FINAL DESIGN REPORT FOR SAND CREEK RESTORATION

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See comment letter also.

October 21, 2021

ENGINEER'S STATEMENT:
The attached drainage plan amendment was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said drainage plan amendment has been prepared according to the criteria established by El Paso County for drainage plans 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.

_____ _____
Mike Bramlett, Colorado P.E. # 32314 Date
For and On Behalf of JR Engineering, LLC

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: _____

By: _____

Title: _____
Address: _____
_____

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

_____ _____
Jennifer Irvine, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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Include permitting requirements.

Add wetlands mitigation plan

INTRODUCTION

A. Project Background

JR Engineering has contracted to provide professional services for the design of the Sand Creek Restoration in El Paso County, Colorado. This project is part of the larger Sterling Ranch development that is occurring across multiple phases and filings adjacent to the channel. Improvements to the channel will include a re-alignment of the channel with a new high-performance, low maintenance design utilizing a meandering bankfull section with a wide flood terrace. Due to the grades on-site, 5 grouted boulder drop structures are also being proposed. The design also includes the construction of the Regional Pond W-3 as proposed in the *2021 Sterling Ranch MDDP* by JR Engineering, and improvements to two existing on-site stock ponds.

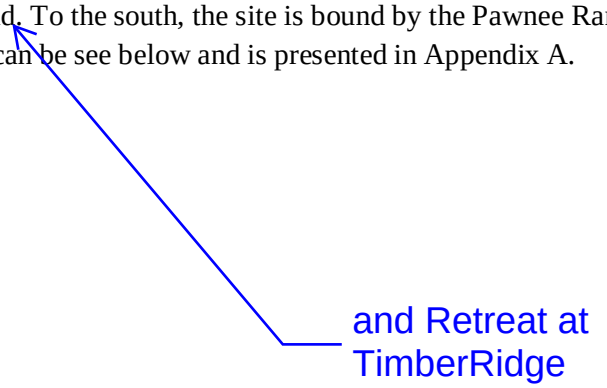
B. Purpose of Study

This *Final Design Report for the Sand Creek Restoration* was prepared to provide a final design for the proposed Sand Creek channel within the Sterling Ranch development. The design will include proposed infrastructure plans; hydrologic and hydraulic modeling; channel hydraulic calculations for Sand Creek, design calculations for the on-line detention and retention ponds; and all relevant figures and reference information.

II. GENERAL LOCATION AND DESCRIPTION

A. Site Location

Sterling Ranch, known as "the site" from herein, is a parcel of land located in Section 27, 28, 33 and 34, Township 12 South, and Section 4, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. To the west the site is bound by Vollmer Road. To the north and east, the site is bounded by undeveloped land. To the south, the site is bound by the Pawnee Rancheros and Woodmen Heights developments. A vicinity map can be see below and is presented in Appendix A.



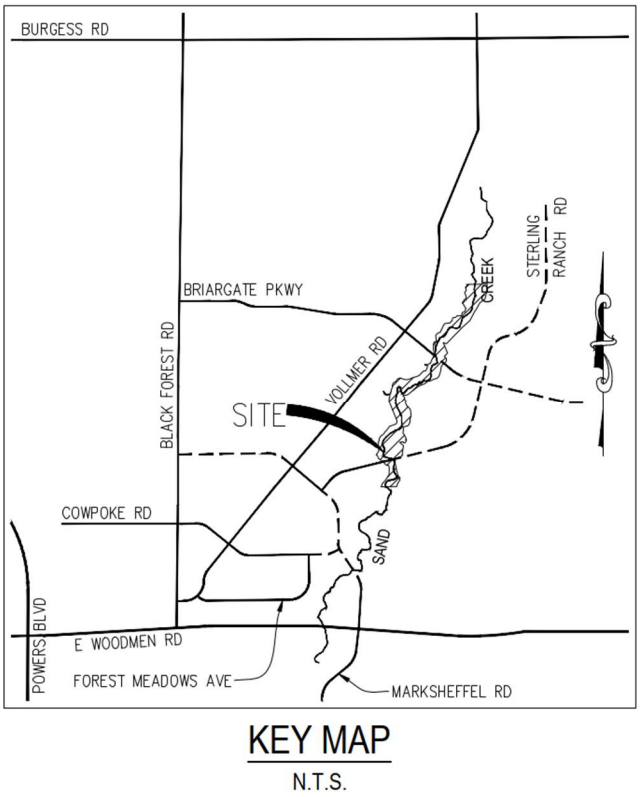


Figure 1 – Vicinity Map

B. Description of Property

Sterling Ranch is 1444 acres and is a Planned Unit Development to be built in multiple phases. The site is currently in various stages of development, with portions already in construction, with others unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, the site slopes from north to south and the existing drainageways follow this topography.

Per a NRCS web soil survey of the area, the site is made up of Type A and B soils. Type A soils cover roughly 65% of the site while Type B soils cover the remaining 35% of the site. Group A soils have a high infiltration rate when thoroughly wet. Type B soils have a moderate infiltration when thoroughly wet. Type D soils have a very slow infiltration rate when thoroughly wet and have a high shrink-swell potential. A NRCS soil survey map has been presented in Appendix A.

(Not adopted by El Paso County)

1996 by Kiowa?

III. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The site lies completely the Sand Creek Drainage Basin. The basin has been previously studied firstly in the 2011 Drainage Basin Planning Study (DBPS) by Wilson, again in the 2018 Sterling Ranch MDDP by M&S, in 2021 DBPS by Stantec, and finally in the 2021 MDDP Amendment by JR Engineering.

The Sand Creek Drainage Basin covers approximately 22 square miles and begins approximately five miles northeast of the Town of Falcon and travels approximately 15 miles to the southeast. The majority of the area within the basin is undeveloped and is characterized as rolling range land typically associated with Colorado's

Revise for Sand Creek

semi-arid climates. Anticipated land use for the basin includes residential, industrial, agricultural and commercial development. Residential developments will range from 0.125 – 5 acre lots with a mix of low, medium and high density developments.

Revise for Sand Creek

B. Previous Studies

As part of its drainage research, JR Engineering reviewed the following drainage studies and reports:

- Sand Creek Drainage Basin Study prepared by Wilson in 2011
- Sand Creek Drainage Basin Study prepared by Kiowa in 1996
- Sand Creek Drainage Basin Study prepared by Stantec in 2021
- Sterling Ranch Master Development Drainage Plan prepared by M&S in 2018
- Sterling Ranch Master Development Drainage Plan Amendment prepared by JR Engineering in 2021

This Final Design Report builds upon the sub-basin delineation and design point convention from the 2021 MDDP Amendment modeling with no changes to the sub-basin hydrology or routed flow rates.

C. Irrigation Facilities

There are no existing irrigation facilities within the site. However, the Sterling Ranch Metropolitan District (SRMD) has been granted a water right to store surface flows along Sand Creek in two existing stock ponds located on Sand Creek, one just north of Sterling Ranch Road and the other north of Briargate Parkway. These surface flows will be comprised of Lawn Irrigated Return Flows from excess irrigation in the developments adjacent to Sand Creek.

D. Floodplain

Based on the FEMA FIRM Map numbers 08041C0533G and 08041C0535G, dated December 7, 2018, the site lies within Zone AE and Zone X of the Sand Creek floodplain. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. All proposed development within the site will occur in Zone X. The current FIRM Map has been presented in Appendix A.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

Storm Drainage analysis and design criteria for this project was taken from “El Paso County Drainage Criteria Manual” and the Colorado Springs Drainage Criteria Manual. The deviations taken with the proposed design are discussed in the Specific Details section of the report.

B. Hydrologic Criteria

The baseline report for this Final Design Report is the 2021 Sand Creek MDDP Amendment, referenced in Section III of this report. No changes to the MDDP sub-basin hydrology are proposed herein.

All hydrologic data was obtained from the aforementioned MDDP Amendment by JR Engineering, October 2021, which was prepared in conformance with the El Paso County Drainage Criteria Manual. The MDDP states:

> “Previously, the MDDP used HEC-HMS to model hydrologic conditions. With all of the on- and off-line detention present along Sand Creek, it was decided that CUHP-SWMM would be a more appropriate way to

model the hydrologic conditions. All hydrologic data was obtained from NOAA Atlas 2 isopluvial maps found in the EPCDCM. Runoff was calculated using CUHP Version 2.0.0, developed by Urban Drainage and Flood Control District. The model utilizes the raingauge classified as "a 24-Hr Type II Storm" to simulate a long duration front storm common to the area, which is the same rain gauge used in the original MDDP. The following rainfall depths were utilized in the model: 2.1 inches for the 2 year storm, 2.5 inches for the 5 year storm, 3.0 inches for the 10 year storm, 3.6 inches for the 25 year storm, 4.1 inches for the 50 year storm, and 4.6 inches for the 100 year storm, which are the same point precipitation values used in the original MDDP. Using Table 5.2 from the EPCDCM, a distribution curve was created for each of the design storms to be used in CUHP. EPA SWMM 5.1 was utilized to route runoff flow rates for the sizing of stormwater storage facilities. The CUHP calculations and SWMM model are presented in Appendices B and C. "

The flow rates used in the design and hydraulic analysis originated from the MDDP report and SWMM modeling files. **Table 3**, below, presents a summary of design flows for the major design storms at various design points.

Table 3: Sand Creek Flow Rates

SAND CREEK FLOW RATES			
Location	Station	Flow Rate (cfs)	
		100-YR Design	100-YR FIS
Northern Bndy	STA: 87+01	1627.1	2600
SRMD Pond 2	STA:73+50	1648.7	2600
Briargate Pkwy	STA:61+55	1833.5	2600
	STA:36+05	2023.6	2600
SRMD Pond 1	STA:16+80	1921.7	2600
Sterling Ranch Road	STA:9+05	1590.5	2600

C. Hydraulic Criteria

The Federal Highway Administration's HY-8 Culvert Analysis Program (Build 7.50 July 28, 2016) was utilized to size the proposed outfall culvert for Pond W-3. The culvert analysis uses a trapezoidal channel section as tailwater to generate a tailwater depth for the analysis, the results of which are imported into SWMM as stage-discharge inputs for the Pond W-3 outfall ratings curve.

To size the outlet structures for the stock ponds, a calculation was done to iteratively determine weir and orifice capacity of various sizes of structure. Once it was determined whether the structure was weir or orifice controlled at each stage, a ratings curve based on head was modeled in SWMM to verify that the structure was large enough to prevent overtopping while still providing the static water surface necessary to maintain the water right for the stock ponds.

The U.S. Army Corps of Engineers HEC-RAS program, version 5.0.3 (September 2016) was used to perform the hydraulic analysis. The final design of the Sand Creek channel and proposed culverts at Sterling Ranch Road and Briargate Parkway are modeled in HEC-RAS to evaluate flow conditions, shear stresses, and velocities for the range of flood events for the purposes of assessing drainageway stability.

For the hydraulic modeling, the flows at the various design points shown in above in Table 3. Each flow change location represents a design point from the MDDP. As shown, flows accumulate further down the stream as more developed area is included in the basin area. During the major storm event flows pass through the stock pond outlet structures undetained so no additional flow change was needed at the stock pond outlets. Pond W-3 has a release rate to keep flows downstream of the pond lower than existing conditions. The HEC-RAS modeling uses

these steady flows, taken from the MDDP.

For the 100-year flood event, two different scenarios were analyzed. One scenario was evaluated using higher Manning's n values (0.05/Native Grasses; 0.07/Gravel or Cobble Bed; 0.12/Herbaceous Wetlands) in order to calculate the extents of the respective water surfaces and show them on the plans. A second scenario, with lower Manning's n values (0.032 Native Grasses; 0.035/Gravel or Cobble Bed; 0.06/Herbaceous Wetlands) was also used to more conservatively analyze velocities and shear stresses. These Manning's *n* values are taken from Table 8-5 of the USDCM.

The downstream boundary condition for Sand Creek at the southern property boundary of Sterling Ranch is taken as normal depth with a channel slope of 0.0664 percent. The upstream boundary condition for Sand Creek at the southern property boundary of Sterling Ranch is taken as normal depth with a channel slope of 0.0664 percent.

Topographic mapping of the area used in the hydraulic model was done by JR Engineering on the NAD 83 Projection and NAVD88 vertical datum. The survey was used to generate a 1-foot contour interval map. The project is designed on a modified State Plane coordinate system (NAD83 Colorado State Plane, Southern Zone, U.S. Foot) and is on the North American Vertical Datum of 1988 (NAVD88 datum).

All hydraulic calculations and applicable charts and graphs are included in **Appendix E** of this report.

V. DRAINAGE FACILITY DESIGN

A. General Concept

There are 3 main criteria that determined the initial concept. The first was the Preliminary Stream Geomorphology Report performed by 5 Smooth Stones Restoration (5SSR), PLLC in April 2021. The second was our previous experience working with the Army Corps of Engineers (ACOE) and their approval process with regards to wetlands disturbances. The third main determinant was El Paso County criteria, and particularly with regards to the previous design done by Kiowa.

For the purposes of being able to work on portions of the design separately, the channel has been broken up into three separate reaches. Reach 1 is the portion of channel south of Sterling Ranch Road to the southern property line, Reach 2 is the portion of channel between Briargate Parkway and Sterling Ranch Road, and Reach 3 is the portion of channel between the northern property line and Briargate Parkway. The general concept of the channel design is to design a low maintenance, high performance channel with a meandering bankfull channel. Along each of the three reaches, the design will cut in a new bankfull section offset to the east from the existing thalweg, grade up to the existing thalweg so that it can remain hydraulically connected to the new thalweg, and then extend a 1% flood terrace to the east between 80 and 120 ft. depending on shear stresses and velocities. The below table provides a summary of the rest of the bankfull design criteria, which was based on the preliminary geomorphology report. Once a preliminary design has been completed, an in-depth geomorphic report will discuss any variances recommended from county criteria.

The purpose of trying to keep the existing channel hydraulically connected to the new thalweg is to maintain as many existing wetlands as possible and satisfy the ACOE. The previous design by Kiowa made no attempt to preserve wetlands in order to satisfy the County's design criteria, and was rejected by the ACOE. While the County's criteria are certainly a determining factor, we consider the need to satisfy the ACOE the highest priority, because without their approval we won't be granted a 404 permit.

The County review of the previous design by Kiowa states that the maximum stable longitudinal slope of the channel is 0.17%. Using this longitudinal slope will require the use of at least 10 and possibly 15 GSB drop structures. This channel slope will also ensure the destruction of more wetlands by taking the existing ones offline

due to large changes in elevation. It is our intent to prove that a steeper slope can remain stable long term, thus allowing us to preserve more wetlands and appease the ACOE.

B. Specific Details

Sand Creek Channel

Based on the Geomorphic Report, a bankfull area of 14 sq.ft., a bankfull width of 17 ft., and a mean depth of 0.71 ft. was used for all the channel sections with a new bankfull section. The straight riffle sections of channel will have a maximum grade of 5%, while the curved sections with the pools will be flat from invert in to invert out. Maximum velocities in the channel were limited to 9 ft/s during the 100-year storm and 7 ft/s during the 10-year storm, with a few exceptions described below. The maximum shear stress allowed is 1.2 lb-ft, and any area above that will require armoring. While modeling the channel, excessive velocities and shears within the riffle sections were ignored since those areas will already be armored with void-filled riprap. The areas with excessive velocities and shears that will require armament are the flood terrace and curve sections of the bankfull section. Permanent geogrid solutions are being considered in these areas as a cost effective way to permanently armor large areas. Ultimately, the goal is to have vegetation re-established within the bankfull section and out in the flood terrace to provide vegetative resistance to reduce velocities and shear stresses within the channel and ensure a permanently stable, albeit steeper channel.

There are 6 grouted boulder drop structures proposed within the channel. There is a 5’ drop and a 2.5’ drop proposed in Reach 1 at station 3+89 and 8+56, respectively. Along Reach 2 there is a 3’ drop at station 50+31 and a 5’ drop at station 55+12. Along Reach 3 there is a 6’ drop at station 72+91 and a 6’ drop at station 75+76. The use of drops larger than 4’ was done in order to maintain grades close to existing so that the existing thalweg could remain connected. Around the GSB all slopes great than 10% will have armored with 36 inch grouted boulders. Sheet piling has been extended across the crest of the drop the full width of the FIS floodplain. Weep drains will be used to prevent any uplift or groundwater migration. The proposed design calls for 61 riffle drops; 8 along Reach 1, 34 along Reach 2, and 19 along Reach 3. The riffles vary in length and slope in order to minimize wetlands disturbances created by grade changes. The geomorphic report called for 100 – 1 foot drop riffle pools in lieu of drop structures. The use of riffles to make up grade differences rather than more drop structures is preferable because it allows for flatter slopes to tie the riffle sections to the existing ground. We limited ourselves to a maximum of 6 or 7 drop structures throughout the project and were able to cut that down to the proposed 4 we have now because going beyond that number would prove to be prohibitively expensive as well as destroying a larger amount of wetlands.

Table 8-3. Design parameters for naturalized channels

Design Parameter	Design Value
Maximum 100-year depth outside of bankfull channel	5 ft
Roughness values	Per Table 8-5
Maximum 5-year velocity, main channel (within bankfull channel width) (ft/s)	5 ft/s
Maximum 100-year velocity, main channel (within bankfull channel width) (ft/s)	7 ft/s
Froude No., 5-year, main channel (within bankfull channel width)	0.7
Froude No., 100-year, main channel (within bankfull channel width)	0.8
Maximum shear stress, 100-year, main channel (within bankfull channel width)	1.2 lb/sf
Minimum bankfull capacity of bankfull channel (based on future development conditions)	70% of 2-year discharge or 10% of 100-yr discharge, whichever is greater[1]
Minimum bankfull channel geometry	Per Table 8-2
Minimum bankfull channel width/depth ratio (Equation 8-3)	9
Minimum entrenchment ratio (Equation 8-4)	3
Maximum longitudinal slope of low flow channel (assuming unlined, unvegetated low flow channel)	0.2 percent
Bankfull channel sinuosity (Equation 8-5)	1.1 to 1.3
Maximum overbank side slope	4(H):1(V)
Maximum bankfull side slope	2.5(H):1(V)
Minimum radius of curvature	2.5 times top width

[1]Roughly equivalent to a 1.5-year event based on extrapolation of regional data.

Compare to County and MHFD criteria. Address deviations.

or N/A?

Table 1. Bankfull Design Criteria

Bankfull Channel	Width; ft		17.0	
	Mean Depth; ft		0.71	
	Max Depth; ft			
	Area; sqft		14.0	
	Bend to Bend Spacing; ft	4.5 -6 times Bankfull Width	77	102
	Radius of Curvature (ROC); ft	2.5 - 3.5 times Bankfull Width	43	60
	Tangent Lengths; ft	1.5 - 2.5 times Bankfull Width	26	43
	Meander Wavelength; ft	9- 12 times Bankfull Width	153	204
	Meander Beltwidth; ft	2 - 3.5 times Bankfull Width	34	60

In the existing conditions, Reach 1 has velocities ranging from 7.33 ft/s to 10.06 ft/s, Reach 2 has velocities ranging from 2.23 ft/s to 10.53 ft/s, and Reach 3 has velocities ranging from 2.33 ft/s to 10.52 ft/s. Shear stresses along Reach 1 range from 1.06 lb/sq ft to 2.03 lb/sq ft, along Reach 2 range from 0.12 lb/sq ft to 2.33 lb/sq ft, and along Reach 3 range from 0.10 lb/ sq ft to 2.65 lb/sq ft.

In the proposed conditions, Reach 1 has velocities ranging from 2.85 ft/s to 9.87 ft/s. The only cross section with velocities above 9 ft/s was just upstream of a drop structure. Shear stresses along Reach 1 range from 0.01 lb/sq ft to 3.29 lb/sq ft. The shear stresses along Reach 1 are consistently higher than the 1.2 lb/sq ft as suggested in the geomorphology report within the bankfull section and around the drop structures, but these areas are going to be armored already. There are no areas within the overbanks that have high shear stresses.

In the proposed conditions, Reach 2 has velocities ranging from 0.99 ft/s to 10.40 ft/s. The only cross section with velocities above 9 ft/s was just downstream of the Briargate Parkway culvert. Shear stresses along Reach 2 range from 0.77 lb/sq ft to 3.32 lb/sq ft. The shear stresses along Reach 2 are consistently higher than the 1.2 lb/sq ft as suggested in the geomorphology report within the bankfull section and around the drop structures, but these areas are going to be armored already. Any areas outside of the bankfull with higher shear stresses than 1.2 lb/sq ft will be reinforced using either coir matting or a permanent geotextile matting.

In the proposed conditions, Reach 3 has velocities ranging from 1.24 ft/s to 7.93 ft/s. Shear stresses along Reach 3 range from 0.01 lb/sq ft to 3.51 lb/sq ft. The shear stresses along Reach 3 are consistently higher than the 1.2 lb/sq ft as suggested in the geomorphology report within the bankfull section and around the drop structures, but these areas are going to be armored already. Any areas outside of the bankfull with higher shear stresses than 1.2 lb/sq ft will be reinforced using either coir matting or a permanent geotextile matting.

Pond W-3

See MDDP comments

The MDDP Amendment hydrology confirmed that a Regional Detention Pond (Pond W-3) at Sterling Ranch Road will be required to reduce 100-year flows to less than existing conditions. The pond is approximately 51.27 ac-ft., which is a considerable reduction in size from the previously proposed 76 ac-ft. pond in the MDDP. Conceptually, the pond will function similarly to how it was proposed in the MDDP. The county prohibits ponding at roadways, so the pond has to outfall before it reaches the proposed conspan arch culvert at Sterling Ranch Road. The proposed outfall will consist of a 3-barrel (2-13'x4', 1-13'x2') box culvert approximately 40 feet north of the road, with an overflow spillway that extends to the wingwalls of the road

culvert, essentially creating one contiguous structure, while still avoiding ponding along the road and allowing flows to pass through the road culvert with freeboard. The smaller center barrel has an invert 0.5' lower than the outer barrels to maintain a low flow channel, while the outer barrels will be used in higher flow events. The overflow weir is approximately 288 feet long. In order to avoid being classified as a jurisdictional dam the overflow weir was set at 10 feet above the invert with a crest elevation of 7012.00. A sheet pile wall with a concrete cap will provide reinforcement for the berm. At the invert of the culvert a 1.5' deep plunge pool will help dissipate energy before entering the culvert at Sterling Ranch Road.

SRMD Pond 1

The large stock pond approximately 700 feet north of Sterling Ranch Road will remain in place with the stream improvements and is now defined as SRMD Pond 1. Previously, the pond was designated as "Waters of the U.S." and Sterling Ranch Metropolitan District was granted a water right to use the pond as storage for irrigation runoff, so it was decided that the best design would be to include the pond in the channel, rather than trying to modify its dimensions or route flows around it. The water right for the stock pond was previously determined to be a volume of 12.25 ac-ft with a surface area of 109,612 sq.ft. Since the pond's dimensions are not proposed to be modified, the water right will remain intact.

The existing stock pond has a berm elevation of 7040, which is 39 feet above the proposed invert of the culvert at Sterling Ranch Road. Using a series of drop structures would require, at a minimum, 4-10' tall drops to achieve this grade and more likely would require a series of 7 drops to get to the toe of slope. Stepping the drops would require a longer longitudinal profile which would in turn take away area from Pond W-3. The existing channel flows around the west side of the pond downstream to Sterling Ranch Road. Given the proposed development west of Sand Creek, there is no possibility to expand the channel west in this area, and so this would end up being the most constricted portion of channel

The most feasible solution to conveying water through the stock pond and also making up 39' of vertical drop was to design an outlet structure for water to discharge out of the stock pond and into Pond W-3. Using an outlet structure allows for a static water surface in the pond that maintains SRMD's water right to the pond. In minor and major storm events, water ponds up to the static WSEL of 7036, where it will outfall into a 25'x25' square orifice. Water flows through the 12'x10' RCBC outfall pipe and discharges into a USBR Type VI impact basin. Flows leave the impact basin and are conveyed to the Pond W-3 outfall via low flow channel. In the event of flows above the 100-year design storm or an emergency situation, flows will overtop the existing berm and down an emergency spillway to Pond W-3. The overflow spillway will be approximately 300 feet long. To reinforce the spillway, a sheetpile cutoff wall with a concrete cap will be incorporated into the design. Due to the fact that this spillway will be an online feature within the channel, it will be armored using a geotextile fabric able to withstand the FIS flow rate.

SRMD Pond 2

Upstream of Briargate Parkway there are two existing stock ponds. The smaller of the two ponds will be removed with the stream restoration, while the larger pond will remain and is now referred to as SRMD Pond 2. Previously, the larger pond was designated as "Waters of the U.S." and Sterling Ranch Metropolitan District was granted a water right to use the pond as storage for irrigation runoff, so it was decided that the best design would be to include the pond in the channel, rather than trying to route flows around it. The water right for the stock pond was previously determined to be a volume of 4.29 ac-ft with a surface area of 53,720 sq.ft. While the pond's grading will be modified, the volume and surface area of the pond will not change, so the water right will remain intact.

The existing stock pond has a berm elevation of 7121, which is 20 feet above the toe of slope. Using a series of drop structures would require, at a minimum, 4-10' tall drops to achieve this grade and more likely would

require a series of 7 drops to get to the toe of slope. Stepping the drops would require a longer longitudinal profile which would in turn take away area from Pond W-3. The existing channel discharges from the pond using a 24" RCP culvert. Given the proposed development west of Sand Creek, there is no possibility to expand the channel west in this area, and so this would end up being the most constricted portion of channel

Similar to Existing Stock Pond 1, the most feasible solution to conveying water through the stock pond and also making up 20' of vertical drop was to design an outlet structure for water to discharge out of the stock pond and into the downstream channel. Using an outlet structure allows for a static water surface in the pond that maintains SRMD's water right to the pond. In minor and major storm events, water ponds up to the static WSEL of 7117.75, where it will outfall into a 25'x25' square orifice. Water flows through the 10'x10' RCBC outfall pipe and discharges into a USBR Type VI impact basin. Flows leave the impact basin and are conveyed south via the Sand Creek Channel. In the event of flows above the 100-year design storm or an emergency situation, flows will overtop the existing berm and down an emergency spillway to the downstream channel. The overflow spillway will be approximately 200 feet long. To reinforce the spillway, a sheetpile cutoff wall with a concrete cap will be incorporated into the design. Due to the fact that this spillway will be an online feature within the channel, it will be armored using a geotextile fabric able to withstand the FIS flow rate.

C. Wetlands

The existing Sand Creek channel has wetlands present along the entire portion within Sterling Ranch. With Sand Creek being an ephemeral stream, and development on both sides of it incomplete, there are not base flows present for many parts of the year. Wetlands are confined to areas mostly within the existing bankfull channel and around the existing stock ponds. With the goal of the proposed channel design to keep the existing thalweg intact wherever possible, it is anticipated that portions of these wetlands will remain intact.

The wetlands along Sand Creek were previously delineated with a total area of 16.29 acres, which does not include areas that will be disturbed from the proposed roadway culverts at Sterling Ranch Road and Briargate Parkway. Of these 16.29 acres, 8.49 acres will be permanently disturbed. Permanently disturbed wetlands are described as any area where improvements occur that causes change in finished grade of the wetland or where vegetation cannot be re-established. Of the 16.29 acres of on-site wetlands, 7.43 acres will be preserved. Preserved wetlands are defined as areas that may or may not have been improved, but who's finished grade has not changed.

Mitigation is currently proposed on-site along the entire stretch of the channel with a total area of 29.67 acres, giving a mitigation to permanent loss ratio of 3.49. Aiming for a ratio above 1 to 1 allows for the possibility that not all the flood terrace will be able to establish wetlands, or that some of the existing ones could become disconnected over time. If the Sand Creek restoration is unable to re-establish wetlands to offset those permanently lost during construction after a set period of time, then the owner will buy credits from the wetland bank.

(which one? CDOTs?)

The anticipated 404 permitting approach is an Individual Permit for just the Sand Creek Restoration plans, independent of the permits obtained by Kiowa for the culverts at Sterling Ranch Road and Briargate Parkway. Section 404 permitting will be accomplished as an independent process with the U.S. Army Corps of Engineers.

D. Future Considerations

Within the Sterling Ranch development there will be more full-spectrum detention ponds constructed as development progresses. All of these ponds are expected to contribute base flows to Sand Creek within Sterling Ranch. Of those currently proposed, Pond FSD14A, which is located along Sterling Ranch Road just east of Pond W-3 and FSD11B, which is located east of Sand Creek along the southern property line are expected to outfall directly into the channel. Future pond outfalls will need to ensure the invert of the pipes are higher than the

proposed 100-year WSEL.

VI. CONCLUSION

The purpose of this report is to present the final design for the proposed Sand Creek Restoration. The design proposed herein meets the requirements of El Paso County and the city of Colorado Springs. The design proposed in this report complies with the El Paso County Drainage Manual, City of Colorado Springs Drainage Criteria Manual, and the proposed Sand Creek MDDP Amendment. The proposed Pond W-3 and the revised existing stock ponds will have no adverse effect on stormwater quality, quantity, or timing and will meet the requirements of CRS §37-92-602 (8) for drain time.

The implementation of drainage concepts presented within this report will assure proper conveyance and attenuation of stormwater discharges with no anticipated adverse impacts to Sand Creek downstream infrastructure. The proposed improvements to the channel will not be injurious to water rights and will be in conformance with established decrees.

Any future off-line water quality or detention ponds shall be final-designed under separate drainage studies occurring with each specific development project or capital improvement project, and shall meet all applicable design criteria at the time of final design.

VII. Design Elements

Presented on the design plans associated with this design memorandum are the proposed drainageway conditions. The drops have been designed to raise the invert anywhere from two to three feet. Design criteria for the project are summarized as follows:

Channel design slope:	0.2 -0.5 percent
Maximum low flow drop height:	7 feet
Outside bend slopes- riprap or grass-lined	4 to 1 maximum
Low flow channel side slopes- riprap lined	3 to 1 maximum
Soil riprap slopes at bridge approaches and exits	3 to 1 maximum
Low flow channel depth	2.5 feet
Manning's n-values:	.025-.035
Froude number-(excluding crests of drops):	.25-.-.75
Minimum channel radius	150 feet
Maximum design velocity	
Grass-lined	5 feet per second
Reinforced turf (TRM)	7 feet per second
Permissible shear stress: low flow channel	
TRM (curled wood mat)	1.55 psf
Type M soil riprap	2.5 psf
Permissible shear stress: floodplain benches and overbanks	
Class B retardance, native vegetation	2.1 psf
TRM (curled wood mat)	1.55 psf
Type M soil riprap	5.0 psf

Please provide the final design attribute table for approval with this report. (also see comment on page 9)

These Froude nos are acceptable

doesn't match plans

Model does not meet these?

VII. REFERENCES

1. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.

2. El Paso County Drainage Criteria Manual Volume 1, El Paso County, CO, October 1994.

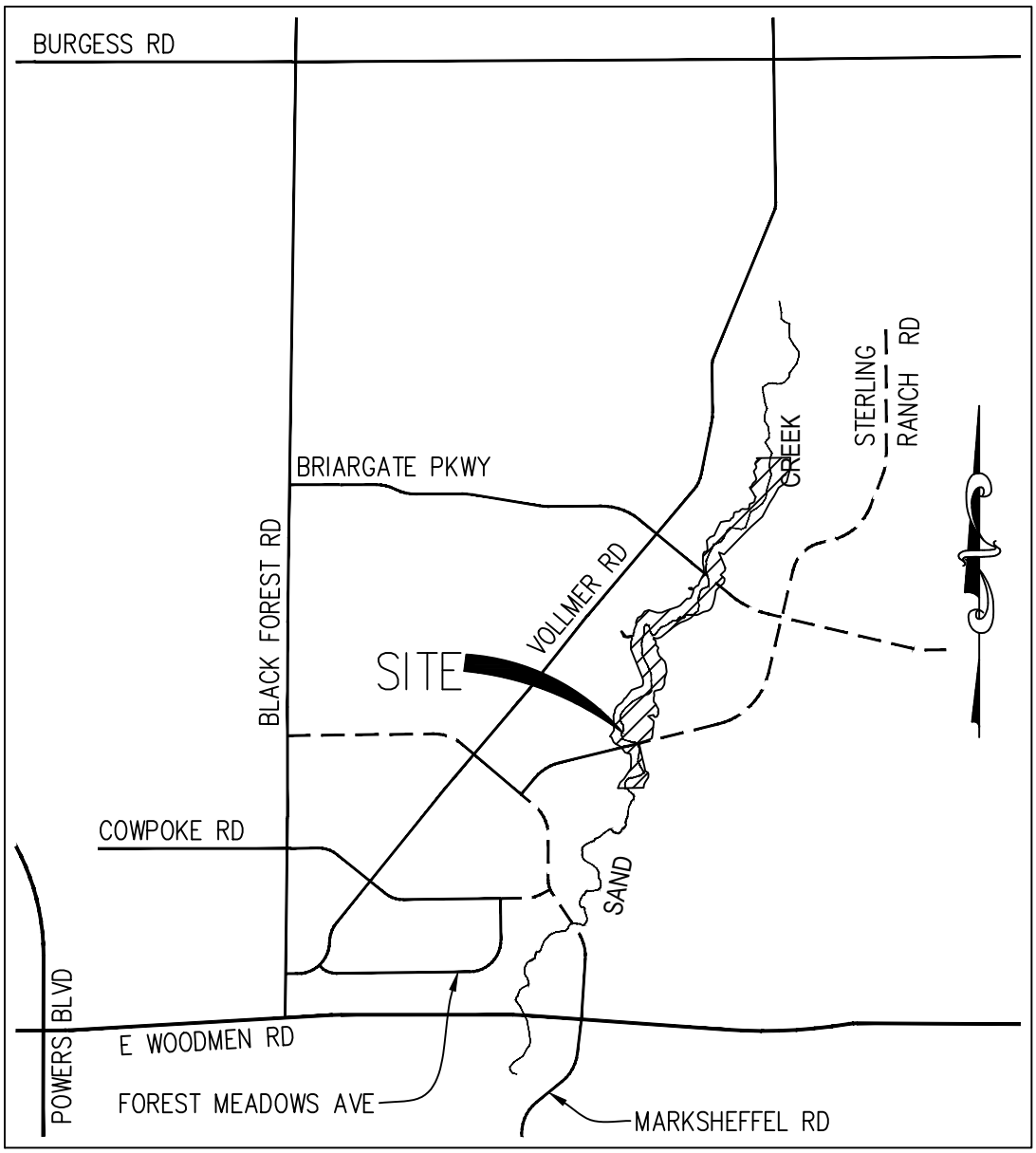
3. Sand Creek Drainage Basin Planning Study, Stantec, January 2021.

4. Sand Creek MDDP Amendment, JR Engineering, October 2021.

5. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.

Appendix A

Figures and Exhibits



KEY MAP

N.T.S.

VICINITY MAP
STERLING RANCH
JOB NO. 25188.03
10/21/2021
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

X:\2510000.all\2518804\Drawings\Vicinity Map.dwg, 8.5x11 Portrait, 10/18/2021 2:40:40 PM, vaughtd

NOTES TO USERS

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

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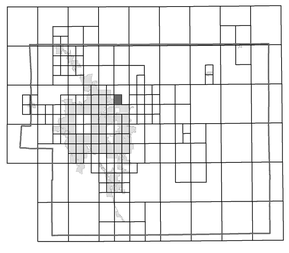
El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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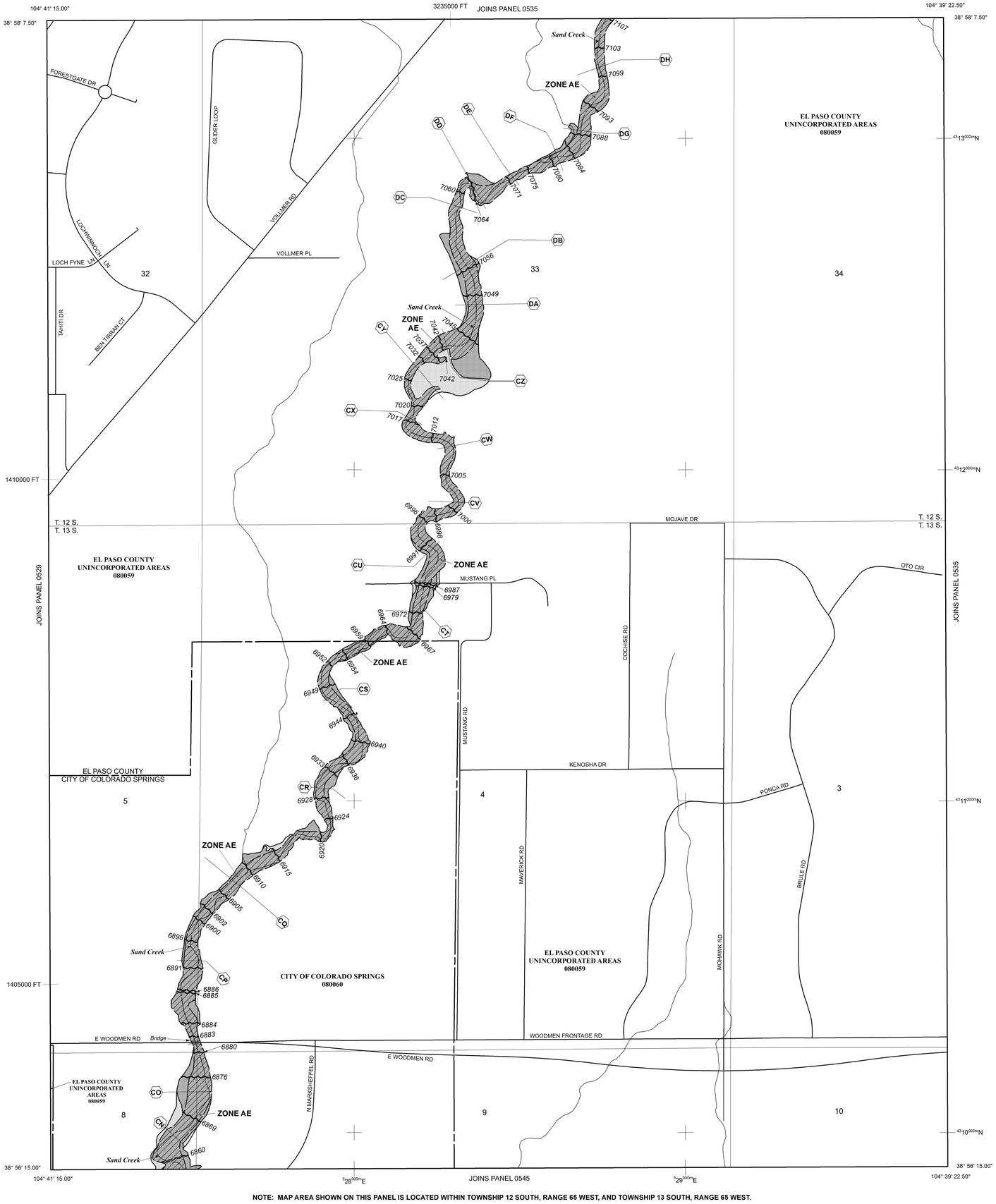

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 — 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

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Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
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MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0533G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0533	G
EL PASO COUNTY	080059	0533	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

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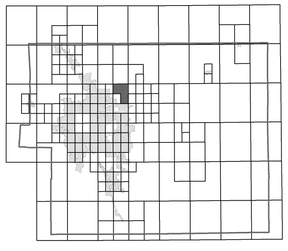

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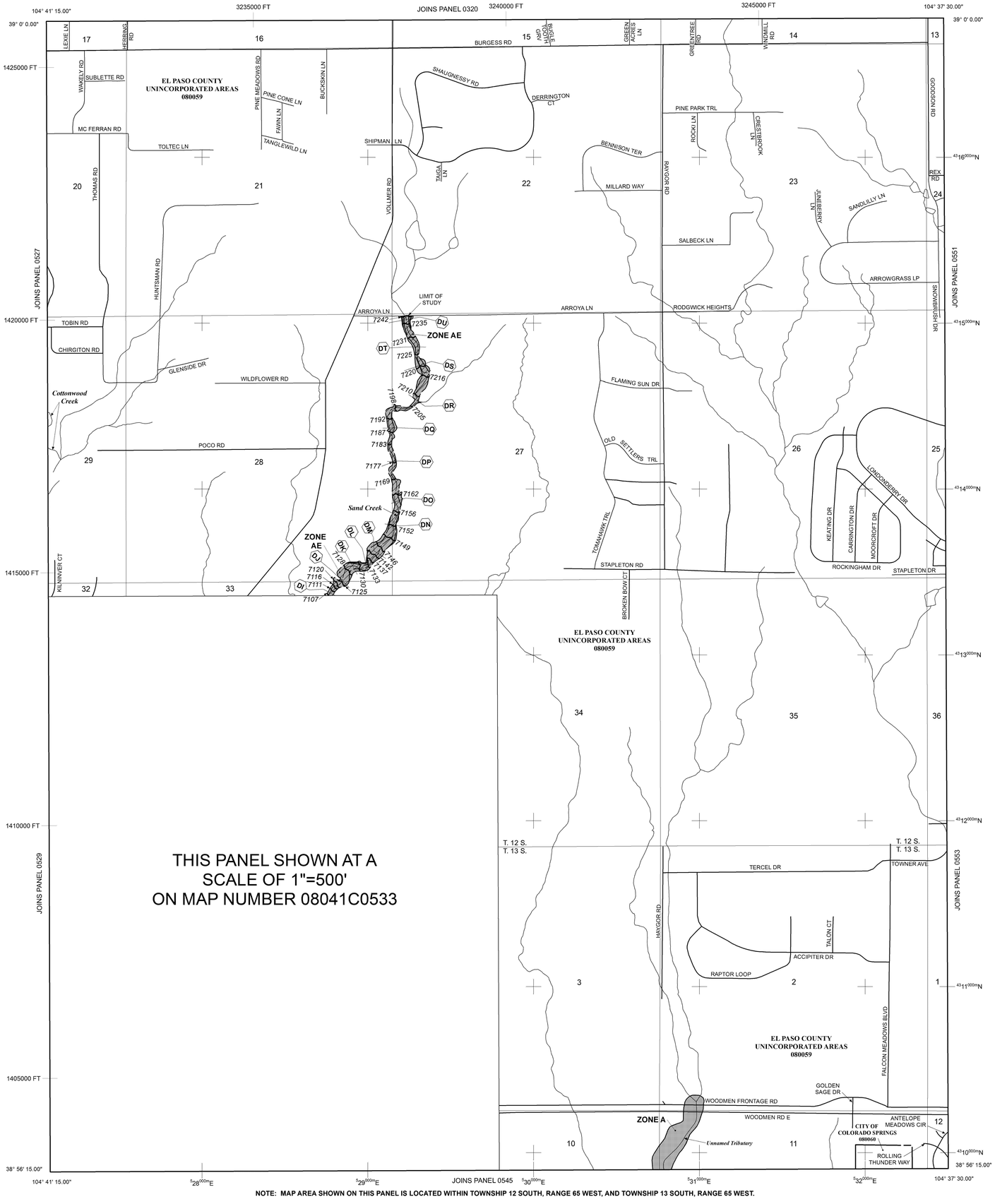

THIS PANEL SHOWN AT A SCALE OF 1"=500' ON MAP NUMBER 08041C0533

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CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
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M1.5 — River Mile

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MARCH 17, 1997

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MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0535G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 535 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
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EL PASO COUNTY	080059	0535	G

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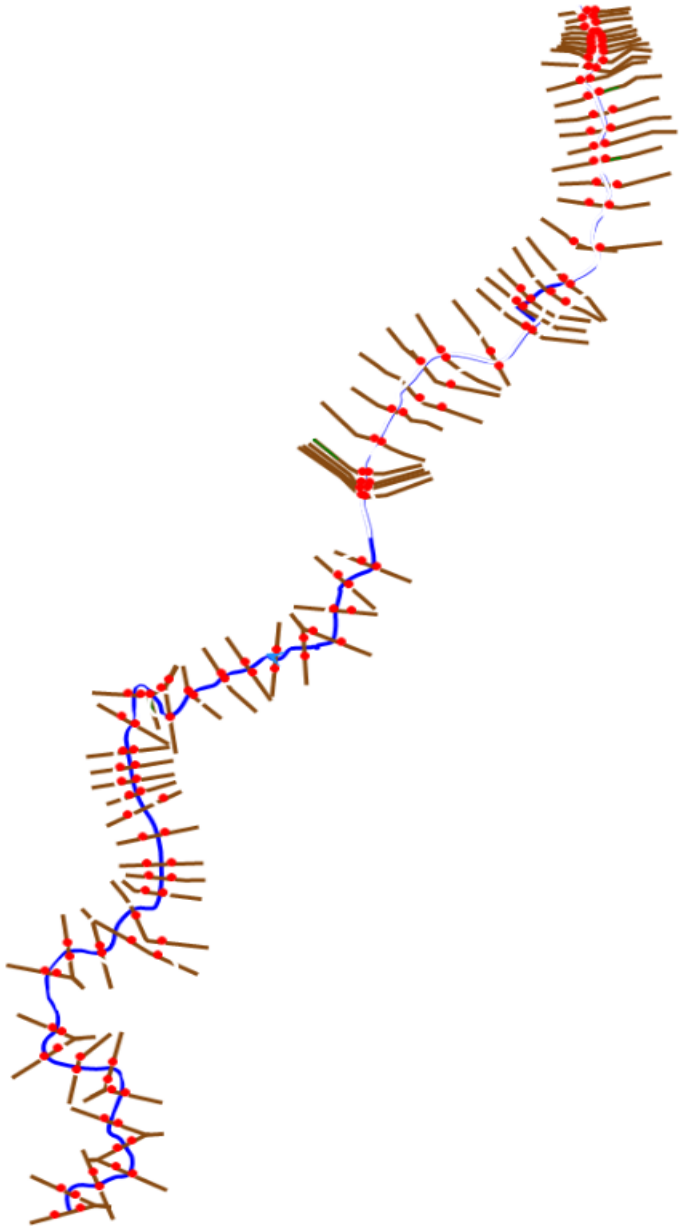
MAP NUMBER 08041C0535G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

Appendix B

Existing Conditions Hydraulic Modeling



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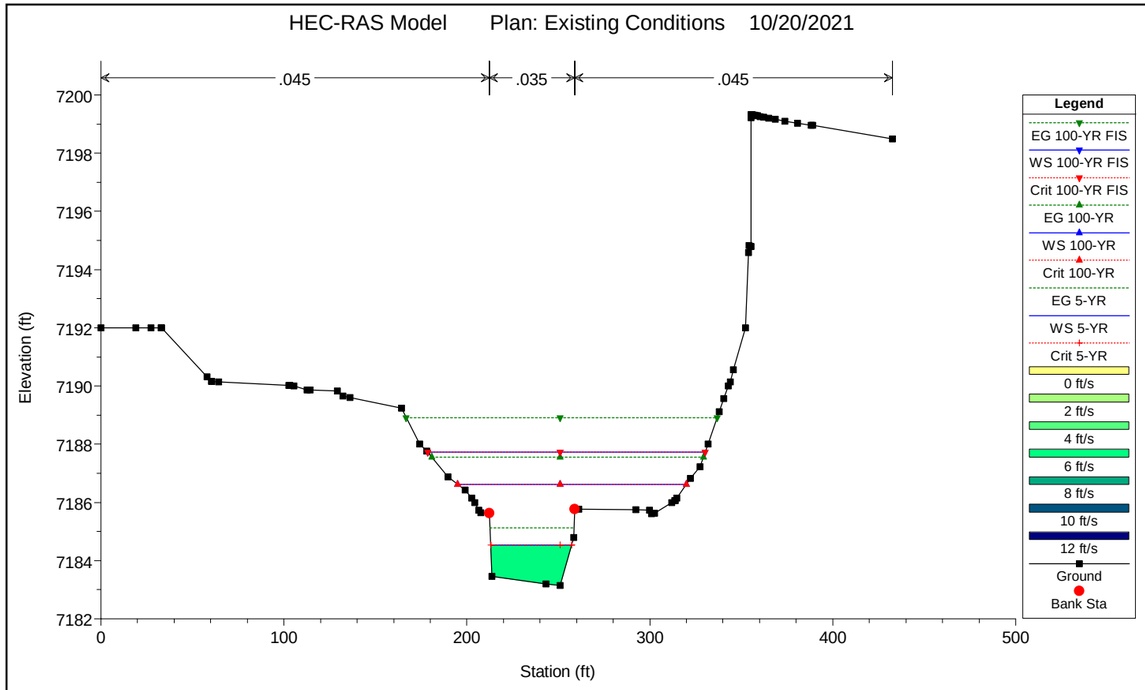
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.035
.045
Elevation (ft)
Station (ft)
Legend
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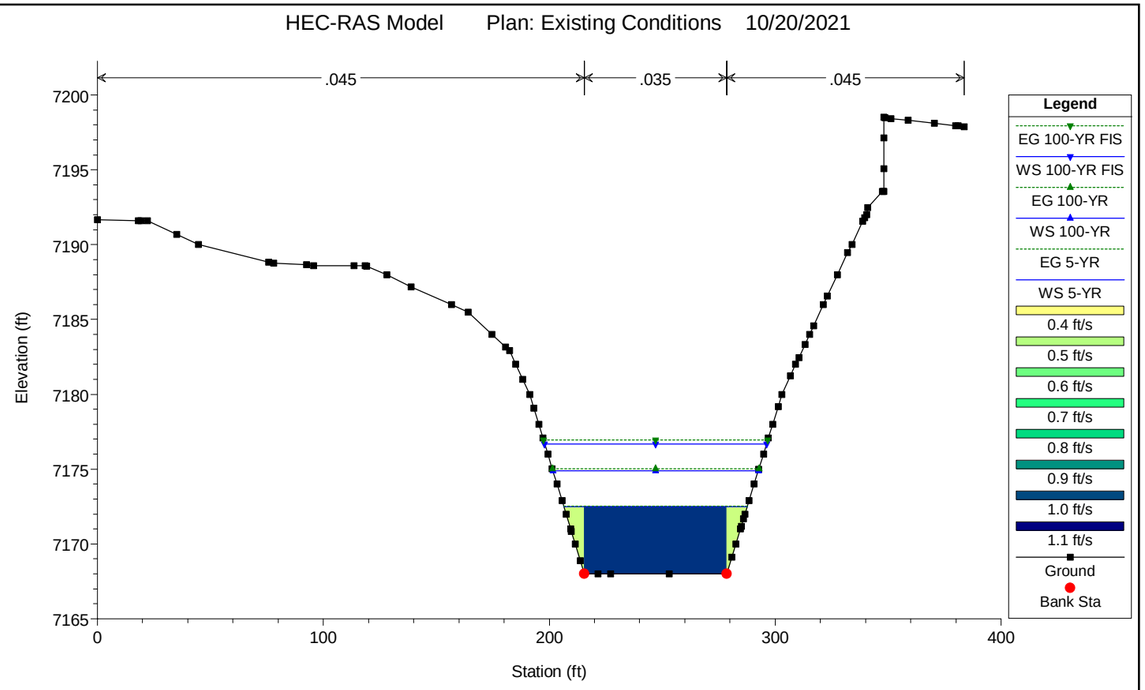
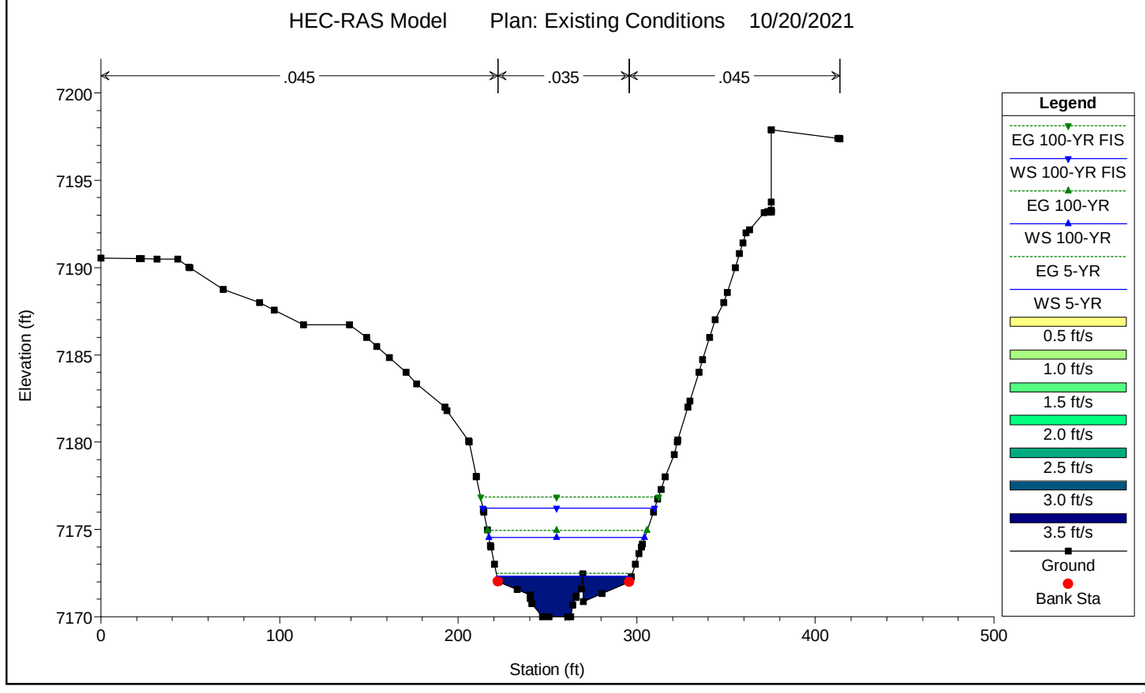
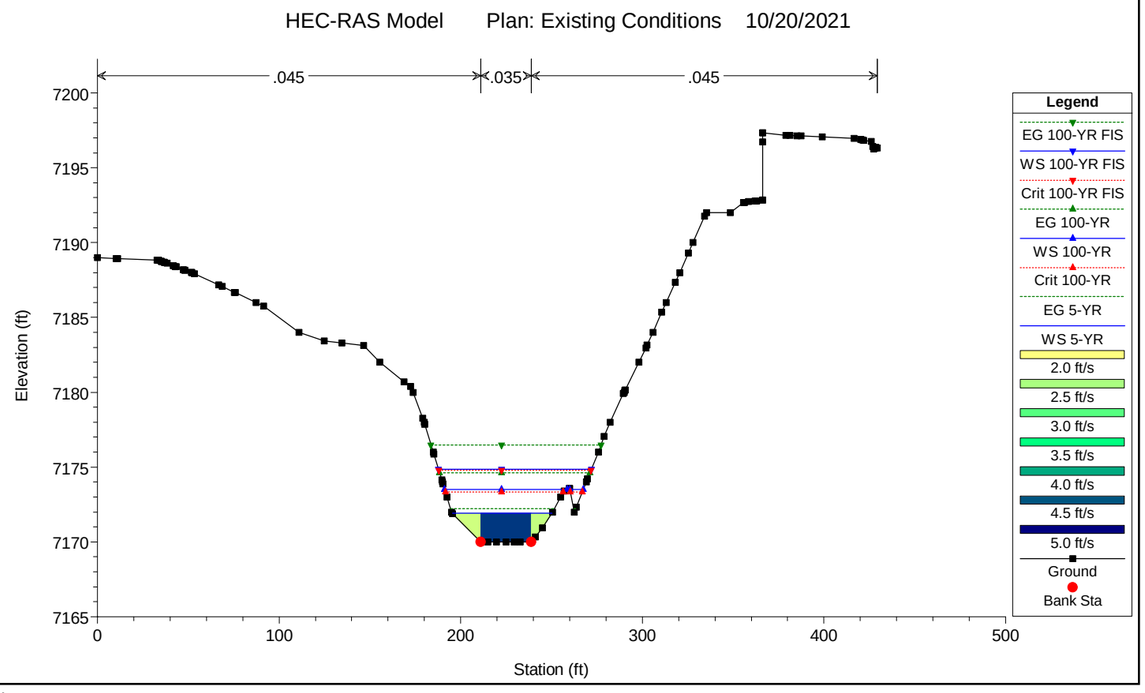
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.4 ft/s
0.5 ft/s
0.6 ft/s
0.7 ft/s
0.8 ft/s
0.9 ft/s
1.0 ft/s
1.1 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
2.0 ft/s
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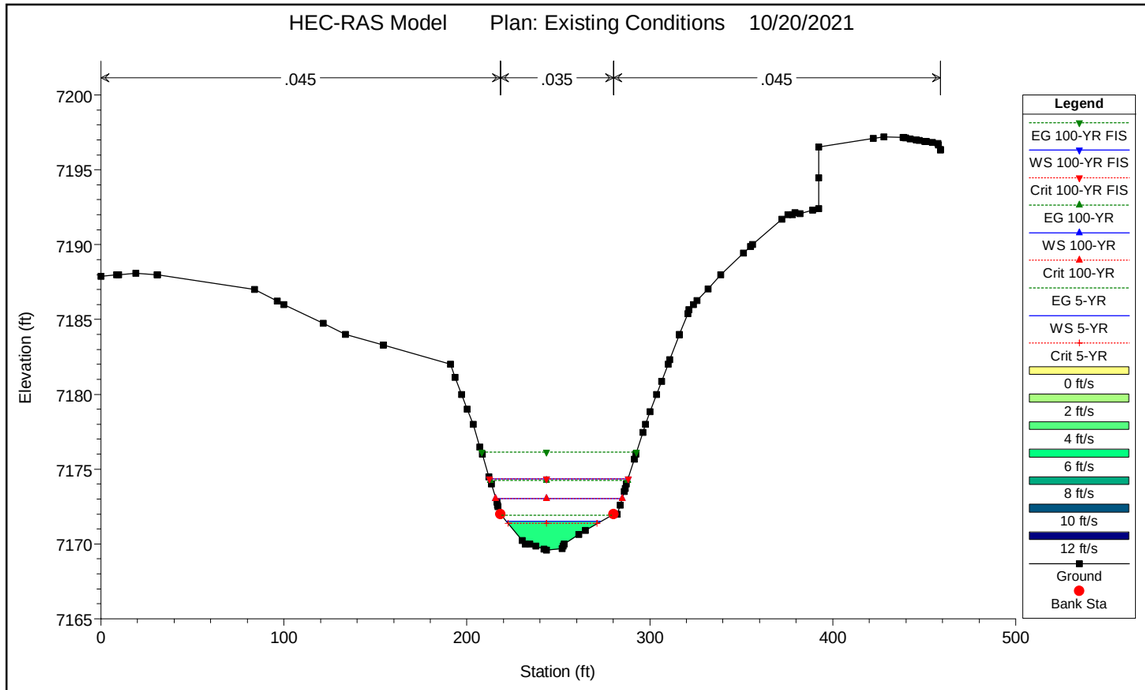
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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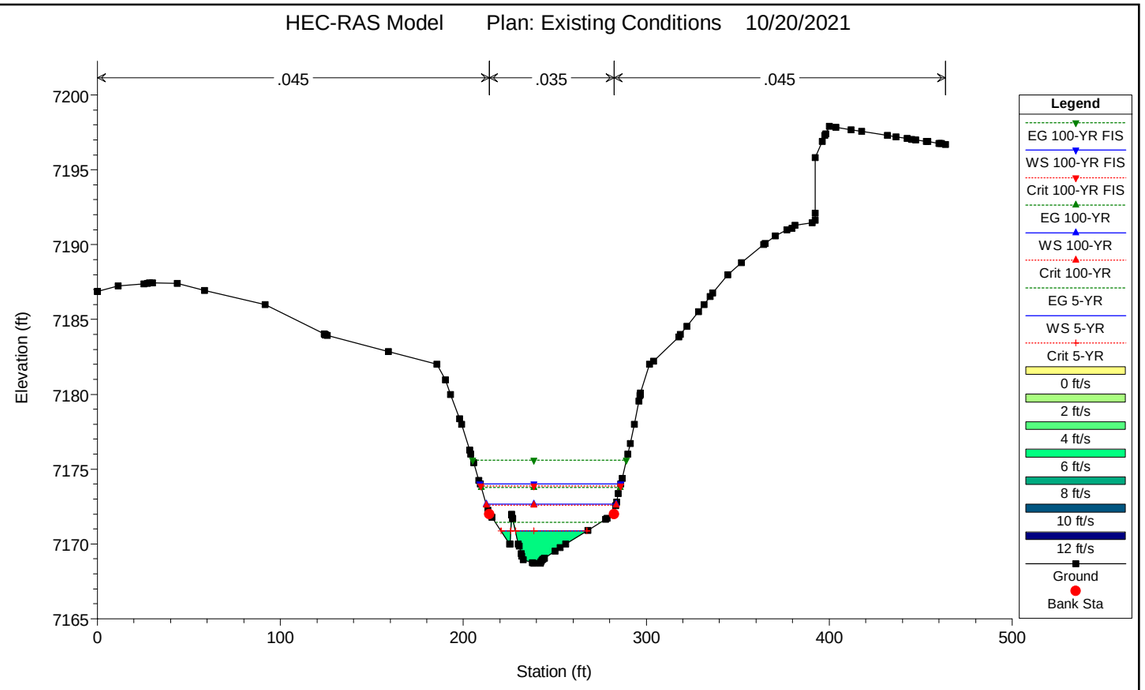
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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2 ft/s
4 ft/s
6 ft/s
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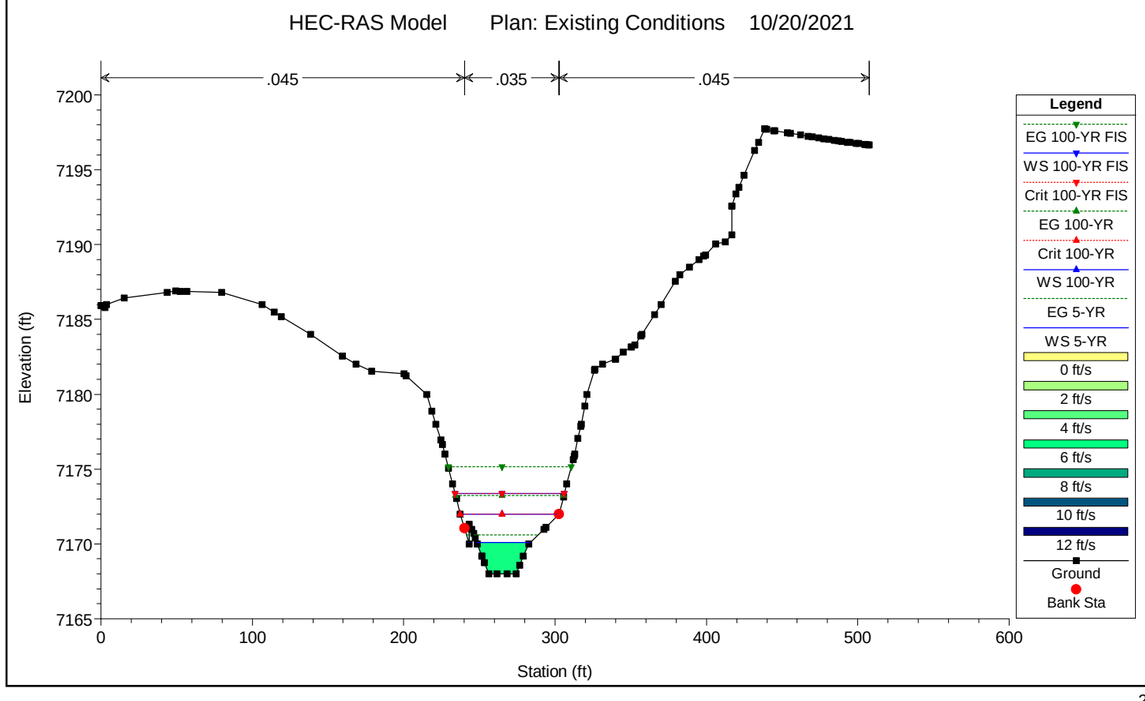
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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2 ft/s
4 ft/s
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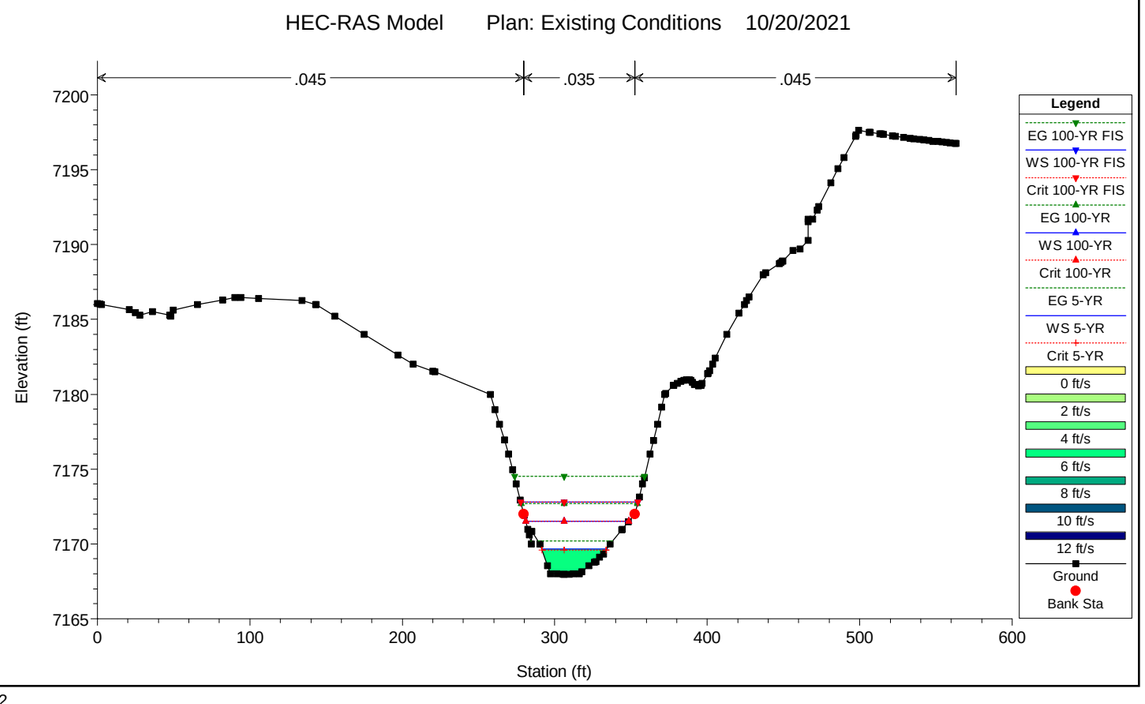
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
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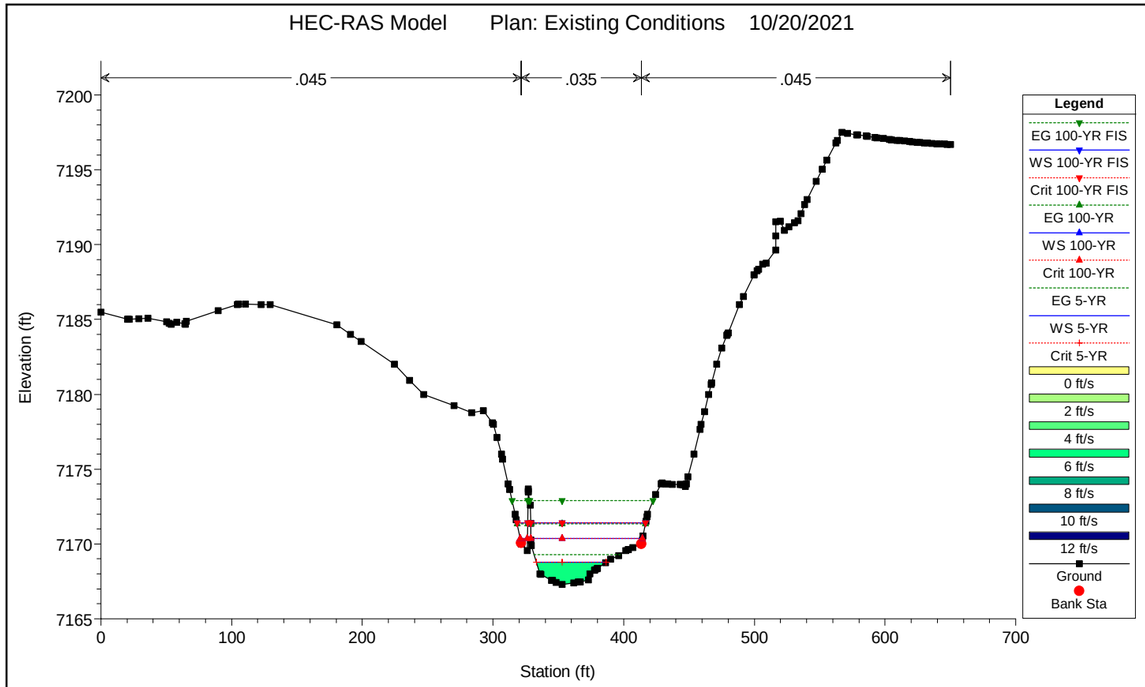
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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4 ft/s
6 ft/s
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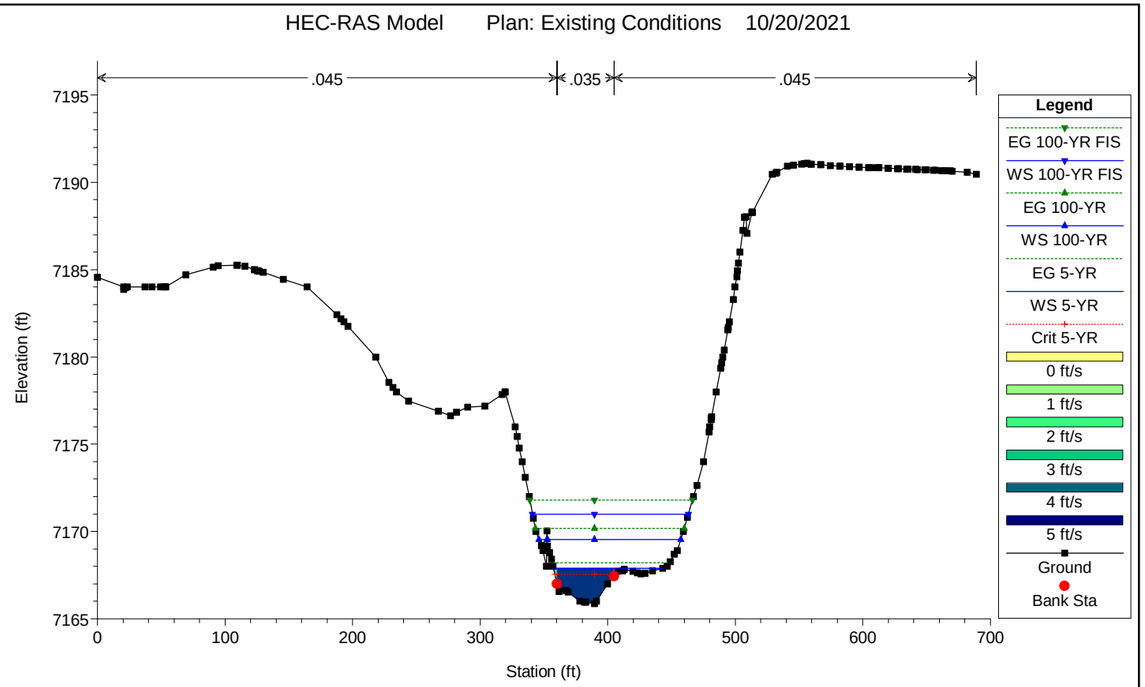
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
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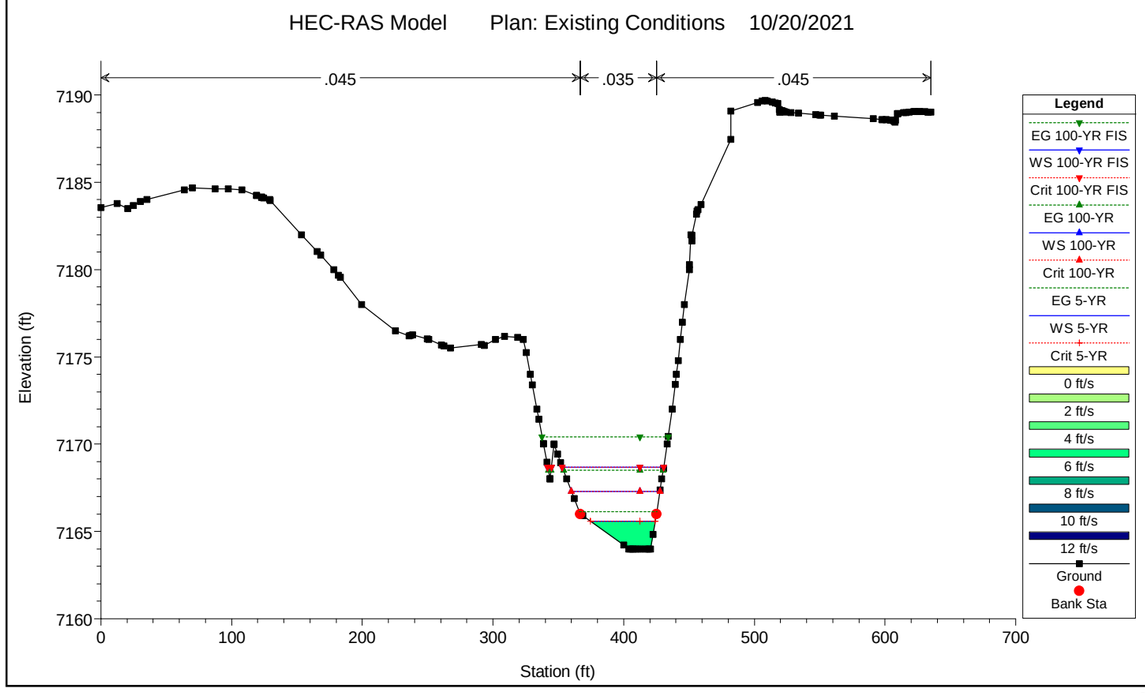
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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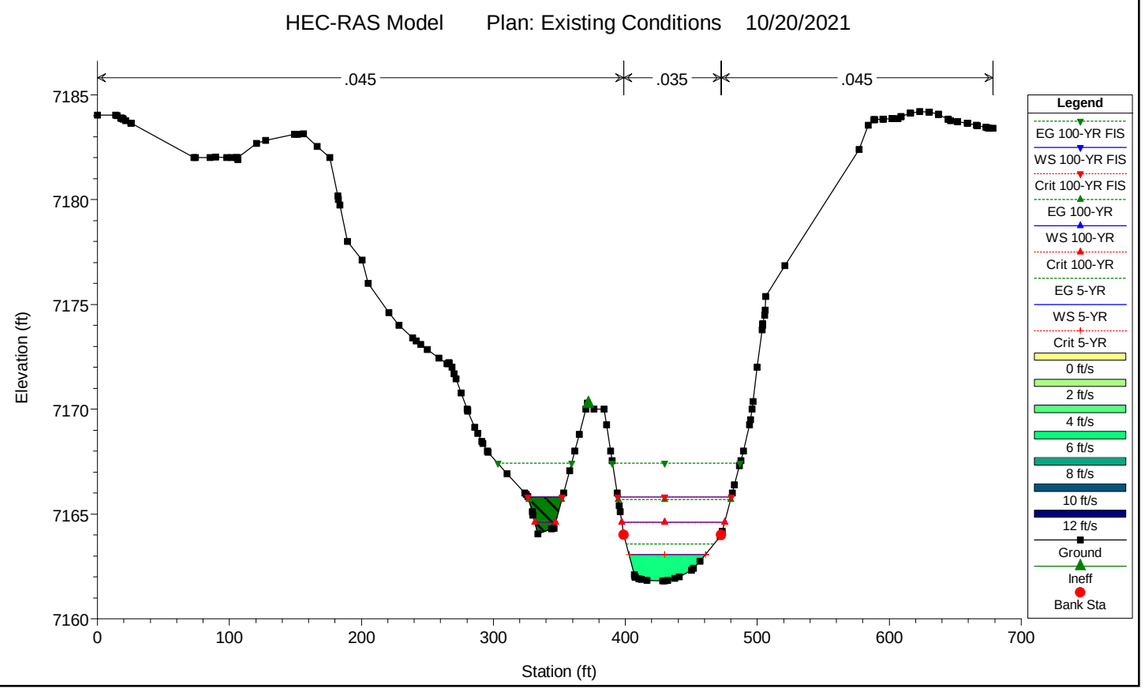
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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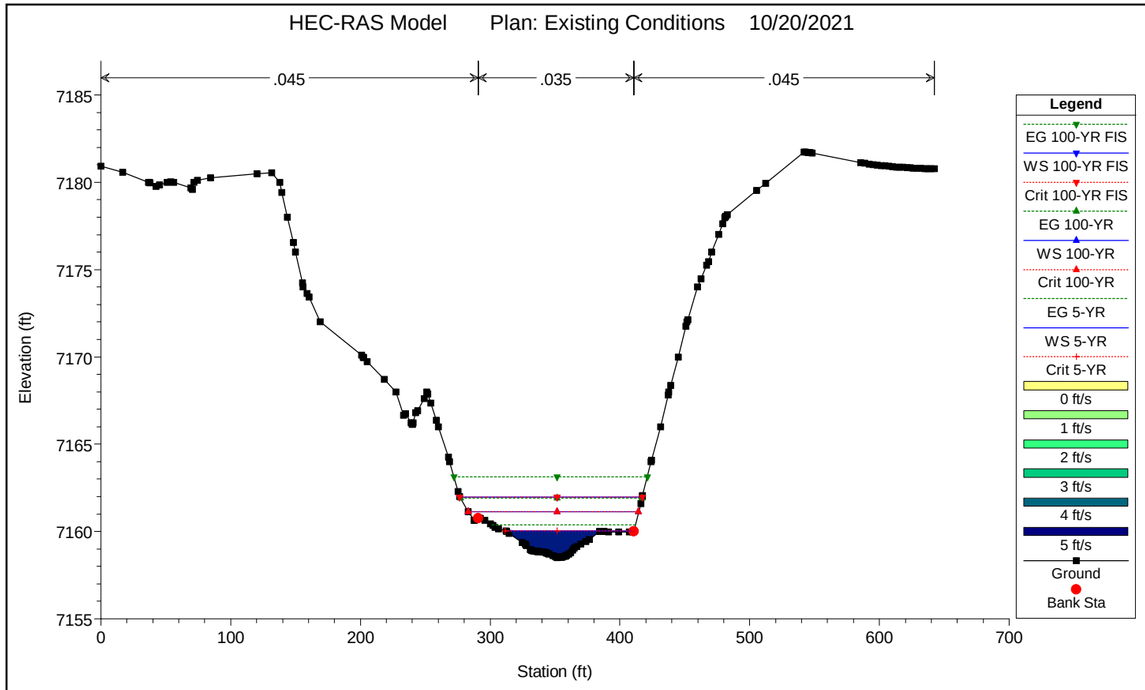
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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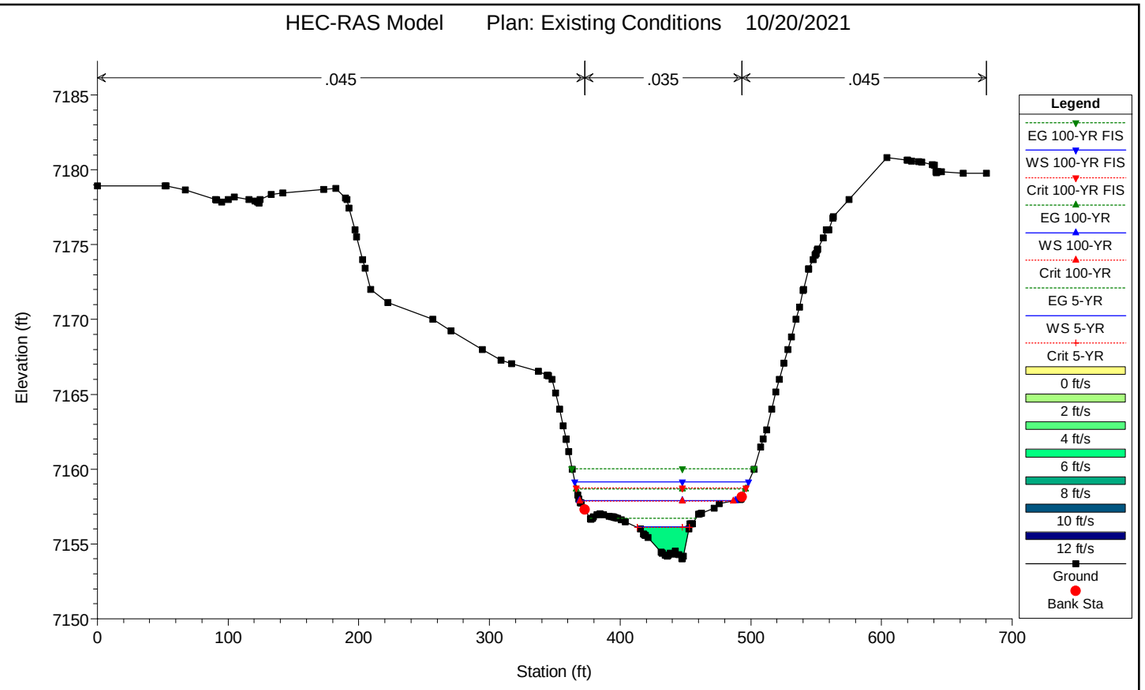
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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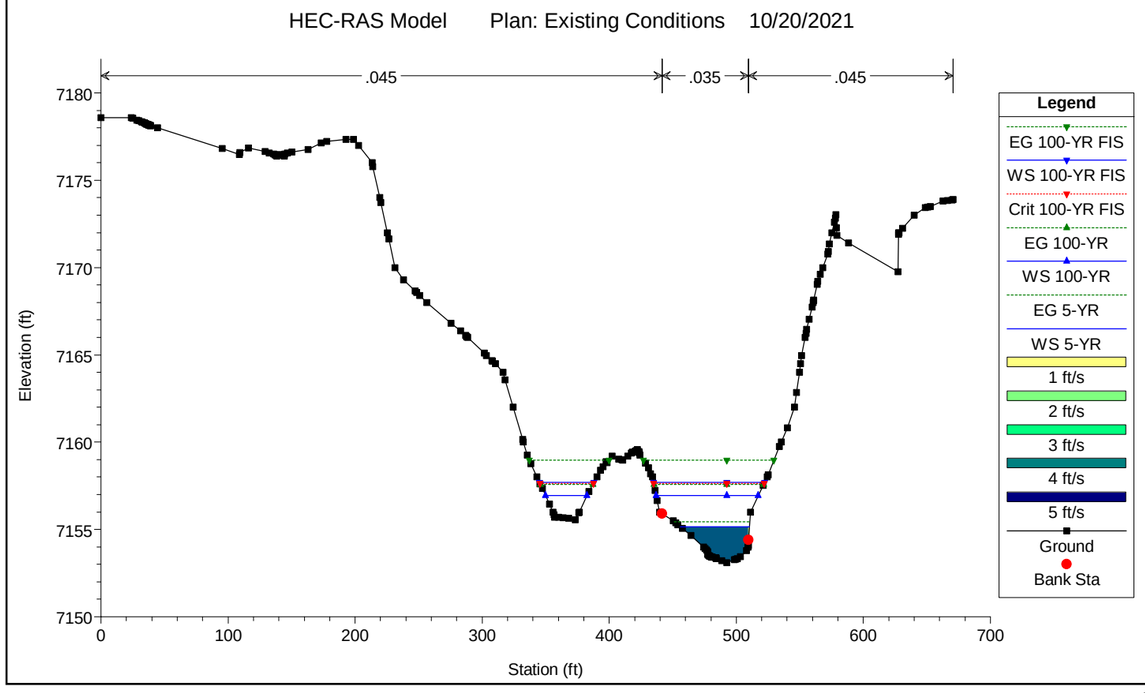
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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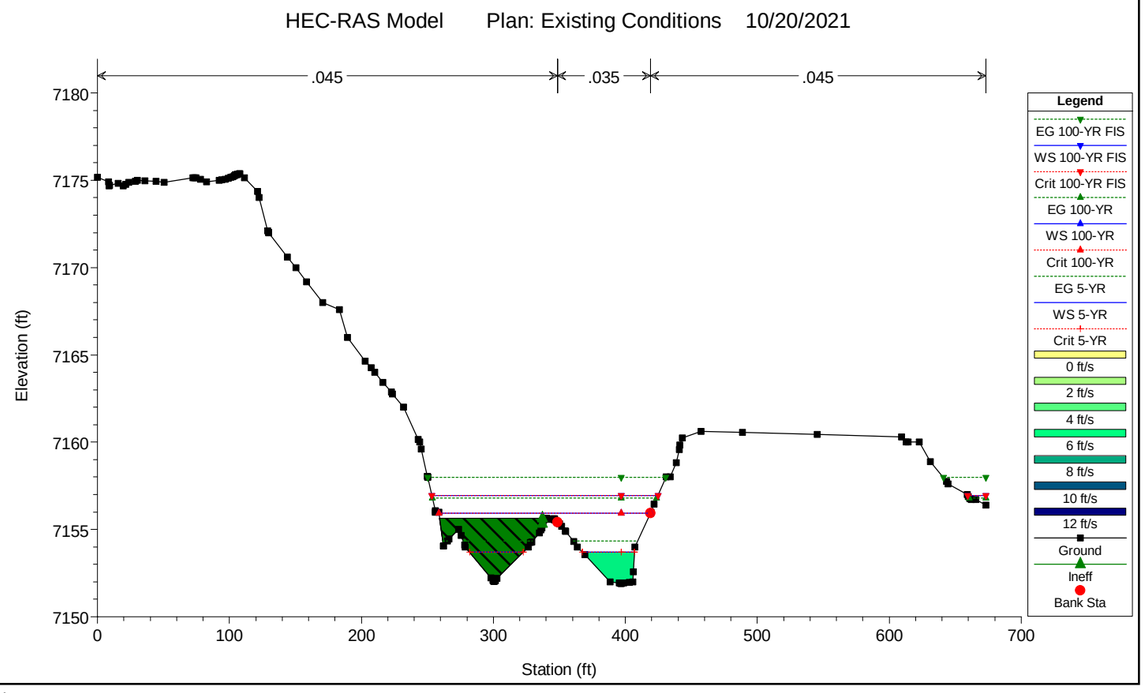
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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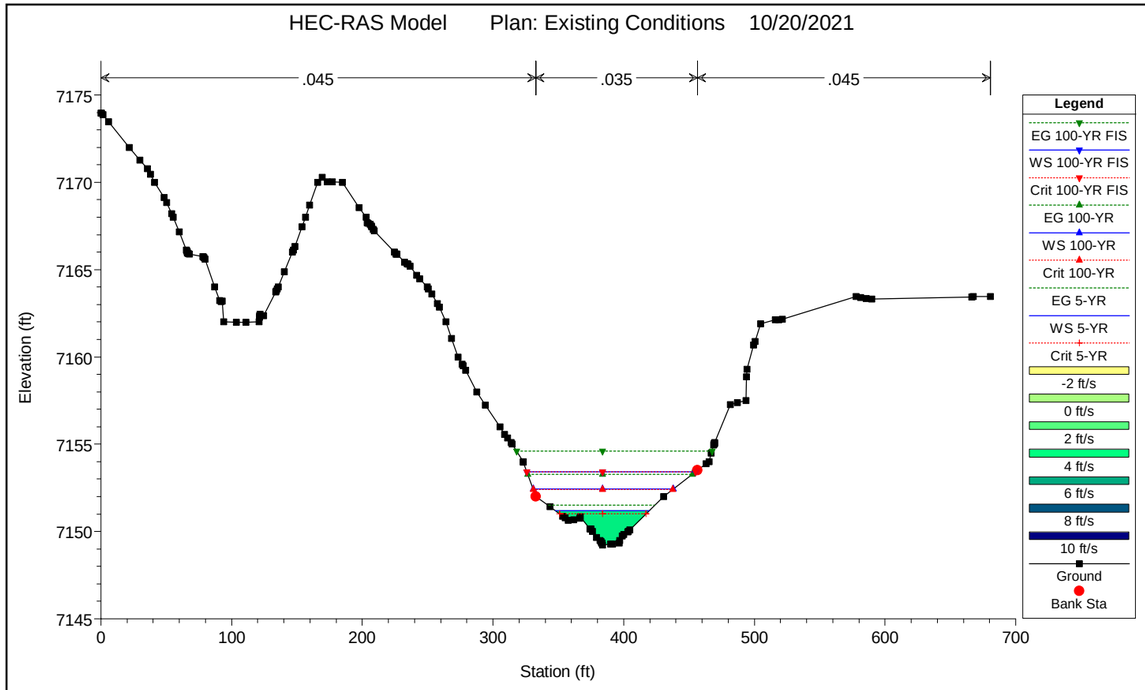
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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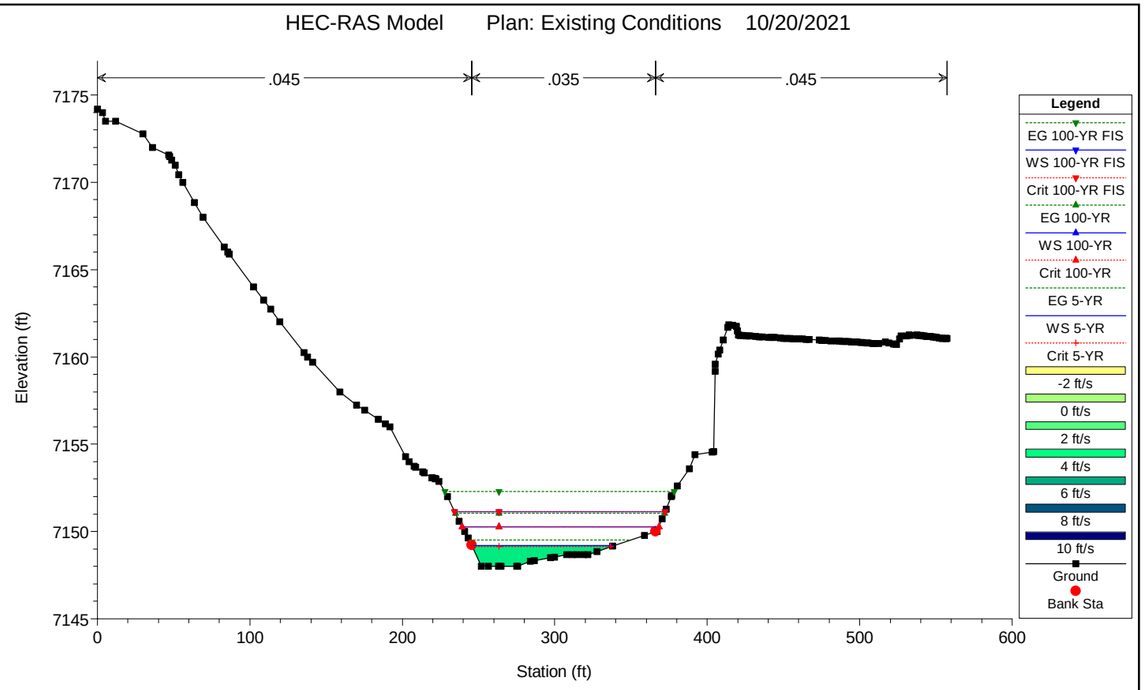
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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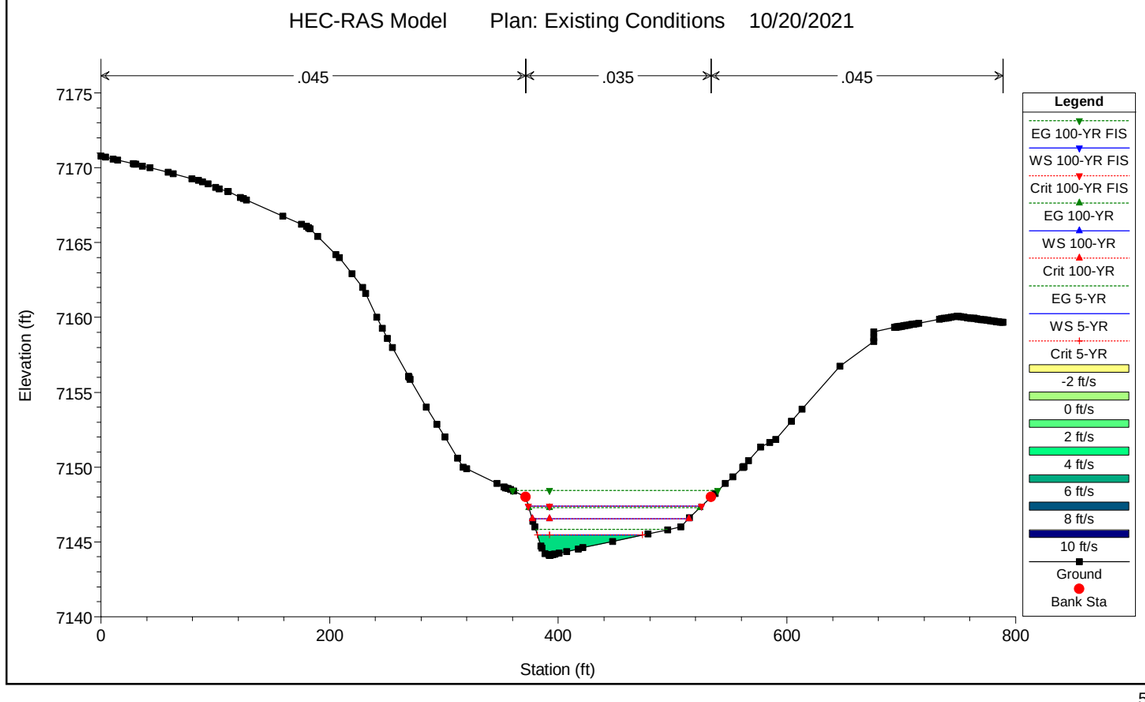
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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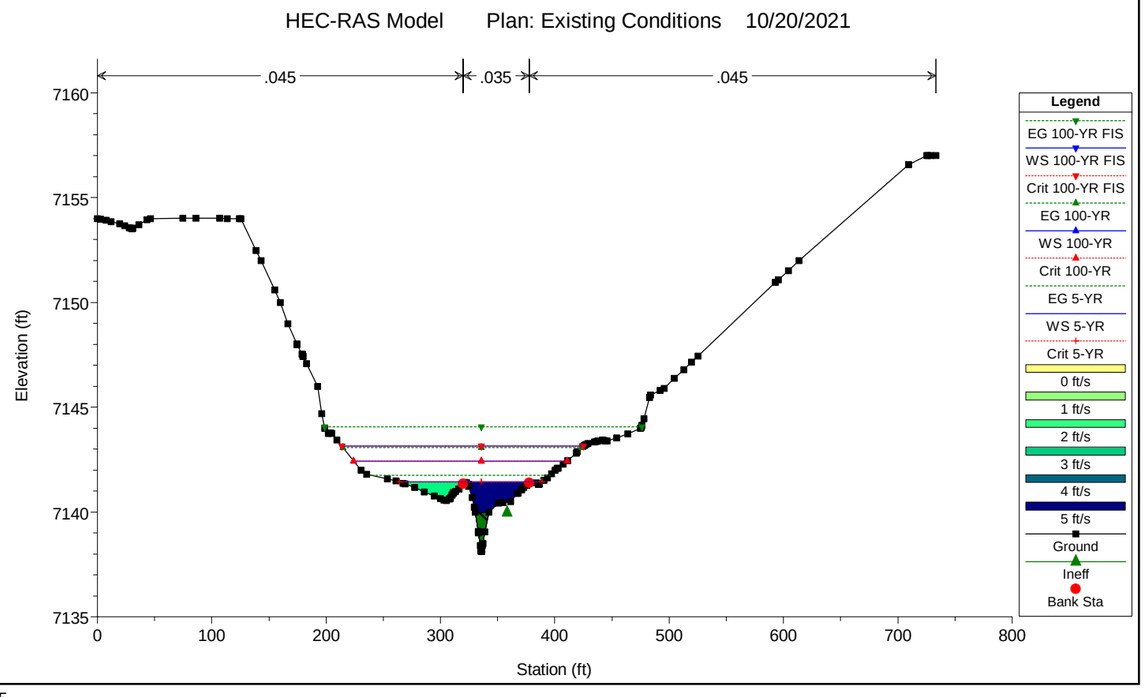
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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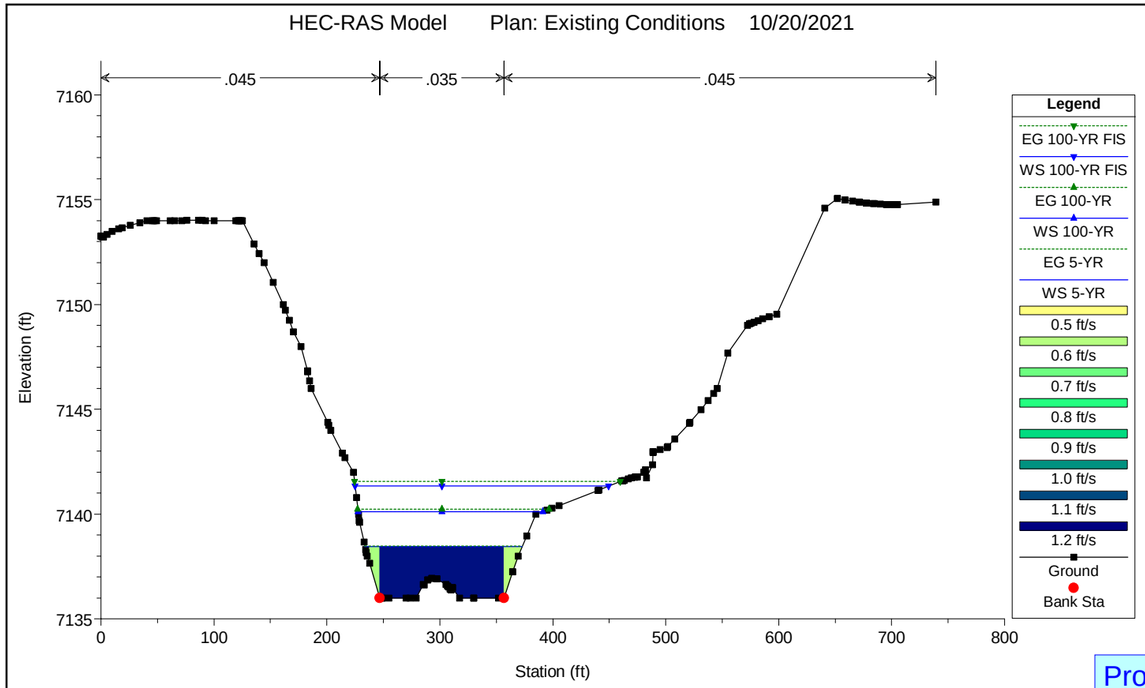
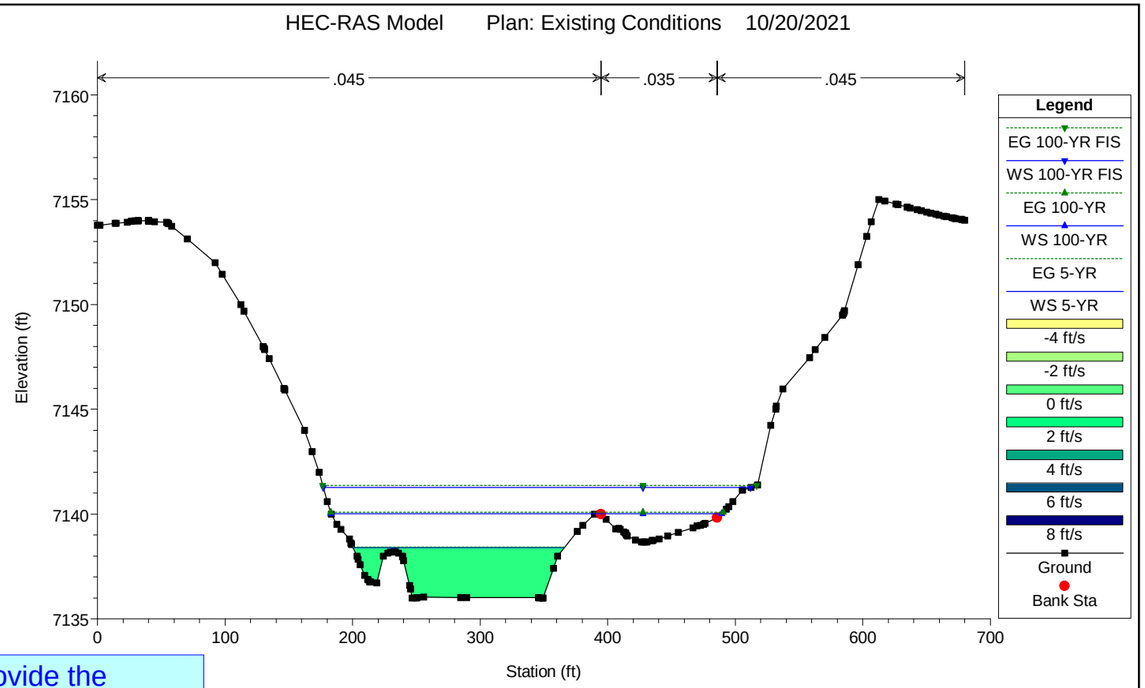
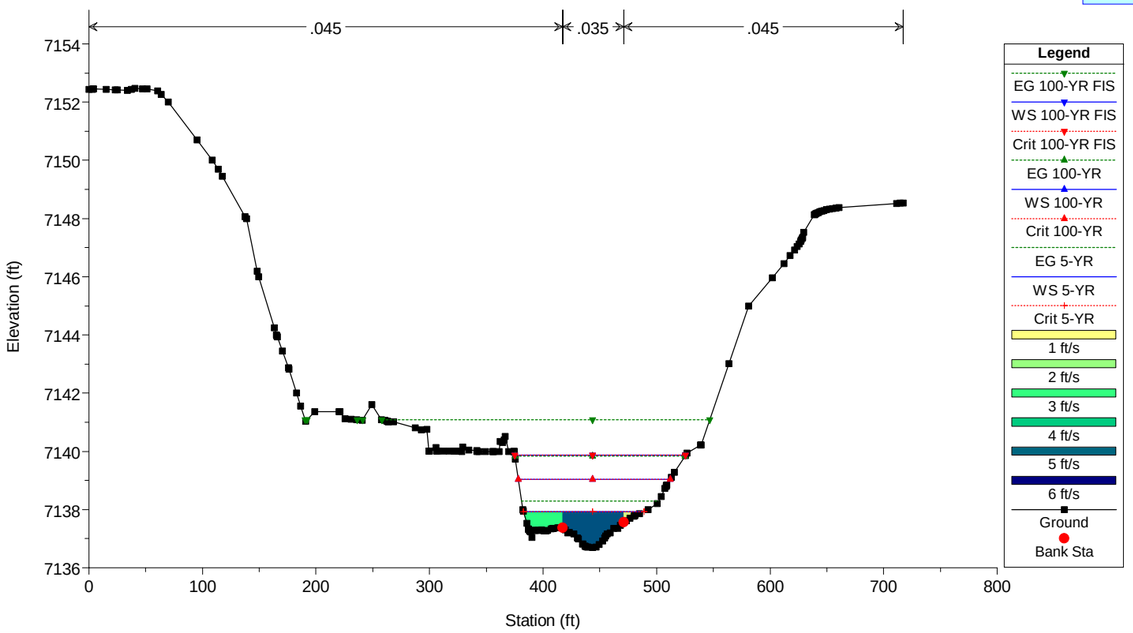
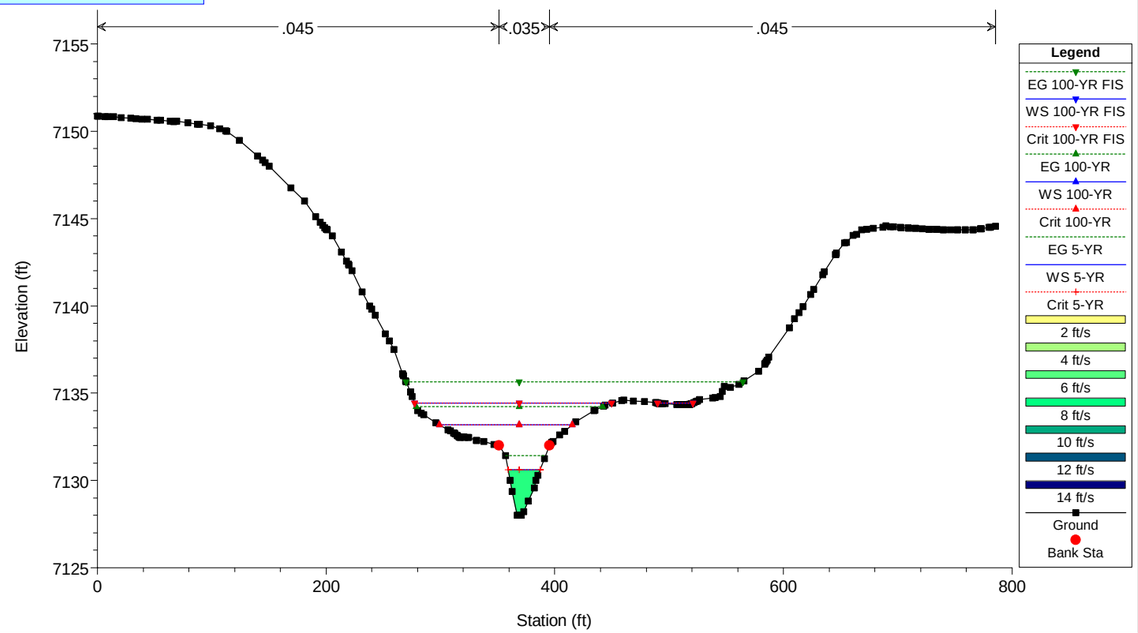
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Ineff
Bank Sta

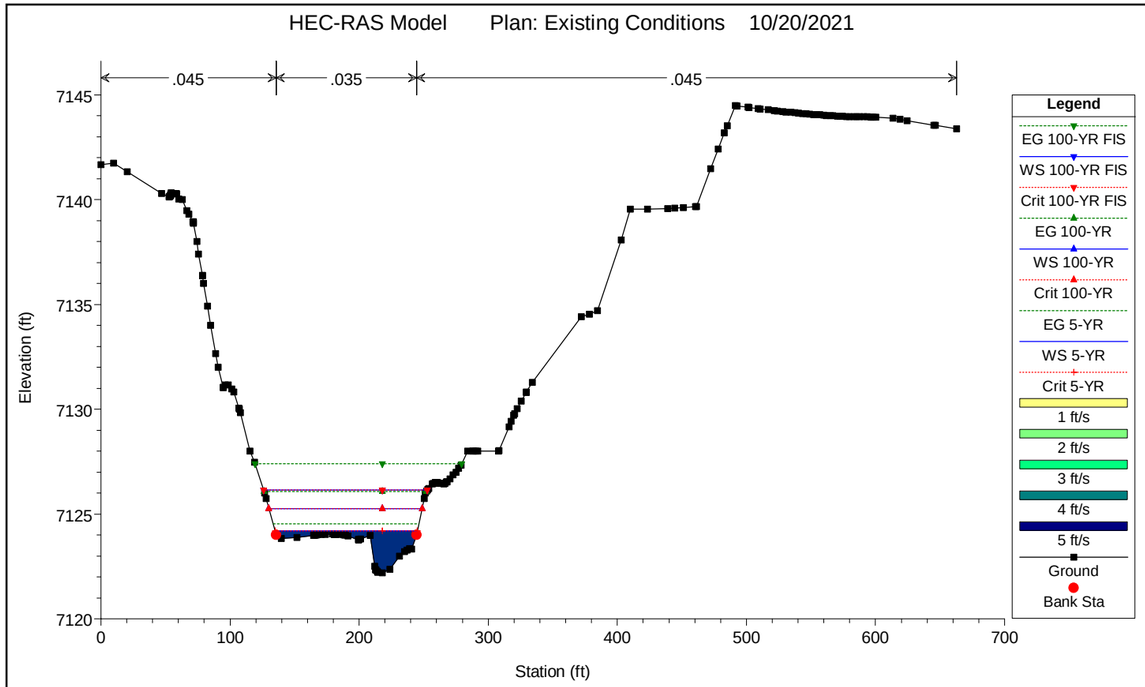




Provide the channel stations?






HEC-RAS Model Plan: Existing Conditions 10/20/2021
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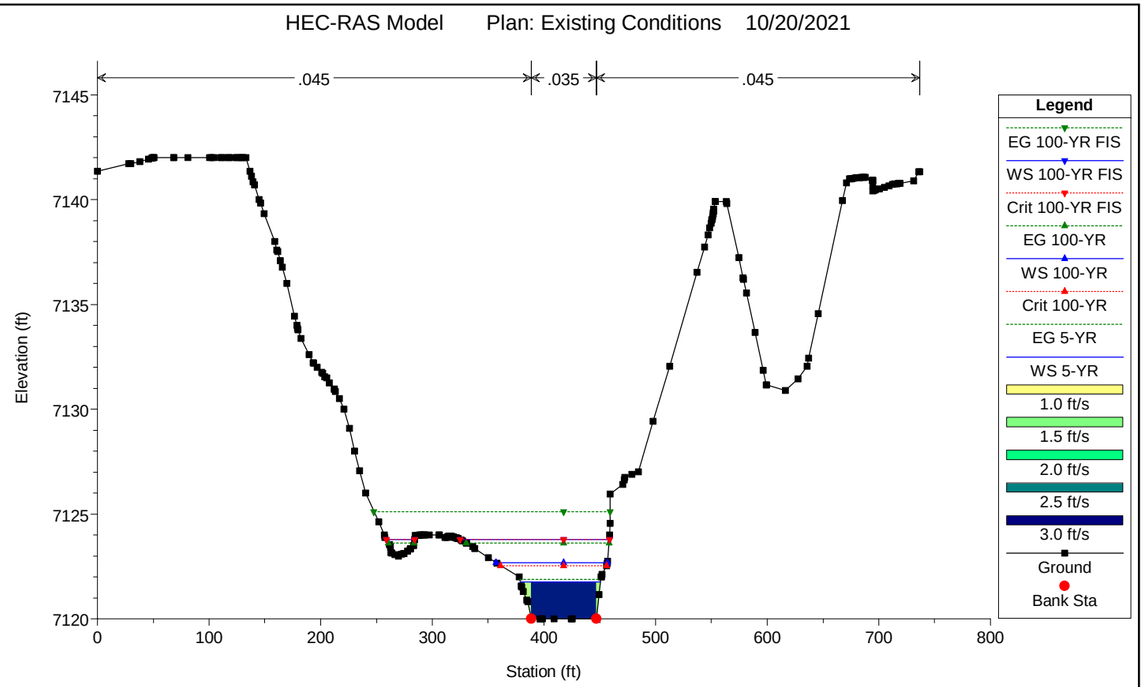
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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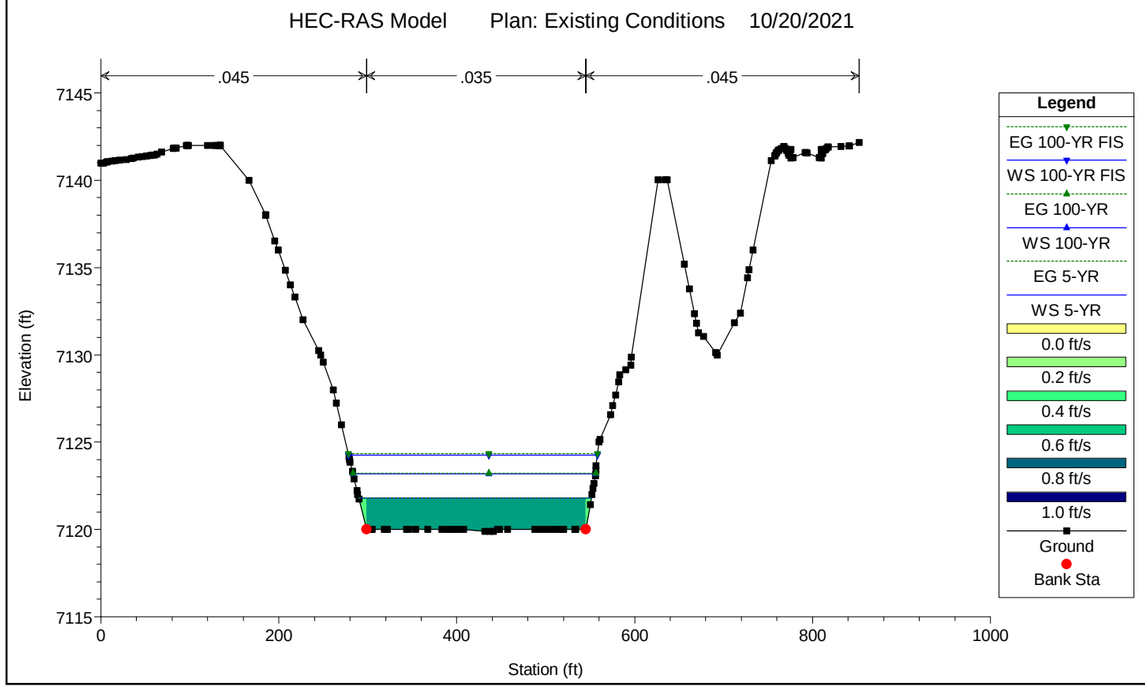
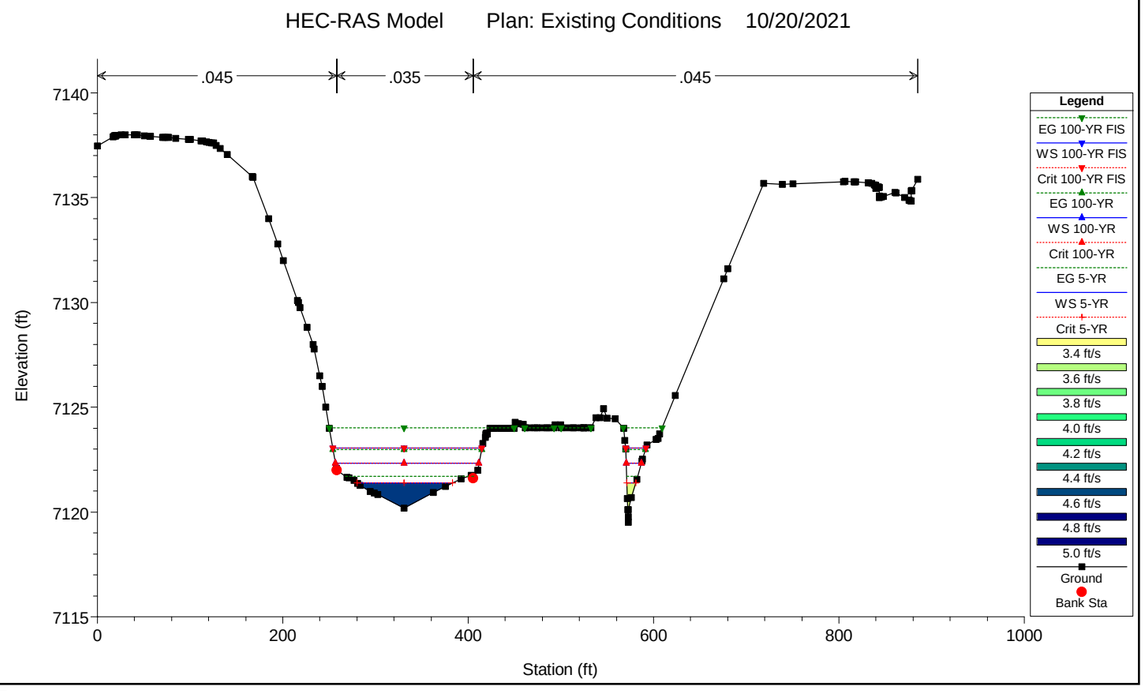
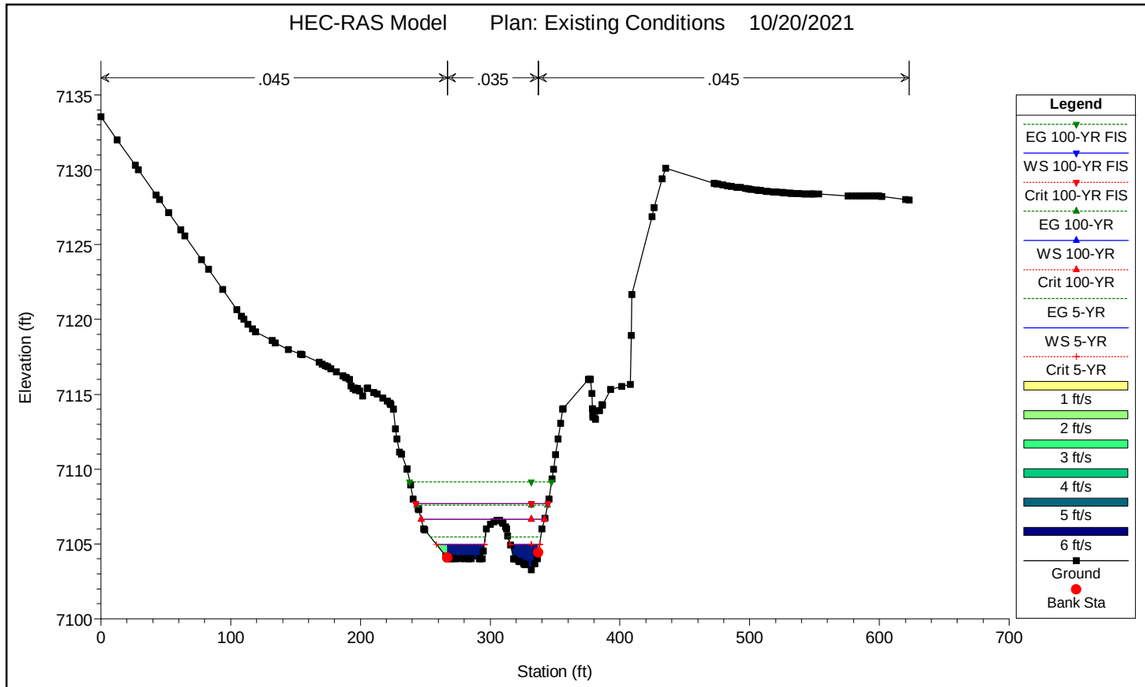
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.4 ft/s
3.6 ft/s
3.8 ft/s
4.0 ft/s
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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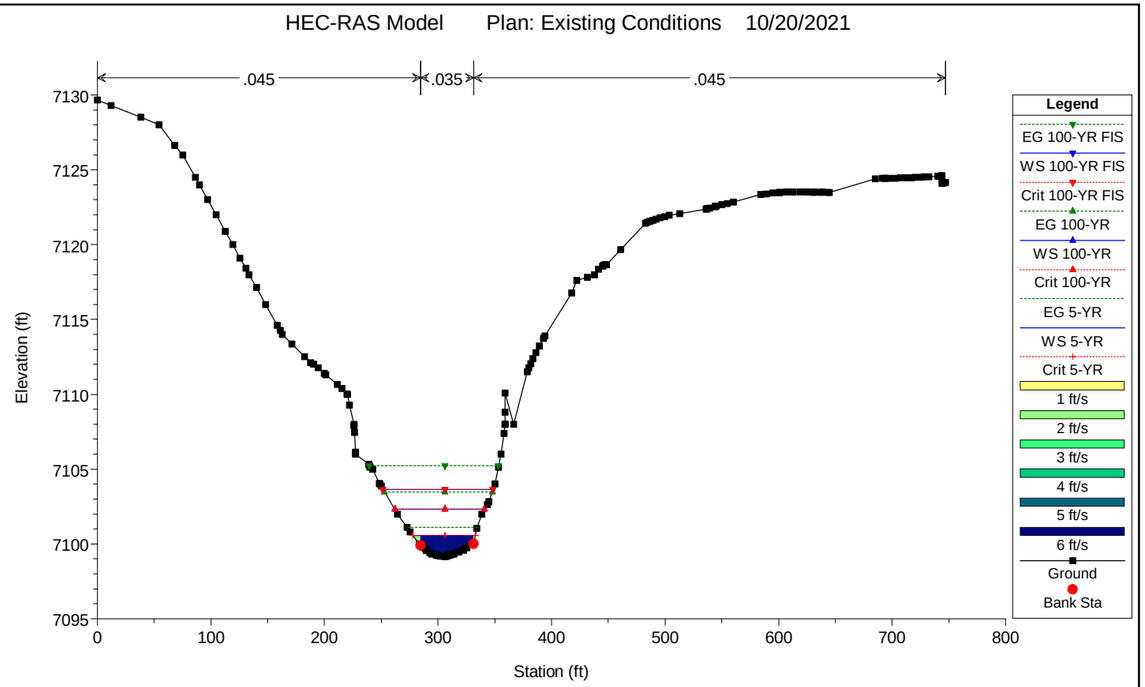
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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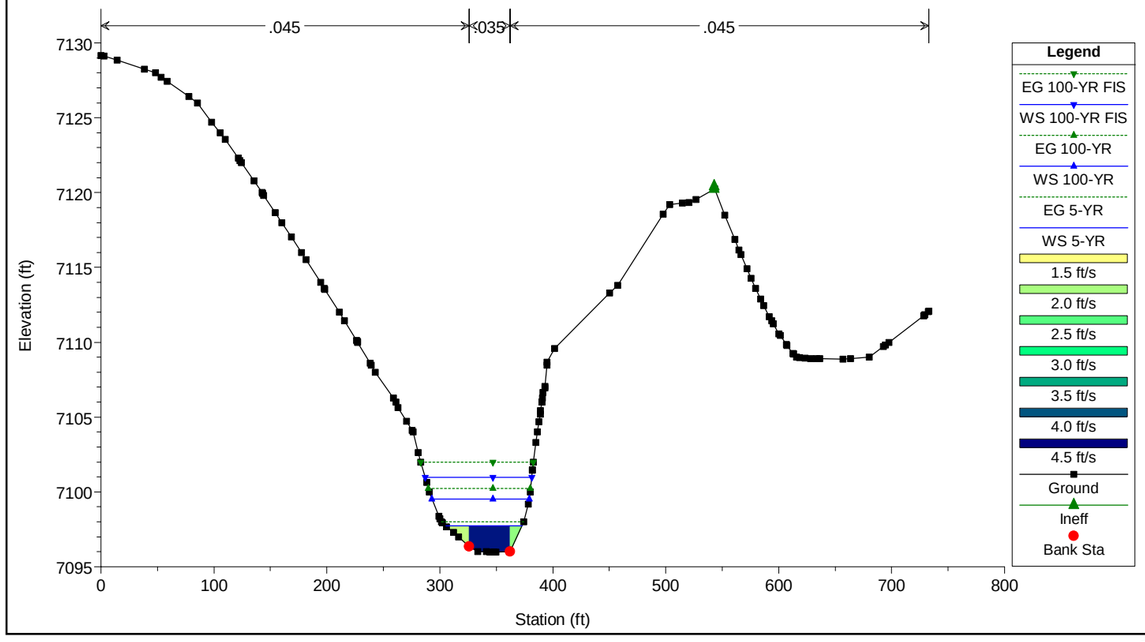
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
2.0 ft/s
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3.0 ft/s
3.5 ft/s
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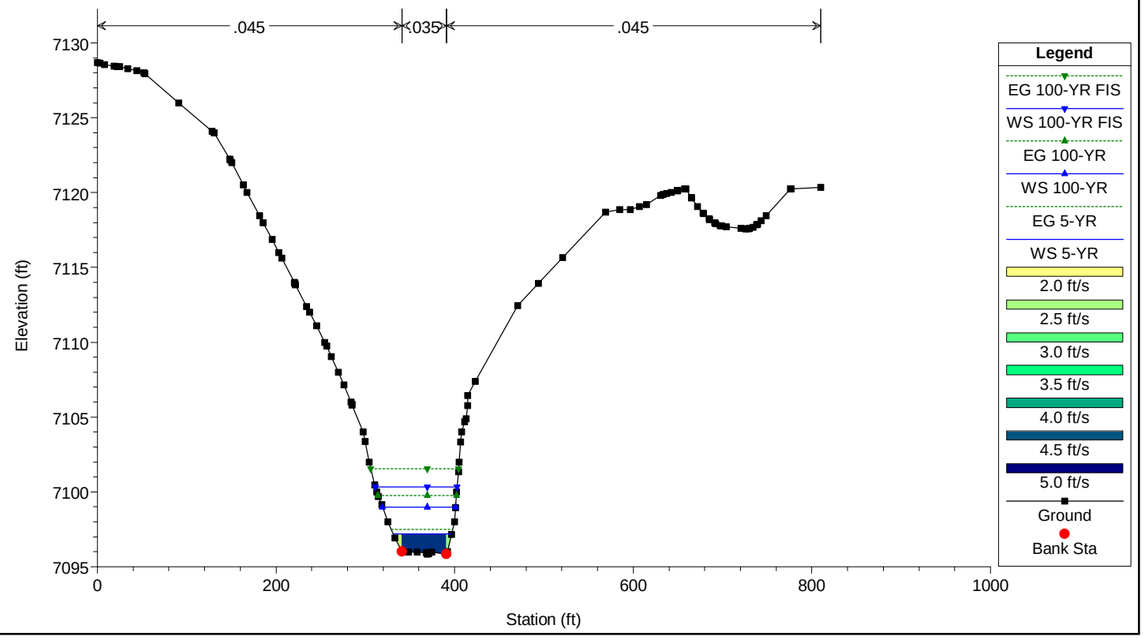
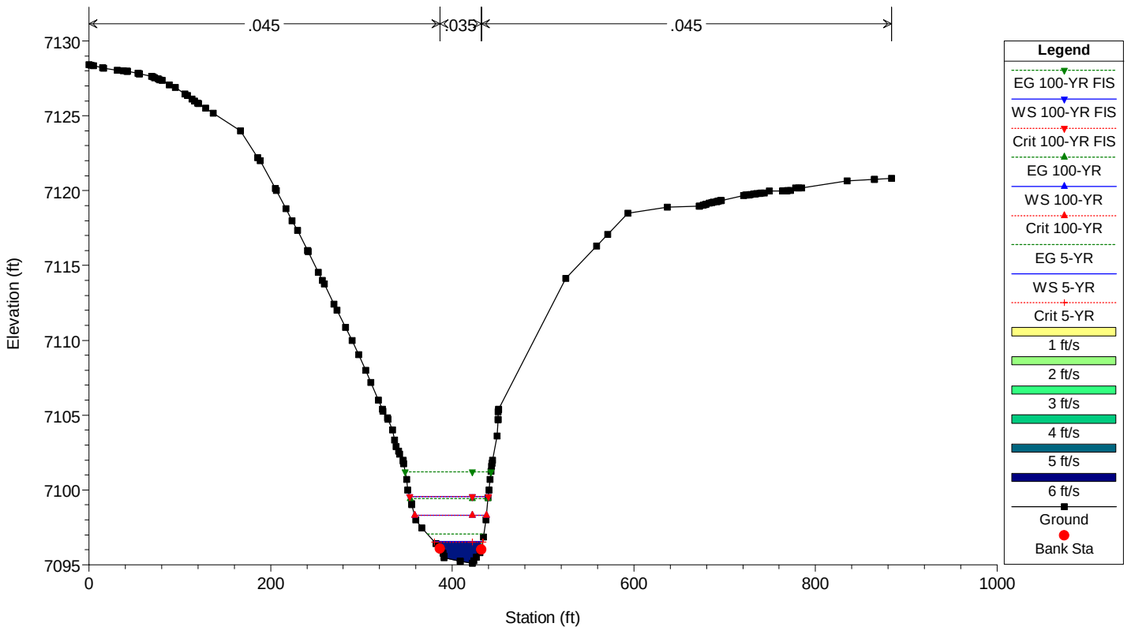
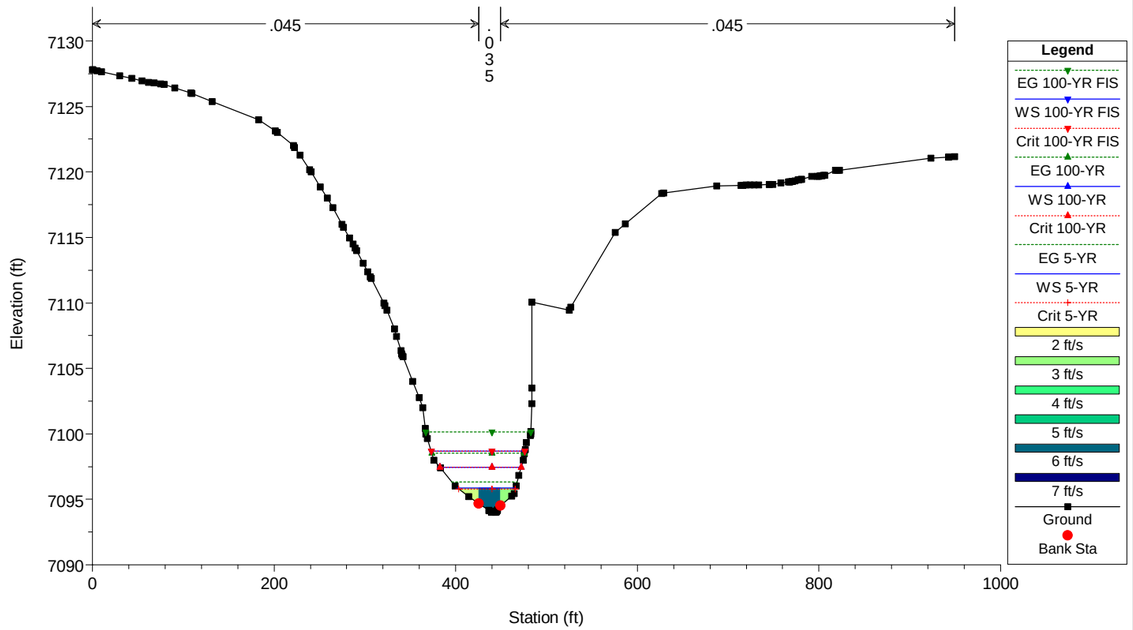
4.5 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
Ground
Bank Sta

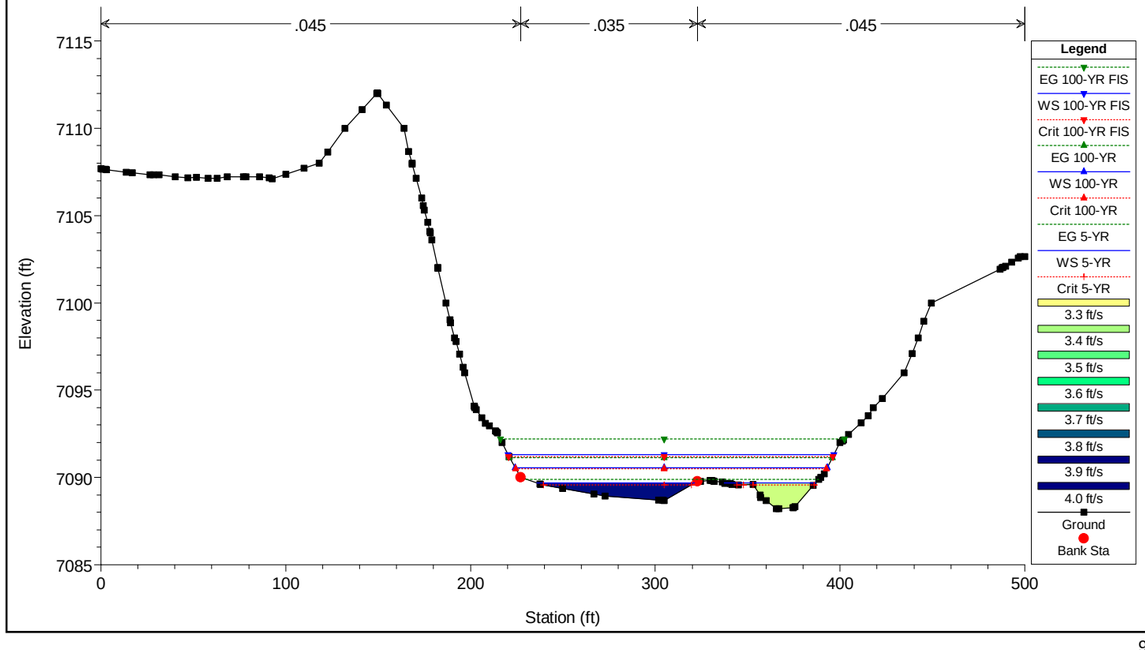
HEC-RAS Model Plan: Existing Conditions 10/20/2021



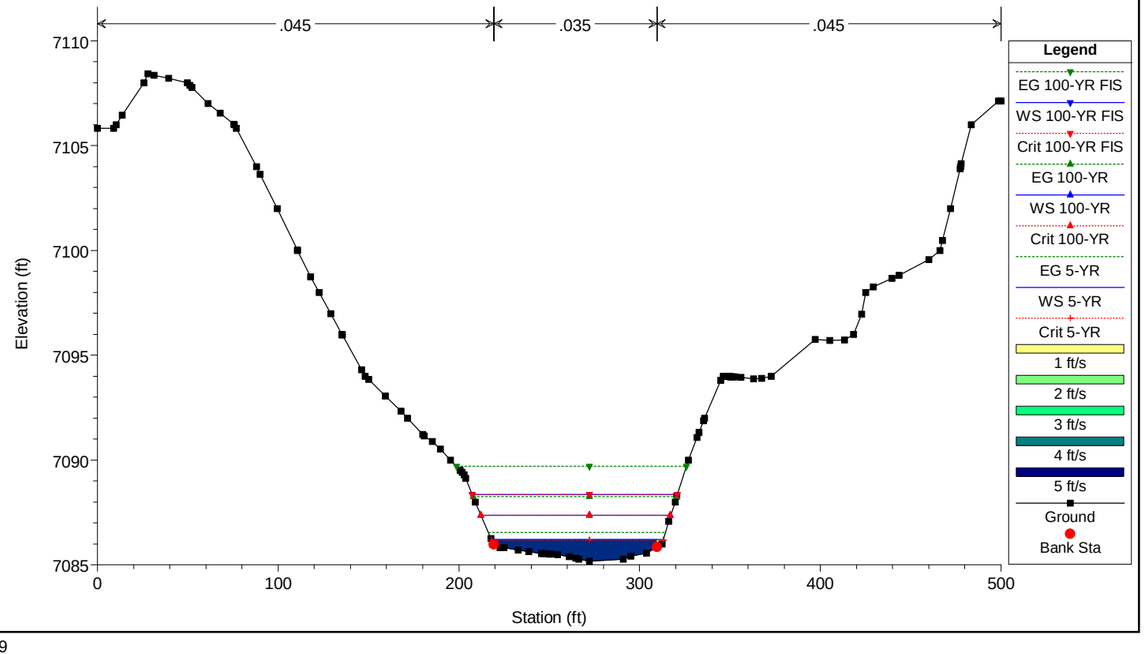
HEC-RAS Model Plan: Existing Conditions 10/20/2021

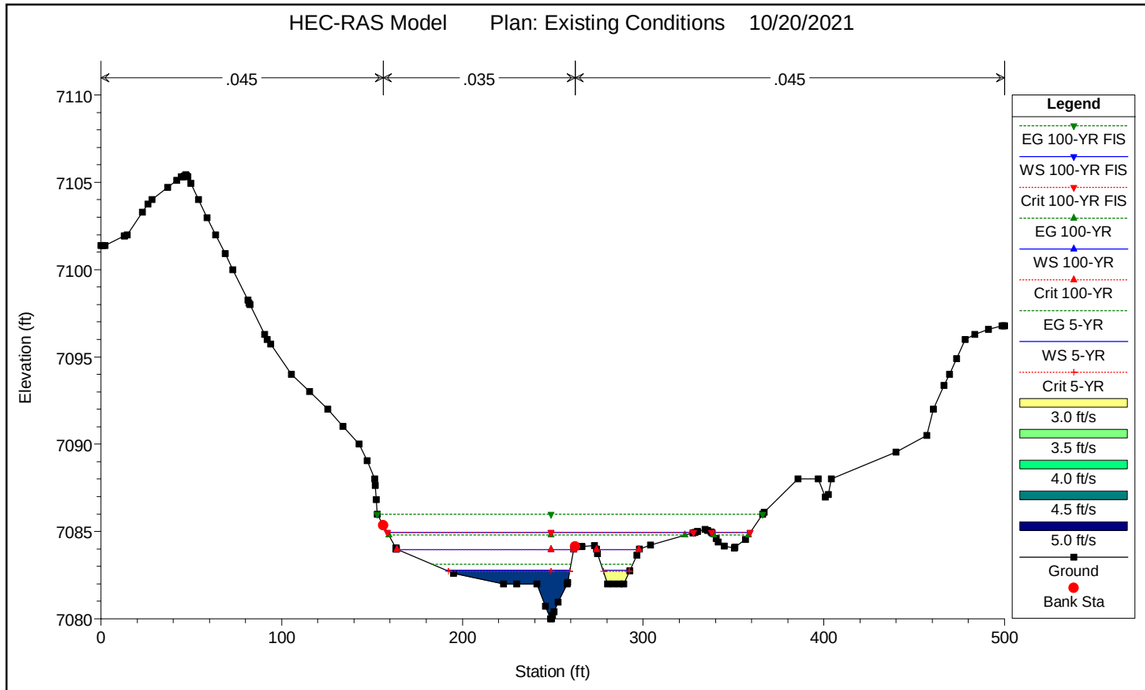


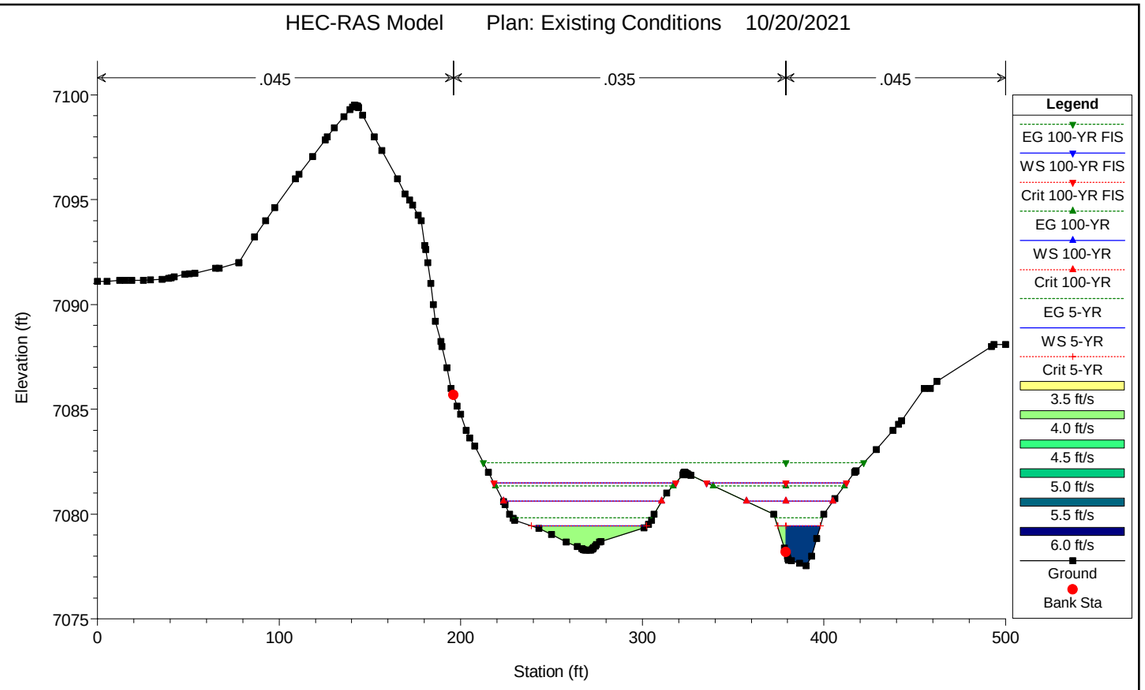
HEC-RAS Model Plan: Existing Conditions 10/20/2021



HEC-RAS Model Plan: Existing Conditions 10/20/2021




HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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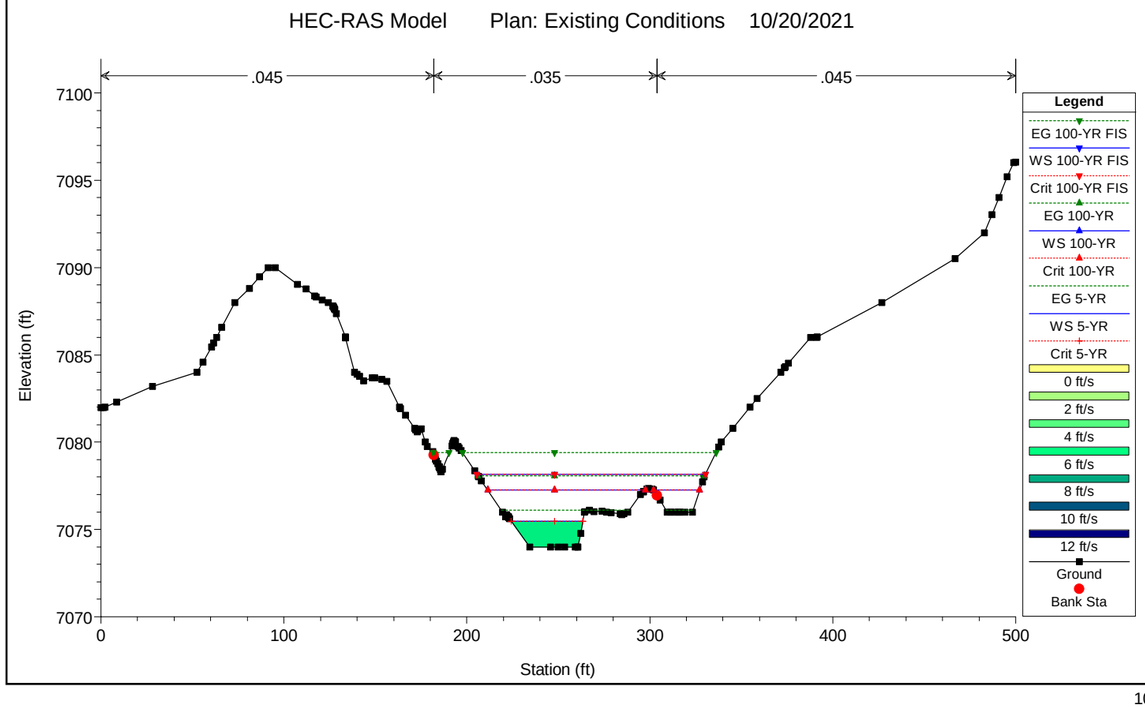
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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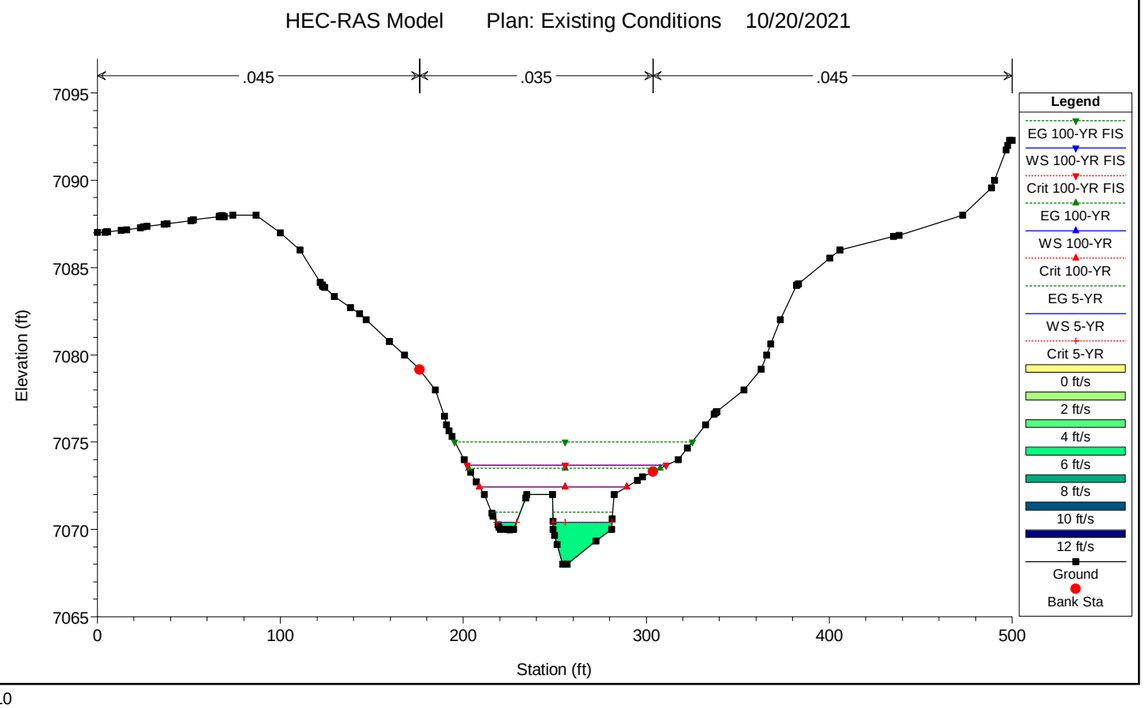
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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2 ft/s
4 ft/s
6 ft/s
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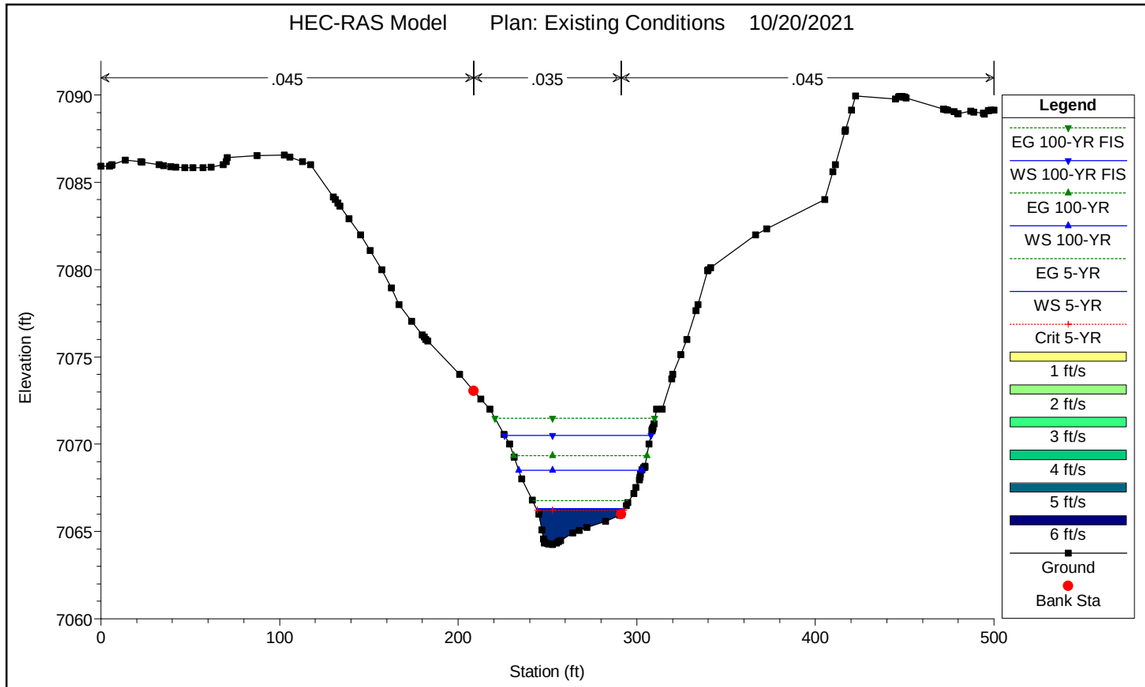
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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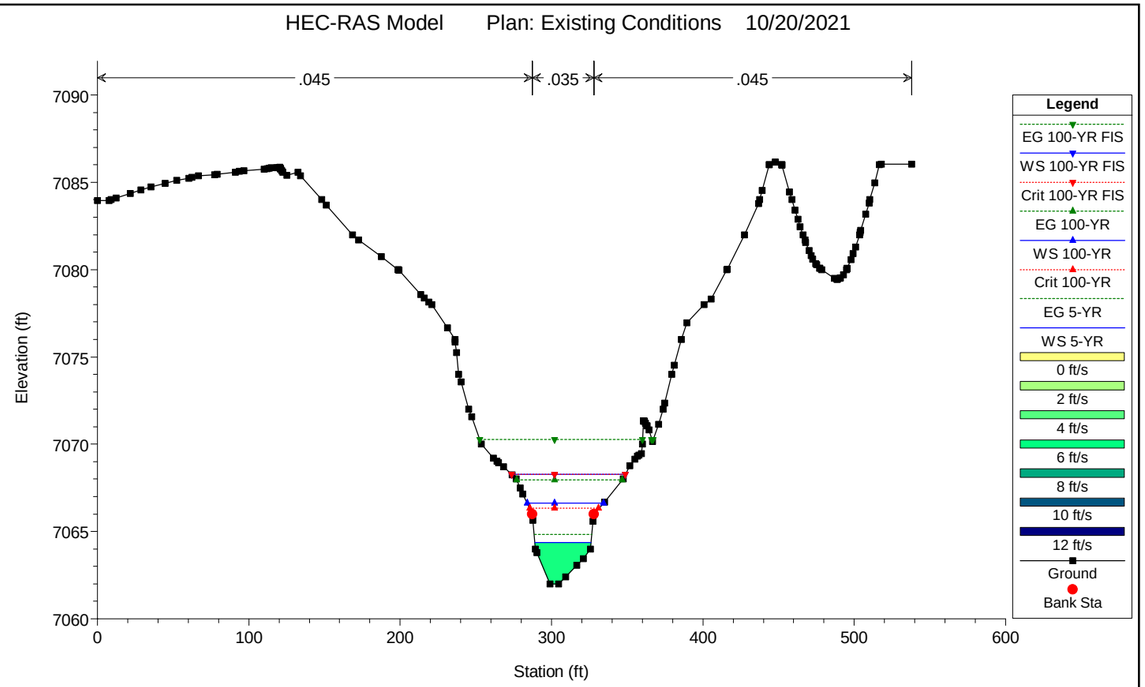
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
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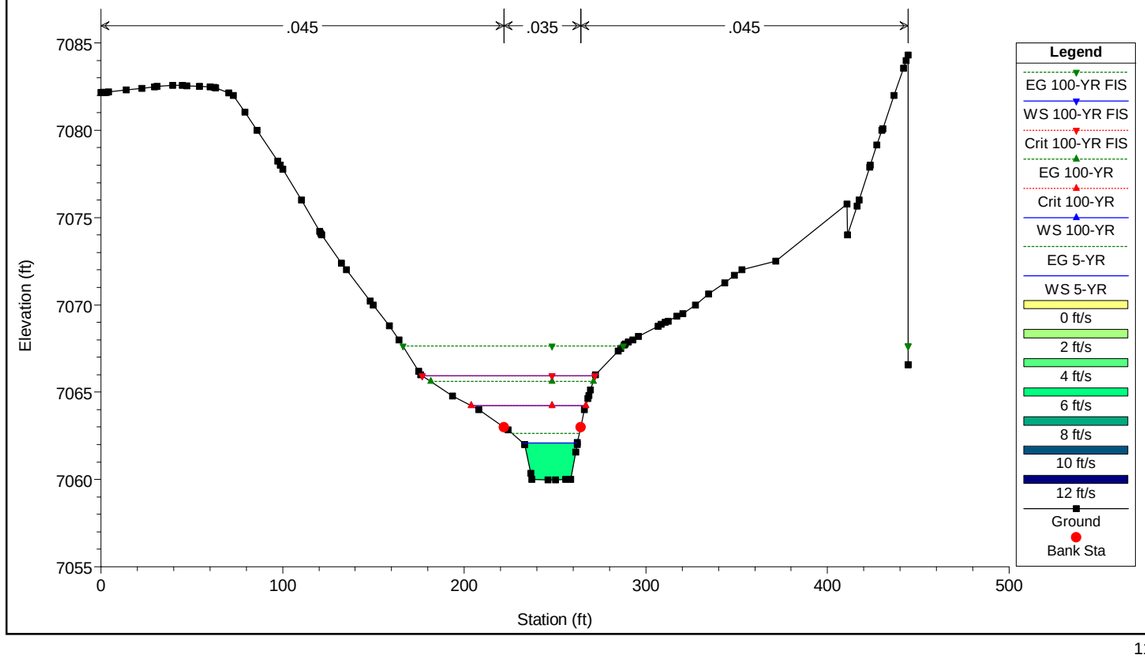
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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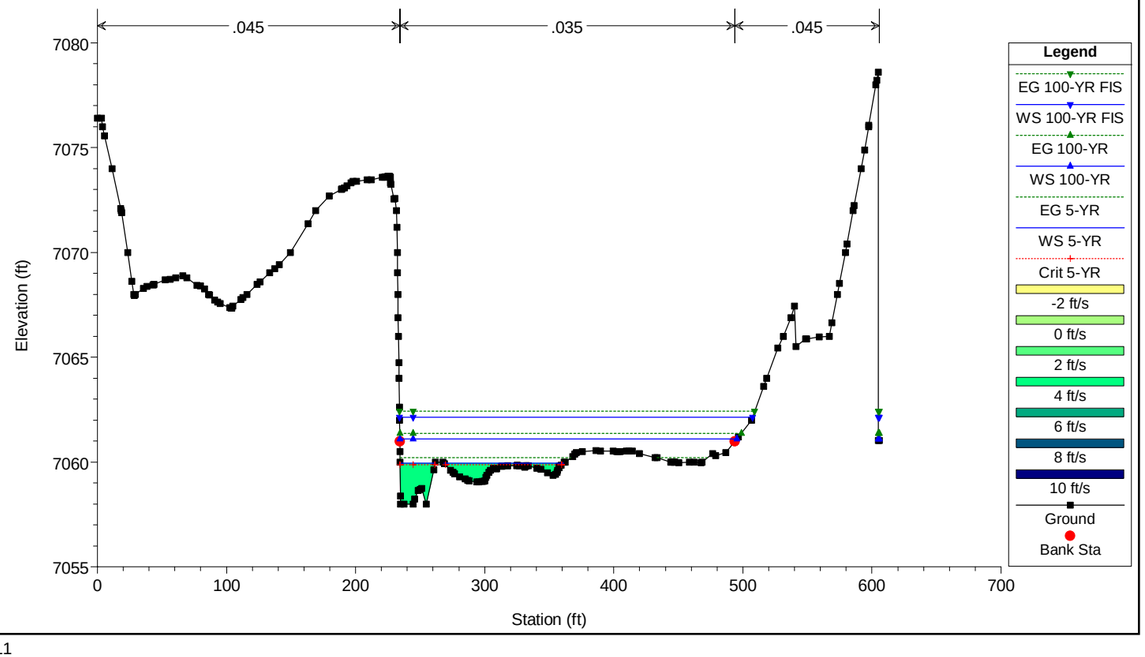
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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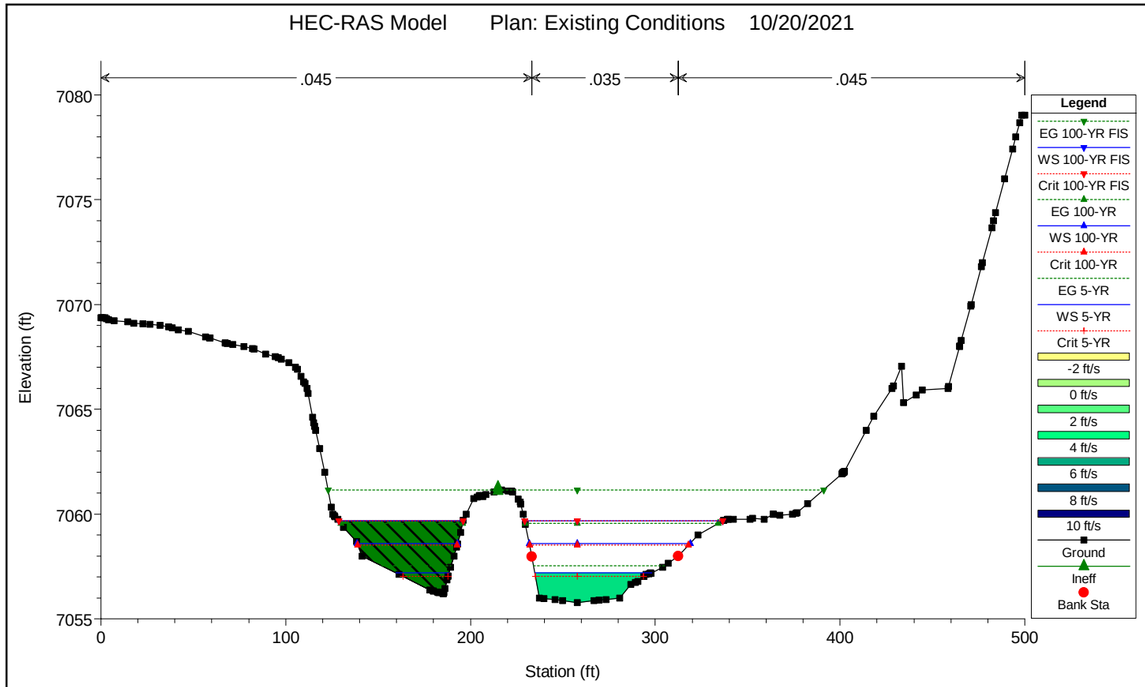
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
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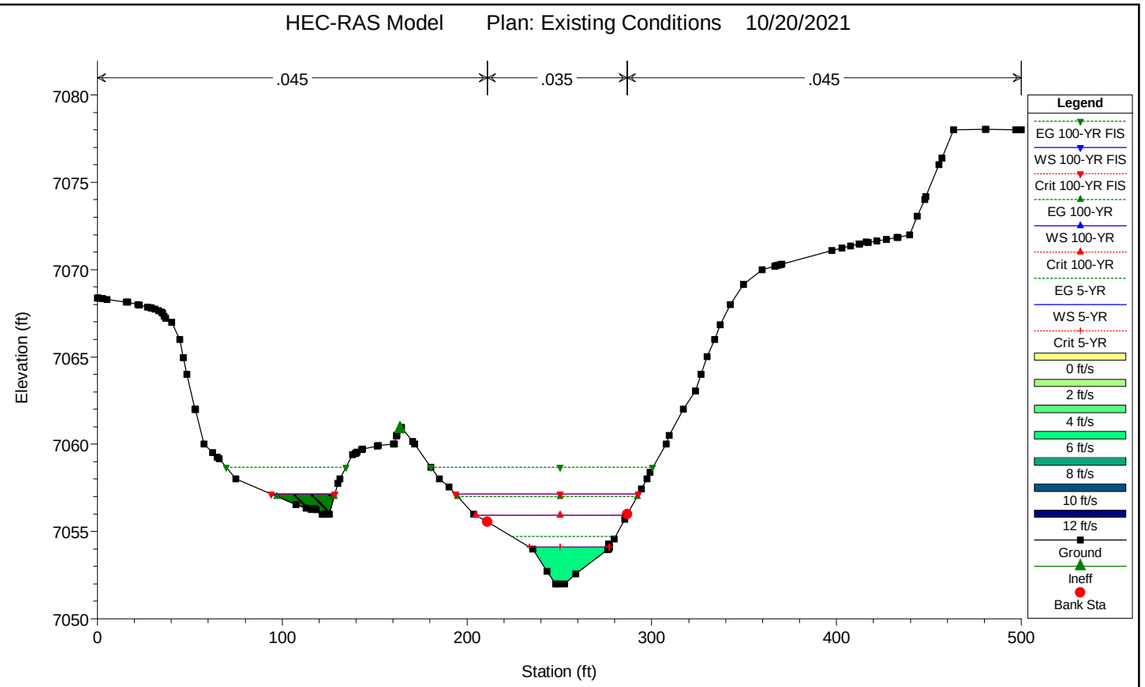
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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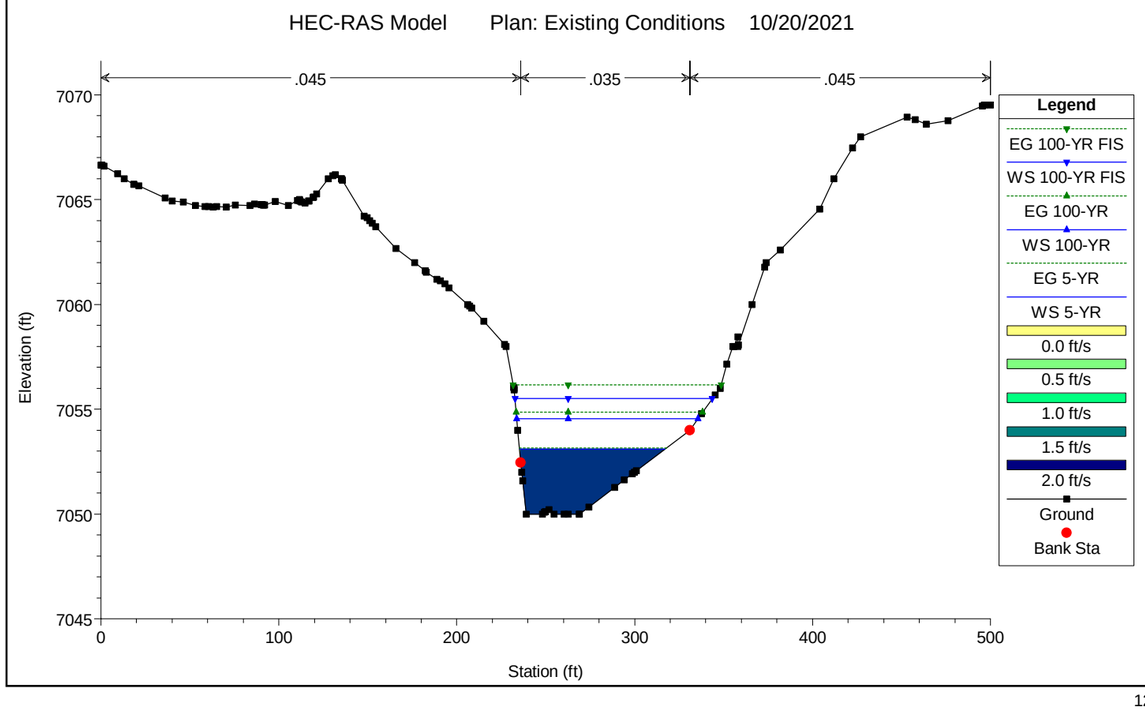
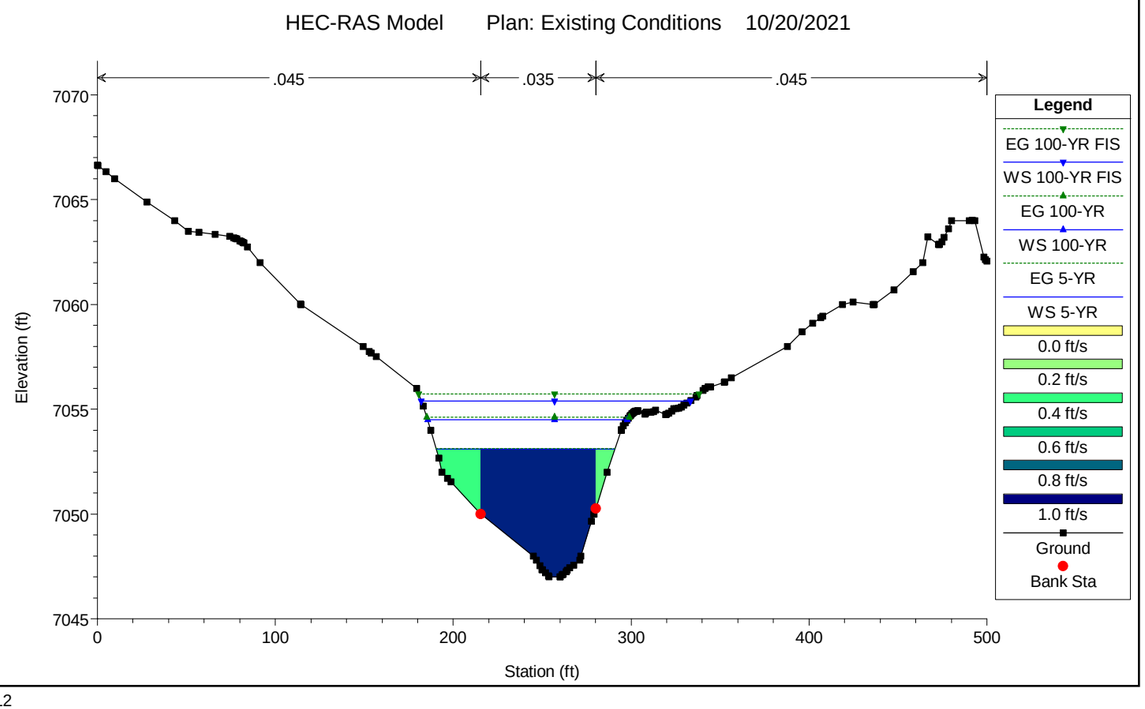
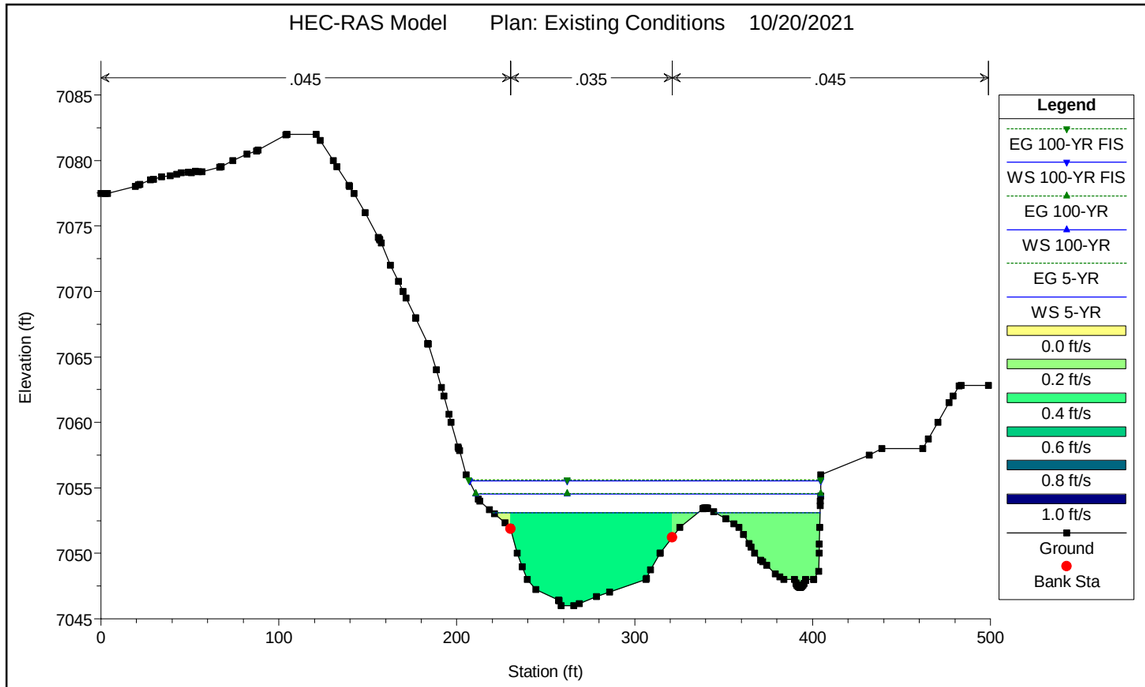
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
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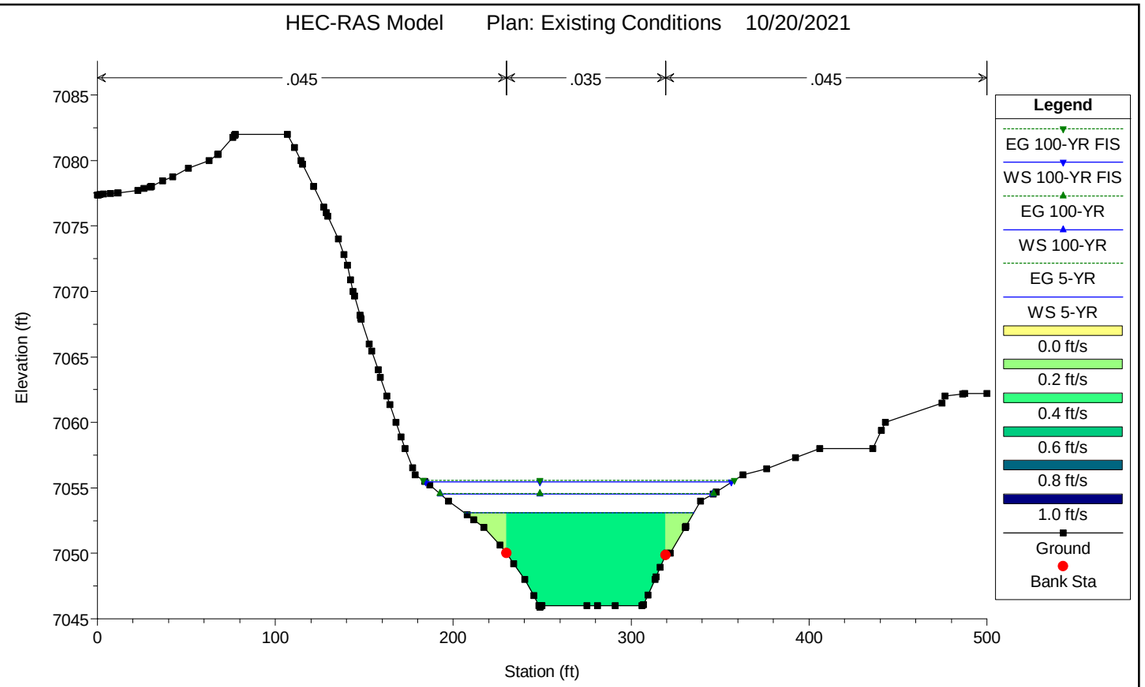
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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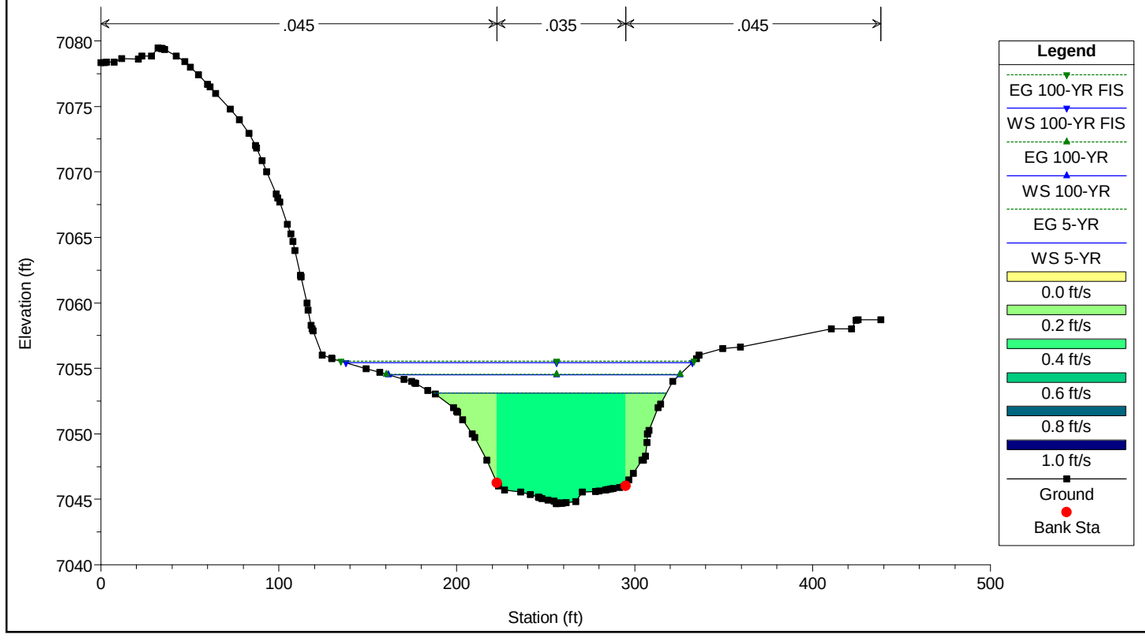
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
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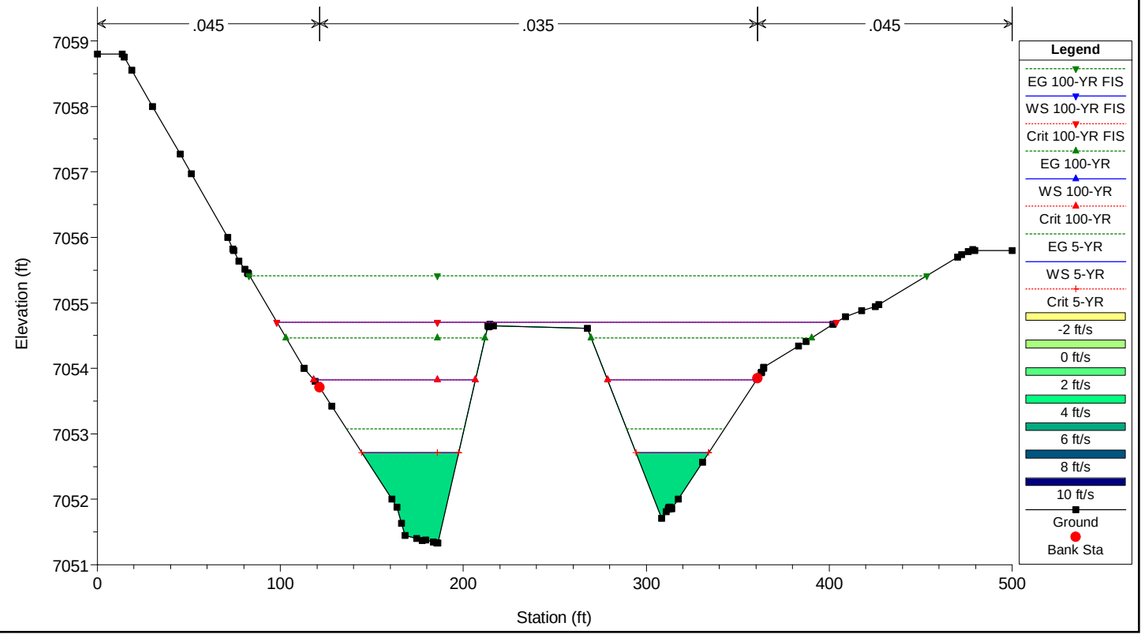
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
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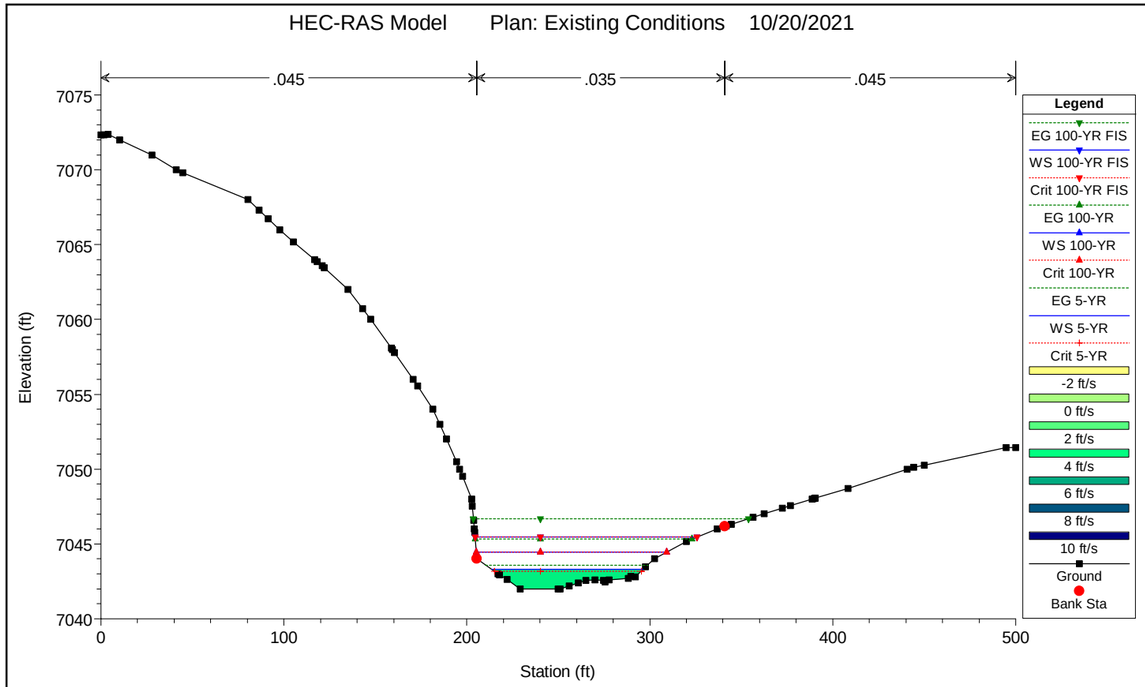
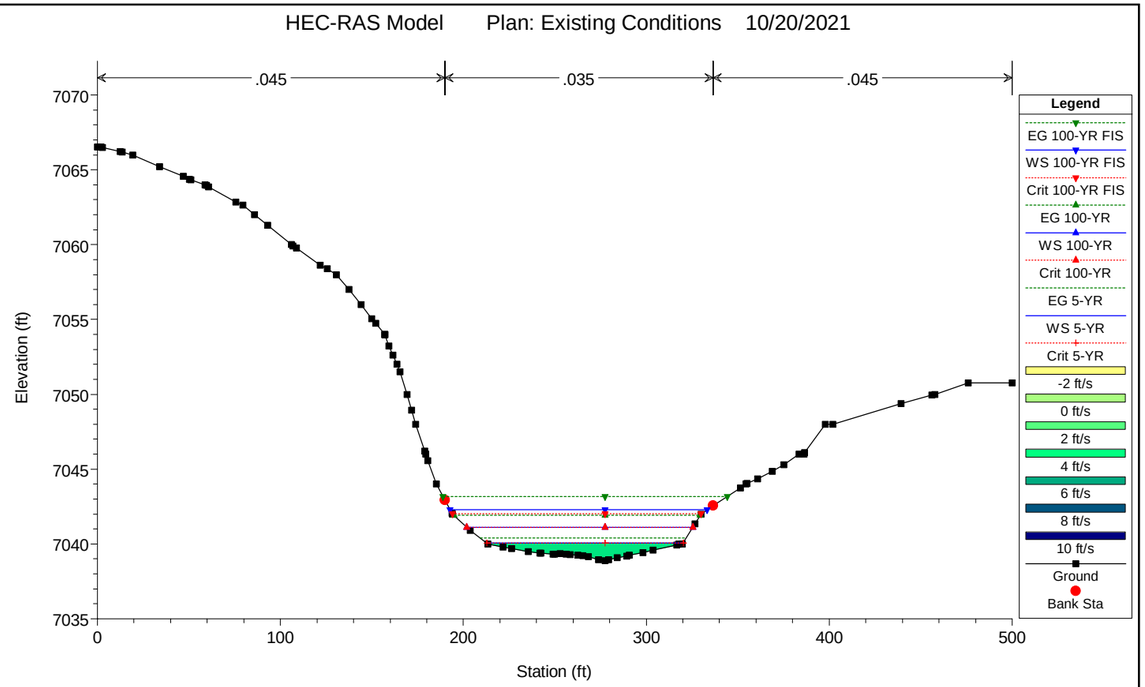
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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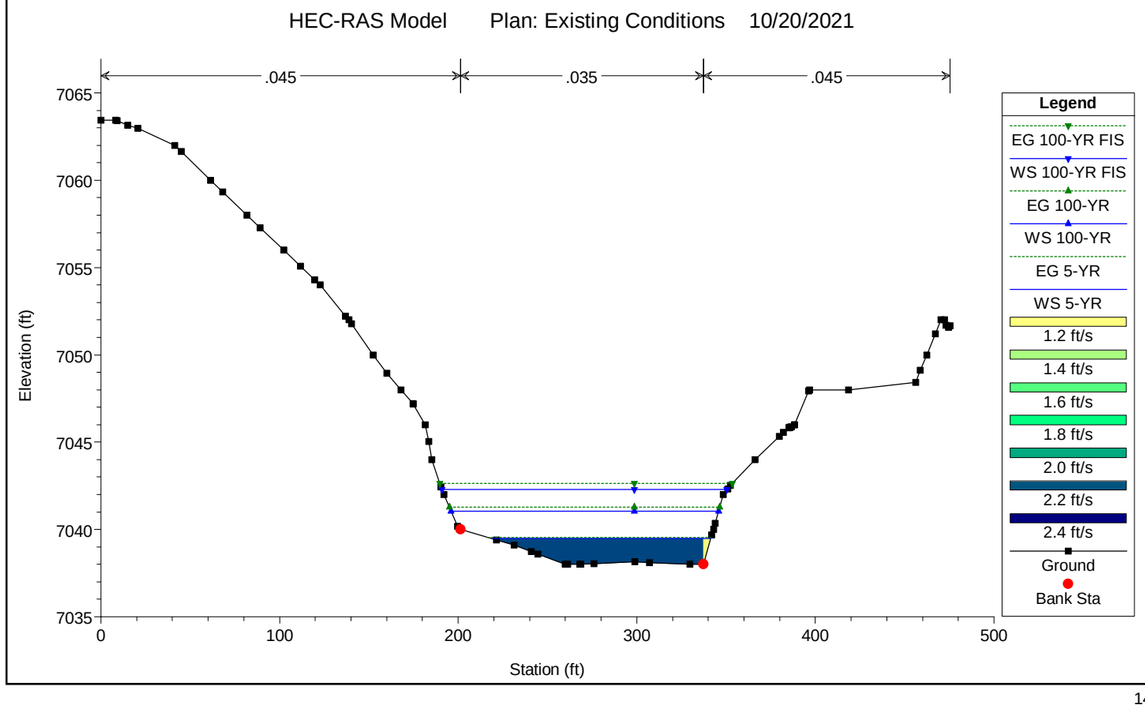
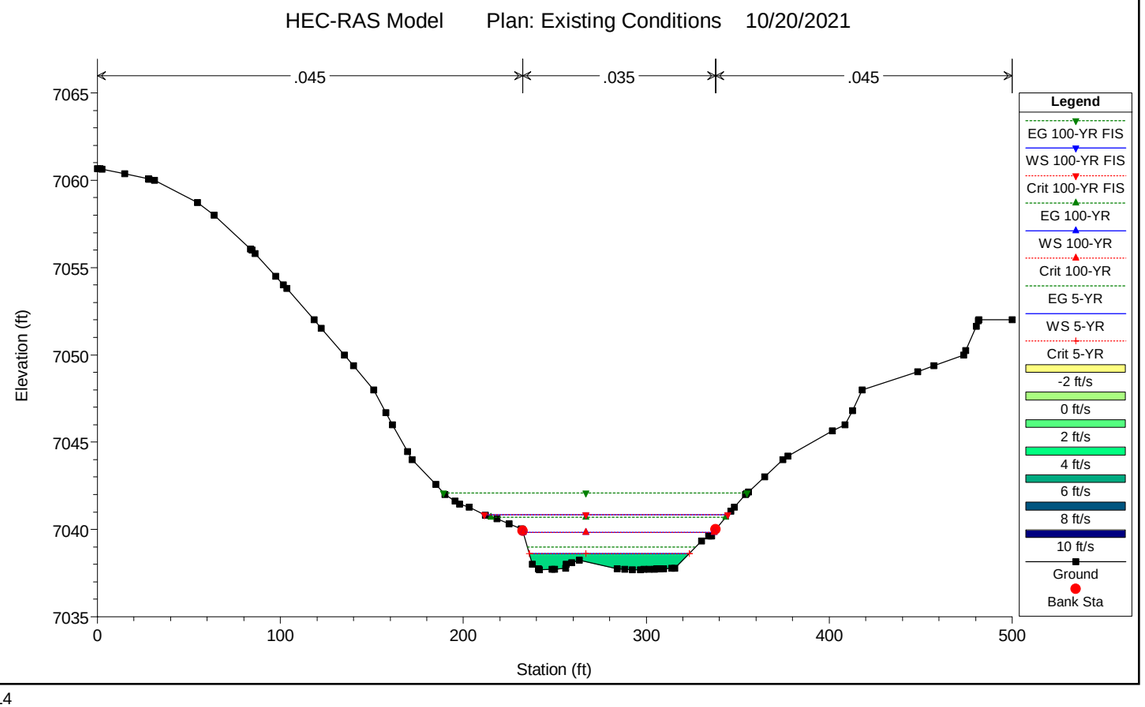
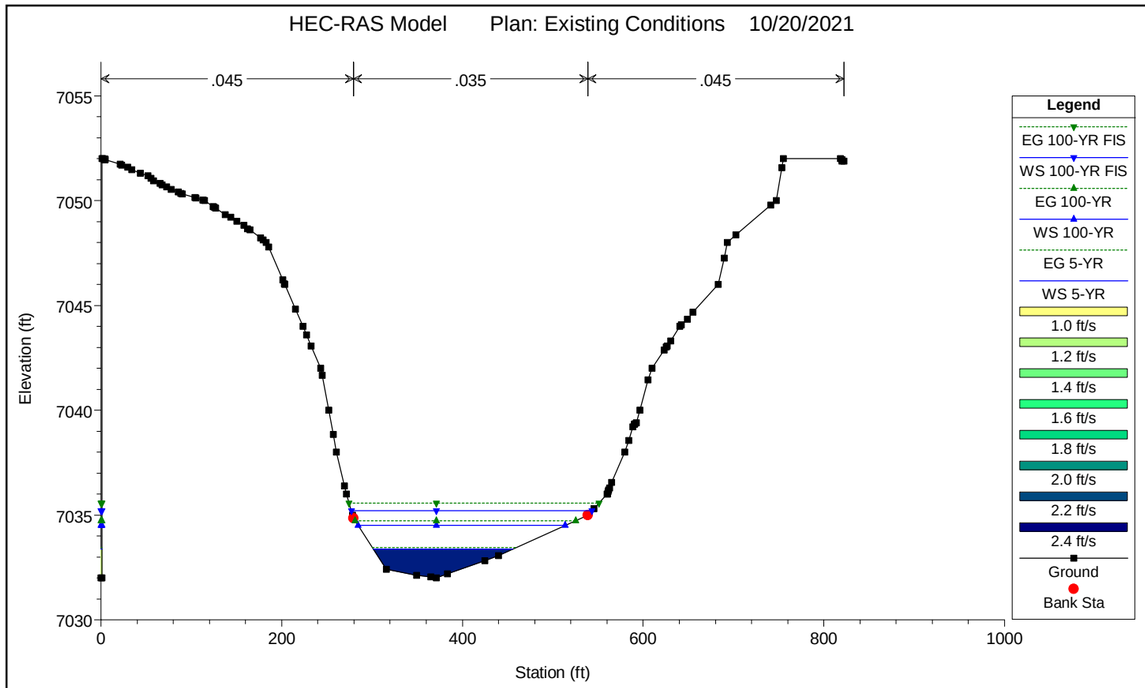
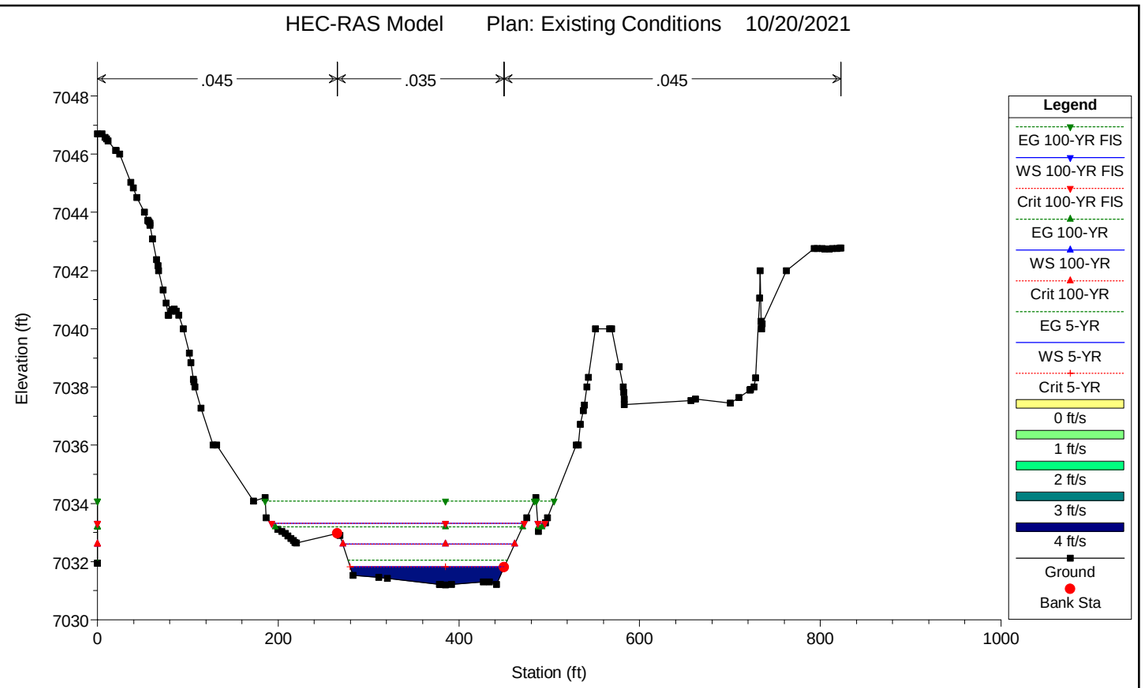
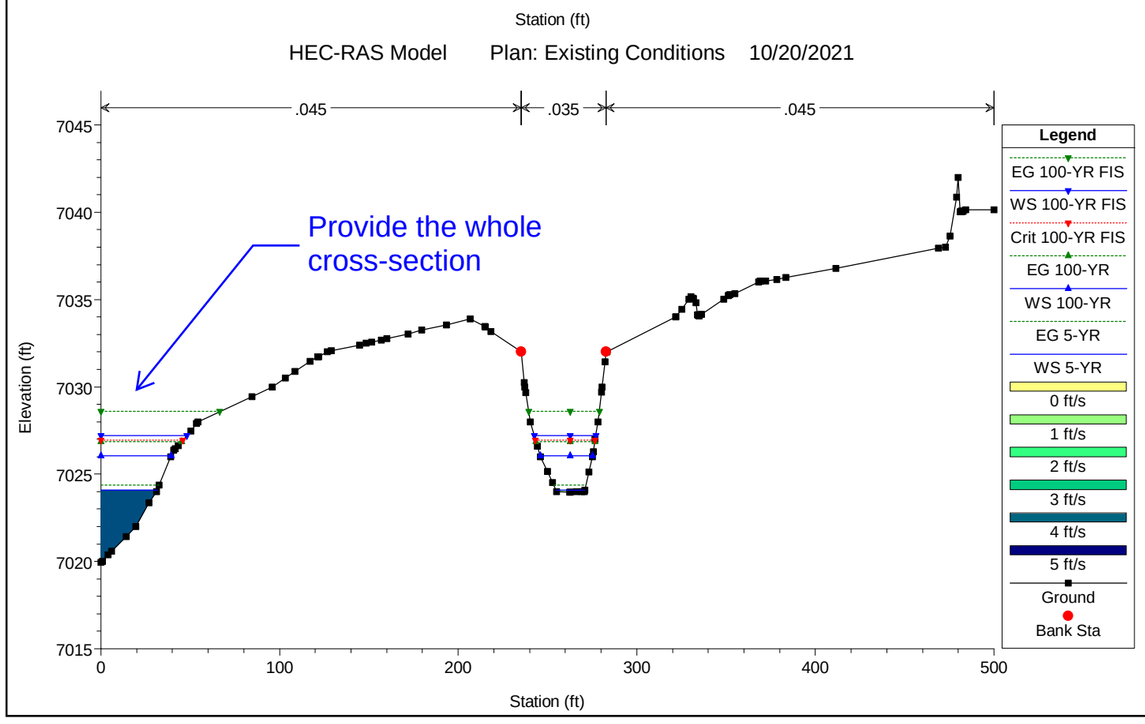
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

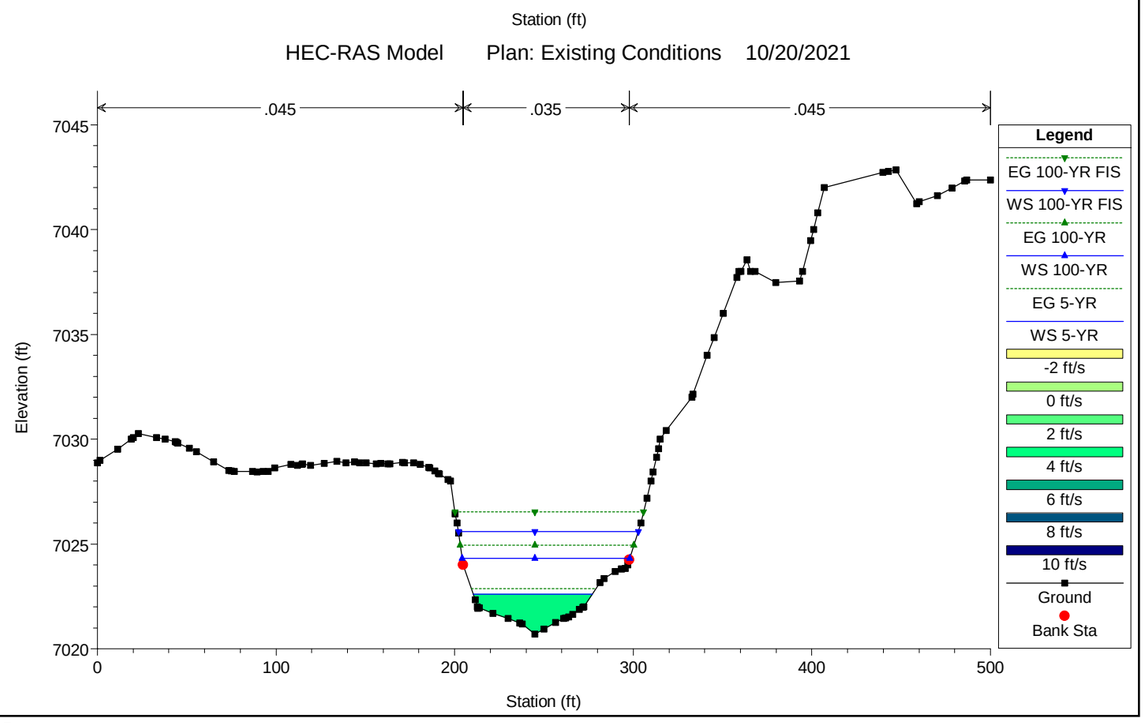

HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Provide the whole cross-section
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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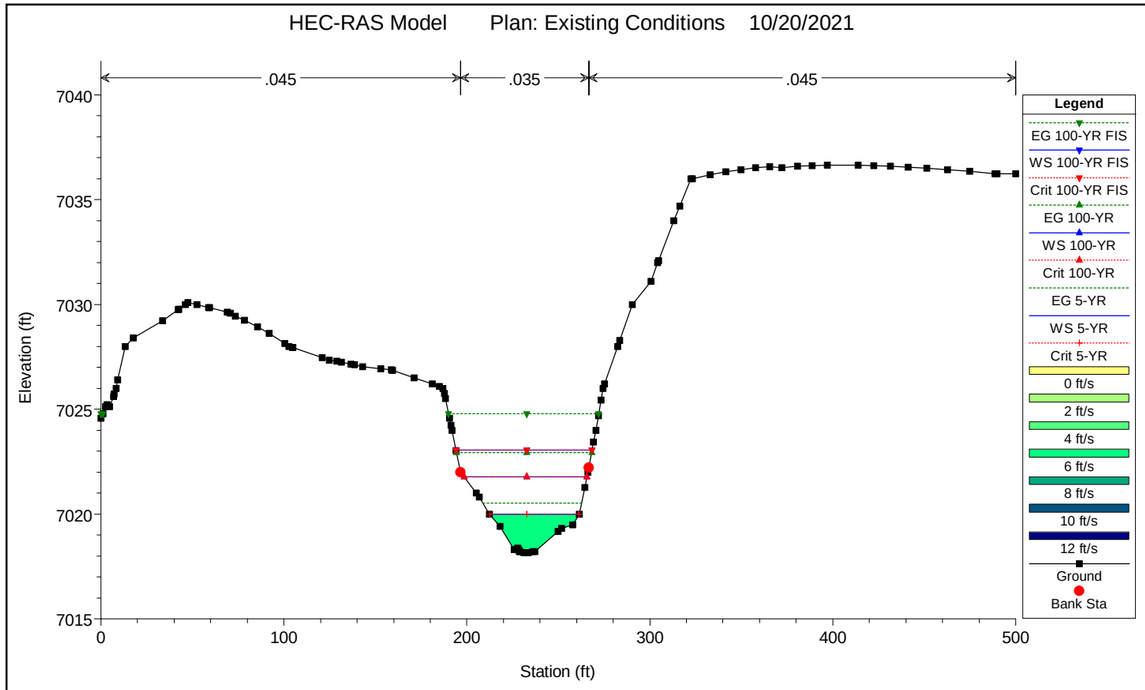
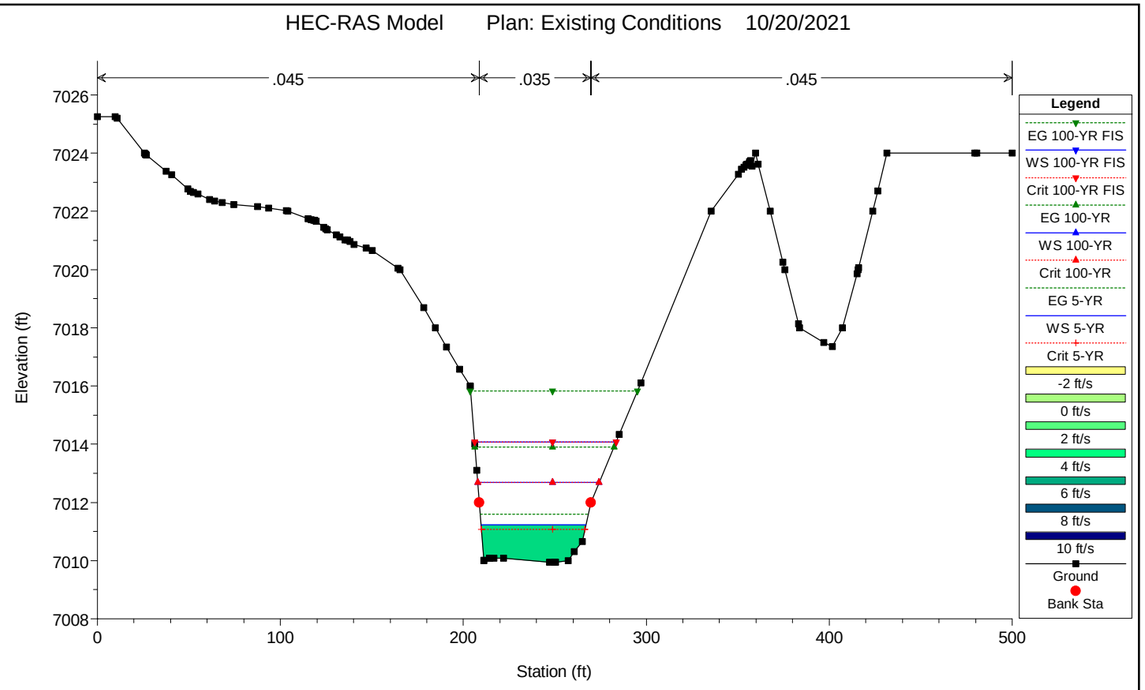
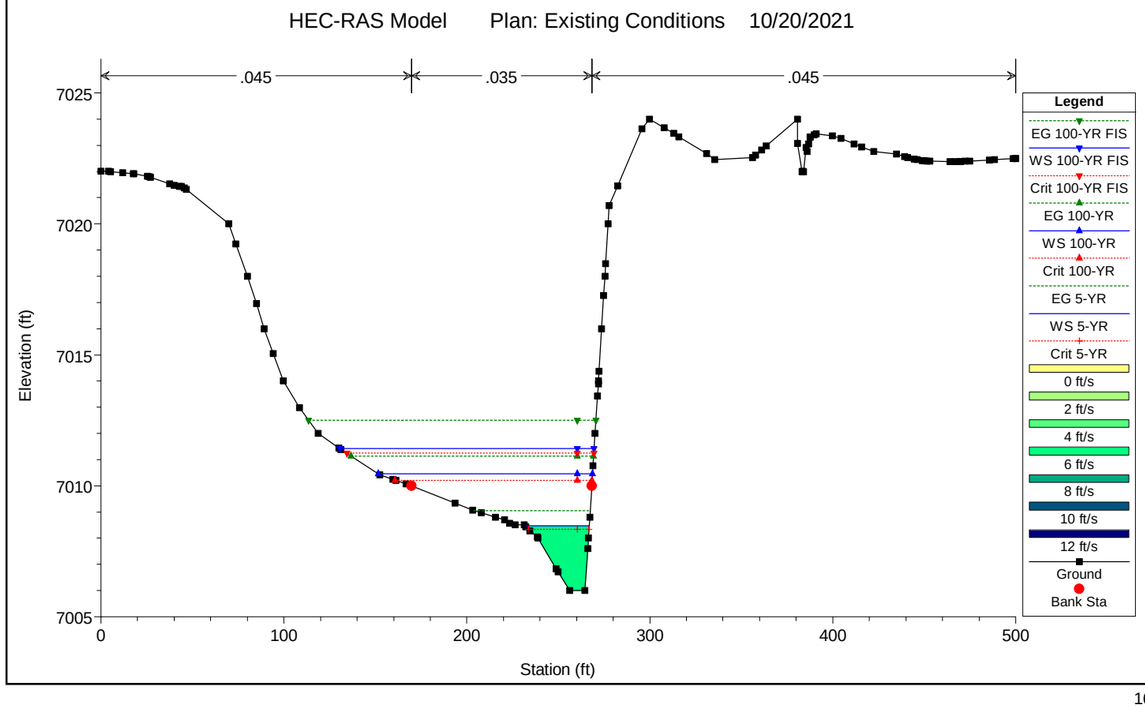
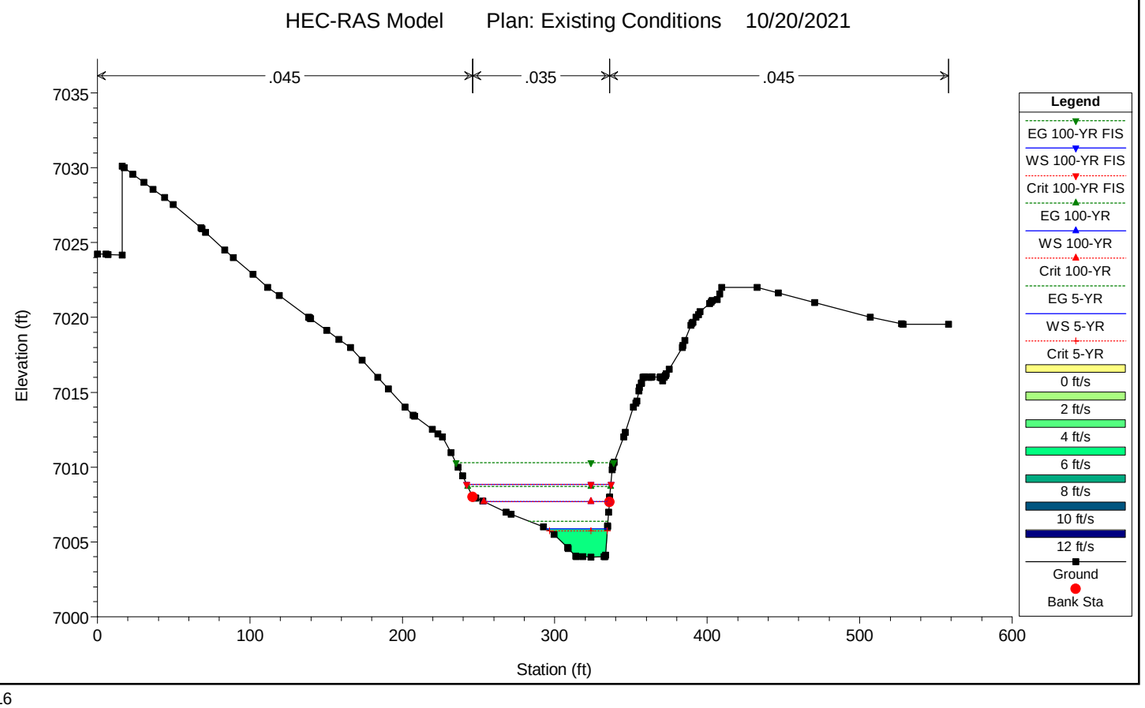
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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.035
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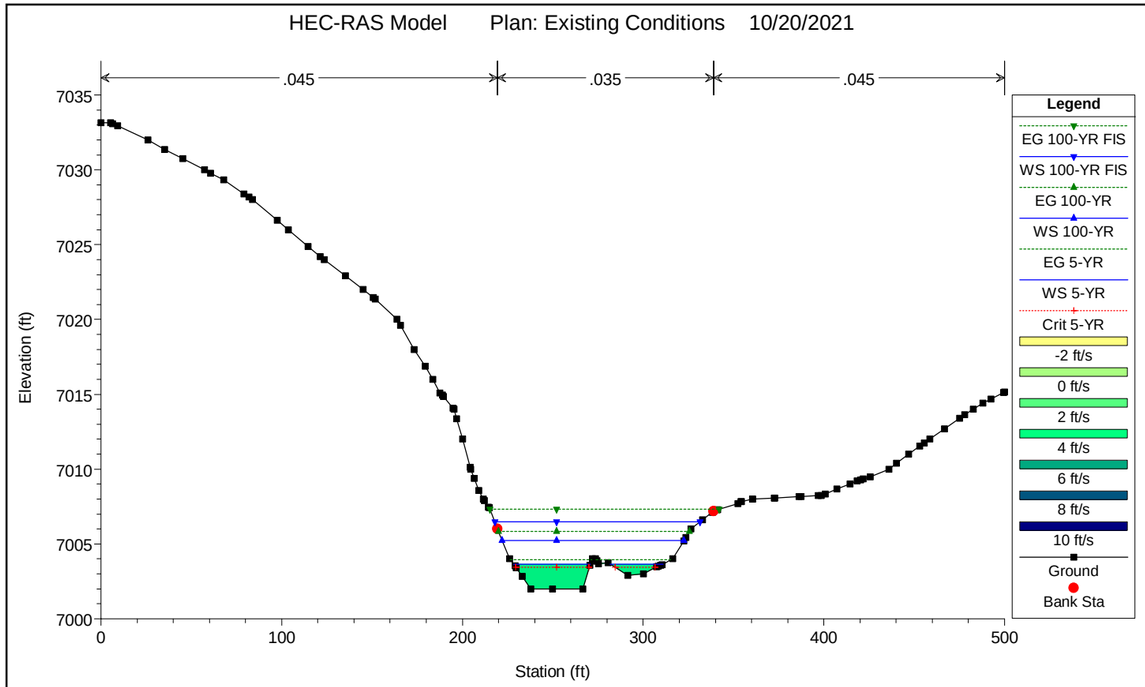
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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.035
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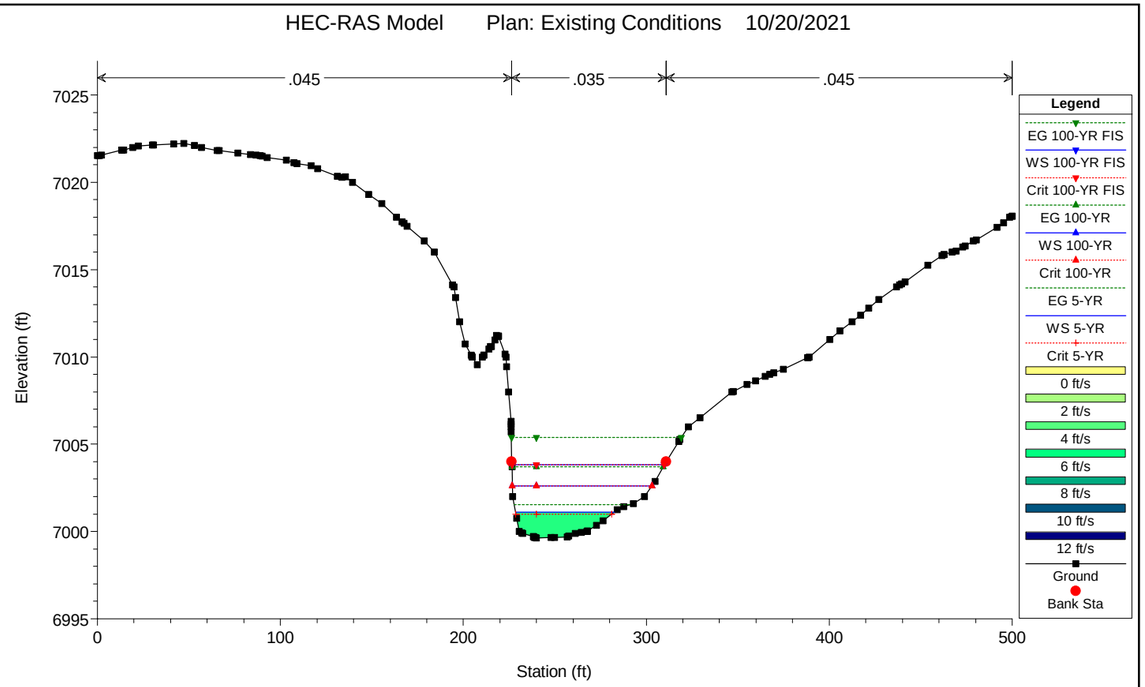
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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.035
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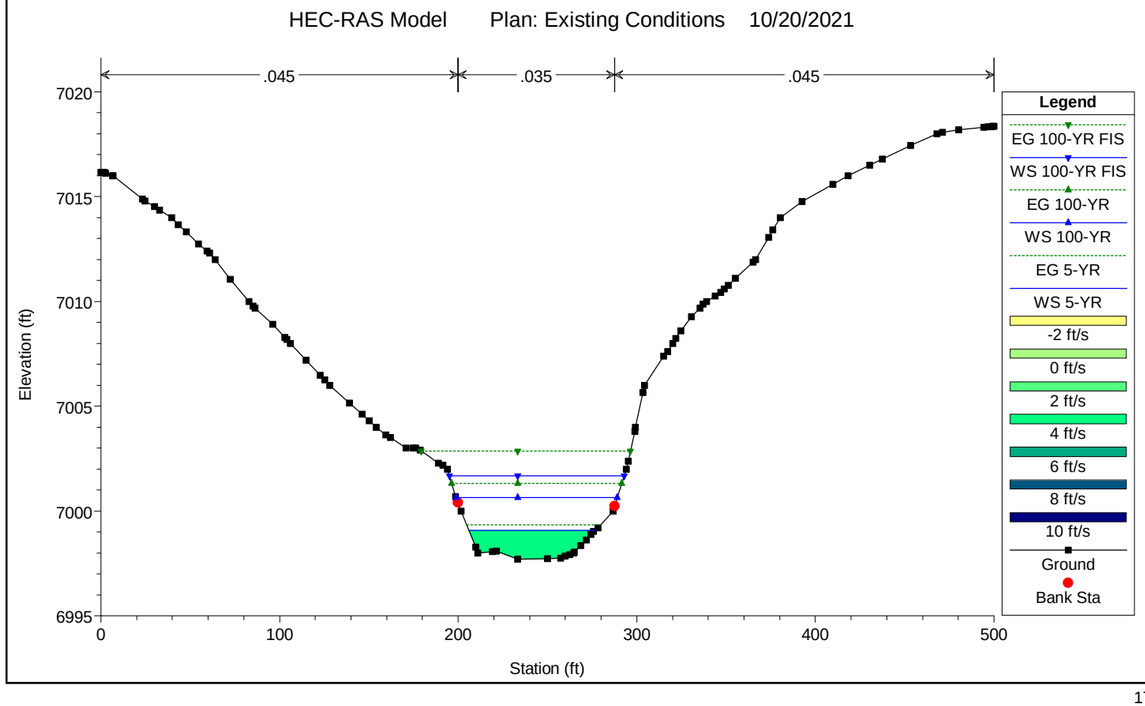
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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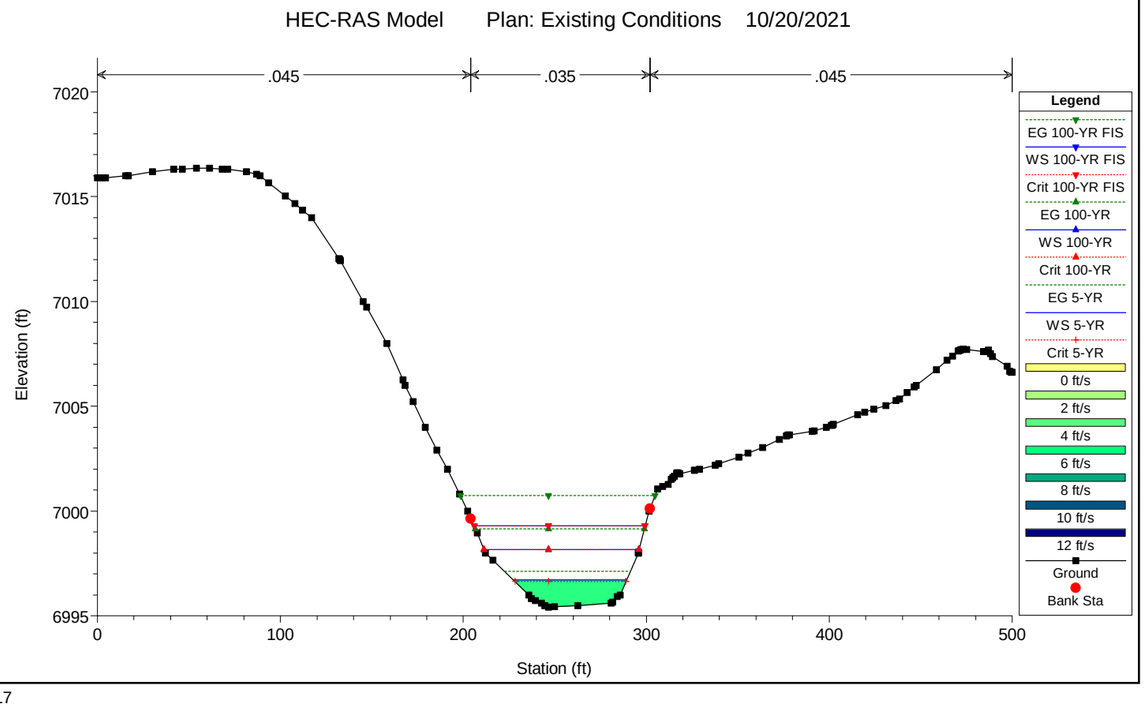
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Existing Conditions 10/20/2021
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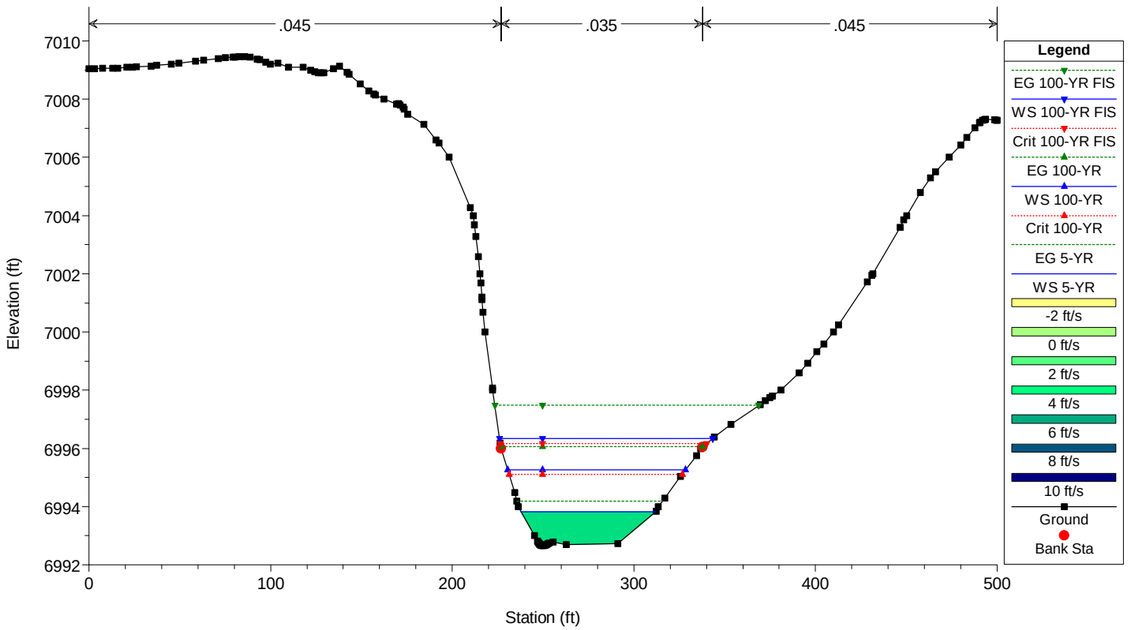
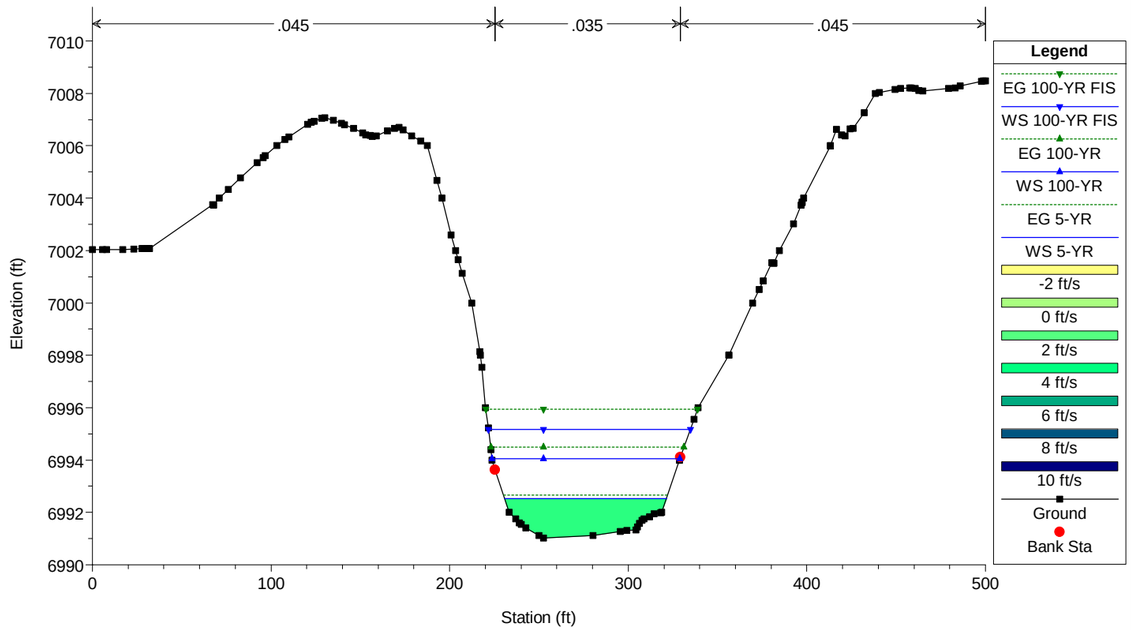
.035
.045
Elevation (ft)
Station (ft)
Legend
EG 100-YR FIS
WS 100-YR FIS
Crit 100-YR FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta

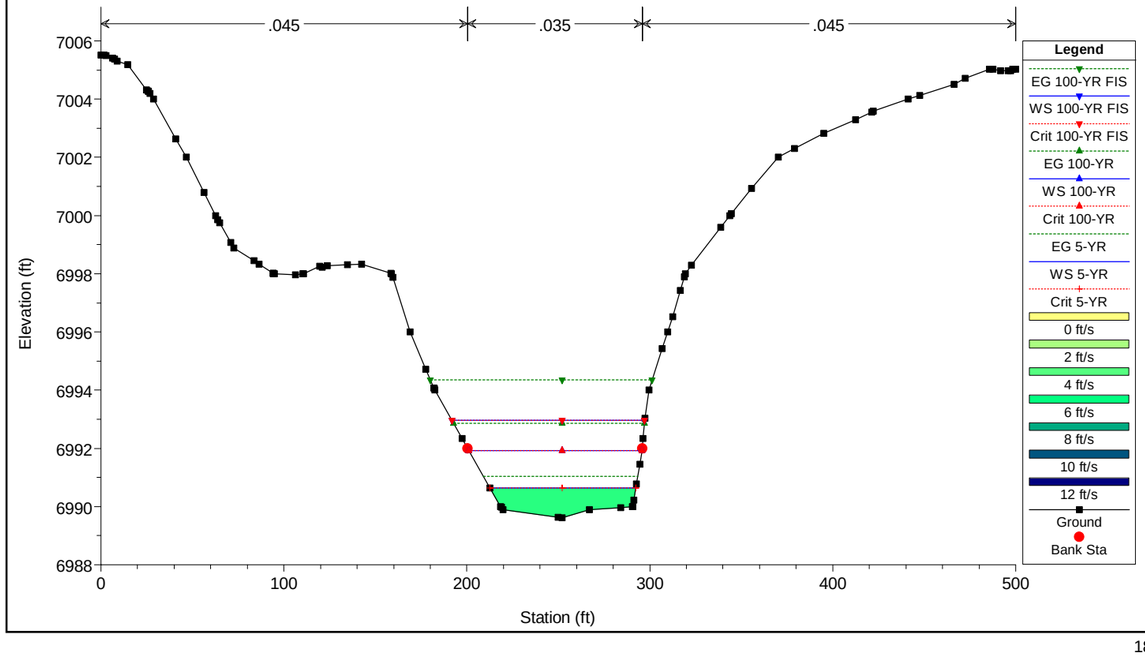
HEC-RAS Model Plan: Existing Conditions 10/20/2021



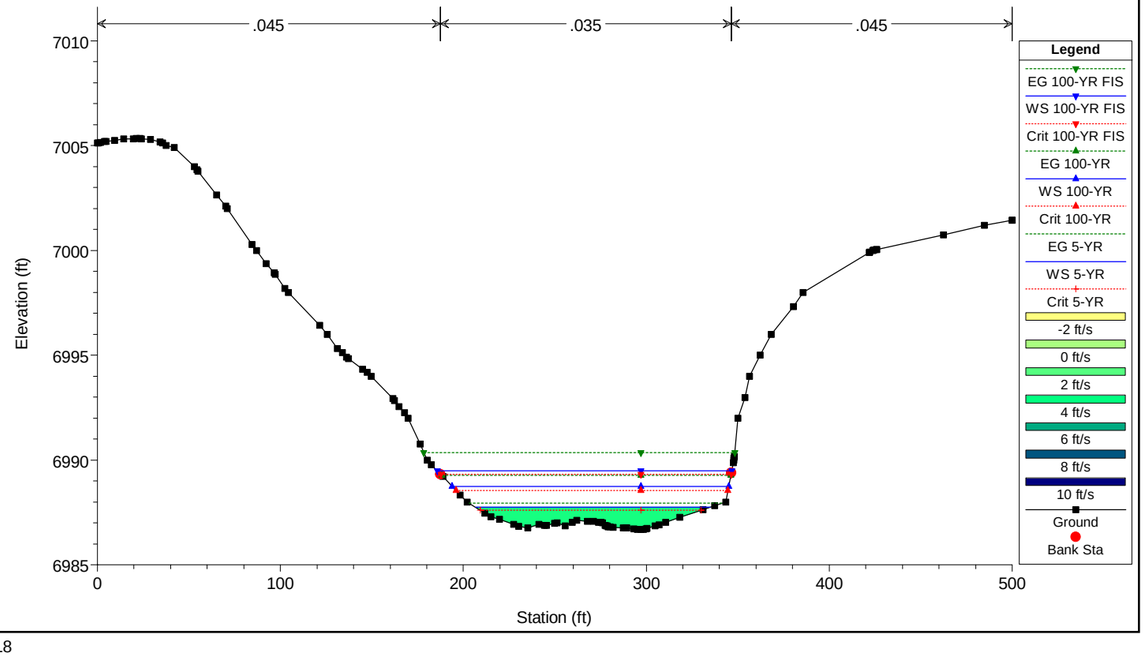
HEC-RAS Model Plan: Existing Conditions 10/20/2021



HEC-RAS Model Plan: Existing Conditions 10/20/2021



HEC-RAS Model Plan: Existing Conditions 10/20/2021



HEC-RAS Model Plan: Existing Conditions 10/20/2021

Sand Creek Reach 3

Legend

- EG 100-YR FIS
- WS 100-YR FIS
- Crit 100-YR FIS
- EG 100-YR
- WS 100-YR
- Crit 100-YR
- EG 5-YR
- WS 5-YR
- Crit 5-YR
- Ground

Elevation (ft)

7200
7150
7100
7050
7000
6950

0
2000
4000
6000
8000
10000
12000

Main Channel Distance (ft)

470 602 804 1006 1208 1410 1612 1815 2017 2219 2421 2820 3016 3212 3382 3569 3674 3998 4195 4301 4484 4588 4784 4980 5177 5373 5570 5684 5766 6163 6364 6565 6765 6966 7166 7367 7528 7759 7983 8178 8345 8489 8814 9118 9356 9541 9683 10006 10315 10464 10630 10733 10849 10963 11098 11216 11313 11424 11526 11670

Existing Conditions

HEC-RAS Plan: Default Scenario River: Sand Creek Reach: Reach 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Vel Total	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
Reach 3	11721	5-YR	312.00	7183.14	7184.54	7184.54	7185.12	0.017444		6.11		6.11	44.13	1.00		1.24	
Reach 3	11721	100-YR	1350.00	7183.14	7186.62	7186.62	7187.56	0.008444	2.08	8.18	2.61	6.57	124.90	0.81	0.30	1.60	0.42
Reach 3	11721	100-YR FIS	2600.00	7183.14	7187.72	7187.72	7188.91	0.008179	3.28	9.83	4.27	7.23	151.60	0.84	0.59	2.09	0.87
Reach 3	11670	5-YR	312.00	7168.00	7172.50		7172.52	0.000079	0.47	1.03	0.47	0.96	81.24	0.09	0.01	0.02	0.01
Reach 3	11670	100-YR	1350.00	7168.00	7174.90		7175.02	0.000335	1.28	2.82	1.28	2.54	91.01	0.19	0.06	0.14	0.06
Reach 3	11670	100-YR FIS	2600.00	7168.00	7176.69		7176.94	0.000551	1.92	4.21	1.92	3.71	98.26	0.25	0.13	0.30	0.13
Reach 3	11614	5-YR	312.00	7170.00	7172.31		7172.49	0.004832	0.59	3.38	0.64	3.37	74.95	0.53	0.04	0.37	0.04
Reach 3	11614	100-YR	1350.00	7170.00	7174.55		7174.95	0.002849	1.92	5.12	2.02	4.92	87.17	0.48	0.20	0.60	0.22
Reach 3	11614	100-YR FIS	2600.00	7170.00	7176.21		7176.84	0.002750	2.64	6.52	2.77	6.10	96.09	0.51	0.32	0.86	0.35
Reach 3	11560	5-YR	312.00	7169.99	7171.92		7172.21	0.005076	2.28	4.68	2.35	3.90	54.70	0.59	0.30	0.61	0.32
Reach 3	11560	100-YR	1350.00	7169.99	7173.50	7173.33	7174.62	0.009611	5.36	9.61	4.38	7.43	74.99	0.90	1.28	2.10	0.86
Reach 3	11560	100-YR FIS	2600.00	7169.99	7174.86	7174.79	7176.49	0.009706	6.81	12.00	5.83	8.96	84.13	0.96	1.83	2.95	1.46
Reach 3	11526	5-YR	312.00	7169.60	7171.50	7171.37	7171.93	0.012769		5.26		5.26	51.45	0.86		0.91	
Reach 3	11526	100-YR	1350.00	7169.60	7173.04	7173.04	7174.23	0.013020	2.33	8.80	3.02	8.61	69.04	0.99	0.39	1.99	0.58
Reach 3	11526	100-YR FIS	2600.00	7169.60	7174.36	7174.36	7176.13	0.011075	3.70	10.81	4.34	10.30	75.76	0.98	0.76	2.60	0.96
Reach 3	11494	5-YR	312.00	7168.70	7170.86	7170.86	7171.45	0.017968		6.14		6.14	44.25	1.01		1.26	
Reach 3	11494	100-YR	1350.00	7168.70	7172.66	7172.61	7173.76	0.013221	1.73	8.43	1.67	8.39	71.04	0.97	0.25	1.87	0.24
Reach 3	11494	100-YR FIS	2600.00	7168.70	7174.01	7173.89	7175.61	0.010554	3.24	10.20	3.09	9.97	77.03	0.94	0.62	2.36	0.57
Reach 3	11456	5-YR	312.00	7167.99	7170.10		7170.59	0.009921		5.60		5.60	35.87	0.79		0.94	
Reach 3	11456	100-YR	1350.00	7167.99	7172.00	7172.00	7173.22	0.014029	2.30	8.89		8.83	65.23	1.00	0.40	2.06	
Reach 3	11456	100-YR FIS	2600.00	7167.99	7173.37	7173.37	7175.17	0.011438	3.89	10.82	2.61	10.52	72.20	0.98	0.82	2.63	0.45
Reach 3	11424	5-YR	312.00	7167.97	7169.67	7169.60	7170.20	0.014234		5.84		5.84	42.78	0.92		1.10	
Reach 3	11424	100-YR	1350.00	7167.97	7171.52	7171.52	7172.68	0.014155		8.67		8.67	67.61	1.01		1.99	
Reach 3	11424	100-YR FIS	2600.00	7167.97	7172.80	7172.80	7174.50	0.012252	1.89	10.48	1.90	10.43	76.70	1.00	0.28	2.55	0.29
Reach 3	11367	5-YR	312.00	7167.28	7168.78	7168.78	7169.30	0.018063		5.74		5.74	53.63	1.00		1.14	
Reach 3	11367	100-YR	1350.00	7167.28	7170.37	7170.37	7171.33	0.014693	1.08	7.87	1.23	7.86	90.82	1.00	0.13	1.73	0.16
Reach 3	11367	100-YR FIS	2600.00	7167.28	7171.43	7171.43	7172.89	0.012926	2.75	9.73	2.82	9.61	96.21	1.00	0.51	2.31	0.53
Reach 3	11313	5-YR	312.00	7165.88	7167.90	7167.54	7168.21	0.006520	1.53	4.50	0.87	4.11	85.37	0.65	0.18	0.61	0.08
Reach 3	11313	100-YR	1350.00	7165.88	7169.55		7170.19	0.006183	2.68	7.16	3.57	5.62	110.76	0.71	0.36	1.21	0.62
Reach 3	11313	100-YR FIS	2600.00	7165.88	7170.99		7171.80	0.005012	3.41	8.29	4.65	6.36	122.32	0.68	0.55	1.43	0.88
Reach 3	11216	5-YR	312.00	7164.00	7165.59	7165.59	7166.13	0.017940		5.90		5.90	49.68	1.01		1.18	
Reach 3	11216	100-YR	1350.00	7164.00	7167.28	7167.28	7168.50	0.012712	2.74	8.92	2.57	8.68	67.69	0.98	0.50	2.02	0.45
Reach 3	11216	100-YR FIS	2600.00	7164.00	7168.68	7168.68	7170.42	0.010388	4.00	10.79	3.78	10.06	80.28	0.95	0.76	2.55	0.77
Reach 3	11098	5-YR	312.00	7161.80	7163.07	7163.07	7163.57	0.018814		5.64		5.64	57.79	1.02		1.12	
Reach 3	11098	100-YR	1350.00	7161.80	7164.60	7164.60	7165.69	0.013800	1.66	8.37	1.80	8.31	93.62	1.00	0.24	1.87	0.27
Reach 3	11098	100-YR FIS	2600.00	7161.80	7165.81	7165.81	7167.42	0.011544	3.13	10.26	3.31	9.96	112.02	0.98	0.60	2.43	0.65
Reach 3	10963	5-YR	312.00	7158.51	7160.04	7160.04	7160.39	0.021631		4.75	0.33	4.75	99.29	1.03		0.89	
Reach 3	10963	100-YR	1350.00	7158.51	7161.13	7161.13	7161.90	0.015205	1.90	7.09	2.70	6.97	131.42	0.99	0.30	1.50	0.51
Reach 3	10963	100-YR FIS	2600.00	7158.51	7161.98	7161.98	7163.14	0.012867	3.31	8.70	3.61	8.39	140.77	0.98	0.67	1.95	0.76
Reach 3	10849	5-YR	312.00	7154.00	7156.13	7156.10	7156.73	0.016521		6.23		6.23	40.48	0.99		1.26	
Reach 3	10849	100-YR	1350.00	7154.00	7157.91	7157.88	7158.69	0.014514	1.79	7.10		7.07	119.45	0.98	0.27	1.48	
Reach 3	10849	100-YR FIS	2600.00	7154.00	7159.15	7158.75	7160.03	0.008054	3.18	7.58	1.88	7.42	132.83	0.79	0.56	1.41	0.25
Reach 3	10733	5-YR	312.00	7153.09	7155.15		7155.44	0.007028		4.32	1.14	4.31	54.43	0.66		0.59	0.12
Reach 3	10733	100-YR	1350.00	7153.09	7156.95		7157.59	0.006278	2.51	6.62	2.01	5.88	113.23	0.70	0.36	1.08	0.26
Reach 3	10733	100-YR FIS	2600.00	7153.09	7157.69	7157.64	7158.97	0.009641	3.95	9.59	3.19	8.15	130.21	0.90	0.80	2.10	0.59
Reach 3	10630	5-YR	312.00	7151.92	7153.70	7153.70	7154.33	0.017342		6.36		6.36	79.93	1.01		1.31	
Reach 3	10630	100-YR	1350.00	7151.92	7155.94	7155.94	7156.79	0.009387	1.44	7.47	0.11	6.66	160.29	0.83	0.18	1.43	
Reach 3	10630	100-YR FIS	2600.00	7151.92	7156.94	7156.94	7157.98	0.008371	3.51	8.82	1.56	6.97	185.45	0.83	0.65	1.79	0.18
Reach 3	10464	5-YR	312.00	7149.23	7151.20	7151.01	7151.50	0.011022		4.40		4.40	71.91	0.78		0.68	
Reach 3	10464	100-YR	1350.00	7149.23	7152.44	7152.41	7153.28	0.014332	1.42	7.35		7.34	107.27	0.98	0.19	1.56	
Reach 3	10464	100-YR FIS	2600.00	7149.23	7153.41	7153.41	7154.61	0.013347	2.99	8.80		8.71	128.84	1.00	0.58	2.00	
Reach 3	10315	5-YR	312.00	7148.00	7149.20	7149.14	7149.51	0.016382		4.48		4.48	93.11	0.91		0.76	
Reach 3	10315	100-YR	1350.00	7148.00	7150.28	7150.28	7151.05	0.015286	2.61	7.08	1.41	6.99	129.28	1.00	0.49	1.50	0.19
Reach 3	10315	100-YR FIS	2600.00	7148.00	7151.13	7151.13	7152.29	0.013032	3.64	8.73	2.83	8.47	137.95	0.99	0.77	1.97	0.53
Reach 3	10006	5-YR	312.00	7144.13	7145.47	7145.46	7145.83	0.020578		4.81		4.81	92.37	1.01		0.90	
Reach 3	10006	100-YR	1350.00	7144.13	7146.56	7146.56	7147.29	0.016060		6.85		6.85	136.95	1.01		1.44	
Reach 3	10006	100-YR FIS	2600.00	7144.13	7147.38	7147.38	7148.43	0.014233		8.25		8.25	151.29	1.01		1.85	
Reach 3	9683	5-YR	312.00	7138.10	7141.43	7141.43	7141.75	0.017346	2.56	4.99	0.57	4.15	124.58	0.95	0.49	0.91	0.05
Reach 3	9683	100-YR	1350.00	7138.10	7142.44	7142.44	7143.08	0.014089	4.26	7.57	3.03	5.64	186.94	0.98	1.00	1.62	0.60
Reach 3	9683	100-YR FIS	2600.00	7138.10	7143.14	7143.14	7144.07	0.014005	5.55	9.34	4.11	6.85	211.21	1.03	1.48	2.22	0.94
Reach 3	9541	5-YR	312.00	7136.00	7138.45		7138.47	0.000262	0.61	1.18	0.59	1.11	139.16	0.14	0.02	0.04	0.02
Reach 3	9541	100-YR	1350.00	7136.00	7140.12		7140.23	0.000718	1.51	2.82	1.23	2.54	163.46	0.25	0.10	0.18	0.07
Reach 3	9541	100-YR FIS	2600.00	7136.00	7141.33		7141.56	0.001018	2.22	4.02	1.35	3.39	224.25	0.31	0.19	0.33	0.09
Reach 3	9426	5-YR	312.00	7138.66	7138.40		7138.42	0.000438	1.03			1.03	165.49	0.00	0.05		
Reach 3	9426	100-YR	1350.00	7138.66	7140.02		7140.09	0.000995	2.09	1.20	0.23	1.99	306.28	0.23	0.18	0.05	0.01
Reach 3	9426	100-YR FIS	2600.00	7138.66	7141.27		7141.36	0.000915	2.51	2.10	0.74	2.41	334.92	0.26	0.23	0.12	0.04
Reach 3	9356	5-YR	312.00	7136.70	7137.93	7137.93	7138.29	0.018040	3.10	5.21	1.37	4.43	106.43	0.98	0.66	0.98	0.19
Reach 3	9356	100-YR	1350.00	7136.70	7139.05	7139.05	7139.84	0.014658	5.38	8.11	3.88	6.51	133.73	1.02	1.43	1.82	0.87
Reach 3	9356	100-YR FIS	2600.00	7136.70	7139.87	7139.87	7141.09	0.014782	6.86	10.26	5.10	8.02	150.41	1.08	2.06	2.59	1.32
Reach 3	9118	5-YR	312.00	7128.00	7130.62	7130.62	7131.41	0.016150		7.13		7.13	28.15	1.01		1.53	
Reach 3	9118	100-YR	1350.00	7128.00	7133.20	7133.20	7134.23	0.008438	2.45	8.50	2.08	6.95	116.34	0.83	0.38	1.70	0.30
Reach 3	9118	100-YR FIS	2600.00	7128.00	7134.42	7134.42	7135.64	0.007568	3.93	9.95	2.78	6.97	202.95	0.83	0.76	2.09	0.31
Reach 3	8814	5-YR	312.00	7122.19	7124.19	7124.19	7124.53	0.022868	1.03	4.64	1.02	4.64	110.27	1.04	0.13	0.88	0.13
Reach 3	8814	100-YR	1350.00	7122.19	7125.26	7125.26	7126.07	0.014828	2.90	7.29	2.87	7.14	118.79	0.99	0.57	1.55	0.56
Reach 3	8814	100-YR FIS	2600.00	7122.19	7126.15	7126.15	7127.39	0.012920	3.85	9.04	3.56	8.71	127.09	0.99	0.84	2.07	0.74
Reach 3	8489	5-YR	312.00	7120.00	7121.76		7121.89	0.002181	1.30	2.89	1.32	2.74	71.82	0.38	0.10	0.24	0.11
Reach 3	8489	100-YR	1350.00	7120.00	7122.68	7122.54	7123.62	0.009626	2.73	8.04	2.96	7.10	99.94	0.87	0.46	1.61	0.52
Reach 3	8489	100-YR FIS	2600.00	7120.00	7123.78	7123.78	7125.12	0.009368	3.38	9.97	4.52	7.83	159.24	0.90	0.59	2.21	0.98
Reach 3	8345	5-YR	312.00	7119.89	7121.80		7121.81	0.000119	0.33	0.69	0.33	0.68	261.72	0.09	0.01	0.01	0.01
Reach 3	8345	100-YR	1350.00	7119.89	7123.17		7123.22	0.000333	0.81	1.68	0.79	1.63	272.90	0.17	0.03	0.07	0.03
Reach 3	8345	100-YR FIS	2600.00	7119.89	7124.24		7124.33	0.000462	1.17	2.39	1.19	2.32	279.54	0.20	0.06	0.12	0.06
Reach 3	8178	5-YR	312.00	7120.19	7121.39	7121.39	7121.71	0.023351		4.65	3.49	4.54	112.49	1.05		0.88	0.84
Reach 3	8178	100-YR	1350.00	7120.19	7122.33	7122.33	7122.98	0.017510	1.28	6.64	4.18	6.39	171.37	1.03	0.17	1.41	0.95

HEC-RAS Plan: Default Scenario River: Sand Creek Reach: Reach 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Vel Total	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
Reach 3	8178	100-YR FIS	2600.00	7120.19	7123.05	7123.05	7124.02	0.014408	2.53	8.12	4.58	7.65	182.94	1.01	0.46	1.81	1.09
Reach 3	7983	5-YR	312.00	7103.29	7104.97	7104.97	7105.47	0.017734	2.61	5.76	1.71	5.53	59.64	0.99	0.51	1.14	0.27
Reach 3	7983	100-YR	1350.00	7103.29	7106.64	7106.64	7107.58	0.014222	5.08	8.13	3.63	7.51	95.09	1.00	1.30	1.81	0.79
Reach 3	7983	100-YR FIS	2600.00	7103.29	7107.68	7107.68	7109.13	0.012875	6.21	10.16	4.57	9.20	102.00	1.01	1.72	2.46	1.08
Reach 3	7759	5-YR	312.00	7099.16	7100.58	7100.58	7101.10	0.016624	2.13	5.87	1.77	5.67	55.36	0.98	0.37	1.15	0.28
Reach 3	7759	100-YR	1350.00	7099.16	7102.31	7102.31	7103.47	0.011302	4.08	9.05	3.22	7.92	79.12	0.95	0.89	2.00	0.62
Reach 3	7759	100-YR FIS	2600.00	7099.16	7103.65	7103.65	7105.24	0.009830	5.17	10.92	4.38	8.99	97.06	0.94	1.22	2.56	0.95
Reach 3	7528	5-YR	312.00	7095.99	7097.73		7097.99	0.005279	1.86	4.38	2.14	3.71	67.43	0.59	0.22	0.56	0.28
Reach 3	7528	100-YR	1350.00	7095.99	7099.53		7100.23	0.005979	3.99	7.56	4.07	5.99	85.90	0.71	0.73	1.30	0.75
Reach 3	7528	100-YR FIS	2600.00	7095.99	7100.97		7102.00	0.005847	5.21	9.40	5.30	7.32	94.31	0.75	1.08	1.80	1.11
Reach 3	7459	5-YR	312.00	7095.85	7097.18		7097.50	0.009314	2.28	4.70	2.58	4.37	65.36	0.75	0.35	0.72	0.42
Reach 3	7459	100-YR	1350.00	7095.85	7098.99		7099.76	0.007158	3.80	7.53	4.19	6.57	81.80	0.76	0.71	1.36	0.82
Reach 3	7459	100-YR FIS	2600.00	7095.85	7100.33		7101.54	0.007025	4.87	9.53	5.33	8.05	91.56	0.80	1.02	1.92	1.17
Reach 3	7424	5-YR	312.00	7095.09	7096.55	7096.52	7097.07	0.015204	1.54	5.80	1.64	5.65	53.72	0.95	0.22	1.11	0.24
Reach 3	7424	100-YR	1350.00	7095.09	7098.30	7098.30	7099.42	0.010726	3.90	8.96	3.68	7.76	79.25	0.92	0.81	1.95	0.75
Reach 3	7424	100-YR FIS	2600.00	7095.09	7099.57	7099.57	7101.21	0.010132	5.58	11.08	4.89	9.30	86.66	0.95	1.38	2.64	1.13
Reach 3	7367	5-YR	312.00	7094.00	7095.88	7095.80	7096.33	0.010773	2.48	6.05	3.01	4.65	64.39	0.84	0.41	1.08	0.55
Reach 3	7367	100-YR	1350.00	7094.00	7097.45	7097.45	7098.52	0.011963	4.90	10.04	5.61	7.16	89.41	0.99	1.18	2.37	1.45
Reach 3	7367	100-YR FIS	2600.00	7094.00	7098.67	7098.67	7100.13	0.011226	6.32	12.08	6.88	8.44	102.85	1.01	1.70	3.08	1.93
Reach 3	7166	5-YR	312.00	7088.68	7089.68	7089.58	7089.89	0.016852		3.89	3.36	3.67	134.72	0.89		0.62	0.73
Reach 3	7166	100-YR	1350.00	7088.68	7090.56	7090.49	7091.15	0.015718	1.76	6.65	4.97	5.94	168.90	0.99	0.27	1.37	1.29
Reach 3	7166	100-YR FIS	2600.00	7088.68	7091.31	7091.20	7092.20	0.013783	2.91	8.28	6.10	7.31	176.31	1.00	0.56	1.84	1.70
Reach 3	6966	5-YR	312.00	7085.18	7086.21	7086.19	7086.55	0.018157	1.34	4.66	1.76	4.62	95.27	0.96	0.19	0.83	0.28
Reach 3	6966	100-YR	1350.00	7085.18	7087.35	7087.35	7088.25	0.014274	3.18	7.72	3.70	7.43	104.83	0.99	0.65	1.67	0.81
Reach 3	6966	100-YR FIS	2600.00	7085.18	7088.35	7088.35	7089.69	0.012176	4.17	9.48	4.56	8.93	113.57	0.98	0.93	2.19	1.06
Reach 3	6765	5-YR	312.00	7080.00	7082.79	7082.73	7083.13	0.015680		4.78	3.04	4.54	83.56	0.91		0.84	0.62
Reach 3	6765	100-YR	1350.00	7080.00	7083.98	7083.98	7084.79	0.016666		7.49	5.20	7.10	121.31	1.04		1.66	1.40
Reach 3	6765	100-YR FIS	2600.00	7080.00	7084.94	7084.94	7086.00	0.013122		8.78	4.02	7.53	190.55	0.99		1.99	0.85
Reach 3	6565	5-YR	312.00	7078.18	7079.44	7079.44	7079.82	0.018577		3.97	5.71	4.69	87.12	0.93		0.66	1.66
Reach 3	6565	100-YR	1350.00	7078.18	7080.61	7080.61	7081.35	0.018198		6.84	7.10	6.91	134.70	1.05		1.48	2.28
Reach 3	6565	100-YR FIS	2600.00	7078.18	7081.49	7081.49	7082.44	0.016331		7.91	7.43	7.79	177.35	1.05		1.79	2.38
Reach 3	6364	5-YR	312.00	7073.98	7075.48	7075.48	7076.11	0.017187		6.39		6.39	39.21	1.01		1.32	
Reach 3	6364	100-YR	1350.00	7073.98	7077.25	7077.25	7078.08	0.013487		7.50	3.89	7.05	111.48	0.96		1.58	0.86
Reach 3	6364	100-YR FIS	2600.00	7073.98	7078.16	7078.16	7079.40	0.013481		9.21	5.53	8.64	125.01	1.01		2.15	1.46
Reach 3	6163	5-YR	312.00	7068.00	7070.41	7070.41	7070.99	0.017609		6.16		6.16	43.12	1.00		1.26	
Reach 3	6163	100-YR	1350.00	7068.00	7072.45	7072.45	7073.49	0.015321		8.20		8.20	80.55	1.01		1.86	
Reach 3	6163	100-YR FIS	2600.00	7068.00	7073.67	7073.67	7075.02	0.013334		9.34	1.23	9.30	108.92	1.00		2.19	0.15
Reach 3	5766	5-YR	312.00	7064.24	7066.30	7066.21	7066.78	0.014027		5.57	1.19	5.55	49.16	0.90		1.02	0.15
Reach 3	5766	100-YR	1350.00	7064.24	7068.52		7069.36	0.007243		7.47	3.49	7.12	68.99	0.76		1.34	0.63
Reach 3	5766	100-YR FIS	2600.00	7064.24	7070.49		7071.47	0.005125		8.18	4.46	7.69	81.92	0.68		1.41	0.83
Reach 3	5684	5-YR	312.00	7062.00	7064.37		7064.84	0.009827		5.52		5.52	36.99	0.79		0.92	
Reach 3	5684	100-YR	1350.00	7062.00	7066.62	7066.32	7067.95	0.009253	1.44	9.26	1.45	9.11	50.34	0.86	0.18	1.97	0.18
Reach 3	5684	100-YR FIS	2600.00	7062.00	7068.27	7068.27	7070.27	0.008777	3.13	11.62	3.48	10.34	75.09	0.90	0.56	2.74	0.65
Reach 3	5570	5-YR	312.00	7059.99	7062.10		7062.63	0.009341		5.86		5.86	30.20	0.78		0.99	
Reach 3	5570	100-YR	1350.00	7059.99	7064.23	7064.23	7065.63	0.010967	2.43	9.58	2.23	9.00	63.00	0.94	0.40	2.17	0.35
Reach 3	5570	100-YR FIS	2600.00	7059.99	7065.94	7065.94	7067.63	0.008194	3.84	10.98	3.51	9.06	95.18	0.87	0.75	2.47	0.65
Reach 3	5373	5-YR	312.00	7057.99	7059.95	7059.87	7060.20	0.015850		3.98		3.98	119.89	0.87		0.64	
Reach 3	5373	100-YR	1350.00	7057.99	7061.11		7061.37	0.006849	0.15	4.09	0.43	4.09	262.03	0.64		0.54	0.03
Reach 3	5373	100-YR FIS	2600.00	7057.99	7062.13		7062.42	0.003534	0.48	4.35	1.35	4.31	274.41	0.51	0.03	0.50	0.12
Reach 3	5177	5-YR	312.00	7055.76	7057.18	7057.02	7057.53	0.011664		4.73		4.73	91.31	0.81		0.76	
Reach 3	5177	100-YR	1350.00	7055.76	7058.60	7058.51	7059.55	0.012145	1.59	7.81	1.63	7.73	141.55	0.93	0.22	1.64	0.23
Reach 3	5177	100-YR FIS	2600.00	7055.76	7059.67	7059.67	7061.16	0.011444	2.97	9.90	2.79	9.38	174.48	0.97	0.55	2.30	0.50
Reach 3	4980	5-YR	312.00	7052.00	7054.12	7054.12	7054.72	0.017620		6.21		6.21	43.14	1.01		1.27	
Reach 3	4980	100-YR	1350.00	7052.00	7055.94	7055.94	7057.00	0.013713	1.31	8.27		8.21	81.80	0.99	0.17	1.84	
Reach 3	4980	100-YR FIS	2600.00	7052.00	7057.14	7057.14	7058.67	0.011221	3.28	10.01	2.38	9.52	133.61	0.96	0.64	2.33	0.39
Reach 3	4784	5-YR	312.00	7049.99	7053.11		7053.16	0.000671	0.33	1.81		1.80	81.85	0.22	0.01	0.09	
Reach 3	4784	100-YR	1350.00	7049.99	7054.55		7054.85	0.002352	1.37	4.43	0.67	4.39	101.91	0.44	0.12	0.46	0.04
Reach 3	4784	100-YR FIS	2600.00	7049.99	7055.51		7056.17	0.003573	2.17	6.51	1.63	6.35	110.93	0.56	0.26	0.92	0.17
Reach 3	4588	5-YR	312.00	7047.00	7053.11		7053.12	0.000061	0.39	0.94	0.31	0.84	100.45	0.08	0.01	0.02	0.01
Reach 3	4588	100-YR	1350.00	7047.00	7054.50		7054.63	0.000444	1.39	2.99	1.05	2.60	112.29	0.21	0.08	0.17	0.05
Reach 3	4588	100-YR FIS	2600.00	7047.00	7055.40		7055.73	0.001006	2.35	4.93	1.21	4.08	151.22	0.33	0.21	0.44	0.08
Reach 3	4484	5-YR	312.00	7046.00	7053.11		7053.11	0.000016	0.09	0.52	0.27	0.44	174.30	0.04	0.00	0.01	0.00
Reach 3	4484	100-YR	1350.00	7046.00	7054.55		7054.58	0.000123	0.46	1.68	0.87	1.38	193.72	0.11	0.01	0.05	0.03
Reach 3	4484	100-YR FIS	2600.00	7046.00	7055.52		7055.61	0.000271	0.89	2.73	1.49	2.22	197.41	0.17	0.04	0.13	0.08
Reach 3	4391	5-YR	312.00	7045.88	7053.11		7053.11	0.000013	0.15	0.53	0.17	0.49	128.96	0.04	0.00	0.01	0.00
Reach 3	4391	100-YR	1350.00	7045.88	7054.52		7054.57	0.000121	0.58	1.82	0.59	1.63	152.90	0.11	0.02	0.06	0.02
Reach 3	4391	100-YR FIS	2600.00	7045.88	7055.44		7055.58	0.000295	1.05	3.07	0.98	2.65	171.80	0.18	0.05	0.16	0.04
Reach 3	4301	5-YR	312.00	7044.65	7053.11		7053.11	0.000009	0.19	0.49	0.22	0.42	130.88	0.03	0.00	0.00	0.00
Reach 3	4301	100-YR	1350.00	7044.65	7054.52		7054.56	0.000090	0.59	1.76	0.76	1.43	163.88	0.10	0.01	0.05	0.02
Reach 3	4301	100-YR FIS	2600.00	7044.65	7055.43		7055.55	0.000233	0.97	3.01	1.24	2.35	194.63	0.17	0.04	0.15	0.06
Reach 3	4195	5-YR	312.00	7051.33	7052.71	7052.71	7053.07	0.020590		4.80		4.80	92.73	1.01		0.90	
Reach 3	4195	100-YR	1350.00	7051.33	7053.82	7053.82	7054.46	0.016858	0.62	6.43		6.42	169.70	1.01	0.06	1.32	
Reach 3	4195	100-YR FIS	2600.00	7051.33	7054.71	7054.71	7055.42	0.014544	2.61	6.84	2.10	6.51	306.04	0.97	0.48	1.40	0.35
Reach 3	3998	5-YR	312.00	7042.00	7043.30	7043.19	7043.59	0.012653		4.34		4.34	82.69	0.82		0.69	
Reach 3	3998	100-YR	1350.00	7042.00	7044.45	7044.45	7045.32	0.015168	1.02	7.52		7.52	104.03	1.01	0.12	1.63	
Reach 3	3998	100-YR FIS	2600.00	7042.00	7045.46	7045.46	7046.68	0.013468	2.13	8.89		8.87	121.32	1.01	0.35	2.04	
Reach 3	3802	5-YR	312.00	7038.89	7040.07	7040.07	7040.40	0.021559		4.59		4.59	107.40	1.02		0.85	
Reach 3	3802	100-YR	1350.00	7038.89	7041.13	7041.13	7041.91	0.015856		7.11		7.11	123.74	1.01		1.52	
Reach 3	3802	100-YR FIS	2600.00	7038.89	7042.28	7042.01	7043.18	0.009794		7.59		7.59	140.51	0.86		1.49	
Reach 3	3674	5-YR	312.00	7038.00	7039.47		7039.55	0.002268		2.24	1.23	2.22	122.55	0.37		0.16	0.10
Reach 3	3674	100-YR	1350.00	7038.00	7041.05		7041.27	0.002279	1.11	3.79	2.01	3.70	149.80	0.42	0.08	0.36	0.21
Reach 3	3674	100-YR FIS	2600.00	7038.00	7042.28		7042.64	0.002249	1.77	4.89	2.36	4.70	159.47	0.44	0.17	0.53	0.26

HEC-RAS Plan: Default Scenario River: Sand Creek Reach: Reach 3 (Continued)

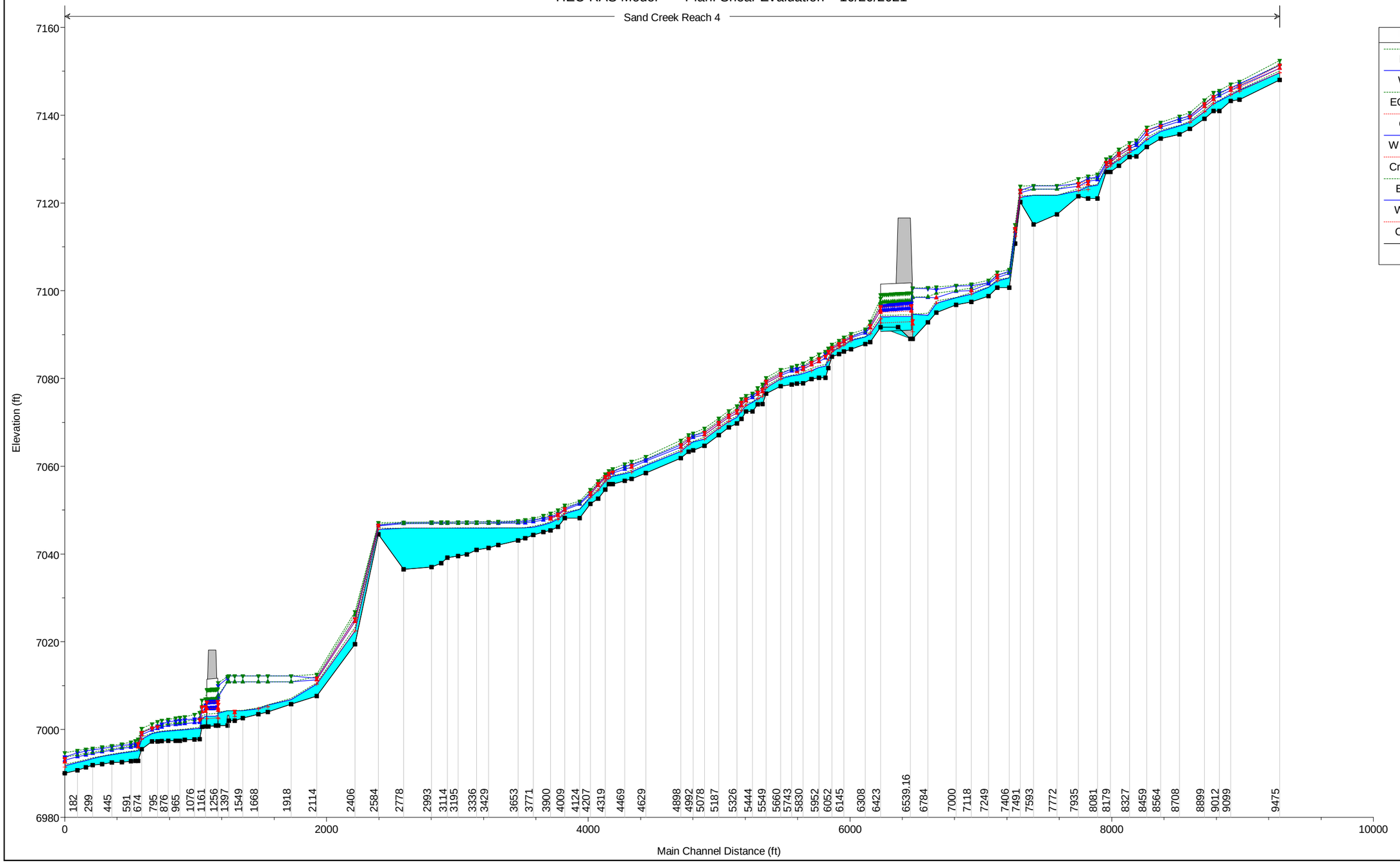
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Left	Vel Chnl	Vel Right	Vel Total	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
Reach 3	3569	5-YR	312.00	7037.69	7038.62	7038.62	7038.99	0.020365		4.90		4.90	87.45	1.01		0.92	
Reach 3	3569	100-YR	1350.00	7037.69	7039.84	7039.84	7040.71	0.015158		7.50		7.50	104.30	1.01		1.62	
Reach 3	3569	100-YR FIS	2600.00	7037.69	7040.84	7040.84	7042.09	0.012029	1.97	9.01	2.02	8.75	133.08	0.97	0.30	2.02	0.31
Reach 3	3382	5-YR	312.00	7032.00	7033.38		7033.46	0.003620	1.12	2.32		2.30	155.73	0.44	0.10	0.20	
Reach 3	3382	100-YR	1350.00	7032.00	7034.50		7034.73	0.004707	1.41	3.86		3.84	229.98	0.55	0.14	0.45	
Reach 3	3382	100-YR FIS	2600.00	7032.00	7035.20		7035.58	0.005364	1.47	4.96	0.53	4.93	267.41	0.62	0.14	0.68	0.03
Reach 3	3212	5-YR	312.00	7031.20	7031.82	7031.82	7032.06	0.022608		3.87	0.25	3.87	170.69	0.99		0.67	
Reach 3	3212	100-YR	1350.00	7031.20	7032.60	7032.60	7033.19	0.016536	0.67	6.20	2.30	6.11	190.52	0.99	0.07	1.25	0.41
Reach 3	3212	100-YR FIS	2600.00	7031.20	7033.31	7033.31	7034.08	0.012393	2.13	7.18	2.92	6.57	286.80	0.92	0.33	1.45	0.46
Reach 3	3016	5-YR	312.00	7023.98	7024.09		7024.37	0.006387	4.24	0.74		4.16	47.78	0.41	0.81	0.04	
Reach 3	3016	100-YR	1350.00	7023.98	7026.05		7026.86	0.011377	7.50	6.05		7.14	68.61	0.85	2.21	1.10	
Reach 3	3016	100-YR FIS	2600.00	7023.98	7027.22	7026.96	7028.59	0.015686	9.43	9.37		9.41	82.57	1.06	3.37	2.29	
Reach 3	2820	5-YR	312.00	7020.69	7022.61		7022.88	0.008379		4.18		4.18	66.70	0.70		0.58	
Reach 3	2820	100-YR	1350.00	7020.69	7024.32		7024.95	0.007525	0.77	6.36	0.34	6.36	93.85	0.74	0.07	1.07	0.02
Reach 3	2820	100-YR FIS	2600.00	7020.69	7025.59		7026.54	0.006379	2.04	7.86	1.98	7.76	100.68	0.74	0.27	1.40	0.26
Reach 3	2421	5-YR	312.00	7018.15	7019.98	7019.98	7020.53	0.017994		5.95		5.95	48.84	1.01		1.20	
Reach 3	2421	100-YR	1350.00	7018.15	7021.77	7021.77	7022.94	0.013850		8.68		8.68	67.24	1.01		1.98	
Reach 3	2421	100-YR FIS	2600.00	7018.15	7023.05	7023.05	7024.79	0.011946	2.21	10.59	1.88	10.52	74.43	1.00	0.36	2.57	0.28
Reach 3	2219	5-YR	312.00	7009.94	7011.22	7011.07	7011.59	0.011574		4.88		4.88	57.32	0.81		0.80	
Reach 3	2219	100-YR	1350.00	7009.94	7012.68	7012.68	7013.91	0.013233	1.61	8.88	1.84	8.80	66.34	0.99	0.23	2.03	0.28
Reach 3	2219	100-YR FIS	2600.00	7009.94	7014.07	7014.07	7015.84	0.010779	3.06	10.77	3.48	10.27	77.32	0.96	0.57	2.57	0.69
Reach 3	2017	5-YR	312.00	7006.00	7008.47	7008.33	7009.06	0.013356		6.14		6.14	35.02	0.90		1.17	
Reach 3	2017	100-YR	1350.00	7006.00	7010.45	7010.21	7011.14	0.009804	1.24	6.68	0.94	6.57	117.01	0.82	0.14	1.23	0.09
Reach 3	2017	100-YR FIS	2600.00	7006.00	7011.42	7011.25	7012.50	0.009321	2.79	8.45	1.98	7.88	139.10	0.86	0.48	1.72	0.28
Reach 3	1815	5-YR	312.00	7003.99	7005.87	7005.73	7006.39	0.012892		5.79		5.79	39.98	0.88		1.06	
Reach 3	1815	100-YR	1350.00	7003.99	7007.71	7007.71	7008.72	0.014565		8.07	0.26	8.07	82.59	1.00		1.80	
Reach 3	1815	100-YR FIS	2600.00	7003.99	7008.83	7008.83	7010.29	0.012618	2.03	9.72	1.89	9.66	94.63	0.99	0.32	2.29	0.29
Reach 3	1612	5-YR	312.00	7002.00	7003.65	7003.44	7003.95	0.010739		4.37		4.37	71.66	0.77		0.66	
Reach 3	1612	100-YR	1350.00	7002.00	7005.23		7005.83	0.007747		6.21		6.21	100.50	0.74		1.04	
Reach 3	1612	100-YR FIS	2600.00	7002.00	7006.46		7007.33	0.006914	1.00	7.47		7.46	113.56	0.75	0.10	1.33	
Reach 3	1410	5-YR	312.00	6999.62	7001.12	7001.00	7001.54	0.013133		5.20		5.20	53.93	0.87		0.91	
Reach 3	1410	100-YR	1350.00	6999.62	7002.62	7002.62	7003.70	0.014367		8.32		8.32	76.34	1.01		1.88	
Reach 3	1410	100-YR FIS	2600.00	6999.62	7003.83	7003.83	7005.40	0.012810		10.05		10.05	83.29	1.00		2.42	
Reach 3	1208	5-YR	312.00	6997.70	6999.08		6999.34	0.008802		4.15		4.15	70.40	0.71		0.58	
Reach 3	1208	100-YR	1350.00	6997.70	7000.64		7001.33	0.008130	0.72	6.67	1.00	6.66	90.22	0.77	0.06	1.17	0.10
Reach 3	1208	100-YR FIS	2600.00	6997.70	7001.67		7002.87	0.008664	2.30	8.81	2.41	8.66	97.76	0.85	0.35	1.80	0.38
Reach 3	1006	5-YR	312.00	6995.41	6996.72	6996.63	6997.12	0.014119		5.03		5.03	62.16	0.89		0.88	
Reach 3	1006	100-YR	1350.00	6995.41	6998.15	6998.15	6999.15	0.014439		8.03		8.03	84.81	1.00		1.78	
Reach 3	1006	100-YR FIS	2600.00	6995.41	6999.29	6999.29	7000.74	0.012792		9.67		9.67	93.49	1.00		2.28	
Reach 3	804	5-YR	312.00	6992.66	6993.83		6994.18	0.014848		4.75		4.75	74.43	0.89		0.82	
Reach 3	804	100-YR	1350.00	6992.66	6995.26	6995.12	6996.06	0.011948		7.17		7.17	97.86	0.91		1.43	
Reach 3	804	100-YR FIS	2600.00	6992.66	6996.34	6996.17	6997.48	0.010727	1.05	8.57	0.94	8.55	117.36	0.91	0.11	1.82	0.10
Reach 3	602	5-YR	312.00	6991.02	6992.52		6992.66	0.004239		3.02		3.02	90.59	0.50		0.30	
Reach 3	602	100-YR	1350.00	6991.02	6994.05		6994.49	0.004810	0.84	5.33		5.32	105.33	0.60	0.07	0.73	
Reach 3	602	100-YR FIS	2600.00	6991.02	6995.17		6995.93	0.005039	2.10	7.01	1.53	6.92	113.07	0.65	0.27	1.12	0.17
Reach 3	470	5-YR	312.00	6989.61	6990.64	6990.64	6991.03	0.019947		5.05		5.05	79.78	1.01		0.96	
Reach 3	470	100-YR	1350.00	6989.61	6991.92	6991.92	6992.86	0.015018		7.77		7.77	94.67	1.01		1.71	
Reach 3	470	100-YR FIS	2600.00	6989.61	6992.96	6992.96	6994.35	0.012402	2.23	9.49	1.90	9.36	105.34	0.99	0.37	2.20	0.29
Reach 3	0	5-YR	312.00	6986.68	6987.75	6987.60	6987.93	0.010811		3.48		3.48	128.21	0.73		0.47	
Reach 3	0	100-YR	1350.00	6986.68	6988.73	6988.54	6989.26	0.010801		5.85		5.85	151.09	0.83		1.03	
Reach 3	0	100-YR FIS	2600.00	6986.68	6989.49	6989.31	6990.35	0.010807	0.66	7.45	0.47	7.44	161.08	0.89	0.06	1.48	0.03

Appendix C

Proposed Conditions Hydraulic Modeling

HEC-RAS Model Plan: Shear Evaluation 10/20/2021

Sand Creek Reach 4



Stability needs to be analyzed for the west bank to Sta. 125+

Proposed Conditions (?)

HEC-RAS Plan: Shear River: Sand Creek Reach: Reach 4

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	9475	5-YR	482.50	7148.00	7149.65	7149.65	7150.08	0.019615	109.44	1.02		1.02			5.27		5.27
Reach 4	9475	100-YR	1627.10	7148.00	7150.69	7150.69	7151.56	0.015243	127.26	1.01		1.62			7.48		7.48
Reach 4	9475	FIS	2600.00	7148.00	7151.35	7151.35	7152.49	0.013654	132.46	1.00		1.94			8.58		8.58
Reach 4	9167	5-YR	482.50	7143.51	7145.69	7145.45	7145.86	0.007977	181.83	0.65	0.07	0.40		1.10	3.30		3.29
Reach 4	9167	100-YR	1627.10	7143.51	7146.64	7146.23	7147.00	0.006504	210.90	0.66	0.25	0.69	0.22	2.70	4.89	2.46	4.81
Reach 4	9167	FIS	2600.00	7143.51	7147.18	7146.72	7147.70	0.006437	218.30	0.69	0.35	0.90	0.34	3.42	5.84	3.36	5.72
Reach 4	9099	5-YR	482.50	7143.25	7144.65	7144.65	7145.03	0.019818	132.90	1.00	1.02	0.90		5.75	4.83		4.92
Reach 4	9099	100-YR	1627.10	7143.25	7145.65	7145.65	7146.33	0.015282	184.34	0.98	1.39	1.33	0.07	7.37	6.55	1.00	6.61
Reach 4	9099	FIS	2600.00	7143.25	7146.17	7146.17	7147.06	0.013322	207.94	0.96	1.46	1.60	0.32	7.82	7.57	2.85	7.43
Reach 4	9012	5-YR	482.50	7140.92	7143.23		7143.37	0.003521	126.41	0.46	0.10	0.29		1.64	3.00		2.99
Reach 4	9012	100-YR	1627.10	7140.92	7144.43		7144.78	0.004949	176.33	0.59	0.32	0.62		3.36	4.74		4.71
Reach 4	9012	FIS	2600.00	7140.92	7145.10		7145.58	0.004948	201.21	0.62	0.41	0.79	0.07	3.98	5.60	1.16	5.51
Reach 4	8967	5-YR	482.50	7140.92	7142.61	7142.61	7143.02	0.020092	120.68	1.02	0.24	0.99		2.20	5.14		5.12
Reach 4	8967	100-YR	1627.10	7140.92	7143.61	7143.61	7144.36	0.015365	155.75	0.99	0.68	1.47		4.59	6.99		6.95
Reach 4	8967	FIS	2600.00	7140.92	7144.20	7144.20	7145.17	0.013469	185.46	0.98	0.84	1.72	0.11	5.40	7.95	1.44	7.83
Reach 4	8899	5-YR	482.50	7139.15	7140.83	7140.83	7141.29	0.019066	100.69	1.01		1.07	0.42		5.44	3.23	5.42
Reach 4	8899	100-YR	1627.10	7139.15	7141.96	7141.96	7142.72	0.013463	181.59	0.95	0.19	1.44	0.30	2.02	7.06	3.18	6.76
Reach 4	8899	FIS	2600.00	7139.15	7142.55	7142.55	7143.46	0.011392	196.52	0.92	0.41	1.64	0.59	3.43	7.91	4.39	7.35
Reach 4	8788	5-YR	482.50	7136.86	7138.33	7138.33	7138.68	0.019364	151.10	0.97		0.81	1.07		4.51	5.96	4.66
Reach 4	8788	100-YR	1627.10	7136.86	7139.37		7139.85	0.009442	192.57	0.78	0.18	0.91	0.85	2.08	5.52	5.76	5.54
Reach 4	8788	FIS	2600.00	7136.86	7139.84	7139.62	7140.55	0.010071	197.04	0.84	0.34	1.27	1.06	3.09	6.80	6.60	6.76
Reach 4	8708	5-YR	482.50	7135.59	7137.52		7137.71	0.005293	117.39	0.56		0.40	0.09		3.49	1.45	3.48
Reach 4	8708	100-YR	1627.10	7135.59	7138.62		7139.07	0.009729	205.59	0.79		0.90	0.50		5.45	4.00	5.42
Reach 4	8708	FIS	2600.00	7135.59	7139.15		7139.77	0.008791	214.78	0.79	0.22	1.11	0.59	2.40	6.35	4.58	6.28
Reach 4	8564	5-YR	482.50	7134.66	7136.30		7136.56	0.013182	154.82	0.82		0.63	0.43		4.10	3.44	4.08
Reach 4	8564	100-YR	1627.10	7134.66	7137.27		7137.72	0.009135	202.32	0.77	0.25	0.88	0.58	2.58	5.43	4.46	5.37
Reach 4	8564	FIS	2600.00	7134.66	7137.68	7137.49	7138.39	0.010419	206.03	0.85	0.44	1.28	0.79	3.64	6.79	5.40	6.70
Reach 4	8459	5-YR	482.50	7132.75	7134.44	7134.44	7134.92	0.018127	92.43	1.00		1.10	0.51		5.60	3.66	5.55
Reach 4	8459	100-YR	1627.10	7132.75	7135.65	7135.65	7136.49	0.014299	130.89	0.98		1.58	0.94		7.41	5.74	7.31
Reach 4	8459	FIS	2600.00	7132.75	7136.49	7136.49	7137.25	0.011053	233.30	0.89		1.42	0.57		7.21	4.32	6.73
Reach 4	8379	5-YR	482.50	7130.59	7132.29		7132.46	0.007852	187.01	0.64	0.13	0.40	0.15	1.67	3.28	1.87	3.26
Reach 4	8379	100-YR	1627.10	7130.59	7133.12		7133.56	0.008198	198.02	0.74	0.34	0.84	0.36	3.23	5.36	3.35	5.27
Reach 4	8379	FIS	2600.00	7130.59	7133.62		7134.26	0.008478	204.60	0.78	0.49	1.13	0.50	4.05	6.50	4.14	6.36
Reach 4	8327	5-YR	482.50	7130.49	7131.55	7131.52	7131.84	0.018859	174.34	0.96	0.36	0.76		2.90	4.37		4.34
Reach 4	8327	100-YR	1627.10	7130.49	7132.29	7132.29	7132.96	0.016060	191.56	1.00	0.68	1.37	0.44	4.53	6.62	3.39	6.52
Reach 4	8327	FIS	2600.00	7130.49	7132.79	7132.79	7133.68	0.014172	198.15	0.99	0.82	1.65	0.62	5.24	7.65	4.34	7.50
Reach 4	8246	5-YR	482.50	7128.49	7129.83	7129.83	7130.23	0.020110	123.21	1.02	0.83	0.98		5.00	5.10		5.09
Reach 4	8246	100-YR	1627.10	7128.49	7130.81	7130.81	7131.48	0.016526	190.30	1.01	1.19	1.36		6.55	6.57		6.56
Reach 4	8246	FIS	2600.00	7128.49	7131.30	7131.30	7132.20	0.014836	196.68	1.01	1.29	1.67	0.16	7.05	7.66	1.73	7.59
Reach 4	8179	5-YR	482.50	7127.03	7128.59	7128.39	7128.75	0.008005	206.19	0.64	0.21	0.38	0.26	2.36	3.19	2.70	3.15
Reach 4	8179	100-YR	1627.10	7127.03	7129.34	7129.09	7129.77	0.009075	216.52	0.76	0.45	0.86	0.61	3.81	5.34	4.66	5.24
Reach 4	8179	FIS	2600.00	7127.03	7129.79	7129.55	7130.42	0.009509	222.74	0.82	0.61	1.17	0.82	4.60	6.49	5.63	6.35
Reach 4	8147	5-YR	482.50	7127.03	7128.04	7128.04	7128.33	0.022096	205.27	1.01	0.25	0.78	0.03	2.22	4.32	0.53	4.30
Reach 4	8147	100-YR	1627.10	7127.03	7128.74	7128.74	7129.36	0.016337	216.59	0.99	0.55	1.29	0.61	3.93	6.35	4.21	6.25
Reach 4	8147	FIS	2600.00	7127.03	7129.19	7129.19	7130.02	0.014739	222.65	0.99	0.70	1.58	0.83	4.71	7.38	5.28	7.24
Reach 4	8081	5-YR	482.50	7121.00	7124.07		7124.23	0.004068	112.03	0.50		0.33			3.25		3.25
Reach 4	8081	100-YR	1627.10	7121.00	7125.26		7125.70	0.006109	150.08	0.66		0.77			5.32		5.32
Reach 4	8081	FIS	2600.00	7121.00	7125.91		7126.54	0.006865	167.43	0.72		1.04			6.36		6.36
Reach 4	8008	5-YR	482.50	7120.99	7123.72	7123.09	7123.89	0.005365	130.09	0.56		0.37			3.33		3.33
Reach 4	8008	100-YR	1627.10	7120.99	7124.92	7124.34	7125.28	0.004976	174.20	0.60	0.04	0.65	0.29	0.83	4.91	3.16	4.81
Reach 4	8008	FIS	2600.00	7120.99	7125.56	7124.89	7126.09	0.004997	178.58	0.63	0.18	0.86	0.47	2.28	5.88	4.34	5.74
Reach 4	7935	5-YR	487.40	7121.53	7122.76	7122.76	7123.20	0.019215	107.79	1.01		1.02			5.29		5.29
Reach 4	7935	100-YR	1648.70	7121.53	7123.85	7123.85	7124.65	0.015348	146.79	1.00		1.54	0.23		7.21	2.24	7.19
Reach 4	7935	FIS	2600.00	7121.53	7124.44	7124.44	7125.48	0.013280	157.99	0.98	0.32	1.81	0.46	2.83	8.23	3.63	8.12
Reach 4	7772	5-YR	487.40	7117.41	7121.72		7121.73	0.000095	193.46	0.09		0.02	0.01		0.87	0.43	0.86
Reach 4	7772	100-YR	1648.70	7117.41	7123.11		7123.17	0.000317	223.53	0.17	0.01	0.08	0.03	0.47	1.95	1.13	1.92
Reach 4	7772	FIS	2600.00	7117.41	7123.87		7123.97	0.000443	233.46	0.21	0.02	0.14	0.05	0.85	2.58	1.54	2.52
Reach 4	7593	5-YR	487.40	7115.12	7121.73		7121.73	0.000006	268.87	0.03	0.00	0.00	0.00	0.01	0.34	0.15	0.34
Reach 4	7593	100-YR	1648.70	7115.12	7123.13		7123.14	0.000035	286.87	0.06	0.00	0.02	0.00	0.22	0.91	0.47	0.90
Reach 4	7593	FIS	2600.00	7115.12	7123.90		7123.92	0.000060	296.59	0.08	0.00	0.03	0.01	0.39	1.29	0.70	1.26
Reach 4	7491	5-YR	487.40	7120.17	7121.28	7121.28	7121.68	0.019627	118.93	1.01		0.99	0.65		5.16	4.25	5.12
Reach 4	7491	100-YR	1648.70	7120.17	7122.30	7122.30	7123.05	0.015765	159.45	1.01		1.49	0.94		7.02	5.65	6.95
Reach 4	7491	FIS	2600.00	7120.17	7122.88	7122.88	7123.81	0.014654	183.17	1.01		1.71	1.09		7.80	6.30	7.72
Reach 4	7452	5-YR	487.40	7110.76	7112.46	7112.46	7112.89	0.018270	107.94	0.99		1.03	0.64		5.36	4.26	5.26
Reach 4	7452	100-YR	1648.70	7110.76	7113.52	7113.52	7114.26	0.016082	166.27	1.01		1.43	1.39		6.82	7.31	6.88
Reach 4	7452	FIS	2600.00	7110.76	7114.10	7114.10	7114.99	0.015145	199.13	1.00		1.60	1.69		7.43	8.42	7.53
Reach 4	7406	5-YR	487.40	7100.67	7102.91		7102.97	0.001814	193.85	0.33	0.04	0.14		1.02	2.07		2.07
Reach 4	7406	100-YR	1648.70	7100.67	7103.95		7104.16	0.002745	212.86	0.45	0.15	0.37		2.24	3.70		3.68
Reach 4	7406	FIS	2600.00	7100.67	7104.49		7104.82	0.003337	222.64	0.51	0.24	0.54		2.93	4.63		4.60
Reach 4	7314	5-YR	487.40	7100.67	7102.22	7102.22	7102.54	0.022908	182.22	1.04		0.84			4.52		4.52
Reach 4	7314	100-YR	1648.70	7100.67	7103.00	7103.00	7103.61	0.017309	224.43	1.01	0.38	1.28		3.06	6.26		6.25
Reach 4	7314	FIS	2600.00	7100.67	7103.47	7103.47	7104.20	0.016081	264.95	1.01	0.59	1.45		4.11	6.88		6.86
Reach 4	7249	5-YR	487.40	7098.77	7100.76		7100.87	0.005648	227.15	0.54	0.07	0.28		1.24	2.74		2.73
Reach 4	7249	100-YR	1648.70	7098.77	7101.55		7101.85	0.006285	255.02	0.63	0.28	0.59	0.04	2.97	4.42	0.76	4.40
Reach 4	7249	FIS	2600.00	7098.77	7101.82		7102.36	0.008897	259.55	0.78	0.49	0.99	0.13	4.04	5.88	1.64	5.83
Reach 4	7118	5-YR	487.40	7097.44	7099.23	7099.23	7099.55	0.021458	174.60	1.01	0.17	0.84		2.02	4.56		4.55

HEC-RAS Plan: Shear River: Sand Creek Reach: Reach 4 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	7118	100-YR	1648.70	7097.44	7100.05	7100.02	7100.61	0.014966	234.24	0.95	0.70	1.16	0.12	4.69	5.99	1.43	5.94
Reach 4	7118	FIS	2600.00	7097.44	7101.14		7101.51	0.004383	240.64	0.57	0.40	0.64	0.28	3.94	4.93	3.11	4.86
Reach 4	7000	5-YR	487.40	7096.76	7098.41		7098.49	0.002454	199.95	0.38	0.15	0.17		2.29	2.23		2.23
Reach 4	7000	100-YR	1648.70	7096.76	7099.91		7100.06	0.001633	220.27	0.35	0.18	0.25		2.73	3.12		3.10
Reach 4	7000	FIS	2600.00	7096.76	7101.05		7101.21	0.001151	230.58	0.31	0.17	0.25	0.00	2.77	3.33	0.12	3.30
Reach 4	6850	5-YR	487.40	7095.02	7097.16	7097.16	7097.67	0.016945	85.19	0.98		1.15	0.49		5.84	3.83	5.70
Reach 4	6850	100-YR	1648.70	7095.02	7098.43	7098.43	7099.43	0.013116	104.51	0.97		1.81	0.94		8.24	5.95	7.91
Reach 4	6850	FIS	2600.00	7095.02	7100.25		7100.87	0.004131	123.38	0.60		0.96	0.55		6.56	5.08	6.26
Reach 4	6784	5-YR	487.40	7092.79	7094.44		7094.85	0.011629	86.47	0.83		0.87	0.40		5.15	3.36	5.04
Reach 4	6784	100-YR	1648.70	7092.79	7098.46		7098.63	0.000740	119.16	0.27	0.09	0.24	0.14	1.94	3.47	2.59	3.23
Reach 4	6784	FIS	2600.00	7092.79	7100.47		7100.66	0.000552	136.28	0.24	0.10	0.25	0.14	2.21	3.72	2.71	3.39
Reach 4	6668	5-YR	538.70	7089.00	7094.66	7090.68	7094.69	0.000131	102.64	0.11	0.03	0.05	0.02	1.13	1.54	1.08	1.32
Reach 4	6668	100-YR	1833.50	7089.00	7098.49	7092.43	7098.57	0.000177	141.91	0.14	0.06	0.11	0.05	1.84	2.53	1.76	2.09
Reach 4	6668	FIS	2600.00	7089.00	7100.52	7093.19	7100.60	0.000155	161.31	0.14	0.06	0.11	0.06	1.97	2.70	1.87	2.19
Reach 4	6539.16		Culvert														
Reach 4	6423	5-YR	538.70	7091.70	7093.64	7093.64	7094.39	0.015943	52.22	1.01		1.48	0.17		6.97	1.83	6.95
Reach 4	6423	100-YR	1833.50	7091.70	7095.51	7095.51	7097.07	0.012561	59.48	1.01		2.41	0.27		10.05	2.56	10.00
Reach 4	6423	FIS	2600.00	7091.70	7096.36	7096.36	7098.28	0.011724	62.21	1.01		2.75	0.31		11.12	2.83	11.05
Reach 4	6343	5-YR	538.70	7088.29	7090.18	7090.18	7090.71	0.012316	96.05	0.89	0.42	1.19	0.75	3.43	6.32	5.08	5.48
Reach 4	6343	100-YR	1833.50	7088.29	7091.52	7091.52	7092.35	0.009551	150.20	0.87	0.77	1.72	1.03	5.39	8.42	6.54	6.85
Reach 4	6343	FIS	2600.00	7088.29	7091.97	7091.97	7092.99	0.009742	155.43	0.90	1.03	2.03	1.20	6.49	9.36	7.19	7.74
Reach 4	6308	5-YR	538.70	7087.82	7089.45		7089.56	0.003622	192.05	0.46	0.21	0.24	0.13	2.66	2.67	1.91	2.66
Reach 4	6308	100-YR	1833.50	7087.82	7090.37		7090.73	0.005190	197.21	0.60	0.44	0.65	0.36	4.08	4.85	3.56	4.79
Reach 4	6308	FIS	2600.00	7087.82	7090.76		7091.26	0.005709	199.65	0.65	0.54	0.85	0.46	4.64	5.73	4.13	5.65
Reach 4	6197	5-YR	538.70	7086.68	7088.64	7088.56	7088.84	0.013868	259.30	0.81	0.49	0.51	0.49	3.76	3.51	3.72	3.53
Reach 4	6197	100-YR	1833.50	7086.68	7089.24	7089.20	7089.79	0.015525	264.94	0.96	0.89	1.15	0.95	5.45	5.94	5.72	5.91
Reach 4	6197	FIS	2600.00	7086.68	7089.50	7089.50	7090.23	0.016268	267.33	1.01	1.07	1.47	1.17	6.14	6.92	6.50	6.88
Reach 4	6145	5-YR	538.70	7086.15	7087.62	7087.62	7087.92	0.021637	209.28	1.01		0.80	0.38		4.41	2.96	4.39
Reach 4	6145	100-YR	1833.50	7086.15	7088.33	7088.33	7088.92	0.017173	261.52	1.01	0.45	1.26	0.86	3.39	6.19	5.27	6.14
Reach 4	6145	FIS	2600.00	7086.15	7088.64	7088.64	7089.38	0.015733	263.93	1.00	0.62	1.46	0.99	4.29	6.92	5.84	6.85
Reach 4	6106	5-YR	538.70	7085.58	7087.04	7086.94	7087.23	0.012720	253.61	0.78	0.29	0.49	0.47	2.68	3.47	3.68	3.47
Reach 4	6106	100-YR	1833.50	7085.58	7087.65	7087.60	7088.19	0.014976	258.82	0.95	0.65	1.14	0.87	4.45	5.94	5.43	5.90
Reach 4	6106	FIS	2600.00	7085.58	7087.91	7087.91	7088.65	0.015863	261.03	1.01	0.82	1.46	1.06	5.15	6.94	6.13	6.89
Reach 4	6052	5-YR	538.70	7084.95	7086.07	7086.07	7086.34	0.022430	247.16	1.01	0.75	0.74	0.21	4.59	4.16	1.96	4.16
Reach 4	6052	100-YR	1833.50	7084.95	7086.74	7086.74	7087.34	0.017051	252.50	1.01	0.99	1.27	0.67	5.79	6.24	4.47	6.20
Reach 4	6052	FIS	2600.00	7084.95	7087.05	7087.05	7087.80	0.015790	254.98	1.01	1.09	1.48	0.81	6.24	7.00	5.13	6.95
Reach 4	6025	5-YR	538.70	7082.34	7084.17	7084.17	7084.75	0.017410	77.73	1.01		1.23			6.09		6.09
Reach 4	6025	100-YR	1833.50	7082.34	7085.79	7085.79	7086.41	0.016416	240.48	0.99	0.34	1.28	0.22	2.87	6.31	2.15	6.28
Reach 4	6025	FIS	2600.00	7082.34	7086.11	7086.11	7086.89	0.015297	244.29	1.00	0.52	1.50	0.40	3.82	7.09	3.20	7.03
Reach 4	6002	5-YR	538.70	7080.15	7082.79		7083.15	0.006242	63.88	0.65		0.67			4.83		4.83
Reach 4	6002	100-YR	1833.50	7080.15	7084.69		7085.42	0.009465	125.35	0.82		1.26	0.02		6.85	0.53	6.85
Reach 4	6002	FIS	2600.00	7080.15	7085.51	7085.01	7086.17	0.010280	222.73	0.84	0.05	1.20	0.31	0.82	6.52	2.91	6.48
Reach 4	5952	5-YR	538.70	7080.15	7082.53		7082.86	0.005257	65.43	0.60		0.61	0.15		4.63	1.96	4.60
Reach 4	5952	100-YR	1833.50	7080.15	7083.85	7083.85	7084.83	0.013921	117.66	0.99		1.76	0.94		8.01	5.79	7.92
Reach 4	5952	FIS	2600.00	7080.15	7084.47	7084.47	7085.54	0.013856	148.41	1.00		1.87	1.20		8.35	6.79	8.28
Reach 4	5895	5-YR	538.70	7079.84	7081.80	7081.80	7082.33	0.018523	91.52	1.02		1.17			5.81		5.81
Reach 4	5895	100-YR	1833.50	7079.84	7083.11	7083.11	7083.96	0.015051	144.68	1.00		1.60			7.42		7.42
Reach 4	5895	FIS	2600.00	7079.84	7083.62	7083.62	7084.61	0.014588	167.00	1.01		1.77			7.98		7.98
Reach 4	5830	5-YR	538.70	7078.90	7081.14		7081.38	0.006172	109.63	0.61		0.49			3.89		3.89
Reach 4	5830	100-YR	1833.50	7078.90	7082.25	7081.99	7082.89	0.010279	154.81	0.84		1.18			6.44		6.44
Reach 4	5830	FIS	2600.00	7078.90	7082.66	7082.50	7083.51	0.011653	171.81	0.91		1.49			7.38		7.38
Reach 4	5784	5-YR	538.70	7078.84	7080.71		7081.00	0.011199	134.52	0.78		0.65			4.29		4.29
Reach 4	5784	100-YR	1833.50	7078.84	7081.79	7081.60	7082.39	0.011201	181.76	0.86		1.13			6.20		6.20
Reach 4	5784	FIS	2600.00	7078.84	7082.25		7082.97	0.010304	194.94	0.85		1.27			6.77		6.77
Reach 4	5743	5-YR	538.70	7078.58	7080.61		7080.72	0.003229	177.65	0.44	0.12	0.23		1.85	2.67		2.65
Reach 4	5743	100-YR	1833.50	7078.58	7081.73		7082.05	0.003954	186.93	0.54	0.30	0.55		3.30	4.56		4.51
Reach 4	5743	FIS	2600.00	7078.58	7082.19		7082.62	0.004278	190.75	0.58	0.38	0.71		3.87	5.33		5.27
Reach 4	5660	5-YR	538.70	7078.23	7079.92	7079.85	7080.20	0.015449	178.26	0.88	0.09	0.69		1.18	4.23		4.23
Reach 4	5660	100-YR	1833.50	7078.23	7080.69	7080.69	7081.41	0.016196	190.14	1.01	0.48	1.44		3.58	6.84		6.82
Reach 4	5660	FIS	2600.00	7078.23	7081.07	7081.07	7081.97	0.014975	195.55	1.01	0.61	1.66		4.28	7.61		7.58
Reach 4	5549	5-YR	538.70	7076.51	7077.86	7077.86	7078.27	0.019528	132.96	1.01	0.38	0.98		3.01	5.13		5.11
Reach 4	5549	100-YR	1833.50	7076.51	7078.92	7078.92	7079.62	0.015865	197.76	1.00	0.82	1.41	0.31	5.17	6.76	2.72	6.71
Reach 4	5549	FIS	2600.00	7076.51	7079.34	7079.34	7080.14	0.014941	228.66	0.99	0.98	1.53	0.51	5.85	7.21	3.79	7.14
Reach 4	5522	5-YR	538.70	7074.16	7075.97	7075.85	7076.32	0.012312	113.01	0.83	0.14	0.78		1.64	4.75		4.74
Reach 4	5522	100-YR	1833.50	7074.16	7076.99	7076.99	7077.95	0.014394	124.29	1.00	0.60	1.73		4.25	7.88		7.83
Reach 4	5522	FIS	2600.00	7074.16	7077.52	7077.52	7078.69	0.013250	130.34	0.99	0.76	1.97		5.06	8.70		8.63
Reach 4	5485	5-YR	538.70	7074.11	7075.33	7075.33	7075.76	0.019265	124.34	1.01	0.77	1.01		4.80	5.24		5.22
Reach 4	5485	100-YR	1833.50	7074.11	7076.40	7076.40	7077.24	0.014998	149.37	1.00	1.10	1.60		6.31	7.42		7.36
Reach 4	5485	FIS	2600.00	7074.11	7076.86	7076.86	7077.88	0.014098	159.95	1.00	1.23	1.81		6.90	8.16		8.09
Reach 4	5444	5-YR	538.70	7072.48	7074.56		7074.69	0.003548	150.98	0.46	0.14	0.28		1.99	2.92		2.91
Reach 4	5444	100-YR	1833.50	7072.48	7075.65		7076.06	0.005543	178.89	0.63	0.39	0.72	0.05	3.76	5.15	0.90	5.11
Reach 4	5444	FIS	2600.00	7072.48	7076.07		7076.61	0.007118	215.13	0.72	0.59	0.95	0.18	4.75	5.92	2.17	5.87
Reach 4	5395	5-YR	538.70	7072.48	7073.91	7073.91	7074.31	0.020794	143.80	1.03	0.45	0.97		3.31	5.06		5.04
Reach 4	5395	100-YR	1833.50	7072.48	7074.91	7074.91	7075.58	0.016595	215.99	1.01	0.86	1.37	0.18	5.29	6.59	1.86	6.55
Reach 4	5395	FIS	2600.00	7072.48	7075.30	7075.30	7076.08	0.015303	241.59	1.00	0.98	1.50	0.39	5.84	7.08	3.14	7.04

HEC-RAS Plan: Shear River: Sand Creek Reach: Reach 4 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	5359	5-YR	538.70	7070.74	7072.63	7072.63	7073.12	0.018221	97.67	1.00		1.11			5.64		5.64
Reach 4	5359	100-YR	1833.50	7070.74	7073.80	7073.80	7074.74	0.014251	131.32	0.99	0.50	1.69		3.79	7.79		7.70
Reach 4	5359	FIS	2600.00	7070.74	7074.55	7074.55	7075.37	0.014969	222.33	1.00	0.89	1.56		5.48	7.30		7.22
Reach 4	5326	5-YR	538.70	7069.72	7071.15		7071.47	0.011378	121.11	0.80	0.53	0.71		4.07	4.51		4.50
Reach 4	5326	100-YR	1833.50	7069.72	7072.09	7072.09	7073.02	0.014584	130.82	1.00	0.94	1.71		5.72	7.80		7.71
Reach 4	5326	FIS	2600.00	7069.72	7072.59	7072.59	7073.73	0.013519	135.98	1.00	1.04	1.97		6.22	8.68		8.55
Reach 4	5263	5-YR	538.70	7068.82	7070.21	7070.21	7070.58	0.018930	147.85	0.98	1.14	0.86		6.23	4.74		4.87
Reach 4	5263	100-YR	1833.50	7068.82	7071.15	7071.15	7071.96	0.015091	156.35	1.00	1.38	1.54		7.37	7.22		7.23
Reach 4	5263	FIS	2600.00	7068.82	7071.57	7071.57	7072.59	0.014263	160.23	1.00	1.50	1.81		7.86	8.12		8.10
Reach 4	5187	5-YR	538.70	7067.05	7068.62	7068.62	7068.99	0.020805	155.91	1.02	0.16	0.93		1.63	4.89		4.89
Reach 4	5187	100-YR	1833.50	7067.05	7069.54	7069.54	7070.31	0.015427	172.10	1.00	0.63	1.49		4.36	7.05		7.01
Reach 4	5187	FIS	2600.00	7067.05	7069.95	7069.95	7070.90	0.014507	179.32	1.00	0.79	1.72		5.09	7.85		7.79
Reach 4	5078	5-YR	538.70	7064.62	7066.22	7066.22	7066.61	0.020570	144.48	1.02	0.49	0.96		3.51	5.03		5.01
Reach 4	5078	100-YR	1833.50	7064.62	7067.18	7067.18	7068.02	0.015224	153.12	1.01	0.71	1.59		4.74	7.39		7.33
Reach 4	5078	FIS	2600.00	7064.62	7067.64	7067.64	7068.67	0.013781	157.61	0.99	0.82	1.81		5.27	8.19		8.10
Reach 4	4992	5-YR	538.70	7063.62	7065.50		7065.66	0.005356	163.15	0.55	0.11	0.35		1.63	3.19		3.19
Reach 4	4992	100-YR	1833.50	7063.62	7066.54		7066.97	0.006183	179.46	0.66	0.34	0.77	0.08	3.33	5.29	1.33	5.26
Reach 4	4992	FIS	2600.00	7063.62	7066.97		7067.55	0.006442	181.86	0.70	0.43	0.98	0.20	3.91	6.15	2.36	6.10
Reach 4	4957	5-YR	538.70	7063.29	7064.92	7064.92	7065.31	0.020123	144.61	1.01		0.94			4.97		4.97
Reach 4	4957	100-YR	1833.50	7063.29	7065.85	7065.85	7066.61	0.015938	178.53	1.01	0.33	1.48		2.82	7.00	0.24	6.98
Reach 4	4957	FIS	2600.00	7063.29	7066.25	7066.25	7067.19	0.014326	184.73	1.00	0.48	1.70	0.25	3.65	7.78	2.38	7.73
Reach 4	4898	5-YR	538.70	7061.84	7063.37	7063.33	7063.76	0.016315	126.12	0.93	0.12	0.90		1.47	4.98		4.96
Reach 4	4898	100-YR	1833.50	7061.84	7064.37	7064.37	7065.25	0.014718	143.85	1.00	0.72	1.63		4.78	7.55		7.46
Reach 4	4898	FIS	2600.00	7061.84	7064.84	7064.84	7065.92	0.013560	147.66	0.99	0.91	1.87		5.67	8.40		8.28
Reach 4	4629	5-YR	538.70	7058.43	7060.11		7060.33	0.009991	170.12	0.73	0.19	0.53		2.13	3.79		3.78
Reach 4	4629	100-YR	1833.50	7058.43	7061.15		7061.65	0.007892	180.62	0.74	0.41	0.91		3.63	5.67		5.63
Reach 4	4629	FIS	2600.00	7058.43	7061.50		7062.20	0.009001	184.09	0.81	0.56	1.22		4.39	6.74		6.69
Reach 4	4521	5-YR	538.70	7057.10	7058.74	7058.63	7059.07	0.013573	128.26	0.86	0.04	0.77		0.71	4.64		4.64
Reach 4	4521	100-YR	1833.50	7057.10	7059.78	7059.75	7060.50	0.014395	178.90	0.96	0.55	1.40		4.04	6.84		6.78
Reach 4	4521	FIS	2600.00	7057.10	7060.28	7060.15	7061.08	0.011755	189.60	0.91	0.72	1.44		4.97	7.22		7.15
Reach 4	4469	5-YR	538.70	7056.64	7058.30		7058.51	0.008020	154.94	0.66	0.34	0.48		3.23	3.68		3.67
Reach 4	4469	100-YR	1833.50	7056.64	7059.35		7059.87	0.008784	178.83	0.77	0.65	0.98		4.87	5.85		5.82
Reach 4	4469	FIS	2600.00	7056.64	7059.94		7060.47	0.009046	253.18	0.78	0.83	0.99		5.69	5.87		5.87
Reach 4	4376	5-YR	538.70	7055.93	7057.70		7057.85	0.005939	178.80	0.57	0.15	0.36	0.15	1.94	3.20	1.95	3.18
Reach 4	4376	100-YR	1833.50	7055.93	7058.46		7058.96	0.010845	227.73	0.83	0.54	0.99	0.52	4.15	5.70	4.08	5.65
Reach 4	4376	FIS	2600.00	7055.93	7058.71	7058.65	7059.43	0.013727	243.49	0.95	0.80	1.38	0.77	5.19	6.85	5.06	6.78
Reach 4	4348	5-YR	538.70	7055.93	7057.24	7057.24	7057.55	0.021719	203.76	1.01	0.29	0.82	0.40	2.43	4.47	3.04	4.45
Reach 4	4348	100-YR	1833.50	7055.93	7058.01	7058.01	7058.57	0.017563	282.12	1.01	0.65	1.21	0.79	4.33	6.02	4.95	5.98
Reach 4	4348	FIS	2600.00	7055.93	7058.33	7058.33	7058.98	0.016391	316.67	1.00	0.77	1.33	0.91	4.91	6.48	5.49	6.43
Reach 4	4319	5-YR	538.70	7054.67	7056.58	7056.58	7056.89	0.022018	202.22	1.02		0.82			4.46		4.46
Reach 4	4319	100-YR	1833.50	7054.67	7057.32	7057.32	7057.83	0.017853	313.82	1.00	0.35	1.14		2.85	5.76		5.75
Reach 4	4319	FIS	2600.00	7054.67	7057.64	7057.64	7058.22	0.016883	374.57	1.00	0.49	1.23	0.14	3.64	6.11	1.56	6.09
Reach 4	4266	5-YR	538.70	7052.63	7054.53	7054.53	7055.00	0.018815	107.36	1.01		1.07			5.48		5.48
Reach 4	4266	100-YR	1833.50	7052.63	7055.64	7055.64	7056.22	0.017513	263.88	1.01		1.24			6.11		6.11
Reach 4	4266	FIS	2600.00	7052.63	7056.04	7056.04	7056.64	0.017283	355.72	1.01		1.27			6.21		6.21
Reach 4	4207	5-YR	538.70	7051.41	7052.90	7052.90	7053.18	0.021246	228.65	0.99		0.74			4.20		4.20
Reach 4	4207	100-YR	1833.50	7051.41	7053.60	7053.60	7054.19	0.017333	254.30	1.01		1.26			6.19		6.19
Reach 4	4207	FIS	2600.00	7051.41	7053.92	7053.92	7054.65	0.016263	266.05	1.01		1.45			6.85		6.85
Reach 4	4124	5-YR	538.70	7048.17	7050.16		7050.25	0.002908	187.54	0.41	0.15	0.21		2.19	2.53		2.51
Reach 4	4124	100-YR	1833.50	7048.17	7051.31		7051.57	0.003523	224.96	0.50	0.30	0.45		3.43	4.08		4.05
Reach 4	4124	FIS	2600.00	7048.17	7051.68		7052.04	0.004493	246.30	0.57	0.44	0.63		4.20	4.86		4.83
Reach 4	4009	5-YR	572.10	7048.19	7049.18	7049.18	7049.51	0.021263	194.73	1.01	0.39	0.85		3.01	4.62		4.60
Reach 4	4009	100-YR	2023.60	7048.19	7050.04	7050.04	7050.77	0.015791	206.68	1.00	0.71	1.44		4.68	6.87		6.83
Reach 4	4009	FIS	2600.00	7048.19	7050.31	7050.31	7051.16	0.014812	210.50	1.00	0.79	1.59		5.09	7.41		7.35
Reach 4	3959	5-YR	572.10	7046.20	7047.93	7047.90	7048.25	0.018233	179.91	0.95	0.05	0.80		0.79	4.53		4.53
Reach 4	3959	100-YR	2023.60	7046.20	7048.83	7048.80	7049.58	0.014989	191.43	0.98	0.45	1.45		3.47	6.95		6.93
Reach 4	3959	FIS	2600.00	7046.20	7049.12	7049.08	7049.99	0.014058	195.20	0.98	0.54	1.59		4.00	7.49		7.46
Reach 4	3900	5-YR	572.10	7045.39	7047.13		7047.39	0.011405	161.42	0.78		0.61			4.11		4.11
Reach 4	3900	100-YR	2023.60	7045.39	7048.16	7047.96	7048.81	0.010547	173.53	0.85	0.29	1.20		2.79	6.52		6.49
Reach 4	3900	FIS	2600.00	7045.39	7048.47	7048.27	7049.26	0.010466	177.17	0.87	0.39	1.38		3.37	7.14		7.11
Reach 4	3847	5-YR	572.10	7044.97	7046.66		7046.87	0.008069	163.73	0.67	0.46	0.48		3.95	3.67		3.70
Reach 4	3847	100-YR	2023.60	7044.97	7047.76		7048.29	0.008053	181.15	0.75	0.79	0.97		5.65	5.91		5.88
Reach 4	3847	FIS	2600.00	7044.97	7048.10		7048.73	0.007910	186.42	0.76	0.88	1.10		6.05	6.43		6.40
Reach 4	3771	5-YR	572.10	7044.36	7046.14		7046.32	0.006491	175.10	0.60	0.09	0.40		1.36	3.37		3.36
Reach 4	3771	100-YR	2023.60	7044.36	7047.37		7047.73	0.005820	234.82	0.63	0.29	0.66		3.07	4.82		4.80
Reach 4	3771	FIS	2600.00	7044.36	7047.74		7048.14	0.006118	275.52	0.65	0.38	0.72		3.60	5.07		5.05
Reach 4	3709	5-YR	572.10	7043.57	7045.95		7046.05	0.002565	174.96	0.40	0.08	0.21		1.47	2.56		2.55
Reach 4	3709	100-YR	2023.60	7043.57	7047.08		7047.41	0.004228	205.90	0.55	0.28	0.58		3.12	4.64		4.61
Reach 4	3709	FIS	2600.00	7043.57	7047.39		7047.81	0.004634	214.44	0.59	0.35	0.70		3.57	5.19		5.15
Reach 4	3653	5-YR	572.10	7043.09	7045.95		7045.98	0.000412	201.81	0.17	0.02	0.05		0.81	1.41		1.40
Reach 4	3653	100-YR	2023.60	7043.09	7047.09		7047.24	0.001238	218.53	0.32	0.11	0.24		2.08	3.17		3.12
Reach 4	3653	FIS	2600.00	7043.09	7047.40		7047.61	0.001499	223.14	0.35	0.15	0.31		2.46	3.68		3.63
Reach 4	3502	5-YR	572.10	7042.03	7045.92		7045.94	0.000186	197.71	0.12	0.02	0.03		0.78	1.12		1.11
Reach 4	3502	100-YR	2023.60	7042.03	7046.96		7047.08	0.000787	206.74	0.26	0.09	0.18		1.99	2.82		2.78
Reach 4	3502	FIS	2600.00	7042.03	7047.24		7047.41	0.001022	209.15	0.30	0.13	0.25		2.37	3.36		3.31
Reach 4	3429	5-YR	572.10	7041.39	7045.92		7045.93	0.000066	247.72	0.07	0.01	0.01		0.58	0.75		0.74

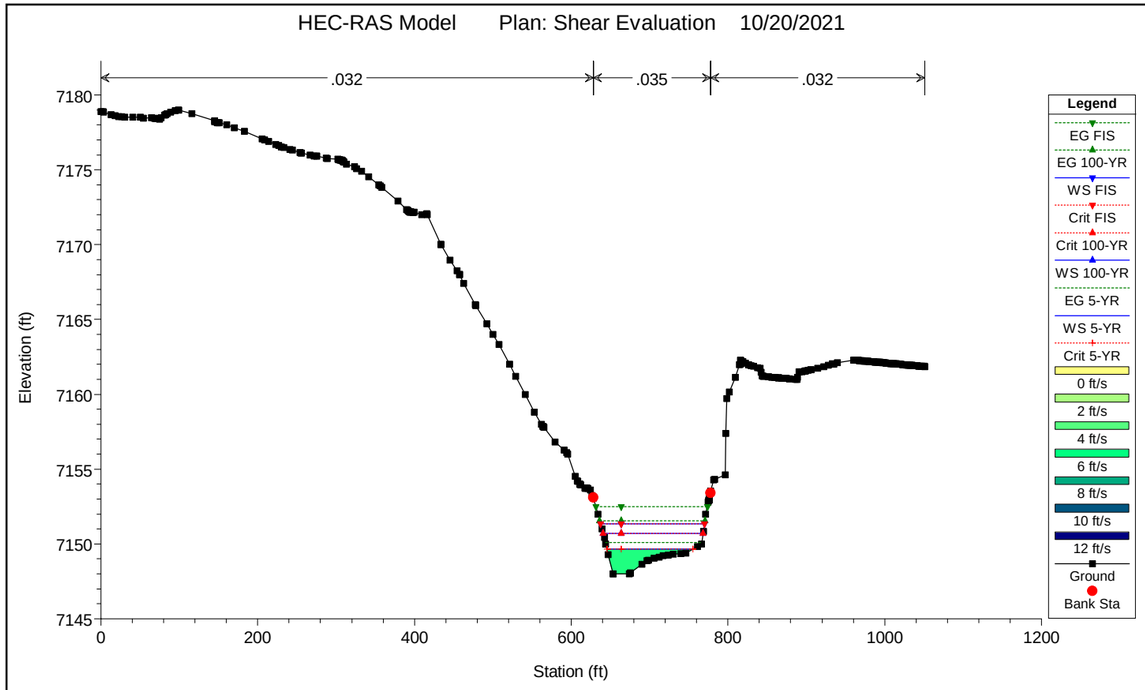
HEC-RAS Plan: Shear River: Sand Creek Reach: Reach 4 (Continued)

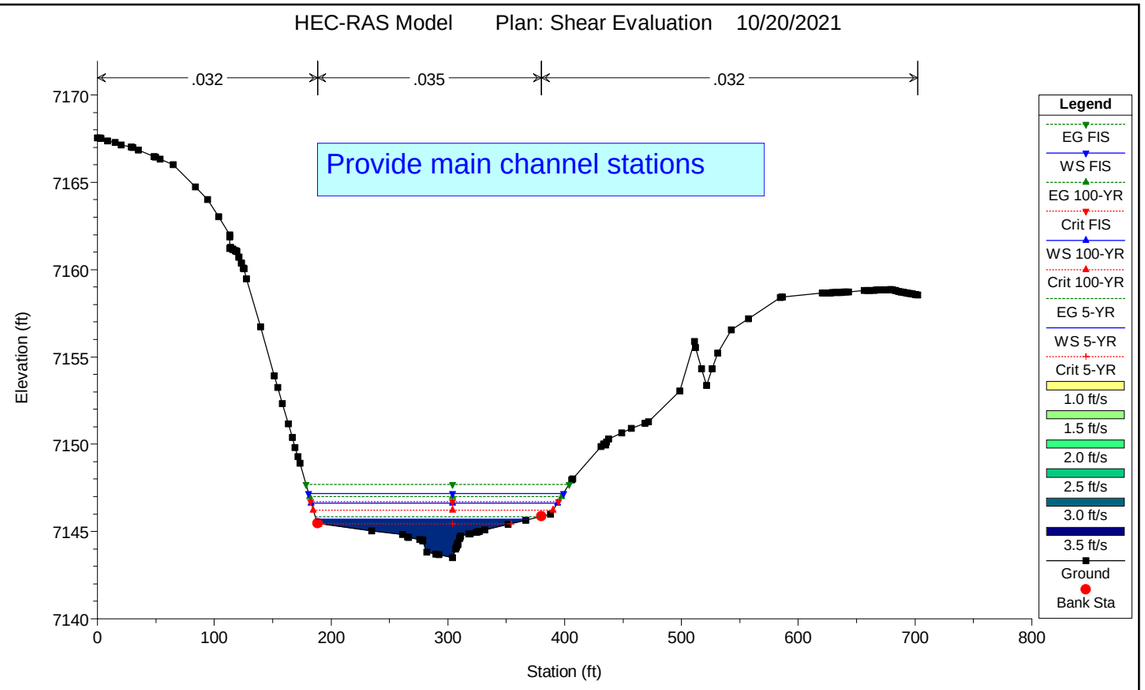
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	3429	100-YR	2023.60	7041.39	7046.97		7047.03	0.000365	298.52	0.18	0.05	0.08		1.59	1.92		1.90
Reach 4	3429	FIS	2600.00	7041.39	7047.25		7047.33	0.000483	307.42	0.21	0.08	0.12		1.90	2.28		2.26
Reach 4	3336	5-YR	572.10	7040.90	7045.92		7045.92	0.000027	366.61	0.05	0.00	0.01	0.00	0.42	0.49	0.22	0.49
Reach 4	3336	100-YR	2023.60	7040.90	7046.97		7047.00	0.000134	374.18	0.11	0.02	0.04	0.01	1.08	1.31	0.66	1.29
Reach 4	3336	FIS	2600.00	7040.90	7047.26		7047.30	0.000178	376.23	0.13	0.03	0.05	0.02	1.28	1.57	0.81	1.55
Reach 4	3262	5-YR	572.10	7039.88	7045.92		7045.92	0.000015	352.67	0.04	0.00	0.00	0.00	0.29	0.42	0.21	0.41
Reach 4	3262	100-YR	2023.60	7039.88	7046.97		7046.99	0.000086	364.63	0.09	0.01	0.03	0.01	0.77	1.18	0.63	1.15
Reach 4	3262	FIS	2600.00	7039.88	7047.25		7047.28	0.000118	367.86	0.11	0.02	0.04	0.01	0.93	1.43	0.77	1.40
Reach 4	3195	5-YR	572.10	7039.55	7045.92		7045.92	0.000008	357.03	0.03	0.00	0.00	0.00	0.28	0.35	0.19	0.34
Reach 4	3195	100-YR	2023.60	7039.55	7046.97		7046.98	0.000052	366.48	0.07	0.01	0.02	0.01	0.81	1.01	0.58	0.99
Reach 4	3195	FIS	2600.00	7039.55	7047.25		7047.28	0.000073	370.41	0.09	0.02	0.03	0.01	0.99	1.24	0.69	1.21
Reach 4	3114	5-YR	572.10	7039.18	7045.92		7045.92	0.000005	346.14	0.02	0.00	0.00	0.00	0.23	0.31	0.18	0.30
Reach 4	3114	100-YR	2023.60	7039.18	7046.97		7046.98	0.000037	367.26	0.06	0.01	0.02	0.00	0.68	0.93	0.43	0.90
Reach 4	3114	FIS	2600.00	7039.18	7047.25		7047.27	0.000053	369.00	0.08	0.01	0.02	0.01	0.83	1.14	0.55	1.11
Reach 4	3065	5-YR	572.10	7037.93	7045.92		7045.92	0.000005	320.62	0.02	0.00	0.00	0.00	0.18	0.32	0.17	0.31
Reach 4	3065	100-YR	2023.60	7037.93	7046.96		7046.98	0.000035	337.88	0.06	0.01	0.02	0.01	0.56	0.95	0.49	0.92
Reach 4	3065	FIS	2600.00	7037.93	7047.25		7047.27	0.000050	339.94	0.07	0.01	0.02	0.01	0.70	1.17	0.62	1.13
Reach 4	2993	5-YR	572.10	7037.01	7045.92		7045.92	0.000003	324.54	0.02	0.00	0.00	0.00	0.22	0.27	0.13	0.26
Reach 4	2993	100-YR	2023.60	7037.01	7046.96		7046.98	0.000022	331.42	0.05	0.01	0.01	0.00	0.65	0.84	0.45	0.81
Reach 4	2993	FIS	2600.00	7037.01	7047.25		7047.26	0.000033	333.27	0.06	0.01	0.02	0.01	0.80	1.04	0.57	1.00
Reach 4	2778	5-YR	572.10	7036.48	7045.92		7045.92	0.000014	231.93	0.04		0.00	0.00		0.50	0.21	0.49
Reach 4	2778	100-YR	2023.60	7036.48	7046.93		7046.96	0.000097	248.52	0.10	0.00	0.04	0.01	0.24	1.48	0.71	1.43
Reach 4	2778	FIS	2600.00	7036.48	7047.20		7047.25	0.000140	251.39	0.12	0.00	0.06	0.02	0.35	1.81	0.91	1.75
Reach 4	2584	5-YR	572.10	7044.49	7045.56	7045.56	7045.88	0.015076	230.56	0.83		0.50	0.99		3.44	5.88	4.06
Reach 4	2584	100-YR	2023.60	7044.49	7046.38	7046.38	7046.86	0.013220	392.49	0.85		0.77	1.42		4.64	7.65	5.14
Reach 4	2584	FIS	2600.00	7044.49	7046.59	7046.59	7047.11	0.013053	431.84	0.86		0.84	1.52		4.96	8.05	5.43
Reach 4	2406	5-YR	572.10	7019.43	7022.46	7022.46	7023.29	0.015558	47.46	1.01		1.58			7.33		7.33
Reach 4	2406	100-YR	2023.60	7019.43	7024.63	7024.63	7026.06	0.013008	74.35	1.01		2.27			9.62		9.62
Reach 4	2406	FIS	2600.00	7019.43	7025.22	7025.22	7026.81	0.012545	81.61	1.01		2.44			10.13		10.13
Reach 4	2114	5-YR	466.80	7007.64	7010.38	7010.38	7010.69	0.013760	163.30	0.82	1.31	0.56		7.22	3.77		4.07
Reach 4	2114	100-YR	1921.70	7007.64	7011.32	7011.32	7012.07	0.015415	183.29	0.99	1.83	1.41		8.85	6.81		6.92
Reach 4	2114	FIS	2600.00	7007.64	7011.68	7011.67	7012.56	0.014468	191.07	0.99	1.83	1.59		8.95	7.45		7.52
Reach 4	1918	5-YR	466.80	7005.76	7006.84		7007.10	0.013667	151.84	0.83		0.64			4.10		4.10
Reach 4	1918	100-YR	1921.70	7005.76	7010.88		7010.91	0.000217	533.01	0.13		0.04	0.01		1.26	0.35	1.26
Reach 4	1918	FIS	2600.00	7005.76	7012.20		7012.22	0.000113	541.01	0.10		0.03	0.01		1.17	0.50	1.17
Reach 4	1740	5-YR	466.80	7003.99	7005.54	7005.16	7005.64	0.005203	234.61	0.52		0.25			2.58		2.58
Reach 4	1740	100-YR	1921.70	7003.99	7010.88		7010.89	0.000038	500.00	0.06		0.01	0.01		0.78	0.50	0.77
Reach 4	1740	FIS	2600.00	7003.99	7012.20		7012.21	0.000032	506.42	0.06		0.01	0.01		0.83	0.55	0.82
Reach 4	1668	5-YR	466.80	7003.52	7004.71	7004.67	7004.97	0.018749	188.51	0.94		0.70			4.13		4.13
Reach 4	1668	100-YR	1921.70	7003.52	7010.88		7010.89	0.000031	434.41	0.06		0.01	0.01		0.77	0.62	0.76
Reach 4	1668	FIS	2600.00	7003.52	7012.20		7012.21	0.000029	438.92	0.06		0.01	0.01		0.85	0.67	0.84
Reach 4	1549	5-YR	466.80	7002.57	7004.31		7004.35	0.002075	396.23	0.32		0.10	0.02		1.59	0.55	1.59
Reach 4	1549	100-YR	1921.70	7002.57	7010.88		7010.88	0.000014	478.52	0.04	0.00	0.01	0.00	0.09	0.59	0.41	0.58
Reach 4	1549	FIS	2600.00	7002.57	7012.20		7012.20	0.000015	484.61	0.04	0.00	0.01	0.00	0.15	0.67	0.47	0.66
Reach 4	1494.166	5-YR	466.80	7002.04	7004.28	7002.98	7004.30	0.000363	372.99	0.15		0.04	0.01		1.12	0.51	1.11
Reach 4	1494.166	100-YR	1921.70	7002.04	7010.87	7003.85	7010.88	0.000024	470.86	0.05		0.01	0.01		0.84	0.80	0.83
Reach 4	1494.166	FIS	2600.00	7002.04	7012.19	7004.13	7012.20	0.000031	478.91	0.06	0.00	0.02	0.00	0.26	0.96	0.47	0.89
Reach 4	1397		Inl Struct														
Reach 4	1256	5-YR	463.11	7000.89	7003.70	7002.44	7003.93	0.002353	44.57	0.40		0.37			3.78		3.78
Reach 4	1256	100-YR	1590.50	7000.89	7007.41	7004.35	7007.88	0.001627	45.48	0.38	0.02	0.59	0.02	0.63	5.52	0.61	5.50
Reach 4	1256	FIS	2600.00	7000.89	7009.98	7005.67	7010.63	0.001418	46.26	0.38	0.04	0.72	0.03	1.00	6.45	0.82	6.39
Reach 4	1214.7		Culvert														
Reach 4	1161	5-YR	463.11	7000.69	7003.07		7003.38	0.005259	63.35	0.60	0.27	0.58	0.08	2.98	4.51	1.27	4.42
Reach 4	1161	100-YR	1590.50	7000.69	7004.71	7004.17	7005.58	0.006383	75.06	0.73	0.65	1.36	0.41	5.12	7.67	3.76	7.29
Reach 4	1161	FIS	2600.00	7000.69	7005.54	7005.21	7006.94	0.007803	80.99	0.84	0.99	2.06	0.69	6.56	9.81	5.18	9.19
Reach 4	1134	5-YR	463.11	7000.63	7002.50	7002.50	7003.12	0.015853	61.72	0.99	0.51	1.31	0.61	3.78	6.44	4.22	6.24
Reach 4	1134	100-YR	1590.50	7000.63	7004.08	7004.08	7005.32	0.011551	76.61	0.96	0.93	2.09	0.97	5.93	9.27	6.09	8.67
Reach 4	1134	FIS	2600.00	7000.63	7005.11	7005.11	7006.69	0.010112	86.30	0.94	1.14	2.48	1.16	6.91	10.62	7.01	9.73
Reach 4	1116	5-YR	463.11	6997.80	7000.26		7000.53	0.004135	67.63	0.54	0.21	0.50	0.29	2.61	4.22	3.25	4.04
Reach 4	1116	100-YR	1590.50	6997.80	7001.64		7002.53	0.007116	78.70	0.77	0.66	1.46	0.83	5.09	7.92	5.93	7.39
Reach 4	1116	FIS	2600.00	6997.80	7002.34	7002.22	7003.84	0.009348	84.39	0.91	1.07	2.33	1.30	6.71	10.33	7.65	9.53
Reach 4	1076	5-YR	463.11	6997.73	7000.15		7000.36	0.003448	79.57	0.48	0.12	0.39	0.20	1.88	3.69	2.57	3.57
Reach 4	1076	100-YR	1590.50	6997.73	7001.55		7002.21	0.005350	92.62	0.66	0.41	1.07	0.54	3.92	6.73	4.67	6.36
Reach 4	1076	FIS	2600.00	6997.73	7002.35		7003.39	0.006386	99.85	0.75	0.66	1.59	0.80	5.17	8.53	5.90	7.96
Reach 4	1004	5-YR	463.11	6997.63	6999.97		7000.12	0.002708	98.24	0.42	0.11	0.28	0.07	1.77	3.09	1.40	3.04
Reach 4	1004	100-YR	1590.50	6997.63	7001.37		7001.83	0.003874	109.34	0.56	0.33	0.74	0.27	3.57	5.55	3.12	5.35
Reach 4	1004	FIS	2600.00	6997.63	7002.20		7002.92	0.004430	115.96	0.62	0.50	1.07	0.42	4.56	6.97	4.09	6.65
Reach 4	965	5-YR	463.11	6997.45	6999.89		7000.02	0.002303	100.61	0.39	0.07	0.25	0.07	1.35	2.93	1.32	2.88
Reach 4	965	100-YR	1590.50	6997.45	7001.24		7001.68	0.003632	116.07	0.54	0.26	0.70	0.25	3.06	5.41	3.02	5.18
Reach 4	965	FIS	2600.00	6997.45	7002.07		7002.74	0.004144	125.52	0.60	0.40	1.01	0.39	4.01	6.77	3.96	6.39
Reach 4	933	5-YR	463.11	6997.45	6999.81		6999.94	0.002439	103.84	0.40	0.05	0.25	0.08	1.09	2.91	1.46	2.88
Reach 4	933	100-YR	1590.50	6997.45	7001.12		7001.56	0.003828	116.43	0.55	0.23	0.70	0.27	2.81	5.39	3.14	5.22
Reach 4	933	FIS	2600.00	6997.45	7001.92		7002.61	0.004378	125.40	0.62	0.35	1.02	0.42	3.64	6.77	4.09	6.46
Reach 4	876	5-YR	463.11	6997.45	6999.67		6999.79	0.002769	120.22	0.42	0.14	0.25	0.08	2.17	2.85	1.47	2.80
Reach 4	876	100-YR	1590.50	6997.45	7000.94		7001.32	0.003723	130.59	0.54	0.34	0.63	0.25	3.67	5.04	2.99	4.89

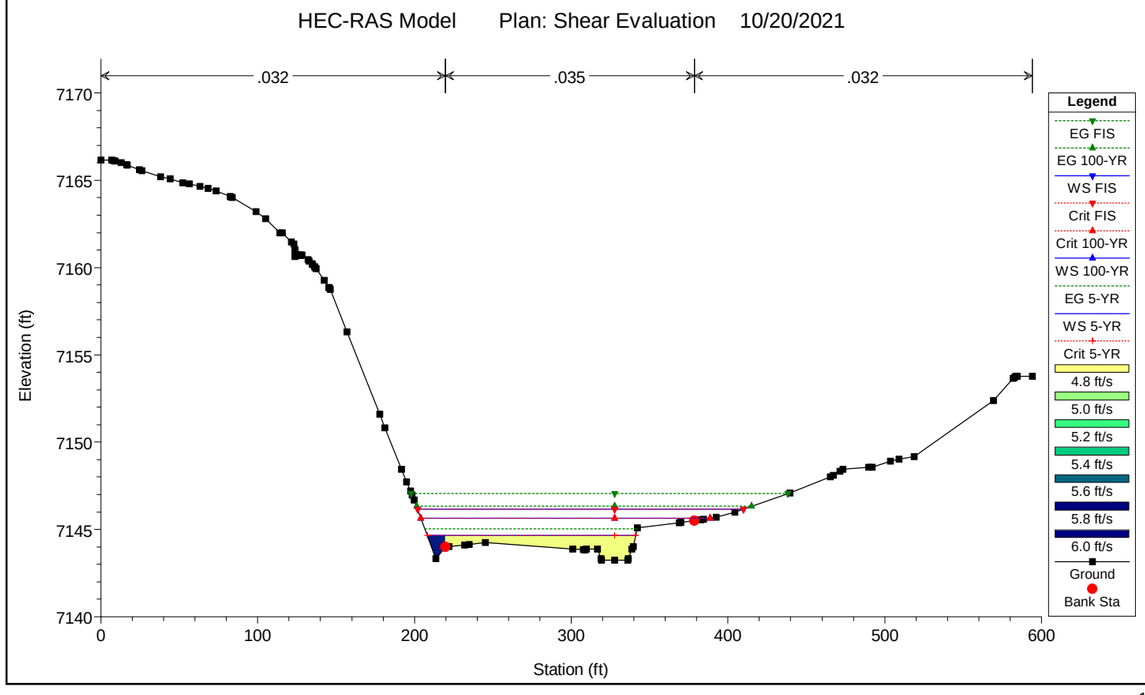
HEC-RAS Plan: Shear River: Sand Creek Reach: Reach 4 (Continued)

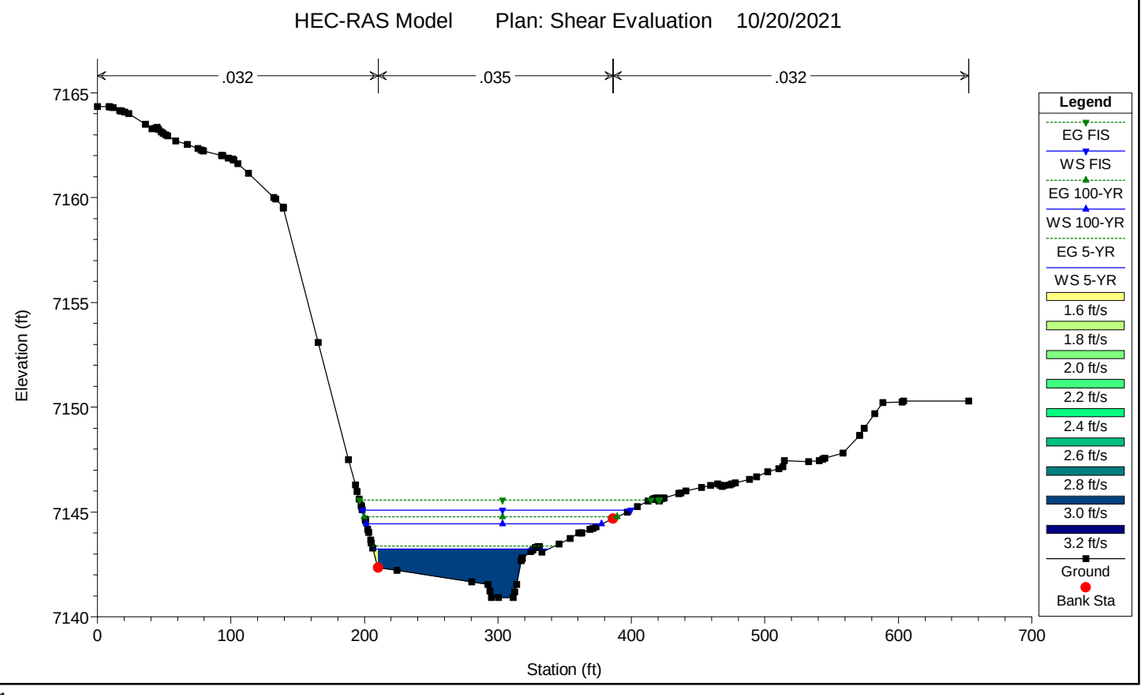
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	876	FIS	2600.00	6997.45	7001.76		7002.34	0.003980	137.12	0.58	0.47	0.88	0.37	4.48	6.21	3.81	5.98
Reach 4	827	5-YR	463.11	6997.33	6999.47		6999.63	0.003865	115.37	0.49	0.17	0.32	0.10	2.33	3.21	1.60	3.16
Reach 4	827	100-YR	1590.50	6997.33	7000.56		7001.08	0.005900	126.04	0.67	0.46	0.90	0.35	4.16	5.90	3.43	5.71
Reach 4	827	FIS	2600.00	6997.33	7001.29		7002.07	0.006339	133.14	0.72	0.64	1.25	0.51	5.10	7.27	4.39	6.98
Reach 4	795	5-YR	463.11	6997.29	6999.33		6999.50	0.004459	119.28	0.52	0.23	0.35	0.16	2.76	3.31	2.15	3.25
Reach 4	795	100-YR	1590.50	6997.29	7000.26		7000.86	0.008007	128.38	0.76	0.66	1.09	0.53	5.00	6.39	4.32	6.19
Reach 4	795	FIS	2600.00	6997.29	7000.76	7000.61	7001.79	0.010346	133.39	0.90	1.02	1.74	0.85	6.40	8.35	5.67	8.04
Reach 4	753	5-YR	463.11	6997.25	6999.04		6999.24	0.008749	151.47	0.68	0.25	0.48	0.17	2.55	3.64	1.98	3.60
Reach 4	753	100-YR	1590.50	6997.25	6999.90		7000.48	0.010007	160.88	0.82	0.55	1.09	0.47	4.26	6.15	3.82	6.03
Reach 4	753	FIS	2600.00	6997.25	7000.34	7000.28	7001.29	0.012444	165.60	0.95	0.85	1.69	0.75	5.50	7.95	5.05	7.76
Reach 4	674	5-YR	463.11	6995.52	6997.77	6997.77	6998.23	0.019051	94.31	1.01	0.09	1.07		1.11	5.46		5.46
Reach 4	674	100-YR	1590.50	6995.52	6998.80	6998.80	6999.47	0.016683	191.06	1.01	0.59	1.37	0.16	4.10	6.57	1.70	6.53
Reach 4	674	FIS	2600.00	6995.52	6999.31	6999.31	7000.22	0.014740	195.00	1.00	0.75	1.68	0.48	4.91	7.69	3.65	7.60
Reach 4	646	5-YR	463.11	6992.83	6995.13		6995.39	0.007276	94.51	0.66	0.44	0.55		3.90	4.11		4.09
Reach 4	646	100-YR	1590.50	6992.83	6996.17	6996.04	6996.89	0.012601	137.20	0.92	1.16	1.35		6.75	6.82		6.81
Reach 4	646	FIS	2600.00	6992.83	6996.76	6996.76	6997.77	0.014405	161.40	1.01	1.58	1.80		8.11	8.09		8.09
Reach 4	627	5-YR	463.11	6992.83	6995.05		6995.24	0.005758	118.31	0.58	0.31	0.41		3.20	3.50		3.49
Reach 4	627	100-YR	1590.50	6992.83	6996.14		6996.63	0.007962	160.27	0.74	0.69	0.89		5.15	5.60		5.58
Reach 4	627	FIS	2600.00	6992.83	6996.76		6997.45	0.008844	183.44	0.80	0.93	1.19		6.17	6.67		6.64
Reach 4	591	5-YR	463.11	6992.76	6994.90		6995.04	0.004603	136.79	0.52	0.20	0.32		2.50	3.09		3.08
Reach 4	591	100-YR	1590.50	6992.76	6995.95		6996.34	0.006447	181.67	0.66	0.49	0.72		4.25	5.01		4.98
Reach 4	591	FIS	2600.00	6992.76	6996.58		6997.12	0.006932	204.07	0.71	0.66	0.94		5.10	5.95		5.92
Reach 4	522	5-YR	463.11	6992.58	6994.65		6994.75	0.003513	187.77	0.44	0.11	0.22		1.77	2.51		2.50
Reach 4	522	100-YR	1590.50	6992.58	6995.71		6995.95	0.003973	228.63	0.52	0.26	0.45		2.98	3.95		3.93
Reach 4	522	FIS	2600.00	6992.58	6996.36		6996.69	0.004090	256.59	0.55	0.34	0.57		3.62	4.64		4.61
Reach 4	445	5-YR	463.11	6992.49	6994.27		6994.41	0.005764	178.89	0.55	0.34	0.31		3.41	2.94		2.96
Reach 4	445	100-YR	1590.50	6992.49	6995.30		6995.59	0.005596	234.46	0.60	0.50	0.55		4.43	4.30		4.31
Reach 4	445	FIS	2600.00	6992.49	6996.00		6996.35	0.004798	263.17	0.59	0.53	0.62		4.71	4.79		4.79
Reach 4	372	5-YR	463.11	6992.12	6993.86		6993.99	0.005630	186.43	0.55	0.38	0.30		3.66	2.84		2.90
Reach 4	372	100-YR	1590.50	6992.12	6994.94		6995.21	0.004478	213.78	0.55	0.45	0.50		4.29	4.18		4.19
Reach 4	372	FIS	2600.00	6992.12	6995.67		6996.03	0.004078	231.84	0.55	0.51	0.60		4.70	4.80		4.80
Reach 4	299	5-YR	463.11	6991.89	6993.39		6993.56	0.006225	150.58	0.59	0.30	0.37		3.08	3.25		3.24
Reach 4	299	100-YR	1590.50	6991.89	6994.56		6994.86	0.005143	208.12	0.59	0.43	0.56		4.05	4.43		4.41
Reach 4	299	FIS	2600.00	6991.89	6995.36		6995.73	0.003981	218.49	0.55	0.43	0.62		4.23	4.91		4.88
Reach 4	249	5-YR	463.11	6991.38	6992.96		6993.18	0.008624	128.86	0.69	0.23	0.52		2.48	3.83		3.81
Reach 4	249	100-YR	1590.50	6991.38	6994.21		6994.57	0.006085	186.81	0.64	0.40	0.68		3.73	4.88		4.85
Reach 4	249	FIS	2600.00	6991.38	6995.09		6995.52	0.004280	194.90	0.57	0.39	0.70		3.94	5.28	0.19	5.23
Reach 4	182	5-YR	463.11	6990.73	6992.49		6992.69	0.006339	124.72	0.60	0.18	0.43		2.16	3.55		3.53
Reach 4	182	100-YR	1590.50	6990.73	6993.83		6994.22	0.004665	149.10	0.59	0.32	0.67	0.10	3.40	5.03	1.55	4.95
Reach 4	182	FIS	2600.00	6990.73	6994.72		6995.23	0.004051	157.67	0.58	0.39	0.80	0.20	3.95	5.83	2.49	5.69
Reach 4	86	5-YR	463.11	6990.03	6991.78	6991.46	6992.03	0.007321	101.61	0.66		0.53	0.03		4.01	0.60	4.01
Reach 4	86	100-YR	1590.50	6990.03	6993.00	6992.62	6993.64	0.007326	118.50	0.74	0.25	1.09	0.43	2.65	6.47	3.83	6.30
Reach 4	86	FIS	2600.00	6990.03	6993.77	6993.36	6994.68	0.007333	126.88	0.78	0.42	1.44	0.66	3.75	7.80	5.05	7.50

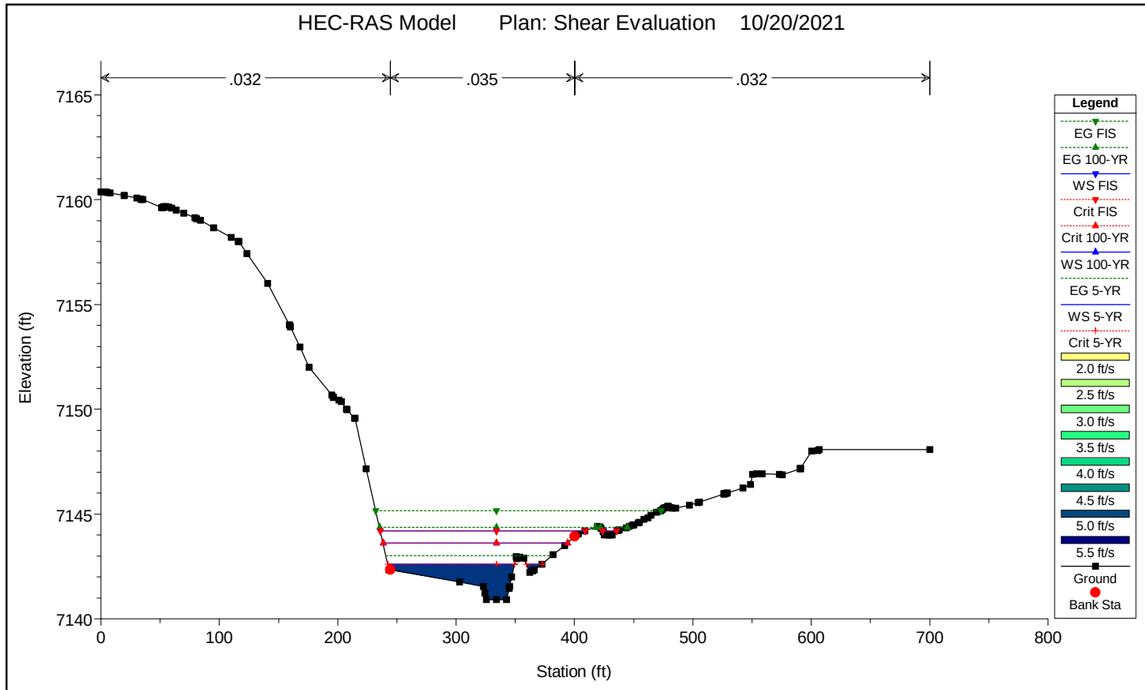
Supercritical / high Froude Nos highlighted

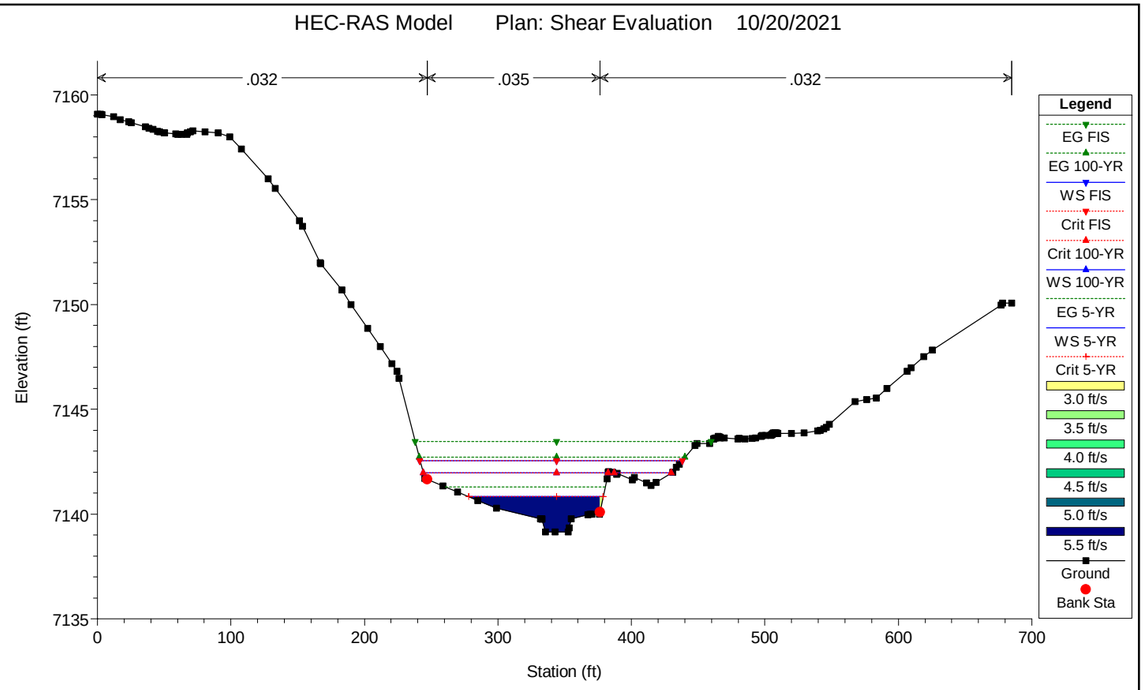

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta

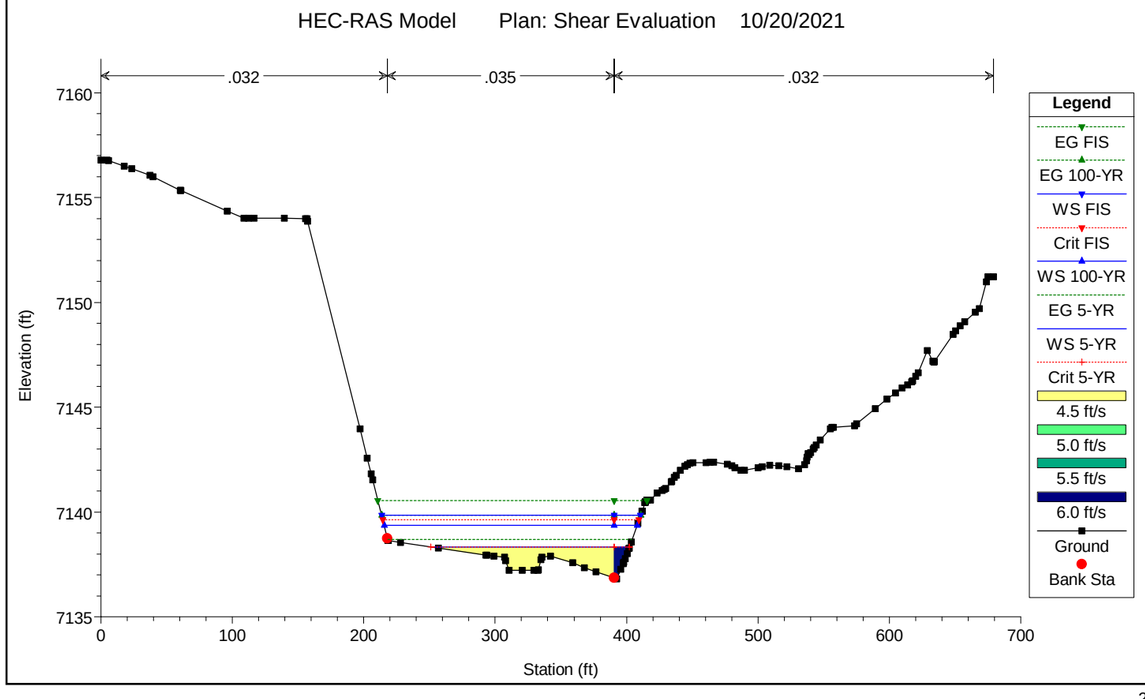

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Provide main channel stations
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta

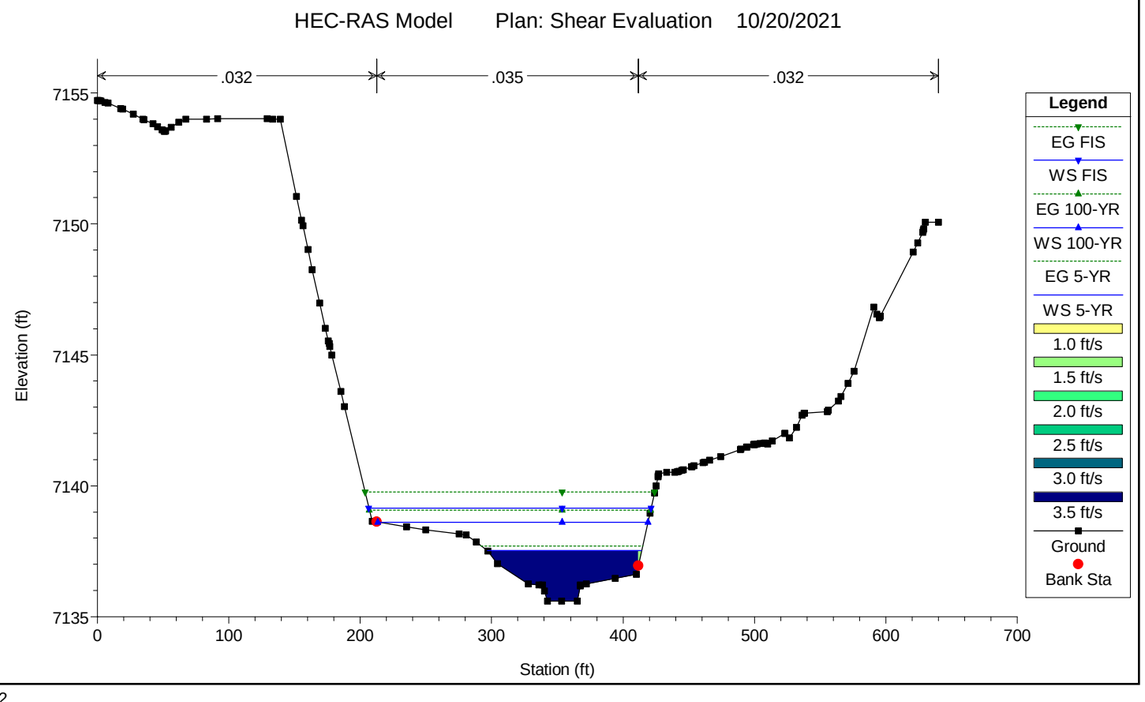

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
5.6 ft/s
5.8 ft/s
6.0 ft/s
Ground
Bank Sta

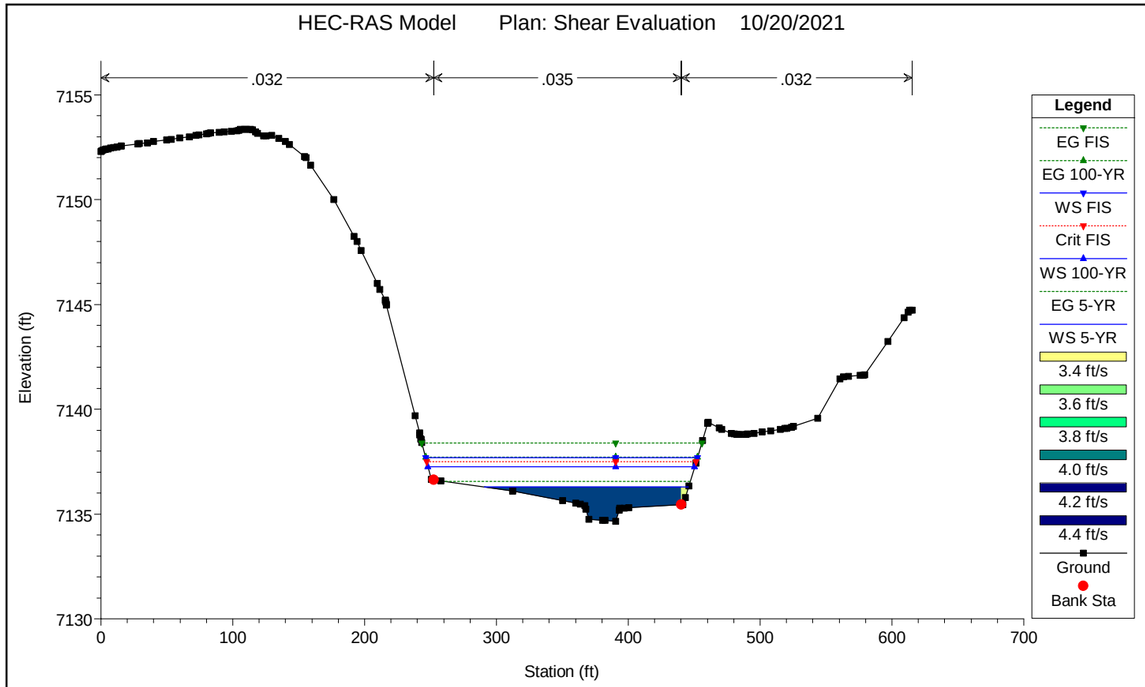

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Bank Sta

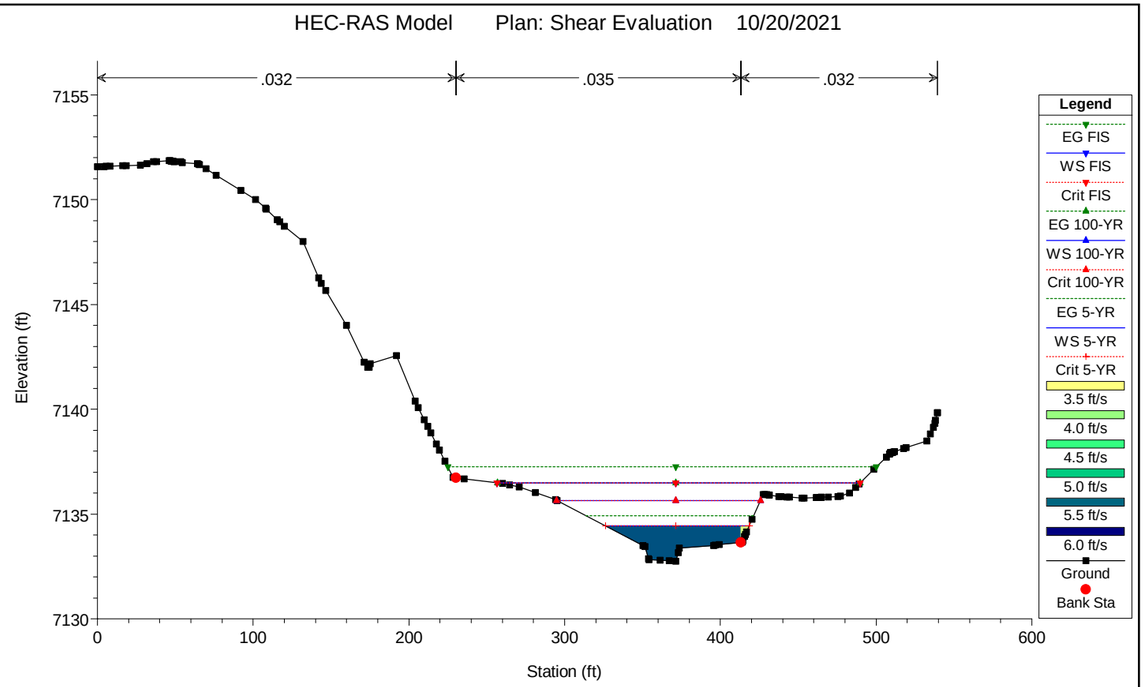

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
Ground
Bank Sta

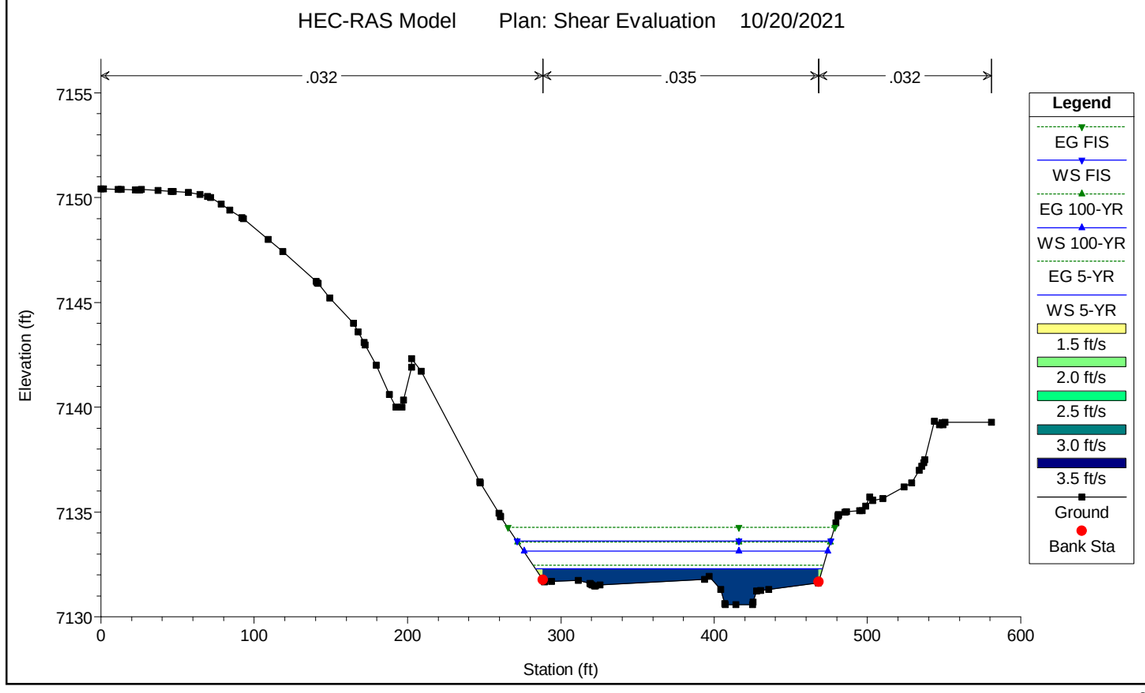

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
Ground
Bank Sta

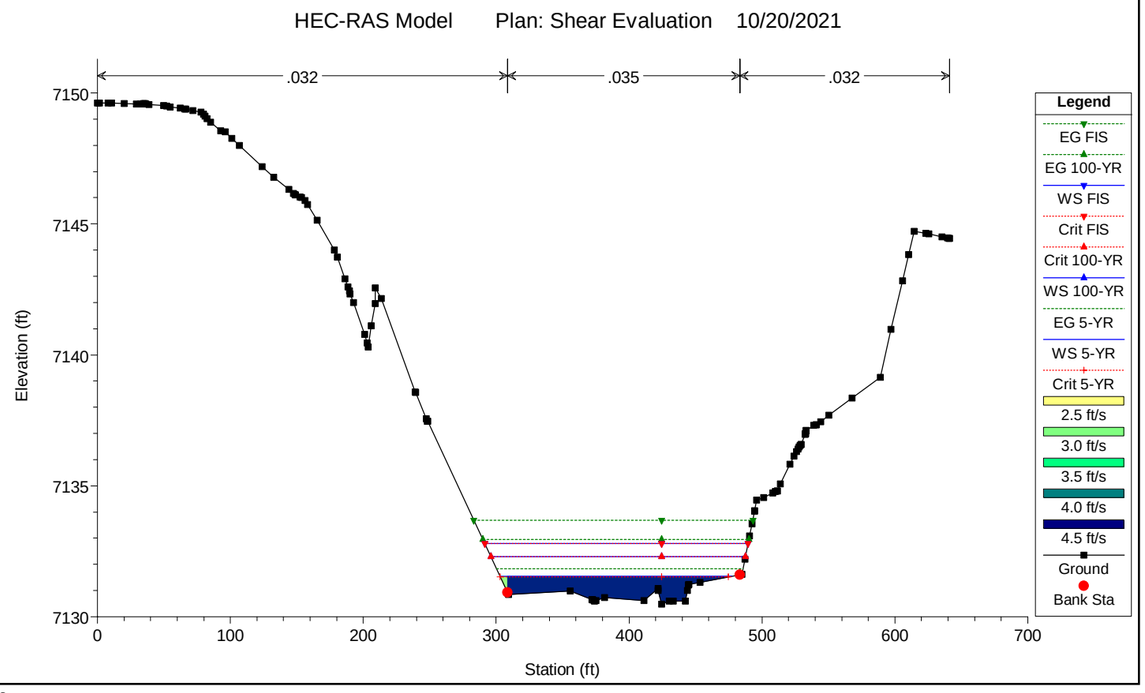

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
Ground
Bank Sta

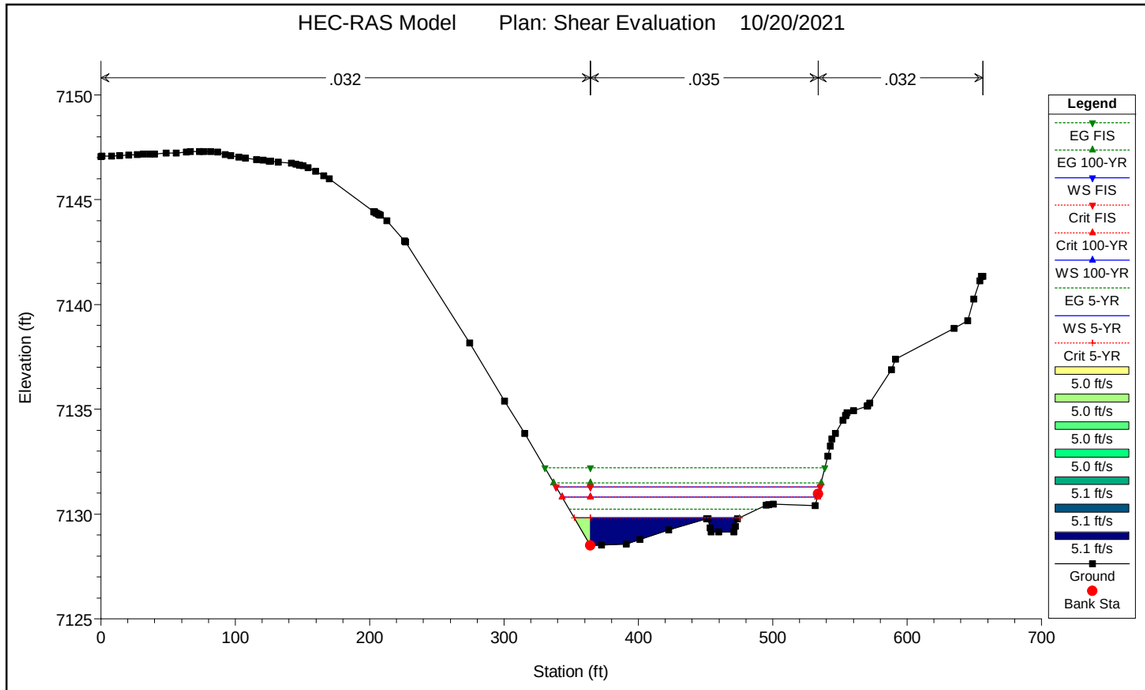

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
EG 5-YR
WS 5-YR
3.4 ft/s
3.6 ft/s
3.8 ft/s
4.0 ft/s
4.2 ft/s
4.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
Crit FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
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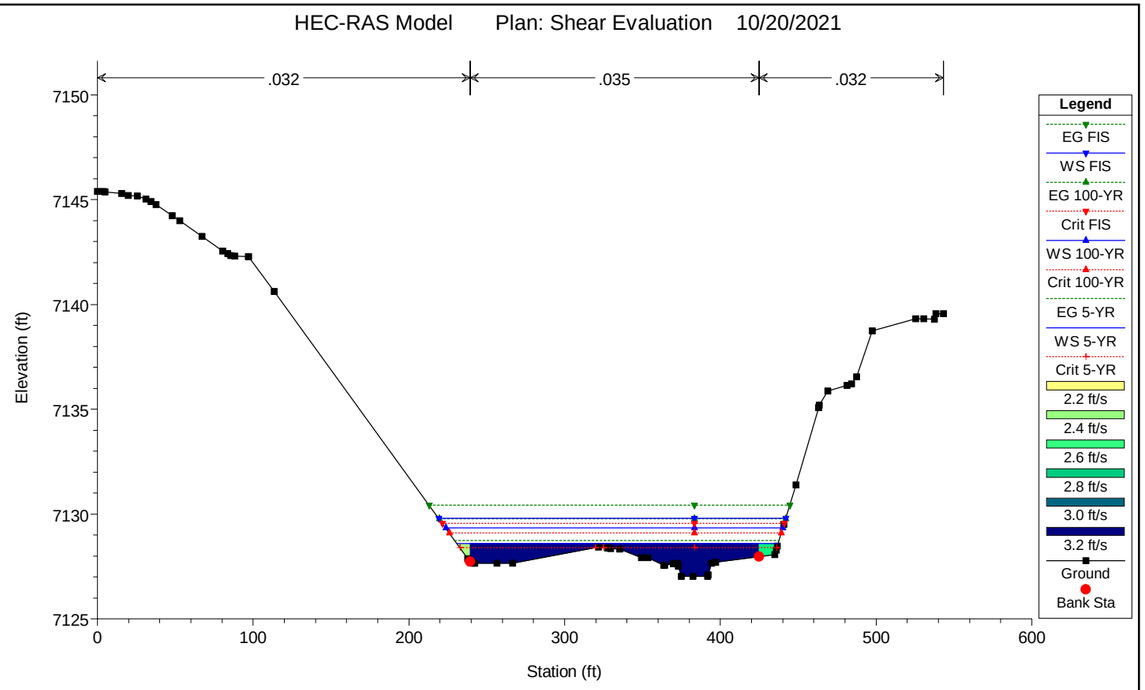
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
5.0 ft/s
5.0 ft/s
5.0 ft/s
5.0 ft/s
5.1 ft/s
5.1 ft/s
5.1 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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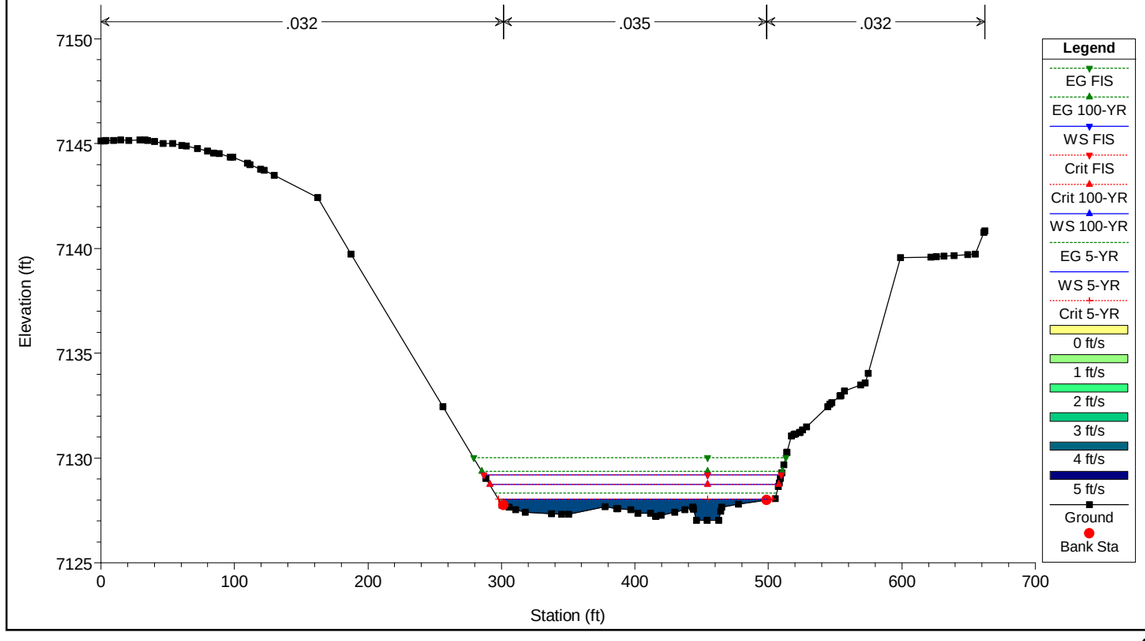
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Bank Sta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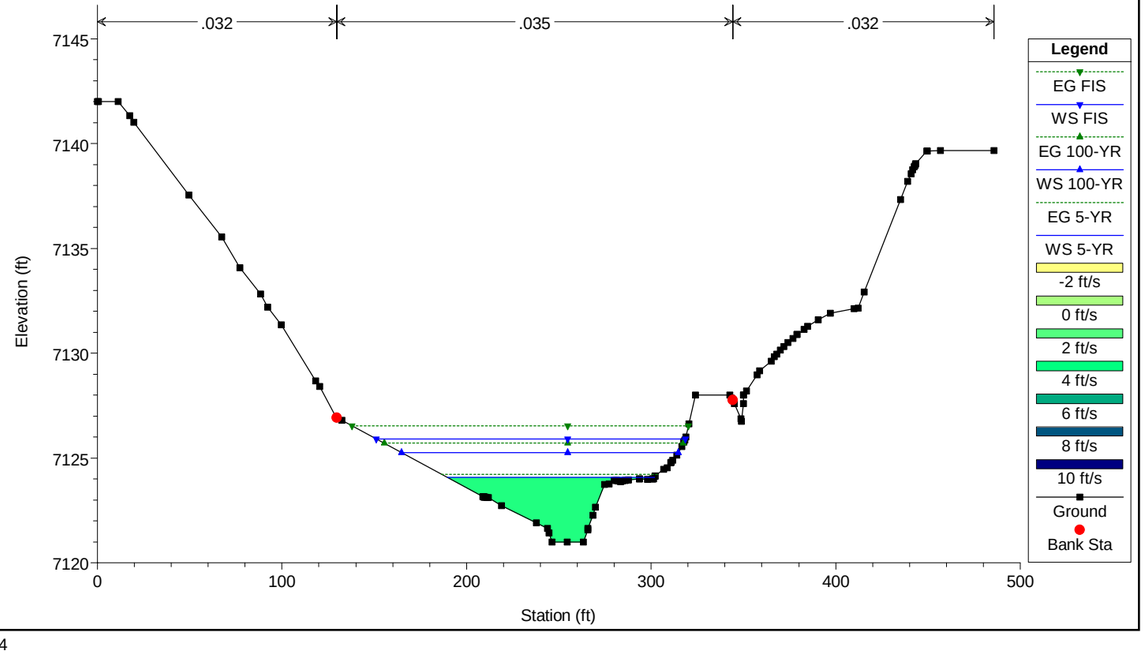
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta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.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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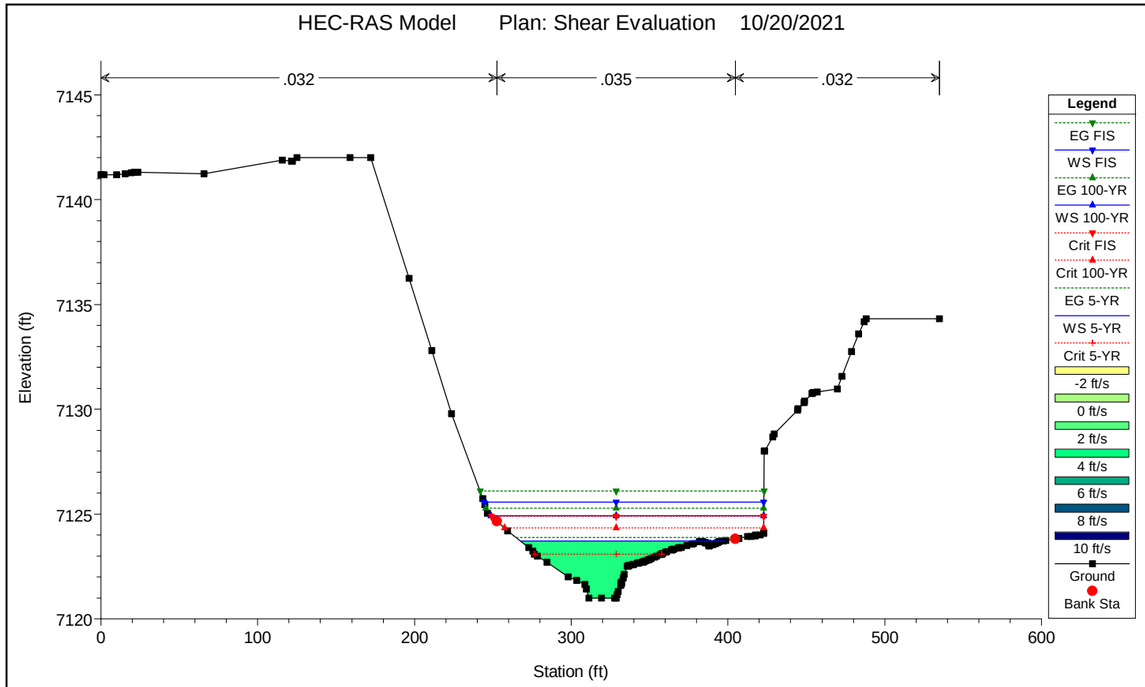
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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WS FIS
EG 100-YR
WS 100-YR
Crit FIS
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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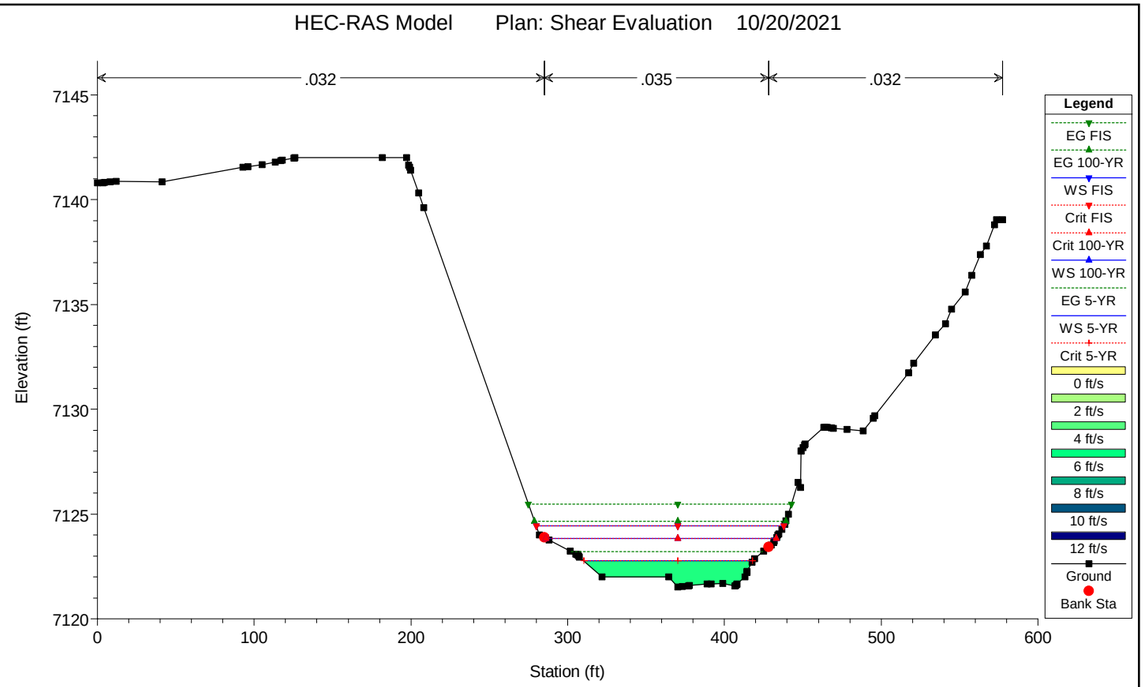
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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2 ft/s
4 ft/s
6 ft/s
8 ft/s
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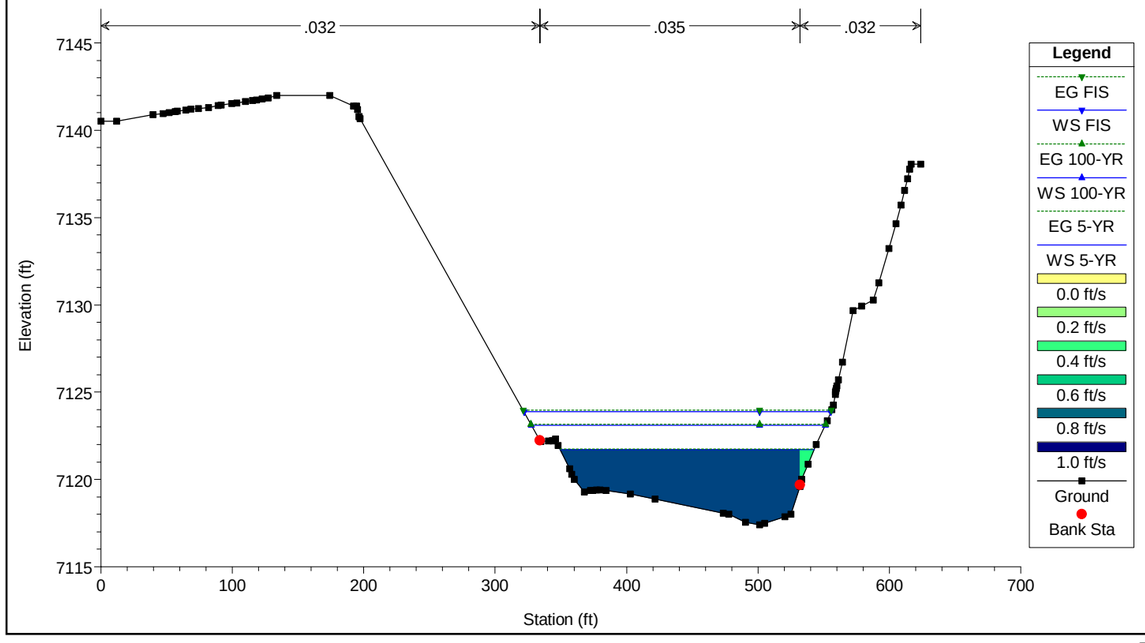
12 ft/s
Ground
Bank Sta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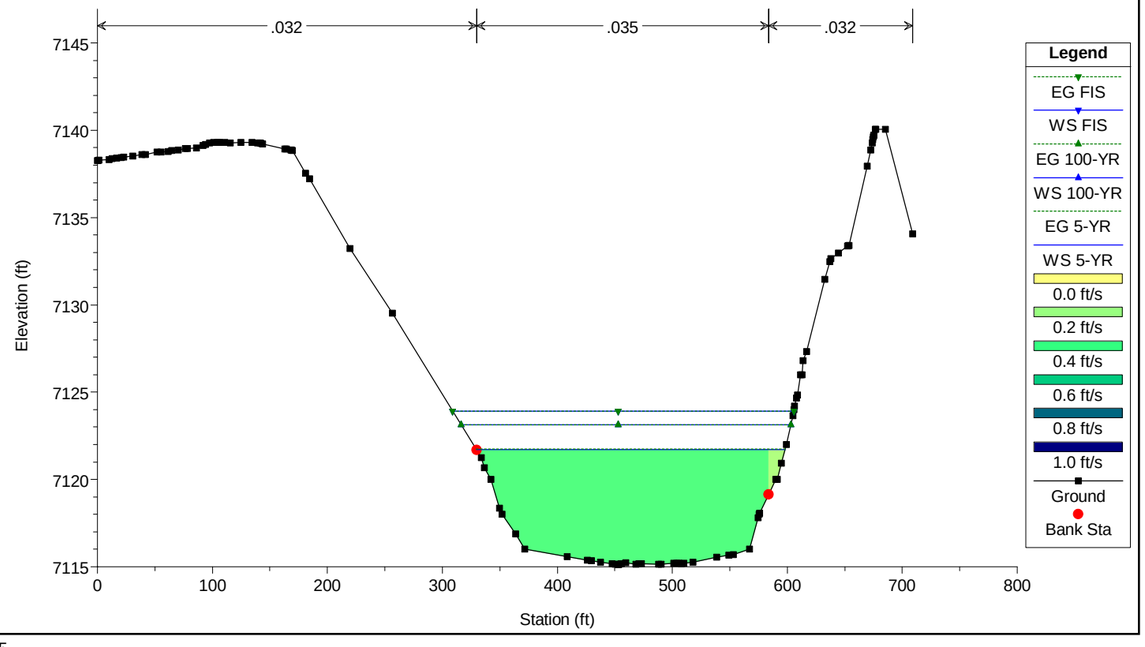
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
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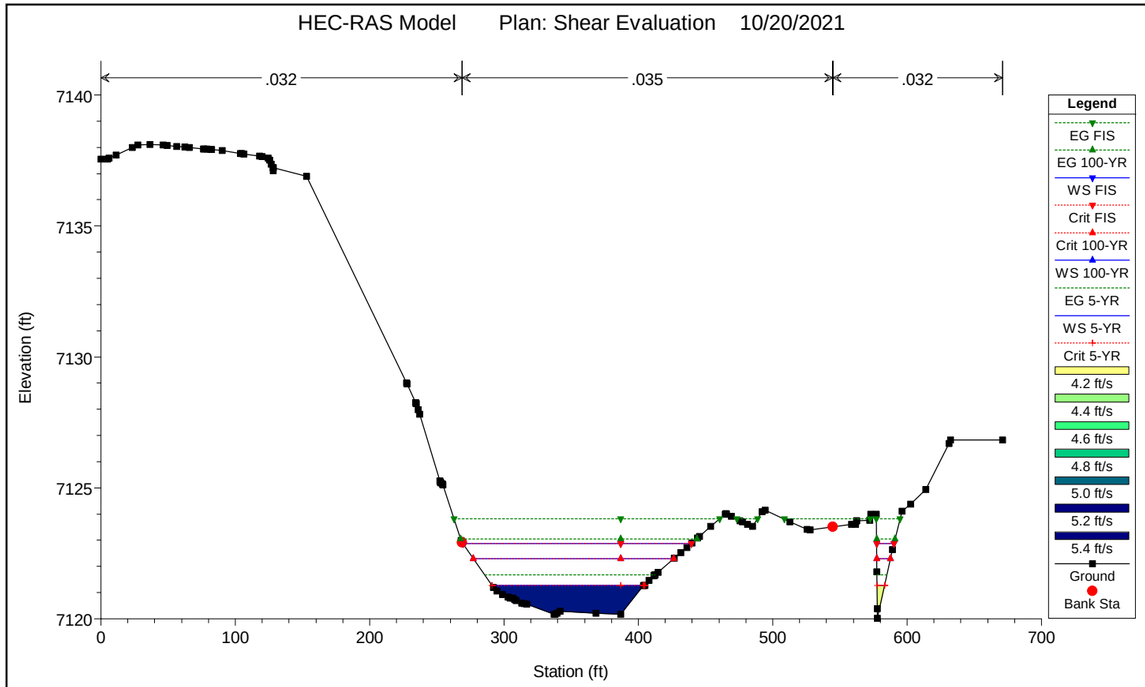
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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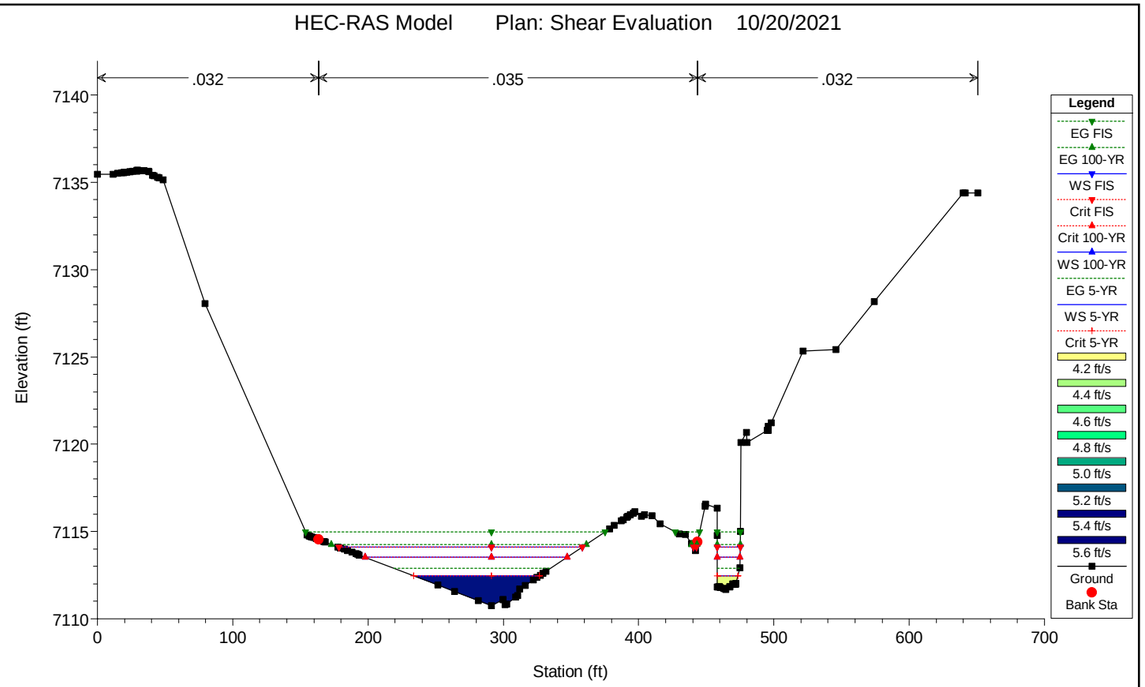
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
Ground
Bank Sta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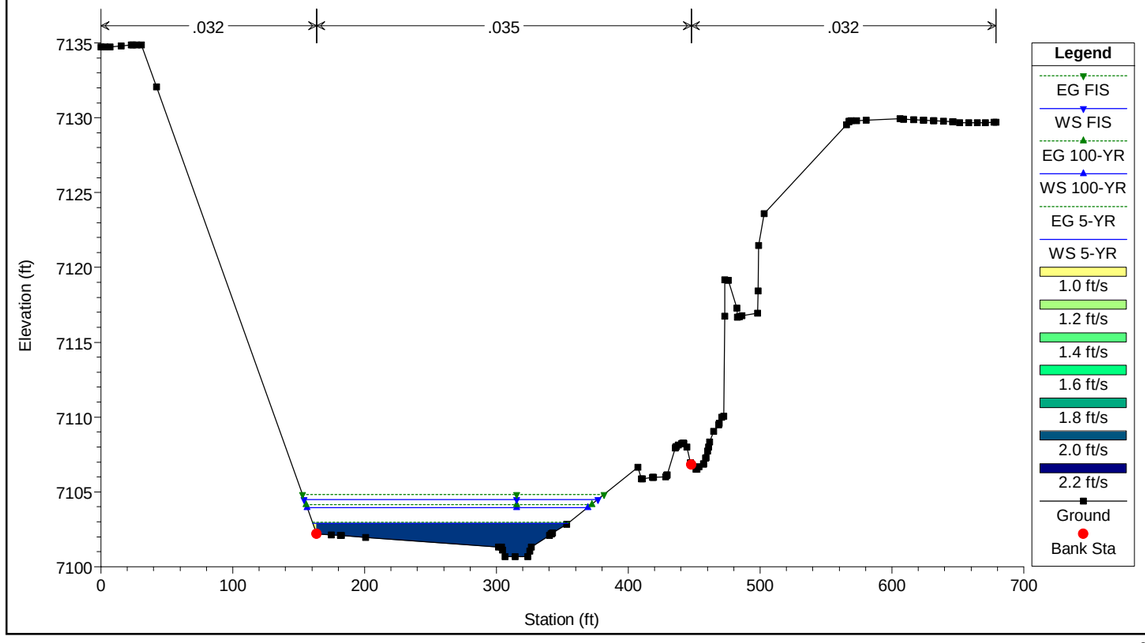
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
5.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
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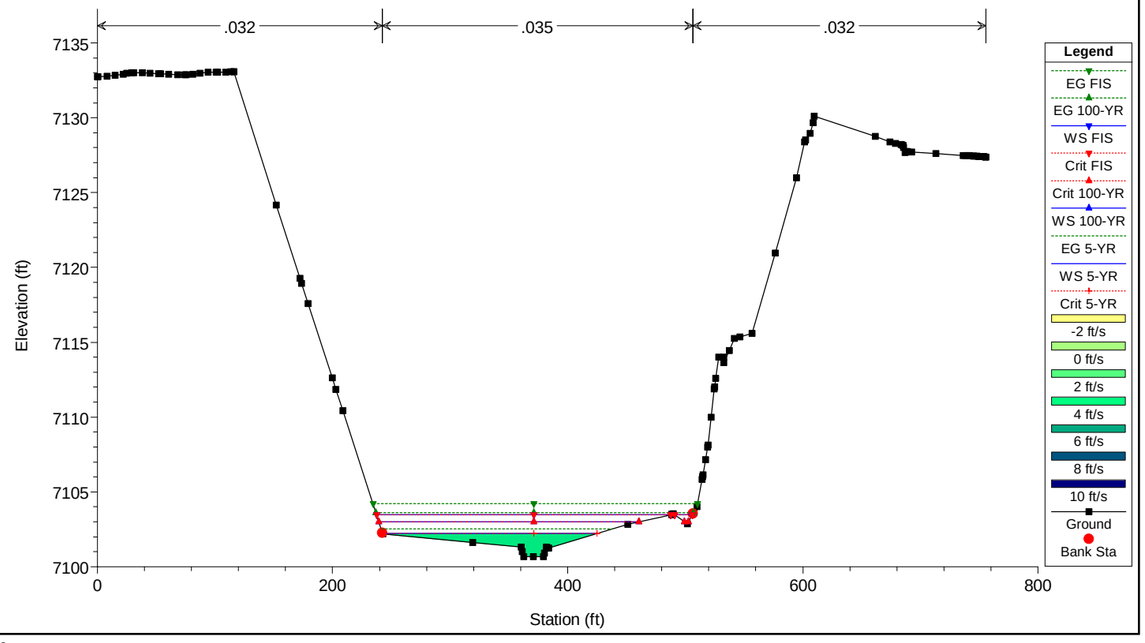
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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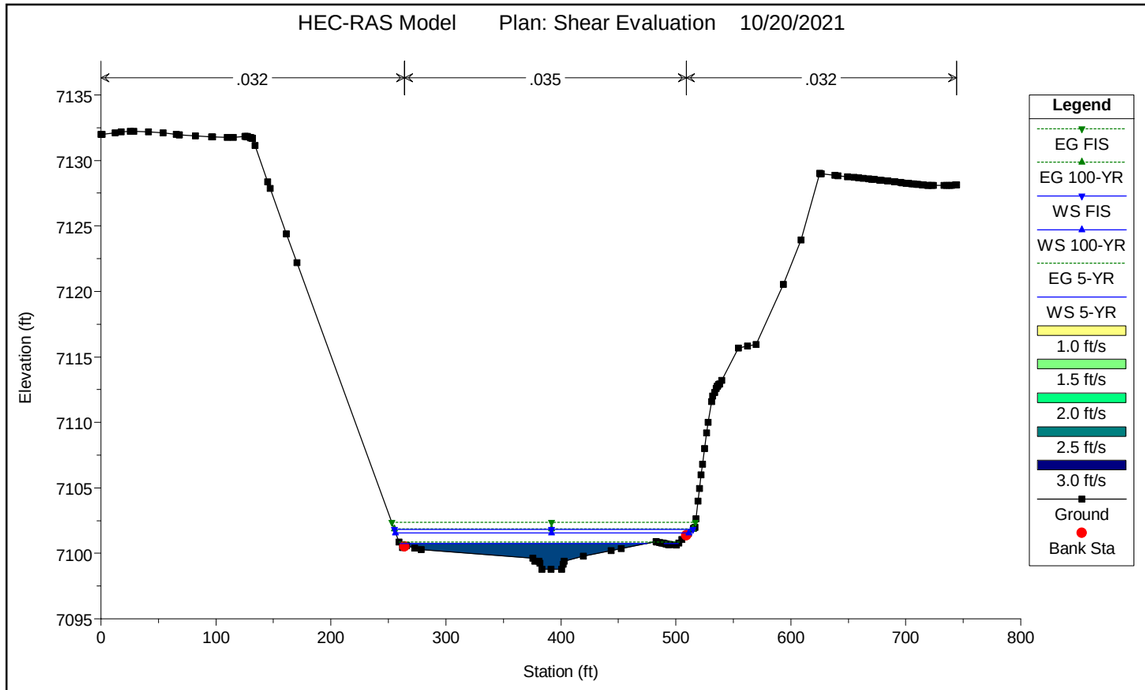
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
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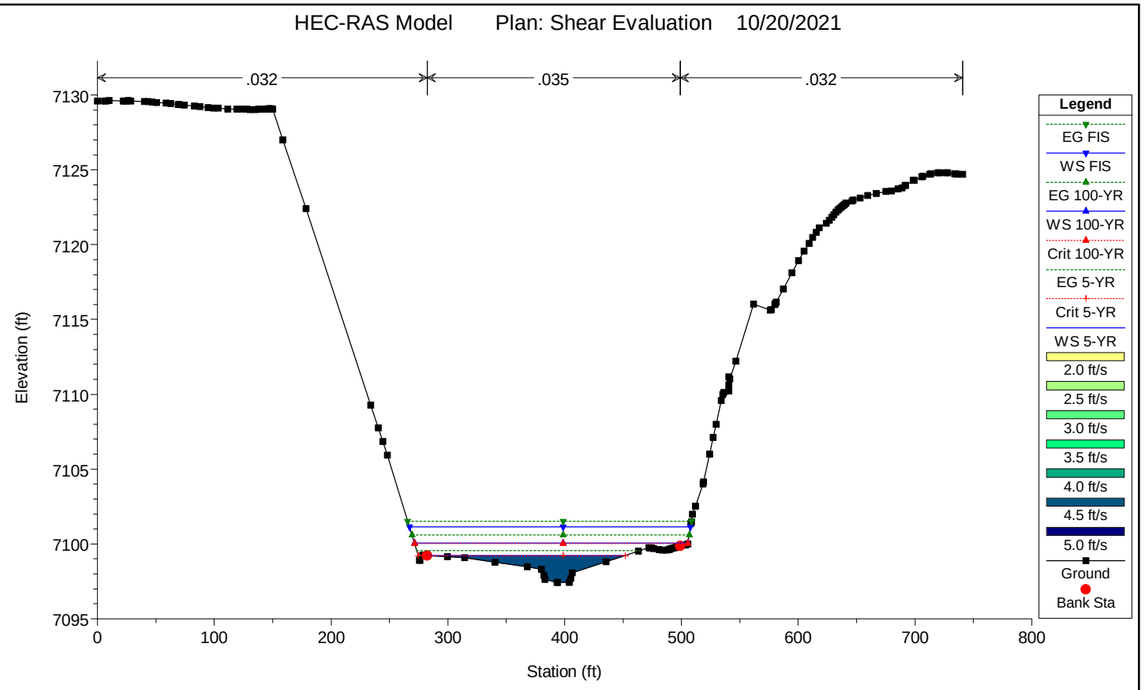
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
WS 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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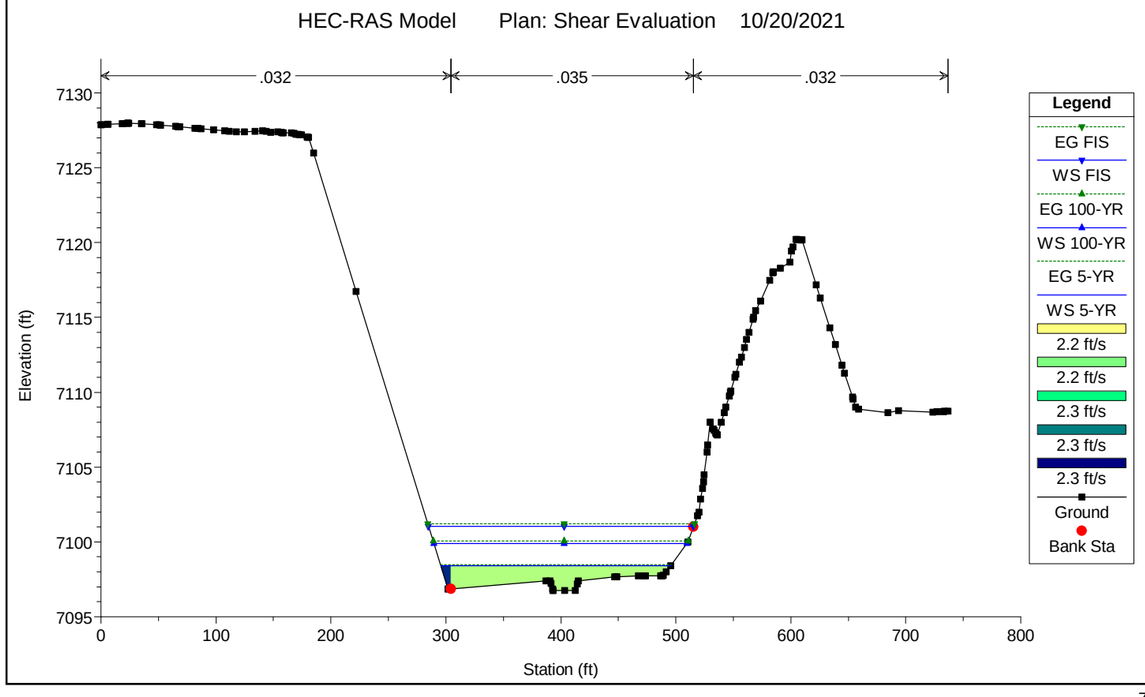
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
Crit 5-YR
WS 5-YR
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
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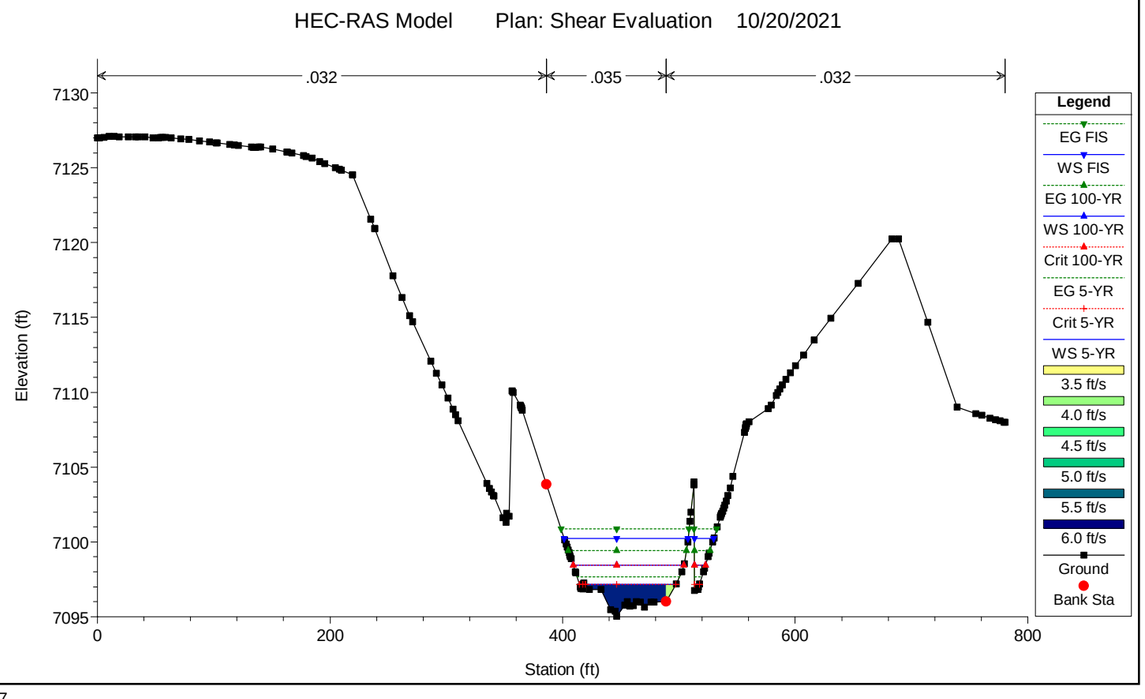
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.2 ft/s
2.2 ft/s
2.3 ft/s
2.3 ft/s
2.3 ft/s
Ground
Bank Sta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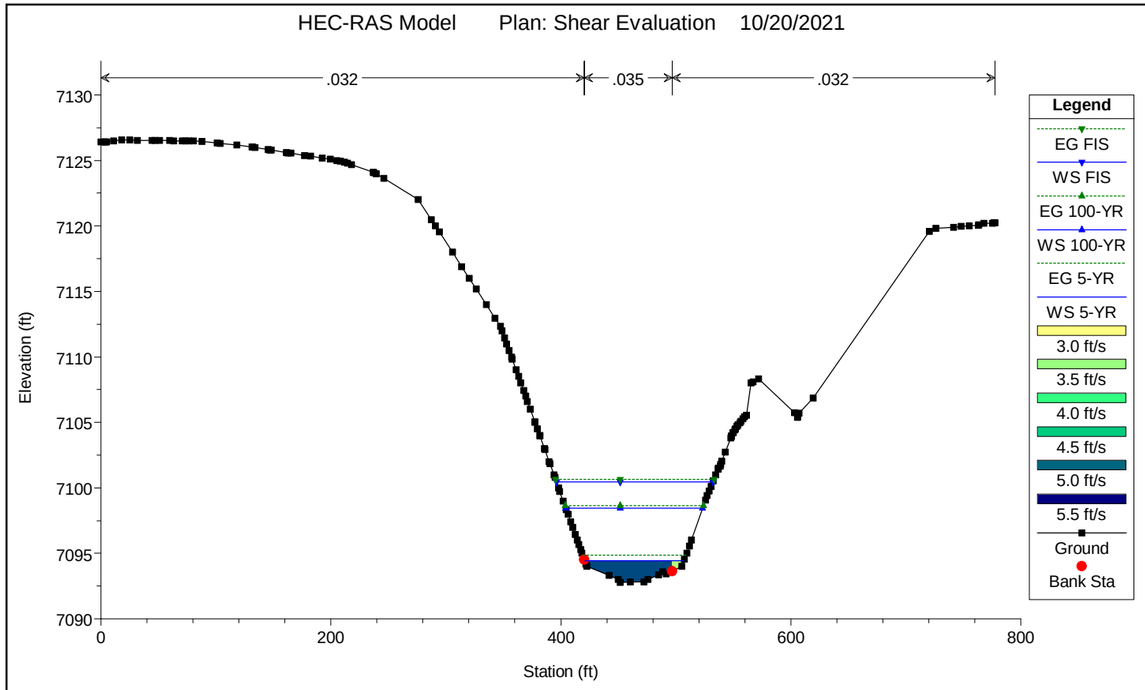
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
Crit 5-YR
WS 5-YR
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
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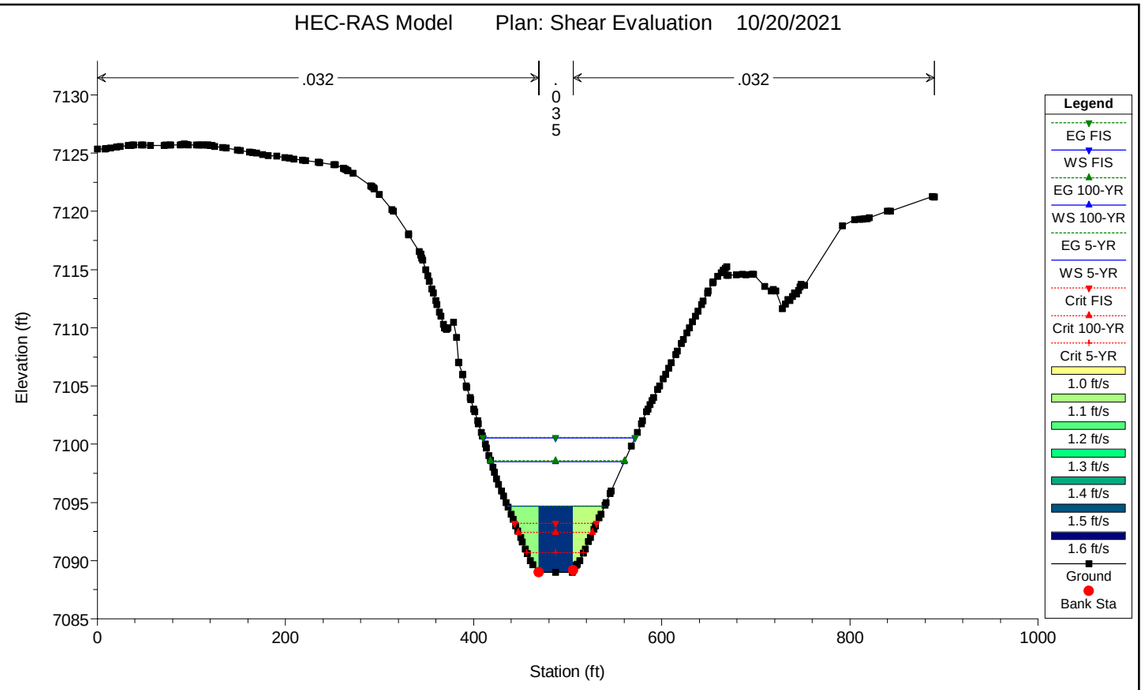
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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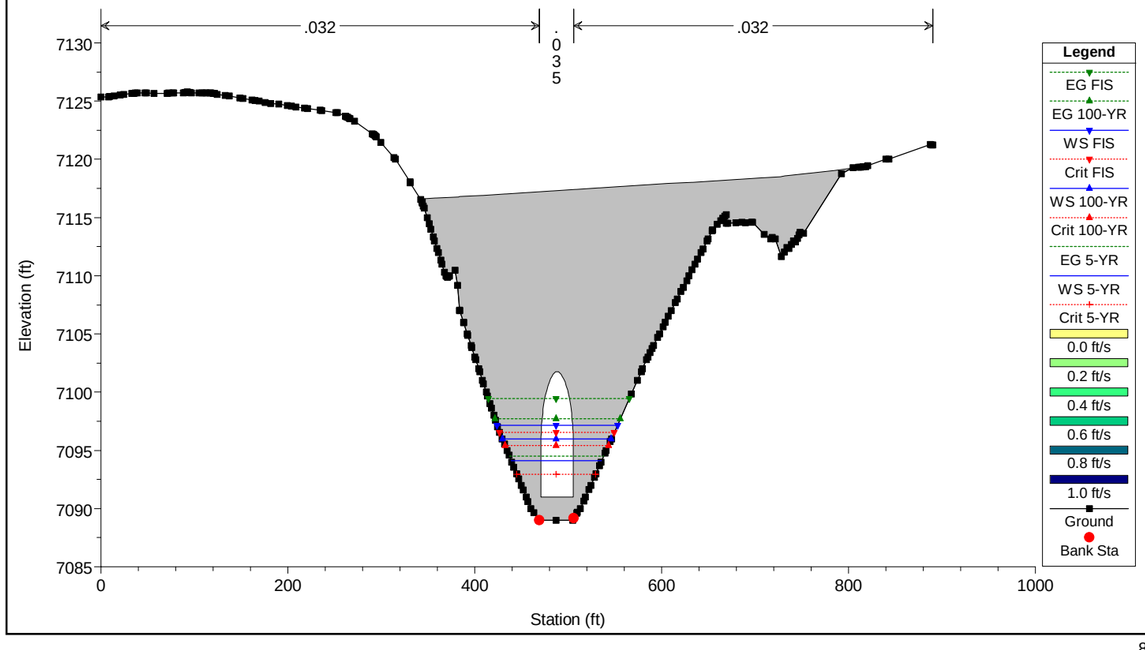
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit FIS
Crit 100-YR
Crit 5-YR
1.0 ft/s
1.1 ft/s
1.2 ft/s
1.3 ft/s
1.4 ft/s
1.5 ft/s
1.6 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
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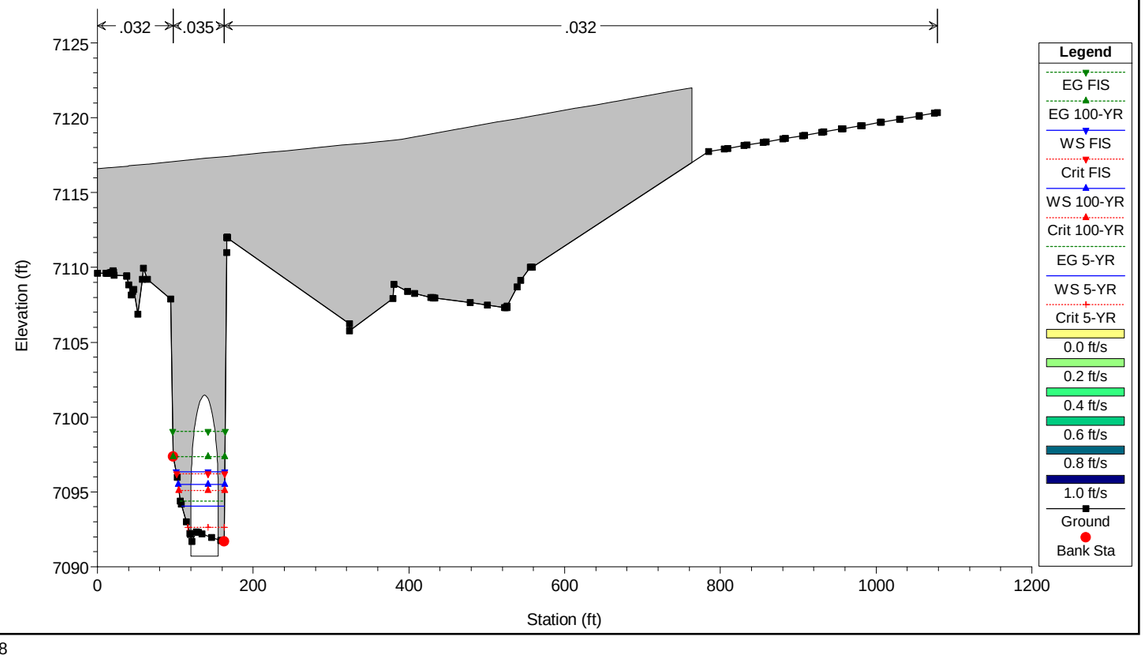
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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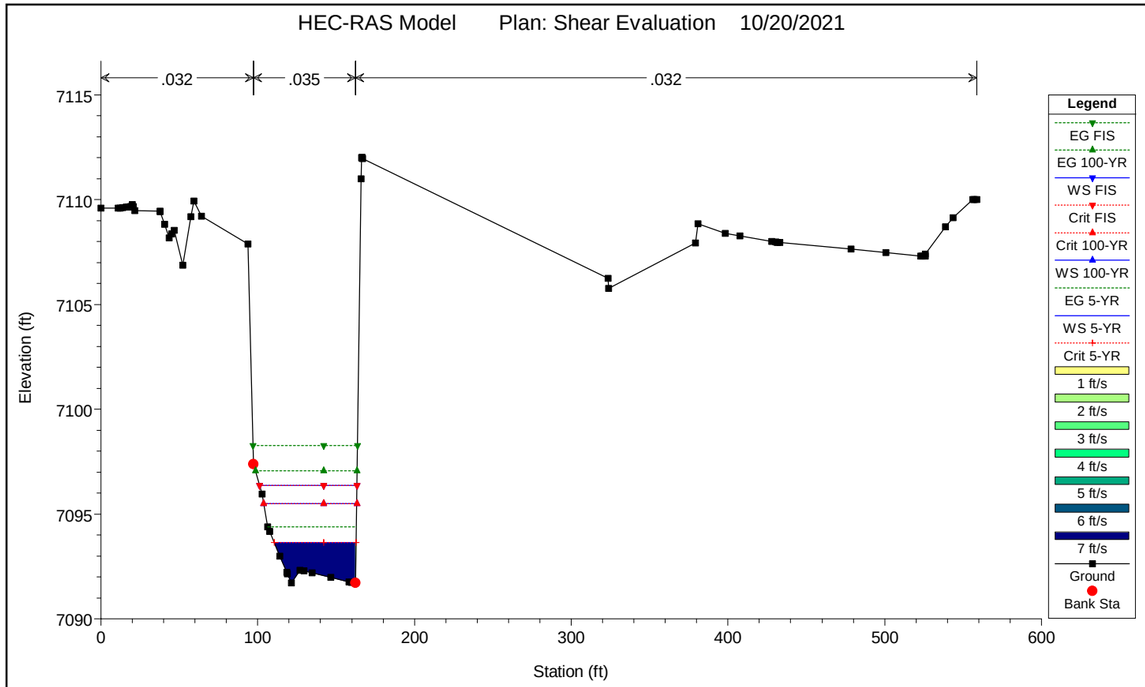
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
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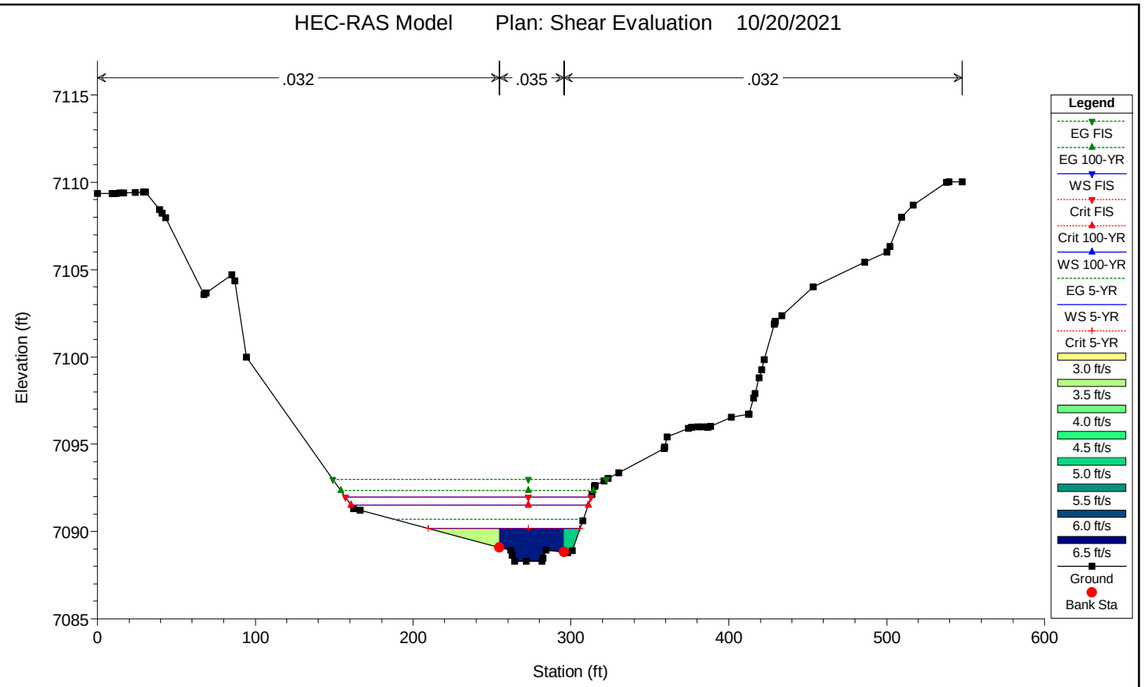
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.0 ft/s
3.5 ft/s
4.0 ft/s
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Ground
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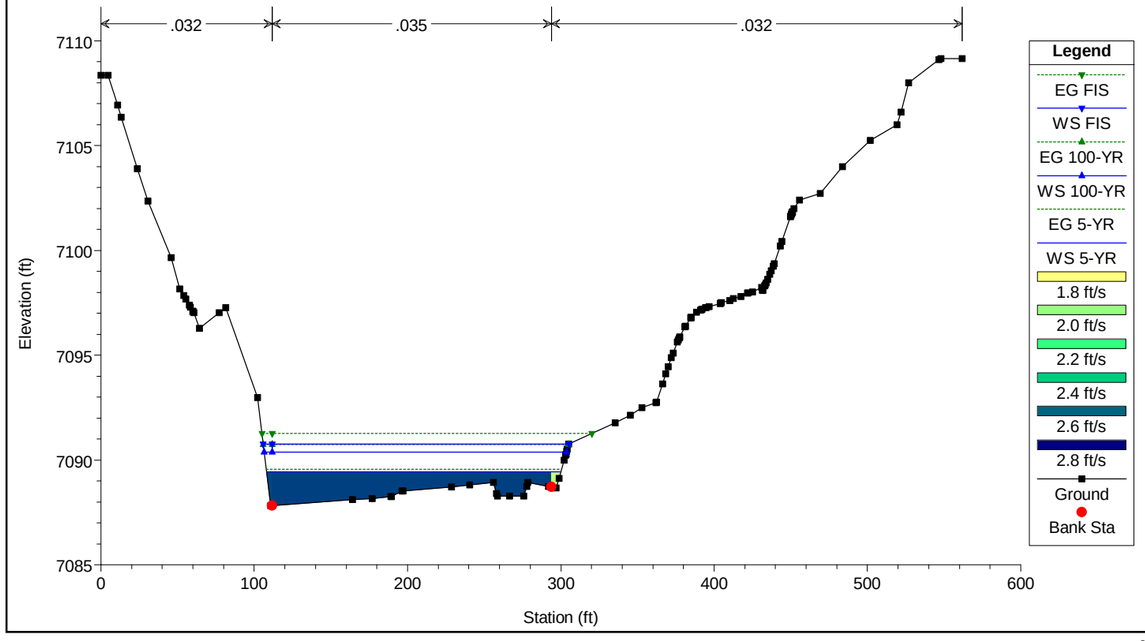
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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1.8 ft/s
2.0 ft/s
2.2 ft/s
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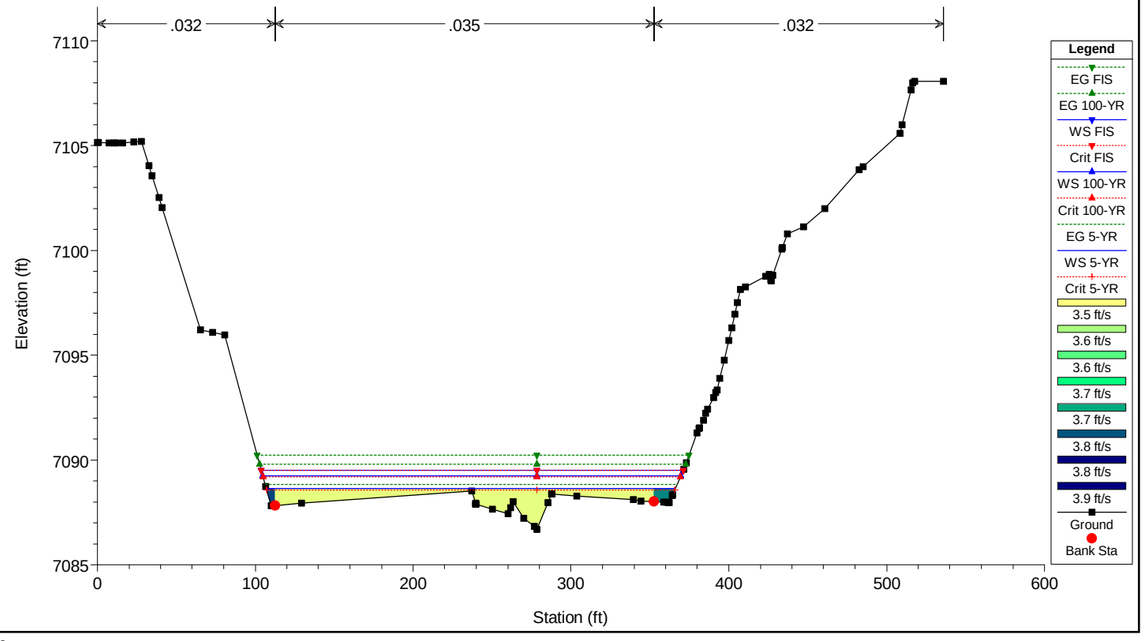
2.8 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3.5 ft/s
3.6 ft/s
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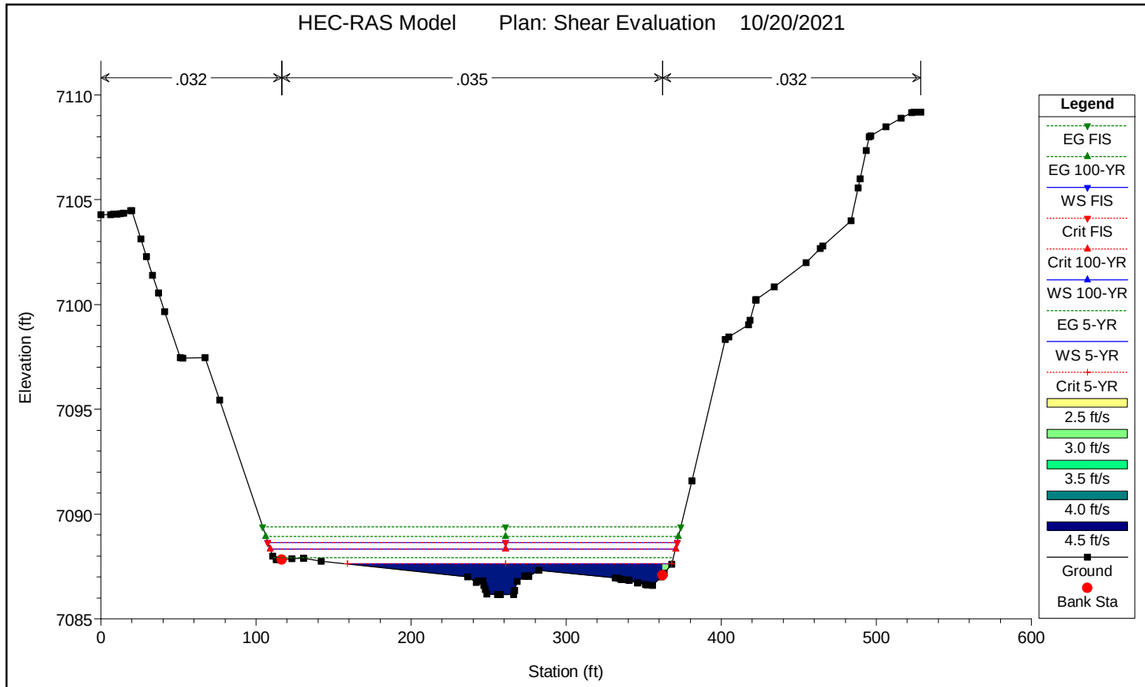
3.8 ft/s
3.9 ft/s
Ground
Bank Sta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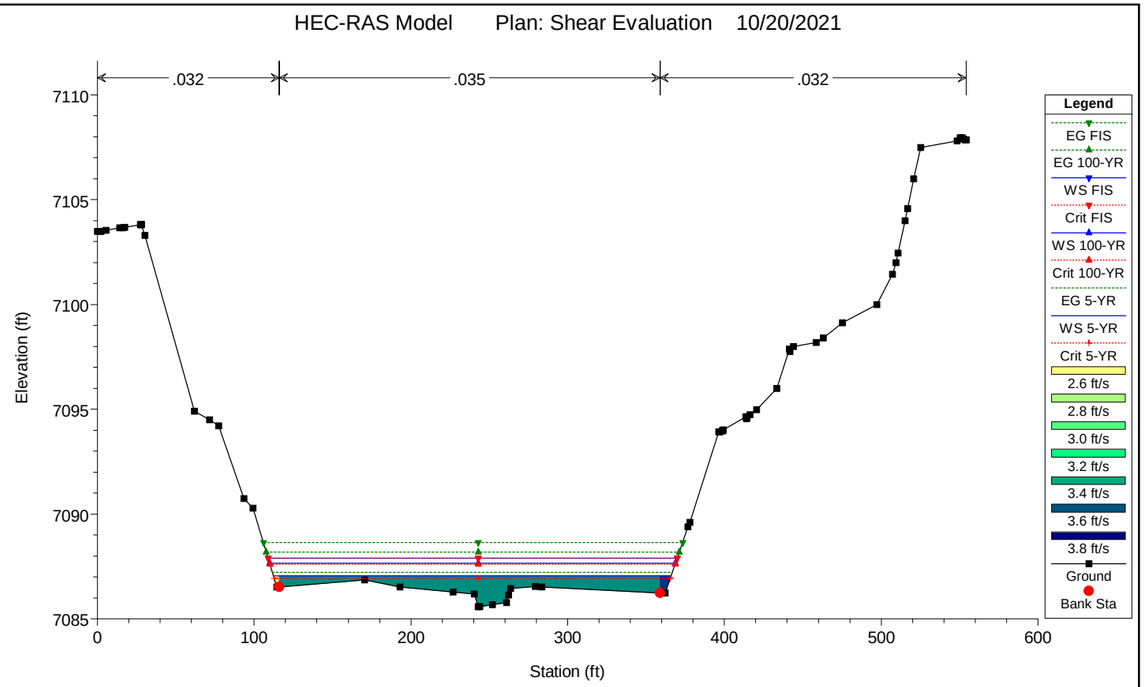
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Bank Sta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.035
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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
3.6 ft/s
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Ground
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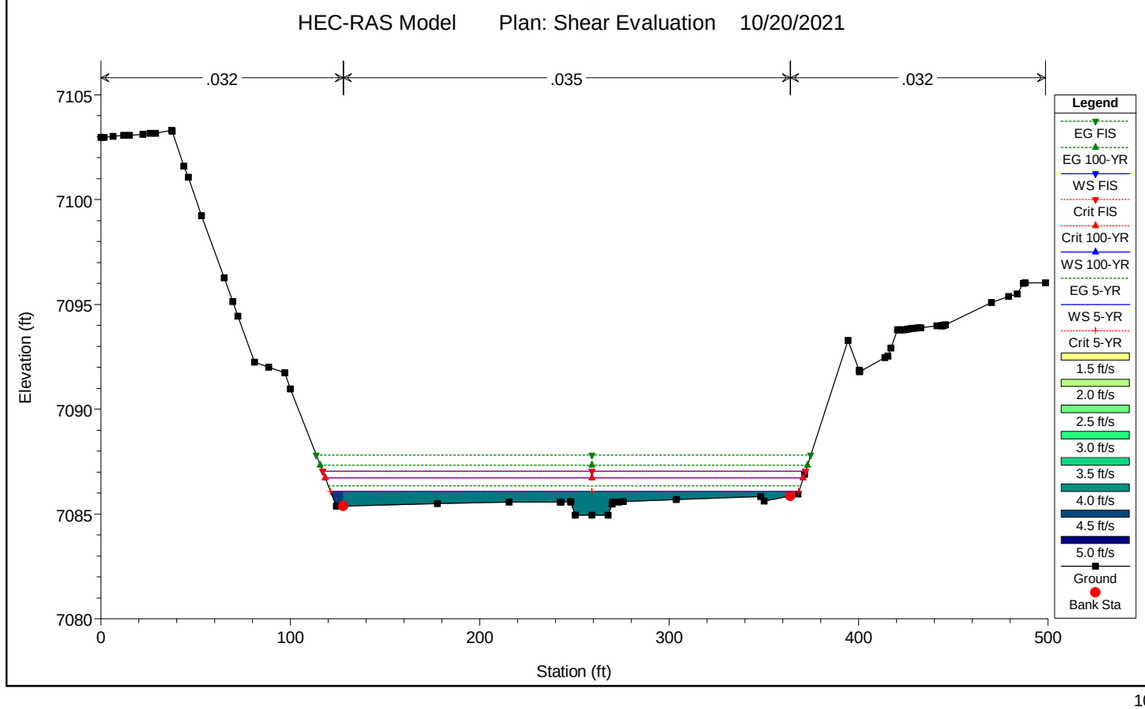
HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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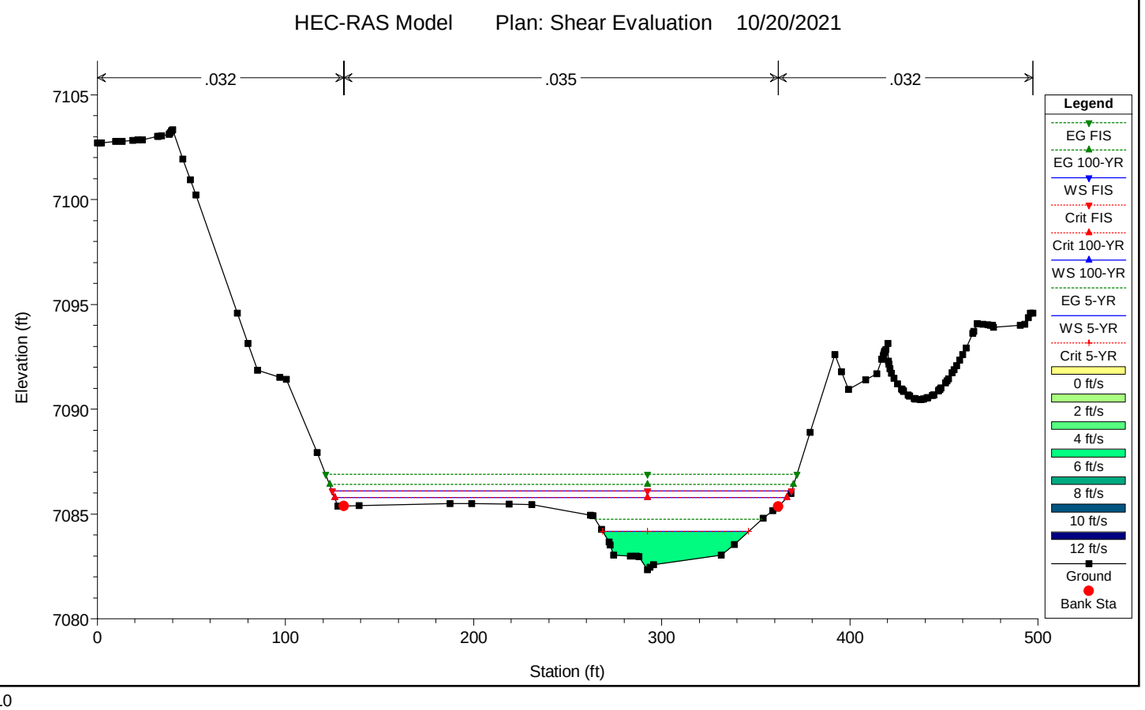
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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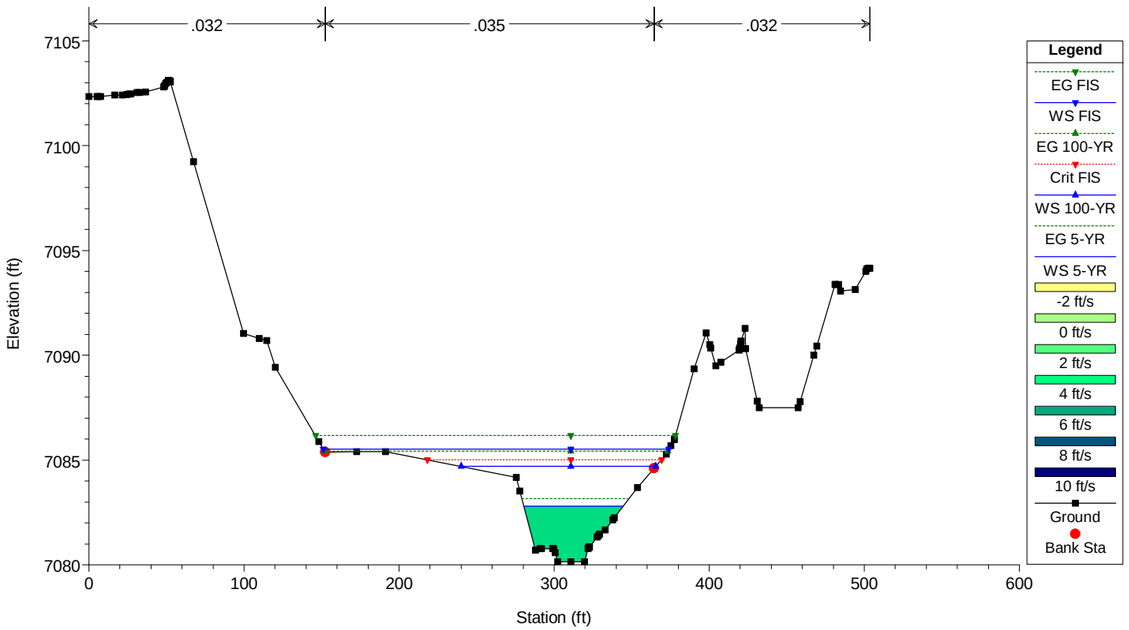
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Shear Evaluation 10/20/2021



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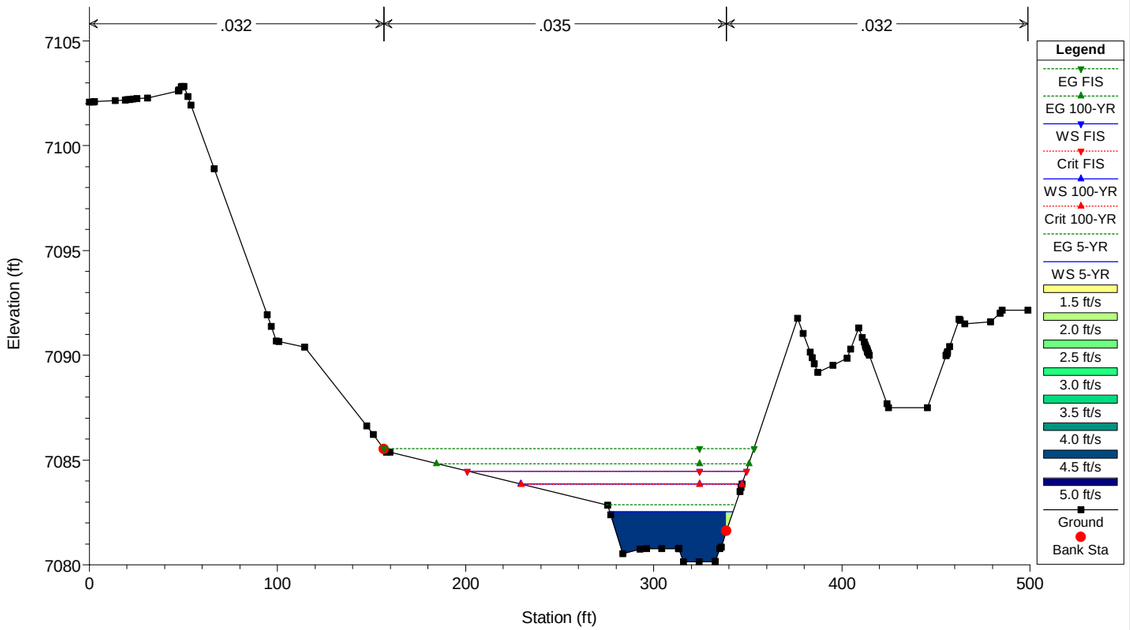

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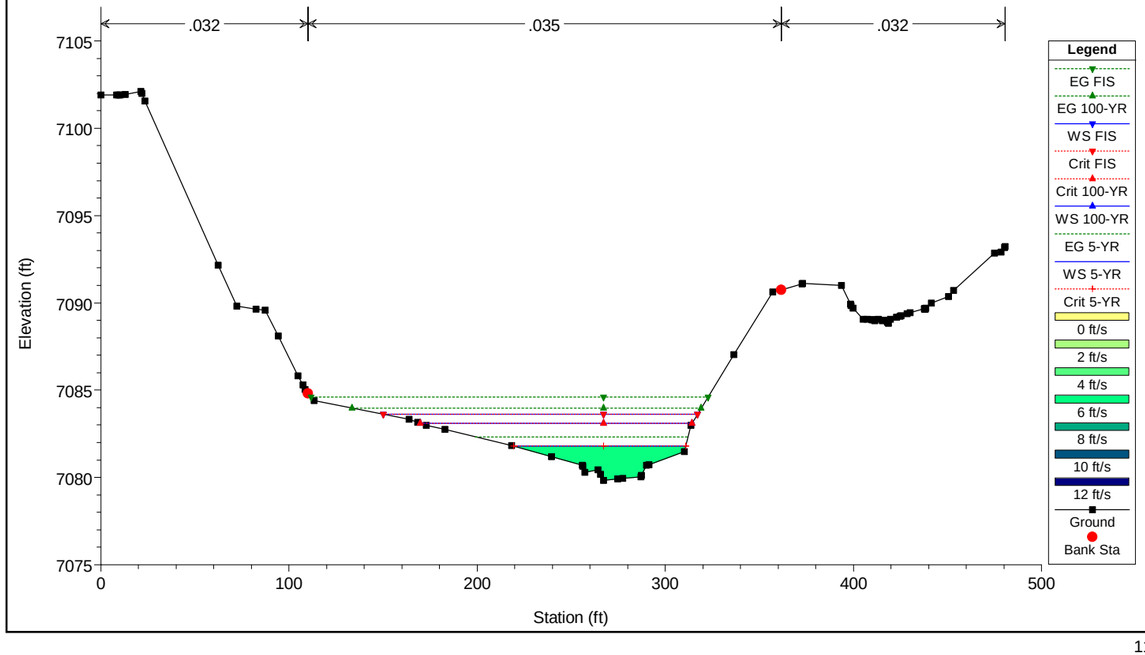

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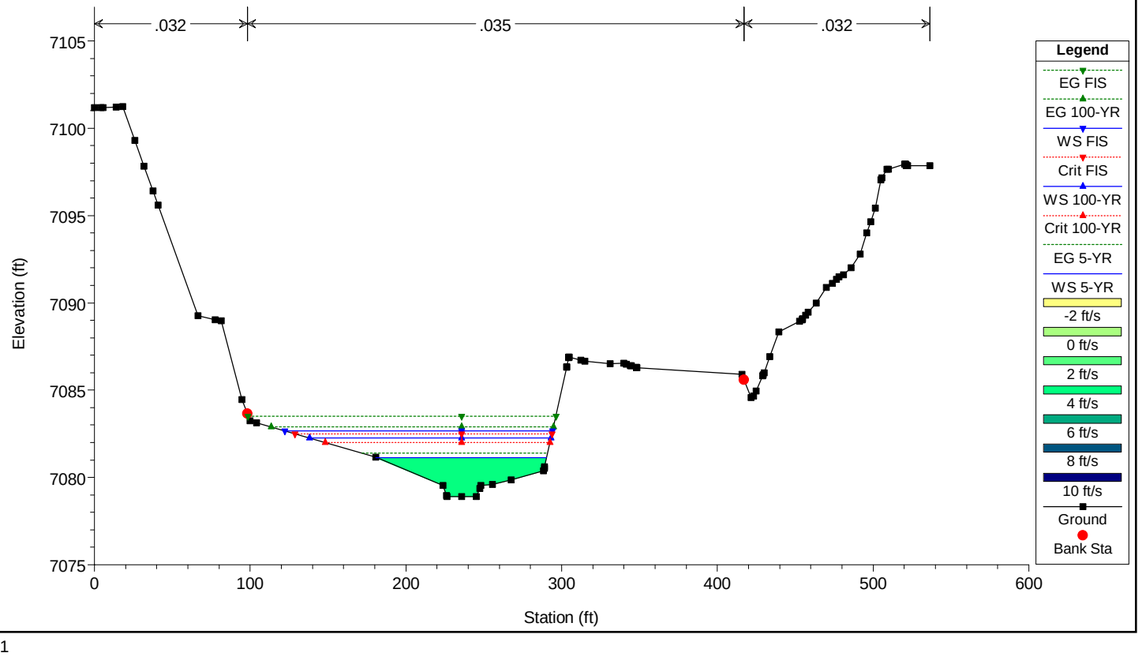

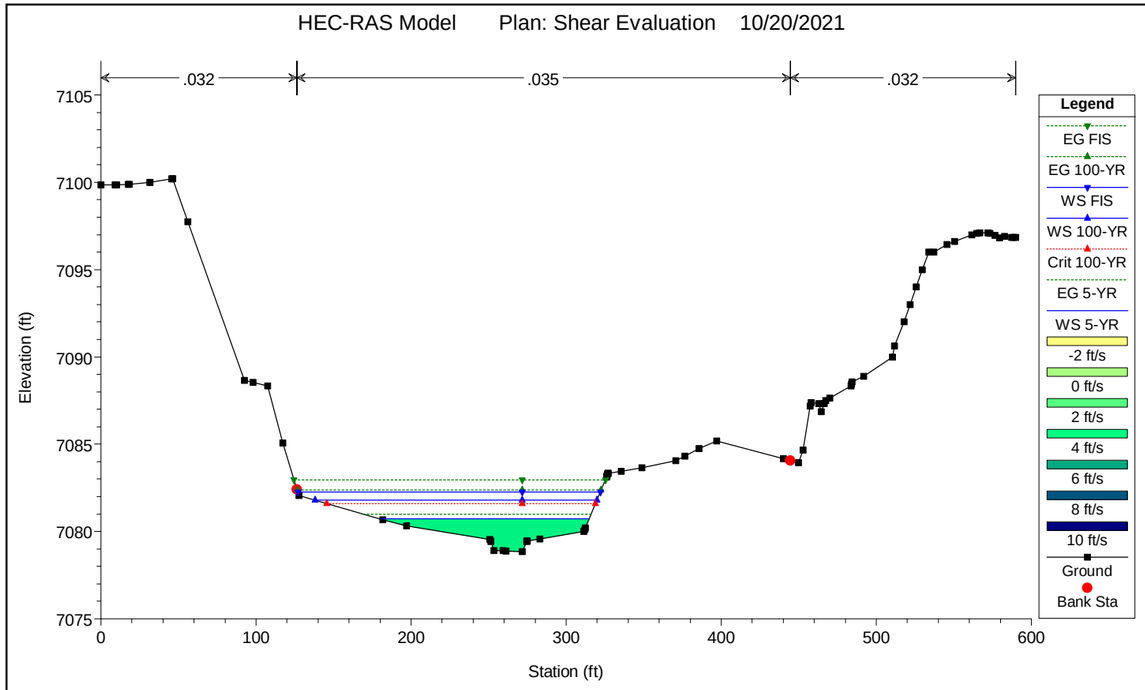
HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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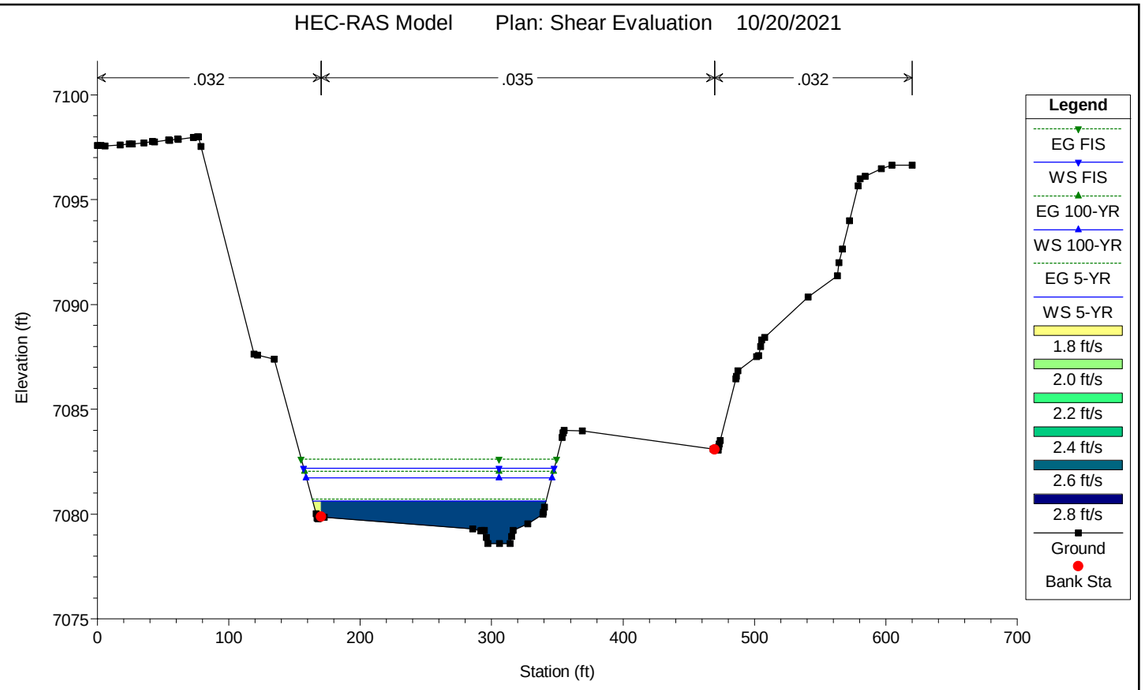
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta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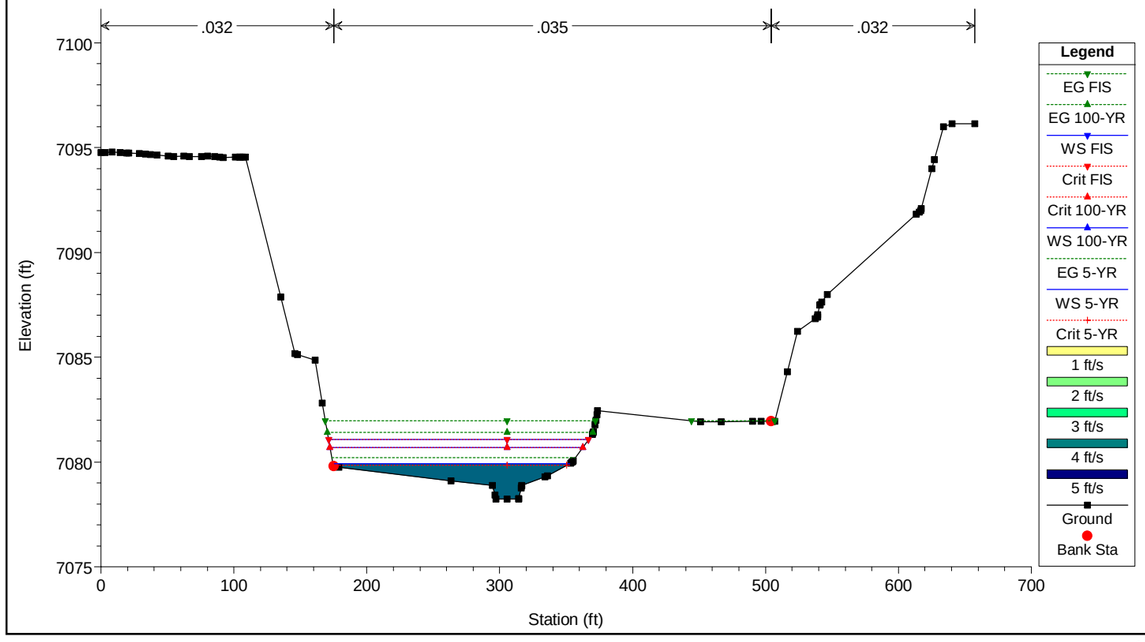
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
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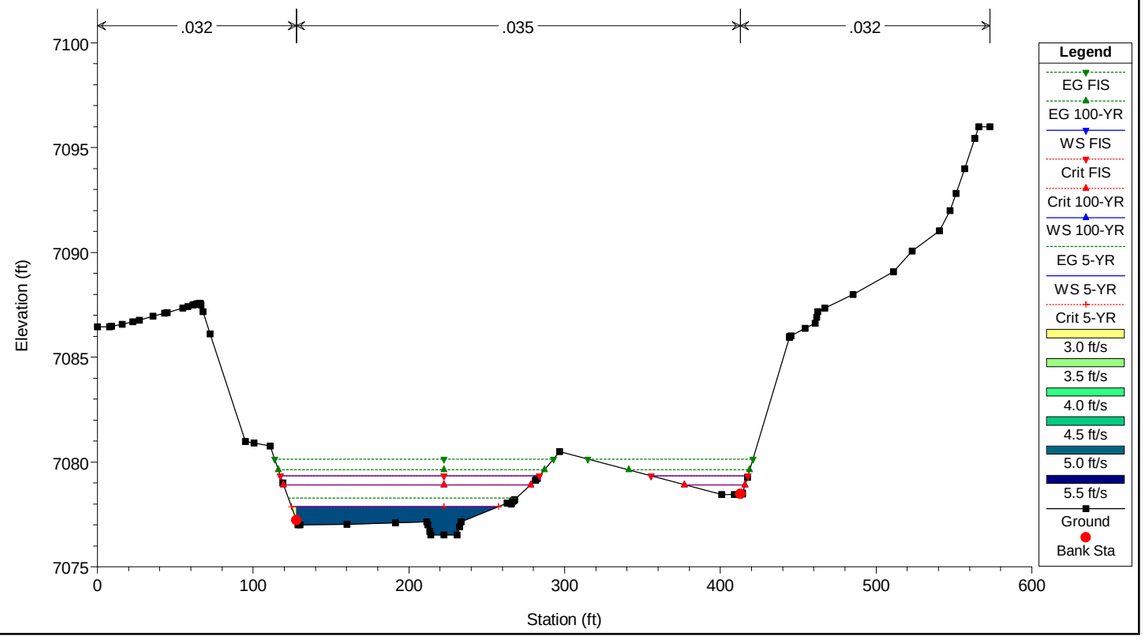
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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3.5 ft/s
4.0 ft/s
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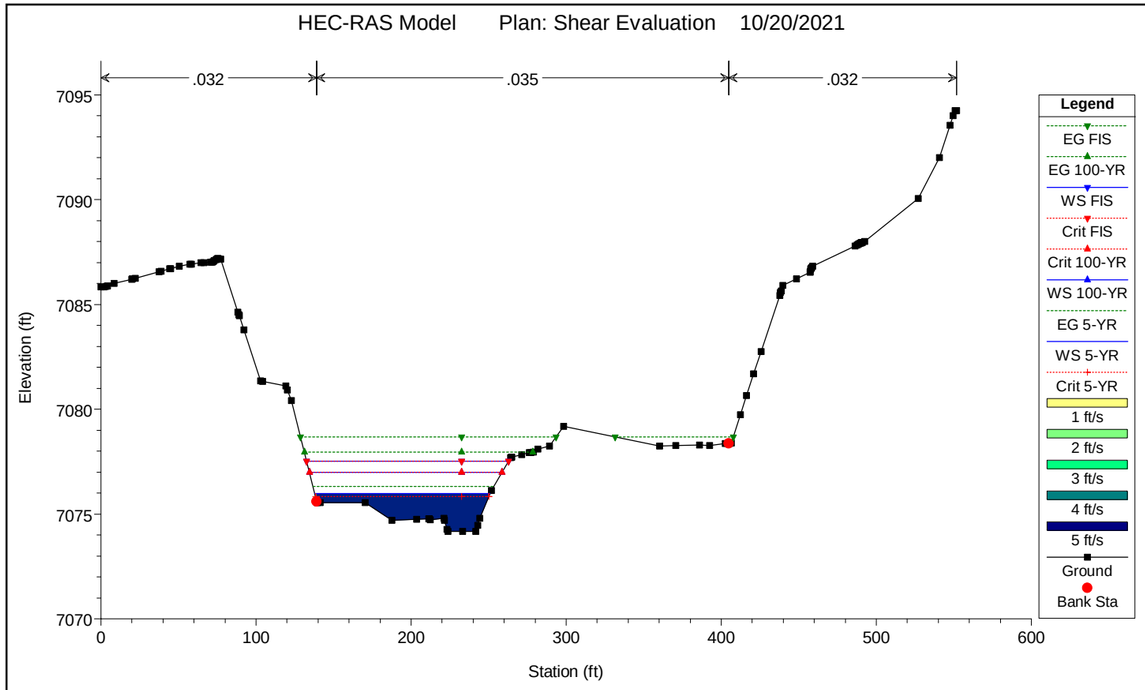
Ground
Bank Sta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Station (ft)
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Crit FIS
Crit 100-YR
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EG 5-YR
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Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
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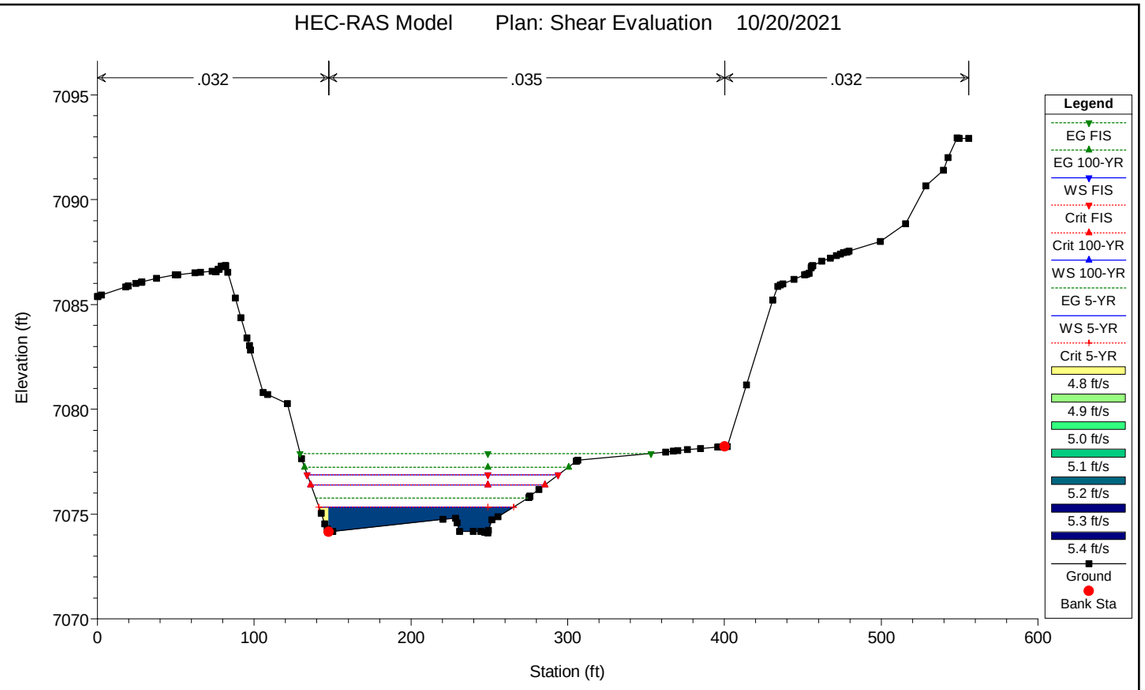
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Elevation (ft)
Station (ft)
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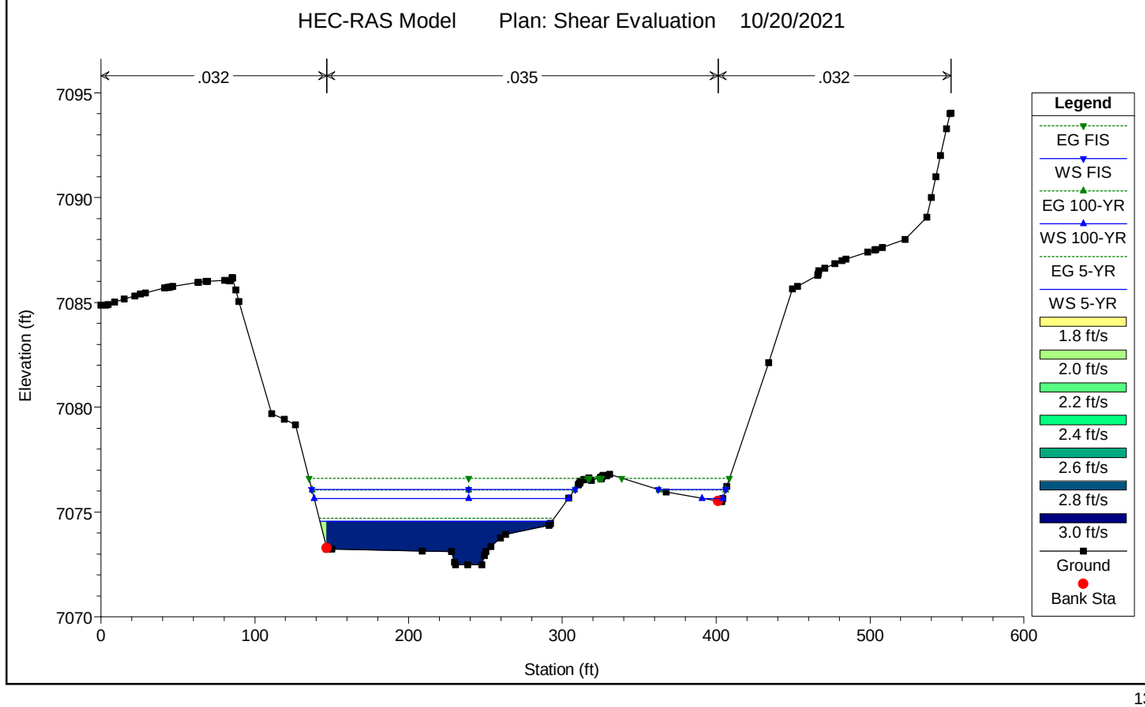
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.8 ft/s
4.9 ft/s
5.0 ft/s
5.1 ft/s
5.2 ft/s
5.3 ft/s
5.4 ft/s
Ground
Bank Sta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Elevation (ft)
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EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
Ground
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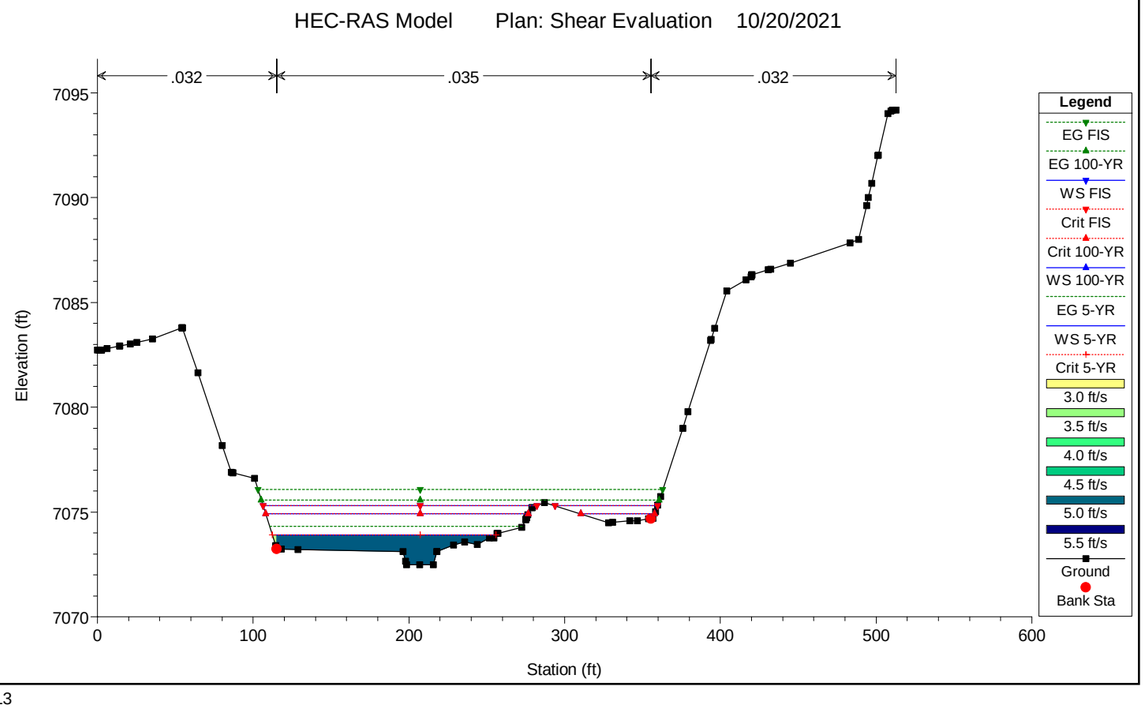
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Elevation (ft)
Station (ft)
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EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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3.5 ft/s
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4.5 ft/s
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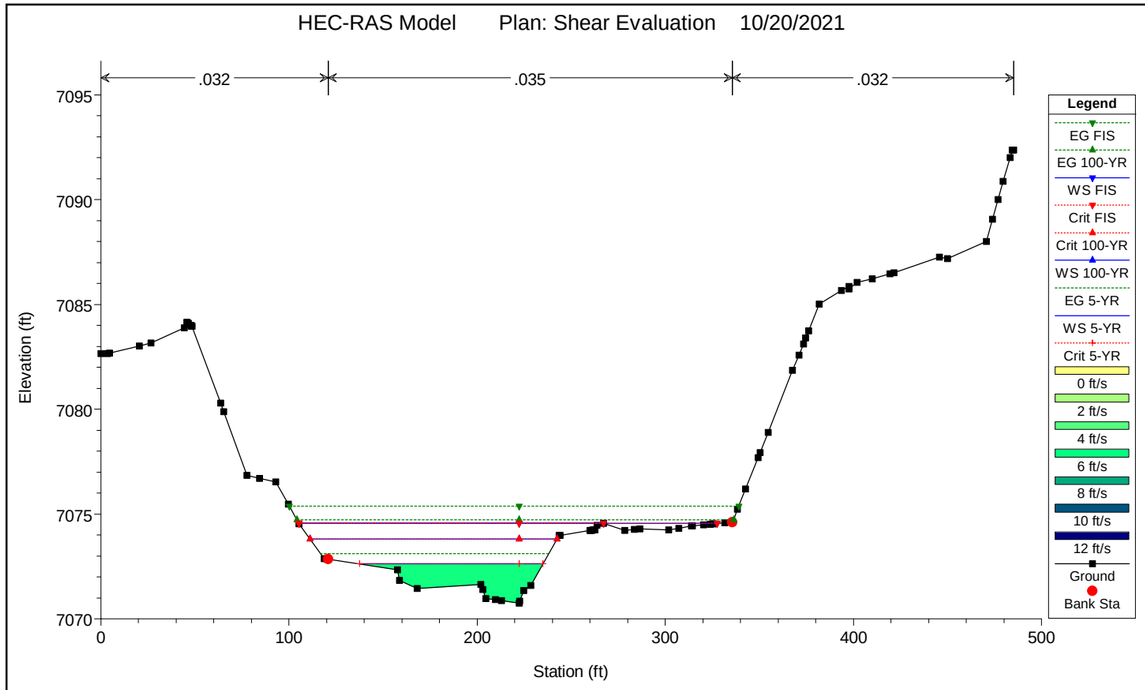
5.5 ft/s
Ground
Bank Sta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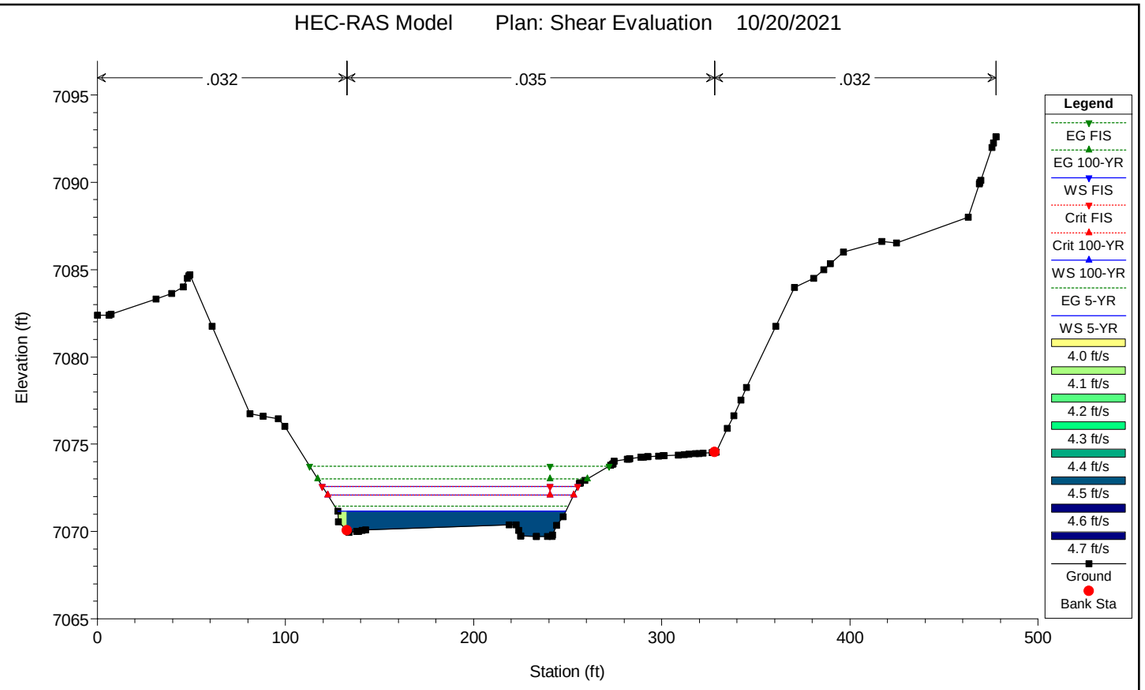
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta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Station (ft)
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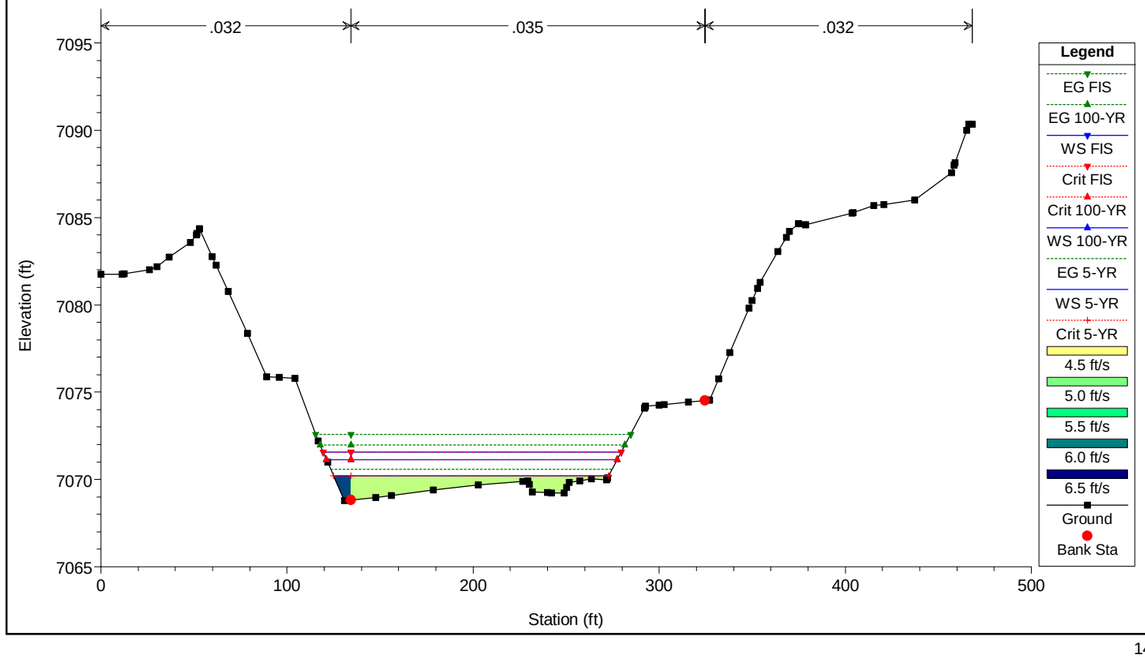
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.0 ft/s
4.1 ft/s
4.2 ft/s
4.3 ft/s
4.4 ft/s
4.5 ft/s
4.6 ft/s
4.7 ft/s
Ground
Bank Sta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Station (ft)
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WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
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6.0 ft/s
6.5 ft/s
Ground
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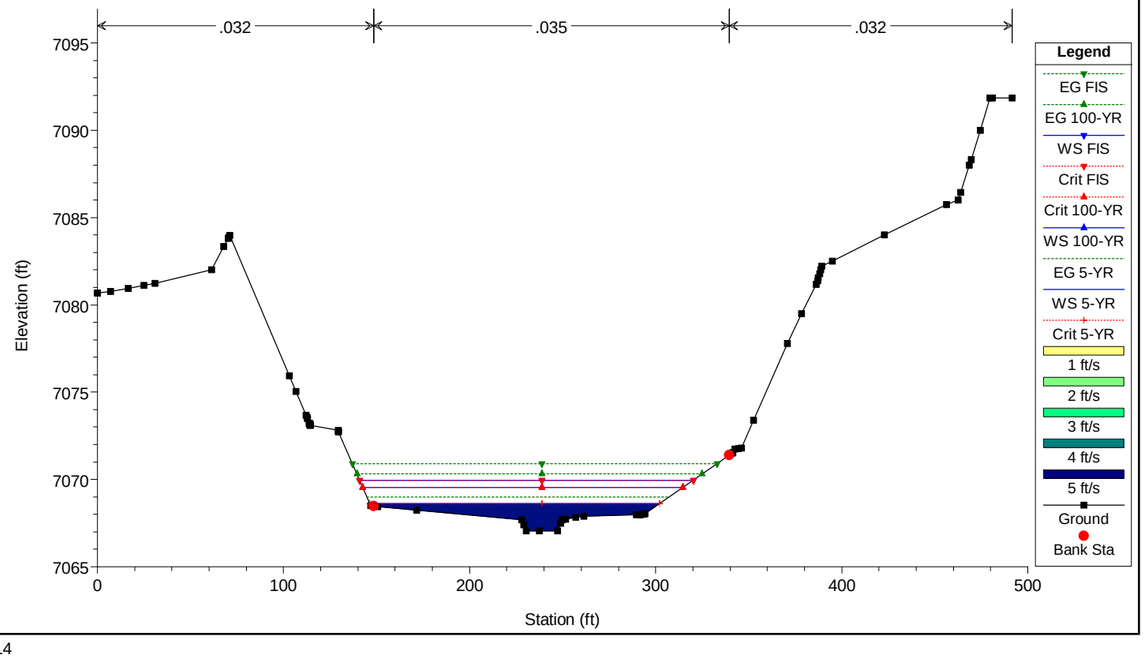
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Station (ft)
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WS FIS
Crit FIS
Crit 100-YR
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EG 5-YR
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Crit 5-YR
1 ft/s
2 ft/s
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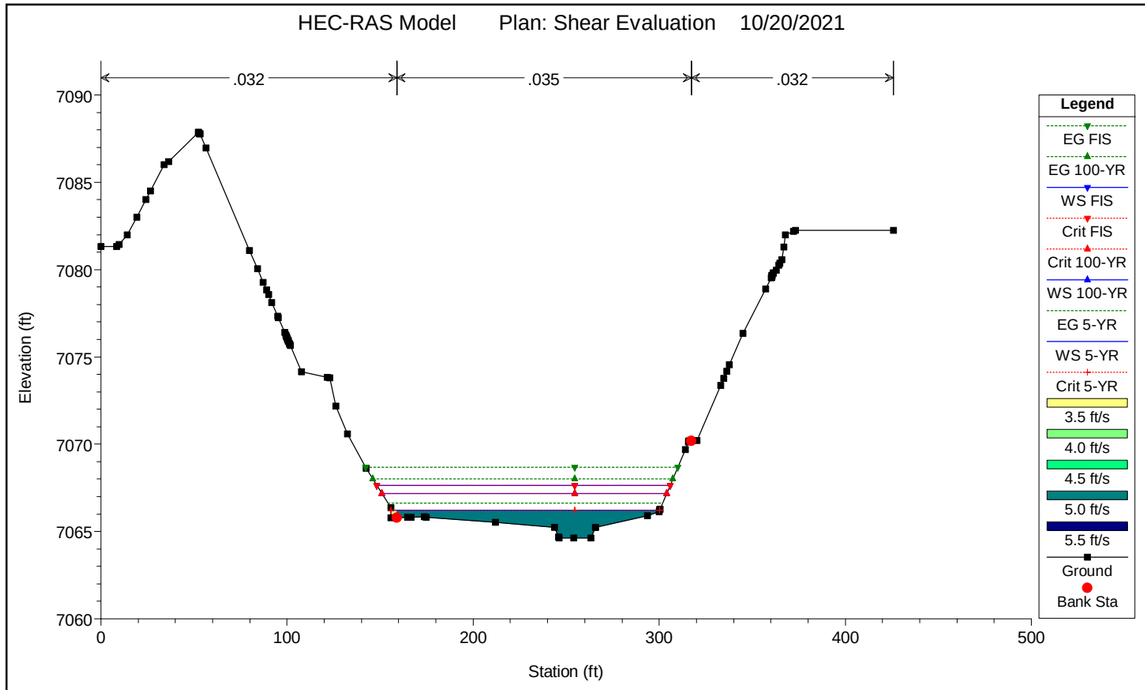
Ground
Bank Sta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Crit 100-YR
WS 100-YR
EG 5-YR
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4.0 ft/s
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Ground
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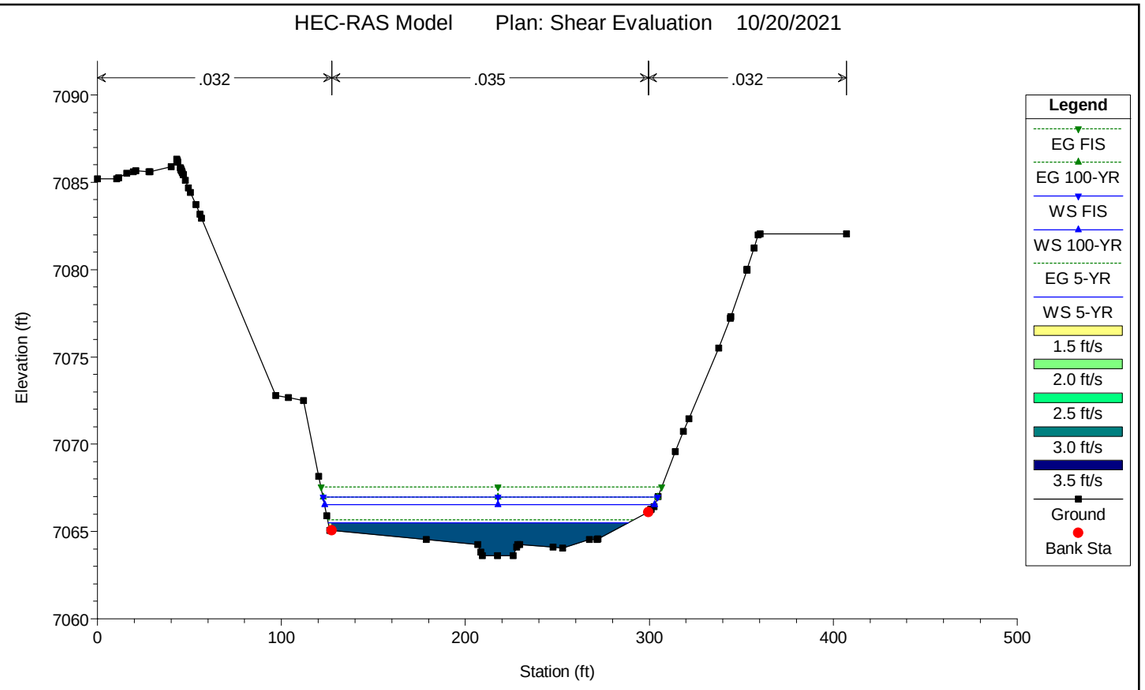
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EG 100-YR
WS FIS
WS 100-YR
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2.5 ft/s
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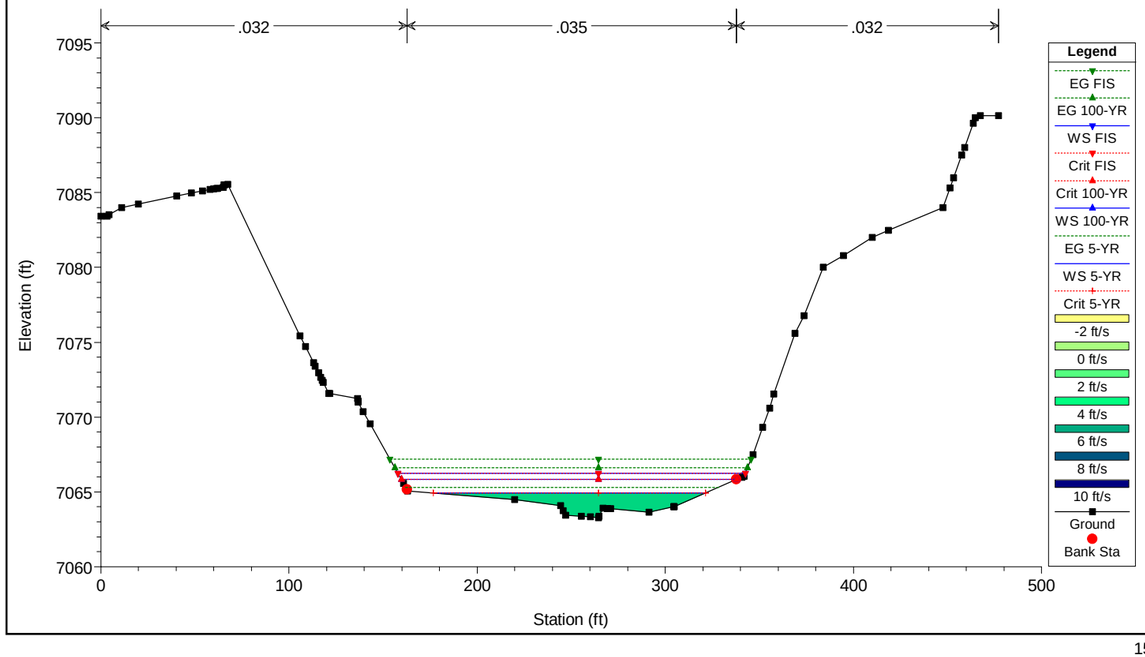
Bank Sta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EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
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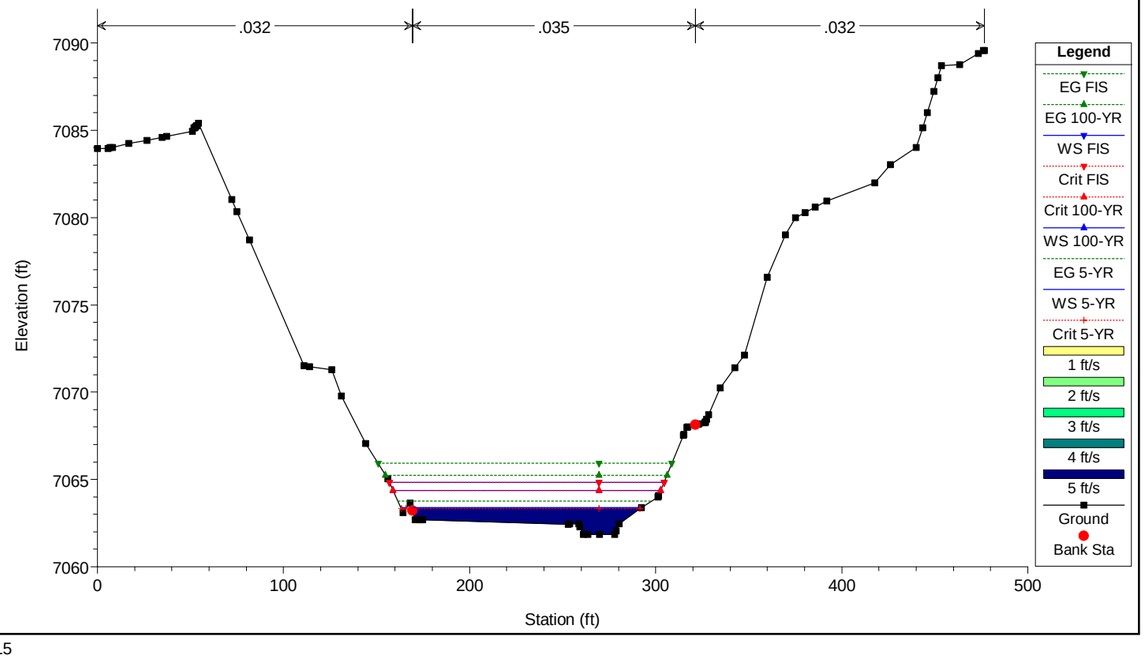
Ground
Bank Sta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Station (ft)
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EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
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Crit 5-YR
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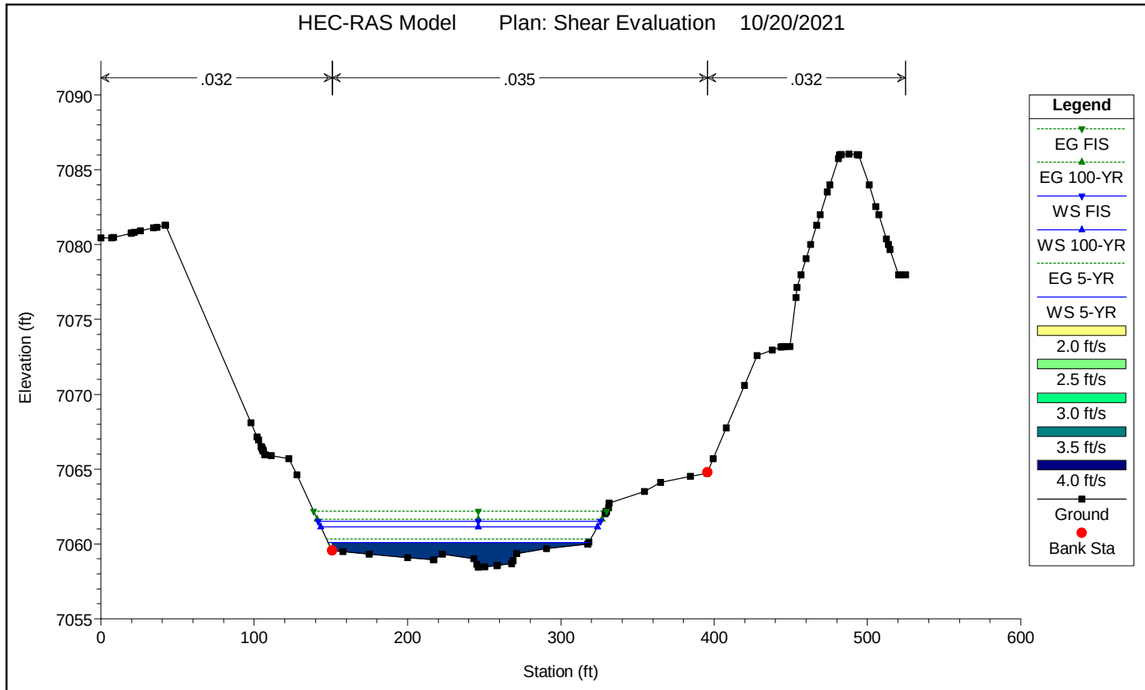
5 ft/s
Ground
Bank Sta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Station (ft)
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EG 100-YR
WS FIS
WS 100-YR
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3.0 ft/s
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4.0 ft/s
Ground
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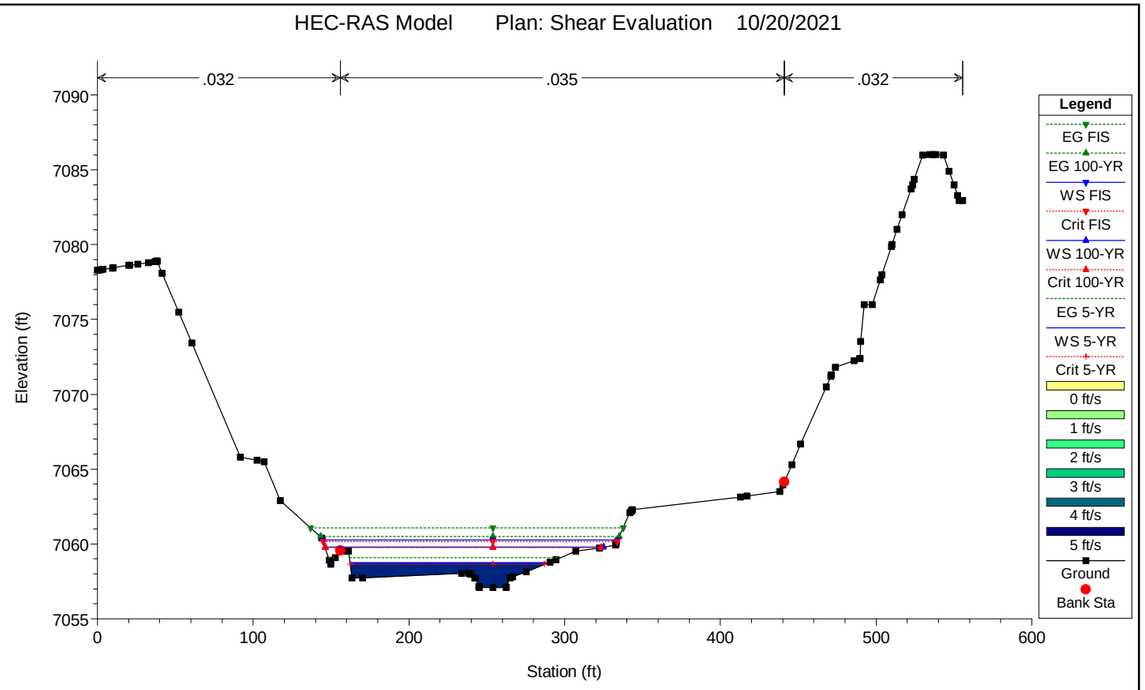
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Station (ft)
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Crit FIS
WS 100-YR
Crit 100-YR
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Ground
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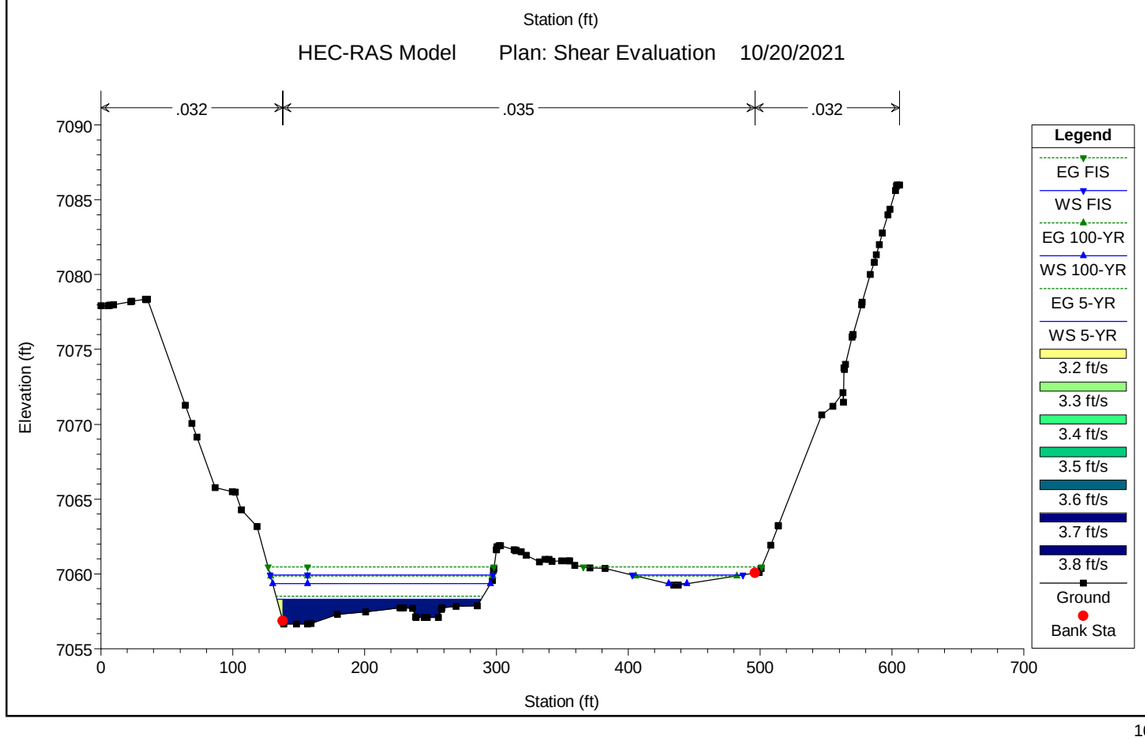
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Elevation (ft)
Station (ft)
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WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.2 ft/s
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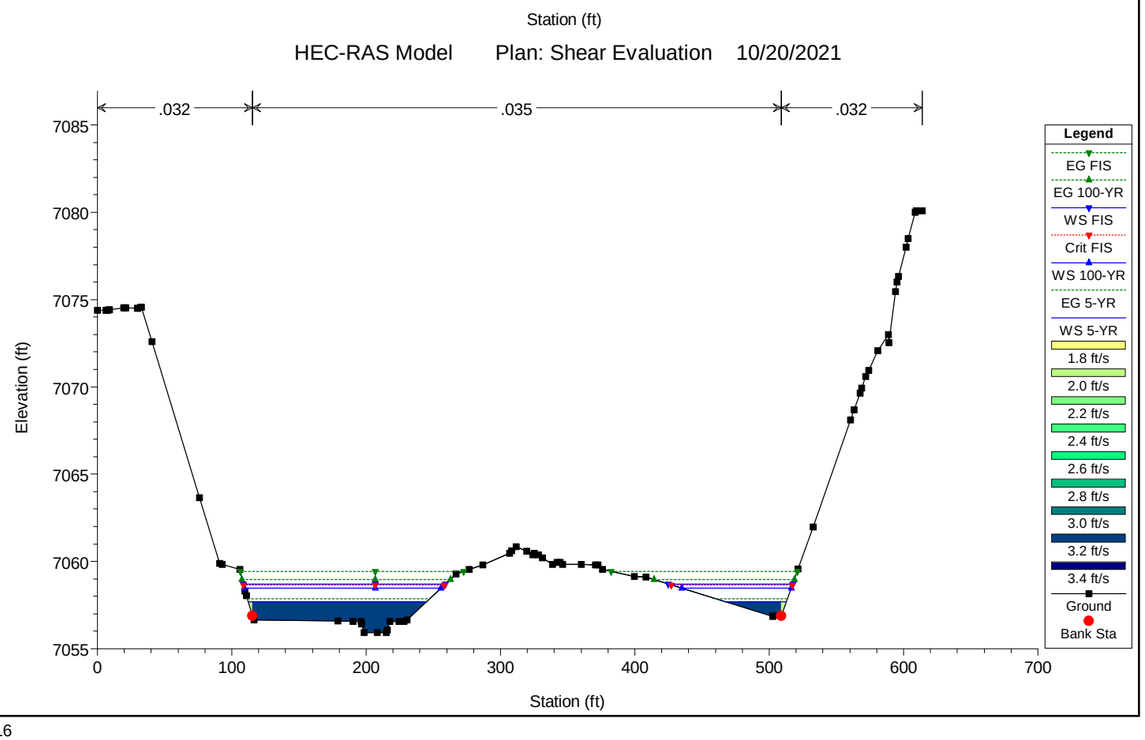
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Station (ft)
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Crit FIS
WS 100-YR
EG 5-YR
WS 5-YR
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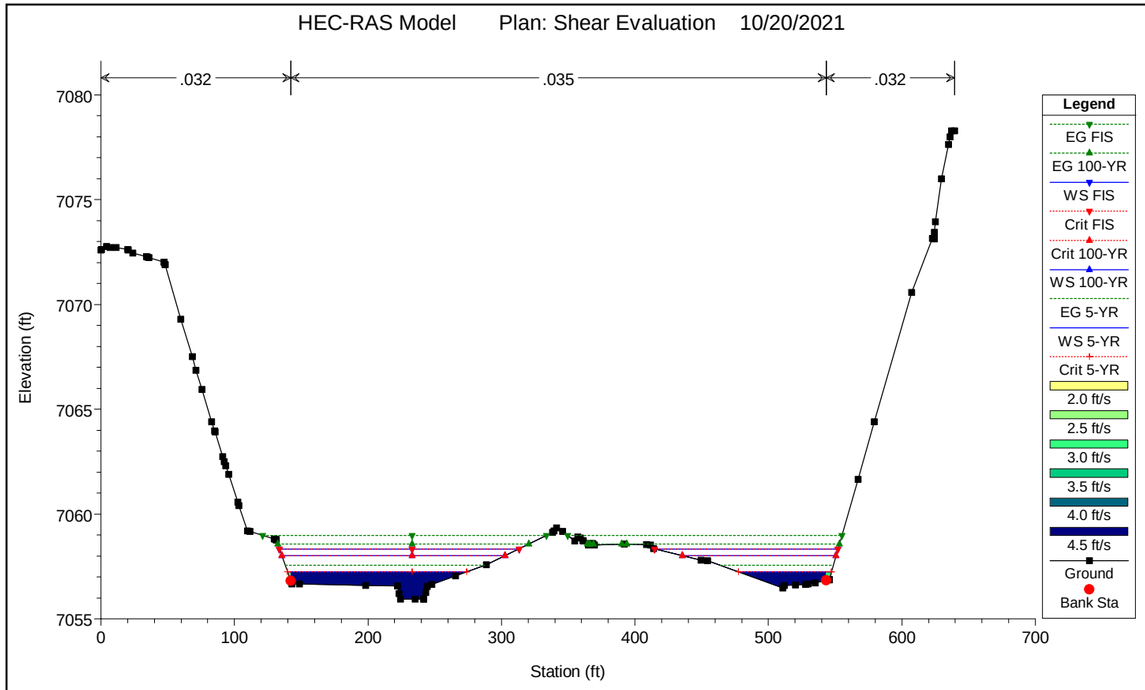
Ground
Bank Sta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Station (ft)
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Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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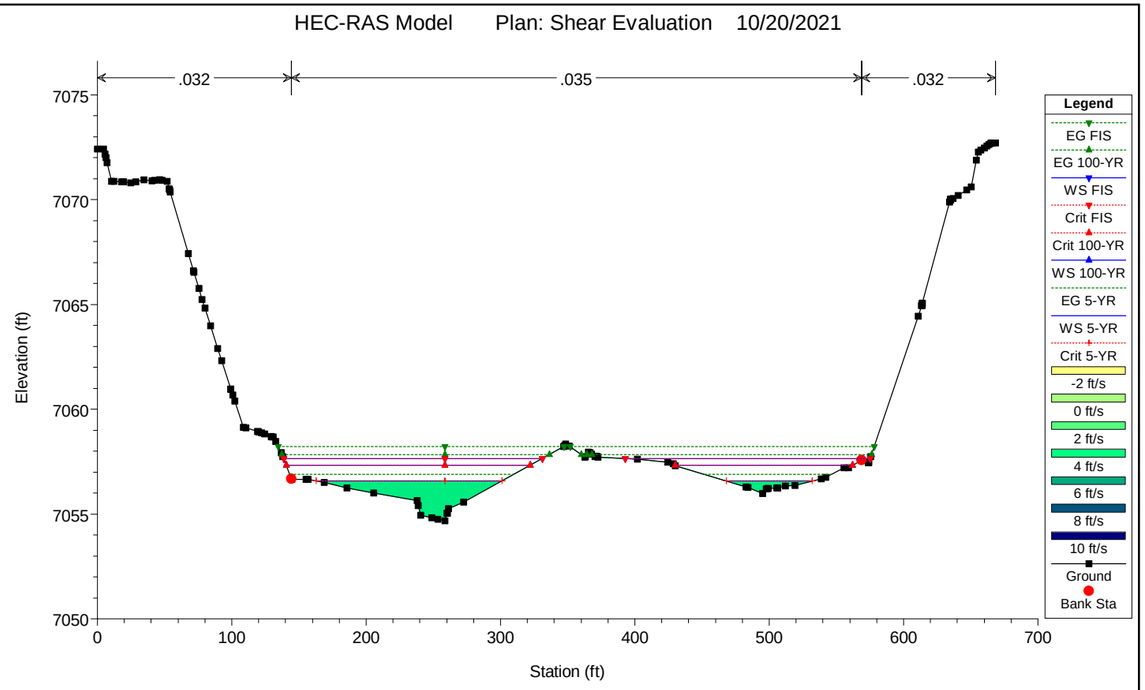
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Station (ft)
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Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
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Crit 5-YR
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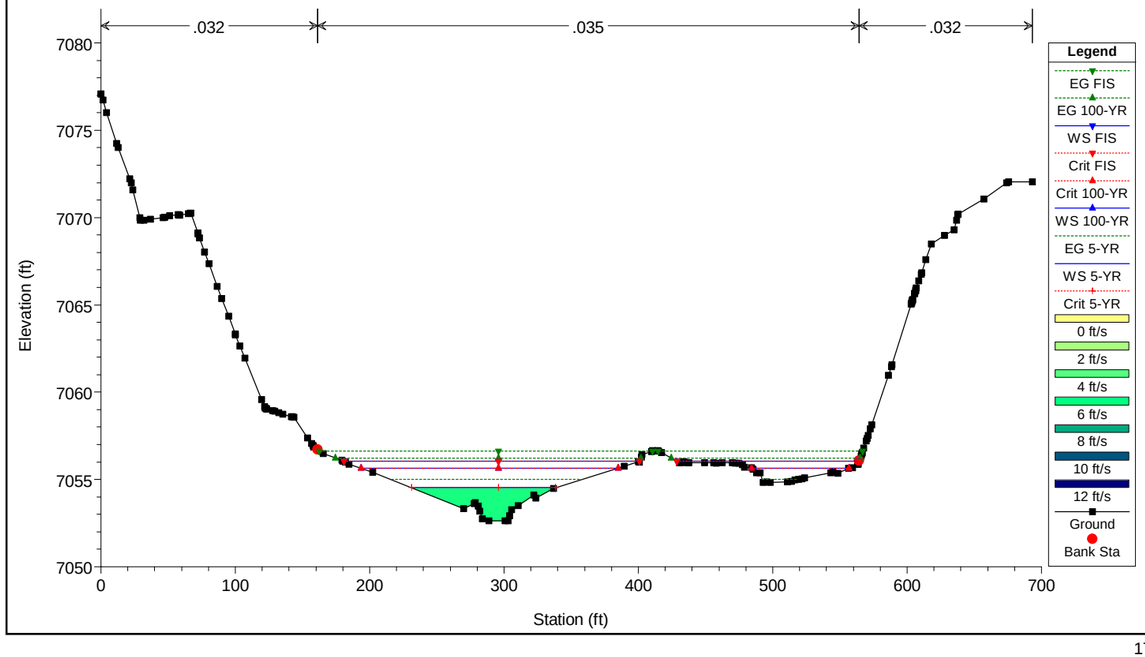
Ground
Bank Sta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Station (ft)
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Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
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Ground
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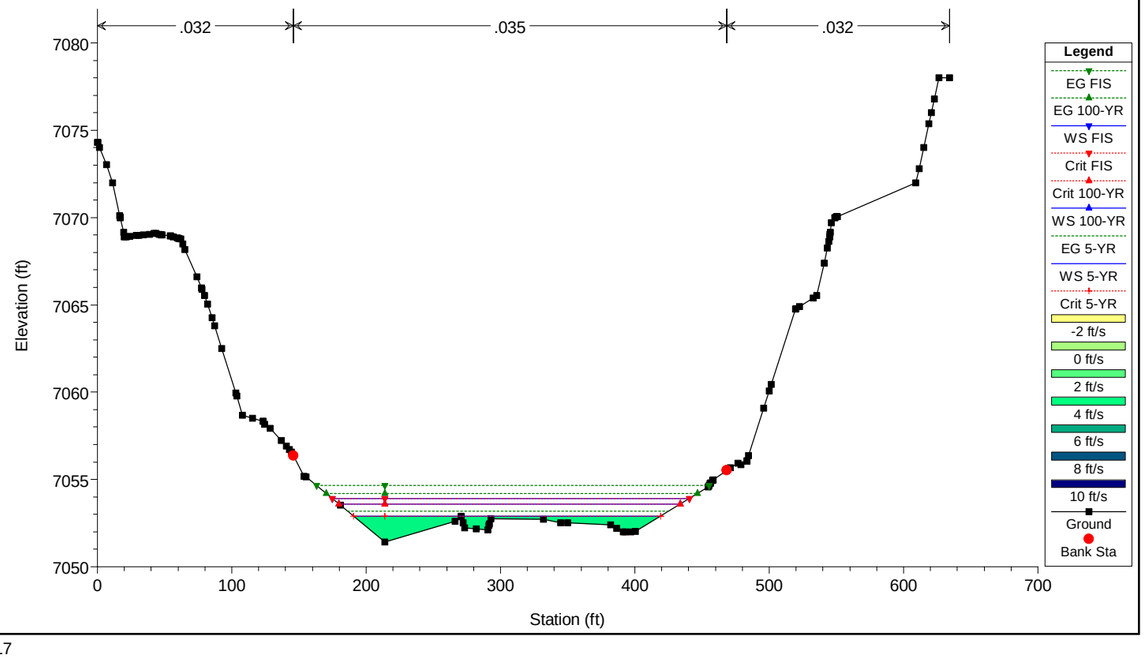
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Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
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Crit 5-YR
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2 ft/s
4 ft/s
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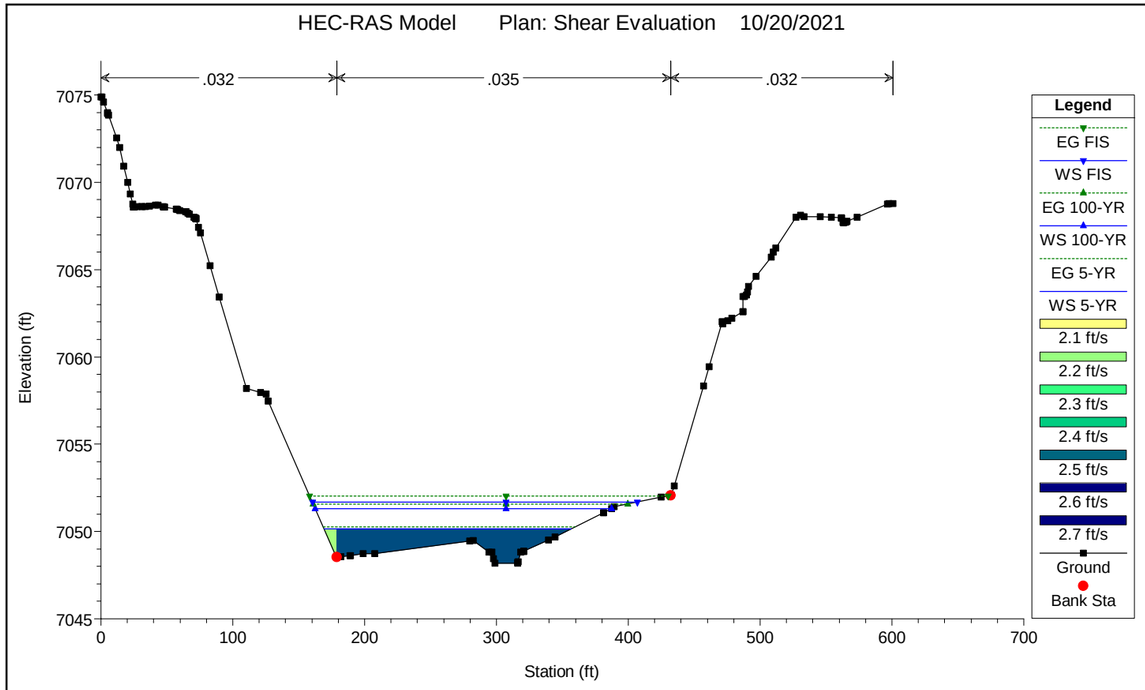
Ground
Bank Sta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EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.1 ft/s
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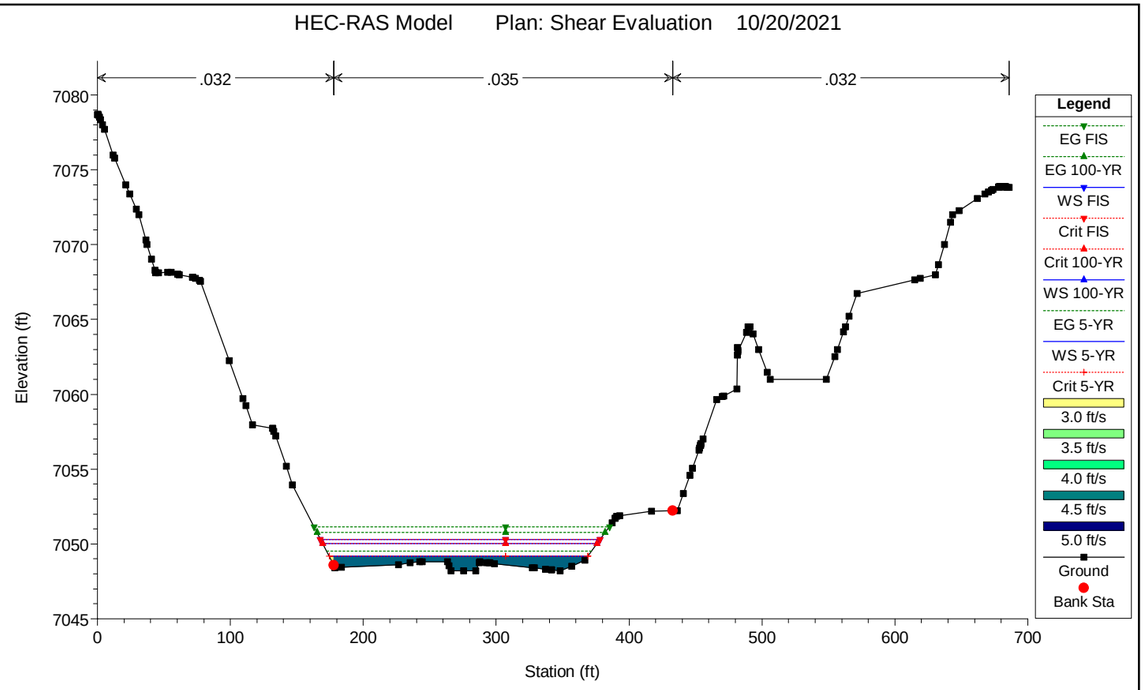
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Elevation (ft)
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Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
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Ground
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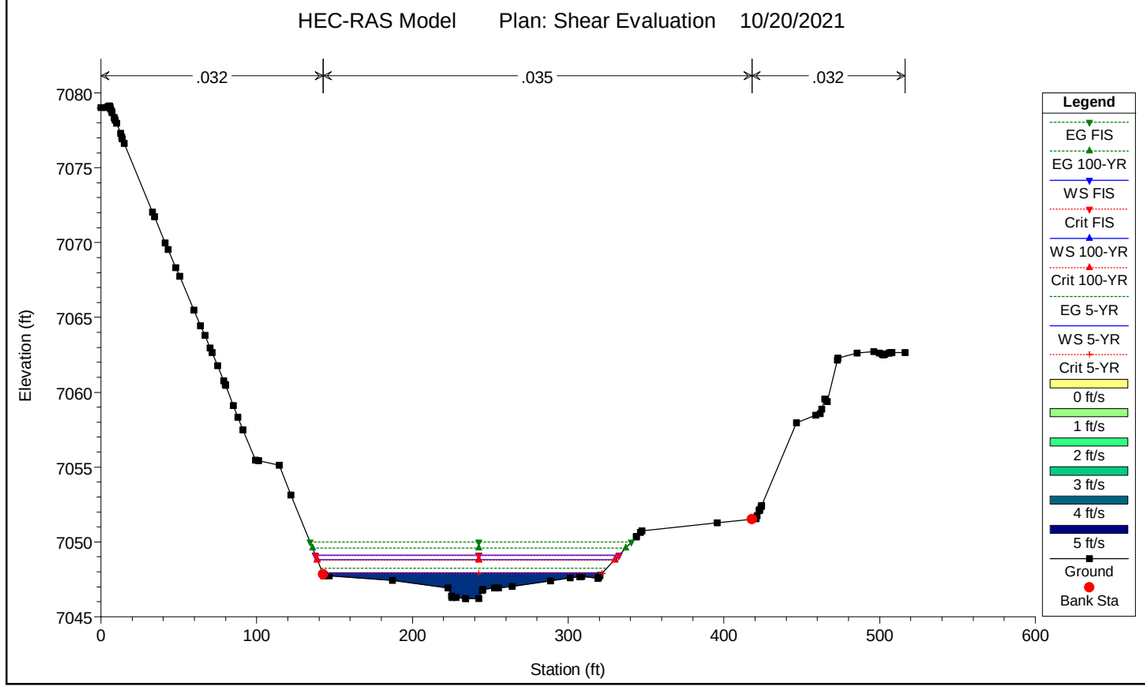
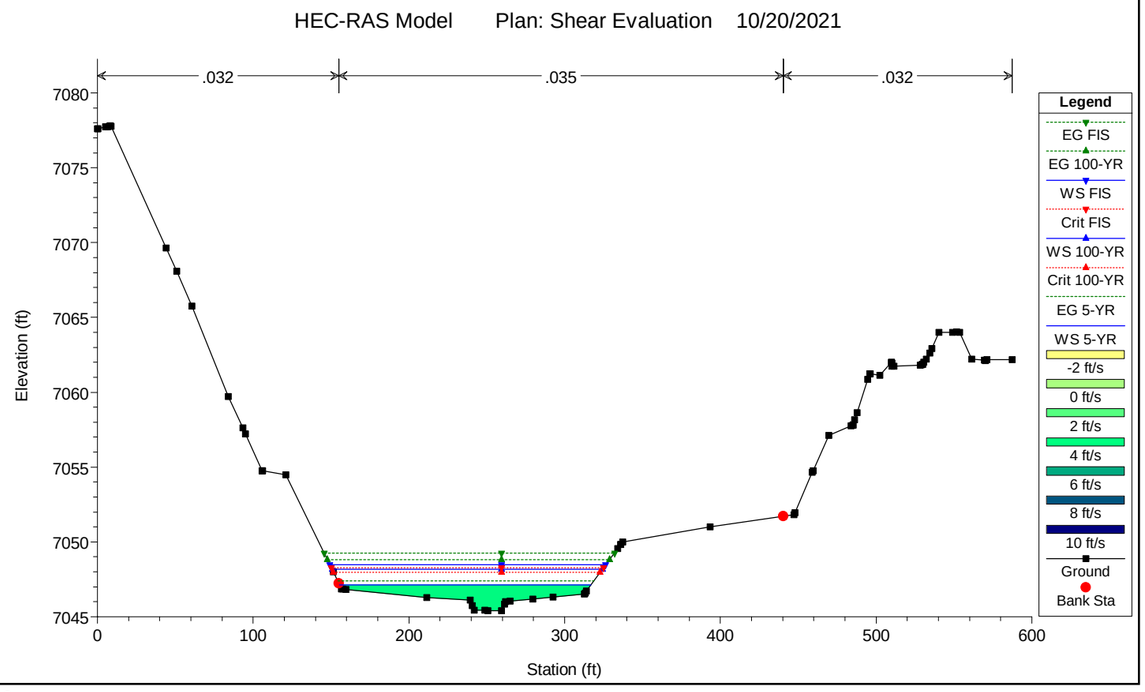

HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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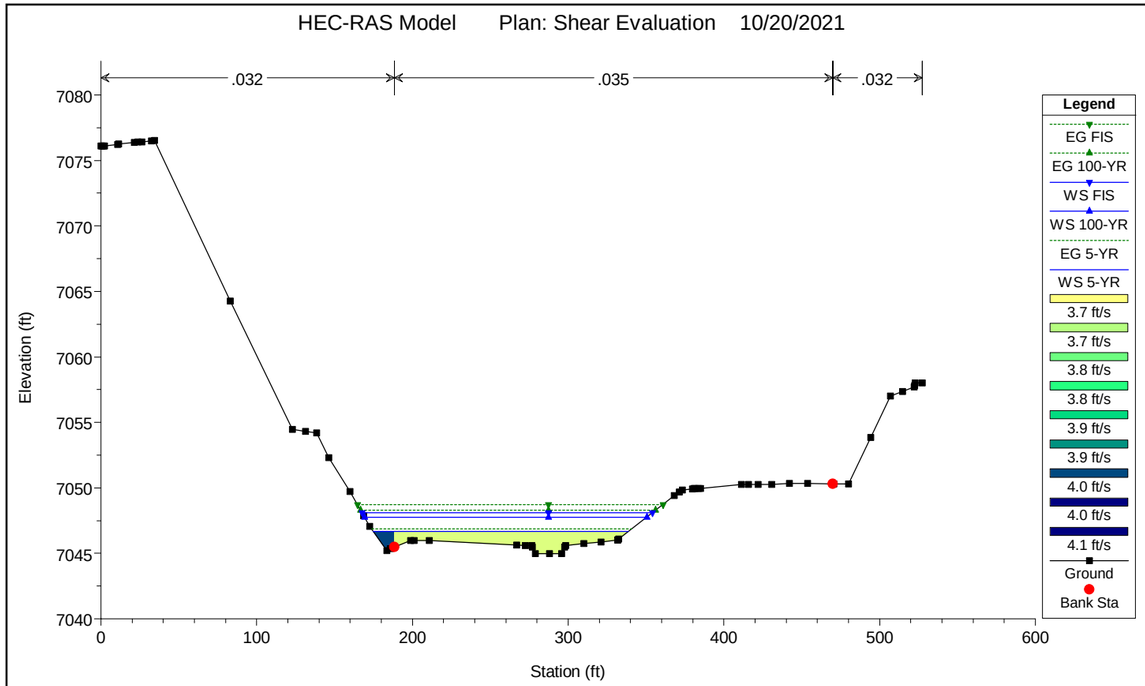
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
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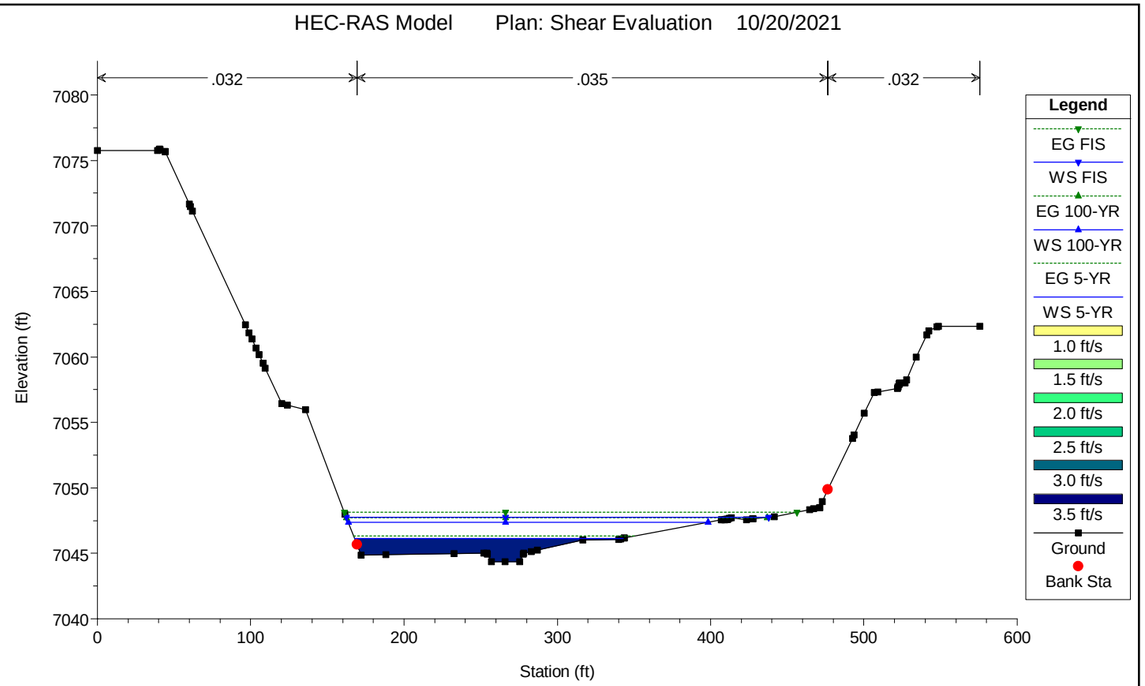
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
WS 100-YR
EG 5-YR
WS 5-YR
3.7 ft/s
3.7 ft/s
3.8 ft/s
3.8 ft/s
3.9 ft/s
3.9 ft/s
4.0 ft/s
4.0 ft/s
4.1 ft/s
Ground
Bank Sta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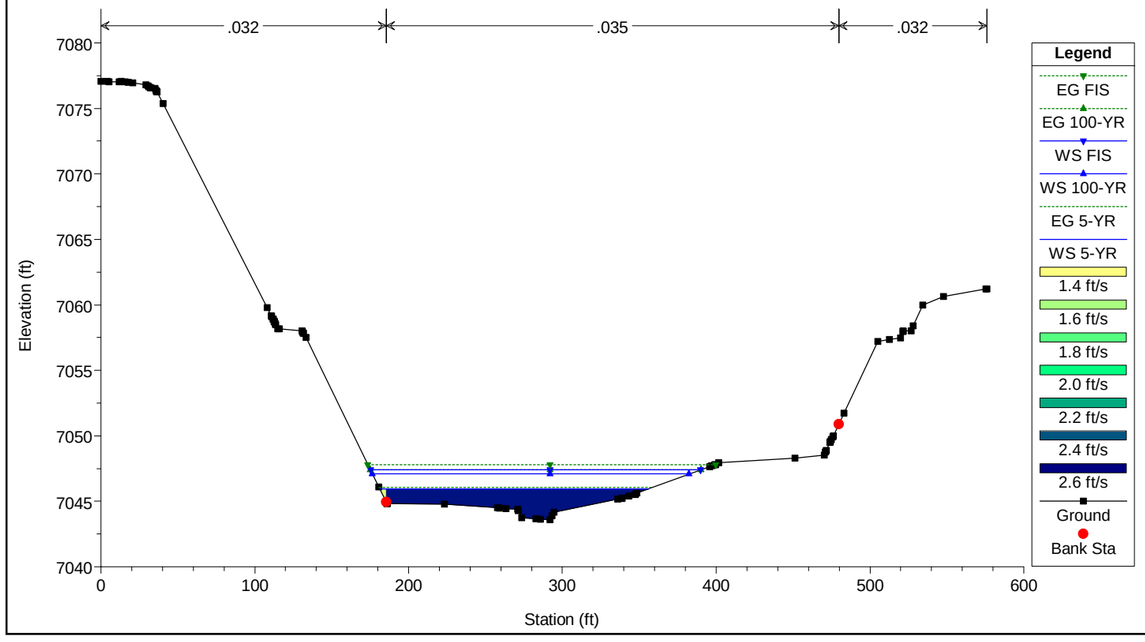
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta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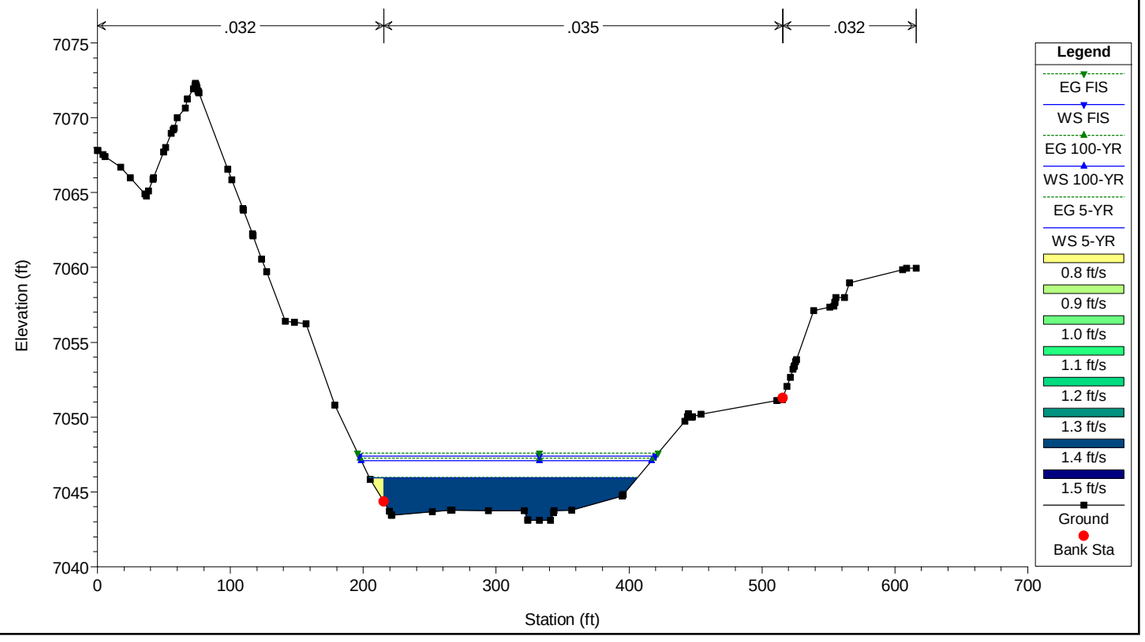
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta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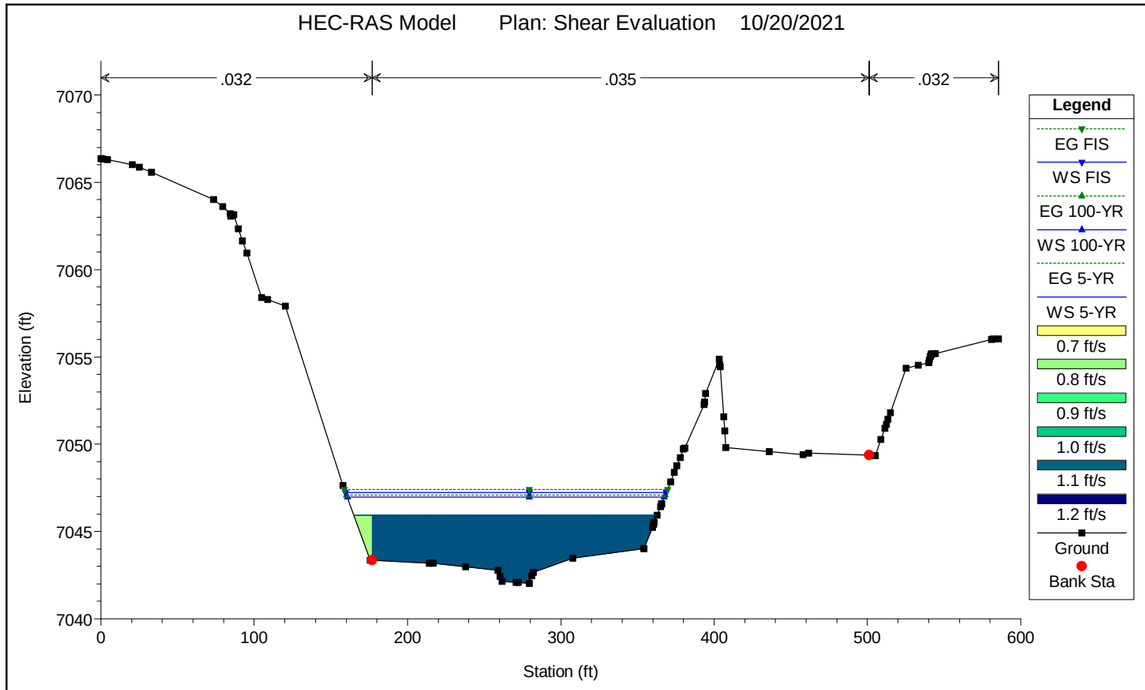
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.8 ft/s
0.9 ft/s
1.0 ft/s
1.1 ft/s
1.2 ft/s
1.3 ft/s
1.4 ft/s
1.5 ft/s
Ground
Bank Sta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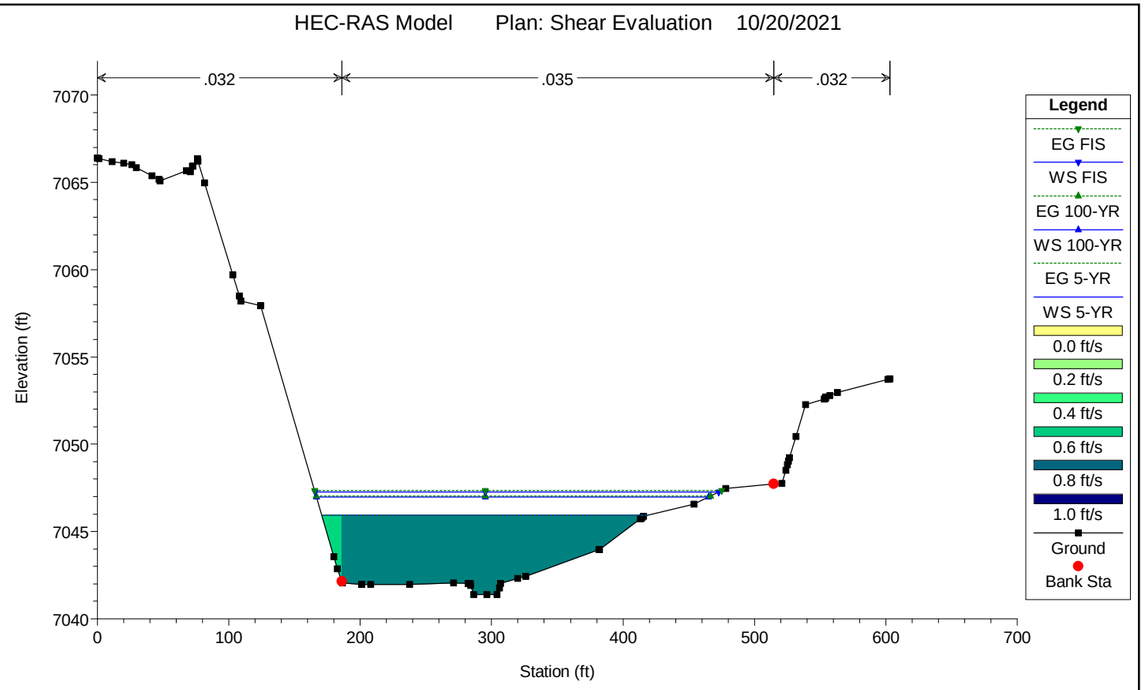
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.7 ft/s
0.8 ft/s
0.9 ft/s
1.0 ft/s
1.1 ft/s
1.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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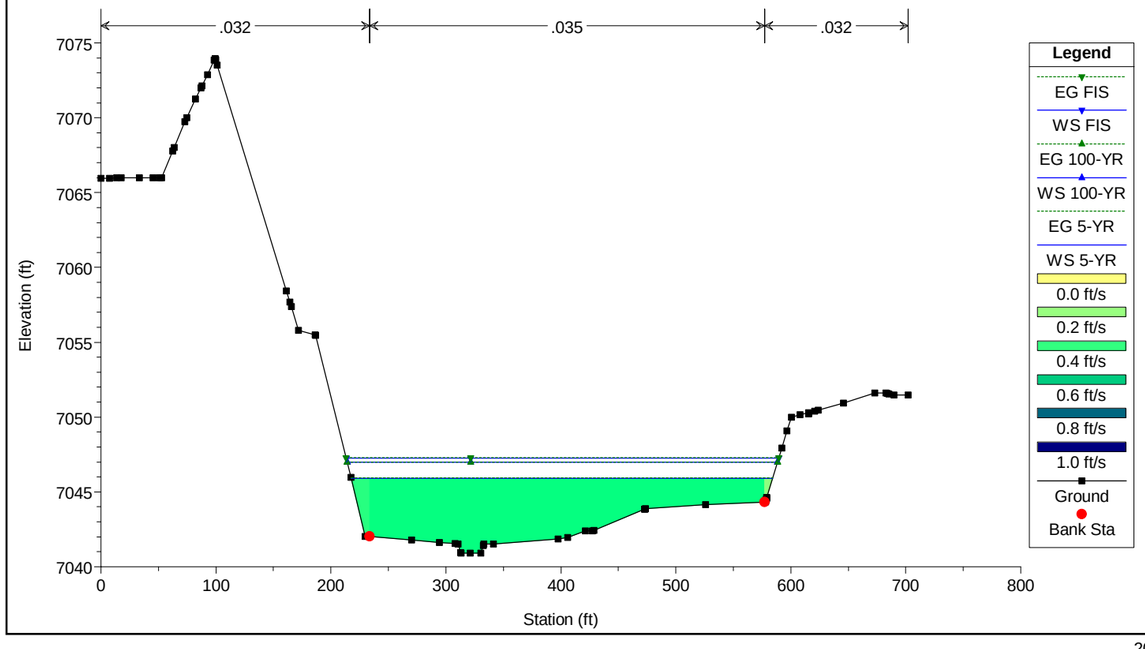
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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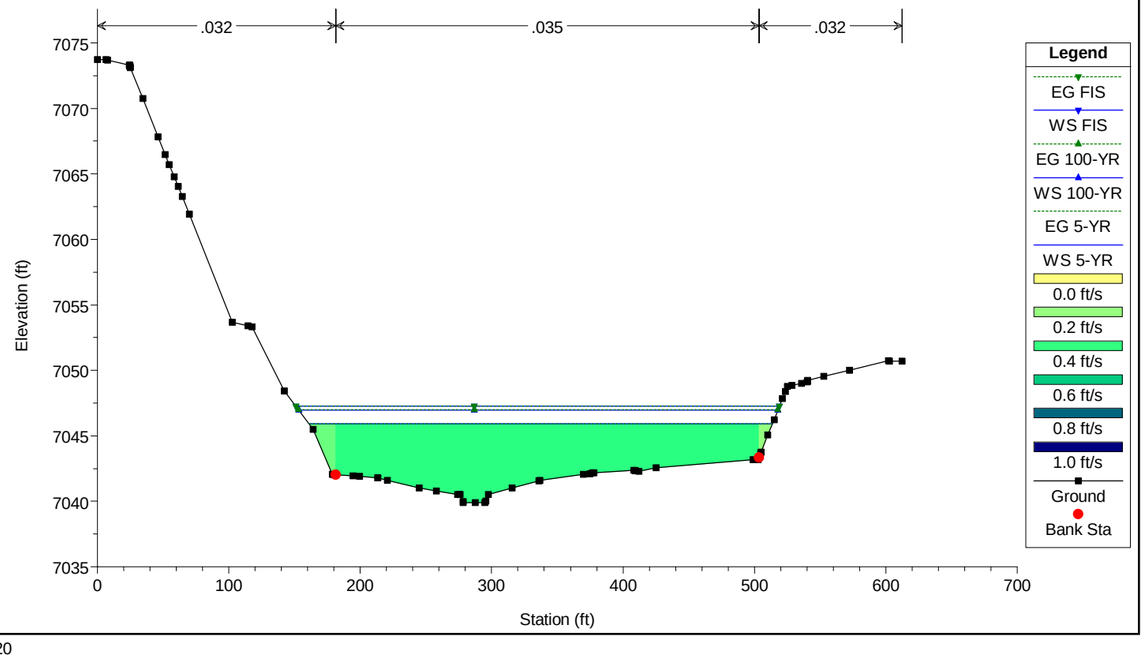
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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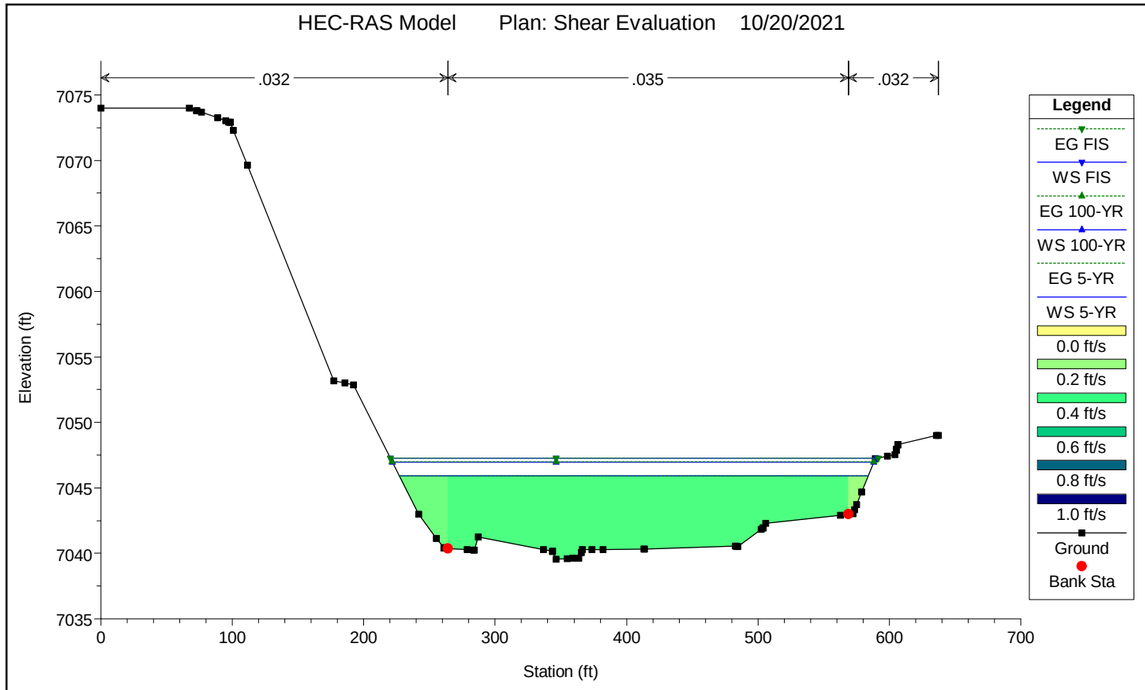
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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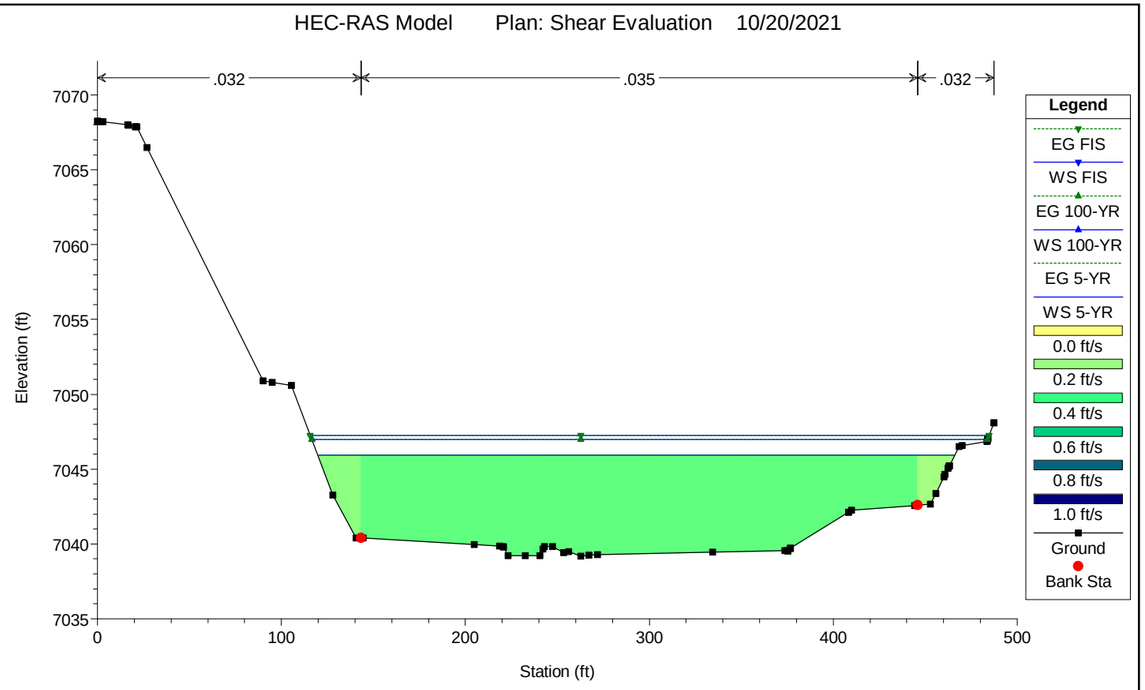
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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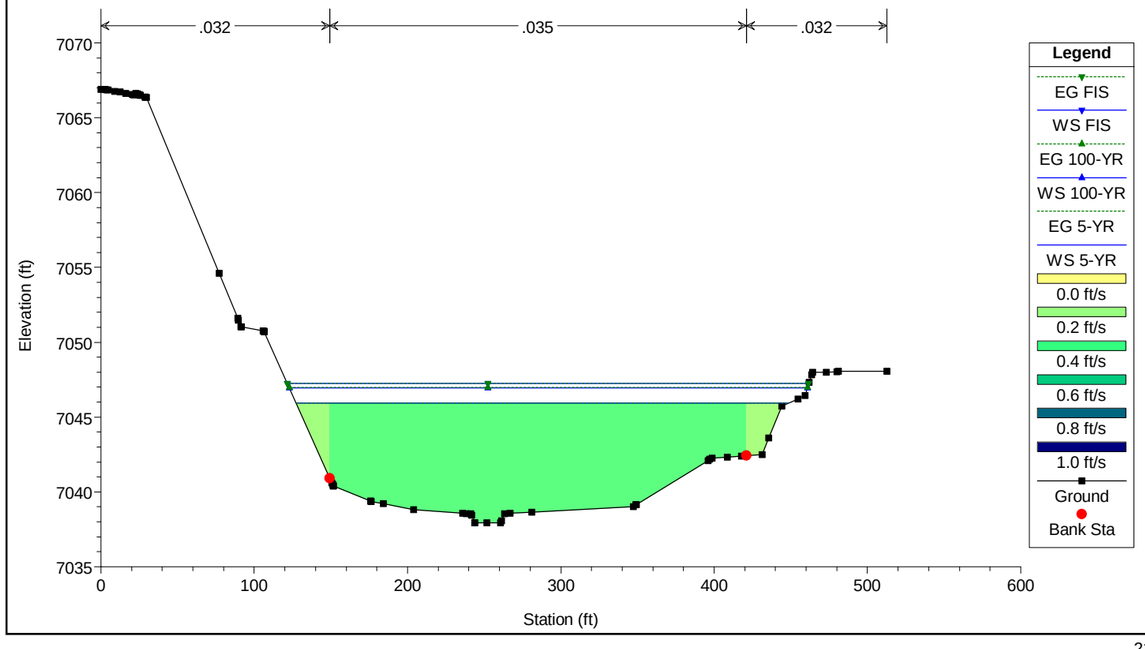
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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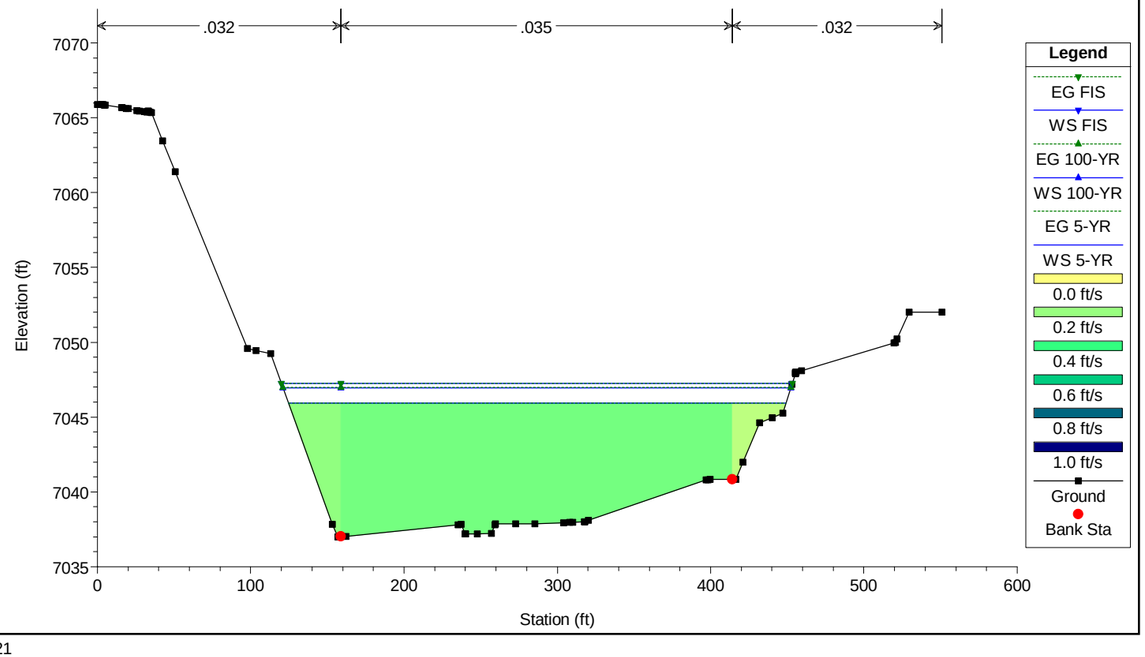
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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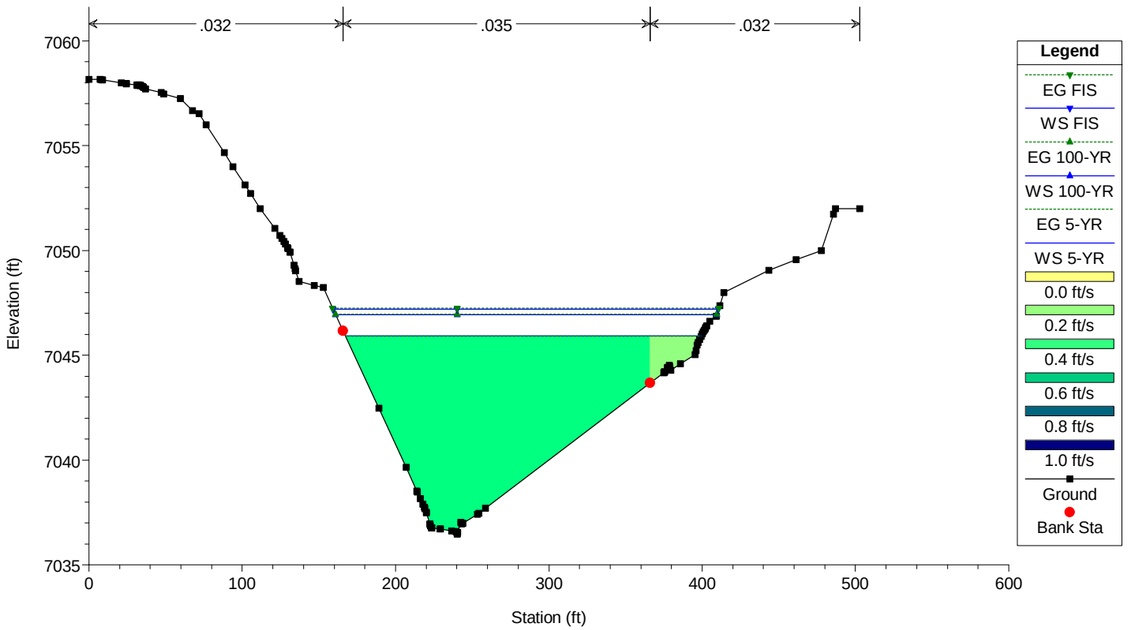
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Shear Evaluation 10/20/2021



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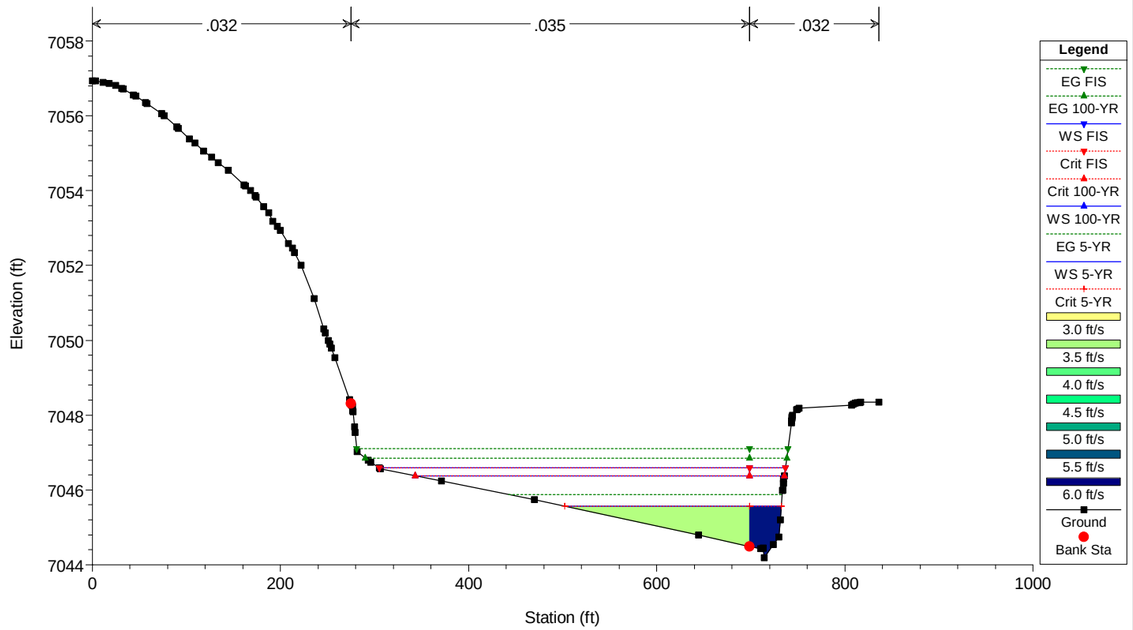

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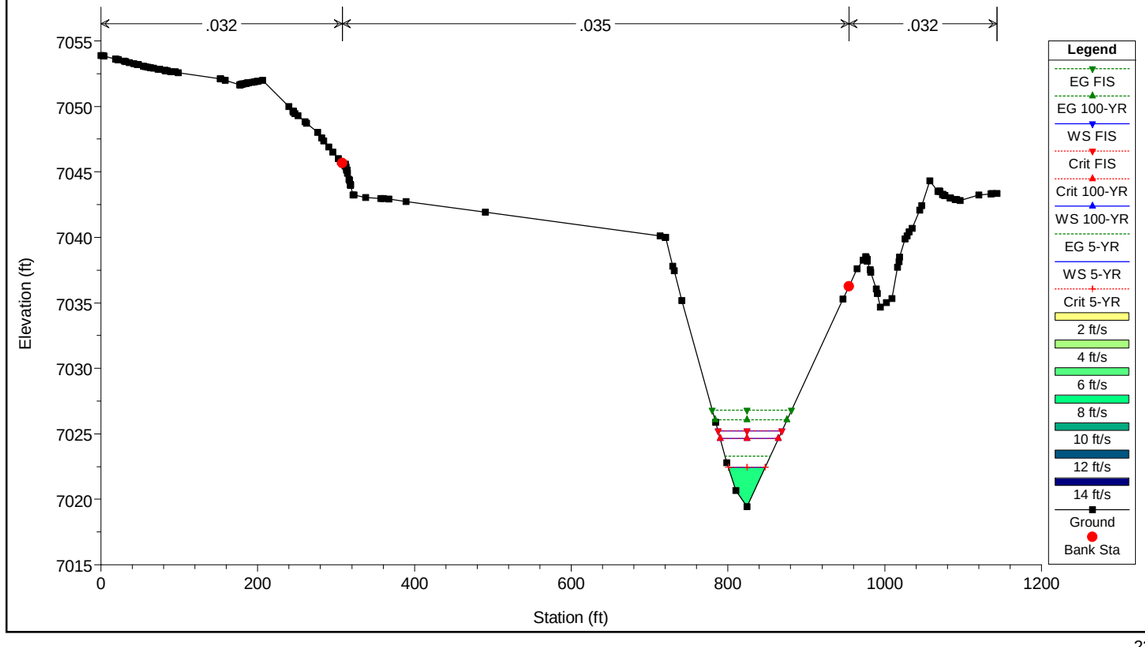

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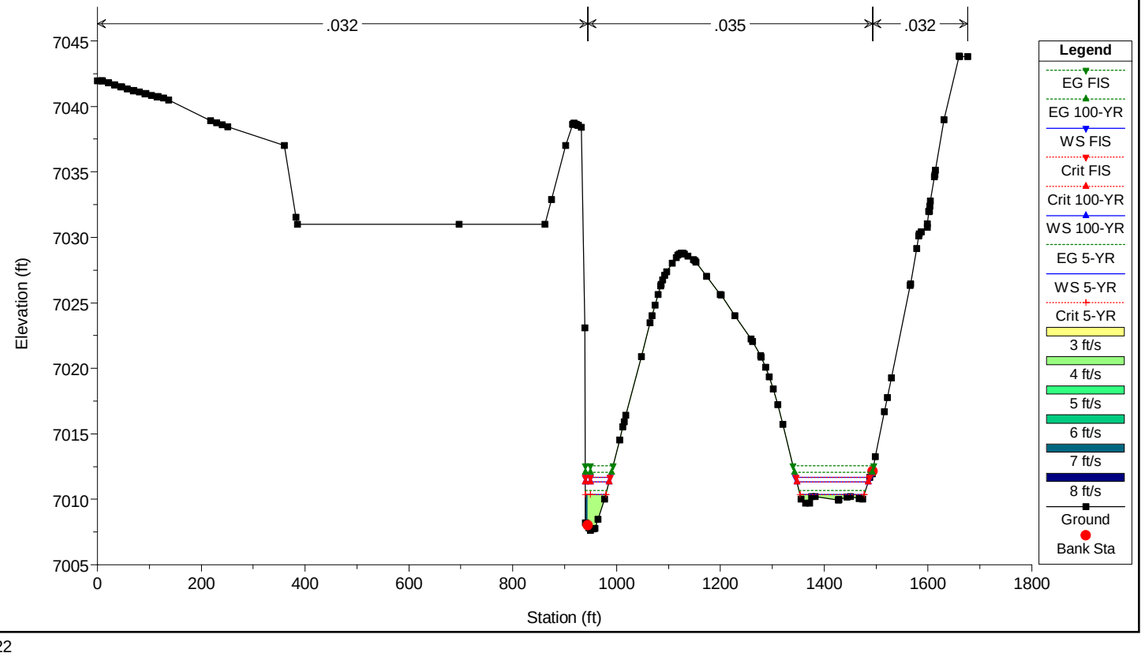
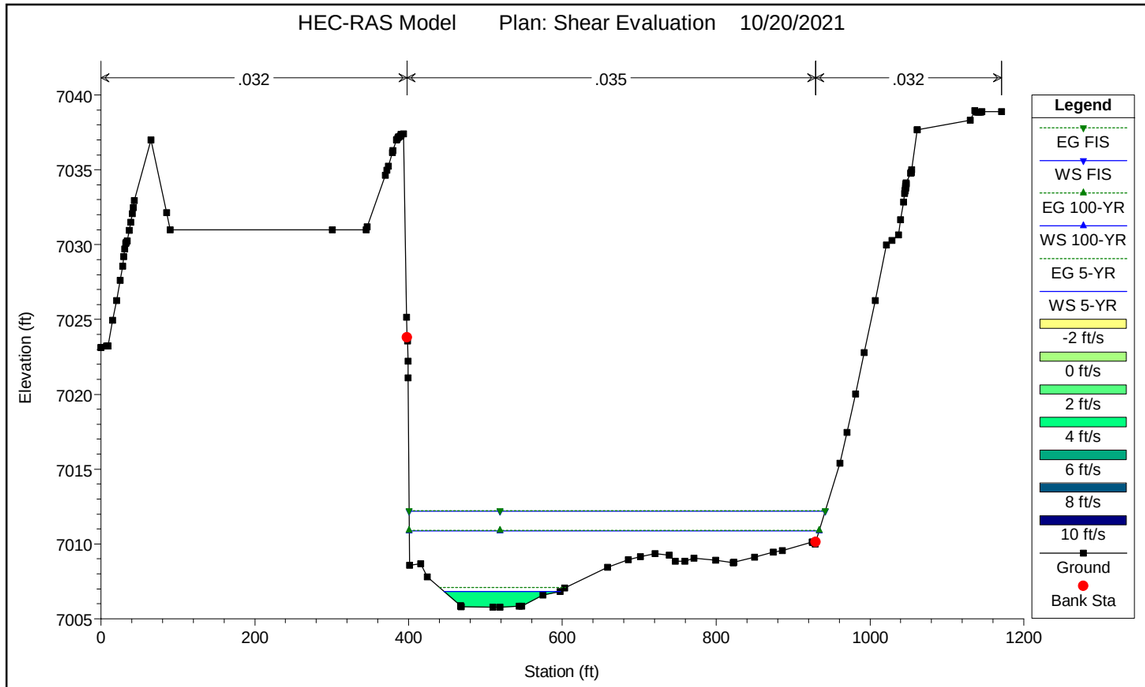
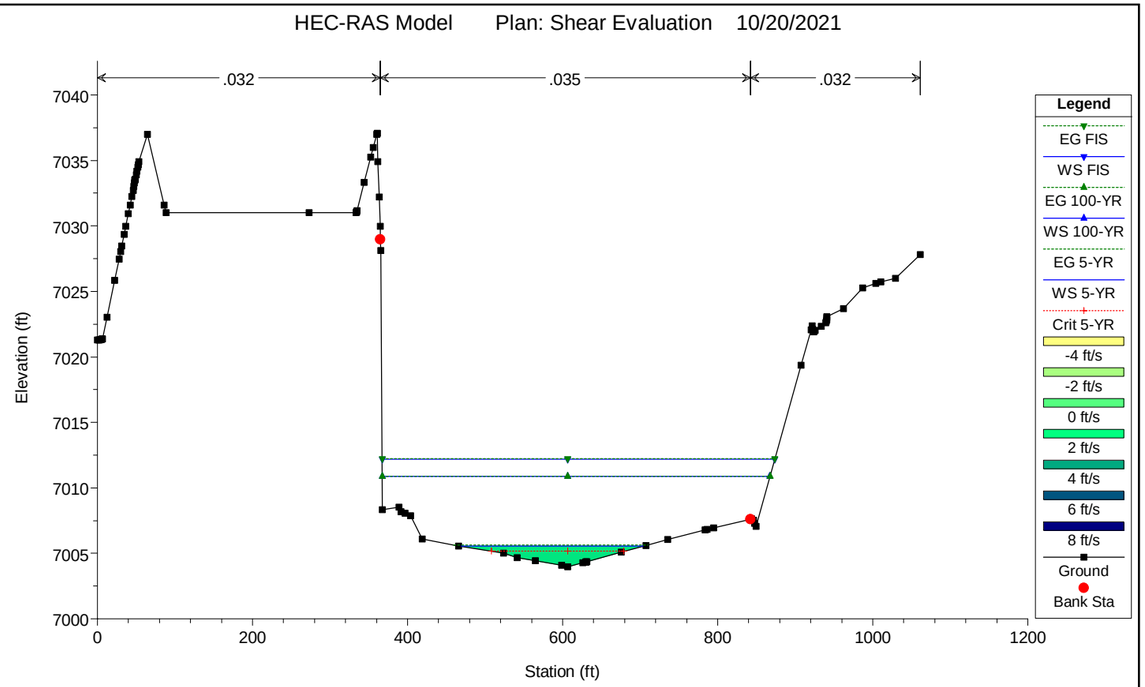



HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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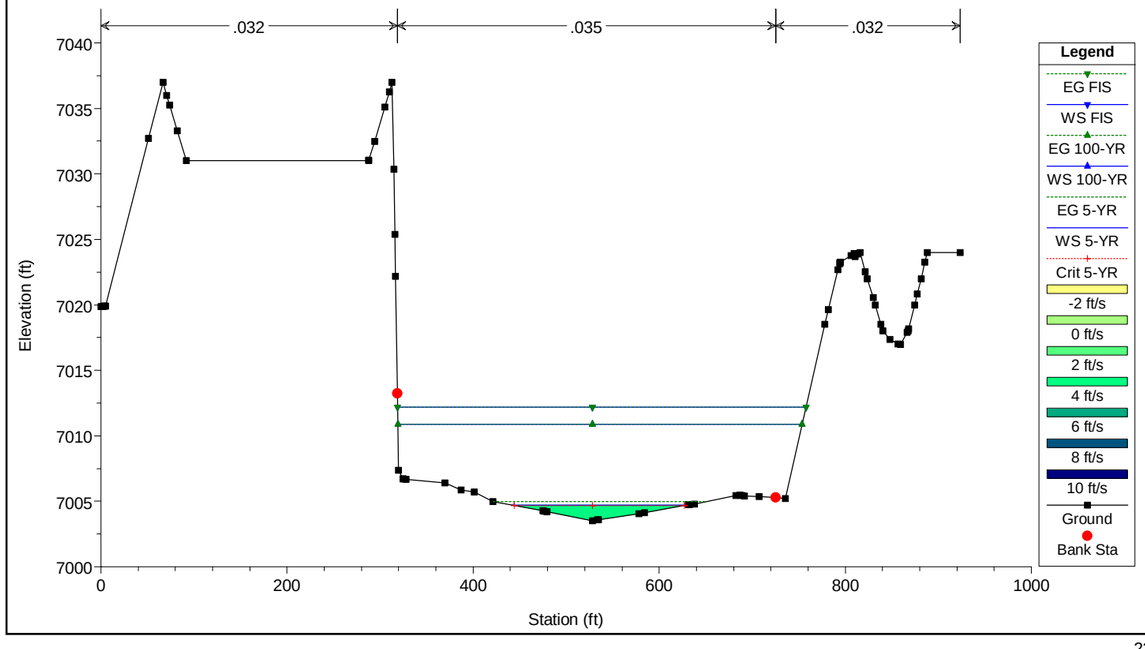
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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0 ft/s
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4 ft/s
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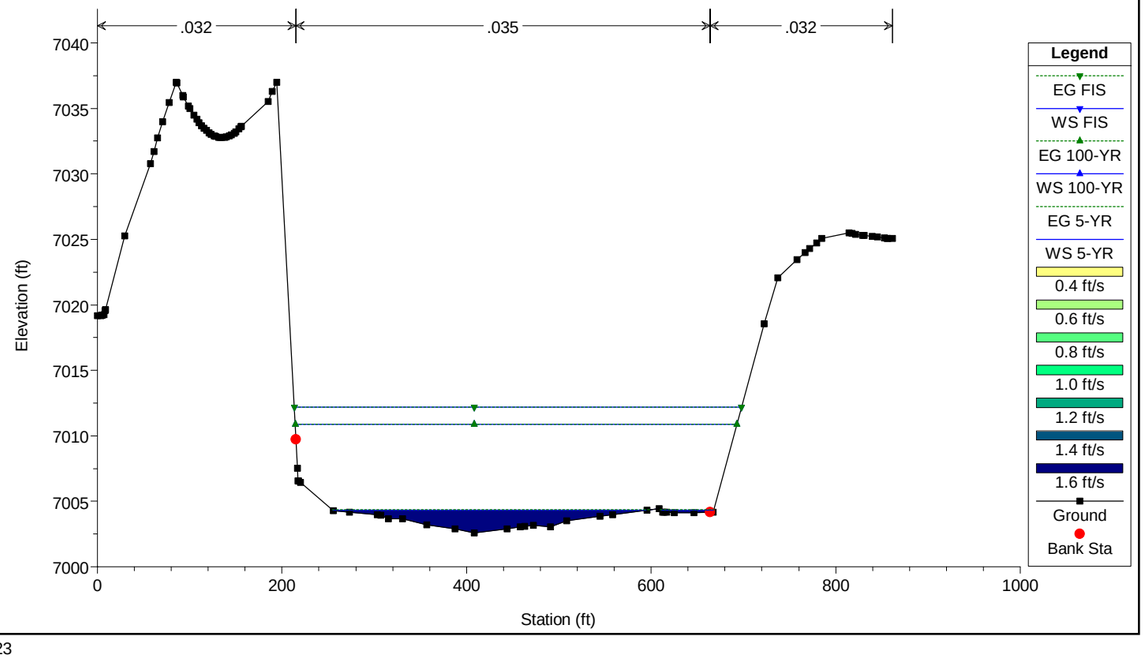
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0.4 ft/s
0.6 ft/s
0.8 ft/s
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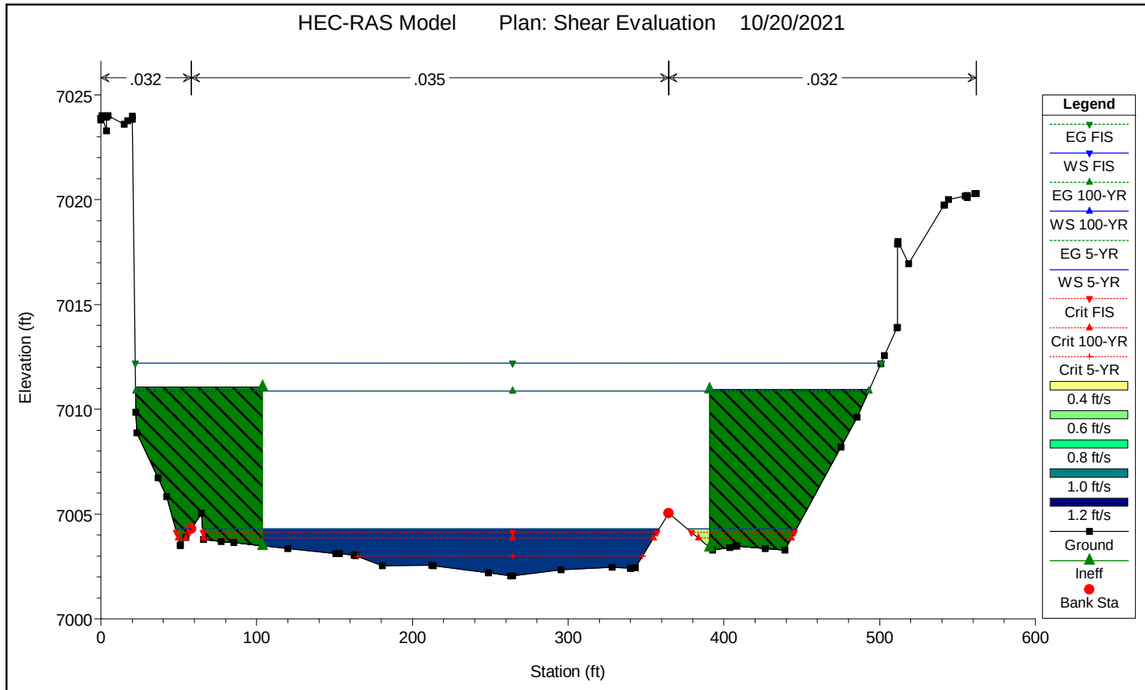
1.2 ft/s
1.4 ft/s
1.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit FIS
Crit 100-YR
Crit 5-YR
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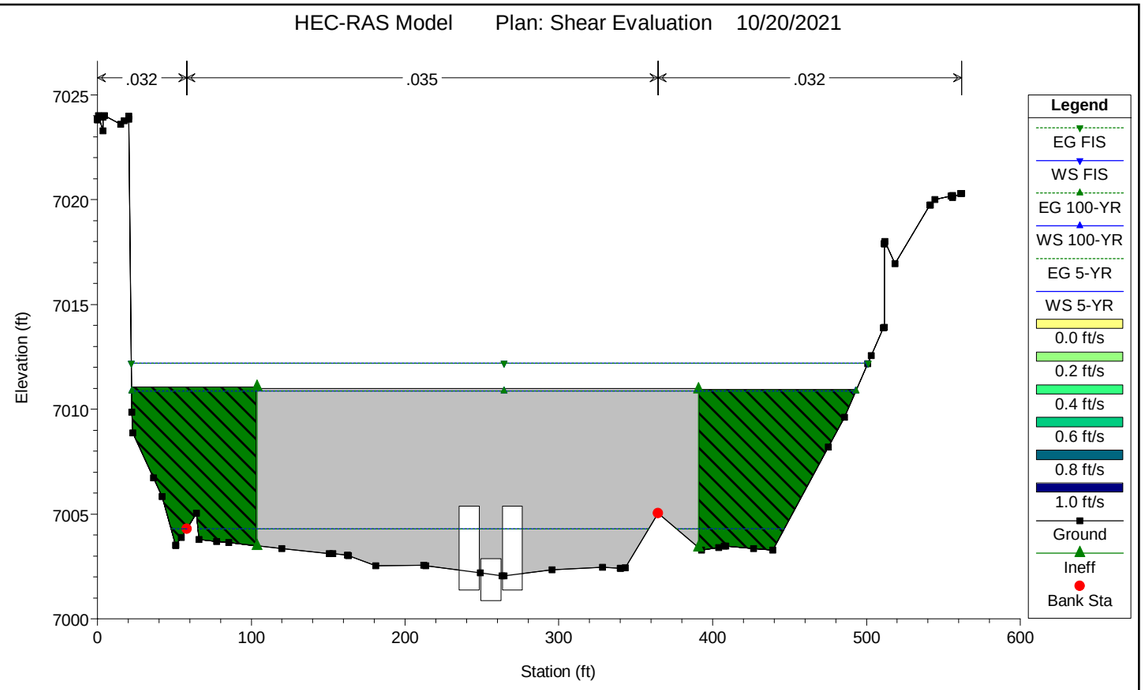
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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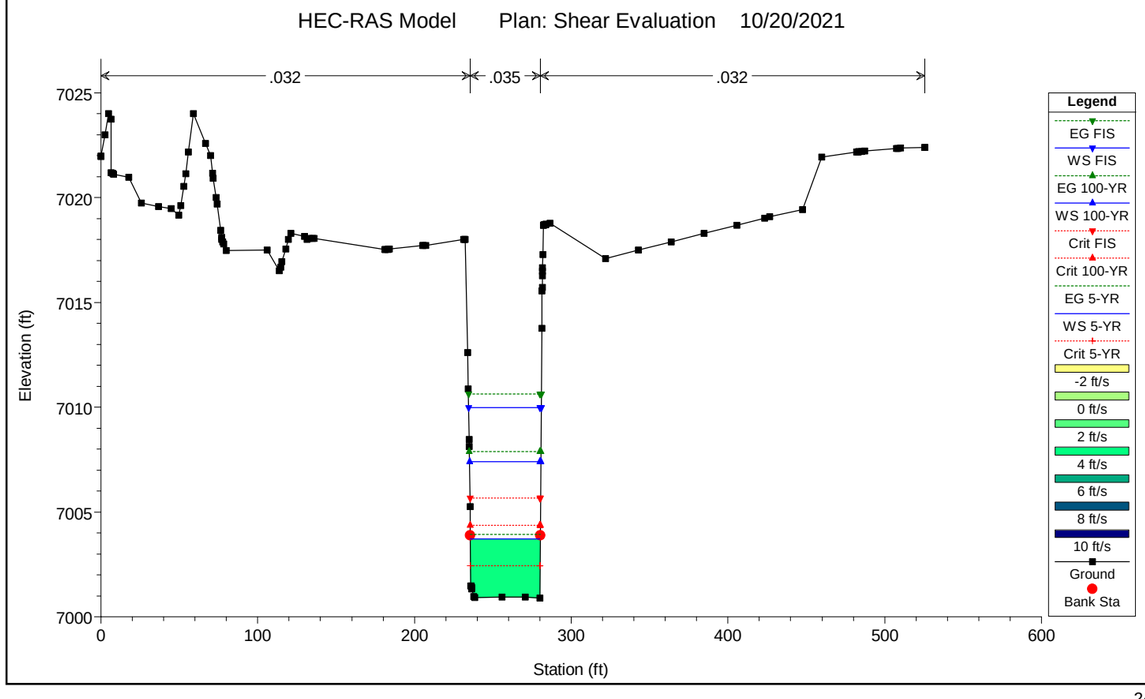
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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WS FIS
EG 100-YR
WS 100-YR
Crit FIS
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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0 ft/s
2 ft/s
4 ft/s
6 ft/s
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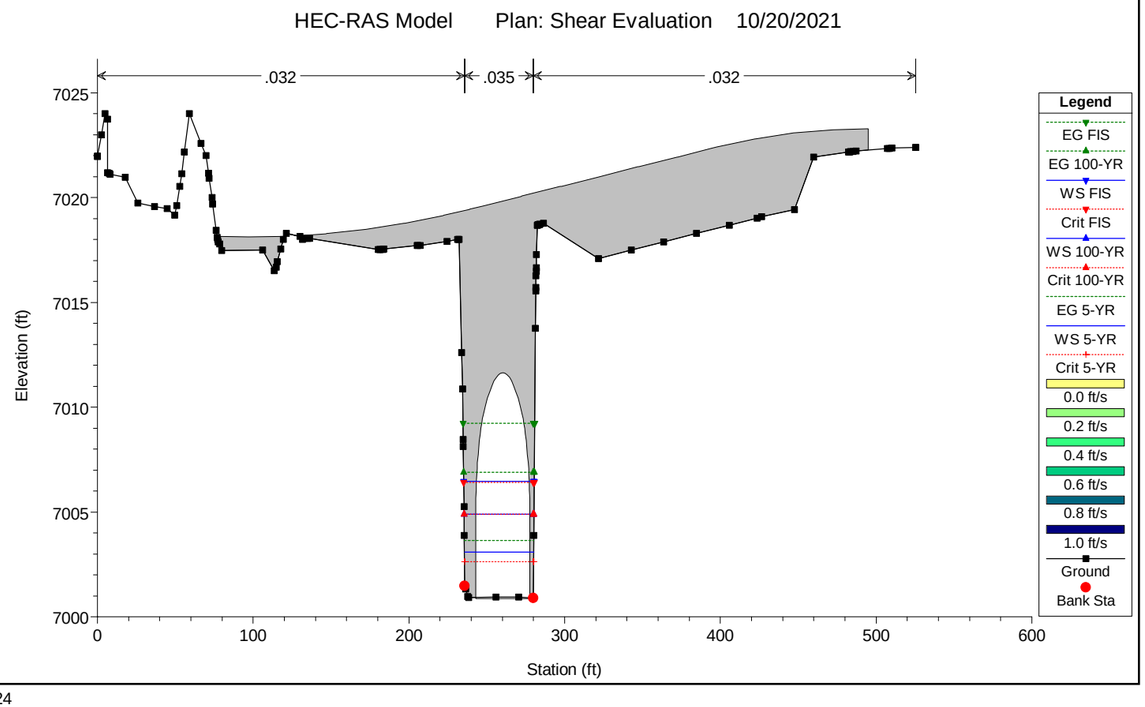
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0.0 ft/s
0.2 ft/s
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0.8 ft/s
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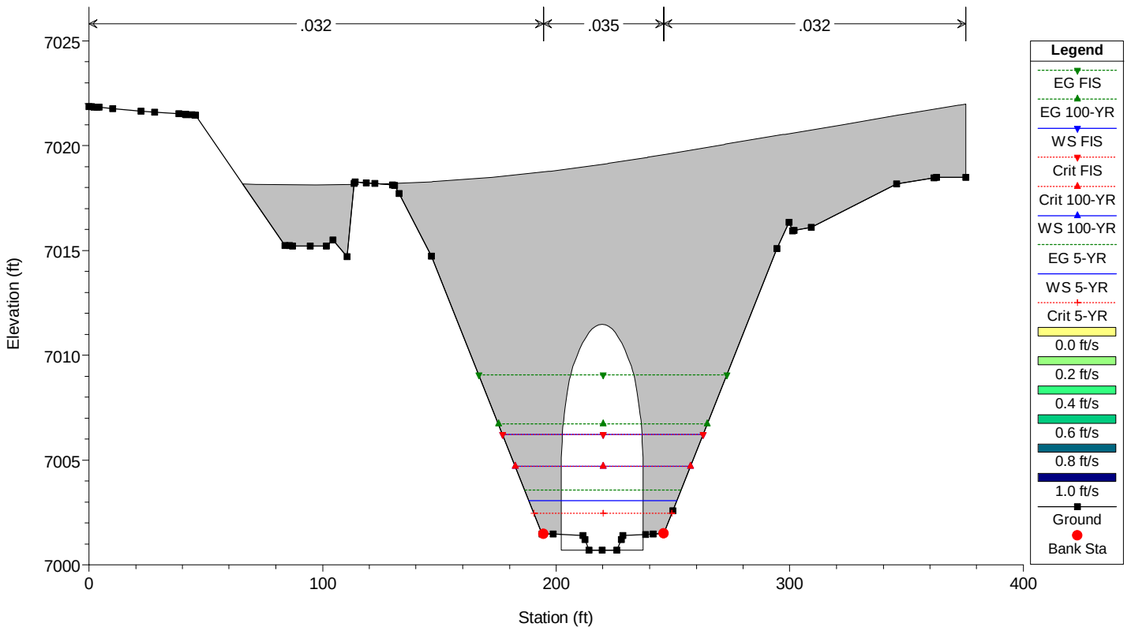
Ground
Bank Sta

HEC-RAS Model Plan: Shear Evaluation 10/20/2021



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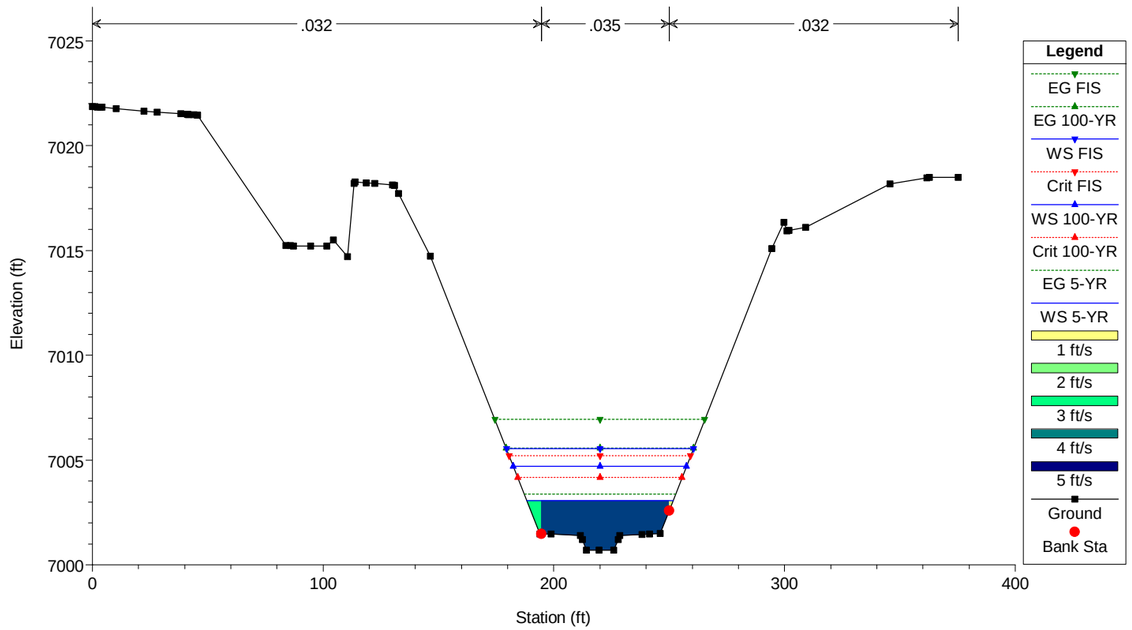

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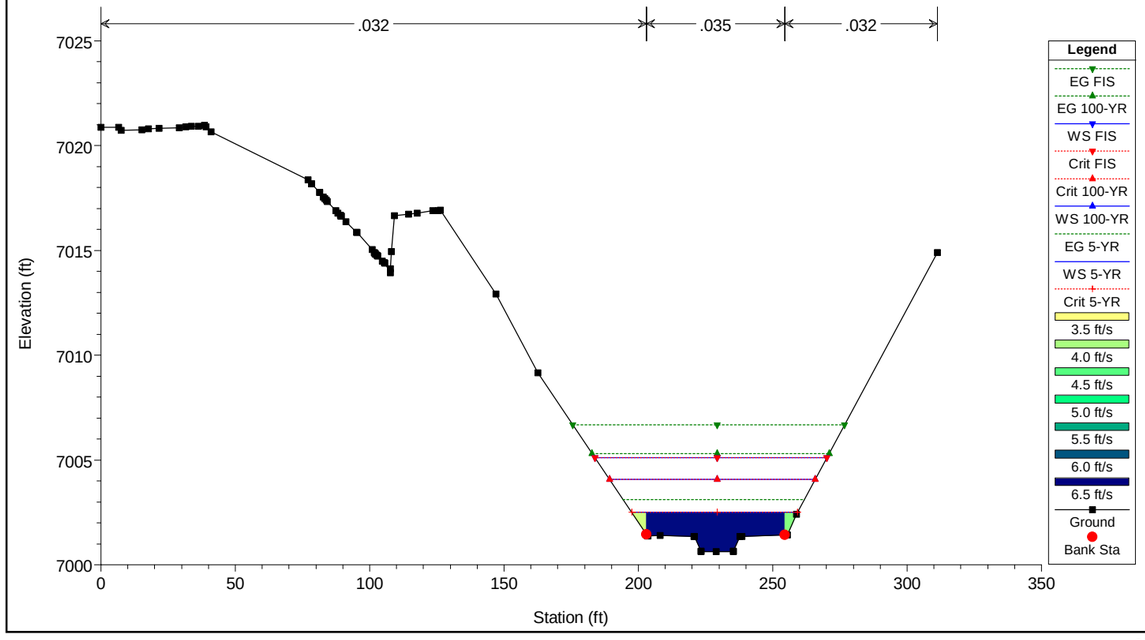

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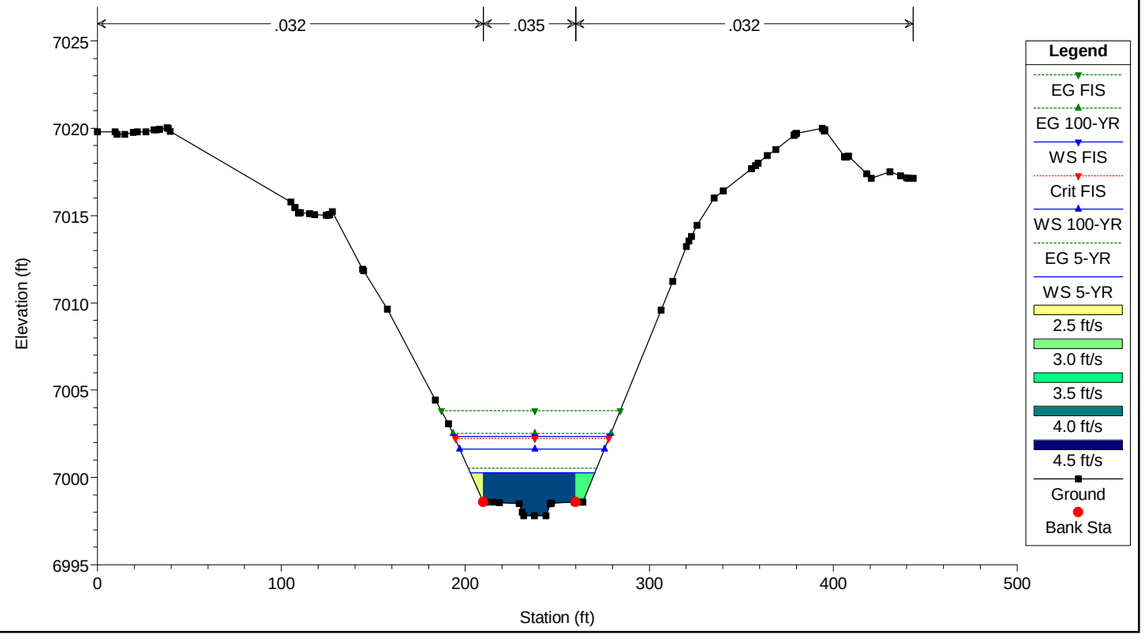

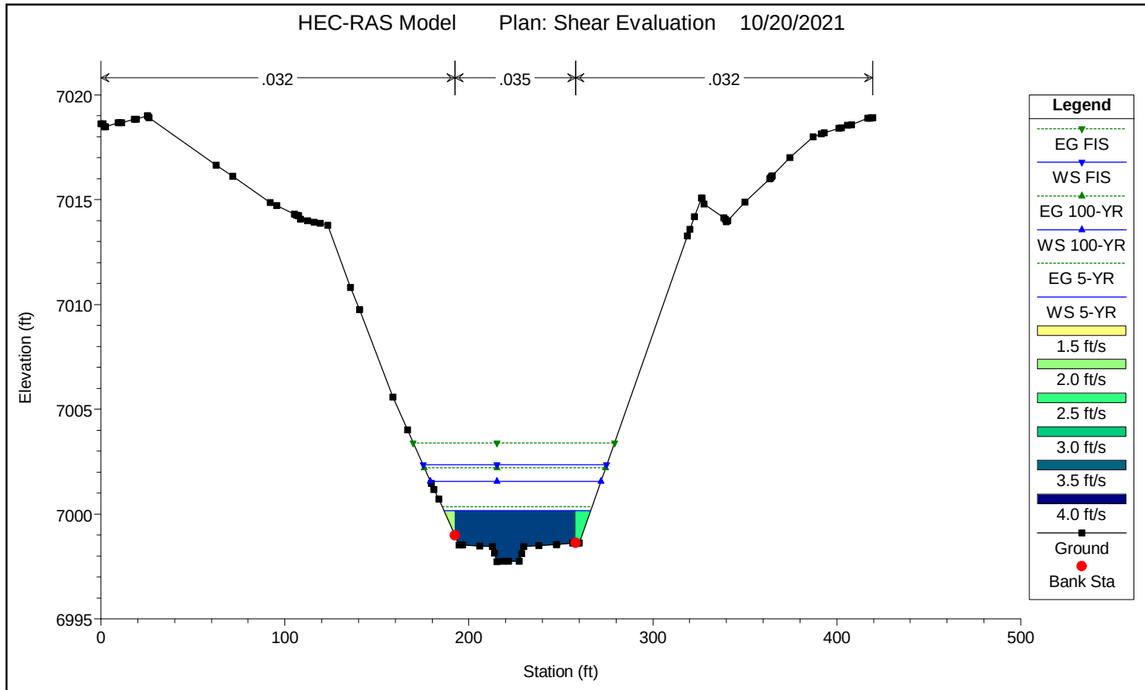
HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
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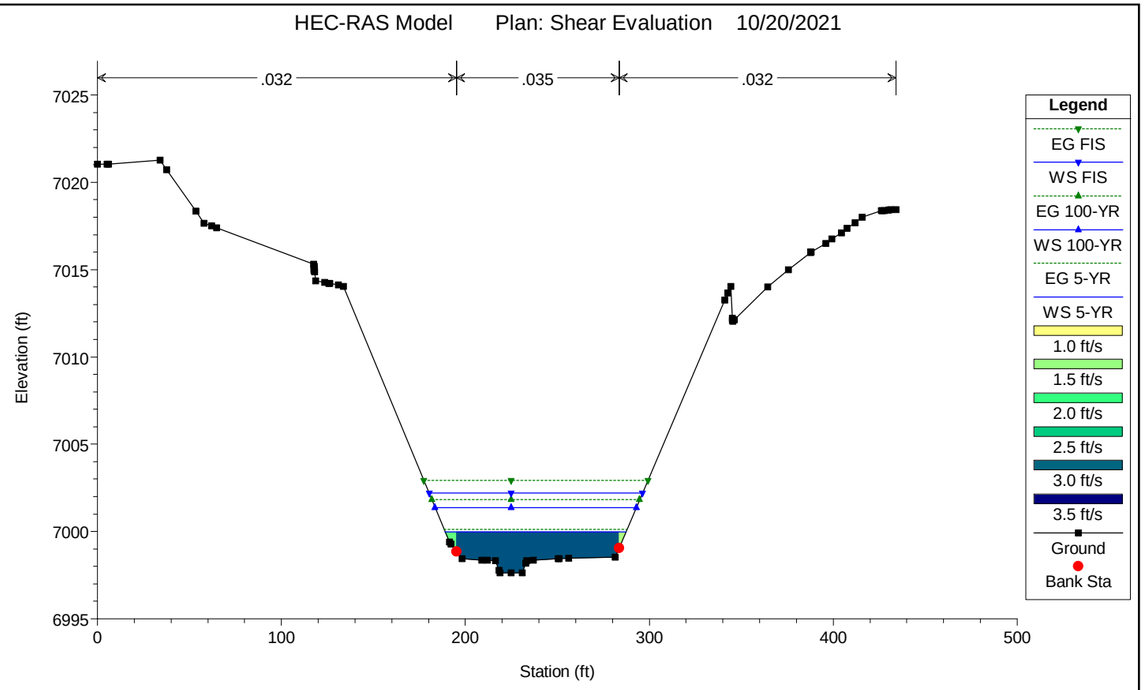
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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1.5 ft/s
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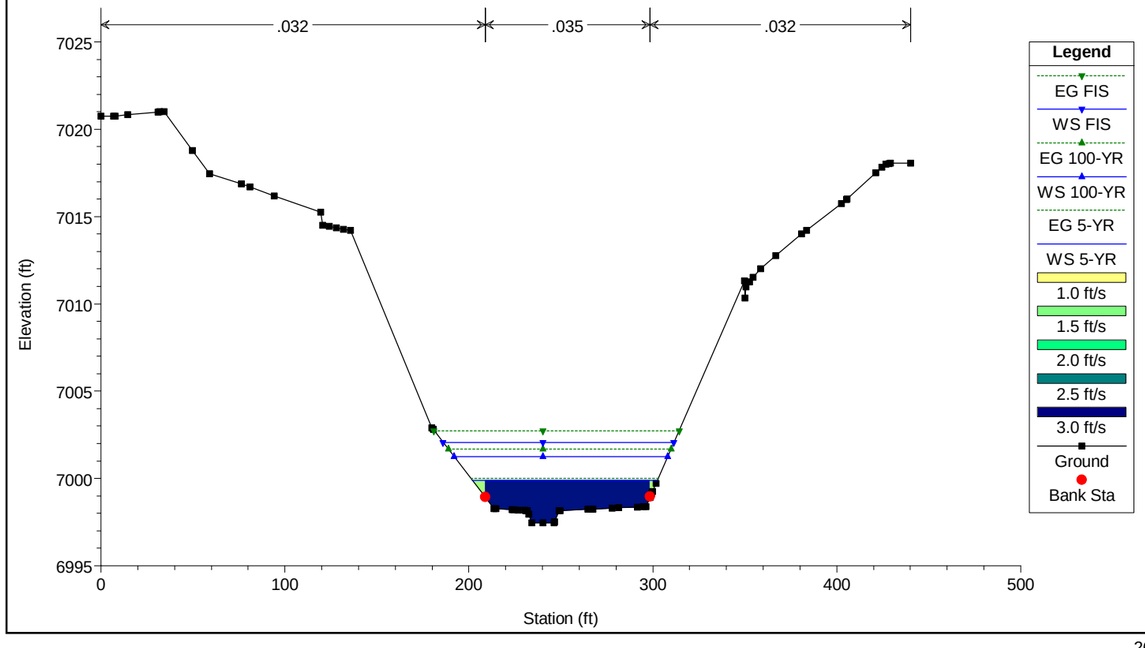
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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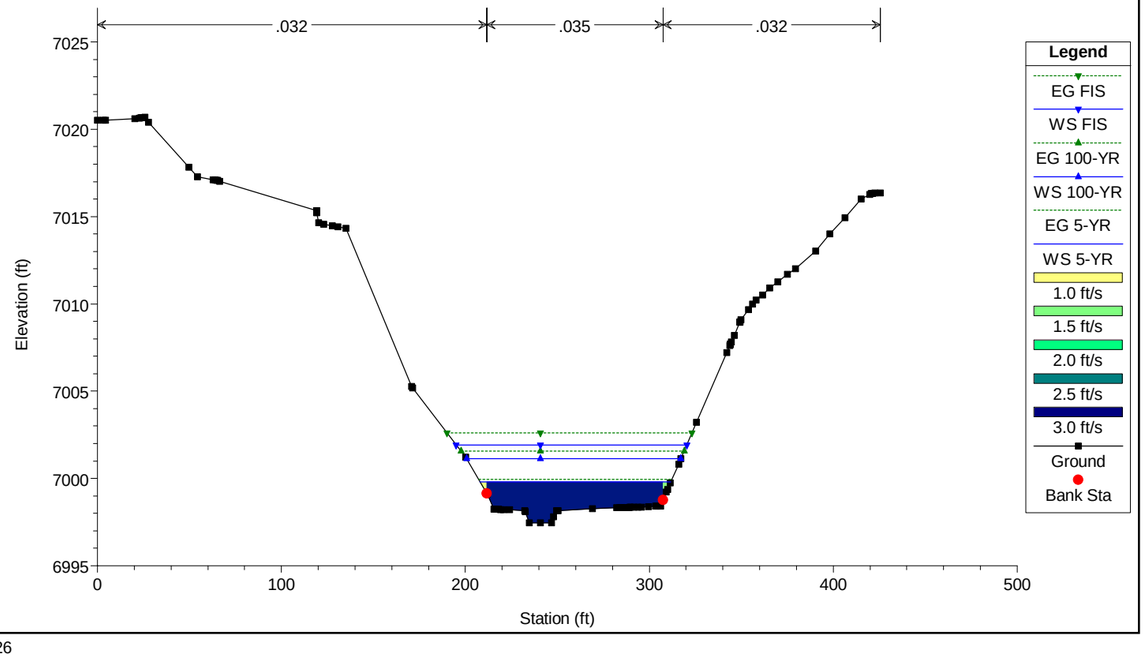
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta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.035
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Elevation (ft)
Station (ft)
Legend
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WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
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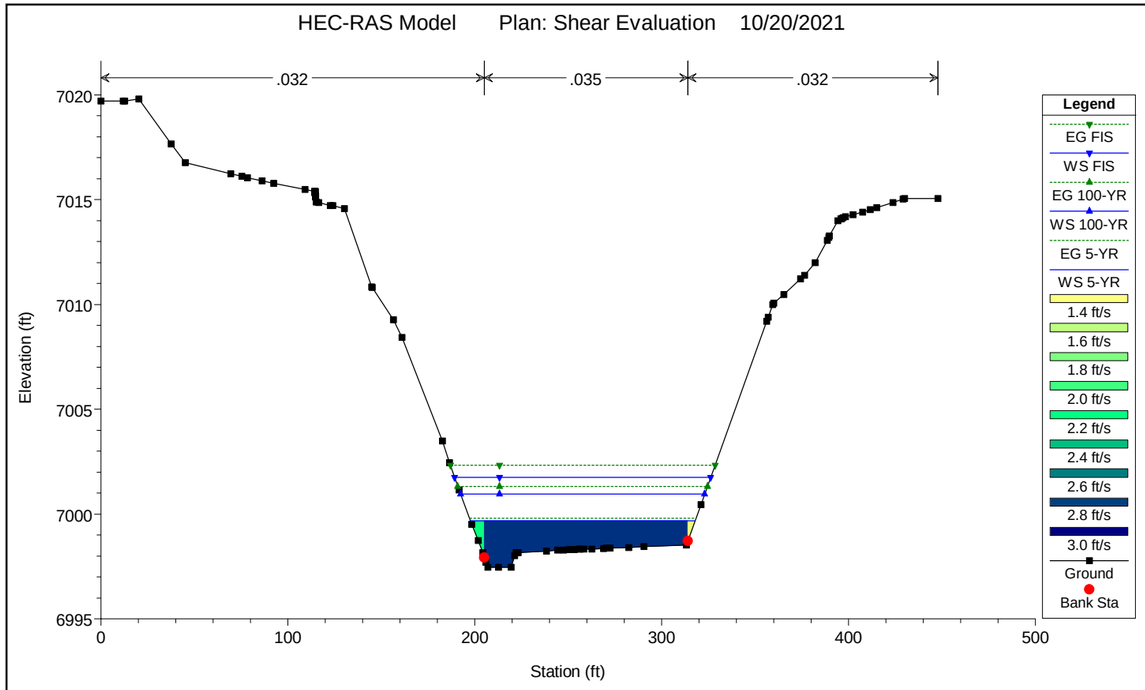
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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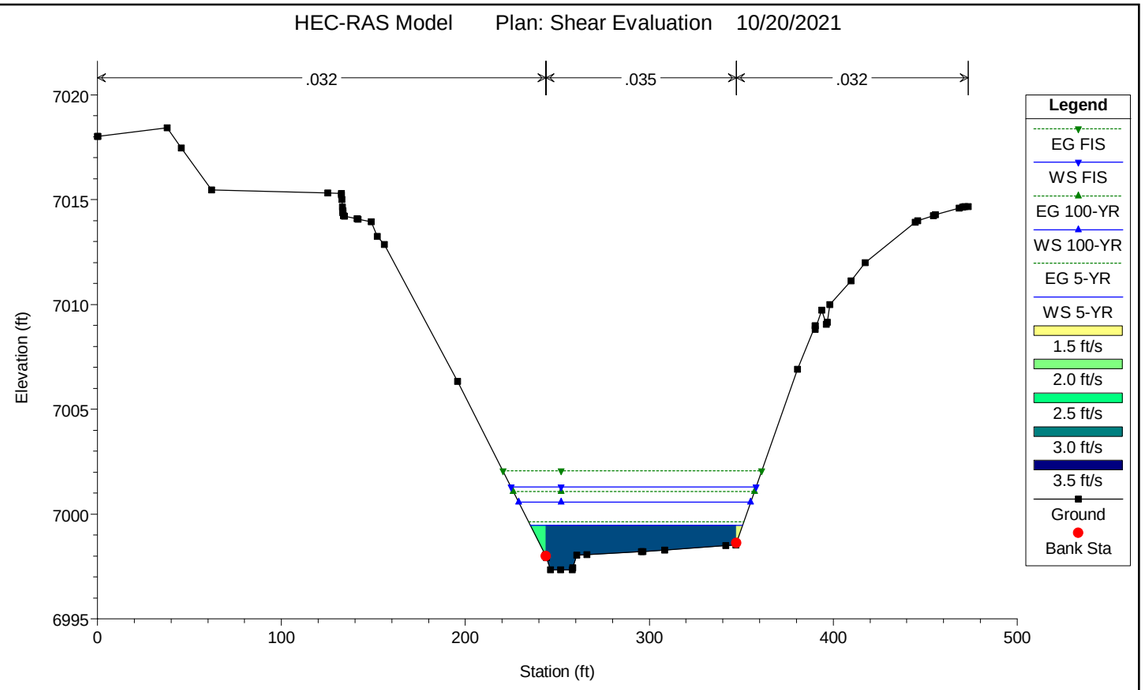
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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WS FIS
EG 100-YR
WS 100-YR
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WS 5-YR
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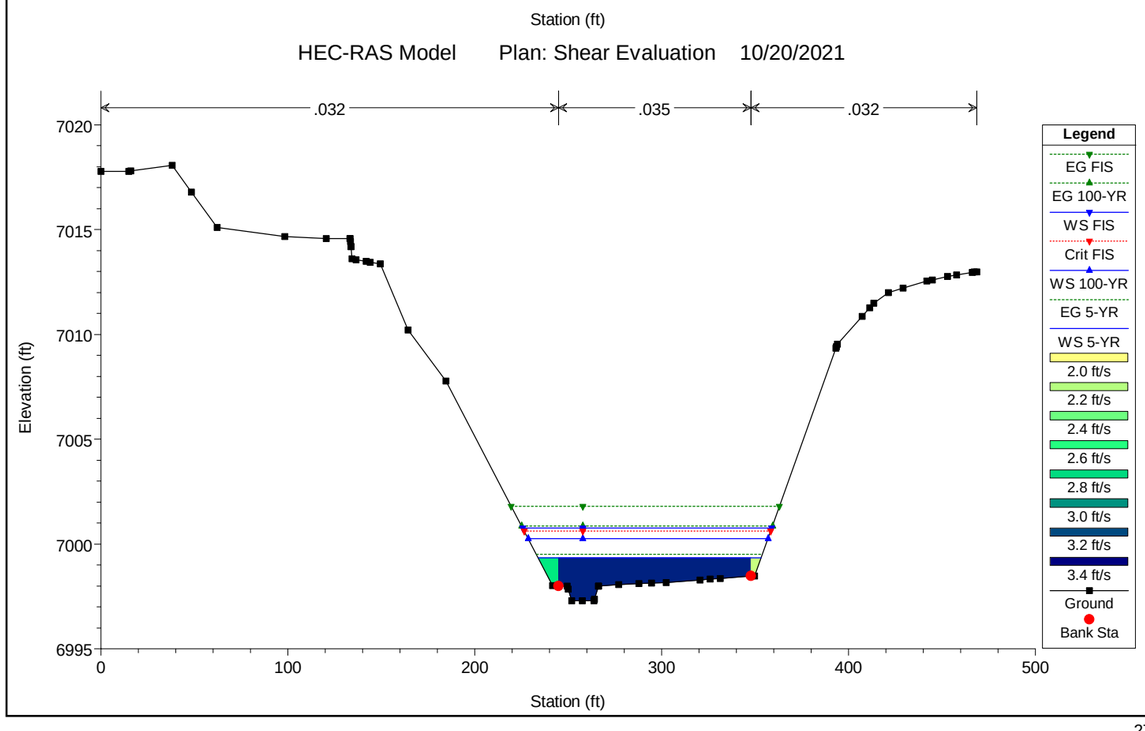
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta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.035
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Elevation (ft)
Station (ft)
Legend
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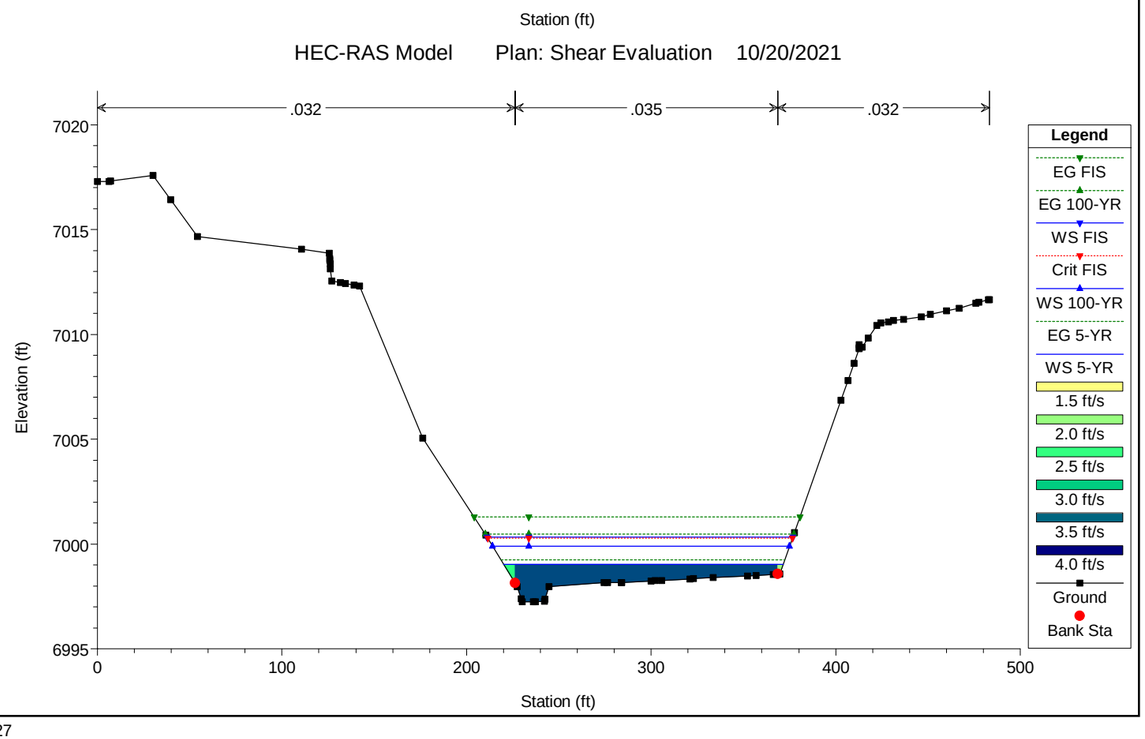
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
EG 5-YR
WS 5-YR
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
Ground
Bank Sta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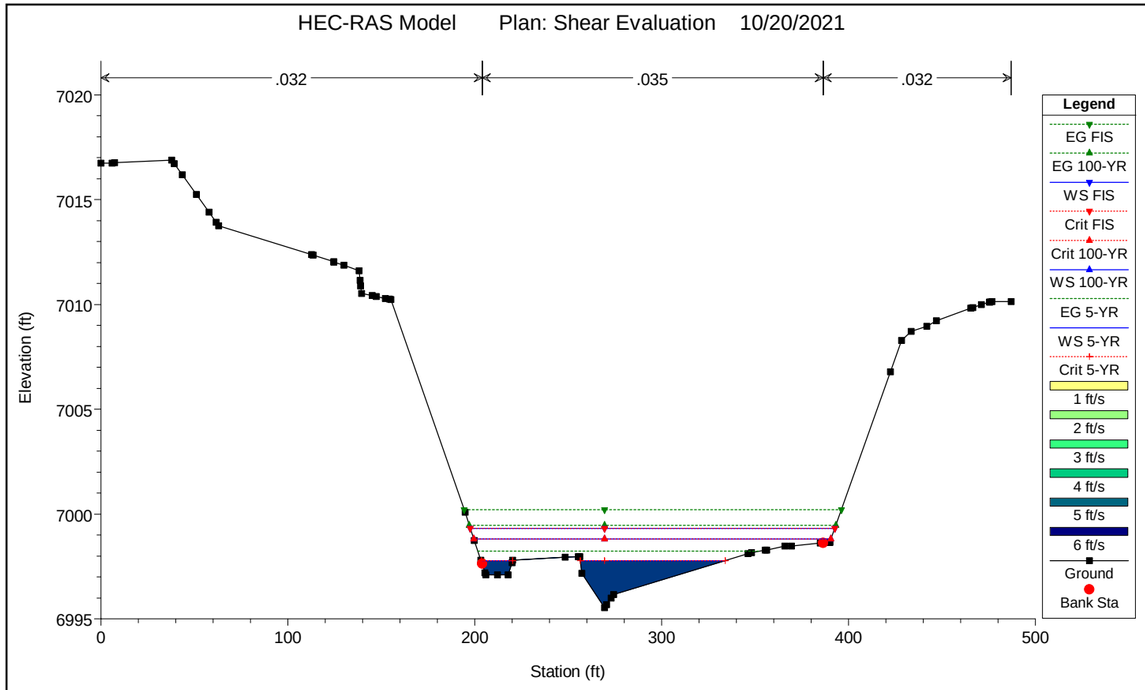
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta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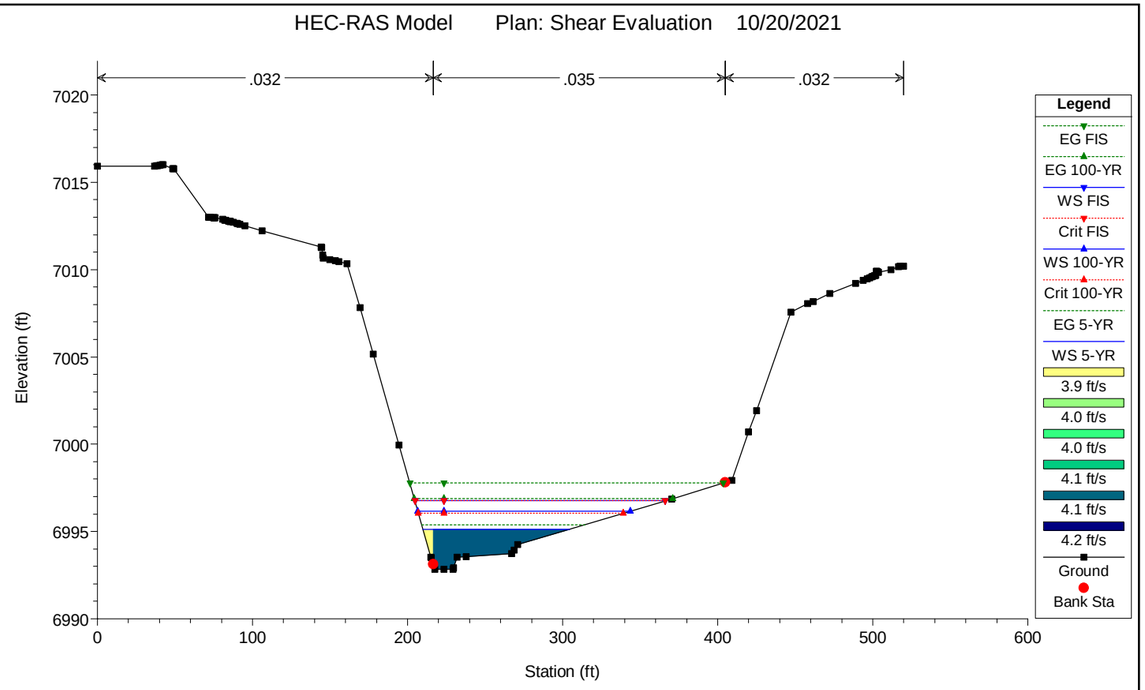
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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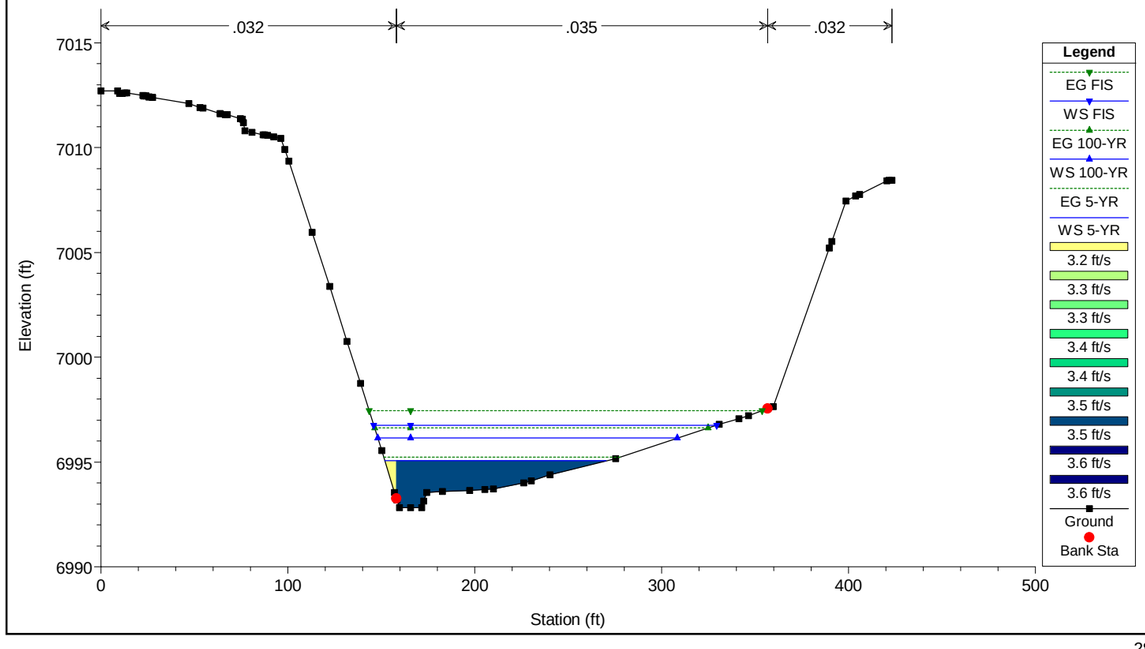
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
3.9 ft/s
4.0 ft/s
4.0 ft/s
4.1 ft/s
4.1 ft/s
4.2 ft/s
Ground
Bank Sta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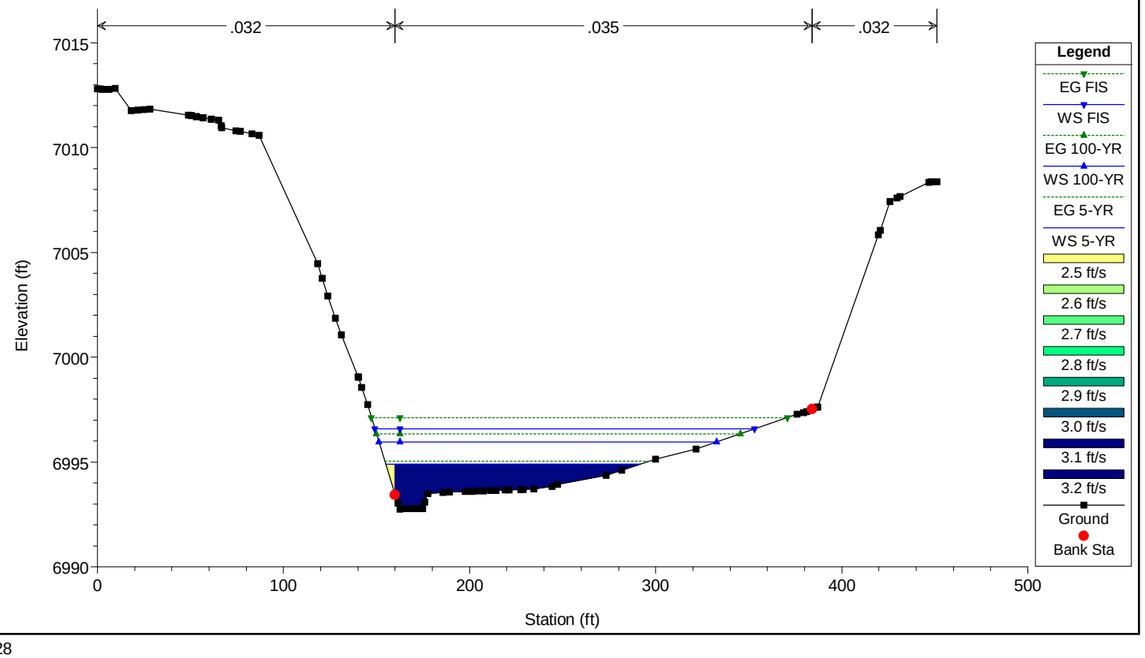
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.2 ft/s
3.3 ft/s
3.3 ft/s
3.4 ft/s
3.4 ft/s
3.5 ft/s
3.5 ft/s
3.6 ft/s
3.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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.035
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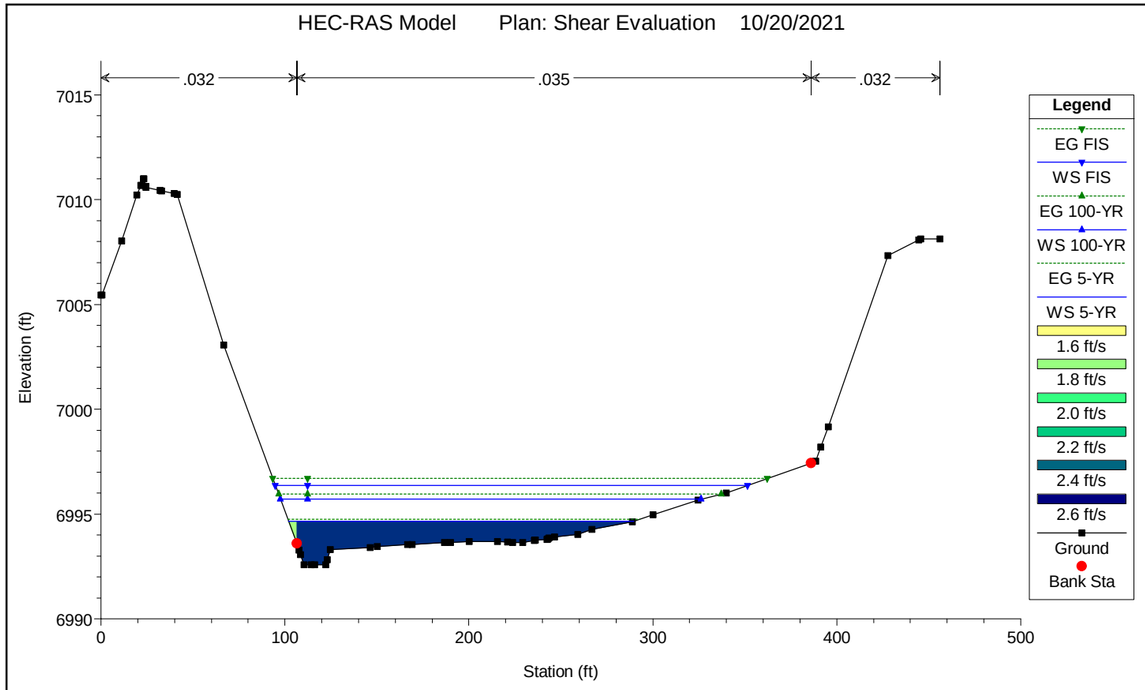
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.5 ft/s
2.6 ft/s
2.7 ft/s
2.8 ft/s
2.9 ft/s
3.0 ft/s
3.1 ft/s
3.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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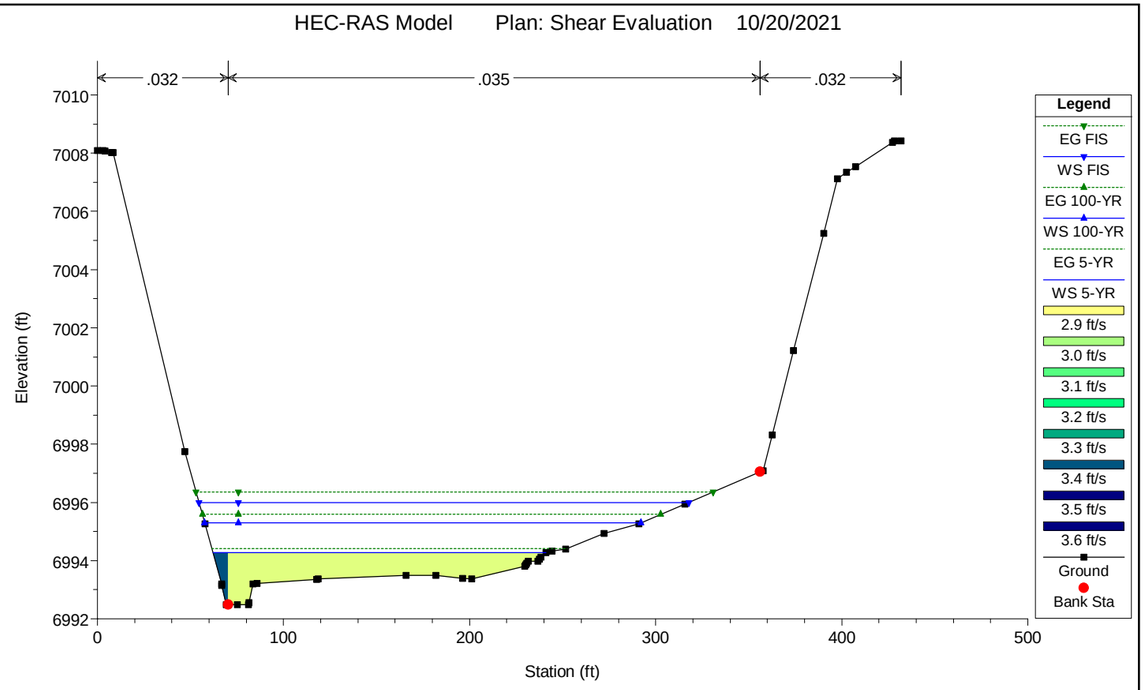
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
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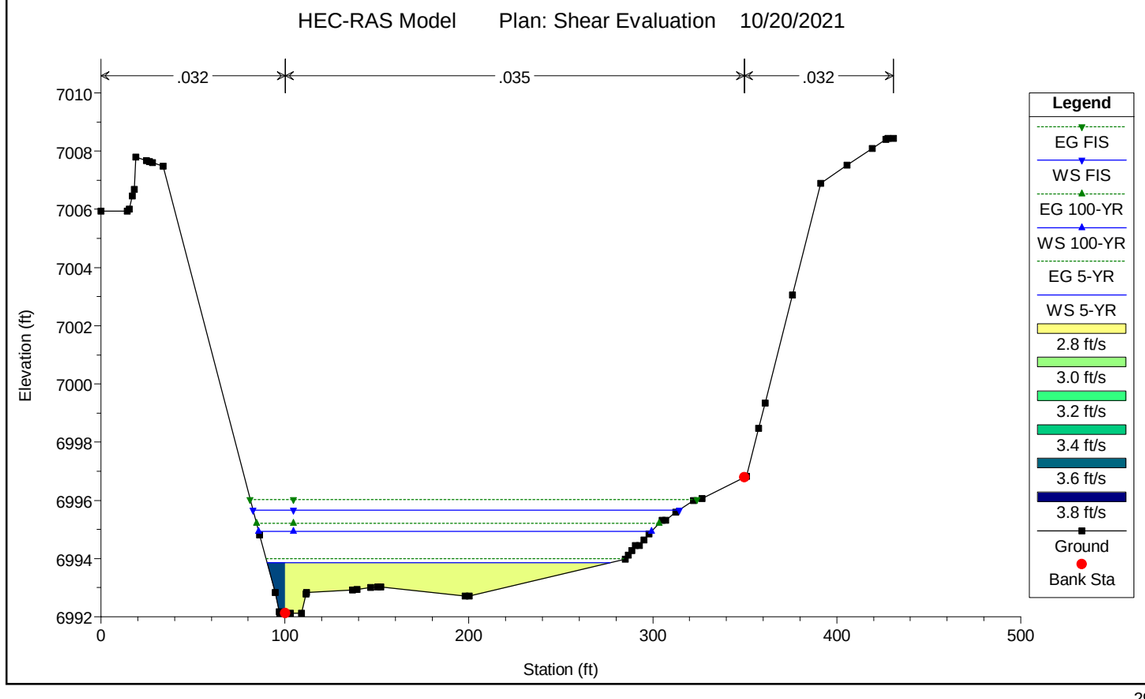
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.9 ft/s
3.0 ft/s
3.1 ft/s
3.2 ft/s
3.3 ft/s
3.4 ft/s
3.5 ft/s
3.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
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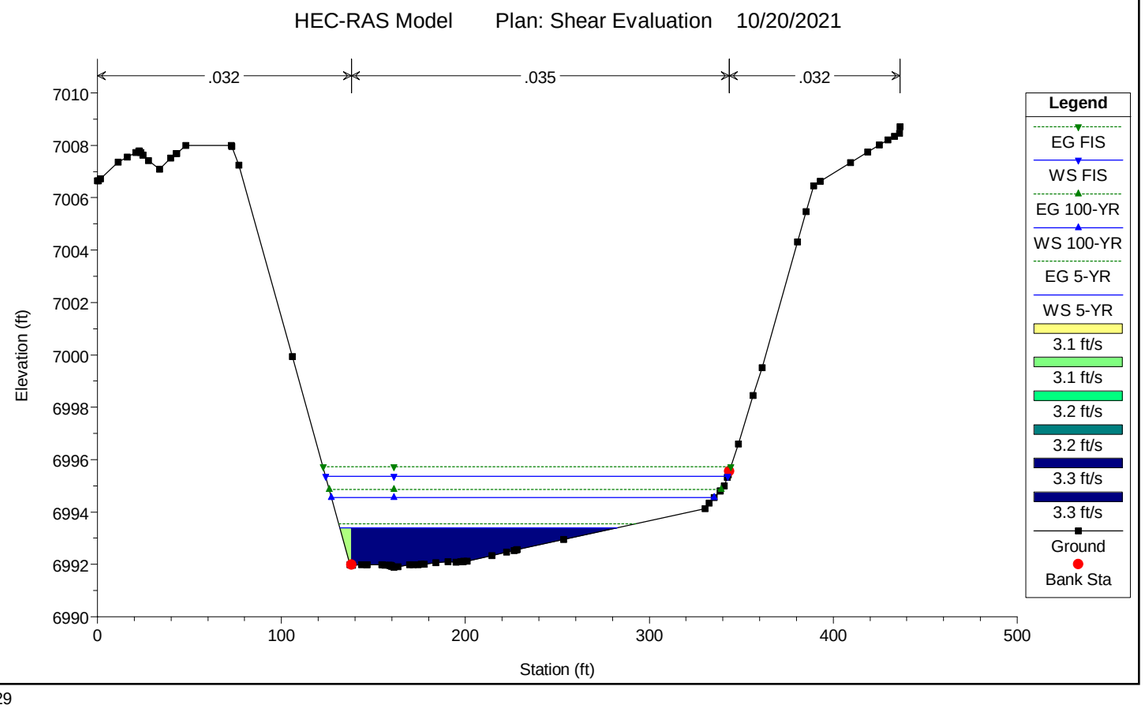
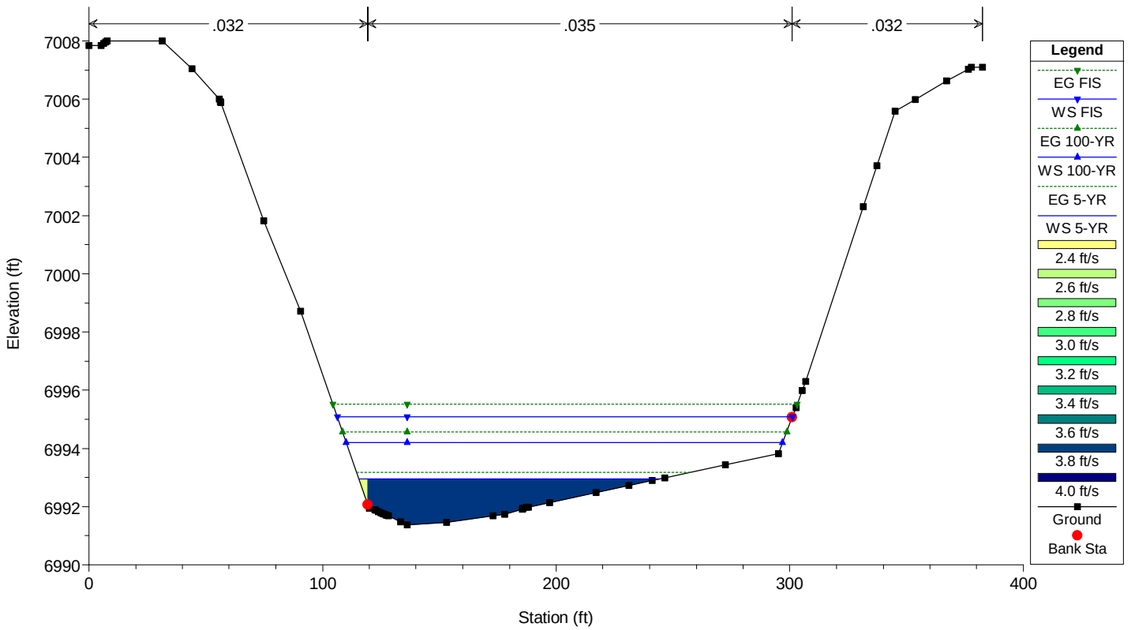
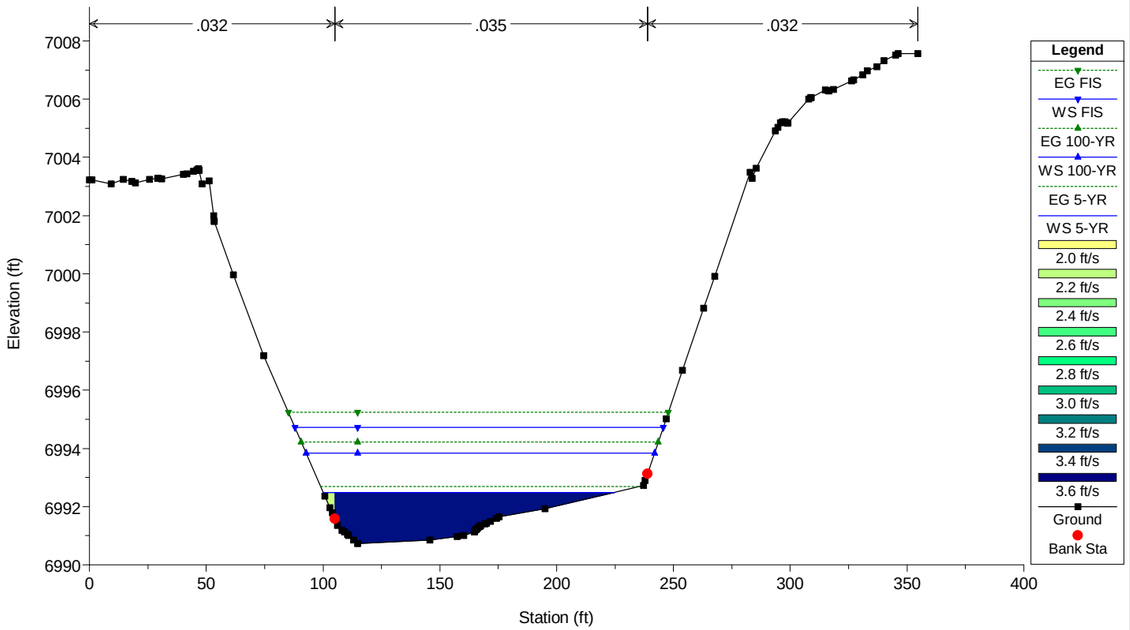
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
3.6 ft/s
3.8 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Shear Evaluation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.1 ft/s
3.1 ft/s
3.2 ft/s
3.2 ft/s
3.3 ft/s
3.3 ft/s
Ground
Bank Sta

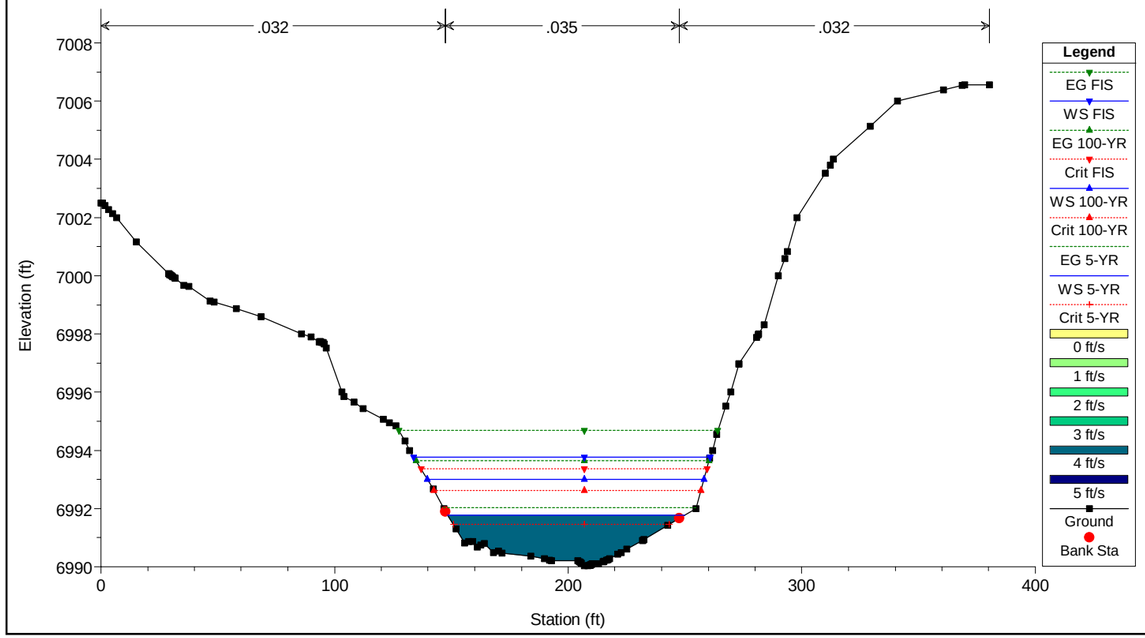
HEC-RAS Model Plan: Shear Evaluation 10/20/2021



HEC-RAS Model Plan: Shear Evaluation 10/20/2021

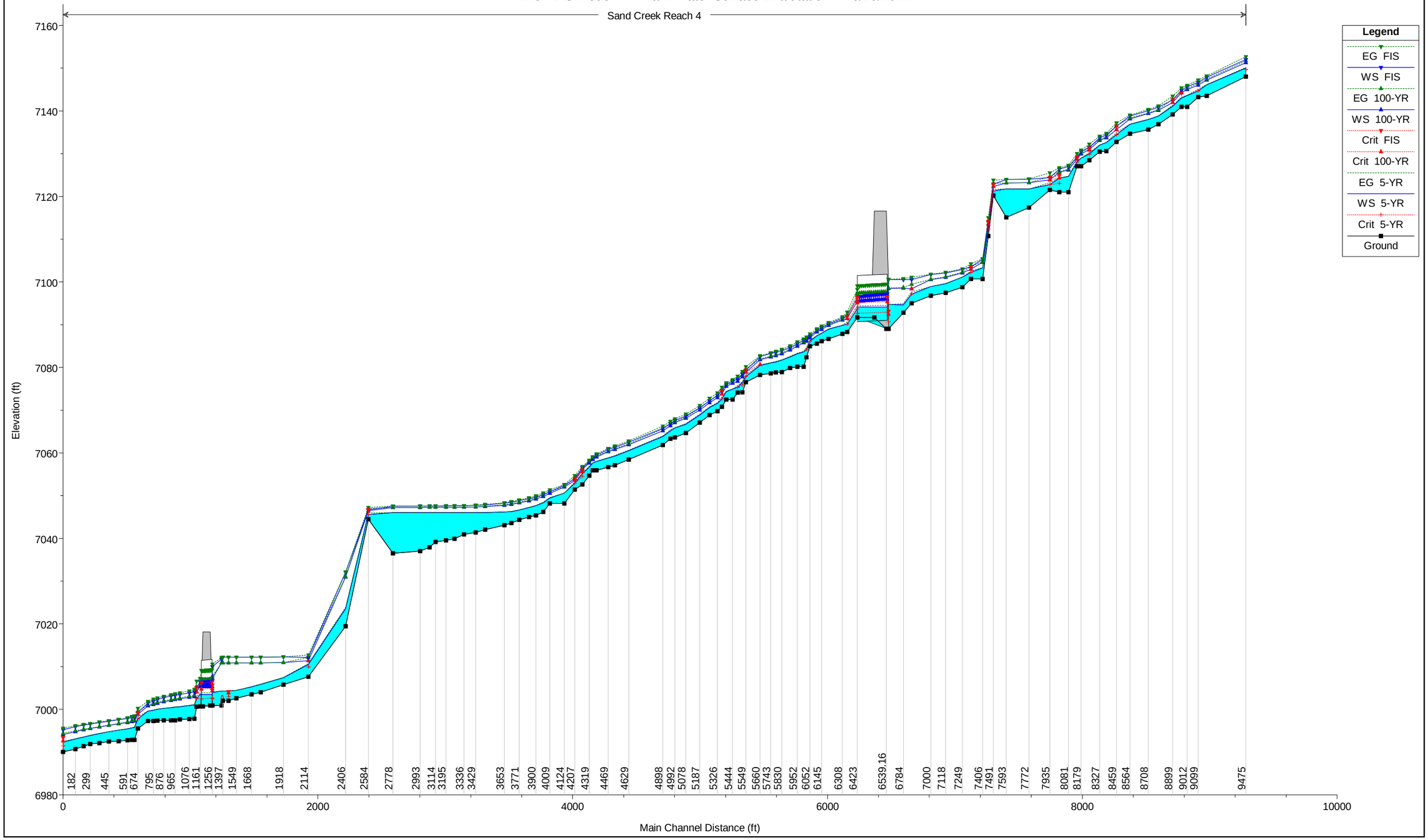


HEC-RAS Model Plan: Shear Evaluation 10/20/2021



HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021

Sand Creek Reach 4



Please label Proposed - Water surface Evaluation Fully Vegetated

HEC-RAS Plan: WS River: Sand Creek Reach: Reach 4

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	9475	5-YR	482.50	7148.00	7150.00	7149.65	7150.21	0.027341	121.95	0.63		1.83			3.68		3.68
Reach 4	9475	100-YR	1627.10	7148.00	7151.28		7151.76	0.023451	131.95	0.65		3.25			5.53		5.53
Reach 4	9475	FIS	2600.00	7148.00	7152.04		7152.71	0.023444	137.94	0.68		4.19			6.55		6.55
Reach 4	9167	5-YR	482.50	7143.51	7146.13		7146.20	0.007452	204.06	0.33	0.17	0.56	0.08	1.31	2.07	0.82	2.06
Reach 4	9167	100-YR	1627.10	7143.51	7147.24		7147.43	0.009055	219.12	0.41	0.51	1.30	0.50	2.65	3.53	2.62	3.48
Reach 4	9167	FIS	2600.00	7143.51	7147.89		7148.17	0.009707	227.99	0.44	0.74	1.79	0.76	3.36	4.31	3.39	4.24
Reach 4	9099	5-YR	482.50	7143.25	7144.69	7144.68	7145.06	0.063673	133.14	0.90	3.38	3.03		6.73	4.47		4.69
Reach 4	9099	100-YR	1627.10	7143.25	7146.02		7146.45	0.025870	202.61	0.66	2.71	2.86	0.48	6.74	5.00	2.12	5.09
Reach 4	9099	FIS	2600.00	7143.25	7146.69		7147.21	0.021511	226.74	0.64	2.76	3.28	0.92	7.04	5.65	3.39	5.61
Reach 4	9012	5-YR	482.50	7140.92	7143.62		7143.70	0.006474	145.85	0.32	0.26	0.61		1.79	2.24		2.24
Reach 4	9012	100-YR	1627.10	7140.92	7145.01		7145.21	0.008553	198.32	0.40	0.70	1.33	0.09	3.28	3.60	0.83	3.58
Reach 4	9012	FIS	2600.00	7140.92	7145.69		7145.99	0.009521	229.41	0.44	0.96	1.87	0.25	4.00	4.45	1.64	4.36
Reach 4	8967	5-YR	482.50	7140.92	7143.04		7143.20	0.021103	140.82	0.55	0.56	1.42		2.44	3.24		3.23
Reach 4	8967	100-YR	1627.10	7140.92	7144.30		7144.64	0.017531	197.31	0.56	1.15	2.36	0.19	4.08	4.69	1.23	4.62
Reach 4	8967	FIS	2600.00	7140.92	7144.86	7144.20	7145.36	0.019179	229.45	0.61	1.59	3.25	0.67	4.97	5.72	2.79	5.48
Reach 4	8899	5-YR	482.50	7139.15	7141.08		7141.35	0.036028	111.07	0.72		2.38	1.07		4.18	3.45	4.17
Reach 4	8899	100-YR	1627.10	7139.15	7141.97	7141.97	7142.70	0.051698	182.22	0.93	0.76	5.57	1.18	2.58	6.94	4.01	6.71
Reach 4	8899	FIS	2600.00	7139.15	7142.54	7142.54	7143.42	0.044491	196.25	0.91	1.58	6.36	2.28	4.30	7.78	5.50	7.42
Reach 4	8788	5-YR	482.50	7136.86	7138.79		7138.91	0.014474	186.95	0.45	0.03	0.88	1.03	0.35	2.50	3.90	2.63
Reach 4	8788	100-YR	1627.10	7136.86	7140.13		7140.34	0.009588	199.78	0.42	0.41	1.38	1.10	2.25	3.63	4.36	3.68
Reach 4	8788	FIS	2600.00	7136.86	7140.85		7141.15	0.009971	212.76	0.45	0.64	1.88	1.14	3.02	4.43	4.43	4.41
Reach 4	8708	5-YR	482.50	7135.59	7138.00		7138.09	0.007444	132.10	0.35		0.71	0.24		2.44	1.65	2.43
Reach 4	8708	100-YR	1627.10	7135.59	7139.37		7139.56	0.009602	216.79	0.42	0.33	1.34	0.71	1.95	3.55	3.26	3.53
Reach 4	8708	FIS	2600.00	7135.59	7140.09		7140.36	0.009394	223.45	0.43	0.57	1.73	0.90	2.81	4.23	3.83	4.19
Reach 4	8564	5-YR	482.50	7134.66	7136.88		7136.95	0.008461	198.83	0.35	0.10	0.61	0.43	0.92	2.15	2.38	2.15
Reach 4	8564	100-YR	1627.10	7134.66	7138.15		7138.32	0.007770	210.16	0.38	0.44	1.18	0.70	2.47	3.38	3.35	3.36
Reach 4	8564	FIS	2600.00	7134.66	7138.79		7139.06	0.008871	215.80	0.42	0.69	1.70	0.98	3.23	4.22	4.09	4.19
Reach 4	8459	5-YR	482.50	7132.75	7134.44	7134.44	7134.92	0.071636	92.44	1.00		4.34	2.01		5.57	4.66	5.54
Reach 4	8459	100-YR	1627.10	7132.75	7135.62	7135.62	7136.48	0.058431	129.99	0.99		6.37	3.78		7.44	7.36	7.44
Reach 4	8459	FIS	2600.00	7132.75	7136.44	7136.44	7137.21	0.044247	228.07	0.89		5.71	2.18		7.24	5.34	6.94
Reach 4	8379	5-YR	482.50	7130.59	7132.60		7132.69	0.010392	191.14	0.39	0.27	0.73	0.30	1.68	2.34	1.80	2.33
Reach 4	8379	100-YR	1627.10	7130.59	7133.73		7133.96	0.010903	206.09	0.45	0.66	1.53	0.69	3.05	3.81	3.12	3.77
Reach 4	8379	FIS	2600.00	7130.59	7134.40		7134.72	0.011358	214.84	0.48	0.93	2.07	0.94	3.78	4.62	3.83	4.55
Reach 4	8327	5-YR	482.50	7130.49	7132.02		7132.11	0.011736	188.02	0.41	0.40	0.80	0.21	2.14	2.44	1.40	2.43
Reach 4	8327	100-YR	1627.10	7130.49	7133.09		7133.34	0.012973	202.10	0.48	0.87	1.75	0.69	3.55	4.04	3.03	4.00
Reach 4	8327	FIS	2600.00	7130.49	7133.69		7134.06	0.014117	210.01	0.53	1.21	2.43	1.01	4.36	4.97	3.87	4.90
Reach 4	8246	5-YR	482.50	7128.49	7129.91	7129.85	7130.25	0.057863	126.47	0.87	2.53	3.02		5.63	4.53		4.63
Reach 4	8246	100-YR	1627.10	7128.49	7130.96	7130.83	7131.51	0.044264	192.23	0.84	3.38	4.04		7.15	5.75	0.17	5.89
Reach 4	8246	FIS	2600.00	7128.49	7131.51	7131.32	7132.23	0.038878	199.42	0.83	3.63	4.88	0.66	7.67	6.67	2.46	6.77
Reach 4	8179	5-YR	482.50	7127.03	7128.95		7129.02	0.008551	211.08	0.35	0.32	0.60	0.43	1.96	2.12	2.37	2.13
Reach 4	8179	100-YR	1627.10	7127.03	7129.92		7130.14	0.011283	224.59	0.45	0.77	1.48	1.04	3.34	3.70	4.09	3.70
Reach 4	8179	FIS	2600.00	7127.03	7130.50		7130.82	0.012345	232.60	0.49	1.06	2.06	1.42	4.09	4.55	4.95	4.54
Reach 4	8147	5-YR	482.50	7127.03	7128.04	7128.04	7128.33	0.087966	205.32	1.01	1.00	3.11	0.12	2.84	4.31	0.68	4.30
Reach 4	8147	100-YR	1627.10	7127.03	7128.74	7128.74	7129.35	0.065191	216.52	0.99	2.18	5.13	2.42	5.01	6.32	5.36	6.27
Reach 4	8147	FIS	2600.00	7127.03	7129.19	7129.19	7130.01	0.057677	222.64	0.98	2.75	6.17	3.27	5.97	7.30	6.69	7.24
Reach 4	8081	5-YR	482.50	7121.00	7124.66		7124.74	0.005373	132.33	0.30		0.56			2.18		2.18
Reach 4	8081	100-YR	1627.10	7121.00	7126.17		7126.37	0.008023	173.67	0.39		1.30			3.59		3.59
Reach 4	8081	FIS	2600.00	7121.00	7127.00		7127.29	0.008883	193.77	0.43	0.03	1.74	0.06	0.36	4.29	0.62	4.29
Reach 4	8008	5-YR	482.50	7120.99	7124.25	7123.09	7124.32	0.006073	164.00	0.31		0.57	0.12		2.17	1.08	2.14
Reach 4	8008	100-YR	1627.10	7120.99	7125.64	7124.34	7125.83	0.006880	178.94	0.37	0.27	1.21	0.68	1.81	3.52	3.35	3.48
Reach 4	8008	FIS	2600.00	7120.99	7126.41	7124.88	7126.70	0.007536	182.74	0.40	0.51	1.69	1.04	2.72	4.32	4.39	4.29
Reach 4	7935	5-YR	487.40	7121.53	7122.76	7122.76	7123.20	0.076191	107.86	1.01		4.07			5.28		5.28
Reach 4	7935	100-YR	1648.70	7121.53	7123.85	7123.85	7124.65	0.060492	147.00	1.00		6.08	0.93		7.17	2.88	7.15
Reach 4	7935	FIS	2600.00	7121.53	7124.43	7124.43	7125.47	0.053281	157.92	0.98	1.26	7.24	1.85	3.60	8.23	4.64	8.14
Reach 4	7772	5-YR	487.40	7117.41	7121.74		7121.75	0.000371	193.64	0.09		0.07	0.02		0.86	0.55	0.85
Reach 4	7772	100-YR	1648.70	7117.41	7123.18		7123.24	0.001178	224.53	0.16	0.03	0.31	0.12	0.61	1.91	1.41	1.88
Reach 4	7772	FIS	2600.00	7117.41	7123.99		7124.09	0.001595	235.07	0.20	0.09	0.50	0.20	1.08	2.49	1.91	2.45
Reach 4	7593	5-YR	487.40	7115.12	7121.73		7121.73	0.000026	268.94	0.03	0.00	0.01	0.00	0.01	0.34	0.19	0.34
Reach 4	7593	100-YR	1648.70	7115.12	7123.16		7123.17	0.000135	287.29	0.06	0.01	0.06	0.02	0.28	0.90	0.60	0.89
Reach 4	7593	FIS	2600.00	7115.12	7123.96		7123.98	0.000231	297.29	0.08	0.02	0.11	0.04	0.49	1.27	0.89	1.25
Reach 4	7491	5-YR	487.40	7120.17	7121.28	7121.28	7121.68	0.076450	119.39	1.00		3.86	2.53		5.09	5.38	5.10
Reach 4	7491	100-YR	1648.70	7120.17	7122.30	7122.30	7123.05	0.061545	159.49	0.99		5.80	3.67		6.93	7.15	6.94
Reach 4	7491	FIS	2600.00	7120.17	7122.88	7122.88	7123.81	0.057172	183.17	0.99		6.67	4.24		7.70	7.96	7.72
Reach 4	7452	5-YR	487.40	7110.76	7112.44	7112.44	7112.88	0.072548	107.31	0.99		4.06	2.49		5.32	5.37	5.32
Reach 4	7452	100-YR	1648.70	7110.76	7113.53	7113.53	7114.29	0.059206	166.79	0.97		5.29	5.14		6.56	9.01	6.83
Reach 4	7452	FIS	2600.00	7110.76	7114.13	7114.13	7115.04	0.054948	200.50	0.96		5.84	6.18		7.10	10.32	7.44
Reach 4	7406	5-YR	487.40	7100.67	7103.30		7103.34	0.002924	201.03	0.22	0.10	0.29		1.10	1.56		1.55
Reach 4	7406	100-YR	1648.70	7100.67	7104.60		7104.72	0.004664	224.68	0.30	0.35	0.78		2.29	2.80		2.79
Reach 4	7406	FIS	2600.00	7100.67	7105.25		7105.44	0.005824	236.49	0.35	0.55	1.17		2.99	3.53		3.51
Reach 4	7314	5-YR	487.40	7100.67	7102.22	7102.22	7102.54	0.091631	182.22	1.04		3.38			4.52		4.52
Reach 4	7314	100-YR	1648.70	7100.67	7103.01	7103.00	7103.61	0.067378	225.39	1.00	1.51	5.02		3.90	6.20		6.19
Reach 4	7314	FIS	2600.00	7100.67	7103.58	7103.48	7104.21	0.051589	269.92	0.91	2.04	4.92	0.07	4.98	6.39	0.54	6.38
Reach 4	7249	5-YR	487.40	7098.77	7101.12		7101.17	0.006731	248.19	0.31	0.19	0.46		1.44	1.84		1.83
Reach 4	7249	100-YR	1648.70	7098.77	7102.12		7102.28	0.008386	262.94	0.39	0.55	1.09	0.23	2.81	3.17	1.56	3.15
Reach 4	7249	FIS	2600.00	7098.77	7102.88		7103.08	0.007264	267.09	0.38	0.66	1.28	0.48	3.25	3.62	2.63	3.60
Reach 4	7118	5-YR	487.40	7097.44	7099.56		7099.69	0.021770	191.36	0.54	0.50	1.22		2.26	2.92		2.91

HEC-RAS Plan: WS River: Sand Creek Reach: Reach 4 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	7118	100-YR	1648.70	7097.44	7101.03		7101.20	0.008068	240.01	0.38	0.70	1.12	0.47	3.32	3.24	2.56	3.23
Reach 4	7118	FIS	2600.00	7097.44	7102.07		7102.25	0.005400	246.27	0.33	0.67	1.10	0.54	3.45	3.42	3.00	3.41
Reach 4	7000	5-YR	487.40	7096.76	7098.89		7098.92	0.002956	206.40	0.22	0.23	0.28		1.87	1.54		1.55
Reach 4	7000	100-YR	1648.70	7096.76	7100.55		7100.64	0.002953	226.32	0.24	0.38	0.56		2.63	2.43		2.44
Reach 4	7000	FIS	2600.00	7096.76	7101.70		7101.82	0.002513	236.28	0.24	0.42	0.65	0.05	2.85	2.76	0.73	2.76
Reach 4	6850	5-YR	487.40	7095.02	7097.15	7097.15	7097.66	0.066360	85.14	0.97		4.50	1.93		5.78	4.85	5.71
Reach 4	6850	100-YR	1648.70	7095.02	7098.43	7098.42	7099.41	0.049718	104.46	0.95		6.84	3.56		8.01	7.40	7.92
Reach 4	6850	FIS	2600.00	7095.02	7100.58		7101.08	0.011379	126.50	0.50		2.83	1.63		5.70	5.69	5.69
Reach 4	6784	5-YR	487.40	7092.79	7094.63		7094.92	0.027465	87.99	0.65	0.08	2.36	1.19	0.66	4.35	3.85	4.31
Reach 4	6784	100-YR	1648.70	7092.79	7098.55		7098.71	0.002542	119.88	0.25	0.31	0.84	0.47	2.33	3.25	3.11	3.17
Reach 4	6784	FIS	2600.00	7092.79	7100.55		7100.73	0.001891	136.96	0.23	0.34	0.86	0.47	2.64	3.47	3.23	3.35
Reach 4	6668	5-YR	538.70	7089.00	7094.67	7090.65	7094.70	0.000417	102.78	0.10	0.08	0.15	0.08	1.29	1.38	1.23	1.32
Reach 4	6668	100-YR	1833.50	7089.00	7098.50	7092.39	7098.57	0.000539	141.96	0.13	0.17	0.32	0.16	2.05	2.21	1.96	2.09
Reach 4	6668	FIS	2600.00	7089.00	7100.52	7093.12	7100.60	0.000463	161.37	0.12	0.18	0.33	0.17	2.17	2.33	2.06	2.19
Reach 4	6539.16		Culvert														
Reach 4	6423	5-YR	538.70	7091.70	7093.78	7093.64	7094.40	0.047801	53.05	0.88		4.78	0.56		6.35	2.13	6.33
Reach 4	6423	100-YR	1833.50	7091.70	7095.51	7095.51	7097.07	0.050268	59.48	1.01		9.63	1.08		10.05	3.27	10.00
Reach 4	6423	FIS	2600.00	7091.70	7096.36	7096.36	7098.28	0.046732	62.23	1.00		10.98	1.23		11.11	3.61	11.04
Reach 4	6343	5-YR	538.70	7088.29	7090.15	7090.15	7090.67	0.045671	95.07	0.86	1.52	4.37	2.76	4.17	6.03	6.21	5.59
Reach 4	6343	100-YR	1833.50	7088.29	7091.45	7091.45	7092.27	0.034160	149.35	0.82	2.62	6.01	3.61	6.30	7.83	7.80	7.14
Reach 4	6343	FIS	2600.00	7088.29	7091.88	7091.88	7092.90	0.033765	154.46	0.84	3.40	6.86	4.05	7.52	8.57	8.44	8.04
Reach 4	6308	5-YR	538.70	7087.82	7089.84		7089.90	0.004950	194.30	0.28	0.34	0.45	0.25	2.24	1.93	1.80	1.93
Reach 4	6308	100-YR	1833.50	7087.82	7091.05		7091.25	0.007589	208.82	0.38	0.78	1.27	0.46	3.62	3.57	2.53	3.53
Reach 4	6308	FIS	2600.00	7087.82	7091.55		7091.82	0.008567	224.25	0.42	1.00	1.69	0.51	4.17	4.24	2.66	4.15
Reach 4	6197	5-YR	538.70	7086.68	7088.92		7089.01	0.015004	261.90	0.45	0.68	0.81	0.71	2.95	2.36	3.03	2.40
Reach 4	6197	100-YR	1833.50	7086.68	7089.81		7090.05	0.016202	270.15	0.52	1.23	1.77	1.36	4.32	3.93	4.61	3.98
Reach 4	6197	FIS	2600.00	7086.68	7090.21		7090.53	0.016209	273.52	0.54	1.45	2.18	1.63	4.80	4.51	5.19	4.56
Reach 4	6145	5-YR	538.70	7086.15	7087.96		7088.07	0.021261	258.40	0.53	0.15	1.06	0.73	1.03	2.67	2.90	2.67
Reach 4	6145	100-YR	1833.50	7086.15	7088.90		7089.16	0.017770	265.97	0.55	0.89	1.93	1.29	3.42	4.10	4.38	4.09
Reach 4	6145	FIS	2600.00	7086.15	7089.31		7089.65	0.017379	269.19	0.56	1.14	2.33	1.52	4.05	4.66	4.91	4.66
Reach 4	6106	5-YR	538.70	7085.58	7087.39		7087.47	0.011122	256.62	0.39	0.39	0.67	0.55	2.13	2.19	2.68	2.20
Reach 4	6106	100-YR	1833.50	7085.58	7088.31		7088.53	0.013756	264.47	0.49	0.88	1.61	1.10	3.55	3.79	4.12	3.80
Reach 4	6106	FIS	2600.00	7085.58	7088.71		7089.01	0.014251	267.96	0.51	1.10	2.03	1.33	4.08	4.40	4.64	4.40
Reach 4	6052	5-YR	538.70	7084.95	7086.16	7086.07	7086.36	0.051362	247.91	0.78	1.91	2.00	0.73	4.77	3.51	2.51	3.54
Reach 4	6052	100-YR	1833.50	7084.95	7086.96		7087.38	0.037389	254.30	0.77	2.47	3.31	1.80	5.97	5.18	4.84	5.20
Reach 4	6052	FIS	2600.00	7084.95	7087.30		7087.84	0.036767	256.96	0.79	2.85	4.02	2.23	6.58	5.92	5.59	5.93
Reach 4	6025	5-YR	538.70	7082.34	7084.17	7084.17	7084.75	0.069553	77.73	1.01		4.93			6.09		6.09
Reach 4	6025	100-YR	1833.50	7082.34	7086.13		7086.50	0.029068	244.44	0.69	1.00	2.88	0.78	3.42	4.93	2.89	4.90
Reach 4	6025	FIS	2600.00	7082.34	7086.64		7087.06	0.022453	248.49	0.63	1.19	2.95	1.11	4.00	5.22	3.82	5.19
Reach 4	6002	5-YR	538.70	7080.15	7083.61		7083.77	0.007795	75.32	0.38		1.08			3.19		3.19
Reach 4	6002	100-YR	1833.50	7080.15	7085.78		7086.02	0.013054	226.71	0.48	0.17	1.73	0.52	1.17	4.01	2.53	3.98
Reach 4	6002	FIS	2600.00	7080.15	7086.36		7086.66	0.011454	234.29	0.47	0.35	1.94	0.74	1.98	4.41	3.26	4.37
Reach 4	5952	5-YR	538.70	7080.15	7083.17		7083.34	0.009698	84.01	0.41		1.22	0.46		3.33	2.42	3.31
Reach 4	5952	100-YR	1833.50	7080.15	7084.98		7085.31	0.015307	173.63	0.53		2.22	1.56		4.60	5.09	4.63
Reach 4	5952	FIS	2600.00	7080.15	7085.57		7085.98	0.015989	197.16	0.55	0.02	2.61	1.91	0.27	5.09	5.79	5.13
Reach 4	5895	5-YR	538.70	7079.84	7082.42		7082.60	0.017806	116.88	0.52		1.49			3.44		3.44
Reach 4	5895	100-YR	1833.50	7079.84	7084.08		7084.39	0.016441	191.45	0.54		2.18			4.50		4.50
Reach 4	5895	FIS	2600.00	7079.84	7084.67		7085.05	0.015839	211.91	0.55		2.46			4.91		4.91
Reach 4	5830	5-YR	538.70	7078.90	7081.70		7081.81	0.008433	132.48	0.37		0.82			2.61		2.61
Reach 4	5830	100-YR	1833.50	7078.90	7083.22		7083.47	0.011806	194.73	0.47		1.71			4.04		4.04
Reach 4	5830	FIS	2600.00	7078.90	7083.90		7084.20	0.010269	200.25	0.45	0.08	1.89		0.76	4.42		4.42
Reach 4	5784	5-YR	538.70	7078.84	7081.27		7081.38	0.010487	159.11	0.40		0.85			2.59		2.59
Reach 4	5784	100-YR	1833.50	7078.84	7082.74		7082.96	0.010046	198.85	0.43	0.10	1.51		0.86	3.83		3.83
Reach 4	5784	FIS	2600.00	7078.84	7083.49		7083.75	0.008856	216.13	0.42	0.29	1.64		1.81	4.12		4.11
Reach 4	5743	5-YR	538.70	7078.58	7081.04		7081.09	0.004554	181.17	0.27	0.24	0.45		1.77	1.94		1.93
Reach 4	5743	100-YR	1833.50	7078.58	7082.46		7082.63	0.006074	193.01	0.35	0.60	1.11		3.14	3.38		3.37
Reach 4	5743	FIS	2600.00	7078.58	7083.22		7083.44	0.006239	218.47	0.36	0.77	1.30	0.05	3.68	3.74	0.63	3.73
Reach 4	5660	5-YR	538.70	7078.23	7080.48		7080.57	0.009177	187.27	0.37	0.21	0.71		1.48	2.34		2.34
Reach 4	5660	100-YR	1833.50	7078.23	7081.76	7080.69	7081.98	0.010118	202.14	0.44	0.62	1.52		2.94	3.84		3.82
Reach 4	5660	FIS	2600.00	7078.23	7082.51		7082.73	0.011925	341.86	0.46	0.99	1.53	0.31	3.93	3.75	1.82	3.75
Reach 4	5549	5-YR	538.70	7076.51	7077.86	7077.86	7078.27	0.079194	132.79	1.01	1.55	3.96		3.86	5.15		5.14
Reach 4	5549	100-YR	1833.50	7076.51	7078.91	7078.91	7079.62	0.063185	197.47	1.00	3.27	5.60	1.24	6.59	6.74	3.45	6.73
Reach 4	5549	FIS	2600.00	7076.51	7079.36	7079.34	7080.14	0.057145	229.86	0.97	3.77	5.88	1.98	7.37	7.08	4.80	7.07
Reach 4	5522	5-YR	538.70	7074.16	7076.53	7075.85	7076.67	0.011649	119.03	0.43	0.33	1.11		1.87	3.03		3.02
Reach 4	5522	100-YR	1833.50	7074.16	7077.76		7078.23	0.019651	135.34	0.61	1.27	3.11		4.27	5.53		5.50
Reach 4	5522	FIS	2600.00	7074.16	7078.54		7079.02	0.025956	228.43	0.68	2.28	3.37	0.22	6.02	5.57	1.27	5.58
Reach 4	5485	5-YR	538.70	7074.11	7075.33	7075.33	7075.76	0.075882	124.30	1.00	3.04	3.96		6.10	5.19		5.23
Reach 4	5485	100-YR	1833.50	7074.11	7076.75		7077.32	0.032530	157.30	0.76	2.73	4.01		6.52	6.02		6.05
Reach 4	5485	FIS	2600.00	7074.11	7077.27		7077.97	0.031367	169.13	0.76	3.13	4.62		7.20	6.66		6.70
Reach 4	5444	5-YR	538.70	7072.48	7074.93		7075.00	0.006066	155.87	0.31	0.30	0.60		1.97	2.24		2.23
Reach 4	5444	100-YR	1833.50	7072.48	7076.34		7076.55	0.010116	231.40	0.43	0.92	1.42	0.36	3.85	3.66	2.04	3.65
Reach 4	5444	FIS	2600.00	7072.48	7076.85		7077.12	0.011843	275.39	0.47	1.26	1.75	0.62	4.63	4.10	2.89	4.11
Reach 4	5395	5-YR	538.70	7072.48	7074.30		7074.46	0.022709	162.12	0.57	0.76	1.46		2.95	3.27		3.26
Reach 4	5395	100-YR	1833.50	7072.48	7075.57		7075.84	0.018552	255.51	0.56	1.34	2.03	0.64	4.45	4.20	2.72	4.20
Reach 4	5395	FIS	2600.00	7072.48	7076.05		7076.39	0.016411	259.63	0.55	1.42	2.29	0.82	4.74	4.65	3.28	4.64

HEC-RAS Plan: WS River: Sand Creek Reach: Reach 4 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	5359	5-YR	538.70	7070.74	7072.62	7072.62	7073.12	0.073051	97.60	1.01		4.45			5.64		5.64
Reach 4	5359	100-YR	1833.50	7070.74	7073.80	7073.80	7074.73	0.056554	131.33	0.99	2.00	6.73		4.83	7.76		7.69
Reach 4	5359	FIS	2600.00	7070.74	7074.55	7074.55	7075.36	0.058942	220.97	0.99	3.47	6.15		6.94	7.26		7.24
Reach 4	5326	5-YR	538.70	7069.72	7071.57		7071.72	0.014111	125.41	0.47	0.74	1.23		3.15	3.14		3.14
Reach 4	5326	100-YR	1833.50	7069.72	7072.90		7073.33	0.017539	140.91	0.58	1.51	2.83		4.87	5.30		5.27
Reach 4	5326	FIS	2600.00	7069.72	7073.48		7074.04	0.019019	153.43	0.62	1.94	3.52		5.69	6.04		6.01
Reach 4	5263	5-YR	538.70	7068.82	7070.60		7070.77	0.017958	151.44	0.51	1.32	1.25		4.45	3.06		3.17
Reach 4	5263	100-YR	1833.50	7068.82	7071.73		7072.17	0.021413	161.63	0.62	2.36	2.90		6.35	5.21		5.30
Reach 4	5263	FIS	2600.00	7068.82	7072.21		7072.79	0.022568	165.98	0.66	2.83	3.67		7.10	6.04		6.13
Reach 4	5187	5-YR	538.70	7067.05	7068.88		7069.08	0.030283	160.43	0.65	0.55	1.80		2.27	3.58		3.57
Reach 4	5187	100-YR	1833.50	7067.05	7070.05		7070.47	0.024636	180.94	0.66	1.41	3.04		4.39	5.25		5.23
Reach 4	5187	FIS	2600.00	7067.05	7070.59		7071.11	0.022713	190.48	0.65	1.68	3.45		5.02	5.78		5.76
Reach 4	5078	5-YR	538.70	7064.62	7066.74		7066.87	0.014214	148.77	0.46	0.52	1.11		2.47	2.94		2.93
Reach 4	5078	100-YR	1833.50	7064.62	7068.09		7068.43	0.014215	162.04	0.52	1.03	2.24		3.90	4.70		4.66
Reach 4	5078	FIS	2600.00	7064.62	7068.65		7069.10	0.014587	167.57	0.54	1.30	2.78		4.54	5.39		5.35
Reach 4	4992	5-YR	538.70	7063.62	7065.84		7065.93	0.008536	169.95	0.36	0.28	0.71		1.79	2.39		2.38
Reach 4	4992	100-YR	1833.50	7063.62	7067.07		7067.34	0.011044	182.45	0.46	0.77	1.74	0.39	3.37	4.14	2.14	4.12
Reach 4	4992	FIS	2600.00	7063.62	7067.60		7067.96	0.011705	185.38	0.49	1.00	2.23	0.63	3.95	4.84	2.91	4.80
Reach 4	4957	5-YR	538.70	7063.29	7065.14		7065.37	0.037588	162.59	0.71		2.06			3.77		3.77
Reach 4	4957	100-YR	1833.50	7063.29	7066.33		7066.76	0.024806	185.33	0.66	0.88	3.06	0.53	3.21	5.26	2.28	5.23
Reach 4	4957	FIS	2600.00	7063.29	7066.87		7067.39	0.021982	189.51	0.65	1.14	3.44	0.97	3.89	5.81	3.49	5.76
Reach 4	4898	5-YR	538.70	7061.84	7063.86		7064.01	0.015288	138.31	0.48	0.40	1.24		2.06	3.13		3.11
Reach 4	4898	100-YR	1833.50	7061.84	7065.18		7065.58	0.016402	150.70	0.56	1.29	2.59		4.44	5.05		5.02
Reach 4	4898	FIS	2600.00	7061.84	7065.77		7066.28	0.016430	156.46	0.58	1.57	3.15		5.06	5.75		5.71
Reach 4	4629	5-YR	538.70	7058.43	7060.53		7060.62	0.010496	174.31	0.40	0.34	0.82		1.96	2.52		2.51
Reach 4	4629	100-YR	1833.50	7058.43	7061.91		7062.16	0.009951	188.26	0.44	0.74	1.58		3.35	3.95		3.93
Reach 4	4629	FIS	2600.00	7058.43	7062.49		7062.81	0.010218	193.84	0.46	0.94	1.96		3.90	4.54		4.51
Reach 4	4521	5-YR	538.70	7057.10	7059.28		7059.40	0.012236	146.36	0.43	0.24	1.02		1.53	2.85		2.83
Reach 4	4521	100-YR	1833.50	7057.10	7060.79		7061.03	0.010769	196.21	0.45	0.76	1.64		3.34	4.00		3.97
Reach 4	4521	FIS	2600.00	7057.10	7061.29		7061.62	0.011675	203.69	0.48	0.93	2.12		3.78	4.67		4.63
Reach 4	4469	5-YR	538.70	7056.64	7058.81		7058.90	0.007604	159.95	0.35	0.44	0.68		2.47	2.36		2.36
Reach 4	4469	100-YR	1833.50	7056.64	7060.29		7060.47	0.010646	284.24	0.43	1.08	1.28	0.12	4.24	3.39	0.97	3.41
Reach 4	4469	FIS	2600.00	7056.64	7060.80		7061.02	0.010531	319.50	0.44	1.23	1.46	0.35	4.64	3.71	2.00	3.73
Reach 4	4376	5-YR	538.70	7055.93	7058.02		7058.10	0.009771	199.54	0.38	0.34	0.72	0.34	1.99	2.35	1.99	2.34
Reach 4	4376	100-YR	1833.50	7055.93	7059.04		7059.28	0.015552	264.24	0.51	1.08	1.76	1.03	3.97	3.93	3.84	3.93
Reach 4	4376	FIS	2600.00	7055.93	7059.45		7059.76	0.017988	307.45	0.56	1.49	2.18	1.41	4.81	4.43	4.65	4.45
Reach 4	4348	5-YR	538.70	7055.93	7057.63		7057.74	0.017577	241.62	0.49	0.44	0.97	0.57	2.16	2.58	2.55	2.58
Reach 4	4348	100-YR	1833.50	7055.93	7058.47		7058.73	0.023621	324.90	0.61	1.20	2.07	1.41	3.99	4.09	4.44	4.10
Reach 4	4348	FIS	2600.00	7055.93	7058.82		7059.14	0.026271	397.62	0.65	1.43	2.43	1.86	4.39	4.48	5.24	4.49
Reach 4	4319	5-YR	538.70	7054.67	7056.70		7056.91	0.055630	237.91	0.81		2.16		0.19	3.64		3.64
Reach 4	4319	100-YR	1833.50	7054.67	7057.64		7057.93	0.033278	375.86	0.70	0.98	2.42	0.28	3.28	4.29	1.42	4.28
Reach 4	4319	FIS	2600.00	7054.67	7057.96		7058.30	0.032654	423.18	0.71	1.25	2.75	0.79	3.88	4.68	2.85	4.66
Reach 4	4266	5-YR	538.70	7052.63	7055.15	7054.53	7055.28	0.018658	190.78	0.51		1.15			2.87		2.87
Reach 4	4266	100-YR	1833.50	7052.63	7056.19	7055.64	7056.42	0.023733	365.42	0.60		1.92	0.08		3.88	0.68	3.88
Reach 4	4266	FIS	2600.00	7052.63	7056.53	7056.04	7056.82	0.023270	391.29	0.61		2.24	0.32		4.32	1.65	4.32
Reach 4	4207	5-YR	538.70	7051.41	7052.88	7052.88	7053.18	0.093598	228.04	1.03		3.18			4.33		4.33
Reach 4	4207	100-YR	1833.50	7051.41	7053.60	7053.60	7054.19	0.068436	254.48	1.00		4.99			6.16		6.16
Reach 4	4207	FIS	2600.00	7051.41	7053.92	7053.92	7054.65	0.064507	266.20	1.01		5.75			6.83		6.83
Reach 4	4124	5-YR	538.70	7048.17	7050.59		7050.64	0.004173	201.52	0.26	0.27	0.39		1.95	1.80		1.81
Reach 4	4124	100-YR	1833.50	7048.17	7052.03		7052.16	0.005908	270.86	0.33	0.64	0.87		3.30	2.89		2.92
Reach 4	4124	FIS	2600.00	7048.17	7052.45		7052.64	0.006938	278.17	0.37	0.84	1.19	0.09	3.85	3.47	0.90	3.49
Reach 4	4009	5-YR	572.10	7048.19	7049.40		7049.58	0.032281	197.76	0.65	0.81	1.72		2.92	3.43		3.43
Reach 4	4009	100-YR	2023.60	7048.19	7050.54		7050.93	0.023706	213.64	0.64	1.43	2.85		4.47	5.06		5.04
Reach 4	4009	FIS	2600.00	7048.19	7050.93		7051.38	0.021301	219.09	0.63	1.54	3.04		4.78	5.37		5.35
Reach 4	3959	5-YR	572.10	7046.20	7048.35		7048.47	0.015824	185.24	0.48	0.24	1.08		1.46	2.84		2.84
Reach 4	3959	100-YR	2023.60	7046.20	7049.82		7050.08	0.011710	204.19	0.47	0.70	1.78		3.12	4.16		4.15
Reach 4	3959	FIS	2600.00	7046.20	7050.27		7050.58	0.011165	210.00	0.47	0.82	1.98		3.50	4.49		4.47
Reach 4	3900	5-YR	572.10	7045.39	7047.62		7047.73	0.010184	167.25	0.40	0.12	0.85		0.98	2.59		2.59
Reach 4	3900	100-YR	2023.60	7045.39	7049.21		7049.47	0.009334	186.01	0.43	0.56	1.62		2.80	4.06		4.03
Reach 4	3900	FIS	2600.00	7045.39	7049.67		7049.98	0.009379	191.39	0.44	0.70	1.86		3.23	4.45		4.42
Reach 4	3847	5-YR	572.10	7044.97	7047.18		7047.27	0.007405	172.25	0.34	0.57	0.66		2.93	2.31		2.36
Reach 4	3847	100-YR	2023.60	7044.97	7048.80		7049.02	0.007536	197.37	0.39	1.02	1.32		4.32	3.67		3.74
Reach 4	3847	FIS	2600.00	7044.97	7049.25		7049.52	0.007741	204.41	0.40	1.17	1.54		4.71	4.04		4.11
Reach 4	3771	5-YR	572.10	7044.36	7046.64		7046.71	0.007142	199.37	0.33	0.20	0.59		1.49	2.17		2.17
Reach 4	3771	100-YR	2023.60	7044.36	7048.34		7048.47	0.006343	304.03	0.34	0.51	0.91		2.78	2.94		2.94
Reach 4	3771	FIS	2600.00	7044.36	7048.85		7049.00	0.005451	313.74	0.33	0.52	0.93		2.91	3.07		3.06
Reach 4	3709	5-YR	572.10	7043.57	7046.27		7046.34	0.005066	183.81	0.29	0.21	0.49		1.59	2.03		2.03
Reach 4	3709	100-YR	2023.60	7043.57	7047.93		7048.09	0.005959	228.11	0.34	0.54	1.04		2.95	3.26		3.25
Reach 4	3709	FIS	2600.00	7043.57	7048.42		7048.60	0.007324	290.41	0.38	0.78	1.20		3.62	3.46		3.46
Reach 4	3653	5-YR	572.10	7043.09	7046.18		7046.21	0.001166	205.18	0.15	0.07	0.17		0.97	1.26		1.25
Reach 4	3653	100-YR	2023.60	7043.09	7047.76		7047.86	0.002565	228.49	0.23	0.29	0.58		2.22	2.55		2.53
Reach 4	3653	FIS	2600.00	7043.09	7048.21		7048.34	0.002908	235.14	0.25	0.37	0.73		2.56	2.90		2.88
Reach 4	3502	5-YR	572.10	7042.03	7046.06		7046.08	0.000620	198.93	0.11	0.06	0.11		0.95	1.05		1.05
Reach 4	3502	100-YR	2023.60	7042.03	7047.42		7047.51	0.002099	210.70	0.22	0.28	0.53		2.24	2.47		2.46
Reach 4	3502	FIS	2600.00	7042.03	7047.80		7047.93	0.002570	213.99	0.24	0.37	0.71		2.63	2.89		2.88
Reach 4	3429	5-YR	572.10	7041.39	7046.04		7046.05	0.000236	254.94	0.07	0.03	0.05		0.71	0.71		0.71

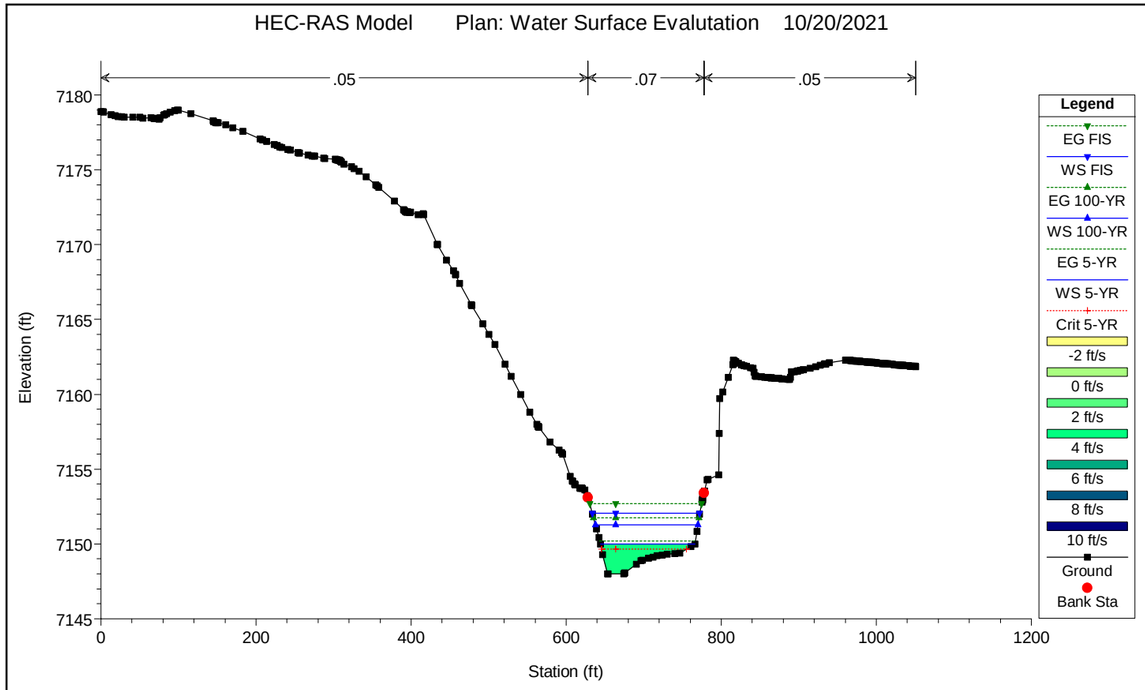
HEC-RAS Plan: WS River: Sand Creek Reach: Reach 4 (Continued)

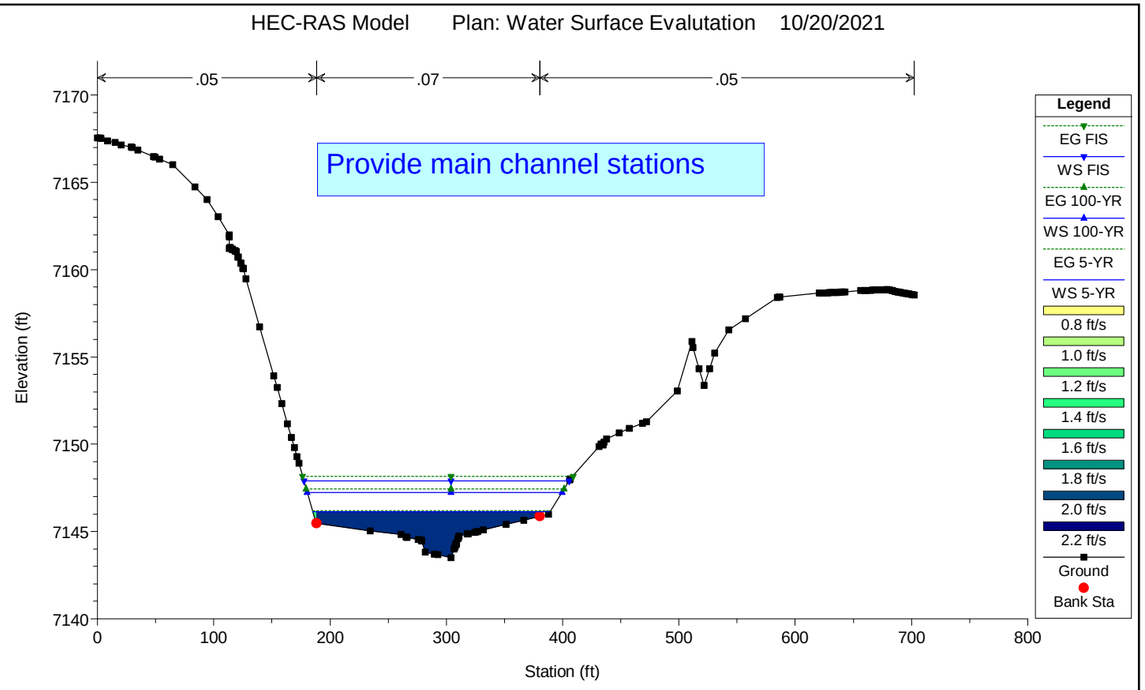
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	3429	100-YR	2023.60	7041.39	7047.35		7047.39	0.001070	310.26	0.15	0.17	0.26		1.83	1.71		1.72
Reach 4	3429	FIS	2600.00	7041.39	7047.71		7047.77	0.001504	349.37	0.18	0.26	0.35		2.27	1.99		2.01
Reach 4	3336	5-YR	572.10	7040.90	7046.03		7046.04	0.000096	367.41	0.04	0.01	0.02	0.01	0.52	0.47	0.27	0.47
Reach 4	3336	100-YR	2023.60	7040.90	7047.30		7047.33	0.000409	376.55	0.10	0.08	0.12	0.04	1.25	1.20	0.80	1.20
Reach 4	3336	FIS	2600.00	7040.90	7047.65		7047.69	0.000529	379.07	0.11	0.10	0.17	0.06	1.47	1.43	0.97	1.43
Reach 4	3262	5-YR	572.10	7039.88	7046.03		7046.03	0.000054	353.91	0.03	0.01	0.01	0.00	0.36	0.41	0.26	0.40
Reach 4	3262	100-YR	2023.60	7039.88	7047.28		7047.30	0.000275	368.19	0.08	0.04	0.09	0.03	0.91	1.09	0.76	1.08
Reach 4	3262	FIS	2600.00	7039.88	7047.63		7047.65	0.000368	372.10	0.10	0.06	0.13	0.05	1.09	1.32	0.93	1.30
Reach 4	3195	5-YR	572.10	7039.55	7046.03		7046.03	0.000028	357.98	0.03	0.01	0.01	0.00	0.35	0.34	0.24	0.33
Reach 4	3195	100-YR	2023.60	7039.55	7047.27		7047.29	0.000168	371.40	0.07	0.04	0.07	0.02	0.96	0.94	0.65	0.94
Reach 4	3195	FIS	2600.00	7039.55	7047.61		7047.63	0.000232	386.05	0.08	0.06	0.10	0.02	1.16	1.15	0.64	1.14
Reach 4	3114	5-YR	572.10	7039.18	7046.02		7046.03	0.000019	346.88	0.02	0.00	0.01	0.00	0.28	0.30	0.22	0.30
Reach 4	3114	100-YR	2023.60	7039.18	7047.26		7047.27	0.000123	369.07	0.06	0.03	0.05	0.02	0.82	0.87	0.54	0.86
Reach 4	3114	FIS	2600.00	7039.18	7047.60		7047.61	0.000173	371.12	0.07	0.04	0.08	0.03	1.00	1.07	0.69	1.05
Reach 4	3065	5-YR	572.10	7037.93	7046.02		7046.02	0.000017	323.33	0.02	0.00	0.01	0.00	0.23	0.31	0.20	0.30
Reach 4	3065	100-YR	2023.60	7037.93	7047.25		7047.27	0.000118	340.00	0.06	0.02	0.06	0.02	0.68	0.90	0.61	0.88
Reach 4	3065	FIS	2600.00	7037.93	7047.59		7047.60	0.000167	342.45	0.07	0.03	0.08	0.03	0.84	1.10	0.78	1.08
Reach 4	2993	5-YR	572.10	7037.01	7046.02		7046.02	0.000010	325.22	0.02	0.00	0.00	0.00	0.27	0.26	0.16	0.26
Reach 4	2993	100-YR	2023.60	7037.01	7047.25		7047.26	0.000075	333.30	0.05	0.02	0.04	0.01	0.78	0.79	0.55	0.78
Reach 4	2993	FIS	2600.00	7037.01	7047.58		7047.59	0.000109	335.47	0.06	0.04	0.06	0.02	0.96	0.97	0.70	0.96
Reach 4	2778	5-YR	572.10	7036.48	7046.02		7046.02	0.000051	233.25	0.04		0.02	0.00		0.49	0.27	0.48
Reach 4	2778	100-YR	2023.60	7036.48	7047.20		7047.23	0.000332	251.41	0.09	0.01	0.14	0.04	0.34	1.40	0.90	1.36
Reach 4	2778	FIS	2600.00	7036.48	7047.50		7047.55	0.000468	254.70	0.11	0.02	0.21	0.07	0.49	1.71	1.15	1.67
Reach 4	2584	5-YR	572.10	7044.49	7045.63	7045.63	7045.95	0.038822	241.87	0.67		1.37	2.67		2.86	6.25	3.68
Reach 4	2584	100-YR	2023.60	7044.49	7046.44	7046.44	7046.96	0.039715	405.00	0.74		2.38	4.37		4.11	8.64	4.83
Reach 4	2584	FIS	2600.00	7044.49	7046.71	7046.71	7047.21	0.034205	439.36	0.71		2.42	4.18		4.27	8.60	4.90
Reach 4	2406	5-YR	572.10	7019.43	7023.60		7023.85	0.012519	61.76	0.48		1.76			4.08		4.08
Reach 4	2406	100-YR	2023.60	7019.43	7030.97		7031.04	0.000960	152.83	0.16		0.36			2.17		2.17
Reach 4	2406	FIS	2600.00	7019.43	7032.07		7032.16	0.000997	166.49	0.16		0.41			2.35		2.35
Reach 4	2114	5-YR	466.80	7007.64	7010.48	7009.90	7010.75	0.033264	165.54	0.65	3.26	1.56		7.33	3.20		3.54
Reach 4	2114	100-YR	1921.70	7007.64	7011.38	7011.38	7012.11	0.052895	184.54	0.92	6.35	5.01		10.57	6.45		6.66
Reach 4	2114	FIS	2600.00	7007.64	7012.13		7012.70	0.028262	201.71	0.71	3.82	3.72		8.37	5.87		5.97
Reach 4	1918	5-YR	466.80	7005.76	7007.37		7007.46	0.010163	181.91	0.38		0.71			2.30		2.30
Reach 4	1918	100-YR	1921.70	7005.76	7010.94		7010.96	0.000813	533.36	0.13		0.15	0.02		1.24	0.46	1.24
Reach 4	1918	FIS	2600.00	7005.76	7012.25		7012.27	0.000434	541.31	0.10		0.11	0.03		1.15	0.64	1.15
Reach 4	1740	5-YR	466.80	7003.99	7005.87		7005.92	0.007344	285.02	0.32		0.43			1.74		1.74
Reach 4	1740	100-YR	1921.70	7003.99	7010.90		7010.91	0.000150	500.09	0.06		0.05	0.02		0.77	0.64	0.77
Reach 4	1740	FIS	2600.00	7003.99	7012.22		7012.23	0.000127	506.52	0.06		0.05	0.02		0.83	0.70	0.82
Reach 4	1668	5-YR	466.80	7003.52	7005.24		7005.31	0.009908	261.02	0.37		0.57	0.01		1.99	0.15	1.99
Reach 4	1668	100-YR	1921.70	7003.52	7010.89		7010.90	0.000119	434.44	0.05		0.04	0.03		0.76	0.78	0.76
Reach 4	1668	FIS	2600.00	7003.52	7012.21		7012.22	0.000111	438.97	0.05		0.05	0.03		0.84	0.85	0.84
Reach 4	1549	5-YR	466.80	7002.57	7004.42		7004.45	0.005378	412.75	0.27		0.28	0.08		1.37	0.81	1.37
Reach 4	1549	100-YR	1921.70	7002.57	7010.88		7010.89	0.000056	478.54	0.04	0.00	0.02	0.01	0.11	0.58	0.52	0.58
Reach 4	1549	FIS	2600.00	7002.57	7012.20		7012.21	0.000057	484.64	0.04	0.00	0.03	0.02	0.19	0.66	0.59	0.66
Reach 4	1494.166	5-YR	466.80	7002.04	7004.28	7002.98	7004.30	0.001448	372.99	0.15		0.15	0.04		1.12	0.65	1.11
Reach 4	1494.166	100-YR	1921.70	7002.04	7010.87	7003.85	7010.88	0.000091	470.86	0.05		0.05	0.04		0.82	1.00	0.83
Reach 4	1494.166	FIS	2600.00	7002.04	7012.19	7004.12	7012.20	0.000119	478.93	0.06	0.01	0.06	0.02	0.33	0.94	0.60	0.89
Reach 4	1397		Inl Struct														
Reach 4	1256	5-YR	463.11	7000.89	7003.90	7002.44	7004.09	0.007590	44.60	0.36		1.25			3.53		3.53
Reach 4	1256	100-YR	1590.50	7000.89	7007.27	7004.35	7007.76	0.007011	45.44	0.40	0.08	2.48	0.08	0.80	5.65	0.78	5.63
Reach 4	1256	FIS	2600.00	7000.89	7009.95	7005.67	7010.60	0.005723	46.25	0.38	0.15	2.89	0.11	1.28	6.47	1.05	6.41
Reach 4	1214.7		Culvert														
Reach 4	1161	5-YR	463.11	7000.69	7003.50		7003.69	0.009746	66.42	0.42	0.63	1.34	0.27	3.01	3.55	1.69	3.49
Reach 4	1161	100-YR	1590.50	7000.69	7005.36		7005.92	0.012918	79.69	0.54	1.56	3.26	1.07	5.25	6.13	4.09	5.93
Reach 4	1161	FIS	2600.00	7000.69	7006.43		7007.27	0.014388	87.38	0.59	2.20	4.60	1.66	6.48	7.56	5.37	7.26
Reach 4	1134	5-YR	463.11	7000.63	7002.50	7002.50	7003.11	0.061627	61.72	0.97	2.00	5.09	2.36	4.77	6.35	5.32	6.24
Reach 4	1134	100-YR	1590.50	7000.63	7004.06	7004.06	7005.26	0.044392	76.39	0.94	3.56	7.96	3.70	7.40	9.04	7.59	8.75
Reach 4	1134	FIS	2600.00	7000.63	7005.05	7005.05	7006.60	0.038932	85.75	0.92	4.31	9.39	4.40	8.59	10.31	8.72	9.91
Reach 4	1116	5-YR	463.11	6997.80	7001.03		7001.15	0.004605	73.83	0.30	0.34	0.77	0.45	2.26	2.79	2.70	2.74
Reach 4	1116	100-YR	1590.50	6997.80	7003.01		7003.37	0.007026	89.73	0.40	0.94	2.04	1.12	4.15	4.96	4.66	4.81
Reach 4	1116	FIS	2600.00	6997.80	7004.11		7004.67	0.008340	99.77	0.46	1.35	3.00	1.62	5.11	6.22	5.78	5.98
Reach 4	1076	5-YR	463.11	6997.73	7000.88		7000.97	0.004026	86.25	0.28	0.23	0.63	0.32	1.78	2.50	2.22	2.44
Reach 4	1076	100-YR	1590.50	6997.73	7002.80		7003.09	0.005932	103.96	0.37	0.69	1.64	0.82	3.48	4.42	3.90	4.26
Reach 4	1076	FIS	2600.00	6997.73	7003.89		7004.33	0.006902	113.82	0.41	1.04	2.38	1.19	4.44	5.51	4.86	5.29
Reach 4	1004	5-YR	463.11	6997.63	7000.63		7000.70	0.003364	103.47	0.25	0.21	0.49	0.16	1.71	2.15	1.44	2.12
Reach 4	1004	100-YR	1590.50	6997.63	7002.46		7002.68	0.005023	118.03	0.34	0.60	1.30	0.52	3.26	3.87	2.94	3.78
Reach 4	1004	FIS	2600.00	6997.63	7003.50		7003.85	0.005939	126.30	0.38	0.90	1.92	0.80	4.15	4.89	3.82	4.74
Reach 4	965	5-YR	463.11	6997.45	7000.51		7000.57	0.003136	107.71	0.24	0.15	0.46	0.15	1.41	2.10	1.39	2.06
Reach 4	965	100-YR	1590.50	6997.45	7002.28		7002.49	0.004876	127.92	0.33	0.50	1.25	0.49	2.91	3.80	2.87	3.67
Reach 4	965	FIS	2600.00	6997.45	7003.29		7003.62	0.005680	138.18	0.37	0.80	1.82	0.75	3.84	4.75	3.69	4.57
Reach 4	933	5-YR	463.11	6997.45	7000.40		7000.47	0.003359	109.53	0.25	0.13	0.47	0.17	1.25	2.10	1.48	2.07
Reach 4	933	100-YR	1590.50	6997.45	7002.11		7002.33	0.005337	127.46	0.34	0.46	1.31	0.54	2.68	3.86	3.00	3.74
Reach 4	933	FIS	2600.00	6997.45	7003.08		7003.43	0.006318	138.56	0.39	0.71	1.93	0.83	3.50	4.86	3.87	4.68
Reach 4	876	5-YR	463.11	6997.45	7000.21		7000.27	0.003649	124.60	0.25	0.25	0.45	0.17	1.92	2.02	1.45	2.00
Reach 4	876	100-YR	1590.50	6997.45	7001.81		7002.02	0.005419	137.52	0.34	0.65	1.21	0.51	3.38	3.66	2.87	3.60

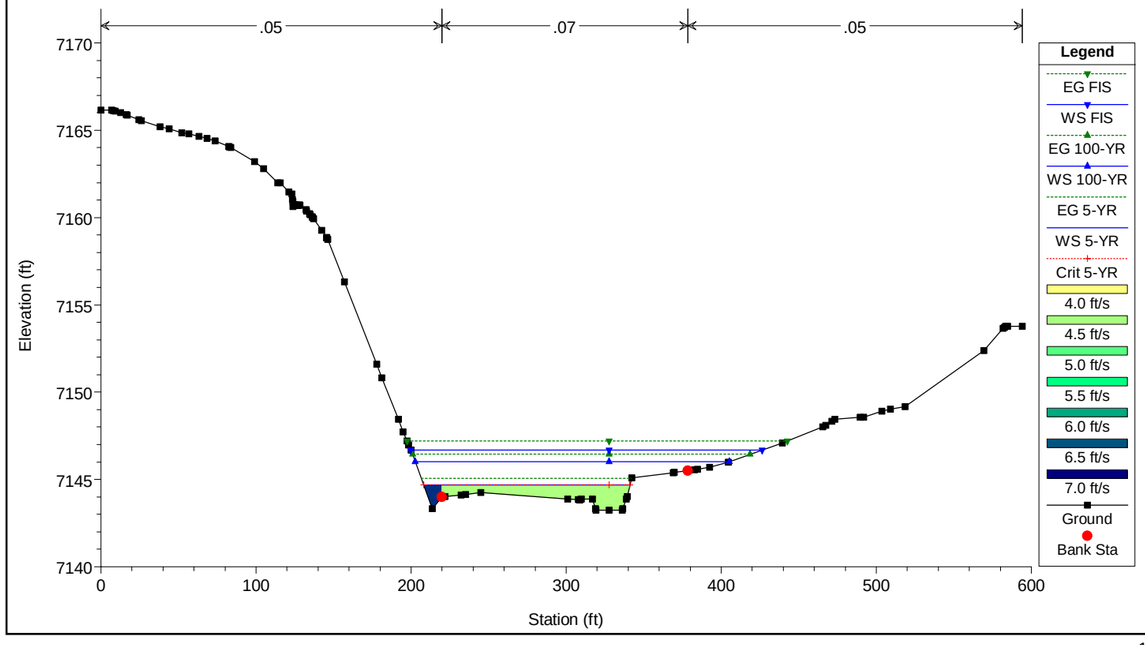
HEC-RAS Plan: WS River: Sand Creek Reach: Reach 4 (Continued)

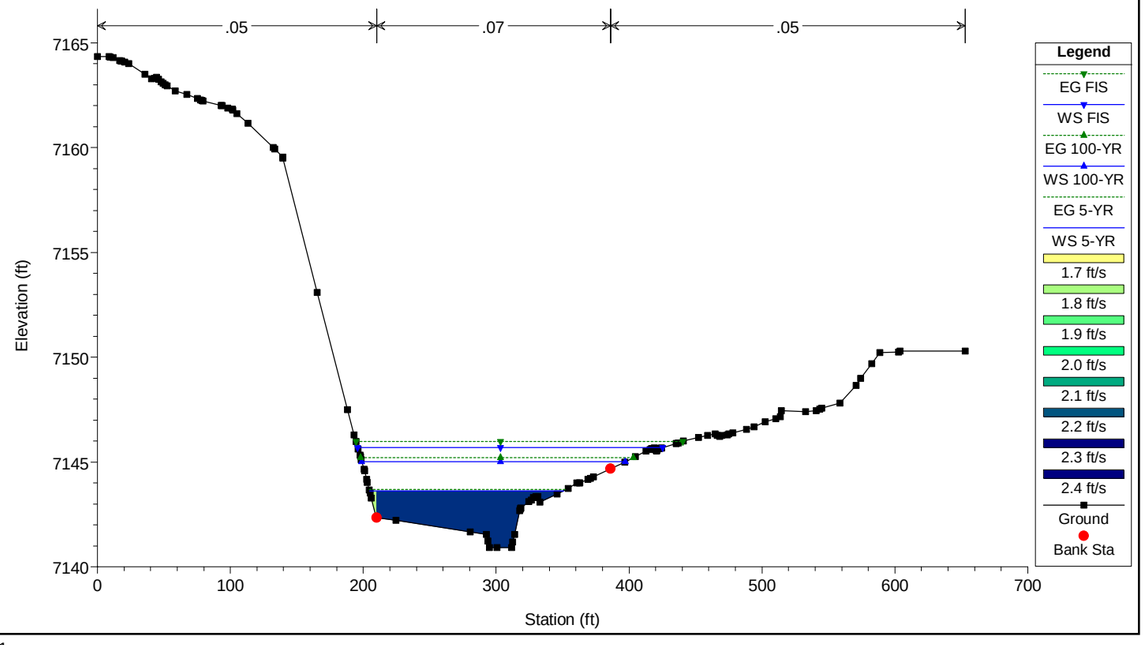
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Top Width	Froude # Chl	Shear LOB	Shear Chan	Shear ROB	Vel Left	Vel Chnl	Vel Right	Vel Total
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(ft/s)	(ft/s)	(ft/s)	(ft/s)
Reach 4	876	FIS	2600.00	6997.45	7002.74		7003.06	0.006380	144.79	0.38	0.95	1.79	0.78	4.25	4.63	3.71	4.54
Reach 4	827	5-YR	463.11	6997.33	6999.98		7000.06	0.004987	120.37	0.29	0.30	0.58	0.21	2.06	2.26	1.59	2.24
Reach 4	827	100-YR	1590.50	6997.33	7001.44		7001.70	0.007641	134.64	0.40	0.81	1.58	0.65	3.69	4.12	3.20	4.05
Reach 4	827	FIS	2600.00	6997.33	7002.28		7002.69	0.009094	142.81	0.45	1.20	2.35	1.01	4.66	5.22	4.15	5.11
Reach 4	795	5-YR	463.11	6997.29	6999.81		6999.90	0.005669	124.01	0.31	0.39	0.62	0.29	2.37	2.31	1.98	2.31
Reach 4	795	100-YR	1590.50	6997.29	7001.16		7001.44	0.008984	137.29	0.43	1.00	1.73	0.85	4.13	4.26	3.71	4.22
Reach 4	795	FIS	2600.00	6997.29	7001.92		7002.37	0.010922	144.80	0.49	1.47	2.62	1.29	5.19	5.44	4.75	5.37
Reach 4	753	5-YR	463.11	6997.25	6999.54		6999.62	0.007319	156.98	0.34	0.32	0.63	0.26	2.00	2.25	1.74	2.24
Reach 4	753	100-YR	1590.50	6997.25	7000.81		7001.04	0.009187	170.90	0.42	0.75	1.52	0.68	3.42	3.89	3.20	3.84
Reach 4	753	FIS	2600.00	6997.25	7001.53		7001.89	0.010559	179.07	0.47	1.09	2.22	1.02	4.27	4.89	4.08	4.82
Reach 4	674	5-YR	463.11	6995.52	6997.77	6997.77	6998.23	0.076201	94.31	1.01	0.34	4.28		1.42	5.46		5.46
Reach 4	674	100-YR	1590.50	6995.52	6998.80	6998.80	6999.47	0.065798	191.09	1.00	2.33	5.41	0.63	5.22	6.54	2.19	6.51
Reach 4	674	FIS	2600.00	6995.52	6999.31	6999.31	7000.21	0.058638	194.99	1.00	2.98	6.66	1.90	6.27	7.66	4.65	7.61
Reach 4	646	5-YR	463.11	6992.83	6995.76		6995.86	0.008160	120.32	0.36	0.65	0.77		3.16	2.52		2.56
Reach 4	646	100-YR	1590.50	6992.83	6997.31		6997.54	0.010351	183.57	0.44	1.31	1.47		4.83	3.74		3.82
Reach 4	646	FIS	2600.00	6992.83	6998.19		6998.49	0.009968	209.92	0.45	1.52	1.81	0.18	5.38	4.32	1.28	4.39
Reach 4	627	5-YR	463.11	6992.83	6995.64		6995.71	0.006272	141.44	0.32	0.45	0.58		2.58	2.20		2.21
Reach 4	627	100-YR	1590.50	6992.83	6997.17		6997.35	0.007850	200.80	0.38	0.92	1.16		4.00	3.34		3.38
Reach 4	627	FIS	2600.00	6992.83	6998.07		6998.31	0.007430	220.04	0.39	1.07	1.45	0.17	4.47	3.90	1.32	3.93
Reach 4	591	5-YR	463.11	6992.76	6995.44		6995.50	0.005451	160.75	0.29	0.33	0.49		2.15	2.01		2.01
Reach 4	591	100-YR	1590.50	6992.76	6996.94		6997.09	0.006491	217.03	0.35	0.68	0.98		3.40	3.07		3.09
Reach 4	591	FIS	2600.00	6992.76	6997.85		6998.05	0.006232	243.30	0.36	0.83	1.20	0.10	3.88	3.56	0.92	3.57
Reach 4	522	5-YR	463.11	6992.58	6995.12		6995.17	0.004073	205.80	0.25	0.19	0.35		1.56	1.67		1.67
Reach 4	522	100-YR	1590.50	6992.58	6996.60		6996.70	0.004469	265.22	0.29	0.41	0.67		2.56	2.54		2.54
Reach 4	522	FIS	2600.00	6992.58	6997.55		6997.68	0.004198	298.93	0.29	0.50	0.81	0.02	2.98	2.91	0.34	2.91
Reach 4	445	5-YR	463.11	6992.49	6994.74		6994.80	0.005838	204.75	0.29	0.43	0.44		2.53	1.84		1.87
Reach 4	445	100-YR	1590.50	6992.49	6996.22		6996.33	0.005155	272.31	0.31	0.61	0.72		3.25	2.60		2.64
Reach 4	445	FIS	2600.00	6992.49	6997.22		6997.35	0.004321	309.04	0.29	0.64	0.80	0.03	3.46	2.87	0.50	2.90
Reach 4	372	5-YR	463.11	6992.12	6994.34		6994.40	0.005057	201.18	0.28	0.42	0.40		2.55	1.76		1.81
Reach 4	372	100-YR	1590.50	6992.12	6995.85		6995.97	0.004723	236.75	0.30	0.61	0.73		3.33	2.68		2.72
Reach 4	372	FIS	2600.00	6992.12	6996.89		6997.03	0.004351	273.61	0.30	0.71	0.86	0.02	3.71	3.01	0.33	3.06
Reach 4	299	5-YR	463.11	6991.89	6993.91		6993.98	0.006550	186.91	0.31	0.42	0.51		2.45	1.99		2.01
Reach 4	299	100-YR	1590.50	6991.89	6995.49		6995.61	0.004966	219.56	0.31	0.56	0.81		3.09	2.83		2.84
Reach 4	299	FIS	2600.00	6991.89	6996.56		6996.72	0.004155	228.86	0.30	0.60	0.95	0.13	3.35	3.25	1.19	3.25
Reach 4	249	5-YR	463.11	6991.38	6993.53		6993.61	0.008219	165.24	0.35	0.37	0.65		2.16	2.25		2.25
Reach 4	249	100-YR	1590.50	6991.38	6995.20		6995.35	0.005487	195.90	0.33	0.52	0.94	0.02	2.92	3.07	0.37	3.07
Reach 4	249	FIS	2600.00	6991.38	6996.30		6996.50	0.004623	205.71	0.32	0.60	1.11	0.18	3.28	3.54	1.46	3.51
Reach 4	182	5-YR	463.11	6990.73	6993.05		6993.13	0.006421	141.55	0.32	0.29	0.61		1.92	2.24		2.23
Reach 4	182	100-YR	1590.50	6990.73	6994.81		6994.98	0.005386	158.50	0.33	0.53	1.10	0.27	2.97	3.42	1.90	3.38
Reach 4	182	FIS	2600.00	6990.73	6995.92		6996.17	0.005105	169.25	0.34	0.68	1.39	0.43	3.52	4.06	2.61	3.98
Reach 4	86	5-YR	463.11	6990.03	6992.36	6991.46	6992.47	0.007322	111.74	0.35	0.11	0.79	0.22	0.97	2.62	1.56	2.59
Reach 4	86	100-YR	1590.50	6990.03	6994.11	6992.62	6994.38	0.007337	130.78	0.39	0.50	1.60	0.74	2.70	4.18	3.50	4.07
Reach 4	86	FIS	2600.00	6990.03	6995.20	6993.36	6995.57	0.007330	148.51	0.41	0.62	2.09	1.01	3.10	5.01	4.31	4.81

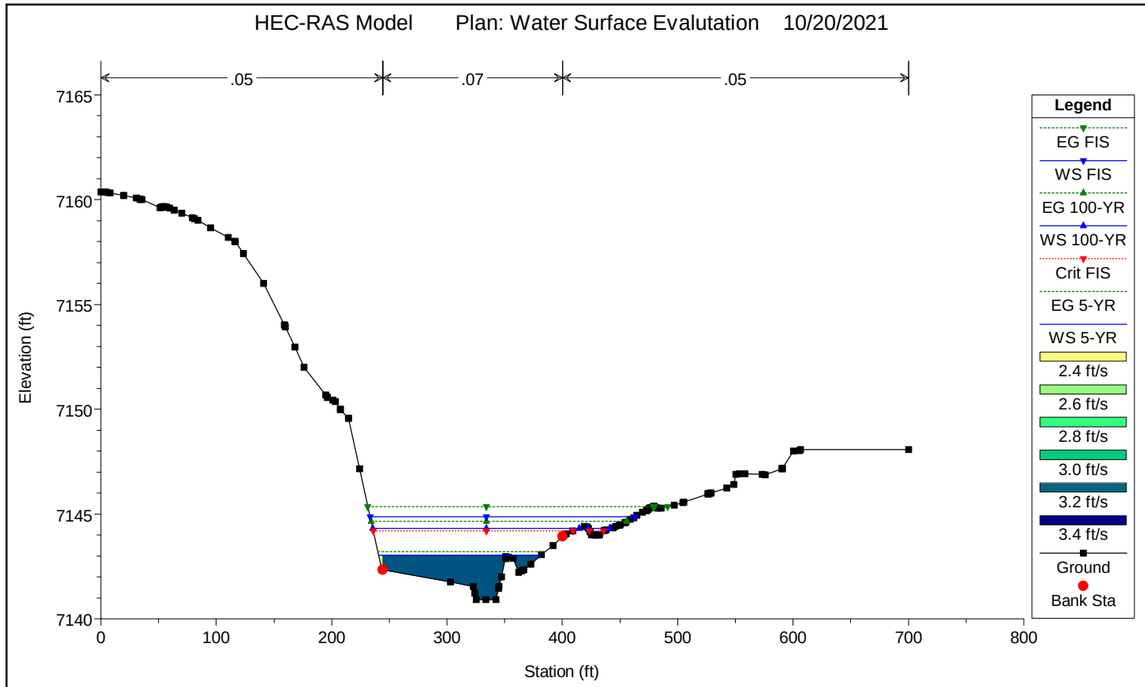
Supercritical / high depths highlighted

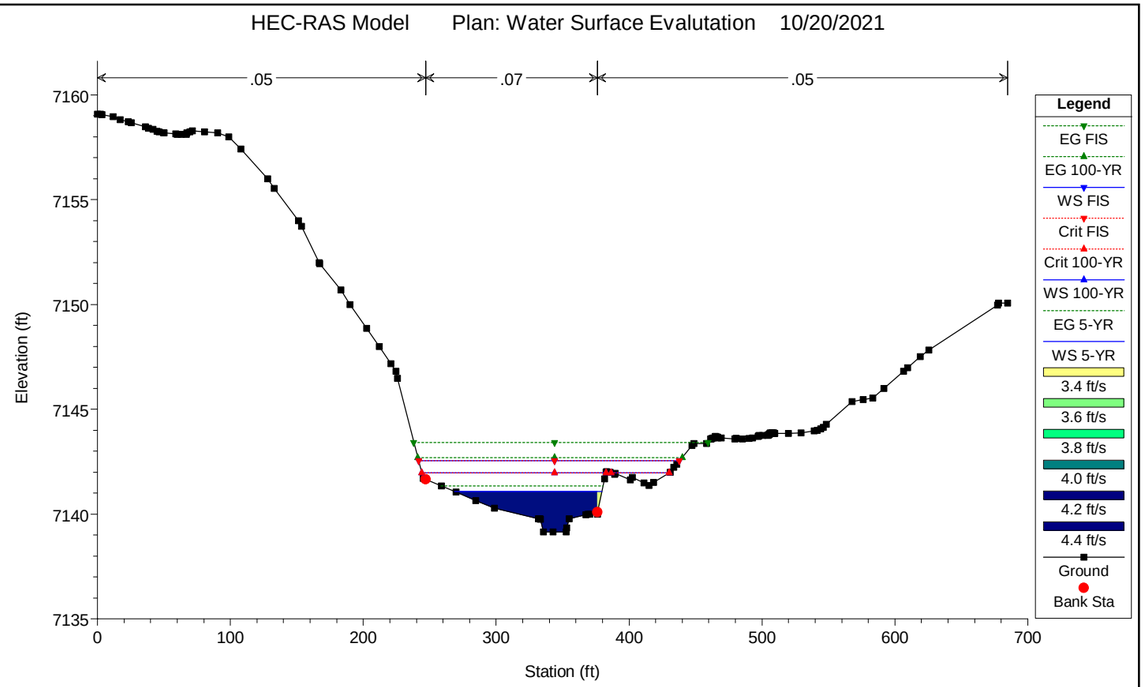

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

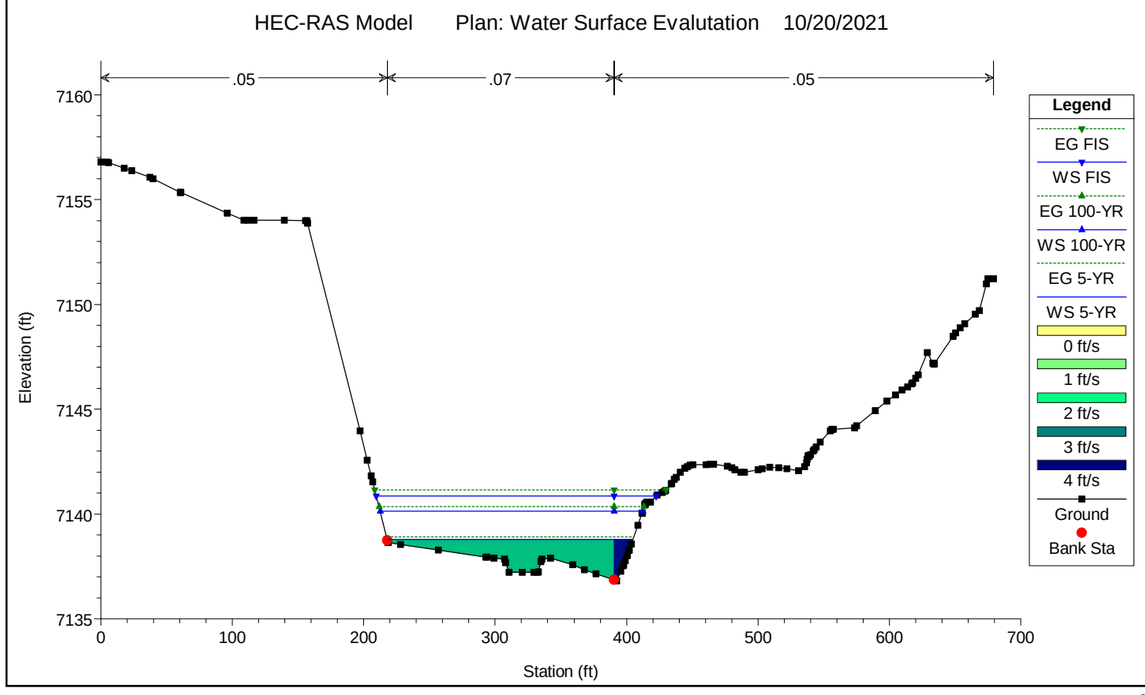

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Provide main channel stations
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.8 ft/s
1.0 ft/s
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta

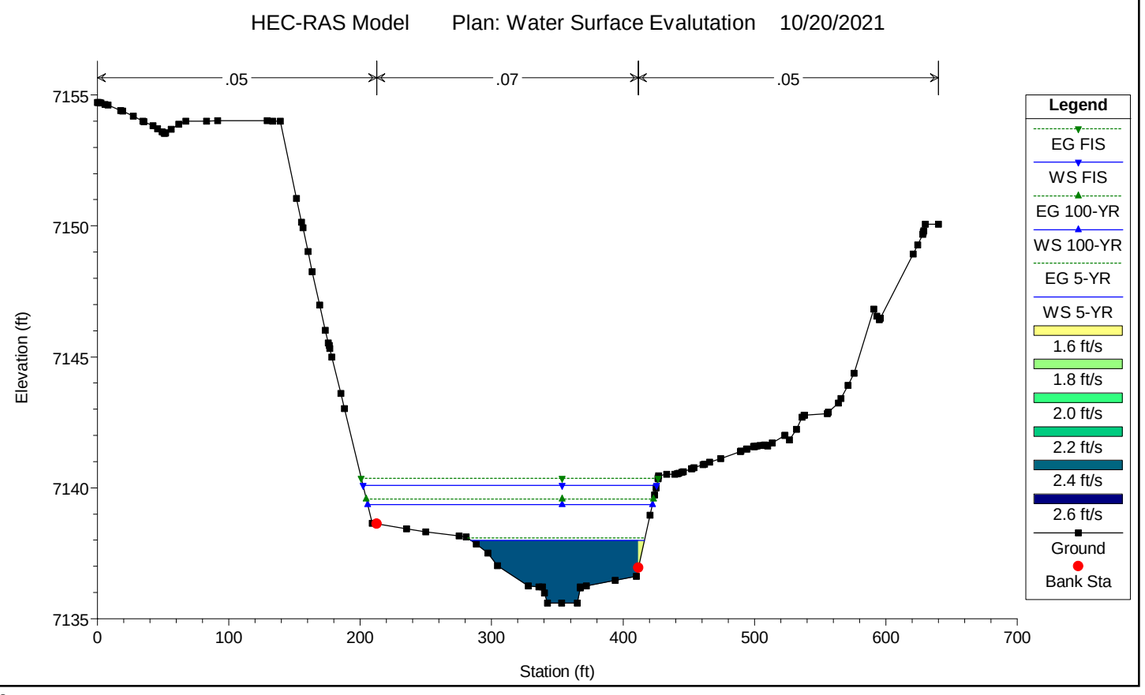

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
6.5 ft/s
7.0 ft/s
Ground
Bank Sta

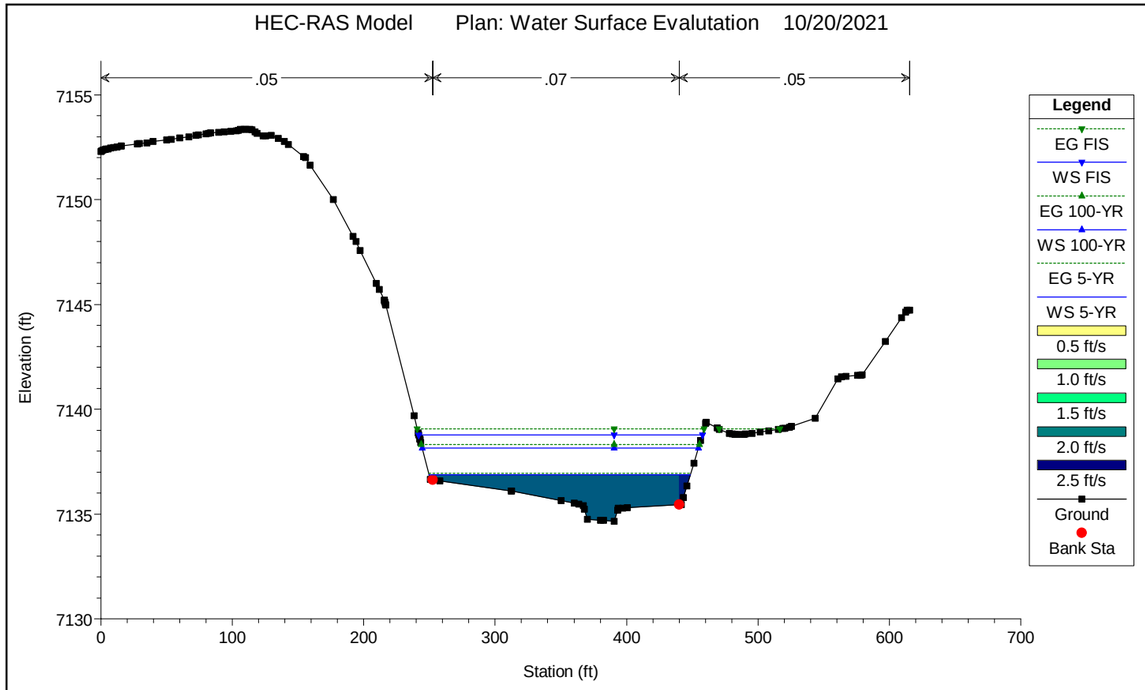

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.7 ft/s
1.8 ft/s
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
Ground
Bank Sta

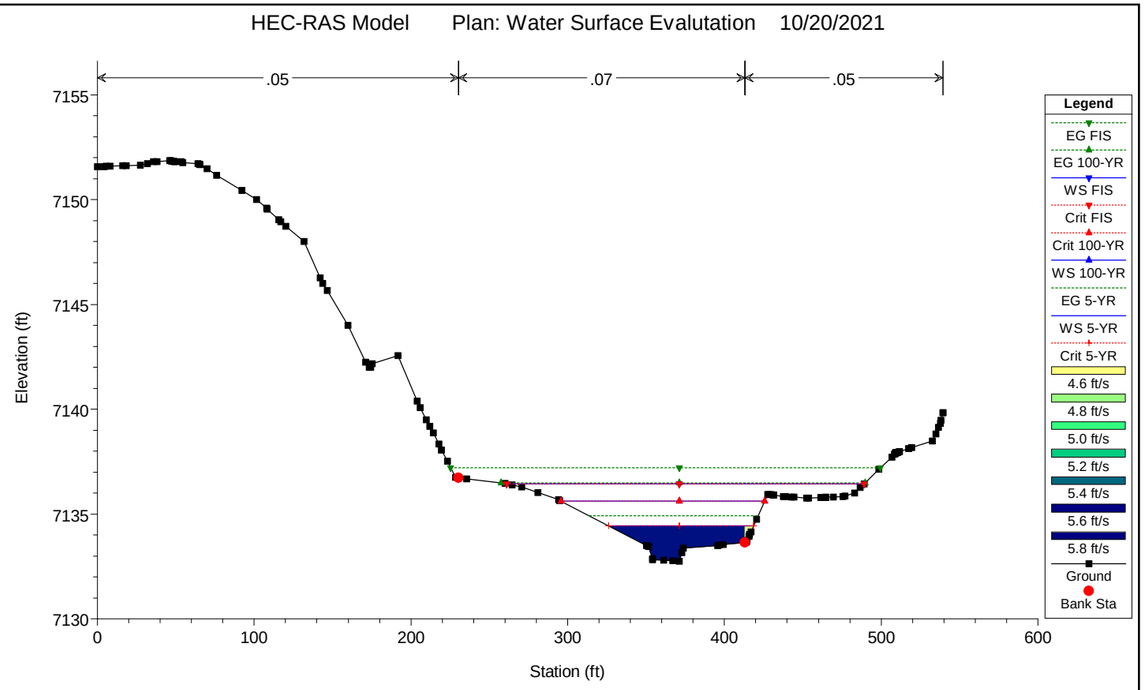

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit FIS
EG 5-YR
WS 5-YR
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.4 ft/s
3.6 ft/s
3.8 ft/s
4.0 ft/s
4.2 ft/s
4.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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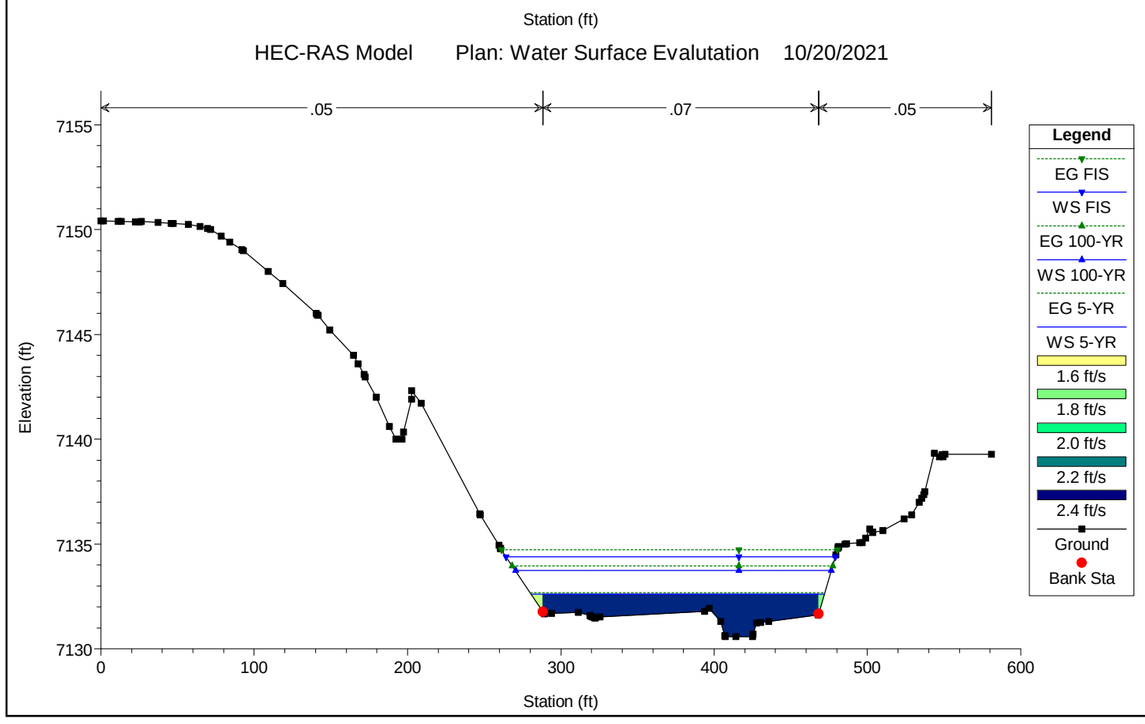
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
5.6 ft/s
5.8 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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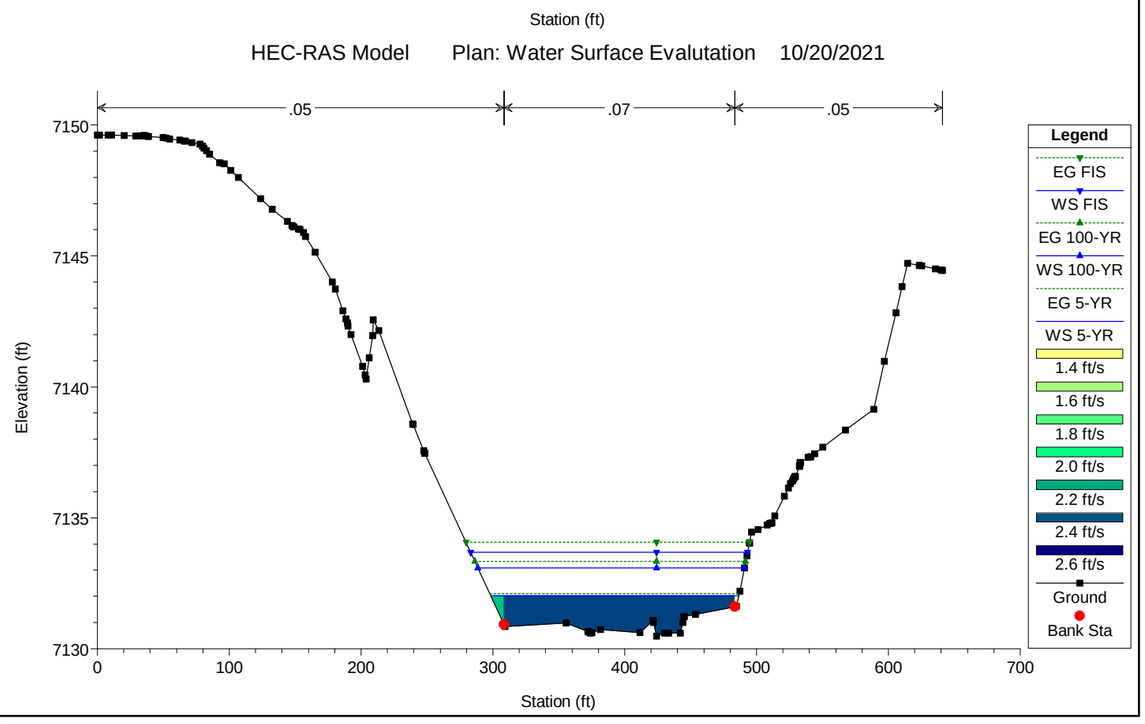
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
Ground
Bank Sta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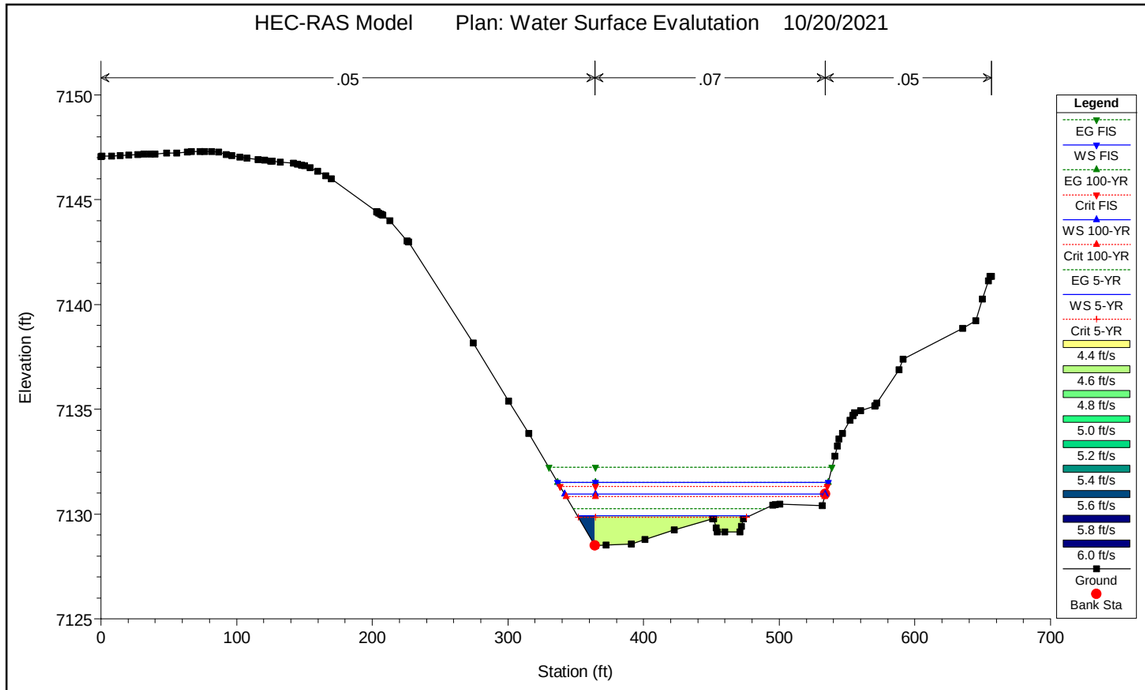
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta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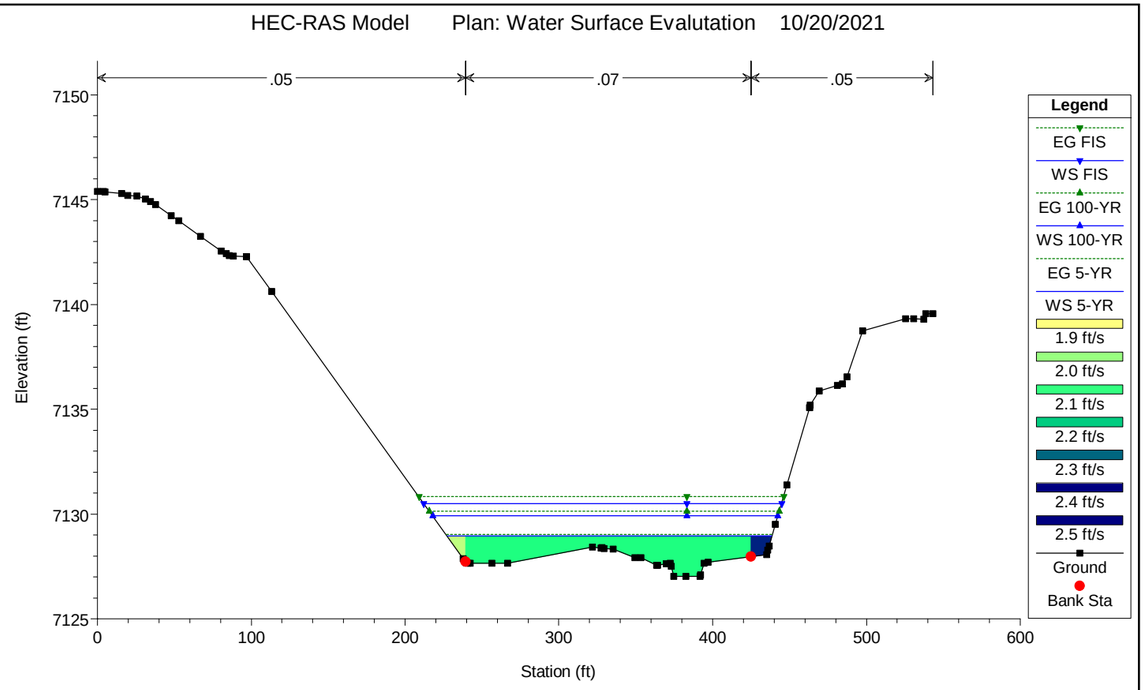
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
5.6 ft/s
5.8 ft/s
6.0 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
Ground
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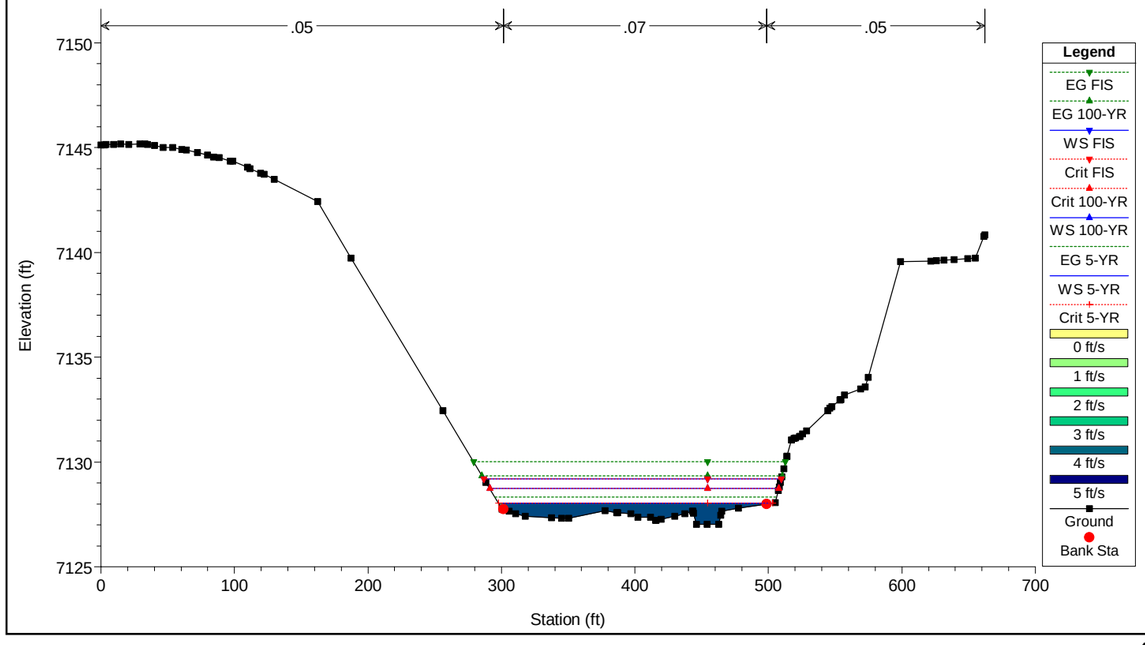
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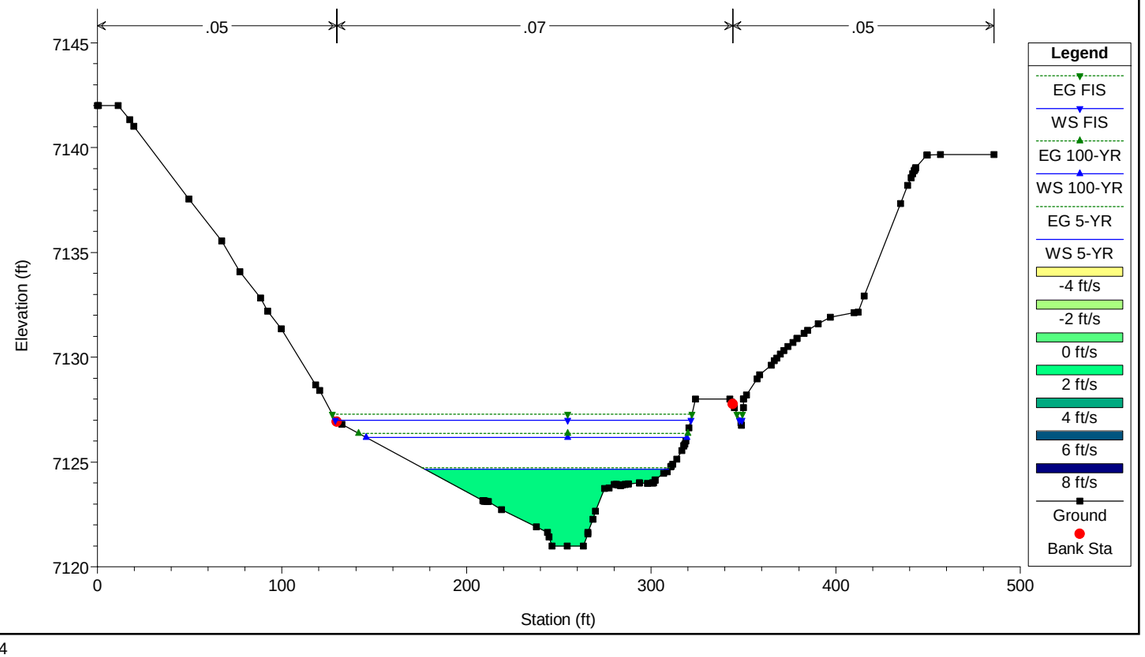
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta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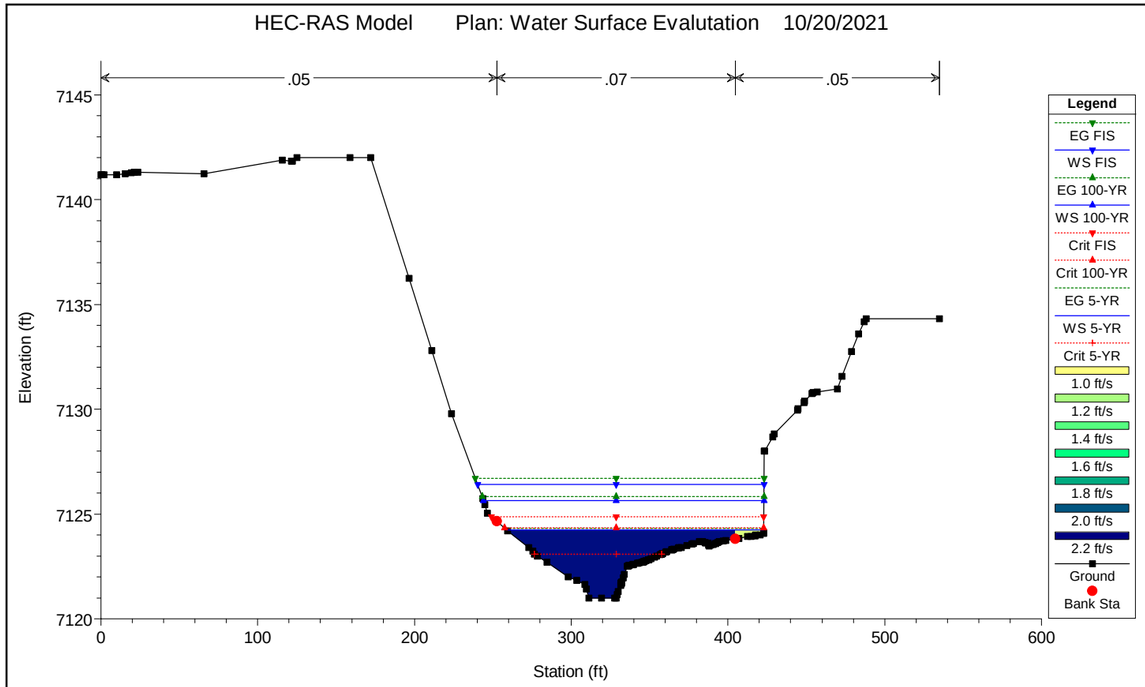
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta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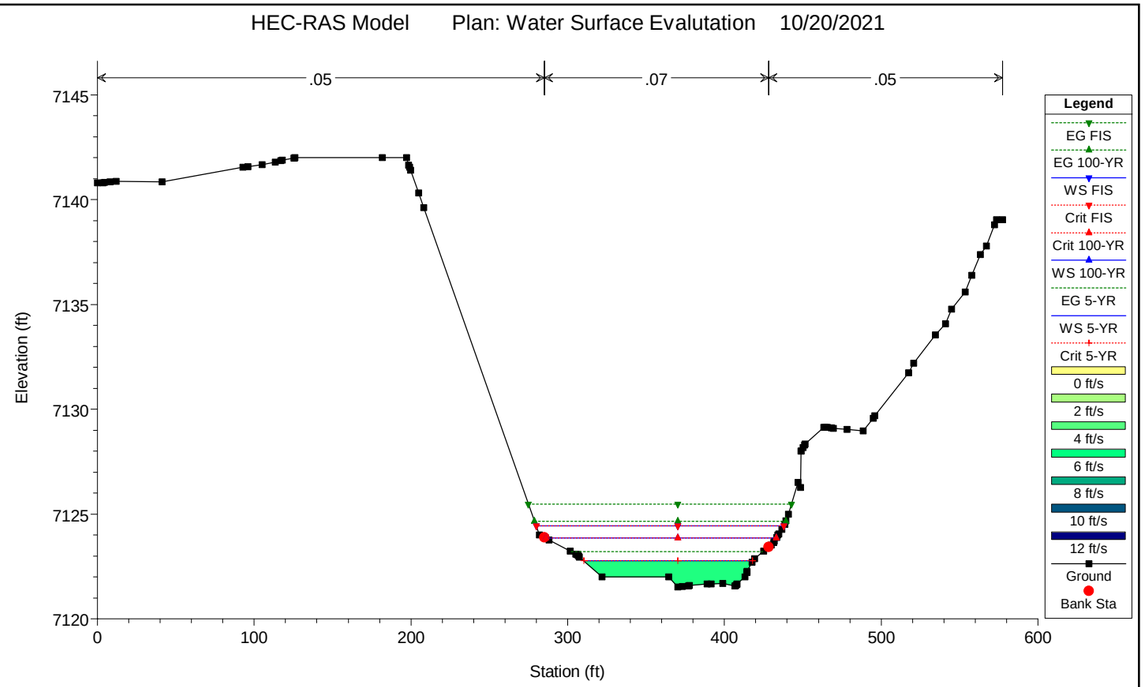
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit FIS
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1.0 ft/s
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta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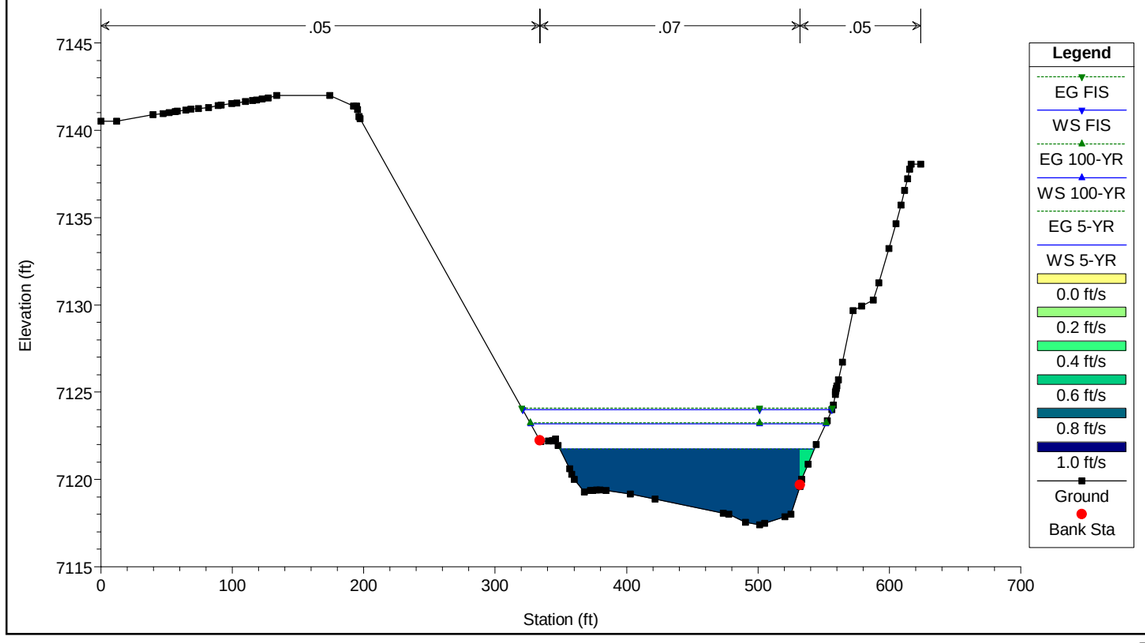
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta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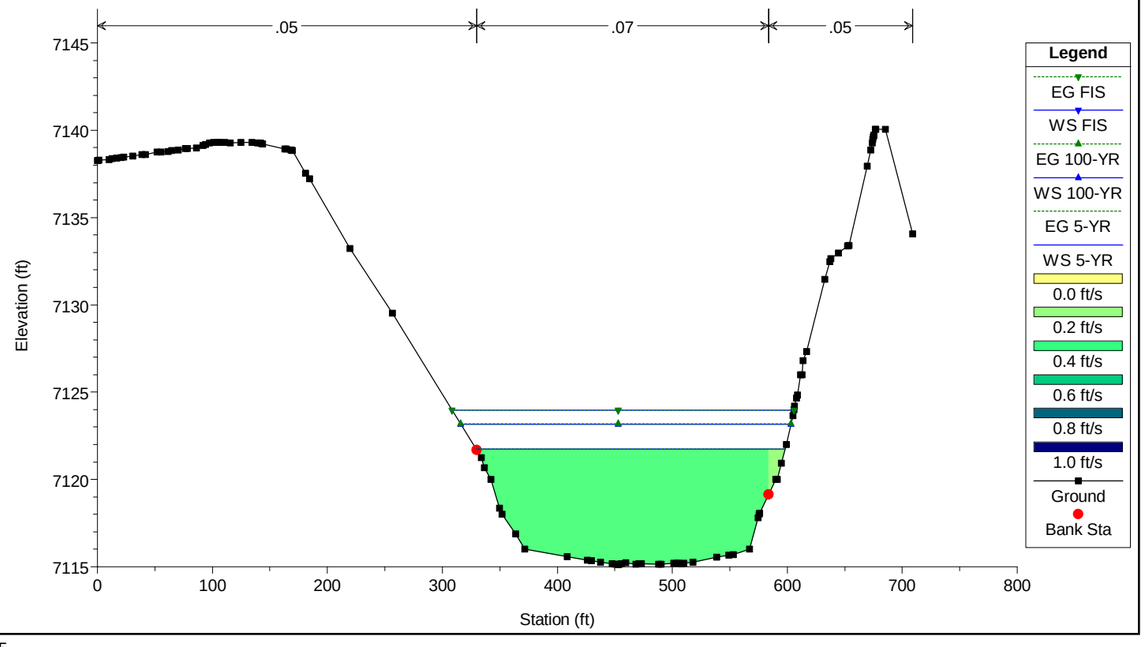
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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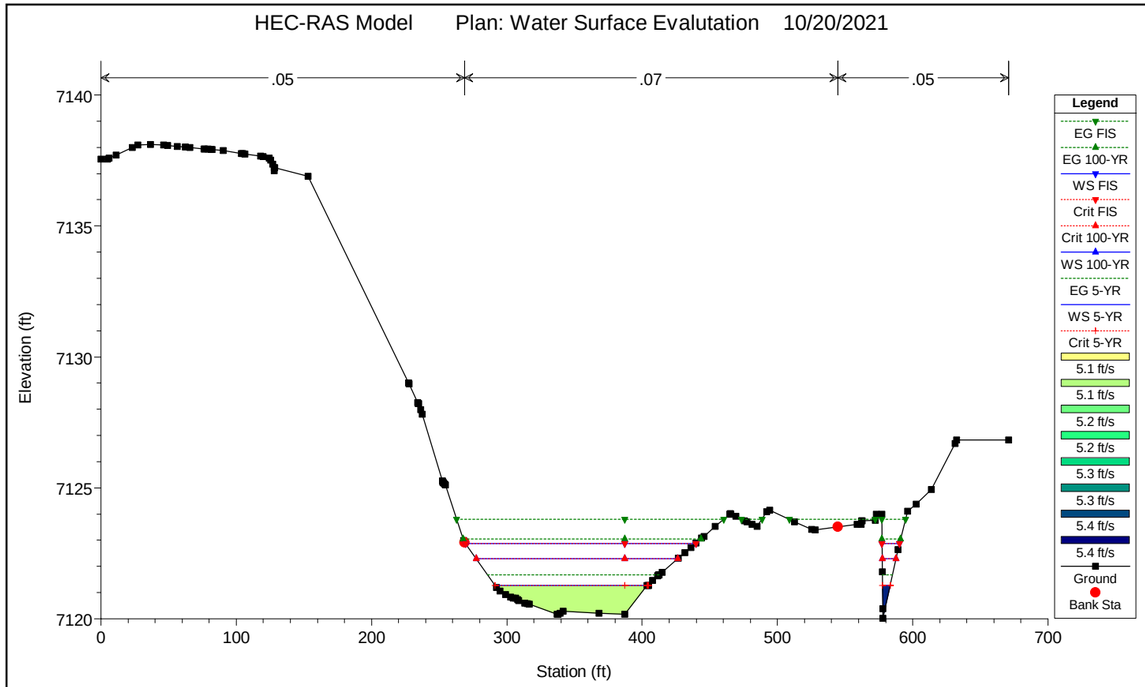
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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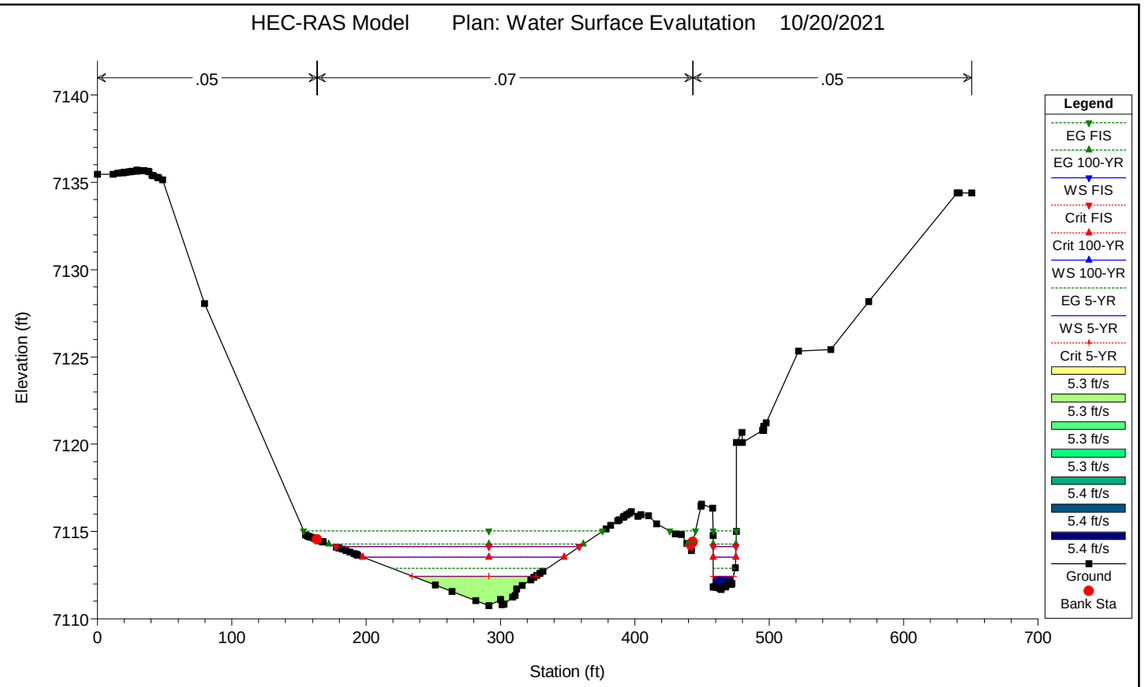
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
5.1 ft/s
5.1 ft/s
5.2 ft/s
5.2 ft/s
5.3 ft/s
5.3 ft/s
5.4 ft/s
5.4 ft/s
Ground
Bank Sta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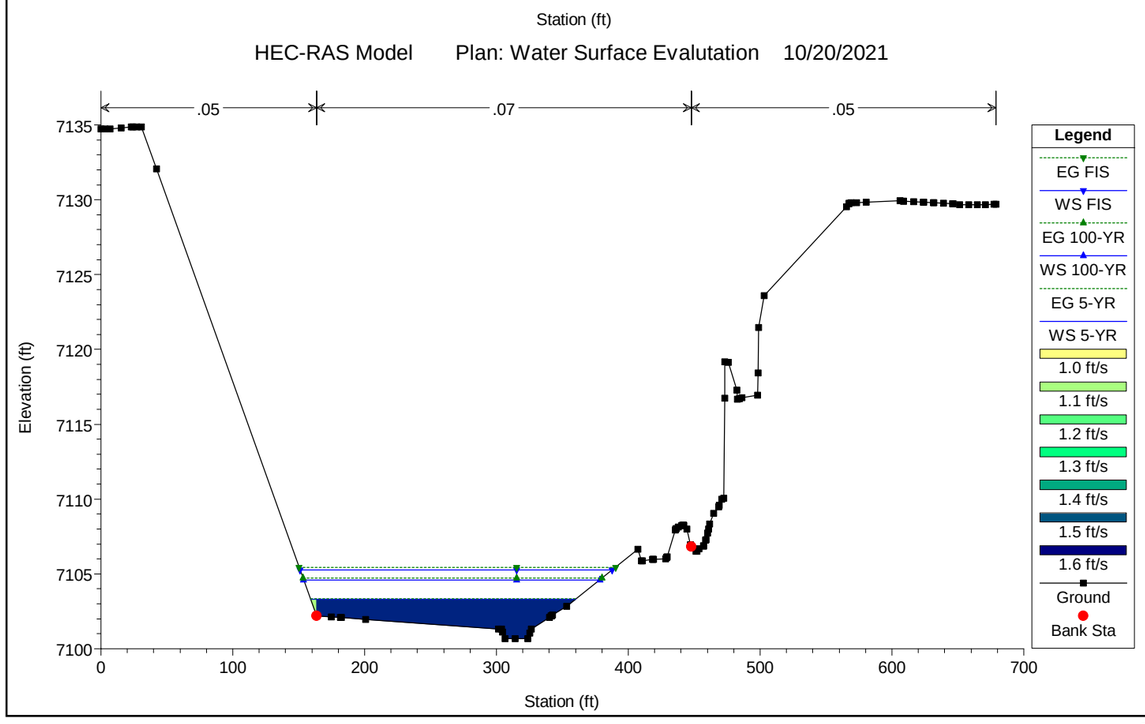
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
5.3 ft/s
5.3 ft/s
5.3 ft/s
5.3 ft/s
5.4 ft/s
5.4 ft/s
5.4 ft/s
Ground
Bank Sta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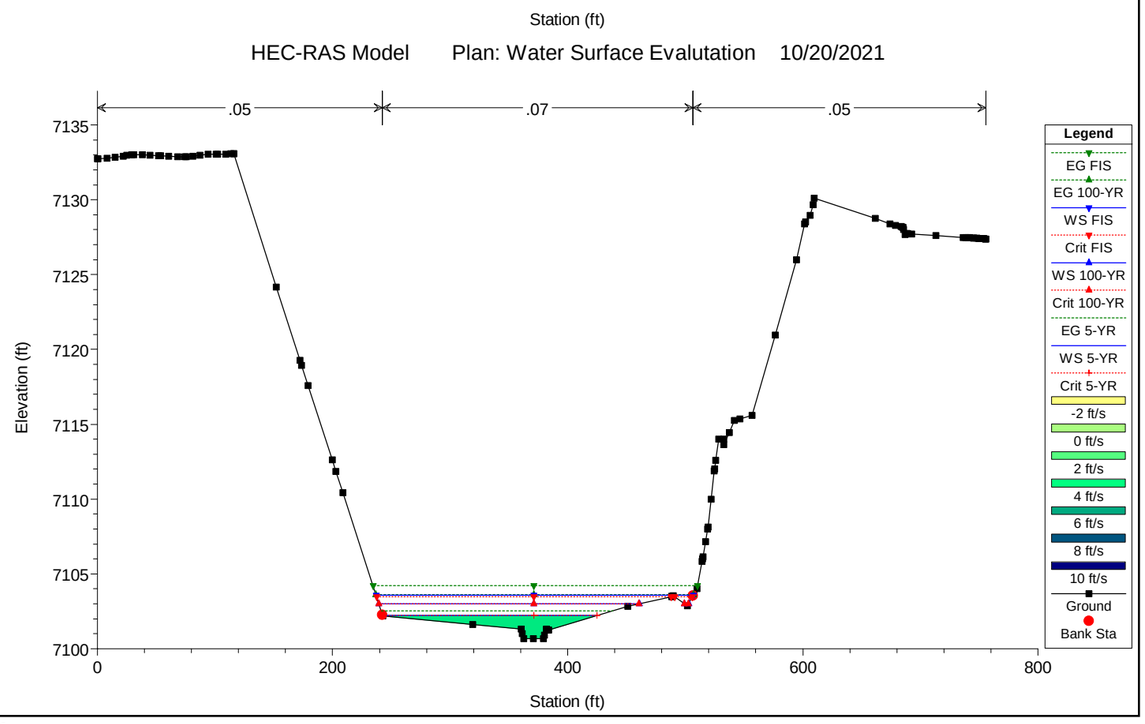
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1.0 ft/s
1.1 ft/s
1.2 ft/s
1.3 ft/s
1.4 ft/s
1.5 ft/s
1.6 ft/s
Ground
Bank Sta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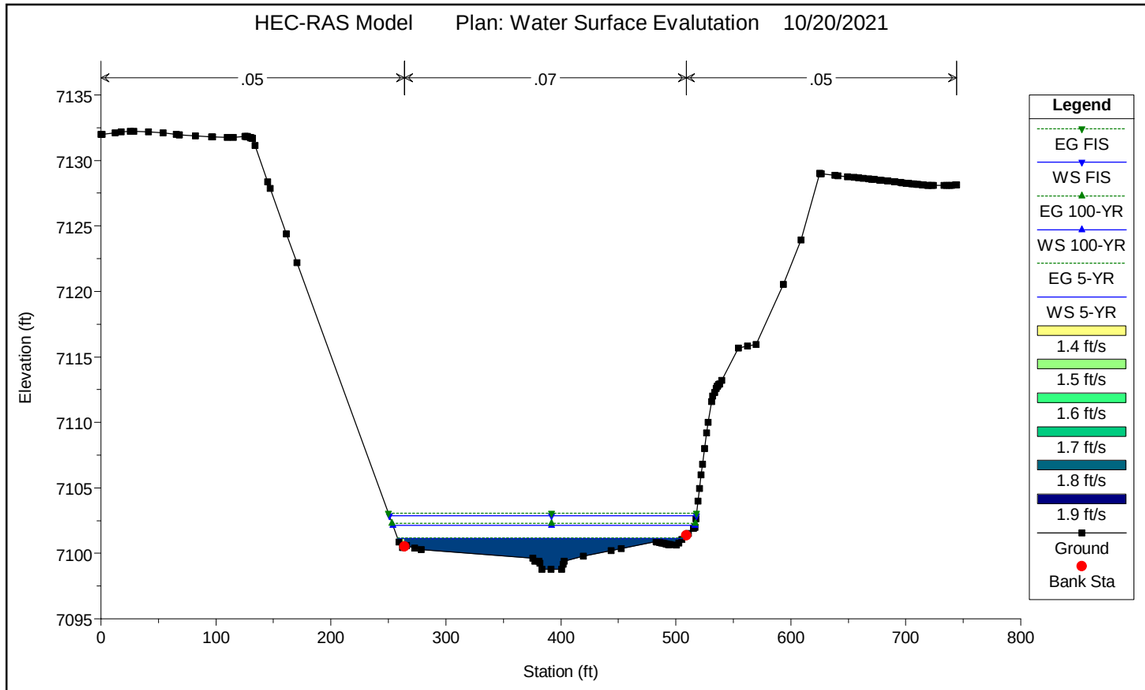
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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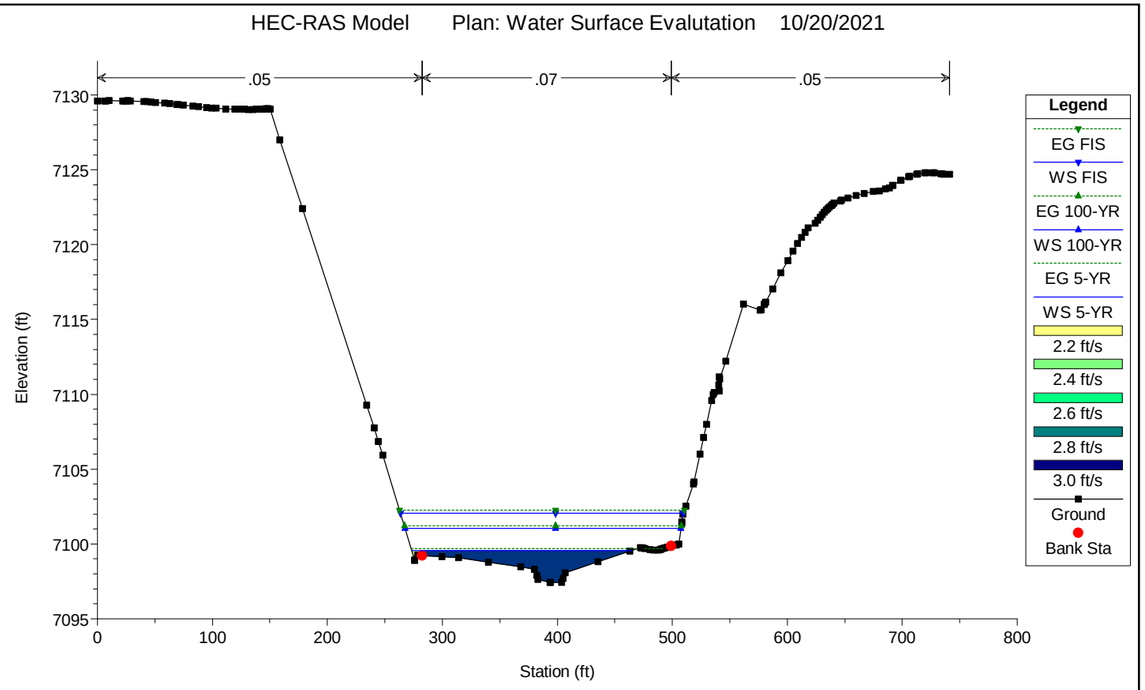
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.5 ft/s
1.6 ft/s
1.7 ft/s
1.8 ft/s
1.9 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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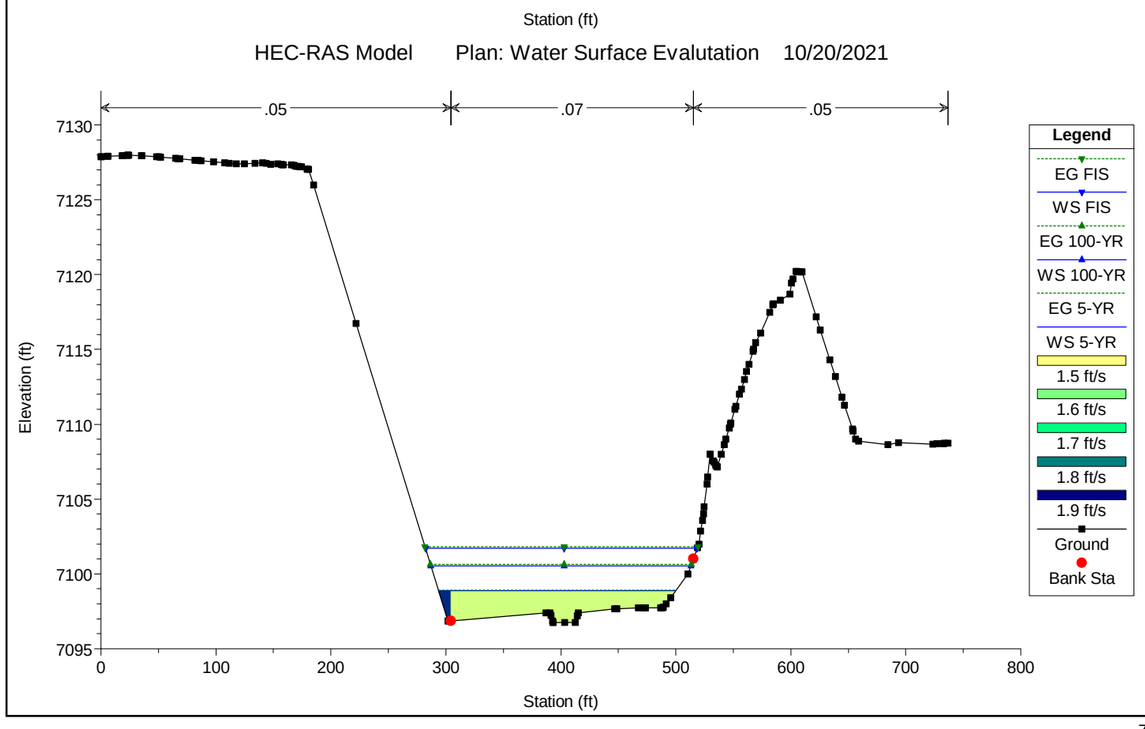
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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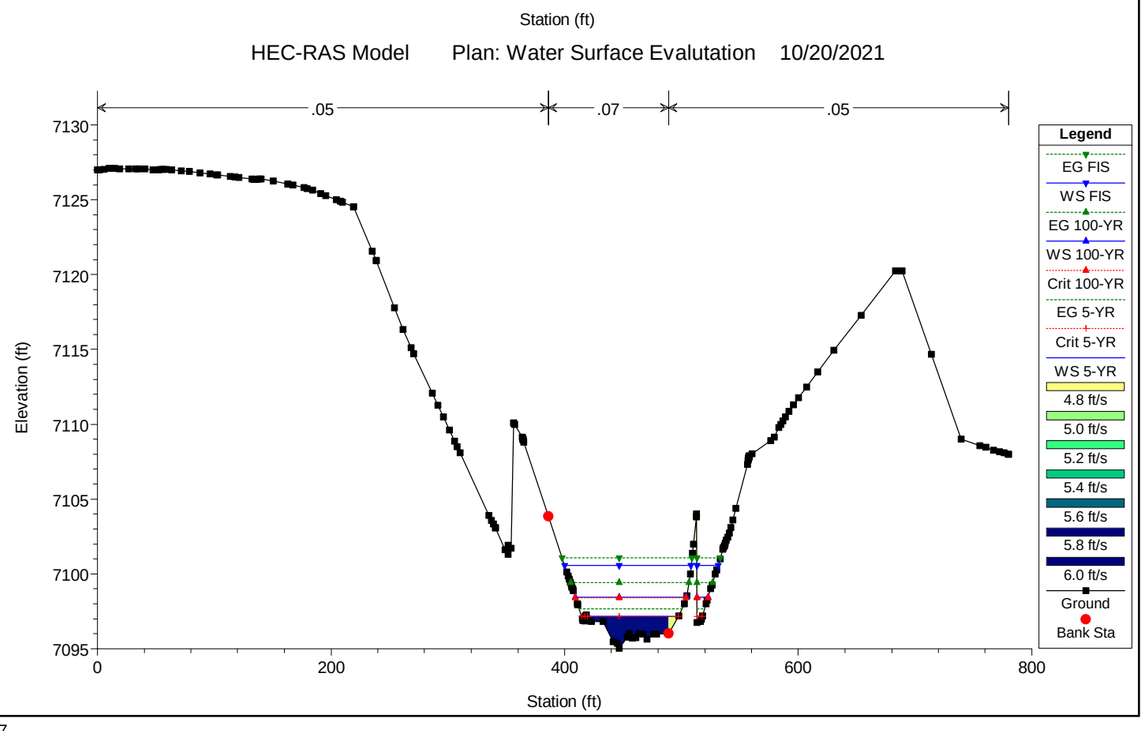
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
1.6 ft/s
1.7 ft/s
1.8 ft/s
1.9 ft/s
Ground
Bank Sta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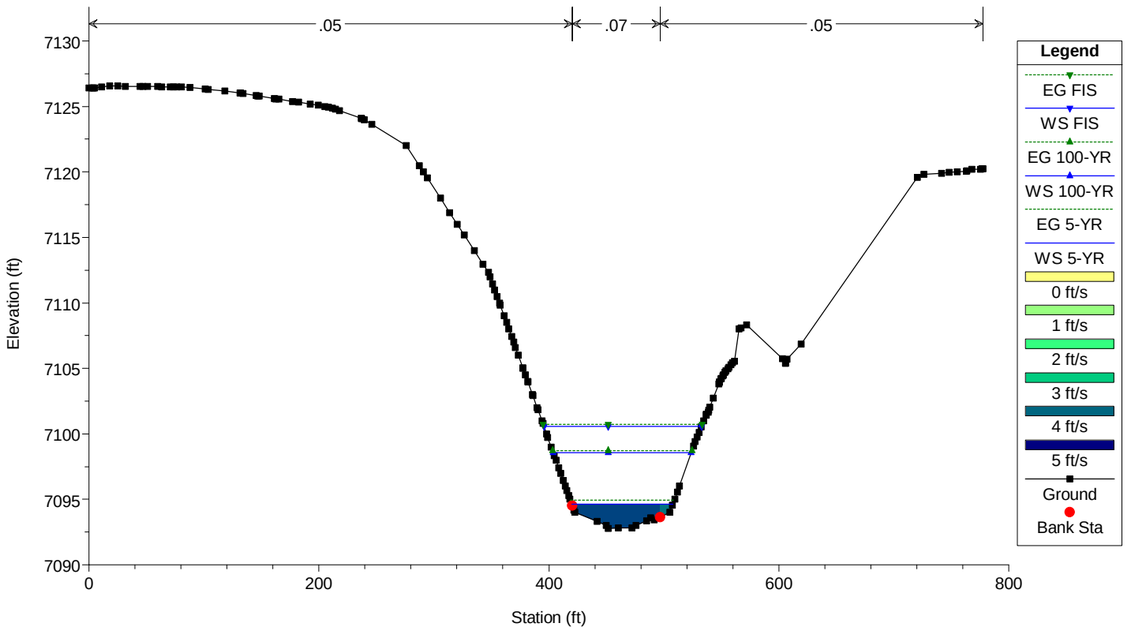
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
Crit 5-YR
WS 5-YR
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
5.6 ft/s
5.8 ft/s
6.0 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



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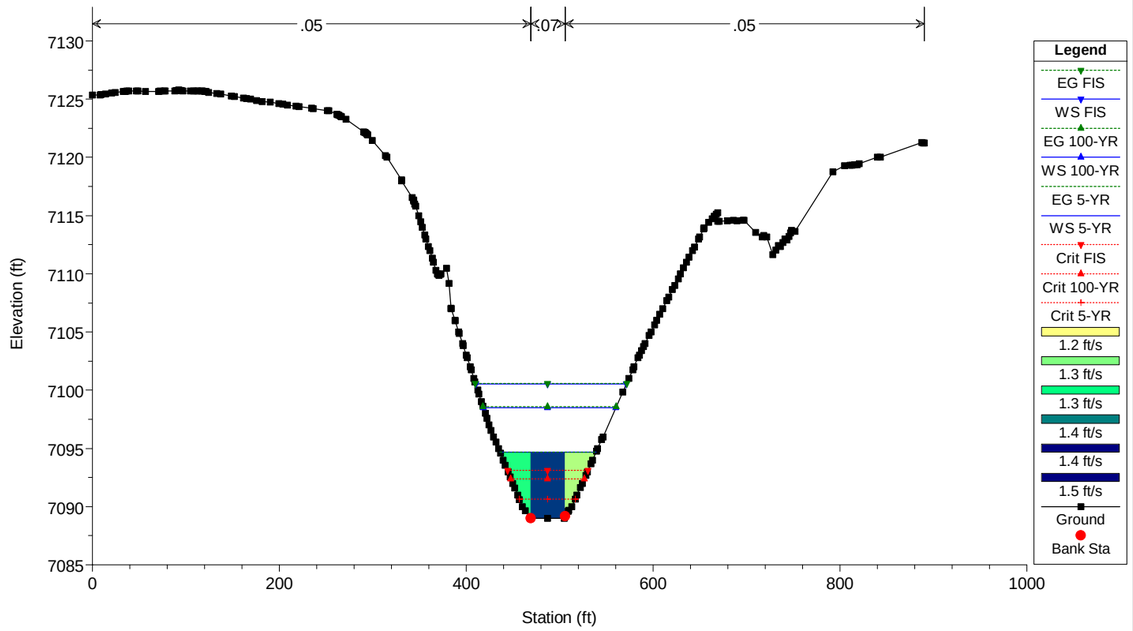

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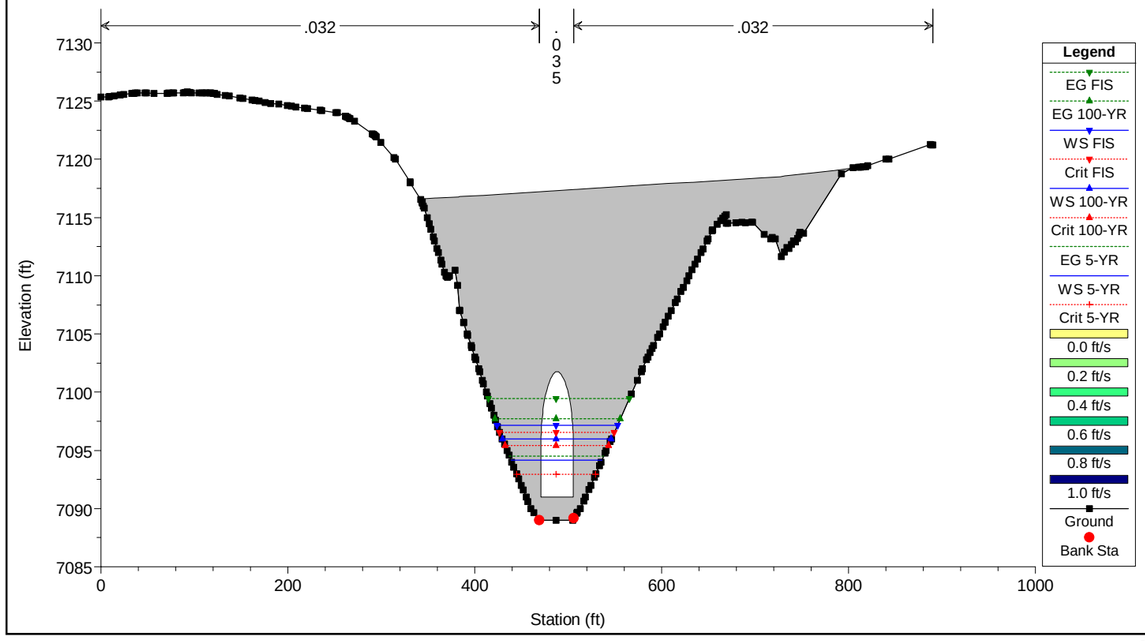

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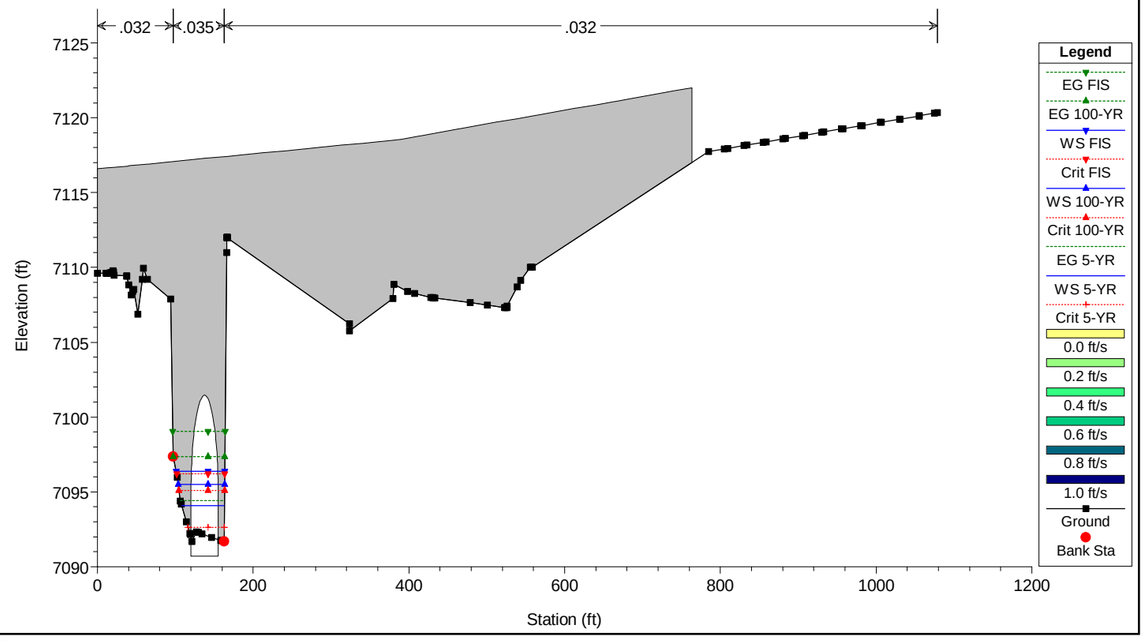
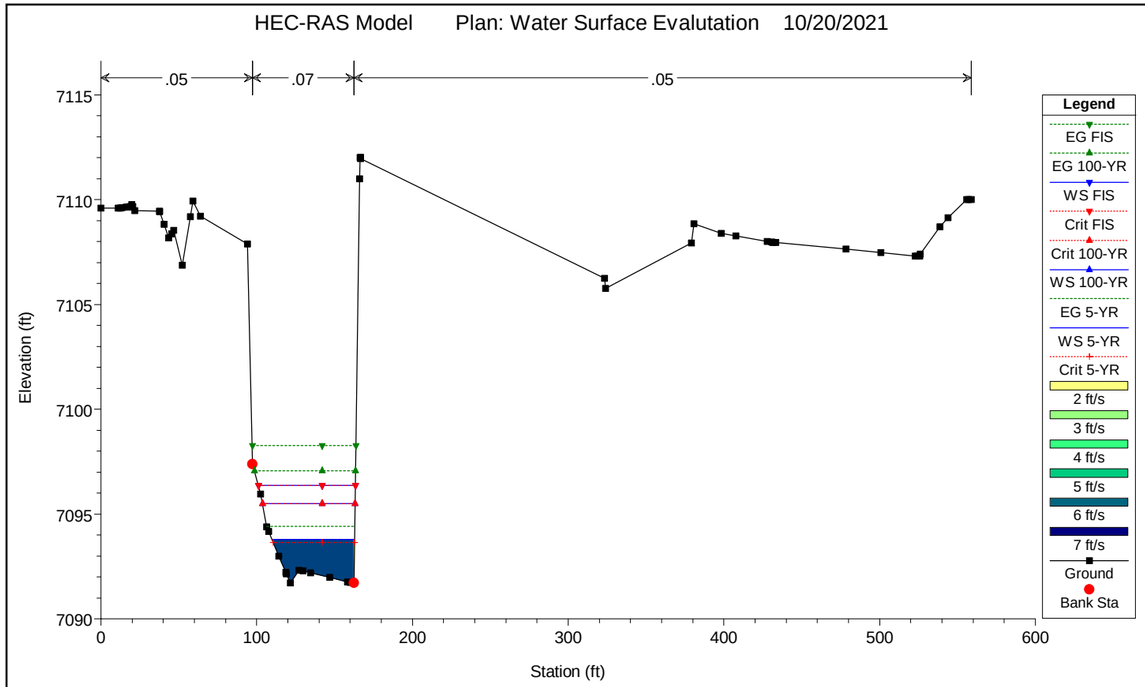
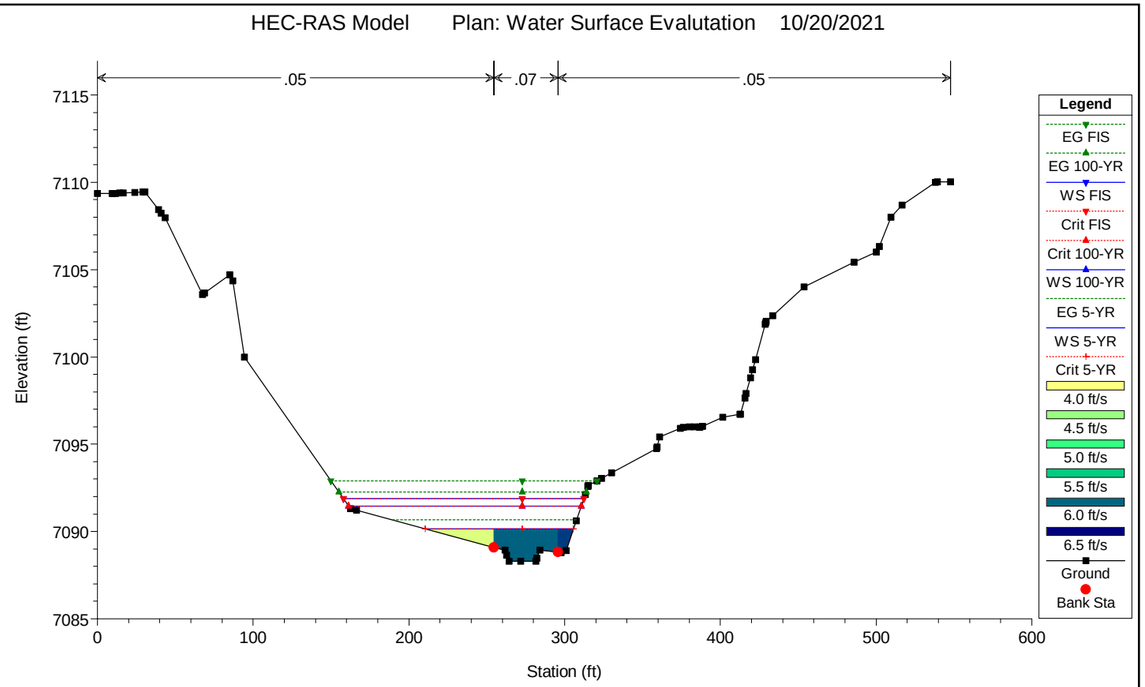



HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta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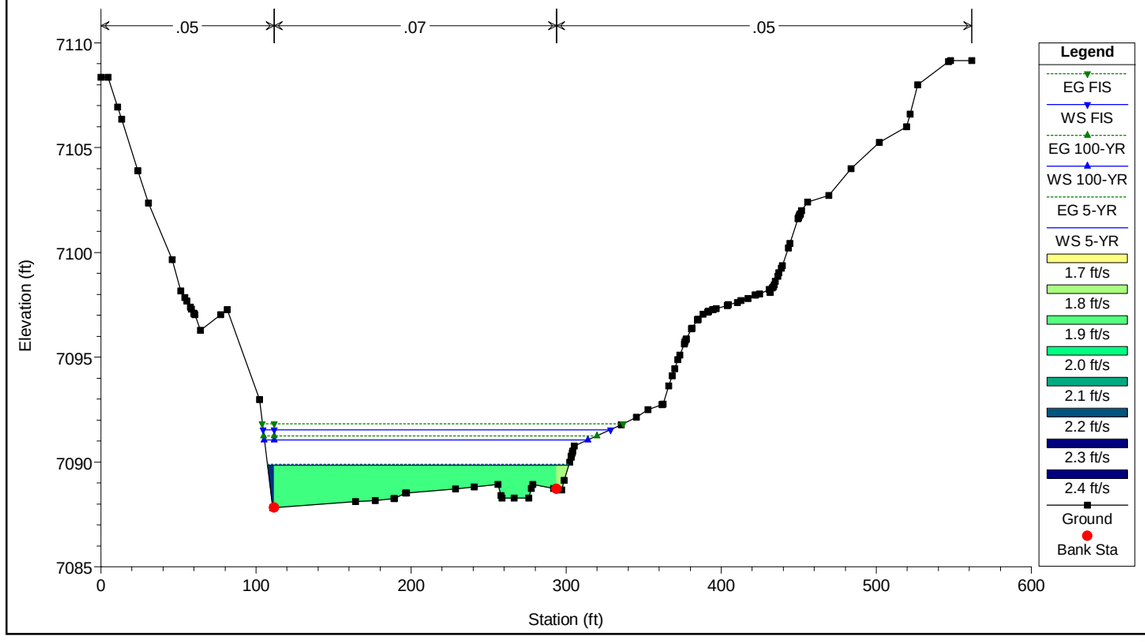
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
6.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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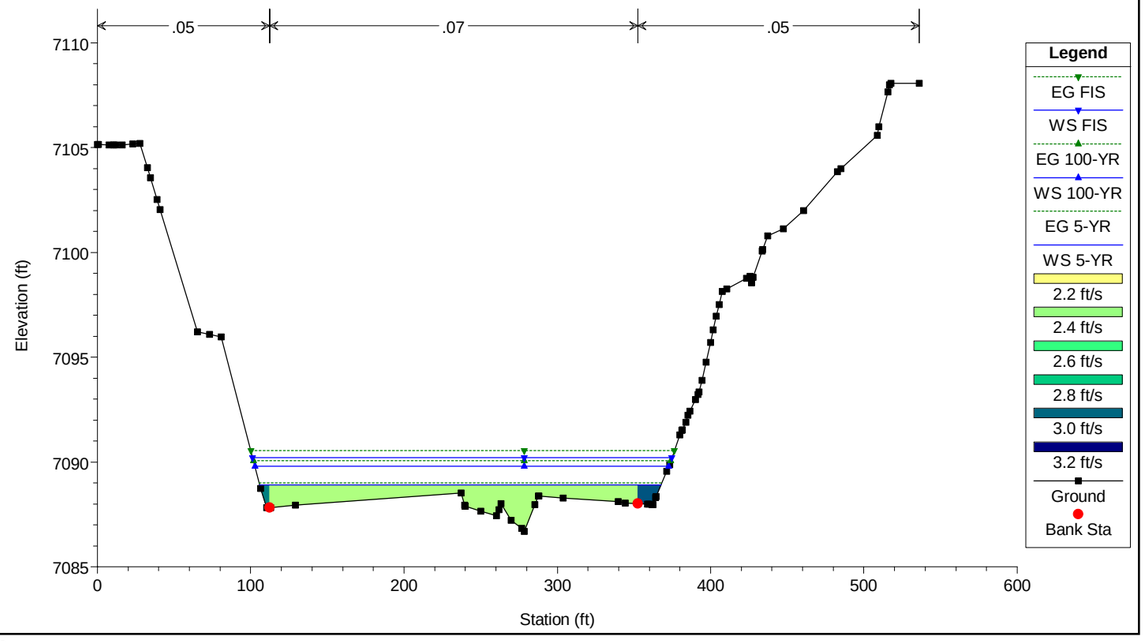
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.7 ft/s
1.8 ft/s
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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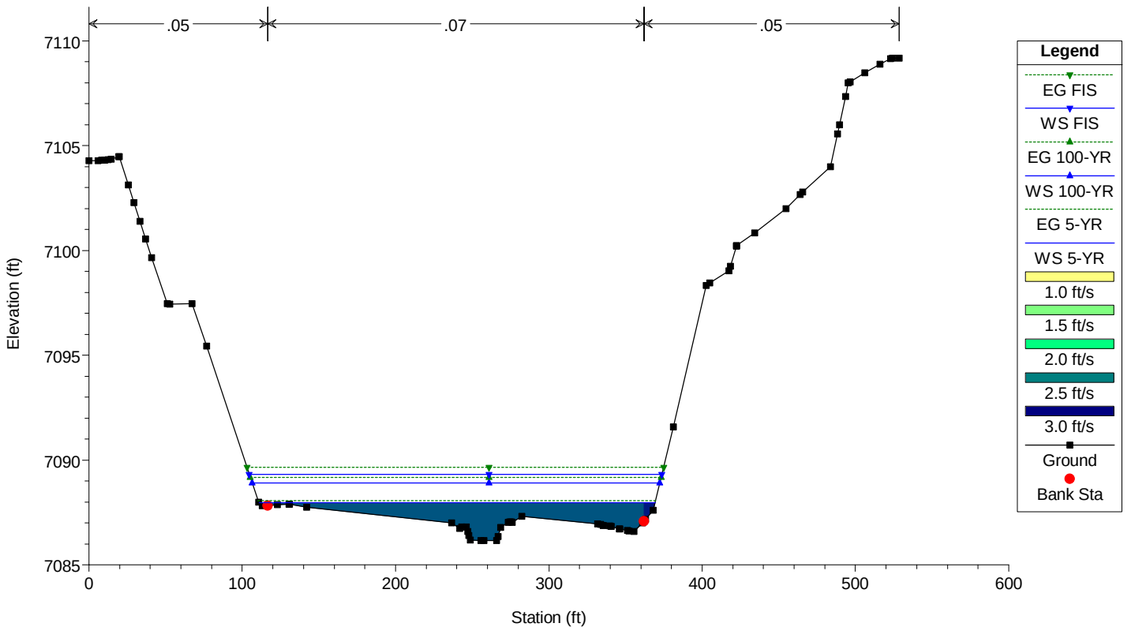
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



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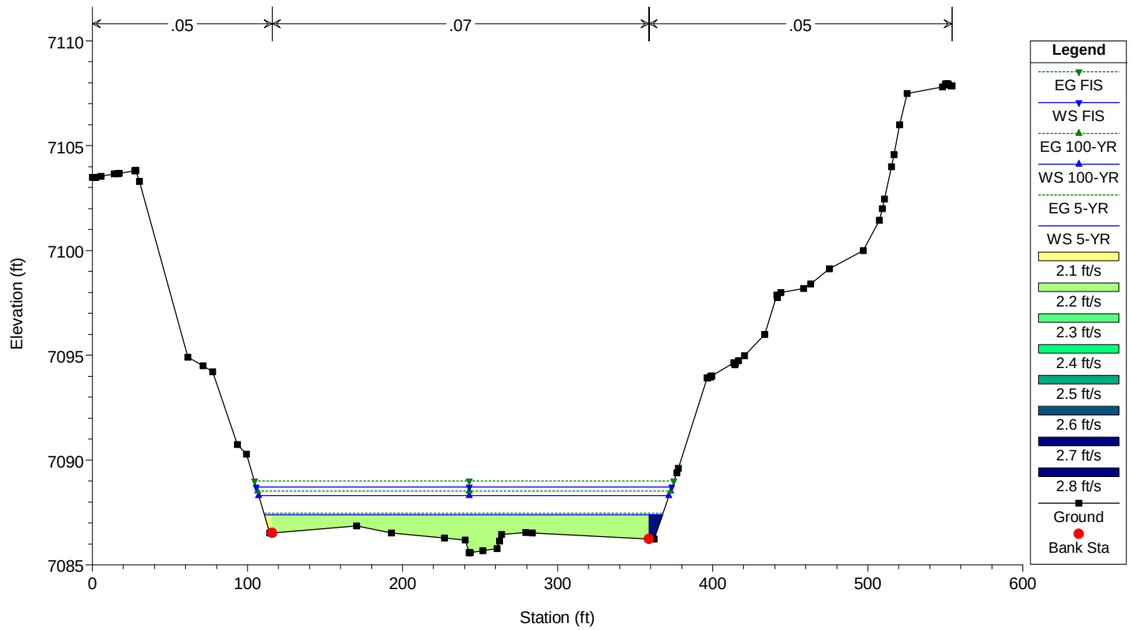

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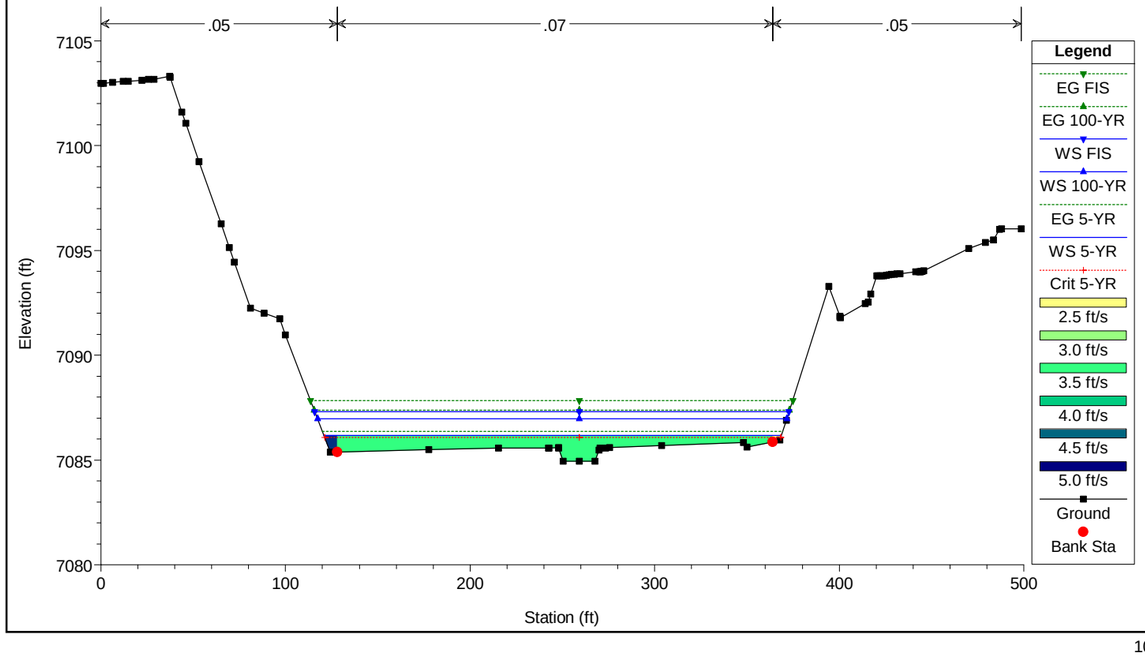

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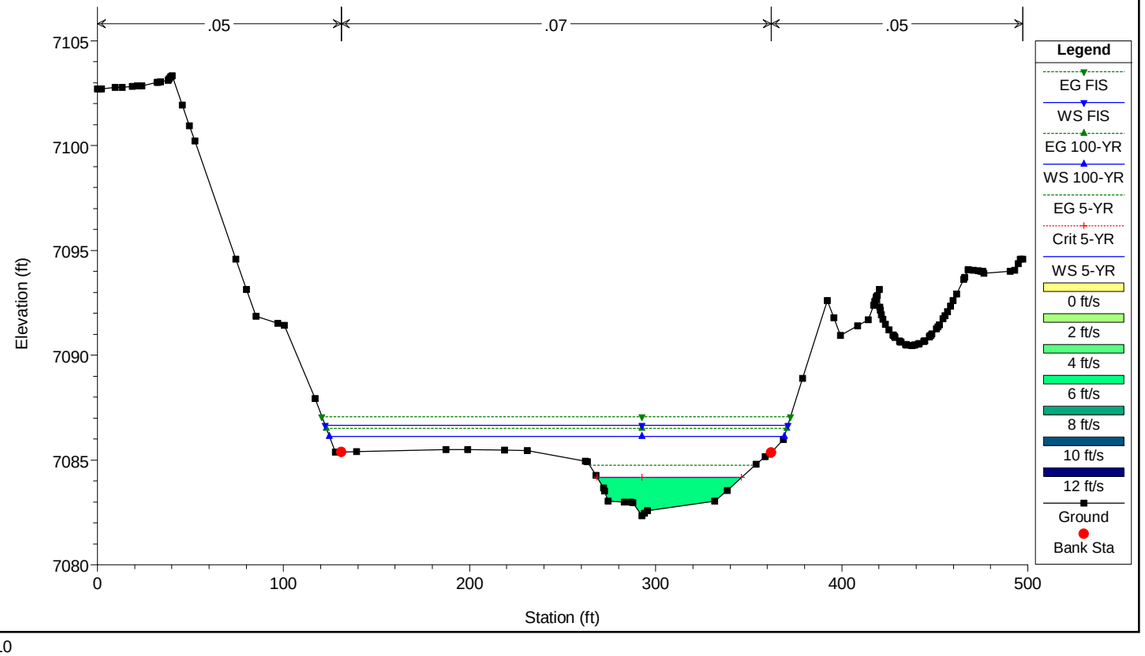
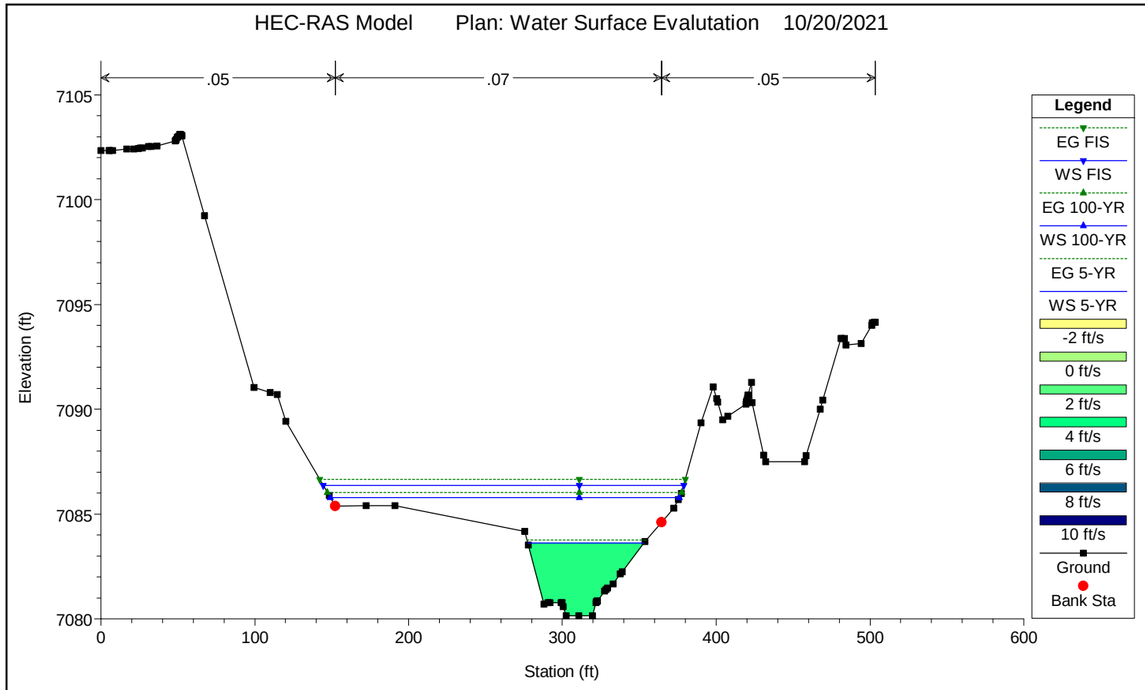
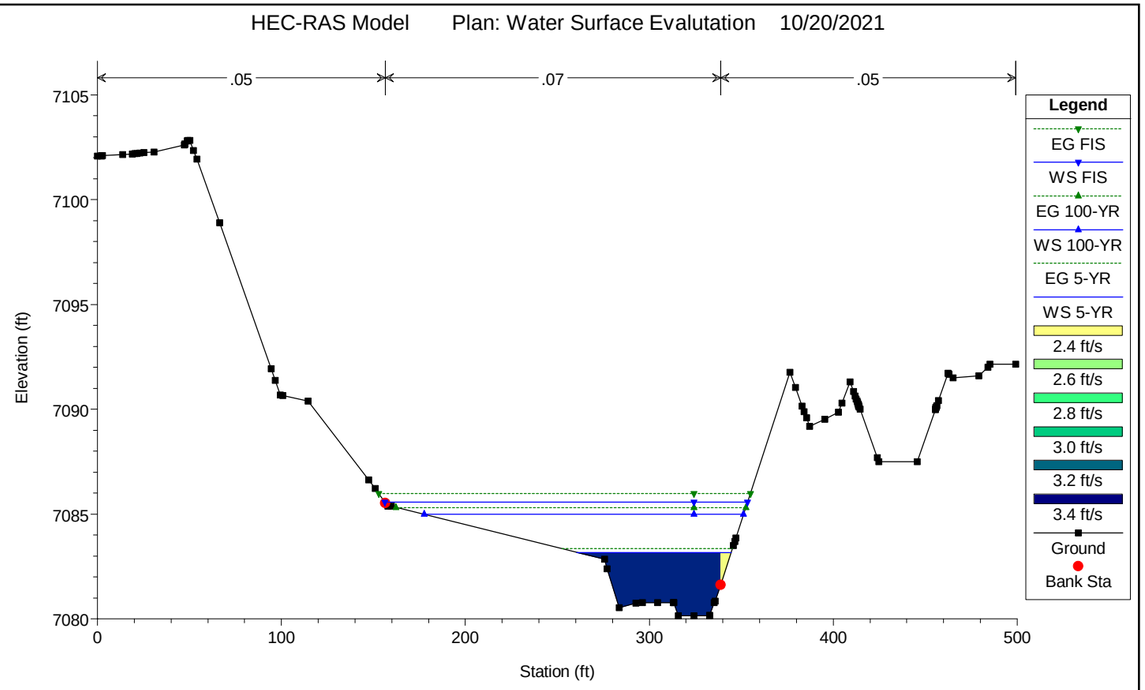
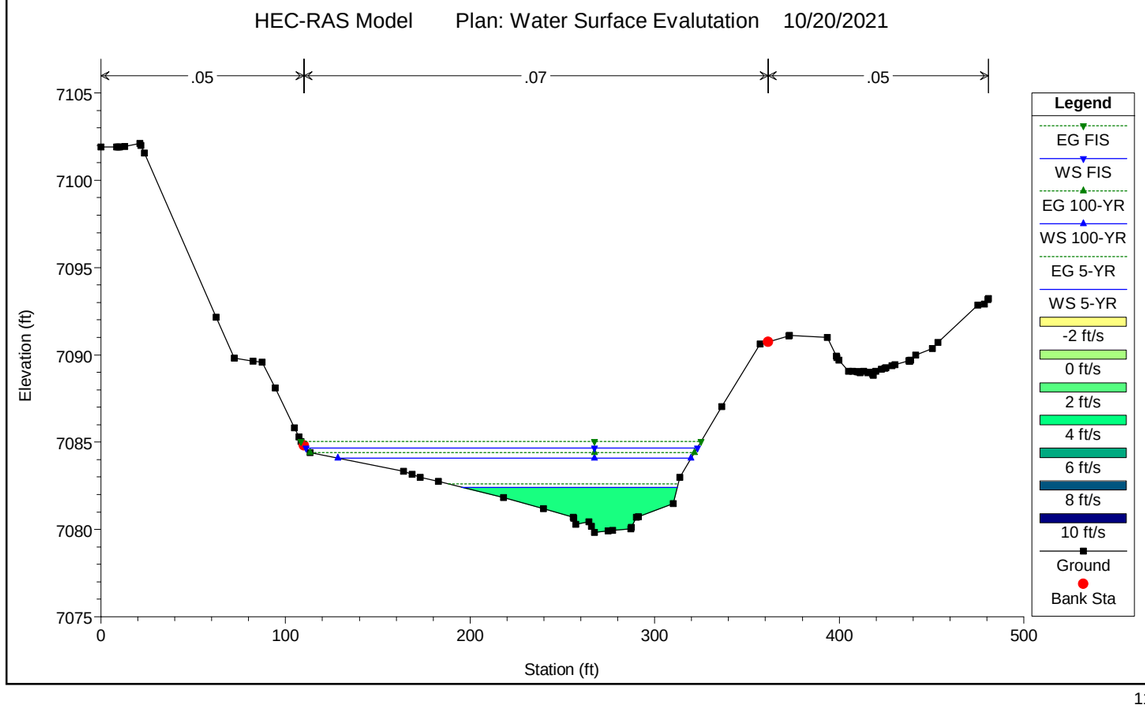



HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
Ground
Bank Sta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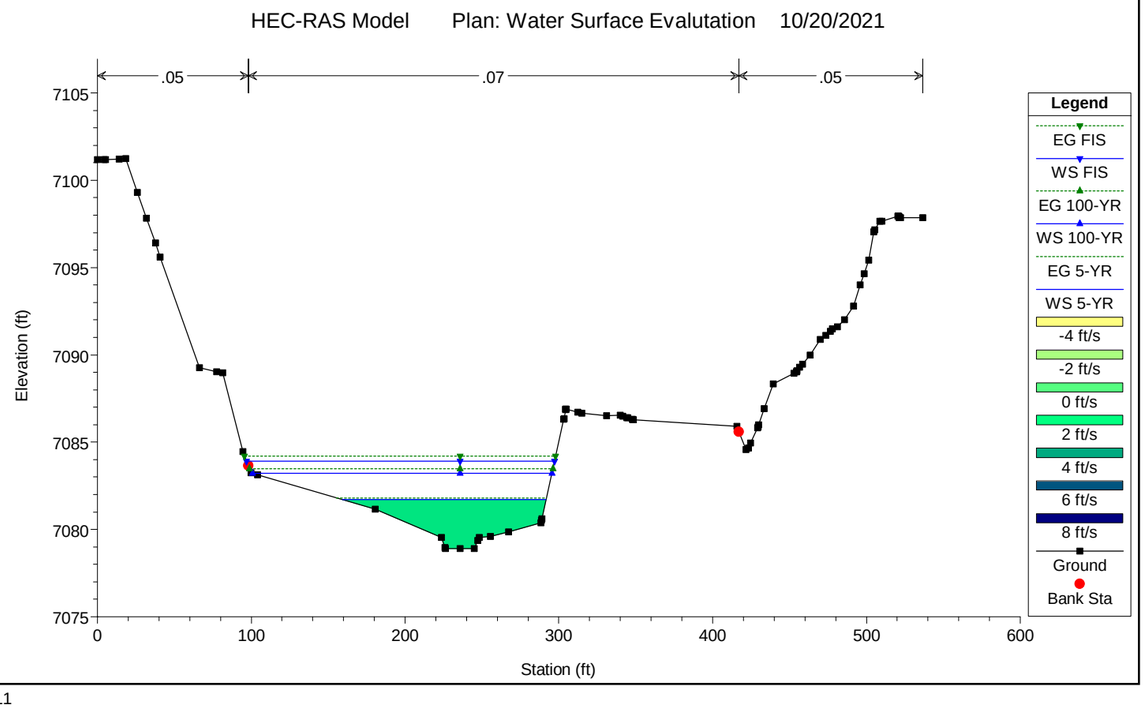
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta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.07
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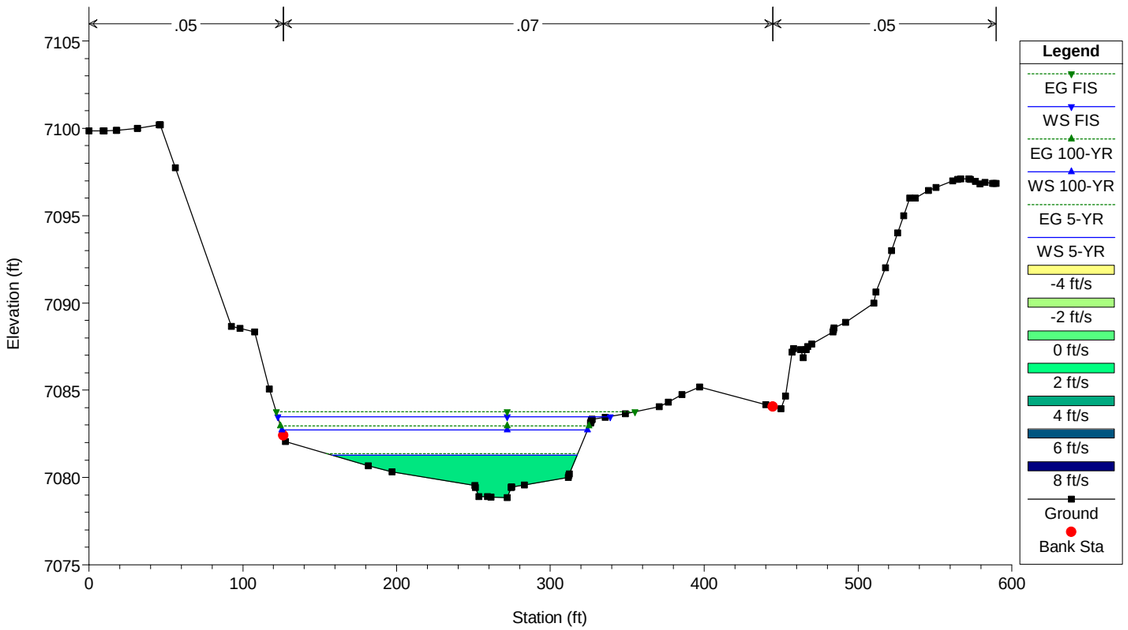
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



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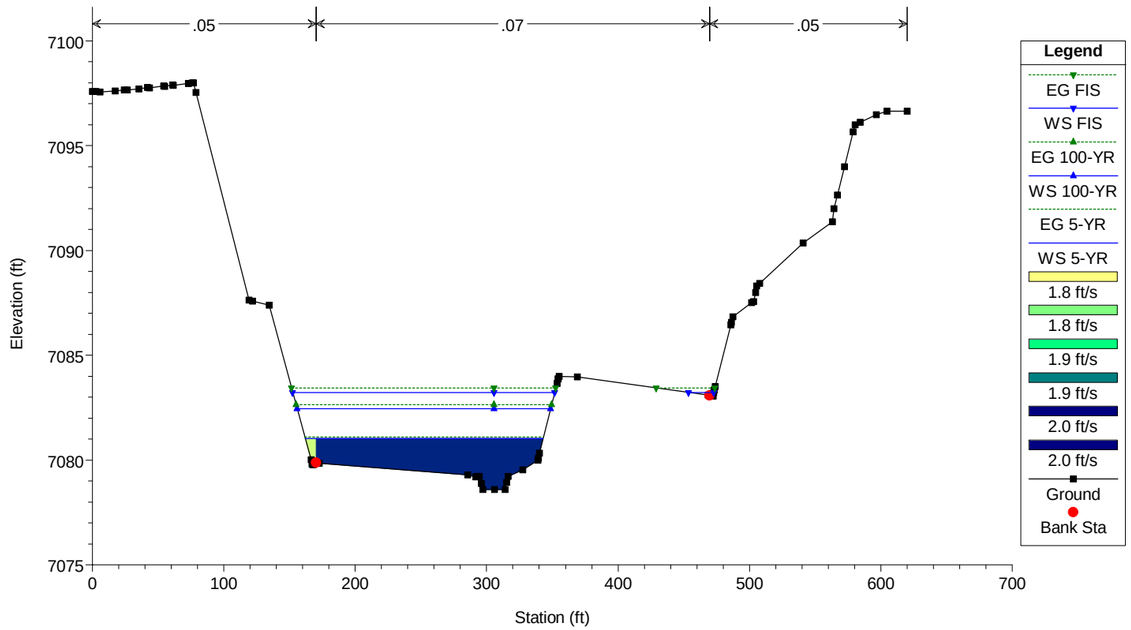

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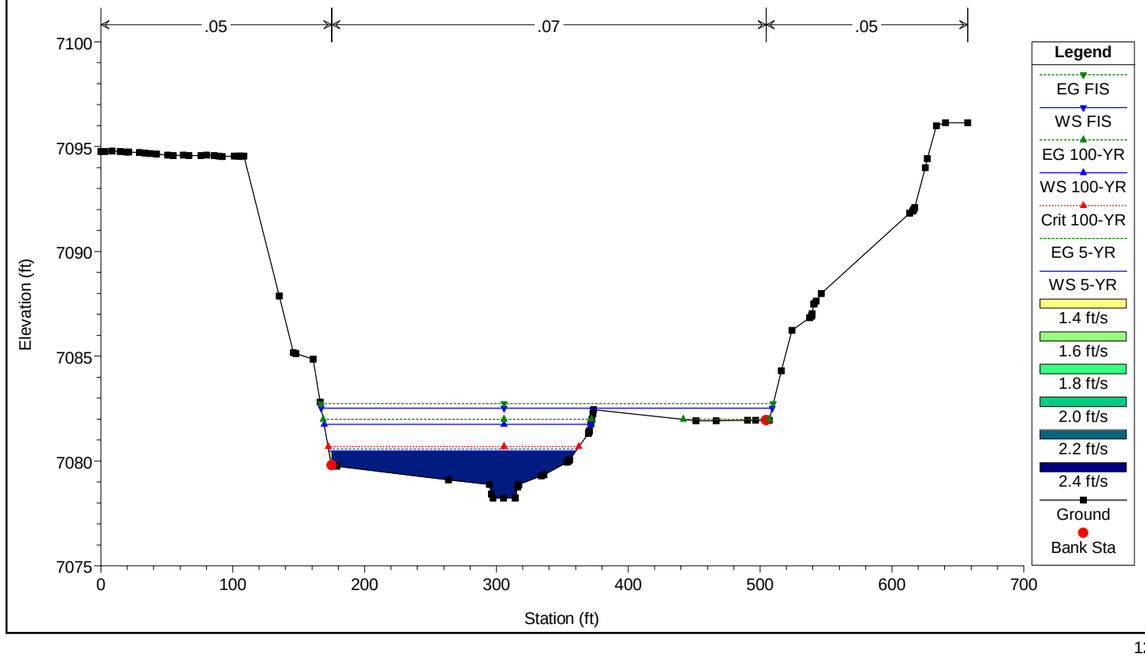

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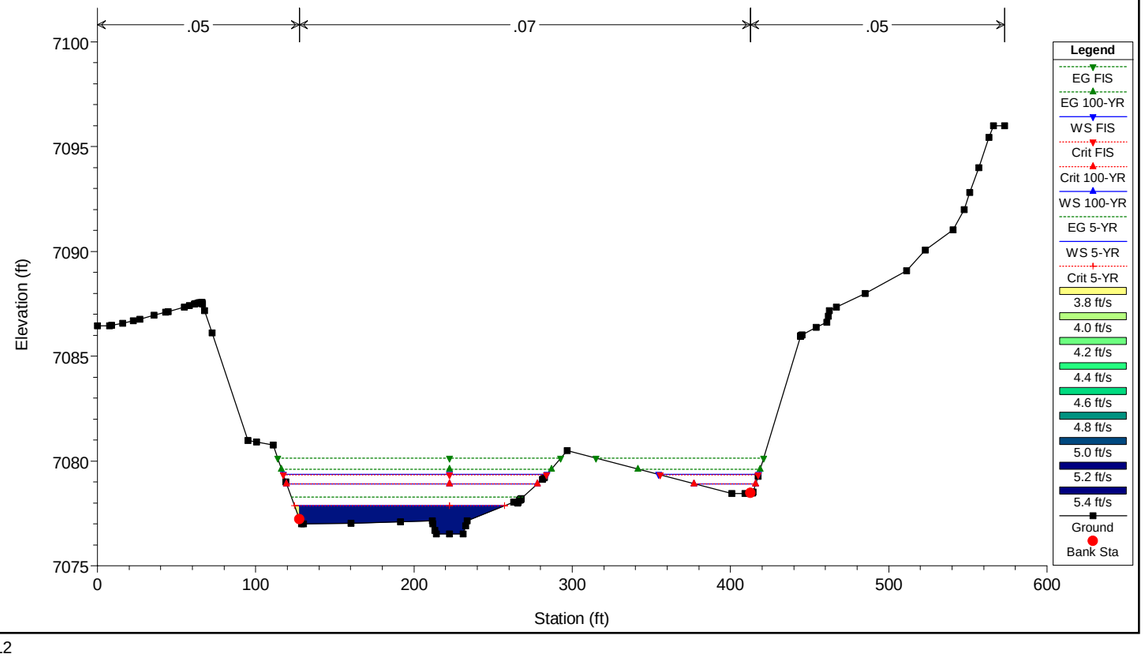

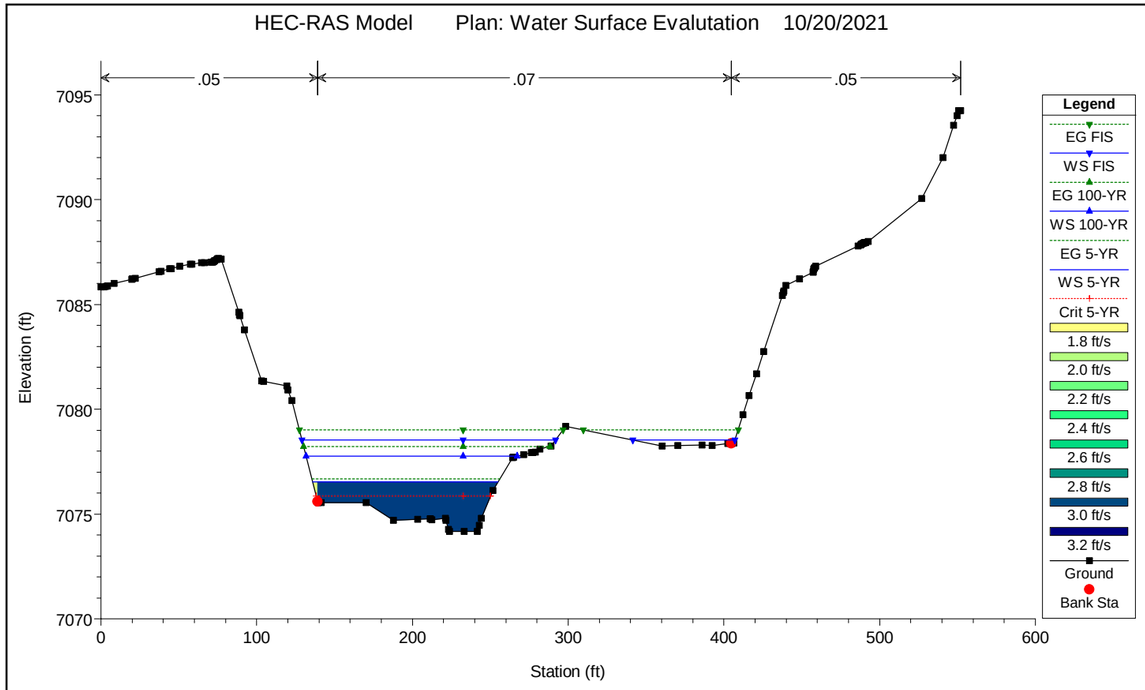
HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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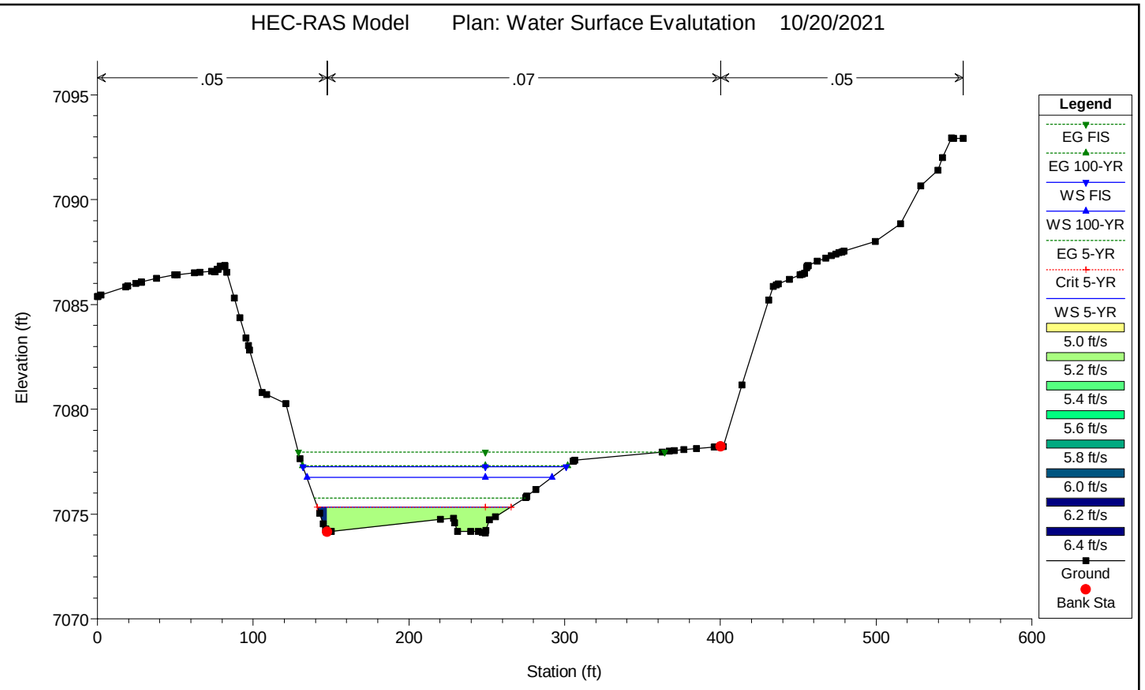
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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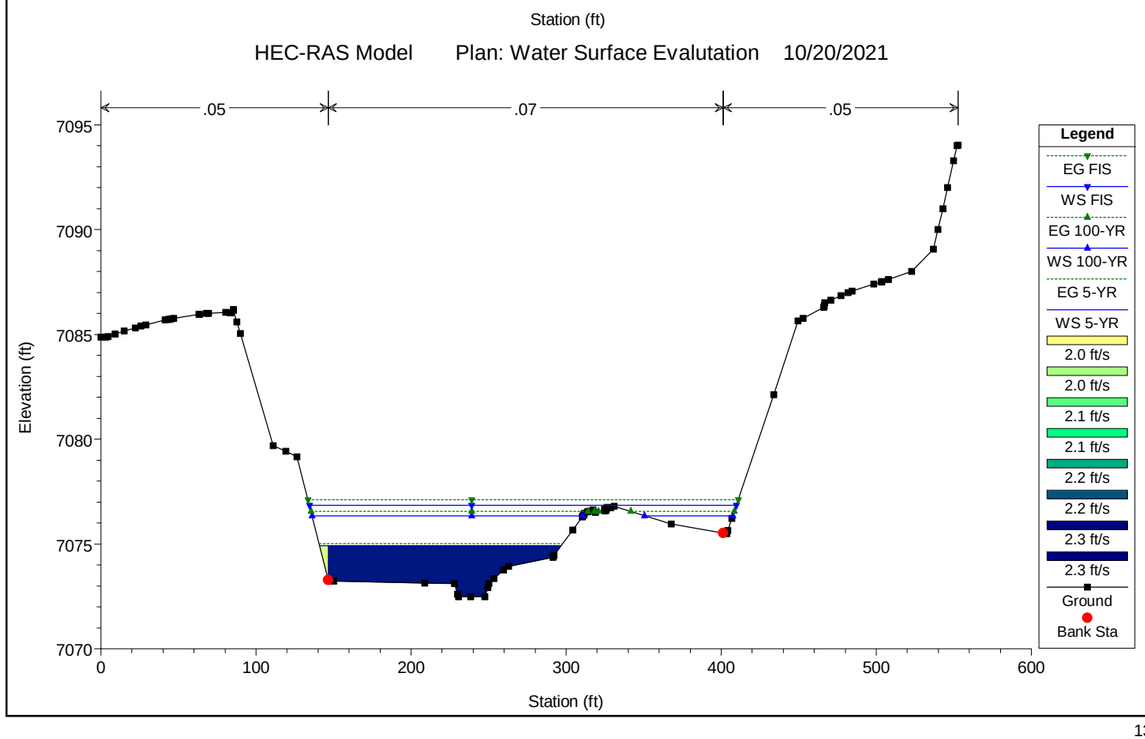
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
Crit 5-YR
WS 5-YR
5.0 ft/s
5.2 ft/s
5.4 ft/s
5.6 ft/s
5.8 ft/s
6.0 ft/s
6.2 ft/s
6.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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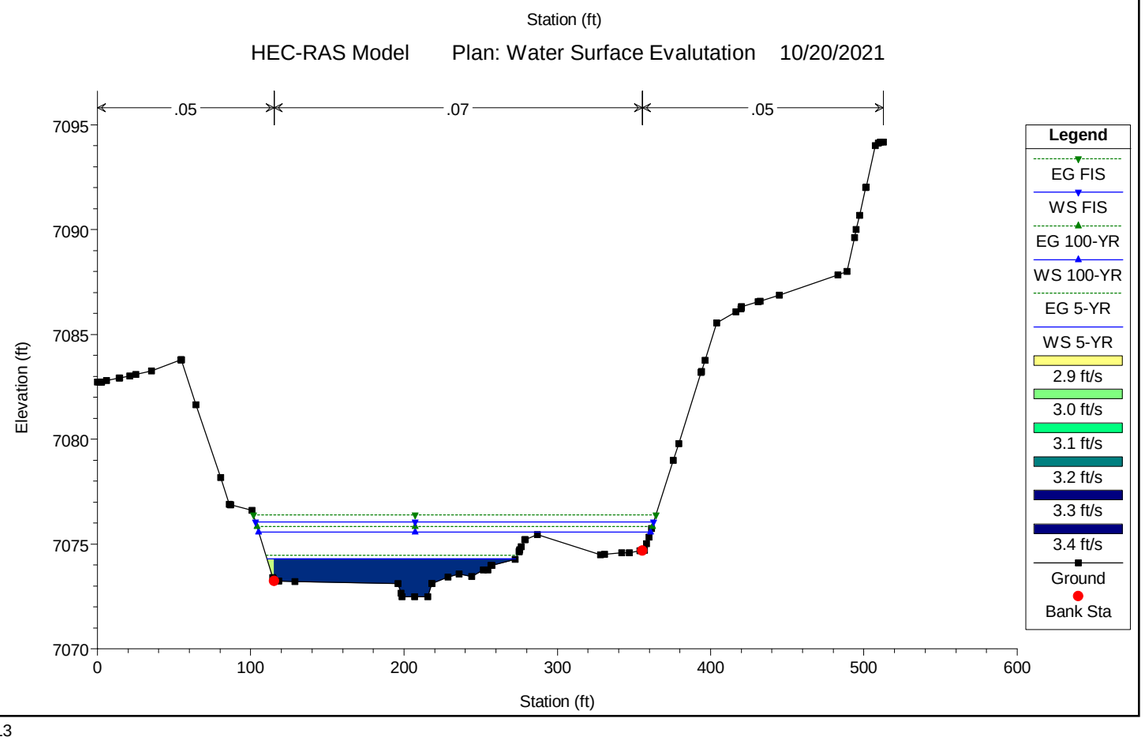
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.0 ft/s
2.0 ft/s
2.1 ft/s
2.1 ft/s
2.2 ft/s
2.2 ft/s
2.3 ft/s
2.3 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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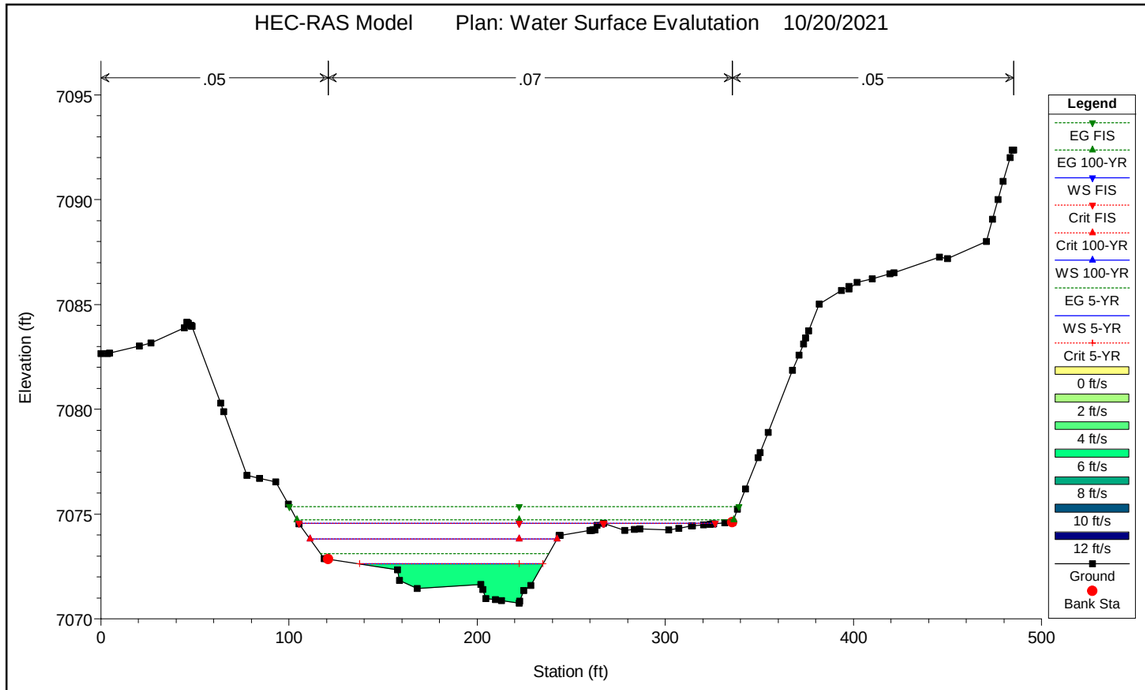
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.9 ft/s
3.0 ft/s
3.1 ft/s
3.2 ft/s
3.3 ft/s
3.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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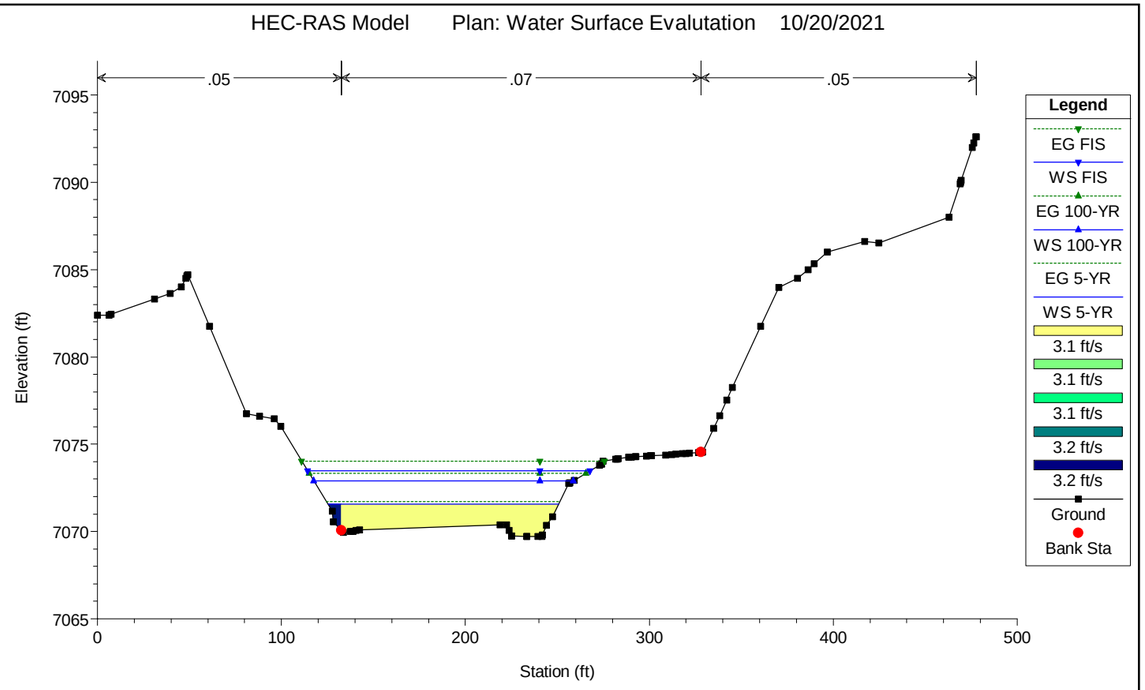
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta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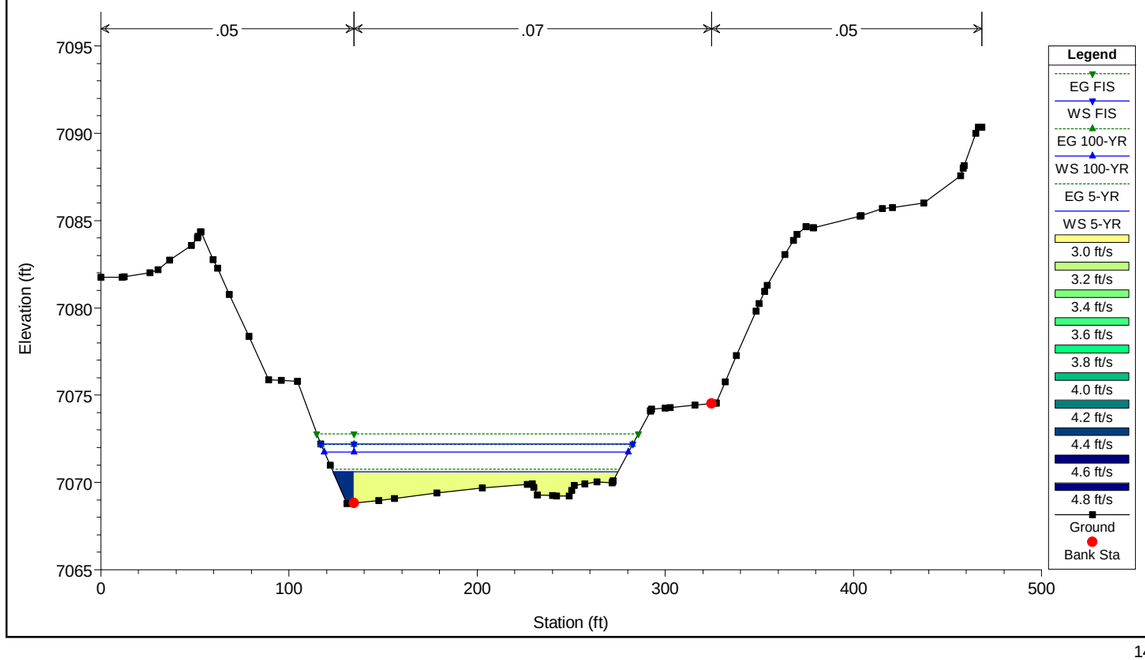
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.1 ft/s
3.1 ft/s
3.1 ft/s
3.2 ft/s
3.2 ft/s
Ground
Bank Sta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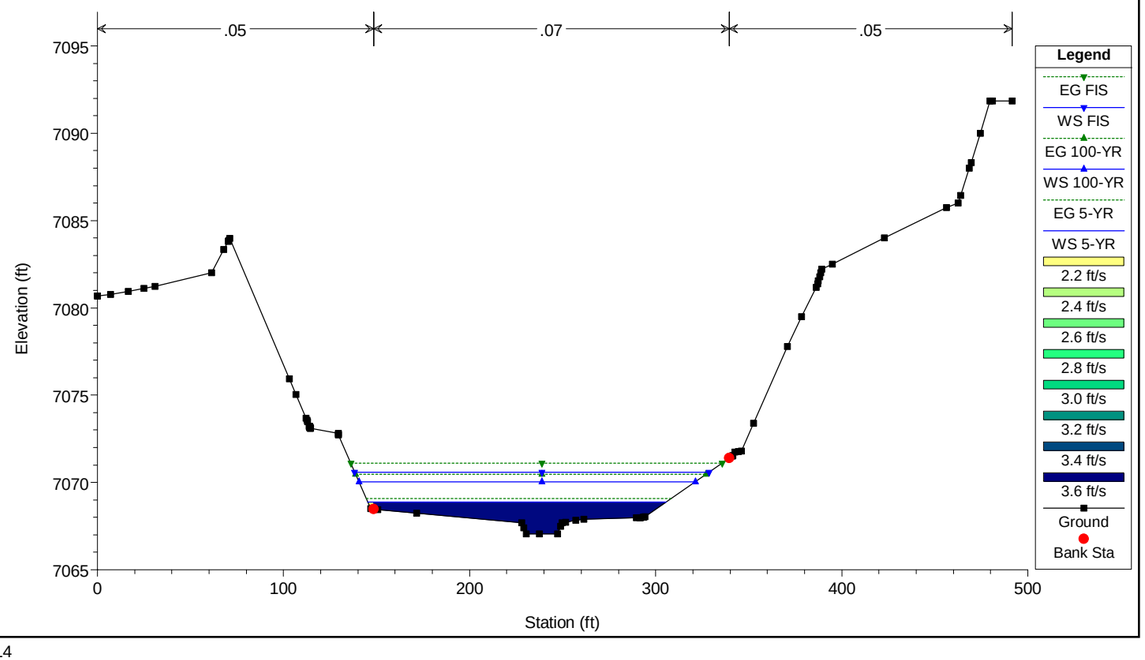
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
3.0 ft/s
3.2 ft/s
3.4 ft/s
3.6 ft/s
3.8 ft/s
4.0 ft/s
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
Ground
Bank Sta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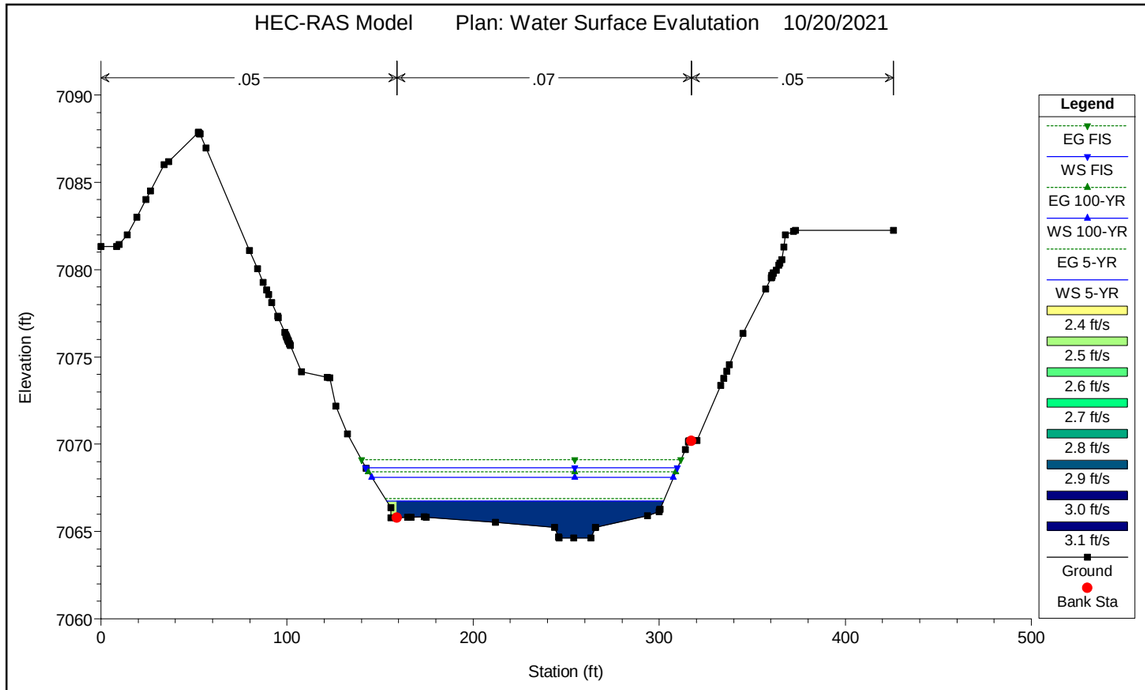
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
3.6 ft/s
Ground
Bank Sta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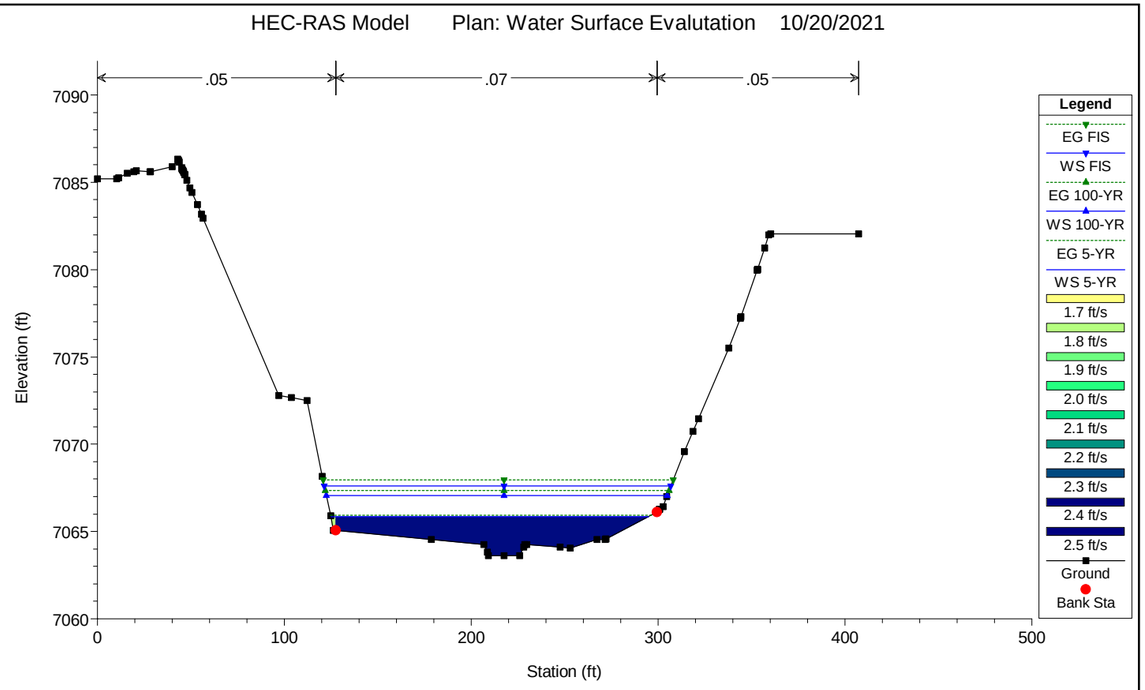
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.4 ft/s
2.5 ft/s
2.6 ft/s
2.7 ft/s
2.8 ft/s
2.9 ft/s
3.0 ft/s
3.1 ft/s
Ground
Bank Sta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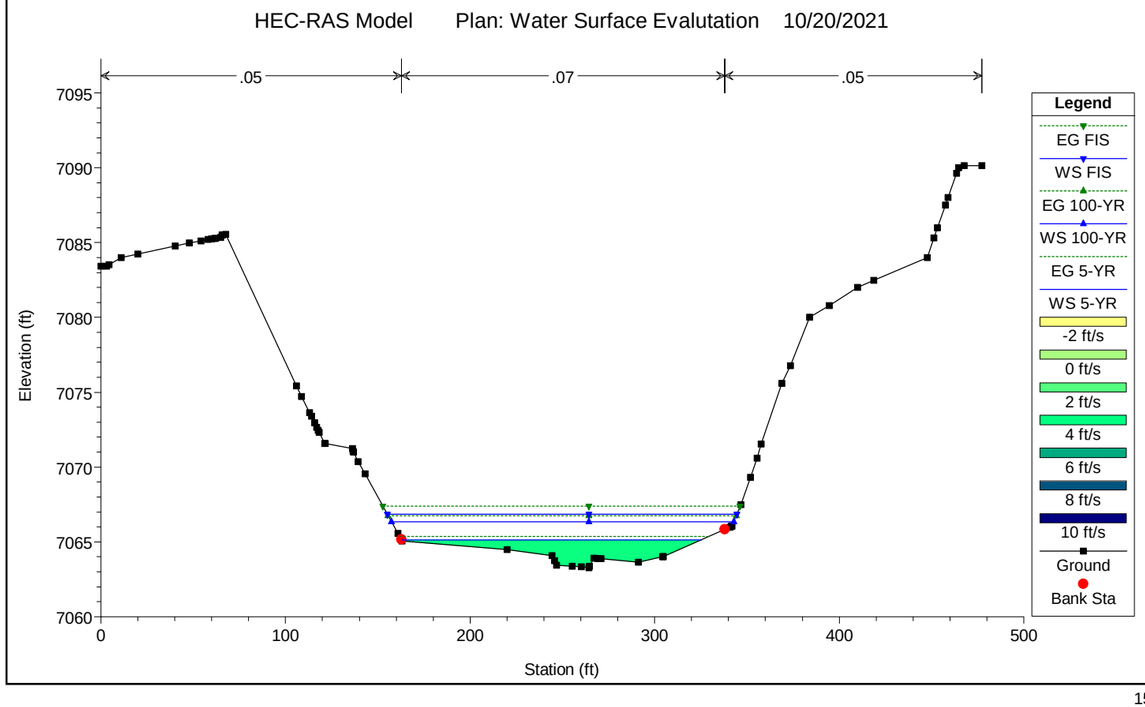
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.7 ft/s
1.8 ft/s
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
Ground
Bank Sta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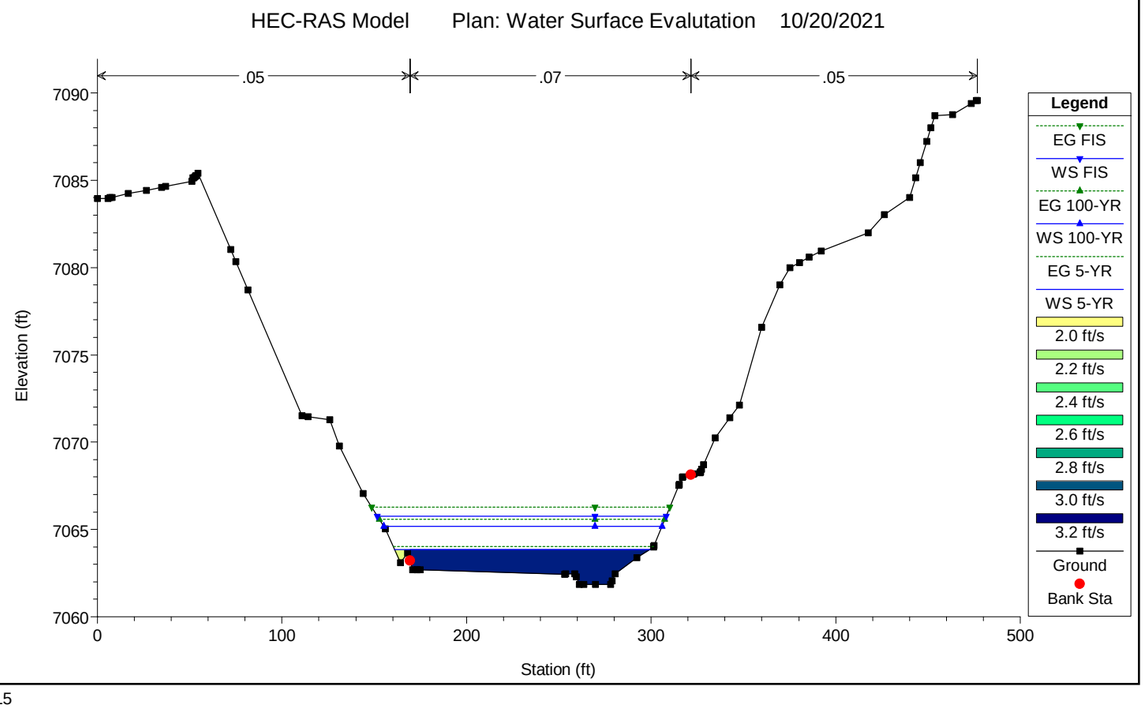
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta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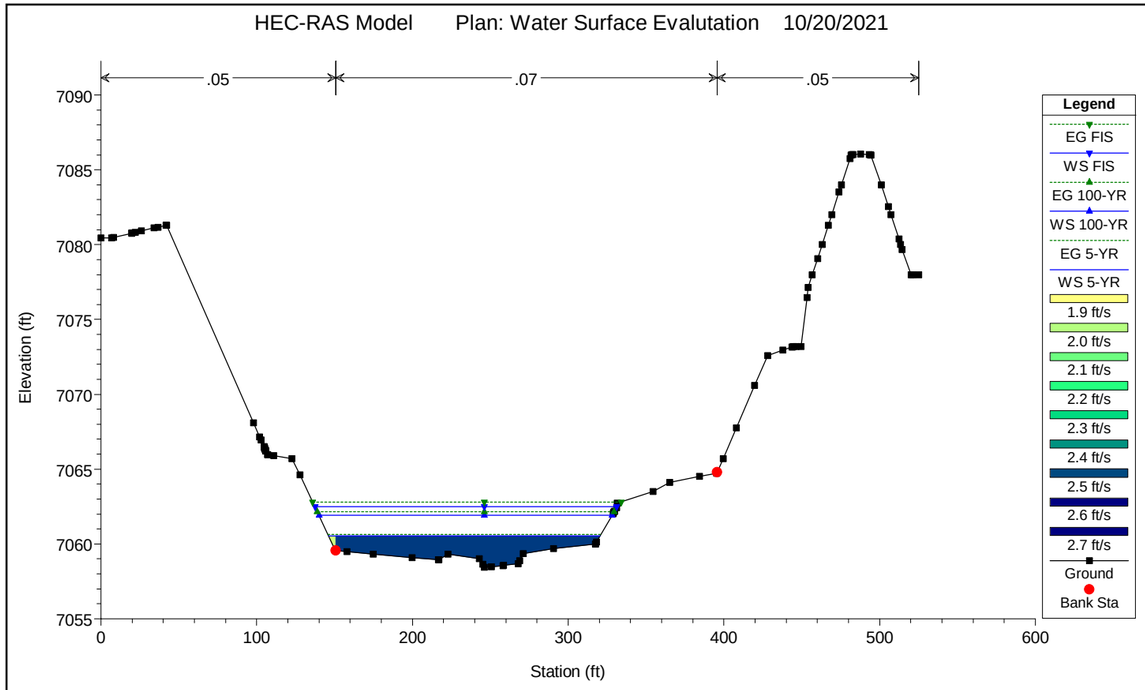
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Bank Sta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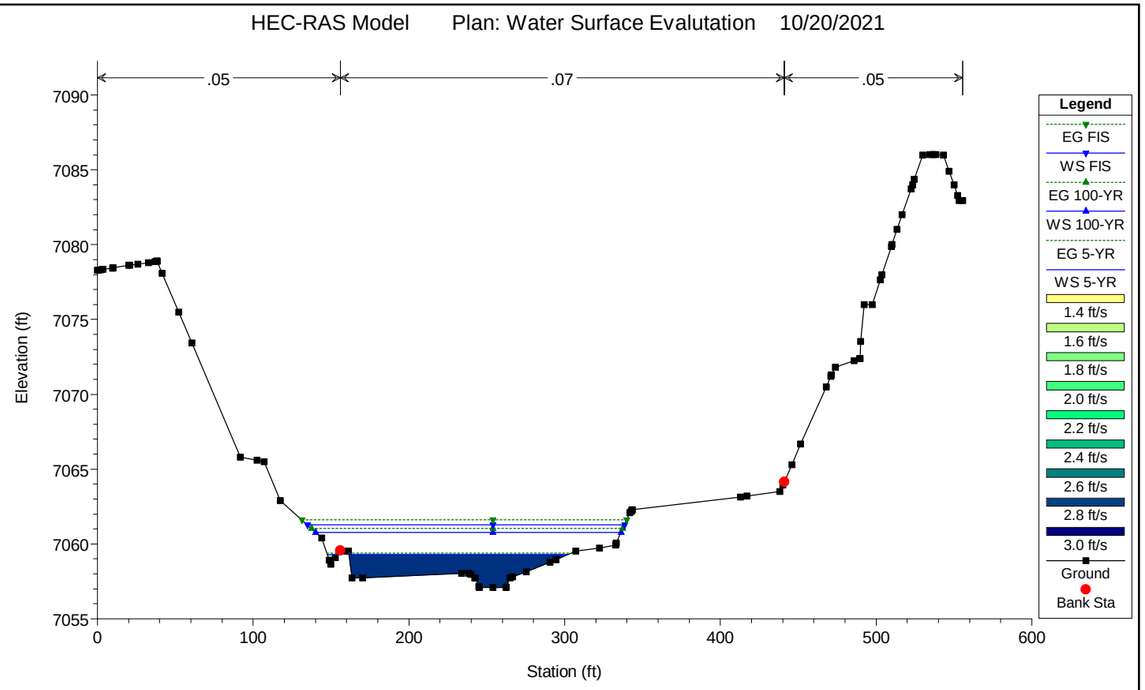
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
2.6 ft/s
2.7 ft/s
Ground
Bank Sta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.05
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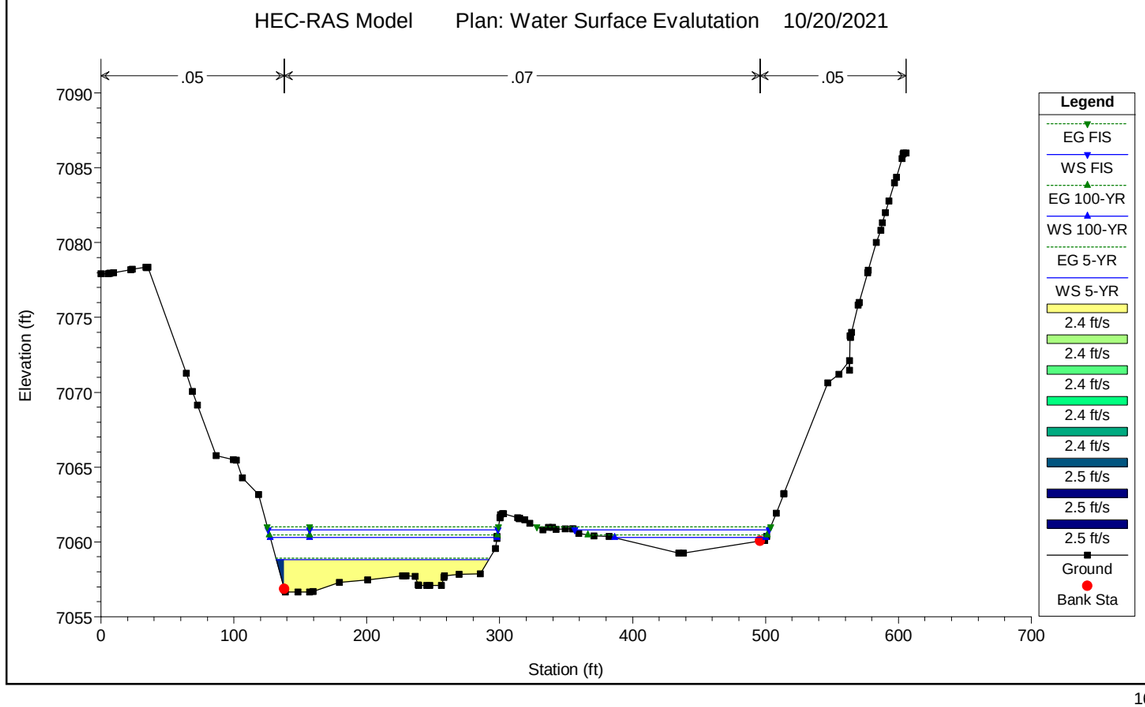
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
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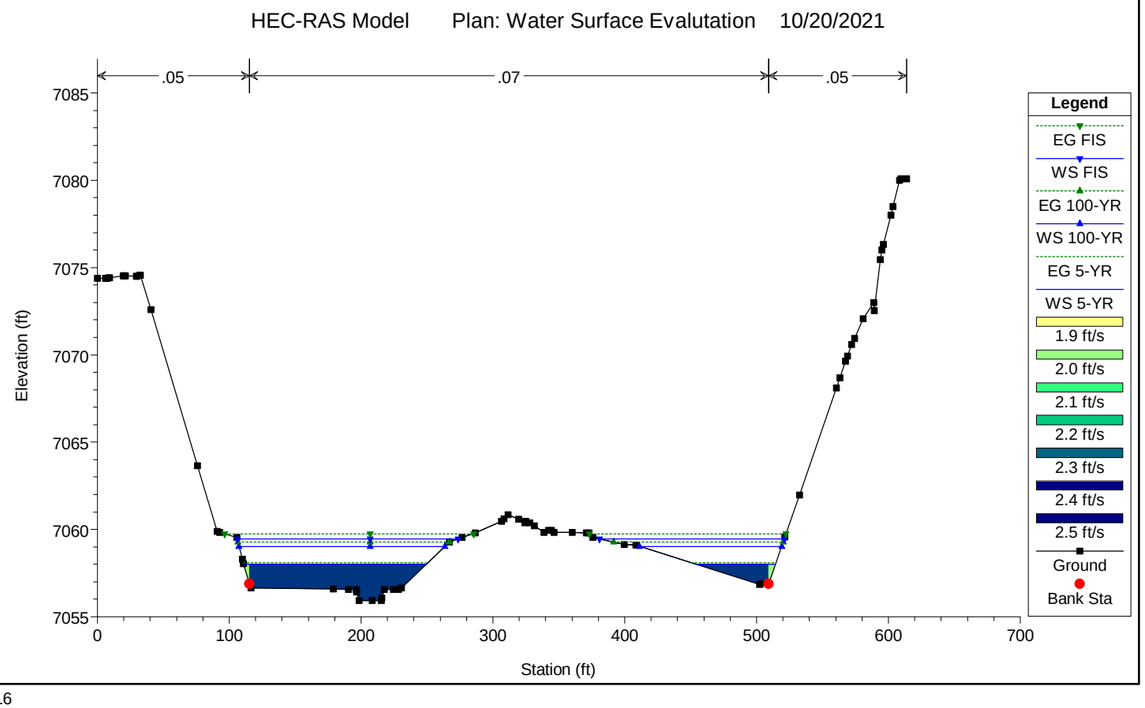
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.4 ft/s
2.4 ft/s
2.4 ft/s
2.4 ft/s
2.4 ft/s
2.5 ft/s
2.5 ft/s
2.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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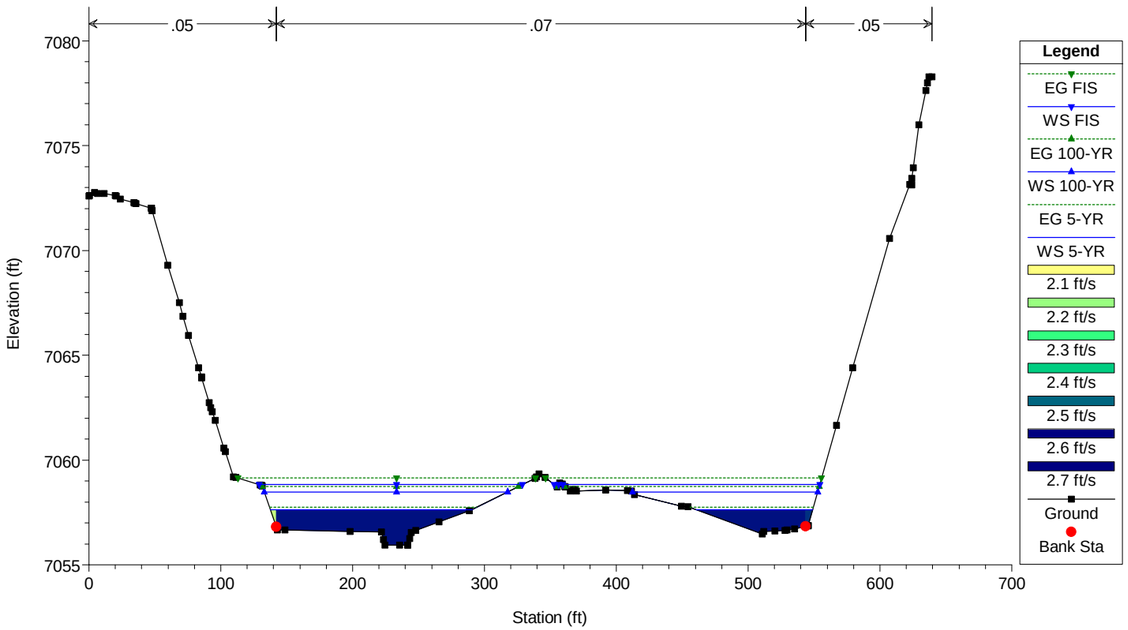
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



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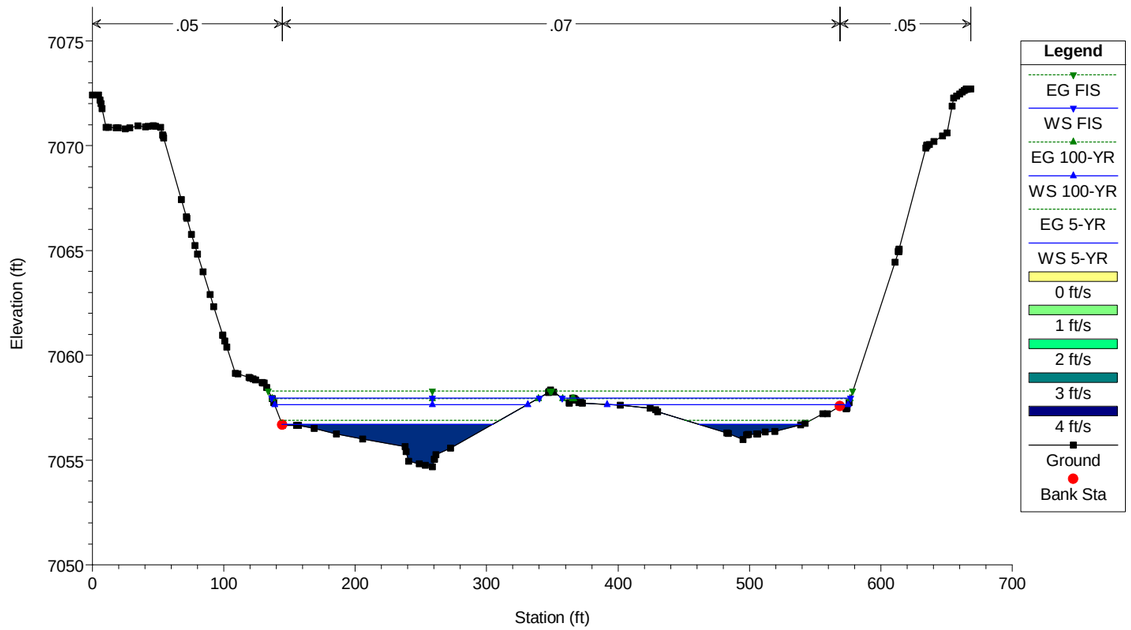

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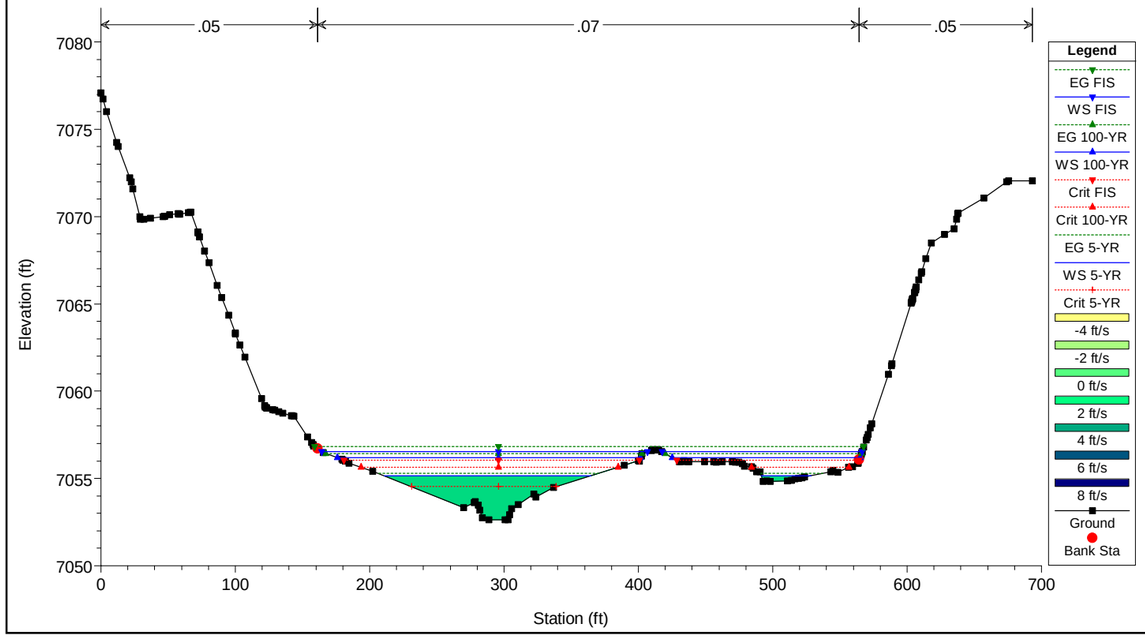

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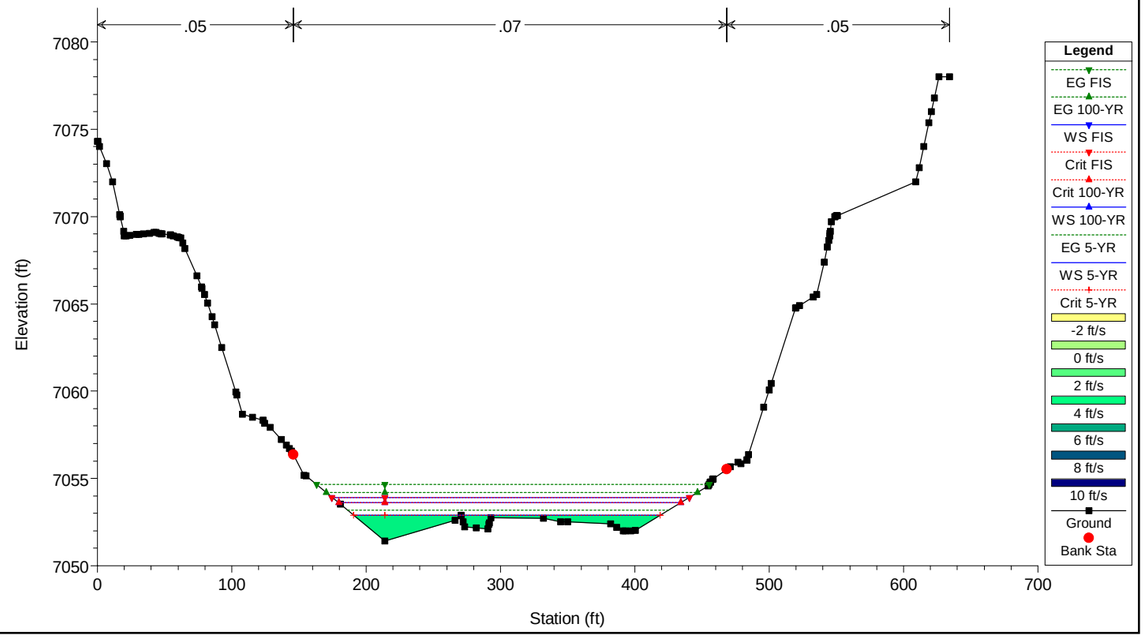
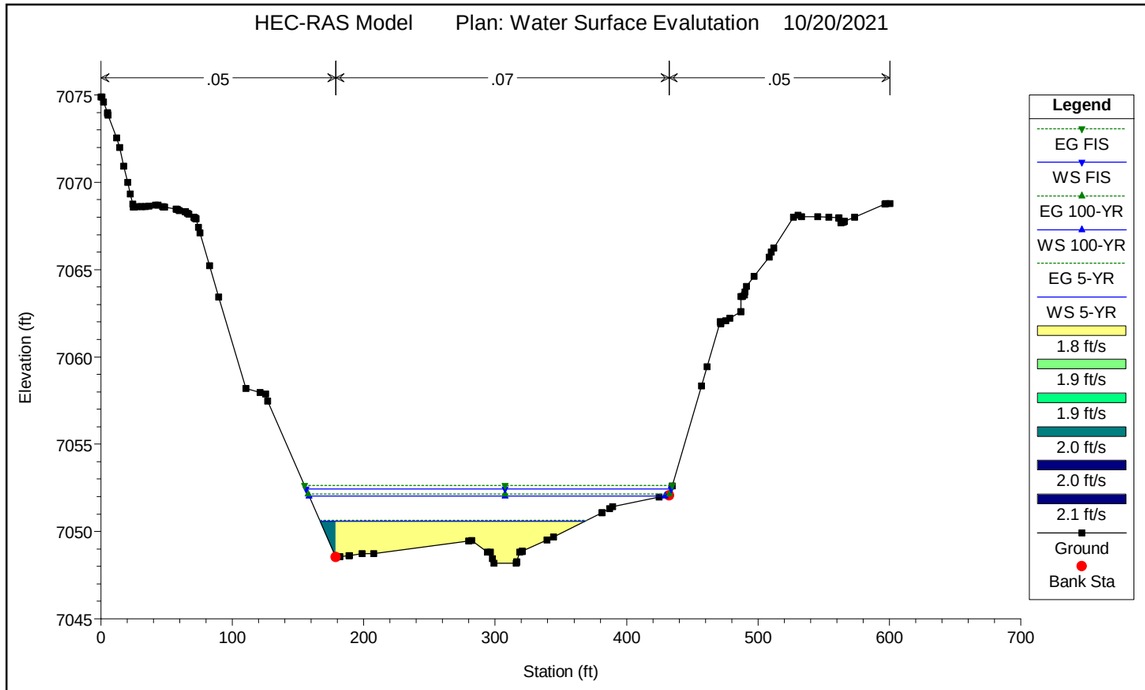
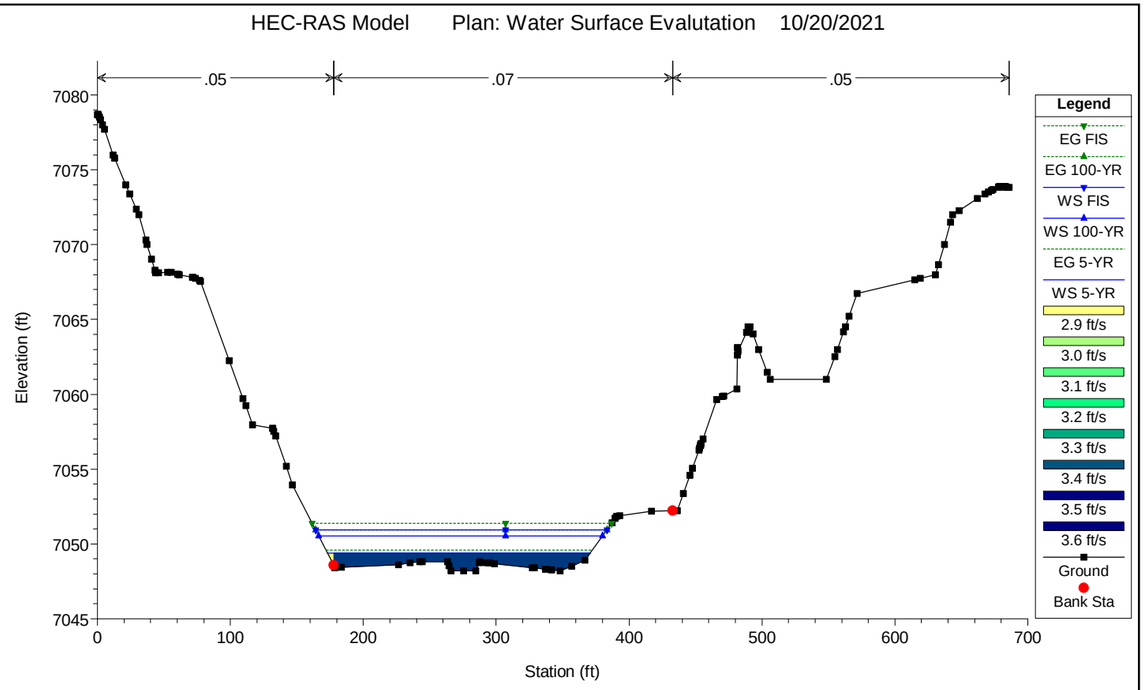



HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.8 ft/s
1.9 ft/s
1.9 ft/s
2.0 ft/s
2.0 ft/s
2.1 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
WS 100-YR
EG 5-YR
WS 5-YR
2.9 ft/s
3.0 ft/s
3.1 ft/s
3.2 ft/s
3.3 ft/s
3.4 ft/s
3.5 ft/s
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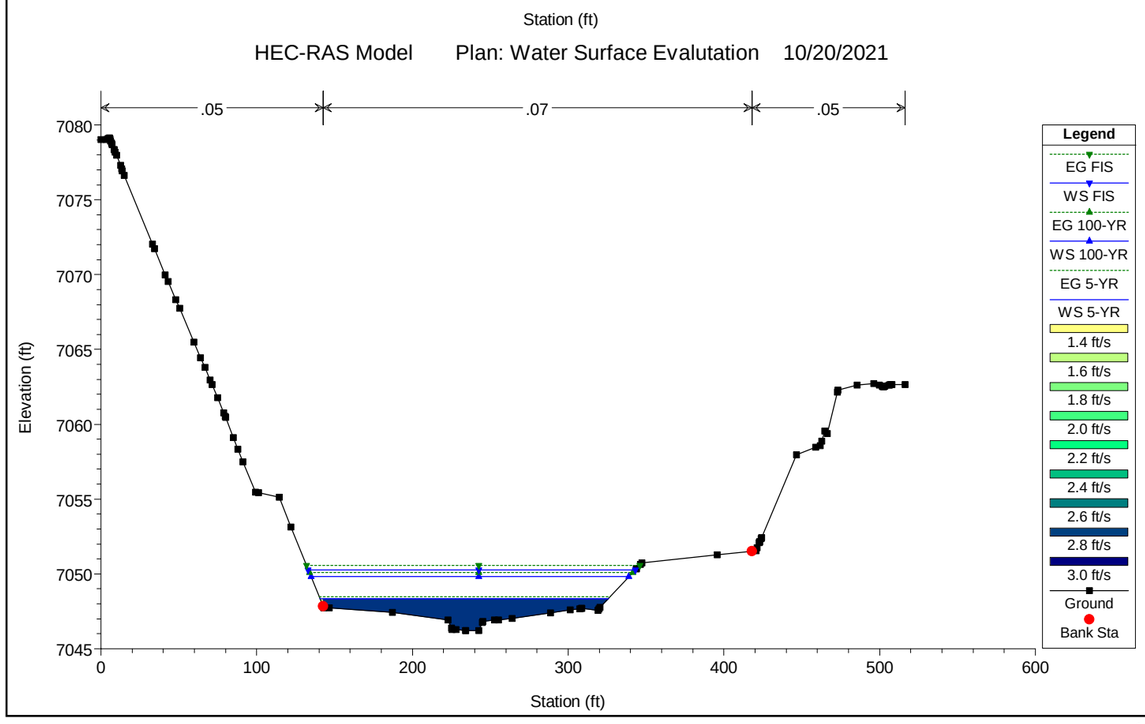
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
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2.8 ft/s
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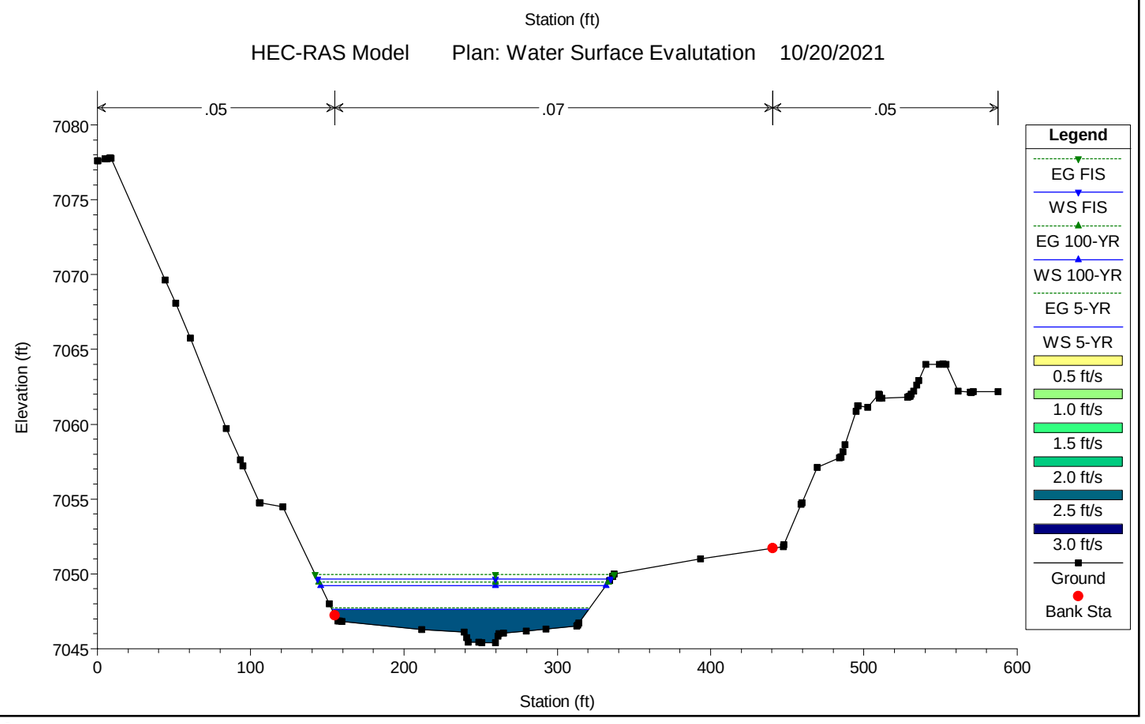
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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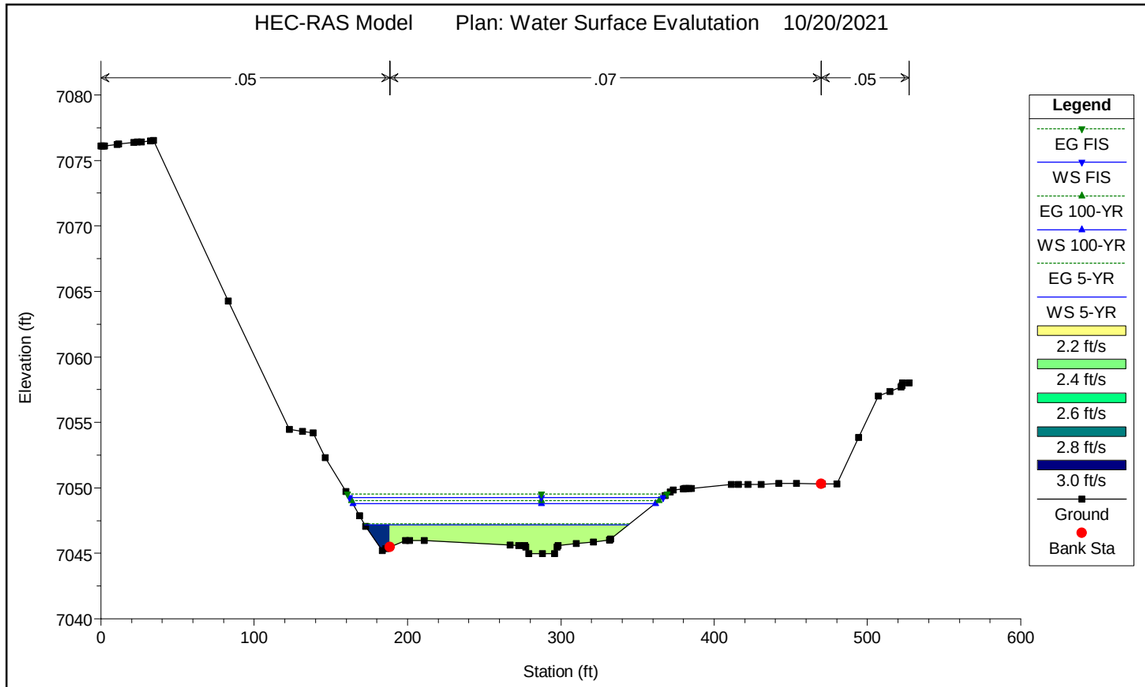
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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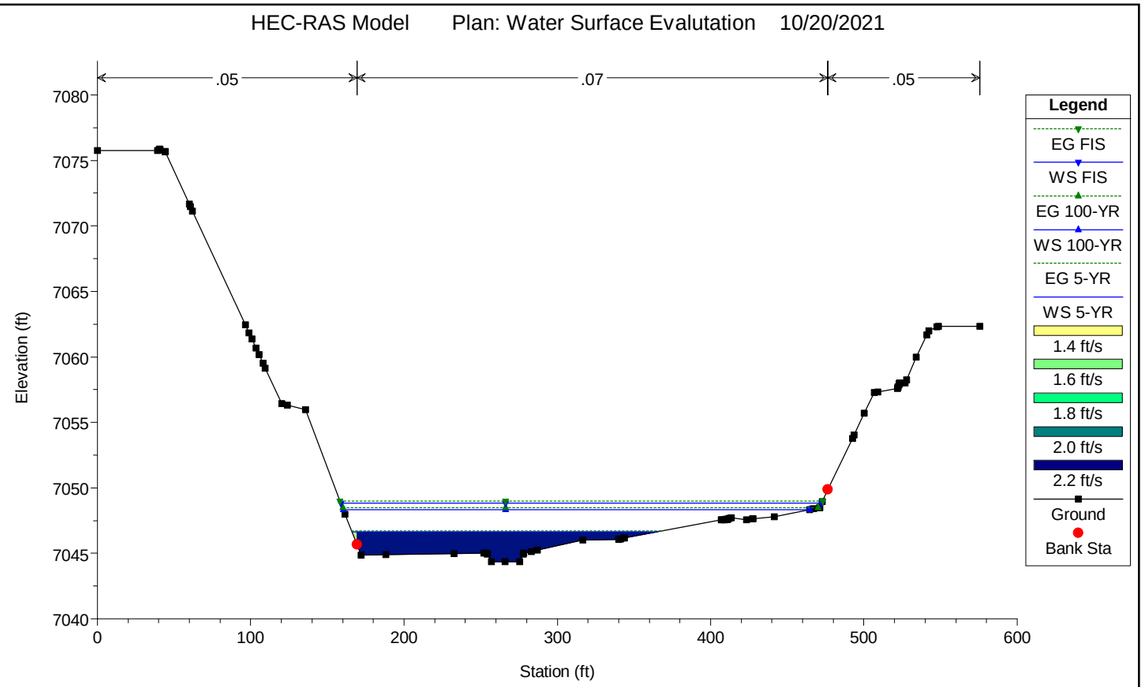
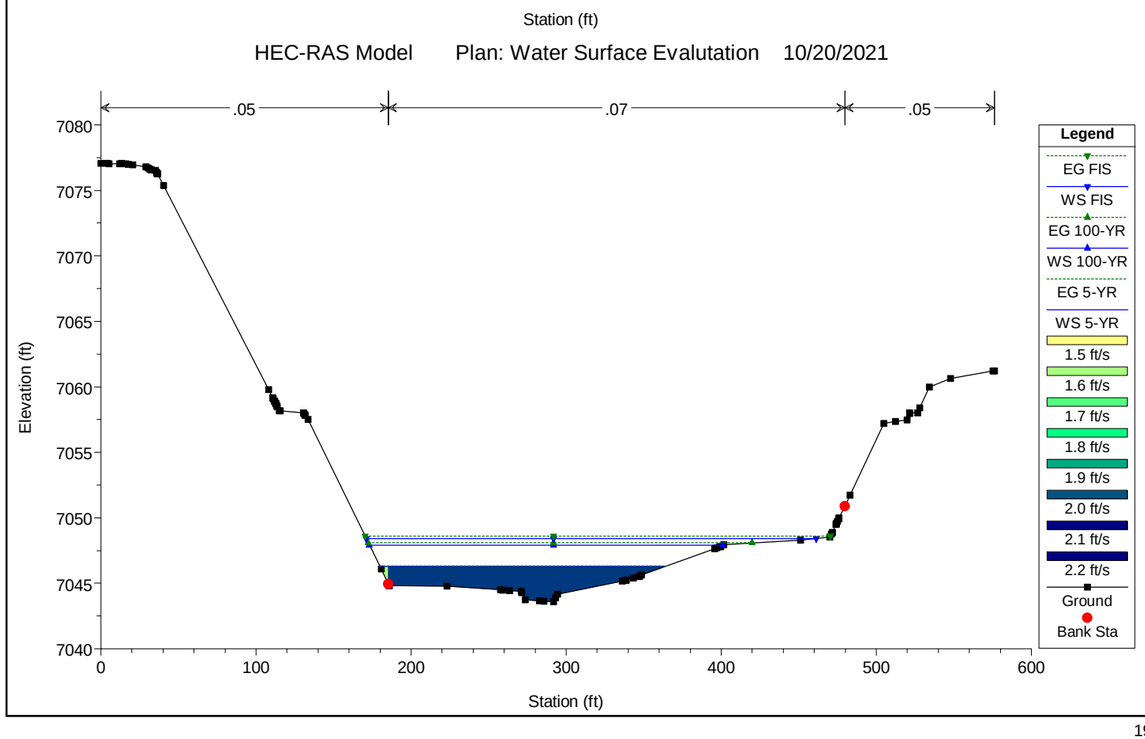
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
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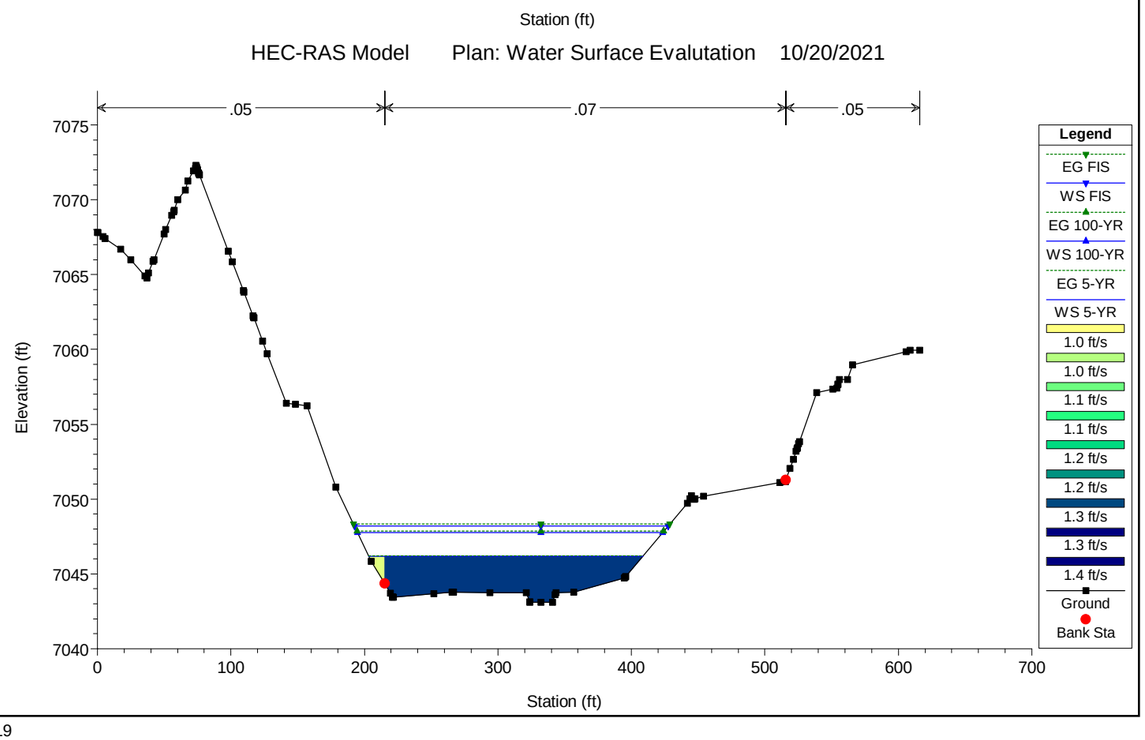
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
1.6 ft/s
1.7 ft/s
1.8 ft/s
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
Ground
Bank Sta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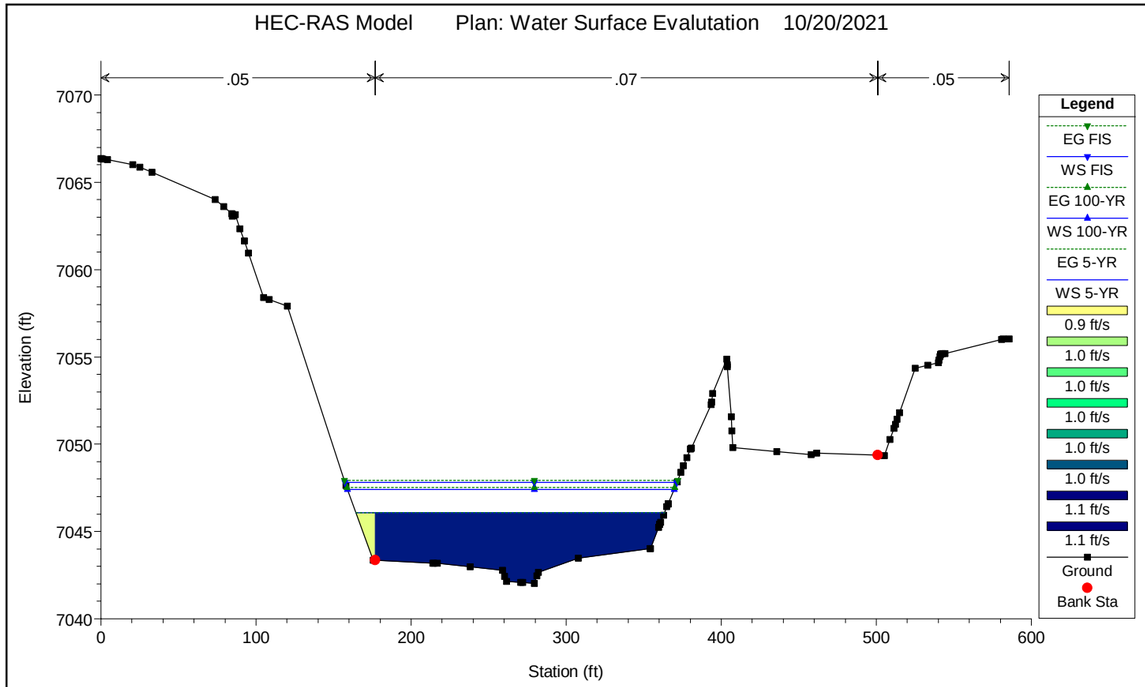
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.0 ft/s
1.0 ft/s
1.1 ft/s
1.1 ft/s
1.2 ft/s
1.2 ft/s
1.3 ft/s
1.3 ft/s
1.4 ft/s
Ground
Bank Sta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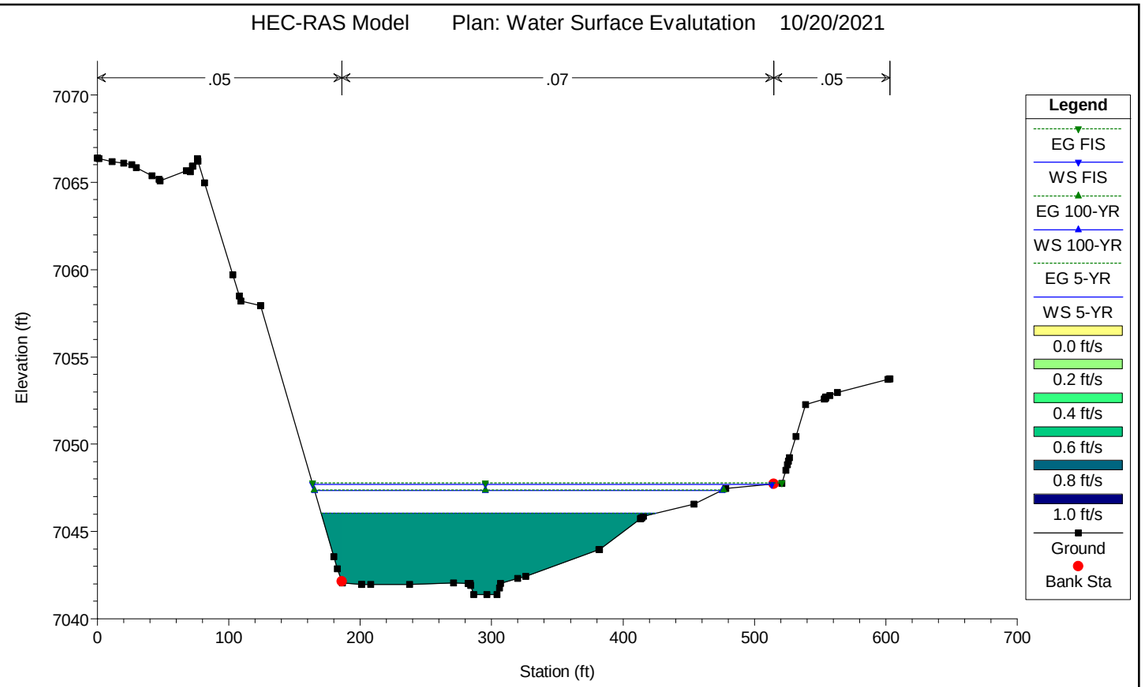
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.9 ft/s
1.0 ft/s
1.0 ft/s
1.0 ft/s
1.0 ft/s
1.0 ft/s
1.1 ft/s
1.1 ft/s
Ground
Bank Sta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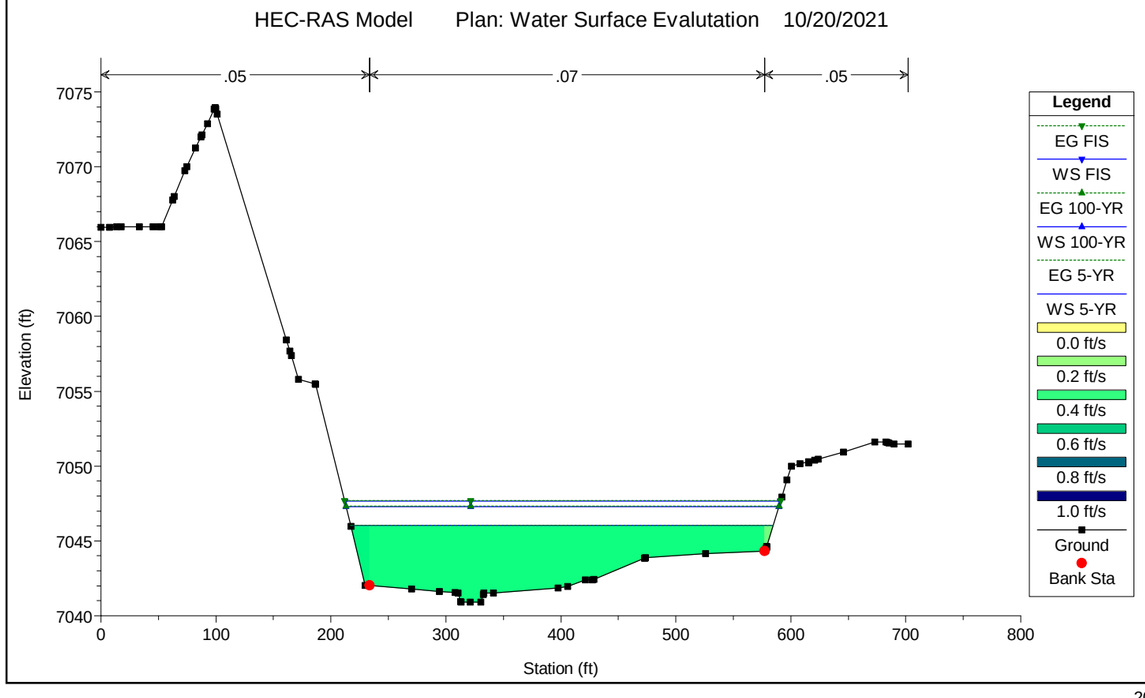
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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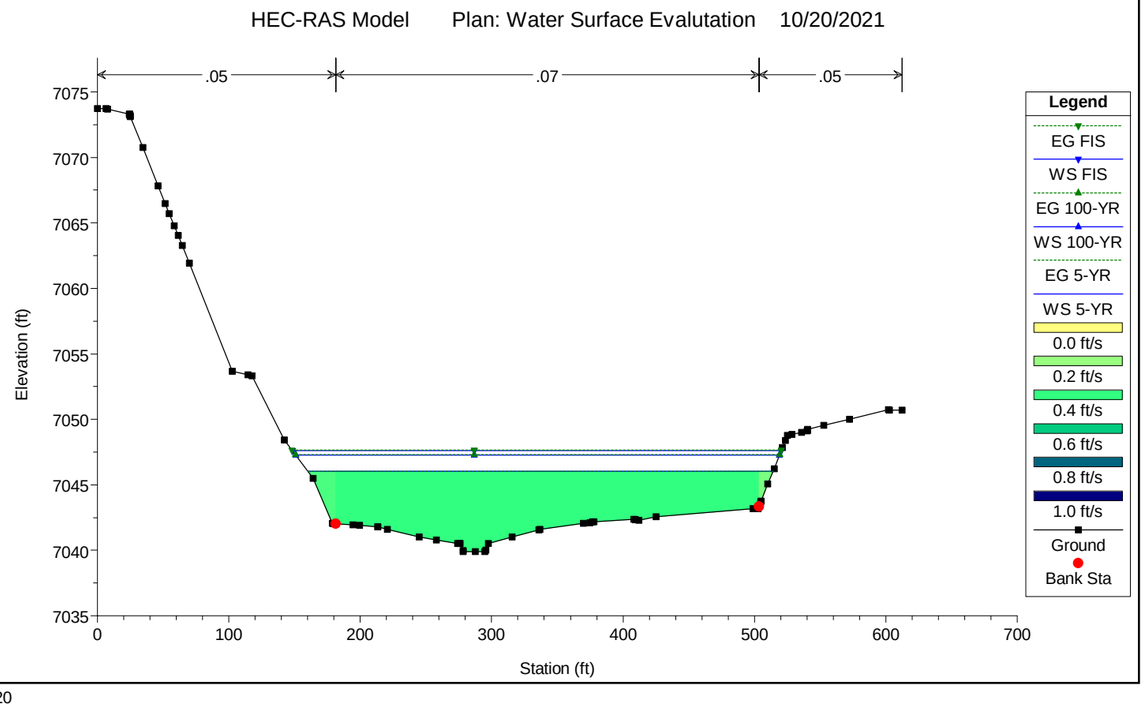
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta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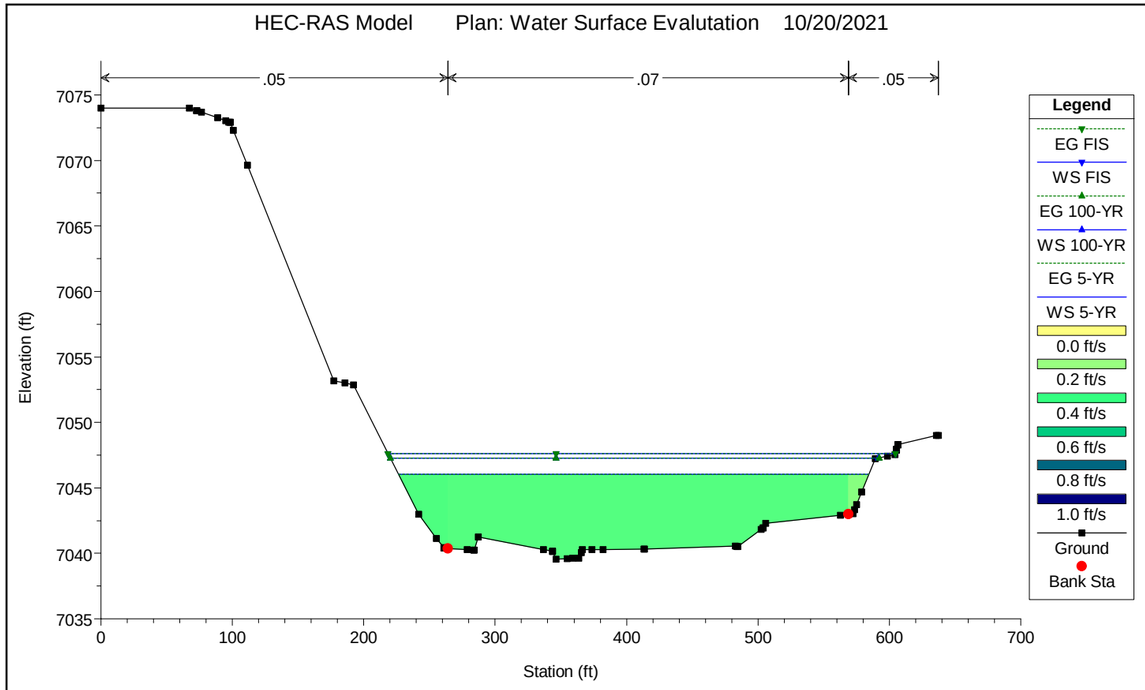
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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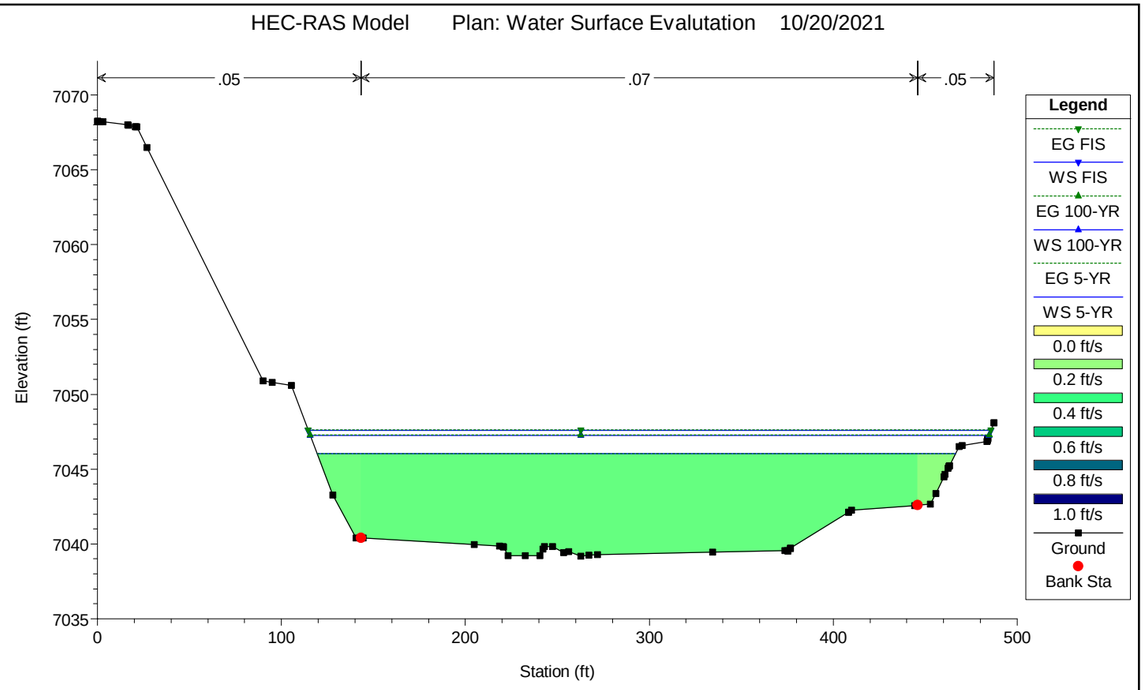
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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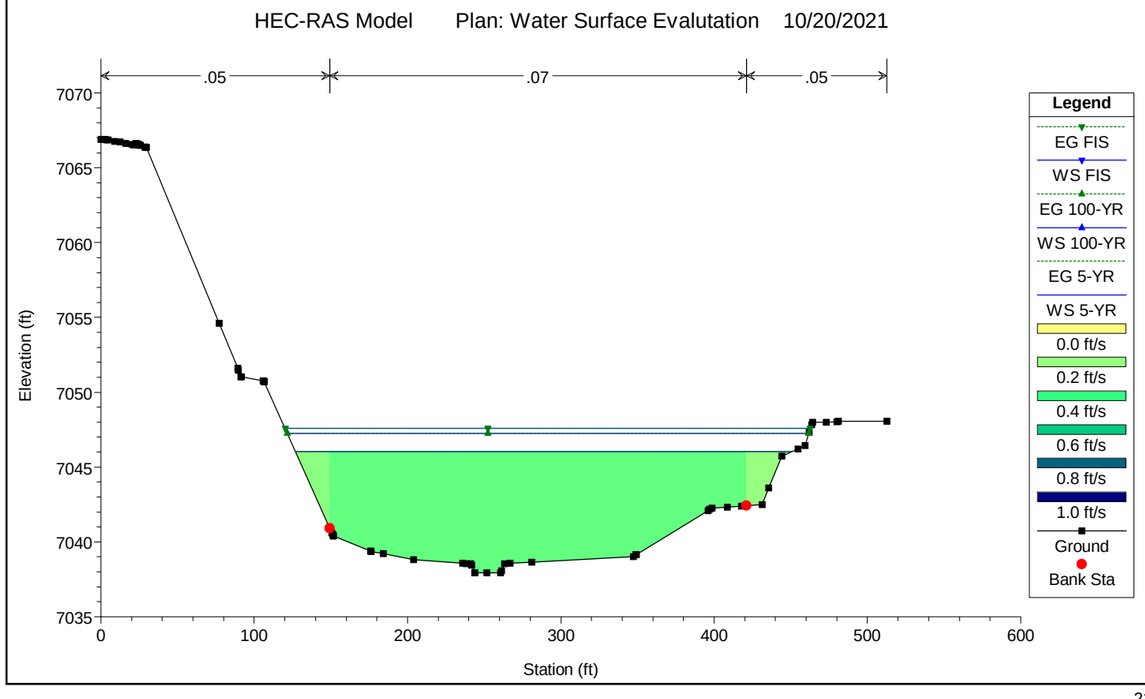
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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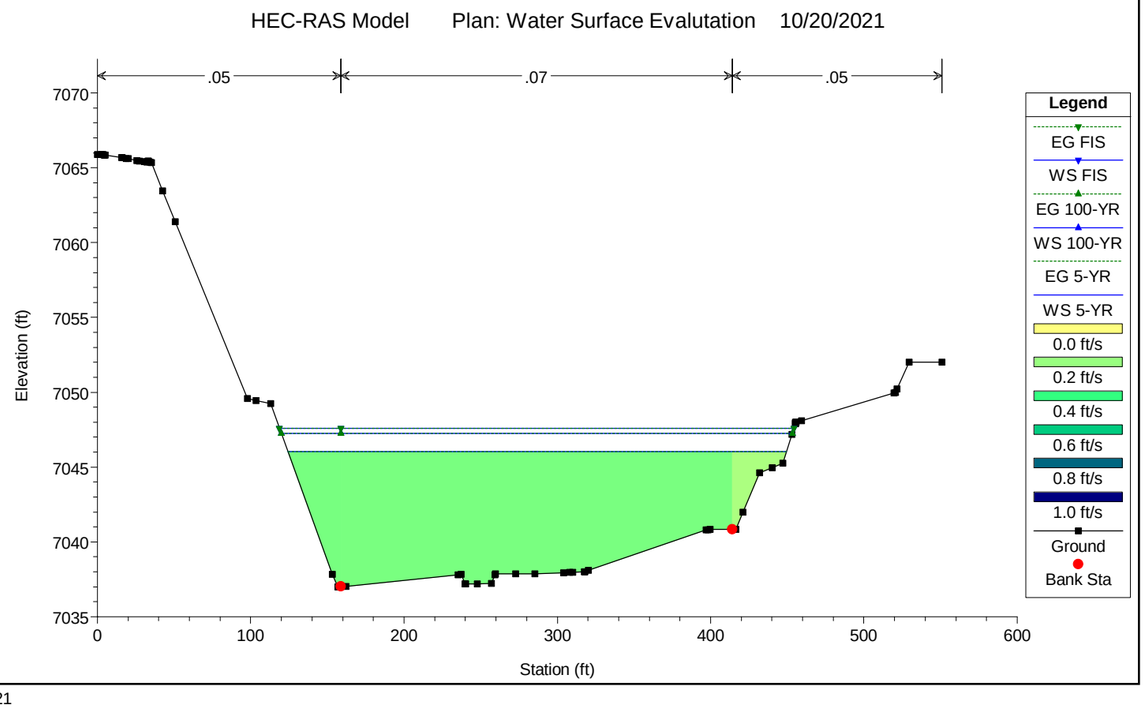
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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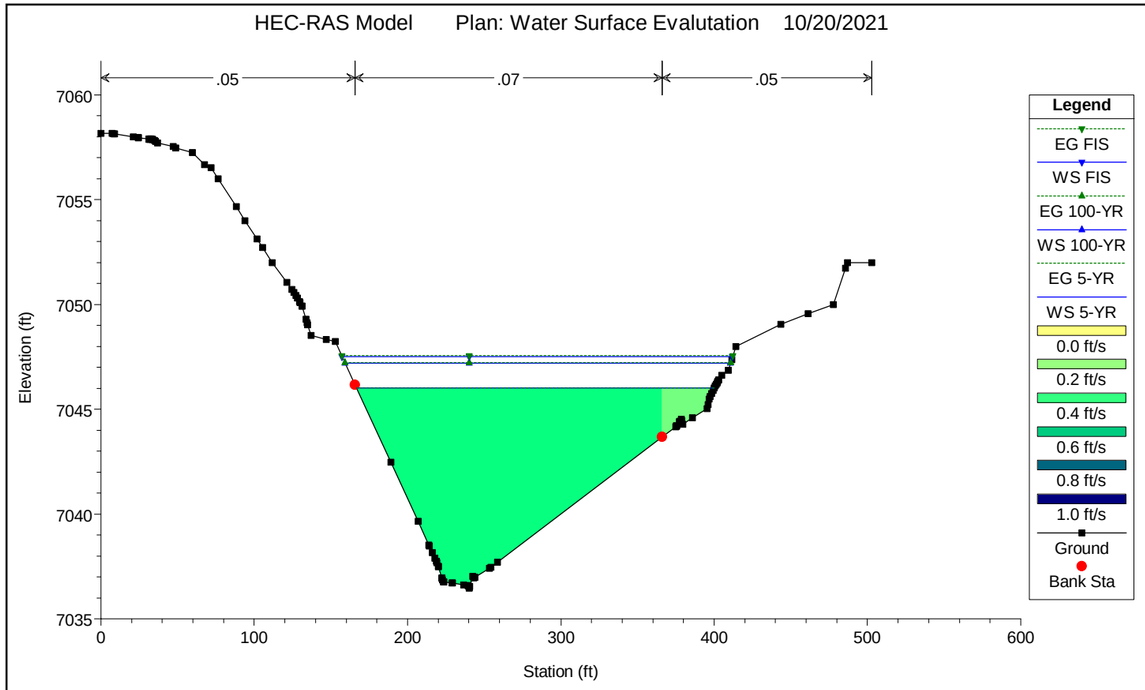
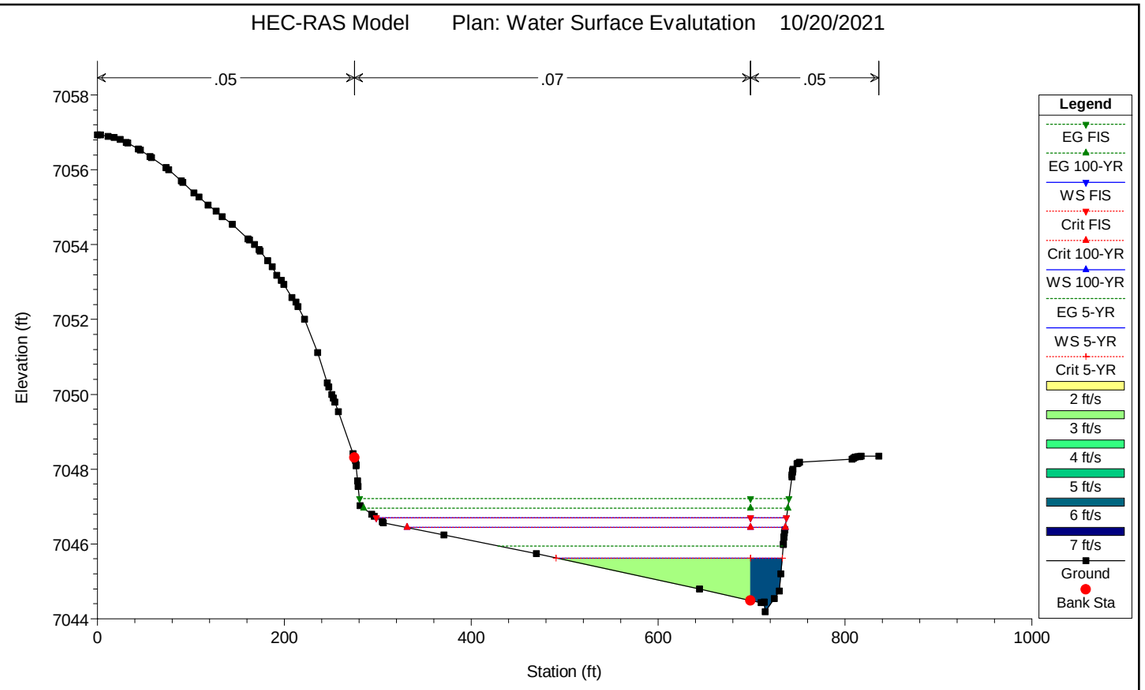
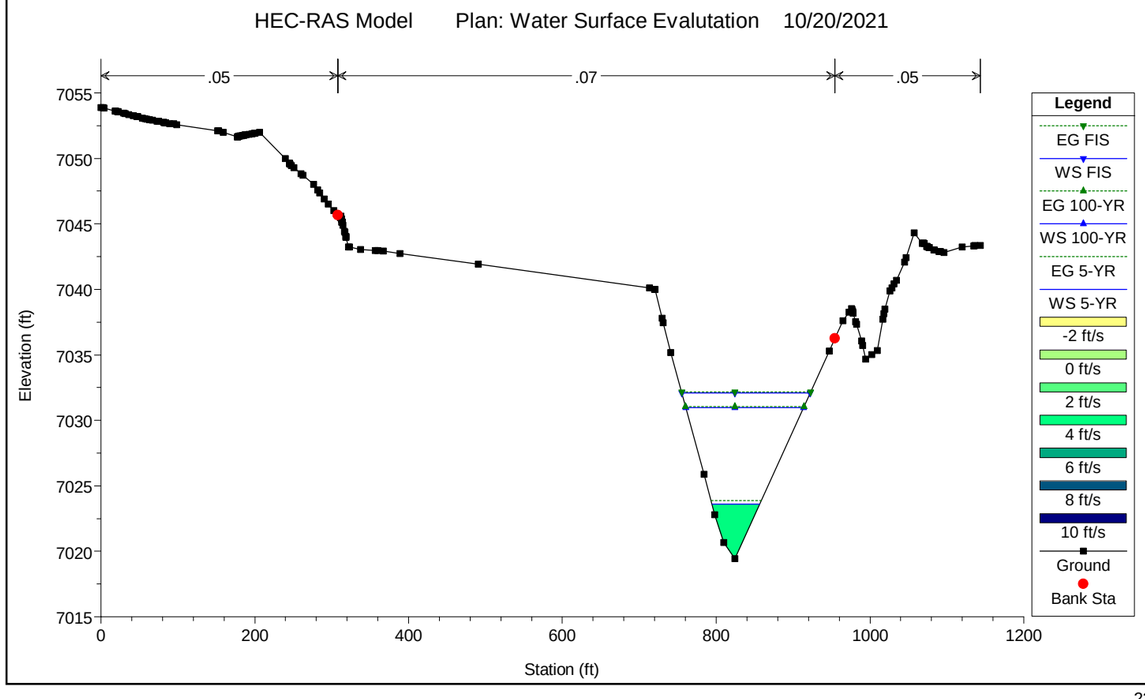
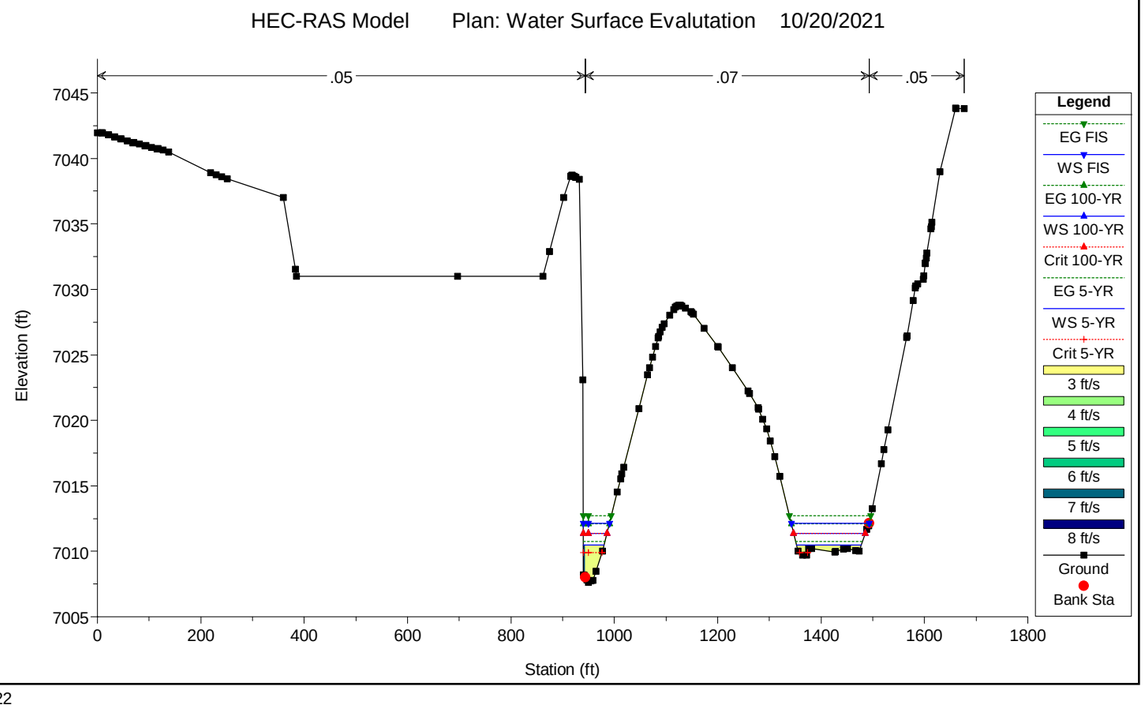
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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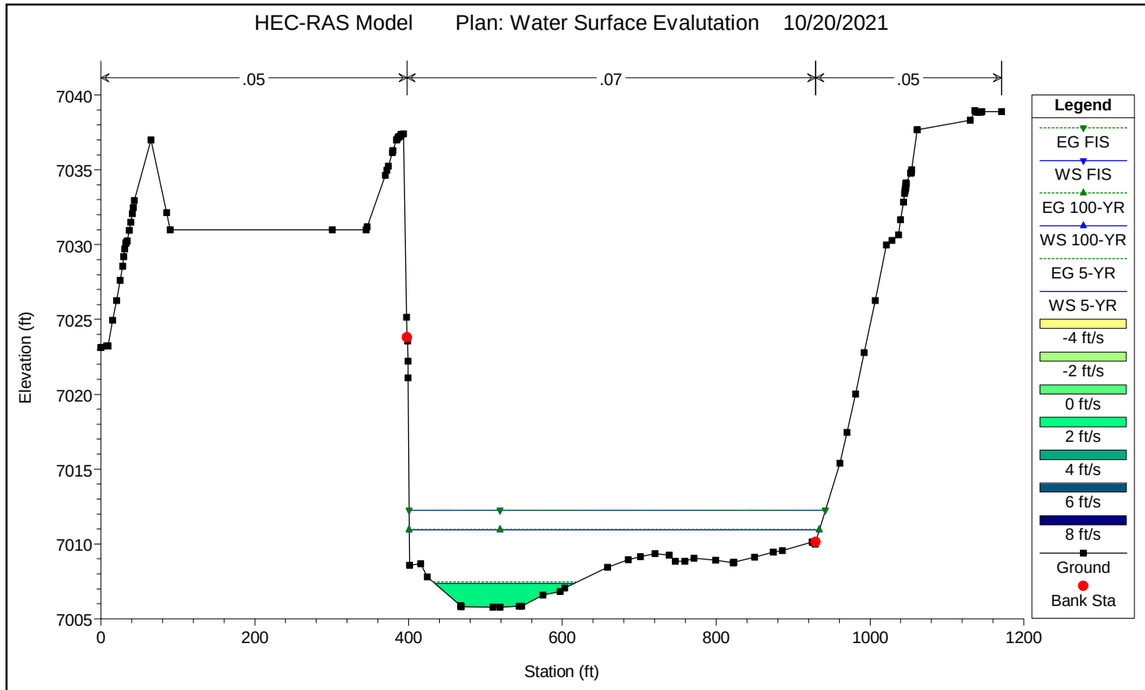
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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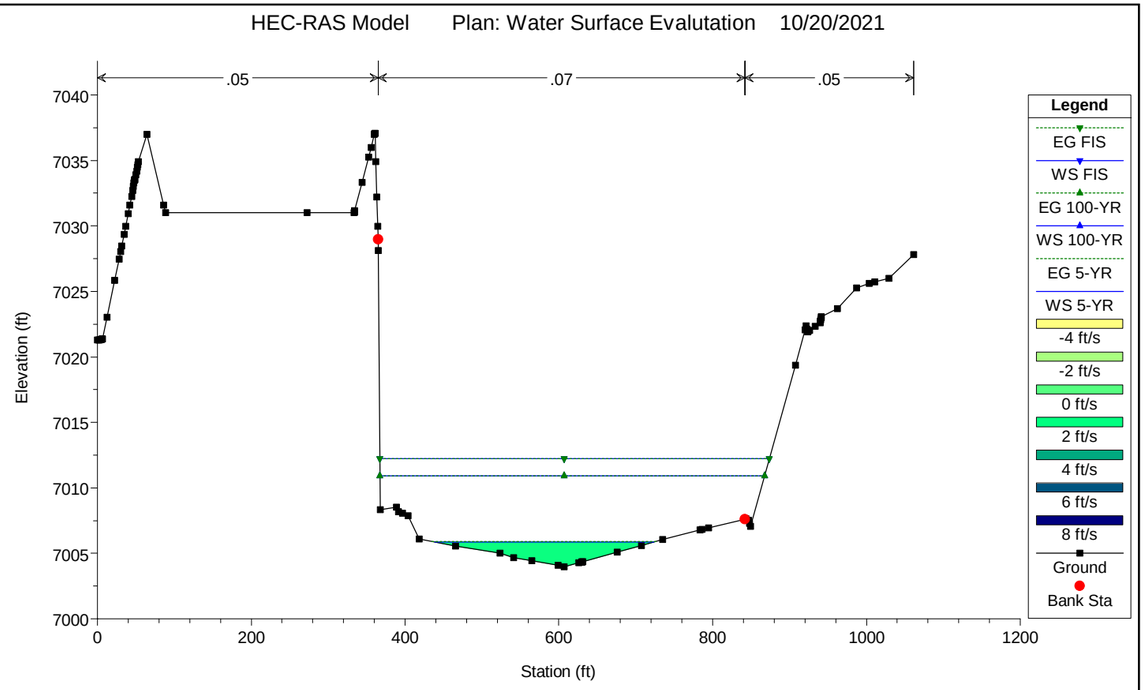
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
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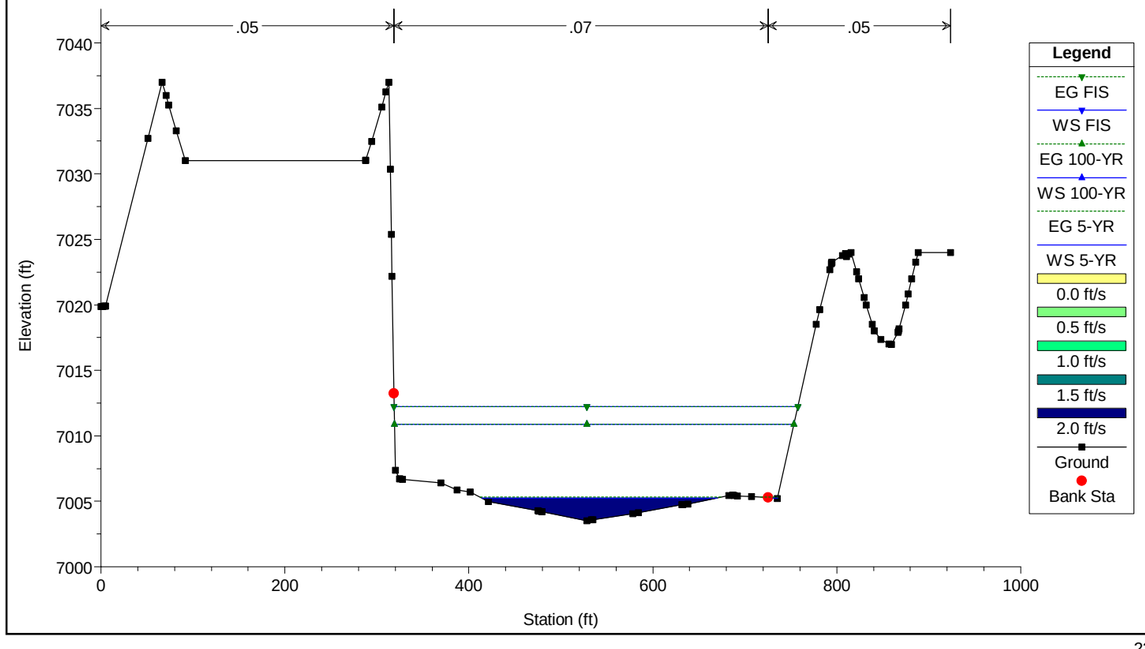
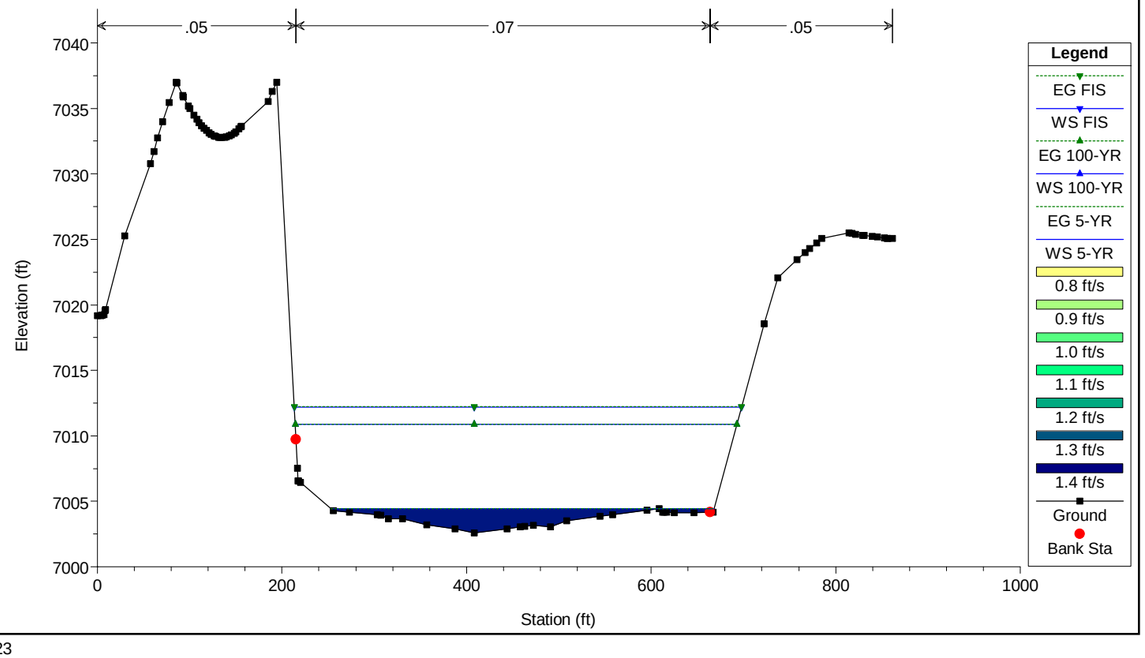
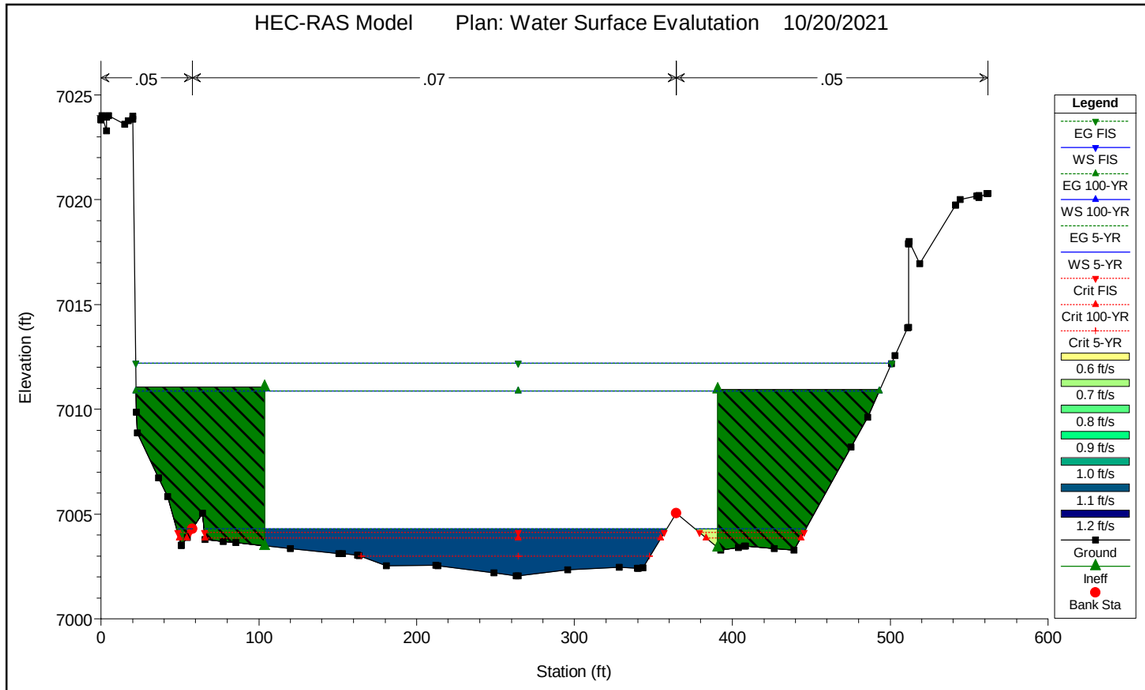
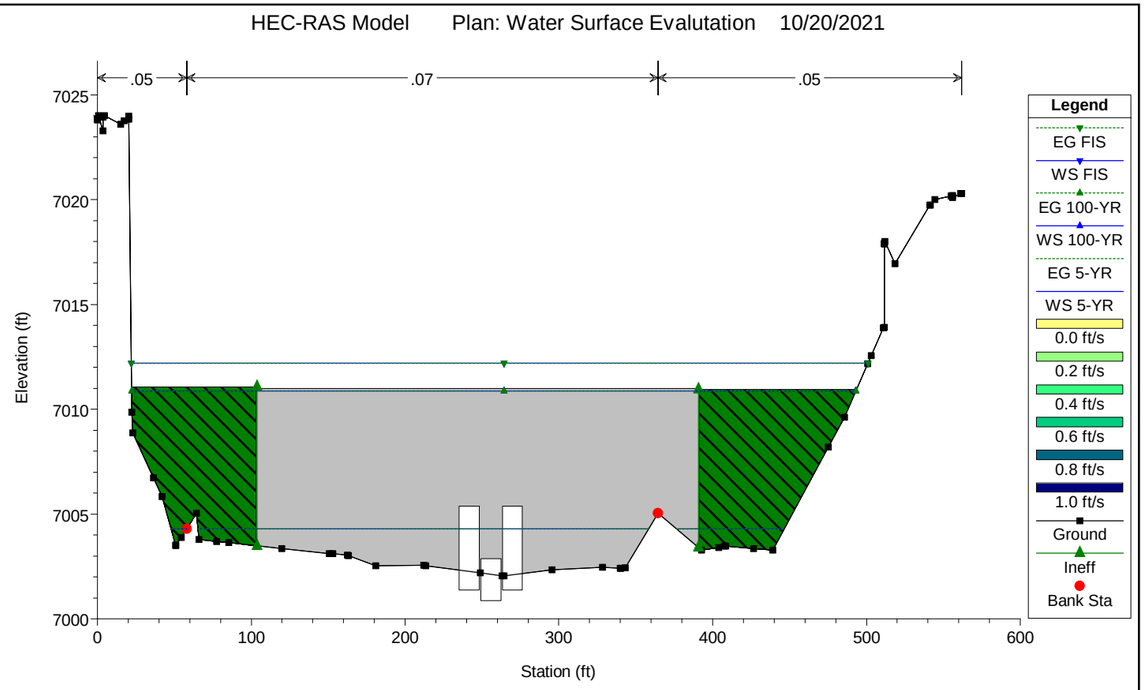
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.8 ft/s
0.9 ft/s
1.0 ft/s
1.1 ft/s
1.2 ft/s
1.3 ft/s
1.4 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit FIS
Crit 100-YR
Crit 5-YR
0.6 ft/s
0.7 ft/s
0.8 ft/s
0.9 ft/s
1.0 ft/s
1.1 ft/s
1.2 ft/s
Ground
Ineff
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
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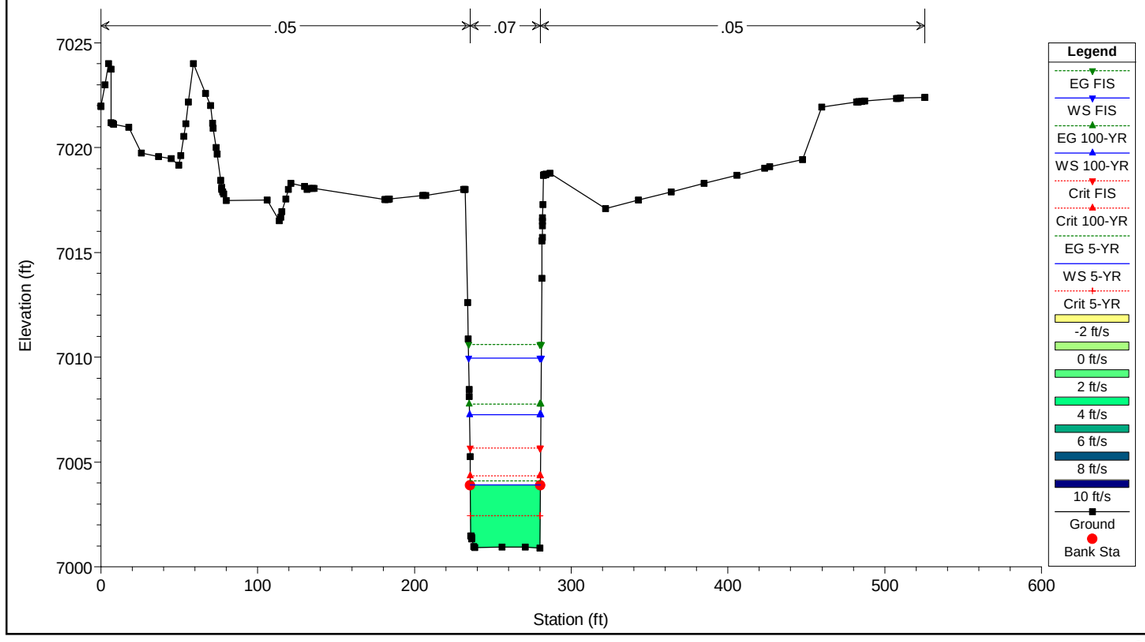
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
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.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
Crit FIS
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
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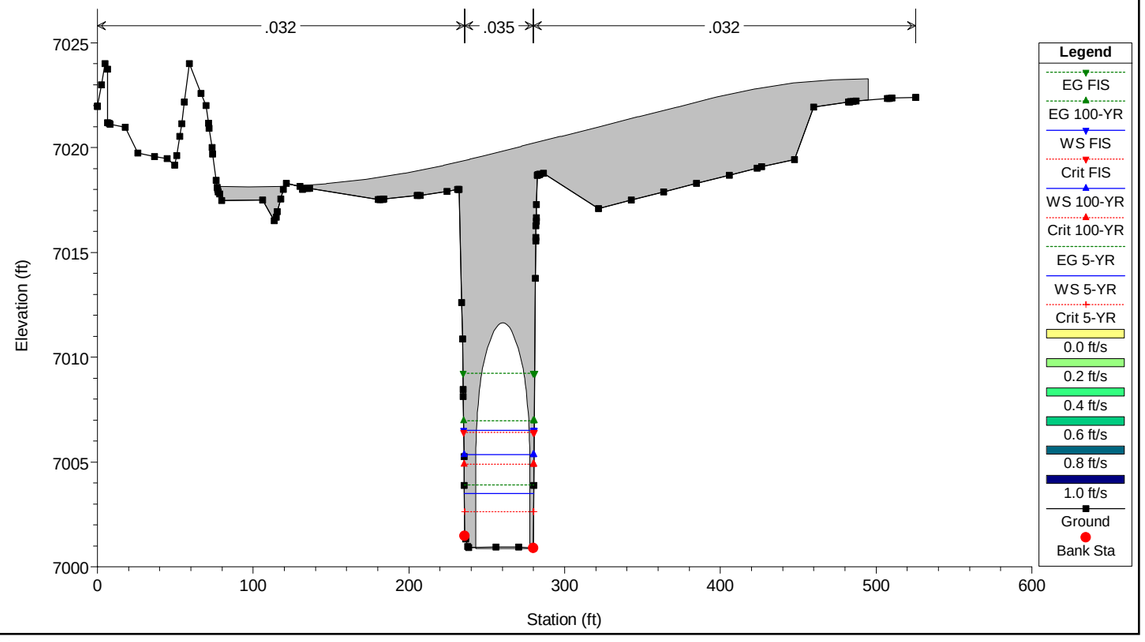
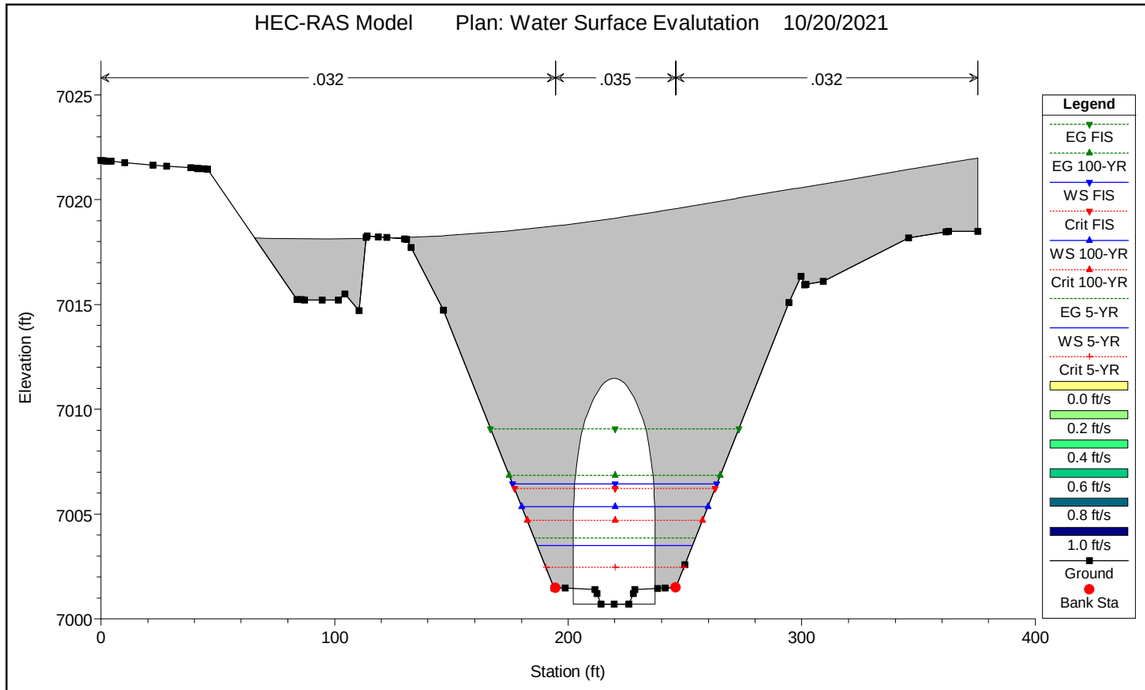
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.032
.035
.032
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
WS 100-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
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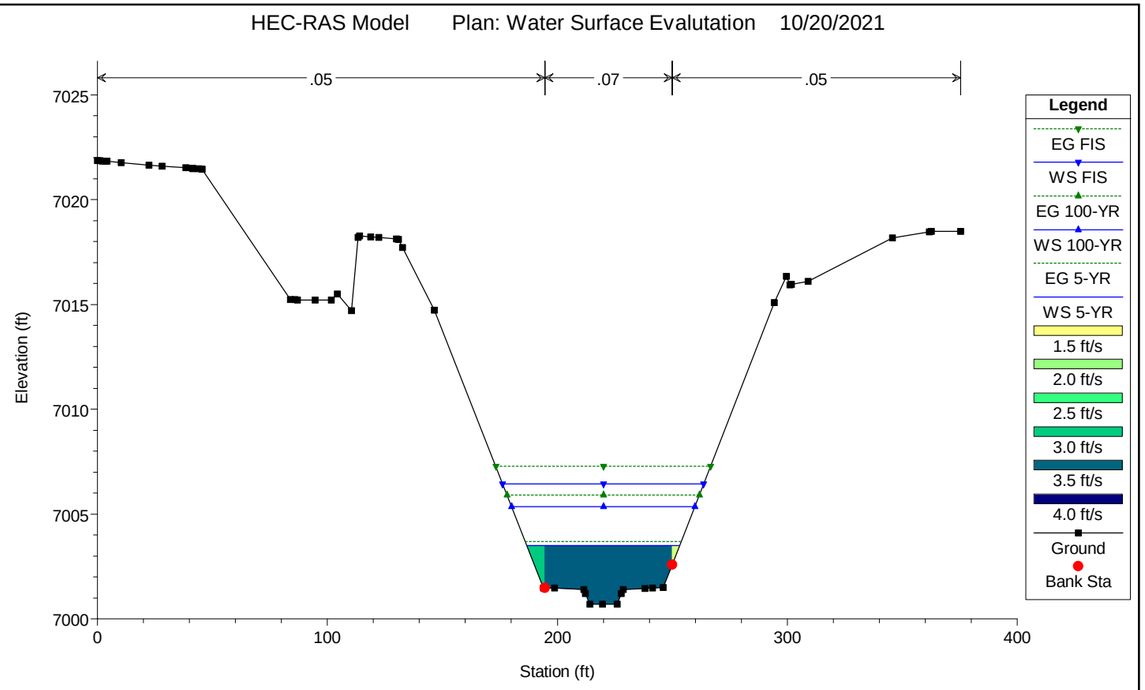
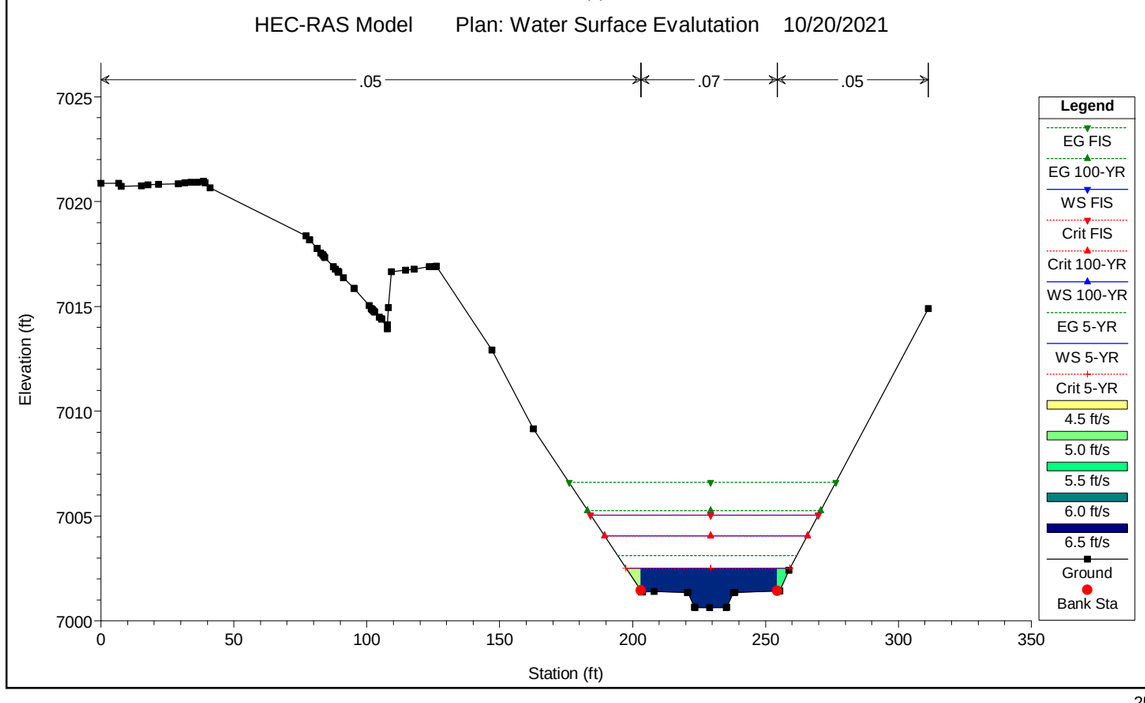
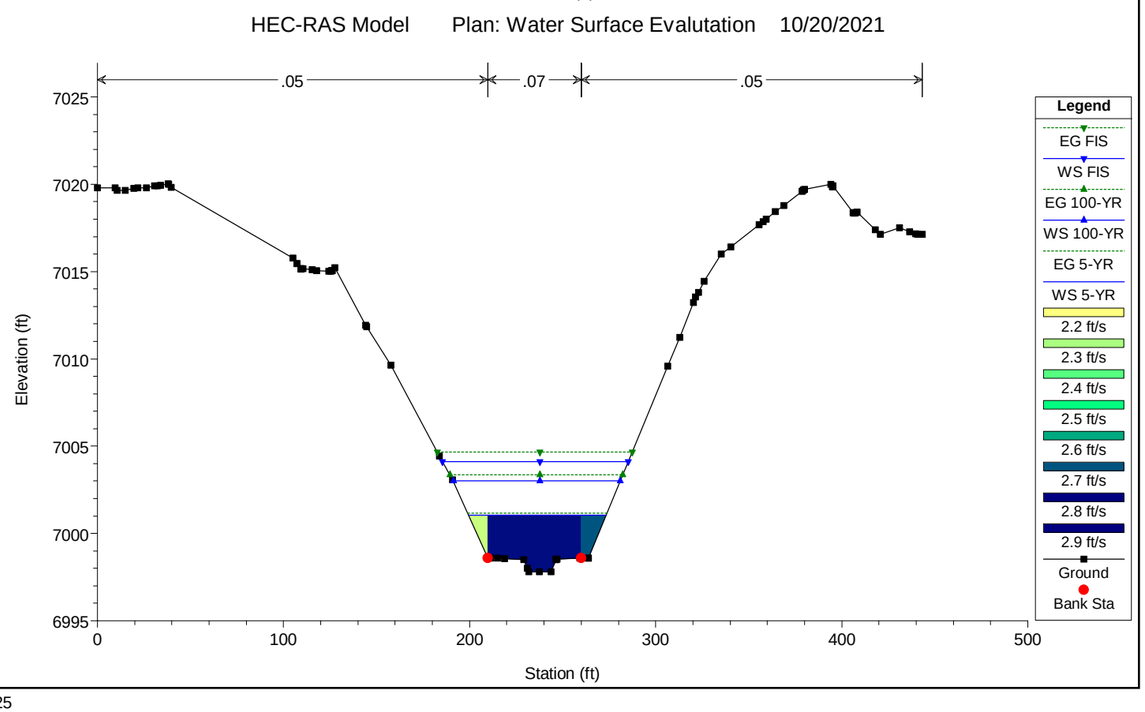
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
6.5 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
2.6 ft/s
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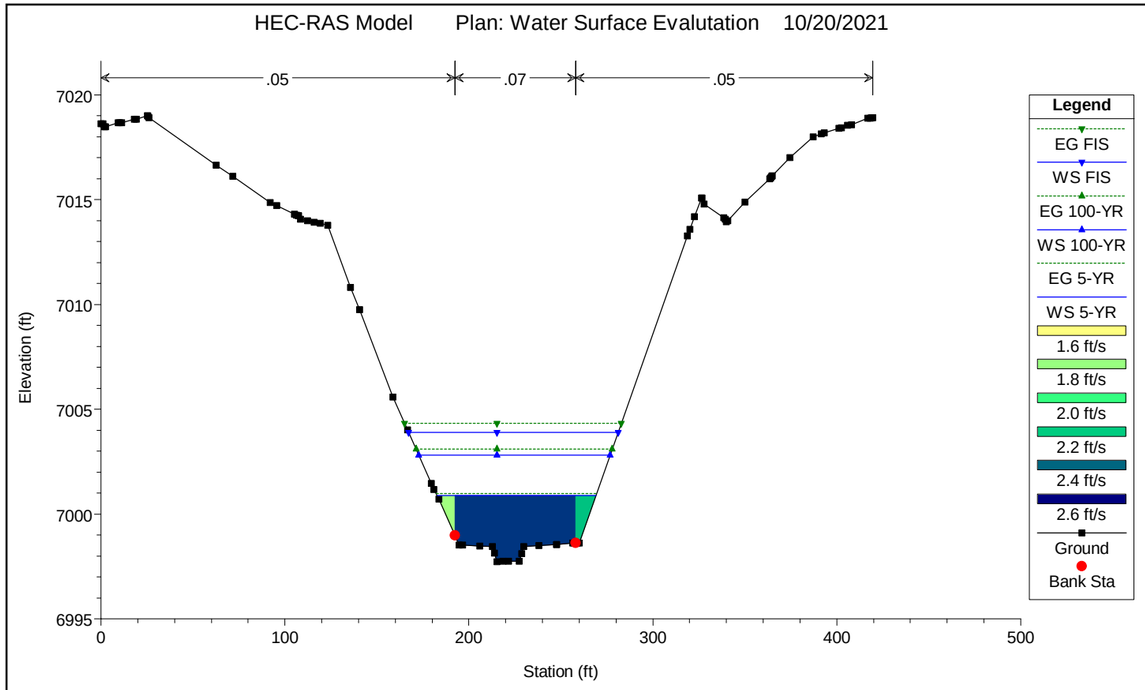
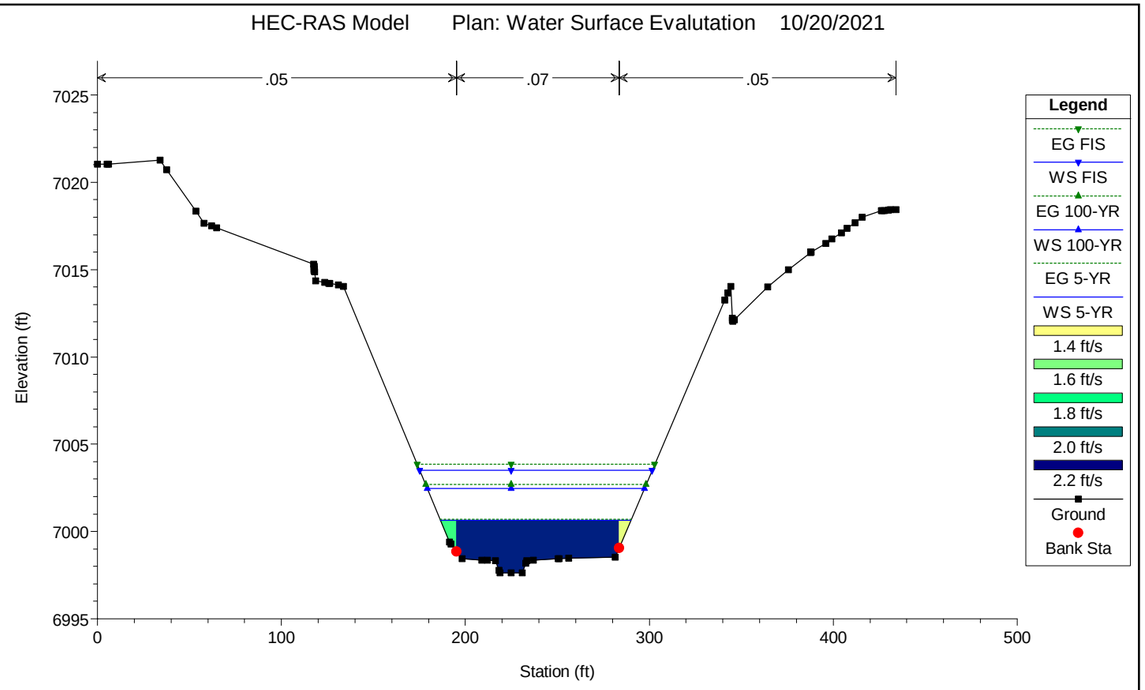
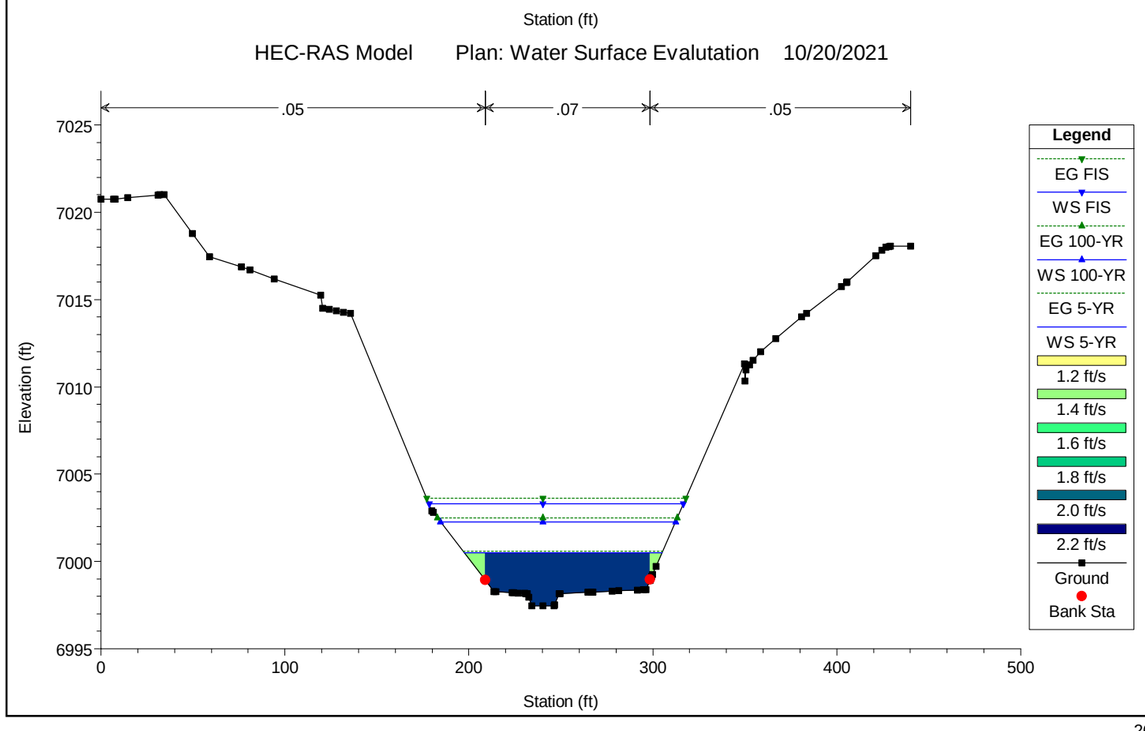
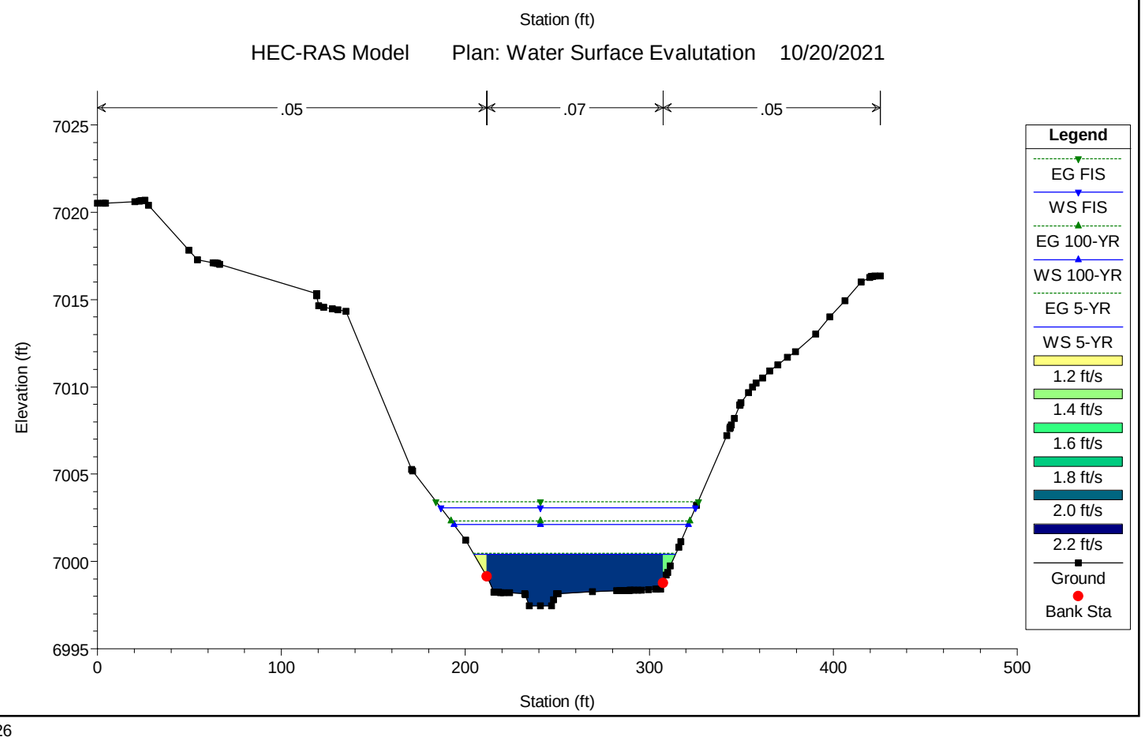
2.9 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta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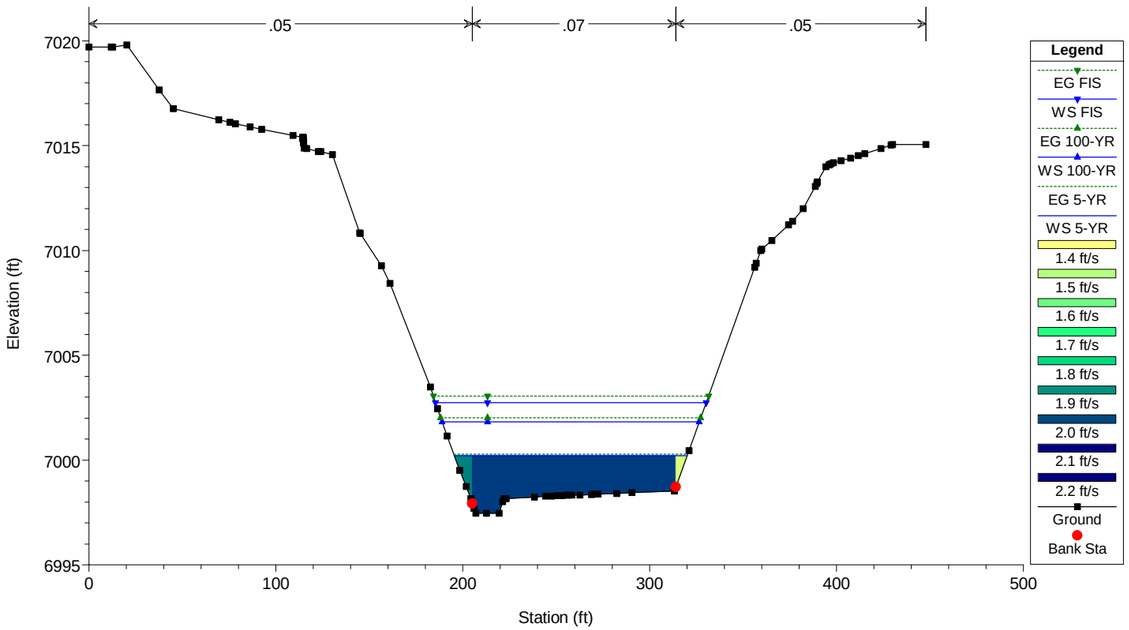
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.2 ft/s
1.4 ft/s
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
Ground
Bank Sta

HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



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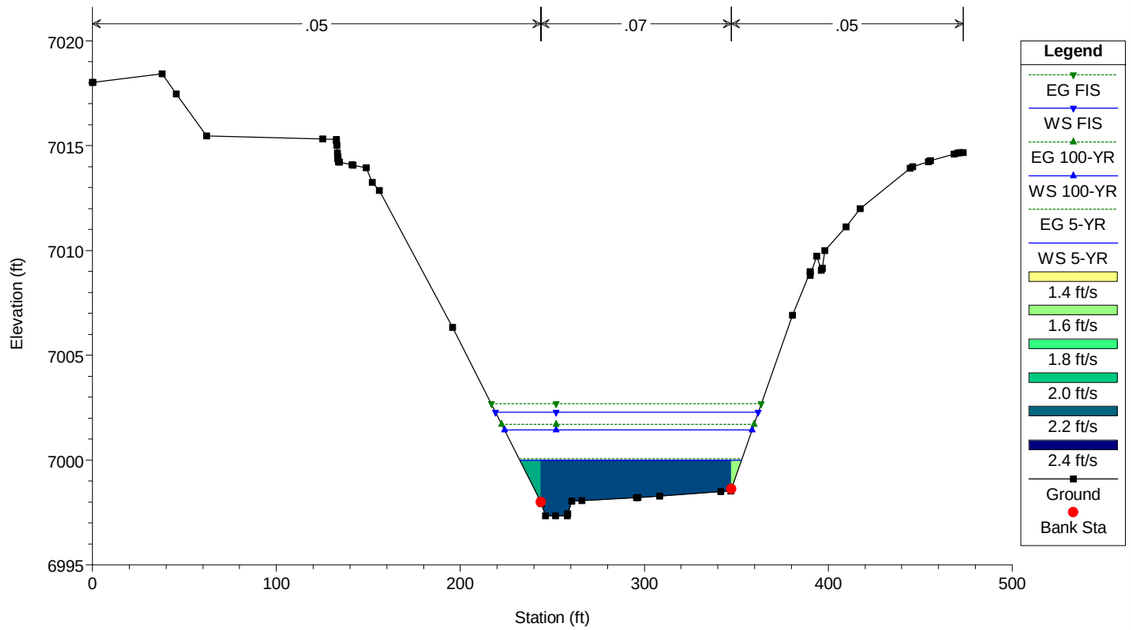

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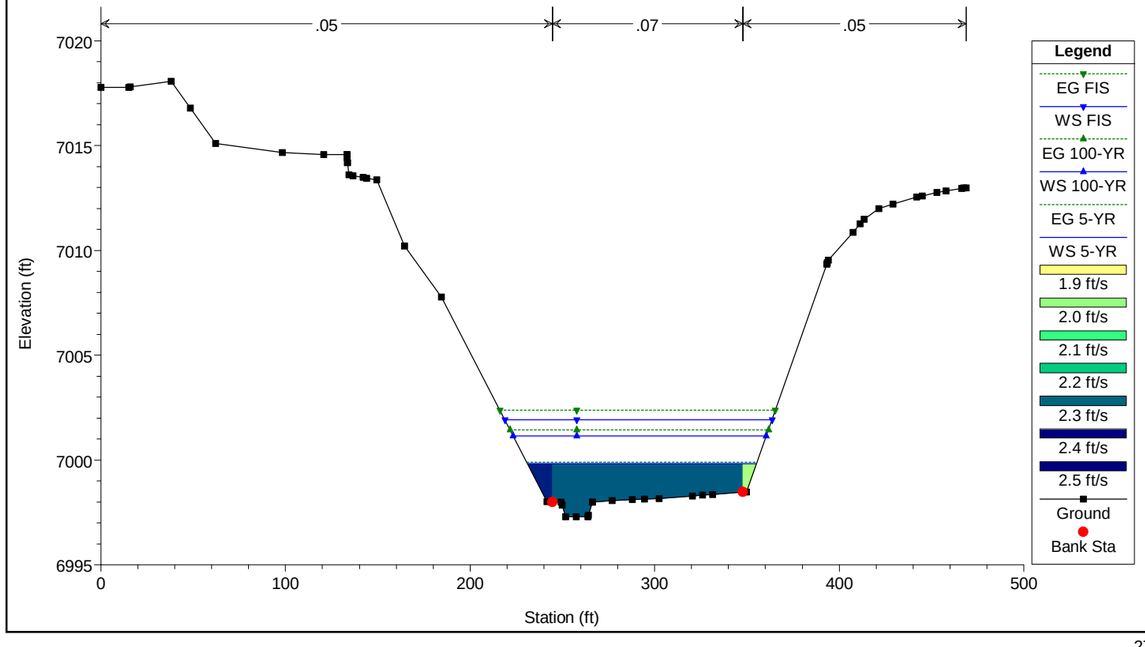

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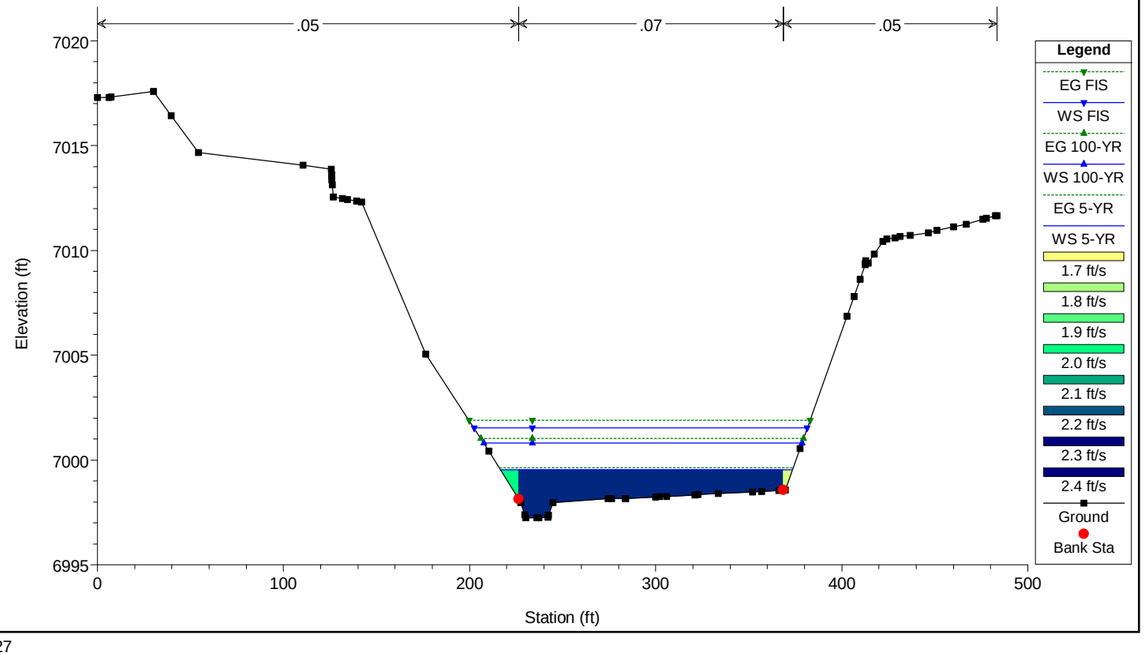

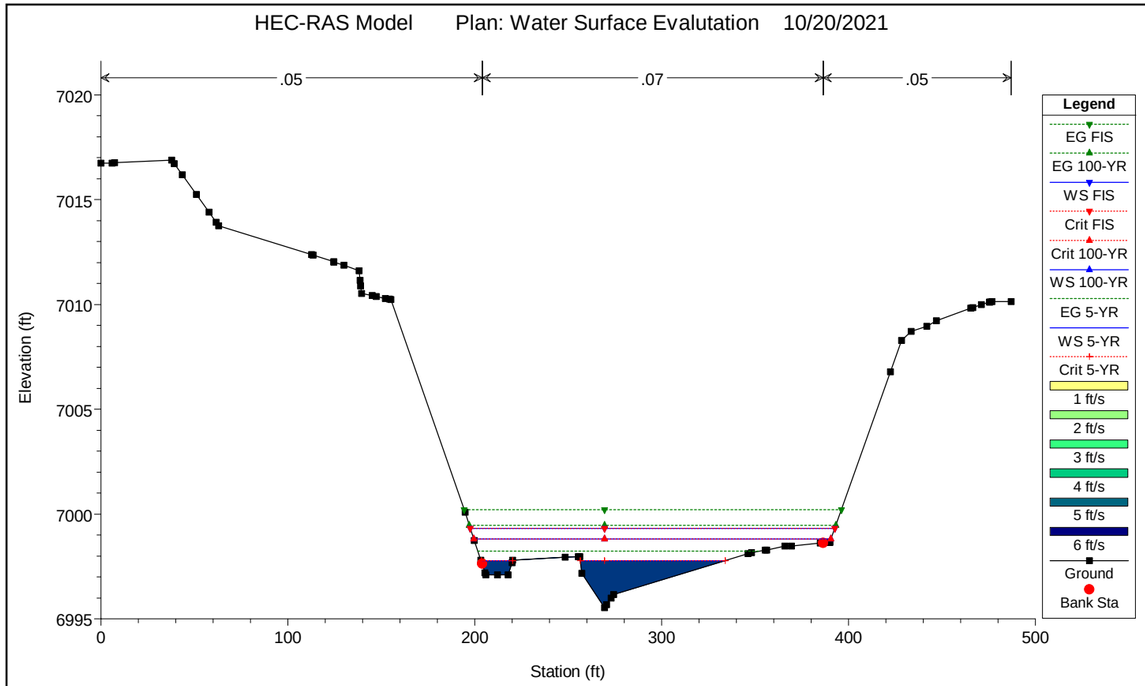
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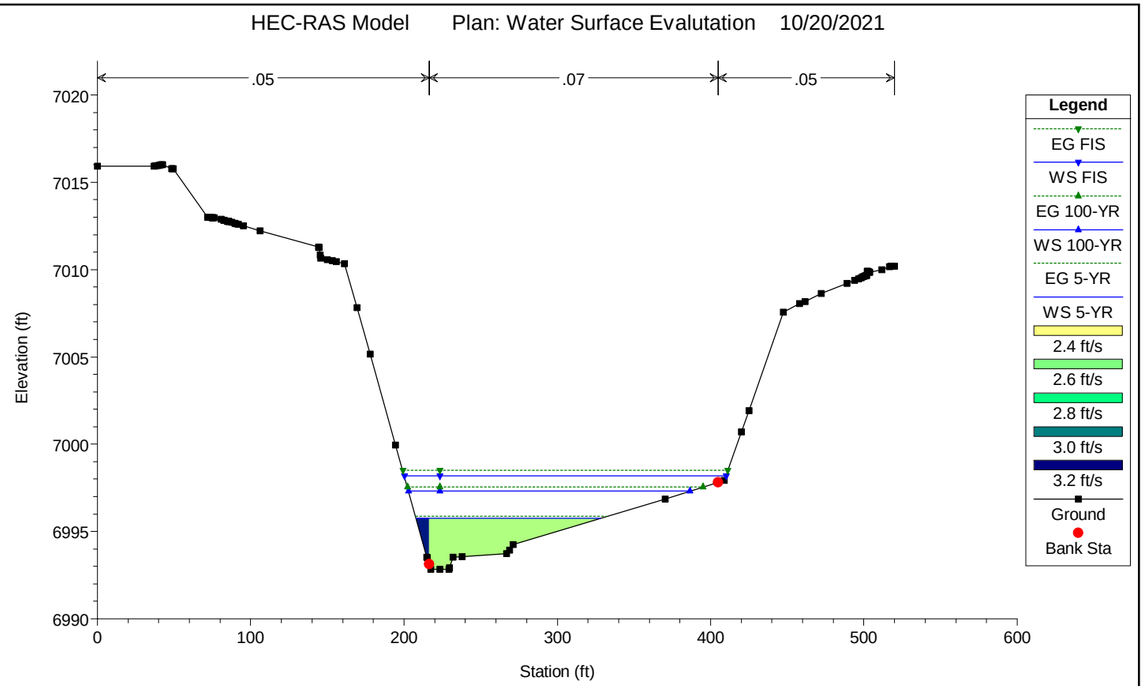
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
EG 100-YR
WS FIS
Crit FIS
Crit 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
Crit 5-YR
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta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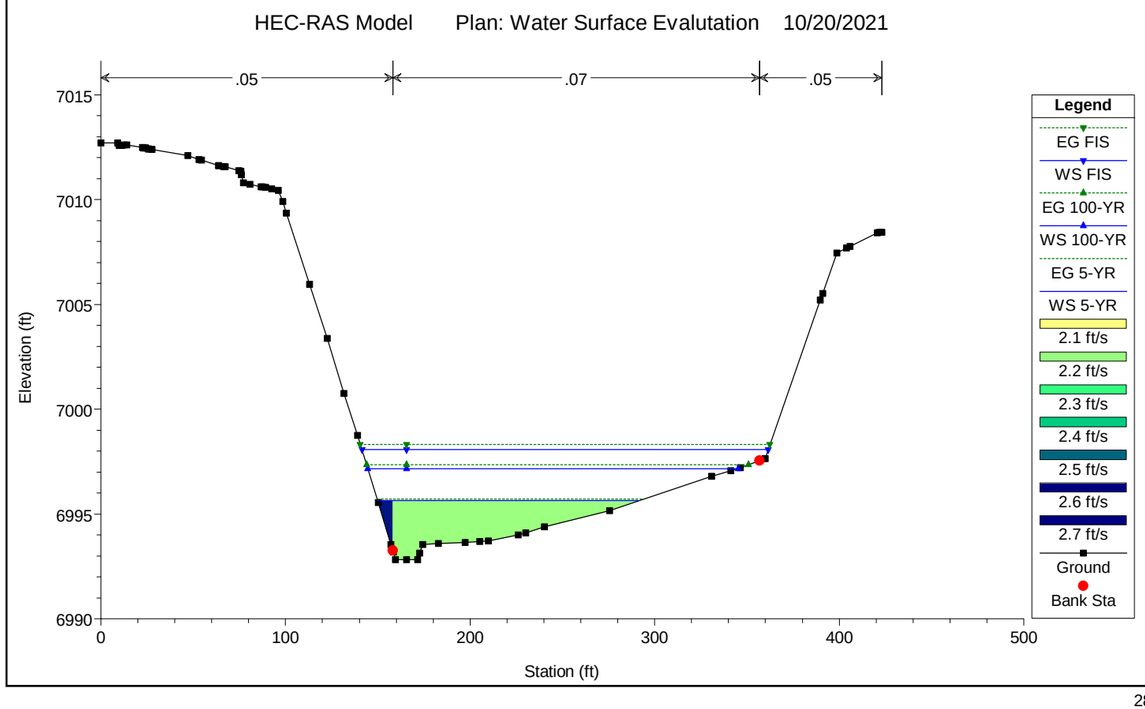
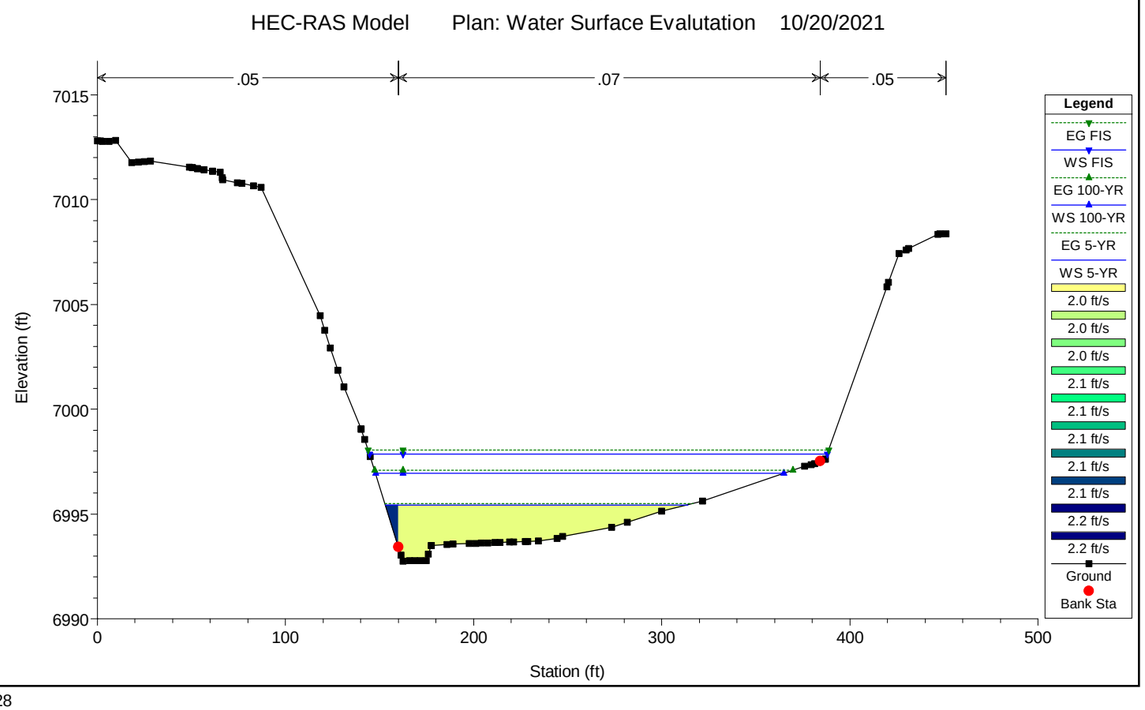
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
2.6 ft/s
2.7 ft/s
Ground
Bank Sta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.05
.07
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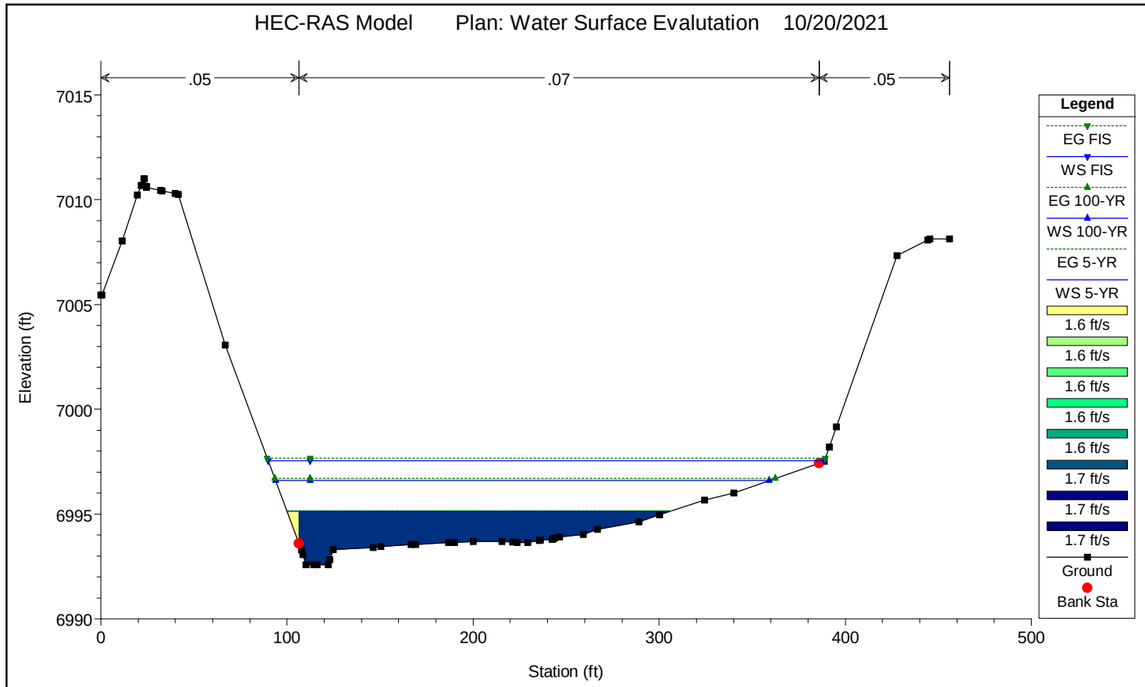
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
2.0 ft/s
2.0 ft/s
2.0 ft/s
2.1 ft/s
2.1 ft/s
2.1 ft/s
2.1 ft/s
2.1 ft/s
2.2 ft/s
2.2 ft/s
Ground
Bank Sta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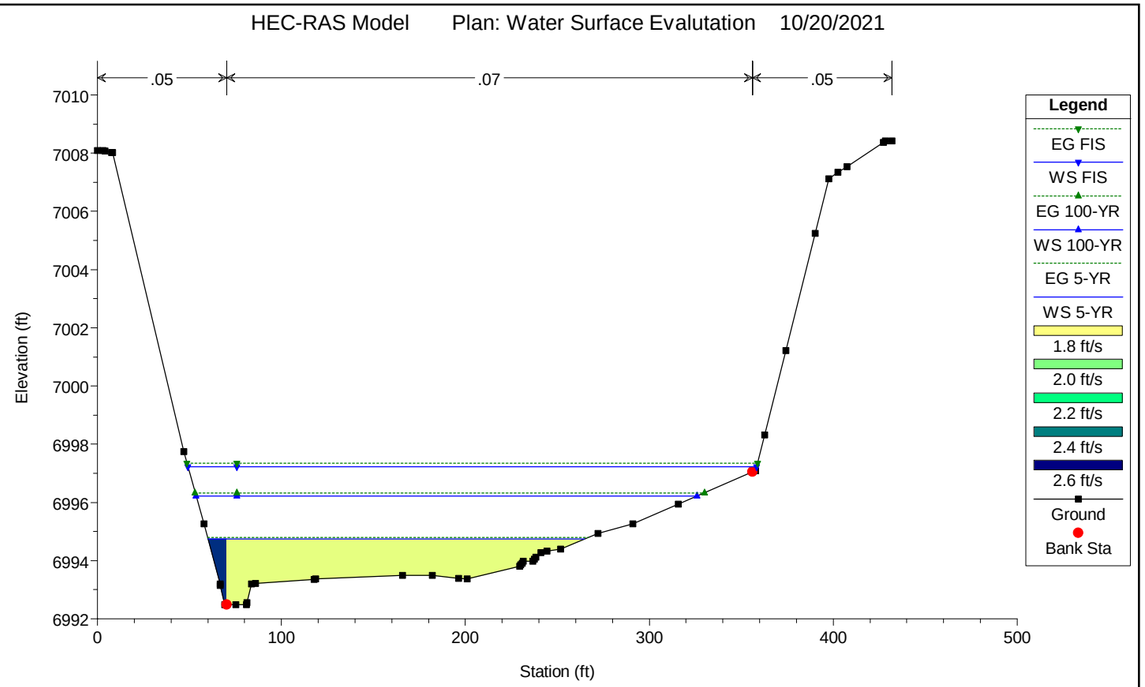
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.6 ft/s
1.6 ft/s
1.6 ft/s
1.6 ft/s
1.7 ft/s
1.7 ft/s
1.7 ft/s
Ground
Bank Sta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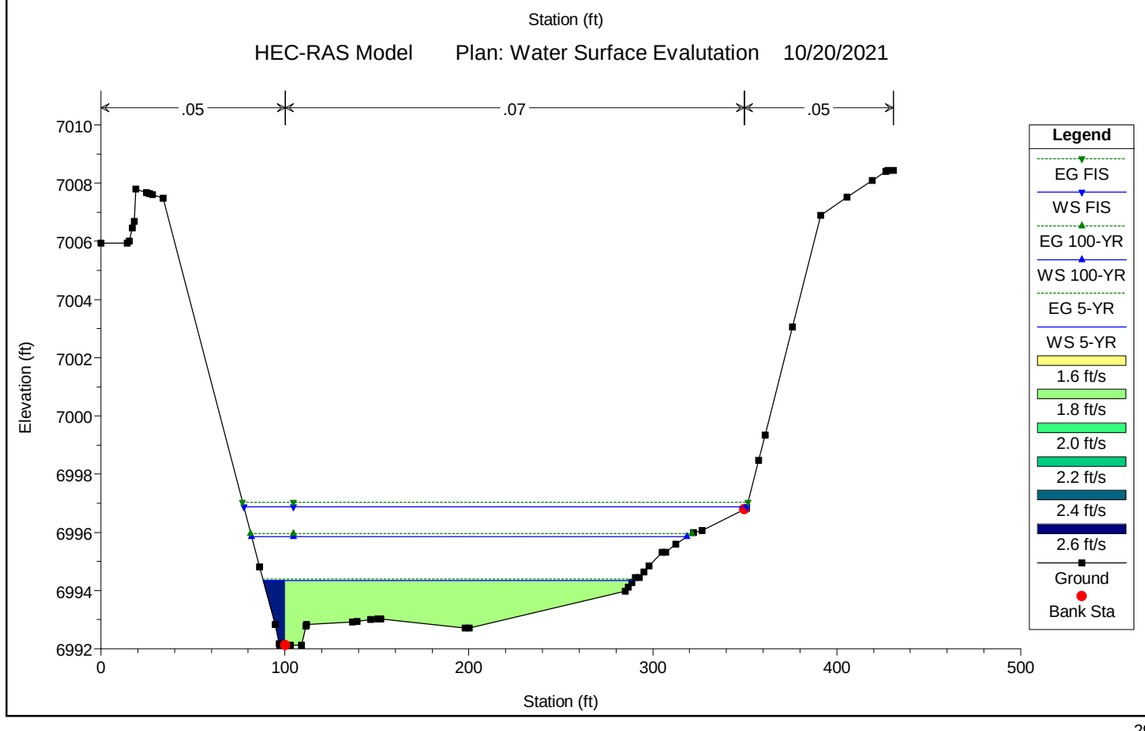
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta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.05
.07
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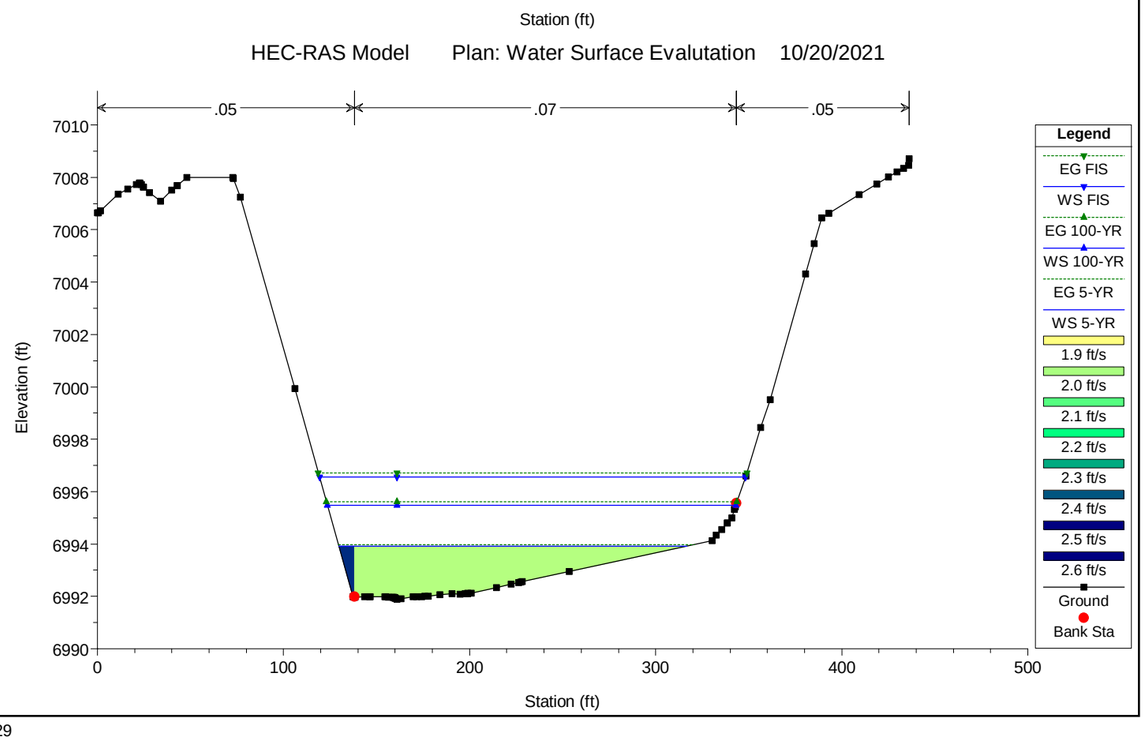
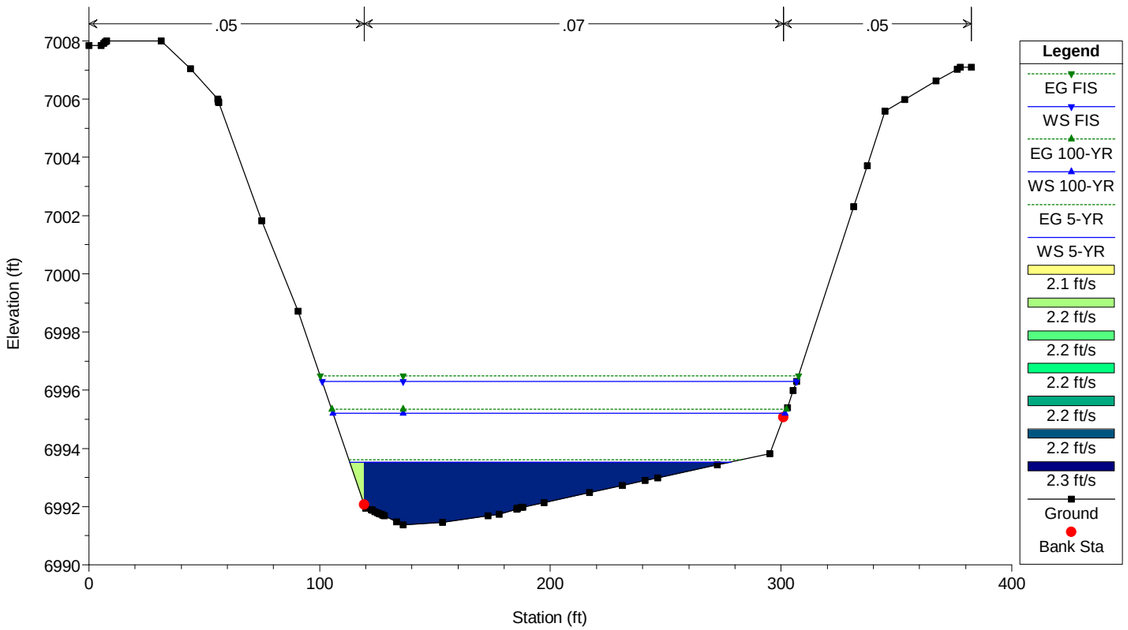
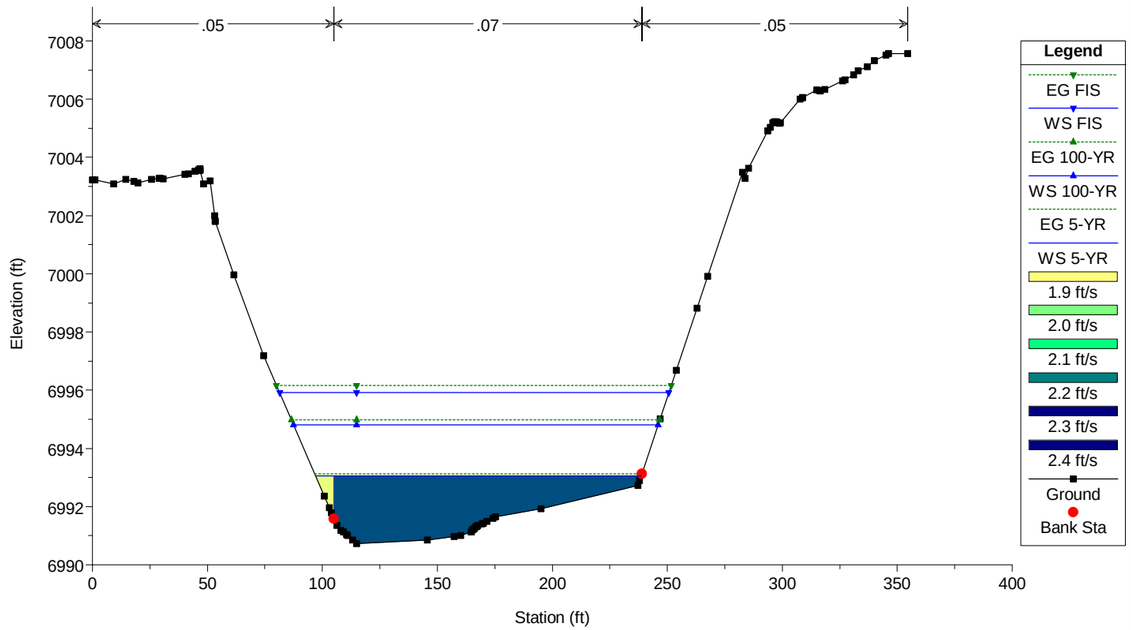
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.6 ft/s
1.8 ft/s
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
Ground
Bank Sta


HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021
.05
.07
.05
Elevation (ft)
Station (ft)
Legend
EG FIS
WS FIS
EG 100-YR
WS 100-YR
EG 5-YR
WS 5-YR
1.9 ft/s
2.0 ft/s
2.1 ft/s
2.2 ft/s
2.3 ft/s
2.4 ft/s
2.5 ft/s
2.6 ft/s
Ground
Bank Sta

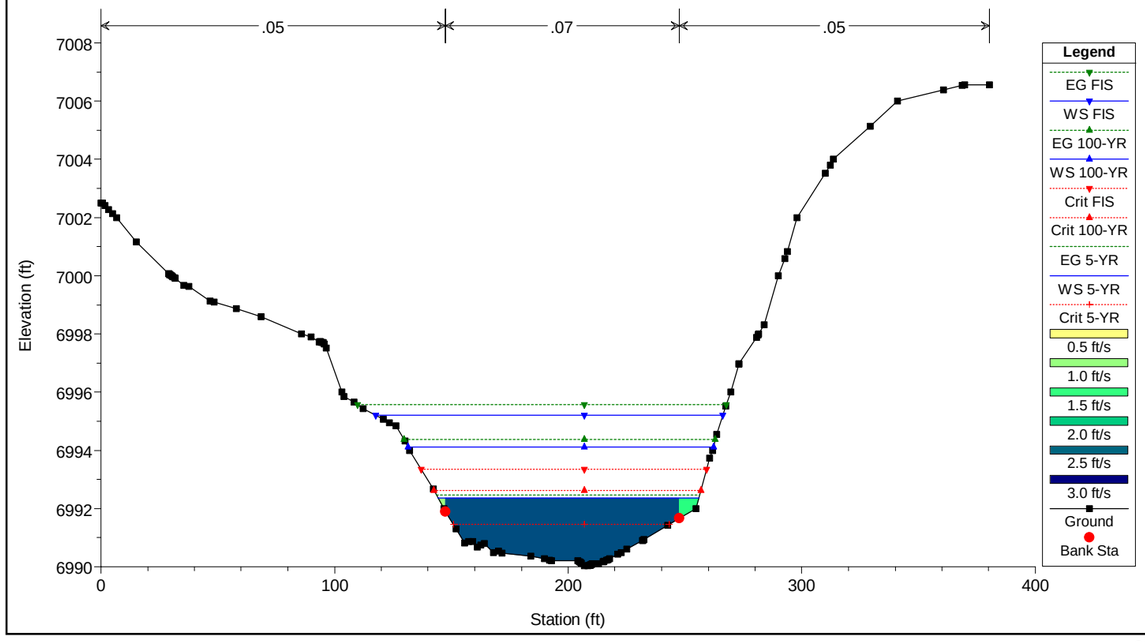
HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



HEC-RAS Model Plan: Water Surface Evalutation 10/20/2021



HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 1550 cfs

Maximum Flow: 2600 cfs

Table 1 - Summary of Culvert Flows at Crossing: SRR (separate berm)

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 (low flow) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7000.88	0.00	0.00	0.00	0.00	0
7003.13	260.00	151.32	108.64	0.00	3
7004.37	520.00	339.63	180.32	0.00	4
7005.52	780.00	552.62	227.38	0.00	4
7006.71	1040.00	773.45	266.59	0.00	4
7008.18	1300.00	994.87	305.19	0.00	4
7009.91	1550.00	1205.48	344.57	0.00	4
7011.14	1820.00	1333.23	369.90	115.89	7
7011.40	2080.00	1359.45	375.23	344.67	5
7011.62	2340.00	1380.22	379.47	580.03	5
7011.81	2600.00	1398.22	383.17	817.61	4
7010.88	1672.34	1307.58	364.76	0.00	Overtopping

Rating Curve Plot for Crossing: SRR (separate berm)

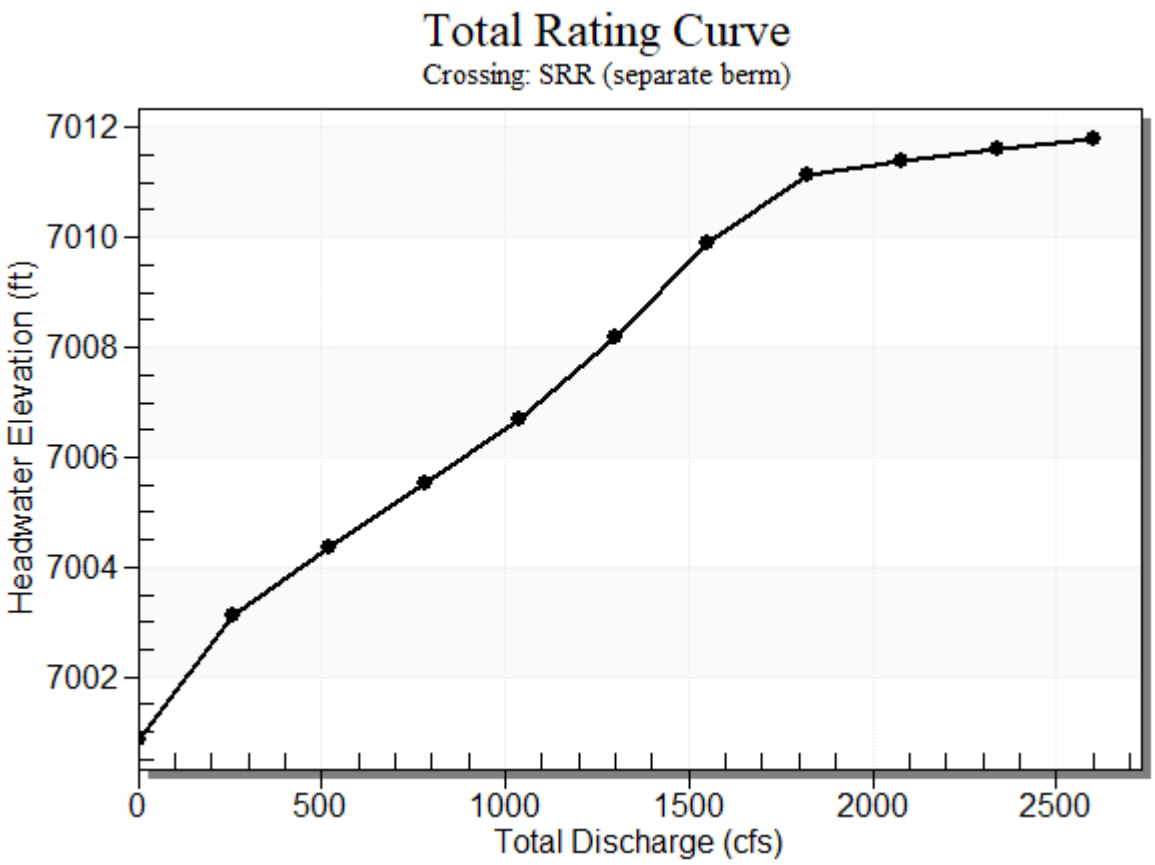


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	7000.88	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
260.00	151.32	7003.13	1.745	1.751	3-M2t	1.225	1.017	1.177	1.738	4.944	2.537
520.00	339.63	7004.37	2.954	2.998	3-M2t	2.077	1.743	2.032	2.593	6.429	3.216
780.00	552.62	7005.52	4.097	4.143	3-M2t	2.886	2.412	2.703	3.264	7.863	3.673
1040.00	773.45	7006.71	5.326	5.184	3-M2t	3.644	3.018	3.274	3.835	9.085	4.027
1300.00	994.87	7008.18	6.800	6.142	7-M2t	4.000	3.569	3.780	4.341	10.124	4.318
1550.00	1205.48	7009.91	8.531	4.111	5-M2t	4.000	4.000	3.780	4.781	0.000	4.558
1820.00	1333.23	7011.14	9.756	4.548	5-M2t	4.000	4.000	3.780	5.218	10.124	4.786
2080.00	1359.45	7011.40	10.024	4.939	5-M2t	4.000	4.000	3.780	5.609	10.124	4.982
2340.00	1380.22	7011.62	10.241	5.306	5-M2t	4.000	4.000	3.780	5.976	10.124	5.159
2600.00	1398.22	7011.81	10.431	5.652	5-M2t	4.000	4.000	3.780	6.322	10.124	5.322

****

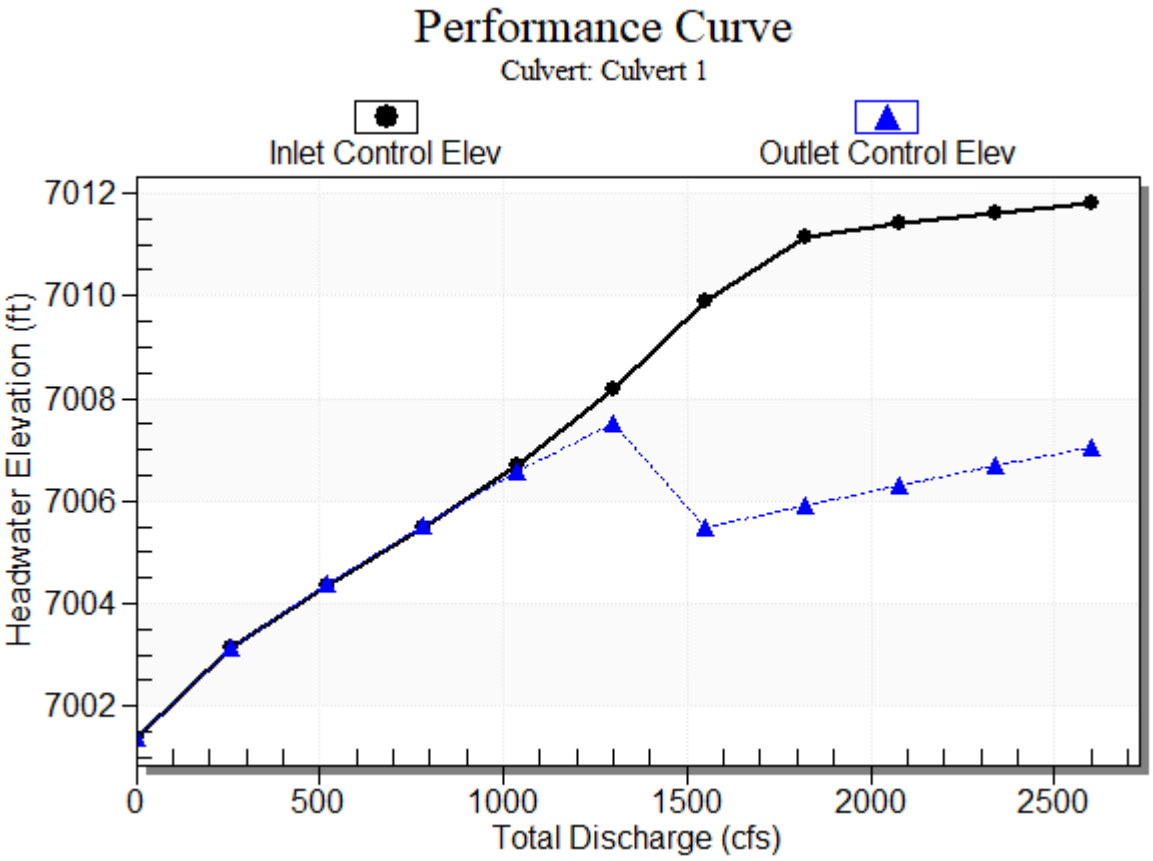
Straight Culvert

Inlet Elevation (invert): 7001.38 ft, Outlet Elevation (invert): 7001.27 ft

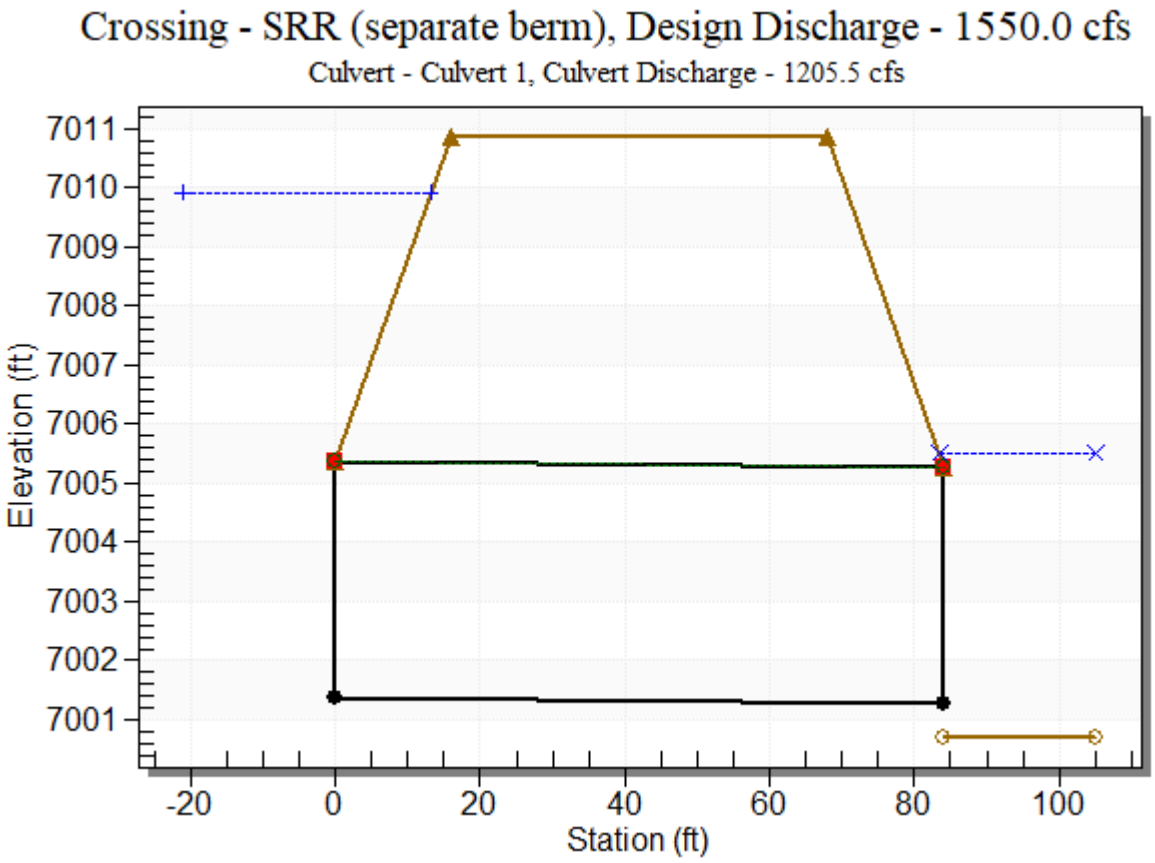
Culvert Length: 84.00 ft, Culvert Slope: 0.0013

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 7001.38 ft

Outlet Station: 84.00 ft

Outlet Elevation: 7001.27 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 13.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Table 3 - Culvert Summary Table: Culvert 2 (low flow)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	7000.88	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
260.00	108.64	7003.13	2.213	2.235	7-M1t	1.340	1.294	1.738	1.738	4.808	2.537
520.00	180.32	7004.37	3.494	3.860	4-FFf	1.865	1.815	2.000	2.593	6.935	3.216
780.00	227.38	7005.52	4.644	5.380	4-FFf	2.000	2.000	2.000	3.264	8.745	3.673
1040.00	266.59	7006.71	5.825	6.807	4-FFf	2.000	2.000	2.000	3.835	10.253	4.027
1300.00	305.19	7008.18	7.300	8.288	4-FFf	2.000	2.000	2.000	4.341	11.738	4.318
1550.00	344.57	7009.91	9.031	9.860	4-FFf	2.000	2.000	2.000	4.781	13.253	4.558
1820.00	369.90	7011.14	10.255	11.097	4-FFf	2.000	2.000	2.000	5.218	14.227	4.786
2080.00	375.23	7011.40	10.524	11.663	4-FFf	2.000	2.000	2.000	5.609	14.432	4.982
2340.00	379.47	7011.62	10.740	12.172	4-FFf	2.000	2.000	2.000	5.976	14.595	5.159
2600.00	383.17	7011.81	10.931	12.642	4-FFf	2.000	2.000	2.000	6.322	14.737	5.322

****

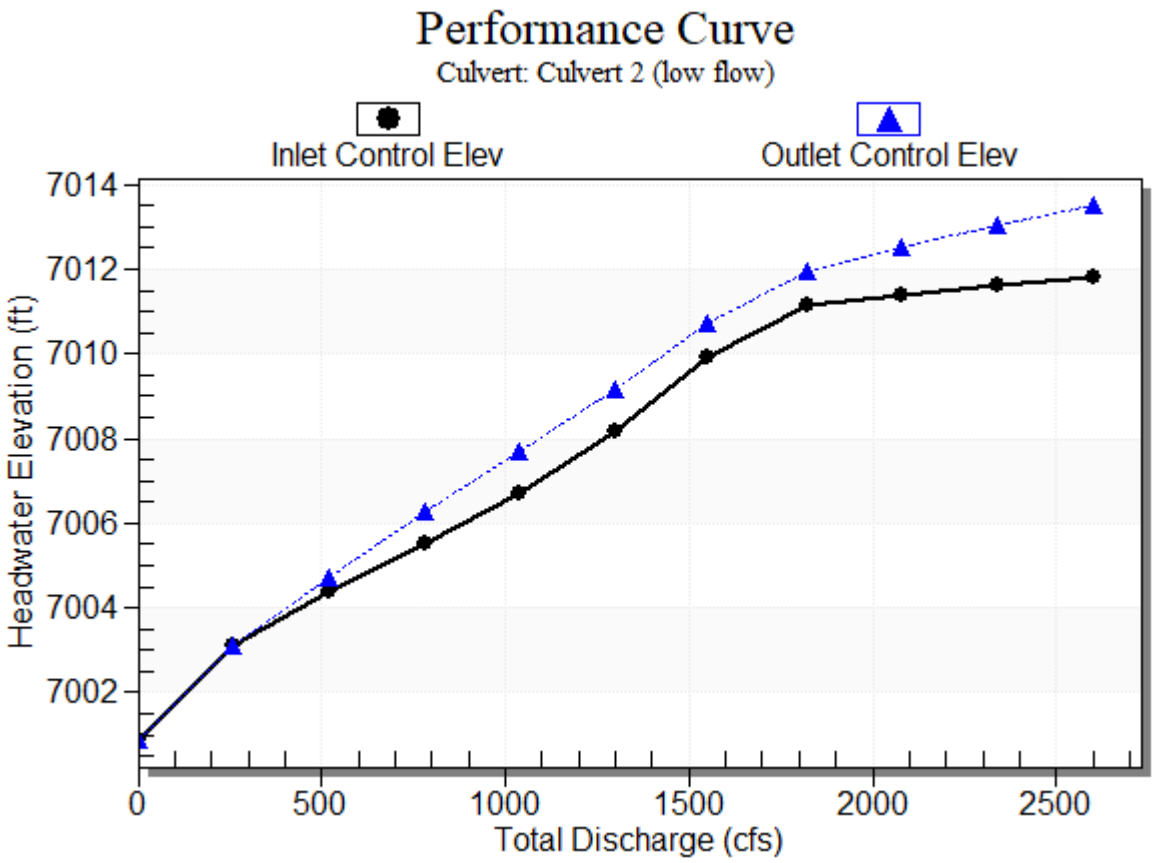
Straight Culvert

Inlet Elevation (invert): 7000.88 ft, Outlet Elevation (invert): 7000.71 ft

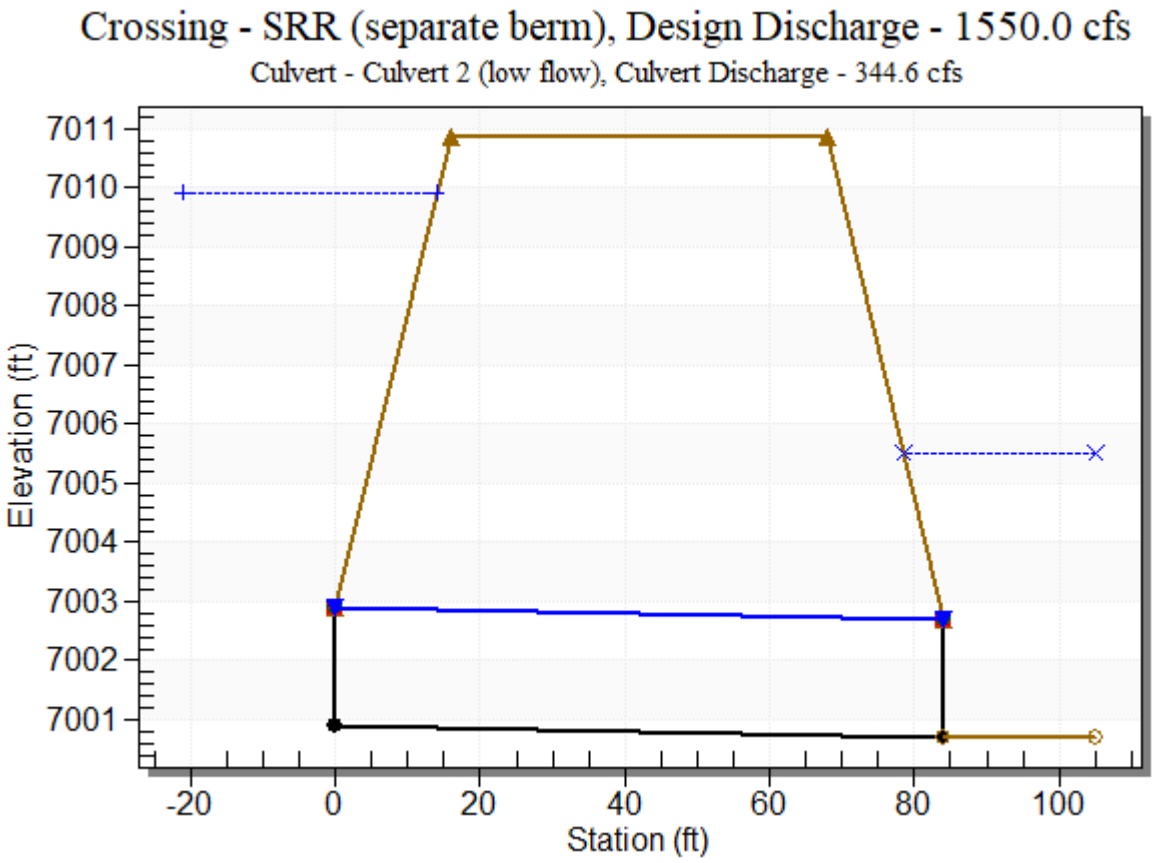
Culvert Length: 84.00 ft, Culvert Slope: 0.0020

****

Culvert Performance Curve Plot: Culvert 2 (low flow)



Water Surface Profile Plot for Culvert: Culvert 2 (low flow)



Site Data - Culvert 2 (low flow)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 7000.88 ft

Outlet Station: 84.00 ft

Outlet Elevation: 7000.71 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2 (low flow)

Barrel Shape: Concrete Box

Barrel Span: 13.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Table 4 - Downstream Channel Rating Curve (Crossing: SRR (separate berm))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7000.71	0.00	0.00	0.00	0.00
260.00	7002.45	1.74	2.54	0.22	0.36
520.00	7003.30	2.59	3.22	0.32	0.38
780.00	7003.97	3.26	3.67	0.41	0.39
1040.00	7004.55	3.84	4.03	0.48	0.40
1300.00	7005.05	4.34	4.32	0.54	0.41
1550.00	7005.49	4.78	4.56	0.60	0.41
1820.00	7005.93	5.22	4.79	0.65	0.42
2080.00	7006.32	5.61	4.98	0.70	0.42
2340.00	7006.69	5.98	5.16	0.75	0.43
2600.00	7007.03	6.32	5.32	0.79	0.43

Tailwater Channel Data - SRR (separate berm)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 52.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0020

Channel Manning's n: 0.0350

Channel Invert Elevation: 7000.71 ft

Roadway Data for Crossing: SRR (separate berm)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 7010.88 ft

Roadway Surface: Paved

Roadway Top Width: 52.00 ft

Existing Stock Pond 1 Proposed Outlet Structure

width	25	area	625	open area x 70%	218.75	0.25
length	25	blockage	0.5			
perimeter	100	blockage	0	avail perm.	100	

Elev (ft)	Head (ft)	Orifice	Weir
7036	0	0	0
7036.25	0.25	526.6381	38.75
7036.5	0.5	744.7787	109.6016
7036.75	0.75	912.1639	201.3509
7037	1	1053.276	310
7037.25	1.25	1177.599	433.2382
7037.5	1.5	1289.995	569.5064
7037.75	1.75	1393.353	717.66
7038	2	1489.557	876.8124
7038.25	2.25	1579.914	1046.25
7038.5	2.5	1665.376	1225.383
7038.75	2.75	1746.661	1413.711
7039	3	1824.328	1610.807
7039.25	3.25	1898.821	1816.296
7039.5	3.5	1970.499	2029.849
7039.75	3.75	2039.66	2251.172
7040	4	2106.552	2480
7040.25	4.25	2171.384	2716.096
7040.5	4.5	2234.336	2959.242
7040.75	4.75	2295.562	3209.239
7041	5	2355.197	3465.905
7041.25	5.25	2413.359	3729.071
7041.5	5.5	2470.152	3998.579
7041.75	5.75	2525.667	4274.285
7042	6	2579.989	4556.051
7042.25	6.25	2633.19	4843.75
7042.5	6.5	2685.338	5137.262
7042.75	6.75	2736.492	5436.474
7043	7	2786.707	5741.28
7043.25	7.25	2836.033	6051.579
7043.5	7.5	2884.516	6367.275
7043.75	7.75	2932.197	6688.277
7044	8	2979.115	7014.499
7044.25	8.25	3025.305	7345.859
7044.5	8.5	3070.801	7682.279
7044.75	8.75	3115.633	8023.683
7045	9	3159.828	8370
7045.25	9.25	3203.414	8721.161
7045.5	9.5	3246.415	9077.1
7045.75	9.75	3288.854	9437.753
7046	10	3330.752	9803.061
7046.25	10.25	3372.129	10172.96
7046.5	10.5	3413.005	10547.41
7046.75	10.75	3453.397	10926.33
7047	11	3493.322	11309.69
7047.25	11.25	3532.796	11697.43
7047.5	11.5	3571.833	12089.5
7047.75	11.75	3610.449	12485.86
7048	12	3648.656	12886.46

Existing Stock Pond 2 Proposed Outlet Structure

width	25	area	625	open area x 70%	218.75
length	25	blockage	0.5		
perimeter	100	blockage	0	avail perm.	100

Elev (ft)	Head (ft)	Orifice	Weir
7117.75	0	0	0
7118	0.25	526.6381	38.75
7118.25	0.5	744.7787	109.6016
7118.5	0.75	912.1639	201.3509
7118.75	1	1053.276	310
7119	1.25	1177.599	433.2382
7119.25	1.5	1289.995	569.5064
7119.5	1.75	1393.353	717.66
7119.75	2	1489.557	876.8124
7120	2.25	1579.914	1046.25
7120.25	2.5	1665.376	1225.383
7120.5	2.75	1746.661	1413.711
7120.75	3	1824.328	1610.807
7121	3.25	1898.821	1816.296
7121.25	3.5	1970.499	2029.849
7121.5	3.75	2039.66	2251.172
7121.75	4	2106.552	2480
7122	4.25	2171.384	2716.096
7122.25	4.5	2234.336	2959.242
7122.5	4.75	2295.562	3209.239
7122.75	5	2355.197	3465.905
7123	5.25	2413.359	3729.071
7123.25	5.5	2470.152	3998.579
7123.5	5.75	2525.667	4274.285
7123.75	6	2579.989	4556.051
7124	6.25	2633.19	4843.75
7124.25	6.5	2685.338	5137.262
7124.5	6.75	2736.492	5436.474
7124.75	7	2786.707	5741.28
7125	7.25	2836.033	6051.579
7125.25	7.5	2884.516	6367.275
7125.5	7.75	2932.197	6688.277
7125.75	8	2979.115	7014.499
7126	8.25	3025.305	7345.859
7126.25	8.5	3070.801	7682.279
7126.5	8.75	3115.633	8023.683
7126.75	9	3159.828	8370
7127	9.25	3203.414	8721.161
7127.25	9.5	3246.415	9077.1
7127.5	9.75	3288.854	9437.753
7127.75	10	3330.752	9803.061
7128	10.25	3372.129	10172.96
7128.25	10.5	3413.005	10547.41
7128.5	10.75	3453.397	10926.33
7128.75	11	3493.322	11309.69
7129	11.25	3532.796	11697.43
7129.25	11.5	3571.833	12089.5
7129.5	11.75	3610.449	12485.86
7129.75	12	3648.656	12886.46

Appendix D

Reference Material

Please provide SCDBPS page 1,
Section IV pages 40, 49, and VII 51-54
and 58-60 (as applicable)

MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT FOR STERLING RANCH

Prepared For:
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20 Boulder Crescent, 2nd Floor
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October 21, 2021
Project No. 25188.04

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(update with revisions)

The last and most crucial comparison is between the updated existing conditions model and the updated proposed conditions model. As seen in Table 1, all of the online and offline detention shows a clear reduction in flows along Sand Creek. The total volume of runoff is very similar in the undeveloped upper portion of the reach at Design Points 74, 75, and 78. As runoff accumulates downstream at Design Points 73, 71, 69, and 63 the volume of runoff drastically increases due to the increased imperviousness of the adjacent developments, but the peak flow rates remain lower than existing due to all of the full spectrum detention ponds along the reach. As seen in Table 1, Pond W-3 reduces peak flow rates downstream of it at Design Points 60A and 53A to below the pre-development rates seen in the updated existing conditions model. Flows have been reduced from 1969.2 and 2197.2 cfs, respectively, to 1889.4 and 1895.2 cfs. A table comparing the peak runoff rates and the total volume of runoff at the design points can be found in **Appendix C**.

DRAINAGE FACILITY DESIGN

General Concept

The third stated purpose of this MDDP Amendment is an evaluation of the required volume for on-line detention at Sterling Ranch Road (Pond W-3). Along with an on-line detention pond, new culverts are proposed at Sterling Ranch Road and Briargate Parkway by others. The amendment also includes revisions to the existing stock pond north of Sterling Ranch Road, the stock ponds north of Briargate Parkway, and improvements to Sand Creek channel.

Specific Details

Compared to the previous preliminary design of Pond W-3, the amount of storage volume has decreased from 78.2 ac-ft. to 50.6 ac-ft. In order to avoid classification as a jurisdictional dam, the maximum ponding depth is 10 feet. The peak release rate has been increased from 1350.6 cfs to 1552.5 cfs. Despite the increase in release rate, peak flow rates along Sand Creek downstream of the pond are lower than existing. The previous MDDP model outfalls at DP 53A, which is defined as the Full Spectrum Pond at Woodmen Drive, and so does the MDDP Amendment SWMM model. The MDDP model over-detains at Pond W-3 in order to reduce flows downstream well below those in the existing conditions. With the goal being to simply reduce flows to less than predevelopment rates, this amount of detention is unnecessary, hence the reduced storage volume and the increased release rate. A complete comparison between existing and proposed conditions of design flows along Sand Creek can be seen below.

Table 1.

Design Point Comparison Summary						
Location	Design Point ID	Existing (Updated)	Proposed (MDDP)	Proposed (Amendment)	% Difference Amend vs. MDDP	% Difference Amend vs. EX
		Q100 (cfs)				
	DP-74	352.3	262.8	293.8	12%	-17%
	DP-75	970.5	950.5	887.9	-7%	-9%
	DP-78	497.7	385.3	422.1	10%	-15%
	DP-73	1672	1506.7	1501.0	0%	-10%
Sterling Ranch N BNDY	DP-71	1734.9	1612.2	1627.1	1%	-6%
Briargate Pkwy X'ing	DP-69	1988.4	1775.7	1827.0	3%	-8%
Sterling Ranch S BNDY	DP-63	1980.7	1385.1	1580.5	14%	-20%
Marksheffel X'ing	DP-60A	1969.2	1661.8	1889.4	14%	-4%
Sand Creek and Pond 3	DP-53A	2197.7	1668.9	1895.2	14%	-14%
Near SE Prop Corner	DP-56	242.9	196.4	144.8	-26%	-51%

Conceptually, the current preliminary design for Pond W-3 is similar to what was previously shown in the MDDP. Ponding will occur adjacent to Sterling Ranch Road and pass through an outlet structure before entering the roadway culvert and continuing downstream. The Sterling Ranch Road culvert is currently proposed to be a Conspan arch, O-535 shape (by others).

The existing stock pond upstream of Sterling Ranch Road will remain in place, with flows passing through the pond and leaving through an outlet structure. The major change in how the pond functions is the new design does not have a diversion structure along Sand Creek that routes flows around the existing pond. Due the narrow space between the proposed development and the existing stock pond, this portion of channel would require extensive reinforcement due to high shears and velocities. In order to maintain the water right for the pond, an outlet orifice structure will maintain a static water surface of 7038 ft and all flows above that elevation will pass undetained through the orifice structure and outfall into Pond W-3. Adding the existing stock pond as online storage directly upstream of Pond W-3 made a drastic difference in peak flows. The time of peak concentration at Sterling Ranch Road was only about 20 minutes different, but the additional storage volume attributed to the stock ponds reduced peak flows by 160 cfs and reduced the maximum volume of water by 1.3 ac-ft.

The proposed channel improvements begin just north of the Sterling Ranch southern property boundary and run north roughly two miles to the northern property boundary. The channel will include a 17 feet wide, 0.71 feet deep, meandering bankfull channel along with a 1% flood terrace along the east side that ranges from 80 feet to 120 feet wide. The straight sections of channel will be rock riffles, while the curves will be eddy pools. The new bankfull will be set

APPENDIX B

EXISTING CONDITIONS HYDROLOGIC CALCULATIONS

Design Point Peak Flow Rate Summary

Design Point	MDDP						MDDP Amendment						% Difference					
	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}
DP-73	225.9	380.7	618	957	1260.4	1582.3	171.2	503.09	791.79	1033.04	1414.41	1672.0	-32%	24%	22%	7%	11%	5%
DP-71	229.3	388.9	629.7	978.8	1277.3	1637.9	175	518.37	818.24	1068.91	1466.2	1734.9	-31%	25%	23%	8%	13%	6%
DP-69	253	434.8	707.7	1100	1453.3	1870.4	189.69	579.88	923.83	1213.68	1675.53	1988.4	-33%	25%	23%	9%	13%	6%
DP-63	251.4	430.7	713.1	1113.2	1496.2	1911.5	175.18	557.4	899.71	1192.36	1661.58	1980.7	-44%	23%	21%	7%	10%	3%
DP-10	36.5	56	106.4	162.9	220.6	287.2	32.32	93.36	146.19	189.33	255.2	300.1	-13%	40%	27%	14%	14%	4%
DP-9A	55.3	94.3	150.3	227.7	299.5	380.5	31.89	101.87	173.68	232.21	321.39	381.1	-73%	7%	13%	2%	7%	0%
DP-9	52.8	88.8	142.1	214.2	281	351.4	28.73	93.68	160.49	215.19	297.14	351.7	-84%	5%	11%	0%	5%	0%
DP-8A	7.7	15.2	27.1	44.2	60.5	78.4	0.56	17.3	31.43	42.65	59.34	70.5	-1275%	12%	14%	-4%	-2%	-11%
DP-8	24.2	45.1	77.8	124.4	169.5	220.9	1.97	50.28	115.07	167.23	245.12	297.4	-1128%	10%	32%	26%	31%	26%
DP-7	32.4	57.1	97.3	156.1	213.8	277.9	22.38	82.23	143.62	194.75	273.43	326.3	-45%	31%	32%	20%	22%	15%
DP-6	12.2	23.9	43.1	70.9	97	125.2	7.82	24.38	46.12	63.58	89.43	106.6	-56%	2%	7%	-12%	-8%	-17%
DP-5	0.5	1.7	4.5	9.4	14.5	20.5	1.18	9.36	20.8	29.82	42.58	50.9	58%	82%	78%	68%	66%	60%
DP-4	11.6	21.5	37.5	60.9	83.1	107.4	12.95	35.87	65.46	89.09	123.98	147.0	10%	40%	43%	32%	33%	27%
DP-3	1.1	1.8	2.8	4.3	5.6	7.1	0.0	0.69	1.71	2.52	3.71	4.5	-10900%	-161%	-64%	-71%	-51%	-57%
DP-2	4.8	7.9	12.4	18.7	24.5	30.9	0.0	4.41	10.85	15.93	23.17	27.9	-47900%	-79%	-14%	-17%	-6%	-11%
DP-1	5	8.2	13	19.6	25.7	32.2	0.0	4.88	11.82	17.63	25.97	31.5	-49900%	-68%	-10%	-11%	1%	-2%
DP-60A	247.7	430.2	707.1	1113	1496.6	1913.5	167.91	546.35	886.79	1179	1649.04	1969.2	-48%	21%	20%	6%	9%	3%
DP-56	23.2	42.5	71.9	115.6	157.4	202.9	0.35	40.19	96.37	141.51	207.98	242.9	-6529%	-6%	25%	18%	24%	16%
DP-53A	262.1	454	763.2	1196.5	1609.8	2061.5	182.68	602.01	983.58	1311.23	1837.86	2197.7	-43%	25%	22%	9%	12%	6%

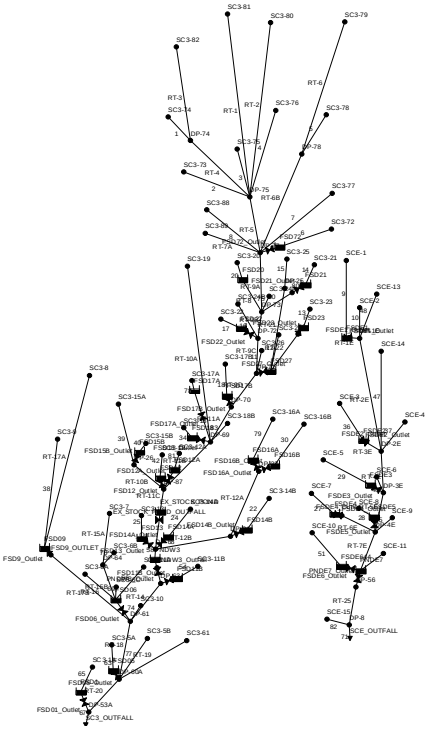
Design Point Total Runoff Volume Summary

Design Point	MDDP						MDDP Amendment						% Difference					
	V_2 (ac-ft)	V_5 (ac-ft)	V_{10} (ac-ft)	V_{25} (ac-ft)	V_{50} (ac-ft)	V_{100} (ac-ft)	V_2 (ac-ft)	V_5 (ac-ft)	V_{10} (ac-ft)	V_{25} (ac-ft)	V_{50} (ac-ft)	V_{100} (ac-ft)	V_2	V_5	V_{10}	V_{25}	V_{50}	V_{100}
DP-73	40.4	61.5	92.1	134.3	173.1	214.9	19.9	51.9	78.6	101.0	136.3	159.9	-103%	-19%	-17%	-33%	-27%	-34%
DP-71	42.5	64.9	97.1	141.6	182.5	226.6	20.7	54.6	82.6	106.2	143.6	168.5	-105%	-19%	-18%	-33%	-27%	-34%
DP-69	50.7	77.4	116.1	169.4	218.6	271.4	24.0	64.4	98.2	126.4	171.2	201.0	-111%	-20%	-18%	-34%	-28%	-35%
DP-63	54.1	82.5	123.8	180.8	233.3	289.9	25.9	69.7	105.9	136.3	184.4	216.4	-109%	-18%	-17%	-33%	-26%	-34%
DP-10	7.6	11.7	17.6	25.8	33.4	41.6	5.4	12.2	17.9	22.5	29.6	34.4	-41%	4%	1%	-15%	-13%	-21%
DP-9A	9.3	14.1	21.1	30.7	39.4	48.8	3.6	9.4	15.2	20.0	27.5	32.5	-159%	-50%	-39%	-53%	-43%	-50%
DP-9	8.4	12.7	19	27.6	35.5	44	3.0	8.1	13.4	17.7	24.4	28.9	-181%	-56%	-42%	-56%	-45%	-52%
DP-8A	1.3	2.1	3.4	5.2	7	8.9	0.1	1.7	3.2	4.3	6.0	7.1	-2153%	-21%	-8%	-22%	-17%	-25%
DP-8	4.4	7	11.1	16.8	22.3	28.4	0.2	4.9	10.3	14.5	21.0	25.3	-2483%	-43%	-8%	-15%	-6%	-12%
DP-7	6.1	10	15.9	24.3	32.4	41.3	3.1	10.3	17.6	23.6	32.8	39.0	-99%	3%	10%	-3%	1%	-6%
DP-6	2.4	4	6.3	9.6	12.7	16	1.0	2.7	4.8	6.5	9.2	10.9	-142%	-51%	-31%	-47%	-38%	-46%
DP-5	0.2	0.4	0.8	1.4	1.9	2.6	0.1	0.5	1.2	1.7	2.6	3.1	-160%	26%	34%	20%	26%	16%
DP-4	2.6	4.2	6.7	10.2	13.5	17.2	1.6	3.7	6.5	8.7	12.0	14.2	-64%	-12%	-3%	-17%	-12%	-21%
DP-3	0.1	0.2	0.3	0.5	0.6	0.8	0.0	0.1	0.2	0.2	0.3	0.4	-9900%	-231%	-98%	-123%	-79%	-97%
DP-2	0.6	0.9	1.4	2.1	2.7	3.4	0.0	0.3	0.7	1.0	1.5	1.8	-59900%	-236%	-108%	-111%	-82%	-88%
DP-1	0.6	0.9	1.3	1.9	2.5	3.1	0.0	0.2	0.6	0.9	1.4	1.7	-59900%	-263%	-110%	-106%	-83%	-86%
DP-60A	55.3	84.4	126.4	184.8	238.5	296.6	26.1	71.2	108.6	139.6	189.0	221.9	-112%	-19%	-16%	-32%	-26%	-34%
DP-56	4	6.3	9.9	14.9	19.8	25.1	0.1	4.0	8.7	12.6	18.2	22.0	-6352%	-58%	-13%	-19%	-9%	-14%
DP-53A	63	96.4	144.7	211.8	273.9	340.9	31.6	84.1	128.0	164.5	221.9	260.5	-99%	-15%	-13%	-29%	-23%	-31%

APPENDIX C

PROPOSED CONDITIONS HYDRAULIC CALCULATIONS

Sterling Ranch 2021 MDDP Amendment



Existing vs. Proposed Peak Flow Rate Design Point Summary

Design Point	Existing Q_2 (cfs)	Proposed Q_2 (cfs)	% Difference	Existing Q_5 (cfs)	Proposed Q_5 (cfs)	% Difference	Existing Q_{10} (cfs)	Proposed Q_{10} (cfs)	% Difference	Existing Q_{25} (cfs)	Proposed Q_{25} (cfs)	% Difference	Existing Q_{50} (cfs)	Proposed Q_{50} (cfs)	% Difference	Existing Q_{100} (cfs)	Proposed Q_{100} (cfs)	% Difference
DP-73	171.2	146.94	-14%	503.09	442.08	-12%	791.79	703.27	-11%	1033.04	919.42	-11%	1414.41	1258.08	-11%	1672.0	1501	-10%
DP-71	175	149.9	-14%	518.37	482.49	-7%	818.24	775.61	-5%	1068.91	1017.54	-5%	1466.2	1379.22	-6%	1734.9	1627.14	-6%
DP-69	189.69	152.58	-20%	579.88	535.56	-8%	923.83	871.26	-6%	1213.68	1149.22	-5%	1675.53	1564.42	-7%	1988.4	1827.02	-8%
DP-63	175.18	130.32	-26%	557.4	432.3	-22%	899.71	722.71	-20%	1192.36	980.68	-18%	1661.58	1347.87	-19%	1980.7	1580.46	-20%
DP-60A	167.91	141.82	-16%	546.35	487.69	-11%	886.79	814.13	-8%	1179	1106.07	-6%	1649.04	1538.1	-7%	1969.2	1889.36	-4%
DP-53A	182.7	141.85	-22%	602.01	488.28	-19%	983.58	816.56	-17%	1311.23	1108.96	-15%	1837.86	1541.94	-16%	2197.7	1895.22	-14%
DP-56	0.4	25.31	7131%	40.19	45.74	14%	96.37	65.36	-32%	141.51	84.3	-40%	207.98	121.98	-41%	242.9	144.77	-40%
DP-8	2.0	27.43	1292%	50.28	49.21	-2%	115.07	69.75	-39%	167.23	89.22	-47%	245.12	122.68	-50%	297.4	146.21	-51%

Existing vs. Proposed Total Runoff Volume Design Point Summary

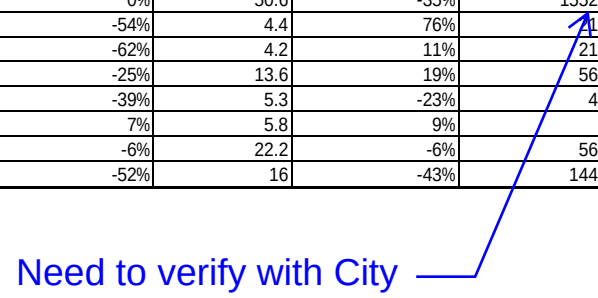
Design Point	Existing V_2 (ac-ft)	Proposed V_2 (ac-ft)	% Difference	Existing V_5 (ac-ft)	Proposed V_5 (ac-ft)	% Difference	Existing V_{10} (ac-ft)	Proposed V_{10} (ac-ft)	% Difference	Existing V_{25} (ac-ft)	Proposed V_{25} (ac-ft)	% Difference	Existing V_{50} (ac-ft)	Proposed V_{50} (ac-ft)	% Difference	Existing V_{100} (ac-ft)	Proposed V_{100} (ac-ft)	% Difference
DP-73	19.9	20.59	4%	51.9	52.17	1%	78.6	78.56	0%	101.0	100.66	0%	136.3	135.64	0%	159.9	158.97	-1%
DP-71	20.7	25.07	21%	54.6	60.76	11%	82.6	90.53	10%	106.2	115.39	9%	143.6	154.98	8%	168.5	181.37	8%
DP-69	24.0	29.22	22%	64.4	71.81	11%	98.2	107.10	9%	126.4	136.26	8%	171.2	181.37	6%	201.0	211.14	5%
DP-63	25.9	58.31	125%	69.7	124.60	79%	105.9	180.76	71%	136.3	226.48	66%	184.4	297.07	61%	216.4	343.71	59%
DP-60A	26.1	85.93	229%	71.2	170.63	140%	108.6	242.44	123%	139.6	301.06	116%	189.0	389.75	106%	221.9	448.06	102%
DP-53A	31.6	86.54	174%	84.1	171.55	104%	128.0	243.98	91%	164.5	302.90	84%	221.9	392.82	77%	260.5	451.12	73%
DP-56	0.1	31.30	50395%	4.0	46.34	1062%	8.7	59.84	584%	12.6	71.50	470%	18.2	89.00	389%	22.0	100.66	357%
DP-8	0.2	32.53	18999%	4.9	48.18	887%	10.3	62.60	511%	14.5	74.57	413%	21.0	93.29	344%	25.3	105.57	317%

Summary of Peak Discharges						
Design Point 75						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	141	235	377	567	751	951
2021 Existing Cond. (cfs)						971
2018 Developed Cond. (cfs)	141	235	377	567	751	951
2021 Developed Cond. (cfs)	95	275	428	555	754	888
Design Point 77						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	n/a	n/a	n/a	n/a	n/a	n/a
2021 Existing Cond. (cfs)						
2018 Developed Cond. (cfs)	210	352	581	887	1168	1468
2021 Developed Cond. (cfs)	144	428	674	880	1204	1428
1996 DBPS Existing Cond. (cfs)						2193
1996 DBPS Developed Cond. (cfs)						2262
Design Point 73						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	226	381	618	957	1260	1582
2021 Existing Cond. (cfs)						1672
2018 Developed Cond. (cfs)	208	354	589	897	1187	1507
2021 Developed Cond. (cfs)	147	442	703	919	1258	1501
Design Point 71						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	229	389	630	979	1277	1638
2021 Existing Cond. (cfs)						1735
2018 Developed Cond. (cfs)	206	349	611	932	1227	1612
2021 Developed Cond. (cfs)	150	482	776	1018	1379	1627
Design Point 69						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	253	435	708	1100	1453	1870
2021 Existing Cond. (cfs)						1988
2018 Developed Cond. (cfs)	213	367	654	1011	1364	1776
2021 Developed Cond. (cfs)	153	536	871	1149	1564	1827
Design Point 68						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	n/a	n/a	n/a	n/a	n/a	n/a
2021 Existing Cond. (cfs)						
2018 Developed Cond. w/o Pnd (cfs)	215	375	715	1188	1675	2204
2021 Developed Cond. (cfs)						
2018 Developed w/Pnd (cfs) Pnd W3	154	200	367	800	1086	1351
2021 Developed Cond. w/ Pnd(cfs)	98	513	952	1336	1863	2202
Design Point 63						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	251	431	713	1113	1496	1912
2021 Existing Cond. (cfs)						1981
2018 Developed Cond. w/o Pnd (cfs)	213	373	721	1198	1705	2237
2018 Developed w/Pnd (cfs)	154	201	376	816	1112	1385
2021 Developed Cond. w/ Pnd(cfs)	130	432	723	981	1348	1580
2011 Wilson (cfs)			1066			1791
1996 DBPS Existing Cond. (cfs)						2508
1996 DBPS Developed Cond. (cfs)						2689
Design Point 61						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	n/a	n/a	n/a	n/a	n/a	n/a
2018 Developed Cond. w/o Pnd (cfs)	214	375	783	1370	1967	2607
2018 Developed w/Pnd (cfs)	157	224	428	928	1287	1620
2021 Developed Cond. w/ Pnd(cfs)						1913
2011 Wilson (cfs)			1232			2087
Design Point 60a						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	248	430	707	1113	1497	1914
2021 Existing Cond. (cfs)						1969
2018 Developed Cond. w/o Pnd (cfs)	216	378	795	1395	2004	2645
2018 Developed w/Pnd (cfs)	162	225	439	950	1321	1662
2021 Developed Cond. w/ Pnd(cfs)	133	480	802	1091	1518	1873
2011 Wilson (cfs)			1265			2133
1996 DBPS Existing Cond. (cfs)						2629
1996 DBPS Developed Cond. (cfs)						3295
Design Point 53a						
Storm Event (YR)	2	5	10	25	50	100
2016 Existing Cond. (cfs)	262	454	763	1197	1610	2062
2021 Existing Cond. (cfs)						2198
2018 Developed Cond. w/o Pnd (cfs)	215	378	792	1392	2009	2657
2018 Developed w/Pnd (cfs)	162	226	442	951	1326	1669
2021 Developed Cond. w/ Pnd(cfs)	142	488	817	1109	1542	1895

MDDP Proposed vs. Amendment Proposed Peak Flow Rate Design Point Summary																		
Design Point	MDDP Q_2 (cfs)	Amend Q_2 (cfs)	% Difference	MDDP Q_5 (cfs)	Amend Q_5 (cfs)	% Difference	MDDP Q_{10} (cfs)	Amend Q_{10} (cfs)	% Difference	MDDP Q_{25} (cfs)	Amend Q_{25} (cfs)	% Difference	MDDP Q_{50} (cfs)	Amend Q_{50} (cfs)	% Difference	MDDP Q_{100} (cfs)	Amend Q_{100} (cfs)	% Difference
DP-74	39.3	33.68	-14%	65.3	94.55	45%	104.8	145.74	39%	158.9	187.2	18%	209.1	251.03	20%	262.8	293.76	12%
DP-75	141.2	95.13	-33%	235.1	274.57	17%	376.6	427.98	14%	566.6	555.2	-2%	750.9	754.29	0%	950.5	887.87	-7%
DP-77	209.9	144.36	-31%	351.9	427.54	21%	580.6	674.49	16%	886.6	880.04	-1%	1168.4	1204.35	3%	1467.7	1427.72	-3%
DP-78	59.7	52.82	-12%	98.4	138.33	41%	154	210.37	37%	232.6	269.64	16%	306.2	360.98	18%	385.3	422.09	10%
DP-73	207.5	146.94	-29%	354.3	442.08	25%	588.5	703.27	20%	897.1	919.42	2%	1187.2	1258.08	6%	1506.7	1501	0%
DP-72	206.2	148.81	-28%	352.5	452.4	28%	586.7	721.06	23%	897.2	943.85	5%	1195.3	1288.24	8%	1518.6	1533.04	1%
DP-71	205.9	149.9	-27%	349.3	482.49	38%	610.5	775.61	27%	932.4	1017.54	9%	1226.9	1379.22	12%	1612.2	1627.14	1%
DP-70	205.3	150.16	-27%	349.8	487.36	39%	614	785.02	28%	940.1	1030.45	10%	1260.6	1398.64	11%	1636.7	1648.68	1%
DP-69	212.7	152.58	-28%	366.6	535.56	46%	653.7	871.26	33%	1010.6	1149.22	14%	1364.1	1564.42	15%	1775.7	1827.02	3%
DP-87	216.9	150.04	-31%	374.6	557.29	49%	681.9	918.47	35%	1072.1	1216.59	13%	1471.5	1696.05	15%	1905.9	2011.71	6%
DP-68	214.6	98.39	-54%	374.5	512.95	37%	714.9	951.59	33%	1187.6	1335.56	12%	1674.9	1863.02	11%	2204.1	2202.16	0%
DP-64	85.9	91.34	6%	112.1	135.67	21%	145.9	170.56	17%	187.5	198.05	6%	222.6	238.16	7%	258	264.76	3%
DP-63	154.4	130.32	-16%	201	432.3	115%	375.7	722.71	92%	815.9	980.68	20%	1112.1	1347.87	21%	1385.1	1580.46	14%
DP-61	156.6	133.17	-15%	223.9	479.78	114%	428	802.47	87%	928.2	1091.45	18%	1287.3	1518.06	18%	1620.1	1873.16	16%
DP-60A	161.6	141.82	-12%	224.8	487.69	117%	439.1	814.13	85%	950.4	1106.07	16%	1320.5	1538.1	16%	1661.8	1889.36	14%
DP-53A	161.6	141.85	-12%	225.7	488.28	116%	441.8	816.56	85%	951.1	1108.96	17%	1326	1541.94	16%	1668.9	1895.22	14%
DP-1E	23.9	12.41	-48%	38.3	29.33	-23%	70.1	43.32	-38%	132.8	54.71	-59%	173	72.19	-58%	220.9	83.88	-62%
DP-2E	48.9	25	-49%	76.8	56.23	-27%	123	82.19	-33%	228.7	103.33	-55%	319.7	135.83	-58%	419.4	157.53	-62%
DP-3E	48.5	27.53	-43%	75.7	60.36	-20%	122.2	88.05	-28%	271.1	111.2	-59%	387.1	160.33	-59%	500.1	205.49	-59%
DP-4E	48.1	29.33	-39%	76.2	63.53	-17%	122.4	93.04	-24%	286.9	117.69	-59%	407.3	169.81	-58%	534.8	214.58	-60%
DP-56	23.1	25.31	10%	35.3	45.74	30%	71.5	65.36	-9%	108.3	84.3	-22%	152.1	121.98	-20%	196.4	144.77	-26%
DP-8	24.1	27.43	14%	37.2	49.21	32%	73.5	69.75	-5%	111.3	89.22	-20%	155.4	122.68	-21%	200.7	146.21	-27%
DP-21	0.6	83.26	13777%	8.8	135.34	1438%	17.8	157.62	786%	57.1	168.07	194%	116.8	175.88	51%	174.9	175.87	1%
DP-22	0.6	64.01	10568%	8.8	116.13	1220%	17.6	138.34	686%	56.8	148.78	162%	105.1	156.5	49%	156.4	156.5	0%
DP-25	5.9	5.48	-7%	9.1	11.81	30%	16.3	17.01	4%	35.1	21.07	-40%	46.4	27.2	-41%	58.2	31.29	-46%
DP-26	0.1	14.77	14670%	1.1	42.79	3790%	3.2	70.03	2088%	7.3	91.26	1150%	9.5	122.38	1188%	12	143.11	1093%
EX_STOCK_POND_1		140.25			536.6			892.43			1190.7			1663.93			1977.61	
EX_STOCK_POND_2		150.16			487.36			785.02			1030.45			1398.64			1648.68	
PNDE7	46.5	33.38	-28%	75.4	70.58	-6%	121.2	103.35	-15%	285.2	130.43	-54%	402.4	203.13	-50%	548	263.89	-52%
PNDW3	214.6	98.39	-54%	374.5	512.95	37%	714.9	951.59	33%	1187.6	1335.56	12%	1674.9	1863.02	11%	2204.1	2202.16	0%

MDDP Proposed vs. Amendment Total Runoff Volume Proposed Design Point Summary																		
Design Point	MDDP V_2 (ac-ft)	Amend V_2 (ac-ft)	% Difference	MDDP V_5 (ac-ft)	Amend V_5 (ac-ft)	% Difference	MDDP V_{10} (ac-ft)	Amend V_{10} (ac-ft)	% Difference	MDDP V_{25} (ac-ft)	Amend V_{25} (ac-ft)	% Difference	MDDP V_{50} (ac-ft)	Amend V_{50} (ac-ft)	% Difference	MDDP V_{100} (ac-ft)	Amend V_{100} (ac-ft)	% Difference
DP-74	5.9	3.03	-49%	9	7.67	-15%	13.6	11.57	-15%	19.8	14.82	-25%	25.5	20.04	-21%	31.6	23.51	-26%
DP-75	22.7	11.05	-51%	34.5	28.82	-16%	51.7	43.58	-16%	75.4	56.16	-26%	97.1	75.80	-22%	120.5	89.00	-26%
DP-77	37.7	18.87	-50%	57.4	48.80	-15%	85.9	73.35	-15%	125.1	94.21	-25%	161.1	127.05	-21%	199.9	148.84	-26%
DP-78	8.9	4.91	-45%	13.5	11.69	-13%	20.1	17.40	-13%	29.3	22.25	-24%	37.7	29.86	-21%	46.7	34.99	-25%
DP-73	40	20.59	-49%	60.8	52.17	-14%	91	78.56	-14%	132.5	100.66	-24%	170.7	135.64	-21%	211.7	158.97	-25%
DP-72	41.3	21.39	-48%	62.9	54.01	-14%	94	81.02	-14%	136.8	103.73	-24%	176.2	139.94	-21%	218.5	163.88	-25%
DP-71	46.3	25.07	-46%	70	60.76	-13%	104.3	90.53	-13%	151.3	115.39	-24%	194.5	154.98	-20%	240.8	181.37	-25%
DP-70	49.5	27.07	-45%	74.5	63.53	-15%	110.6	93.91	-15%	160.1	119.38	-25%	205.4	159.58	-22%	254	186.59	-27%
DP-69	57.5	29.22	-49%	86.1	71.81	-17%	127.4	107.10	-16%	183.8	136.26	-26%	235.3	181.37	-23%	290.6	211.14	-27%
DP-87	66.5	36.52	-45%	98.9	85.01	-14%	145.6	125.21	-14%	209.1	158.35	-24%	267.1	209.60	-22%	329.1	243.67	-26%
DP-68	81.8	52.17	-36%	123.7	116.00	-6%	183.9	170.02	-8%	264.9	214.21	-19%	338	282.34	-16%	415.8	328.37	-21%
DP-64	7	7.58	8%	9.1	10.25	13%	11.8	12.52	6%	15.2	14.33	-6%	18.1	17.03	-6%	21.1	18.87	-11%
DP-63	85.6	58.31	-32%	129.5	124.60	-4%	192.3	180.76	-6%	276.7	226.48	-18%	352.8	297.07	-16%	433.5	343.71	-21%
DP-61	103.7	77.34	-25%	157.8	157.74	0%	235.1	225.56	-4%	338.4	280.80	-17%	431.3	365.20	-15%	529.8	420.44	-21%
DP-60A	111	85.93	-23%	168.6	170.63	1%	250.4	242.44	-3%	359.5	301.06	-16%	457.7	389.75	-15%	561.5	448.06	-20%
DP-53A	112	86.54	-23%	170	171.55	1%	252.6	243.98	-3%	362.6	302.90	-16%	461.7	392.82	-15%	566.5	451.12	-20%
DP-1E	3.1	2.48	-20%	5.2	5.19	0%	8.4	7.73	-8%	12.7	10.00	-21%	16.6	13.56	-18%	20.9	15.96	-24%
DP-2E	6.1	6.20	2%	10.4	11.94	15%	16.9	17.25	2%	25.7	21.76	-15%	33.7	28.79	-15%	42.2	33.45	-21%
DP-3E	7	14.58	108%	13.7	23.17	69%	23.4	31.00	32%	36.1	37.75	5%	47.4	47.87	1%	59.3	54.63	-8%
DP-4E	7.6	20.87	175%	15.6	31.30	101%	27.2	41.12	51%	43	49.10	14%	57.2	61.38	7%	72	69.66	-3%
DP-56	7.7	31.30	307%	16.1	46.34	188%	28.6	59.84	109%	51.3	71.50	39%	71.7	89.00	24%	92.9	100.66	8%
DP-8	8	32.53	307%	16.7	48.18	189%	26.6	62.60	135%	53	74.57	41%	74	93.29	26%	95.9	105.57	10%
DP-21	6.3	18.90	200%	11.3	28.63	153%	18.3	37.13	103%	27.5	44.19	61%	35.6	54.63	53%	44	61.68	40%
DP-22	6.3	14.58	131%	10.7	22.19	107%	16.7	28.91	73%	24.6	34.37	40%	31.5	42.35	34%	38.7	47.87	24%
DP-25	1.3	0.40	-69%	1.9	0.79	-58%	2.8	1.12	-60%	4.1	1.40	-66%	5.2	1.84	-65%	6.4	2.14	-67%
DP-26	0.7	1.86	166%	0.9	4.79	432%	1.2	7.24	504%	1.5	9.33	522%	1.8	12.58	599%	2.1	14.79	604%

Full Spectrum Detention Pond Updates											
MDDP By M&S				Proposed Designs By JR & Others							
Name	Peak Inflow	Stored Volume	Peak Release Rate	Name	Design Firm	Peak Inflow	Percent Difference	Stored Volume	Percent Difference	Peak Release Rate	Percent Difference
	100-YR (cfs) From MDDP By M&S	100-YR (ac-ft)	100-YR (cfs)			100-YR (cfs) From MDDP By JR		100-YR (ac-ft)		100-YR (cfs)	
FSD1	68.9	2.2	25.4		Unchanged	77.21	12%	2.3	5%	25.4	0%
FSD5	129.1	5.2	30.1	Pond 1	Matrix	150.8	17%	6.2	19%	3.7	-88%
FSD6	608.6	26.0	149.6	Pond W-6	JR	597.1	-2%	24.6	-5%	139.3	-7%
FSD9	410.1	13.8	289.9	Pond W-4	JR	386	-6%	10.8	-22%	264.75	-9%
FSD11A	24.3	0.6	12.3	Removed							
FSD11B	213.7	8.2	69.5		JR	209.4	-2%	6.7	-18%	77	11%
FSD12	270.0	8.9	103.1	Pond 4	M&S	205.1	-24%	5.8	-35%	103.1	0%
Added - FSD12A				Pond 1	M&S	48.9		1.4		23.4	
FSD13	136.9	5.0	47.2	Pond 8	M&S	153.6	12%	5.1	2%	43.8	-7%
FSD14A	466.3	17.3	142.2		JR	425.6	-9%	16.6	-4%	176.2	24%
FSD14B	94.1	3.8	19.3		Unchanged	215.7	129%	10.2	168%	19.3	0%
FSD15B	31.9	1.0	12		Unchanged	24	-25%	3.1	210%	12	0%
FSD16A	351.8	13.8	128.3		JR	579.1	65%	17.5	27%	128.3	0%
FSD16B	143.8	5.8	28.1		JR	143.8	0%	6.7	16%	28.2	0%
FSD17	180.6	4.7	86.1	Pond C	JR	74.0	-59%	2.7	-43%	26.7	-69%
Added - FSD17B				Pond B	JR	69.3		2.8		24.3	
FSD18	174	5.3	69.6	Pond A	JR	75.5	-57%	2.9	-45%	32.2	-54%
FSD20	56.6	1.2	42.4		Unchanged	62.9	11%	0.5	-58%	44.35	5%
FSD21	37.5	0.8	30.1		Unchanged	51.3	37%	0.9	13%	30.3	1%
FSD22	52.6	1.0	43.8	Pond 1	Classic	56.5	7%	1.5	50%	24	-45%
FSD23	28.4	0.6	18.6		Unchanged	22.6	-20%	0.1	-83%	21.17	14%
FSD27	206.3	4.2	161.9	Pond 2	Classic	167.3	-19%	6.9	64%	91.9	-43%
FSD72	76.0	1.3	73.4		Unchanged	68.7	-10%	1.2	-8%	62.1	-15%
Added				EX Stock Pond 1	JR	1977.6		36.0		1897.2	
Added				EX stock Pond 2		1648.7		8.7		1644.8	
PNDW3	2204.1	78.2	1350.6		JR	2202.2	0%	50.6	-35%	1552.53	15%
FSD-E1	127.4	2.5	84		Unchanged	58.5	-54%	4.4	76%	21.81	-74%
FSD-E2	143.9	3.8	74.7		Unchanged	54.7	-62%	4.2	11%	21.11	-72%
FSD-E3	298.4	11.4	101.3		Unchanged	224.7	-25%	13.6	19%	56.99	-44%
FSD-E4	165.2	6.9	43.6		Unchanged	101.3	-39%	5.3	-23%	4.91	-89%
FSD-E5	99.9	5.3	10		Unchanged	106.6	7%	5.8	9%	3.8	-62%
FSD-E6	467.5	23.7	123.3		Unchanged	441.6	-6%	22.2	-6%	56.78	-54%
PND-E7	548	28.0	196.4		Unchanged	263.9	-52%	16	-43%	144.77	-26%



APPENDIX D

REFERENCE MATERIAL

STERLING RANCH
RETENTION POND VOLUME

(Pond Volume Calculation)

BIG POND

Elevation	SF	CF	Storage AF	Storage Sum
7028	0.00	-		0
7030	53,785.00	53,785.00	1.23	1.23
7032	70,507.00	124,292.00	2.85	4.09
7034	87,672.00	158,179.00	3.63	7.72
7036	109,612.00	197,284.00	4.53	12.25

Total = 533,540 CF

Total = 12.25 Ac-ft

At Elevation 7035, the Storage is 9.98 Ac-ft.
At Elevation 7034, the Storage is 7.72 Ac-ft.

Calculated by: VAS

Date: 4/21/2016

Checked by: VAS

STERLING RANCH

"BIG POND"

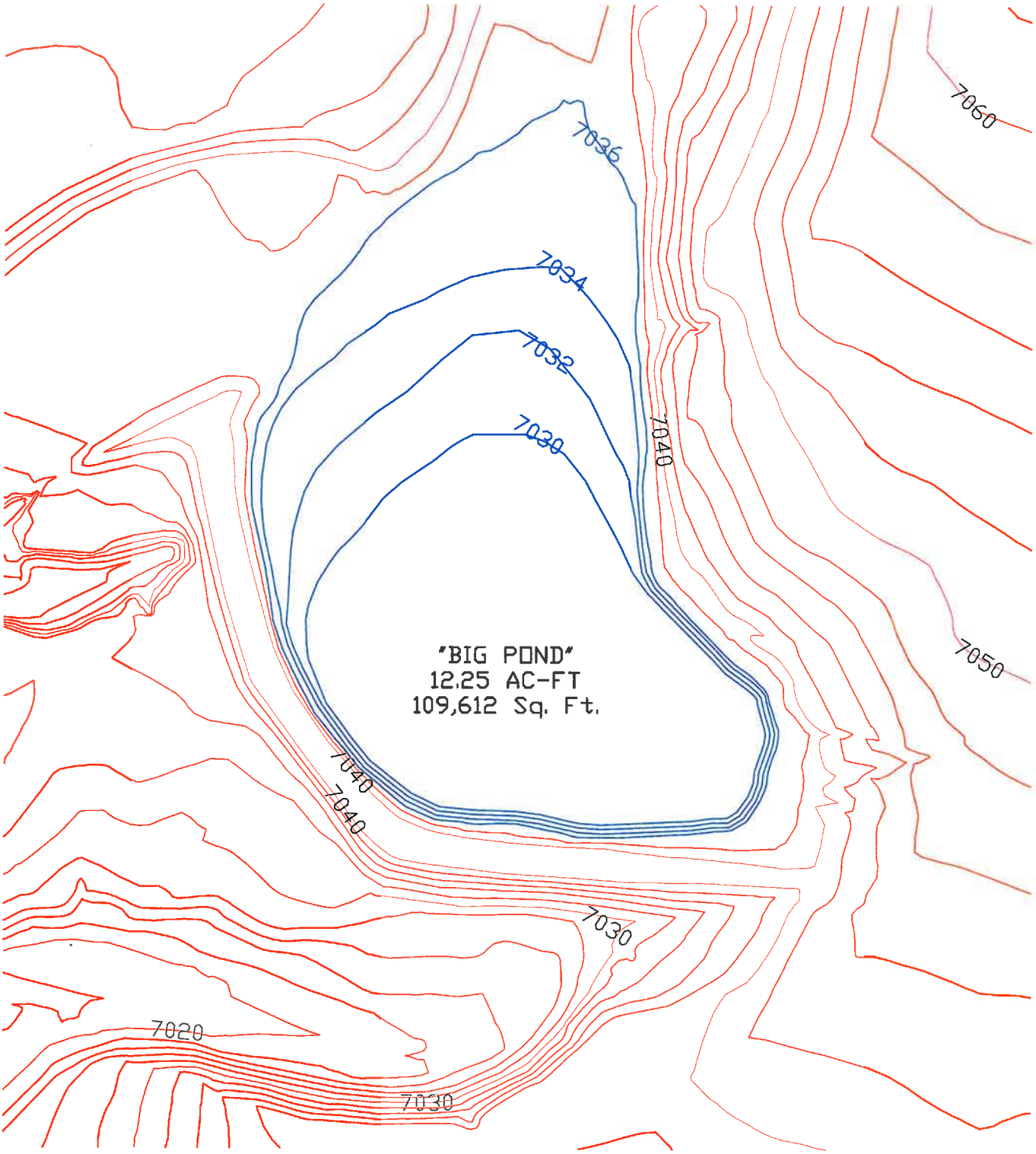


EXHIBIT
STERLING RANCH
JOB NO. 09-001
DATE PREPARED: 4-25-16
DATE REVISED:

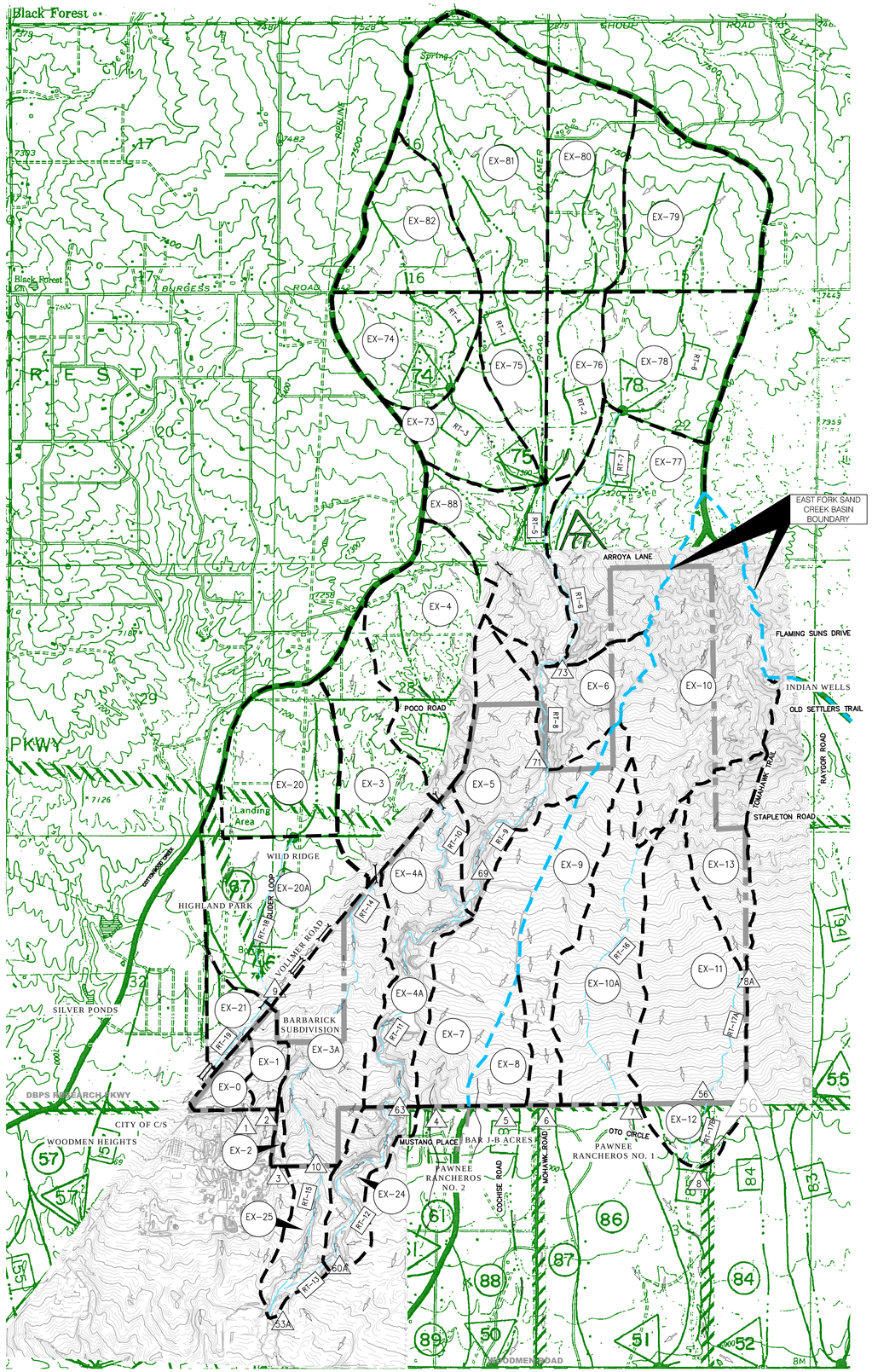
CIVIL CONSULTANTS, INC.

20 BOULDER CRESCENT, STE. 110
COLORADO SPRINGS,
COLORADO 80903

v 719.955.5485
f 719.444.8427

APPENDIX E

DRAINAGE MAPS



0 600 1200 2400

Scale in Feet

LEGEND

BASIN ID – SC3–77

DESIGN POINT – 87

REACH IDENTIFIER – RT–17A

BASIN BOUNDARY –

EAST FORK SAND CREEK BASIN BOUNDARY –

FLOW DIRECTION –

BASIN SUMMARY

BASIN	CN	AREA (ACRES)	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)
EX–0	62	23.8	0.037	5.0	8.2	13.0	19.6	25.7	32.2
EX–1	62	25.7	0.040	4.8	7.9	12.4	18.7	24.5	30.9
EX–2	62	5.5	0.009	1.1	1.8	2.8	4.3	5.6	7.1
EX–3	62	136.8	0.214	22.0	36.4	57.6	86.9	114.0	143.1
EX–3A	61	188.1	0.294	28.3	47.4	75.7	115.1	152.2	192.6
EX–4	62	192.0	0.300	30.1	49.9	79.1	119.5	157.0	197.3
EX–4A	62	151.5	0.237	24.7	40.8	64.4	97.0	127.2	160.1
EX–5	62	153.9	0.240	24.2	40.0	63.4	95.9	125.9	158.2
EX–6	62	90.2	0.141	15.3	25.5	40.1	60.7	79.9	100.5
EX–7	56	165.0	0.258	11.6	21.5	37.5	60.9	83.1	107.4
EX–8	45	42.0	0.066	0.5	1.7	4.5	9.4	14.5	20.5
EX–9	54	131.9	0.206	12.2	23.9	43.1	70.9	97.0	125.2
EX–10	60	270.7	0.423	32.7	56.0	91.1	140.1	185.9	236.1
EX–10A	41	179.3	0.280	0.6	2.2	7.3	17.4	29.1	43.1
EX–11	43	209.3	0.327	18.0	29.8	47.7	73.4	98.3	126.1
EX–12	51	39.5	0.062	2.2	5.1	10.1	17.7	25.1	33.3
EX–13	55	89.3	0.139	7.7	15.2	27.1	44.2	60.5	78.4
EX–20	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
EX–20A	64	179.7	0.281	32.2	51.9	80.5	119.8	155.9	194.6
EX–21	65	33.3	0.052	8.6	13.5	20.7	30.5	39.4	49.0
EX–24	59	63.1	0.099	9.5	16.6	27.5	42.9	57.4	73.0
EX–25	43	54.4	0.085	0.3	1.5	4.8	10.7	17.2	25.1
EX–73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
EX–74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
EX–75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
EX–76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
EX–77	62	230.6	0.360	34.7	56.9	90.6	137.5	180.9	227.7
EX–78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
EX–79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
EX–80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
EX–81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
EX–82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3
EX–88	62	139.2	0.217	22.2	36.7	58.0	87.6	115.0	144.4

DESIGN POINT SUMMARY (PEAK FLOW)

DESIGN POINT	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)	LOCATION
DP–74	0.371	39.3	65.3	104.8	158.9	209.1	262.8	
DP–75	1.413	141.2	235.1	376.6	566.6	750.9	950.5	
DP–78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP–73	2.528	225.9	380.7	618.0	957.0	1260.4	1582.3	
DP–71	2.669	229.3	388.9	629.7	978.8	1277.3	1637.9	STERLING RANCH NORTHERN BNDRY
DP–69	3.209	253.0	434.8	707.7	1100.0	1453.3	1870.4	
DP–63	3.446	251.4	430.7	713.1	1113.2	1496.2	1911.5	STERLING RANCH SOUTHERN BNDRY
DP–10	0.508	36.5	56.0	106.4	162.9	220.6	287.2	COLORADO SPRINGS/EL PASO BNDRY
DP–9A	0.557	55.3	94.3	150.3	227.7	299.5	380.5	VOLLMER/TAHITI DRIVE
DP–9	0.505	52.8	88.8	142.1	214.2	281.0	351.4	VOLLMER/LOCHWINNOCH LN
DP–8A	0.139	7.7	15.2	27.1	44.2	60.5	78.4	D/S STERLING RANCH EASTERN BNDRY
DP–8	0.528	24.2	45.1	77.8	124.4	169.5	220.9	D/S STERLING RANCH SOUTHERN BNDRY
DP–7	0.703	32.4	57.1	97.3	156.1	213.8	277.9	STERLING RANCH SOUTHERN BNDRY
DP–6	0.206	12.2	23.9	43.1	70.9	97.0	125.2	STERLING RANCH SOUTHERN BNDRY
DP–5	0.066	0.5	1.7	4.5	9.4	14.5	20.5	STERLING RANCH SOUTHERN BNDRY
DP–4	0.258	11.6	21.5	37.5	60.9	83.1	107.4	STERLING RANCH SOUTHERN BNDRY
DP–3	0.009	1.1	1.8	2.8	4.3	5.6	7.1	STERLING RANCH SOUTHERN BNDRY
DP–2	0.040	4.8	7.9	12.4	18.7	24.5	30.9	STERLING RANCH SOUTHERN BNDRY
DP–1	0.037	5.0	8.2	13.0	19.6	25.7	32.2	STERLING RANCH SOUTHERN BNDRY
DP–60A	3.545	247.7	430.2	707.1	1113.0	1496.6	1913.5	FUTURE MARKSHEFFEL X–ING
DP–56	0.466	23.2	42.5	71.9	115.6	157.4	202.9	STERLING RANCH SOUTHERN BNDRY
DP–53A	4.138	262.1	454.0	763.2	1196.5	1609.8	2061.5	SAND CREEK AND POND 3

DESIGN POINT SUMMARY (VOLUME)

DESIGN POINT	AREA (SQ MI)	V_2 (AC–FT)	V_5 (AC–FT)	V_{10} (AC–FT)	V_{25} (AC–FT)	V_{50} (AC–FT)	V_{100} (AC–FT)	LOCATION
DP–74	0.371	5.9	9.0	13.6	19.8	25.5	31.6	
DP–75	1.413	22.7	34.5	51.7	75.4	97.1	120.5	
DP–78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP–73	2.528	40.4	61.5	92.1	134.3	173.1	214.9	
DP–71	2.669	42.5	64.9	97.1	141.6	182.5	226.6	STERLING RANCH NORTHERN BNDRY
DP–69	3.209	50.7	77.4	116.1	169.4	218.6	271.4	
DP–63	3.446	54.1	82.5	123.8	180.8	233.3	289.9	STERLING RANCH SOUTHERN BNDRY
DP–10	0.508	7.6	11.7	17.6	25.8	33.4	41.6	COLORADO SPRINGS/EL PASO BNDRY
DP–9A	0.557	9.3	14.1	21.1	30.7	39.4	48.8	VOLLMER/TAHITI DRIVE
DP–9	0.505	8.4	12.7	19.0	27.6	35.5	44.0	VOLLMER/LOCHWINNOCH LN
DP–8A	0.139	1.3	2.1	3.4	5.2	7.0	8.9	D/S STERLING RANCH EASTERN BNDRY
DP–8	0.528	4.4	7.0	11.1	16.8	22.3	28.4	D/S STERLING RANCH SOUTHERN BNDRY
DP–7	0.703	6.1	10.0	15.9	24.3	32.4	41.3	STERLING RANCH SOUTHERN BNDRY
DP–6	0.206	2.4	4.0	6.3	9.6	12.7	16.0	STERLING RANCH SOUTHERN BNDRY
DP–5	0.066	0.2	0.4	0.8	1.4	1.9	2.6	STERLING RANCH SOUTHERN BNDRY
DP–4	0.258	2.6	4.2	6.7	10.2	13.5	17.2	STERLING RANCH SOUTHERN BNDRY
DP–3	0.009	0.1	0.2	0.3	0.5	0.6	0.8	STERLING RANCH SOUTHERN BNDRY
DP–2	0.040	0.6	0.9	1.4	2.1	2.7	3.4	STERLING RANCH SOUTHERN BNDRY
DP–1	0.037	0.6	0.9	1.3	1.9	2.5	3.1	STERLING RANCH SOUTHERN BNDRY
DP–60A	3.545	55.3	84.4	126.4	184.8	238.5	296.6	FUTURE MARKSHEFFEL X–ING
DP–56	0.466	4.0	6.3	9.9	14.9	19.8	25.1	SAND CREEK AND POND 3
DP–53A	4.138	63.0	96.4	144.7	211.8	273.9	340.9	SAND CREEK AND POND 3

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (SQ MI)	Q_{10} (CFS)	Q_{100} (CFS)
DP–50	0.32	47.0	195.7
DP–51 (BASIN 86)	0.33	17.7	74.1
DP–52	1.67	80.5	456.5
DP–56	0.79	63.6	265.0

Values reported from SCDBPS
(DP 50, 51, 52 Not analyzed as a part of this study)
DBPS Reach 85(Basin91)=Q10=28.8cfs Q100=115.2cfs

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2018 STERLING RANCH MDDP

EXISTING HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09–002
FILE: \dwg\Eng Exhibits\2018–MDDP–ExistCondWSWrkMap.dwg
DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS
SCALE
HORIZ: NTS
VERT: NTS
DATE: 08–22–18

DM1

File: O:\09002A\Sterling Ranch District\dwg\Eng Exhibits\2018 MDDP\2018–MDDP–ExistCondWSWrkMap.dwg Plotstamp: 11/13/2018 1:52 PM

Proposed Conditions Design Point Summary		
	Peak Flow	Volume
Design Point	Q_{100} (cfs)	V_{100} (ac-ft)
DP-74	293.8	23.5
DP-75	887.9	89.0
DP-77	1427.7	148.8
DP-78	422.1	35.0
DP-73	1501.0	159.0
DP-72	1533.0	163.9
DP-71	1627.1	181.4
DP-70	1648.7	186.6
DP-69	1827.0	211.1
DP-87	2011.7	243.7
DP-68	2202.2	328.4
DP-64	264.8	18.9
DP-63	1580.5	343.7
DP-61	1873.2	420.4
DP-60A	1889.4	448.1
DP-53A	1895.2	451.1
DP-1E	83.9	16.0
DP-2E	157.5	33.5
DP-3E	205.5	54.6
DP-4E	214.6	69.7
DP-56	144.8	100.7
DP-8	146.2	105.6
DP-21	175.9	61.7
DP-22	156.5	47.9
DP-25	31.3	2.1
DP-26	143.1	14.8

Proposed Conditions Basin Summary	
Basin	Q_{100} (cfs)
SC3-1A	75.4
SC3-5A	150.8
SC3-5B	203.1
SC3-6A	165.7
SC3-6B	101.3
SC3-6C	179.7
SC3-7	166.7
SC3-8	195.4
SC3-9	225.8
SC3-10	48.7
SC3-11A	18.8
SC3-11B	209.4
SC3-12	205.1
SC3-12A	48.9
SC3-13	153.6
SC3-14A	425.6
SC3-14B	215.7
SC3-15A	133.3
SC3-15B	24.0
SC3-16A	579.1
SC3-16B	143.8
SC3-17	74.0
SC3-17B	69.3
SC3-18	75.5
SC3-18B	63.2
SC3-19	213.5
SC3-20	62.9
SC3-21	51.3
SC3-22	56.5
SC3-23	22.6
SC3-24A	42.6
SC3-24B	16.5
SC3-25	31.3
SC3-26	9.0
SC3-27	130.7
SC3-61	74.6
SC3-72	68.7
SC3-73	99.0
SC3-74	151.9
SC3-75	75.4
SC3-76	79.4
SC3-77	86.4
SC3-78	219.2
SC3-79	239.3
SC3-80	168.2
SC3-81	256.3
SC3-82	159.0
SC3-88	59.5
SC3-89	33.7
SCE-1	58.5
SCE-2	83.6
SCE-3	54.7
SCE-4	72.2
SCE-5	244.7
SCE-6	2.4
SCE-7	153.7
SCE-8	106.6
SCE-9	2.9
SCE-10	441.6
SCE-11	10.5
SCE-13	73.9
SCE-14	54.3
SCE-15	69.5

SWMM BASIN

SWMM DETENTION POND

SWMM DESIGN POINT

PREVIOUS EAST FORK BASIN TRANSFER AREA

ADDITIONAL EAST FORK BASIN TRANSFER AREA

EAST FORK BASIN BOUNDARY

2018 MDDP DRAINAGE BASIN BOUNDARY

2021 MODIFIED DRAINAGE BASIN BOUNDARY

See comments on MDDP Plan

PROPOSED DRAINAGE MAP
SAND CREEK MDDP AMENDMENT
JOB NO. 25188.04
08/17/21
SHEET 1 OF 1

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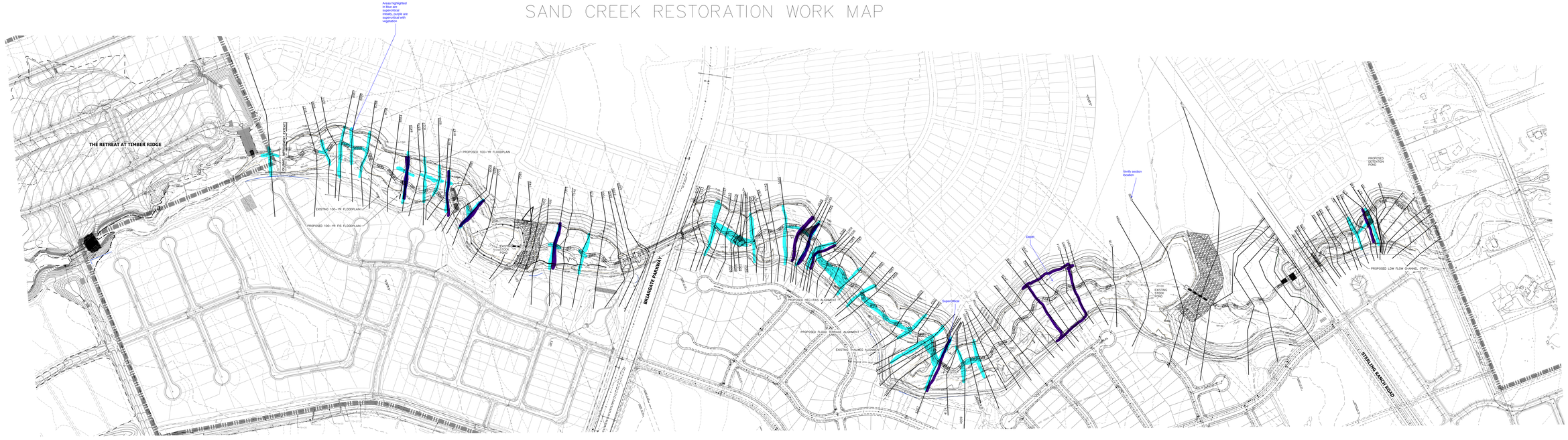
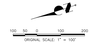
X:\25100\00.all\25188\04\SWMM\Baseflies\25188\04 SWMM Prop Conditions Baseflie Map.dwg, Layout1, 10/18/2021 10:29:01 AM, vaughtd

Appendix E

Work Map

SAND CREEK RESTORATION WORK MAP





HEC-RAS WORK MAP
SAND CREEK RESTORATION
DRAWN BY: CHECKED BY:
DATE: 10.02.2020
SHEET 1 OF 1