

PRINCE LAKE NO. 1 CONSTRUCTION PLANS

BOULDER COUNTY, COLORADO

DAM I.D.: 060209, WATER DIVISION 1, WATER DISTRICT 6

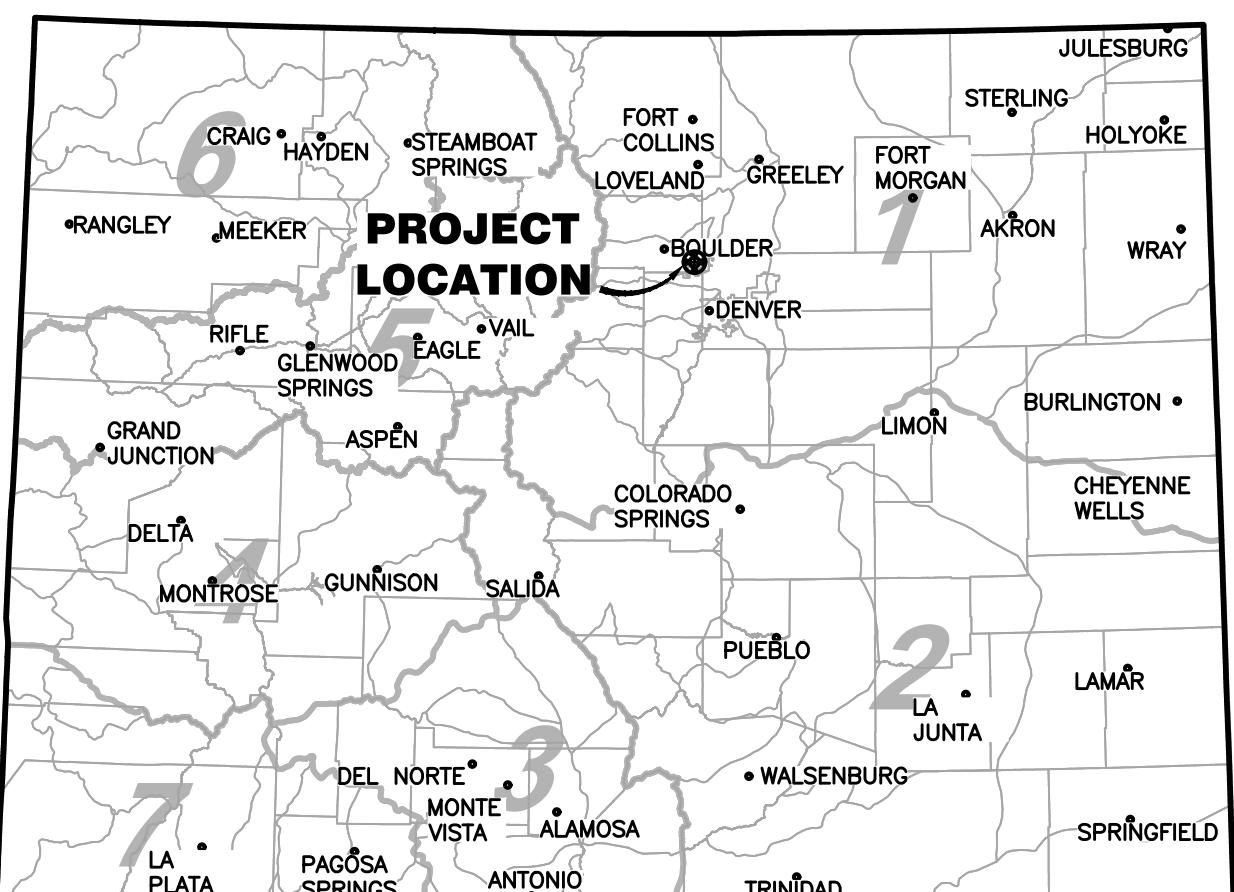
OCTOBER, 2023

OWNER: BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT
5201 ST. VRAIN ROAD
LONGMONT, CO 80503
(303) 413-7077

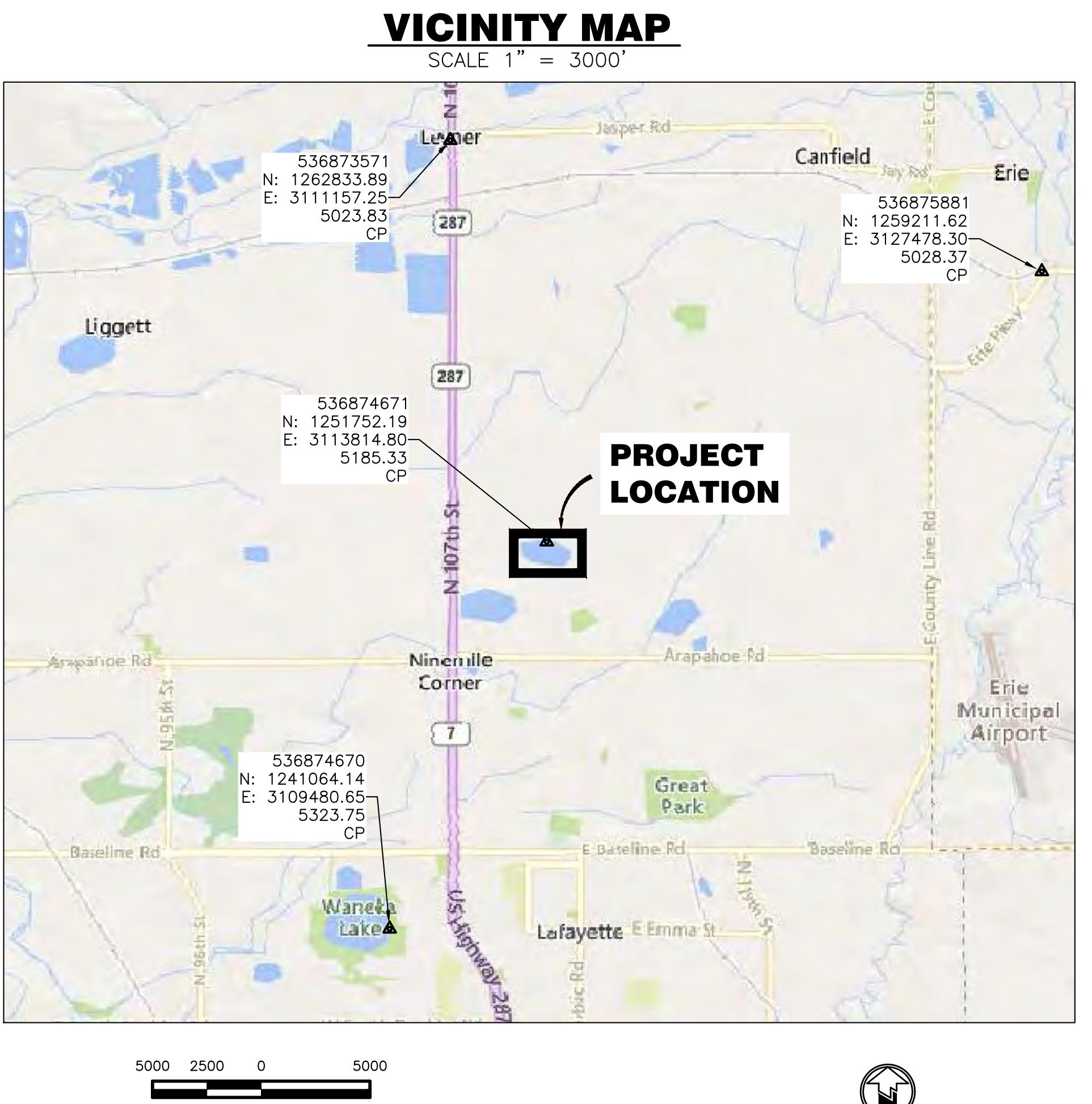
ENGINEER: APPLEGATE GROUP, INC.
1490 W. 121st AVENUE
SUITE 100
DENVER, CO 80234
(303) 452-6611

GEOTECH: CESARE, INC.
7108 S. ALTON WAY
CENTENNIAL, CO 80112
(303) 220-0300

SURVEYOR: ASCENT GEOMATICS SOLUTIONS
8620 WOLFF CT
WESTMINSTER, CO 80031
(303) 928-7128



LOCATION MAP
NOT TO SCALE



These plans have been prepared by me or under my direct supervision.	
_____ Steven A. Smith Colorado P.E. No. 43364	
Approved on the _____ day of _____, 20_____ State Engineer	
By: John Hunyadi, Chief, Colorado Dam Safety Colorado P.E. No. 42709	
These plans represent the AS-CONSTRUCTED conditions of _____ Dam to the best of my knowledge and judgment, based in part on information furnished by others, as of the _____ day of _____, 20_____. _____ Steven A. Smith Colorado P.E. No. 43364	

**BOULDER COUNTY PARKS AND
OPEN SPACE DEPARTMENT**

**PRINCE LAKE NO 1 DAM
REHABILITATION**

COVER SHEET

**Applegate
Group, Inc.**

Water Resource Advisors for the West
1490 West 121st Ave., Suite 100
Denver, CO 80234
(303) 452-6611
Fax: (303) 452-2759
email: info@applegategroup.com Website: www.applegategroup.com

REVISIONS					
1	12/JUL/23	LID	SS	Issued for SEC Final Review	DESCRIPTION
NO	DATE	BY	CHK'D		

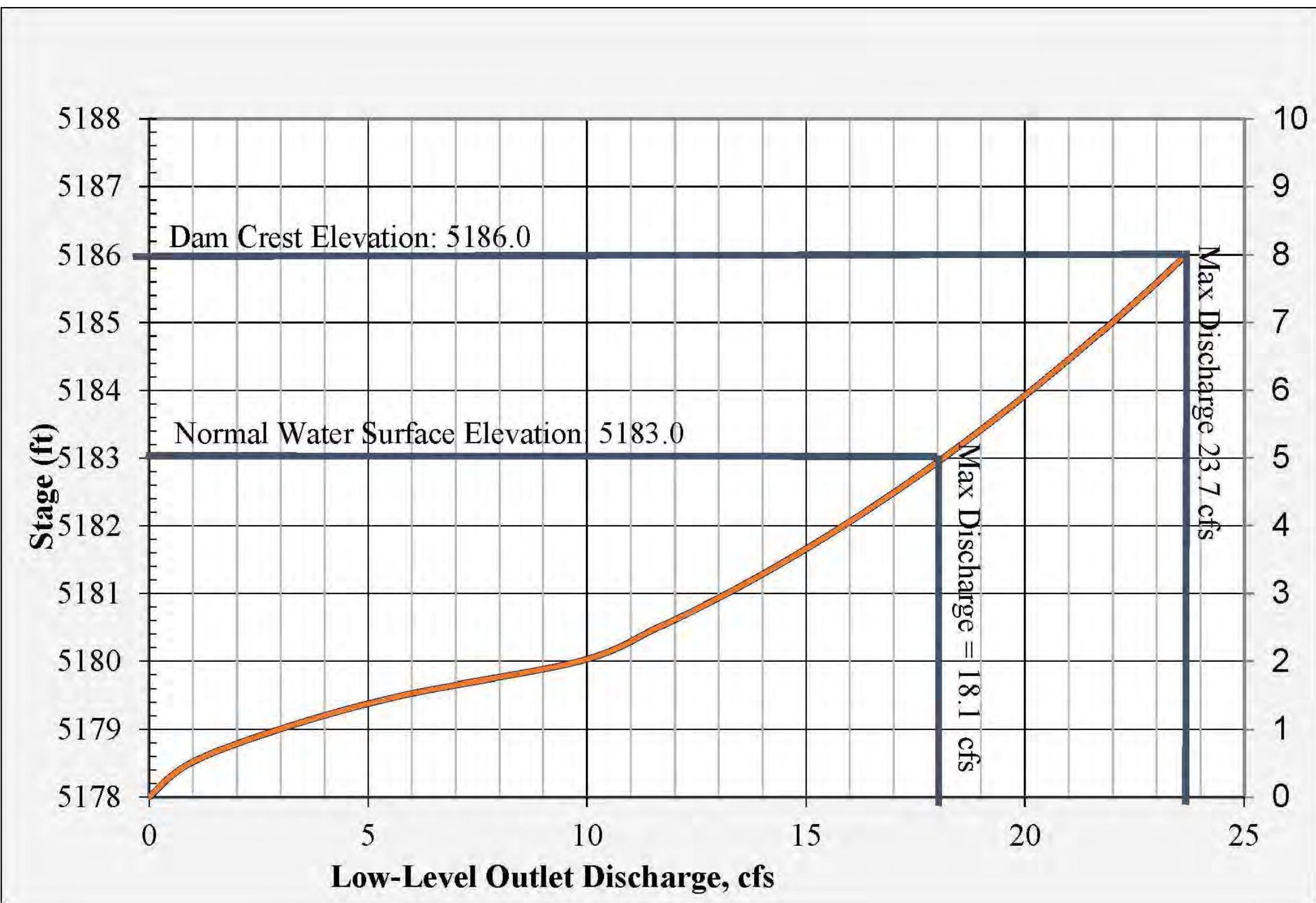
Date: 17/OCT/23
Job No: 21-129
Drawn: LD/TH
Design: SS
Checked: TD
Scale: As Noted



Sheet: 1
of: 20
Filing No. C - 2118

Plot Date: 10/20/23-9:45am. Plotted by mkskd. Drawing Path: N:\Z\129 Prince Lake No 1 Dam\Drawings\Plan Set\Drawing NamePrince_Lake_Cover_exhibitB.dwg

OUTLET WORKS DISCHARGE RATING CURVE

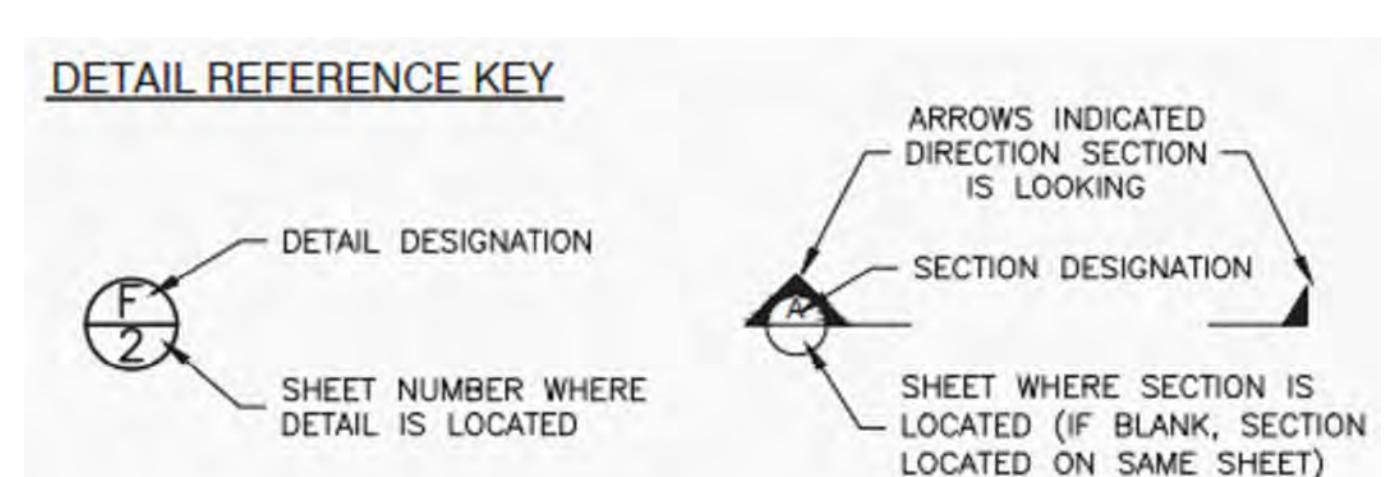


Outlet Works Discharge Equation
 $Q = 4E-06H^5 - 0.0003H^3 + 0.0088H^2 - 0.0963H^2 + 0.5681H + 0.0113$
 H(ft) = Gage Height(ft) = WSE(ft) - 5178.0 ft

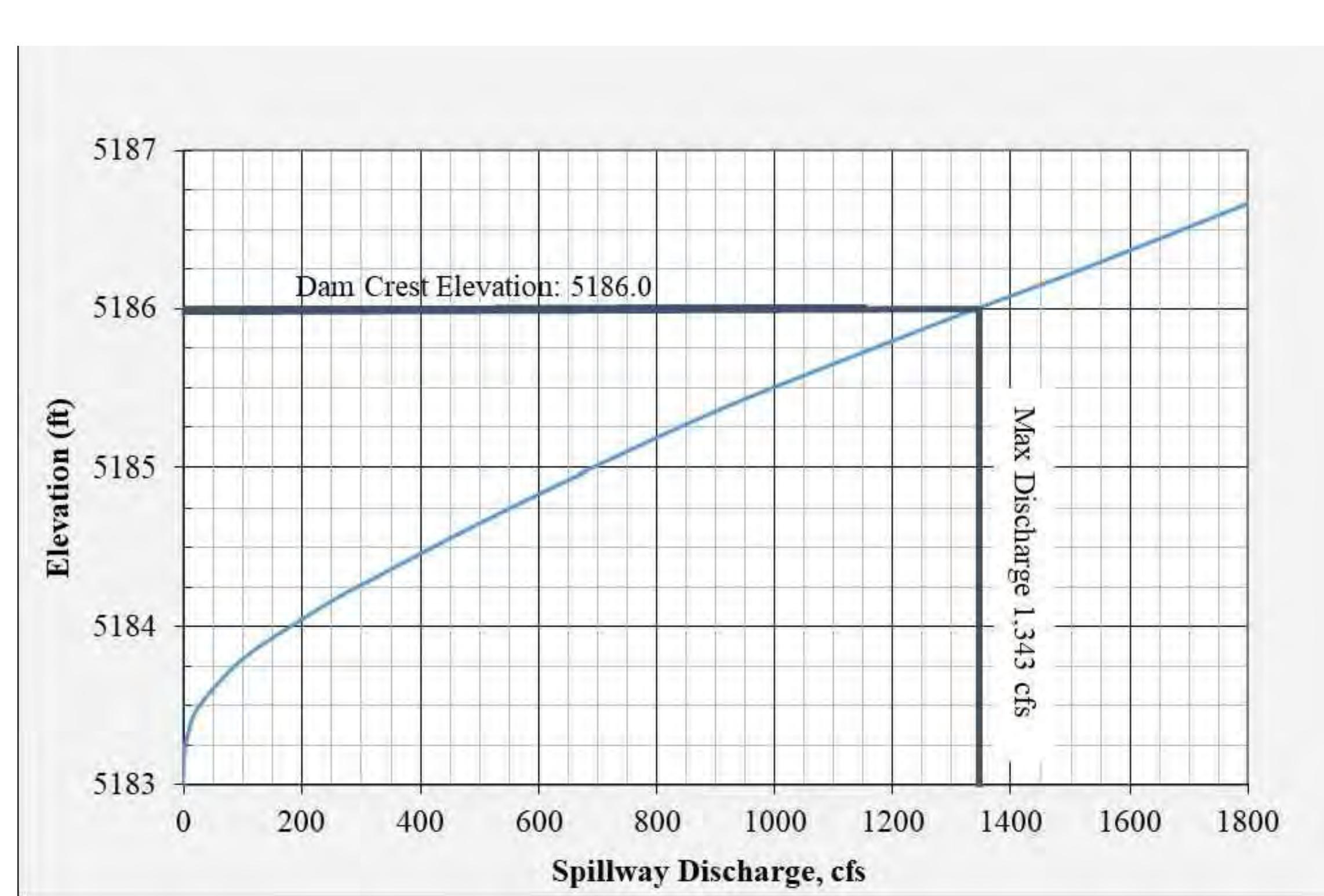
Note: Outlet works discharge shown in hydraulics table was determined as the minimum of 18" orifice flow and 18" pipe discharge. Orifice discharge calculated using orifice flow equation: Orifice Coef x Sqrt (2 x g x h) x Orifice Area; Orifice Coef = 0.62. Pipe discharge calculated based on Hazen Williams minor losses and Bernoulli Equation for energy conservation. Hazen Williams Coef = 150. Entrance Loss Coef = 0.5. Exit Loss Coef = 1. The 5th order polynomial curve equation shown above was determined using a trendline in Excel, and had a resulting $R^2 = 0.999$.

Sheet List Table

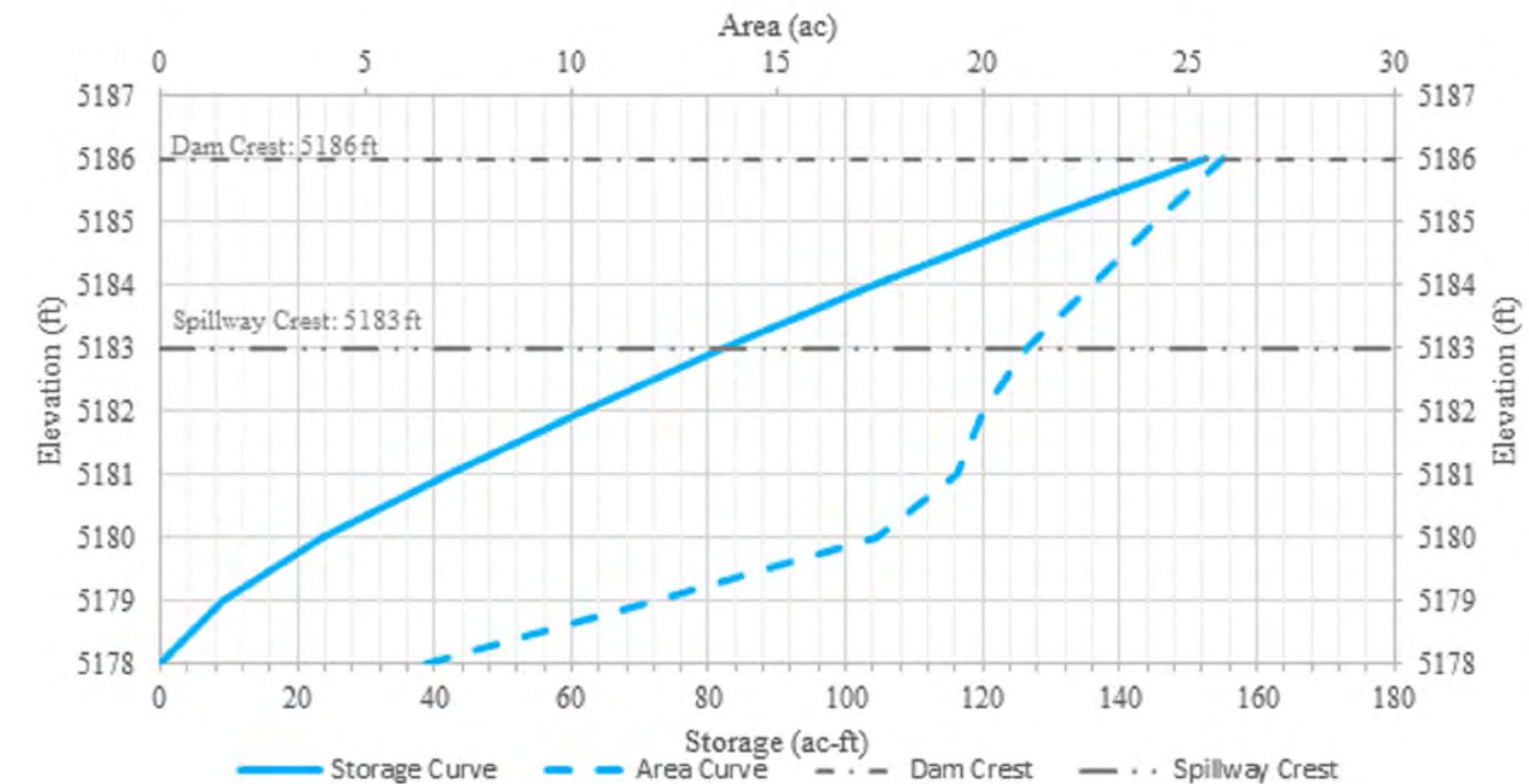
- No. Sheet Title
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 - 3 GEOTECHNICAL DATA
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DETAIL REFERENCE KEY

SPILLWAY DISCHARGE RATING CURVE



Spillway Discharge Equation
 $Q (cfs) = 82.611H^2/4+209.01H-65.263$, where H is the depth of water over the spillway crest, WSEL minus the spillway crest elevation of 5183 feet. Spillway discharge calculated with HEC-RAS using a 1D model reach for the spillway, connected to the downstream 2D model to accurately model tailwater effects on spillway discharge. The 2-order polynomial above was fit to the resulting spillway rating table, resulting in an R^2 of 0.997.



Prince Lake No. 1 Dam Elevation-Area-Capacity and Hydraulics Table

Gage Height ft	Elevation ft	Area ac	Storage ac-ft	Discharge (cfs)	
				Low-Level Outlet	Spillway
0.0	5178.0	6.50	0.00	0.00	
0.5	5178.5	9.28	4.57	0.94	
1.0	5179.0	12.06	9.13	2.95	
1.5	5179.5	14.74	16.46	5.76	
2.0	5180.0	17.42	23.79	9.83	
2.5	5180.5	18.39	32.98	11.63	
3.0	5181.0	19.35	42.17	13.19	
3.5	5181.5	19.69	52.02	14.58	
4.0	5182.0	20.03	61.86	15.85	
4.5	5182.5	20.55	72.13	17.03	
5.0	5183.0	21.06	82.40	18.13	0.00
5.5	5183.5	21.86	93.33	19.16	28.00
6.0	5184.0	22.65	104.25	20.15	184.00
6.5	5184.5	23.42	115.96	21.08	423.08
7.0	5185.0	24.18	127.66	21.98	694.44
7.5	5185.5	25.01	140.16	22.84	1000.00
8.0	5186.0	25.83	152.66	23.68	1342.86

Notes:

- [A] Gage height based on Elevation 5178.0 feet at Gage Height 0.0 feet.
- [B] Elevation based on October 2021 survey by Ascent Geomatics Solutions.
- [C] Surface area based on October 2021 survey by Ascent Geomatics Solutions.
- [D] Storage volume calculated in CAD based on October 2021 survey by Ascent Geomatics Solutions.
- [E] Low-level outlet discharge calculated as the minimum of 18" orifice flow and 18" pipe discharge. Orifice discharge calculated using orifice flow equation: Orifice Coef x Sqrt (2 x g x h) x Orifice Area; Orifice Coef = 0.62. Pipe discharge calculated based on Hazen Williams minor losses and Bernoulli Equation for energy conservation. Hazen Williams Coef = 150. Entrance Loss Coef = 0.5. Exit Loss Coef = 1.
- [F] Spillway discharge calculated with HEC-RAS using a 1D model reach for the spillway, connected to the downstream 2D model to accurately model tailwater effects on spillway discharge. A 2-order polynomial was fit to the resulting spillway rating table, resulting in an R^2 of 0.997. The resulting polynomial is $Q=82.611H^2/4+209.01H-65.263$, where H is the depth of water over the spillway crest, WSEL minus the spillway crest elevation of 5183 feet.

ISSUED FOR CONSTRUCTION

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 Denver, CO 80204
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 Fax: (303) 452-5601
 email: info@applegategroup.com Website: www.applegategroup.com

PRINCE LAKE NO 1 DAM REHABILITATION HYDRAULIC DATA AND SHEET LIST

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

	12/Jul/23	LID	SS	Issued for SEQ Final Review	DESCRIPTION	REVISIONS
NO.	DATE	BY	C/N/D			
1	17/OCT/23					
Job No:	21-129					
Drawn:	LD/TH					
Design:	SS					
Checked:	TD					
Scale:	As Noted					



OF:

Plot Date: 10/20/23-9:45am. Pictor by:mksd. Drawing Path: N:\Z\129 Prince Lake No 2 Dam\Drawings\Plan Set\Drawings\Plan Set\Drawing Name:Prince.Dam.Hydraulic Data Exhibit.dwg



PROJECT NO:	21.3065		
PROJECT NAME:	Prince Lake No. 1		
DRAWN BY:	ZLM	CHECKED BY:	JAC2
DWG DATE:	10.06.21	REV. DATE:	--
BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT			
PRINCE LAKE NO 1 DAM REHABILITATION			
GEOTECHNICAL DATA			

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Applegate Group, Inc.
Geotechnical Engineers & Construction Materials Consultants
Water Resource Advisors for the West

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FIGURE 2
Boring Location Plan

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

PRINCE LAKE NO 1

REVISIONS

Date:	17/OCT/23
Job No:	21-129
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Design:	SS
Checked:	TD
Scale:	AS SHOWN



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Or: 20
Plot Date: 10/7/2023 9:46am. Plotted by:ymkda. Drawing Path: N:\Z\129 Prince Lake No 2\Boring Drawings\Plan Set\Drawings\Plan Set\Drawing Name:Prince.Dwg Exhibit Cwg

PRINCE LAKE NO 1 DAM REHABILITATION EXISTING SITE PLAN

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

Revised Name: Prince Lake No 1 Dam Drawings Plan Set Drawing

REVISIONS

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Job No: 21-129
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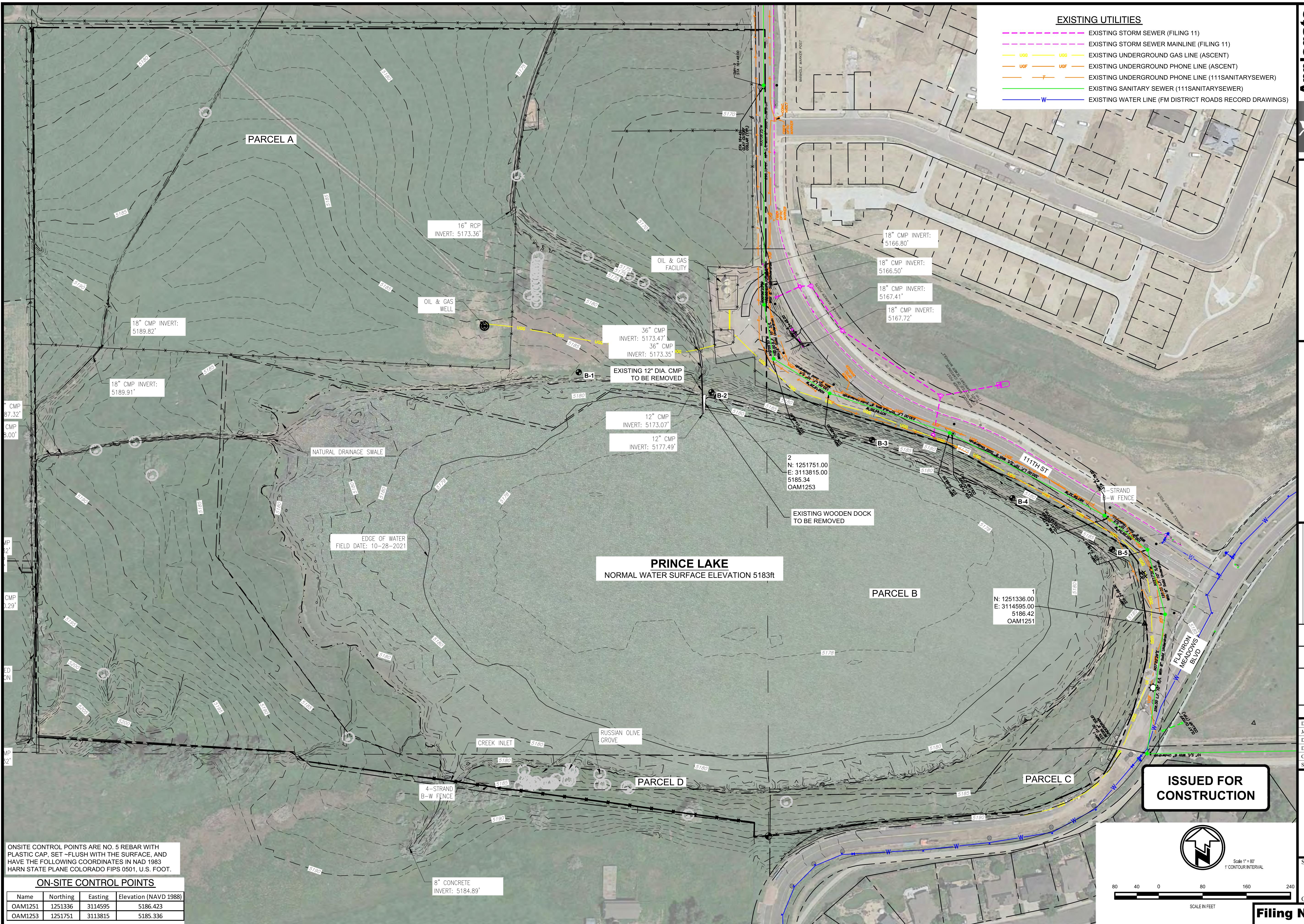
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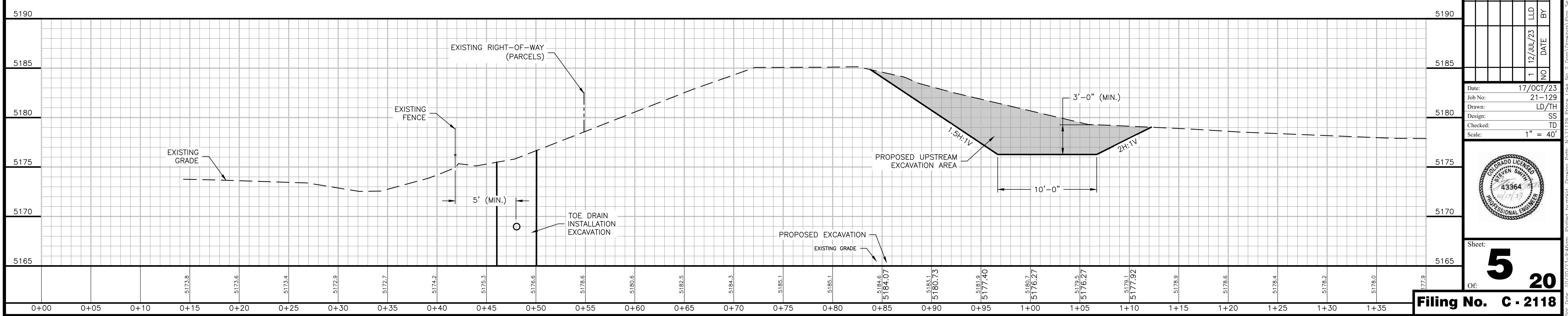
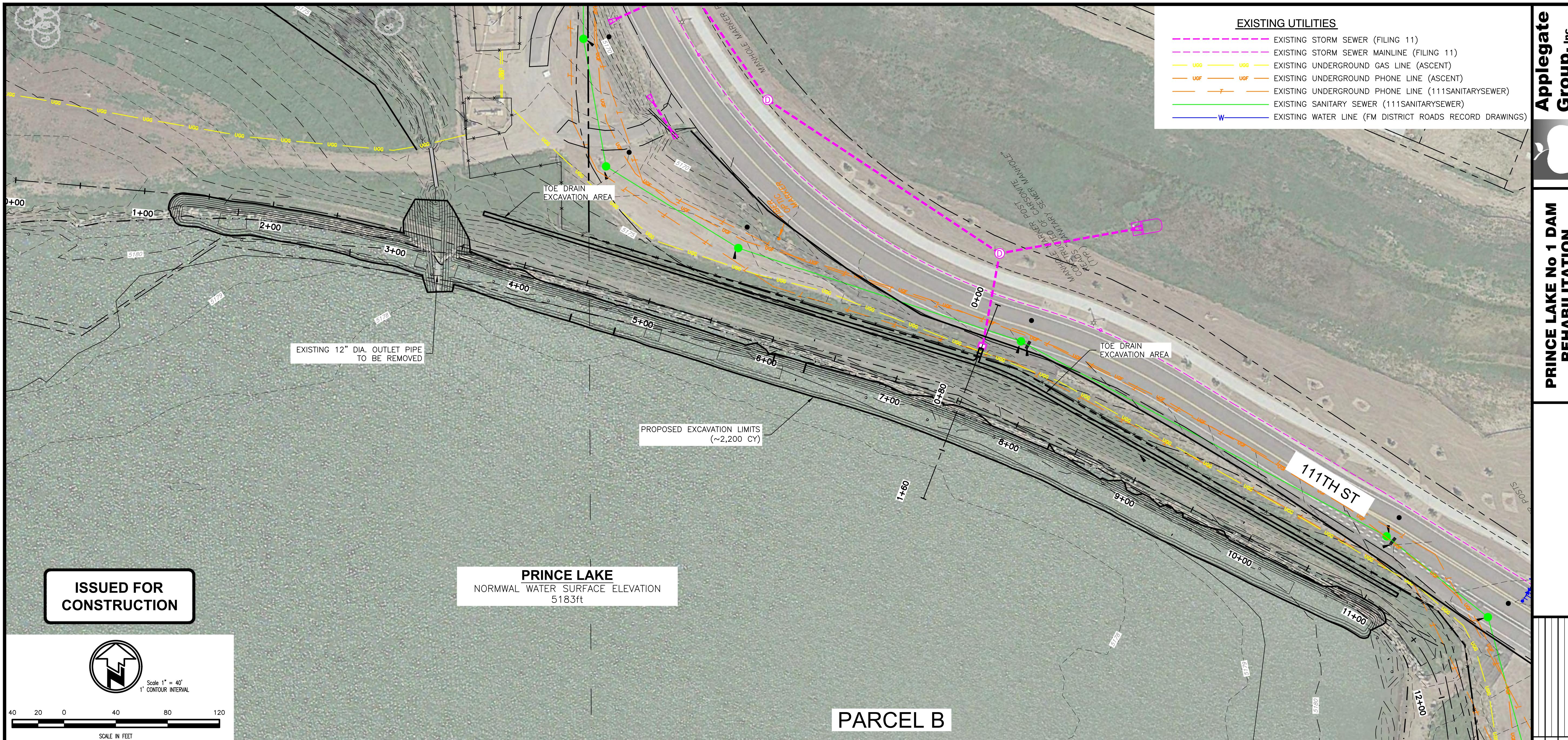
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EXISTING UTILITIES

- - - EXISTING STORM SEWER (FILING 11)
- - - EXISTING STORM SEWER MAINLINE (FILING 11)
- UCC UCC EXISTING UNDERGROUND GAS LINE (ASCENT)
- UOF UOF EXISTING UNDERGROUND PHONE LINE (ASCENT)
- T T EXISTING UNDERGROUND PHONE LINE (111SANITARYSEWER)
- W W EXISTING SANITARY SEWER (111SANITARYSEWER)
- W EXISTING WATER LINE (FM DISTRICT ROADS RECORD DRAWINGS)





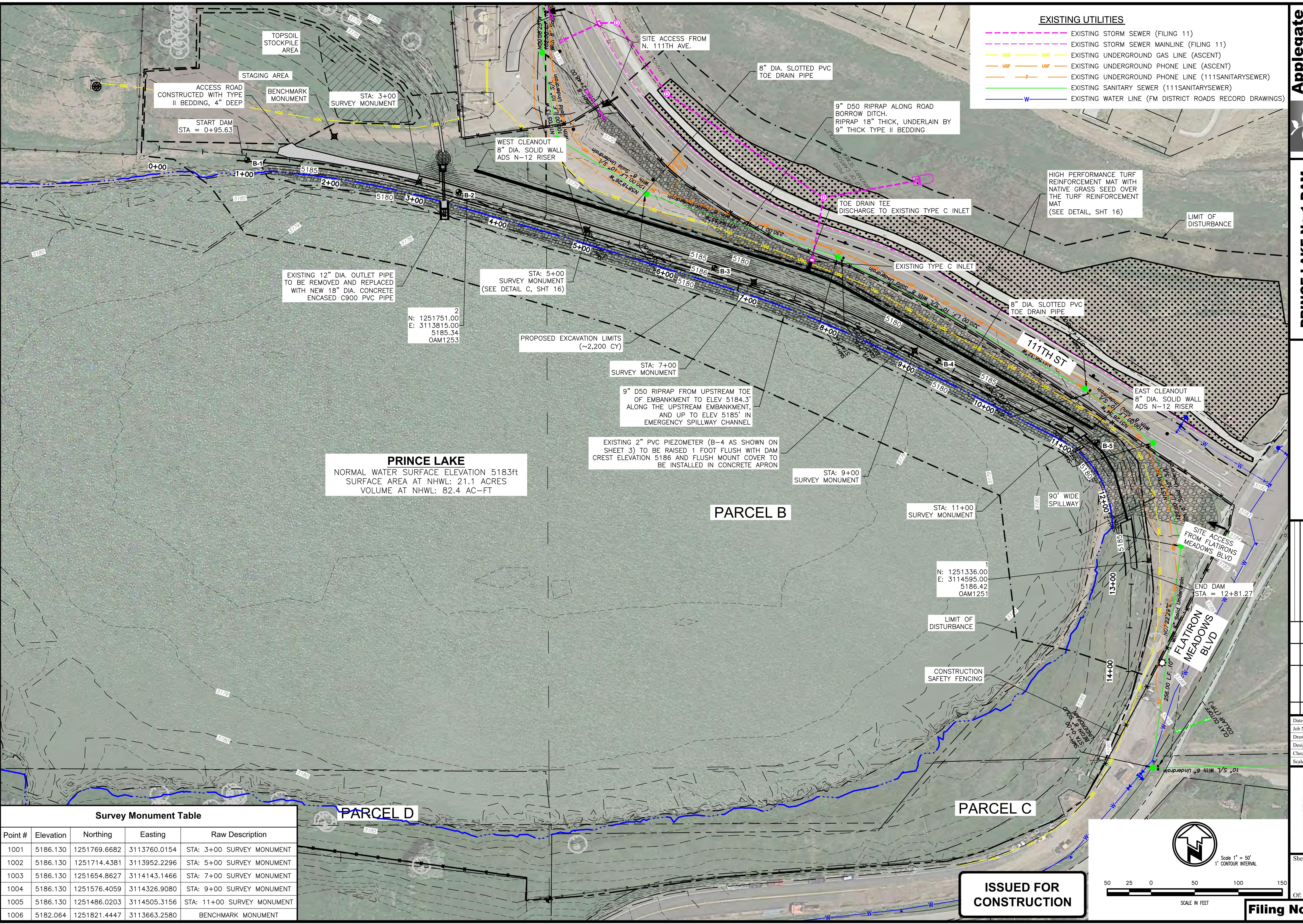
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PRINCE LAKE NO 1 DAM REHABILITATION

PROPOSED SITE PLAN

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

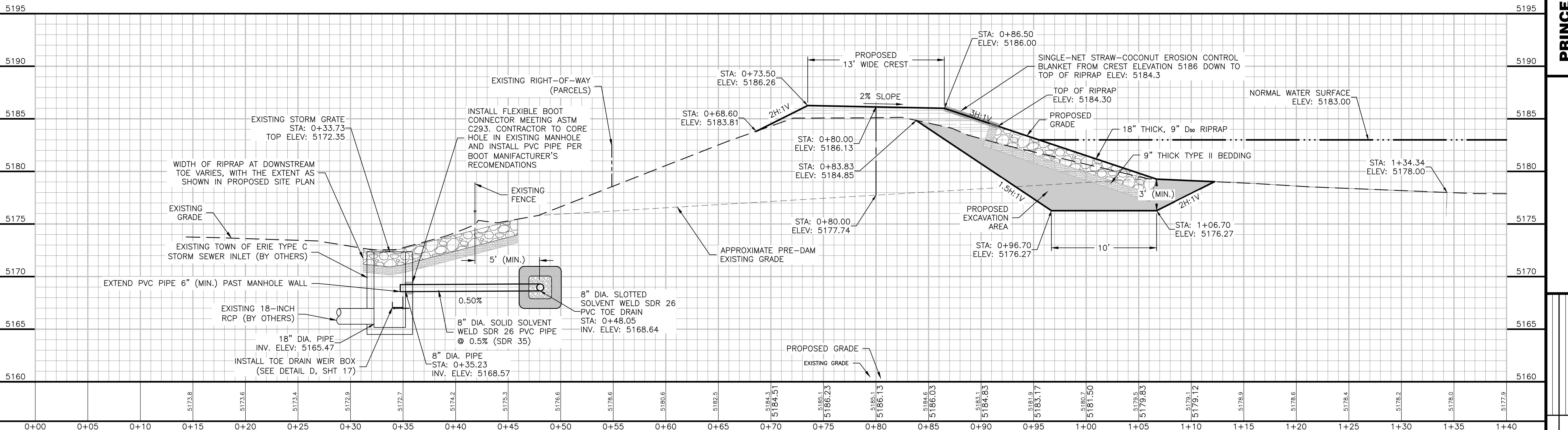
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**PRINCE LAKE NO 1 DAM
REHABILITATION**

MAXIMUM DAM SECTION

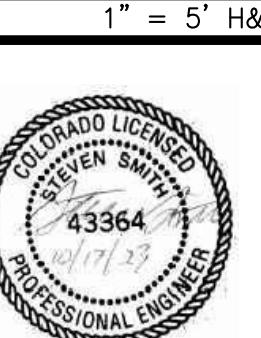
**BOULDER COUNTY PARKS AND
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DAM SECTION AT DAM CENTERLINE STATION 8+50
SCALE 1" = 5'

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Scale: 1" = 5' H&V



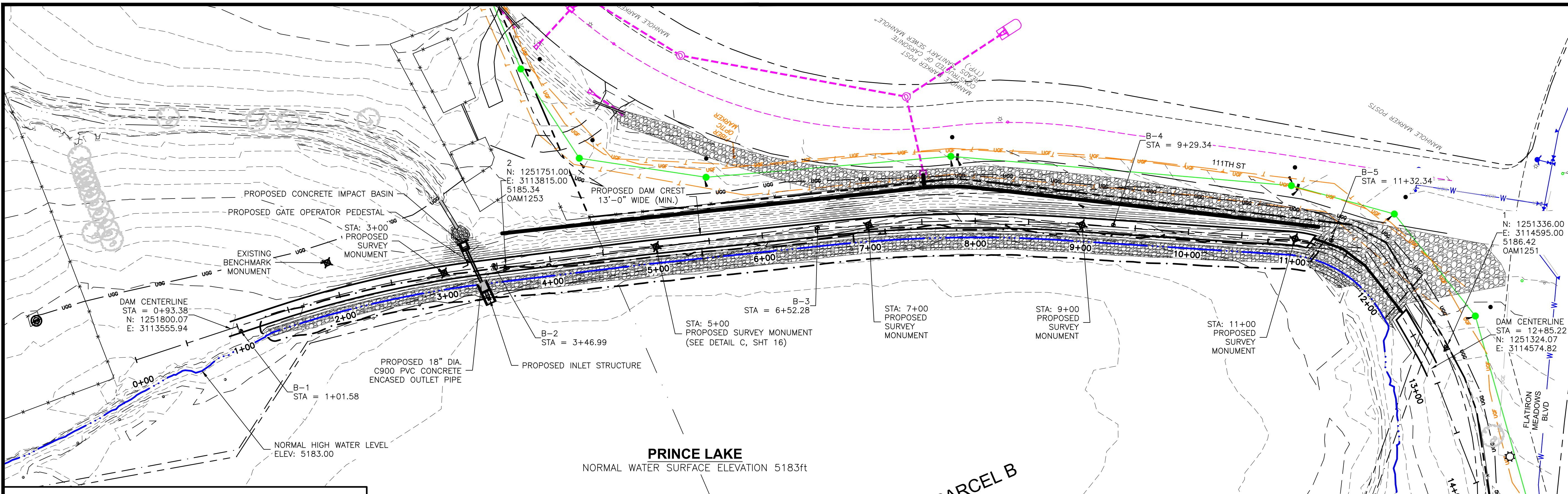
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Of: 20
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PRINCE LAKE NO 1 DAM REHABILITATION

DAM PLAN AND PROFILE

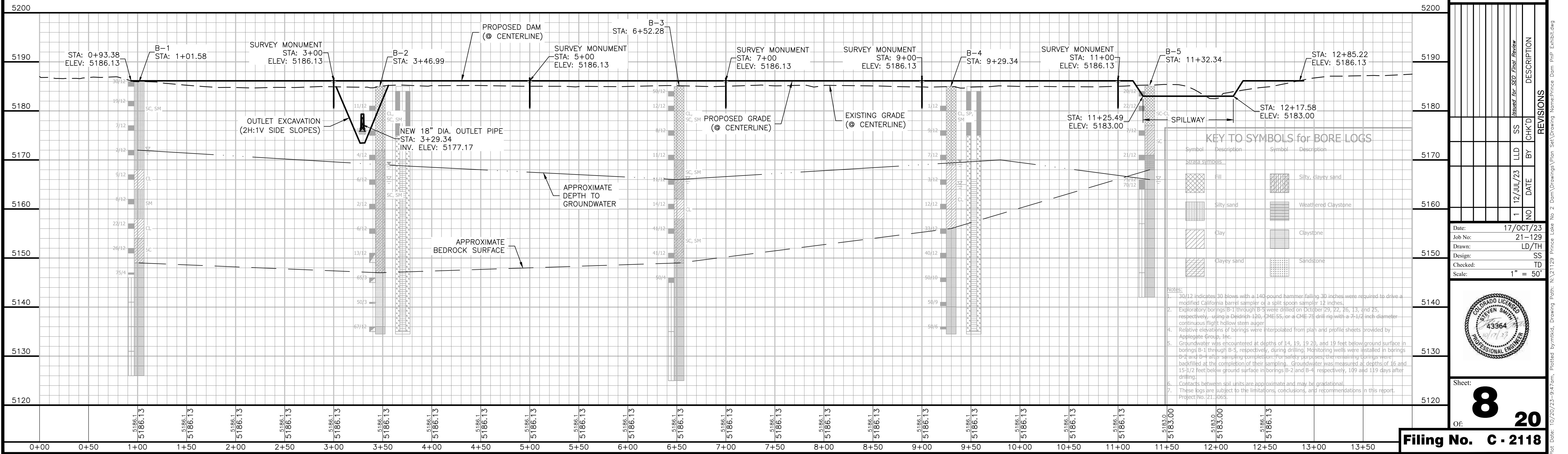
BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT



PRINCE LAKE
NORMAL WATER SURFACE ELEVATION 5183ft

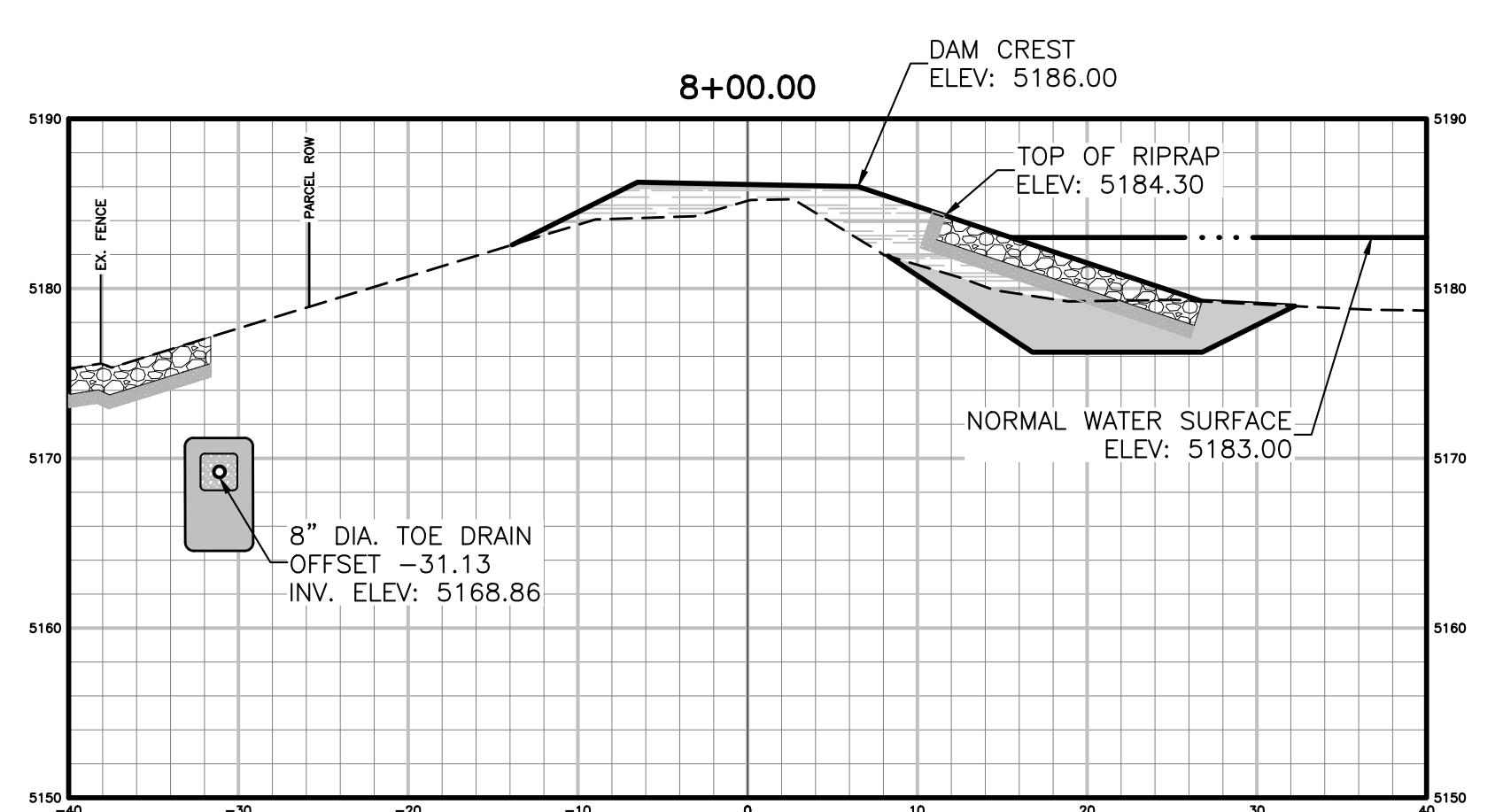
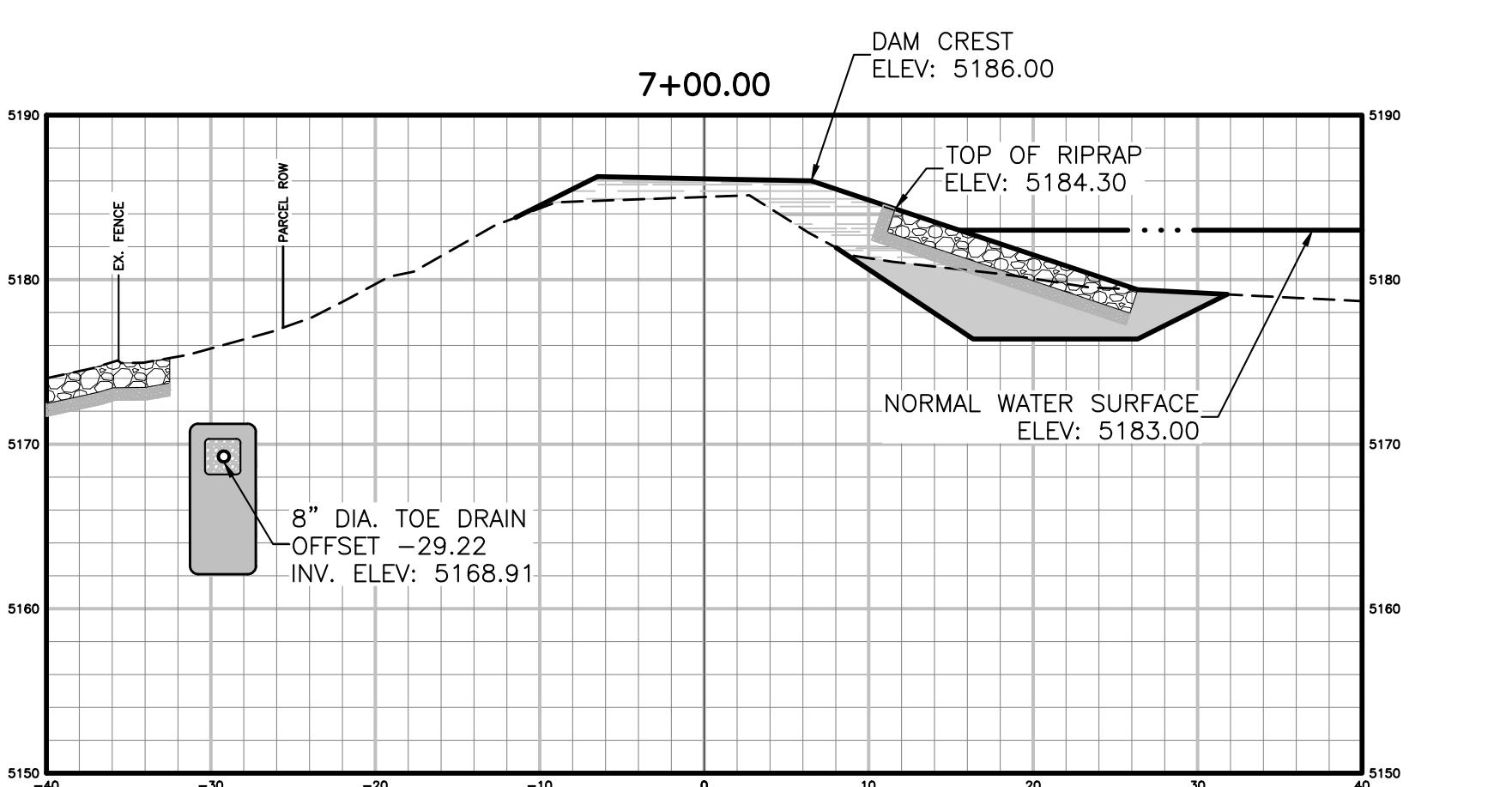
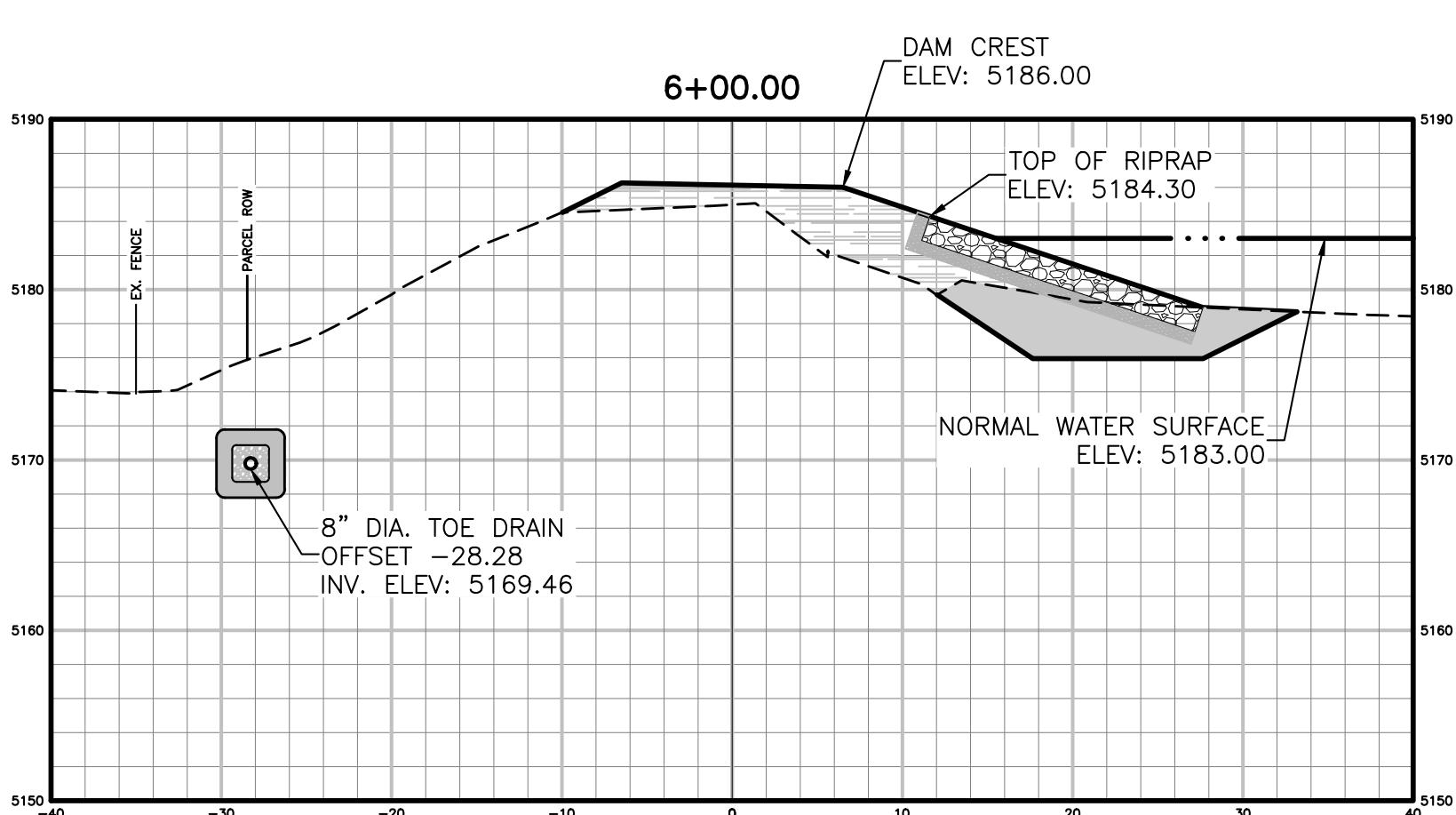
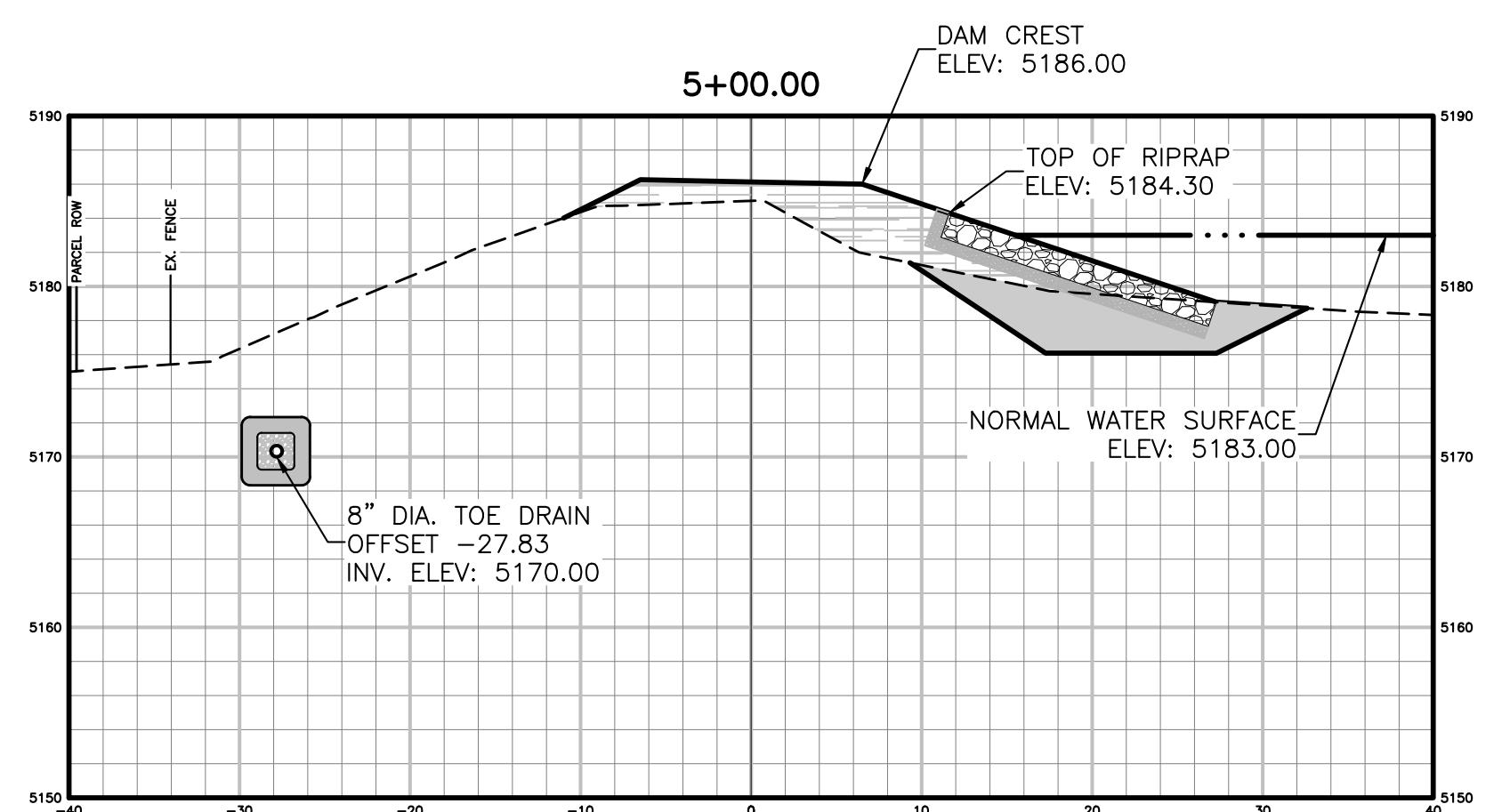
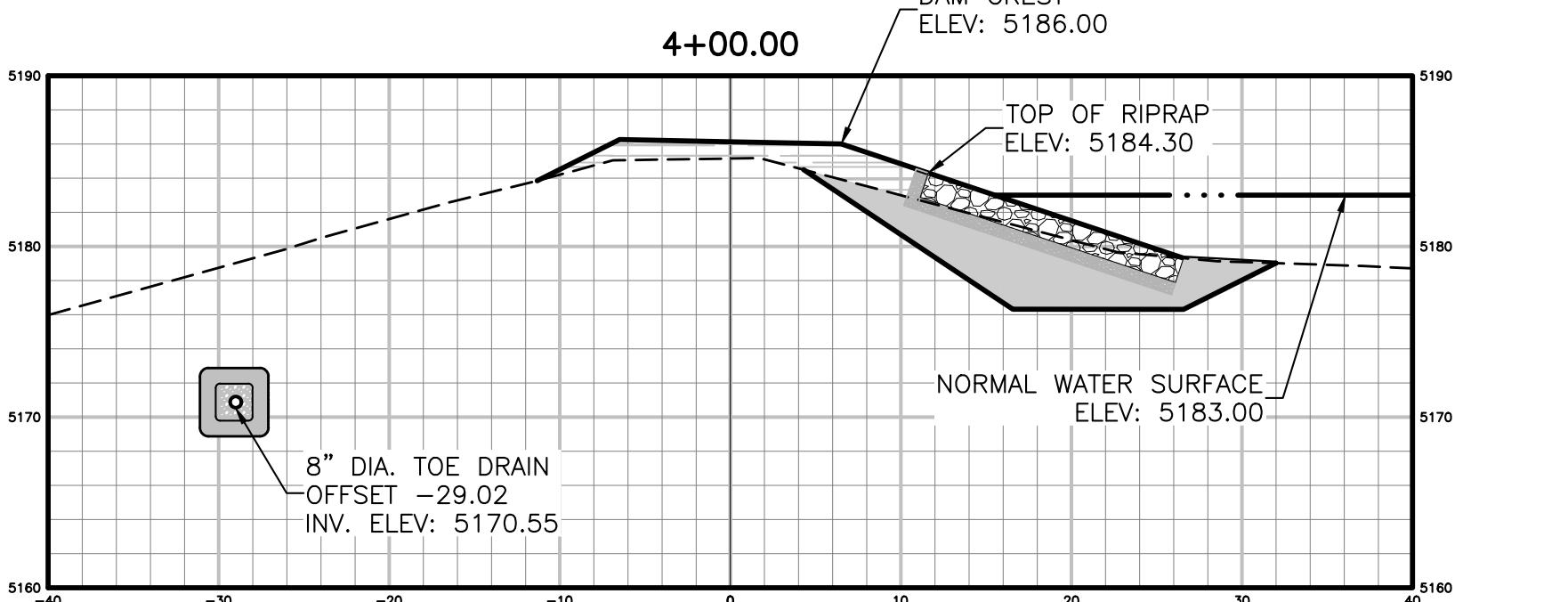
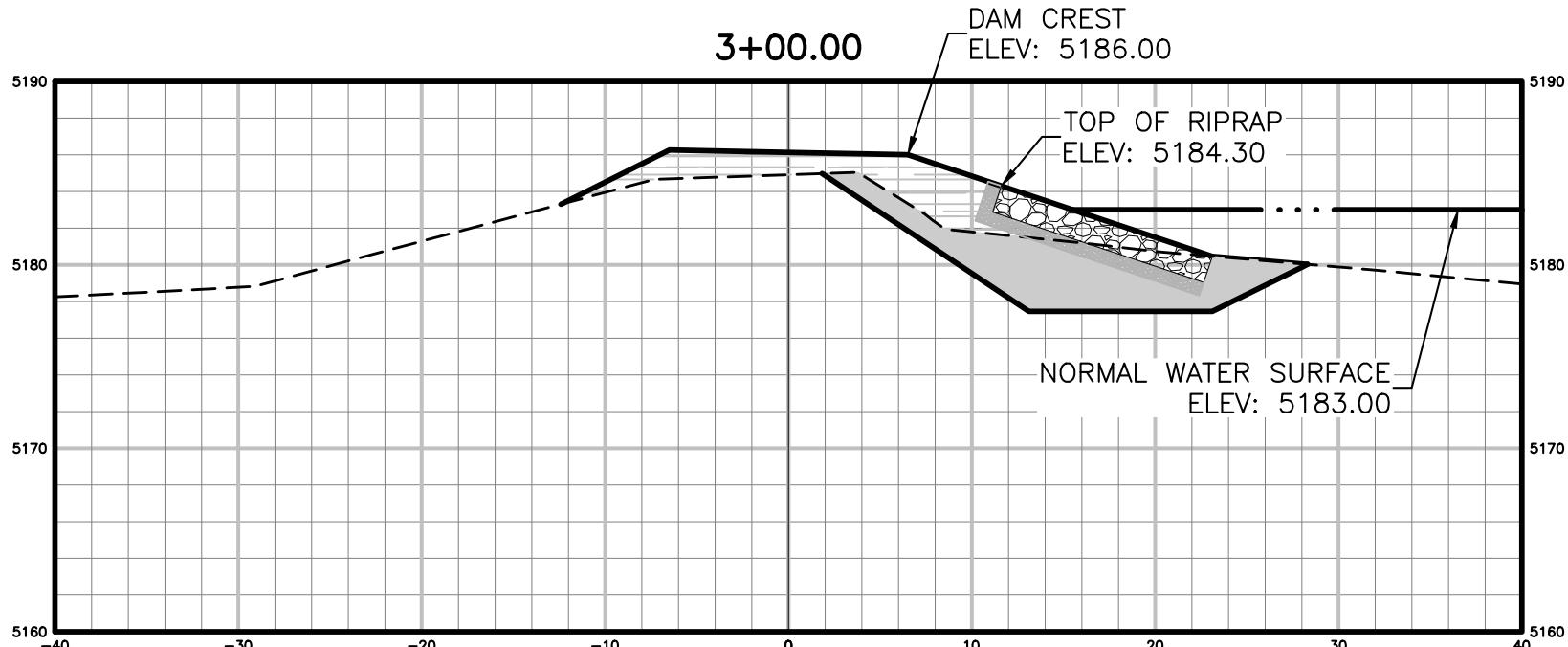
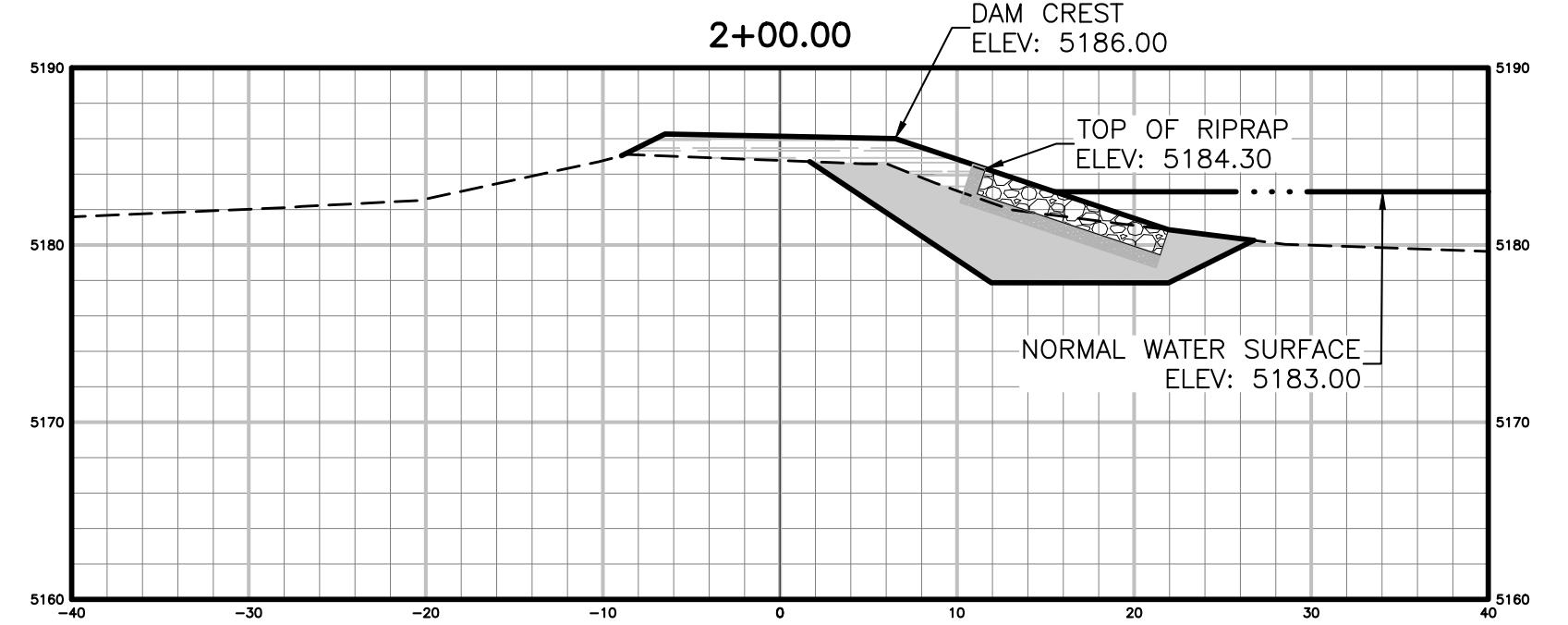
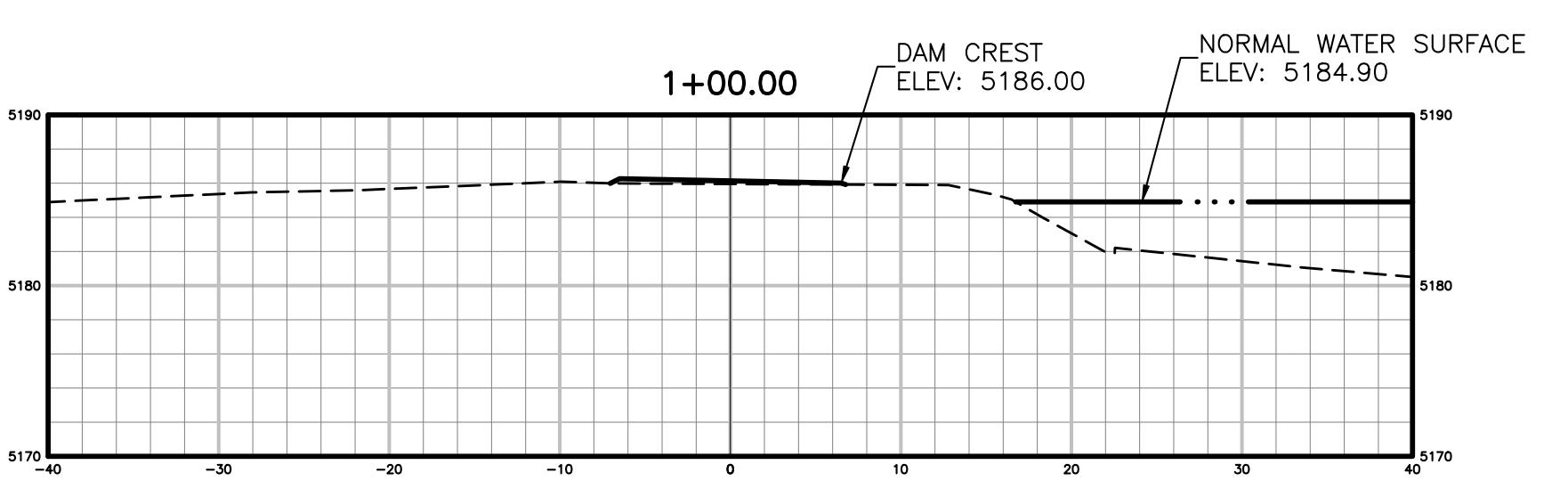
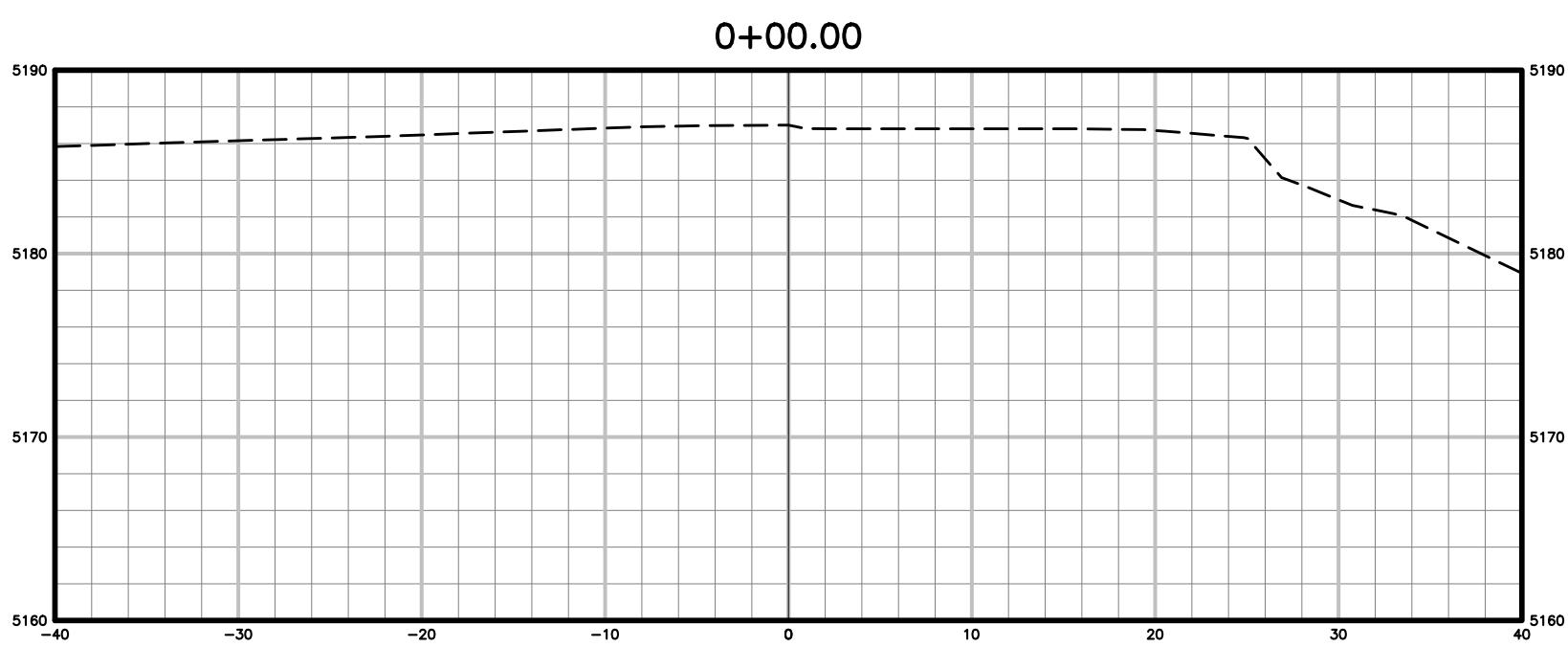
ISSUED FOR CONSTRUCTION

Survey Monument Table				
Point #	Elevation	Northing	Easting	Raw Description
1001	5186.130	1251769.6682	3113760.0154	STA: 3+00 SURVEY MONUMENT
1002	5186.130	1251714.4381	3113952.2296	STA: 5+00 SURVEY MONUMENT
1003	5186.130	1251654.8627	3114143.1466	STA: 7+00 SURVEY MONUMENT
1004	5186.130	1251576.4059	3114326.9080	STA: 9+00 SURVEY MONUMENT
1005	5186.130	1251486.0203	3114505.3156	STA: 11+00 SURVEY MONUMENT
1006	5182.064	1251821.4447	3113663.2580	BENCHMARK MONUMENT



PRINCE LAKE NO 1 DAM REHABILITATION

DAM CROSS-SECTIONS 1



BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

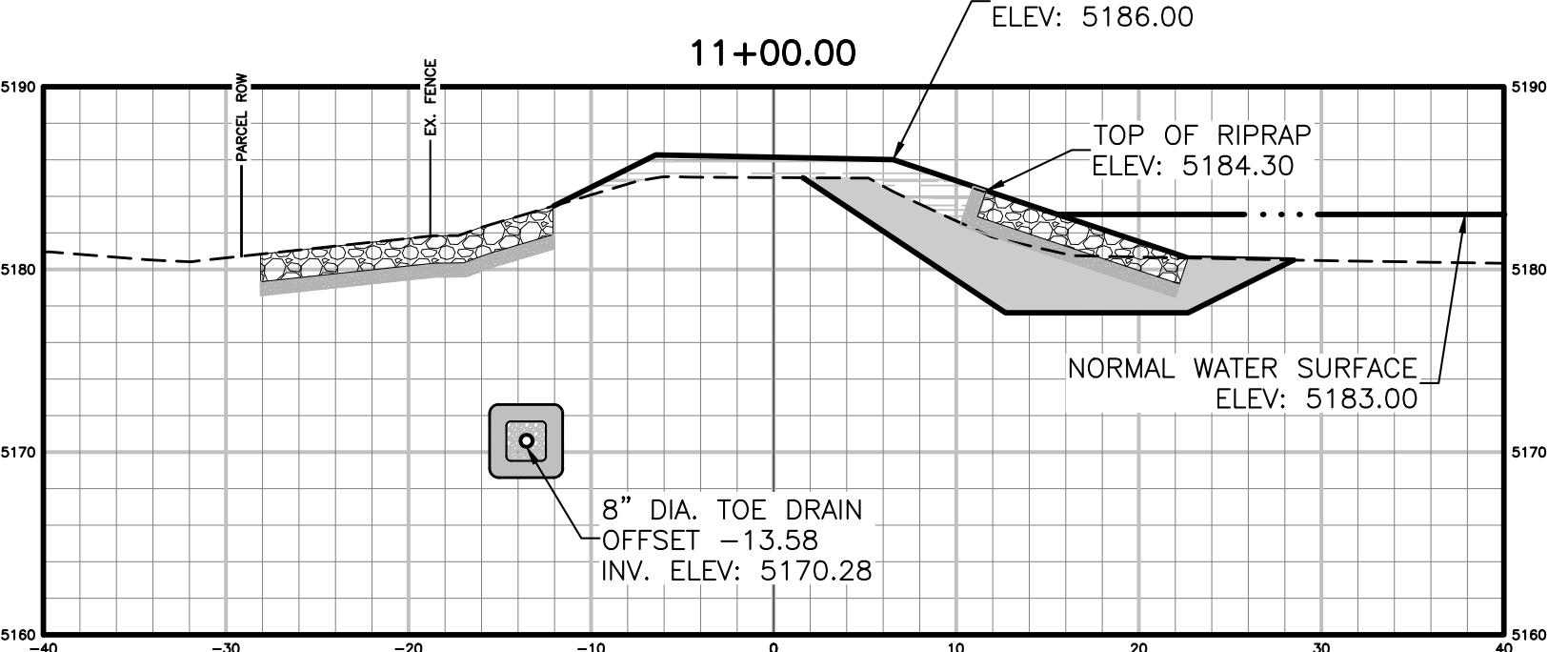
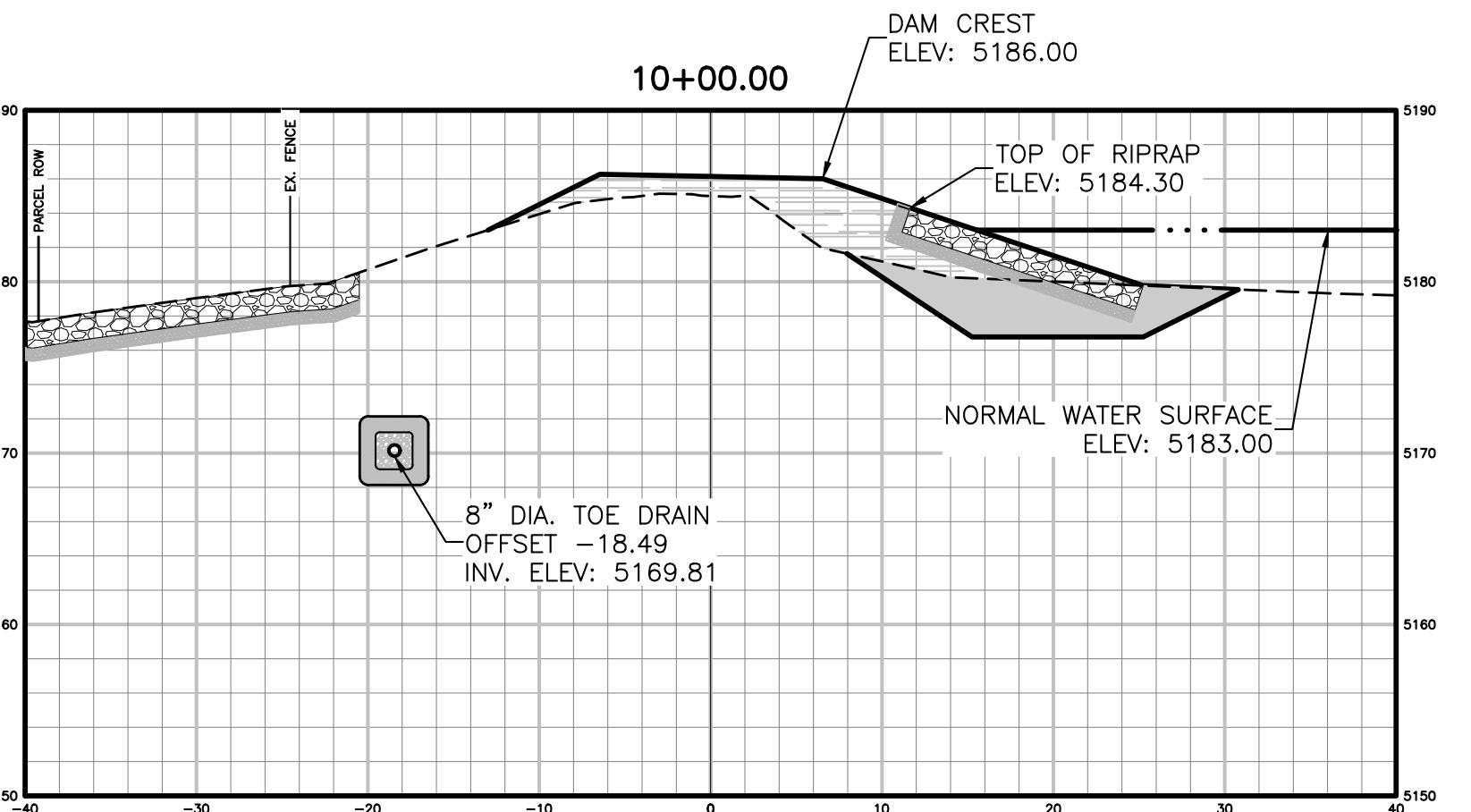
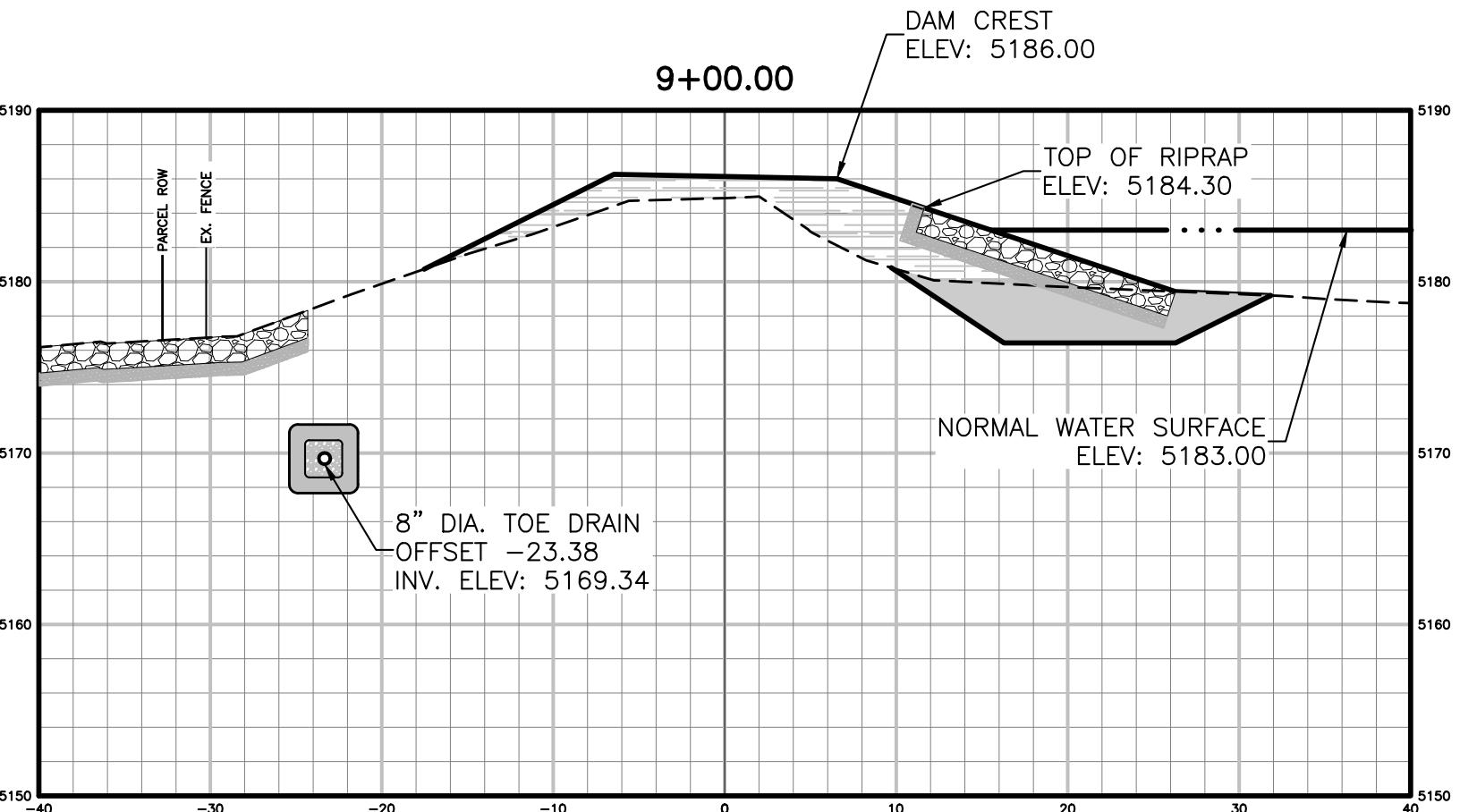
REVISIONS

Date: 17/OCT/23
 Job No: 21-129
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 Scale: 1" = 10'



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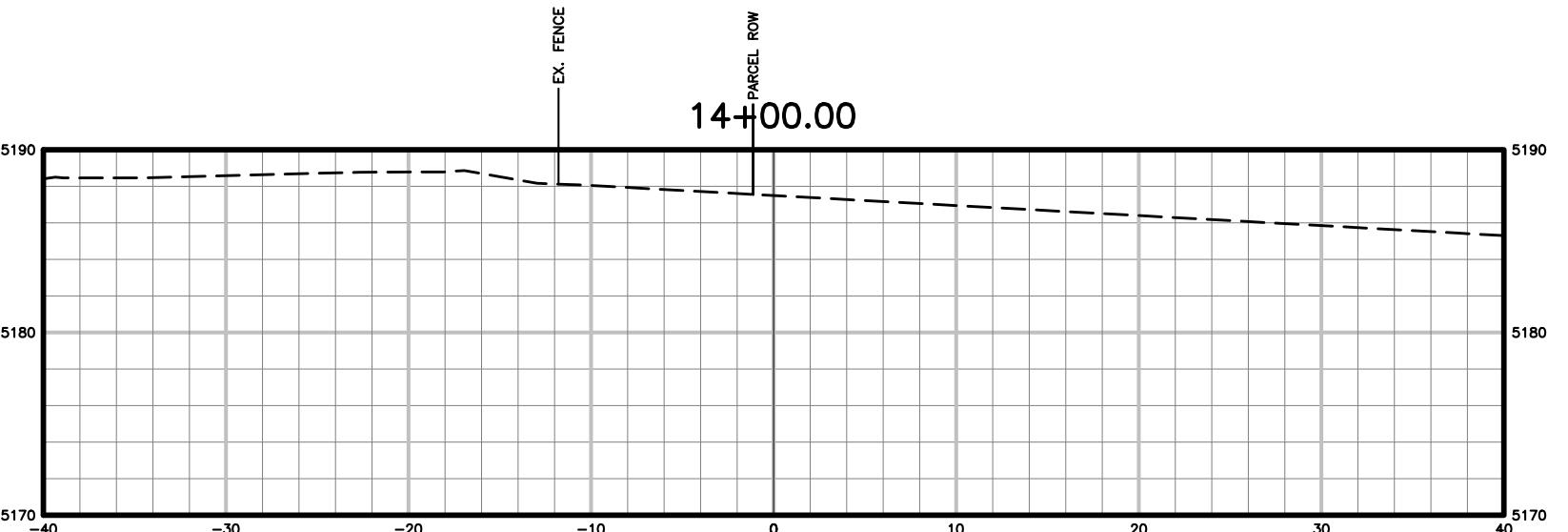
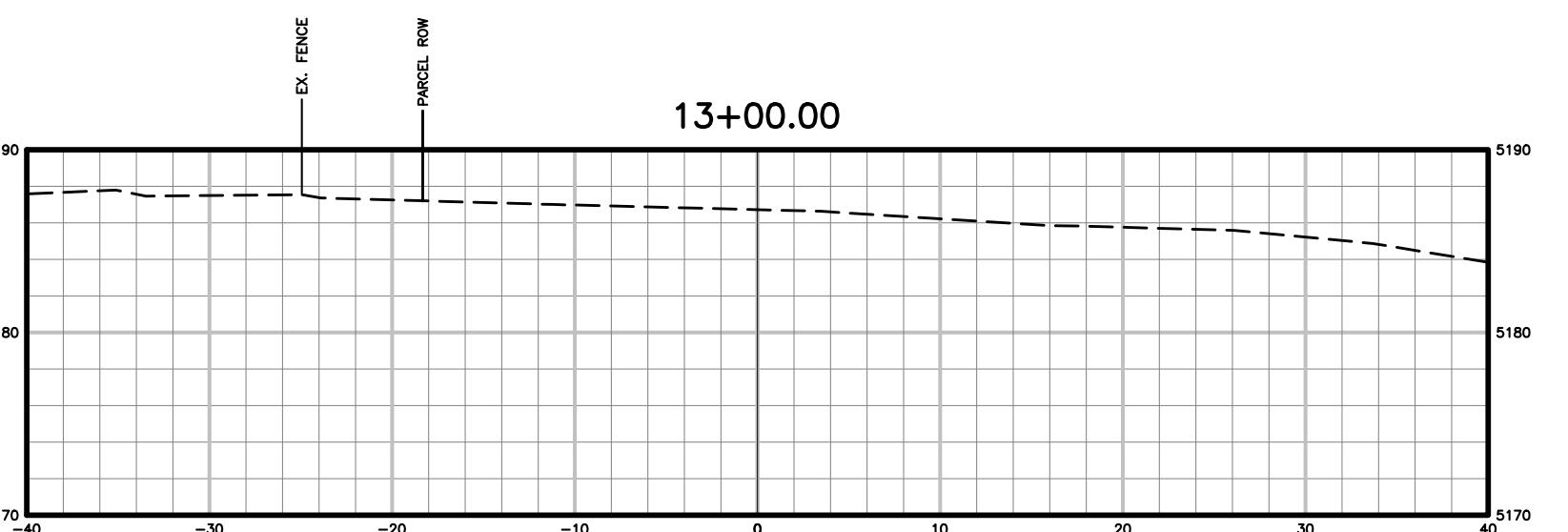
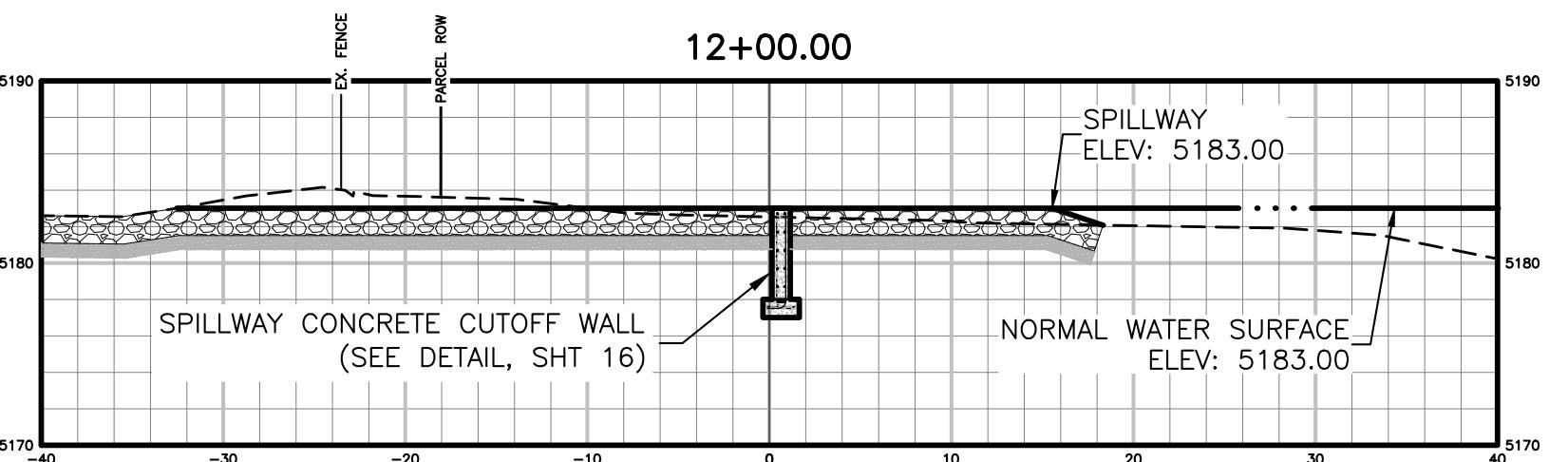


PRINCE LAKE No 1 DAM REHABILITATION

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(303) 452-6611
Fax: (303) 452-2759

PRINCE LAKE No 1 DAM REHABILITATION

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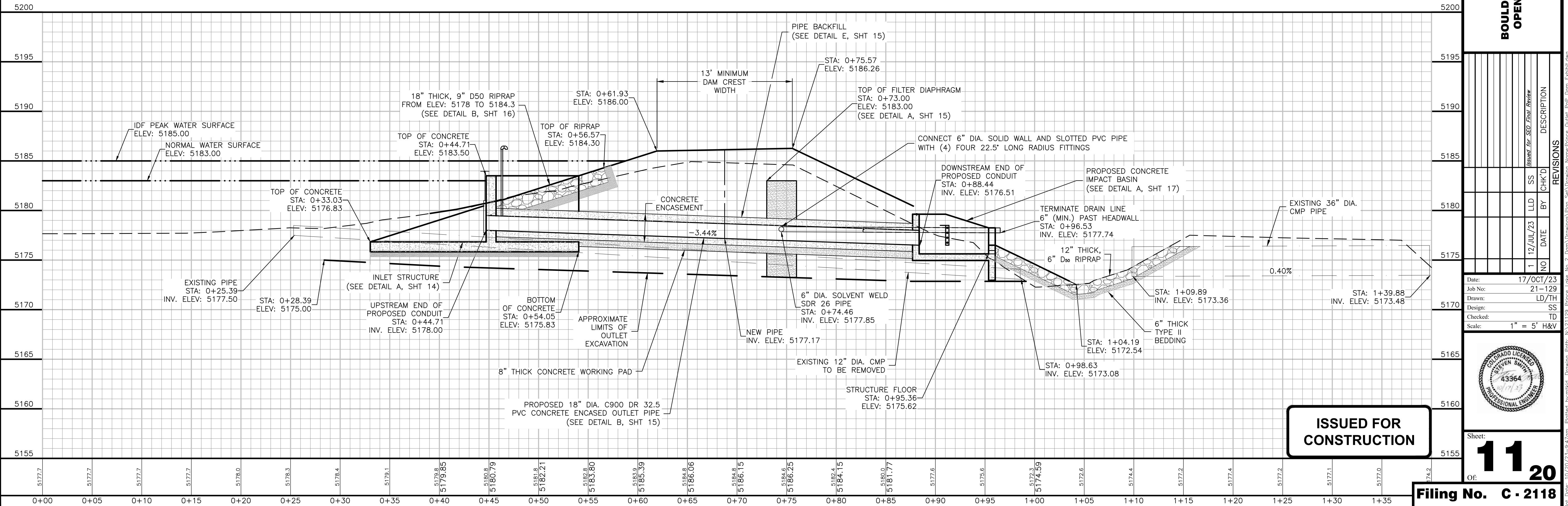
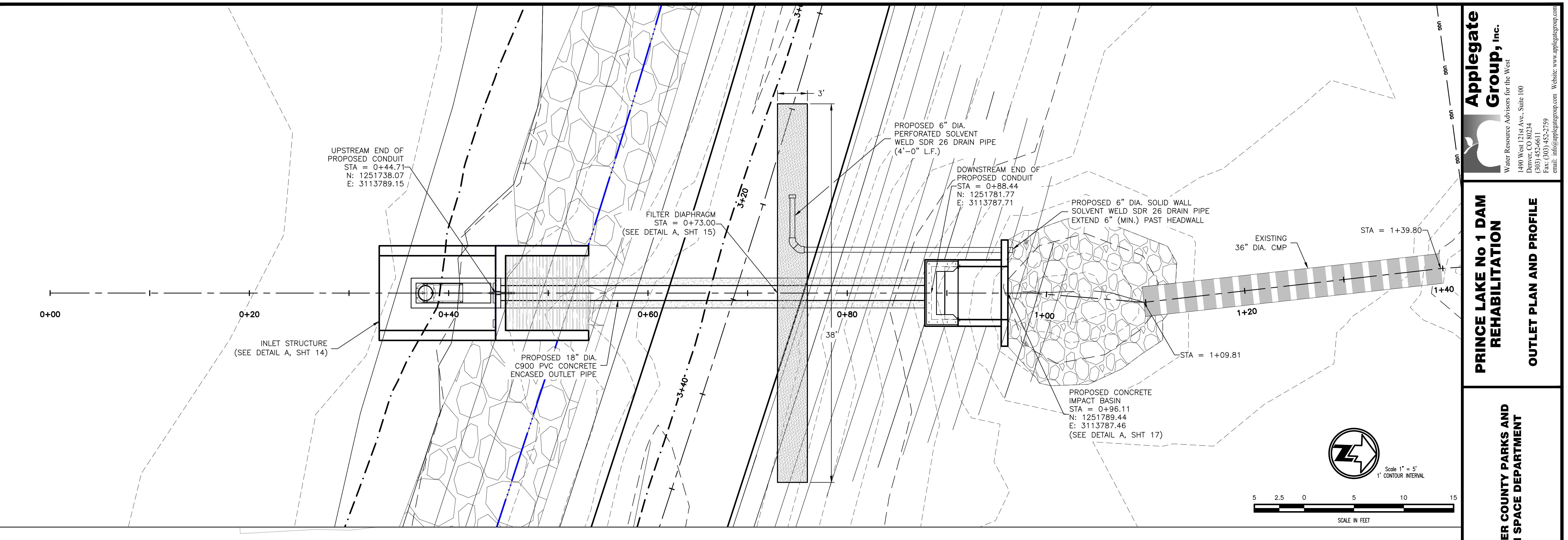


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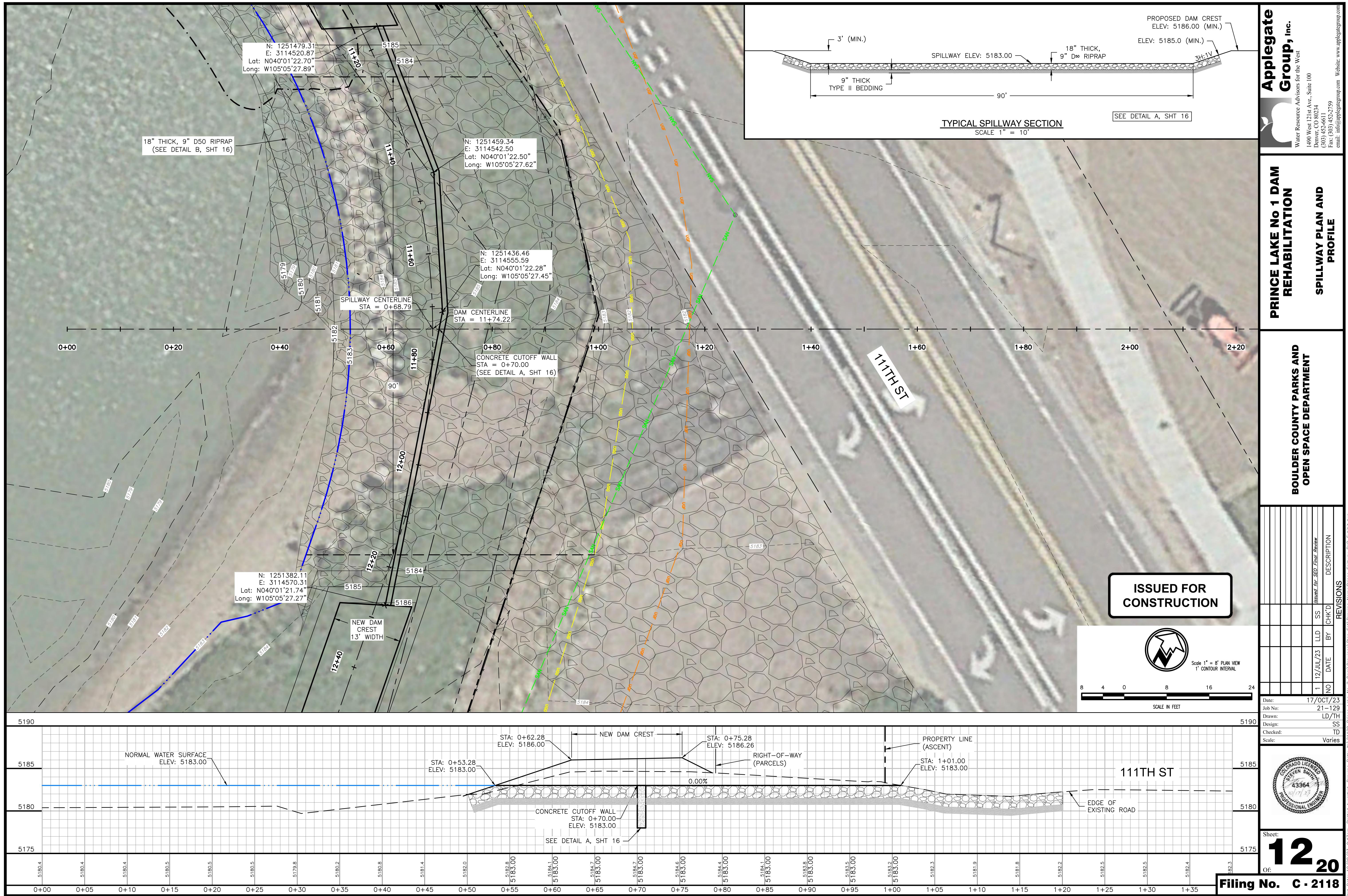
OUTLET PLAN AND PROFILE



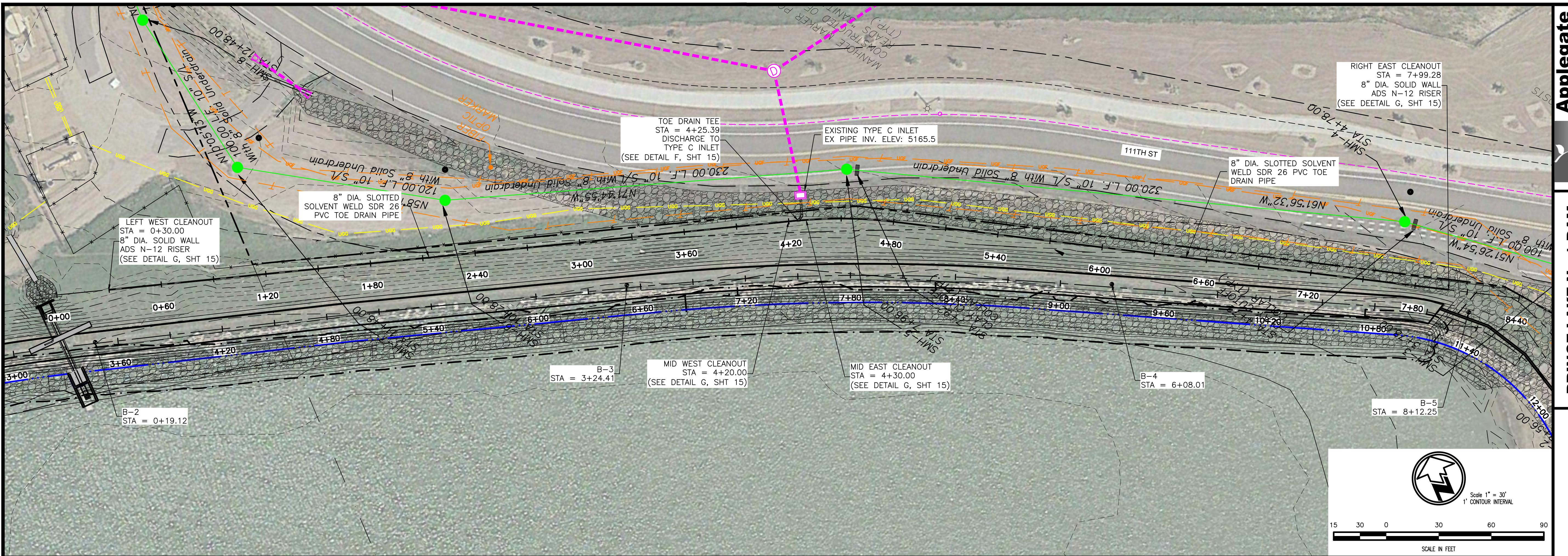
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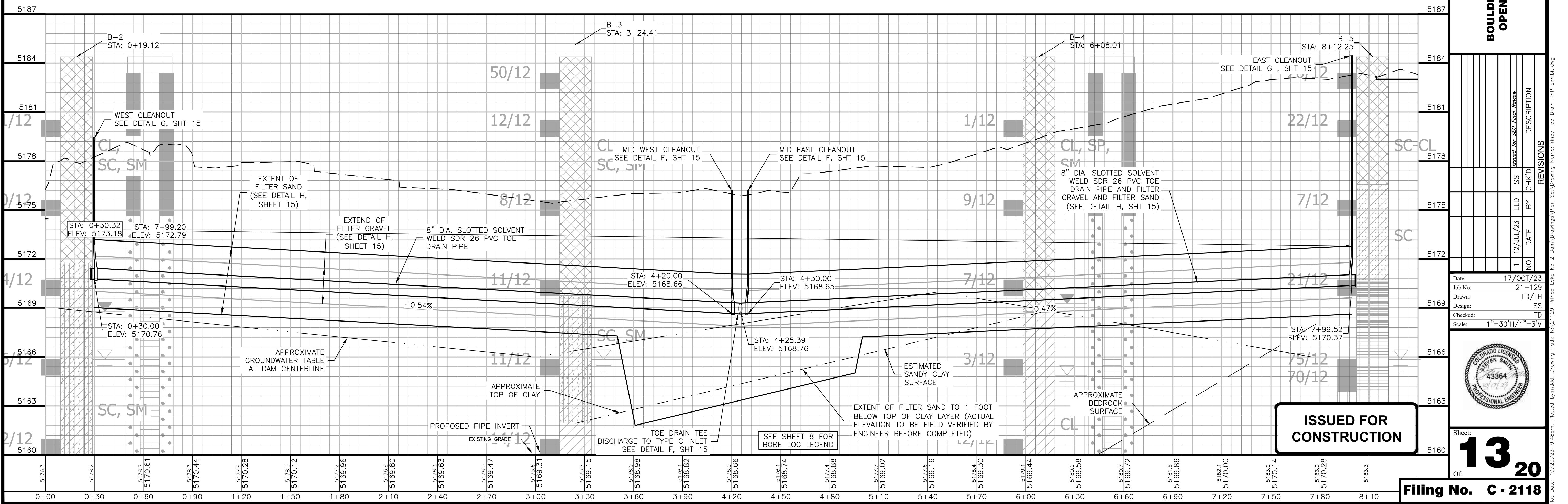
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PRINCE LAKE NO. 1 DAM REHABILITATION

Group, Inc.
advisors for the West
Suite 100

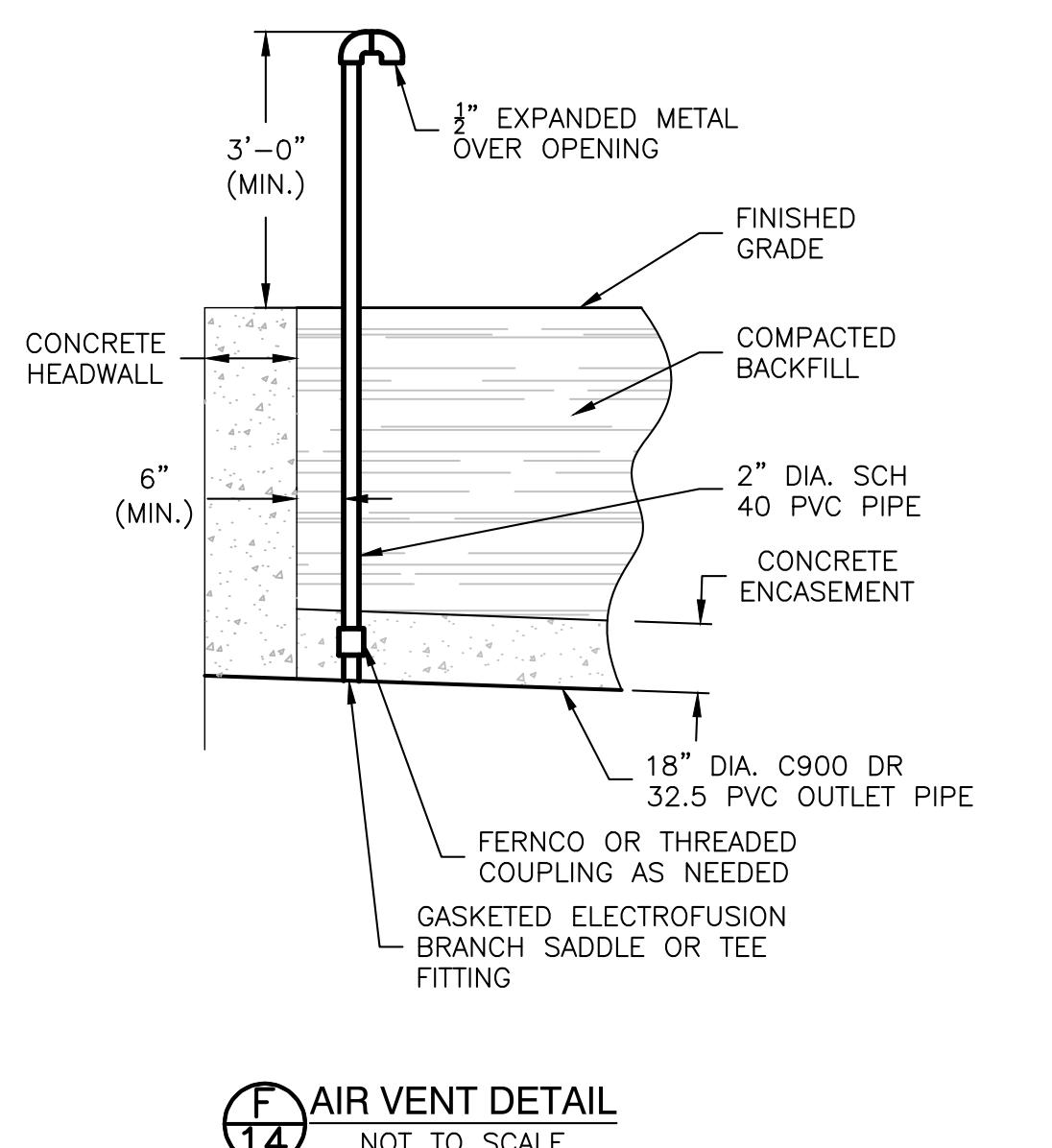
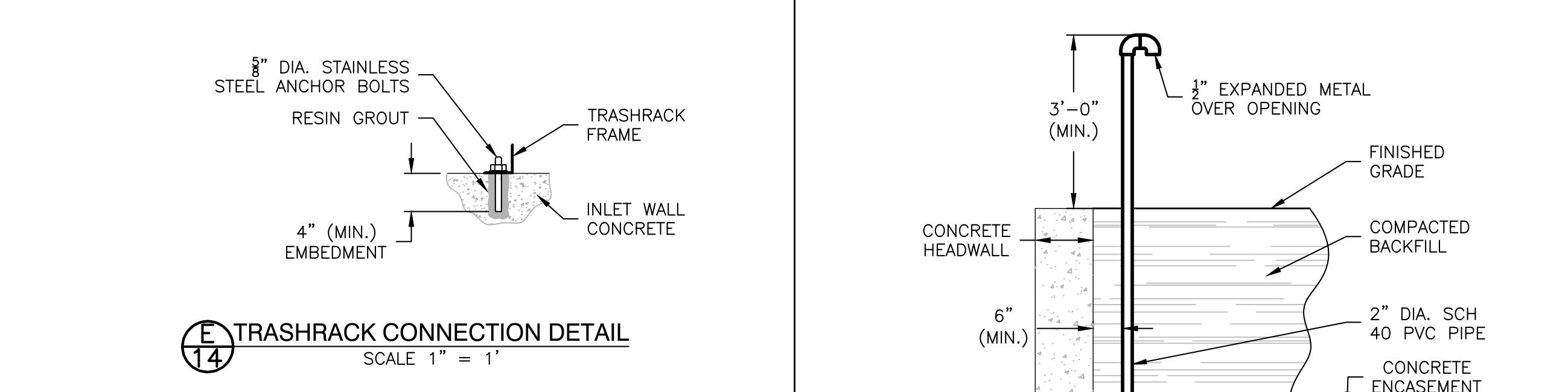
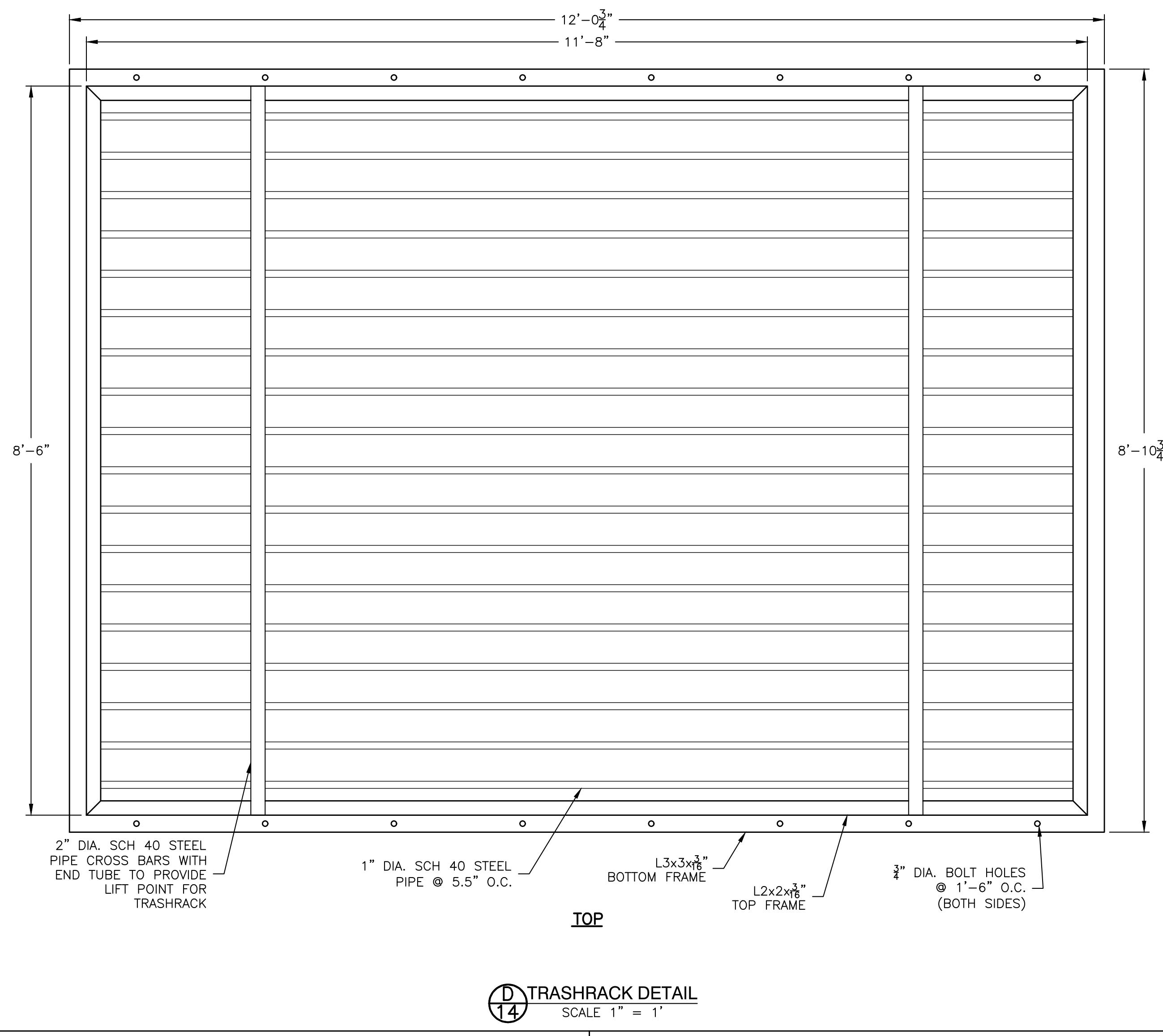
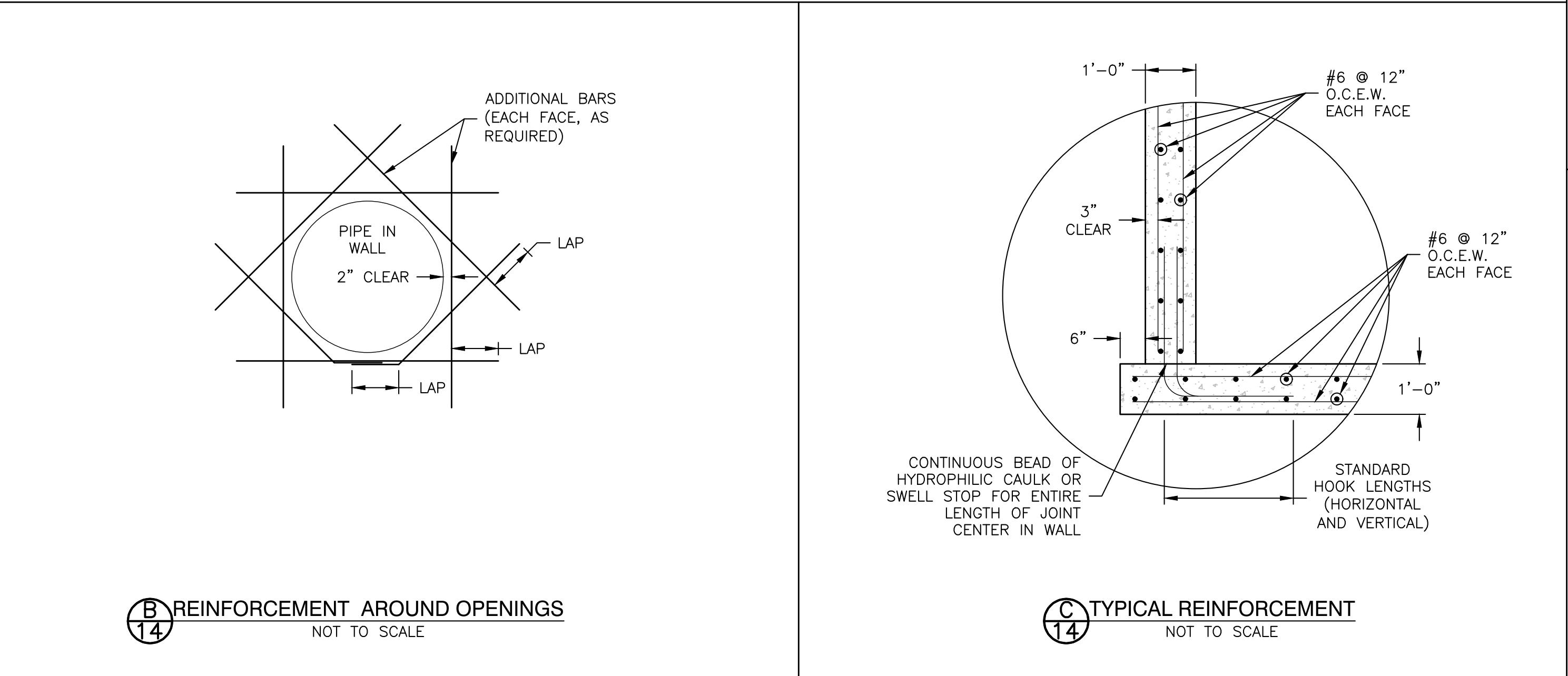
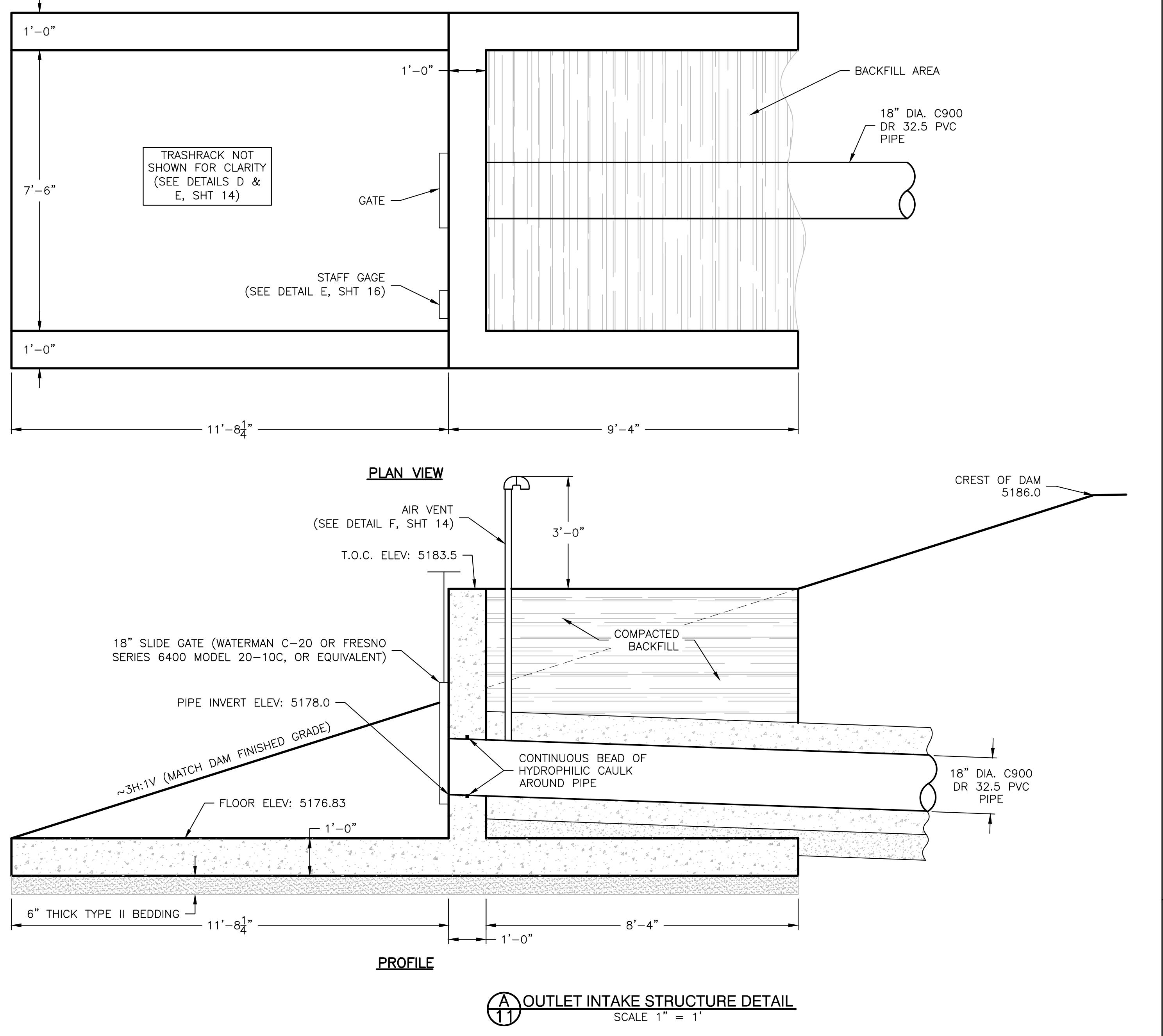
Denver, CO 80234
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Fax: (303) 452-2759
email: info@applegategroup.com Website: www.applegategroup.com



PRINCE LAKE NO 1 DAM REHABILITATION

INLET DETAILS

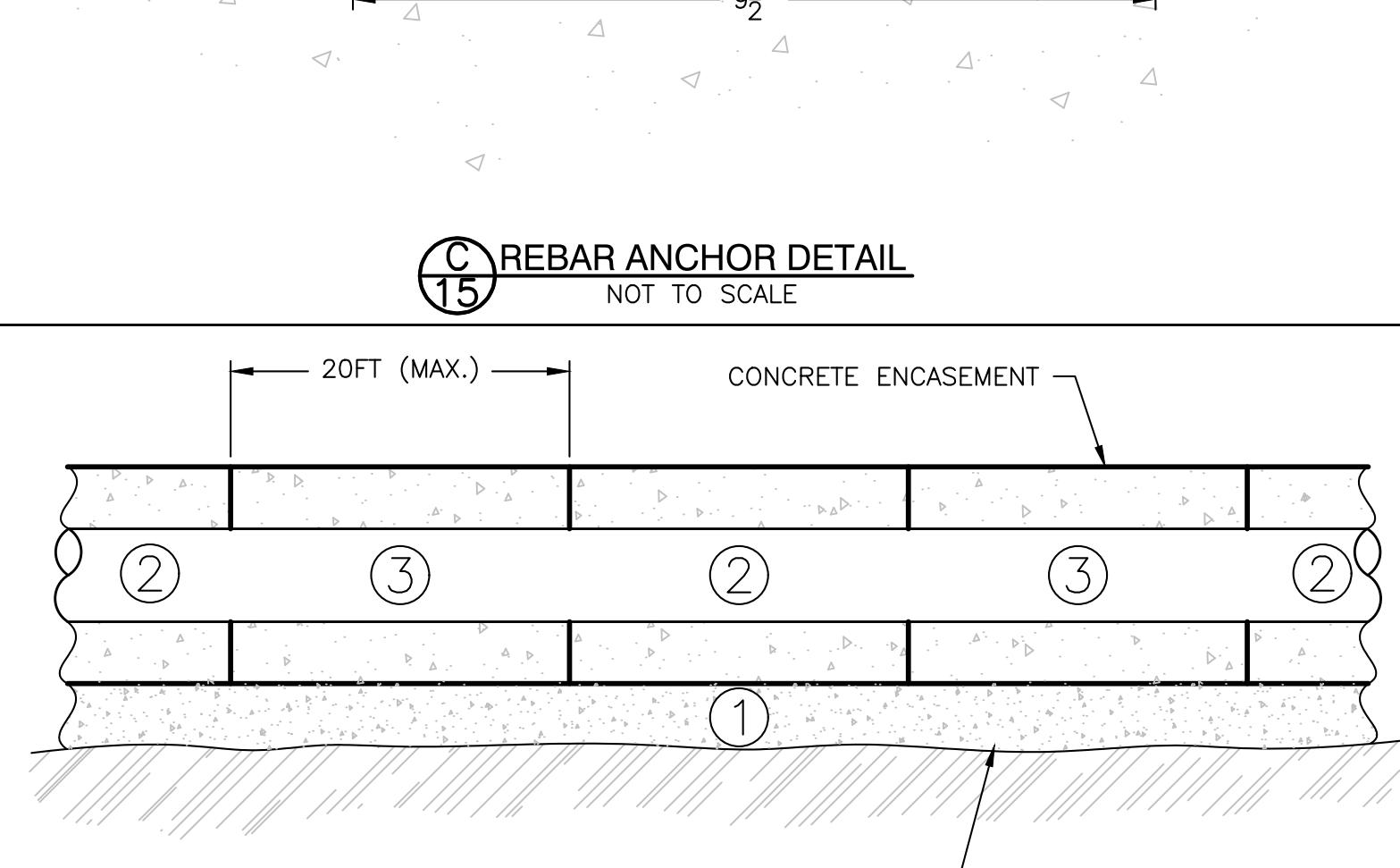
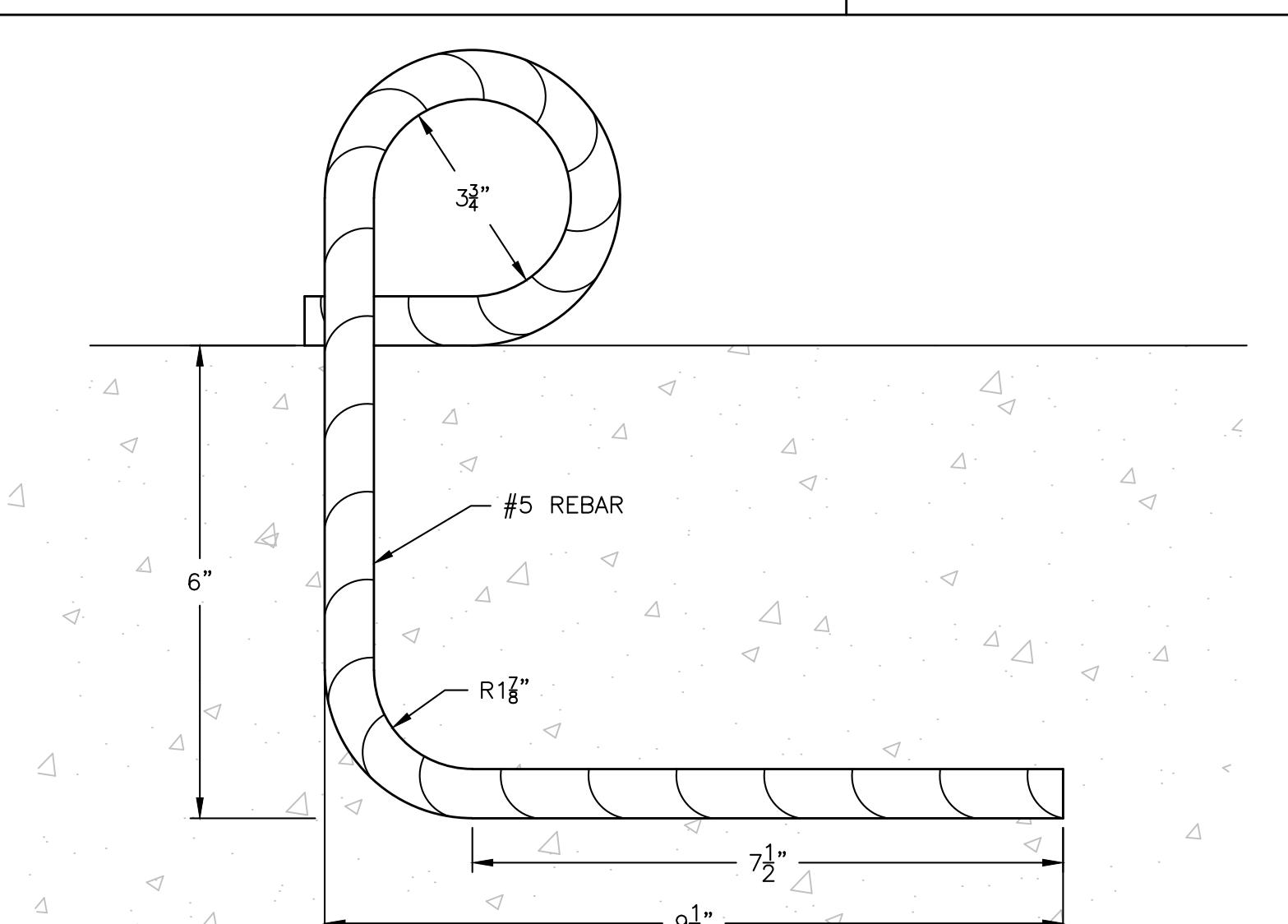
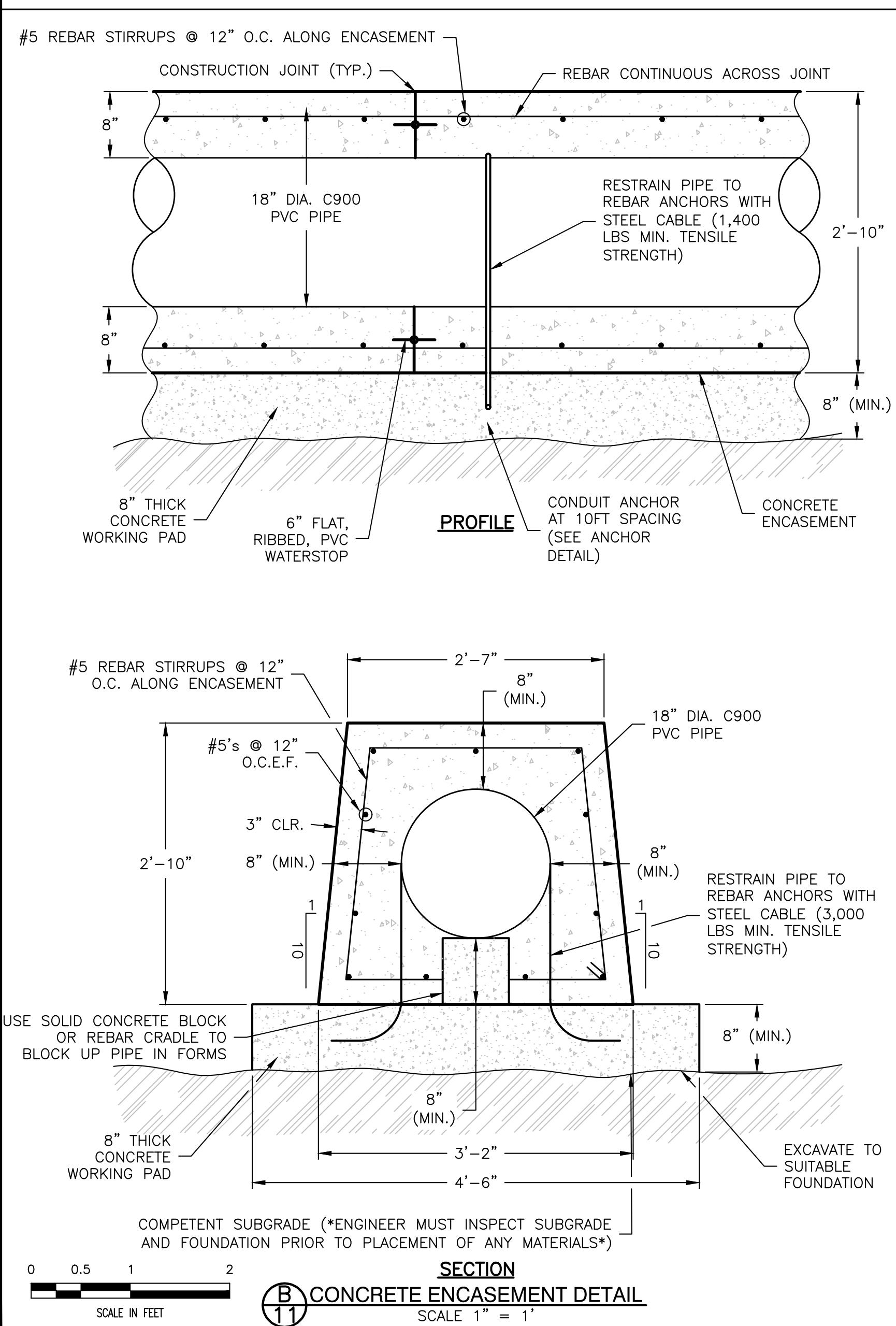
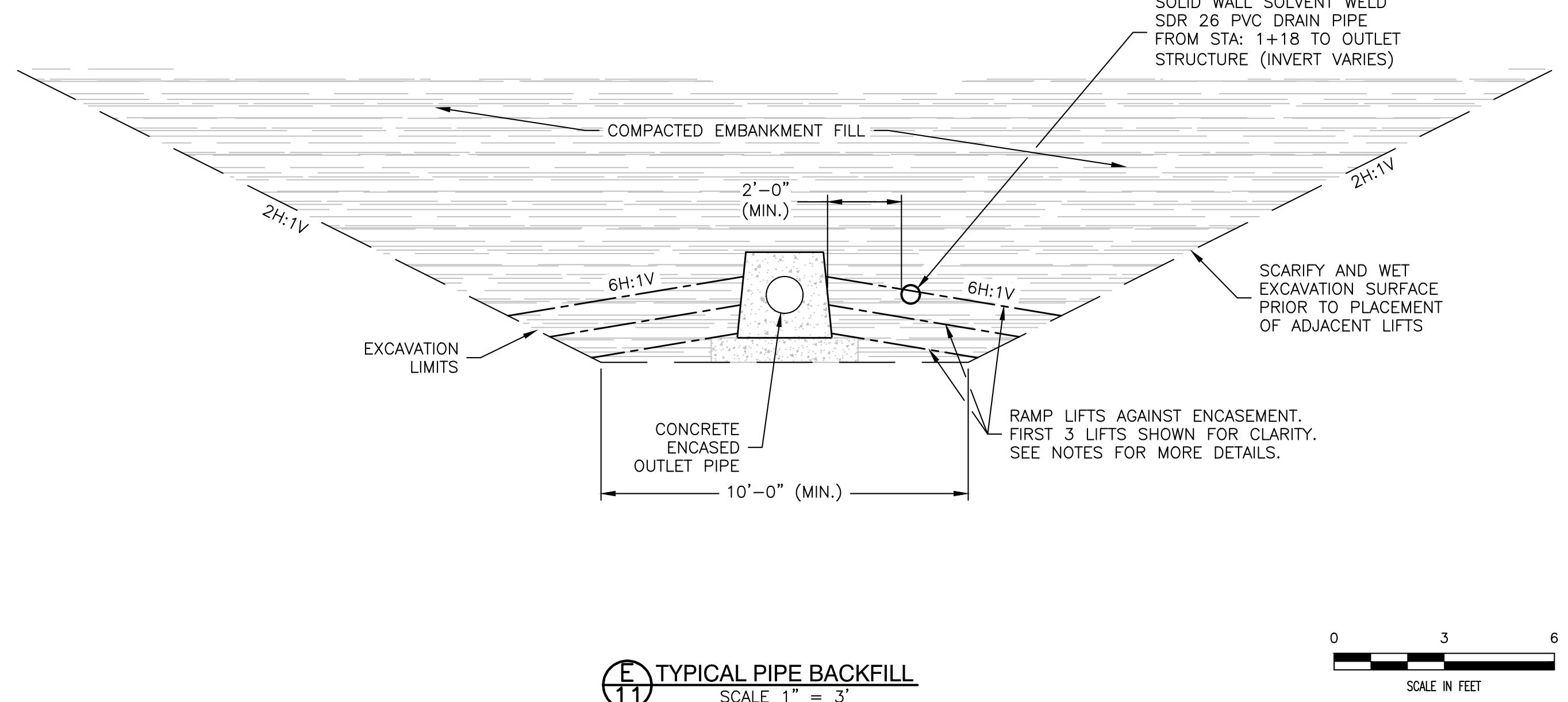
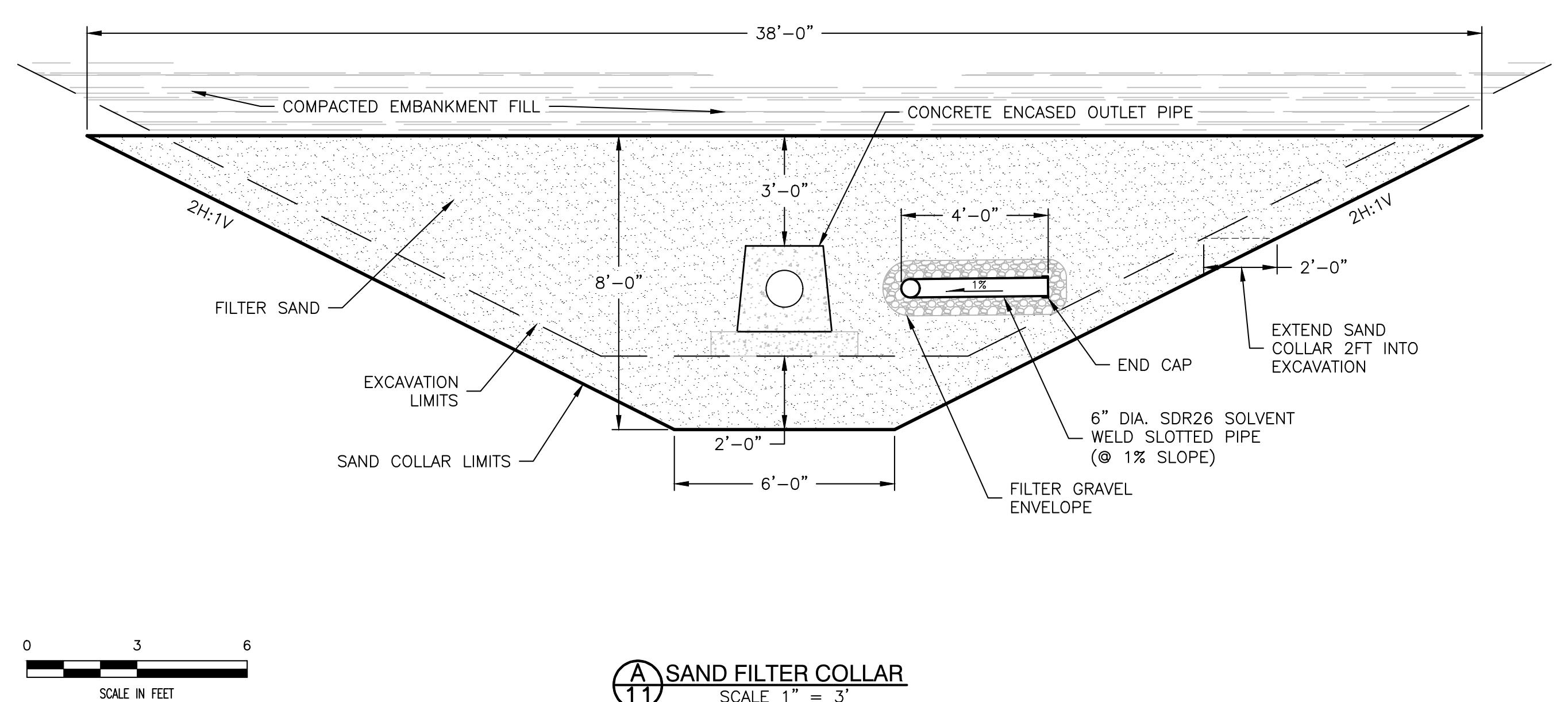
BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT



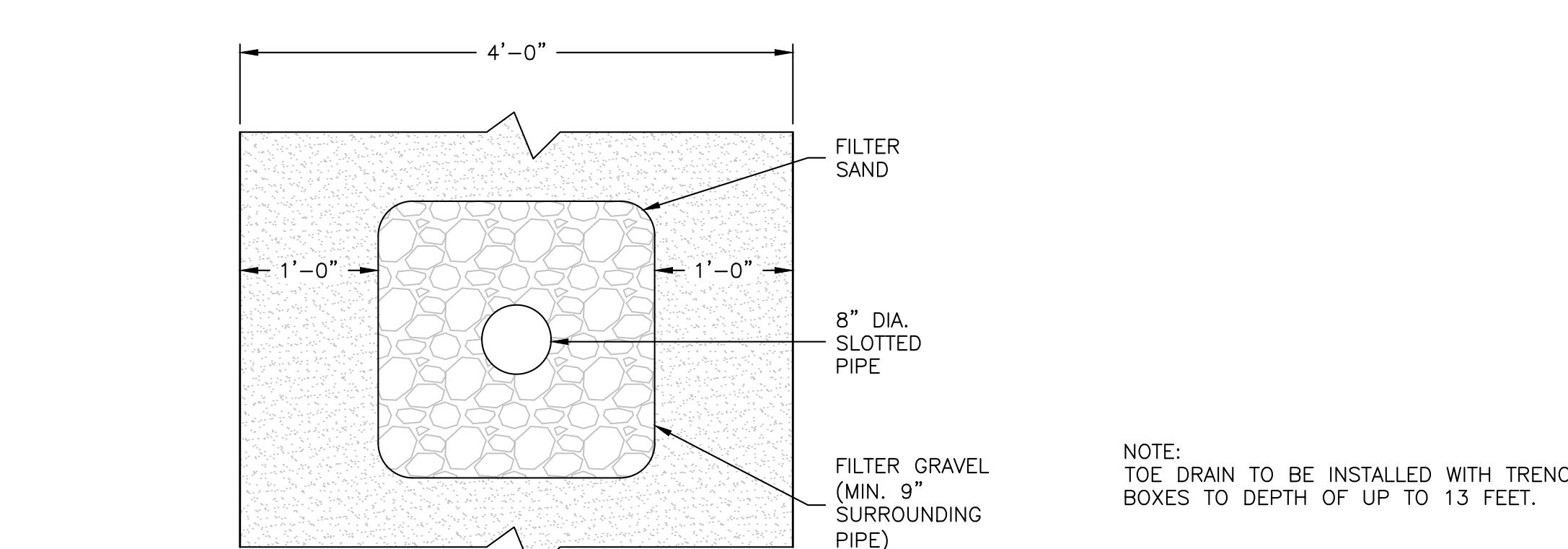
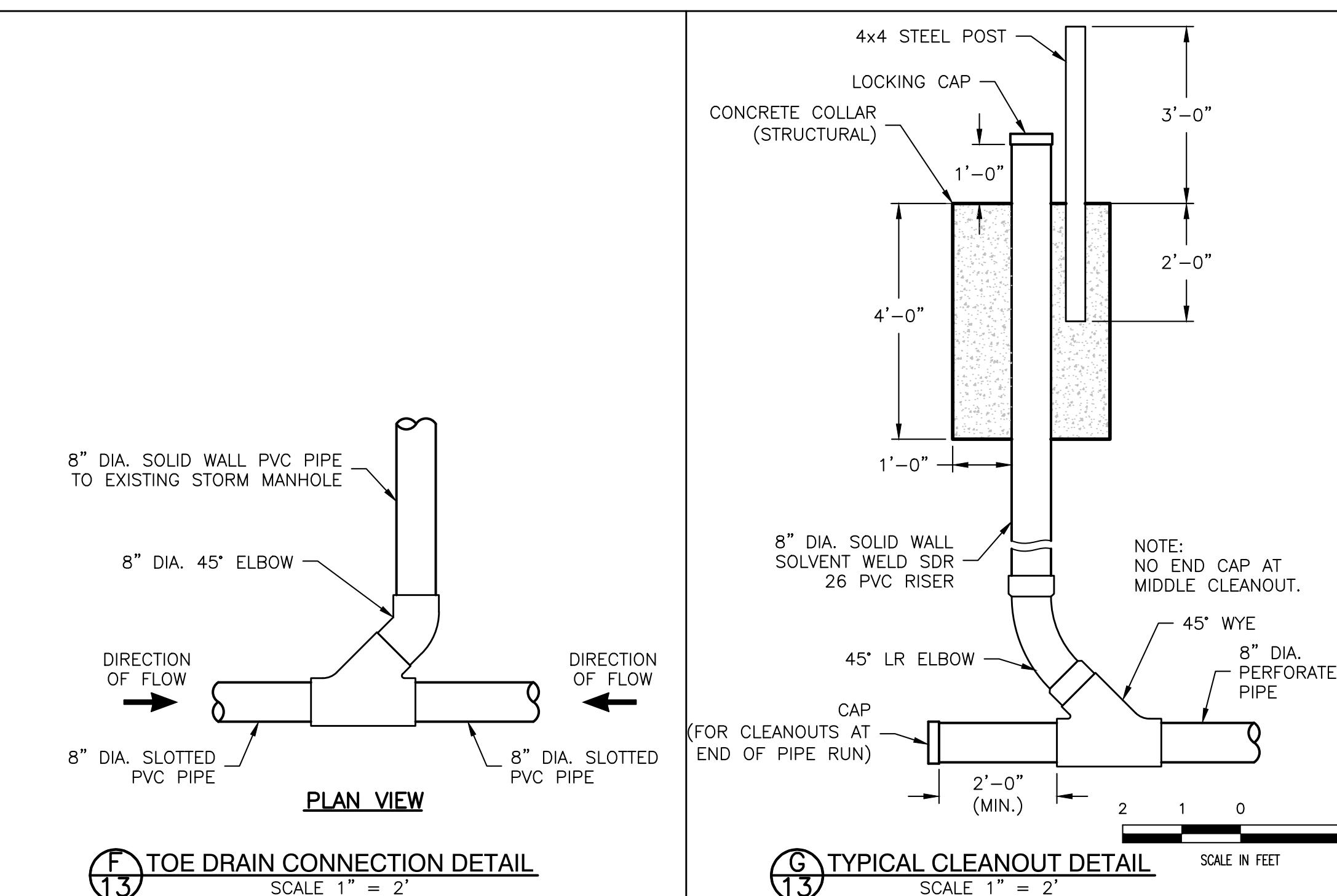
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Sheet: 14
of: 20

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PRINCE LAKE NO 1 DAM REHABILITATION FILTER DIAPHRAGM, OUTLET ENCASEMENT AND TOE DRAIN DETAILS



- NOTES:
1. CONCRETE WORKING PAD WITH REBAR ANCHORS CAST FIRST PRIOR TO CONCRETE ENCASEMENT.
 2. CONCRETE ENCASEMENT SHALL BE CAST IN 20FT SECTION ALTERNATING AS SHOWN WITH #2 SECTIONS CAST FIRST, FOLLOWED BY #3 SECTIONS.
 3. SPACE ANCHORING SYSTEM EVERY 10FT ALONG CONDUIT ALIGNMENT.



H SLOTTED PIPE WITH GRAVEL ENVELOPE
NOT TO SCALE

Date: 17/OCT/23
Job No: 21-129
Drawn: LD/TH
Design: SS
Checked: TD
Scale: As Noted



Sheet: 15 OF: 20
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Plot Date: 10/20/23 9:48am. Plotted by:ymkdw. Drawing Path: N:\Z\11\2118 Prince Lake No 2 Dam\Drawings\Plan Sets\Drawing Name Prince Dam Details Exhibit.dwg

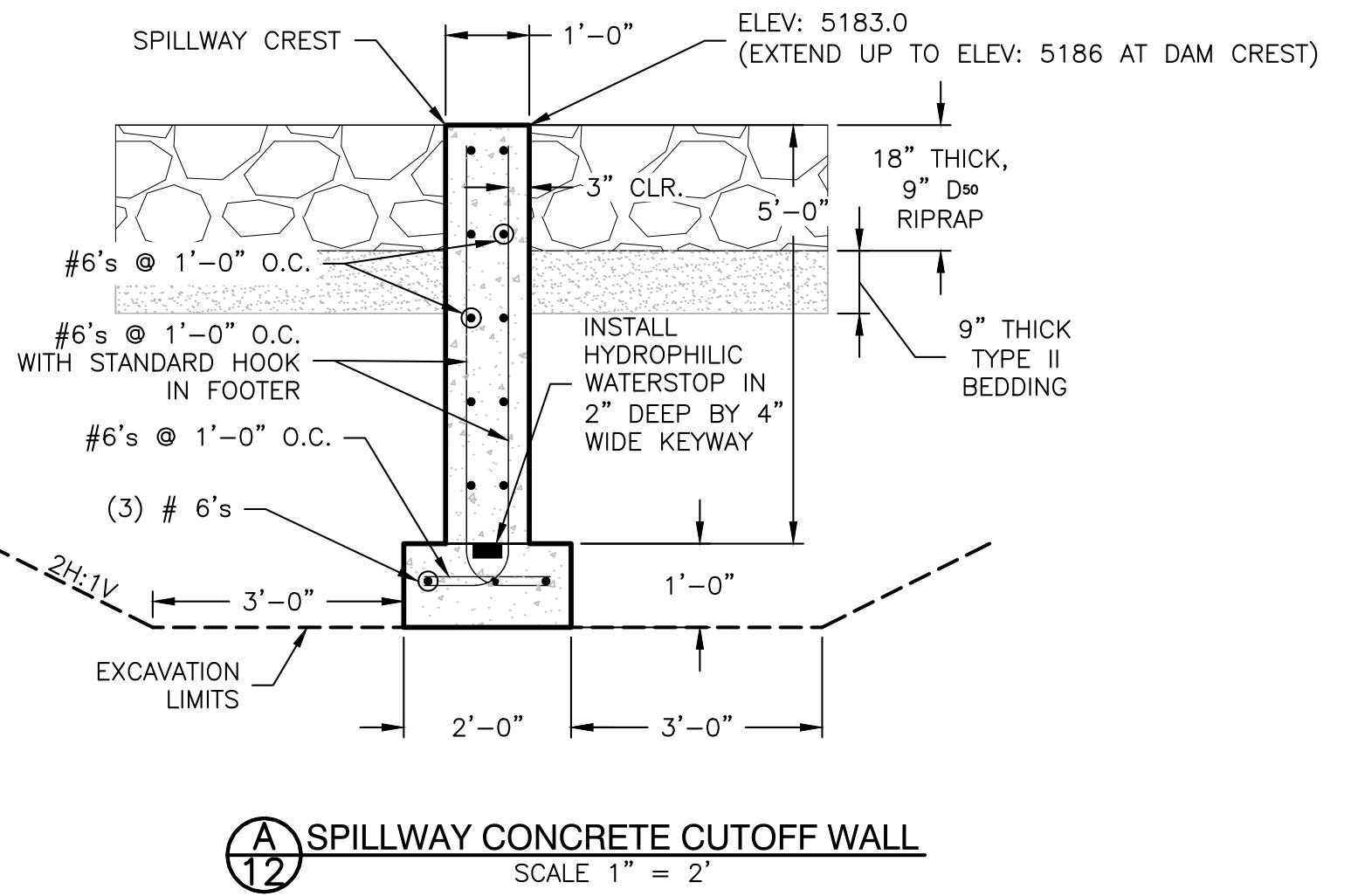
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Applegate Group, Inc.

Water Resource Advisors for the West
1490 West 12th Ave., Suite 100
Denver, CO 80234
(303) 452-2661
Fax: (303) 452-2759
email: info@applegategroup.com Website: www.applegategroup.com

PRINCE LAKE NO 1 DAM REHABILITATION

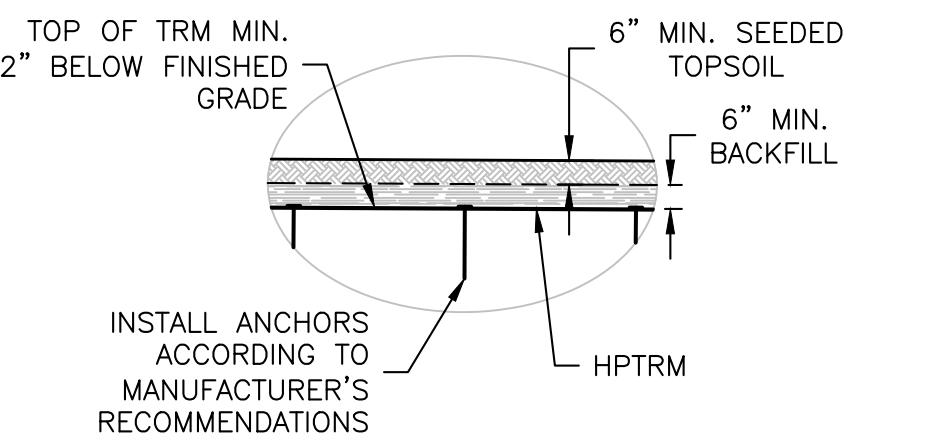
OUTLET AND UPSTREAM RIPRAP DETAILS



A SPILLWAY CONCRETE CUTOFF WALL

12

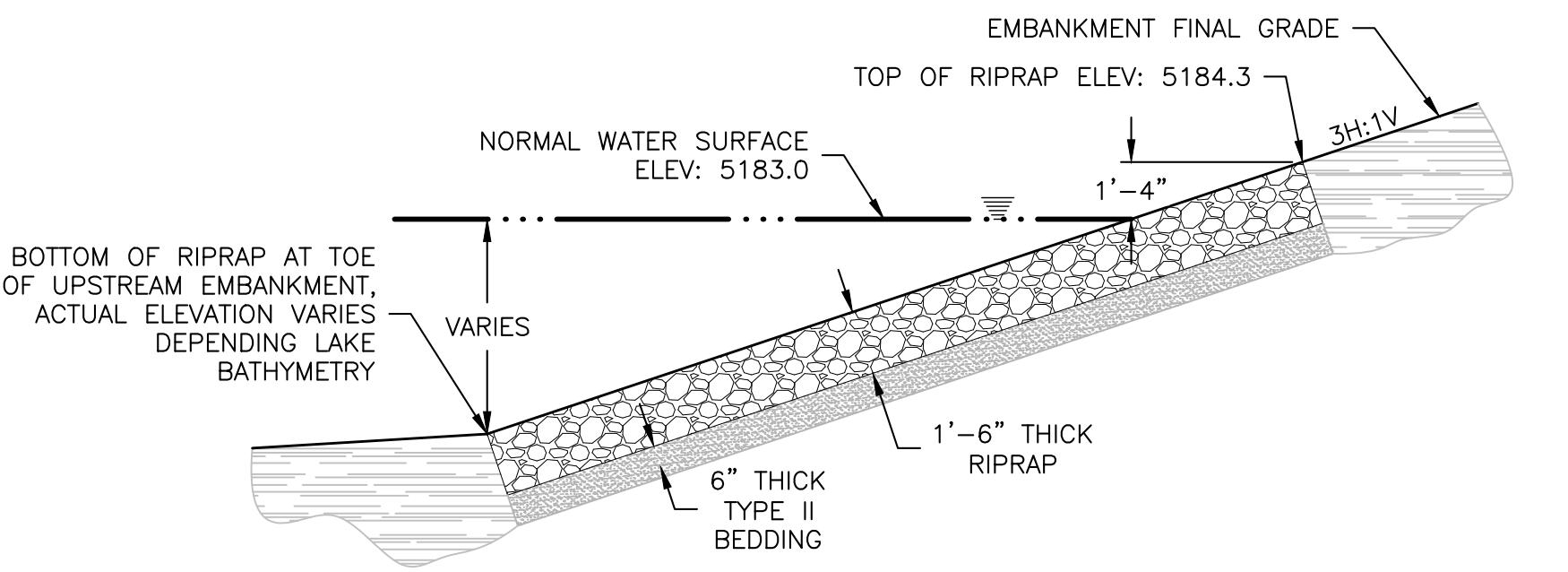
SCALE 1" = 2"



F TRM INSTALLATION

6.18

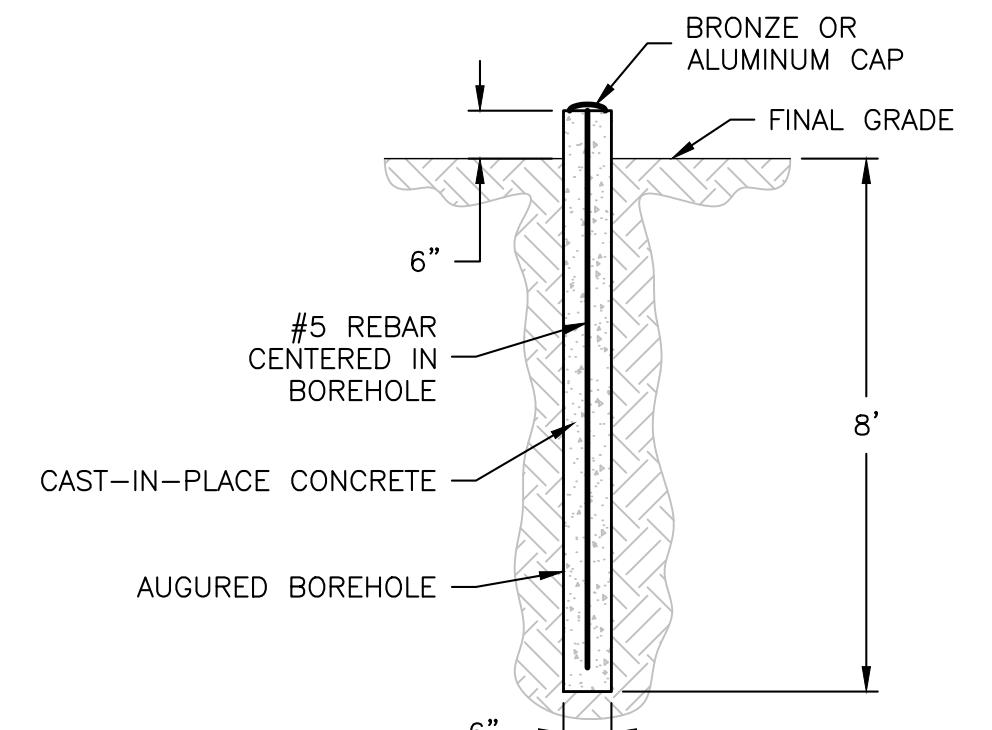
NOT TO SCALE



B UPSTREAM SLOPE PROTECTION DETAIL

11,12

NOT TO SCALE



C SURVEY MONUMENT

8

NOT TO SCALE

NOTE:
STEVENS STYLE C STAFF GAGE TO BE INSTALLED ON HEADWALL
FOR INLET STRUCTURE, WITH 0.0 FEET INSTALLED AT ELEVATION
5178.00, TOP OF STAFF GAGE AT ELEVATION 5186.00, I.E. 2.5'
ABOVE TOP OF H-WALL. ATTACH USING 5/8" DIA. STAINLESS STEEL
ANCHOR BOLTS WITH 4" (MIN) EMBEDMENT AND RESIN GROUT. SS
BOLTS SPACED AT 6-INCH SPACING.

E STAFF GAGE DETAIL

14

NOT TO SCALE

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

REVISIONS

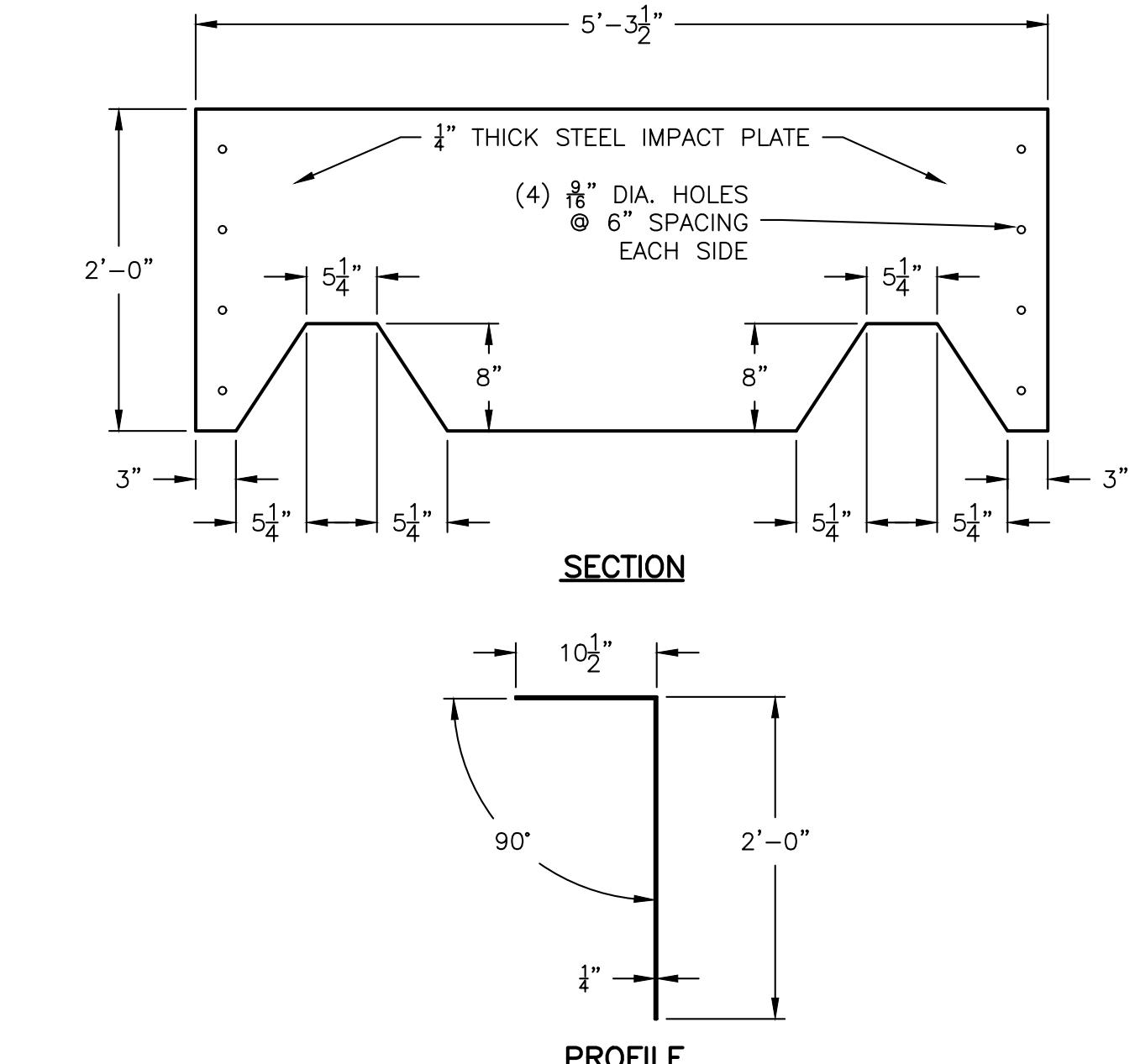
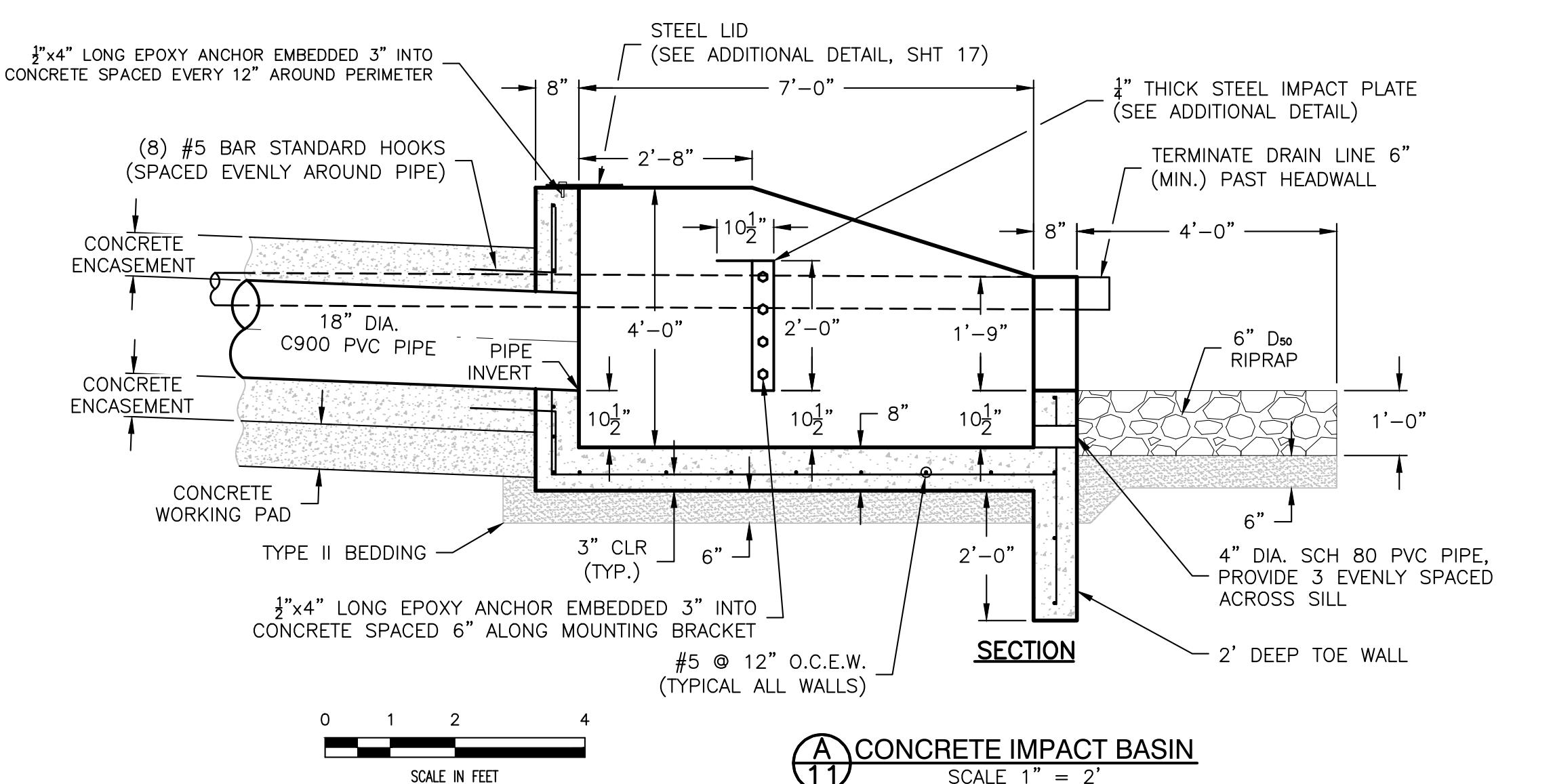
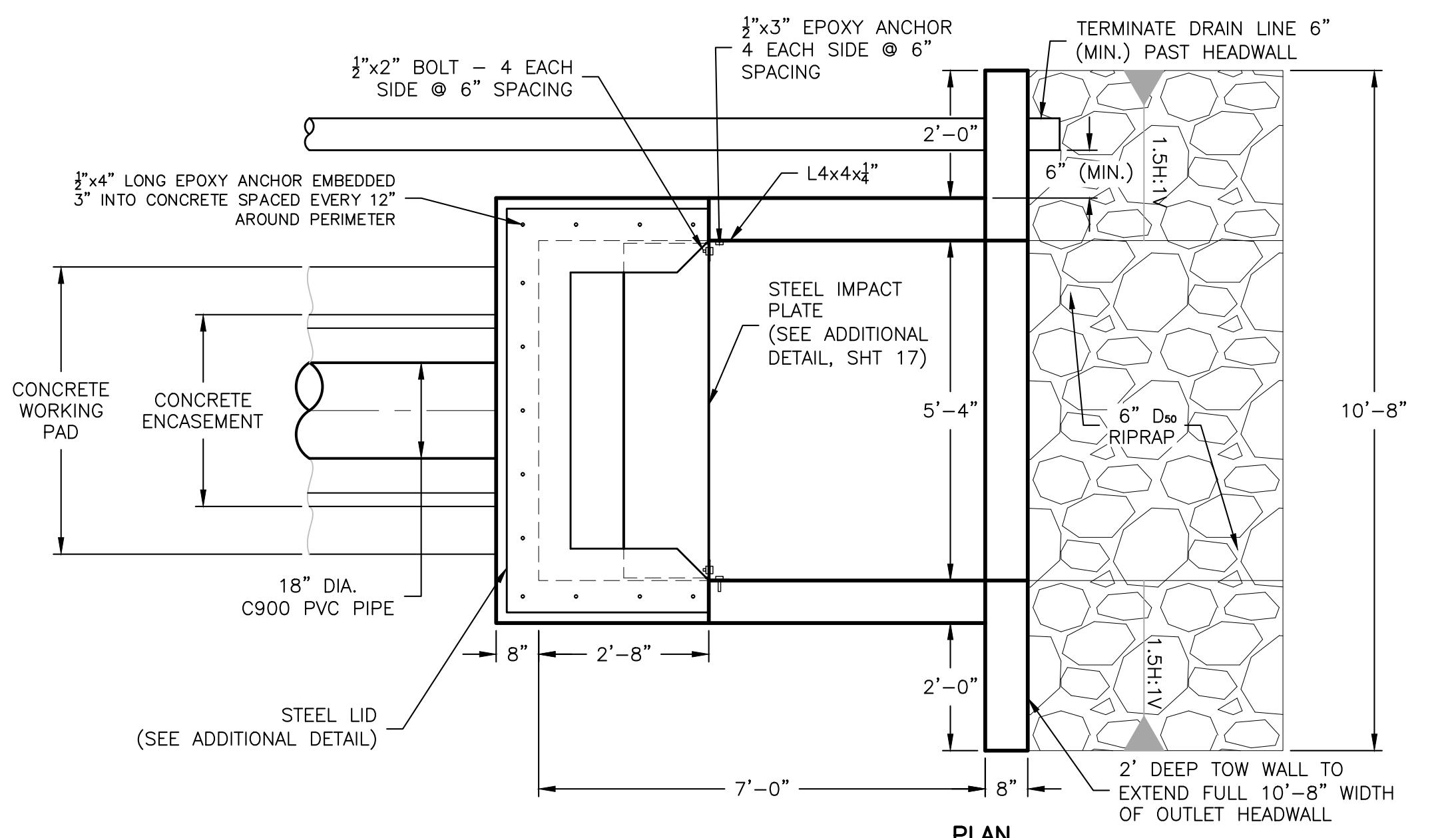
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Design:	SS
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Scale:	As Noted



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OF:
20

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PRINCE LAKE No 1 DAM REHABILITATION

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT



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Sheet:
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Of: **20**

Plot Date: 10/20/23-9:48am, Plotted by:mtkid, Drawing Path: N:\21129 Prince Lake No 2 Dam\Drawings\Plan Set\Drawing Name:Prince Dam Details Exhibit.dwg

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

Restoration Exhibit dwg

Princen Prince Proposed Restoration Exhibit dwg

Date: 17/OCT/23
 Job No: 21-129
 Drawn: LD/TH
 Design: SS
 Checked: TD
 Scale: 1" = 50'



Sheet: 18

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PRINCE LAKE NO 1 DAM REHABILITATION EROSION AND SEDIMENT CONTROL PLAN

BOULDER COUNTY PARKS AND OPEN SPACE DEPARTMENT

Revisions Control Plan Exhibit Drawing Name: Prince Lake No 1 Dam Erosion and Sediment Control Plan

Date: 17/OCT/23
 Job No: 21-129
 Drawn: LD/TH
 Design: SS
 Checked: TD
 Scale: 1" = 50'



Sheet: 19
 Of: 20
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Plot Date: 10/20/23-9:48am. Plotted by: mksd. Drawing Path: N:\Z\129 Prince Lake No 2 Dam\Drawings\Plan Sets\Drawing Name: Prince Lake No 1 Dam Erosion and Sediment Control Plan Exhibit Drawing Name: Prince Lake No 1 Dam Erosion and Sediment Control Plan



