6.0 SUPPLEMENTAL INFORMATION

CONTECH SUPERSTRUCTURE PLANS

Submitted by CONTECH Engineered Solutions on 5/25/2021

100'-0" x 30'-0"

MESA TOP DRIVE SOUTH BRIDGE

ELITE PROPERTIES of AMERICA, INC

REVIEW AND APPROVAL

APPROVED FOR FABRICATION	APPROVED AS NOTED FOR FABRICATION	REVISE & RESUBMIT
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REVIEWED BY:

COMPANY:

DATE:

PLEASE CHECK ONE BOX FOR EACH SHEET AND ADD COMMENTS AS NEEDED ON APPROPRIATE SHEETS

DRAWING INDEX

SHEET NO.	DESCRIPTION
1	TITLE PAGE
2	GENERAL NOTES & ANCHOR DETAILS
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BY RELEASING CONTECH ENGINEERED SOLUTIONS TO FABRICATE, CUSTOMER ACKNOWLEDGES CONTECH SUBMITTAL PLANS HAVE BEEN REVIEWED BY ALL RELATED PARTIES TO THE PROJECT AND THEY ARE DIRECTING CONTECH TO FABRICATE ACCORDING TO THE APPROVED PLANS.

CONTECH
CONTRACT
DRAWING

COLORADO LICENSED
NATHAN EVANS
53643
PROFESSIONAL ENGINEER
5-25-21

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800-328-2047 320-345-9126 320-506-3148 FAX
BIGR BRIDGE

DATE: 7/24/2020	
DESIGNED: NBE	DRAWN: RDH
CHECKED: NBE	APPROVED: NBE
PROJECT No.: 621715	SEQUENCE No.: 030
SHEET: 1 OF 10	

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GENERAL NOTES:

C

1. CONTECH ENGINEERED SOLUTIONS HAS AISC QUALITY CERTIFIED BRIDGE FABRICATION - ADVANCED (MAJOR) WITH A FRACTURE CRITICAL AND SOPHISTICATED PAINT ENDORSEMENT AND CWB CERTIFIED TO CSA STANDARD W47.1 DIVISION 2.

2. DESIGN IS IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8th EDITION 2017.

3. MATERIALS (UNLESS NOTED OTHERWISE):
   a. STRUCTURAL STEEL: ASTM A588 WEATHERING STEEL
      TUBES: ASTM A847 WEATHERING STEEL
   b. ELASTOMERIC PADS: GRADE 4, 60 DUROMETER
   c. SHEET PILING: ASTM A929 (GALV)
      STRUCTURAL BOLTS: ASTM F3125 GRADE A325 (TYPE 1)
   d. GUARDRAIL BOLTS: ASTM A307 (GALV)

4. DESIGN LOADINGS:
   a. BRIDGE DEAD LOAD PLUS 37.5 FUTURE WEARING SURFACE.
   b. VEHICLE LIVE LOAD: HL-93, MAX ADTT = 160
   c. WIND LOADING PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 3.8:
      WIND SPEED = 115 MPH
      WIND EXPOSURE CATEGORY = C
      MAX HEIGHT OF STRUCTURE = 33 FT.
   d. BRIDGE RAIL DESIGNED FOR TL-1 LOADING IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS APPENDIX A13.2 (RAIL HAS NOT BEEN CRASH TESTED)
   e. SEISMIC LOADING PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 3.10:
      SITE CLASS: D
      PGA = 0.058
      S_S = 0.125
      S_1 = 0.035
      PERIOD OF BRIDGE = T_m = 0.076 SEC

5. BRIDGE TO BE BUILT TO THE REQUIREMENTS OF AWS D1.5.

6. ALL SHOP WELDING SHALL USE THE GAS METAL ARC WELDING OR FLUX CORED ARC WELDING PROCESS.

7. FINISH:
   ALL EXPOSED SURFACES OF STEEL TO BE CLEANED IN ACCORDANCE WITH STEEL STRUCTURES PAINTING COUNCIL SURFACE PREPARATION SPECIFICATIONS NO. 1, SSPC-SP1 SOLVENT CLEANING. EXPOSED SURFACES OF STEEL SHALL BE DEFINED AS THOSE SURFACES SEEN FROM THE DECK OR FROM THE OUTSIDE (AND BOTTOM) OF THE STRUCTURE. ALL OTHER SURFACES TO HAVE STANDARD MILL FINISH.

8. ALL BOLTED CONNECTIONS ARE CONSIDERED TO BE PRETENSIONED OR SLIP-CRITICAL CONNECTIONS. ALL BOLTS ARE TO BE PRETENSIONED PER THE REQUIREMENTS OF SECTION 8.2 OF THE SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH-STRENGTH BOLTS BY RCSC.

9. ALL BOLTS, NUTS AND WASHERS SHALL BE FURNISHED IN THE AMOUNT OF 5% IN EXCESS OF THE NUMBER REQUIRED FOR EACH SIZE AND LENGTH.

10. IF BOLTS DO NOT SMOOTHLY ENGAGE UP TO SNUG-TIGHT, THERE MAY BE AN OBSTRUCTION WITHIN THE THREADS. THE BOLTS SHOULD BE REMOVED, THE THREADS ON THE BOLT AND NUT CLEANED AND RETAPPED IF NECESSARY TO ALLOW SMOOTH INSTALLATION OF THE BOLT. (IF APPLICABLE)

11. MAINTENANCE NOTE: CONTECH RECOMMENDS NOT APPLYING DE-ICING OR DUST PROHIBITIVE CHEMICALS OR SALTS TO ANY PART OF THE BRIDGE STRUCTURE. IF DE-ICING OR DUST PROHIBITIVE CHEMICALS OR SALTS ARE APPLIED TO ANY PART OF THE BRIDGE STRUCTURE, CONTECH WILL NOT BE RESPONSIBLE FOR ANY RESULTANT ACCELERATED CORROSION.

CONCRETE NOTES

1. BIG R BRIDGE IS RESPONSIBLE FOR THE STRUCTURAL DESIGN OF THE CONCRETE DECK. ALL ISSUES RELATED TO MATERIAL SUPPLY, TESTING AND INSTALLATION ARE OUTSIDE OF BIG R BRIDGE'S RESPONSIBILITY.

2. CONCRETE MIX DESIGN, MATERIALS, MIXING, PLACEMENT, FINISHING AND TESTING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 601 OF CDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2017 EDITION.

3. MINIMUM MATERIAL REQUIREMENTS:
   a. CONCRETE: CLASS D OR H: f_c = 4500 psi AT 28 DAY
      AIR CONTENT OF 5.5% +/- 1%
      UNIT WEIGHT OF 145 PCF MAX
   b. REINFORCING: ASTM A615 GRADE 60 OR ASTM A775 FOR EPOXY COATING

4. THE USE OF EPOXY COATED REBAR, GALVANIZED REBAR, DECK SEALERS OR ANY OTHER FORM OF PROTECTION OF THE REBAR SHALL BE DONE AS NEEDED FOR LOCAL CONDITIONS OR AS REQUIRED PER THE PROJECT CONTRACT DOCUMENTS AND IS NOT THE RESPONSIBILITY OF BIG R BRIDGE.

5. THE CONTRACTOR MUST EXERCISE CARE TO CONTROL TRAFFIC AND STORAGE OF MATERIALS ON THE FORM DECK BEFORE CONCRETE IS PLACED.

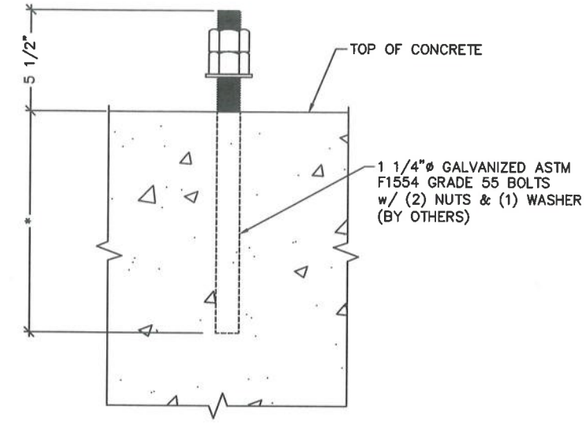
6. LONGITUDINAL BARS MAY BE SPLICED IF REQUIRED. SPLICES SHALL BE STAGGERED EVERY OTHER LONGITUDINAL BAR. SPLICES SHALL BE LOCATED AT OR NEAR THE ONE-THIRD POINT OF THE BAY SPANS FROM FLOOR BEAM TO FLOOR BEAM. REQUIRED SPLICE LENGTHS ARE AS FOLLOWS:

BAR SIZE	NORMAL WEIGHT CONCRETE (145 PCF)	LIGHT WEIGHT CONCRETE (120 PCF)
#4	29"	35"
#5	36"	43"
#6	43"	52"
#7	50"	60"
#8	57"	69"
#9	70"	85"

7. STAY IN PLACE GALVANIZED FORM DECK SHALL BE USED ON THE BRIDGE. FORM DECK SHALL BE SHOP ATTACHED TO FLOOR BEAMS VIA SELF-DRILLING FASTENERS, WELDING OR POWER ACTUATED FASTENERS. LONGITUDINAL SHEET LAPS SHALL BE ATTACHED WITH SELF-DRILLING FASTENERS AT 36" MAXIMUM SPACING. THE ATTACHMENT OF THE FORM DECK TO THE FLOOR BEAMS IS ONLY NECESSARY TO KEEP THE FORM DECK IN PLACE DURING TRANSPORTATION AND DURING THE CONCRETE PLACEMENT. THE FORM DECK IS NOT REQUIRED FOR DIAPHRAGM ACTION OR COMPOSITE ACTION AND PROVIDES NO STRUCTURAL BENEFIT TO THE TRUSS OR THE DECK AFTER THE CONCRETE IS SET.

8. CONCRETE TO BE FINISHED WITH A TRANSVERSE BROOM FINISH.

9. THE USE OF GROOVED CONTRACTION JOINTS SHALL BE PUT IN PER THE PROJECT CONTRACT DOCUMENTS OR AT THE DISCRETION OF THE ENGINEER AND OWNER. IF CONTRACTION JOINTS ARE USED, THEY SHALL BE PLACED OVER THE CENTERLINE OF THE FLOOR BEAMS AS NEEDED.



ANCHOR BOLT DETAIL

*NOTE:
ANCHOR BOLTS ARE DESIGNED BY CONTECH FOR STEEL STRENGTH IN SHEAR AND TENSION OF THE ANCHOR BOLT ONLY. ALL DESIGN CONSIDERATIONS REGARDING CONCRETE BREAKOUT STRENGTH IN SHEAR AND TENSION, PULLOUT STRENGTH, CONCRETE SIDE-FACE BLOWOUT STRENGTH, CONCRETE PRYOUT STRENGTH, EMBEDMENT DEPTH, TYPE OF ANCHORAGE OR ANY OTHER CONCRETE FAILURE MODES ARE NOT CONSIDERED AND ARE NOT THE RESPONSIBILITY OF CONTECH. IF LARGER DIAMETER BOLTS ARE REQUIRED TO MEET ANY OF THESE REQUIREMENTS, THAT INFORMATION MUST BE PROVIDED TO CONTECH PRIOR TO BEGINNING ANY FABRICATION ON THE BRIDGE.

D

LIFTING WEIGHTS			
ITEM	QTY	UNIT WEIGHT (LBS)	TOTAL WEIGHT (LBS)
BRIDGE SECTION 1A	1	21,710	21,710
BRIDGE SECTION 1B	1	32,311	32,311
BRIDGE SECTION 2A	1	31,920	31,920
BRIDGE SECTION 2B	1	47,349	47,349
LOOSE ITEMS	–	–	18,000
		TOTAL BRIDGE WEIGHT:	151,290

	BEARING REACTION IN KIPS	MAX AT INTERIOR STRINGER			MAX AT EXTERIOR STRINGER			TOTAL AT ABUTMENT		
		P	H	L	P	H	L	P	H	L
	DEAD LOAD (DC)	53.78			39.77			240.89		
	WEARING SURFACE LOAD (DW)	13.44			34.42			109.14		
HL-93	VEHICLE LOAD (LL)	90.43			68.83			193.83		
HL-93	VEHICLE LOAD + DYNAMIC LOAD ALLOWANCE (LL+IM)	104.99			79.91			236.87		
	WIND LOAD (WS)	−30.00*	3.00			3.00		−30.00*	15.00	
	THERMAL LOAD (TU)			13.32			13.32			66.59
	BREAKING FORCE (BR)			7.20			7.20			36.00
	SEISMIC LOAD (EQ)		13.36	26.72		13.36	26.72		66.79	133.59

"P": VERTICAL LOAD
"H": HORIZONTAL LOAD TRANSVERSE TO THE STRUCTURE
"L": HORIZONTAL LOAD LONGITUDINAL TO THE STRUCTURE
* WIND LOAD UPLIFT ASSUMES FULL 20 PSF TO DECK AREA IS APPLIED TO ONE STRINGER LINE

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PROFESSIONAL ENGINEER
NBE
5-25-21

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100'-0" x 30'-0"
MESA TOP DRIVE SOUTH BRIDGE
ELITE PROPERTIES of AMERICA, INC
FOUNTAIN, CO

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BIG R BRIDGE

DATE: 7/24/2020
DESIGNED: NBE
DRAWN: RDH
CHECKED: NBE
APPROVED: NBE
PROJECT No.: 621715
SEQUENCE No.: 030
SHEET: 2 OF 10

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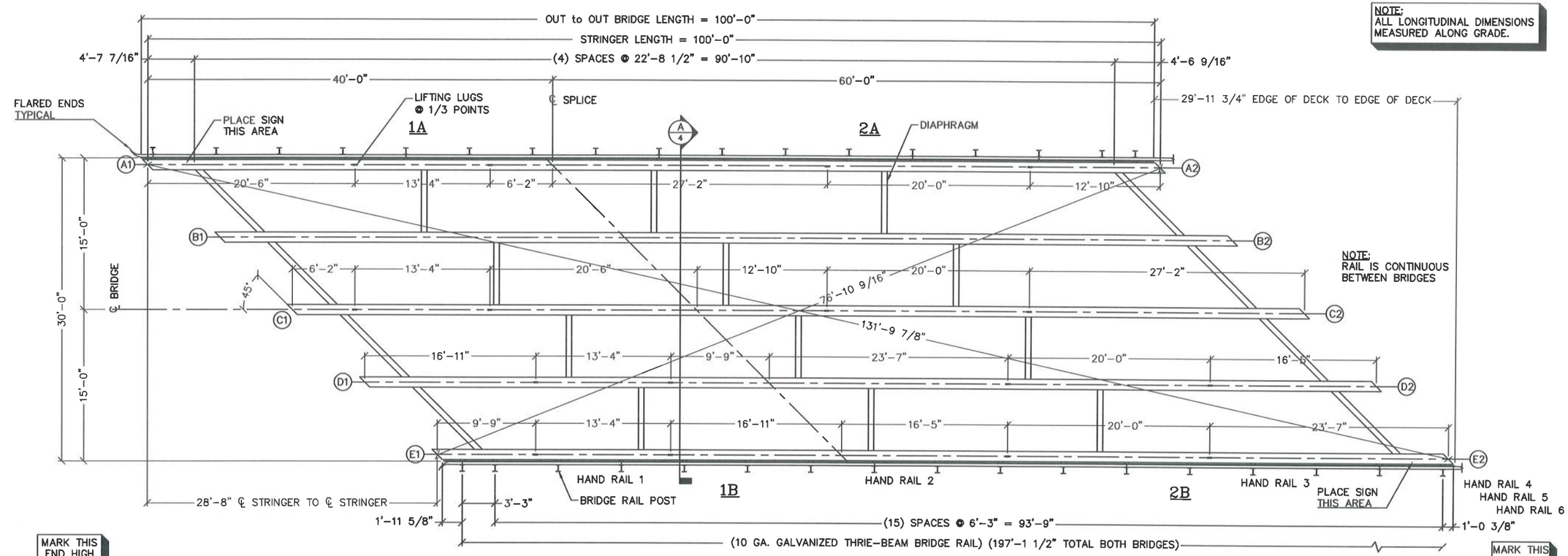
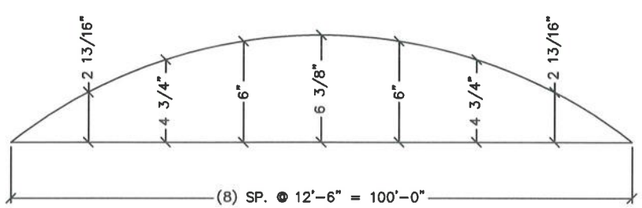


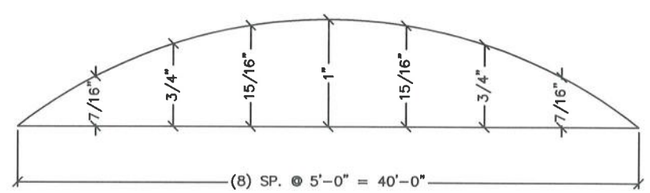
NOTE:
ALL LONGITUDINAL DIMENSIONS MEASURED ALONG GRADE.

NOTE:
RAIL IS CONTINUOUS BETWEEN BRIDGES

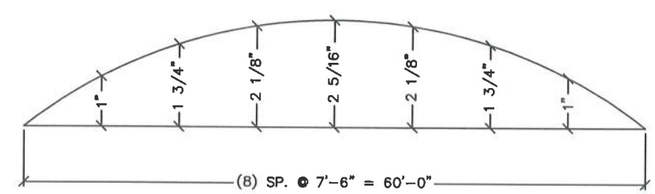
FRAMING PLAN



CAMBER DETAIL
(FULL BRIDGE)



CAMBER DETAIL
(STRINGER SECTION 1)



CAMBER DETAIL
(STRINGER SECTION 2)

C

MEMBERS	DESCRIPTION
GIRDER	W 36x232
DIAPHRAGM	W 21x44
POST BLOCK	W 14x22
SIDE DAM	PL 1/4"

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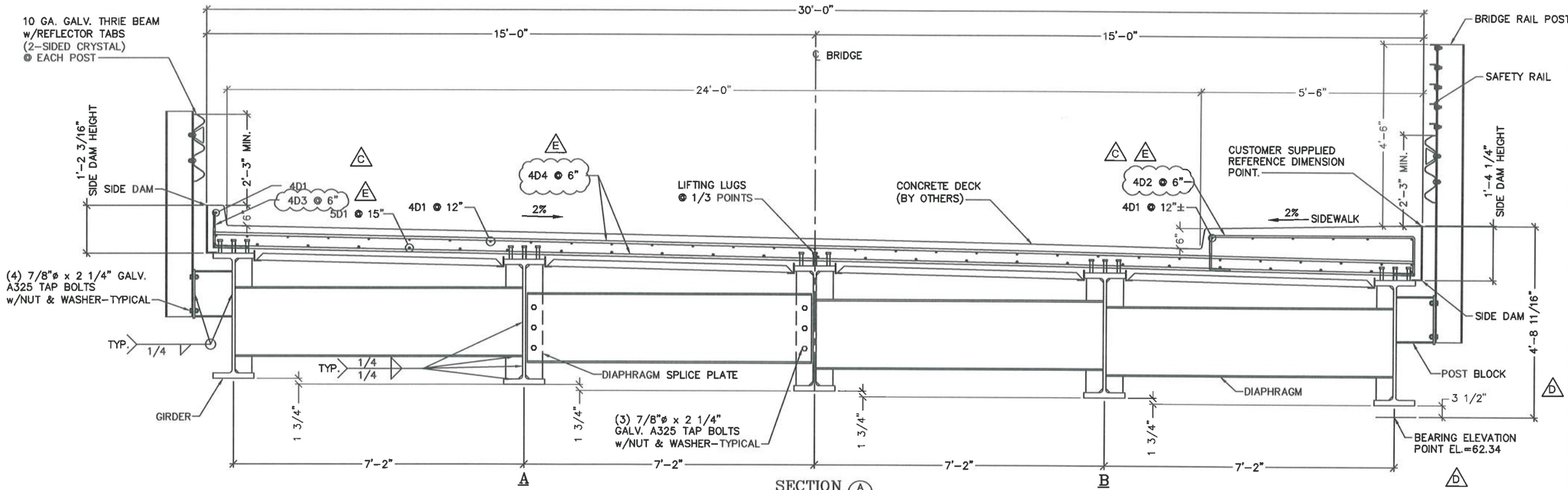
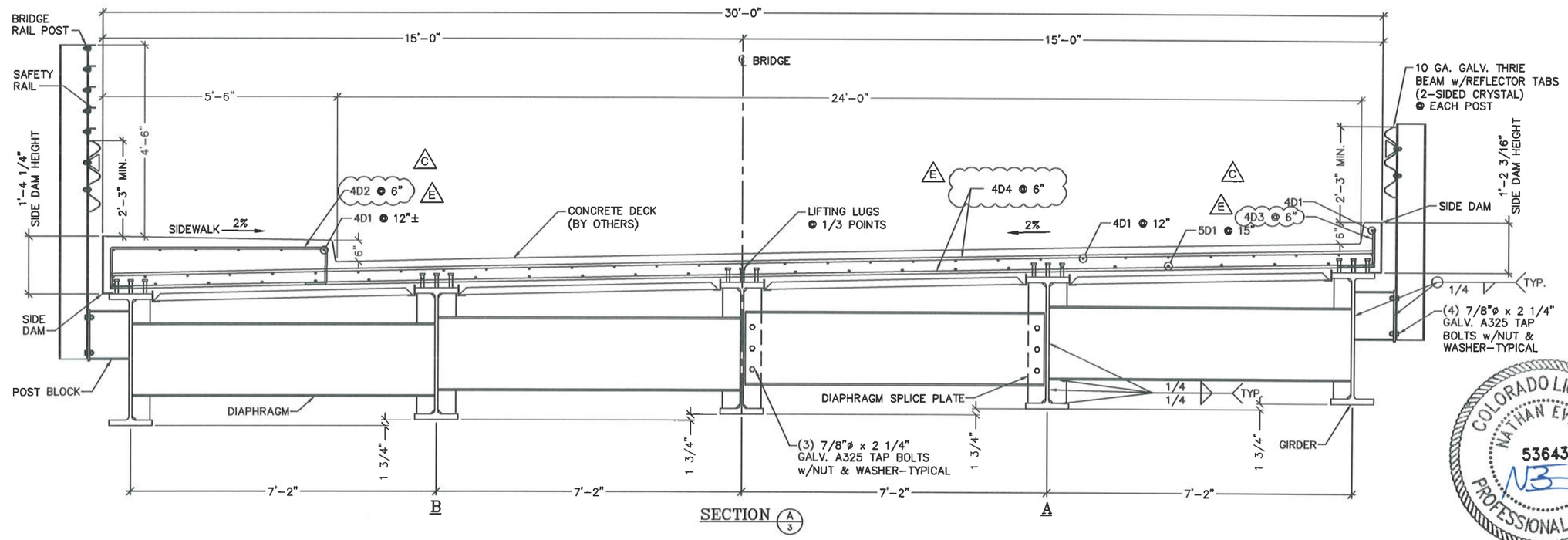


SECTION A/3

SOUTH BRIDGES (BUILD 2)



SECTION A/3

NORTH BRIDGES (BUILD 2)

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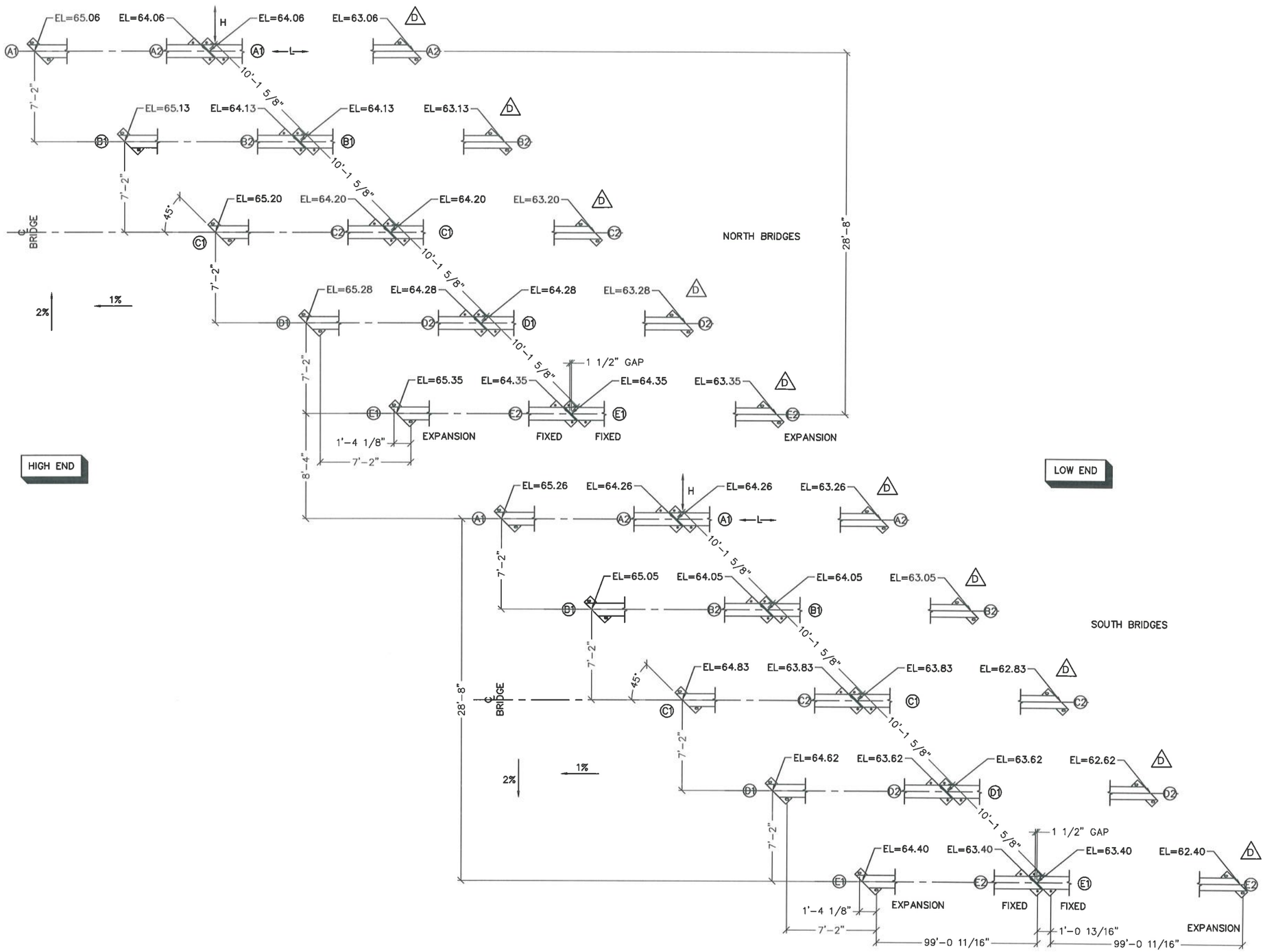

⚠ ANCHOR BOLT LAYOUT

(ELEVATIONS ARE AT BEARING SEATS)

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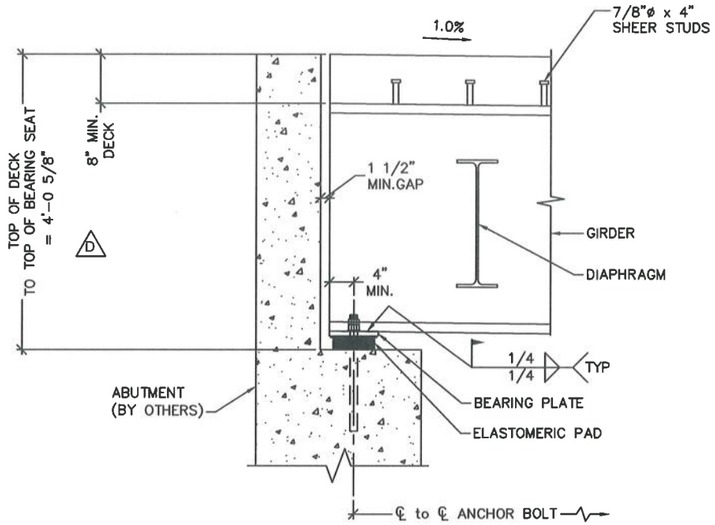
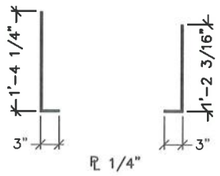
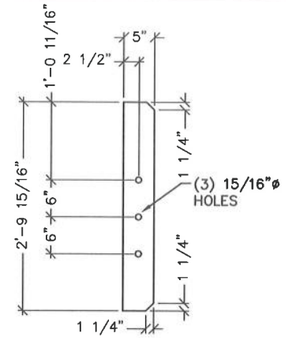


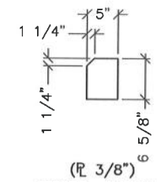
BEARING DETAIL



SIDE DAM DETAIL



FULL DEPTH DIAPHRAGM CONNECTION PLATE



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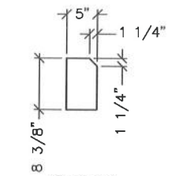

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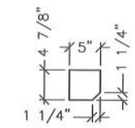
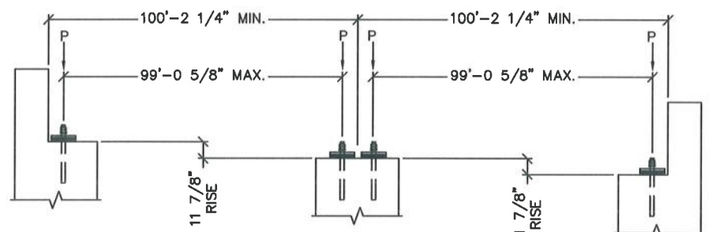
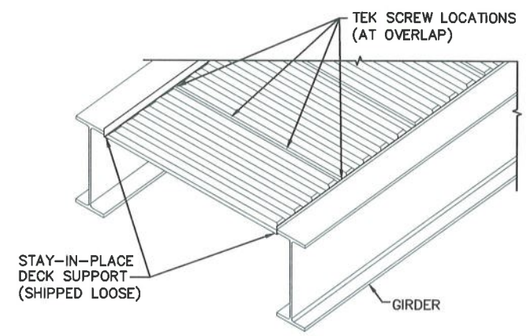


FULL DEPTH CONNECTION PLATE

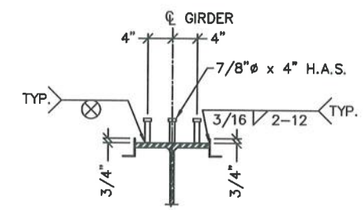


ANCHOR BOLT ELEVATION

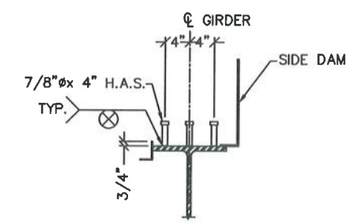


NOTES:
1) STAY-IN-PLACE DECK PANS TO BE ATTACHED IN THE FIELD TO THE SUPPORT ANGLE WITH SELF-TAPPING TEK SCREWS PLACED AT THE FOUR PAN CORNERS AND AT THE 1/3 POINTS ALONG THE LONGITUDINAL OVERLAPS. (4 PER SHEET).

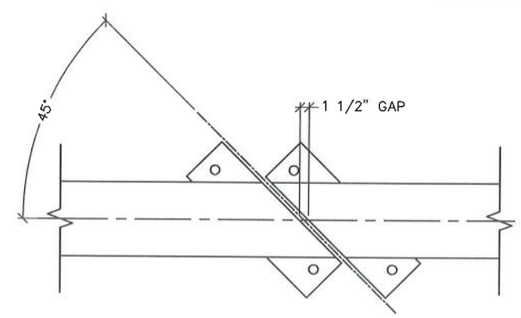
TYPICAL STAY-IN-PLACE DECK MOUNTING DETAIL



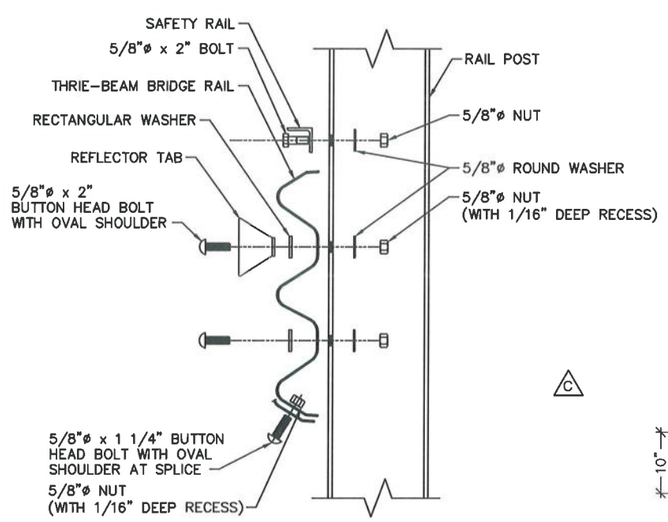
GIRDER DETAIL



TYPICAL EXTERIOR GIRDER DETAIL

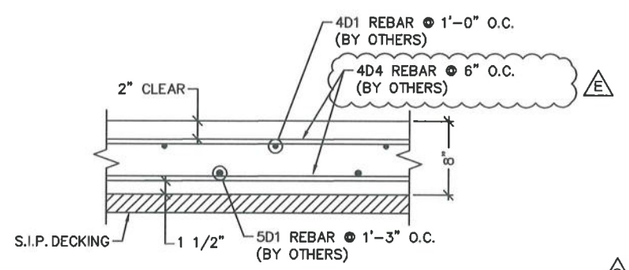


BRIDGE GAP DETAIL

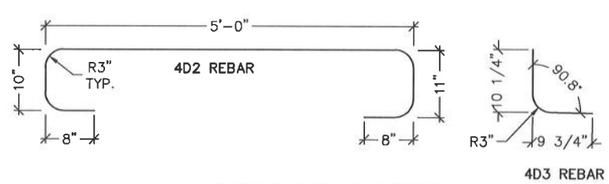


THRIE-BEAM RAIL ATTACHMENT DETAIL

(W 8x18 POSTS)



TYPICAL DECK SECTION



BENT REBAR DETAILS

NOTES:
1. ALL CONCRETE & REBAR BY OTHERS
2. ALL QUANTITIES ARE FOR ONE BRIDGE

REBAR SCHEDULE

MARK	TYPE	QUANTITY	LENGTH	REMARKS
4D1	STRAIGHT	38	99'-8"	EPOXY*
4D2	BENT	202	8'-1"	EPOXY
4D3	BENT	202	1'-8"	EPOXY
4D4	STRAIGHT	405	29'-7"	EPOXY
5D1	STRAIGHT	100	99'-8"	EPOXY*

DIGIT PRECEDING LETTER DENOTES SIZE OF REBAR

* SEE CONCRETE NOTE 6 ON PG. 2 FOR SPLICING

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COLORADO LICENSED
NATHAN EVANS
53643
PROFESSIONAL ENGINEER
5-25-21

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B	12/14/2020	CUSTOMER COMMENTS	RDH
A	9/25/2020	CUSTOMER COMMENTS	RDH

100'-0" x 30'-0"
MESA TOP DRIVE SOUTH BRIDGE
ELITE PROPERTIES of AMERICA, INC
FOUNTAIN, CO

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
19000 Cr 68 Greeley, CO 80631
800-338-2047 320-345-9126 320-566-3148 FAX

BIGR BRIDGE

DATE: 7/24/2020	
DESIGNED: NBE	DRAWN: RDH
CHECKED: NBE	APPROVED: NBE
PROJECT No.: 621715	SEQUENCE No.: 030
SHEET: 6 OF 10	

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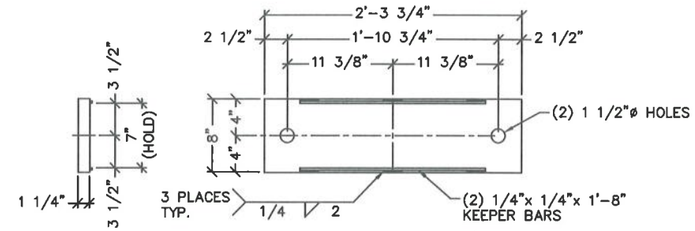
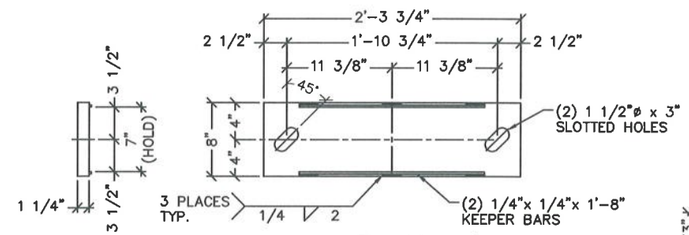
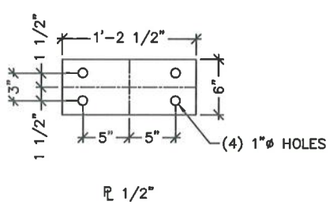


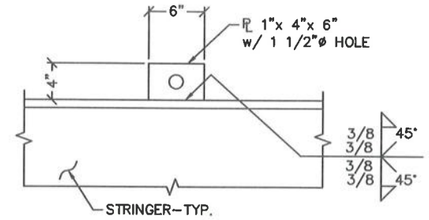
BEARING PLATE DETAIL (FIXED)
(SHIPS LOOSE)



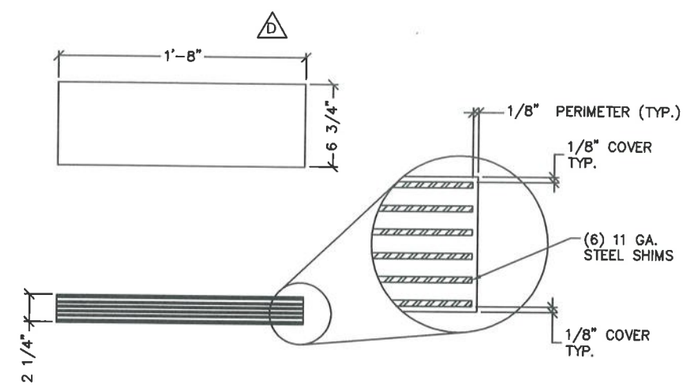
BEARING PLATE DETAIL (EXPANSION)
(SHIPS LOOSE)



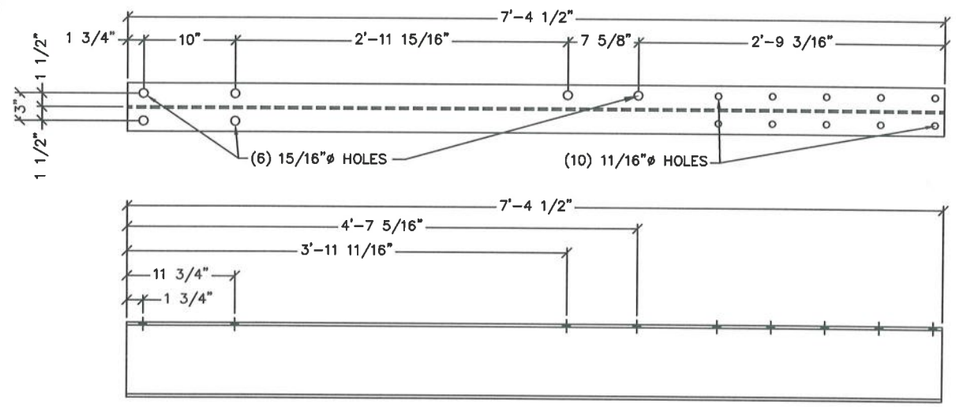
POST BLOCK PLATE DETAIL



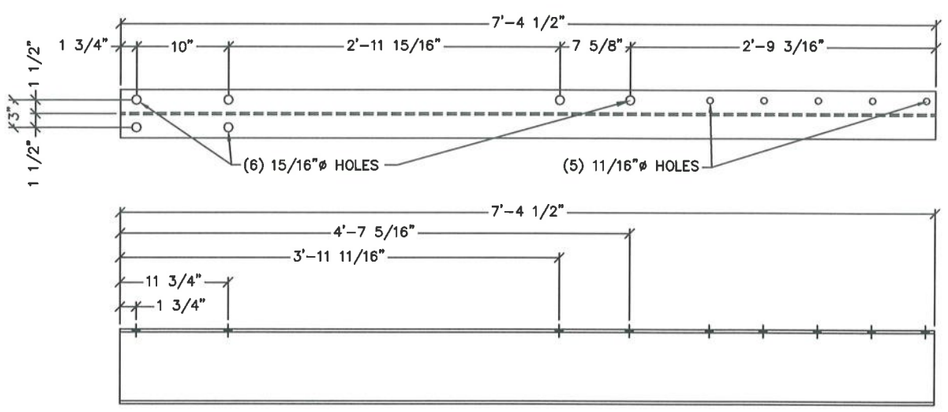
MAX. 24,000 # @ 45° LIFT ANGLE
LIFTING LUG DETAIL



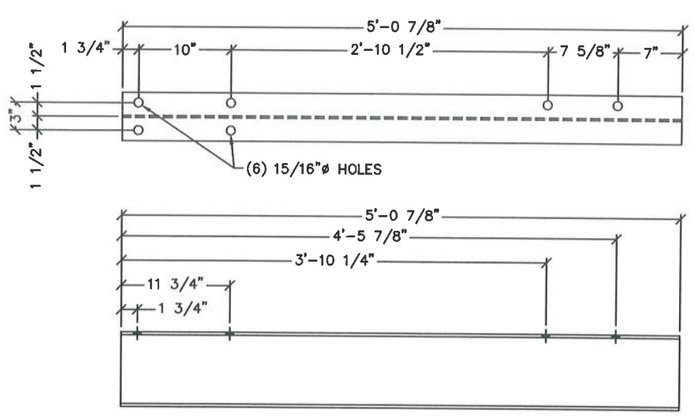
(GRADE 4, 60 DUROMETER)
LAYERED ELASTOMERIC PAD



W8x18
BRIDGE RAIL POST DETAIL
(SHIPS LOOSE)



W8x18
BRIDGE RAIL POST DETAIL
(SHIPS LOOSE)



W8x18
BRIDGE RAIL POST DETAIL
(SHIPS LOOSE)

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NATHAN EVANS
53643
PROFESSIONAL ENGINEER
5-25-21

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100'-0" x 30'-0"
MESA TOP DRIVE SOUTH BRIDGE
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FOUNTAIN, CO

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BIGR BRIDGE

DATE: 7/24/2020	
DESIGNED: NBE	DRAWN: RDH
CHECKED: NBE	APPROVED: NBE
PROJECT No.: 621715	SEQUENCE No.: 030
SHEET: 7 OF 10	

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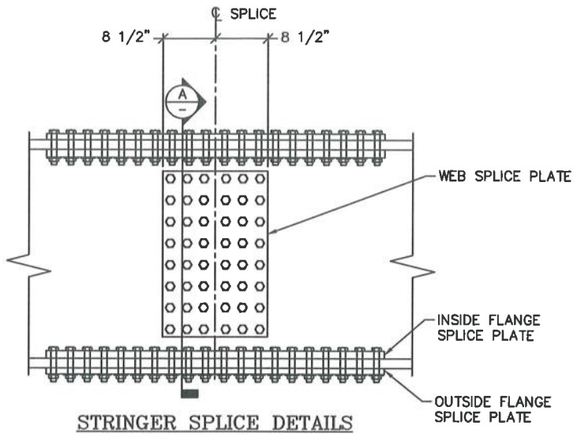
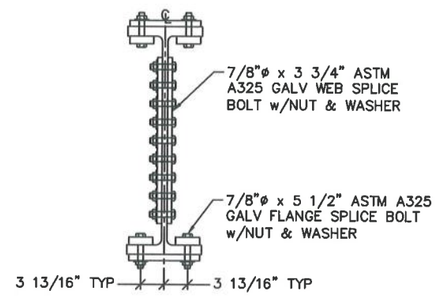
MEMBERS	QTY	THICKNESS	SIZE	HOLES	BOLTS w/NUT & WASHER	BOLT QTY
WEB SPLICE PLATE	10	3/4"	1'-5" x 2'-3"	15/16"	7/8"ø x 3 3/4" A325 GALV	240
INSIDE BTM FLANGE SPLICE PLATE	10	1 1/4"	3 7/8" x 4'-7"	15/16"	–	–
OUTSIDE BTM FLANGE SPLICE PLATE	5	1"	11 1/2" x 4'-7"	15/16"	7/8"ø x 5 1/2" A325 GALV	200
INSIDE TOP FLANGE SPLICE PLATE	10	1 1/4"	4 3/8" x 4'-7"	15/16"	–	–
OUTSIDE TOP FLANGE SPLICE PLATE	5	1"	1'-0" x 4'-7"	15/16"	7/8"ø x 5 1/2" A325 GALV	200



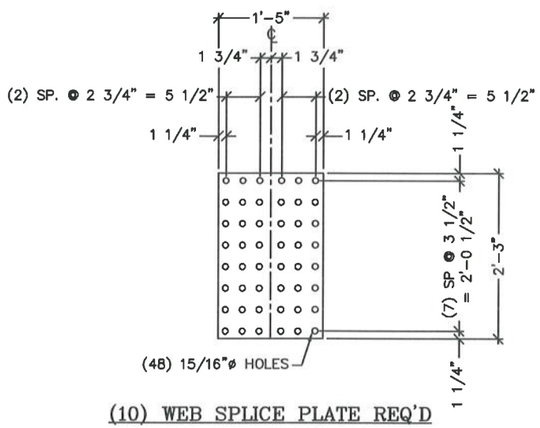
STRINGER SPLICE DETAILS

SHOP NOTE:
15/16"ø HOLES IN STRINGER FLANGE AND WEB

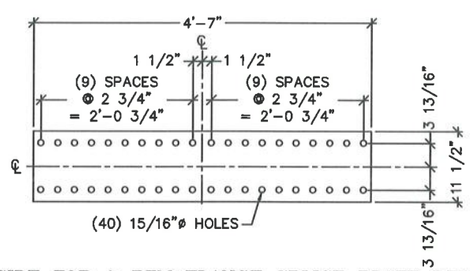


SECTION A

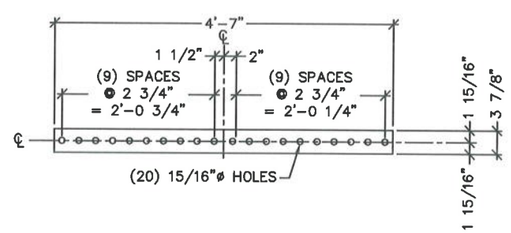
CONTRACTOR NOTE:
FIELD WELDING TO BE PERFORMED BY A WELDER CERTIFIED PER AWS D1.5 BRIDGE WELDING CODE.



(10) WEB SPLICE PLATE REQ'D



(5) OUTSIDE TOP & BTM FLANGE SPLICE PLATE REQ'D



(10) INSIDE TOP & BTM FLANGE SPLICE PLATE REQ'D

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53643
PROFESSIONAL ENGINEER
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BIGR BRIDGE

DATE: 7/24/2020	
DESIGNED: NBE	DRAWN: RDH
CHECKED: NBE	APPROVED: NBE
PROJECT No.: 621715	SEQUENCE No.: 030
SHEET: 8 OF 10	

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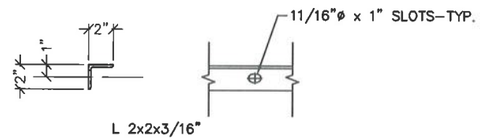
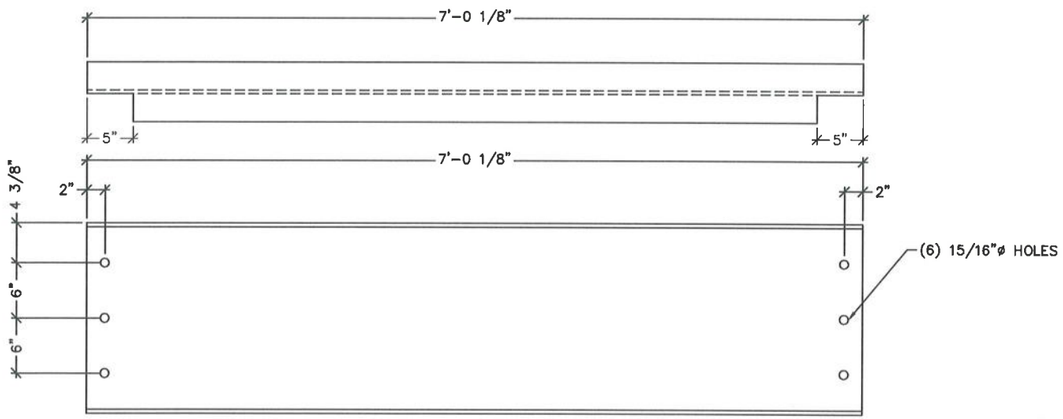
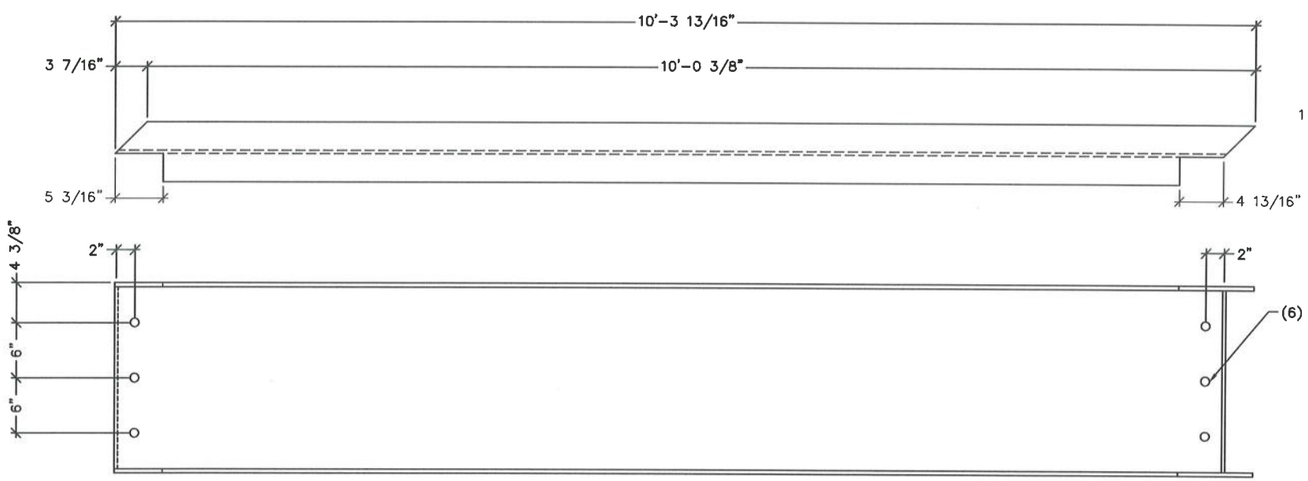


ANGLE SLOT DETAIL



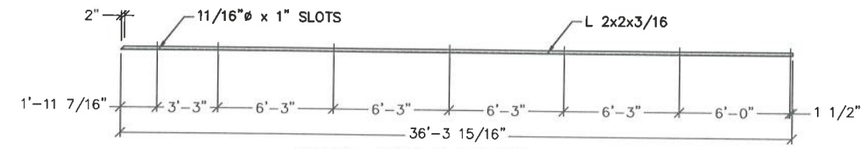
W 21x44

DIAPHRAGM DETAIL



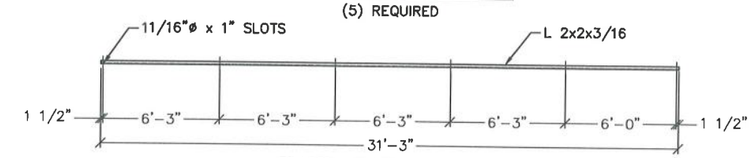
W 21x44

DIAPHRAGM DETAIL



HAND RAIL 1 DETAIL

(5) REQUIRED



HAND RAIL 2 DETAIL

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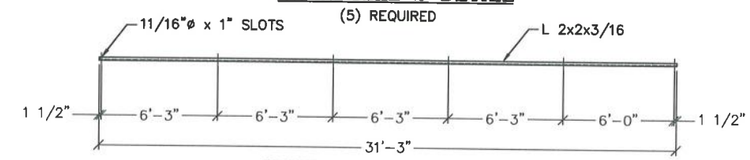

HAND RAIL 3 DETAIL

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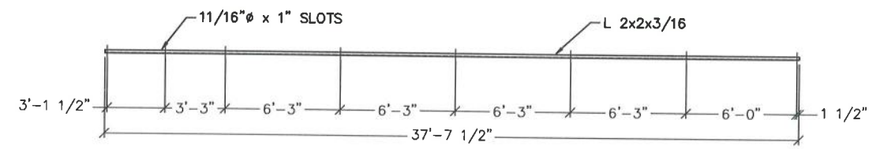

HAND RAIL 4 DETAIL

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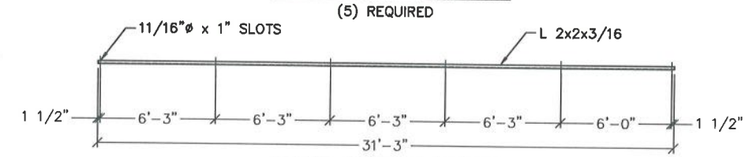
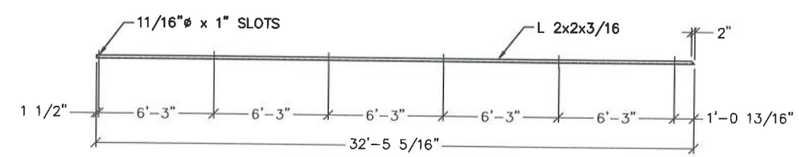


HAND RAIL 5 DETAIL

(5) REQUIRED



HAND RAIL 6 DETAIL

(5) REQUIRED

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NATHAN EVANS
53643
PROFESSIONAL ENGINEER
5-25-21

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100'-0" x 30'-0"
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BIG R BRIDGE

DATE: 7/24/2020	
DESIGNED: NBE	DRAWN: RDH
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PROJECT No.: 621715	SEQUENCE No.: 030
SHEET: 9 OF 10	

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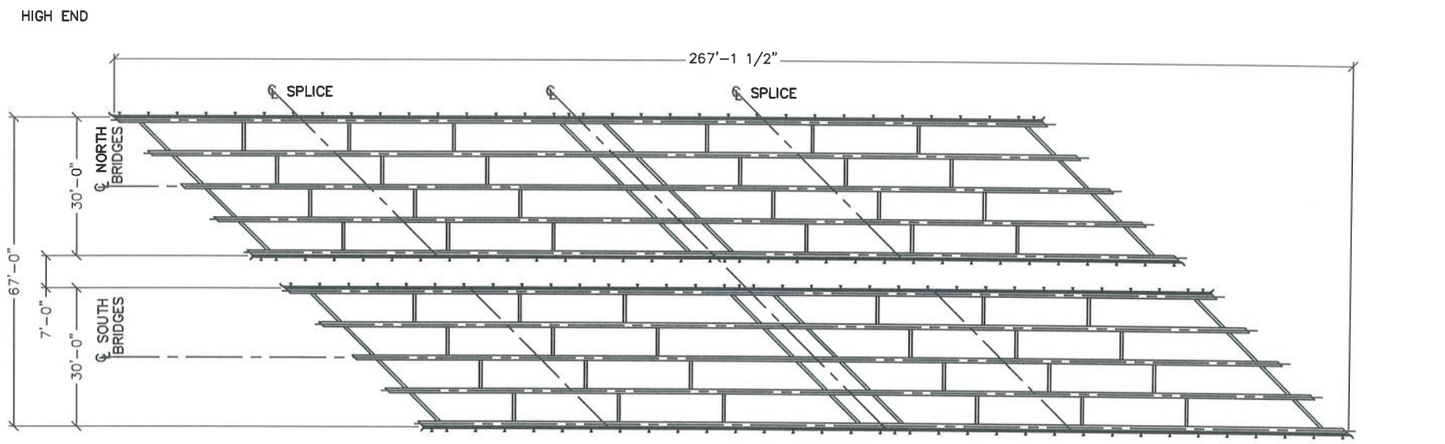
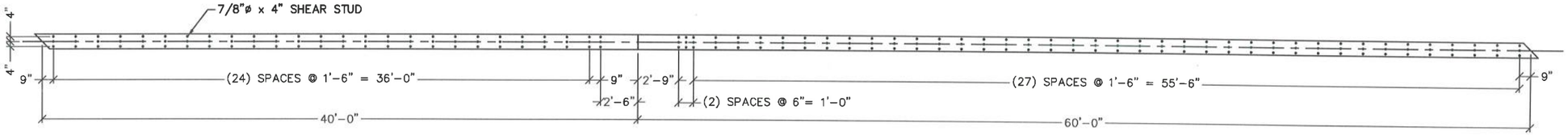
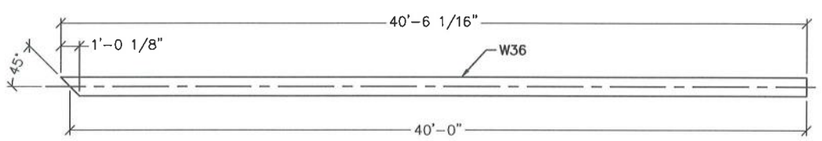


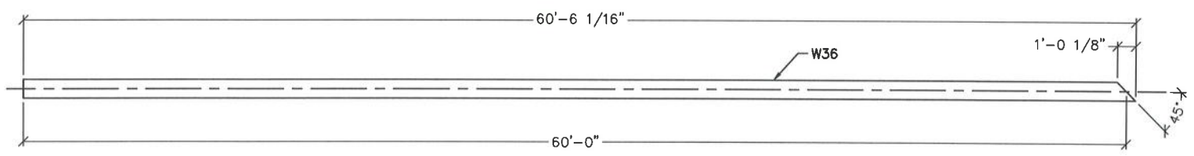
PROJECT LAYOUT



SHEAR STUD DETAIL



GIRDER DETAIL



GIRDER DETAIL

CONTECH
CONTRACT
DRAWING

COLORADO LICENSED
NATHAN EVANS
53643
PROFESSIONAL ENGINEER
5-25-21

AISC CERTIFIED FABRICATOR

This design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to adhere to these restrictions will result in Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech assumes no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY
E	5/25/2021	REVISED PER REVIEWER COMMENTS	TLF
D	5/13/2021	REVISED PER REVIEWER COMMENTS	TLF
C	4/5/2021	CUSTOMER COMMENTS	TLF
B	12/14/2020	CUSTOMER COMMENTS	RDH
A	9/25/2020	CUSTOMER COMMENTS	RDH

100'-0" x 30'-0"
MESA TOP DRIVE SOUTH BRIDGE
ELITE PROPERTIES of AMERICA, INC
FOUNTAIN, CO

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
800-338-2047 10950 Ci Ni Greeley, CO 80631 320-545-9126 320-545-3145 FAX
BIG R BRIDGE

DATE: 7/24/2020	
DESIGNED: NBE	DRAWN: RDH
CHECKED: NBE	APPROVED: NBE
PROJECT No.: 621715	SEQUENCE No.: 030
SHEET: 10 OF 10	

C:\AUTODESK VAULT WORKING\-2020\BEAM\621715\CAD\CONTRACT\621715-030 REV E.DWG 5/25/2021 8:21 AM

HYDRAULIC INFORMATION

Submitted by Classic Consulting on 7/12/2021 as well as included as B06 in the Bridge Substructure Plans

HYDRAULIC REPORT
FOR
FOREST LAKES FILING 6
MESA TOP BRIDGE
EL PASO COUNTY, COLORADO

January 2021
Revised June 2021

Prepared for:
FOREST LAKES RESIDENTIAL DEVELOPMENT, LLC
2138 FLYING HORSE CLUB DR.
COLORADO SPRINGS CO 80921
(719) 592-9333

Prepared by:
CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. CASCADE AVENUE, SUITE 200
COLORADO SPRINGS CO 80903
(719) 785-0790

Job no. 1175.60
PCD File # SF-20-027

HYDRAULIC REPORT FOR FOREST LAKES FILING 6 MESA TOP BRIDGE

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____

Kyle R Campbell, Colorado P.E. #29794 Date

DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: Forest Lakes Residential Development, LLC

By: _____

Title: _____

Address: 2138 Flying Horse Club Dr.

Colorado Springs, CO 80921

EL PASO COUNTY ONLY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____

Jennifer Irvine, P.E. Date

County Engineer / ECM Administrator

CLASSIC CONSULTING ENGINEERS & SURVEYORS

HYDRAULIC REPORT FOR FOREST LAKES FILING 6 MESA TOP BRIDGE

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APPENDICES

VICINITY MAP

SOILS MAP (S.C.S. SURVEY)

F.E.M.A. MAP

USACOE LETTER

FEMA LOMR

DRAINAGE MAP

BRIDGE HYDRAULIC SECTIONS

CHANNEL SECTIONS EXISTING CONDITIONS

CHANNEL SECTIONS PROPOSED CONDITIONS

BRIDGE HYDRAULICS

SCOUR ANALYSIS

BRIDGE PLANS

PURPOSE

This document is the Hydraulic Report for Forest Lakes Filing 6 Mesa Top Bridge. The purpose of this report is to provide drainage design paraments for the proposed bridge and define areas tributary to the proposed bridge.

PROJECT DESCRIPTION

The Forest Lakes Filing 6 is 79.168 acres of a phased master planned community located in northern El Paso County, Colorado. The proposed Filing 6 is located in the far westerly portion of the overall Forest Lakes Community, and is east of Filing 5 and includes a bridge crossing as a part of the continuation of Mesa Top Drive. The Filing 6 boundary is just north of the confluence of Beaver Creek, Hell Creek and North Beaver Creek. These watersheds are tributary to Monument Creek. The site is located within the Beaver Creek Drainage Basin.

A previous MDDP Amendment and Preliminary Drainage Report for Filings 5, 6, 7 has been approved by the County and defines existing and updated developed peak flow data for the 5-year and 100-year recurrence intervals within the Filings 5, 6, & 7 portions of the property. The previous report established the overall drainage design information and to identified the required storm drainage and flood control facilities within the Filings 5, 6, & 7 property. Final development of Filing 6 is consistent with this approved report with minor modification to the surrounding lot layout but no changes to the overall roadway design. The vicinity map for the Filings 5, 6, & 7 Amendment area is presented in the Appendix of this report.

As the limits of Filing 6 are outside of the existing drainage corridors, other than the bridge crossing, there is no land development grading proposed within the existing wetlands, mouse habitat, and/or 100-year floodplain limits, other than to construct and the mid-span supports for the bridge structure. The drainage maps in the Appendix of this report show the existing wetland limits, Preble's Jumping Mouse habitat limits, and effective FEMA floodplain in the area of the bridge. An existing historic ranch access road is present in the area of the bridge.

This road continues to be used for construction access to the west portion of the community. The proposed pier width is designed as 36" diameter mid-bridge column supports.

PREVIOUS REPORTS

The latest and most applicable previously approved drainage study is the following:

1. "Master Development Drainage Plan Amendment and Preliminary Drainage Report for Forest Lakes (Filing 5, 6, 7)," by Classic Consulting Engineers & Surveyors LLC, approved April 1, 2019.
2. "Final Drainage Report for Forest Lakes Filing No. 5," by Classic Consulting Engineers & Surveyors, LLC, approved June 9, 2020.

SOILS AND GEOLOGY

The soils within the Forest Lakes Filing 6 and tributary area are Hydrologic Soil Group B, mostly Jarre-Tecolote complex and Peyton-Pring complex (See Appendix for Soil Map).

DRAINAGE CRITERIA

Calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. El Paso County requires freeboard of 2' form the 100-year water surface to the bottom of the bridge deck structure, which is obtained with this design.

HEC-RAS 5.07 was utilized to perform the existing and proposed conditions modeling. Sections used to model the proposed conditions (in relationship to the bridge) were also used in the existing condition modeling to compare identical sections.

FLOODPLAIN STATEMENT

The Mesa Top Bridge is located within a floodplain as determined by the Flood Insurance Rate Map (F.I.R.M.) Map Number 08041 C0267G, effective date, December 7, 2018 (See Appendix for overlay exhibit). A Floodplain Development Permit will be obtained prior to construction of the bridge.

This floodplain was modeled in the June 23, 2004 LOMR (see Appendix), and reflects a 100-year flow rate of 1,932 cfs for the 3.5 square mile North Beaver Creek Tributary area.

EXISTING DRAINAGE CONDITIONS

As defined in the MDDP Amendment and Preliminary Drainage Report, the proposed bridge crossing is located in the North Beaver Creek Drainage corridor.

(Q_5 = 1,047 cfs and Q_{100} = 3,123 cfs) is the overall runoff within North Beaver Creek channel as defined by the "Forest Lakes Master Development Drainage Plan El Paso County Colorado," by Kiowa Engineering Corporation, last revised April 11, 2002 (MDDP). This flow was used for air modeling and analysis. The 3.5 square mile northerly and western tributary North Beaver Creek Basin approximately bi-sects the Filing 6 boundary and drains from the north to the south-east into the larger Beaver Creek. Within North Beaver Creek are FEMA Effective 100-yr floodplain limits (Zone AE with no regulatory floodway) and US Corps of Engineers Jurisdictional Wetlands. These limits are shown and notated on the Drainage Maps. While the 2004 FEMA flows of Q_{100} = 1,932 cfs are less than the 2002 MDDP flows of Q_{100} = 3,123 cfs, the MDDP flows were used for the modeling effort in order to be conservative and match existing County Drainage Records.

The proposed bridge has been positioned in a location to ensure that the abutments are sitting outside of the limits of the existing 100-year floodplain. This was done to eliminate any FEMA processing and to maintain the drainage corridor topography and vegetation. Provided in the appendix, in the Hydraulic Calculations Section are the analysis that depicts both the Existing Conditions Profile and Proposed Conditions Profiles. A 0.3 contraction coefficient was used in modeling for the left overbank as reflected in the calculations in the appendix.

As a part of the bridge construction, impacts to existing non-wetland vegetation will take place, but no 404 Permitting is required as coordinated with USACOE letter in Appendix.

Grain sizes of D50 and D90 were used based upon results of site specific geotechnical works in the area and coordination with the geotechnical consultant.

A freeboard of 2' minimum from 100-year water surface elevation to bottom of the bridge deck was maintained. As reflected in the Appendix, the provided freeboard is in excess of 6'. Limits of rip rap are

reflected as 1' above the 100 W.S.E. for the top, and either the toe of existing slope (where waters of the U.S. are present) or buried where noted on the exhibits in the Appendix. All Rip-Rap installation to be conducted in accordance with El Paso County Engineering Criteria Manual Specifications. Rip Rap sizing of D50 = 24" (VH) is proposed for this corridor and will be placed on 10" inches of granular bedding

SUMMARY

Based upon the finding of this analysis, we do not see any adverse impacts that the bridge introduces into the drainage corridor. While an increase in water surface elevation is identified per the modeling at section 700, this is based on upon the aforementioned MDDP flows and not the FEMA recognized base flood flows which are much less.

PREPARED BY:

Kyle R. Campbell
Division Manager

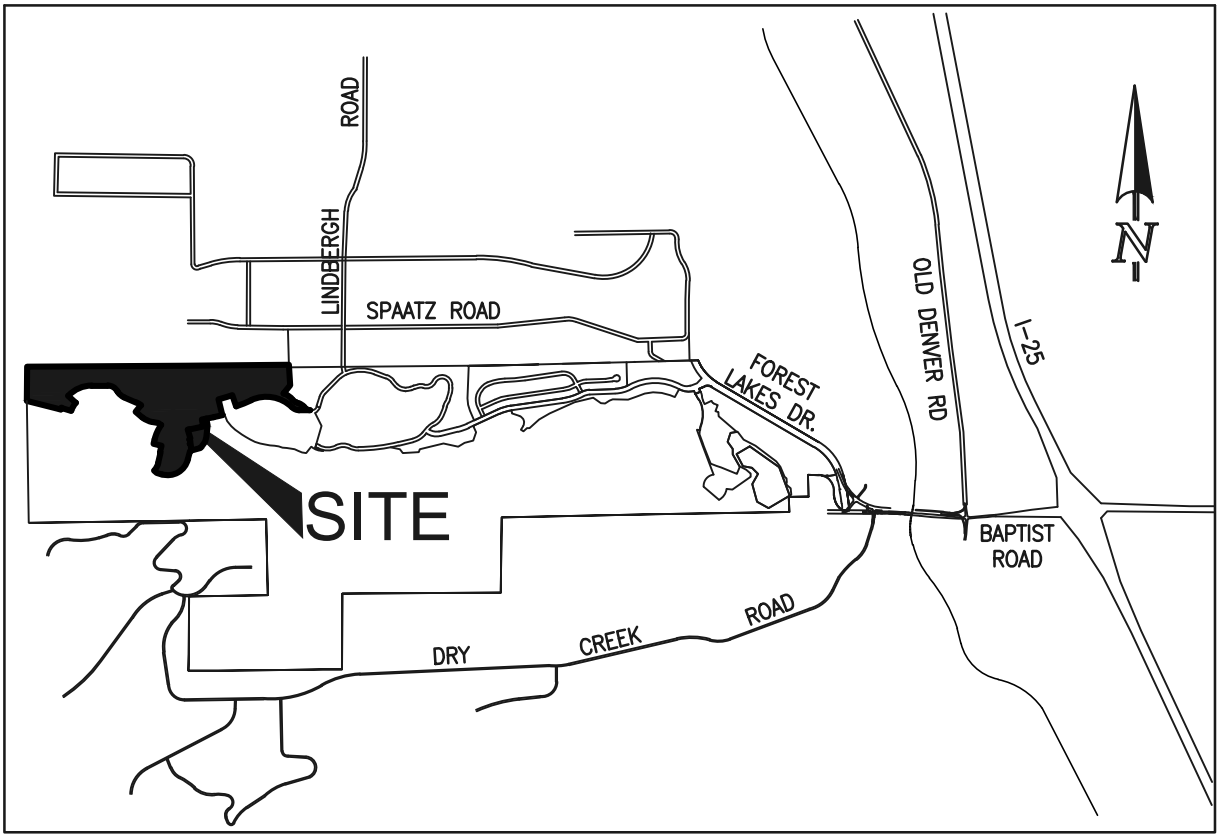
db/117560/Hydraulic Report Fil 6 Mesa Top Bridge.doc

REFERENCES

1. City of Colorado Springs and El Paso County Drainage Criteria Manual Volume 1, May 2014.
2. Drainage Criteria Manual (Volume 3) latest revision April 2008, Urban Drainage and Flood Criteria District.
3. "Forest Lakes Master Development Drainage Plan," by Kiowa Engineering Corporation, revised April 11, 2002.
4. "Preliminary and Final Drainage Report Forest Lakes Subdivision Filing No. 1," by Kiowa Engineering Corporation, filed September 8, 2004.
5. "Drainage Report Amendment for Preliminary and Final Drainage Report Forest Lakes Subdivision Filing No. 1," by Classic Consulting Engineers & Surveyors, LLC, dated August 2015.
6. "Debris Flow/Mudflow Analysis Forest Lakes Subdivision (Phase 2) Lindbergh Road and W. Baptist Road El Paso County, Colorado," by CTL Thompson Inc., dated August 6, 2018.
7. "Master Development Drainage Plan Amendment and Preliminary Drainage Report for Forest Lakes (Filing 5, 6, 7)," by Classic Consulting Engineers & Surveyors LLC, approved April 1, 2019.
8. "Final Drainage Report for Forest Lakes Filing 5," by Classic Consulting Engineers & Surveyors, LLC, approved June 9, 2020.

APPENDIX

VICINITY MAP



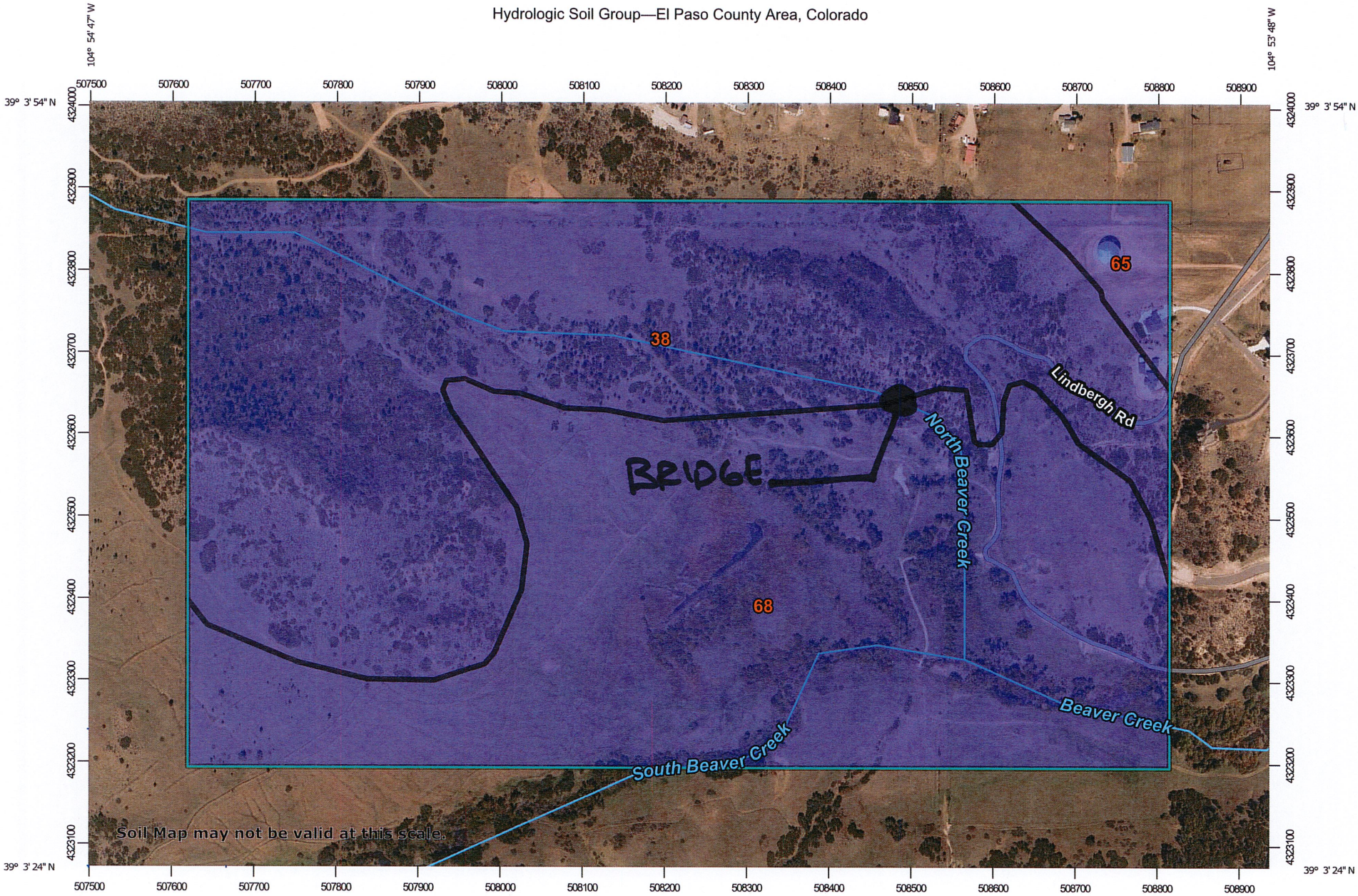
VICINITY MAP

NOT TO SCALE

N:\117560\DRAWINGS\CONSTRUCTION\GRADING-EROSION\01-117560-TITLE.dwg, 10/14/2020 10:30:39 AM, 1:1

SOILS MAP (S.C.S. SURVEY)

Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:6,570 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
38	Jarre-Tecolote complex, 8 to 65 percent slopes	B	101.7	49.6%
65	Perrypark gravelly sandy loam, 3 to 9 percent slopes	B	5.0	2.4%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	98.5	48.0%
Totals for Area of Interest			**205.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

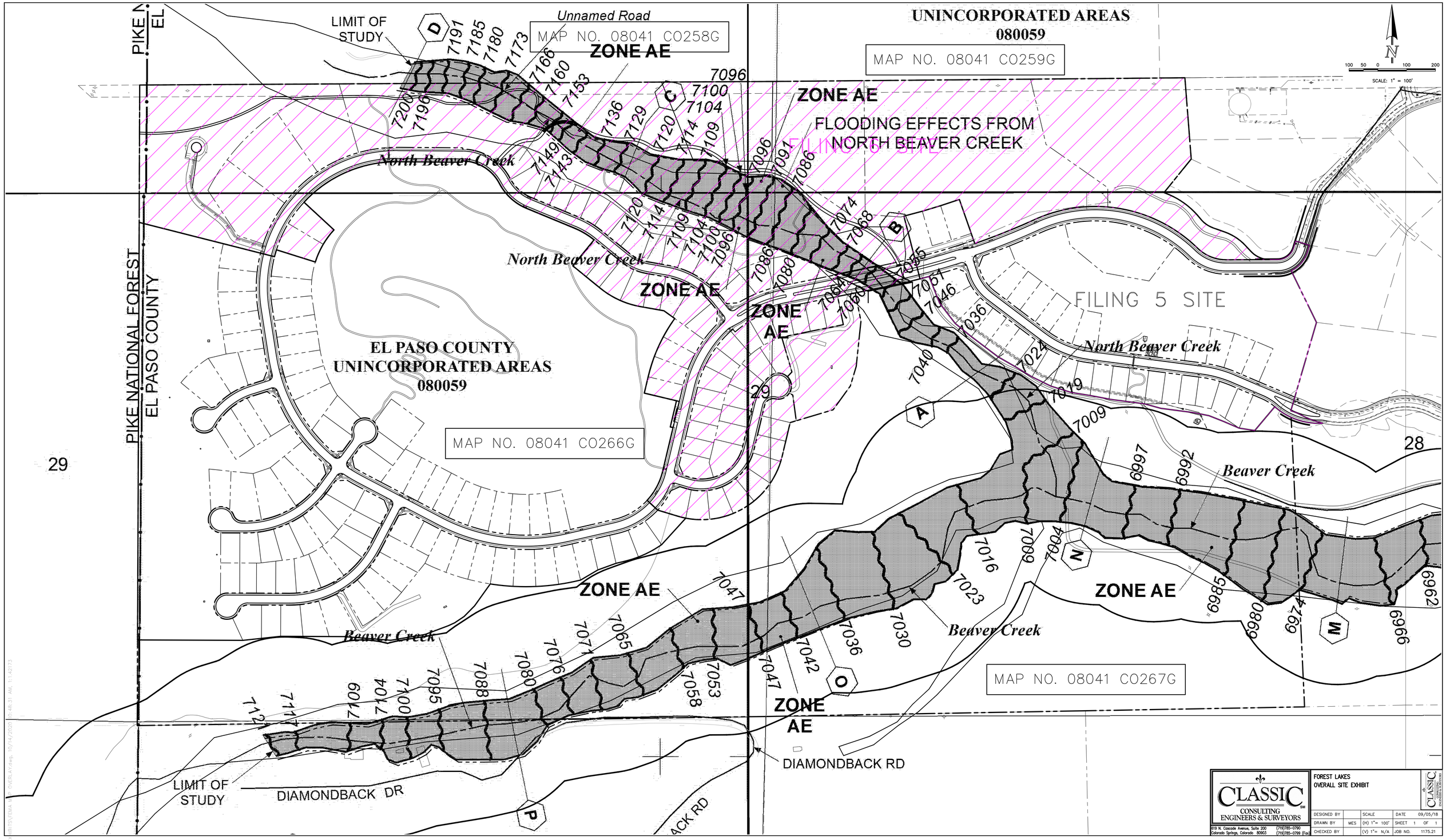
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

F.E.M.A. MAP



CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FOREST LAKES
OVERALL SITE EXHIBIT

DESIGNED BY		SCALE		DATE	09/05/18
DRAWN BY	MES	(H) 1"= 100'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	1175.21

USACOE
LETTER

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT
201 WEST 8TH STREET, SUITE 350
PUEBLO, COLORADO 81003

November 24, 2020

Regulatory Division

SUBJECT: No Permit Required – Action No. SPA-2020-00242-RDS, Forest Lakes Mesa Top Drive Bridge Project, in Monument, El Paso County, Colorado

James Boulton
Classic Communities
2138 Flying Horse Club Drive
Colorado Springs, CO. 80921

Mr. Boulton:

This letter responds to your September 10, letter request for a No Permit Required determination of Department of the Army permit requirements for the proposed Forest Lakes Mesa Top Drive Bridge Project located at approximately latitude 39.0614, longitude -104.9044, in Monument, El Paso County, Colorado.

The work, as described in your application will consist of construction of a planned and designed bridge minimizing and avoiding discharge of fill into waters of the U.S. including wetlands in North Beaver Creek.

We have assigned Action No. SPA-2020-00242-RDS to this project. Please reference this number in all future correspondence concerning the project.

Based on the on my site visit and information provided, we have determined that a Department of the Army permit is not required since the project as planned and designed would not result in the discharge of dredged/fill material into waters of the United States. However, please be advised that there are potential waters of the U.S. located in close proximity of the project site and it is incumbent upon you to remain informed of any changes in the U.S. Army Corps of Engineers (Corps) Regulatory Program regulations and policy as they relate to your project. If your plans change such that waters of the U.S. could be impacted by the proposed project, please contact our office for a reevaluation of permit requirements.

This decision is based on a preliminary jurisdictional determination (JD) that there may be waters of the United States on the project site. Preliminary JDs are advisory in nature and may not be appealed. An approved JD is an official Corps determination that "waters of the U.S." and/or "navigable waters of the U.S." are either present or absent on a particular site. An approved JD precisely identifies the limits of those waters on the project site determined to be jurisdictional under the CWA or RHA. If you

wish, you may request that the Corps reevaluate this case and issue an approved JD. If you request an approved JD, you may not begin work until the approved JD, which may require coordination with the Environmental Protection Agency, is completed. Please contact me if you wish to request an approved JD for this case.

If you have any questions concerning our regulatory program, please contact me at (719) 600-8641 or by e-mail at Joseph.A.Martinez@usace.army.mil.

At your convenience, please complete a Customer Service Survey on-line available at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Sincerely,

Tony Martinez, R.E.M.
Regulatory Program Manager
Southern Colorado Regulatory Branch

FEMA LOMR

CLASSIC℠
CONSULTING
ENGINEERS & SURVEYORS

Federal Emergency Management Agency

Washington, D.C. 20472

MAR 0 1 2004

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903-2208

IN REPLY REFER TO:
Case No.: 03-08-0449P
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of This Revision: JUN 2 3 2004

Dear Mr. Brown:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

For: Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: Mr. Kevin Stilson, P.E., CFM
Regional Floodplain Administrator
Pikes Peak Regional Building Department

[redacted] P.E.
Principal
Kiowa Engineering Corporation

 | Issue Date: MAR 01 2004 | Effective Date: JUN 23 2004 | Case No.: 03-08-0449P | LOMR-APP

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas) COMMUNITY NO.: 080059	NO PROJECT	BASE MAP CHANGES HYDROLOGIC ANALYSIS HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
IDENTIFIER	Beaver Creek Letter of Map Revision	APPROXIMATE LATITUDE & LONGITUDE: 39.057, -104.875 SOURCE: USGS QUADRANGLE DATUM: NAD 83	
FLOODING SOURCE(S) & REVISED REACH(ES)	Beaver Creek – from the confluence with Monument Creek to approximately 12,000 feet upstream of Bristlecone Lake Dam North Beaver Creek – from the confluence with Beaver Creek to approximately 3,400 feet upstream Pinon Lake Tributary – from the confluence with Beaver Creek to approximately 850 feet upstream of Long Valley Drive		

SUMMARY OF REVISIONS

Effective Flooding:	Zone A	No BFEs*
Revised Flooding:	Zone AE	BFEs
Increases:	YES	YES
Decreases:	YES	NONE

* BFEs – Base Flood Elevations

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 08041C0260 F Date: March 17, 1997 TYPE: FIRM NO.: 08041C0270 F Date: March 17, 1997 TYPE: FIRM NO.: 08041C0286 F Date: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILES: 351P through 358P SUMMARY OF DISCHARGES TABLE

* FIRM – Flood Insurance Rate Map; ** FBFM – Flood Boundary and Floodway Map; *** FHBM – Flood Hazard Boundary Map

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

100803 01.DA03080449 102-IAC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

100803 01.DA03080449 102-IAC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Steve L. Olsen
Director, Federal Insurance and Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panels and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

This information will be published in the *Federal Register* and your local newspaper as detailed below.

LOCAL NEWSPAPER Name: *El Paso County News*
Dates: 03/17/2004 03/24/2004

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Beaver Creek	Approximately 120 feet upstream of confluence with Monument Creek	None	6,736	08041C0286 F
	Approximately 12,000 feet upstream of Bristlecone Lake Dam	None	7,116	08041C0270 F
North Beaver Creek	Approximately 40 feet upstream of confluence with Beaver Creek	None	7,004	08041C0270 F
	Approximately 3,400 feet upstream of confluence with Beaver Creek	None	7,198	08041C0260 F
Pinon Lake Tributary	Approximately 100 feet upstream of confluence with Beaver Creek	None	6,818	08041C0286 F
	Approximately 850 feet upstream of Long Valley Drive	None	6,890	08041C0286 F

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

100803 01.DA03080449 102-IAC

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate new hydrologic, hydraulic, and topographic data along Beaver Creek from the confluence with Monument Creek to approximately 12,000 feet upstream of Bristlecone Lake Dam; along North Beaver Creek from the confluence with Beaver Creek to approximately 3,400 feet upstream; and along Pinon Lake Tributary from the confluence with Beaver Creek to approximately 850 feet upstream of Long Valley Drive. This has resulted in increases and decreases in SFHA width and establishment of BFEs for Beaver Creek, North Beaver Creek, and Pinon Lake Tributary. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Beaver Creek:		
Approximately 120 feet upstream of confluence with Monument Creek	None	6,736
Approximately 12,000 feet upstream of Bristlecone Lake Dam	None	7,116
North Beaver Creek:		
Approximately 40 feet upstream of confluence with Beaver Creek	None	7,004
Approximately 3,400 feet upstream of confluence with Beaver Creek	None	7,198
Pinon Lake Tributary:		
Approximately 100 feet upstream of confluence with Beaver Creek	None	6,818
Approximately 850 feet upstream of Long Valley Drive	None	6,890

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These

modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903-2208

APPROXIMATE SCALE IN FEET

1,000 500 0 1,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 260 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0260	F
MONUMENT, TOWN OF	080064	0260	F
PALMER LAKE, TOWN OF	080065	0260	F

REVISED TO LOMR

MAP NUMBER
08041C0260 F

JUN 23 2004

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

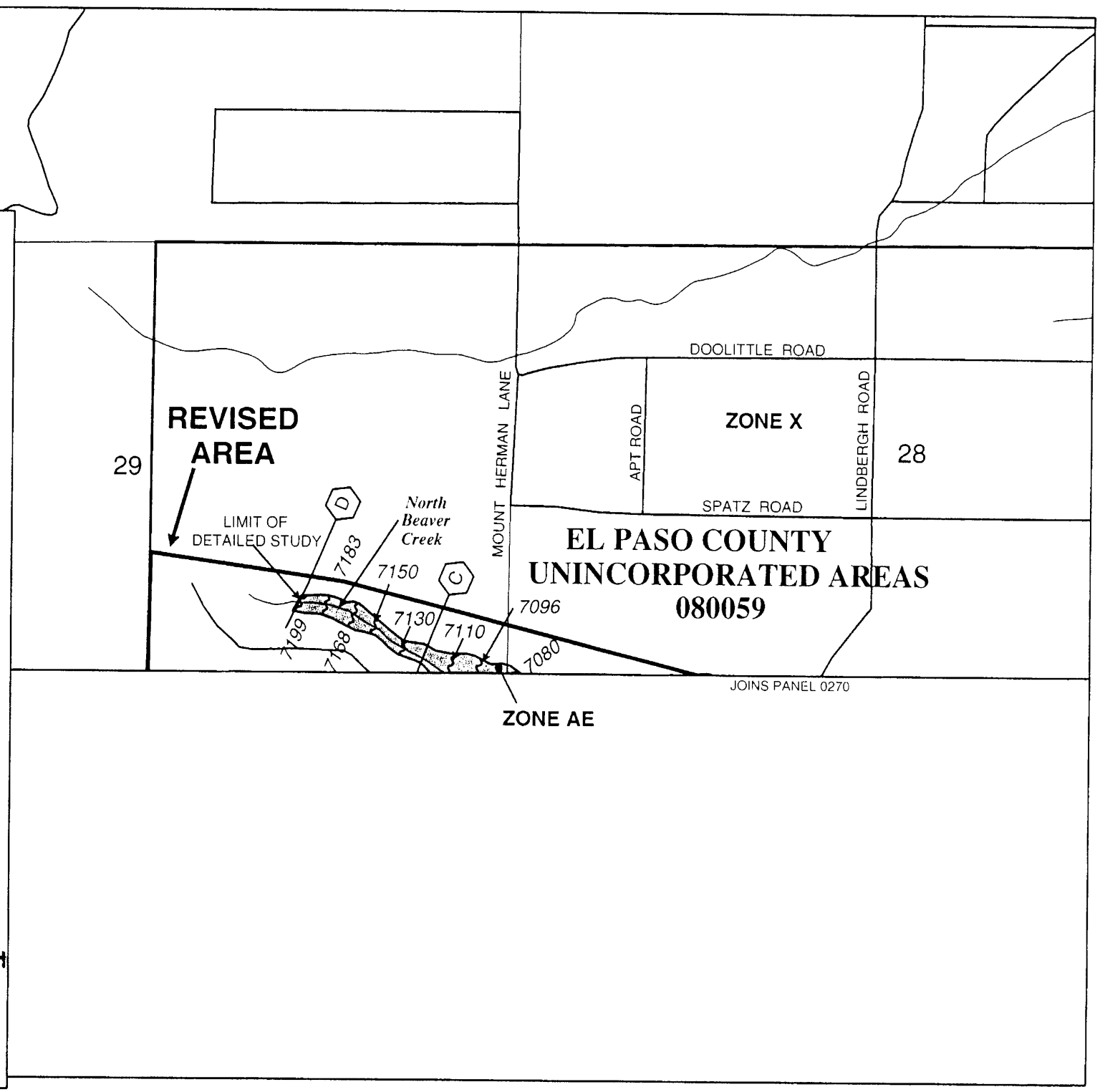
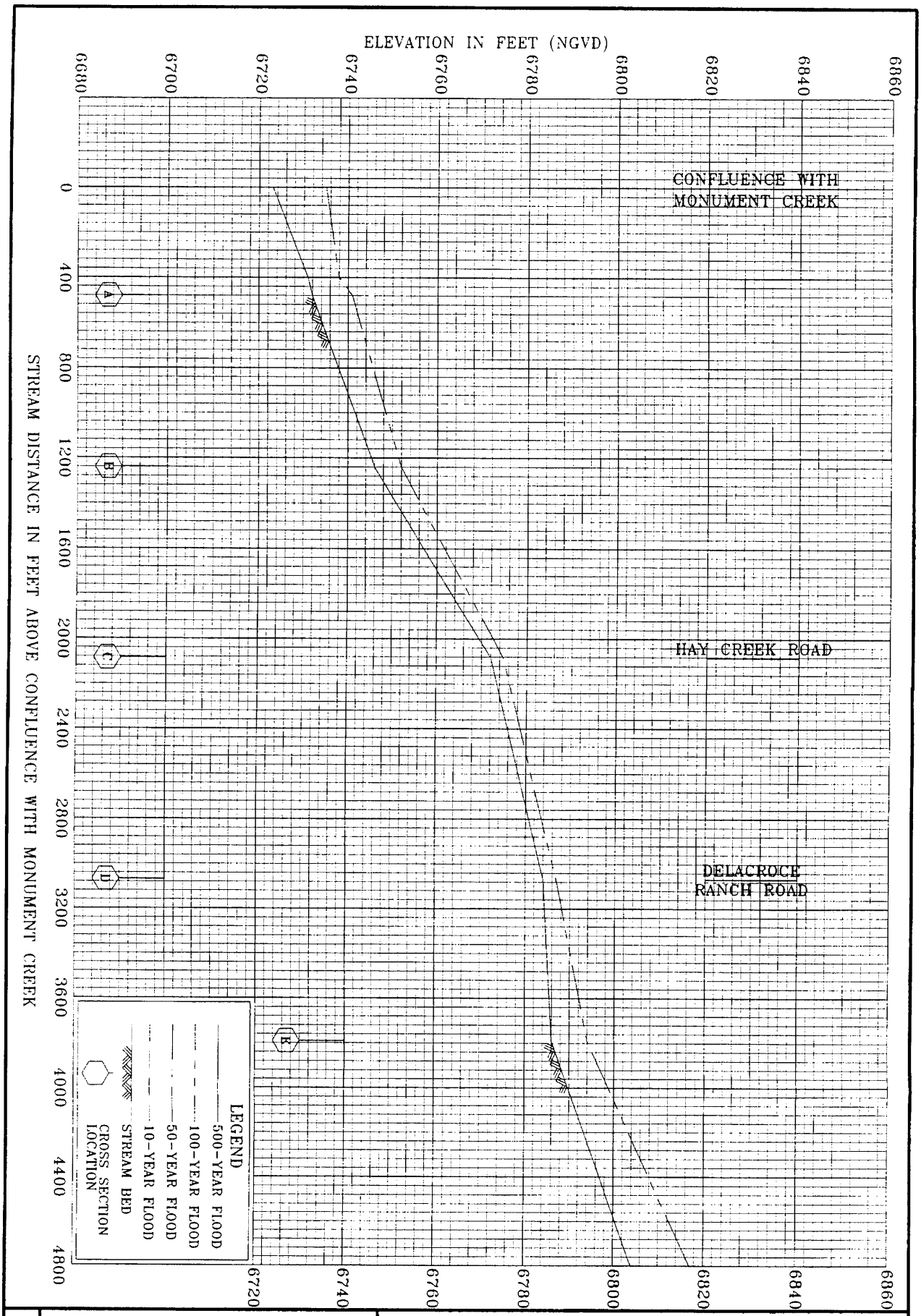


Table3. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Beaver Creek					
At Inlet to Bristlecone Lake	22.0	__[1]	__[1]	8,624	__[1]
At Confluence With Monument Creek	26.8	__[1]	__[1]	6,992	__[1]
North Beaver Creek					
At Confluence With Beaver Creek	3.5	__[1]	__[1]	1,932	__[1]
Pinon Lake Tributary					
At Confluence With Beaver Creek	0.41	__[1]	__[1]	140	__[1]

1Data Not Available

TO
LOMR
JUN 23 2004



351P

FEDERAL EMERGENCY MANAGEMENT AGENCY

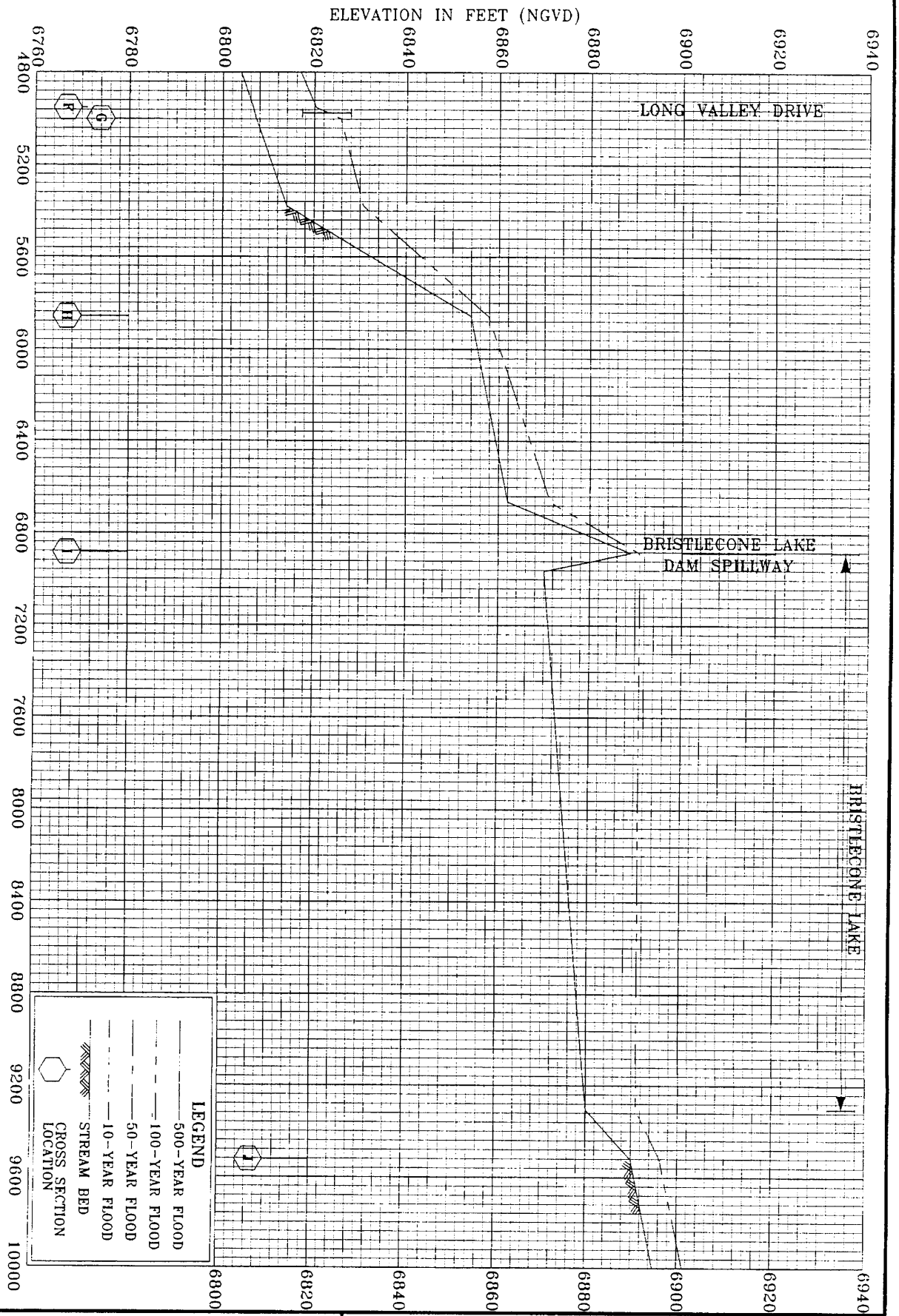
EL PASO COUNTY, CO

(UNINCORPORATED AREAS)

FLOOD PROFILES

BEAVER CREEK

REVISED TO REFLECT LOMR DATED JUN 23 2004



352P

FEDERAL EMERGENCY MANAGEMENT AGENCY

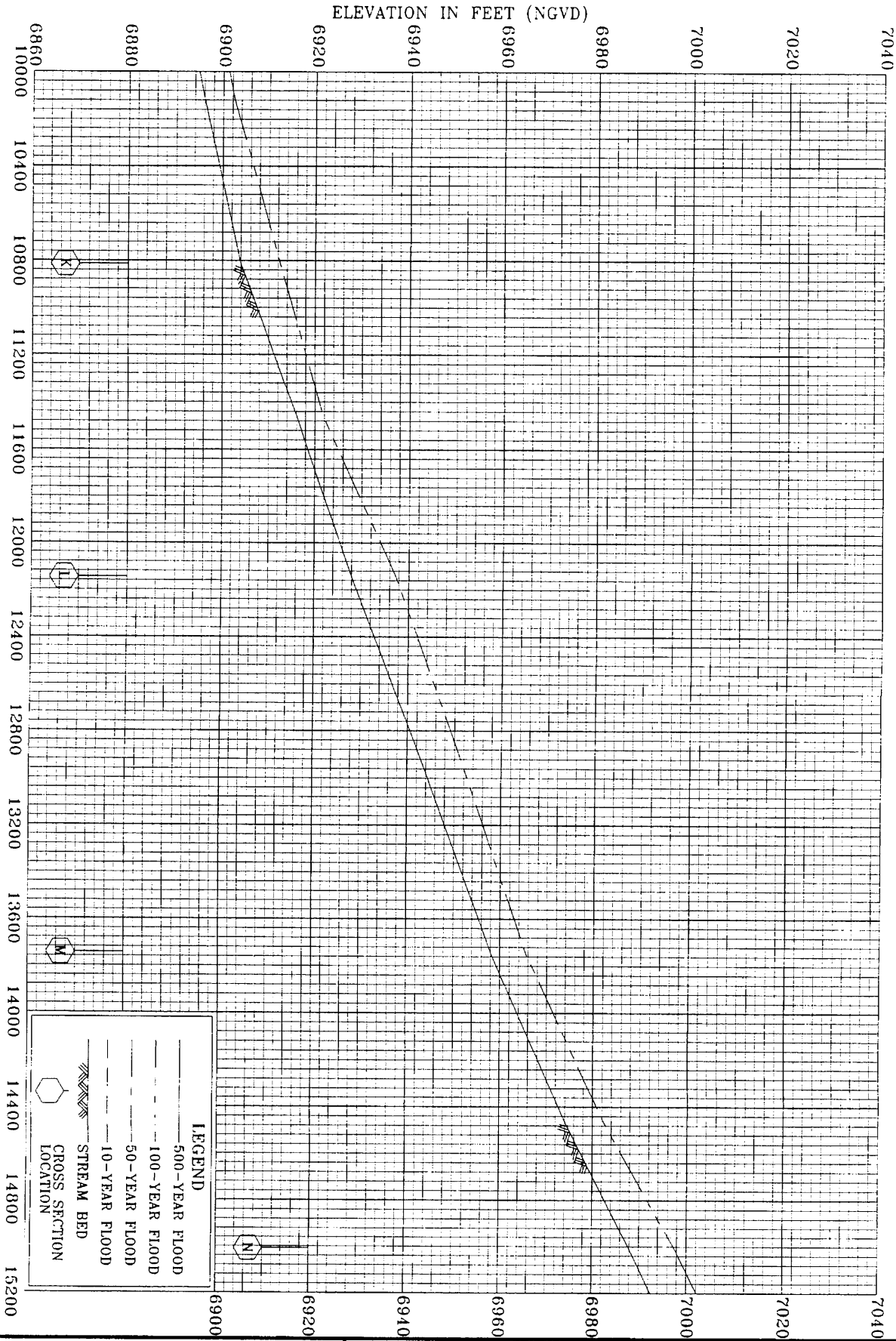
EL PASO COUNTY, CO

(UNINCORPORATED AREAS)

FLOOD PROFILES

BEAVER CREEK

REVISED TO REFLECT LOMR DATED JUN 23 2004



353P

FEDERAL EMERGENCY MANAGEMENT AGENCY

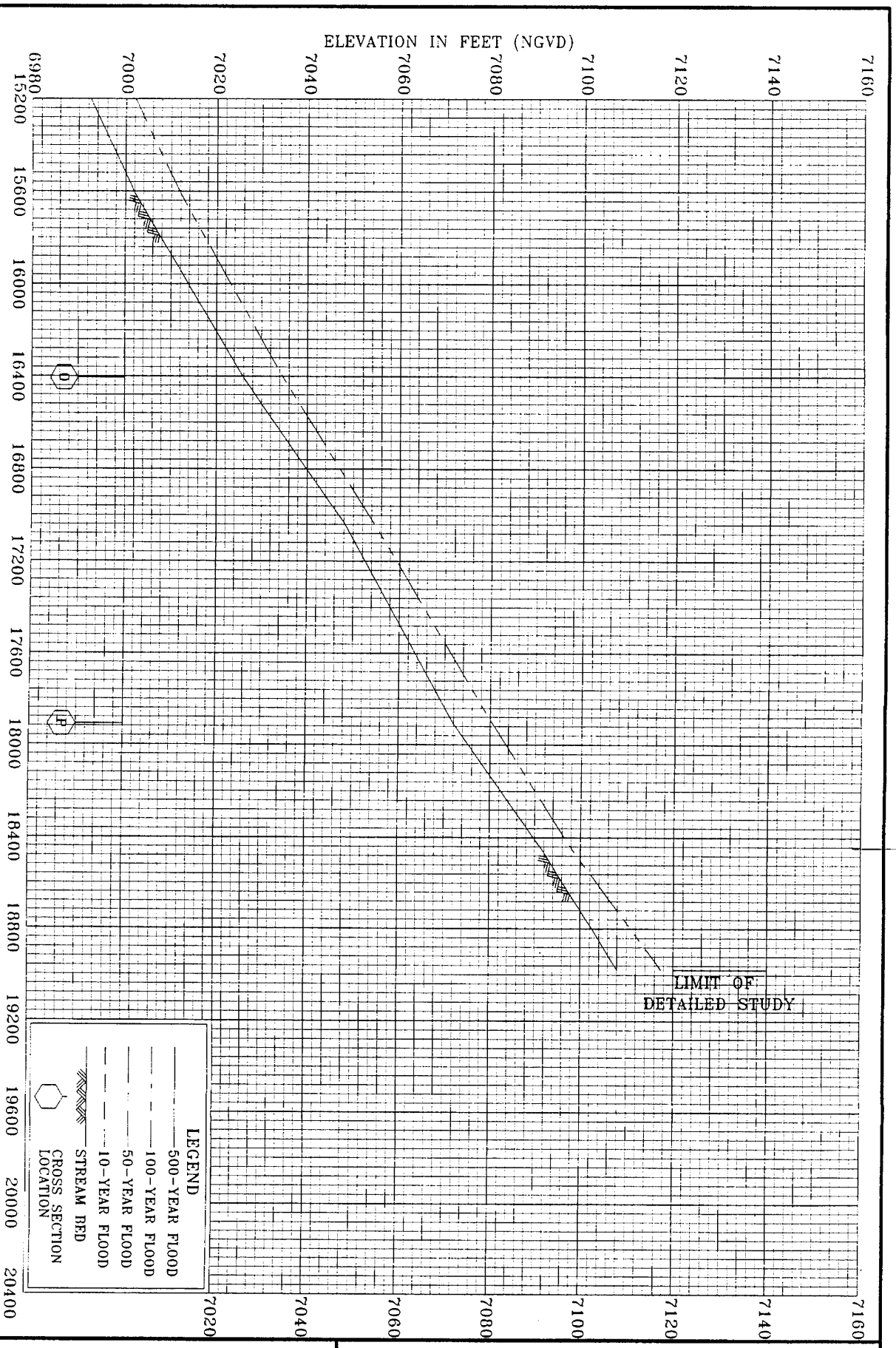
EL PASO COUNTY, CO

(UNINCORPORATED AREAS)

FLOOD PROFILES

BEAVER CREEK

REVISED TO REFLECT LOMR DATED JUN 23 2004



354P

FEDERAL EMERGENCY MANAGEMENT AGENCY

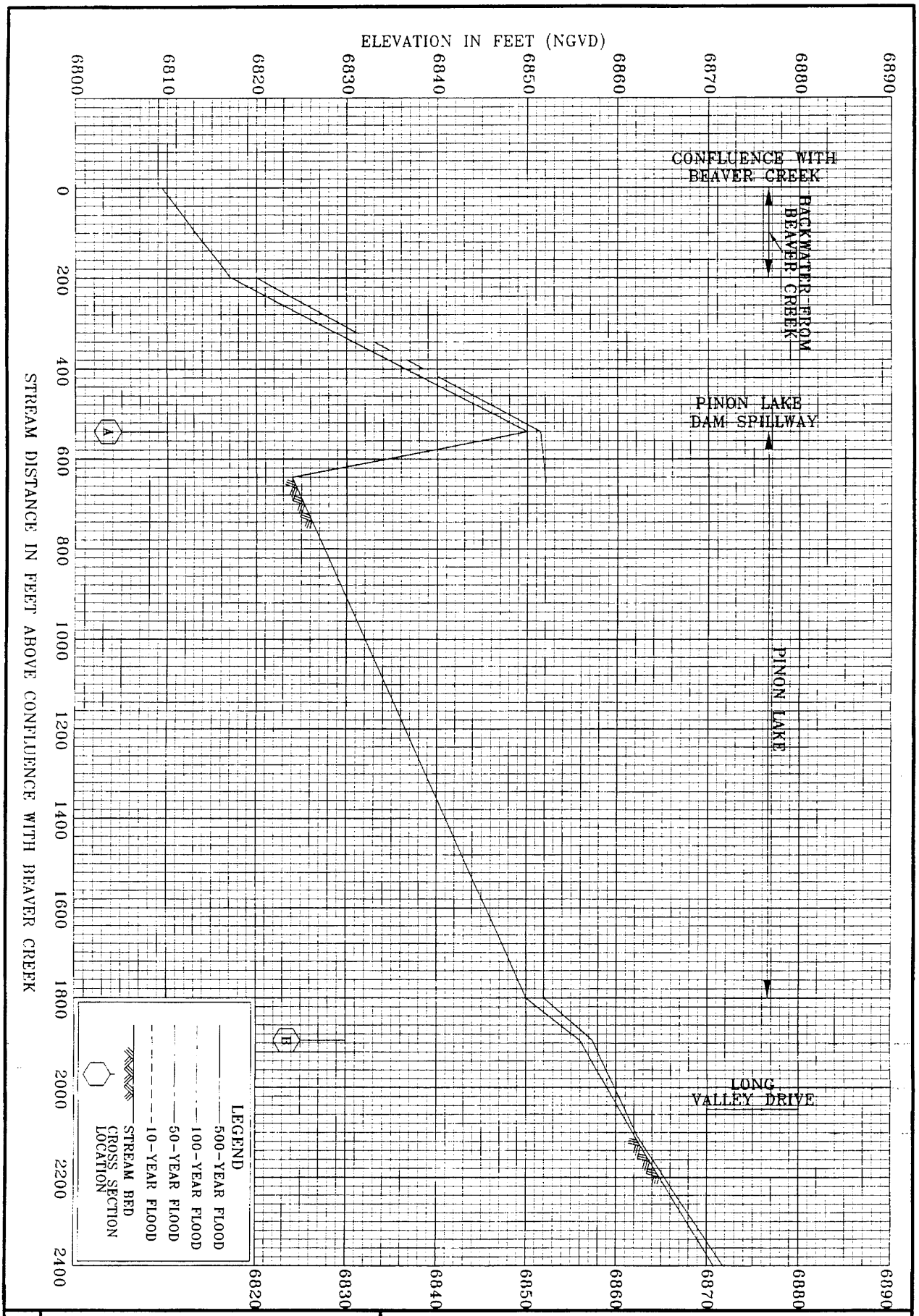
EL PASO COUNTY, CO

(UNINCORPORATED AREAS)

FLOOD PROFILES

BEAVER CREEK

REVISED TO REFLECT LOMR DATED JUN 23 2004



355P

FEDERAL EMERGENCY MANAGEMENT AGENCY

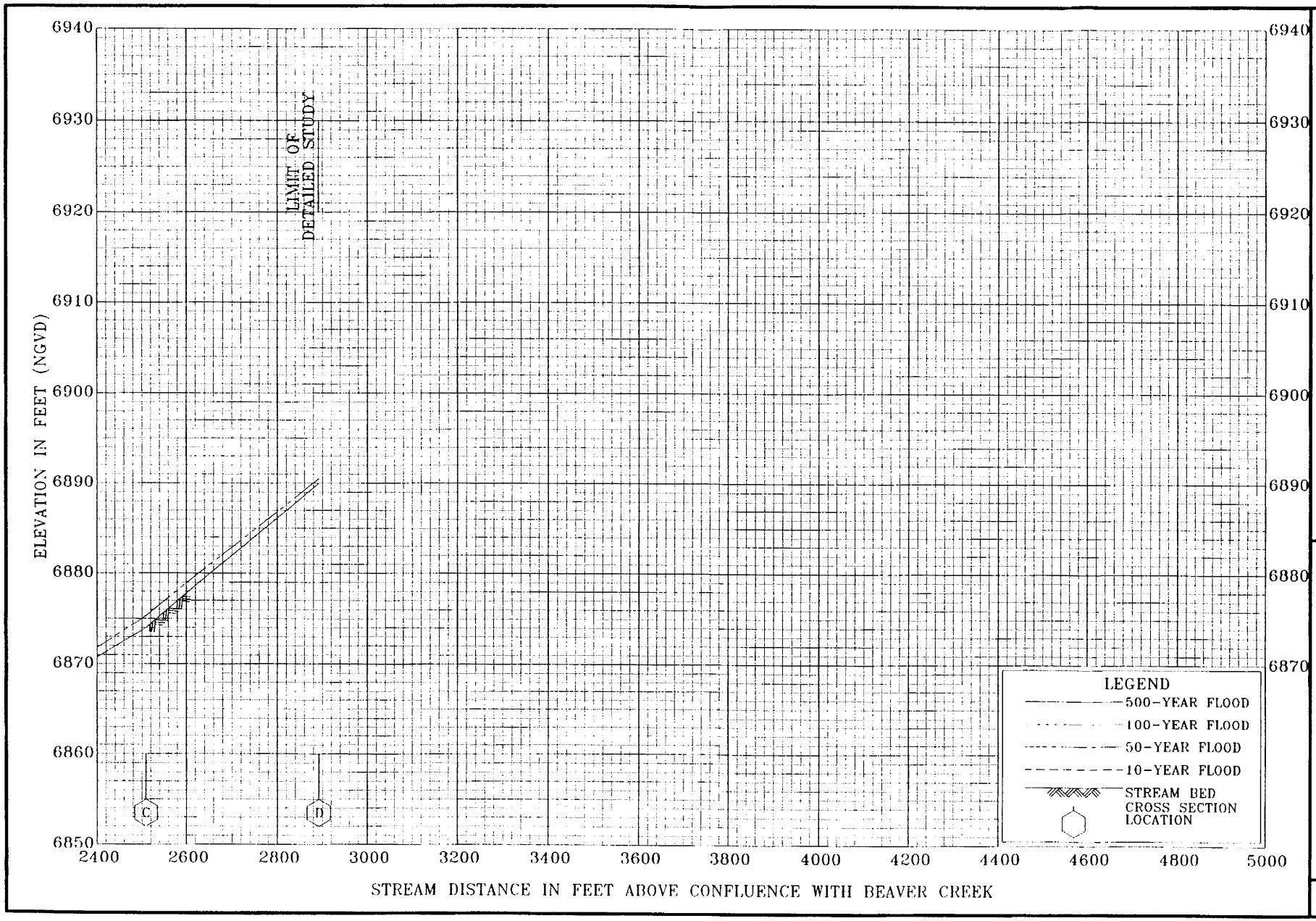
EL PASO COUNTY, CO

(UNINCORPORATED AREAS)

FLOOD PROFILES

PINON LAKE TRIBUTARY

REVISED TO REFLECT LOMR DATED JUN 23 2004



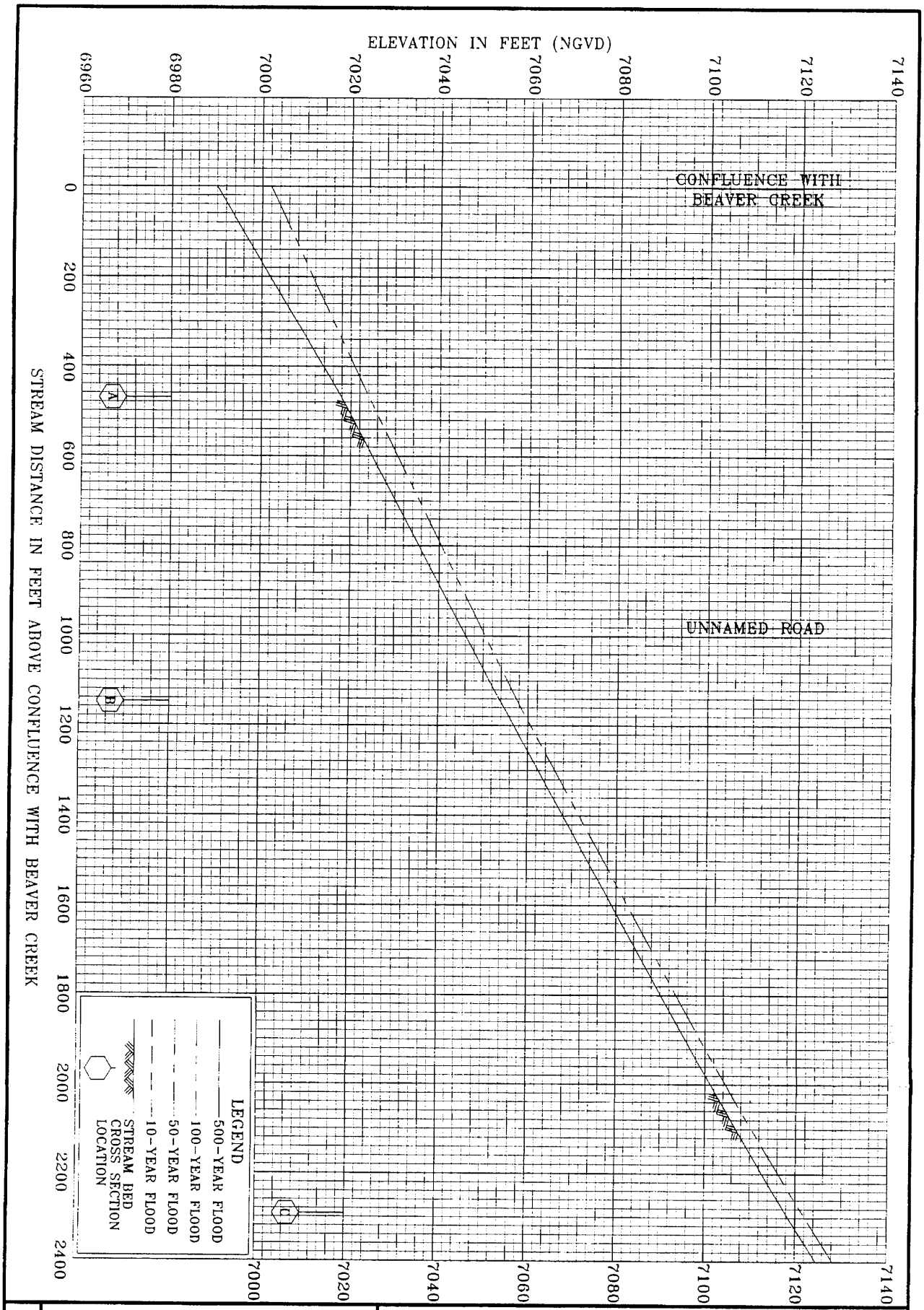
FLOOD PROFILES

PINON LAKE TRIBUTARY

REVISED TO REFLECT LOMR DATED JUN 23 2004

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
(UNINCORPORATED AREAS)



357P

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO

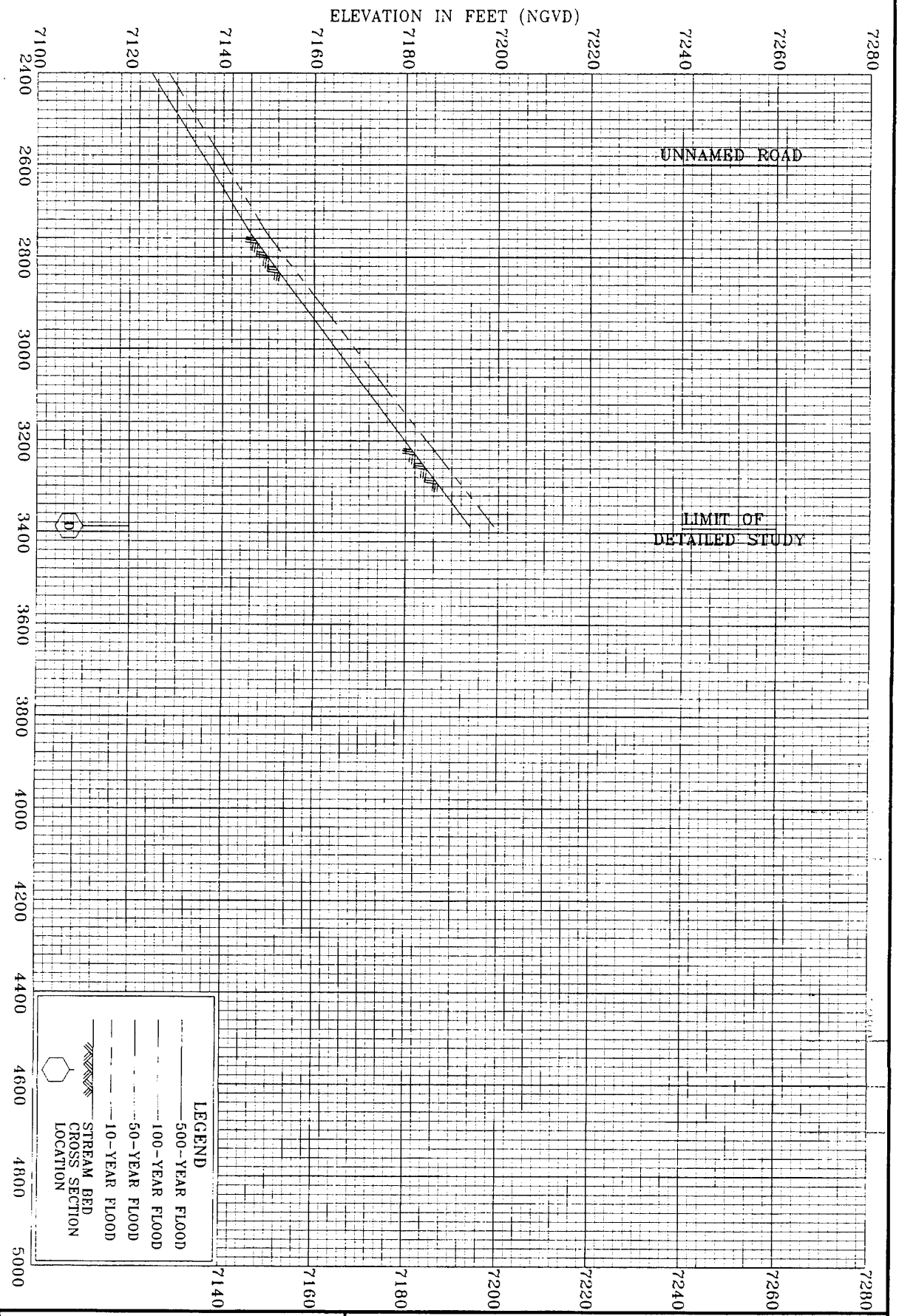
(UNINCORPORATED AREAS)

FLOOD PROFILES

NORTH BEAVER CREEK

REVISED TO REFLECT LOMR

EFFECTIVE JUN 2 2 2004



358P

FEDERAL EMERGENCY MANAGEMENT AGENCY

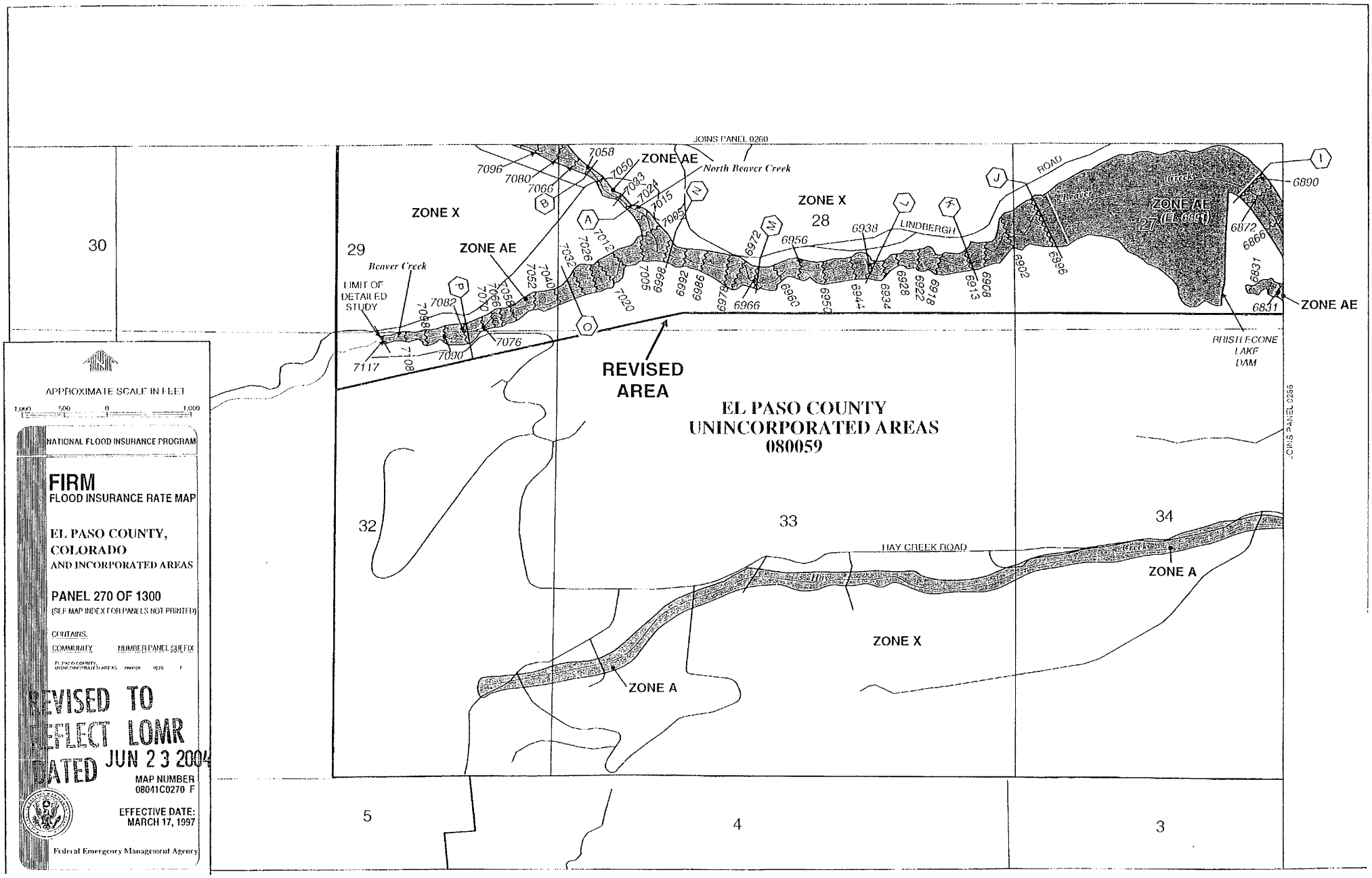
EL PASO COUNTY, CO

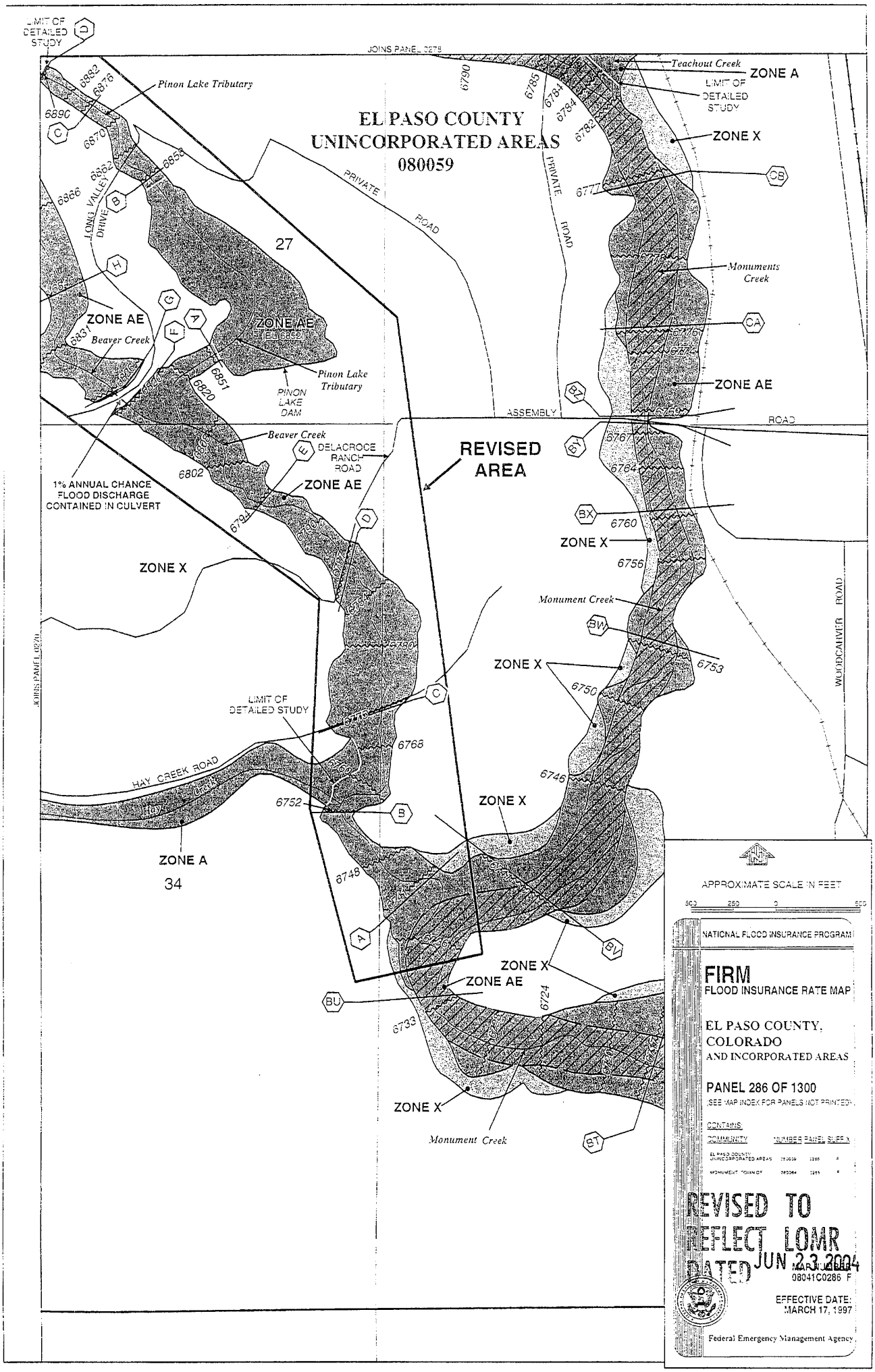
(UNINCORPORATED AREAS)

FLOOD PROFILES

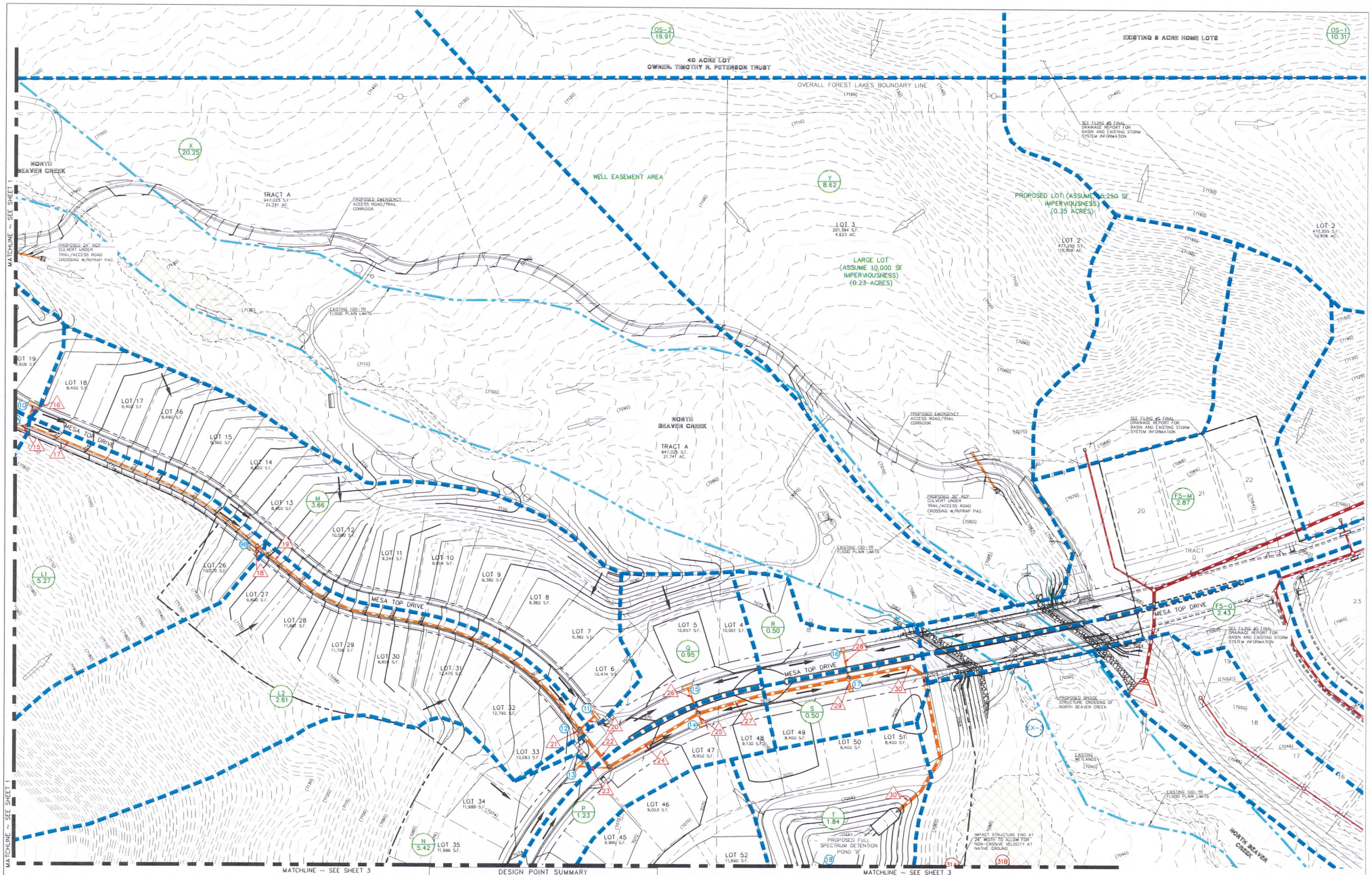
NORTH BEAVER CREEK

REVISED TO REFLECT LOMR DATED JUN 2 0 2001


JOINS PANEL 0260
ZONE AE
North Beaver Creek
ZONE X
29
ZONE AE
Beaver Creek
LIMIT OF DETAILED STUDY
ZONE X
28
LINDBERGH
ROAD
ZONE AE
27 (EL 6891)
ZONE AE
BRISTLECONE LAKE DAM
REVISED AREA
EL PASO COUNTY
UNINCORPORATED AREAS
080059
JOINS PANEL 0280
30
32
33
34
HAY CREEK ROAD
ZONE A
ZONE X
ZONE A
5
4
3
APPROXIMATE SCALE IN FEET
1,000 500 0 1,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 270 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0270 F
REVISED TO REFLECT LOMR DATED JUN 23 2004
MAP NUMBER
08041C0270 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency


EL PASO COUNTY
UNINCORPORATED AREAS
080059
LIMIT OF DETAILED STUDY
JOINS PANEL 0278
Pinon Lake Tributary
Teachout Creek
ZONE A
ZONE X
PRIVATE ROAD
LONG VALLEY DRIVE
27
ZONE AE
Beaver Creek
PINON LAKE DAM
Monuments Creek
ASSEMBLY ROAD
REVISED AREA
DELACROCE RANCH ROAD
1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
Monument Creek
WOODCARVER ROAD
HAY CREEK ROAD
34
JOINS PANEL 0279
APPROXIMATE SCALE IN FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 286 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY
NUMBER
PANEL
SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS
080059
0286
F
MONUMENT, TOWN OF
080064
0255
F
REVISED TO REFLECT LOMR DATED JUN 23 2004
MAP NUMBER
08041C0286 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency

DRAINAGE MAP



BASIN RUNOFF		
BASIN	Q5 (CFS)	Q100 (CFS)
A	9.8	23.8
B1	4.2	14.9
B2	3.9	11.3
C	6.2	19.9
D	3.9	11.7
E	2.9	13.9
F1	4.1	8.3
F2	2.3	4.7
G	4.7	9.6
H1	3.0	6.2

BASIN	Q5 (CFS)	Q100 (CFS)
H2	5.2	10.9
J	6.4	27.6
K	4.1	8.1
L1	2.5	10.9
L2	5.9	15.6
M	7.3	15.9
N	5.1	17.3
P	3.7	7.1
Q	2.3	4.7
R	1.5	2.8
S	1.7	3.4

BASIN	Q5 (CFS)	Q100 (CFS)
T	4.1	9.3
U	1.3	3.6
W	3.2	13.4
X	5.6	37.7
Y	3.6	20.4
Z1	1.5	5.1
Z2	1.5	5.2

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	FEATURE
9A	6.4	27.6	15' TYPE R AT-GRADE
9B	2.4	21.6	15' TYPE R AT-GRADE
10	4.1	8.1	15' TYPE R AT-GRADE
11	7.3	16.1	15' TYPE R AT-GRADE
12	5.7	21.9	15' TYPE R AT-GRADE
13	5.1	17.3	15' TYPE R AT-GRADE
14	3.7	7.1	10' TYPE R SUMP
15	2.1	18.5	15' TYPE R SUMP
16	1.5	2.8	5' TYPE R SUMP
17	1.7	3.4	5' TYPE R SUMP
18	66.4	183.5	FSD/SWQ POND "B"
EX-3	18.0	111.2	FROM SITE TO N. BEAVER CREEK

PIPE RUN SUMMARY			
PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
15	6.4	16.4	24"
16	4.1	7.9	18"
17	10.3	23.8	24"
18	2.4	14.7	24"
19	12.5	38.1	30"
20	7.3	12.5	24"
21	5.7	14.7	24"
22	24.9	63.9	42"
23	5.1	13.0	18"
24	29.7	76.2	42"
25	3.7	7.1	18"

PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
26	2.1	18.5	24"
27	34.1	98.7	48"
28	1.5	2.8	18"
29	1.7	3.4	18"
30	36.2	102.2	48"
31	0.9	60.0	30"

N

50 25 0 50 100

SCALE: 1" = 50'

CLASSIC CONSULTING

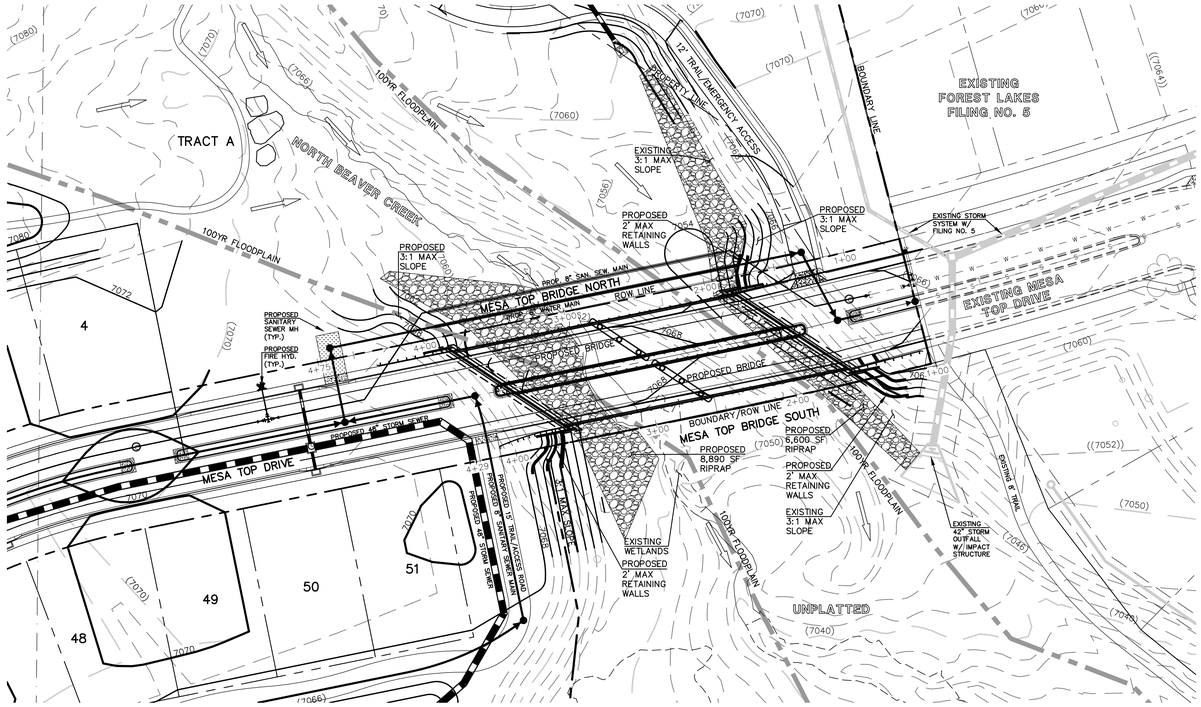
819 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

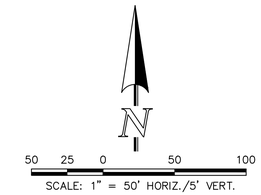
FOREST LAKES FILING NO. 6

DEVELOPED CONDITIONS DRAINAGE MAP

DESIGNED BY	MAL	SCALE	DATE	10/05/20
DRAWN BY	MAL	(H) 1" = 50'	SHEET	2 OF 4
CHECKED BY		(V) 1" = N/A	JOB NO.	1175.60

BRIDGE HYDRAULIC SECTIONS





CHANNEL DESCRIPTION

BOTTOM MATERIAL – COHESIVE ☐ NON COHESIVE ☒
BOTTOM MATERIAL SIZE – CLAY ☐ SILT ☒ SAND ☒ GRAVEL ☐ COBBLES ☐ OTHER _____

STREAM FORM – STRAIGHT ☒ MEANDERING ☐ BRAIDED ☐
MANNINGS "n" FOR DESIGN – CHANNEL 0.04 OVERBANK 0.10
DEBRIS – BRUSH ☒ TREES/LOGS ☐ ICE ☐ OTHER _____

COMPARISON OF HYDRAULICS

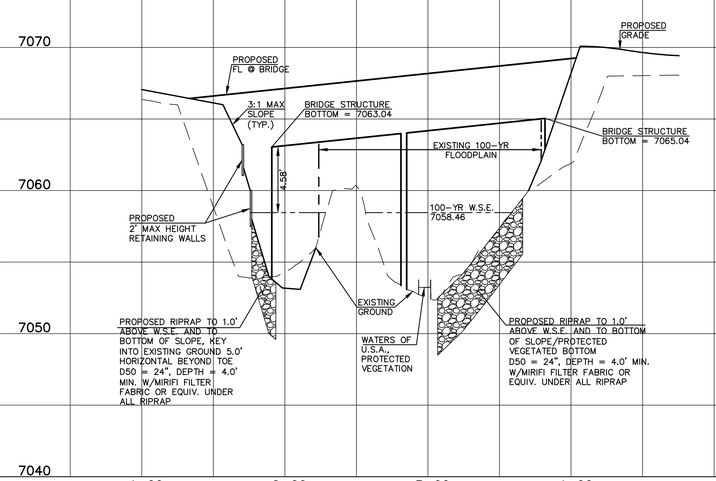
FOR DESIGN DISCHARGE (100 YR Q= 3,123 CFS)

	VELOCITY	FREEBOARD	BRIDGE LOSS
NATURAL CHANNEL	8.8 ft/s	N/A	N/A
PROPOSED CHANNEL	5.7 ft/s	4.58 ft*	1.66 ft

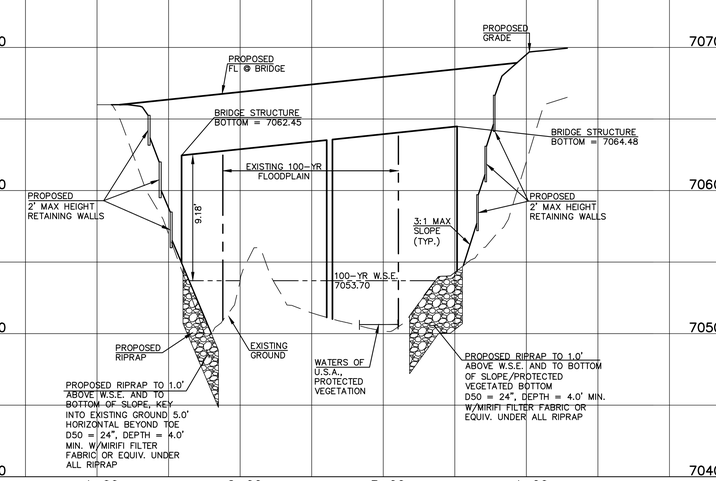
*MEASURED AT 25' UPSTREAM OF BRIDGE FACE
MINIMUM FREEBOARD REQUIRED FOR LOW-DEBRIS STREAM = 2.26'

NOTE: PROFILES ARE DRAWN LOOKING DOWNSTREAM.
PLAN VIEW SHOWN TRUE NORTH.
CHANNEL FLOWS TO THE SOUTH.

MESA TOP DRIVE BRIDGE (NORTH BRIDGE HCL)
(LOOKING DOWNSTREAM)



MESA TOP DRIVE BRIDGE (SOUTH BRIDGE HCL)
(LOOKING DOWNSTREAM)



48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799(Fax)

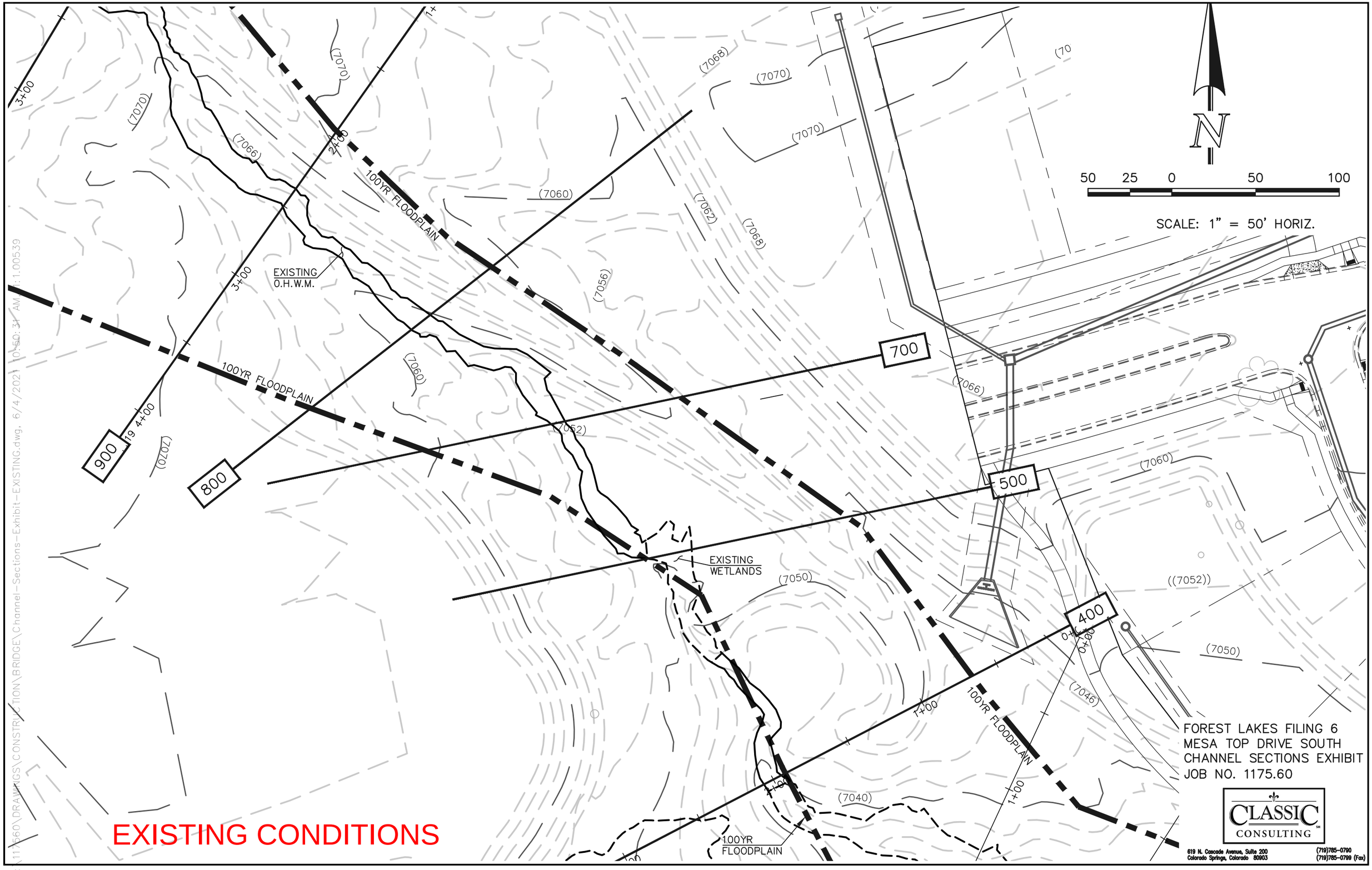
FOREST LAKES FILING NO. 6
BRIDGE HYDRAULIC INFORMATION
MESA TOP DRIVE OVER NORTH BEAVER CREEK

DESIGNED BY	MAL	SCALE	DATE 12/22/20
DRAWN BY	MES	(H) 1"= 50'	SHEET 1 OF 1
CHECKED BY		(V) 1"= 5'	JOB NO. 1175.60

N:\1175ROT\DRAWINGS\CONSTRUCTION\BRIDGE\BRIDGE HYDRAULIC SECTIONS.dwg, 7/12/2021 9:40:56 AM, 1:1

CHANNEL SECTIONS
EXISTING CONDITIONS

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS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EXISTING WETLANDS
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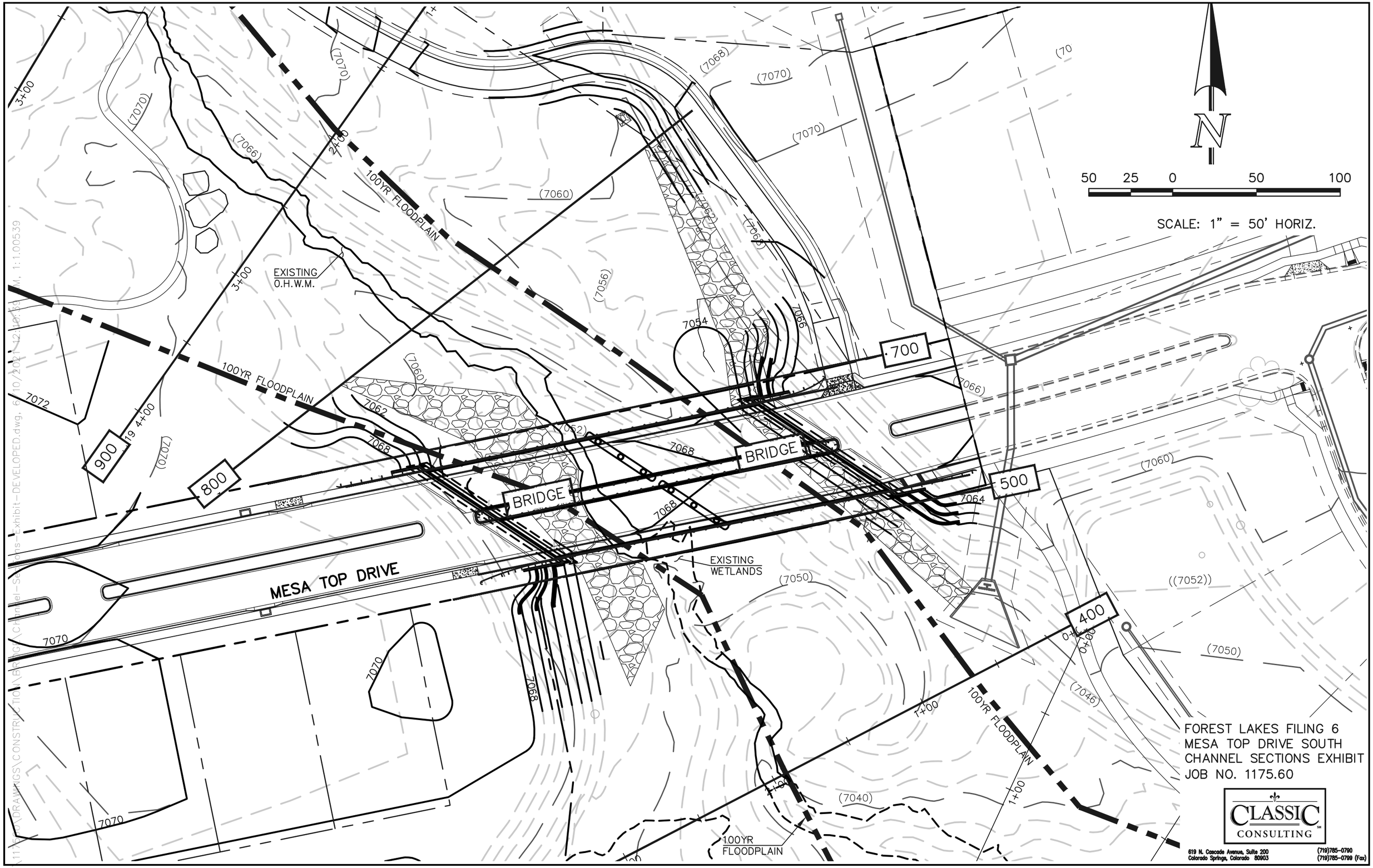
800
700
500
400
3+00
4+00
24+00
0+00
1+00
(7070)
(7068)
(7066)
(7062)
(7060)
(7056)
(7052)
(7050)
(7046)
(7040)
((7052))
FOREST LAKES FILING 6
MESA TOP DRIVE SOUTH
CHANNEL SECTIONS EXHIBIT
JOB NO. 1175.60
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)
EXISTING CONDITIONS

CHANNEL SECTIONS
PROPOSED CONDITIONS

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS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100YR FLOODPLAIN
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BRIDGE
EXISTING WETLANDS
100YR FLOODPLAIN
100YR FLOODPLAIN
100YR FLOODPLAIN
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FOREST LAKES FILING 6
MESA TOP DRIVE SOUTH
CHANNEL SECTIONS EXHIBIT
JOB NO. 1175.60
CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

BRIDGE HYDRAULICS

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

EXISTING CONDITIONS

HEC-RAS Plan: Plan 02 River: N. BEAVER Reach: REACH 1 Profile: PF 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
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REACH 1	800	PF 2	3123.00	7057.88	7061.70	7061.70	7062.70	0.018729	8.01	389.71	195.87	1.00
REACH 1	700	PF 2	3123.00	7052.36	7056.80	7056.80	7058.01	0.017609	8.83	353.79	146.36	1.00
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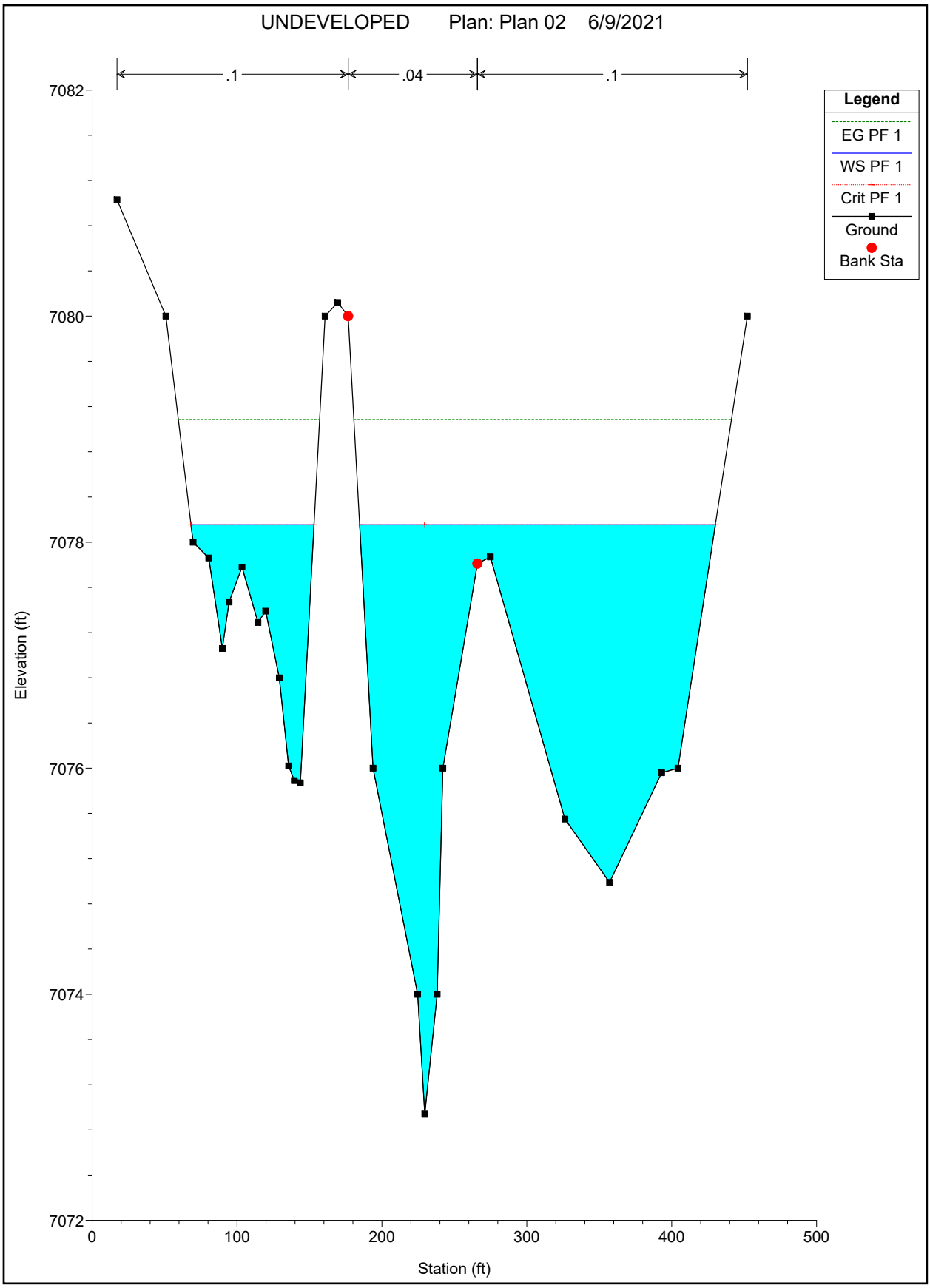
EXISTING CONDITIONS



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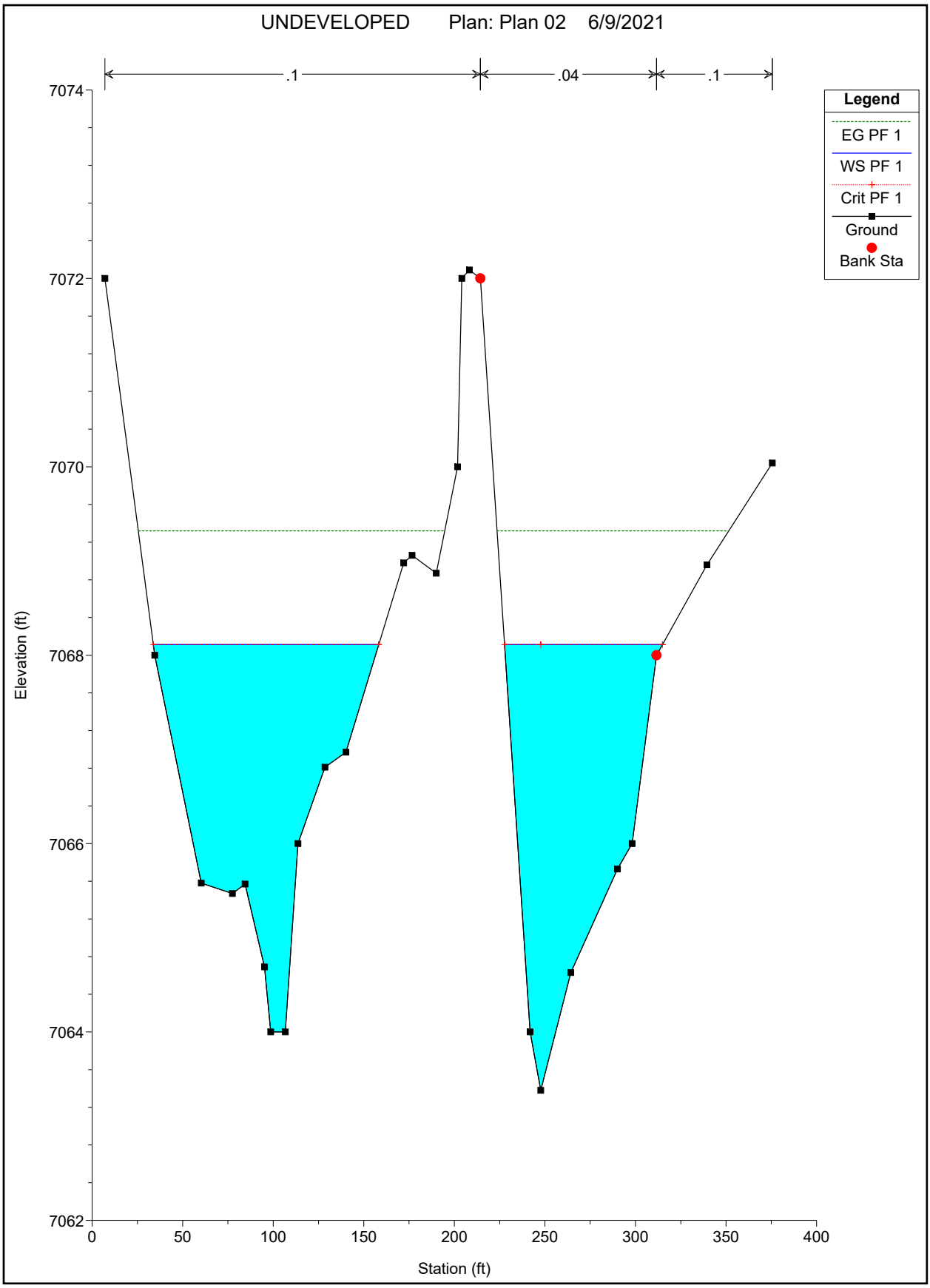
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Crit PF 1
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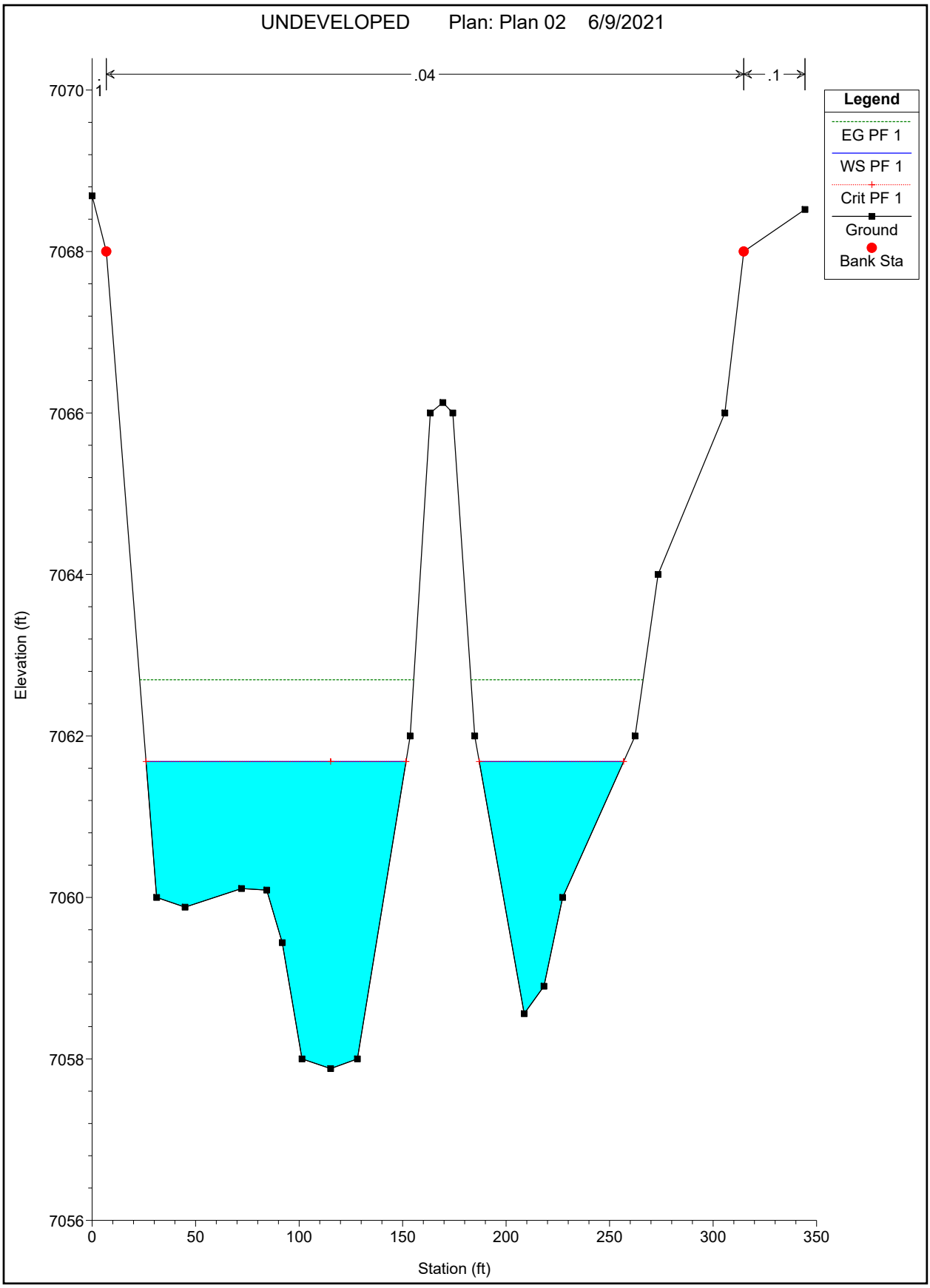
Station (ft)

SECTION 800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Legend
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Crit PF 1
Ground
Bank Sta
Elevation (ft)
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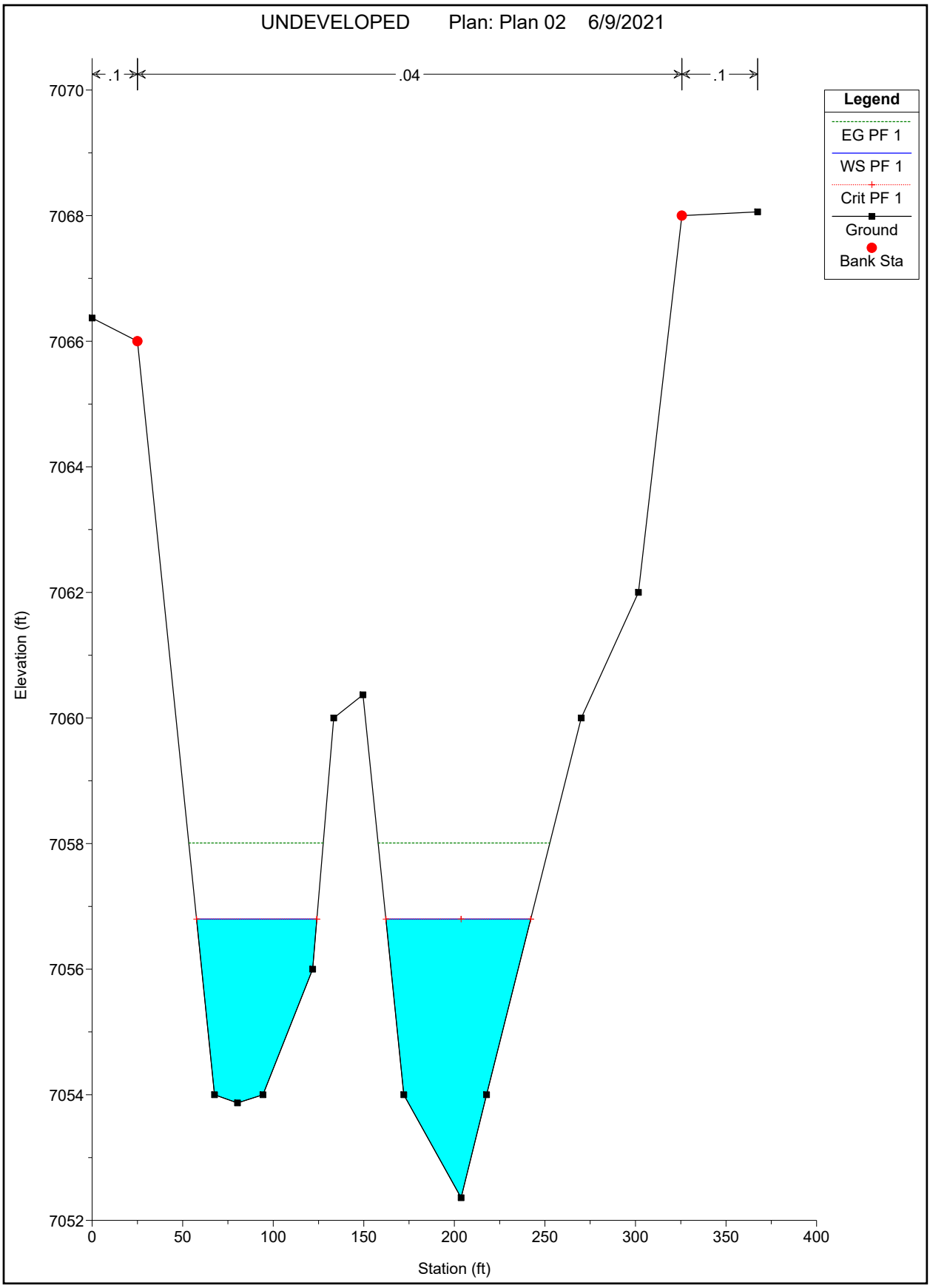
Station (ft)

SECTION 700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.04
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Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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7066
7064
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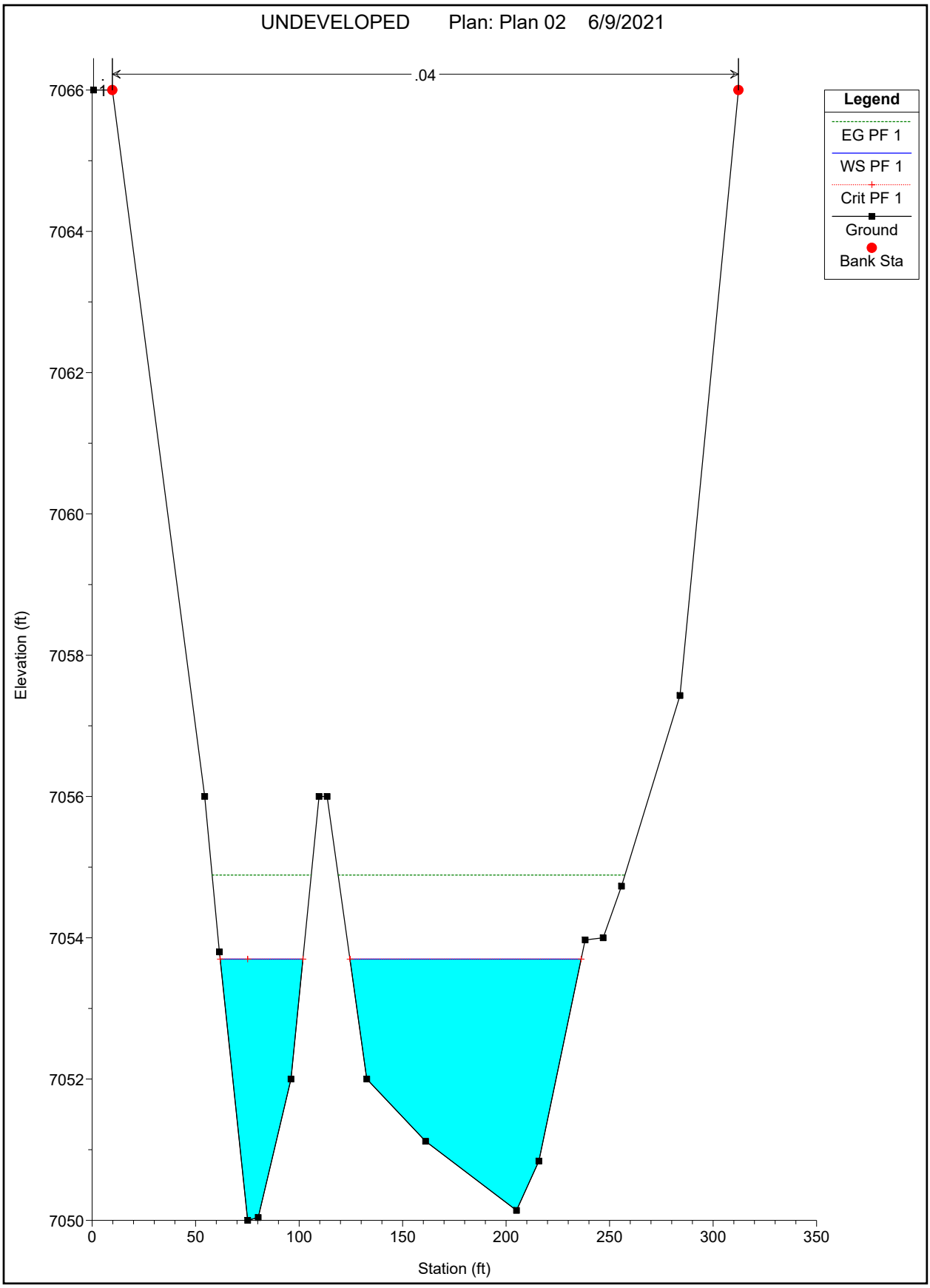
400
Station (ft)

SECTION 500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Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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7052
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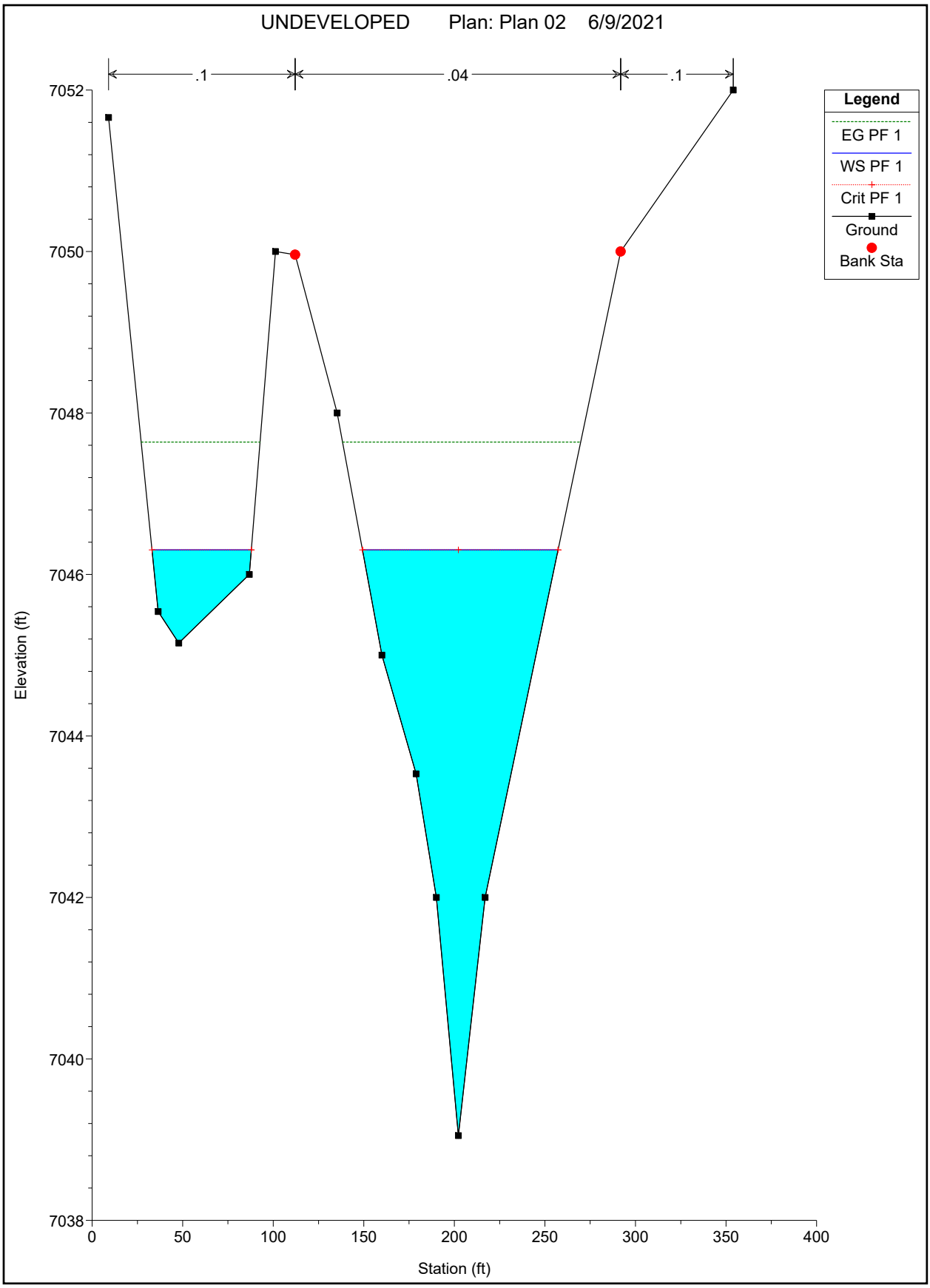
Station (ft)

SECTION 400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.1
.04
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
7052
7050
7048
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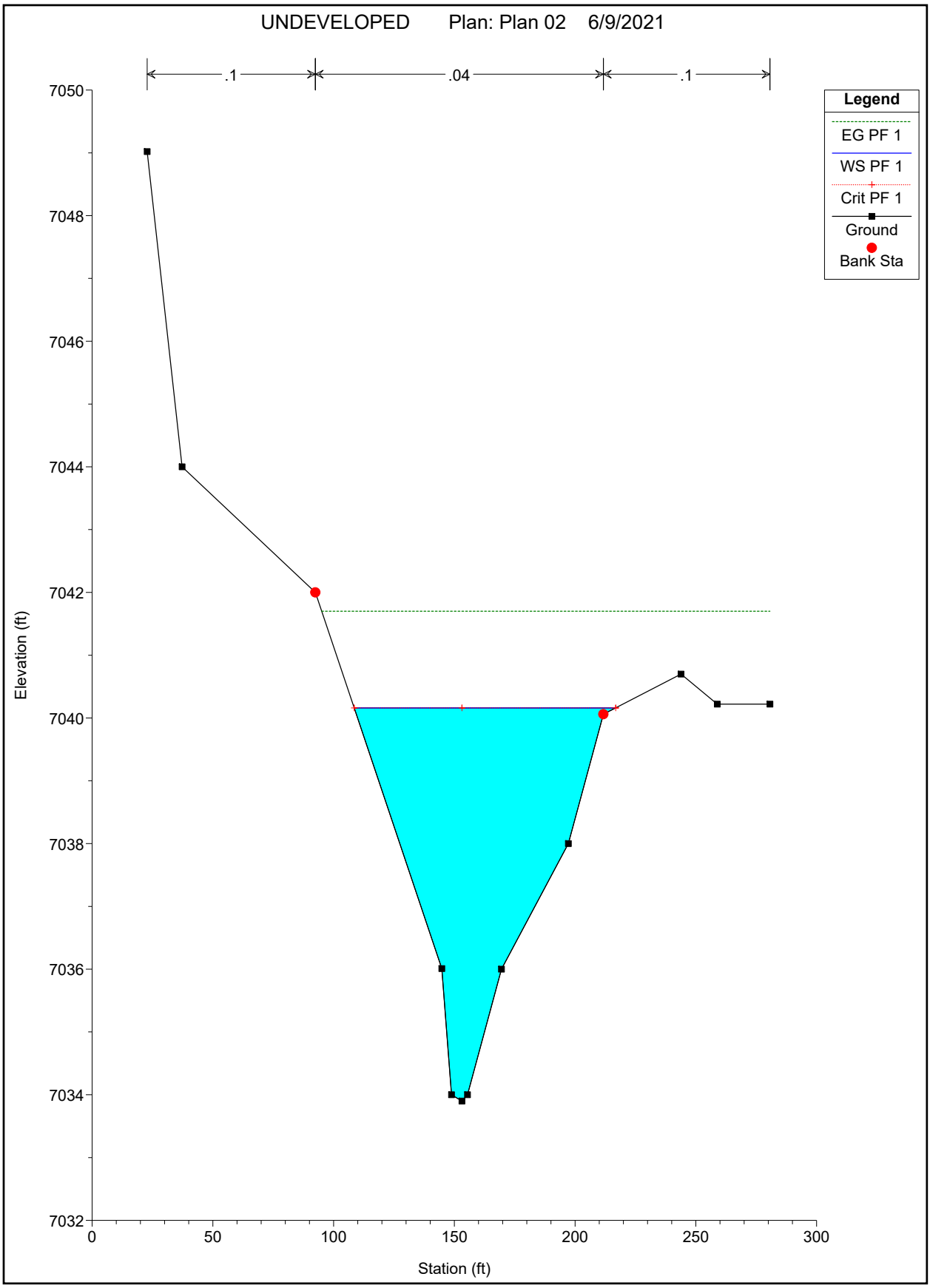
Station (ft)

SECTION 300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.04
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
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7050
7048
7046
7044
7042
7040
7038
7036
7034
7032
0
50
100
150
200
250
300
Station (ft)

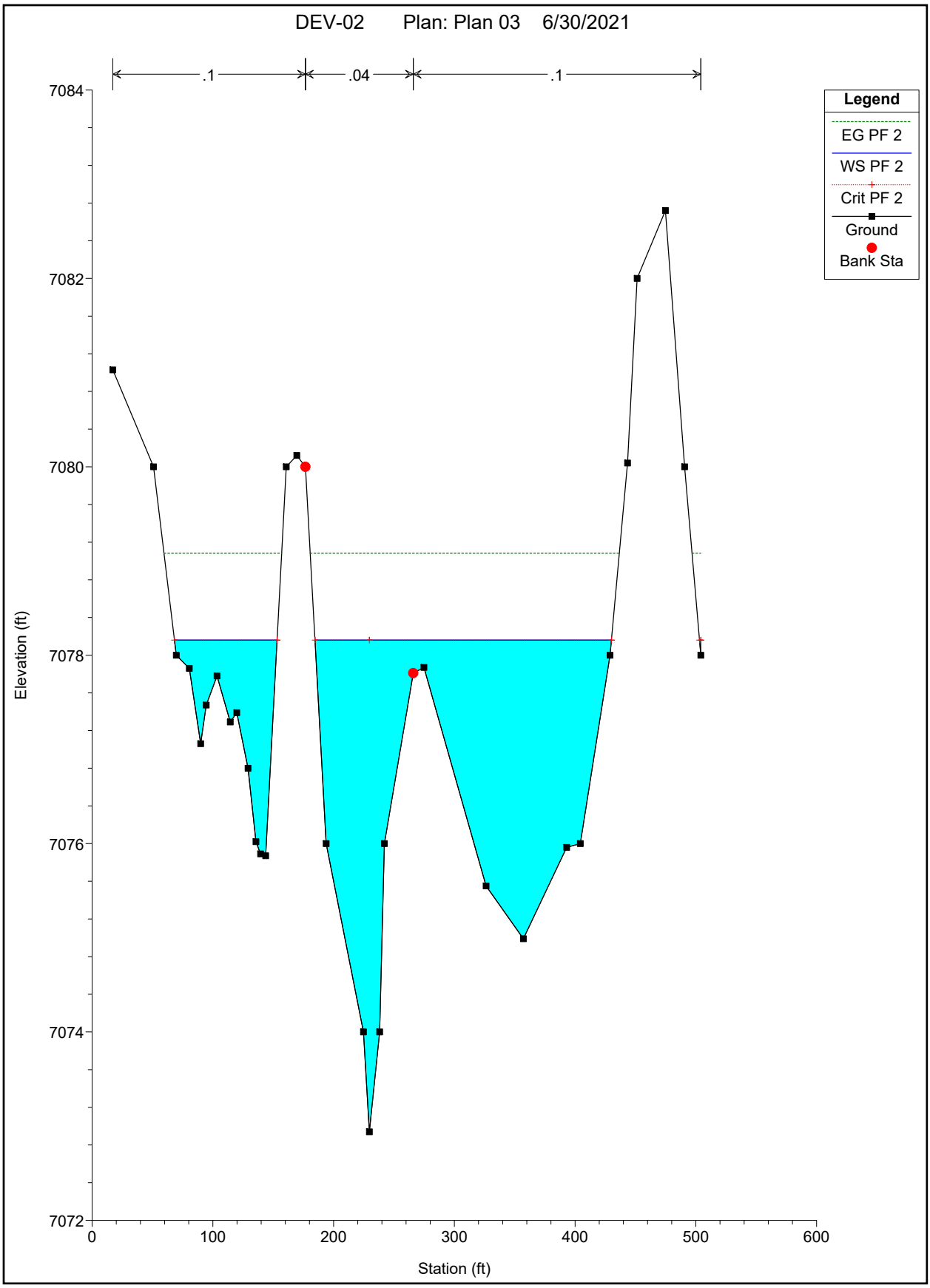
DEVELOPED CONDITIONS

HEC-RAS Plan: Plan 03 River: N. BEAVER Reach: REACH 1 Profile: PF 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH 1	1000	PF 2	3123.00	7072.94	7078.16	7078.16	7079.08	0.017967	9.38	608.92	331.58	1.02
REACH 1	900	PF 2	3123.00	7063.38	7068.11	7068.11	7069.32	0.019043	10.03	478.75	211.67	1.06
REACH 1	800	PF 2	3123.00	7057.88	7061.70	7061.70	7062.70	0.018755	8.02	389.51	195.83	1.00
REACH 1	700	PF 2	3123.00	7052.36	7058.46	7056.92	7058.96	0.004331	5.67	550.60	153.33	0.53
REACH 1	600		Bridge									
REACH 1	500	PF 2	3123.00	7050.00	7053.70	7053.70	7054.89	0.017888	8.74	357.20	151.72	1.00
REACH 1	400	PF 2	3123.00	7039.05	7046.31	7046.31	7047.64	0.014672	9.36	368.06	162.82	0.95
REACH 1	300	PF 2	3123.00	7033.90	7040.16	7040.16	7041.70	0.016528	9.95	314.03	108.32	1.01

SECTION 1000

DEVELOPED CONDITIONS



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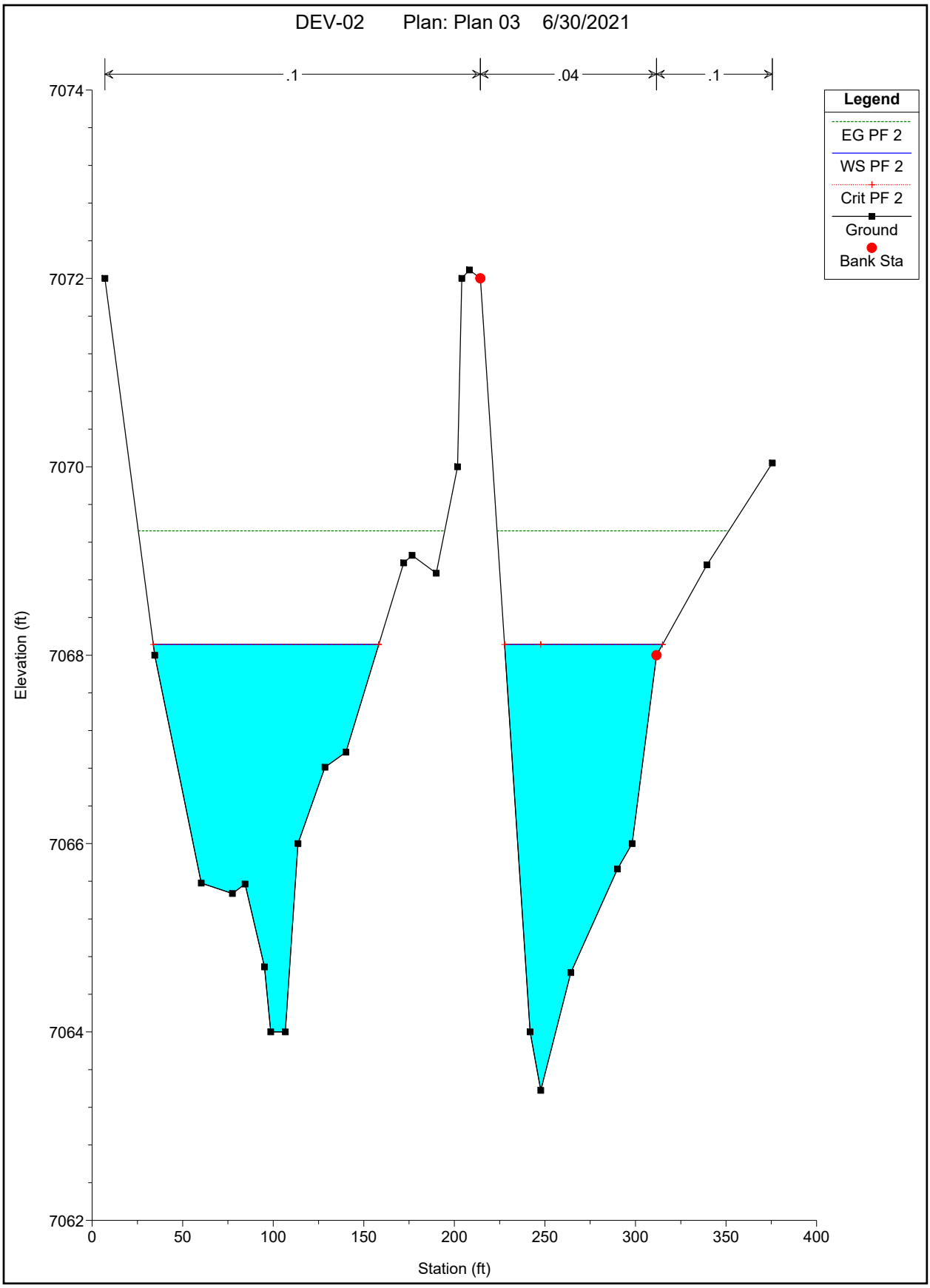
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WS PF 2
Crit PF 2
Ground
Bank Sta
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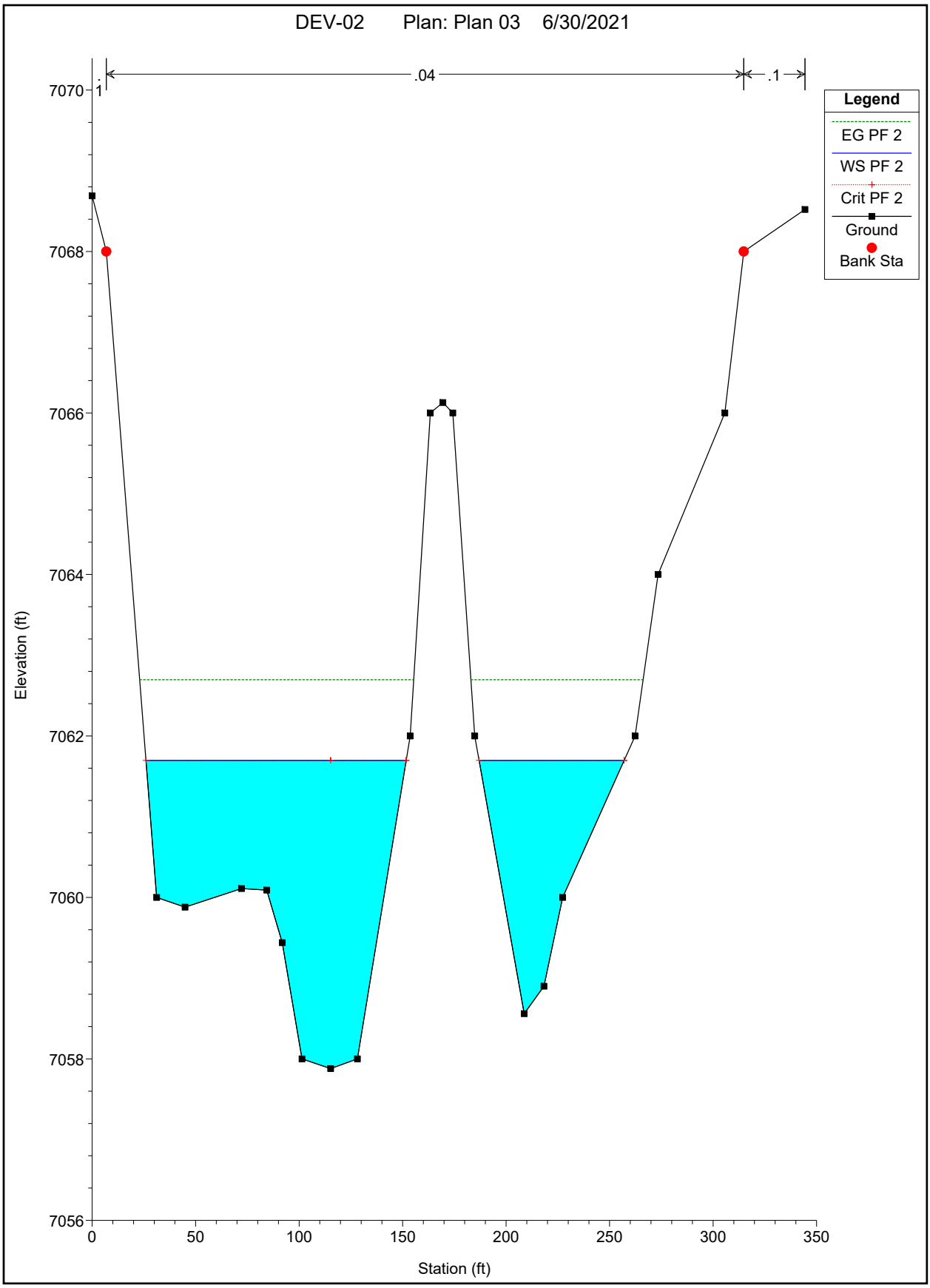
400
Station (ft)

SECTION 800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.04
.1
1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
7070
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7066
7064
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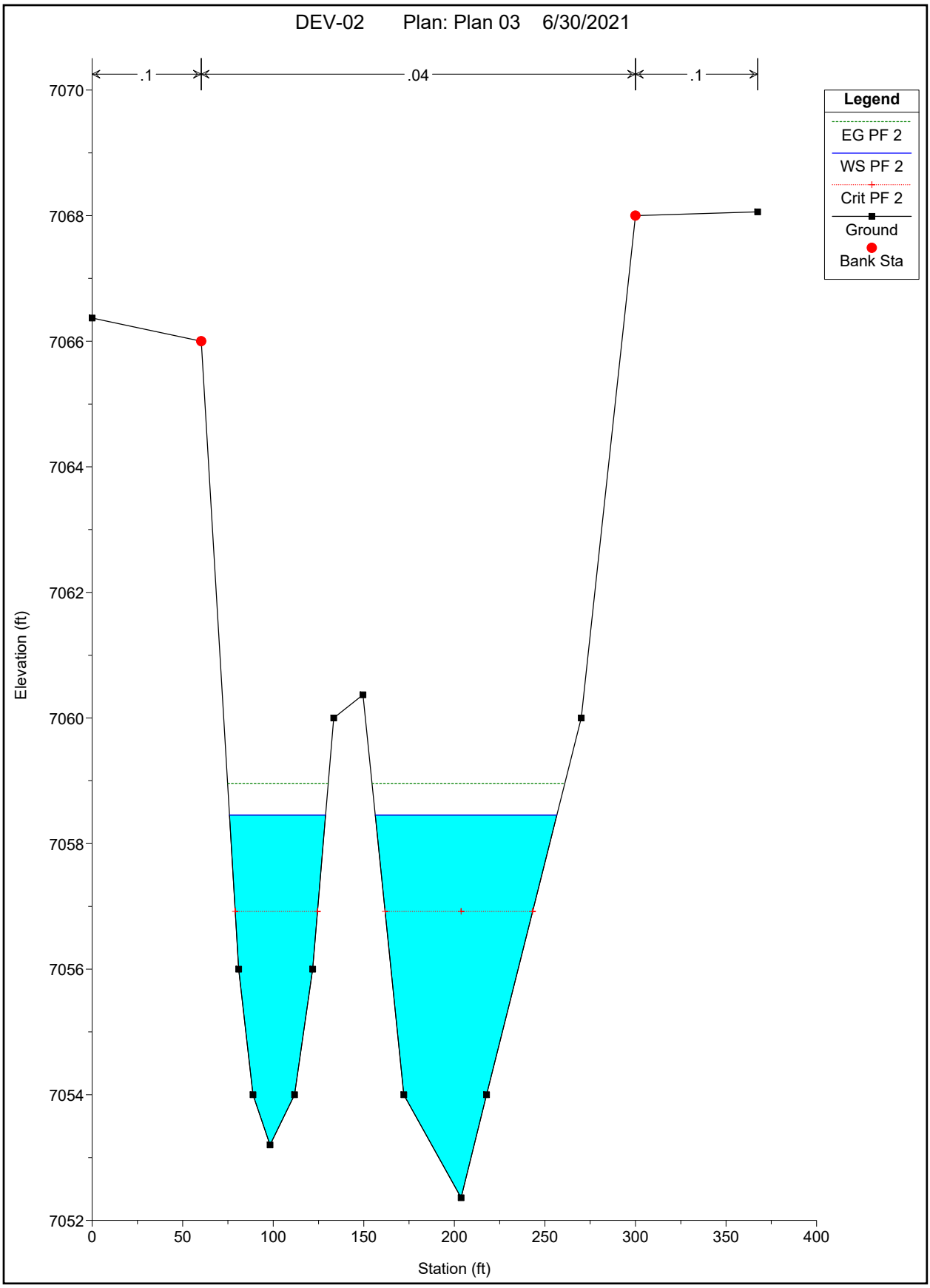
0
50
100
150
200
250
300
350
Station (ft)

SECTION 700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WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
7070
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7066
7064
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100
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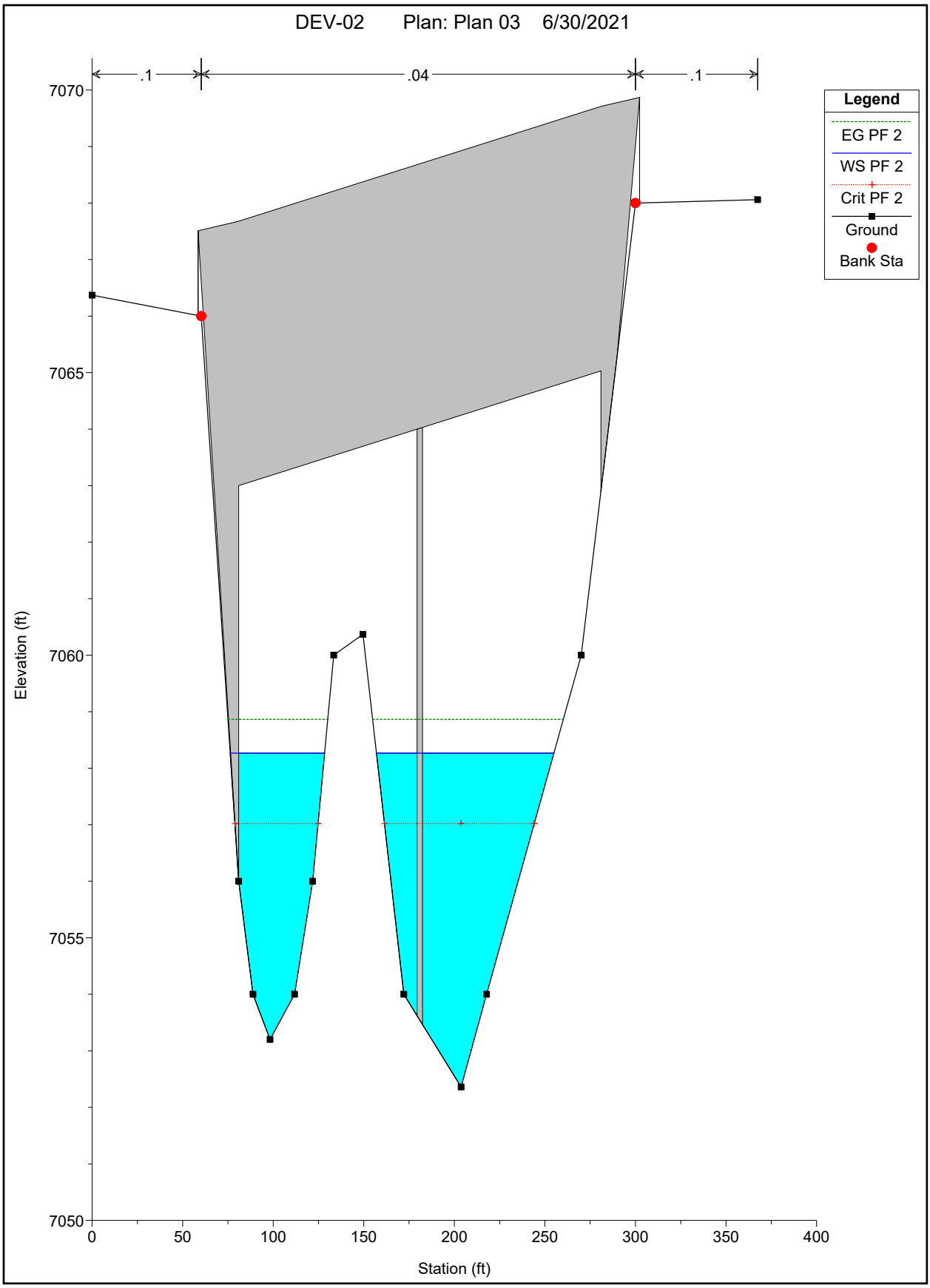
200
250
300
350
400
Station (ft)

SECTION 600 BR UP



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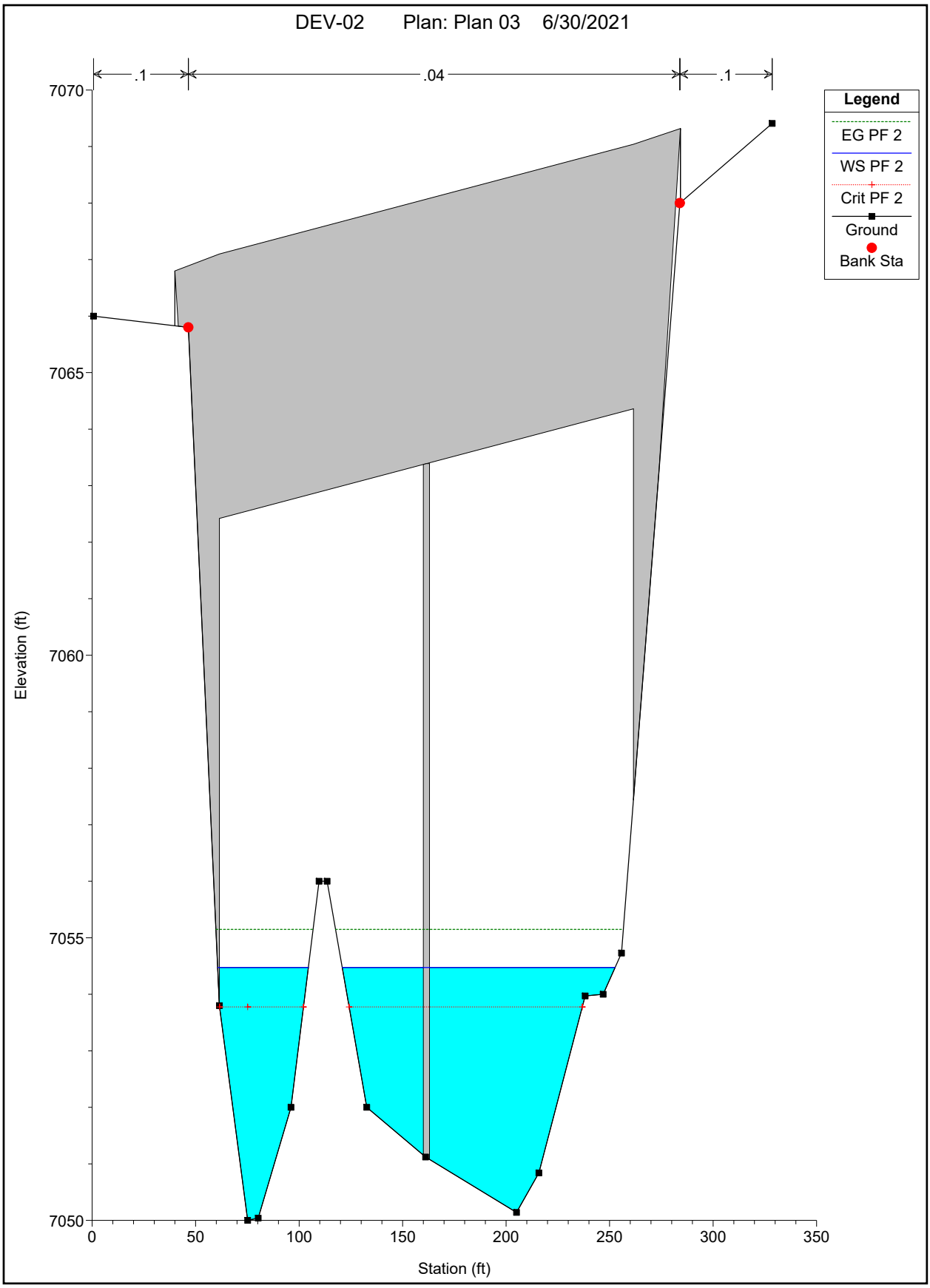

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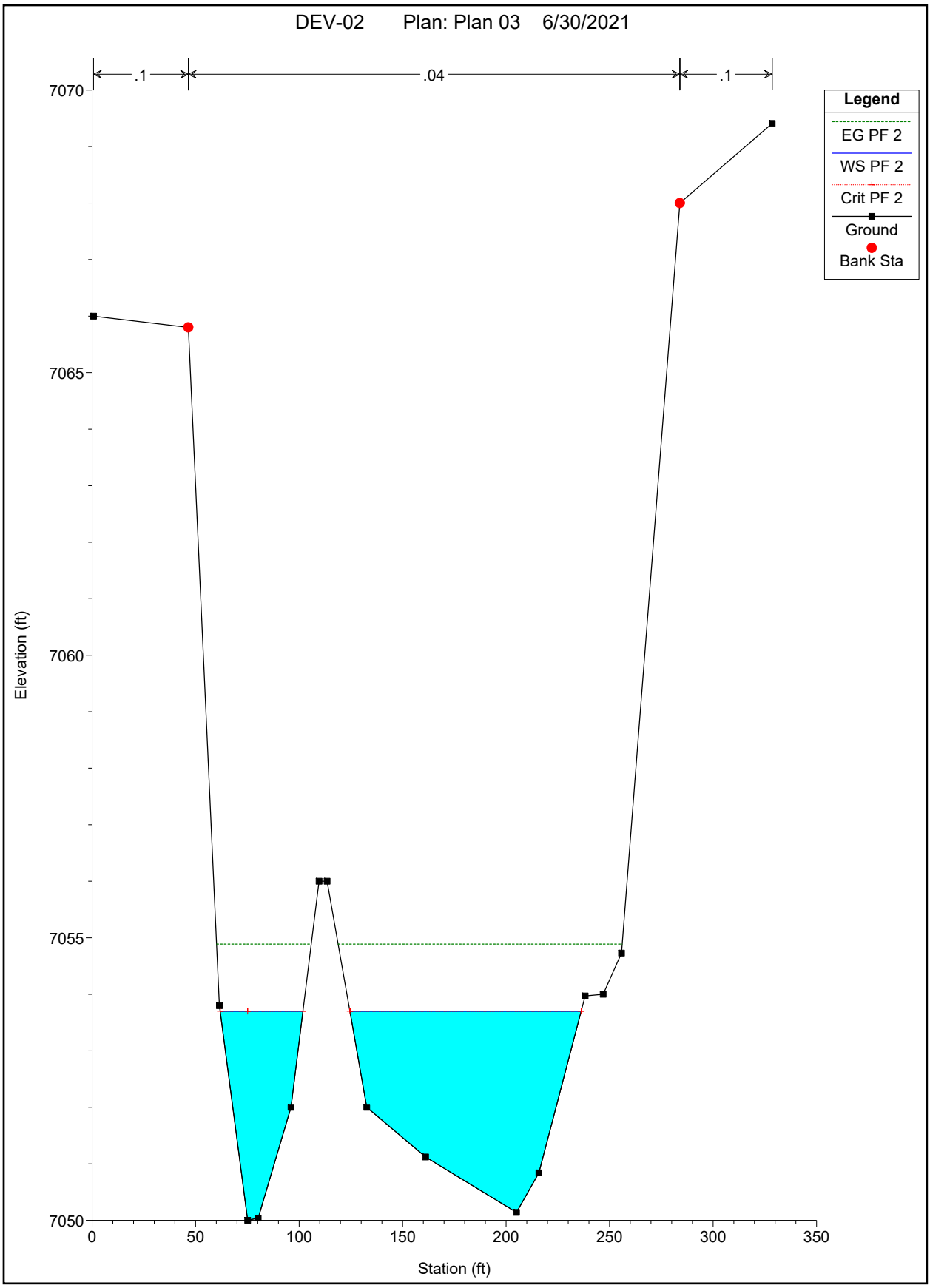
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Legend
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WS PF 2
Crit PF 2
Ground
Bank Sta
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0
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100
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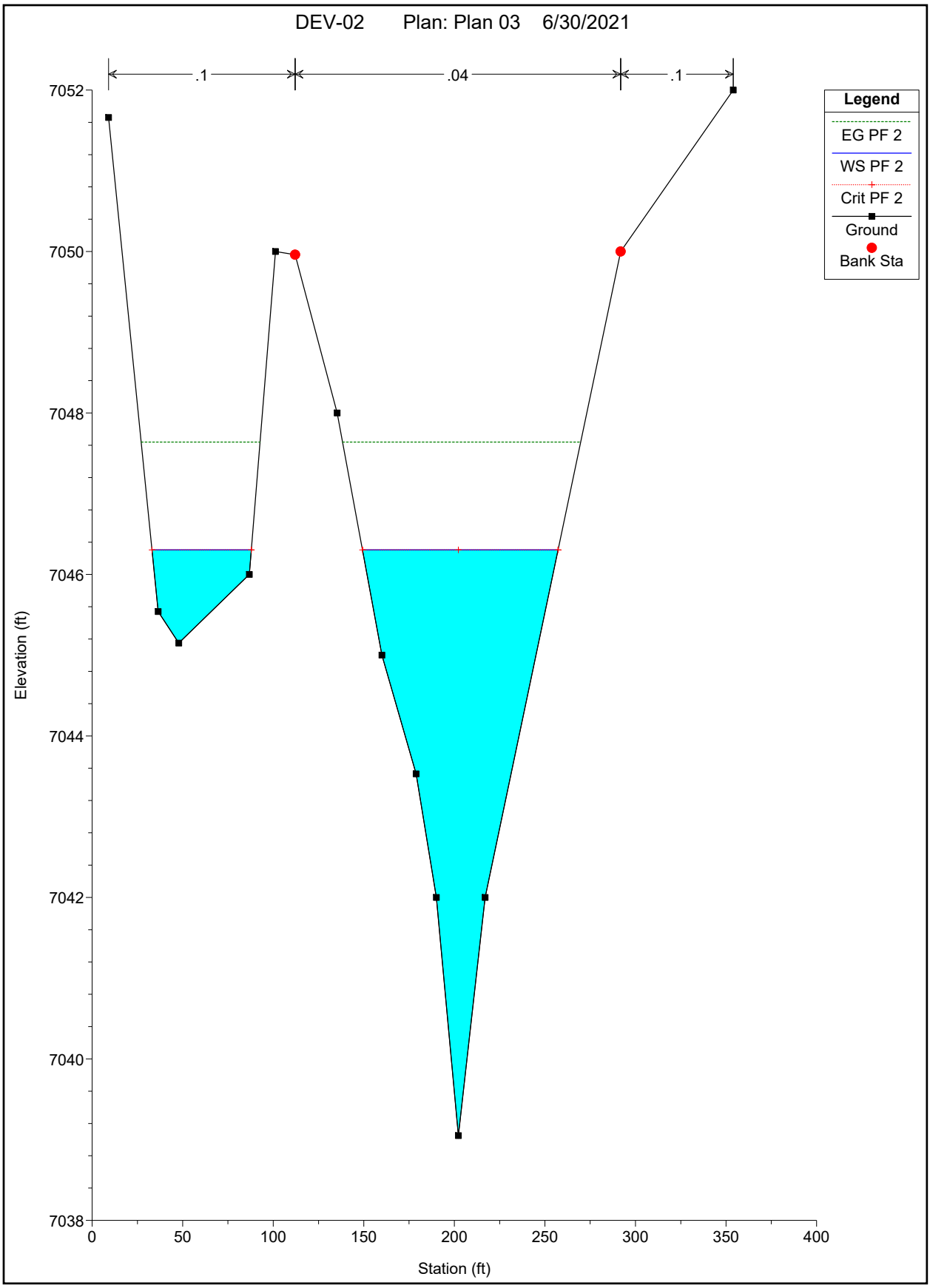
200
250
300
350
Station (ft)

SECTION 400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.1
Legend
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WS PF 2
Crit PF 2
Ground
Bank Sta
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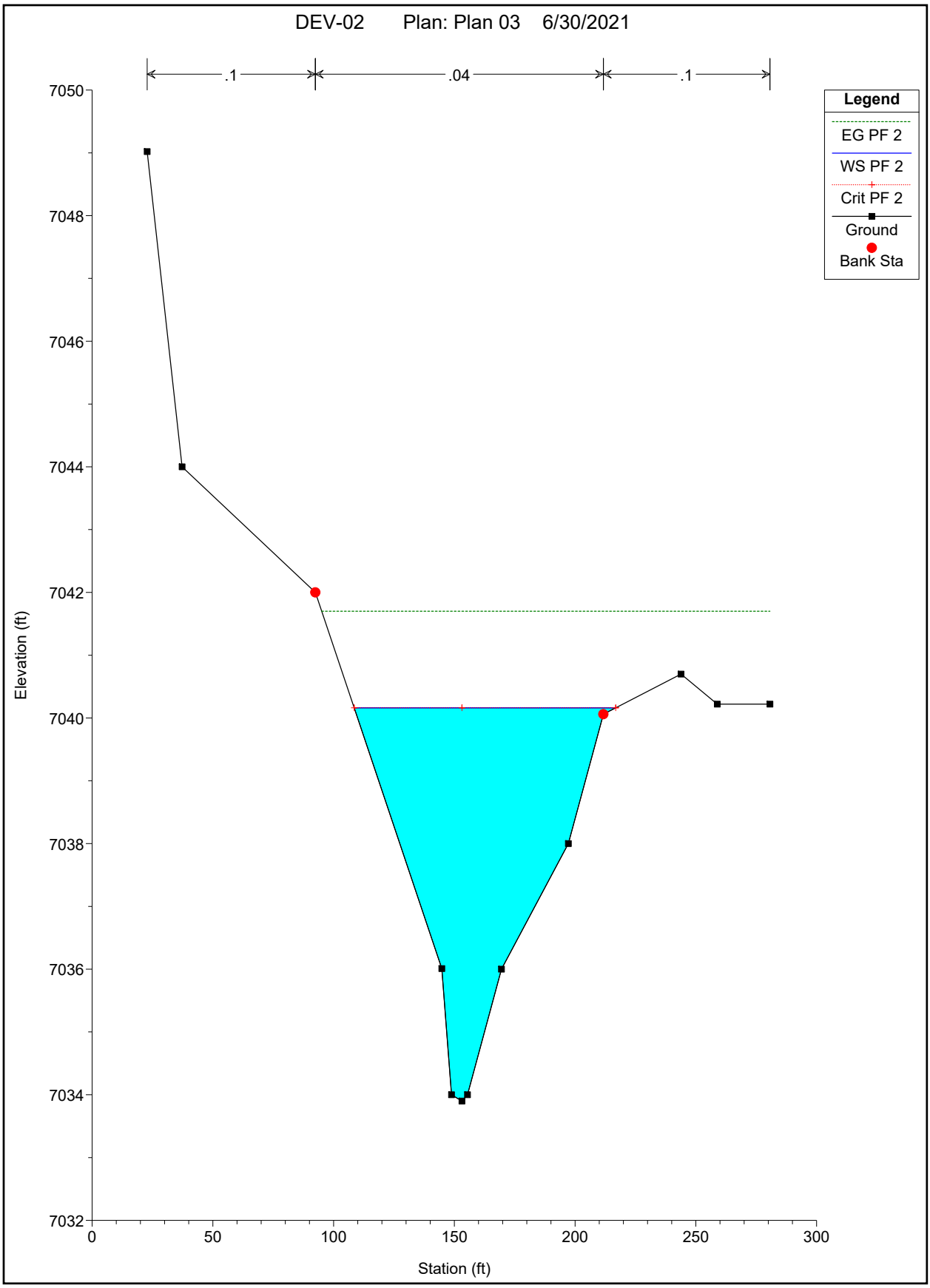
Station (ft)

SECTION 300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.04
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Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
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7048
7046
7044
7042
7040
7038
7036
7034
7032
0
50
100
150
200
250
300
Station (ft)

SCOUR ANALYSIS

GEOTECHNICAL REPORT

Subsurface Soil Investigation
North Beaver Creek Bridge
Forest Lakes Filing 5, 6, & 7
Monument, Colorado

Prepared by Entech Engineering, Inc on 9/4/2020

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SUBSURFACE SOIL INVESTIGATION
NORTH BEAVER CREEK BRIDGE
FOREST LAKES FILING 5, 6, & 7
MONUMENT, COLORADO

Prepared for

FLRD
6385 Corporate Drive, Suite 200
Colorado Springs, Colorado 80919

Attn: Jim Boulton

March 4, 2020
Revised August 12, 2020
Revised September 4, 2020

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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9-4-20
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Austin M. Nossokoff, P.E.

Reviewed by:

Joseph C. Goode, Jr., P.E.
President

AMN/amn

Encl.

Entech Job No. 200150
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TABLES

Table 1: Summary of Laboratory Test Results
Table 2: North Beaver Creek Bridge Design Parameters

FIGURES

Figure 1: Vicinity Map
Figure 2: Test Boring Location Map

APPENDICES

Appendix A: Test Boring Logs
Appendix B: Laboratory Test Results

SUBSURFACE SOIL INVESTIGATION
NORTH BEAVER CREEK BRIDGE
FOREST LAKES FILING 5, 6, & 7
MONUMENT, COLORADO

1.0 INTRODUCTION

FLRD is planning the construction of twin vehicular bridges where the proposed Mesa Top Drive intersects North Beaver Creek. The project site is located west of existing Mesa Top Drive in southwestern Monument, Colorado. A Vicinity Map is presented in Figure 1. The Test Boring Location Map, Figure 2, indicates the approximate bridge locations and test boring locations.

This report describes the subsurface conditions encountered in test borings drilled in the footprints of the proposed vehicular bridge abutments and center supports and provides recommendations for design and construction. The subsurface investigation for the vehicular bridges included drilling five (5) borings placed along the east side, west side, and center support of the proposed bridges, collecting samples of soil from the borings, performing laboratory tests on selected samples and conducting a geotechnical evaluation of the investigation findings. Drilling and subsurface investigation activities for the test borings were performed by Entech Engineering, Inc. (Entech). The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 6.

2.0 PROJECT AND SITE DESCRIPTION

It is Entech's understanding that the project will consist of the construction of twin vehicular bridges across existing North Beaver Creek. Two bridge spans, each 30 feet wide, are proposed. Adjacent properties consist of future residential parcels and existing residential parcels. North Beaver Creek flows to the southeast. At the time of drilling, water was not flowing in the channel.

3.0 SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

The subsurface conditions on this site were investigated by drilling five (5) exploratory test borings. The test borings were placed in the footprints of the proposed location of the vehicular bridge abutments and center support. The approximate locations of the test borings are indicated on the Test Boring Location Map, Figure 2. The test borings were advanced with a power-driven continuous-flight auger-drilling rig to depths of 30 to 35 feet. Samples were obtained during drilling using the Standard Penetration Test, ASTM D-1586, utilizing a split-barrel sampler and a California sampler. Results of the Standard Penetration Tests are shown on the Test Boring Logs. The Test Boring Logs are presented in Appendix A.

Soil samples were obtained with respect to depth in the borings utilizing the Standard Penetration Test (ASTM D-1586) using 2-inch O.D. split-barrel and California samplers. Results of the Standard Penetration Testing (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified in the field and described on the boring logs. The field classifications were later verified using laboratory testing and grouped by soil type. The soil types (identified by number) are included on the boring logs.

Water content testing (ASTM D-2216) was performed on samples recovered from the borings and the results are shown on the boring logs. Grain-Size Analysis (ASTM D-422) and Atterberg Limits testing (ASTM D-4318) were performed on selected samples to assist in classifying the materials encountered in the borings. Volume change testing was performed on selected samples using the Swell/Consolidation test in order to evaluate potential expansion/compression characteristics of the soil. Soluble sulfate testing was performed on samples of soil to evaluate the potential for below grade degradation of concrete due to sulfate attack. The laboratory testing results are summarized on Table 1 and are presented in Appendix 2.

4.0 SUBSURFACE CONDITIONS

Two (2) soil types were encountered in the borings drilled for the proposed drainage improvements: Soil Type 1: slightly silty to very silty sand (SM, SM-SW), and Soil Type 2: very silty and clayey sandstone (SM, SC). The soil was classified using the results of the laboratory testing and the Unified Soil Classification System (USCS). Observations for groundwater presence were made in each of the boreholes following completion of drilling.

4.1 Soil and Bedrock

Soil Type 1 is a slightly silty to very silty sand (SM, SM-SW). The sand was encountered in all of the test borings at the existing surface grade and extended to depths ranging from 13 to 21 feet bgs. Standard Penetration Testing resulted in SPT N-values of 9 to greater than 50 bpf, indicating loose to very dense states. Water content and grain size testing resulted in approximately 1 to 18 percent water content and approximately 5 to 41 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits testing resulted in a liquid limit of no value and a plasticity index of non-plastic. Sulfate testing on a sample of sand resulted in 0.01 percent soluble sulfate by weight, indicating the sand exhibits negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 is a very silty and clayey sandstone (SM, SC). The sandstone was encountered in all of the test borings at depths ranging from 13 to 21 feet bgs and extended to the termination of the test borings (30 to 35 feet). Standard Penetration Testing resulted in SPT N-values of 21 to greater than 50 bpf, indicating medium dense to very dense states. Water content and grain size testing resulted in approximately 11 to 20 percent water content and approximately 33 to 47 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits testing resulted in a liquid limit of 25 and plastic index of 8. Sulfate testing on a sample of sandstone resulted in less than 0.01 percent soluble sulfate by weight, indicating the sandstone exhibits negligible potential for below grade concrete degradation due to sulfate attack.

Additional soil descriptions can be seen on the enclosed drill logs. (Appendix A). A summary of the laboratory test results is presented in Table 1. Laboratory results are presented in Appendix B. It should be noted that the soil classification shown on the logs is based on the engineer's visual classification of the samples at the depths indicated. The soil types may vary between samples and locations tested. Also, stratification lines shown on the logs represent the approximate boundary between soil types and the actual transition may be gradual and vary with location.

4.2 Groundwater

Groundwater was encountered in all of the Test Borings at 10 to 19 feet during and subsequent to drilling. Creek flow will vary due to rainfall, drainage and other factors not readily apparent at this time. Groundwater will likely be encountered during the drilling of the piers. Casing of the pier holes may be recommended during caisson drilling.

5.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the borings drilled for the bridges to be constructed at the location previously described. If subsurface conditions different from those described herein are encountered during construction or if the project elements change from those described, Entech Engineering, Inc. should be notified so that the evaluation and recommendations presented below can be reviewed and revised if necessary.

Subsurface conditions at the bridge abutments consist of silty to slightly silty sand overlying very silty and clayey sandstone bedrock. Bedrock was encountered at 13 to 16 feet at the proposed West abutment. Bedrock was encountered at 16 to 21 feet at the proposed East abutment. Bedrock was encountered at 19 feet at the proposed center support. Water was encountered at 10 to 19 feet in the test borings. Water was not flowing in creek at the time of the investigation. SPT N-values measured in the soils indicated loose to very dense states. The bridge abutments should be supported on drilled piers bearing into formational bedrock. Alternatively, bridge abutments may be supported on driven H-pile foundations.

Any newly placed fill should be placed according to the "Structural Fill" paragraph. Prior to placing the structural fill, the surface should be scarified, moisture-conditioned and compacted. The structural fill should be moisture-conditioned to within ± 2% of its optimum moisture content to aid in compaction.

5.1.1 Deep Foundation Systems (Drilled Piers)

A drilled pier foundation system is recommended for the vehicular bridges on this site. Drilled piers shall conform to CDOT specifications.

- Drilled piers should be a minimum of 25 feet in total length and extend into the bedrock a minimum of 6 feet or 4 pier diameters, whichever is greater. Given the soil conditions measured in the borings drilled for the proposed structure and our observation, overall pier lengths of 25 feet are anticipated.

- Drilled piers should be designed to support compressive loads using a maximum ultimate end-bearing pressure of 90,000 psf and a skin friction of 9,000 psf. A resisting factor of 0.6 is recommended. The frictional component of pier capacity should be determined using only the portion of the pier extending into bedrock. Use of the upper 3 feet of bedrock for frictional resistance is not recommended in order to account for possible weathering of the bedrock surface.

- Drilled piers should be designed to transmit a minimum dead-load end bearing pressure of 5,000 psf to the bedrock in order to help control possible uplift forces. If the minimum dead load end bearing pressure cannot be achieved, the pier(s) should be advanced further into the site sandstone bedrock in order to develop additional uplift resistance. The additional uplift resistance developed as a result of the bedrock/pier interaction can be estimated using a skin friction resistance of 3500 psf for the portion of the pier which extends into the bedrock beyond the minimum recommended penetration length. Pier portions in bedrock, which are cased during pier drilling, should not be included in uplift resistance calculations.

- Shear rings should be cut into the lower portion of the pier to aid in skin friction development. In the event that temporary casing installation is necessary to support the bedrock portion of the pier hole during drilling and shear rings cannot be cut, the pier hole sidewall can alternately be roughened as part of the pier drilling process in order to assist skin friction development.

- Piers may be designed to resist lateral loads assuming a modulus of horizontal subgrade reaction of 25 pci in the native, medium dense overburden soils (20 pci should be used for overburden material below the water table). A modulus of horizontal subgrade reaction of 225 pci in the native, dense sandstone is recommended (125 pci should be used for bedrock material below the water table). Resistance to lateral loads should be neglected in the upper native soils.

- Pier reinforcing should be designed based on the pier diameter and the expected maximum anticipated compressive loads. Piers should also be reinforced to resist uplift forces due to potential expansion of the bedrock as well as any tensile forces transmitted by the supported structure.

- Closely spaced piers should be avoided unless the associated pier capacities are appropriately reduced. To avoid reduction of pier capacity, piers should be separated by a minimum of 3 pier diameters for compression loading. A pier spacing of 4 pier diameters is recommended for tension loading. Reduction factors for lateral loading based on spacing are recommended as follows: [Pier Spacing: Lateral Reduction Factor] 8D:1; 6D:0.7; 4D:0.4; and 3D:0.25.

- Grade beams used in conjunction with the piers should be designed to span the unsupported length between supporting piers.

- Pier holes and pier hole bottoms should be cleaned prior to placing concrete. Temporary casing of the pier holes will likely be necessary to control groundwater. Concrete should be placed in the pier holes shortly after they have been drilled, cleaned and observed. Concrete should not be placed in pier holes having more than 6 inches of water depth, unless placed by tremmie methods.

Entech Engineering, Inc. should observe the pier hole drilling and identify that the end bearing strata is consistent with the subsurface conditions described in this report. Fulltime observation during pier drilling is typically required by the local Regional Building Authority.

5.1.2 Deep Foundation Systems (Driven H-Piles)

As an alternative to drilled piers, H-Piles may be used for bridge abutment foundations. Based on evaluation of the site subsurface conditions, it is believed that the H-piles will achieve most of their compressive strength through end bearing and skin friction in the underlying sandstone bedrock (Soil Type 2). Some frictional resistance will also be developed in the overburden sand material (Soil Type 1). An ultimate axial capacity of 18ksi for the steel is recommended, which includes a resistance factor of 0.65. Additional design parameters for use in the H-pile design, which include ultimate end bearing and side resistance are presented in Table 2. L Pile

parameters for the sand and sandstone are also included in Table 2. The recommendations and parameters apply to piles spaced by horizontal distances of at least 3 times the pile width. If the piles are spaced closer, reductions in the pile capacity may be warranted. The following unit weights are recommended for the site soil and bedrock.

Unit weight of overburden sand	125 pcf
Unit weight of sandstone bedrock	125 pcf

It should be noted that portions of the planned bridge site are underlain by areas of loose sand. If loose areas are encountered in the excavation, the sands may undergo post construction settlement due to backfill loads above and beside the bridge structure components. This potential settlement around the piles may form negative skin friction (i.e. down drag) on the pile surface, which would need to be accounted for as a design load on the pile. Local experience has shown that a negative skin friction pressure of 300 psf applied to the portion of the pile in the loose sand soil (Type 1) is appropriate for estimating the down drag load, should loose areas be encountered.

It is recommended that full-time observation of the H-pile installation be monitored to compile driving logs for each pile. At a minimum, the log should include: the driving resistance per foot of pile and per inch of pile over the last 3 inches; the pile driver make and model; rated energy; pile cushion/condition; observed damage; and final pile top location. The guidance set forth in the State of Colorado Standard Specifications for Road and Bridge Construction, Section 502, Piling, is recommended. Piles should be driven 10 feet into bedrock or refusal. It is recommended that a test pile be driven and its capacity be evaluated by way of static load testing and/or through use of a pile driving analyzer.

5.2 Bearing Capacity/Lateral Pressures

The following values are recommended for use in designing below grade foundation walls subjected to unbalanced lateral loads and/or retaining walls that may be associate with this project.

Recommended Design Values – Lateral Loading*

Equivalent fluid density for lateral earth pressure (active case), pcf (sand)	45
Equivalent fluid density for lateral earth pressure (active case), pcf (saturated)	110
Equivalent fluid density for lateral earth pressure (passive case), pcf (sand)	250
Soil density (loose sand and gravel), psf	115

Soil density (compacted sand and gravel), psf	125
Angle of Internal Friction (loose sand), degrees	28
Angle of Internal Friction (compacted sand), degrees	34
Coefficient of sliding between concrete and site sand	0.35
Bearing Capacity (compacted sand/native medium dense sand)	2400 psf

*Note: The passive pressure should be evaluated for site-specific conditions. The above lateral loading design values are for non-expansive, granular backfill conditions with level backslope angles and no surcharge loads. If the backfill slope angles are greater than zero degrees, if the backfill is surcharged, or if the backfill is not free draining, the design values must be adjusted to account for additional lateral loading.

Granular backfill material should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density (ASTM D-1557). Granular backfill should be placed at a moisture content of ±2% of its optimum moisture content. Density tests should be taken on the backfill to verify compaction, at 1-foot intervals.

5.3 Site Seismic Classification

Based on the subsurface conditions encountered at the site, the site meets the conditions of a Site Class D. Recommended design values for seismic analysis are as follows (expressed as percent of gravity):

Short Period Spectral Response S_s: 18.5%

1-Second Spectral Response S_1: 5.9%

5.4 Concrete

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete placed below surface grade. The test results indicated 0.01 to less than 0.01 percent soluble sulfate (by weight). The test results indicate the sulfate component of the in-place soils presents a negligible exposure threat to concrete placed below the site grade.

Type II cement is recommended for concrete at this site. To further avoid concrete degradation during construction it is recommended that concrete not be placed on frozen or wet ground. Care should be taken to prevent the accumulation or ponding of water in the foundation excavation

prior to the placement of concrete. If standing water is present in the foundation excavation, it should be removed by ditching to sumps and pumping the water away from the foundation area prior to concrete placement. If concrete is placed during periods of cold temperatures, the concrete must be kept from freezing. This may require covering the concrete with insulated blankets and adding heat to prohibit freezing.

5.5 Structural Fill

Areas to receive fill should have all topsoil, organic material or debris removed. Fill must be properly benched. The surface should be scarified and moisture conditioned to within ±2 percent of its optimum moisture content and compacted to 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557) for granular soils and 95 percent of its maximum Standard Proctor Dry Density (ASTM D-698) prior to placing new fill. New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557). Standard (ASTM D-698 cohesive) fill materials should be placed at a moisture content conducive to compaction, usually ±2 percent of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech Engineering, Inc. Any imported soils should be approved by Entech Engineering, Inc. prior to being hauled to the site. Granular structural fill shall meet CDOT Class 1 Backfill requirements. Following the above subgrade preparation recommendations, and adhering to the recommended maximum bearing pressure, it is expected to result in foundation designs which should limit total and differential vertical movements to 1 and ½ inches, respectively.

5.6 Winter Construction

In the event construction of the planned facility occurs during winter, foundations and subgrades should be protected from freezing conditions. Concrete should not be placed on frozen soil and once concrete has been placed, it should not be allowed to freeze. Similarly, once exposed, the subgrade should not be allowed to freeze. During site grading and subgrade preparation, care should be taken to avoid burial of snow, ice or frozen material within the planned construction area.

5.7 Construction Observations

It is recommended that Entech observe and document the following activities during construction.

- Excavated subgrades and subgrade preparation.
- Placement of drains (if installed).
- Placement/compaction of fill material.
- Drilled Pier Installation/ Driven H-Pile Installation

6.0 CLOSURE

The subsurface investigation, geotechnical evaluation and recommendations presented in this report are intended for use by FLRD with application to the planned vehicular bridges where Mesa Top Drive intersects North Beaver Creek in southwestern Monument, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in same locality and under similar conditions. No other warranty, expressed or implied is made. During final design and/or construction, if conditions are encountered which appear different from those described in this report, Entech Engineering, Inc. requests that it be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT FLRD
PROJECT N. BEAVER CREEK BRIDGE
JOB NO. 200150

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			5.4	NV	NP				SM-SW	SAND, SLIGHTLY SILTY
1	2	5			40.8			0.01			SM	SAND, VERY SILTY
1	4	2-3			14.7						SM	SAND, SILTY
1	4	10			7.5						SM-SW	SAND, SLIGHTLY SILTY
1	5	5			12.6	NV	NP				SM	SAND, SILTY
2	5	20			33.6						SM	SANDSTONE, SILTY
2	2	20			47.1			<0.01			SM	SANDSTONE, VERY SILTY
2	3	30			32.5	25	8				SC	SANDSTONE, CLAYEY

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TABLE 2

North Beaver Creek Bridge Design Parameters

Depth Below Existing Ground Surface		Groundwater Elevation (ft) Below Existing Ground	Soil/Rock Description	Deep Foundation Axial Capacity Parameters			Lpile[PLUS] Parameters					
Top	Bottom			Ultimate Side Resistance (ksf)	Ultimate End Bearing (ksf)	Strength Limit State Resisting Factor	p-y Curve	Unit Weight γ[1] (pcf)	Peak Friction Angle ϕ (deg)	Initial Static Modulus of Subgrade Reaction, k (pci)	Undrained Cohesion s_u (psf)	Strain Factor ε_{50} (in/in)
0	4	10-19.5	Sand (Loose)	—	—	—	Sand	120	32	25	N/A	N/A
0-4	13-21		Sand (Medium Dense)	—	—	—	Sand	120 62[1]	32	90 60[1]	N/A	N/A
13-21	30-35 (BOE)		Sandstone, medium strength (Dense)	9	90	0.6	Sandstone (sand)	125 67.5[1]	38	225 125[1]	4000	0.005

[1] = Submerged

FIGURES

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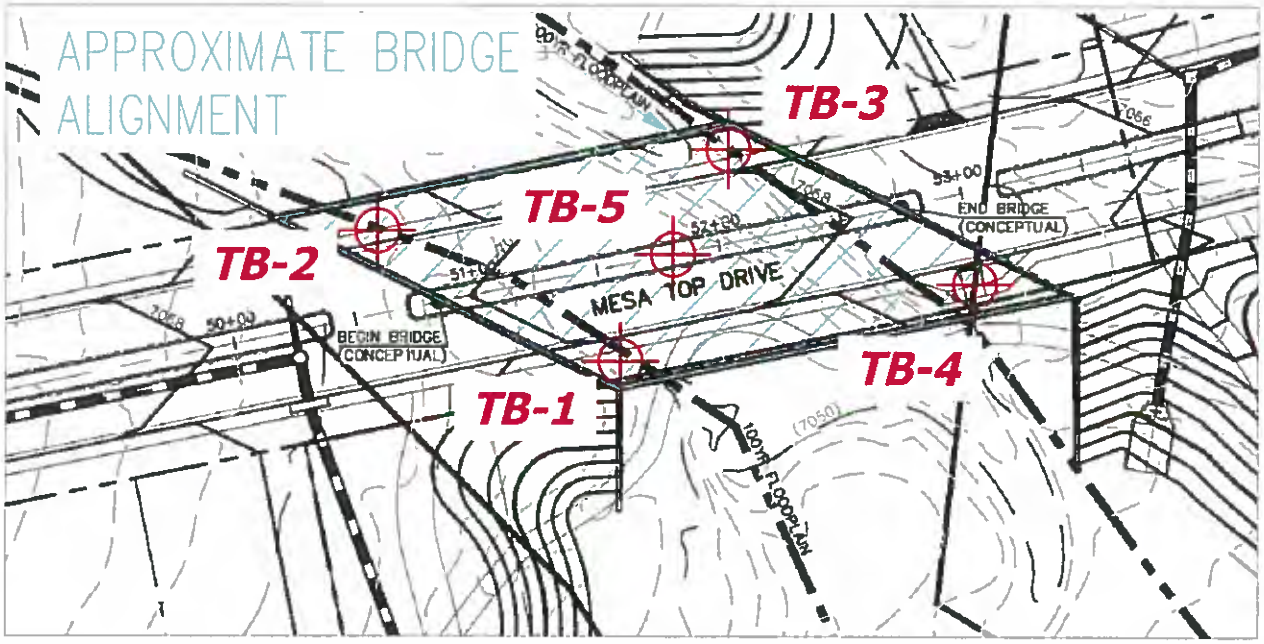
385 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

Vicinity Map North Beaver Creek Bridge Forest Lakes, Filings 5, 6 & 7 Monument, CO For: FLRD			
DRAWN: AMN	DATE: 2/12/20	CHECKED:	DATE:

JOB NO.: 200150

FIG NO.: 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

N

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Test Boring Location Map
North Beaver Creek Bridge
Forest Lakes, Filings 5, 6 & 7
Monument, CO
For: FLRD

DRAWN:	DATE:	CHECKED:	DATE:
AMN	08/04/20		

JOB NO.: 200150

FIG NO.: 2

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 1/22/2020
Job # 200150

REMARKS

WATER @ 10', 1/28/20

SAND, GRAVELLY, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN TO RED BROWN, VERY DENSE TO MEDIUM DENSE, DRY TO WET

SANDSTONE, SILTY, FINE TO COARSE GRAINED, RED BROWN, VERY DENSE, MOIST

* - HIGH BLOW COUNTS TO GRAVEL

* - BULK SAMPLE TAKEN

B - BOUNCE

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	**	1.2	1
5	**	5.1	1
10	50* / 9"	4.9	1
15	20	10.9	1
20	50 / 4"	13.9	2
25	B	16.5	2
30	50 / 4"	10.3	2

TEST BORING NO. 2
DATE DRILLED 1/22/2020
CLIENT FLRD
LOCATION N. BEAVER CREEK BRIDGE

REMARKS

WATER @ 13', 1/27/20

SAND, VERY SILTY TO SILTY, FINE TO COARSE GRAINED, BROWN TO RED BROWN, MEDIUM DENSE, MOIST

SANDSTONE, VERY SILTY TO SILTY, FINE TO COARSE GRAINED, RED BROWN, VERY DENSE, MOIST

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	12	2.9	1
5	20	8.4	1
10	18	3.4	1
15	50 / 8"	12.0	2
20	50 / 6"	14.4	2
25	50 / 5"	19.5	2
30	50 / 4"	15.7	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: AN	DATE: 8-12-20

JOB NO.: 200150
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 1/22/2020
Job # 200150

REMARKS

WATER @ 19.5', 1/28/20

Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
		9	5.3	1
5		19	2.5	1
10		27	1.5	1
15		*	8.2	1
20		9	17.8	1
25		50 / 4"	11.6	2
30		50 / 4"	11.0	2
35		50 / 4"	14.4	2

SAND, GRAVELLY, SILTY, FINE TO COARSE GRAINED, BROWN TO RED BROWN, LOOSE TO MEDIUM DENSE, DRY TO WET

COBBLES

SANDSTONE, SILTY TO CLAYEY, FINE TO COARSE GRAINED, RED BROWN, VERY DENSE, MOIST

* - BULK SAMPLE TAKEN

TEST BORING NO. 4
DATE DRILLED 1/22/2020
CLIENT FLRD
LOCATION N. BEAVER CREEK BRIDGE

REMARKS

WATER @ 19', 1/28/20

Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
		13	4.7	1
5		20	3.0	1
10		*	1.8	1
15		*	1.8	1
20		41	12.4	2
25		50 / 4"	13.2	2
30		50 / 4"	10.9	2
35				

SAND, GRAVELLY, SILTY TO SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST TO DRY

COBBLES

WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, RED BROWN, DENSE TO VERY DENSE, MOIST

* - BULK SAMPLE TAKEN

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		MN	8-13-20

JOB NO. 200150
FIG NO. A- 2

TEST BORING NO. 5
DATE DRILLED 7/22/2020
Job # 200150

TEST BORING NO.
DATE DRILLED
CLIENT FLRD
LOCATION N. BEAVER CREEK BRIDGE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 18', 7/28/20						
SAND, SILTY WITH COBBLES, FINE TO COARSE GRAINED, BROWN, VERY DENSE TO DENSE, DRY				50 / 8"	1.6	1
	5			39	3.2	1
COBBLES	10			50 / 11"	2.2	1
	15			*	4.4	1
HIGHLY WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, RED BROWN, MEDIUM DENSE TO VERY DENSE, MOIST TO WET	20			21	13.0	2
	25			50 / 1"	16.1	2
	30			50 / 1"	14.9	2

* - BULK SAMPLE TAKEN

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	5					
	10					
	15					
	20					

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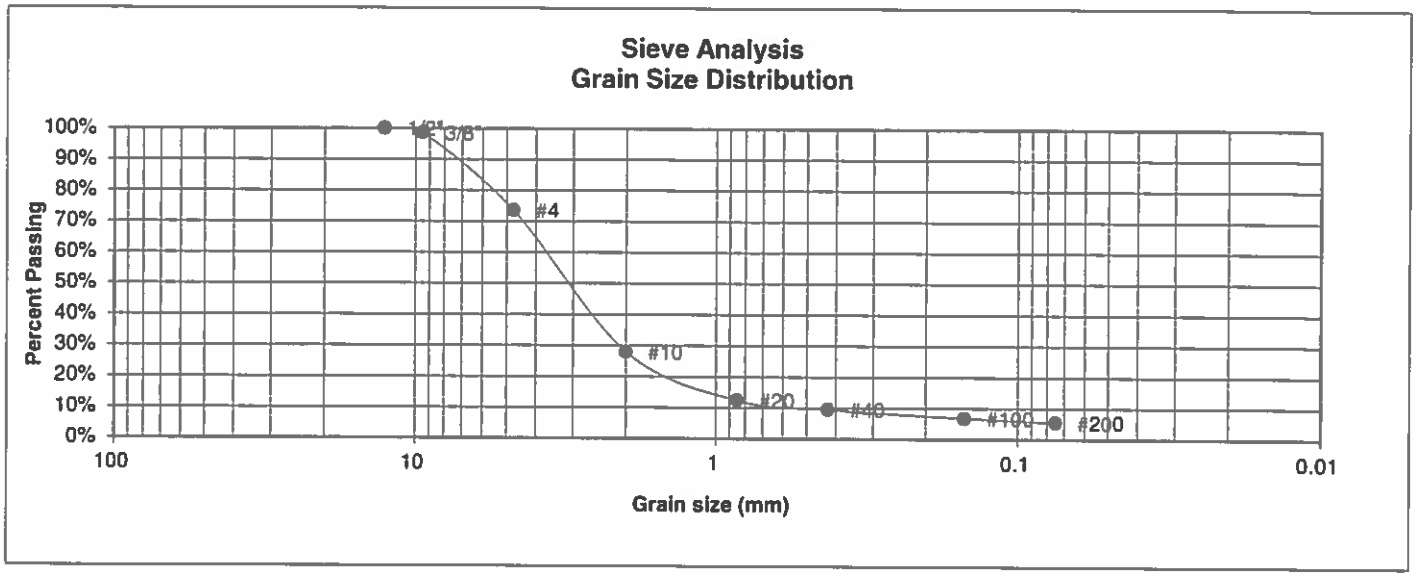
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 8-4-20

JOB NO.: 200150
FIG NO.: A- 3

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SM-SW	CLIENT	FLRD
SOIL TYPE #	1	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	1	JOB NO.	200150
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.5%
4	73.6%
10	27.9%
20	12.4%
40	9.5%
100	6.9%
200	5.4%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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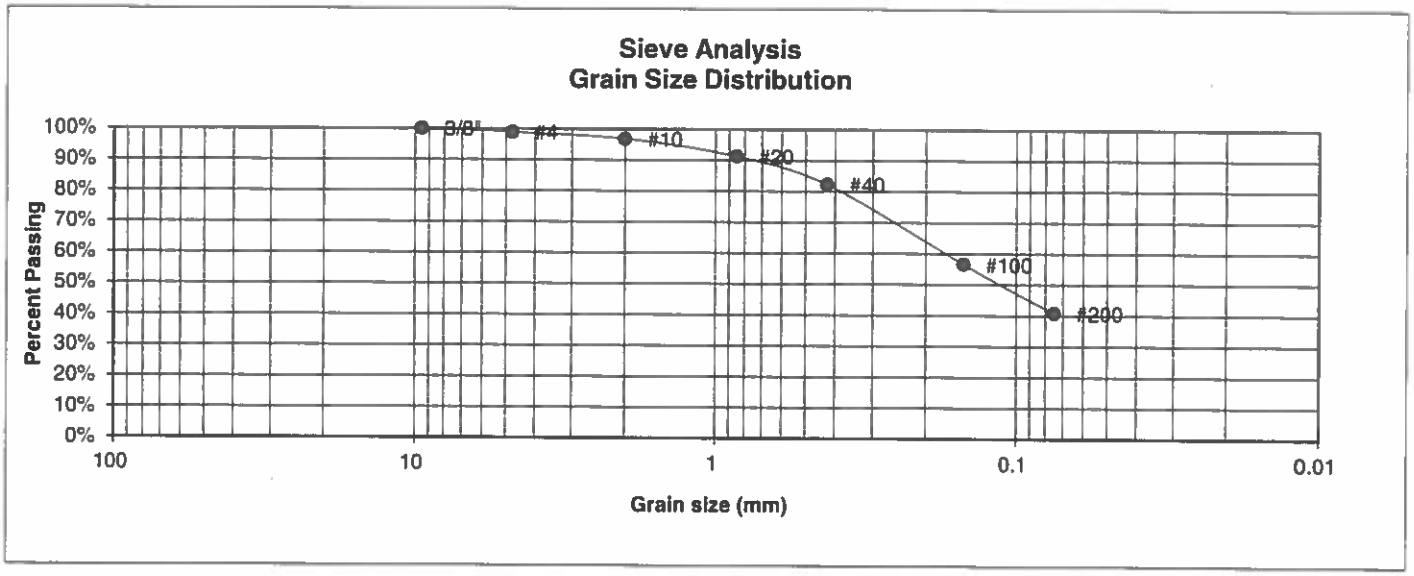
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			8-12-20

JOB NO.: 200150

FIG NO.: B-1

UNIFIED CLASSIFICATION	SM	CLIENT	FLRD
SOIL TYPE #	1	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	2	JOB NO.	200150
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.9%
10	96.8%
20	91.3%
40	82.2%
100	56.6%
200	40.8%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

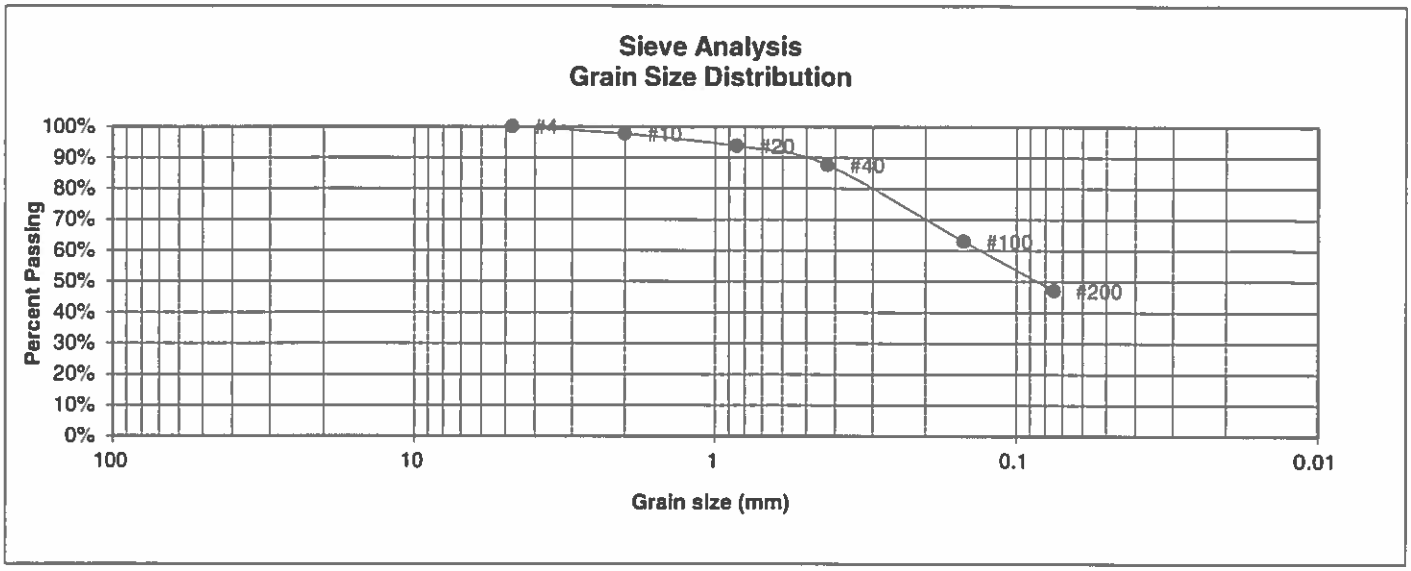
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		N	8-12-20

JOB NO.: 200150

FIG NO.: B-2

UNIFIED CLASSIFICATION	SM	CLIENT	FLRD
SOIL TYPE #	2	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	2	JOB NO.	200150
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.7%
20	93.8%
40	87.7%
100	63.0%
200	47.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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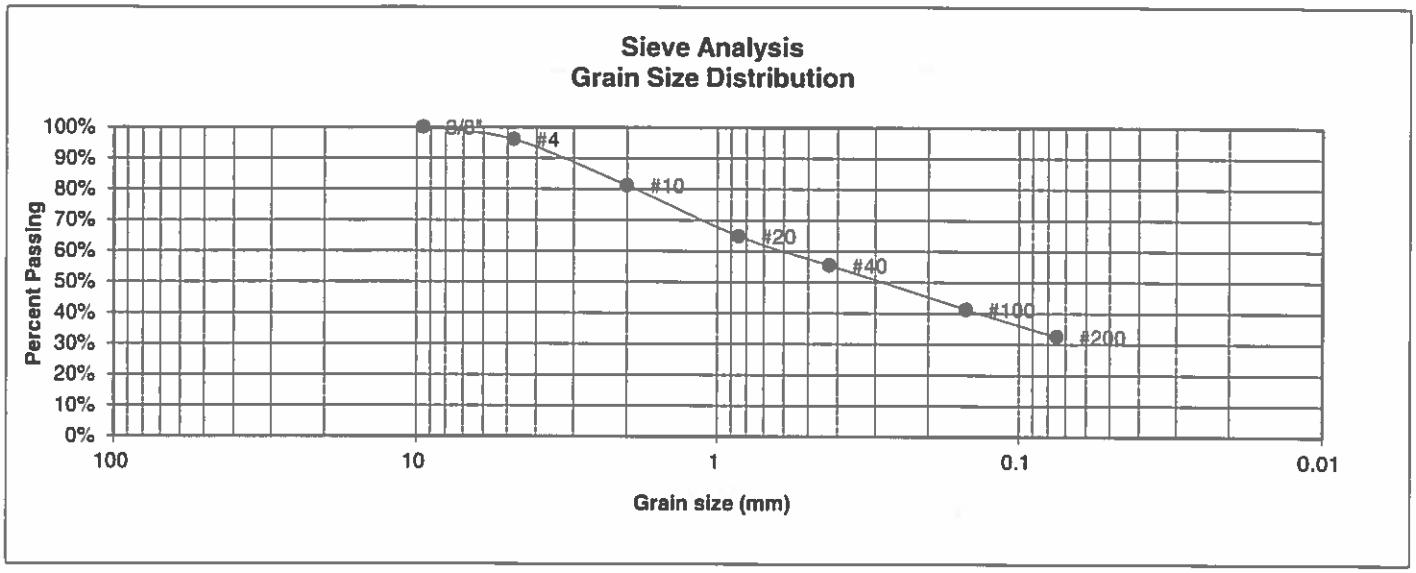
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED: AN	DATE: 8-12-20

JOB NO.: 200150

FIG NO.: B-3

UNIFIED CLASSIFICATION	SC	CLIENT	FLRD
SOIL TYPE #	2	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	3	JOB NO.	200150
DEPTH (FT)	30	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.0%
10	81.2%
20	64.8%
40	55.5%
100	41.3%
200	32.5%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	25
Plastic Index	8

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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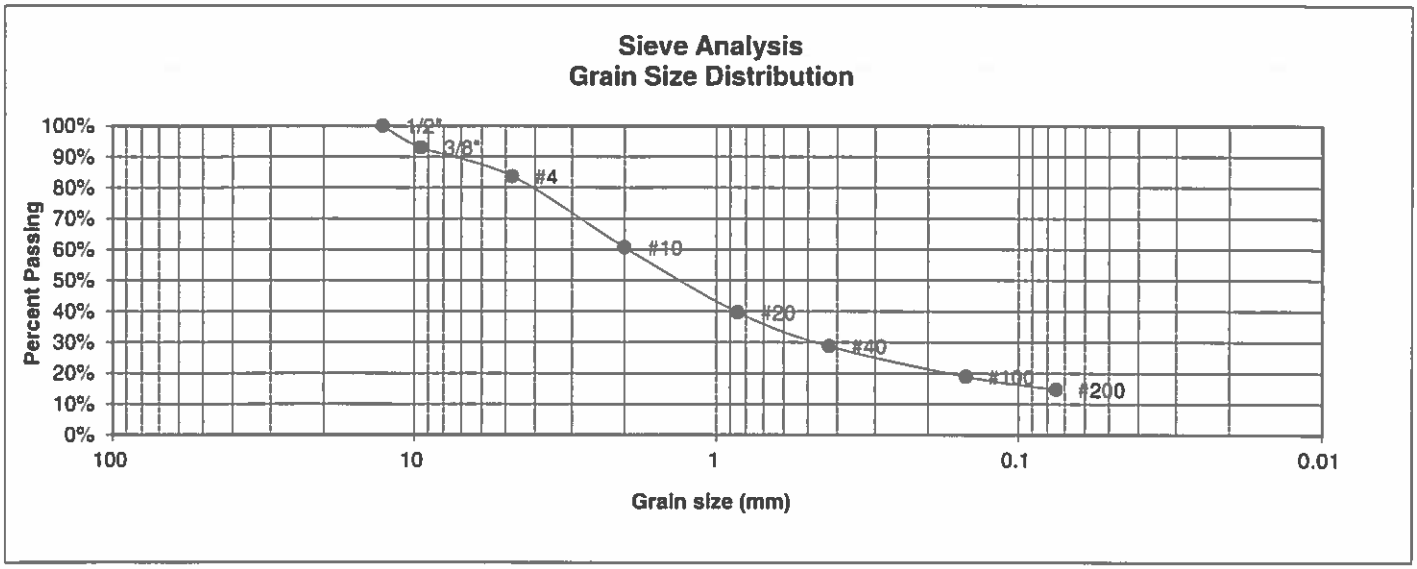
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 8-12-20

JOB NO.: 200150

FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	FLRD
SOIL TYPE #	1	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	4	JOB NO.	200150
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	93.0%
4	83.6%
10	60.6%
20	39.6%
40	28.7%
100	18.9%
200	14.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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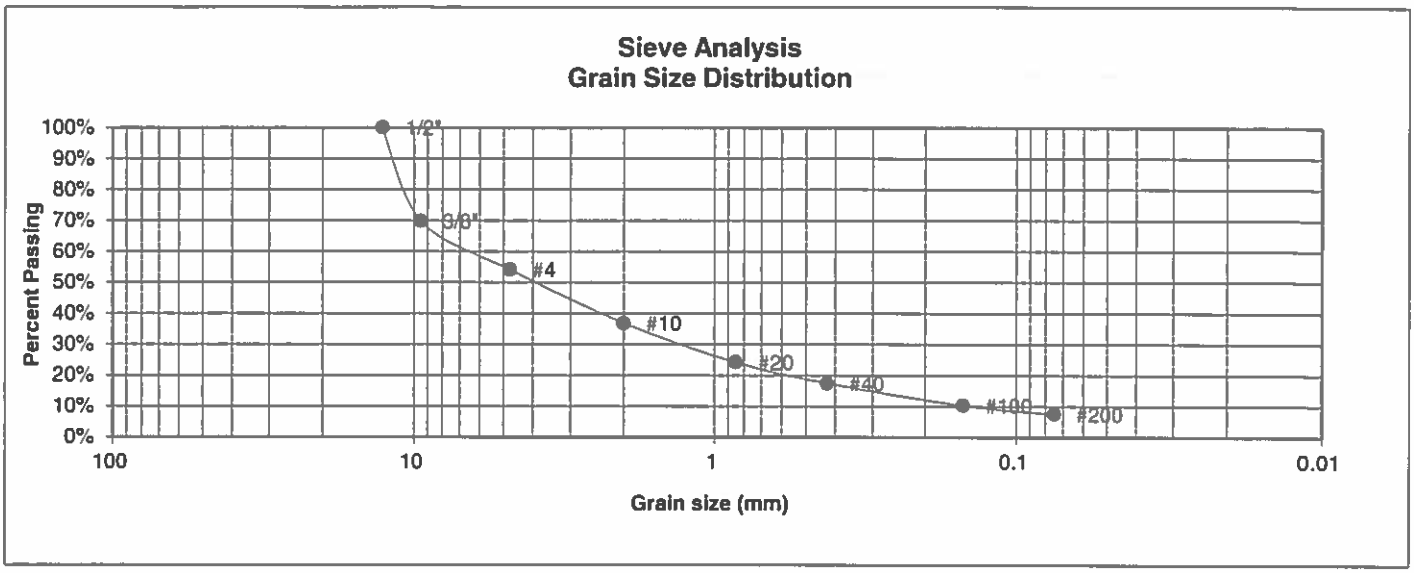
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED: AN	DATE: 8-12-20

JOB NO.: 200150

FIG NO.: B-5

UNIFIED CLASSIFICATION	SM-SW	CLIENT	FLRD
SOIL TYPE #	1	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	4	JOB NO.	200150
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	69.9%
4	54.1%
10	36.8%
20	24.2%
40	17.4%
100	10.3%
200	7.5%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

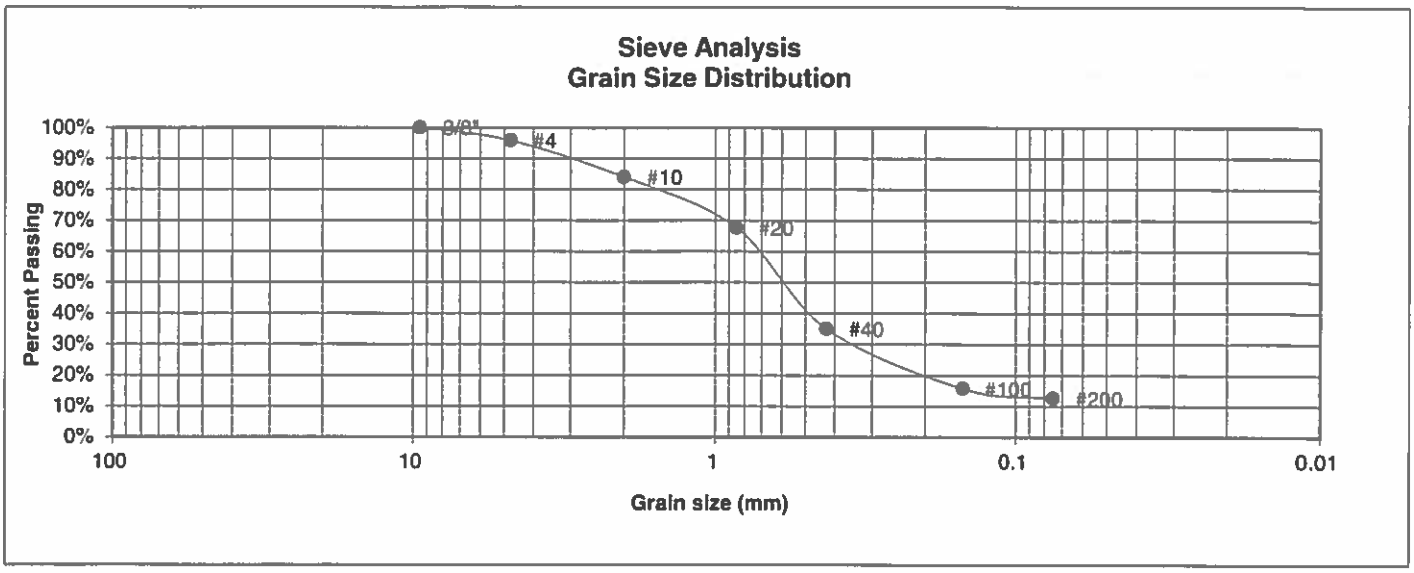
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 8-12-20

JOB NO.: 200150

FIG NO.: B-6

UNIFIED CLASSIFICATION	SM	CLIENT	FLRD
SOIL TYPE #	1	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	5	JOB NO.	200150
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.8%
10	84.0%
20	67.6%
40	35.0%
100	15.7%
200	12.6%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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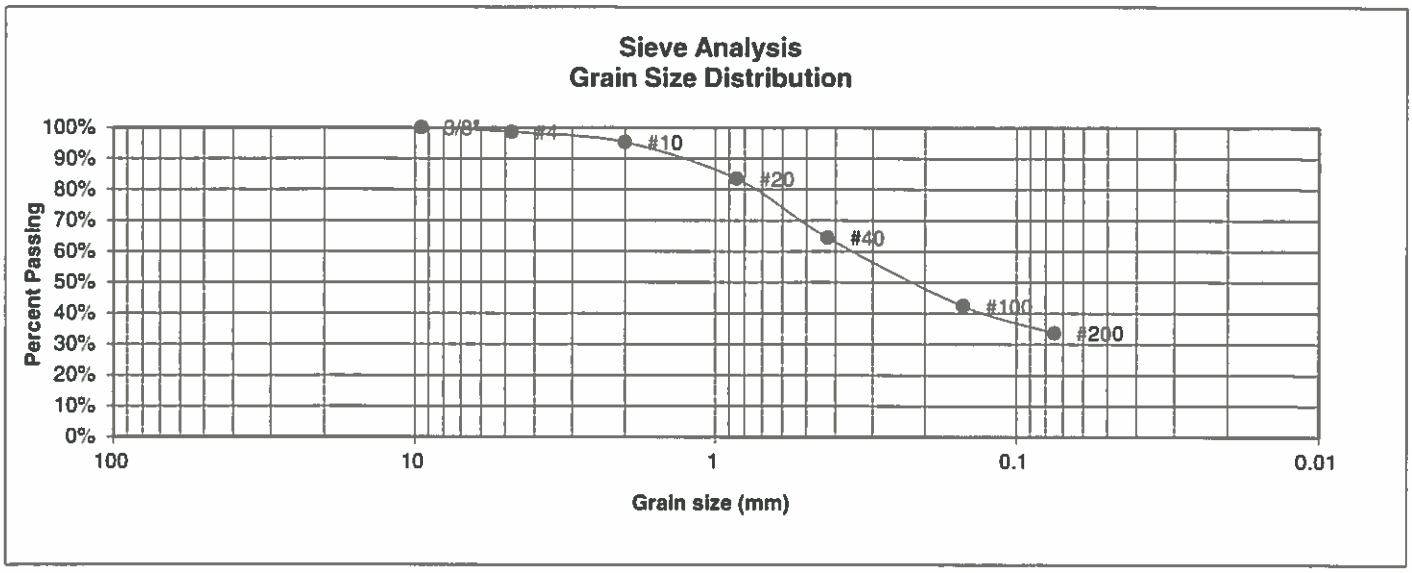
JOB NO.: 200150

FIG NO.: B-7

UNIFIED CLASSIFICATION	SM	CLIENT	FLRD
SOIL TYPE #	2	PROJECT	N. BEAVER CREEK BRIDGE
TEST BORING #	5	JOB NO.	200150
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.6%
10	95.3%
20	83.5%
40	64.4%
100	42.4%
200	33.6%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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LABORATORY TEST RESULTS

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			8-12-20

JOB NO.: 200150

FIG NO.: B-8

CLIENT	FLRD	JOB NO.	200150
PROJECT	N. BEAVER CREEK BRIDGE	DATE	2/3/2020
LOCATION	N. BEAVER CREEK BRIDGE	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-2	5	1	SM	0.01
TB-2	20	2	SM	<0.01

QC BLANK PASS

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LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 8-10-20

JOB NO.: 200150

FIG NO.: B-9