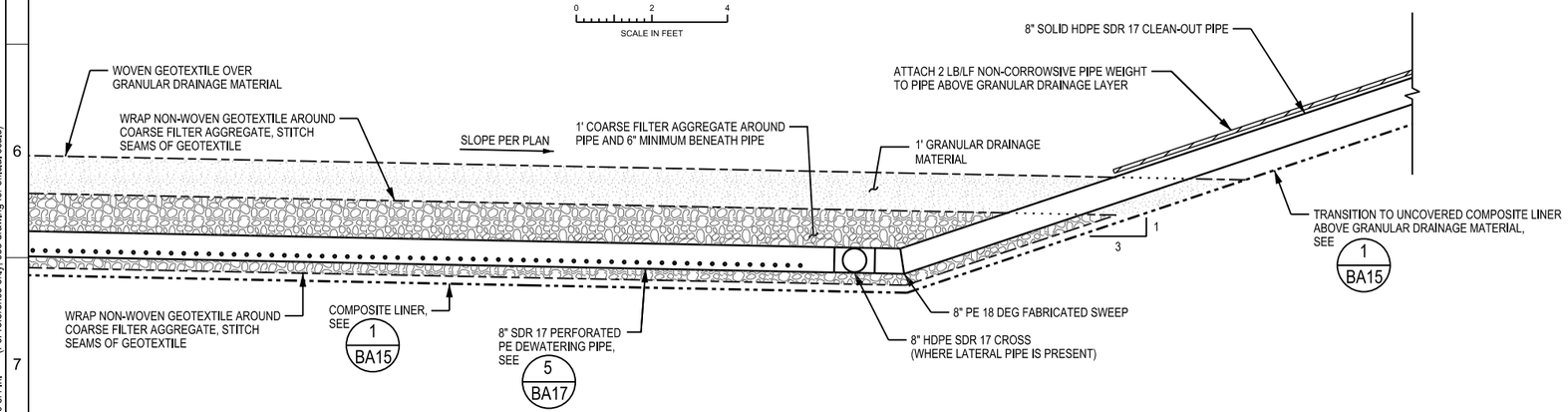


SECTION: DEWATERING LATERAL PIPE 2 BA2

SEE NOTE ON SECTION 1 OF THIS SHEET

TYP

SCALE IN FEET

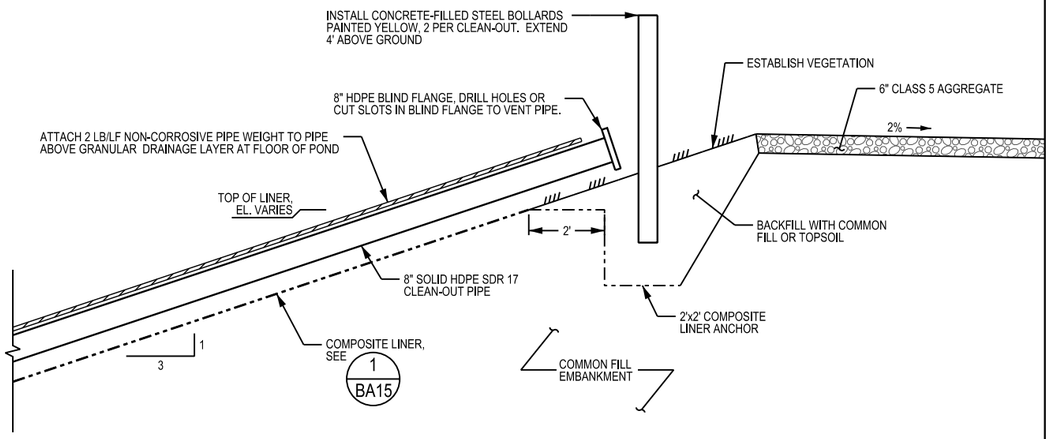


SECTION: PERFORATED DEWATERING PIPE TO CLEAN-OUT CONNECTION 3 BA2

SEE NOTE ON SECTION 1 OF THIS SHEET

TYP

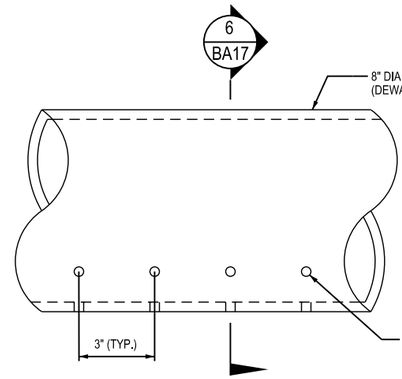
SCALE IN FEET



SECTION: CLEAN-OUT AT TOP OF EMBANKMENT 4 BA2

TYP.

SCALE IN FEET

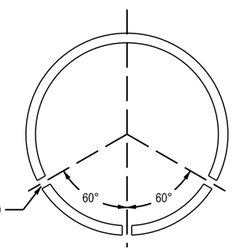


NOTE: DO NOT PERFORATE PIPE WITHIN 1' OF THE ENDS OF THE PIPE. ALL HOLES SHALL BE FACTORY DRILLED AND DEBURRED.

DETAIL: PERFORATED DEWATERING PIPE 5 BA16&17

TYP.

NOT TO SCALE



SECTION: PERFORATED DEWATERING PIPE 6 BA17

TYP.

NOT TO SCALE

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2019 BAP2 CONST DWGS_BA17 Dewatering System Details.dgn
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NO	REVISION	ZONE	DATE	BY	CHK	ENG
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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR

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FIRST NAME: DANIEL J. RIGGS

SIGNATURE:

DATE: 9/16/2019 LICENSE# 49559

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SHERCO GENERATING PLANT
BECKER, MINNESOTA

DWN: BLP	DATE: 9/6/2019	CHK: JRM	DATE:
ENG: DJR	DATE:	CHK:	DATE:
PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

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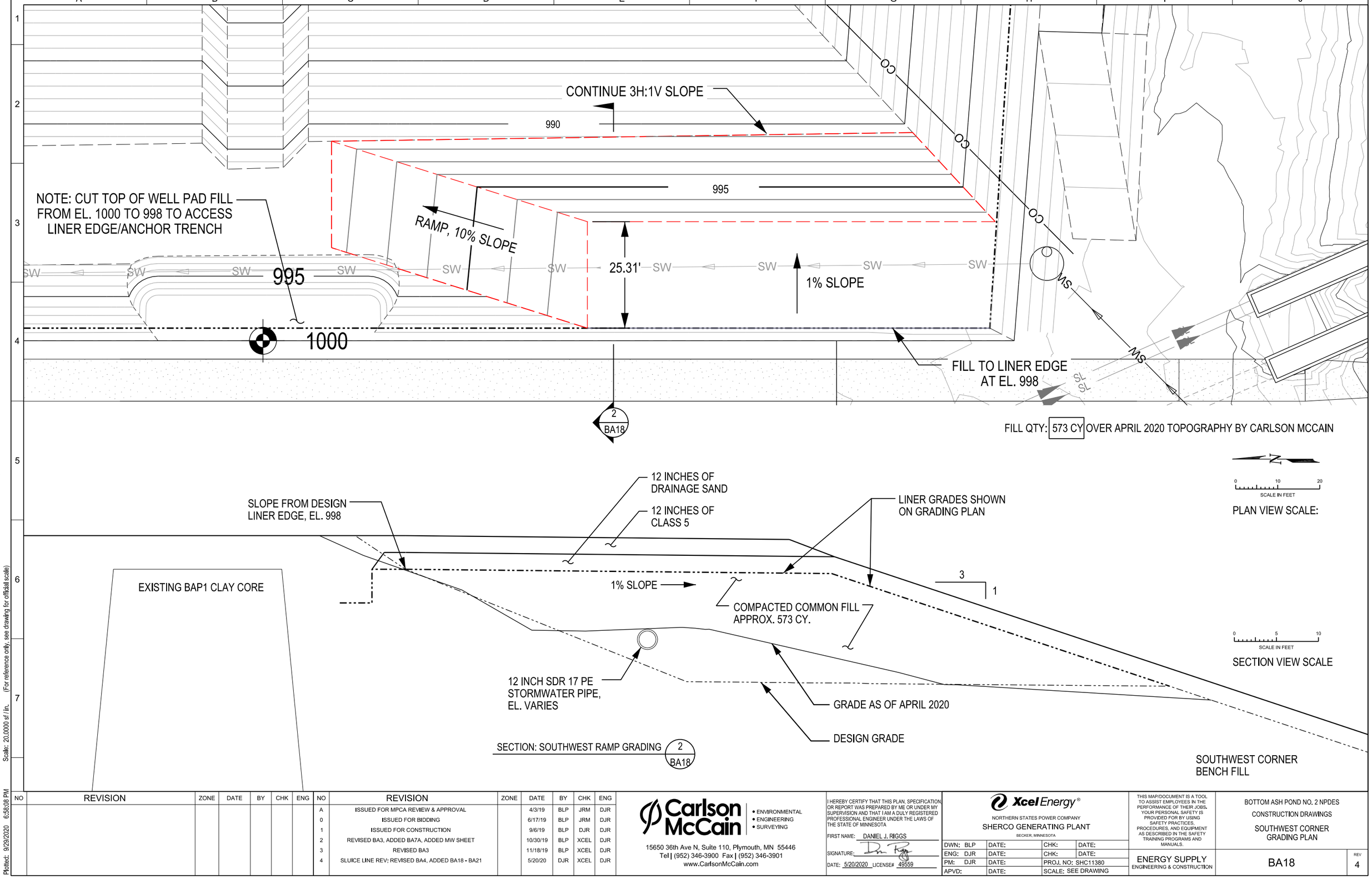
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
DEWATERING SYSTEM DETAILS

BA17 REV 1



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1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR
4	SLUICE LINE REV; REVISED BA4, ADDED BA18 - BA21		5/20/20	DJR	XCEL	DJR

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ENG: DJR	DATE:	CHK:	DATE:
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APVD:	DATE:	SCALE: SEE DRAWING	

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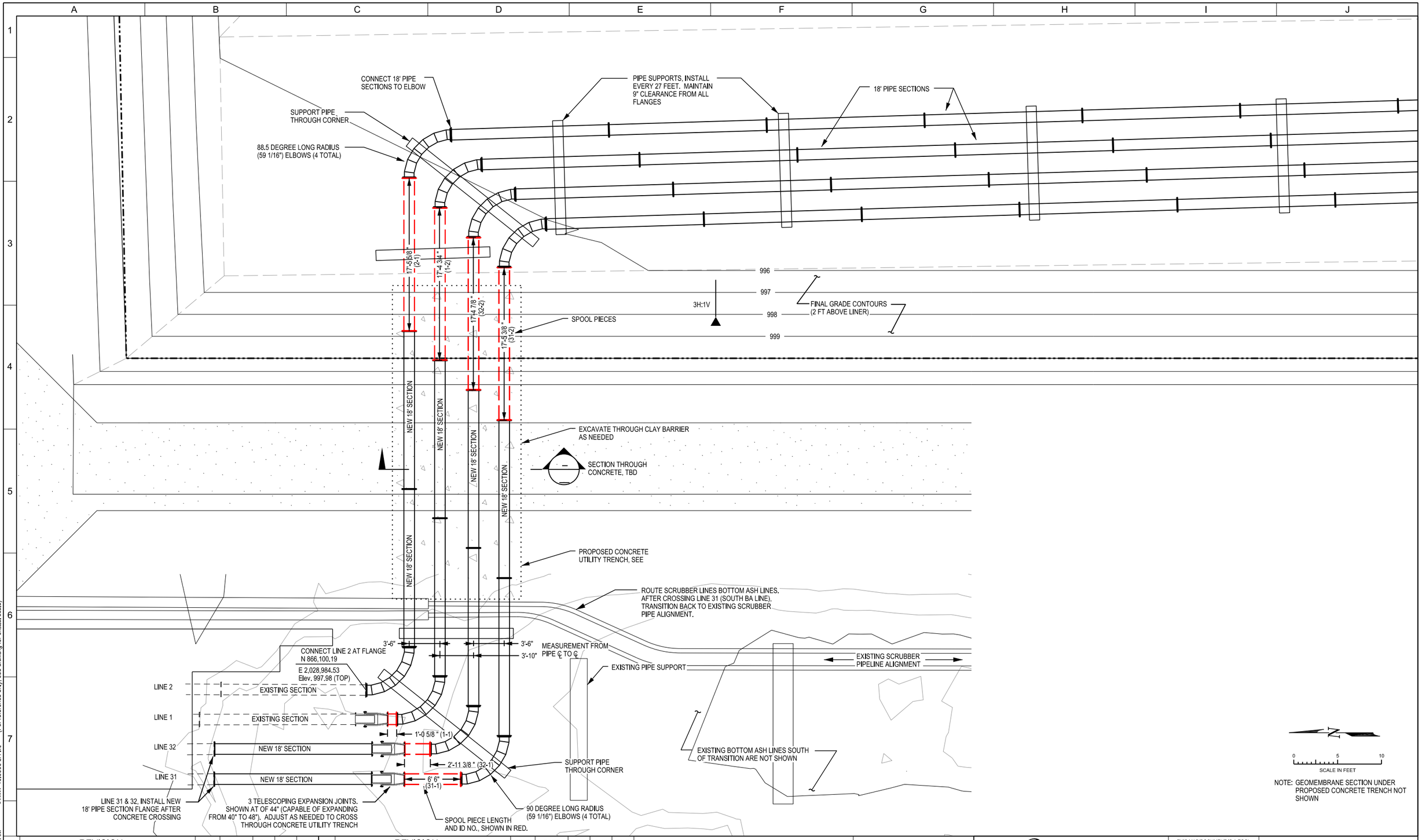
BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
SOUTHWEST CORNER GRADING PLAN

BA18 REV 4



NOTE: GEOMEMBRANE SECTION UNDER PROPOSED CONCRETE TRENCH NOT SHOWN

NO	REVISION	ZONE	DATE	BY	CHK	ENG
A	ISSUED FOR MPCA REVIEW & APPROVAL		4/3/19	BLP	JRM	DJR
0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR
4	SLUICE LINE REV: REVISED BA4, ADDED BA19 - BA21		5/20/20	DJR	XCEL	DJR

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APVD:	DATE:	SCALE: SEE DRAWING	

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS

SLUICE LINE TRANSITION FROM BAP1

BA19

REV 4

File: P:\Projects\XCEL\3404-19 Bottom Ash Pond 2\2019 Services\drawings\CONST drawings\2020 BAP2 CONST DWGS_BA19 BA Sluice Line Installation Plan_REV4.dgn
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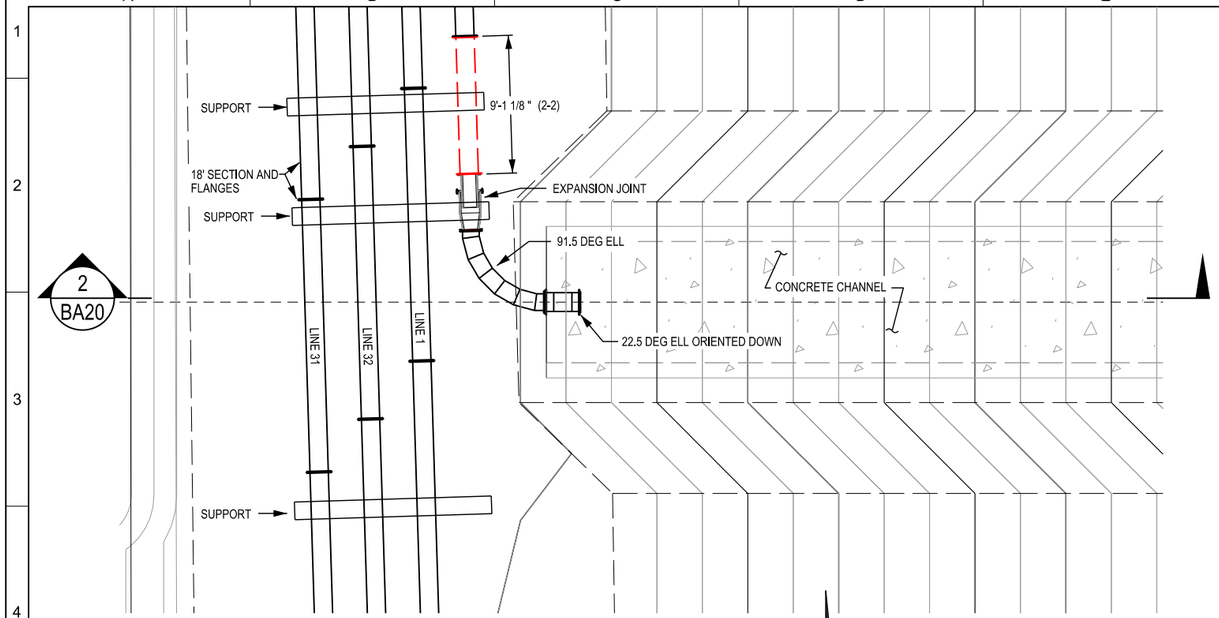
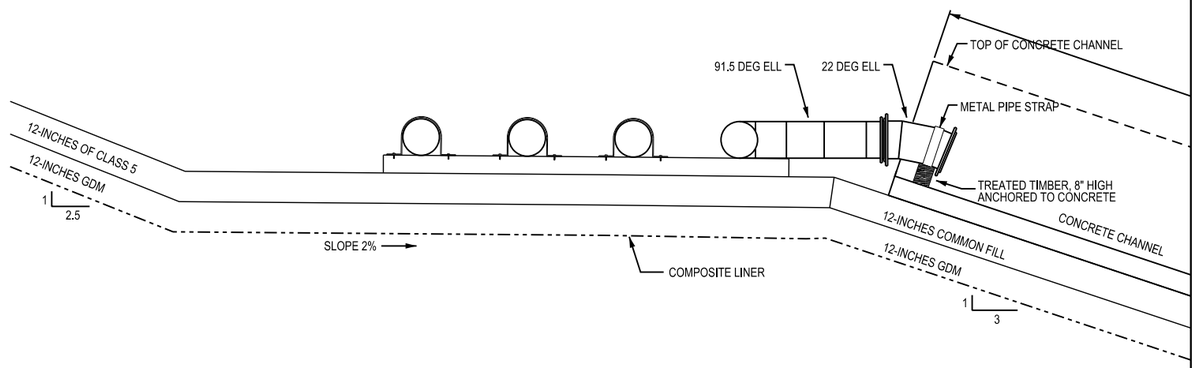
Plotted: 5/20/2020 11:42:05 AM



PLAN: BOTTOM ASH LINE #2 SLUICE PIPE OUTLET 1 BA4

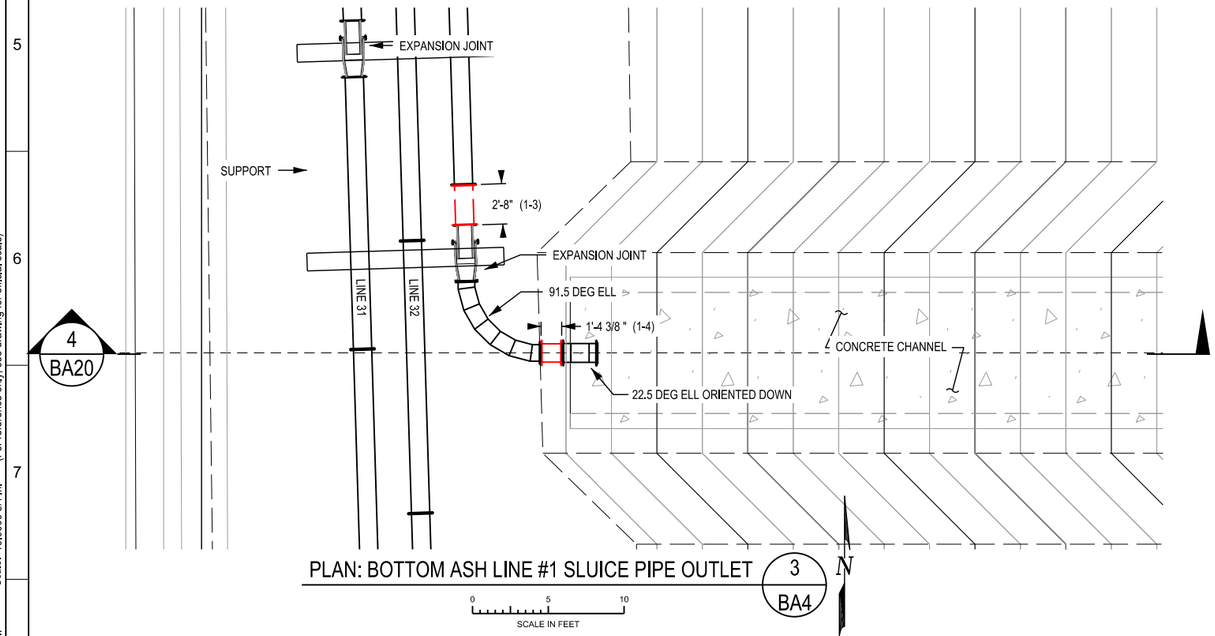
0 5 10
SCALE IN FEET

N



SECTION: BOTTOM ASH LINE #2 SLUICE PIPE OUTLET 2 BA20

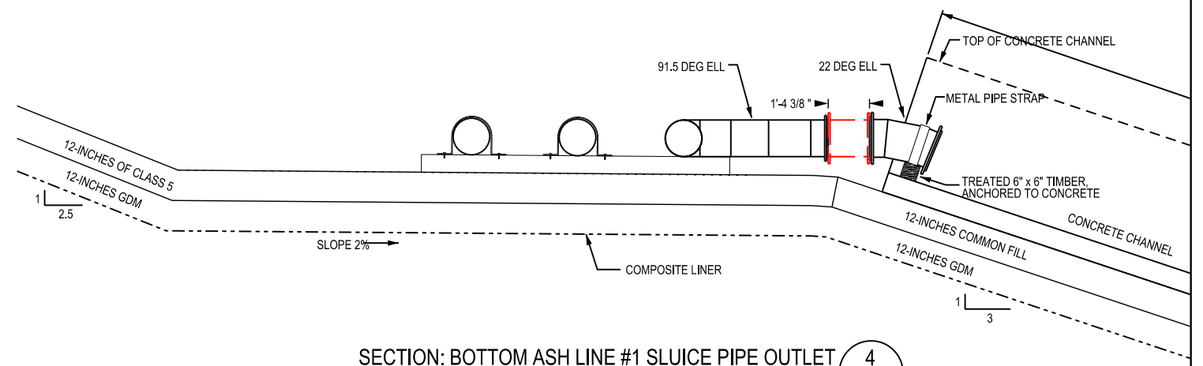
0 2.5 5
SCALE IN FEET



PLAN: BOTTOM ASH LINE #1 SLUICE PIPE OUTLET 3 BA4

0 5 10
SCALE IN FEET

N



SECTION: BOTTOM ASH LINE #1 SLUICE PIPE OUTLET 4 BA20

0 2.5 5
SCALE IN FEET

NO	REVISION	ZONE	DATE	BY	CHK	ENG
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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR
4	SLUICE LINE REV; REVISED BA4, ADDED BA19 - BA21		5/20/20	DJR	XCEL	DJR

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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

FIRST NAME: DANIEL J. RIGGS

SIGNATURE:

DATE: 5/20/2020 LICENSE# 49559

Xcel Energy®
NORTHERN STATES POWER COMPANY
SHERCO GENERATING PLANT
BECKER, MINNESOTA

DWN: BLP	DATE:	CHK:	DATE:
ENG: DJR	DATE:	CHK:	DATE:
PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

THIS MAP/DOCUMENT IS A TOOL TO ASSIST EMPLOYEES IN THE PERFORMANCE OF THEIR JOBS. YOUR PERSONAL SAFETY IS PROVIDED FOR BY USING SAFETY PRACTICES, PROCEDURES, AND EQUIPMENT AS DESCRIBED IN THE SAFETY TRAINING PROGRAMS AND MANUALS.

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
BOTTOM ASH LINES #2 & #1 SLUICE PIPE OUTLET PLAN AND SECTIONS

BA20 REV 4

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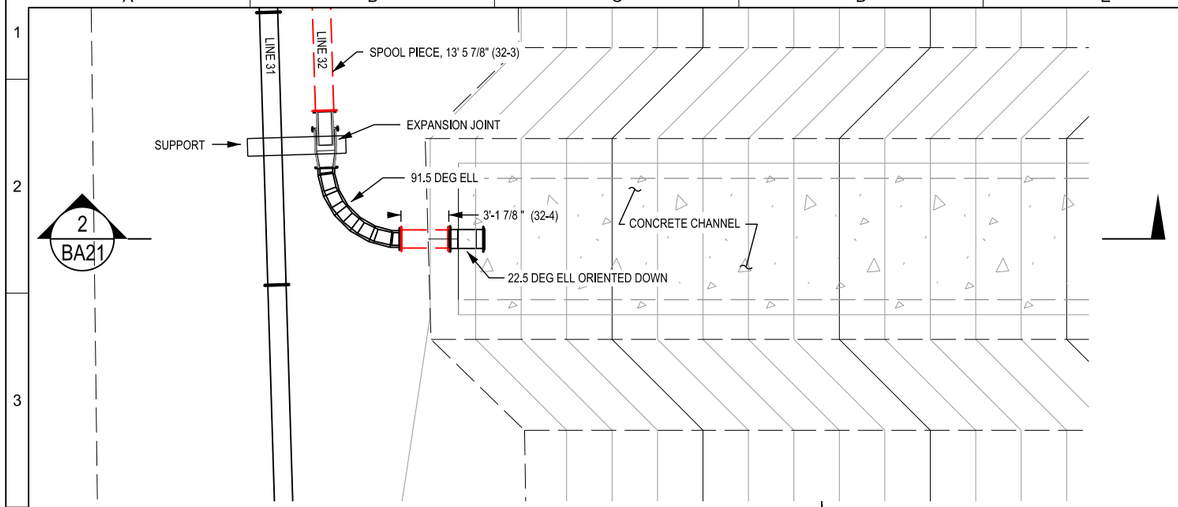
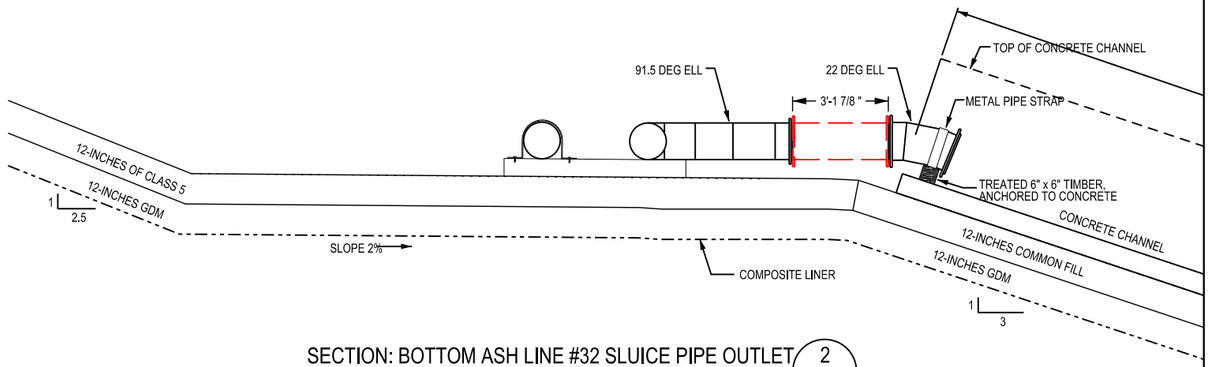


PLAN: BOTTOM ASH LINE #32 SLUICE PIPE OUTLET (1 / BA4)

0 5 10
SCALE IN FEET



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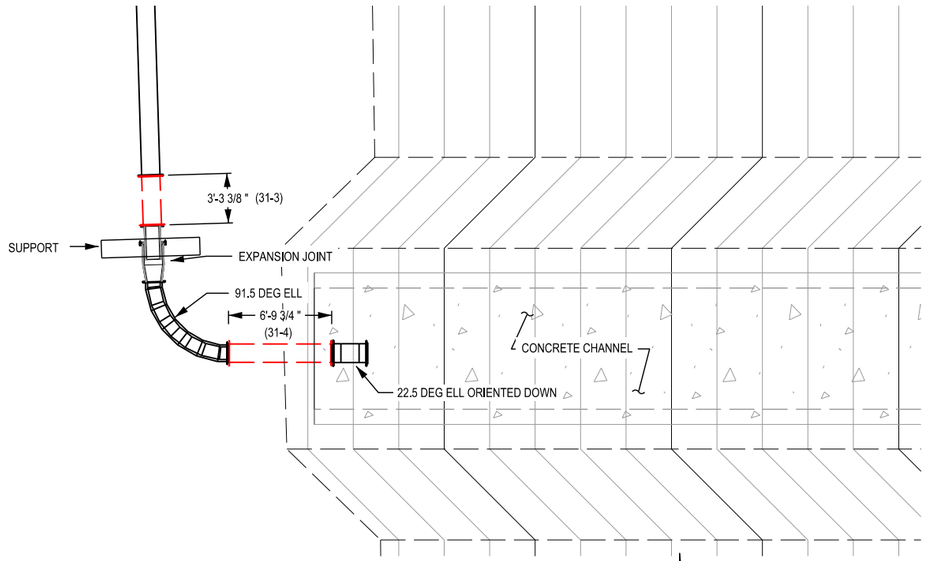
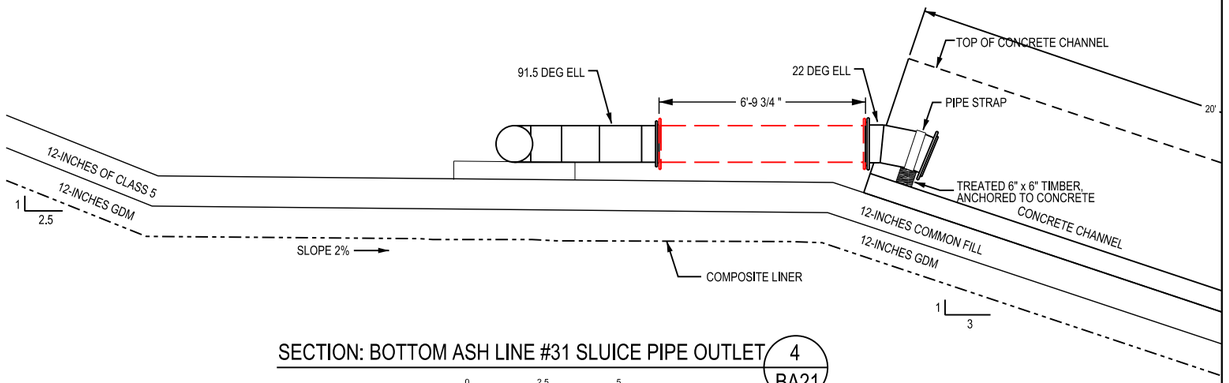
0 2.5 5
SCALE IN FEET



PLAN: BOTTOM ASH LINE #31 SLUICE PIPE OUTLET (3 / BA4)

0 5 10
SCALE IN FEET



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0 2.5 5
SCALE IN FEET

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0	ISSUED FOR BIDDING		6/17/19	BLP	JRM	DJR
1	ISSUED FOR CONSTRUCTION		9/6/19	BLP	DJR	DJR
2	REVISED BA3, ADDED BA7A, ADDED MW SHEET		10/30/19	BLP	XCEL	DJR
3	REVISED BA3		11/18/19	BLP	XCEL	DJR
4	SLUICE LINE REV; REVISED BA4, ADDED BA19 - BA21		5/20/20	DJR	XCEL	DJR

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FIRST NAME: DANIEL J. RIGGS

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Xcel Energy®
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DWN: BLP	DATE:	CHK:	DATE:
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PM: DJR	DATE:	PROJ. NO: SHC11380	
APVD:	DATE:	SCALE: SEE DRAWING	

THIS MAP/DOCUMENT IS A TOOL TO ASSIST EMPLOYEES IN THE PERFORMANCE OF THEIR JOBS. YOUR PERSONAL SAFETY IS PROVIDED FOR BY USING SAFETY PRACTICES, PROCEDURES, AND EQUIPMENT AS DESCRIBED IN THE SAFETY TRAINING PROGRAMS AND MANUALS.

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BOTTOM ASH POND NO. 2 NPDES
CONSTRUCTION DRAWINGS
BOTTOM ASH LINES #32 & #31 SLUICE PIPE OUTLET PLAN AND SECTIONS

BA21 REV 4

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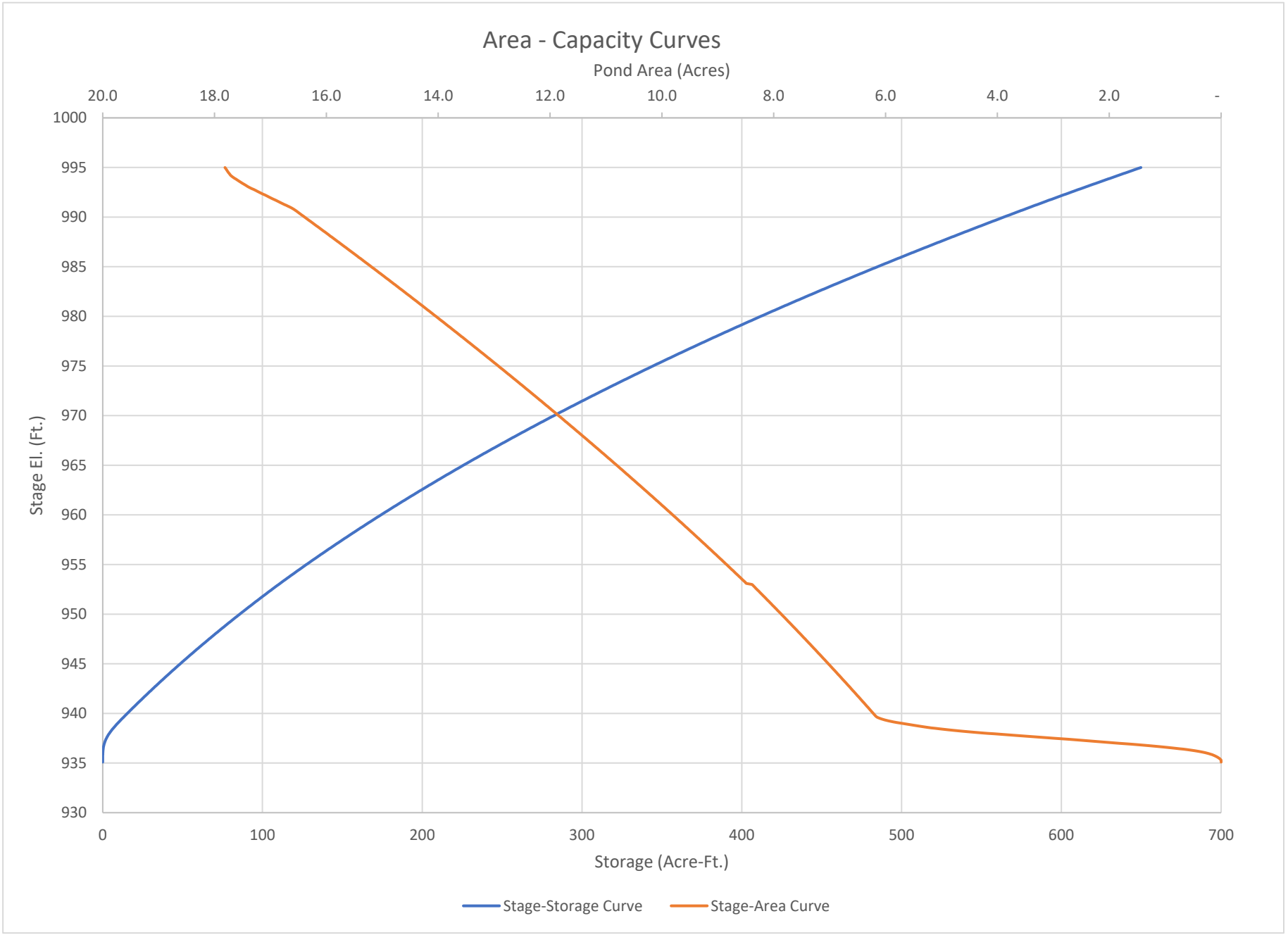
Plotted: 5/20/2020 12:10:18 PM

APPENDIX C –AREA-CAPACITY CURVE


Area - Capacity Curves
Pond Area (Acres)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
-
Stage El. (Ft.)
1000
995
990
985
980
975
970
965
960
955
950
945
940
935
930
0
100
200
300
400
500
600
700
Storage (Acre-Ft.)
Stage-Storage Curve
Stage-Area Curve

APPENDIX D – SECONDARY OUTLET CAPACITY CALCULATIONS

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Your Natural Resource

Project Bottom Ash Pond 2 - overflow Pipe Calc | Project No. 3484-19
Signature [signature] | Date 9/24/2020

Calculate the Flow of a Full Secondary outlet pipe using Manning Equation.

Pipe: 24-inch SDR 11
ID: 19.375" or 1.615'
Length: 170 ft.
Elevation: 989' (IE) - 963' (IE.) = 26 ft.

Mannings $Q = \frac{1.49}{n} \cdot A \cdot \left(\frac{A}{P}\right)^{2/3} \cdot S^{1/2}$

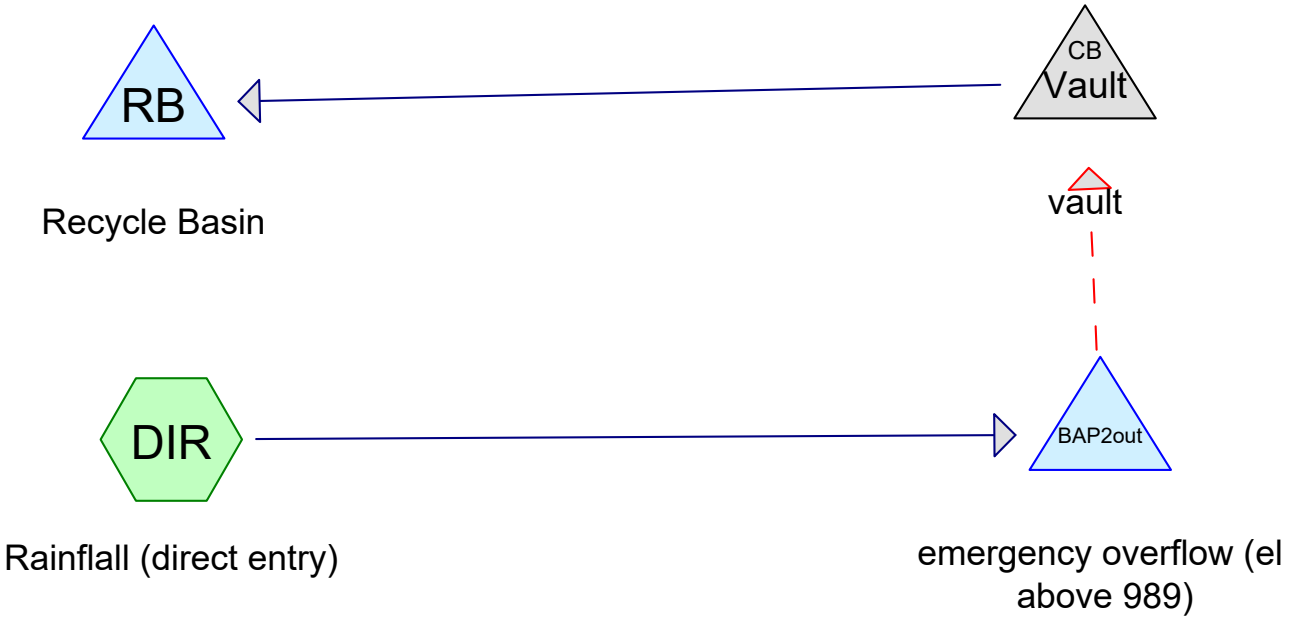
where:

Q = pipe flow, cfs.
n = manning Number, 0.01 for PEP
A = pipe area = $\pi \left(\frac{1.615\ ft}{2}\right)^2 = 2.048\ ft^2$
P = wetted perimeter, (full pipe) = $\pi \cdot d = \pi (1.615^{ft}) = 5.074^{ft}$
S = slope = $\Delta EL / length = 26' / 170' = 0.153\ ft/ft.$

$\therefore Q = \frac{1.49}{0.01} \cdot (2.048 ft^2) \left(\frac{2.048 ft^2}{5.074 ft}\right)^{2/3} \cdot (0.153\ ft/ft)^{1/2}$

$= 65.2\ CFS = \underline{29,264\ GPM}$

Maximum Flow from BAP2 Sluice Pipes is <u>11,000 GPM</u>



Subcat Reach Pond Link

Routing Diagram for CCR Secondary Discharge Pipe Flow
Prepared by {enter your company name here}, Printed 9/24/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
18.800	100	direct rainfall (DIR)
18.800	**100**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
18.800	Other	DIR
18.800		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	18.800	18.800	direct rainfall	DIR
0.000	**0.000**	**0.000**	**0.000**	**18.800**	**18.800**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	BAP2out	989.00	963.00	170.0	0.1529	0.011	19.4	0.0	0.0
2	Vault	960.00	952.56	2,188.0	0.0034	0.011	24.3	0.0	0.0

Time span=0.00-100.00 hrs, dt=0.10 hrs, 1001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DIR: Rainflall (direct entry) Runoff Area=18.800 ac 100.00% Impervious Runoff Depth=9.78"
Flow Length=1' Tc=0.0 min CN=100 Runoff=272.27 cfs 15.322 af

Pond BAP2out: emergency overflow Peak Elev=991.78' Storage=46.291 af Inflow=284.52 cfs 116.663 af
19.4" Round Culvert n=0.011 L=170.0' S=0.1529 '/' Outflow=10.95 cfs 70.367 af

Pond RB: Recycle Basin Inflow=10.95 cfs 70.367 af
Primary=10.95 cfs 70.367 af

Pond Vault: vault Peak Elev=961.65' Inflow=10.95 cfs 70.367 af
24.3" Round Culvert n=0.011 L=2,188.0' S=0.0034 '/' Outflow=10.95 cfs 70.367 af

Total Runoff Area = 18.800 ac Runoff Volume = 15.322 af Average Runoff Depth = 9.78"
0.00% Pervious = 0.000 ac 100.00% Impervious = 18.800 ac

Summary for Subcatchment DIR: Rainflall (direct entry)

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

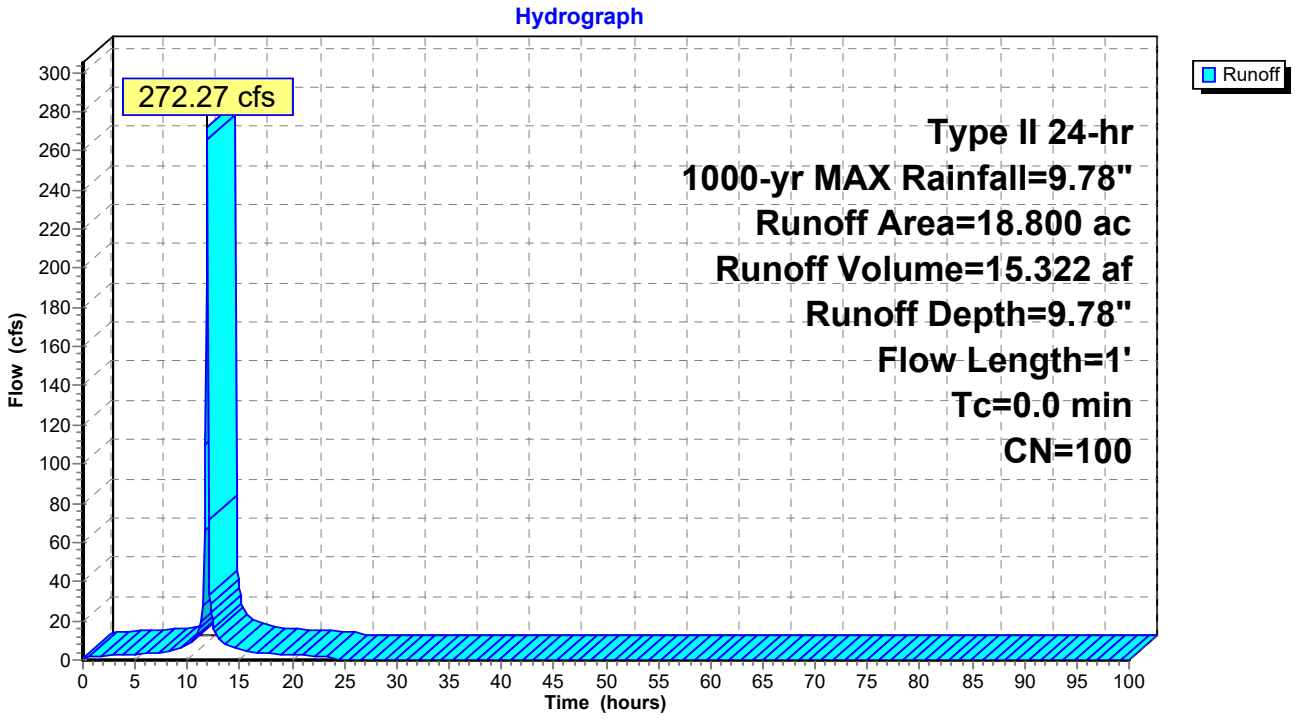
Runoff = 272.27 cfs @ 11.88 hrs, Volume= 15.322 af, Depth= 9.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.10 hrs
Type II 24-hr 1000-yr MAX Rainfall=9.78"

	Area (ac)	CN	Description
*	18.800	100	direct rainfall
	18.800		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	1		1.00		**Direct Entry,**

Subcatchment DIR: Rainflall (direct entry)



Summary for Pond BAP2out: emergency overflow (el above 989)

Inflow Area = 18.800 ac,100.00% Impervious, Inflow Depth > 74.47" for 1000-yr MAX event
Inflow = 284.52 cfs @ 11.88 hrs, Volume= 116.663 af, Incl. 12.25 cfs Base Flow
Outflow = 10.95 cfs @ 100.00 hrs, Volume= 70.367 af, Atten= 96%, Lag= 5,287.4 min
Secondary = 10.95 cfs @ 100.00 hrs, Volume= 70.367 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.10 hrs / 3
Peak Elev= 991.78' @ 100.00 hrs Surf.Area= 17.137 ac Storage= 46.291 af
Flood Elev= 995.00' Surf.Area= 17.870 ac Storage= 102.975 af

Plug-Flow detention time= 2,069.0 min calculated for 70.242 af (60% of inflow)
Center-of-Mass det. time= 795.2 min (3,495.1 - 2,700.0)

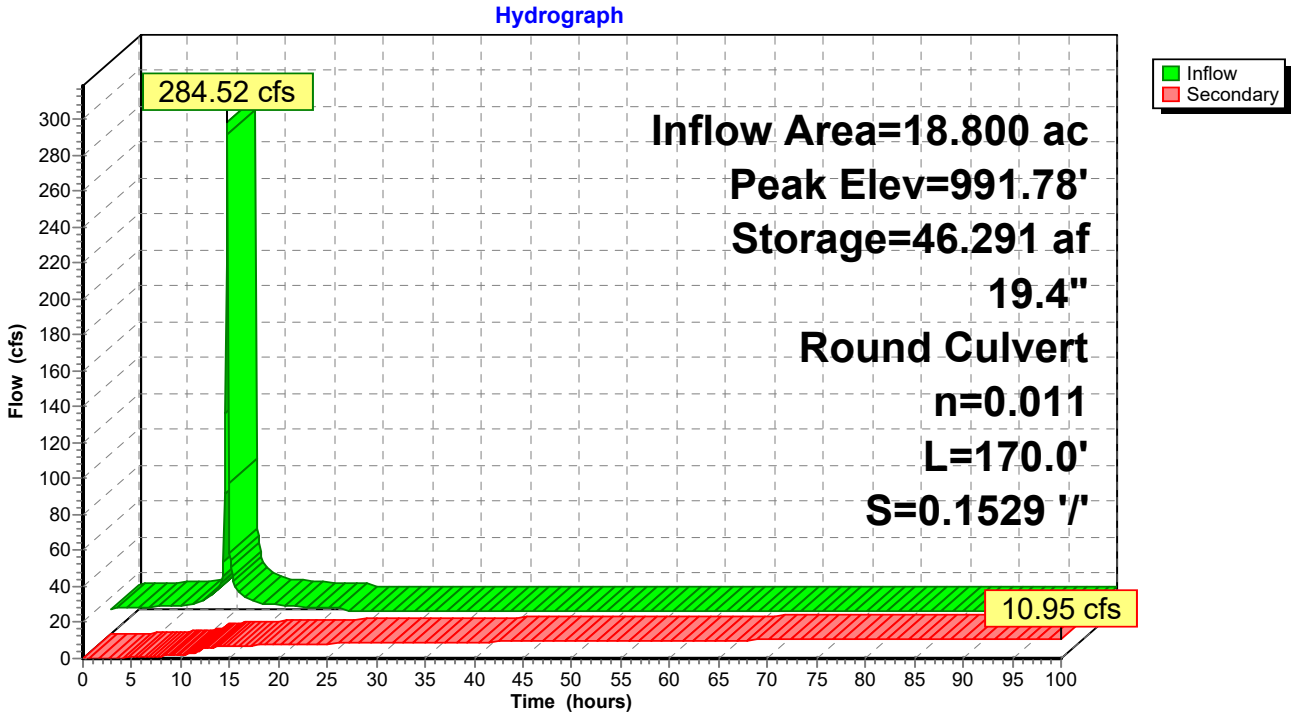
Volume	Invert	Avail.Storage	Storage Description
#1	989.00'	102.975 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
989.00	16.280	0.000	0.000
990.00	16.530	16.405	16.405
991.00	16.850	16.690	33.095
992.00	17.220	17.035	50.130
993.00	17.540	17.380	67.510
994.00	17.760	17.650	85.160
995.00	17.870	17.815	102.975

Device	Routing	Invert	Outlet Devices
#1	Secondary	989.00'	**19.4" Round emergency overflow** L= 170.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 989.00' / 963.00' S= 0.1529 '/' Cc= 0.900 n= 0.011, Flow Area= 2.05 sf

Secondary OutFlow Max=10.95 cfs @ 100.00 hrs HW=991.78' TW=961.65' (Dynamic Tailwater)
1=emergency overflow (Inlet Controls 10.95 cfs @ 5.33 fps)

Pond BAP2out: emergency overflow (el above 989)



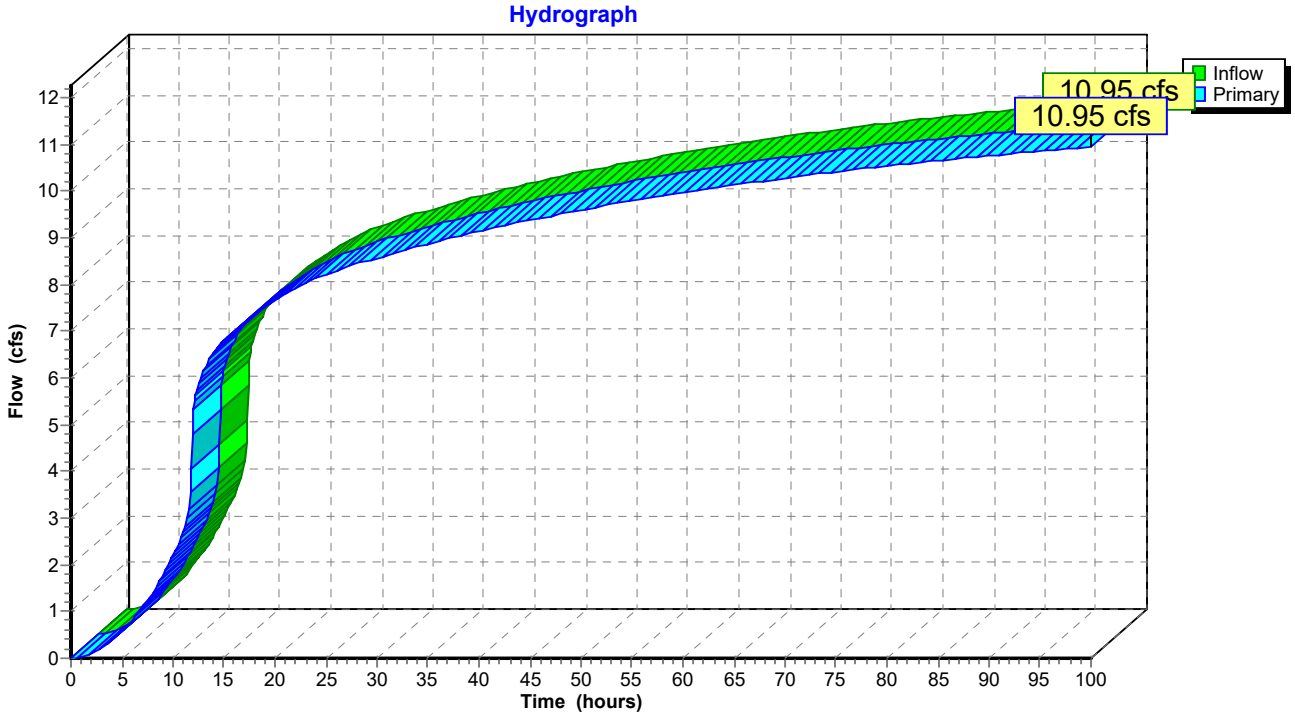
Summary for Pond RB: Recycle Basin

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	10.95 cfs @ 100.00 hrs, Volume=	70.367 af
Primary	=	10.95 cfs @ 100.00 hrs, Volume=	70.367 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.10 hrs / 3

Pond RB: Recycle Basin



Summary for Pond Vault: vault

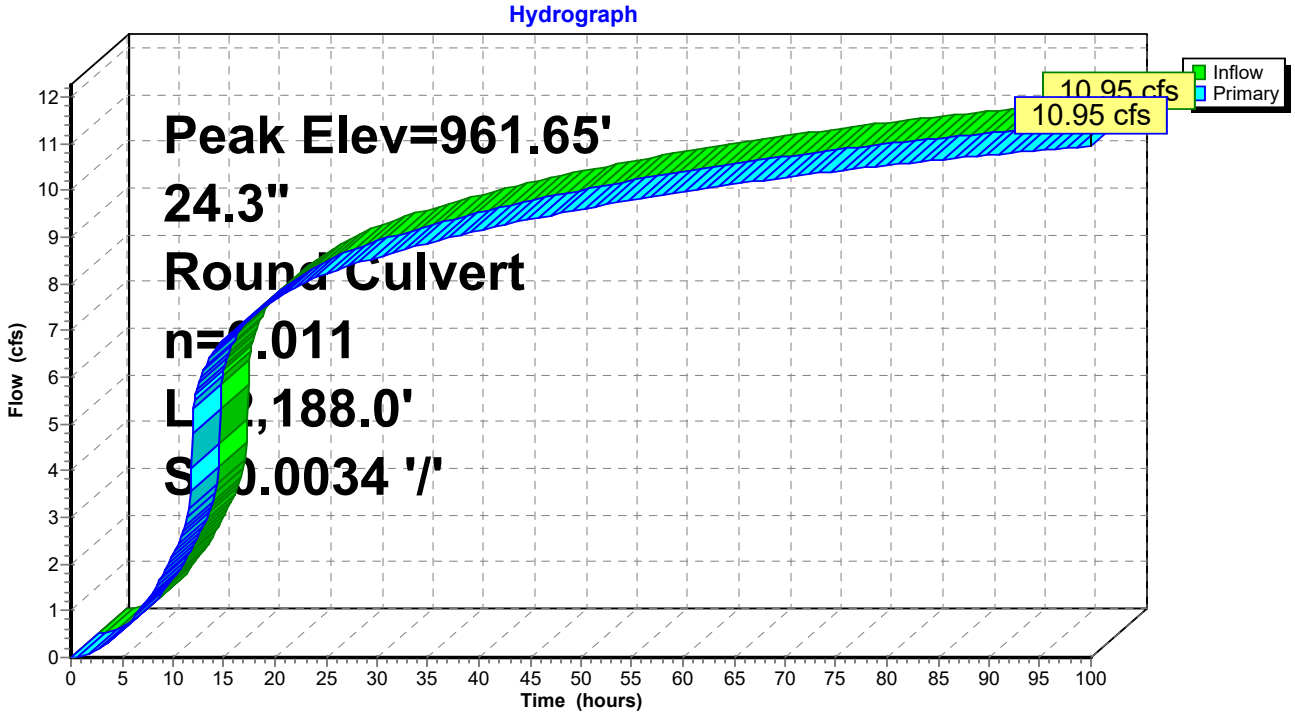
Inflow	=	10.95 cfs @ 100.00 hrs, Volume=	70.367 af
Outflow	=	10.95 cfs @ 100.00 hrs, Volume=	70.367 af, Atten= 0%, Lag= 0.0 min
Primary	=	10.95 cfs @ 100.00 hrs, Volume=	70.367 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.10 hrs / 3
Peak Elev= 961.65' @ 100.00 hrs
Flood Elev= 972.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	960.00'	**24.3" Round Culvert** L= 2,188.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 960.00' / 952.56' S= 0.0034 '/' Cc= 0.900 n= 0.011, Flow Area= 3.22 sf

Primary OutFlow Max=10.95 cfs @ 100.00 hrs HW=961.65' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 10.95 cfs @ 5.30 fps)

Pond Vault: vault



APPENDIX E – CONSTRUCTION SPECIFICATIONS

Technical Specifications

Bottom Ash Pond No. 2
NPDES Permit No. 0002186
Project No. SHC-11380
Sherburne County Generating Plant
Becker, Minnesota

February 2020

Prepared for:

Xcel Energy, Inc.

Prepared By:

Carlson McCain

TABLE OF CONTENTS

I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Minnesota.

Date: February 6, 2020

Daniel J. Riggs, P.E.

49559
Registration No.

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 – GENERAL

1.01 TECHNICAL SPECIFICATION DOCUMENTS

A. The format of these Technical Specifications is based upon the CSI MASTERFORMAT. However, differences in format and subject matter location do exist. It is Contractor's sole responsibility to thoroughly read and understand these Technical Specifications and request written clarification of those portions, which are unclear.

B. Division of the Work as made in these Technical Specifications is for the purpose of specifying and describing Work, which is to be completed. There has been no attempt to make a classification according to trade or agreements, which may exist between Contractor, SubContractors, or trade unions or other organizations. Such division and classification of the Work shall be Contractor's sole responsibility.

C. Should a discrepancy between the Technical Specifications and the Drawings occur, the higher standard shall prevail.

1.02 EXISTING SITE CONDITIONS AND USES

A. The Project (Site or Project) is located within the Sherburne County Generating Plant (Sherco or Plant) property, south of Highway 10 in Becker, Minnesota.

B. Fences and gates control access to the Site. Only authorized access is permitted. Xcel Energy (Company) and other Contractor vehicles use roadways within and near the Site. Company's vehicles shall have the right-of-way at all times.

C. Groundwater monitoring wells are present and are sampled regularly.

1.03 WORK COVERED BY TECHNICAL SPECIFICATION DOCUMENTS

A. The overall scope of work, which is more fully described in these Technical Specifications includes, but is not necessarily limited to, furnishing all labor, tools, equipment, and materials necessary to perform the Work:

<u>Bottom Ash Pond No. 2 Construction Project</u>

1. Construction of Bottom Ash Pond No. 2 will occur north of and adjacent to existing Scrubber Solids Pond 2, and east of and adjacent to existing Bottom Ash Pond 1. Construction of the Bottom Ash Pond No. 2 will consist of two phases. Phase 1, consisting of excavating to the base grades of the pond and construction of perimeter embankments and discharge piping, will occur in 2019. Installation of the Bottom Ash Pond No. 2 composite base and slope liner and slope cover soils will occur in 2020.

2. Provide a Project schedule in accordance with the milestone dates provided by Company.
3. Sign and comply with storm water construction permit requirements.
4. Review existing survey data and submit topographic acceptance forms.
5. Provide Contractor's GPS ("Global Positioning System") Site calibration file to Engineer.
6. Install and maintain appropriate erosion and sediment best management practices (BMP's).
7. Control dust generated by wind or by Contractor's vehicle traffic. Water is available at the Pond 1 Fill Station, as shown on the Drawings.
8. Remove and properly dispose of trees and vegetation from the designated soil-borrow area, as needed, as shown on the Drawings. Areas requiring additional excavation may incorporate the topsoil into the common fill.
9. Strip and salvage Class 5 aggregate on existing roads, as shown on the Drawings. Salvaged Class 5 aggregate shall be stockpiled in the location shown on the Drawings.
10. Excavate native soil from the designated soil borrow area and construct the perimeter embankments on the north, south, east and west sides of Bottom Ash Pond No. 2. Excavations shall follow the contours outlined in the Drawings. Construct the embankments using specified materials to the lines and grades shown on the Drawings. Segregate and remove unusable gravel/cobble seams encountered during excavation, as further defined in these Technical Specifications. Rock that is segregated during excavation of common fill shall be removed from Site and disposed of properly by the Contractor.
11. Furnish and install all high density polyethylene (HDPE) and corrugated metal (CMP) pipes.
12. Furnish and install filter aggregate and geotextiles around dewatering pipes.
13. These specifications do not include furnishing or installation of the vault. Those are provided in a separate document.
14. Load, haul and place topsoil and establish turf on exterior and interior embankment slopes, perimeter areas where shown on the Drawings and areas disturbed by Contractor's activities. Topsoil shall be loaded from the topsoil stockpiles shown on the Drawings.
15. Furnish and install erosion blanket on all new and disturbed areas, as shown on the Drawings.
16. Construct all other related items associated with the Work including, but not limited to, access roads, ramps, drainage features, temporary sumps and marker posts.
17. Remove and properly dispose of trees and vegetation from the designated soil-borrow area, as needed, and on the Bottom Ash Pond No. 2 interior embankments, as shown on the Drawings (2019 Construction). Upon removing trees and vegetation, load, haul, and place common fill material as necessary to the lines and grades shown on the Drawings. Unsuitable material shall be subcut and replaced according to these Technical Specifications. Compact topsoil left in place and common fill placed as necessary with a smooth drum roller.

18. Prepare a geomembrane and GCL material storage area by placing 6 inches of clean fill to elevate the storage area above existing grade and provide for drainage from the storage area. Coordinate with Company to determine location of storage areas.
19. Furnish and install composite liner consisting of geosynthetic clay liner (GCL) and HDPE geomembrane liner for Bottom Ash Pond No. 2. Cover edges of future tie-in locations with plywood, as shown on the Drawings.
20. Provide daily composite liner installation results to Engineer, as further defined in these Specifications. Company and Engineer will be collecting daily composite liner installation data and providing the information to the Minnesota Pollution Control Agency (MPCA) in phases in order to obtain approval of the liner installation from the MPCA in a timely manner. Delays in the collection of the data may delay construction of other phases of the Project.
21. An electronic leak location survey will be conducted by Owner's representative. Leak testing will occur in two phases: the first phase will be conducted on bare liner following installation of composite liner. The second phase will be conducted following placement of dewatering pipe drainage sand and aggregates.
22. Place Screened Sand Layer over composite slope liner. Screened Sand is available from the stockpiles east of Pond 3, as shown on the Drawings.
23. Coordinate with Company for completion of electrical liner leak location testing. Provide electrical isolation at the liner edges and phase boundaries, as directed by the Company or Engineer. Leak testing may be conducted in phases to facilitate liner installation and cover soil placement. Provide assistance to leak testing Contractor, as further specified in these Specifications.
24. Maintain the sand cover in a moist, electrically conductive condition during electrical liner leak location testing, as further defined in these Specifications. Temporary haul roads within the leak-testing footprint for water wagon access are acceptable; however, temporary roads will need to be "flipped" or removed in order to complete testing.
25. Load, haul and place common fill on the Bottom Ash Pond No. 2 interior berm slopes and interior benches, as shown on the Drawings. Common fill shall be obtained from the stockpiles shown on the Drawings. Common fill shall not be placed over the liner until leak-testing activities are complete.
26. Load, haul and place topsoil and establish turf on interior berm slopes, interior benches and areas disturbed by Contractor's activities. Topsoil shall be loaded from the topsoil stockpiles shown on the Drawings.
27. Reuse salvaged Class 5 aggregate and supplement with imported Class 5 aggregate, as necessary, on road surfaces shown on the Drawings.
28. Furnish and install erosion blanket on all new and disturbed areas, as shown on the Drawings.
29. Provide soil testing services and reporting as described in these Technical Specifications.
30. Construct or restore all other related items associated with the Work including, but not limited to, access roads, ramps, drainage features, temporary sumps and marker posts.

31. Survey all required surfaces in accordance with the Technical Specification. The surveys shall be signed by a State of Minnesota registered land surveyor

32. Clean up and restore the Site, establish drainage, and neatly trim stockpiles.

Note: The term “furnish,” “provide” and “install” are as defined in Section 01095 “Definitions and Standards.”

B. It is the intent of the Technical Specifications to cover all aspects of the Projects. Should there be some item or items not shown on the Drawings or not described in these Technical Specifications, which are required for the Work, those items and the furnishing of all labor, materials, and equipment shall be considered incidental to the Work and no additional compensation will be provided. Contractor is responsible for verifying quantities for pricing and to complete the Work.

C. The Work includes the furnishing of all labor, equipment, tools, machinery, materials, and other items required for the construction of a complete Project as specified. Equipment furnished shall be in safe operating condition and of adequate size, capacity, and condition for the performance of the Work. Contractor shall obtain all measurements necessary for the Work and shall be responsible for establishing all dimensions, levels, and layout of the Work.

D. Contractor shall be solely responsible for the coordination of its activities with regard to the Projects and the activities of SubContractors and Company.

1.04 GENERAL PROJECT REQUIREMENTS

A. General:

1. Maintain access to property for Company’s vehicles and equipment at all times.
2. Implement requirements of the National Pollutant Discharge Elimination System (NPDES) construction storm water permit for storm water control.
3. Coordinate and conduct a pre-job meeting with local union business agents from each craft involved in the execution of the Projects. The meeting shall address the scope, schedules, working conditions and jurisdiction of Work. The meeting shall take place a minimum of 3 weeks prior to the start of the Project.
4. Contractor's personnel working on the Site shall display an assigned access badge provided by the Company. Contractor's personnel will not be granted admission to the Site without this access badge. Contractor’s personnel will only be granted access upon completing Company’s required drug/background screening program. In addition, Contractor’s personnel must complete the required General Safety Orientation program (GSOX) prior to entering the Site. Contractor shall ensure that all personnel badge in and out each time they enter or exit the Site. Company may conduct random badge audits throughout the life of the Project. Contractor’s personnel found in non-compliance with the badge audit may be removed from the Site. Contractor shall be responsible to return all badges to the Company representative at the end of the Project or whenever Contractor’s personnel no longer need access to the Site. Cost of replacing lost or damaged access badges is $100.00/badge and shall be

deducted from Contractor's final payment.

5. Contractor shall use the gates shown on the Drawings for Site access for personnel and Contractor's heavy equipment and material deliveries. Equipment deliveries/removal shall be coordinated with the Company.
6. Contractor's licensed vehicles (including SubContractors) will not be authorized to enter the Site unless Contractor's name or logo is displayed on the vehicle. This requirement does not apply to Contractor's personnel entering through the designated gate and traveling directly to Contractor's designated parking area (shown on the Drawings). Unauthorized personnel will not be allowed on the Site.
7. Provide the appropriate medical services and first-aid equipment including, but not limited to, portable eyewash stations, AED's and first-aid kits. Contractor shall also provide an action plan identifying the appropriate medical response in case of an emergency.
8. Conduct daily safety meetings during construction and require attendees to sign meeting summaries. Copies of the daily safety meetings shall be provided to Company.
9. Complete and sign daily safety checklists (provided by Company).
10. Provide Project information on a weekly basis that includes, at a minimum, the number of on-site staff (including SubContractors), hours worked, equipment used, volume of material placed, water usage, and any other information requested by Company. Company's representative will coordinate with Contractor to determine the format and schedule for the weekly submittal.
11. Complete Company drug/background screening requirements and safety orientations for all employees that will be working on-site.
12. Provide adequate water and wagons/trucks to eliminate dusting issues while hauling/working material within the Site.
13. Implement a spill plan to control the release of chemicals (gasoline, oils, diesel fuel, etc.). Any leaks to hoses, fuel lines, etc., shall be repaired immediately. Contractor is responsible for immediate cleanup of contaminated water and soils. Contractor shall have an on-site oil spill clean-up kit available at all times. If washouts are caused by the spill, Contractor is responsible for restoring the damaged area to original conditions. Contractor shall immediately report any spills to Company. A written report shall be submitted to Company within 48 hours. The report shall contain information on the cause of the spill, spill volume, time of spill, duration of spill and the cleanup activities. Reportable spills include: any foreign substance that is spilled into the ponds or onto the ground, such as hydraulic fluids, diesel fuel, gasoline, oil, etc. and any ash or ash-contact water that is released to unlined areas.
14. Company has a construction trailer on-site, which is available to Contractor. Contractor shall be allowed to use the office located on the south end of the trailer. The Company will provide power and telephone service to the trailer; however, Contractor shall be responsible for providing drinking water, sanitation facilities, trash disposal, and temporary lighting as needed.

15. Fire Protection: Contractor shall make all arrangements necessary to assure that the Site and the Work have adequate fire protection services throughout the duration of the Work. Any special fees or charges imposed by the local governmental units or other organization to provide such services shall be paid by Contractor.
16. Portable Power Requirements: Contractor shall comply with Company's electrical requirements for portable power units. When working in a wet location either GFCIs or an assured grounding program must be used (a wet location is any area that is potentially subject to saturation with moisture from sources such as the weather. Any job being done outdoors, no matter what the weather conditions are, is considered to be in a wet location. Any area inside a structure that is subject to saturation with moisture from any source is also considered a wet location). Electrical cords used in a wet location that are plugged into a receptacle that is part of a permanent wiring system must be protected at the source with a GFCI. For example, when an extension cord is plugged into a receptacle inside a service center and is run out to the parking lot to supply power to a drill, the receptacle must have a GFCI either built into the receptacle or the breaker. If it doesn't have a built in GFCI, then a portable GFCI must be used. Company personnel or Engineer shall inspect all power units prior to Contractor placing them into service.

1.05 CONSTRUCTION QUALITY ASSURANCE (CQA) ACTIVITIES

A. Contractor shall be responsible for all CQA activities as outlined in the Technical Specifications. Contractor shall use only testing laboratories and methods as outlined in the Technical Specifications.

B. Contractor shall be responsible for coordinating all sample collection activities and deliveries with testing laboratories and shall follow the "CQA labeling system" as provided by Company.

C. CQA activities include but are not limited to:

1. Source laboratory testing on soil materials
2. In-place laboratory testing on soil materials
3. In-place density testing on soil materials
4. Source laboratory and in-place testing on cast-in place concrete

1.06 PERMITS

A. Contractor shall sign a general permit authorization to discharge storm water associated with construction activity under the NPDES issued by the Minnesota Pollution Control Agency and any other required construction permits. Contractor shall be responsible to obtain other permits that may be required.

1.07 WORK SEQUENCE

A. Construct Work in stages to accommodate operation of existing facilities during construction period; coordinate construction progress schedule and operations with Engineer.

B. Complete construction activities in accordance with the milestone schedule.

1.08 CONSTRUCTION PROGRESS SCHEDULES

A. Prepare and submit construction progress schedule a minimum of 4 weeks prior to the start of construction.

B. Prepare schedules in form of horizontal bar chart:

1. Provide separate horizontal bar for each operation.
2. Horizontal Time Scale: Identify first work day of each week.
3. Scale and spacing to allow for notations and future revisions.
4. Arrange listings in order of start of each item of Work.

C. Construction Progress Schedule:

1. Show complete sequence of construction by activity.
2. Show dates for beginning and completion of each major element of construction and installation dates for major items. Elements shall include, but not be limited to, the following:
   a. Site preparation.
   b. Shop Drawing receipt from supplier/manufacturer, submittal to Engineer, review and return to supplier/manufacturer.
   c. Material and equipment order, manufacturer, delivery.
   d. Performance tests and supervisory services activity.
   e. Schedule for each major work item.
   f. Subgrade excavation/grading
   g. Stormwater collection placement
   h. Topsoil placement
   i. Erosion control
   j. Surface water management
   k. SubContractor's items of Work.
   l. Final cleanup
   m. Allowance for inclement weather.
   n. Miscellaneous items.
3. Show projected percentage of completion for each item as of first day of each month.

D. Schedule Revisions:

1. Every week to reflect changes in progress of Work.
2. An updated schedule should be presented at the weekly progress meetings
3. Indicate progress of each activity at date of submittal.
4. Show changes occurring since previous submittal of schedule.
   a. Major changes in scope.
   b. Activities modified since previous submittals.
   c. Revised projections of progress and completion.

d. Other identifiable changes.

5. Provide narrative report as needed to define:
   a. Problem areas, anticipated delays, and impact on schedule.
   b. Corrective action recommended and its effect.
   c. Effect of changes on schedule of other Contractors.

1.09 CONTRACTOR USE OF SITE

A. Definition of Site: The Site is defined as the area within the fenced boundary shown on the Drawings. Contractor shall limit operations, including material and equipment storage, to within those boundaries.

B. Contractor shall keep driveways, roads, and entrances clear and available to Company and Company's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on Site.

C. Hours of Operation: Contractor's operations shall be limited to the hours of 6:00 a.m. to 6:30 p.m. (Central Daylight Time), Monday through Friday, unless prior arrangements are made with Company. Work on Saturdays, Sundays and holidays is not allowed unless prior authorization is received from Company.

D. Protection and Repair of Existing Facilities and Utilities: Contractor shall perform operations carefully and in such a manner as to protect existing facilities and utilities. Obstructions not shown on the Drawings may exist and shall be exposed by Contractor without damage. Contractor shall be responsible for damage to existing facilities and utilities resulting from Contractor’s operations, and shall repair or replace damaged items to Company’s satisfaction. Groundwater monitoring wells shall be protected during construction.

E. Unfavorable Construction Conditions: When unfavorable weather, soil, drainage, or other unsuitable construction conditions exist, Contractor shall confine operations to Work, which will not be adversely affected by such conditions. No portion of the Work shall be constructed under conditions, which would adversely affect the quality of the Work, unless special means or precautions are taken to perform the Work in a proper and satisfactory manner.

F. Survey Markers: Contractor shall conduct operations so as to preserve benchmarks, survey reference points, and stakes existing or established by Company for the construction. Contractor will be charged the expense of repairing or replacing survey markers and shall be responsible for mistakes or lost time resulting from damage or destruction of survey markers due to Contractor’s operations.

G. Company's operations personnel will occupy the Site and existing buildings during entire period of construction for conduct of normal operations. Contractor shall cooperate with Company during construction operations to minimize conflict and facilitate Company’s operations.

H. Contractor shall, at all times, conduct operations to ensure least inconvenience to Company, other Contractors, general public, and operation of existing facilities.

I. Coordinate use of Site under direction of Engineer and/or Company.

J. Assume full responsibility for protection and safekeeping of materials and equipment.

K. Obtain and pay for use of additional storage or Work areas needed for operations at

no additional cost to Company.

1.10 FUTURE WORK

A. None

1.11 PREORDERED MATERIALS OR EQUIPMENT

A. None

1.12 COMPANY-FURNISHED MATERIALS OR EQUIPMENT

A. Common fill soils as specified in Section 02207 are available on-site. Contractor is responsible for selection of soils and processing soils to meet the requirements of the Technical Specification.

B. Topsoil as specified in Section 02486 is available on-site, as shown on the Drawings.

C. Screened Sand as specified in Section 02201 is available on-site, as shown on the Drawings.

D. Contractor to coordinate with Engineer and Company for proper soil selection.

E. Company will provide benchmark and Site coordinate information necessary for construction of the Work.

F. Company shall provide a construction trailer office for Contractor's use during the Project, as further defined in the Technical Specifications.

G. Company shall provide access to the fill station on the west end of Scrubber Solids Pond 1 for dust control, as shown on the Drawings.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION

SECTION 01040

COORDINATION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall coordinate material supply, material delivery/unloading, construction, and inspection to assure efficient and orderly completion of the Work.

B. Contractor shall notify Company, in writing, when coordination of Company's or other Contractor's activities are required.

1.02 PROJECT PERSONNEL

A. Company's representative is:

Mr. John Hunt
Xcel Energy
13999 Industrial Blvd.
Becker, MN 55308
Phone: (763) 261-3508
Mobile: (763) 242-2196
Email: John.Hunt@xcelenergy.com

B. The Engineer is:

Mr. Dan Riggs, P.E.
Carlson McCain, Inc.
15650 36th Ave N, Suite 110
Plymouth, MN 55446
Phone: (952) 346-3855
Mobile: (612) 916-4406
Email: driggs@carlsonmccain.com

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.01 PRIMARY CONTROL MONUMENT

A. Benchmarks will be provided at the Site by Company to establish primary vertical control. Contractor shall only use the benchmarks identified by Company for calibration purposes.

B. Monuments or references for primary horizontal control will be provided at the Site by Company for construction of Work. Contractor shall only use the monuments or references identified by Company for calibration purposes.

C. Contractor shall preserve and maintain primary control monuments.

1.02 PRIMARY LINE AND GRADE

A. Primary line and grade shall be provided and established by Contractor from the primary control monuments identified by Company, as listed above.

B. Contractor shall provide primary line and grade for all Work including, but not limited to:

1. Establishing primary line and grade of:

    a. Bottom Ash Pond No. 2 base construction
    b. Bottom Ash Pond No. 2 perimeter embankments
    c. Bottom Ash Pond No. 2 composite liner anchor limits
    d. Bottom Ash Pond No. 2 perimeter stormwater control features
    e. Bottom Ash Pond No. 2 embankment removal limits

2. Arranging operations to avoid interference with primary lines and grades.
3. Checking accuracy of line and grade by visual inspection, checks between stakes, and daily checks (with surveying equipment) between primary control monuments and stakes.
4. Responsible for protection and preservation of stakes.

1.03 CONSTRUCTION LINE AND GRADE

A. Contractor shall bear sole responsibility for correct transfer of construction lines and grades from primary line and grade points and for correct alignment and grade of completed Work based upon lines and grades shown on the Drawings.

B. Contractor shall transfer line and grade for open cut construction of utilities from primary line and grade stakes to Work by means of grade boards, laser beam or other approved methods.

1.04 DOCUMENTATION SURVEY

A. Contractor shall be responsible for providing survey tolerances as specified prior to documentation survey.

B. Contractor shall perform documentation survey using a Minnesota registered land surveyor in accordance with the Technical Specifications.

C. Re-survey of any points not meeting documentation tolerances will be at Contractor's expense.

D. Elevations and thicknesses shall be reported to the hundredth of a foot (0.01'), and rounding to the nearest 0.1 foot shall not be used in the determination to satisfy the minimum requirements for each soil layer.

E. **An as-built topographic survey of the composite liner shall be performed following installation.**

F. For elevation, grade, and material thickness verification, the following points shall be surveyed:

1. Top, midpoint and bottom of the perimeter interior and exterior slopes at 100-foot intervals. Top and bottom points shall be located along the grade break lines.
2. Every node on an orthogonal 100-foot grid in the base area of Bottom Ash Pond No. 2. The registered land surveyor shall establish the grid layout such that there is not more than 100 feet of distance between the toe-of-slope and the first grid line.
3. Edge of geomembrane at 50-foot intervals along straight runs and at all grade breaks and changes in alignment.
4. Determine Screened Sand material thickness by repeating survey shots over the established grid before and after placement of the Screened Sand. The finished top of the Screened Sand Material surface shall be based upon the thickness verification survey and not upon design surface contours. Soil thickness verification shall be measured perpendicular to the slope.
5. Verify topsoil thickness at 100-foot intervals by taking survey shots before and after placement of topsoil
6. Verify Class 5 thickness at 50-foot intervals by taking survey shots before and after placement of Class 5 along the left and right shoulders and the road centerline

G. For elevation and grade verification, the following points shall be surveyed:

1. Top of discharge pipes, decant , and dewatering pipes at 100-foot intervals.
2. Flow-line of exterior surface water ditches at 100-foot intervals.
3. Bottom of stormwater drainage pipes inlets and outlets.

1.05 LOT CORNERS AND SURVEY MONUMENTS

A. Provide services of registered land surveyor to replace lot corners and survey monument disturbed by construction operations.

1.06 SUBMITTALS

A. Prior to the start of Work, provide "existing topographic conditions acceptance forms" or submit survey data from a Minnesota registered land surveyor to

document actual topographic conditions, as further described in these Technical Specifications.

B. When requested by Engineer, Contractor shall submit a statement certifying elevations and locations of Work are in conformance with Contract Documents and explain all deviations.

C. Within 3 weeks of final surveys, provide a topographic survey and as-built drawing of entire Project area, including borrow area(s) as applicable. Provide as-built drawing markups. Provide contours and TIN files in CAD format (.dgn or .dwg)

D. The registered land surveyor shall sign the as-built drawings and submit to Engineer in printed and electronic format, a tabulation of results of survey Work performed in the format included on the Drawings. The tabulation shall use the format provided by Engineer.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 Verify existing conditions.

3.02 Perform construction staking as needed.

3.03 Contractor shall make no changes or relocations to benchmarks, monuments or reference points without prior written approval from Company.

3.04 Contractor shall report to Company when any benchmark, monument or reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3.05 Contractor shall replace benchmarks, monuments and reference points, which are lost or destroyed at no additional cost to Company. Replacement shall be re-established based on original survey control.

3.06 Contractor shall establish and maintain all lines and levels, located and laid out, by instrumentation and similar appropriate means, as required to efficiently complete all Work indicated by the Drawings and Technical Specifications.

3.07 As construction proceeds, Contractor shall check every element for line, level, and plumb.

3.08 If requested by Engineer, Contractor shall provide sufficient staking to clearly define all construction elements.

3.09 Locations of existing sewers, culverts, and other utilities shown on the Drawings are approximate and shall be field-verified by Contractor, prior to construction, as required to complete the Work.

3.010 Contractor shall notify Engineer 48 hours in advance of performing documentation survey work.

***END OF SECTION**

SECTION 01095

DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Basic definitions are provided in the General Conditions.

B. Additional technical definitions are provided in appropriate sections of these Technical Specifications.

C. Abbreviations and acronyms are sometimes used in the Technical Specifications to identify reference standards. Implied words and meanings shall be interpreted as appropriate.

D. When a standard is specified by reference, Contractor shall comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or when applicable codes established more strict standards.

E. When published standards are referenced, the publication in effect on the date of issue of Contract Documents shall apply, unless specified otherwise.

F. Structures and Surface Features: For purpose of this section, shall mean existing structures and surface features, including but not limited to buildings, pavements, curb and gutter, signs, posts, fences, trees, shrubs, and other landscaped features.

G. Salvaged Topsoil: Natural loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils available from overlying portions of areas to be excavated for construction or in identified on-site stockpiles.

H. Unsuitable Material (for common fill): Topsoil, peat, organic soils (greater than 3%), and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by Engineer.

I. Utilities: Existing gas mains; water mains; electric lines; conduits, telephone, and other communication lines; sewer pipe; cable television, other utilities, and appurtenances.

J. Influence Zone Under Foundations, Pavements, or Sidewalks: Area below foundation or pavement and sidewalk base bounded by 1 horizontal to 2 vertical slope extending outward from 1 ft beyond outer edges of foundation, pavement, or sidewalk.

K. Influence Zone around Piping or Electrical Ducts: Area below limits bounded by line 12 in. above pipe or duct and by 1 horizontal to 2 vertical slope extending outward from that line 1 ft beyond outer edge of pipe or duct.

L. Should a definition in this section conflict with other technical specification sections; those definitions in other technical specification sections shall govern.

M. Geosynthetics; synthetics, HDPE Liner, LLDPE Liner, liner, geomembrane, geocomposite and GCL are all considered “geosynthetics”.

1.02 ABBREVIATIONS, NAMES, AND ADDRESSES OF ORGANIZATIONS

Contractor shall obtain copies of referenced standards, direct from the publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

AASHTO American Association of State Highway and Transportation Officials
44 North Capital Street, NW
Washington, DC 20001

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

GRI Geosynthetic Research Institute
475 Kedron Avenue
Folsom, PA 19033-1208

MN/DOT Minnesota Department of Transportation
395 John Ireland Blvd
St. Paul, MN 55155-1899

MPCA Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

OSHA Occupation Safety and Health Administration
Region 5 Office
230 South Dearborn Street, Room 3244
Chicago, Illinois 60604

1.03 OTHER DEFINITIONS

A. Furnish: Supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. Install: Operations at the Project Site, including unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

C. Provide or Provider: To furnish and install in-place, complete and ready for the intended use.

D. Installer: Contractor or another entity engaged by Contractor, either as an employee, SubContractor, or Contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authorities having jurisdiction.

E. Project Site: Is the space available for performing construction activities, either exclusively or in conjunction, with others performing work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

F. Standard Specifications: Minnesota Department of Transportation "Standard Specifications for Construction" 2014 edition with revisions and supplements.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

(Not Applicable)

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section stipulates the requirements for transmission of submittals from Contractor to Company and Engineer, and actions required by the parties regarding submittals.

B. Submittal shall be made at least 15 days before the subject of the submittal is to be incorporated into the Work. Company or Engineer will respond within 7 days from receipt of submittal.

C. Submittals shall be identified with the Project name, name of submittal, and technical specification section in which the submittal was required.

D. Submittals will be accepted only from Contractor. Submittals from SubContractors, vendors, suppliers, or others will be returned without review or action.

E. Only those submittals required by the technical specification will be accepted. Unsolicited submittals will be returned without review or action.

F. All engineering data, regardless of origin, shall be stamped with the approval of Contractor. Contractor's stamp of approval will be a representation to Company that Contractor has assumed full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that it has reviewed or coordinated each submittal with the requirements of the Technical Specifications. Submittals received without Contractor’s stamp of approval shall be returned without review or action.

G. All engineering data shall be identified by use of the nomenclature established by the Technical Specifications. Equipment drawings shall have the equipment name and number clearly displayed. Material drawings shall have the engineer's structure name and structure number (when applicable) clearly displayed.

1.02 CORRESPONDENCE

A. Correspondence forwarding engineering data shall be addressed to the Company's Representative and the Engineer as follows.

To Company's Representative:

Mr. John Hunt
Xcel Energy
13999 Industrial Blvd.
Becker, MN 55308

To engineer:

Mr. Dan Riggs, P.E.
Carlson McCain, Inc.
15650 36th Ave N, Suite 110
Plymouth, MN 55446

B. A letter of transmittal shall accompany all submissions of engineering data and shall include a list of the data included in the transmittal. Lists shall include manufacturer's drawing numbers identified with the corresponding Project equipment or structure nomenclature as applicable. The letter shall be identified by Company's Project name.

1.03 REVIEW OF SUBMITTALS

A. The Engineer's review of engineering data will cover only general conformity of the data to the Technical Specifications, external connections, and interfaces with equipment and materials furnished under separate specifications. The Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the equipment, material, device, or item indicated or the accuracy of the information submitted; nor shall review by the Engineer be construed as relieving Contractor from any responsibility for errors or deviations from the requirements of the Technical Specifications.

B. All engineering data submitted after final processing by the Engineer and acceptance by Company shall become a part of the awarded Agreement and the Work indicated or described thereby shall be performed in conformity therewith unless otherwise required by Company.

1.04 SUBMITTAL FOR APPROVAL

A. Submit 1 copy to the Engineer and 1 copy to Company's representative.

B. Engineer will review, make notations as appropriate and/or provide comments to the submittal. Company will return submittals to Contractor with the required actions as described below:

- NO EXCEPTIONS TAKEN. Contractor may proceed without further action.

- RESUBMIT. Contractor shall review Engineer's notations, revise subject of submittal as required to conform to the requirements of the Drawings and Technical Specifications, and resubmit to Engineer for additional action.

1.

C. No Work shall be performed in connection with the fabrication or manufacture of equipment and materials until the data has been reviewed by the Engineer, except at Contractor's own risk and responsibility.

D. If changes are made at the Site to correct manufacturing errors, revised Drawings incorporating the changes shall be prepared and submitted to the Engineer.

E. Drawings shall be in sufficient detail to indicate the kind, size, and arrangement of component materials and devices; the external connections, anchorages, and supports required; the dimensions needed for installation and correlation with the foundations; and other information specifically requested herein.

F. Each Drawing submitted shall generally be black line on white background or blue line on white background. Color drawings will be acceptable, where appropriate. Print size shall not exceed 24 inches by 36 inches.

G. Each Drawing submitted shall be clearly marked with the name of the Project, the specification title, the specification number, the Engineer's assigned number when so advised, and Contractor's name. If catalog pages are submitted, the applicable items shall be indicated.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION

3.01 SUBMITTAL REQUIREMENTS

A. Provide complete copies of required submittals as follows:

1. Construction progress schedule:
   a. Two copies of initial schedule or electronic copy
   b. Two copies of each revision or electronic copy
2. Shop Drawings: Two (2) copies or electronic copy
3. Test results: Two (2) copies or electronic copy
4. Other required submittals:
   a. Two (2) copies or electronic copy

B. Deliver required copies of submittals to Company.

END OF SECTION

SECTION 01410

CONSTRUCTION QUALITY ASSURANCE FOR INDEPENDENT TESTING SERVICES

PART 1 - GENERAL

1.01 CONTRACTOR CONSTRUCTION QUALITY ASSURANCE

A. For purposes of documenting construction, Contractor shall adhere to a Company approved construction quality assurance (CQA) program during construction. The CQA program shall include collecting material source samples and performing tests on materials placed during construction. Testing will determine whether the properties of the materials proposed for use during construction comply with the requirements of these Technical Specifications and whether the installation of the approved materials complies with the requirements of these Technical Specifications.

B. This section applies to CQA activities that require use of an independent testing laboratory.

1.02 CONTRACTOR RESPONSIBILITIES

A. Contractor will employ and pay for services of an independent testing SubContractor to perform specified source and in-place testing of materials identified for use in these Technical Specifications. Contractor shall employ Texas Research International (TRI) or approved equal to perform laboratory destructive testing of the high density polyethylene geomembrane.

B. Contractor shall submit the independent testing Subcontractor Contractor proposes to use for collecting samples and material testing to the Owner for approval.

1.03 INDEPENDENT TESTING SUBCONTRACTOR DUTIES

A. Cooperate with Company and Contractor; provide qualified personnel to perform Work after due notice to proceed.

B. Perform specified inspections, secure samples, and test materials.

1. Comply with specified standards.
2. Ascertain compliance of materials with these Technical Specifications.

C. Promptly notify Contractor of observed irregularities or deficiencies of Work, equipment, or material.

D. Promptly submit written report of each test and inspection. Contractor shall provide one copy each to Engineer and material supplier. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address, and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions if test is performed in field.
7. Date of test.
8. Identification of product and specification section.
9. Company will provide Contractor with “CQA Labeling System” for labeling soil materials and tests
10. Location of sample or test in Project.
11. Type of inspection or test.
12. Results of tests and compliance with these Technical Specifications.
13. Interpretation of test results, when requested by Engineer.

E. Perform additional tests as required by Engineer.

1.04 LIMITATIONS OF AUTHORITY OF INDEPENDENT TESTING SUBCONTRACTOR

A. Independent testing SubContractor is not authorized to:
1. Release, revoke, alter, or enlarge on requirements of the Technical Specifications.
2. Approve or accept any portion of Work.
3. Perform any duties of Contractor.

1.05 CONTRACTOR RESPONSIBILITIES

A. Provide 24-hour notice to Engineer of sampling/testing activities to allow Engineer to witness sample/test collection.

B. Furnish samples to independent testing SubContractor or provide access to Site for obtaining samples.

C. Furnish copies of product test reports to Engineer and Company.

D. Provide survey locations (coordinates and elevations) for each test collected during the Project.

E. Furnish labor and facilities:

1. To provide access to Work to be tested.
2. To obtain and handle samples at Project Site or at source of product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify independent testing SubContractor sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

G. Make arrangements with independent testing SubContractor and pay for additional samples and tests required for Contractor’s convenience.

H. Employ and pay for services of independent testing SubContractor to perform additional inspections, sampling, and testing required when initial tests indicate Work does not comply with the Technical Specifications.

PART 2 COMPANY CONSTRUCTION QUALITY ASSURANCE PROGRAM

2.01 COMPANY CONSTRUCTION QUALITY ASSURANCE

A. Company will be conducting a construction quality assurance (CQA) program during construction in conjunction with Contractor's construction quality assurance program. Company's CQA program may include collecting random samples and performing tests on materials proposed for use in construction. Contractor shall provide access to materials sources for sampling.

B. Company's CQA program may also include conducting field tests during construction to determine whether the constructed materials meet installation requirements. Contractor shall provide access to the construction area for testing throughout construction.

C. Contractor may ask to review results of Company's CQA testing program during construction. Test results are the property of the Company and will be submitted to Contractor at Company's discretion.

PART 3 CONSTRUCTION QUALITY ASSURANCE DISPUTE RESOLUTION

3.01 ENGINEER REVIEW OF CQA TEST DATA

A. In all cases, the Engineer shall carefully review each test result and determine if the potential for laboratory error or mis-reporting exists before deciding on the course of action.

B. Engineer shall issue a written field order outlining the approach to be taken in each case of a discrepancy. The order shall be binding on both the Company and Contractor.

C. Contractor's testing must always show results that meet or exceed the acceptability criteria. Company's passing results shall NOT be considered a substitute for Contractor's failing test results.

D. If Contractor's testing shows passing results, but Company's testing shows failing results:

1. Field Density Tests: Contractor and Company shall each test the same exact location and re-compact and/or moisture condition the soil until each party shows passing results.
2. Grain Size Distribution Tests: Contractor and Company shall split a representative sample and send to their respective laboratories. In the event that there is still a discrepancy at this point, Contractor's test shall be deemed valid.
3. Permeability Tests: Contractor and Company shall split a representative sample and send to their respective laboratories. In the event there is still a discrepancy at this point, Contractor's test shall be deemed valid.

E. Engineer shall make final determination after resolution activities have been performed and issue a written statement addressing either the acceptability or the need for additional confirmation testing. This statement shall be binding to both Company and Contractor.

END OF SECTION

SECTION 01560

PROTECTION OF ENVIRONMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. Contractor, in executing the Work, shall maintain Work areas on and off-site free from environmental pollution that would be in violation of any federal, state or local regulations.

1.02 SUBMITTALS

A. Proof of training as required by paragraph 1.04.A. of this section.

1.03 REFERENCES

A. "Protecting Water Quality in Urban Areas, MPCA Manual" when used in this section refers to the Minnesota Pollution Control Agency's "PROTECTING WATER QUALITY IN URBAN AREAS, Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban and Developing Areas of Minnesota", March 1, 2000 Revision.

B. General Permit Authorization to Discharge Stormwater Associated with Construction Activity under the National Pollutant Discharge Elimination System/State Disposal System Permit Program, Issued August 1, 2013 as administered by the Minnesota Pollution Control Agency.

1.04 TRAINING

A. Contractor shall have trained individuals working on the Project in accordance with the Minnesota Pollution Control Agency (MPCA) General Permit Authorization to Discharge Stormwater Associated with Construction Activity Part III.A.2.a.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 STORMWATER POLLUTION PREVENTION

A. Contractor shall fully comply with MPCA General Permit Authorization to Discharge Stormwater Associated with Construction Activity.

B. Contractor shall fully comply with the storm water pollution prevention plan requirements identified on the Drawings.

3.02 PROTECTION OF AIR QUALITY

A. Contractor shall minimize air pollution by requiring use of properly operating combustion emission control devices on construction vehicles and equipment used

by Contractor, and encouraging shutdown of motorized equipment not actually in use.

B. Contractor will not be permitted to burn trash on the construction Site.

C. If temporary heating devices are necessary, Contractor shall use the type with the best available technology to minimize air pollution.

3.03 USE OF CHEMICALS

A. Chemicals used during Project construction or furnished for Project operation must not unduly harm the environment and must have such approval from either U.S. EPA or U.S. Department of Agriculture or another applicable regulatory agency.

B. Contractor's use of such chemicals and disposal of residues shall be in conformance with manufacturer's and regulatory guidelines.

3.04 NOISE CONTROL

A. Contractor shall conduct operations in such a manner as to cause the least annoyance to residents in the vicinity of the Work, and shall comply with applicable local ordinances.

B. Contractor shall equip compressors, generators, hoists, and other apparatus with such mechanical devices as may be necessary to minimize noise and dust. Compressors must be equipped with silencers on intake lines. Noise from dewatering equipment must be mitigated as directed by Engineer.

C. Contractor shall equip gasoline or oil-operated equipment with silencers or mufflers on intake and exhaust lines.

D. Contractor shall conduct the operation of dumping and hauling rock in trucks so as to cause minimum of noise and dust.

3.05 DUST CONTROL

A. Contractor shall take special care in providing and maintaining temporary roadways, Company's existing roads, haul roads, and public roads used for construction operations in clean conditions during construction operations. Contractor shall provide road-cleaning equipment capable of removing mud/soil from paved surfaces. Road cleaning equipment shall be maintained and ready for use at all times during construction.

B. Contractor shall apply water to control dust and to minimize the raising of dust from construction operations, and shall provide positive means to prevent airborne dust from dispersing into the atmosphere. Contractor shall provide water tank trucks or water wagons equipped with water cannons capable of delivering water through either front- or rear-mounted nozzles. Tank trucks or wagons shall be of sufficient size and mobility and carry a sufficient quantity of water to control dust generated by Contractor's activities. Water tank trucks or water wagons shall be maintained and ready for use at the Sites at all times during construction. Water used for dust control need not be potable but shall not be contaminated. Chemical dust suppressant shall not be used.

C. Contractor shall comply with local environmental regulations for dust control and the direction of the Company. If Contractor's dust control measures are considered inadequate, the Engineer may require Contractor to take additional dust control measures.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Material and equipment incorporated into Work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type, and quality specified or as specifically approved.

B. Manufactured and fabricated materials and equipment:

1. Design, fabricate, and assemble in accordance with engineering and shop practices standard with industry.

2. Material and equipment shall be suitable for service conditions.

C. Do not use material or equipment for purpose other than for which it is designed or specified.

1.02 MANUFACTURER'S INSTRUCTIONS

A. Installation of materials shall comply with manufacturer's instructions. Obtain and distribute printed copies of such instructions to parties involved in installation, including 2 copies to Engineer.

1. Maintain one set of complete instructions at job Site during installation until completion of entire Project.

B. Handle, store, install, connect, clean, condition, and adjust materials in accordance with manufacturer's written instructions and in conformance with the Technical Specifications.

1. If job conditions or specified requirements conflict with manufacturer's instructions, consult Engineer for further instructions.

a. Do not proceed with Work without written instructions.

1.03 ELECTRICAL REQUIREMENTS

A. Contractor shall comply with Company's electrical requirements for portable power units. When working in a wet location either GFCIs or an assured grounding program must be used (a wet location is any area that is potentially subject to saturation with moisture from sources such as the weather. Any job being done outdoors, no matter what the weather conditions are, is considered to be in a wet location. Any area inside a structure that is subject to saturation with moisture from any source is also considered a wet location). Electrical cords used in a wet location that are plugged into a receptacle that is part of a permanent wiring system must be protected at the source with a GFCI. For example, when an extension cord is plugged into a receptacle inside a service center and is run out to the parking lot to supply power to a drill, the receptacle must have a GFCI either built into the receptacle or the breaker. If it doesn't have a built in GFCI, then a portable GFCI must be used. Company personnel shall inspect all power units prior to Contractor placing them into service.

1.04 SHIPPING AND STORAGE

A. Contractor shall receive, check, unload, handle, and store all materials and equipment to be incorporated in the construction under this technical specification, unless otherwise specified. Contractor shall be responsible for the prompt unloading of materials and equipment and shall pay any demurrage. Items shall be handled in a manner that is consistent with safe and sound material handling practices.

B. For all items, packaging shall be adequate to prevent contamination, mechanical damage, or deterioration during the field storage period. The storage area shall be well drained and all items shall be stored on cribbing or equivalent to avoid trapping water and to allow air circulation. Any special storage requirements, if required, shall be forwarded to the job Site with each shipment to which they are applicable.

C. Items and material purchased by Contractor and others are subject to a receiving inspection by the Company at the Site. Contractor shall conduct inspections to verify that items or materials furnished by Contractor meet the requirements of the Contract Documents. Nonconforming issues are not to be submitted without prior authorization by Company, and unacceptable items shall be returned at Contractor's expense.

D. Company assumes no responsibility for materials and equipment stored on Site. Contractor assumes full responsibility for damage or loss due to storage of materials and equipment.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

DIVISION 2

SITE CONSTRUCTION

SECTION 02101

SITE PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal and disposal of trees, brush and vegetation.

B. Removing rock and brush/stump stockpiles.

C. Stripping and stockpiling Class 5 Aggregate.

D. Disposal of rocks.

1.02 PROJECT/SITE CONDITIONS

A. Provide 72-hour notice, prior to beginning construction, to Company of utilities, structures, and surface features.

1.03 COORDINATION

A. Coordinate Work with Company before performing work at Project Site.

1.04 SUBMITTALS

A. Submit for documentation subgrade acceptance form for topographic conditions.

1.05 OWNERSHIP OF MATERIALS

A. All soil materials, raw or processed, produced by Contractor's work under this section shall remain the property of Company except as specified otherwise.

B. Contractor shall manage materials produced under this section by stockpiling, incorporating into the Work or removing from Site, as further directed in these Technical Specifications.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 REVIEW AND ACCEPTANCE OF EXISTING TOPOGRAPHIC CONDITIONS

A. Contractor shall satisfy itself that the existing topographic conditions in the construction area shown on the Drawings are an accurate representation and shall formally acknowledge and accept such existing conditions as the basis for Contractor's bid by completing the "Existing Topographic Conditions Acceptance Form."

B. If Contractor contends that existing topographic conditions are different from that shown on the Drawings, Contractor shall submit survey data from a land surveyor registered in the State of Minnesota to document actual topographic conditions, and shall identify with such submission additional work required. Following negotiation with Company regarding additional work and execution of a Change Order, Contractor shall acknowledge and accept such revised existing conditions as the basis for Contractor's bid and Change Order by completing the "Existing Topographic Conditions Acceptance Form."

C. There shall be no opportunity for a claim for extra work due to differing topographic conditions once stripping or excavation work has started or if Contractor does not sign and complete the form.

3.02 PREPARATION

A. Provide protection and support during construction for existing utilities, structures, and surface features adjacent to construction area or easements and rights-of-way.

B. Remove obstructions such as mounds of dirt, stone or debris located within working limits.

C. Obstructions such as street signs, small culverts, and guard posts located within construction easements of rights-of-way may be removed if promptly replaced to original condition unless otherwise specified.

3.03 TREE AND VEGETATION REMOVAL/DISPOSAL

A. Clear and grub trees within the Work area. All trees shall be burned or disposed off-site. Contractor shall obtain burning permit prior to burning cleared and grubbed materials. All burning activities require 24-hour monitoring. Any unburned materials remaining at the end of the Project shall be removed from the Site and properly disposed by the Contractor.

B. Strip vegetation a minimum 3-inches below surface and dispose of vegetation off-site at an approved disposal location. Once vegetation has been removed, the remaining soils can be incorporated into the common fill excavation or left in-place and compacted using a smooth-drum roller.

3.04 SALVAGED CLASS 5 AGGREGATE

A. Where necessary, strip Class 5 aggregate full-depth without mixing subgrade soils.

B. Place salvaged Class 5 aggregate in locations shown on the Drawings.

3.05 DISPOSAL OF ROCKS

A. Rock segregated during Contractor's operation shall be stockpiled in areas away from the Work area for future disposal.

B. Prior to completion of the Project, remove rock stockpiles from the Site and re-grade stockpile areas.

C. Upon rock materials leaving the Site, ownership of rocks shall transfer to Contractor and Contractor shall be responsible for the proper disposal of the rock.

3.06 RESTORATION

A. Restore existing utilities, surface features, and structures to conditions equal to or exceeding the condition, which existed prior to construction.

3.07 MAINTENANCE AND RESTORATION OF ON-SITE AND OFF-SITE HAUL ROADS

A. While hauling operations are in progress, Contractor shall maintain haul roads in condition satisfactory to the Engineer. Work shall include any or all of the following items:

1. Application of water
2. Bituminous material
3. Calcium chloride
4. Sweeping
5. Others as necessary

B. When hauling operations are completed, Contractor shall:

1. Restore to condition that existed at the time hauling operations were started; or
2. Compensate the local road authority in the amount satisfactory to that road authority.

C. Company shall make the determination as to the kind and amount of Work required to restore the haul road to a condition equal to the time hauling operations began.

D. When hauling operations are complete and restoration is complete to the satisfaction of Company, Contractor will be relieved of any additional obligation in connection to the maintenance and restoration of the haul road.

END OF SECTION

SECTION 02201

GRANULAR MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for the installation of the screened sand layer and coarse and fine filter aggregate, as shown on the Drawings, directly over the geomembrane.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM D421 - Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
2. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600kN-m/m^3)).
3. ASTM D2434 – Standard Test Method for Permeability of Granular Soils (constant head).
4. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.03 SUBMITTALS

A. Contractor to provide at least one sample and gradation report for each source of material prior to material being brought on-site.

1.04 SOIL MATERIAL QUALITY ASSURANCE

A. Independent testing Contractor shall be approved by Company.

PART 2 – PRODUCTS

2.01 SOURCE OF MATERIAL

A. Company will provide the screened sand layer and has completed testing to confirm the material conforms to the Technical Specifications.

2.02 Screened Sand Layer: Durable, coarse rounded to sub-angular gravel exhibiting the following:

A. Grain Size: 100% passing 3/8-inch sieve and maximum 5% by weight which passes the #200 Sieve.

B. Minimum permeability: at 95% of the Standard Proctor Dry Density (ASTM D-698) 1x10^{-3} cm/sec or greater.

C. A uniformity coefficient less than 6.

2.03 Coarse Filter Aggregate

A. A mineral product meeting the following gradation requirements:

Sieve	% Passing
1"	100
3/4"	80-100
3/8"	35-60
#4	0-10
#10	0-5

B. The portion of material retained on the 3/8" sieve shall contain no angular particles and not more than 30 percent subangular particles as defined by ASTM D2488. Crushing or other processing methods which result in sharp edges shall not be used.

2.04 Fine Filter Aggregate (if prescribed by Engineer)

A. A mineral product meeting the following gradation requirements:

Sieve	% Passing
3/8"	100
#4	10-50
#10	0-5
#200	0-2

PART 3 - EXECUTION

3.01 FILL USAGE

A. Around dewatering pipes, as shown on the Drawings.

3.02 PREPARATION

A. Contractor shall receive Engineer's permission to begin installation of screened sand layer. No screened sand material shall be placed over the geomembrane until inspection and testing of the geomembrane has been completed and all test results and required documentation have been submitted to Company and Engineer in accordance with these Technical Specifications. After geomembrane inspection and review of the documentation, Engineer will give Contractor authorization to proceed with the placement of materials over the geomembrane. This notice does not imply final acceptance of the geomembrane or related work. Final acceptance of the geomembrane is specified in Section 02920. Inspection and submission of required documentation for geomembrane work may be done in phases to facilitate timely placement of the granular materials.

B. Contractor shall be responsible for surface water control within construction limits and shall keep the construction well drained and minimize surface water ponding.

C. Subgrade elevation shall be documented by Contractor and approved by Engineer for conformance, prior to placement of screened sand layer material.

3.03 PLACEMENT

A. Placement of screened sand materials on geomembrane shall not proceed at ambient temperatures below 5°C (40°F), or above 40°C (100°F) without written consent from Engineer.

B. In no case shall any construction equipment be allowed to travel directly on the geomembrane. Place screened sand over the geomembrane in a single lift. A minimum 1-foot thickness of screened sand material shall be in place over the geomembrane for low ground pressure tracked vehicle traffic. Do not allow rubber-tired vehicles on screened sand layer after placement. Operation of hauling equipment will be allowed only on areas with a 3-foot minimum thickness. No hauling equipment will be allowed on slopes.

C. Screened sand layer placement shall be performed in a manner that minimizes the formation and propagation of wrinkles in the geomembrane. Wrinkles shall not be permitted to be folded over beneath the screened sand material. Contractor shall perform screened sand material placement operations in accordance with an approved placement plan.

D. Contractor shall provide a spotter while spreading screened sand material over the geomembrane. A spotter shall be assigned to work full time with each piece of earth moving equipment used screened sand material placement over the geomembrane. The spotter shall be positioned to observe the location of the blade or bucket relative to the geomembrane and communicate this information to the equipment operator to prevent damage to the geomembrane. The spotter shall also track and minimize the formation and propagation of wrinkles in the geomembrane and communicate this information to the operator. Measures shall be taken to stop wrinkle formation and propagation. Screened sand layer material may be placed ahead of small wrinkles using a backhoe or similar equipment to trap the wrinkle.

E. Spread upslope (90^{o} to slope) only on all applications except the haul ramp. No abrupt stops or starts on slope. No stockpiling on slope. Spreading shall be performed by pushing screened sand material from discrete dumping points along the built-up traffic areas, and pushing the materials outward over that material already placed. Screened sand material shall be rolled over the edge of the material already placed, rather than pushed or slid across the surface of the geomembrane.

F. Do not compact material on the geomembrane.

G. Use only square-nosed shovels over the geomembrane. The use of pointed-nose shoves or spades shall not be allowed while placing screened sand material over the geomembrane.

H. Protect buried pipes, geotextiles, geosynthetics, and similar installations.

I. Contractor shall place screened sand material by such method as to prevent wrinkling and possible damage to the geomembrane liner(s). It shall be Contractor's responsibility to ensure that the geosynthetics are not damaged. Should they become damaged, Contractor shall at its own expense:

1. Immediately notify the Engineer, and
2. Coordinate with the geosynthetic installer to make any necessary repairs at Contractor's expense.

J. Place coarse aggregate over non-woven rub sheets and around the dewatering pipes to the dimensions shown on the Drawings. Place Filter Aggregates carefully by dropping from backhoe or loader bucket from a height of less than 2 feet. Spread by hand with rakes, square-nosed shovels or other suitable tools. No pointed-nosed shovels shall be allowed over the geomembrane. Do not spread with mechanical equipment.

3.04 ADJUSTMENT AND CLEANING

A. Neatly trim remaining stockpiles upon completing the placement of the screened sand layer materials. Restore the disturbed areas around the screened sand layer stockpiles to their original conditions by grading and establishing vegetation.

3.05 SCREENED SAND LAYER MAINTENANCE

A. Contractor shall be responsible for screened sand layer thickness, grade, and material quality until Company's Final Acceptance of the Project.

B. Contractor shall be responsible for retesting material that has been displaced and removing and replacing material, which does not meet Specifications at no additional cost to Company.

PART 4 – CONSTRUCTION QUALITY TESTING

4.01 SOIL MATERIAL QUALITY ASSURANCE

A. In-place testing to be completed by an approved independent testing Contractor. Laboratory testing shall be in accordance with Section 01410.

B. Quality assurance retesting of material not meeting the technical specification requirements shall be performed by Contractor at no additional cost to Company. Contractor is responsible for all costs related to retests of material.

C. **For Screened Sand Material over Base Liner**, provide the following test results from in-place material at locations selected by Engineer:

Section 1.01 Property	***Section 1.02 Test Method***	***Section 1.03 Frequency***
Constant Head Permeability	ASTM D2434	1 test per 10,000 CY placed
Grain Size Analysis	ASTM D421	1 test per 10,000 CY placed
USCS Soil Classification	ASTM 2487	1 test per 10,000 CY placed

4.02 SURVEY QUALITY CONTROL

A. Screened Sand layer shall be graded to the minimum thicknesses as shown on Drawings and specified herein. Thickness tolerance of the screened sand layer shall be between –0.0 and +0.1 feet.

B. Thickness tolerance of the coarse and fine filter aggregate (below and above dewatering pipes) shall be between -0.1 and + 0.1 feet.

END OF SECTION

SECTION 02207

COMMON FILL

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for construction with common fill soils.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
   2. ASTM D1140- Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 um) Sieve.
   3. ASTM D1556- Standard Test Method for Density of Soil in-Place by the Sand Cone Method.
   4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)
   5. ASTM D1587- Standard Practice for Thin-Walled Tube Sampling of Soils for geotechnical purposes.
   6. ASTM D2216- Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
   7. ASTM D2487- Standard Test Method for Classification of Soils for Engineering Purposes.
   8. ASTM D4318- Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   9. ASTM D6938 - Standard Test Method for In-place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.03 SUBMITTALS

A. None

1.04 SOIL MATERIAL SOURCE QUALITY ASSURANCE

A. One (1) of each of the following:

   1. USCS Soil Classification.
   2. Standard Proctor

PART 2 - PRODUCTS

2.01 SOURCE OF MATERIAL

A. On-site soils are available for use as common fill material. Contractor is responsible for selecting material for use that conforms to these Technical Specifications. Only on-site material that meets, or has been processed to meet, these Technical Specifications shall be used for common fill material.

2.02 COMMON FILL

A. Natural soils determined by Engineer's visual observation in the field to be CL, GM, SW, SP, SC, SM or ML soils, free of organic and other deleterious material, except when otherwise approved by Engineer.

B. Excavated subsoil from designated borrow and excavation areas, processed as required, to be used for embankments, backfill, and subgrade excavation replacement where applicable.

C. Material free from roots, debris, and stones, or cemented sandstone clods, larger than twelve (12) inches.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability of surface to receive installation of material.

B. Proof-roll and examine surfaces to receive fill and subgrades within influence zone to determine existence of soft areas, areas loosened by frost action or softened by flooding, groundwater or weather or existence of unsuitable materials.

3.02 PREPARATION

A. Sample, test, and submit test results of source soils.

B. Prepare surfaces to receive materials to lines and grades shown on Drawings prior to placement.

3.03 BACKFILLING AND COMPACTION

A. Notify Engineer before placing fill material.

B. Do not use frozen material or place fill on frozen subgrade.

C. Where pipes or electrical conduits leave structures, protect by backfilling pipe or duct influence zone down to undisturbed soil with common fill.

D. Place common fill simultaneously on both sides of free-standing structures.

E. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials. When approved by Engineer, jetting, flooding, puddling, or vibroflotation methods may be used for compacting if Contractor furnishes test results to confirm required degree of compaction being obtained uniformly throughout entire mass.

F. Lift Thickness and Compaction: Place and compact fill material in maximum lift thickness and to minimum densities listed below.

	Fill Placement	Maximum Compacted Lift Thickness (inches)	Standard Proctor (%)
A	Common Fill for Embankment Construction	12	95
B	Common Fill for Anchor Trench Backfill	8	95
C	Common Fill for Subcut Replacement	8	95

PART 4 – CONSTRUCTION QUALITY TESTING

4.01 FIELD QUALITY CONTROL

A. In-place testing shall be performed by Contractor at locations selected by Engineer. All testing shall be performed in accordance with the Technical Specifications. Density testing shall be performed in accordance with the ASTM D6938 standard.

B. Contractor shall notify Engineer a minimum of 24-hours prior to testing.

4.02 SURVEY QUALITY CONTROL

A. Common fill layer shall be graded to the minimum thicknesses as shown on Drawings and specified herein. Thickness tolerance of the common fill layer shall be +/-0.1 foot. Elevation tolerance shall be +/- 0.1 foot.

4.03 IN-PLACE DENSITY TESTING

A. Contractor shall be responsible for performing in-place density testing on all common fill material at the minimum frequencies as listed below. Testing shall be performed at locations as determined by Engineer.

	Fill Placement	Minimum Testing Frequency
A	Common Fill for Subgrade and Berm Construction	1 per 3,000 CY placed min 1 per lift
B	Common Fill for Anchor Trench Backfill	1 per 100 LF of Anchor Trench
C	Common Fill for Subcut Replacement	1 per lift

B. In-place density testing technician shall meet the requirements specified in section 01410. Contractor shall be responsible for any retesting of material not meeting specification at no additional cost to Company.

4.04 IN-PLACE DENSITY TEST SURVEYING

A. In-place density testing locations shall be documented by Contractor using GPS survey methods.

4.05 IN-PLACE DENSITY TEST REPORTING

A. Contractor shall notify Company at the end of each day the number of density tests taken, the number of passing density tests, material proctors used, and the location of the tests. Contractor shall complete the Company's "Contractor Material Testing Acceptance Form" at the end of each day documenting the test results. The tests recorded each day will not be accepted until all required signatures are captured on the "Contractor Material Testing Acceptance Form".

B. All testing reports shall be provided to Company concurrently with Contractor.

END OF SECTION

SECTION 02210

CLASS 5 AGGREGATE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes the furnishing and installation of aggregate road surfacing to construct access roads or as required to repair damage to existing unpaved roads.

1.02 REFERENCES

A. Minnesota Department of Transportation standard plates manual hereafter referred to as MNDOT Standard Plates.

B. Minnesota Department of Transportation Standard Specifications for Construction, Current Edition, hereafter referred to as MNDOT Standard Specifications.

C. American Society for Testing and Materials, Current Edition.

1.03 SUBMITTALS

B. Contractor to provide at least one sample and gradation report for each source of material prior to material being brought on-site.

1.04 PRODUCT DELIVERY, SEQUENCING, AND SCHEDULING

A. Include road construction and restoration activities in the Project schedule.

PART 2 - PRODUCTS

2.01 AGGREGATE

A. Contractor is responsible for providing aggregate road surfacing that conforms to the Technical Specifications.

B. Material: Class 5, as specified in "Standard Specifications" Section 3138.

C. Remove oversize material encountered in deposits from which material is taken by screening or crushing to required sizes.

D. Composite material shall be substantially free from shale and lumps or balls of clay and shall conform to pertinent gradation requirements.

PART 3 - EXECUTION

3.01 GENERAL

A. Construct to original width of road as shown on the Drawings, in 6-inch lift thickness as indicated on the Drawings.

B. Place materials when surface is dry and atmospheric temperature is above 40 degrees F.

3.02 SUBGRADE

A. Prepare subgrade in conformance with Section 02207.

B. Provide water, if required, for compaction.

3.03 ROAD SURFACING

A. Construct road surfacing in accordance with "Standard Specifications" Section 2211.3.

PART 4 – CONSTRUCTION QUALITY TESTING

4.01 FIELD QUALITY CONTROL

A. In-place testing shall be performed by Contractor on all placed Class 5 aggregate. All testing shall be performed in accordance with the Technical Specifications. Density testing shall be performed in accordance with the MnDOT 2111 standard.

B. Contractor shall notify Engineer a minimum of 24-hours prior to testing.

4.02 SURVEY QUALITY CONTROL

A. Class 5 aggregate shall be graded to the minimum thicknesses as shown on Drawings and specified herein. Thickness tolerance of the common fill layer shall be between -0.0 feet and +0.1 feet.

4.03 COMPACTION TESTING

A. Contractor shall be responsible for performing a proof roll compaction test on all placed Class 5 aggregate. Test will consist of a loaded tandem axle truck traveling at 2.5 to 5 mph along the entire length of aggregate road surface. The Test spacing shall be a maximum of six (6) feet, measured perpendicular to the direction of travel.

B. Testing shall be performed in the presence of the Engineer.

C. Test will be measured from the top of the unrolled road surface to the bottom of the tire rut.

D. Acceptance Requirements: Deflection no greater than ½-inch. Failing tests (greater than ½-inch deflection) will be repaired and tested again.

4.04 COMPACTION TEST REPORTING

A. Engineer will document which stations or area of the project have passed the compaction testing and which need to be repaired and retested.

END OF SECTION

SECTION 02220

EXCAVATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in this section includes excavation activities for the removal of common fill from the soil borrow areas (2019 construction) for use in the Bottom Ash Pond No. 2 project as shown on the Drawings, and installation of the discharge control structure and piping.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D1140- Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 um) Sieve.
3. ASTM D1556- Standard Test Method for Density of Soil in-Place by the Sand Cone Method.
4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)
5. ASTM D2487- Standard Test Method for Classification of Soils for Engineering Purposes.
6. ASTM D6938 – Standard Test Method for In-place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.03 SUBMITTALS

A. Shoring, Bracing, and Sheeting Layout and Details: Engineer will review submitted material to ascertain effect on new construction. Engineer will not review shoring, bracing, and sheeting for structural integrity or effect on existing facilities.

B. Additional soil testing results as may be required.

C. Submit for approval the proposed method of excavation including machinery types, sizes, and models and how Contractor proposes to monitor and protect nearby existing structures as shown on the Drawings.

D. Submit any proposed alternate excavation procedures that Contractor proposes to use.

1.04 JOB CONDITIONS

A. Soil Borrow Areas: Excavation shall take place within the limits of Bottom Ash Pond No. 2 embankment construction or designated borrow areas as shown in the Drawings.

B. Regulatory Requirements: Work shall be in accordance with any permit conditions and practices incorporated into the Project. All excavations shall be in accordance with applicable laws and regulations.

C. It shall be solely Contractor's responsibility to review available tests and reports, conduct additional tests, and otherwise determine to its own satisfaction the location and nature of all surface and subsurface features and the soil and water conditions that may be encountered. Company's information on Site conditions may be reviewed at Company's offices as scheduled with Company.

D. Use of explosives will not be permitted.

E. Contractor shall be solely responsible for determining the means and methods for meeting the compaction requirements outlined in these Technical Specifications unless otherwise specified herein. Contractor shall be solely responsible for utilizing means and methods that protect adjacent structures and utilities from damage resulting from Contractor's operations, specifically including, but not limited to, settlement, consolidation, displacement, cracking, vibration, undermining, washout, and uplift caused by excavating, compaction, dewatering, or any other operation. If requested by Contractor, Company will accompany Contractor in examination of existing adjacent structures prior to beginning the Work. Examination will be intended to provide Contractor opportunity to document relevant existing structural damage or problems.

F. Provide all shoring, bracing, sheet piling, trench boxes, tie backs, and other measures required to perform all Work in accordance with laws and regulations. Specifically, all excavations shall conform to the requirements of OSHA set forth in 29 CFR 1926, Subpart P (Occupational Safety and Health Standards-Excavations).

1.05 FIELD MEASUREMENTS

A. Verify control monuments and intended elevations for Work as shown on Drawings.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability and condition of surfaces to perform Work.

B. Locate and protect overhead and underground utilities.

3.02 PREPARATION

A. Identify required lines, grades, levels, contours, and datum.

B. Protect benchmarks, structures, equipment, and partially completed Work.

C. Over-excavate soft areas of subgrade not capable of in-situ compaction as directed by Engineer.

D. Notify corporations, companies, individuals, or authorities owning above- or below ground conduits, wires, pipes, or other utilities running to property or encountered during excavating operations.

E. Cap or remove and relocate services in accordance with instructions by owners of services.

F. Protect, support, and maintain conduits, wires, pipes, and other remaining utilities in accordance with requirements of owners of said services.

G. Keep construction Site free-draining.

H. Fill settled areas where excavations or trenches were backfilled and holes made by demolition, tree removal, and Site preparation work.

I. Remove all topsoil, organic material, and soft, wet, or loose soils below proposed construction areas. During excavation or exposure of in-situ soils, Contractor shall subcut 2 feet beneath plan subgrade if soft, wet, or loose soils are encountered. Replace unsuitable materials with common fill material. Soft, wet, loose, and incompetent soils will be determined by the Engineer.

J. Contractor shall stage construction to prevent slippage or sloughing of material during construction.

3.03 COMMON EXCAVATION

A. Excavations shall conform to lines and grades as staked, and as shown on Drawings.

B. Excavations beyond those lines and grades without the Engineer’s authorization will be considered unauthorized work.

C. Method of excavation shall be consistent with soil types encountered and result in competent subgrade.

D. Remove stumps, roots, debris, large stones or boulders, and any other deleterious material from excavated materials to be used in embankments.

E. Do not excavate within influence zone of existing footings or foundations without prior approval of Engineer.

F. Provide temporary controls such as diversions and dewatering equipment to prevent surface runoff from entering excavations and to remove ponded water from excavations. Maintain excavations in a dry and stable condition at all times.

G. Notify Company or Engineer of any unsatisfactory soil materials encountered that require additional excavation, including peat, debris, lake sediments, fat clays, or other soils subject to compressibility. If Company determines that additional excavation is required, through no fault or neglect of Contractor, the additional excavation will be paid for as a change in the Work.

H. Extend excavations a sufficient distance to allow placement and compaction of aggregate bedding and other required backfill materials, prevent sloughing of materials into the excavation, and to permit observation of the Work by Company. Excavate to sufficient depth to remove loose or disturbed native soil. Avoid over excavating sound native soil.

I. Upon completion of excavation, notify Engineer before proceeding with further work.

3.04 FIELD QUALITY CONTROL

A. Contractor shall provide written documentation as required by Article 1.03 of this Section that explains the procedure that will be used to protect nearby structures from damage by the excavation operation. Company must approve the procedure prior to Work commencing. Contractor's Work and related records shall be subject to inspection and audit by Company.

END OF SECTION

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in the section includes riprap for erosion protection, as shown on Drawings.

1.02 SUBMITTALS

A. None

PART 2 - PRODUCTS

2.01 SOURCE OF MATERIAL

A. Riprap is on-site and is stockpiled north of Pond 3, as shown on the Drawings.

B. Contractor is responsible for selecting riprap material that conforms to the Technical Specifications.

2.02 MATERIALS

A. Class of riprap shall be as shown on Drawings and in accordance with standard specification Section 3601.

B. Geotextile in accordance with Section 02921.

PART 3 - EXECUTION

3.01 USAGE

A. For use in erosion control, as shown on the Drawings.

3.02 PREPARATION

A. Areas on which bedding material and riprap are to be placed shall be graded and dressed to lines and grades shown on Drawings or as required by Engineer.

B. Culvert aprons shall be shaped to the approximate cross sections and profiles as shown on Mn/DOT standard plate 3134.

C. Contractor shall place geotextile under riprap and cover completely. No fabric shall be exposed along edges or under riprap. Contractor shall place riprap so geotextile is not damaged.

D. The geotextile shall conform to the requirements of section 02921.

3.03 INSTALLATION

A. Place riprap in areas as shown on Drawings and in accordance with "Standard Specifications." Section 02511

END OF SECTION

SECTION 02273

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 - GENERAL

1.01 SUMMARY

A. Work covered under this section includes the manufacture, fabrication (if needed), and supply and installation of the geosynthetic clay liner (GCL). As part of the composite liner system, all Work shall be performed in accordance with the lines, grades, cross-sections, and dimensions on the Drawings, or as directed by Company.

B. Sufficient geosynthetic clay liner and accessory bentonite shall be furnished to cover all areas to be lined as shown on the Drawings, including overlaps at field seams and anchor trenches.

C. It is the intent of these Technical Specifications to ensure that the performance criteria for the Project is achieved. It shall be the Contractor's responsibility to ensure that these criteria are met.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
2. ASTM D5321 - Standard test method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear.
3. ASTM D5890 – Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
4. ASTM D5891 – Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
5. ASTM D5993 – Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners
6. ASTM D6243 - Standard Test Method for Determining the Internal and Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method.
7. ASTM D6766 – Standard Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Aqueous Solutions
8. ASTM D6768 – Standard Test Method for Tensile Strength of Geosynthetic Clay Liners
9. ASTM D6495 - Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners.
10. ASTM D6496 – Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched

1.03 SEQUENCING AND SCHEDULING

A. Submit material delivery and installation schedule for incorporation into the Project schedule.

1.04 SUBMITTALS

A. Contractor shall submit certification in writing that the surface upon which the geosynthetic clay liner is to be installed is acceptable (complete form contained at the end of this section or provide similar form for approval).

B. Contractor shall submit certificate of compliance from supplier for each roll of geosynthetic clay liner delivered to the Site, indicating material compliance with the specified manufacturer specifications prior to or at the time of delivery of the material.

C. Test methods and results defining physical properties as specified herein, of the GCL to be used for this Project. Test results shall be representative of each roll of GCL furnished for this Project (e.g., a test sample taken between two consecutive rolls from a continuous run will be considered representative of both rolls). Test results shall be reported with corresponding roll identification numbers.

D. Statement of GCL manufacturer's quality control procedures and frequency of sampling.

E. Contractor shall submit certified test results from the supplier to Engineer to obtain approval for use of the product prior to mobilization of the product to the Project Site. Any proposed alternate geosynthetic clay liner not approved by Engineer shall not be used.

F. Contractor shall submit a plan for installation layout identifying placement patterns and overlap orientations prior to placement. The layout diagram shall be to scale and used as a construction plan and shall include all necessary dimensions and details. The layout diagram shall be compatible with the panel and seam layout requirements specified in Article 3.02 of this section.

G. Submit for documentation a material and workmanship warranty prior to substantial completion.

1.05 EXPERIENCE

A. The GCL installation shall be performed under the direct supervision of a single field supervisor who must remain on-site throughout installation, including inspection of the surface upon which the GCL is to be installed, GCL handling and storage, panel layout and placement, seaming, seam testing, panel and seam repair, installation of appurtenances, anchorage and other GCL-related work. The field supervisor shall have a personal GCL installation record totaling at least 1 million square feet.

B. The GCL manufacturer shall have at least 5 years continuous experience in manufacturing GCL rolls and/or a manufacturing record totaling not less than 5 million square feet of GCL. The manufacturer shall have produced GCL for at least 10 completed facilities similar in scope to this Project.

C. The Contractor shall have at least 5 years continuous experience in the installation of GCL and an installation record totaling at least 5 million square feet. Contractor shall have installed GCL for at least 10 completed sites similar in scope to this Project.

D. The GCL manufacturer and any GCL installation SubContractors to the Contractor must be approved by Company prior to mobilization for GCL installation. Company has the right to reject any CGL manufacturer or Installer, and request that Contractor select an alternate.

1.06 PRE-INSTALLATION MEETING

A. Representatives of the Contractor and any GCL SubContractors shall attend a meeting prior to installation of the geomembrane to discuss details of the proposed design, installation, quality control documentation requirements and schedule.

PART 2 – PRODUCTS

2.01 GEOSYNTHETIC CLAY LINER (GCL)

A. The GCL must meet the requirements of ASTM D-6495. The Contractor shall submit certified test results from the supplier to Engineer to obtain approval for use of the product prior to mobilization of the product to the Project Site. Any proposed alternate GCL not approved by Engineer shall not be used.

B. The GCL shall have an internal friction coefficient of not less than 15 degrees as determined by ASTM D-5321 test method for measurement of the friction angle against the subgrade soil used in the analysis. The GCL supplier can submit testing that has been performed on soil materials having the same soil type to the subgrade soils used for the construction to demonstrate the minimum friction angle requirement is met.

C. No disassociation of geotextile components from the bentonite core shall occur. A sample of the bentonite geosynthetic placed in 70°F tap water for one hour shall not delaminate.

D. The geosynthetic clay liner shall be manufactured utilizing a minimum of 0.75 pound per square foot of high swelling sodium bentonite at 0 percent moisture content. If the material is manufactured at a higher moisture content, it shall have the minimum of 0.75 pound per square foot of bentonite when adjusted to 0 percent moisture level.

E. GCLs shall consist of natural sodium bentonite between polypropylene geotextiles that are connected by needle-punching.

F. Rolls shall be a minimum of 12 feet wide and 80 feet long. A 6-inch lap line and a 9-inch match line shall be printed or marked in the field on both edges of the upper geotextile of the GCL (as installed) to assist in overlap quality control.

G. Each roll shall be marked with the following information:
   1. Manufacturer's name and brand name.
   2. Lot and roll number.
   3. Roll length and width.
   4. Total roll weight.

H. All rolls shall be bagged in packaging that is water and UV resistant.

I. GCL Properties:
   1. General Properties:
      a. Swell Index: 24 mL/2g minimum (ASTM D5890).
      b. Bentonite Fluid Loss: 18 mL maximum (ASTM D5891).
      c. Bentonite Mass/Area: 0.75 lb/ft^2 0 percent moisture content (ASTM D5993).
      d. **GCL Panel and Seam Permeability: 1.08 x10-9 cm/s maximum (CETCO Resistex 300 or approved equal)** (ASTM D6766).
   2. GCL Installation on Slopes Flatter than 10H:1V:
      a. GCL Hydrated Internal and Interface Shear Strength: 150 lb/ft^2 at 200 lb/ft^2 normal stress (ASTM D5321 and D6243).
      b. GCL Tensile Strength: 30 lb/in minimum (ASTM D6768).
      c. GCL Peel Strength: 1 lb/in minimum (ASTM D6496).
   3. GCL Installation on Slopes Equal to or greater than 3H:1V:
      a. GCL Hydrated Internal and Interface Shear Strength: 500 lb/ft^2 at 200 lb/ft^2 normal stress (ASTM D5321 and D6243).
      b. GCL Tensile Strength: 50 lb/in minimum (ASTM D6768).
      c. GCL Peel Strength: 3.5 lb/in minimum (ASTM D6496).

2.02 ACCESSORY BENTONITE

A. Accessory bentonite used to augment seam overlaps, penetrations, and panel edges at structures shall be powdered or granulated bentonite of the same type used in the manufacture of the GCL.

PART 3 – EXECUTION

3.01 SUBGRADE INSPECTION

A. Contractor shall certify in writing that the surface upon which the GCL is to be installed is acceptable (acceptance form contained at the end of this section).

B. The subgrade shall be prepared and compacted in accordance with Section 02207. Debris, roots, solid mineral particles larger than 1/2-inch diameter, and other material that may damage the GCL shall be removed. Prior to the deployment of the GCL, the subgrade shall be final-graded to fill any voids or cracks and rolled to provide a smooth surface for the installation of the GCL.

C. After subgrade surface has been accepted by Contractor, it shall be Contractor's responsibility to identify any change in subgrade condition that may require repair work. Special care shall be taken to maintain prepared GCL subgrade (i.e., dry and free of foreign matter). Daily observations shall ascertain the integrity of subgrade. Damage to subgrade caused by precipitation shall be repaired at Contractor's expense. Damage to subgrade caused by Contractor shall be repaired at Contractor's expense. GCL placement over subgrades having damage or excessive moisture as determined by Engineer is not acceptable.

D. Particular attention shall be paid to subgrade condition at the panel edges. Panel edges shall lay flat against the subgrade with no puckering, creasing, or curling.

3.02 HANDLING, TRANSPORTATION, STORAGE AND PLACEMENT

A. GCL rolls shall be packaged and labeled prior to transporting to the Site. GCL rolls delivered to the Site shall be wrapped in an impermeable and opaque protective cover. Rolls shall be stored on a flat dry surface raised several inches above the ground. Covering stored materials is suggested to avoid any unnecessary stress on the packaging and to protect materials from moisture in the event of rain.

B. Rolls shall be handled utilizing a solid steel bar inserted through the core bar and slings or chains attached to the ends of the bar. The core bar shall be suspended from a spreader bar so that the edges of the GCL are not damaged by the suspending straps or chains. Where the GCL has a non-woven geotextile on one side and a woven geotextile on the other, panels shall be placed with the non-woven side against the subgrade, and the woven side oriented upwards.

C. On-site storage of the GCL rolls shall be in a safe manner according to manufacturer's recommendations, with rolls protected from grease, dirt, moisture, excessive heat, direct sunlight, vehicle traffic, and other possible sources of damage including theft and vandalism. Storage areas shall be at the location approved by the Company. In addition, the on-site storage of the GCL is subject to Company's approval of storage arrangement, including pallets, timbers, or other support and separation from ground, stacking height, packaging/covering, etc.

D. GCL and appurtenant materials delivered to the Site shall be checked for proper labeling and visually inspected for transport or manufacturing damage. Company reserves the right to reject any unacceptable material at no cost to Company.

E. Only that quantity of GCL that is to be placed on a particular day shall be removed from the packaging. GCL rolls shall be transported from the storage area to the construction area using wide lifting straps and properly sized forklifts, front-end loaders, or other appropriate equipment. Under no circumstances shall any heavy equipment be allowed directly on the GCL. Prior to placement, the GCL shall be visually inspected for damage and manufacturing defects. GCL material that, in the opinion of Company or Engineer, is damaged or otherwise unsuitable shall not be used for the Project.

3.03 INSTALLATION

A. Edge seams shall be perpendicular to the toe of the slope at all times.

B. Seam areas or runs shall also be flat and clear of any large rocks, debris or ruts. Contacting surfaces shall be clean and clear of dirt or native soil with all edges pulled tight to maximize contact and to smooth out any wrinkles or creases. Edge overlaps shall be a minimum of 6 inches and verified by Engineer. A proper seam shall cover the 6-inch lap line and leave the 9-inch match line exposed. End overlaps shall be a minimum of 3 feet and in a rainlap orientation and verified by Engineer.

C. All seams shall be augmented with granular bentonite to ensure seam integrity as necessary or as required by manufacturer's recommendations. Granular bentonite, where required, shall be dispersed evenly from the panel edge to the lap line at a minimum rate of 1/4 pound per lineal foot continuously along all seams or overlap areas. Accessory bentonite shall be of the same type as the material within the geosynthetic clay liner.

D. The Contractor shall only work on an area that can be completed in one working day or before an inclement weather condition. Completion can be defined as the full installation and anchoring of the bentonite blanket and placement of the overlying geomembrane. Any GCL that is hydrated prior to placement of the geomembrane will be removed and replaced at the Contractor’s expense.

E. Large rips or tears or thin worn areas shall be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch over the damage. The patch shall overlap the GCL at least 12 inches on all edges. Accessory bentonite shall be placed between the patch and the repaired material at a rate of 1/2 pound per lineal foot of edge, spread in a 6-inch width. The above procedures shall also be implemented in the event that a rip or tear or thin worn area occurs on a sloped surface. In this instance, the edges of the patch shall be fastened to the repaired liner with construction adhesive, as recommended by the GCL supplier in addition to the bentonite-enhanced seam.

F. During start-up of the geosynthetic clay liner installation, an agent or representative of the manufacturer shall provide on-site assistance as needed and instruction to the Contractor and Company regarding product application techniques.

3.04 PROTECTION AFTER INSTALLATION

A. Protect movement of GCL after installation by sandbagging or other approved methods.

B. The GCL shall be kept clean and free of soil, debris, and foreign material until covered by the geomembrane. The geomembrane shall be installed in direct contact with the GCL.

C. No vehicle traffic will be permitted directly on the GCL. Only soft-soled/rubber-soled boots and shoes shall be worn on the GCL. Tracked vehicles and trucks

with low-pressure tires will be permitted to travel on a minimum of 12-inch thickness of cover soil over the GCL. Vehicles with high-pressure tires will be permitted to travel on a minimum of 3-foot thickness of cover soil over the GCL.

D. GCL Installer shall coordinate with Contractor and geomembrane Installer regarding deployment, seaming, and testing of geomembrane and placement of cover soils over GCL such that geomembrane installation and cover soil placement occurs expeditiously and without damage to the GCL.

E. Geomembrane deployment and positioning shall be done such that no disruption of the GCL occurs, particularly at the overlapped seams.

3.05 CLEANUP

A. Contractor shall place ALL material scraps in Company designated area at the end of each working day. Disposal of scraps in the anchor trenches will not be acceptable. No scraps of materials shall be allowed to be left on top of GCL.

B. Once the installation of the GCL is complete, the Contractor shall:
   1. Remove all sand bags from Site; or
   2. Remove all sand bags and place in Company designated area.

PART 4 – WARRANTY

4.01 MATERIAL/WORKMANSHIP WARRANTY

A. A 5-year material and 1-year workmanship warranty shall be provided by the Contractor.

END OF SECTION

Certificate of Acceptance of
Geosynthetic Clay Liner Subgrade Surface by Contractor

DESCRIPTION OF AREA TO BE CERTIFIED:_____

_____

_____

LOCATION:_____
PROJECT:_____
ADDRESS:_____

The undersigned, _____ certifies he/she is a representative of _____, duly authorized to execute this certificate, that he/she visually inspected the subgrade surface described above on _____ and found the surface to be acceptable for installation of the geomembrane.

This certification is based on observations of the surface of the subgrade only. No sub terrain inspections or tests have been performed and_____ (Company) makes no representations or warranties regarding conditions which may exist below the surface of the subgrade.
Date: _____ Signature: _____
Name:_____Title:_____

CERTIFICATE RECEIVED BY CONTRACTOR
Date_____
Contractor_____
Name_____
Signature_____
Title_____

CERTIFICATE RECEIVED BY COMPANY
Date:_____
Company:_____
Name: _____
Signature_____
Title:_____

SECTION 02276

EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Work includes the furnishing of the permanent and temporary erosion control as required by the erosion control plan, as shown on the Drawings.

B. Erosion control blanket shall be installed as detailed on the Drawings.

C. Contractor shall sign the NPDES construction activity permit for the Site.

1.02 SUBMITTALS

A. Manufacturer's certificates indicating specification conformance test results of furnished material.

PART 2 – PRODUCTS

2.01 EROSION CONTROL BLANKET

A. North American Green S75 or approved equal.

B. North American Green VMAX SC250 or approved equal.

PART 3 – EXECUTION

3.01 USAGE

A. On all disturbed areas with slopes greater than 10:1.

3.02 EROSION CONTROL BLANKET

A. Place in accordance with manufacturer’s recommendations.

B. At a minimum, anchor upstream edges of all materials at least 4 inches into the soil to prevent underflow. Hand rake topsoil as necessary to prevent a ridge or depression along upstream edge.

C. Shingle materials downslope.

D. Overlaps shall be as follows:
1. End lap – 24 inches minimum.
2. Edges – 4 inches minimum

E. Staple sizes and spacing to be in accordance with “Standard Specification” Section 3885.

END OF SECTION

SECTION 02486

TURF RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. This section contains requirements for topsoil, seeding, fertilizing, and mulching.

B. Seed all areas disturbed by construction activities at the Site.

1.02 REFERENCES

A. “Standard Specifications for Construction", State of Minnesota Department of Transportation, 2014 Edition with latest supplements.

1.03 SUBMITTALS

A. Test Results:
Supplier’s analysis for standard products and seed composition.

B. Submit in accordance with Section 01300.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver fertilizer to Site in original, unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law.
2. Deliver seed to Site in unopened, original bags bearing supplier's name and address, type of seed contained, percentage of purity and germination.
3. Fertilizer and seed delivered to Site shall be stored in a waterproof location as directed by Company.
4. Locate mulch on Site where indicated by Company.

1.05 GUARANTEE

A. Guarantee seeded area for duration of one year after seeding to be alive and in satisfactory growth at end of guarantee period.
1. For purpose of establishing acceptable standard, scattered bare spots, none larger than 1 square foot will be allowed up to maximum of 3 percent of seeded area.
2. Acceptance will be based upon meeting this standard one year after initial seeding or reseeding.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Contractor shall use salvaged topsoil from on-site excavation activities for restoration. Additional topsoil shall be obtained from the topsoil stockpiles shown on the Drawings.

2.02 FERTILIZER

A. Contractor shall collect topsoil samples for analysis to determine the appropriate fertilizer recommendations. Contractor shall submit results with fertilizer recommendations to Company.

B. Contain minimum percentage by weight of:
   1. Prior to Seeding (6-24-24):
      Nitrogen
      Phosphorus
      Potash
   2. After Seeding (18-5-9):
      Nitrogen
      Phosphorus
      Potash

2.03 GRASS SEED

A. General
   1. Local nursery grown seed sources in the specified seed mix.
   2. Weeds shall not exceed 0.25%.
   3. Comply with current U.S. Department of Agriculture rules and regulations.
   4. Mix grass seeds in proportions by weight to meet or exceed minimum percentages of purity and germination as required in Standard Specification Section 3876.D.1 for Seed Mix 25-121.

2.04 WATER

A. Contractor shall be responsible for water.

2.05 MULCH

A. Type 1 or Type 5 per Standard Specifications Section 3882.

PART 3 - EXECUTION

3.01 SITE PREPARATION FOR SEEDING

A. Topsoil
   1. No topsoil shall be placed or worked in frozen or muddy condition.
   2. Prepare areas to be seeded to required depth of approximately 3 inches by disking, rototilling, harrowing or other approved means.
   3. Remove and dispose of rock, trash, or other materials brought to surface from preparation activities.

3.02 TOPSOIL/FINISH GRADING

A. Topsoil/finish grade is established final grade as shown on the Drawings. Grades not otherwise indicated are uniform levels or slopes between points where elevations are given or between such points and existing finished grades. Finish grade shall be approved by the Engineer prior to seeding.

B. Grade, rake, and roll with roller weighing not more than 100 lbs/lf and not less than 25 lbs./lf.

3.03 APPLYING FERTILIZER

A. Apply fertilizer uniformly over the designated area using mechanical spreading devices. Mix thoroughly with disk into upper 2 inches of soil.

B. Apply at a rate shown in Section 2.02.A.

C. Apply fertilizer no more than 48 hours prior to seeding.

3.04 SEEDING

A. Do not seed on saturated or frozen soil.

B. Do not seed when wind velocity exceeds 6 mph.

C. Seed all areas disturbed by construction.

D. The grass seed shall be drilled horizontally across the slope.

3.05 MULCHING

A. Mulch seeded areas within 3 days after seeding is complete.

B. Application rate shall be 2 tons per acre or no more than 1 inch in depth.

C. Mulch shall be spread uniformly in a continuous blanket. Mulch shall be started on the windward side of relatively flat area or on the upper part of a steep slope and continued uniformly until area is covered. The mulch shall not be bunched.

D. Do not mulch during periods of excessively high winds.

E. Immediately following the spreading of the mulch, the material shall be anchored securely into the soil a minimum of 3-inches by means of a mulch anchoring machine equipped with large coulter-type discs spaced on approximate 8-inch centers. All anchoring shall be at right angles to slope. Edges of the discs shall be dull to prevent cutting of the mulching and equipment operation shall be such as to embed the mulch to the required depth. In areas where equipment cannot be used, mulch shall be secured by shallow covering of earth or by embedding with approved hand methods, including straight-bladed spade with dull edge.

3.06 CLEANUP

A. Paved surface and other Site areas shall be kept clean of seeding, fertilizing, and mulching materials.

B. Clean up shall occur at the end of each work day or as required by Company. Pavement shall be swept with a street sweeper as directed by Engineer throughout the Project.

C. Restore existing utilities, surface features, and structures to condition equal to condition, which existed prior to construction.

D. Replace to original condition or better, damaged vegetation or landscape work.

3.07 MAINTENANCE OF SEEDED AREA

A. Maintenance of seeded areas shall begin immediately following last seeding application. Continue until Work is accepted.

B. Maintain seeded area by watering, mowing, and replanting as necessary to produce uniform stand of grass until Work is accepted.

C. Rework/replace topsoil where original topsoil has eroded or washed away as directed by Engineer.

D. Re-mulch any areas where the original mulch has washed away as directed by the Engineer.

E. Implement erosion control measures as required to keep area free of rutted and eroded soils.

3.08 ACCEPTANCE OF SEEDED AREAS

A. Contractor shall notify Company in writing 7 days prior to inspecting seeded area for acceptance.

B. Contractor and Company shall inspect seeded areas for contract compliance and acceptance of Work. Upon completion of inspecting seeded areas, Company shall provide written acceptance or rejection to Contractor with further requirement for completing the seeding work. Seeding work remaining to be completed shall be re-inspected by Company before Final Acceptance.

3.09 SURVEY QUALITY CONTROL

A. Topsoil shall be graded to the minimum thicknesses as shown on Drawings and specified herein. Thickness tolerance of topsoil shall be between -0.0 feet and +0.1 feet. Elevation tolerance shall be +/- 0.1 foot.

END OF SECTION

SECTION 02610

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes the supply and installation of discharge and decant piping.

1.02 REFERENCES

A. American Water Works Association (AWWA).

B. American Society for Testing and Materials (ASTM):
1. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
2. ASTM D790 – Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
3. ASTM D1238 – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
4. ASTM D1248 – Standard Specification for Polyethylene Plastics and Extrusion Materials for Wire and Cable
5. ASTM D1505) – Standard Test Method for Density of Plastics by the Density-Gradient Technique
6. ASTM D1693 – Standard Test Method for Environmental Stress Cracking of Ethylene Plastics.
7. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
8. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material.
9. ASTM D2122 - Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings.
10. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
11. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
12. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

1.03 SUBMITTALS

A. Manufacturer's certificates indicating conformance test results of furnished material to Technical Specifications.

B. Provide information where applicable as follows:

1. Manufacturer's name.
2. Nominal pipe size.
3. High density polyethylene (HDPE) classification, ASTM D3350.
4. Use for each type and size of pipe.

5. Extrusion date.
6. Lot number.

C. Stock density, melt flow, flexural modulus tensile strength, coloration, resin type and cell classification where applicable.

D. Provide instructions on special handling during transportation and storage.

E. Aforementioned submittals provided to Company a minimum of 30 days prior to beginning Work.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle and protect product to ensure product is not damaged.

B. Elevate material above grade.

C. Store and handle in such a manner as to prevent soil from entering or becoming lodged in the pipe.

D. Provide protection for flanges and fittings by storing inside or packaging with impermeable opaque material.

PART 2 - PRODUCTS

2.01 Physical Properties - Dimensions as shown on Drawings.

Density	ASTM D1505	not less than 0.941 – 0.955 g/cm^3
Melt Flow	ASTM D1238 – Condition E	not greater than 0.4 gm/10 min
Flexural Modulus	ASTM D790	110,000 to less than 160,000 psi.
Tensile Strength at Yield	ASTM D638	3,000 to less than 3,500 psi
Environmental Stress Crack Resistance	ASTM D1693 - Condition C	shall be in excess of 1,000 hrs (5,000 hrs) with zero failures
Hydrostatic Design Basis	ASTM D2837	1,600 psi at 230C

2.02 Pipe

A. Acceptable Manufacturers:
1. Phillips Driscopipe, Inc., Dallas, Texas.
2. Poly Pipe Industries, Gainesville, Texas.
3. Or approved equal.

B. High performance, high molecular weight, high density polyethylene pipe.

C. Material designation PPI-PE 3408.

D. ASTM D3350, minimum cell classification value 345444C.

E. Marking: Intervals of 5 feet or less.
1. Manufacturer's name or trademark.

2. Nominal pipe size.
3. HDPE cell classification, ASTM D3350.
4. Legend: Industrial pipe SDR 11, 17 or 26 as indicated on Drawings.
5. ASTM F714.
6. Extrusion date, period of manufacture or lot number.
7. Perforated pipe to be pre-drilled prior to delivery to site.
   a. Pattern as shown on Drawings.

F. Fittings

1. Molded from polyethylene compound having cell classification equal or exceeding compound used in pipe to insure compatibility of resins.
2. Be of same manufacture as pipe.
3. Fusion-weld joints.
4. Markings:
   a. Manufacturer's name or trademark.
   b. Nominal size.
   c. Material designation "HDPE".
   d. ASTM D3261.

PART 3 - EXECUTION

3.01 SITE CONDITIONS

A. Examine and verify acceptability of surface to receive product.

3.02 HDPE PIPE INSTALLATION

A. Location, lines, and grades as shown on Drawings.

B. Welded joints.
1. Weld in accordance with manufacturer's recommendations for butt fusion methods.
2. Butt fusion equipment used in joining procedures capable of meeting conditions recommended by manufacturer, including, but not limited to: Temperature required, alignment, and fusion pressures.

C. All HDPE pipe butt-fusion joints will be conducted using a data logger. Data logger data will be furnished to engineer at least once per week. Data logger joint number will correspond to a surveyed joint in the field.

D. Use electro-fusion pipe couplings where specifically shown on the Drawings or as otherwise directed by Engineer. Follow installation instructions from the electro-fusion system manufacturer.

E. No defective pipe shall be installed. Defective pipe shall be removed from Site and replaced at Contractor’s expense.

F. Perforations (if applicable):

1. Perforate pipe in pattern shown on Drawings.
2. Flush pipe prior to placement.

3.03 EXCAVATION AND PREPARATION OF SUBGRADE

A. Excavate and prepare subgrade as specified in Section 02201 and Section 02220 and as shown on Drawings.

3.04 BACKFILL AND COMPACTION

A. Remove trash and debris from trench. Remove loose soil from bottom of trench, or re-compact loose soil to 100 percent Standard Proctor maximum dry density before placing backfill materials.

B. Place common fill in maximum 4 inch loose lifts under pipe haunches and compact each lift to at least 100 percent Standard Proctor maximum dry density with vibrating compactor until firmly compacted to pipe spring line.

C. Place common fill in maximum 6 inch loose lifts to a height of 4 feet above top of pipe. Compact each lift to at least 95 percent Standard Proctor maximum dry density with vibrating compactor.

D. Backfill remainder of trench with common fill in maximum 12 inch loose lifts. Compact each lift to at least 95 percent Standard Proctor maximum dry density with vibrating compactor.

3.05 PIPE TO MANHOLE CONNECTION (if applicable)

A. Pipe to Manhole Connection:

1. Connect pipe to precast manholes by means as shown on Drawings.

3.06 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to Specification:

1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5 percent of shipment or delivery.
2. Cracks sufficient to impair strength, durability or serviceability of pipe.
3. Defects indicating improper proportioning, mixing, and molding.
4. Damaged ends, where damage would prevent making a satisfactory joint.
5. Noticeable variations from true alignment and grade with sufficient cause for rejection of Work.

B. Acceptance of fittings, stubs, or other specially fabricated pipe sections based on visual inspection at Site and documentation that they conform to these Technical Specifications.

3.07 HYDROSTATIC PRESSURE TEST

A. The discharge pipe, secondary pipe and vault outlet pipe shall be hydrostatically pressure tested after installation AND after pipe is backfilled, in accordance with ASTM F2164-13. Pneumatic testing of the polyethylene pipe will not be permitted.

Discharge pipe will be hydrostatically tested one additional time following installation of all vault pipes and valves.

B. Pressure testing equipment shall consist of a water pump capable of pressurizing the test section in a reasonable time against any elevation head pressure that may be present. The pressure monitoring gauge or sensor shall be accurate to within two percent of full scale, and located at the lowest point in the test section.

C. The high points of the test section may require venting to bleed off any trapped air while the pipe is filled with water.

D. The maximum test pressure shall not exceed 1.5 times the system design pressure nor shall it exceed the maximum pressure rating of the lowest pressure-rated component in the test section. The system design pressure will be determined from the maximum head pressure provided by the pump manufacturer.

E. The test procedure will consist of an initial expansion phase and a test phase. During the initial expansion phase, the test section will be pressurized to the test pressure and make-up water will be added as needed to maintain maximum test pressure for four hours. During the test phase, the pressure will be reduced by 10 psi and monitored for one hour. If the pressure remains steady (within 5% of the target test pressure) for the entire test phase duration, a passing test will be indicated.

F. If the test section does not pass due to leakage, equipment failure, etc., the section shall be de-pressurized for at least 8 hours before retesting.

END OF SECTION

SECTION 02615

CORRUGATED METAL PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes the supply and installation of corrugated metal pipe.

1.02 REFERENCES

A. American Association of State Transportation and Highway Officials, Current Edition, hereafter referred to as “AASHTO”

B. American Society for Testing and Materials (ASTM)

C. American Water Works Association (AWWA)

1.03 SUBMITTALS

A. Manufacturer's certificates indicating conformance test results of furnished material to Technical Specifications.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle and protect product to ensure product is not damaged.

B. Elevate material above grade.

C. Store and handle in such a manner as to prevent soil from entering or becoming lodged in the pipe.

PART 2 - PRODUCTS

2.01 PIPE

A. Corrugated Metal Pipe (CMP): Galvanized corrugated steel pipe in conformance with the requirements of AASHTO M-36.

PART 3 - EXECUTION

3.01 EXECUTION

A. Examine and verify acceptability of surface to receive product.

3.02 CORRUGATED METAL PIPE INSTALLATION

A. Location, lines, and grades as shown on Drawings.

A. Install galvanized corrugated steel pipe in conformance with the requirements of AASHTO M-36.

3.03 BACKFILL

A. Backfill with required pipe bedding and cover material to spring line of incoming pipe as shown on Drawings.

3.04 PIPE TO MANHOLE CONNECTION

A. Pipe to Manhole Connection:

1. Connect pipe to precast manholes by means as shown on Drawings.

3.05 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to specification:

1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded.
2. Cracks sufficient to impair strength, durability or serviceability of pipe.
3. Defects indicating improper proportioning, mixing, and molding.
4. Damaged ends, where damage would prevent making satisfactory joint.
5. Noticeable variations from true alignment and grade sufficient cause for rejection of Work.

B. Acceptance of fittings, stubs or other specially fabricated pipe sections based on visual inspection at Site and documentation that they conform to these Technical Specifications.

END OF SECTION

SECTION 02920

HIGH DENSITY POLYETHYLINE (HDPE) GEOMEMBRANE

PART 1 – GENERAL

1.01 SUMMARY

A. Work includes manufacture, fabrication (if needed), supply, and installation of smooth and textured high density polyethylene (HDPE) geomembrane liner system. Textured geomembrane shall have a smooth edge for seaming.

B. Performing on-site quality control testing for geomembrane installation and providing daily quality control documentation to Company or Engineer.

C. Union requirements for geomembrane installation personnel.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) Standards specifically referenced in this Section:

1. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
2. ASTM D751 Standard Test Method for Coated Fabrics
3. ASTM D792 Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
4. ASTM D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
5. ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
6. ASTM D1505 Standard Test Method for Density of Plastics by the Density Gradient Technique.
7. ASTM D1603 Standard Test Method for Carbon Black Content in Olefin Plastics.
8. ASTM D3895 Standard Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry.
9. ASTM D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
10. ASTM D4437 Standard Practice for Non-destructive Testing (NDT) Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
11. ASTM D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
12. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geosynthetics
13. ASTM D5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembrane Using Notched Constant Tensile Load Test
14. ASTM D5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
15. ASTM D5641 Standard Practice of Geomembrane Seam Evaluation by Vacuum Chamber.

16. ASTM D5721 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
17. ASTM D5885 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.
18. ASTM D5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
19. ASTM D6365 Standard Practice for the Nondestructive Testing of Geomembrane Seams using the Spark Test.
20. ASTM D6747 Standard Guide for Selection of Techniques for Electrical Detection of Potential Leak Paths in Geomembrane
21. ASTM D6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-fusion Methods
22. ASTM D7002 Standard Practice for Leak Location on Exposed Geomembranes Using the Water Puddle System
23. ASTM D7007 Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earth Materials
24. ASTM D7238 Standard Test Method for Effect of Exposure of Un-reinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
25. ASTM D7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane
26. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

B. Geosynthetic Research Institute (GRI) Standards:
1. GRI GM 6: Pressurized Air Channel Test for Dual Seamed Geomembranes
2. GRI GM 9: Cold Weather Seaming of Geomembranes
3. GRI GM 29 Field Integrity Evaluation of Geomembrane Seams (and Sheet) Using Destructive and/or Nondestructive Testing
4. GM10: Specification for the Stress Crack Resistance of Geomembrane Sheet.
5. GM13: Test Methods, Test Properties and Testing Frequency for HDPE Smooth and Textured Geomembranes.
6. GM 14: Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
7. GM 19: Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

C. U.S. Environmental Protection Agency Technical Guidance Document “Quality Control Assurance and Quality Control for Waste Containment Facilities,” EPA/600/R-93/182, September 1993, 305 pgs.

1.03 SUBMITTALS

A. The following submittals shall be provided to and approved by Company prior to delivery of geomembrane to the Site or mobilization of the Contractor’s geomembrane crew or equipment:
1. Contractor shall supply information from the resin manufacturer regarding the resin type, properties as specified herein, and production dates of the resin used for this Project. The resin type identification shall include the cell classification of the resin in accordance with the requirements of the latest ASTM Designation D3350.

2. Contractor shall submit from the geomembrane sheet manufacturer, test methods and results defining physical properties as specified herein, of the geomembrane to be used for this Project. Test results shall be submitted for all geomembrane furnished for the Project at the frequencies as specified in the GRI standards. Tests results shall be reported with the corresponding roll identification numbers to those rolls delivered to the Site.
3. Contractor shall supply a statement of the geomembrane manufacturer's quality control procedures, identification of any resin admixtures, frequency of sampling, methods of material transportation and storage, and acceptance criteria for roll goods delivered to the Site.
4. Contractor shall provide submittals describing the geomembrane sheet manufacturer's details of any factory seaming process proposed. Roll test results which may not be available prior to construction (i.e., environmental stress crack) shall be presented as preliminary prior to construction, with final test results submitted or affected rolls within the construction time frame.
5. Contractor shall submit from the extrudate weld rod manufacturer, verification that the weld rod was manufactured using the same resin as was used in the geomembrane sheets prior to using material.
6. Contractor shall submit a proposed panel and seam layout diagram specifying the type and location of all field and factory seams. The layout diagram shall be to scale and used as a construction plan and shall include all necessary dimensions and details. The layout diagram shall be compatible with the panel and seam layout requirements specified in this section.
7. Contractor shall submit an installation schedule.
8. Contractor shall submit a list of personnel performing field supervision, and quality control, along with experience records and resumes.
9. Contractor shall submit a list of equipment types proposed to be used in panel layout, membrane seaming, and destructive and nondestructive testing, and calibration verification.

B. The Contractor shall remit the following during geomembrane Installation:
1. Contractor shall, at the end of each working day provide a detailed report of work completed that day, including:
   a. Panel placement
   b. Trial welds results
   c. Subgrade acceptance form
   d. Seams
   e. Seam testing (air and vacuum tests)
   f. Destructive tests
   g. Repair log
2. Company shall review with the Contractor and sign the above report at the end of each day. Company shall be provided with a copy not more than 24 hours from the date of the report.

C. Contractor shall update their liner layout drawings on a daily basis. The Drawings shall include all panel locations and numbering, seam locations and numbering, and test locations and numbering. The Contractor shall maintain a current liner layout drawing on the construction Site at all times. At the request of Company a copy of the current liner layout drawing will be submitted with 24 hours.

D. Contractor shall submit final as-built liner layout drawing(s) to Company within 14 calendar days of completion of the liner work. Drawings shall be submitted in

paper and digital form. The as-built liner layout drawing shall be prepared based on GPS survey of the panel seams.

E. Quality control certificates indicating resin type, properties as specified herein, and production dates shall be provided with each shipment of extrudate rods delivered to the Site no later than the time of delivery.

F. Prior to the installation of any geomembrane, the Contractor shall submit Contractor's certification in writing that the surface upon which the geomembrane is to be installed is acceptable (complete form contained at end of this section).

G. The Contractor shall satisfy all union labor requirements with the appropriate union hall prior to beginning placement of the geomembrane and submit union agreement documentation to Company.

1.04 EXPERIENCE

A. The geomembrane installation shall be performed under the direct supervision of a single field supervisor who must remain on Site throughout installation, including inspection of the surface upon which the geomembrane is to be installed, geomembrane handling and storage, panel layout and placement, seaming, seam testing, panel and seam repair, installation of appurtenances, anchorage and other geomembrane-related work. The field supervisor shall have a personal HDPE or geomembrane installation record totaling at least 1 million square feet.

B. The geomembrane manufacturer shall have at least 5 years continuous experience in manufacturing smooth and textured polyethylene geomembrane rolls and/or a manufacturing record totaling not less than 5 million square feet of polyethylene geomembrane. The manufacturer shall have produced polyethylene geomembrane for at least 10 completed facilities similar in scope to this Project.

C. The Contractor shall have at least 5 years continuous experience in the installation of polyethylene geomembranes and an installation record totaling at least 5 million square feet. Contractor shall have installed polyethylene geomembrane for at least 10 completed sites similar in scope to this Project.

D. Field seaming of geomembrane panels shall be performed under the direction of a seaming supervisor who may or may not be the same person as the field supervisor. The seaming supervisor shall have a personal polyethylene geomembrane installation record totaling at least 1 million square feet with the mil-thicknesses and using the seaming methods proposed for this Project.

E. The designated quality control technician shall have a personal polyethylene geomembrane installation record totaling at least 1 million square feet with the mil-thicknesses and using the seaming methods proposed for this Project. The quality control technician shall be responsible for providing the daily installation documentation identified in this section.

F. The geomembrane manufacturer and any geomembrane installer SubContractors to the Contractor must be approved by Company prior to mobilization for geomembrane installation. Company has the right to reject any geomembrane manufacturer or Installer, and request that Contractor select an alternate.

1.05 PRE-INSTALLATION MEETING

A. Representatives of the Contractor and any geomembrane SubContractors shall attend a meeting prior to installation of the geomembrane to discuss details of the proposed design, installation, quality control documentation requirements and schedule.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Raw Materials:
1. Textured HDPE geomembrane, and extrudate rods used for this Project shall be manufactured of new, first quality resins, designed specifically for use in flexible membrane liner installations.
2. HDPE resin used in manufacturing geomembranes used for this Project shall meet requirements set forth in the latest revision of the Geosynthetics Research Institute (GRI) for HDPE (GRI GM 13).
3. Recycled polymer shall not be added to the resin. However, the resin may contain polymer reclaimed during the manufacturing process if reclaimed polymer content does not exceed 10 percent by weight.

B. Geomembrane Roll Goods
1. HDPE geomembrane sheets used for this Project shall meet the requirements set forth in the latest revision of the Geosynthetics Research Institute (GRI) for HDPE, both smooth and textured (GRI GM 13).
2. The geomembranes shall consist of unreinforced high density polyethylene containing at a maximum 3 percent by weight additives, fillers, or extenders.
3. The geomembranes shall be free of holes, blisters, striations, undispersed raw material, and contamination by foreign matter.
4. The geomembranes shall be supplied as a continuous sheet with no factory seams in rolls. Each roll shall be identified and labeled with the thickness of the geomembrane, length and width, manufacturer, lot number, and roll identification number. This identification number shall be used to identify roll location on the panel layout record drawing.

C. Extrudate: Resin used in the polyethylene extrudate shall be the same as that used to manufacture the geomembrane sheets. Extrudate rods are to be delivered in original containers with the manufacturer's labeling. Extrudate rods shall be free of dirt, grease, moisture, other contaminants, and shall be free of damage.

D. Neoprene Foam: Closed cell, weatherproof, black neoprene foam with adhesive backing suitable for long-term sun and liquid exposure. Dimensions shall be as specified on the Drawings.

E. Clamped Boots: Boots required to seal the HDPE geomembrane to the structures passing through it shall be made of the same materials as the geomembrane. The boots shall be fabricated so that all field assembly, welding, and seam testing can be accomplished using equipment and procedures regularly employed in the field for equipment and HDPE geomembrane installation. Smooth geomembrane shall be used in all geomembrane boots.

F. Banding Straps: Type 302 stainless steel banding straps suitable for use on the pipe diameters shown on the Drawings. Banding strap dimensions shall be as specified on the Drawings. All surfaces of the banding straps shall be machined smooth to prevent tearing or puncturing of the HDPE pipe boots. Outer lip of boot shall be sealed with silicone sealant as shown on Drawings.

2.02 EQUIPMENT

A. Extruding equipment shall be equipped with a temperature gauge at the barrel and nozzle.

B. Fusion equipment shall be equipped with a temperature gauge capable of continuous monitoring.

C. Provide digital or dial continuous temperature recording instruments, in satisfactory working condition, with each welding unit. Welding equipment shall not be operated without functioning temperature recording instruments for measuring geomembrane sheet temperature.

D. A coupon cutter and a calibrated tensiometer shall be provided for in-field seaming pre-qualification testing and destructive sample testing.

E. Store, transport, and operate all equipment to avoid damage to geomembranes.

F. Glass top of each vacuum box must be clear and free of scratches for easy reading of pressure gauge. The sealing gasket shall be intact and functioning to form close seals during testing.

G. Company reserves the right to order the Contractor to remove any equipment that in Company's opinion is not satisfactory. The Contractor will remove the equipment promptly from the construction Site and replace the unsatisfactory equipment with suitable equipment within 24 hours.

PART 3 – EXECUTION

3.01 SUBGRADE INSPECTION

A. Contractor shall certify in writing that the surface upon which the geomembrane is to be installed is acceptable (acceptance form contained at end of this section).

B. Contractor shall provide daily written acceptance for the surface to be covered by the geomembrane in that day's operations. The surface shall be maintained in a manner during geomembrane installation to ensure subgrade suitability.

C. After subsurface has been accepted by Engineer, it shall be Contractor's responsibility to indicate to Engineer any change in subsurface conditions that may require repair work and perform required repair work. Damage to subsurface caused by work involved in installing geomembrane shall be repaired at Contractor's expense. Geomembrane placement over damaged subsurface, as determined by Company or Engineer, is not acceptable. Nothing will waive Contractor's contractual requirements with respect to warranty on installed system.

3.02 ANCHOR TRENCH

A. Backfilling of anchor trench:
   1. Backfill and compaction of anchor trench shall be performed by the Contractor.
   2. Contractor shall monitor the backfilling of anchor trench to ensure proper method is employed. Any damage noticed shall be reported to Company.

3.03 HANDLING, TRANSPORTATION AND STORAGE

A. Geomembrane rolls shall be packaged and labeled prior to transporting to the Site. Geomembrane rolls delivered to the Site shall be wrapped in a relatively impermeable and opaque protective cover, which may consist of a sacrificial wrap of geomembrane. The sacrificial wrap shall be removed prior to geomembrane installation.

B. Geomembrane transportation shall be in a manner that minimizes the possibility of material damage during shipment. When offloading geomembrane from the truck, straps and a spanbar shall be used. Direct contact with forklifts or front end loaders to offload the material will not be allowed without written consent from Company.

C. On-site storage of the geomembrane rolls shall be in a safe manner, with rolls protected from grease, dirt, moisture, excessive heat, direct sunlight, vehicle traffic, and other possible sources of damage including theft and vandalism. The rolls will be placed in neat order and placed such that identification tags for each roll can be read. Storage areas shall be at the Company's designated location.

D. Geomembrane and appurtenant materials delivered to the Site shall be checked for proper labeling and visually inspected for transport or manufacturing damage. Company reserves the right to reject any unacceptable material at no cost to Company. Any roll that arrives on Site without factory roll identification will not be used for the Work and will be removed from the Site promptly.

E. Only that quantity of geomembrane that is to be placed on a particular day shall be removed from the packaging. Geomembrane rolls shall be transported from the storage area to the construction area and deployed using wide lifting straps and properly sized forklifts, front-end loaders, or other appropriate equipment.

F. Under no circumstances shall any heavy equipment be allowed directly on the geomembranes unless approved by Company.

G. Prior to placement, the geomembranes shall be visually inspected for compliance with this section. Geomembrane material, which in the opinion of the Engineer, is damaged or does not meet the Technical Specifications will be rejected by the Engineer. Minor damage may be repaired as specified in this Section. Damage to geomembranes caused by Contractor during handling shall be repaired or replaced at Contractor's expense.

3.04 PANEL LAYOUT AND PLACEMENT

A. Panel and Seam Layout Diagram

1. Prepare panel and seam layout diagram so that panel seams run parallel to the direction of maximum slope (i.e., down the slope).
2. All slopes steeper than or equal to 10H:1V shall use geomembrane textured on both sides, unless specifically identified otherwise on the Drawings.
3. The textured slope panels shall extend past top or bottom grade-break lines as shown on the Drawings no less than ten feet.
4. Slope panels shall not be constructed from more than two pieces of geomembrane (i.e., not more than one cross-seam shall be permitted on any one slope panel).
5. Cross seams in slope panels, where allowed, shall be oriented at 45^{o}. Cross seams shall be located on at least the bottom half of the slope, wherever possible.
6. Cross seams in adjacent panels shall be staggered.
7. Assign identification number to each seam for reference to test results and record Drawings.
8. Seams shall not be located at low points in the subgrade unless required by Site geometry and approved by Company.

B. PANEL PLACEMENT

1. Panel size and placement shall be in general accordance with the panel layout diagram submitted to Company as defined in this Technical Specification.
2. Geomembrane shall be anchored with sand bags or other approved methods to prevent uplift and damage by wind.
3. A panel identification number shall be assigned to each panel for reference to test results and Record Drawings. The panel identification number and geomembrane roll number shall be written on each panel by the Contractor with a grease pencil or fluorescent spray paint, immediately following deployment of the panel. Contractor shall insure panel identification is in a location as to not impact panel seaming.
4. **SMOKING DURING PLACEMENT OF PANELS IS PROHIBITED.** Wearing damaging shoes or engaging in any behavior which may damage the geomembrane is prohibited.
5. Eating, drinking, disposal of food wraps, drinking bottles and cans on top of geomembrane is not allowed.
6. Place panels with appropriate slack incorporated into geomembrane to accommodate expansion and contraction without jeopardizing the integrity of the geomembrane.
7. If Contractor plans to use ATV's or other lightweight equipment to traffic over geosynthetics as a means of panel deployment the Contractor <u>MUST</u> outline this in their plan of execution and obtain written consent of the Company.

3.05 SEAMING

A. Seaming Methods: All seams shall be joined using a heat extrusion or hot fusion (split wedge) weld process in accordance with the geomembrane manufacturer's recommendations. The Contractor shall maintain in working order at the Site at least one spare seaming apparatus for each type of welder used. The hot fusion weld process will be used whenever possible. The use of extrusion welded seams shall be limited to repairs and any areas or seam configuration inaccessible to fusion welding equipment.

B. Factory and field seams shall meet the minimum specifications set forth by the latest revision of the GRI.

C. Seam Configuration and Preparation:
   1. Overlap panels to be seamed at least 3 inches but not more than 6 inches. The loose end of the upper panel shall extend no more than 3 inches from the weld. All seams shall be made in a rainflap manner with the loose end of the upper panel shingled over the downgradient panel.
   2. Cross seams on slopes, where allowed, shall be made at a 45 degree angle to the edge of the panel.
   3. The contact area between panels shall be clean and free of moisture, dust, dirt, debris, and foreign material. A protective layer of filter fabric or a sacrificial HDPE strip shall be used directly beneath each seam overlap to achieve proper support and a clean work surface, if necessary.
   4. Where extrusion welding is used, the contact surfaces between panels shall be ground to remove oxidation prior to welding. Grinding shall not result in grooving of the liner or reduction of the liner thickness by more than 10 percent. The grinding motion shall be made perpendicular to the seam. Grinding in a direction parallel to the seam shall not be permitted. All ground areas shall be covered completely with extrudate.
   5. Seams shall be aligned to minimize the number and size of wrinkles.

D. Test Seam
   1. A prequalification test seam sample shall be prepared with each piece of seaming equipment/seamer approximately every four hours at the beginning of each seaming period (usually morning and afternoon), unless otherwise directed by Company. Each sample shall be prepared by the operator of the equipment for that seaming period and shall be at least 6 feet long (in the direction of the seam) by at least 1 foot wide and may be performed on scrap pieces of geomembrane.
   2. Six 1-inch wide specimens (coupons) from each test seam sample shall be prepared for on-site field testing for shear and peel strength. For dual wedge welding equipment, both tracks shall be tested for peel. Coupons shall be prepared using a sheet cutter so that consistent, uniform 1-inch wide coupons are obtained. Samples should be distributed evenly over the 6 feet length.
   3. Each specimen shall be labeled with an equipment and operator identification number, date, ambient air temperature, operating temperature, speed of seaming equipment, and field test results.
   4. The Contractor will make these test seams in the presence of Engineer.
   5. The extension rates for these tests will not exceed 2-inches per minute unless permission from the Engineer is given.

6. Three coupons shall be tested in shear and three in peel. All coupons shall exhibit the required strength at yield and failure mechanism FTB as set forth in *Section 3.05B*. Seam separation equal to or greater than 10% of the track width shall be considered a failing test. If any of the coupons fail, the reason for the failure shall be identified and corrected prior to preparing another test seam. The new test seam shall be prepared reflecting adjustments made to the seamer/seaming equipment and a new set of coupons shall be cut and tested.
7. The seaming equipment/seaming personnel combination shall not be used until satisfactory prequalification test seams have been prepared and witnessed by Engineer.
8. The test results on all prequalification test seams will be reported by the Contractor and reported to Engineer.

E. Climatic Conditions for Seaming
1. Seaming shall be performed only when panel temperatures are between 32°F and 170°F, unless otherwise approved by Company. If seaming is permitted to be performed at panel temperatures below 32°F, the panel contact surface shall be preheated and Contractor shall certify in writing that the low-temperature seaming procedures will not cause any short-term or long-term damage to the geomembrane or the welded seam. Contractor shall demonstrate to Company that field seams comply with Project Specifications using pre-qualification test seams. Contractor shall submit to Company, for approval, detailed procedures for seaming at low temperatures, including the following:
   a. Preheating of the geomembrane
   b. Provision of a tent or other device if necessary to prevent heat losses during seaming and rapid heat losses subsequent to seaming.
   c. Number of additional test welds to determine appropriate seaming parameters.
2. Seaming during rainy weather or when dew is present on panels shall not be allowed.
3. Contractor shall provide any special lighting required for seaming during low-light or dark hours.
4. Contractor shall leave slack in the geomembrane as necessary to account for thermal expansion or contraction of geomembrane. Stress on panels due to thermal expansion and contraction shall be minimized by performing field seaming operations during the coolest parts of the day or night, if necessary. Special scheduling or extended hours of operation require approval by Company.
5. All welding shall provide a tight, leak proof, homogeneous bond between panels. All seams shall extend to ends of panels.
6. Welding equipment shall be continuously monitored to control the temperature of extrudate and wedge. If recording equipment allows for a hard copy of the monitoring, a copy of the monitoring labeled with the weld identification number will be submitted to Company.

3.06 PIPE AND STRUCTURE PENETRATION SEALING SYSTEM

A. Penetration sealing systems shall be constructed from the base geomembrane material, flat stock, prefabricated boots and accessories as shown on the Drawings.

B. All penetration sealing systems must be tested. Where field non-destructive testing cannot be performed, field spark testing shall be performed using standard holiday leak detectors in accordance with ASTM 6365. Spark testing should be performed in areas where both air pressure testing and vacuum testing are not possible.

3.07 DEFECTS AND REPAIRS

A. Identification: Broom or wash geomembrane if amount of dust or mud inhibits inspection.

B. Evaluation: Non-destructively test each suspect location in seam and non-seam areas. Repair each location failing nondestructive testing.

C. Repair Procedures:
1. Repair defective seams by reconstruction.
2. Repair tears or pinholes by seaming or patching.
3. Repair blisters, larger holes, undispersed raw materials, and contamination by foreign matter with patches.
4. Surfaces of geomembrane to be patched shall be abraded no more than 1 hour prior to repair.
5. Seams used in repairing patches shall be approved extrusion welded seams and may be subjected to same destructive test procedures as outlined for other seams.
6. Patches shall be made of same geomembrane, extend minimum of 150 mm (6 in.) beyond edge of defects, and applied using approved extrusion welding methods only. Report areas of repair to Company immediately.
7. Wrinkles in the geomembrane shall be removed or repaired as directed by Company or field Engineer.
    a. Wrinkles shall be repaired by cutting the geomembrane at the top edge of the wrinkle and overlapping the cut panels. The cut panels shall be repaired in accordance with Subpart 3.07 of this section.

D. SEAM RECONSTRUCTION PROCEDURES:
1. Seam reconstruction for extrusion welding process shall be achieved by installing a cap strip over the defective weld a minimum of 6 inches either side of the weld and extrusion welding.
2. Seam reconstruction for fusion process shall be achieved by cutting out existing seam and welding in replacement strip or by welding a cap strip over the defective seam length.

E. Verification of Repairs: Test each repair non-destructively. Repairs passing nondestructive test shall be taken as indication of adequate repair. Failed tests indicate repair shall be redone and retested until passing test results.

3.08 GEOMEMBRANE ACCEPTANCE

A. Contractor shall retain ownership and responsibility for geomembrane until acceptance by Company. Geomembrane liner will be accepted by Company when:
1. Written certification letter, including "As-Built" Drawings, is received by Company.
2. Installation of the geomembrane is complete.

3. All required documentation of installation is submitted to Company, including inspector's final report.
4. Verification of adequacy of field seams and repairs, including associated testing, and associated survey information is complete and all paperwork accepted and approved by Company.

3.09 CLEANUP

A. The Contractor shall place ALL material scraps in Company designated area at the end of each working day. Disposal of scraps in the anchor trenches will not be acceptable. No scraps of materials will be allowed to be left on top of liner.

B. Once liner installation is complete the Contractor shall:
1. Remove all excess geomembrane and geomembrane scraps from Site.
2. Remove all sand bags from Site; or
3. Remove all sand bags and place in Company designated area; or
4. If sand in sand bags is acceptable as the screened sand layer material the Contractor may empty each bag and remove and dispose of the empty bags. This will only be allowed if the material meets the criteria for the screened sand layer. The Contractor must receive permission from Company prior to emptying the sand bags onto the liner.

PART 4 – CONSTRUCTION QUALITY TESTING

4.01 NONDESTRUCTIVE TESTING OF PRODUCTION SEAMS

A. All field seams shall be non-destructively tested by the Contractor over the full seam length before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of test, and outcome of all non-destructive testing shall be recorded and submitted to the Company.

B. Nondestructive testing of seams shall be completed no later than 1 day after the seaming is completed. Documentation of the test results shall be tabulated and submitted to the Company or Engineer on the same day testing is completed. Additional geomembrane shall not be deployed until the results of the previous day’s nondestructive testing have been submitted and approved by the Company or Engineer unless otherwise approved by the Company. All defects found during testing shall be numbered and marked immediately after detection. All defects found shall be repaired, retested and re-marked to indicated acceptable completion of the repair.

C. Non-destructive tests shall be performed by experienced technicians familiar with the specified test methods.

D. Visual Inspection: A visual inspection of all seams shall be performed. This inspection shall look for obvious flaws in seaming patches, penetration sealing, material defects, or other problems. Deviations from acceptable workmanship standards shall be noted and corrected.

E. Pressure Testing (Double-Fusion Welds): Where a double-fusion weld seaming system is employed, the continuity of the seam shall be tested with air pressure in accordance with the following procedure. The flow channel must not be obstructed by foreign objects or geomembrane material throughout the length of seam being tested. The vacuum test described in *Section 4.01F* must be employed for testing of all seams that do not have a continuous flow channel:

1. A test device consisting of an inflation needle and pressure gauge mounted on a "T" fitting shall be used for air pressure testing. Insert the needle into the flow channel and seal the end of the channel around the needle. Connect a pump (such as a small bicycle pump) to the test device.
2. Ascertain that the flow channel is continuous by leaving the other end of the channel open and pumping air through the channel. If air does not pass through the channel the test length must be shortened until a continuous length of flow channel is found.
3. Seal and clamp both ends of the flow channel to assure an airtight seal. Inflate the flow channel to 25 to 30 psig. Allow one minute for the seam to stabilize.
4. Re-inflate as needed to achieve 25 to 30 psig on the seam and test for a period of five minutes.
5. At the end of the test period, if the pressure has not dropped more than 2 psi, the test shall be considered a pass and the following procedure will be implemented;
    a. Remove the test device and clamps.
    b. Make any repairs, if necessary, to the area where the flow channel was clamped or inflated.
    c. Record the test results, mark the seam as a pass, the date tested, and proceed to the next seam.
6. If the pressure drops below the 2 psi allowance, the test shall be considered a failure and the following procedure shall be implemented to identify the failure:
    a. Check to determine if there is excessive seepage around the inflation needle.
    b. Check both ends of the seam to ensure the flow channel is completely sealed off.
    c. Walk the length of the seam; look and listen for air leaks.
    d. If either of these procedures fails to identify the leak, trim the seam overlap and vacuum test the seam to locate the leak.
    e. Once the leak is identified, make the necessary repairs and retest the seam.
7. Seam to be approved before testing by Engineer; test to be performed in presence of Engineer.

F. Vacuum Testing: Vacuum testing shall be used to test the continuity of extrusion welded and mechanical seams. A clear topped vacuum box, supplied by Contractor, shall be placed over the seam to be tested after application of a soapy solution. Upon evacuation, bubbles will be evident through the viewing window if the seam lacks integrity. The following procedure shall be followed:

1. Wet seam to be tested with a soapy solution mixed at a ratio of 1 ounce soap to 1 gallon water. No antifreeze solution is allowed to be added to the water.
2. Place vacuum box over seam to be tested, evacuate box to a vacuum equal to 3 to 5 inches water column, and tug up to ensure a leak tight seal has been developed.
3. Examine the seam for 5 to 10 seconds to detect soap bubbles.

4. If the bubbles are not evident, move to next test location. Adjacent test sections are to overlap by at least 1 inch.
5. If bubbles are present, mark area clearly for repair.
6. If the vacuum testing indicates leakage, the area shall be spot patched; or if major leaks are detected, the entire seam shall be reworked.
7. Seam to be visually inspected and approved for air testing by Engineer before air testing; test to be done in presence of Engineer.

4.02 DESTRUCTIVE TESTING OF PRODUCTION SEAMS

A. The purpose of destructive testing is to verify that the seaming process has produced seams of acceptable mechanical integrity. Sample frequency shall follow a graduated scale as follows:
   1. One seam sample shall be taken at random for each 500 lineal feet of seam, until five (5) consecutive passing results are obtained. At the discretion of the Engineer, sample frequency can subsequently be increased to one per 1,000 lineal feet of seam. After five (5) passing results at each frequency, the frequency can be increased by 500 lineal feet increments up to 2,000 lineal feet. Sample frequency shall return to one sample per 500 lineal feet upon a single failing field or laboratory result. Sample locations shall be designated by Company. Each sample shall be shown on the panel layout drawing. The collection of samples for destructive seam testing shall be completed the same day the seaming is completed. All holes in the installed geomembrane resulting from obtaining samples shall be repaired immediately. The sample ID number shall be marked on the patch. All repairs shall be 100 percent vacuum tested or spark tested for continuity.

B. *Maximum frequency of test locations shall be agreed upon by the Contractor and Company prior to commencement of installation*. Additional test locations, not to exceed agreed upon maximum frequency, shall be determined during seaming at Company's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds or other potential cause of imperfect welding.

C. Contractor shall not be informed in advance of locations where seam samples will be taken.

D. Number each sample and identify sample number and location on panel layout drawing.

E. Samples shall be 0.4 m (16 in.) wide by 2.1 m (44 in.) long with seam centered lengthwise. Cut one 25 mm (1 in.) wide strip from each end of sample and test in field, by hand or tensiometer, for peel and shear respectively. The tested sample shall not fail through the seam. If tensiometer is not available and if 25 mm (1.0 in.) wide specimen is too difficult to test by hand, 10 mm (0.5 in.) wide specimen is acceptable. Cut remaining sample into 3 parts and distribute as follows:
   1. One portion to Contractor for field documentation testing, 0.40 m by 0.38 m (16 in. by 15 in.).
   2. One portion to Contractor for independent laboratory testing, 0.40 m by 0.38 m (16 in. by 15 in.) if required.

F. One portion to Company for archive storage, 0.40 m by 0.30 m (16 in. by 12 in.).

For field testing, the Contractor shall cut 10 identical 1-inch wide replicated specimens from the sample. The Contractor shall test five specimens for seam shear strength and five for peel strength. Peel tests shall be performed on both inside and outside weld tracks. To be acceptable 4 out of five specimens must pass the test criteria with less than 10% separation. The Contractor shall submit field documentation test results to the Company as soon as they become available, but no later than 1 working day after the sample was taken. Field seams shall meet the minimum specifications of GRI GM 19:

Note: All seams must exhibit a film-tear bond.

G. Contractor shall be responsible for submitting destructive sample to an independent laboratory testing agency as outlined in Section 01410. Contractor shall notify Company prior to samples being sent to laboratory and laboratory shall report results to Company concurrently with reporting results to Contractor.

H. All testing equipment required for these quality control tests shall be provided by Contractor. Any seams failing the quality control tests shall be repaired at Contractor's expense until passing test results are obtained. At all times, care shall be exercised to avoid damaging the geomembrane.

I. Engineer shall be present for all field documentation testing of seam strength.

J. Contractor shall submit results of test it performs as a result of its quality control assurance program to Company.

4.03 PROCEDURES FOR DESTRUCTIVE TEST FAILURE

A. The following procedures shall apply when sample fails destructive test:
   1. Obtain additional destructive test samples at locations approximately 10 feet on either side of the failed test location.
   2. Perform destructive tests.
   3. If test passes, the seam shall be considered adequate.
   4. If tests fail, all seams represented by the original destructive test shall be repaired with a cap-strip extrusion welded to all sides of the capped area. All cap-strip seams shall be non-destructively tested until adequacy of the seams is achieved. Cap strip seams exceeding 150 feet in length shall be destructively tested.

B. In any case, acceptable seams shall be bounded by 2 passed test locations (i.e., above procedure shall be followed in both directions from original failed location), and one sample for destructive testing shall be taken within reconstructed area.

C. If sample fails laboratory destructive test (whether conducted by independent laboratory or by Contractor's laboratory), above procedures shall be followed considering laboratory tests exclusively. Since final seam must be bounded by 2 passed test locations, it may be necessary to take one or more new samples for laboratory testing in addition to one required in reconstructed seam area.

4.04 SURVEY DOCUMENTATION

A. Contractor shall be responsible for performing a GPS survey of all documentation locations and shall submit results of survey to Company as part of record documents.

B. Contractor shall comply with Section 01050 when completing documentation survey.

C. Documentation survey shall include the following at a minimum. Contractor shall survey any additional documentation points as requested by Company needed for completing record drawings
   1. Panel Intersections
   2. Repair Locations
   3. Destruct Locations
   4. Shoulder of anchor trench
   5. Edge of geomembrane
   6. Tie in locations

4.05 GEOMEMBRANE ACCEPTANCE

A. Contractor shall retain all responsibility for the geomembrane and related work until final acceptance is received from Company.

END OF SECTION

Certificate of Acceptance of
Geomembrane Subgrade Surface by Contractor

DESCRIPTION OF AREA TO BE CERTIFIED:_____

_____

_____

LOCATION:_____
PROJECT:_____
ADDRESS:_____

The undersigned, _____ certifies he/she is a representative of _____, duly authorized to execute this certificate, that he/she visually inspected the subgrade surface described above on _____ and found the surface to be acceptable for installation of the geomembrane.

This certification is based on observations of the surface of the subgrade only. No sub terrain inspections or tests have been performed and_____ (Company) makes no representations or warranties regarding conditions which may exist below the surface of the subgrade.

Date: _____ Signature: _____
Name:_____ Title:_____

CERTIFICATE RECEIVED BY CONTRACTOR
Date_____
Contractor_____
Name_____
Signature_____
Title_____

CERTIFICATE RECEIVED BY COMPANY
Date:_____
Company:_____
Name: _____
Signature_____
Title:_____

SECTION 02921

GEOTEXTILE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes manufacture, fabrication (if needed), furnishing and installation of geotextile, as required, for reinforcement of:

1. Riprap underlayment
2. Geomembrane protection under stormwater pipes

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D3776—Standard Test Method of Mass per Unit Area of Woven Fabric.
2. ASTM D4491—Standard Test Method for Water Permeability of Geotextiles by Permittivity.
3. ASTM D4533—Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
4. ASTM D4632—Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
5. ASTM D4751—Standard Test Method for Determining Apparent Opening Size of a Geotextile.
6. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geotextiles, Geomemebranes, and Related Products.

B. Geosynthetics Research Institute (GRI)

1. GT7 – Determination of Long-Term Design Strength of Geotextiles
2. GT8 -- Fine Fraction Filtration Using Geotextile Filters.
3. GT12a – Test Methods and Properties for Nonwoven Geotextiles Used as Protection Materials
4. GT13a – Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate.

C. Standard Specifications are defined as the "Standard Specifications for Construction", State of Minnesota Department of Transportation, 2014 Edition with latest supplements.

1.03 SUBMITTALS

A. Manufacturer's certificates indicating conformance test results of furnished material to the Technical Specifications.

1.04 QUALITY ASSURANCE AND MATERIAL HANDLING

A. Roll Identification:

1. Provide geotextiles in rolls wrapped in relatively impermeable and opaque protective covers and marked or tagged with following information:
   a. Manufacturer's name
   b. Product identification
   c. Lot number
   d. Roll number
   e. Roll dimensions
2. Indicate special handling marked on geotextile itself, e.g., "This Side Up".
3. Conformance testing indicating conformance with Technical Specifications.

B. Handle geotextiles in such manner as to insure geotextiles are not damaged.

PART 2 - PRODUCT

2.01 GENERAL

A. Unless otherwise noted on the Drawings, furnish materials whose minimum average roll values as defined by GRI, meet or exceed geotextile fabric properties.

B. Except when specifically authorized, supplier shall not furnish special run or value added products.

C. Orient polymeric yarns or fibers into stable network to retain relative structure during handling placement, and long-term service.

D. Unless longer durability is specified, geotextiles shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration.

2.02 GEOTEXTILE FABRIC MINIMUM PROPERTIES: All properties listed are minimum average roll values (MARV)

A. Riprap and road surface material underlayment

1. Shall be a Type 3, woven, polypropylene fabric in accordance with Section 3733 in Standard Specifications.

B. Geomembrane protection

1. Shall be a Type 3, non-woven, polypropylene fabric in accordance with Section 3733 in Standard Specifications.

PART 3 - EXECUTION

3.01 GEOTEXTILES INSTALLATION

A. General

1. On slopes, roll down slope in such manner as to continually keep geotextile sheet in tension.
2. In presence of wind, weight geotextiles with sandbags or equivalent. Install sandbags during placement and keep in place until replaced with cover materials.
3. Take necessary precautions to prevent damage to underlying layers during placement of geotextile.
4. During placement of geotextiles, care shall be taken not to entrap in geotextile, stones, excessive dust or moisture that could damage geomembrane or hamper subsequent seaming.
5. Do not expose geotextiles to precipitation prior to being installed and do not expose to direct sunlight for more than 15 days, unless otherwise specified.

B. Seams and Overlaps:

1. On slopes steeper than 10 horizontal/1 vertical, seam geotextiles:

   a. Seam by sewing, adhesive, fusion or other approved means.
   b. Continuously seam; do not spot seam.
   c. Overlap geotextile 6 inches prior to seaming.
   d. Sew horizontal seams along slope, not across slope.
   e. Using polymeric thread with properties equal to or exceeding those of geotextile.

2. On slopes less than 10 horizontal/1 vertical, seam or overlap geotextile:
   a. Overlap 18 inches.
   b. Spot seaming when overlapping may be considered as a measure to mitigate against wind uplift.
   c. Orient overlaps in direction of earth placement equipment travel.

C. Geotextile Repair:

1. On slopes:
   a. Sew fabric patch into place using double sewn lock stitch, seams 1/4 to 3/4 in. apart and no closer than 1 in. from any edge.
   b. Should any tear exceed 10% of width of roll, remove roll from slope and replace.
2. On non-slope areas: spot seam a fabric patch in place with minimum of 24 inch overlap in each direction.
3. Remove soil or other material that may have penetrated torn geotextile.

END OF SECTION

SECTION 02950

CAST-IN PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes manufacture, fabrication (if needed), furnishing and installation of concrete structures, as required.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C33—Concrete Aggregates.
2. ASTM C94—Ready-Mixed Concrete.
3. ASTM C150—Portland Cement.
4. ASTM C260—Air-Entraining Admixtures for Concrete.
5. ASTM C494—Chemical Admixtures for Concrete.
6. ASTM C618—Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
7. ASTM C31—Making and Curing Concrete Test Specimens in the Field.
8. ASTM C39—Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM C109—Test for Compressive Strength of Hydraulic Cement Mortars.
10. ASTM C138—Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
11. ASTM C143—Test for Slump of Portland Cement Concrete.
12. ASTM C173—Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C192—Making and Curing Test Specimens in the Laboratory.
14. ASTM C231—Test for Air Content of Freshly Mixed Concrete by the Pressure Method

B. American Associate of State Highway and Transportation Officials (AASHTO):

1. AASHTO T277—Standard Method of Test for Rapid Determination of the Chloride Permeability of Concrete.

C. American Concrete Institute (ACI):

1. ACI 211.1—Standard Practice for Selection Proportions for Normal and Heavy Weight Concrete.
2. ACI 212.1R—Guide for Use of Admixtures in Concrete.
3. ACI 226.3R—Use of Fly Ash in Concrete.
4. ACI 301—Specifications for Structural Concrete for Buildings.
5. ACI 302—Guide for Concrete Floor and Slab Construction.
6. ACI 304—Recommended Practice for Measuring, Mixing, Trasporting, and Placing Concrete.

7. ACI 305R—Hot Weather Concreting.
8. ACI 306R—Cold Weather Concreting.
9. ACI 308—Standard Practice for Curing Concrete.
10. ACI 309—Recommended Practice for Consolidation of Concrete.
11.

1.03 SUBMITTALS

A. Submit for approval the following data:

1. Concrete Admixture Product Data: Include brand name, manufacturer, and dosage rate range.

2. Concrete Mix Design:

a. Portioning of all materials
b. Slump
c. Air entrainment
d. 3,7, and 28 day compression test results
e. Unit weight of fresh and dry concrete
f. Sieve analysis and source of fine and coarse aggregates
g. Test for aggregate type organic impurities
h. Water-cement ratio

3. Data Indicating That Concrete Admixtures Conform to Specification Requirements

1.04 QUALITY ASSURANCE

A. Contractor shall employ acceptable testing laboratory to perform materials evaluation, testing and design of concrete mixes.

1. ASTM C143—Test for Slump of Portland Cement Concrete, one test for each truck-load at point of discharge.
2. ASTM C39—Compressive Strength of Cylindrical Concrete Specimens, one set for each truck-load of concrete, one specimen tested at 3 days, one specimen tested at 7 days, one specimen tested at 28 days, and one retained for later testing if required.
3. ASTM C173—Test for Air Content of Freshly Mixed Concrete by the Volumetric Method, one for each set of compressive strength specimens.

PART 2 - PRODUCT

2.01 GENERAL

A. Unless otherwise noted on the Drawings, furnish materials, tools, equipment and services for all grout and concrete materials.

B. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

2.02 MATERIALS

A. Portland Cement; ASTM C150 Type 111A:

1. Cement used shall correspond to that upon which selection of concrete proportions was based.
2. Use only one brand of cement.

B. Admixtures: When required or permitted, conform to appropriate specifications listed below; admixtures used shall be of the same composition as used in established required concrete proportions.

1. Air-entraining admixtures: ASTM C260.
2. All high-range water-reducing admixtures conforming to ASTM C494, Type F.
3. Provide admixtures of same type, manufacturer and quality as used in establishing required concrete proportions in the mix design.

C. Water: Potable.

D. Aggregates:

1. ASTM C33.
   a. Fine aggregate shall consist of clean, hard, durable, and uncoated particles. Free from injurious amounts of salt, alkali, or other objectionable material.
   b. Fine aggregates shall have fineness modulus (FM) of about 3.0, but not less than 2.5

2. Coarse aggregates:

   a. Sieve Size — Percent Passing

Sieve Size	Percent Passing
1-1/2”	100
1-1/4”	95-100
¾”	55-85
3/8”	20-45
No. 4	0-7

   b. Coarse aggregate shall consist of durable particles of crushed quarry rock including quartzite, gneiss, and granite, or mine trap rock including basalt, diabase, gabbro, and other igneous rock types. Coarse aggregate shall be free from injurious amounts of salt, alkali, dust, clay or other objectionable materials.

3. Regard fine and coarse aggregates as separate ingredients. Each size of coarse aggregate, as well as combination of sizes when two or more are sed, shall conform to grading requirements of applicable ASTM specifications.

E. Joint Fillers

1. Construction Joints: Two-part, semi-rigid, 100% solid epoxy joint filler. Approved product are:
   a. Epolith-P, by Sonneborn Building Products
   b. Masterfill 300, by BASF

F. Formwork Materials: Formwork shall consist of wood or metal to provide a continuous, straight, smooth finish.

2.03 MIXING AND PRODUCTION OF CONCRETE – READY-MIXED CONCRETE

A. Batch, mix and transport ready-mixed concrete in accord with ASTM C94 and ACI 304. Plant equipment and facilities shall conform to “Check List for Certification of Ready Mixed Concrete Production Facilities” of National Ready Mixed Concrete Association, 900 Spring Street, Silver Spring, MD 20910.

B. Provide ready-mix for all concrete work.

2.04 MIXING – CONTROL OF ADMIXTURES

A. Charge chemical admixtures into mixtures as solutions.

B. Measure by means of an approved mechanical dispensing device.

C. Liquid added is part of mixing water.

D. Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended

E. If two or more admixtures are used, add them separately to avoid possible interactions that might interfere with efficiency of either admixture, or adversely affect concrete.

F. Add high-range water-reducing admixtures at end of mixing cycles after all other ingredients have been introduced and thoroughly mixed.

G. Do not use calcium chloride, thiocyanates (and all admixtures that contribute free chlorine in excess of 0.1 percent by weight of cement).

2.05 MIXING – TEMPERING AND CONTROL OF MIXING WATER

A. Mix concrete only in quantities for immediate use. Discard concrete which has set.

B. Discharge concrete from red-mix trucks within time limit and drum revolutions as stated in ASTM C96 and ACI 304.

C. When concrete arrives at project with slump below suitable for placing, water may not be added. The superplasticizer or high-range water-reducer may be added, based on the recommendations of the superplasticizer supplier or their on-site representative, to the slump suitable.

D. Incorporate water by additional mixing equal to at least half of total mixing required.

E. Addition of water in excess of design proportion constitutes cause for rejection of batch.

2.06 MIXING – WEATHER CONDITIONS

A. Cold Weather: Comply with ACI 306.

1. In cold weather, temperature of concrete when delivered at site shall conform to the following limitation:

Air Temperature F°	Minimum Concrete Temperature F°
30 to 45	60
0 to 30	65

2. If water or aggregate is heate3d above 100 degrees F, combine water with aggregate in mixer before cement is added. Do no mix cement with water ore with mixtures of water and aggregate having a temperature greater than 100 degrees F.

3. Hot weather: Comply with ACI 305.

PART 3 - EXECUTION

3.01 CONCRETE PROPORTIONNING

A. General: Use concrete of specified quality capable of being placed without excessive segregation and, when cured, of developing all characteristics required.

B. Strength: Concrete shall be normal weight concrete with a minimum 28 day compressive strength of 5000 psi and a maximum water-cement ratio by weight of 0.4 (may be less to reduce shrinkage) and obtain a three day strength of 3500 psi.

C. Durability: Entrain air in all concrete. Maintain air content between 5.5 and 7.5 percent by volume measured by pressure method.

D. Slump: Except as noted otherwise, proportion and produce concrete to have a maximum slump of 3 inches after charging all admixtures. Determine slump per ASTM C143. Measure slump at point of discharge into forms.

E. Use admixtures in accordance with manufacturer's instructions. Calcium chloride is not permitted.

F. Selection of concrete proportions shall be in accordance with ACI "Building Code Requirements for Reinforced Concrete" Part 3, Chapter 4.

3.02 PLACEMENT

A. Before placing concrete, verify the installation.

B. General:

1. Comply with recommendations of ACI Standard 304, Chapter 6.
2. Deposit concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within sections.
3. Locate construction joints between sections and where the new topping meets the old.
4. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.

5. Do no deposit concrete which has partially hardened or has been contaminated by foreign materials.
6. Provide expansion joints, either formed or saw-cut, in new topping above all floor joints in existing slab within 4 hours of concrete placement.

C. Deposit concrete as neatly as practicable in its final position to avoid segregation due to handling or flowing.

D. Do not subject concrete to any procedure which will cause segregation.

E. Maximum free fall of concrete when being placed is 5 feet.

F. Do not allow construction equipment or personnel to induce external vibrations into freshly placed concrete after concrete has been consolidated.

G. Consolidation:

1. Consolidate all concrete by vibration so that concrete is thoroughly worked around reinforcement if exposed, around embedded items, and into corners of forms eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
2. Use internal vibrators to consolidate concrete effectively.
3. Do no use vibrators to transport concrete within forms.
4. Insert vibrator and withdraw at points approximately 19 inches apart.
5. At each insertion, all duration sufficient to consolidate concrete but not sufficient to cause segregation.
6. Keep at least one standby vibrator for each three vibrators in use, during all concrete placing operations.

H. Set edge forms and intermediate screed strips accurately to produce designated elevations and contours of finished surface.

I. Provide extra concrete (increased thicknesses) as necessary to produce finished surfaces within specified tolerances at designated elevations and contours at no additional cost to Owner.

J. Align concrete surfaces of screed strips by use of strike-off templates or approved compacting type screeds.

K. Dampen wood forms to prevent moisture loss.

3.03 CURING AND PROTECTION

A. Beginning immediately after placement, protect concrete from premature drying, hot or cold temperatures, and mechanical injury, and maintain with minimal moisture loss at a relatively constant temperature for a period necessary for the hydration and hardening of the concrete, but not less than 72 hours. Materials and methods of curing are subject to approval

B. To avoid plastic or drying shrinkage cracks during warm, dry or windy weather, follow ACI 302, ACI 305 and ACI 308 during handling, finishing and curing of concrete.

C. Fog misting is required until wet burlap or other approved curing material is placed over the concrete. Do not sure fog misting to apply water to the surface of the concrete to facilitate lubrication for finishing purposes.

D. Start curing immediately after finishing is completed.

E. Cover fresh concrete with plastic sheets or moist burlap covered with plastic. Keep burlap wet for the 7 day cure and then remove. At that time, the section of floor will be opened for use.

F. Comply with ACI 308 for standard curing practices not specifically defined herein.

END OF SECTION