

March 17, 2021

Jered Lawson
Director of Partnerships and Strategic Initiatives
Pie Ranch
2080 Cabrillo Hwy
Pescadero CA 94060

Subject: **Base Flood Elevation Study
Pie Ranch, Pescadero, California**

Dear Jared:

Sherwood Design Engineers, Inc. (Sherwood) is pleased to present our base flood elevation (BFE) study for the farmhouse, offices, and the Farmstand at Pie Ranch in Pescadero, California. The base flood elevation study was conducted in compliance with San Mateo County requirements to determine the 100-year 24-hour flood stage elevation in the creek adjacent to the subject buildings.

INTRODUCTION

Pie Ranch is located at 2080 CA-1 in Pescadero, California and encompasses two parcels including portions of Green Oaks Creek. Bowman & Williams Consulting Engineers and Land Surveyors provided topographic survey information for both parcels at Pie Ranch dated June of 2015. In this survey, 13 buildings are shown including the farmhouse, offices, and the Farmstand. The basis of elevation for this survey was a rapid static GPS observation on control point #69 with the orthometric height being provided by the National Geodetic Survey (NGS) opus. The elevation of control point #69 = 332.45' (NAV88).

Green Oaks Creek carries water west from the Santa Cruz Mountains through a well-defined natural channel that meanders through the site and conveys water to a drainage ditch adjacent to Highway 1. There are two 48" corrugated metal pipe (CMP) culverts that have been installed in the creek that allow for vehicle access across the channel. The channel topography ranges from being more deeply incised with steep side slopes in the upslope or foothill area, and transitioning to a lower gradient channel and floodway as the stream traverses the farm fields on the property.

The channel in some portions is filled with heavy debris including downed trees, root balls, dense vegetation and stones. In other reaches near the end of the channel, the channel is relatively clean with grasses and other medium-density vegetation. The overall site is vegetated with grass and trees with most impervious surfaces coming from buildings.

METHODS

Sherwood has prepared a base flood elevation study, using the Federal Emergency Management Agency (FEMA) guidelines and requirements related to the development of a BFE study. For obtaining a peak discharge to model a base flood, FEMA specifies using either the United States Geologic Survey's (USGS) regional regression equations, the United State Department of Agriculture's TR-55 method, or

the Rational Method, though these three methods vary in accuracy¹. Sherwood employed the USGS regional regression equations to determine the 100-year 24-hour peak runoff flow.

USGS StreamStats hydrologic analysis determined that the 100-year 24-hour flood peak discharge is 222 cubic feet per second (CFS) based on mean annual precipitation and drainage area parameters. See Appendix D for Streamstats data at Pie Ranch.

Sherwood employed the United States Army Corp of Engineer's Hydrologic Engineering Center – River Analysis System (HEC-RAS) to conduct a hydraulic analysis of the stream and model the base flood elevation at different locations on the site.

The survey surface and the one-dimensional HEC-RAS model were employed to determine the BFE. Applying Manning's roughness coefficients that ranged from 0.045-0.010 depending on the cross-section location, corresponding channel topography, land coverage and other relevant inputs, the model was run to compute the BFE. The extent of the HEC-RAS model started upstream and adjacent to the greenhouse building and ended downstream where the creek leaves the site with cross-sections placed in relevant locations along the creek. The model extended approximately 1,633 feet across the site from east to west.

RESULTS

The corner of the farmhouse building pad (note, the farmhouse was destroyed in the 2020 CZU fire and the building pad refers to the ground at the remaining foundation) closest to the creek is at an elevation of 191.0'. The BFE in the creek adjacent to the farmhouse building was calculated to be 182.11'.

The ground elevation of the southeast corner of the Farmstand is at 156.32' and the calculated BFE in this section of the stream was calculated to be 155.55'. the ground elevation of the northwest corner of the Farmstand is 154.52' whereas the calculated BFE in this area is 154.87'.

The resulting Base Flood Elevation Map for Pie Ranch can be found in Appendix A with BFE Cross Sections of Green Oaks Creek in Appendix B.

CONCLUSION

The intent of this study is to determine the BFE at the farmhouse building pad and Farmstand building at Pie Ranch in Pescadero, California. The BFE at the Farmhouse is 182.11. The BFE at the Farmstand is 155.55.

The results indicate that at the Farmhouse the existing pad at ground level is 8.9 feet above the BFE for the 100-year 24-hour flood event. The results indicate that the ground level at the existing Farmstand is - 0.35 below to 0.77 feet above the BFE for the 100-year 24-hour flood event. It should be noted that finish floor elevation of the Farmstand was not provided but the finish floor elevation is above the ground elevation via several stairs to enter the Farmstand.

Based on the results of the hydrology and hydraulic modeling, the existing farm building pad is well above the BFE for the creek. The BFE at the Farmstand is close to or above the ground surface at the Farmstand. The finish floor elevation of the Farmstand should be surveyed. In the future, if the Farmstand is modified or replaced the finish floor elevation shall be set above a minimum elevation of 156.6 feet to be at least one foot higher than the BFE.

¹ Federal Emergency Management Agency. "Managing Floodplain Development in Approximate Zone A Areas, a Guide for Obtaining and Developing Base (100-year) Flood Elevations". April 1995.

Thank you for the opportunity to assist on this project. If you have any questions or require any additional information, please contact SDE Project Manager Andy Greenberg at (831) 426-9054 or agreenberg@sherwoodengineers.com or me at the same phone number or at phaase@sherwoodengineers.com.

Sincerely,



PETER HAASE, MS, PE
Principal Engineer



MADELINE RONS, EIT, ENV SP
Design Engineer I

APPENDICES

- Appendix A: Base Flood Elevation Map
- Appendix B: Cross Sections of Base Flood Elevation Extents
- Appendix C: GeoHECRAS Results Summary
- Appendix D: USGS Streamstats Results





SCALE: 0 40'		
Note: If the graphic scale does not equal 1", this sheet has been modified from its original form.		
NO	DATE	REVISION

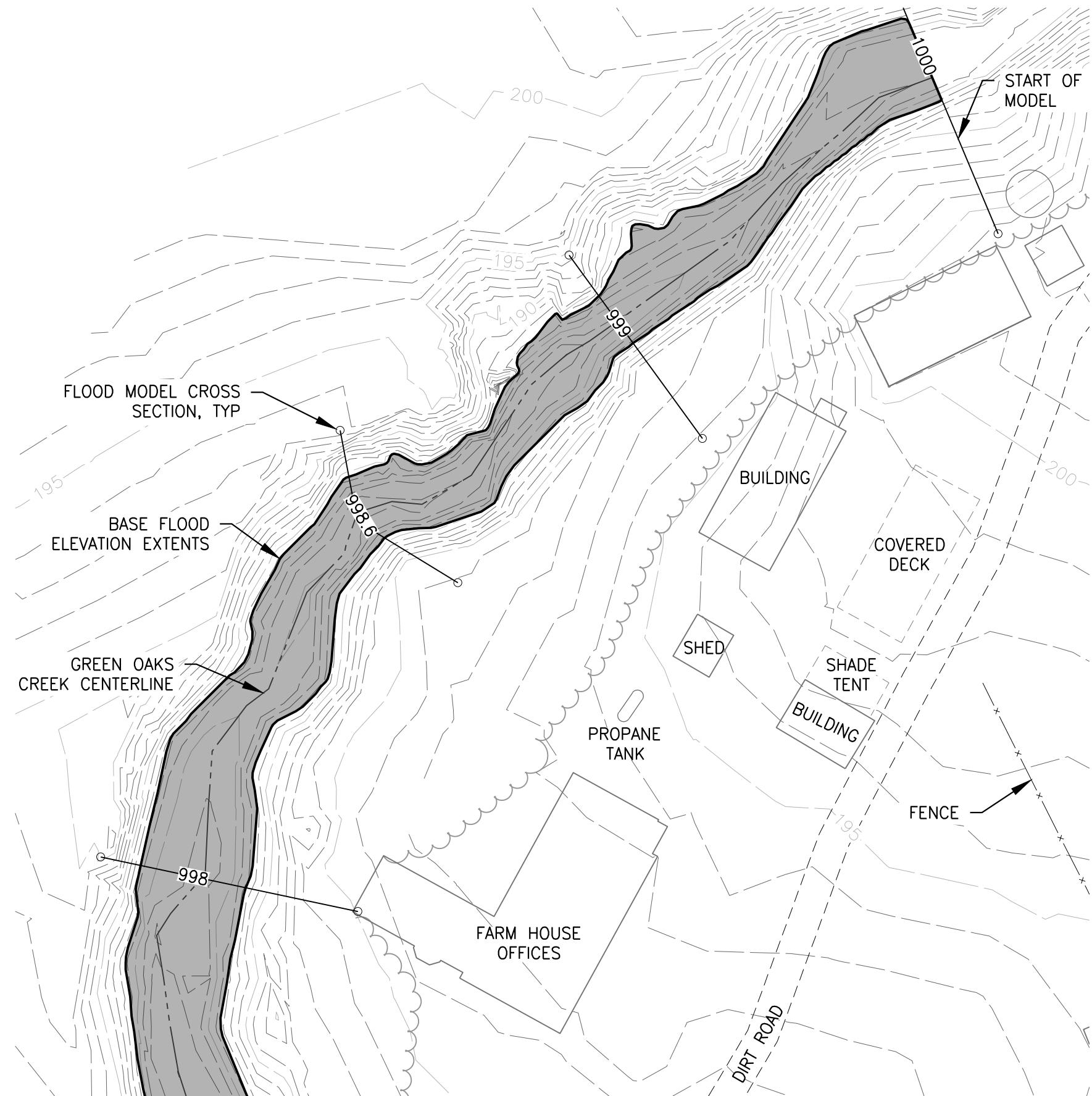
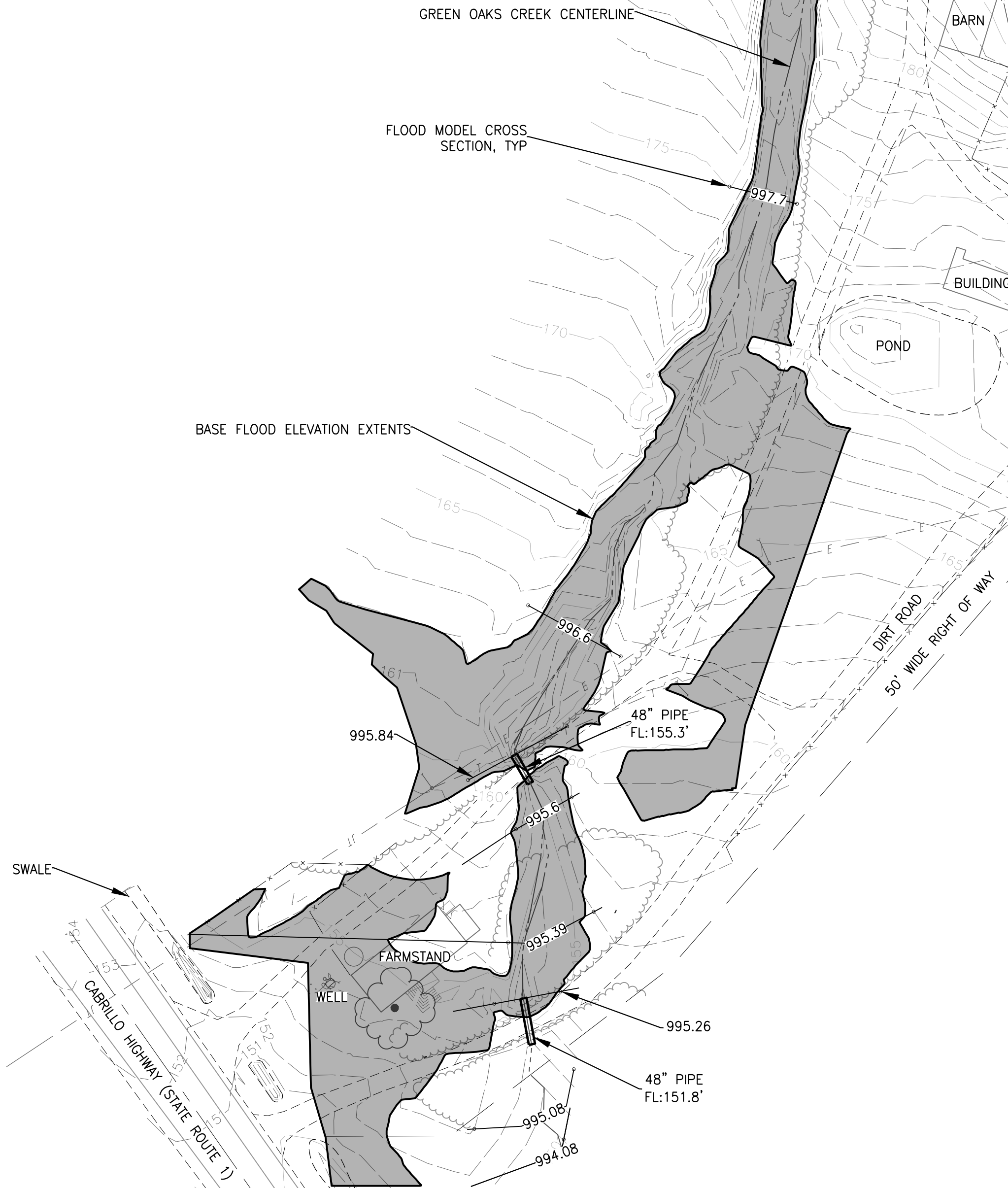
2018 Sherwood Design Engineers The designs and concepts shown are the sole property of Sherwood Design Engineers and may not be used without the prior written consent of Sherwood Design Engineers.	
PROJECT NO.	20-285
DATE	3/11/2021
DRAWN	MAR
DESIGNED	
CHECKED	PHH

PIE RANCH PROPERTY, LLC
2080 CABRILLO HIGHWAY
PESCADEO CALIFORNIA

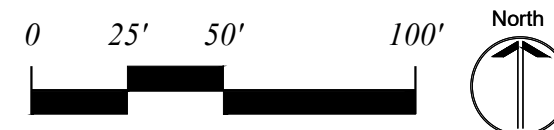
BASE FLOOD
ELEVATION MAP

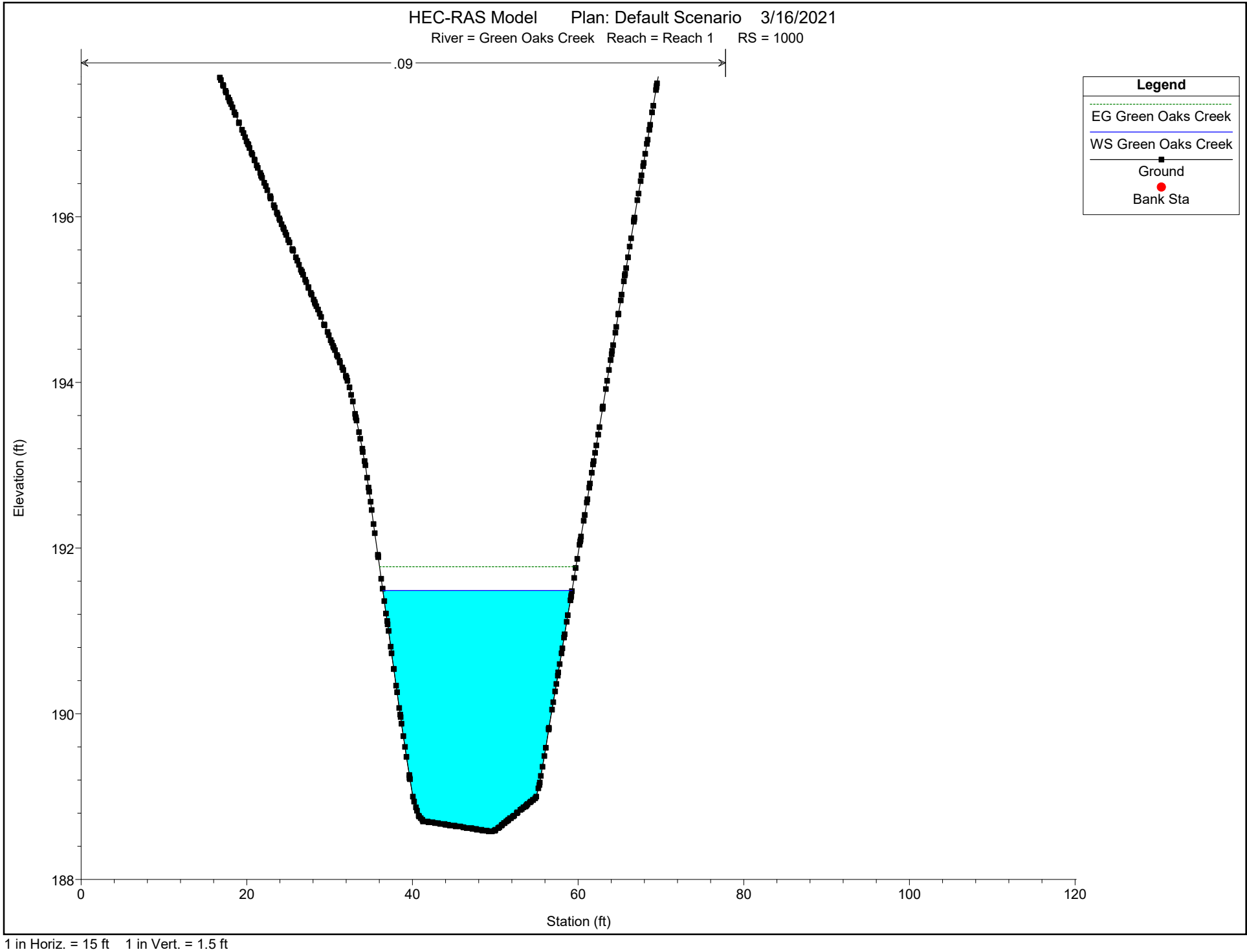


1 BARN ENLARGEMENT SCALE: 1"=30'

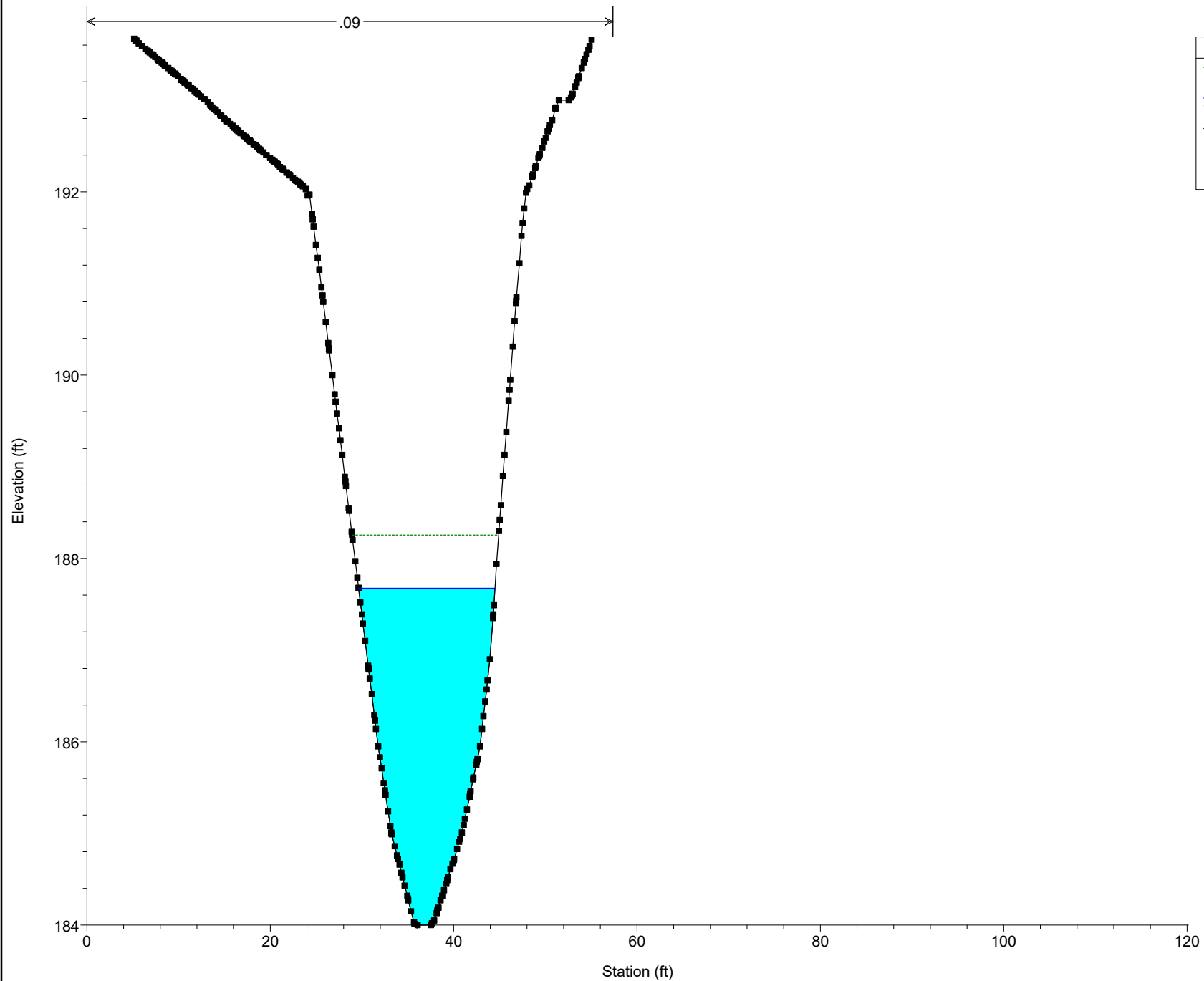


2 FARM HOUSE OFFICES ENLARGEMENT SCALE: 1"=30'





HEC-RAS Model Plan: Default Scenario 3/16/2021
River = Green Oaks Creek Reach = Reach 1 RS = 999

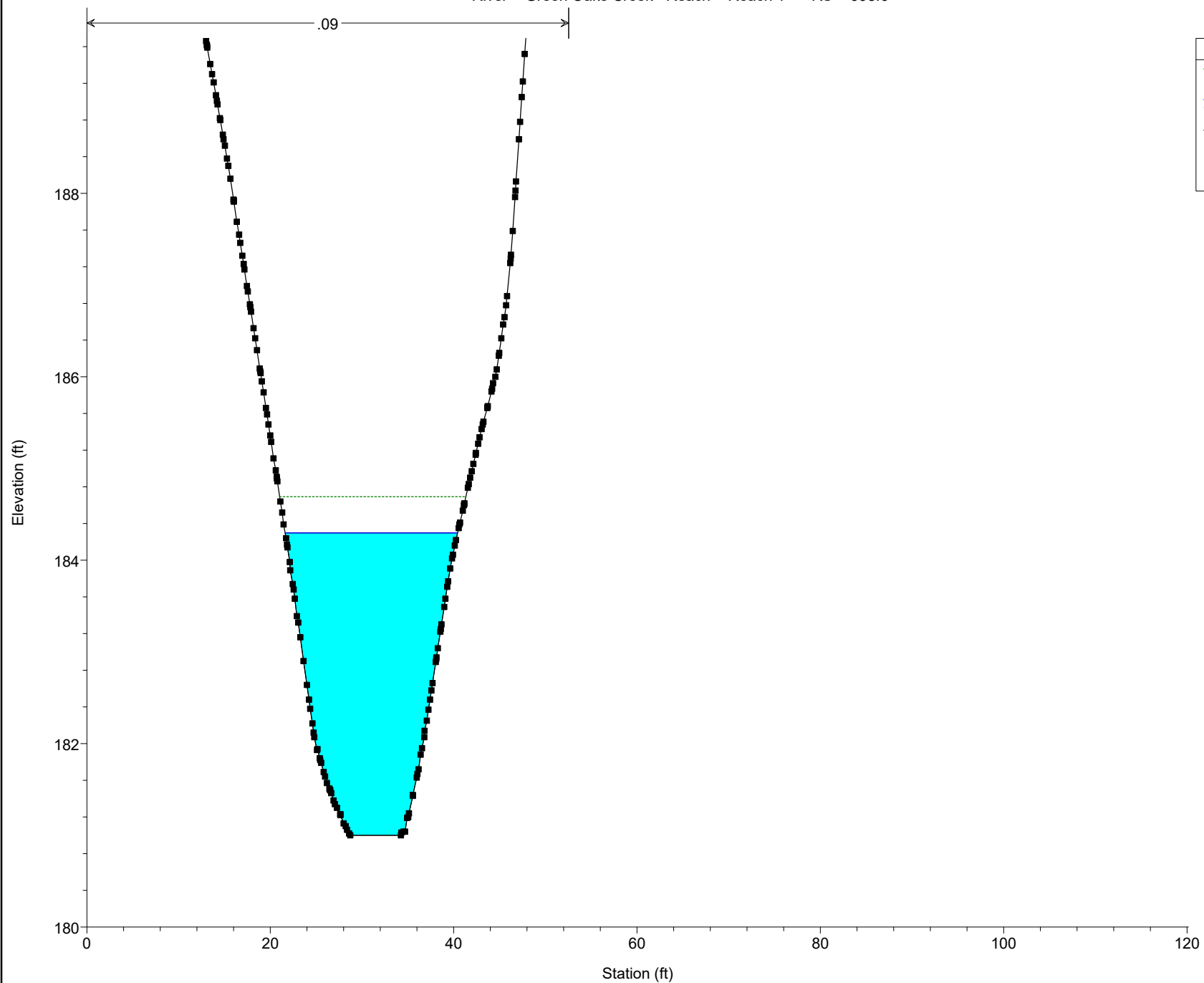


Legend	
EG Green Oaks Creek	
WS Green Oaks Creek	
Ground	
Bank Sta	

1 in Horiz. = 15 ft 1 in Vert. = 1.5 ft

HEC-RAS Model Plan: Default Scenario 3/16/2021

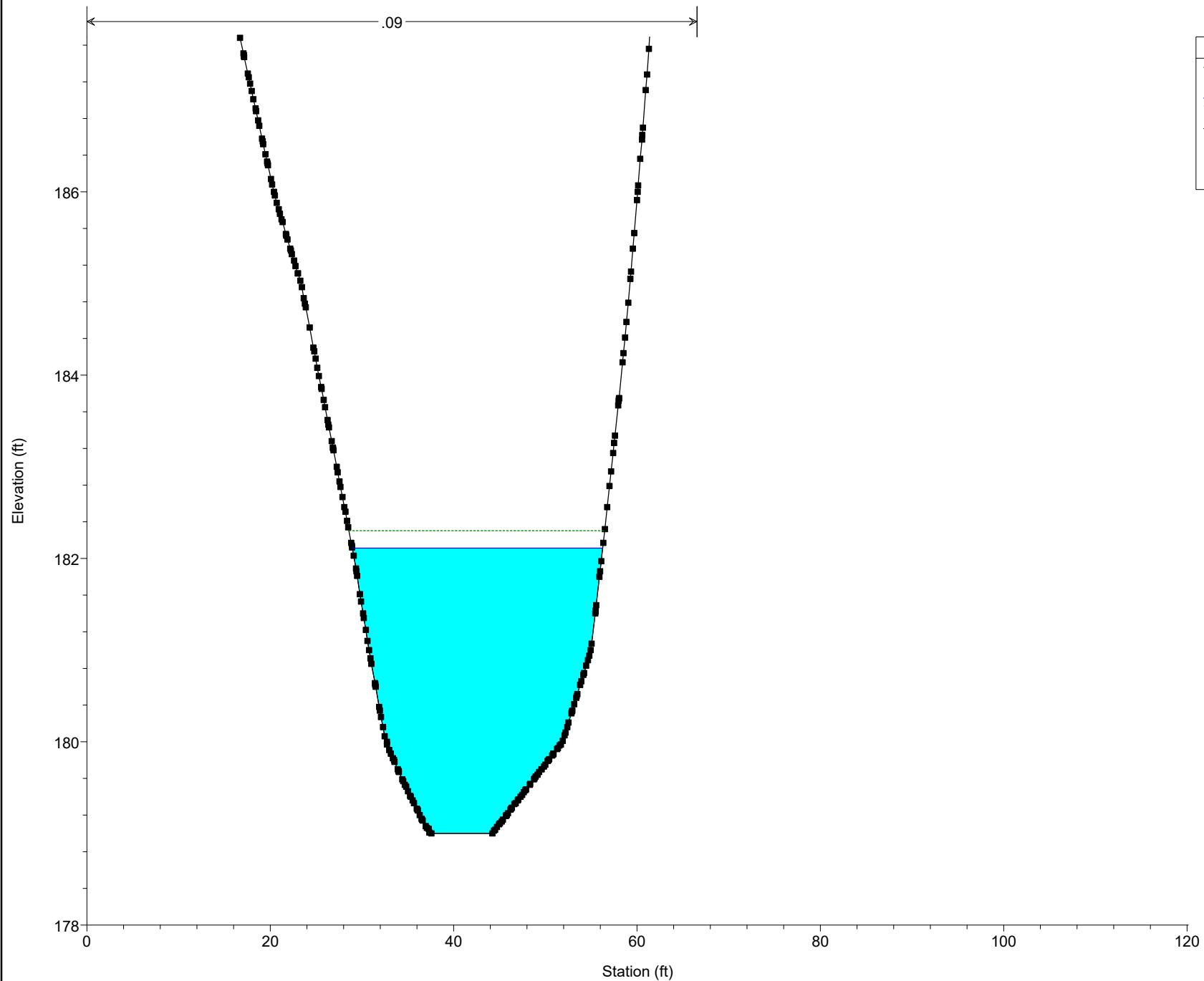
River = Green Oaks Creek Reach = Reach 1 RS = 998.6



Legend	
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WS Green Oaks Creek	
Ground	
Bank Sta	

1 in Horiz. = 15 ft 1 in Vert. = 1.5 ft

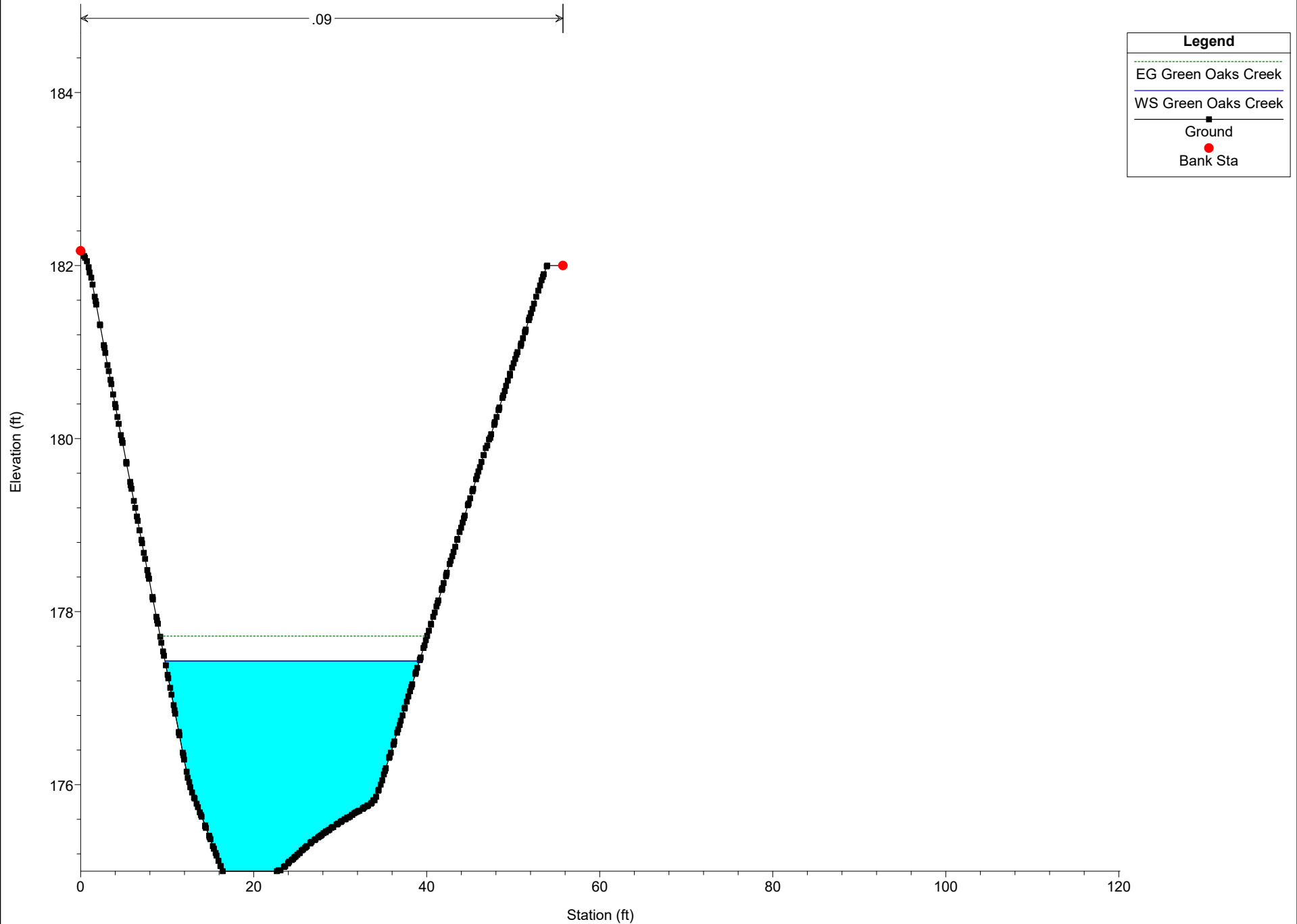
HEC-RAS Model Plan: Default Scenario 3/16/2021
River = Green Oaks Creek Reach = Reach 1 RS = 998



Legend	
EG Green Oaks Creek	
WS Green Oaks Creek	
Ground	
Bank Sta	

1 in Horiz. = 15 ft 1 in Vert. = 1.5 ft

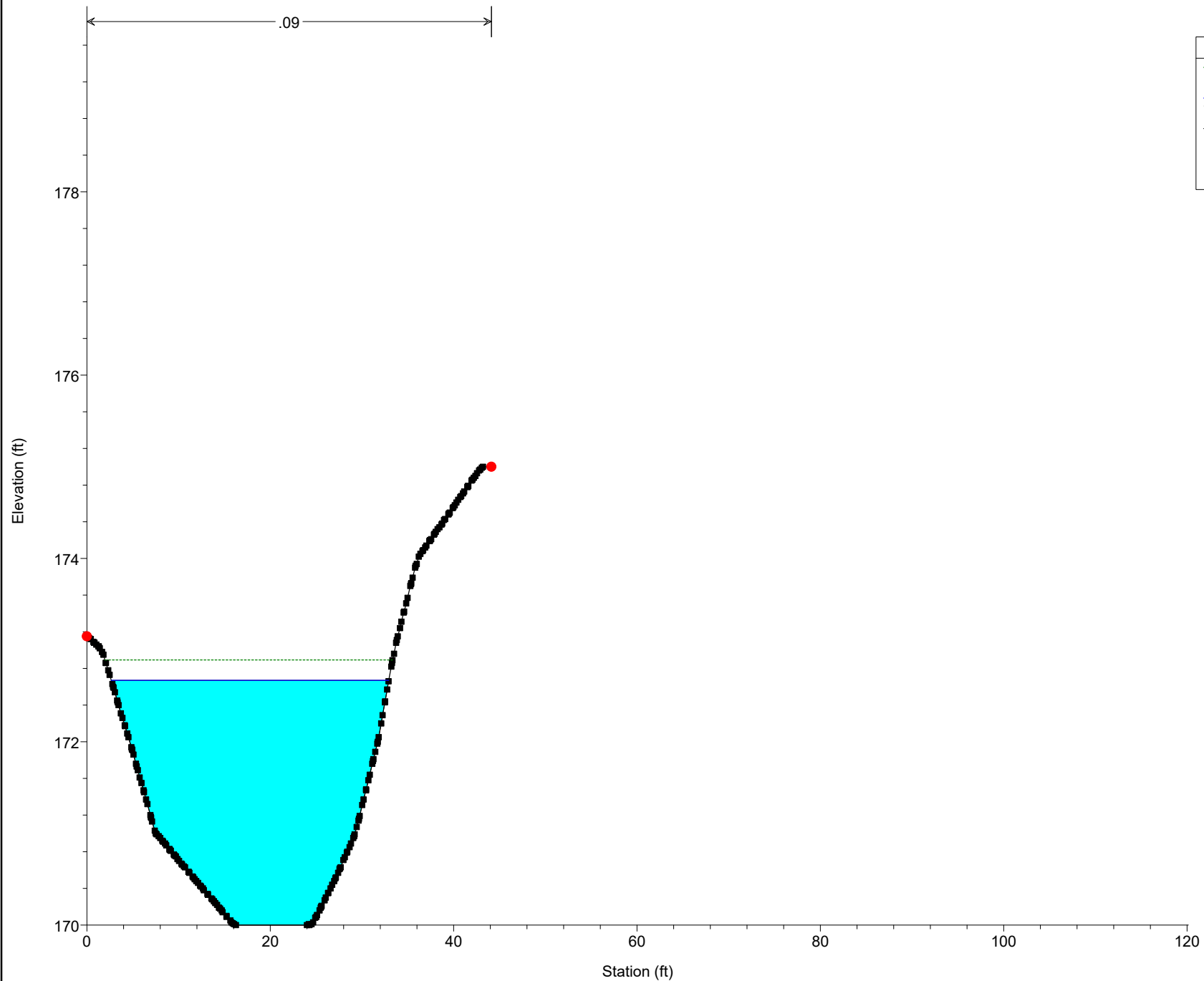
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HEC-RAS Model Plan: Default Scenario 3/16/2021

River = Green Oaks Creek Reach = Reach 1 RS = 997.7

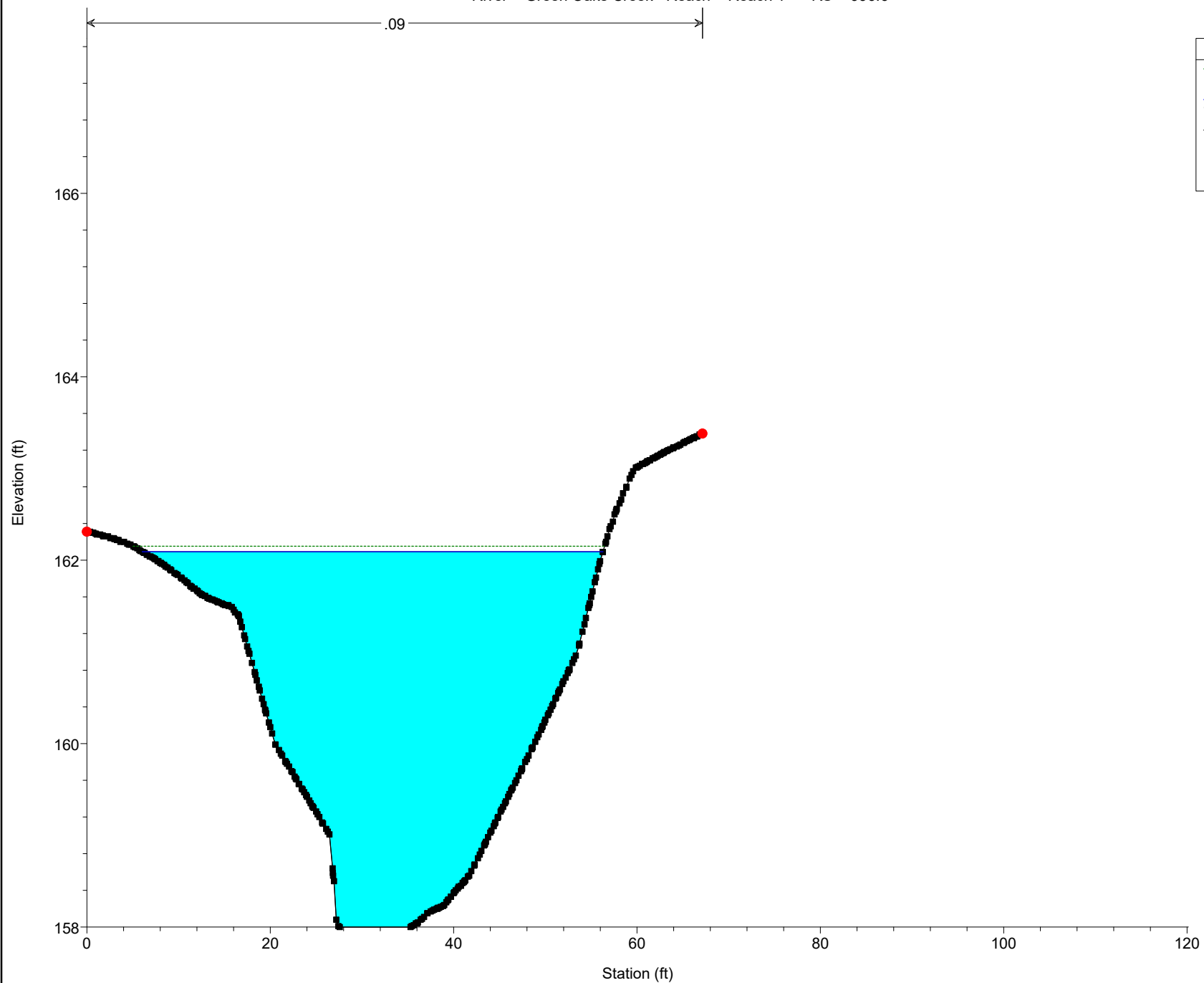


Legend	
EG Green Oaks Creek	
WS Green Oaks Creek	
Ground	
Bank Sta	

1 in Horiz. = 15 ft 1 in Vert. = 1.5 ft

HEC-RAS Model Plan: Default Scenario 3/16/2021

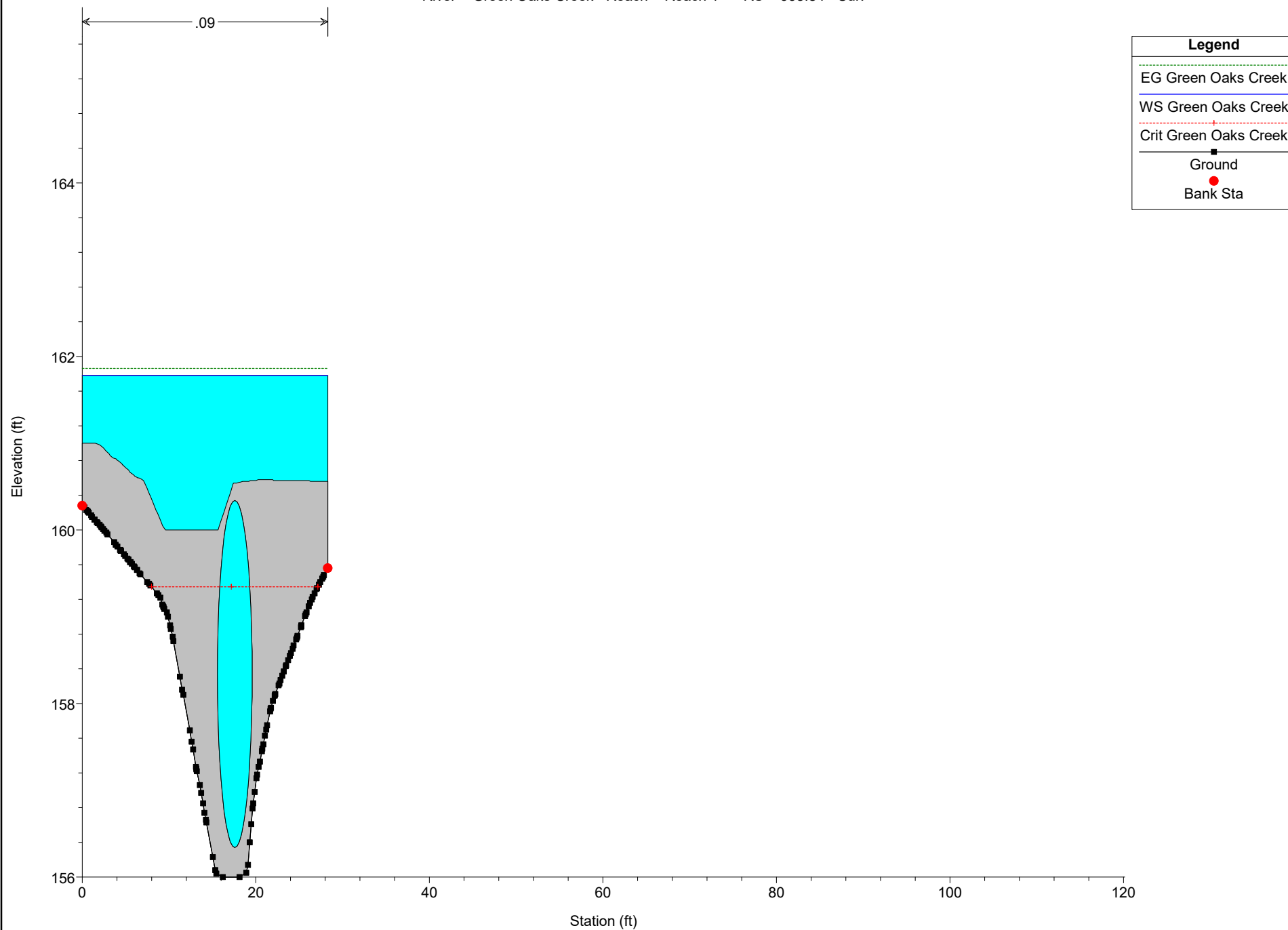
River = Green Oaks Creek Reach = Reach 1 RS = 996.6



Legend	
EG Green Oaks Creek	
WS Green Oaks Creek	
Ground	
Bank Sta	

1 in Horiz. = 15 ft 1 in Vert. = 1.5 ft

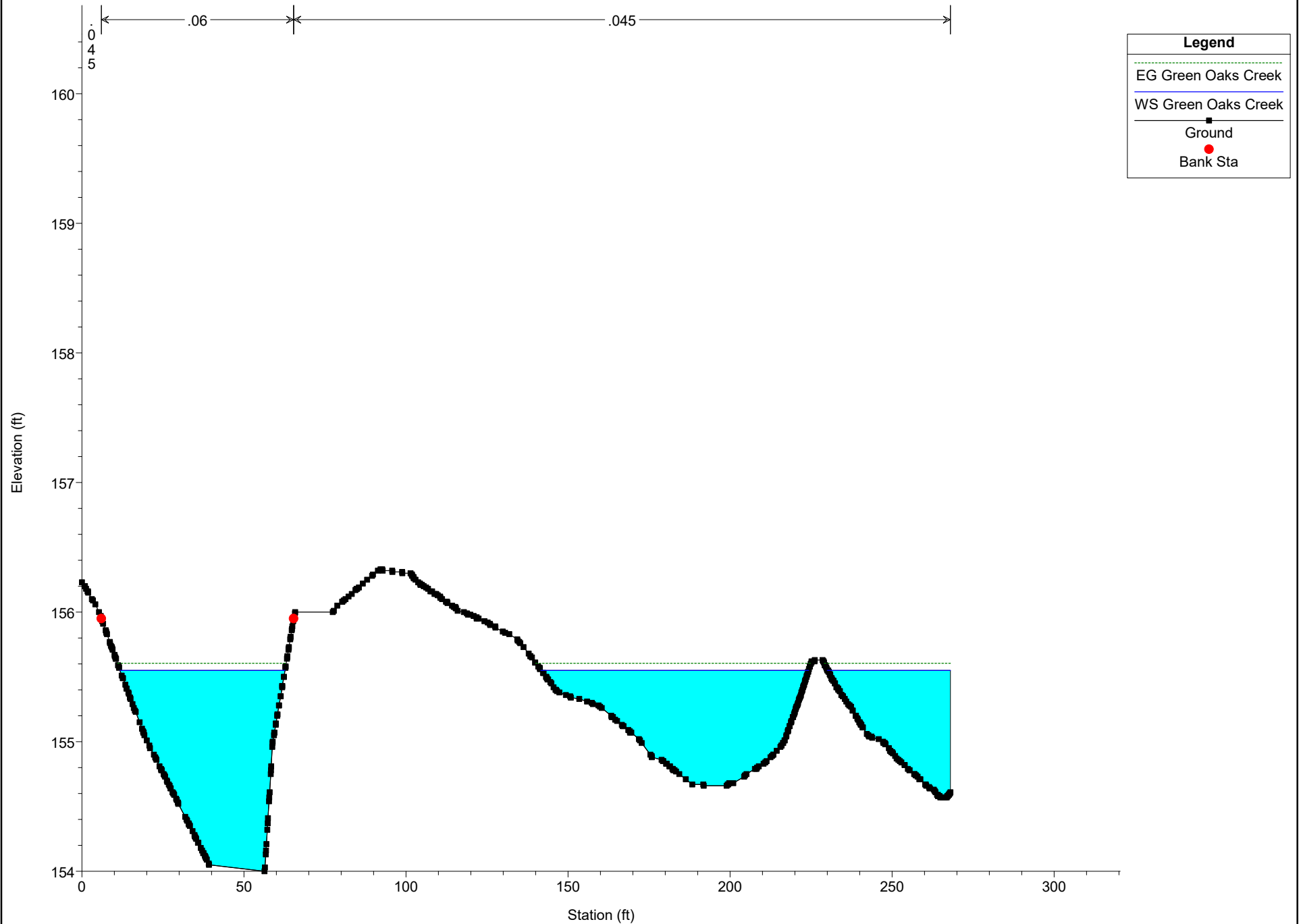
HEC-RAS Model Plan: Default Scenario 3/16/2021
River = Green Oaks Creek Reach = Reach 1 RS = 995.84 Culv



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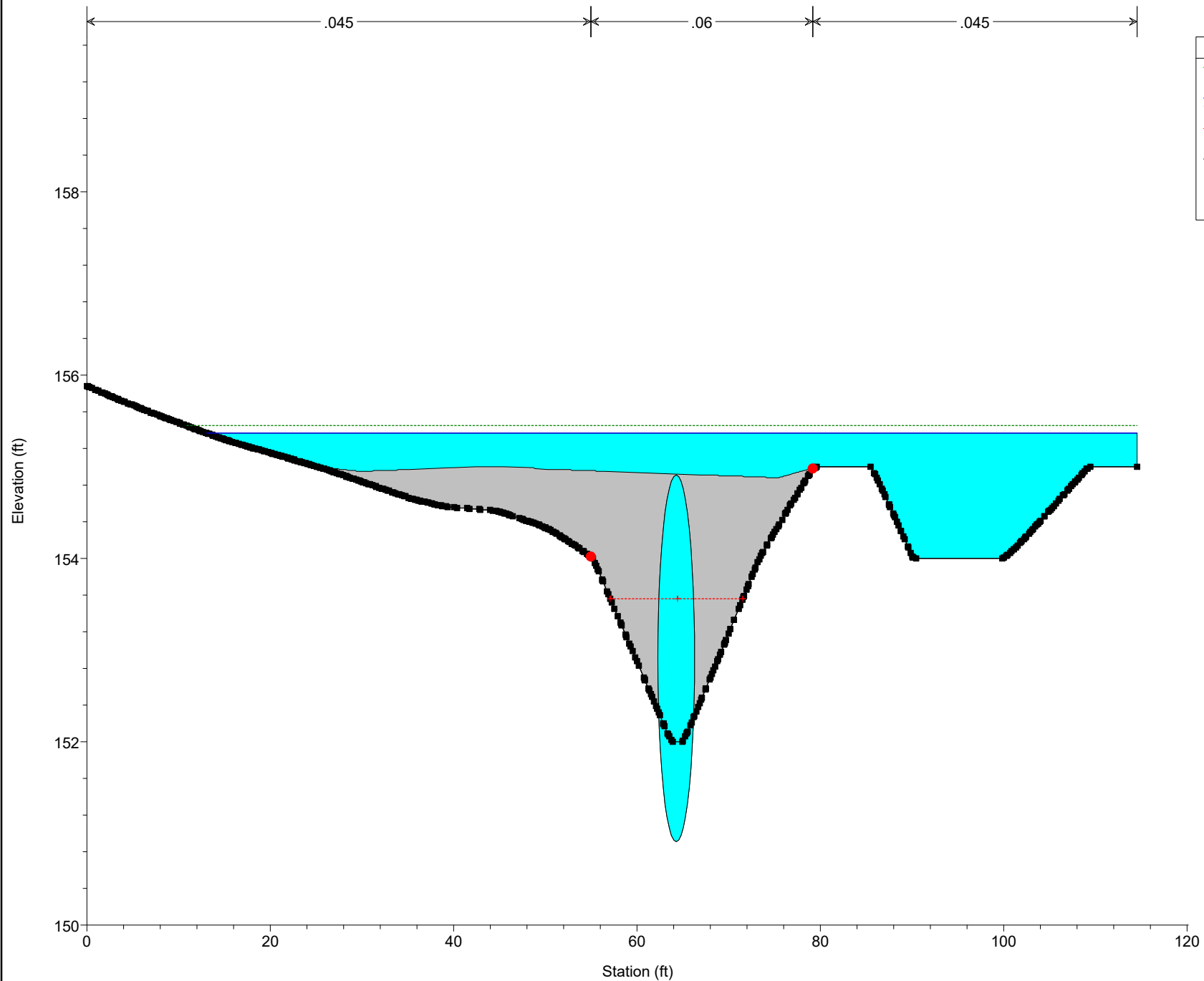
HEC-RAS Model Plan: Default Scenario 3/16/2021

River = Green Oaks Creek Reach = Reach 1 RS = 995.39



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HEC-RAS Model Plan: Default Scenario 3/16/2021
River = Green Oaks Creek Reach = Reach 1 RS = 995.26 Culv

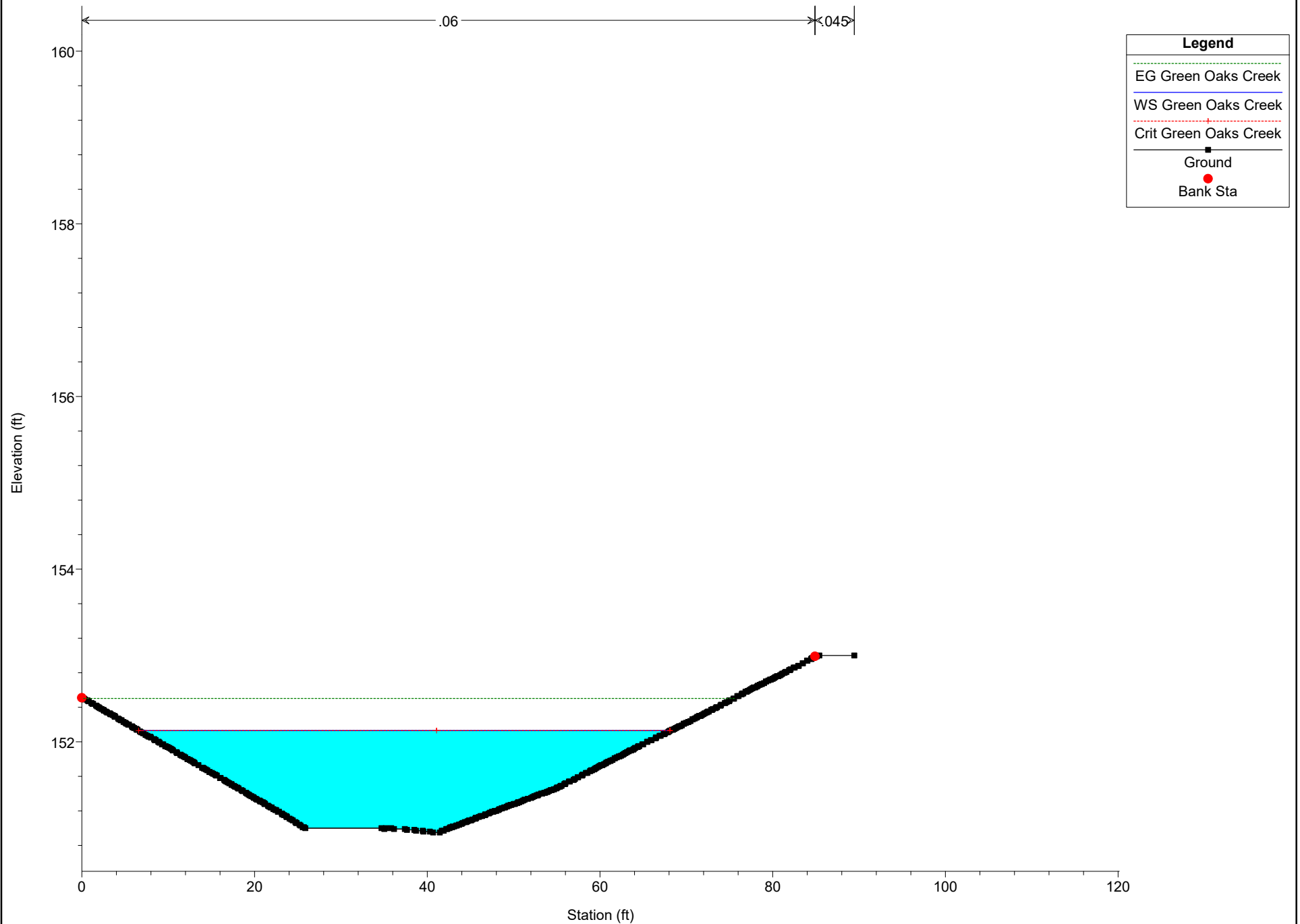


Legend	
EG Green Oaks Creek	
WS Green Oaks Creek	
Crit Green Oaks Creek	
Ground	
Bank Sta	

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HEC-RAS Model Plan: Default Scenario 3/16/2021

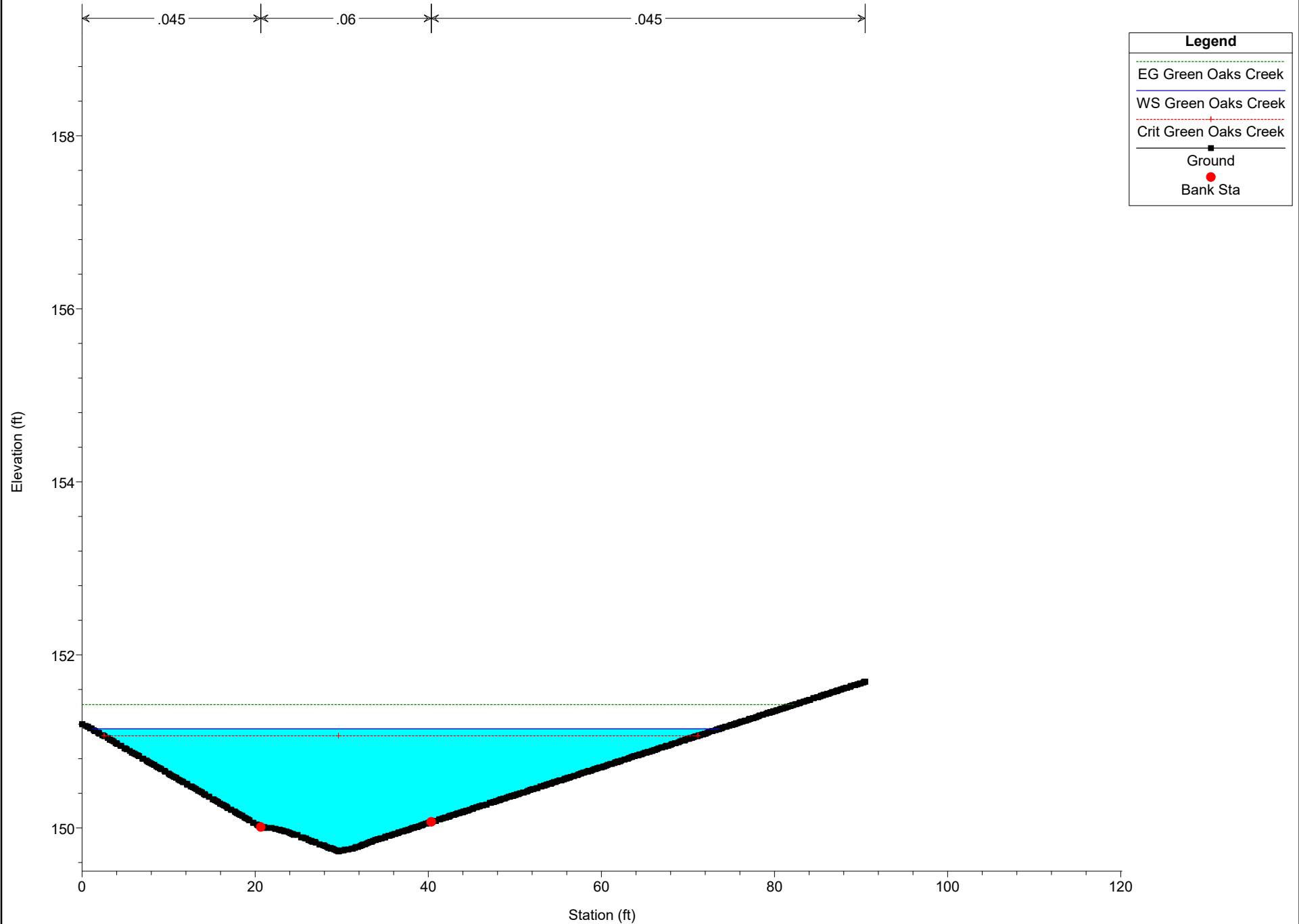
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1 in Horiz. = 15 ft 1 in Vert. = 1.5 ft

HEC-RAS Model Plan: Default Scenario 3/16/2021

River = Green Oaks Creek Reach = Reach 1 RS = 994.08



Appendix C: GeoHEC-RAS Results Summary

HEC-RAS Plan: Default Scenario River: Green Oaks Creek Reach: Reach 1 Profile: Green Oaks Creek

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	Green Oaks Creek	222.00	188.58	191.49		191.77	0.024874	4.30	51.65	22.83	0.50
Reach 1	999	Green Oaks Creek	222.00	184.00	187.67		188.25	0.050160	6.11	36.31	14.87	0.69
Reach 1	998.6	Green Oaks Creek	222.00	181.00	184.30		184.69	0.034172	5.05	43.92	18.81	0.58
Reach 1	998	Green Oaks Creek	222.00	179.00	182.11		182.30	0.015470	3.49	63.58	27.32	0.40
Reach 1	997.95	Green Oaks Creek	222.00	178.00	181.23		181.51	0.022523	4.24	52.35	21.67	0.48
Reach 1	997.8	Green Oaks Creek	222.00	175.00	177.43		177.72	0.033272	4.30	51.58	29.42	0.57
Reach 1	997.7	Green Oaks Creek	222.00	170.00	172.67		172.89	0.022330	3.77	58.84	30.28	0.48
Reach 1	997.6	Green Oaks Creek	222.00	167.19	169.99		170.30	0.038244	4.48	49.56	29.56	0.61
Reach 1	997.5	Green Oaks Creek	222.00	166.00	169.06	168.22	169.27	0.023223	3.69	60.22	32.84	0.48
Reach 1	997.1	Green Oaks Creek	222.00	163.50	165.08	165.08	165.63	0.115769	5.94	37.36	34.03	1.00
Reach 1	996.6	Green Oaks Creek	222.00	158.00	162.09		162.15	0.004839	1.95	113.96	50.26	0.23
Reach 1	996.2	Green Oaks Creek	222.00	157.00	161.95		161.97	0.002730	1.12	198.10	131.75	0.16
Reach 1	996.1	Green Oaks Creek	222.00	156.94	161.88		161.92	0.002018	1.72	128.92	30.11	0.15
Reach 1	995.91	Green Oaks Creek	222.00	156.00	161.78	159.26	161.86	0.004742	2.30	96.73	28.31	0.22
Reach 1	995.84		Culvert									
Reach 1	995.67	Green Oaks Creek	222.00	155.81	157.78	157.74	158.32	0.048095	5.93	37.44	32.43	0.97
Reach 1	995.6	Green Oaks Creek	222.00	155.00	157.68	157.19	157.94	0.017587	4.09	54.60	42.31	0.61
Reach 1	995.5	Green Oaks Creek	222.00	154.79	156.33	156.33	156.80	0.052886	5.48	40.51	42.74	0.99
Reach 1	995.39	Green Oaks Creek	222.00	154.00	155.55		155.61	0.006330	1.98	119.10	171.60	0.35
Reach 1	995.31	Green Oaks Creek	222.00	152.00	155.37	154.67	155.44	0.004117	2.53	105.70	101.48	0.31
Reach 1	995.26		Culvert									
Reach 1	995.21	Green Oaks Creek	222.00	152.00	153.64		153.89	0.019507	4.31	56.68	62.24	0.64
Reach 1	995.08	Green Oaks Creek	222.00	150.95	152.13	152.13	152.50	0.058682	4.89	45.37	61.50	1.00
Reach 1	994.08	Green Oaks Creek	222.00	149.73	151.14	151.06	151.42	0.027043	4.73	53.64	72.46	0.74

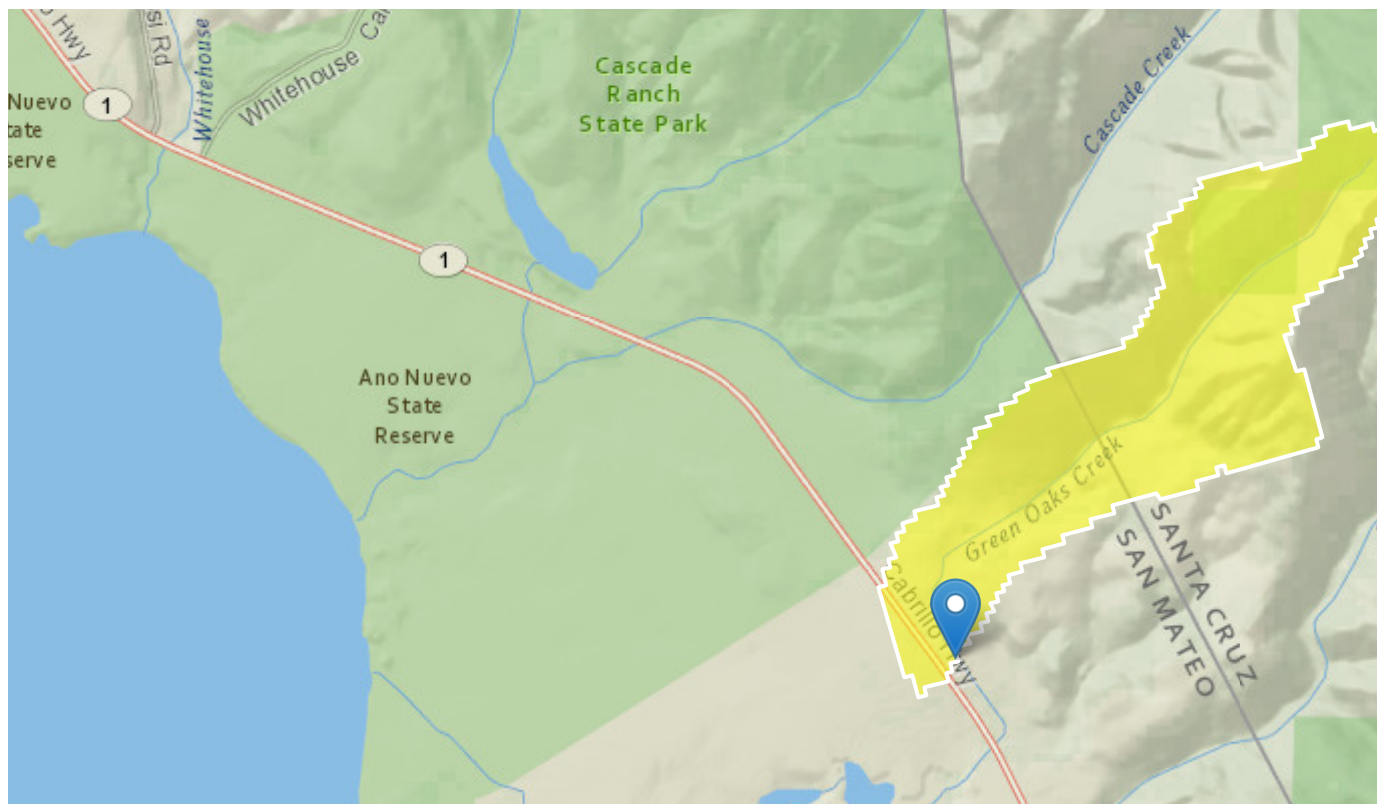
StreamStats Report

Region ID: CA

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Time: 2021-03-05 11:46:07 -0800



From <https://streamstats.usgs.gov/ss/> on 03/05/2021 by Madeline Rons.

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.6	square miles
PRECIP	Mean Annual Precipitation	34.2	inches

Peak-Flow Statistics Parameters[2012 5113 Region 1 North Coast]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
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Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.6	square miles	0.04	3200
PRECIP	Mean Annual Precipitation	34.2	inches	20	125

Peak-Flow Statistics Flow Report[2012 5113 Region 1 North Coast]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	SEp
50_percent_AEP_flood	36.9	ft ³ /s	14.9	91.4	58.6
20_percent_AEP_flood	78.8	ft ³ /s	37.1	167	47.4
10_percent_AEP_flood	110	ft ³ /s	53.7	225	44.2
4_percent_AEP_flood	153	ft ³ /s	76.9	304	42.7
2_percent_AEP_flood	186	ft ³ /s	93.1	371	42.7
1_percent_AEP_flood	222	ft ³ /s	108	455	44.3
0_5_percent_AEP_flood	256	ft ³ /s	125	526	44.4
0_2_percent_AEP_flood	302	ft ³ /s	143	637	46

Peak-Flow Statistics Citations

Gotvald, A.J., Barth, N.A., Veilleux, A.G., and Parrett, Charles, 2012, Methods for determining magnitude and frequency of floods in California, based on data through water year 2006: U.S. Geological Survey Scientific Investigations Report 2012–5113, 38 p., 1 pl. (<http://pubs.usgs.gov/sir/2012/5113/>)

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Application Version: 4.4.0