

Hydrology and Hydraulics Report

Big Meadow Bridge #0064
over
Meadow Brook

T8 R3 NBPP, Maine

2727000
WIN 27270.00



Maine Department of Transportation Bridge Program

Note: *Hydrology Report* and *Hydraulics Report* originally included in Draft PDR submitted on 2025-05-07 and in Final PDR submitted on 2025-07-23. *Hydraulics Appendix* originally included in Draft PDF submitted on 2025-05-07.

HYDROLOGY REPORT

Meadow Brook begins in a wetland located 3.5 miles upstream of the bridge and ends 5.7 miles downstream of the bridge at Little Meadow Brook. There is no stream gage on Meadow Brook nor on other waterbodies near the bridge. Meadow Brook was not studied in detail in the Flood Insurance Study (FIS) for Washington County effective July 18, 2017 (Reference 1, Supplemental Hydrology and Hydraulic Data (SHHD)). The Flood Insurance Rate Map (FIRM) Index for Washington County, effective July 18, 2017 (Reference 2, SHHD), identifies the project location as not having a Special Flood Hazard Area, which means it is a Zone X: area of minimal flood hazard. Permitting for this crossing is partially governed by the Land Use Planning Commission (LUPC). As shown on the zoning map in the SHHD, the project site is not within a Flood Prone Area Protection Subdistrict (P-FP) and is therefore not subject to any permitting requirements pertaining to base flood elevations (Reference 15, SHHD). Meadow Brook is not discussed in the *Historic Flooding in Major Drainage Basins, Maine* document published in 2007 (Reference 3, SHHD). There are no anecdotal reports of the existing bridge overtopping.

Because there are no stream gages on Meadow Brook, the peak flow values and drainage basin characteristics are taken from USGS StreamStats (Reference 4, SHHD). These characteristics are based on Lombard's and Hodgkin's *Estimating flood magnitude and frequency on gaged and un-gaged streams in Maine: U.S. Geological Survey Scientific Investigations Report 2020-5092*. StreamStats does not provide a discharge for the 1.1-year storm event; this flow value was estimated by dividing the 2-year flow value in half. The hydrology data is shown in Table 1 and the full StreamStats report is included in the SHHD.

Table 1 Hydrology Summary

Drainage Area	4.68	mi ²
Q1.1	31.4	ft ³ /s
Q10	111	ft ³ /s
Q25	137	ft ³ /s
Q50	157	ft ³ /s
Q100	177	ft ³ /s
Q500	236	ft ³ /s

Reported by: Kayla Hampe, PE

Date: May 7, 2025

The bankfull width (BFW) of Meadow Brook is 16' per measurements by MaineDOT ENV staff taken during a joint site visit of MaineDOT and WSP staff, dated November 20, 2024. Per the Environmental Coordination table on page 5, the proposed BFW is 16' and the proposed clear span is 20', which exceeds the minimum clear span of 1.2 BFW.

HYDRAULIC REPORT

Two-dimensional (2D), steady state hydraulic analyses were performed to analyze the existing and proposed hydraulic conditions at the bridge. The software package used to develop the SRH-2D (Sediment and River Hydraulics, Two-Dimensional) (Reference 7, SHHD) model for the crossing is Aquaveo's Surface-water Modeling System (SMS) Version 13.3 (Reference 8, SHHD). SMS incorporates the HY-8 Culvert Analysis Program, which was developed by the Federal Highway Administration (FHWA) as a culvert design tool. Culverts can be modeled using HY-8 within an SRH-2D simulation. HY-8 calculates the 1D flow through the culvert, while SRH-2D calculates the 2D flow dynamics around the culvert.

The modeling process consists of importing background data (including elevations, satellite imagery, GIS data, and CAD linework); defining a mesh, boundary conditions, material coverages, and monitoring points and lines; creating simulations and defining model control parameters for each flood event; and running the model. Additionally, since no calibration data is available, sensitivity analyses were performed to verify that the model accurately represents the hydraulic conditions of the project site. The model development process is described in detail in the SHHD.

Headwater elevations and stream velocities are reported in Table 2 for the peak flows for the existing and proposed structures. Supporting water surface elevation profile plots, and velocity and depth plan view images are included in the SHHD. Headwater depth values were taken at a location upstream of the culvert that is outside the influence of the structure and used to calculate HW/D ratios for Q50 and Q100. The proposed HW/D ratios are 0.73 and 0.76 for Q50 and Q100, respectively. Both ratios are less than the maximum limits of 0.9 for Q50 per Section 2.3.10.2A of the Bridge Design Guide (Reference 14, SHHD) and 1.0 for Q100 per Section 5.3 of the MAP Users Guide (Reference 6, SHHD).

Since bedrock is near the surface and exposed at some locations near the bridge, a scour analysis was deemed unnecessary for this site.

Table 2 Hydraulics Summary

		Existing Structure	Proposed Structure
		11'-5" Span and 7'-3" Rise Steel Structural Plate Pipe Arch	20'-0" Span and 8'-0" Rise Pre-Cast Reinforced Concrete Box Culvert
Total Area of Waterway Opening	ft ²	64	103
Headwater Elevation @ Q1.1	ft	579.4	579.1
Headwater Elevation @ Q10	ft	580.7	580.2
Headwater Elevation @ Q25	ft	581.0	580.5
Headwater Elevation @ Q50	ft	581.3	580.7
Headwater Elevation @ Q100	ft	581.6	580.9
Headwater Elevation @ Q500	ft	582.3	581.4
HW/D @ Q50		0.60	0.73
HW/D @ Q100		0.65	0.76
Flood of Record - Unknown			
Maximum Velocity @ Q1.1	ft/s	4.6	3.5
Maximum Velocity @ Q10	ft/s	6.8	4.8
Maximum Velocity @ Q25	ft/s	7.5	5.2
Maximum Velocity @ Q50	ft/s	8.0	5.4
Maximum Velocity @ Q100	ft/s	8.6	5.7
Maximum Velocity @ Q500	ft/s	10.1	6.5

Reported by: Kayla Hampe, PE

Date: May 7, 2025

Note: All elevations based on North American Vertical Datum (NAVD) of 1988.

Appendix

Hydraulics Data

Hydrology Report

StreamStats Report

Region ID: ME
Workspace ID: ME20240809181603368000
Clicked Point (Latitude, Longitude): 45.54378, -68.01061
Time: 2024-08-09 14:16:30 -0400



+ Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	4.68	square miles
ELEV	Mean Basin Elevation	666.8	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	5.46	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	3.75	inches
I24H200Y	Maximum 24-hour precipitation that occurs on average once in 200 years	6.03	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	4.42	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	2.67	inches
I24H500Y	Maximum 24-hour precipitation that occurs on average once in 500 years	6.84	inches
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	4.94	inches
I24H5Y	Maximum 24-hour precipitation that occurs on average once in 5 years	3.26	inches
JULAVPRE	Mean July Precipitation	3.88	inches
PCTSNDGRV	Percentage of land surface underlain by sand and gravel deposits	0	percent
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0	dimensionless
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	28.693	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Statewide multiparameter peakflows SIR 2020 5092]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	4.68	square miles	0.26	5680

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
I24H2Y	24 Hour 2 Year Precipitation	2.67	inches	1.92	4.17
STORAGE	Percent Storage	28.693	percent	0	29.4
I24H5Y	24 Hour 5 Year Precipitation	3.26	inches	2.48	5.38
I24H10Y	24 Hour 10 Year Precipitation	3.75	inches	2.84	6.38
I24H25Y	24 Hour 25 Year Precipitation	4.42	inches	3.3	7.75
I24H50Y	24 Hour 50 Year Precipitation	4.94	inches	3.65	8.79
I24H100Y	24 Hour 100 Year Precipitation	5.46	inches	3.99	9.88
I24H200Y	24 Hour 200 YearPrecipitation	6.03	inches	5.26	11.1
I24H500Y	24 Hour 500 Year Precipitation	6.84	inches	5.95	13.1

Peak-Flow Statistics Flow Report [Statewide multiparameter peakflows SIR 2020 5092]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct (other -- see report)

Statistic	Value	Unit	PIL	PIU	ASEp
50-percent AEP flood	62.8	ft^3/s	32.9	120	39.1
20-percent AEP flood	90.8	ft^3/s	48.3	171	38.1
10-percent AEP flood	111	ft^3/s	58.2	212	38.9
4-percent AEP flood	137	ft^3/s	70.7	265	39.9
2-percent AEP flood	157	ft^3/s	79.7	309	39.7
1-percent AEP flood	177	ft^3/s	90.2	347	40.7
0.5-percent AEP flood	204	ft^3/s	100	415	42.8
0.2-percent AEP flood	236	ft^3/s	114	487	43.8

Peak-Flow Statistics Citations

Lombard, P.J., and Hodgkins, G.A.,2020, Estimating flood magnitude and frequency on gaged and ungaged streams in Maine: U.S. Geological Survey Scientific Investigations Report 2020–5092, 56 p. (<https://doi.org/10.3133/sir20205092>)

➤ Base Flow Statistics

Base Flow Statistics Parameters [Maine August Unit Baseflow RivResAppl 2021]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
PCTSNDGRV	Percent Underlain By Sand And Gravel	0	percent	0	73
JULAVPRE	Mean July Precipitation	3.88	inches	3.3	4.9

Base Flow Statistics Flow Report [Maine August Unit Baseflow RivResAppl 2021]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct (other -- see report)

Statistic	Value	Unit	SE
Mean August unit baseflow	0.312	ft^3/s/mi^2	20.8

Base Flow Statistics Citations

2021, Pamela J. Lombard, Robert W. Dudley, Mathias J. Collins, Rory Saunders, Earnie AtkinsonModel estimated baseflow for streams with endangered Atlantic Salmon in Maine, USA; John Wiley & Sons Ltd., River Research and Applications, Volume 37, Issue 9, pp 1254-1264. (<https://doi.org/10.1002/rra.3835>)

➤ Annual Flow Statistics

Annual Flow Statistics Parameters [Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	4.68	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	666.8	feet	239	2120

Annual Flow Statistics Disclaimers [Statewide Annual SIR 2015 5151]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Annual Flow Statistics Flow Report [Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
Mean Annual Flow	10.7	ft^3/s

Annual Flow Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (<http://dx.doi.org/10.3133/sir20155151>)

➤ Bankfull Statistics

Bankfull Statistics Parameters [Appalachian Highlands D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	4.68	square miles	0.07722	940.1535

Bankfull Statistics Parameters [New England P Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	4.68	square miles	3.799224	138.999861

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	4.68	square miles	0.07722	59927.7393

Bankfull Statistics Flow Report [Appalachian Highlands D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	28.8	ft
Bieger_D_channel_depth	1.75	ft
Bieger_D_channel_cross_sectional_area	51.1	ft^2

Bankfull Statistics Flow Report [New England P Bieger 2015]

Statistic	Value	Unit
Bieger_P_channel_width	38.9	ft
Bieger_P_channel_depth	1.93	ft
Bieger_P_channel_cross_sectional_area	76	ft^2

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	21.3	ft
Bieger_USA_channel_depth	1.67	ft
Bieger_USA_channel_cross_sectional_area	39.3	ft^2

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bieger_D_channel_width	28.8	ft
Bieger_D_channel_depth	1.75	ft
Bieger_D_channel_cross_sectional_area	51.1	ft^2
Bieger_P_channel_width	38.9	ft
Bieger_P_channel_depth	1.93	ft
Bieger_P_channel_cross_sectional_area	76	ft^2
Bieger_USA_channel_width	21.3	ft
Bieger_USA_channel_depth	1.67	ft
Bieger_USA_channel_cross_sectional_area	39.3	ft^2

Bankfull Statistics Citations

Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p.
(https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_campaign=PDFCoverPages)

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Application Version: 4.23.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

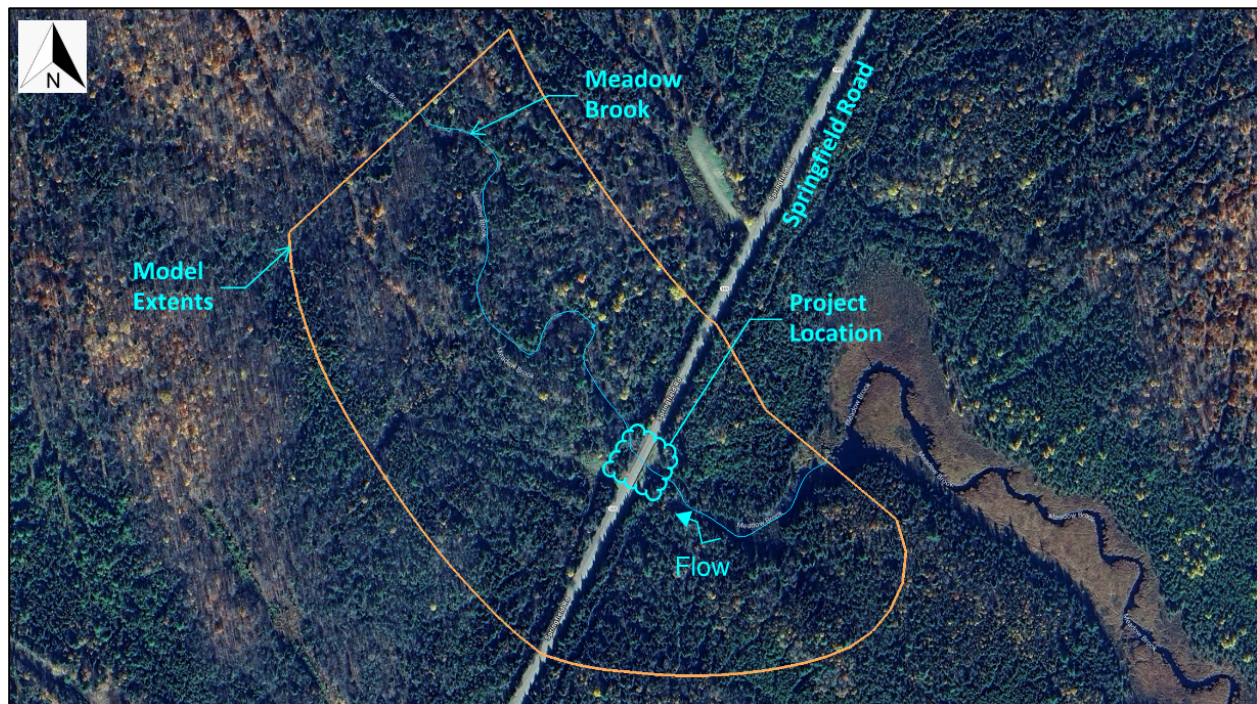
2D Hydraulic Modeling Narrative

HYDRAULIC MODELING

Two-dimensional (2D), steady state hydraulic analyses were performed to analyze the existing and proposed hydraulic conditions at the bridge. The software package used to develop the SRH-2D (Reference 7) model for the crossing is Aquaveo's SMS Version 13.3 (Reference 8). The program allows the user to develop a 2D hydraulic, sediment, temperature, and vegetation model that incorporates the finite volume method in conjunction with implicit first- and second-order numerical schemes to approximate a solution for the 2D depth averaged Saint Venant equations. SMS incorporates the HY-8 Culvert Analysis Program, which was developed by FHWA as a culvert design tool. Culverts can be modeled using HY-8 within an SRH-2D simulation. HY-8 calculates the 1D flow through the culvert, while SRH-2D calculates the 2D flow dynamics around the culvert.

Surface Generation

A conventional survey (Reference 13) was completed for this project and incorporated into the model as an XML file. The survey included stream bathymetry, roadway elevations, and bank geometry near the existing bridge but did not adequately encompass the topography for the extents of the model. A LiDAR surface was used to supplement the on-the-ground survey to incorporate missing areas within the extents of the model. LiDAR data was downloaded from the NOAA Data Access Viewer website (Reference 10). The model extents are shown below.



2D Hydraulic Model Extents

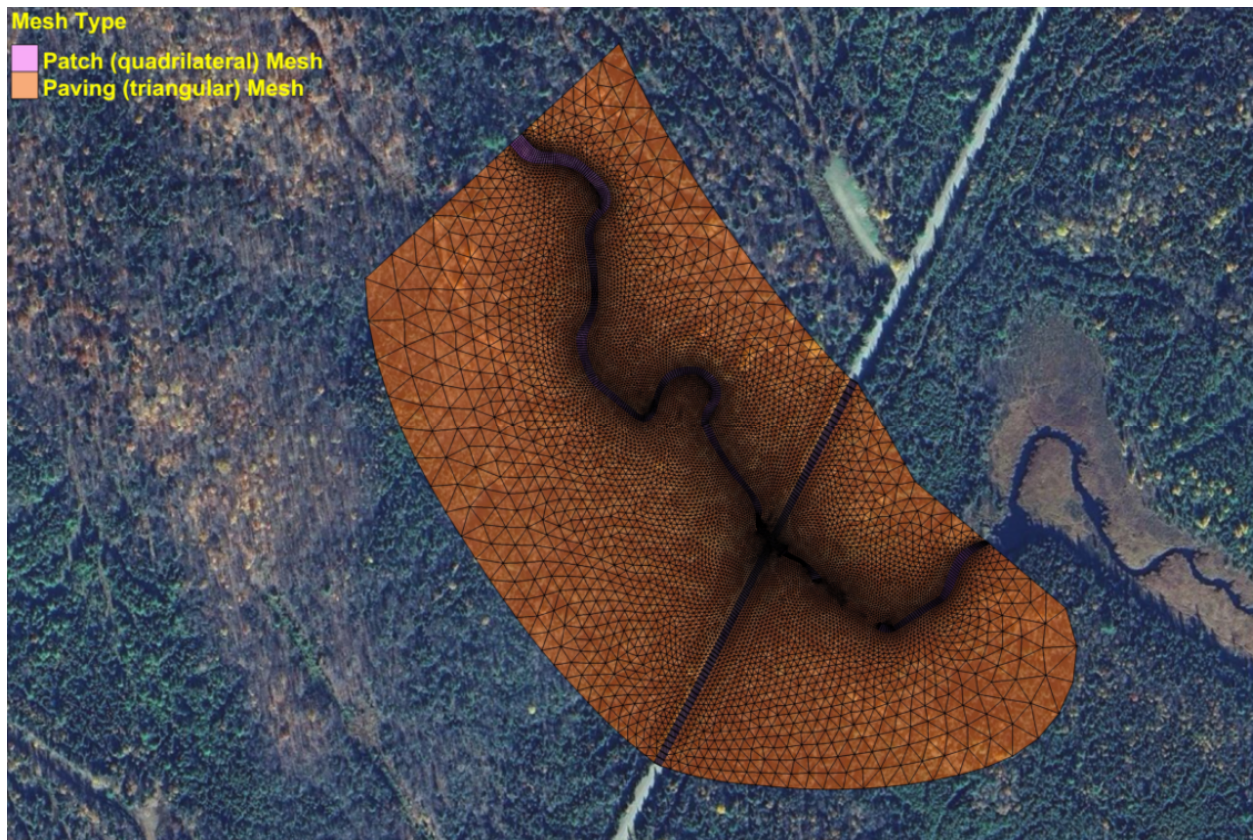
The LiDAR data reflects the water surface elevation; therefore, the feature stamping tool was used to define the channel outside the limits of the survey. By inspecting the difference between the LiDAR water surface and the survey data, the channel bottom was taken to be 2'

below the LiDAR water surface. The slopes of the stream were calculated as 0.0110 ft/ft upstream and 0.0026 ft/ft downstream. The survey, LiDAR, and stamp data were combined to create an existing terrain surface for the existing conditions model. The existing surface was modified for the proposed conditions model to incorporate the proposed streambed through the proposed bridge by using the feature stamping tool using the following parameters:

- a single span clear distance of 20'-0" between culvert walls;
- a cross-section with a 2' wide shelf on each side, and a roughly u-shaped channel that is 1'-10" deep between the shelves;
- and a streambed elevation of 576.33' at the culvert inlet and a slope down at 0.007 ft/ft to an elevation of 575.74' at the culvert outlet.

Mesh Development

The upstream limit of the model begins 780' upstream of the crossing. The downstream limit is 1800' downstream of the crossing. Triangular mesh elements were used to model the floodplains and surrounding terrain, and quadrilateral mesh elements were used to model the brook and roads except for one location within the brook upstream of the bridge which was modeled using triangular elements. Triangular mesh was used in the upstream location to better represent the surveyed terrain. The size of the elements was adjusted based on their proximity to the bridge and brook to optimize the model.



Plan View of Project Site and Mesh Elements

Material Properties

The material properties used were based on aerial imagery and site photos, and input as Mannings' n roughness coefficients to the Materials SMS coverage. A roughness coefficient of 0.045 was used for Meadow Brook. A proposed Materials coverage was created by modifying the existing Materials coverage to include the streambed through the proposed box culvert using the same Manning's n value as the stream.



Plan View of Existing Materials

Boundary Conditions

The StreamStats peak flows were input as constant discharge distributed at the inlet using conveyance for the upstream boundary conditions of Meadow Brook. The downstream boundary conditions were calculated as a water surface elevation assuming subcritical flow and normal depth, based on a composite roughness coefficient of 0.051 at low flows and 0.086 at high flows, a normal slope of 0.013 ft/ft, and the StreamStats discharge. The normal slope was based on the assumption that the water surface slope is an approximation of the energy gradeline slope and the streambed slope. The water surface slope was calculated using estimated elevations from the LiDAR data near the downstream boundary.

The existing culvert was modeled using the HY-8 boundary condition with the culvert inverts, type, shape, and geometry as inputs shown below. The data for the existing culvert is taken from the latest bridge inspection report (Reference 11), the existing plans (Reference 12), and the survey (Reference 13).

Crossing Properties

Name:

Parameter	Value	Units
DISCHARGE D...	Optional--Model will determine val...	Optional Inf...
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	0.000	cfs
Design Flow	0.000	cfs
Maximum Flow	0.000	cfs
TAILWATER D...	Optional--Model will determine val...	Optional Inf...
Channel Type	Rectangular Channel	
Bottom Width	0.000	ft
Channel Slope	0.0000	ft/ft
Manning's n (channel)	0.000	
Channel Invert Elev...	0.000	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.000	ft
Crest Length	11.000	ft
Crest Elevation	588.530	ft
Roadway Surface	Paved	
Top Width	35.000	ft

Culvert Properties

[Add Culvert](#)

[Duplicate Culvert](#) [Alternative Designs](#)

[Delete Culvert](#)

Parameter	Value	Units
CULVERT DATA		
Name	Existing Culvert	
Shape	Pipe Arch	
Material	Steel Structural Plate	
Size	Define...	
Span	136.800	in
Rise	86.900	in
Embedment Depth	0.000	in
Manning's n	0.034	
Culvert Type	Straight	
Inlet Configuration	Projecting (Ke=0.9)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	576.920	ft
Outlet Station	70.000	ft
Outlet Elevation	576.720	ft
Number of Barrels	1	
Computed Culvert Slope	0.002857	ft/ft

Existing Culvert HY-8 Inputs

The proposed culvert was modeled using pressure arcs with a flat ceiling type and low chord elevations of 582.33' and 581.74' at the inlet and outlet, respectively. The Manning's n value of the ceiling of the box was set as 0.012. Other parameters for the proposed culvert were input using the feature stamping tool outlined in the Surface Generation above.

Sensitivity Analysis

A sensitivity analysis of the downstream model boundary conditions was performed to verify model convergence of the water surface profile downstream of the bridge. Convergence occurs when a downstream boundary condition, roughness, or mesh resolution is changed but the solution remains similar. For this study, the water surface elevation at the downstream boundary condition was changed for the 100-year flood event to demonstrate that the downstream boundary condition did not affect the solution at the project site. A sensitivity analysis of Manning's Roughness Coefficient was also completed to verify model convergence. The roughness coefficient of the channel was increased and decreased by 0.005 and evaluated for the 100-year flood event; the results show no appreciable effect on the water surface elevations or stream velocities near the bridge for these changes. Based on the sensitivity analyses, the model is taken to be reliable.

Scour Considerations

Since bedrock is shallow near the bridge, and the proposed structure is a box culvert, a scour analysis is not necessary. An evaluation of the mobility of the special fill inside the proposed box culvert is anticipated as part of the Habitat Connectivity Design.

References

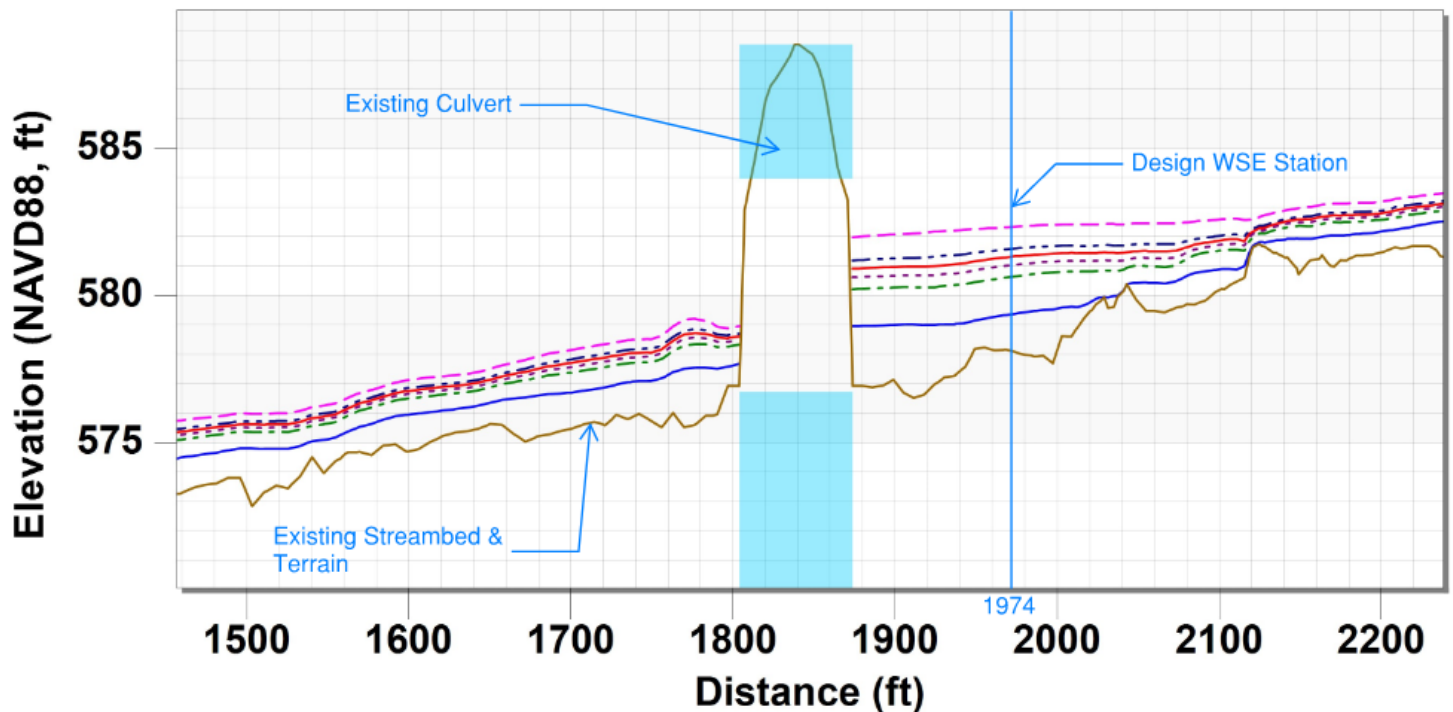
1. Washington County Flood Insurance Study Number 23029CV000A, Effective July 18, 2017
2. National Flood Insurance Program Flood Insurance Rate Map Index, Map Number 23029CIND1A, Effective July 18, 2017
3. Historic Flooding in Major Drainage Basins, Maine, ENSR Corporation, October 2007, Document No.: 12092-003-B
4. United States Geological Survey (USGS), USGS StreamStats Version 4.28.1
<https://streamstats.usgs.gov/ss/>
5. Maine Department of Transportation (MaineDOT), Federal Highway Administration (FHWA), US Army Corps of Engineers and Maine Turnpike Authority, "Programmatic Biological Assessment for Transportation Projects for the Gulf of Maine Distinct Population Segment of Atlantic Salmon and Designated Critical Habitat", dated May 2016
6. Federal Highway Administration (FHWA), Maine Department of Transportation (MaineDOT), U.S. Fish and Wildlife Service, Army Corps of Engineers, and Maine Turnpike Authority, "User's Guide for the Maine Atlantic Salmon Programmatic Consultation (MAP)", Version 1.0, dated March 2017
7. US Bureau of Reclamation (USBR) Sediment and River Hydraulics, Two-Dimensional (SRH-2D), version 3.6.5
8. Aquaveo, LLC., Surface-Water Modeling System (SMS), Version 13.3
9. National Oceanic and Atmospheric Administration (NOAA), NOAA: Data Access Viewer
<https://coast.noaa.gov/dataviewer/#/>
10. Federal Highway Administration (FHWA), Hydraulic Engineering Circular, HEC-18 Evaluation Scour at Bridges, 5th Edition, April 2012
11. Highway Bridge Inspection Report for Structure Number: 0064, Maine Department of Transportation (MaineDOT), dated June 27, 2023
12. Existing Plans Entitled "Hot Brook Bridge Between the Towns of Danforth & T8-R4 and Meadow Brook Bridge in the Township of T8-R3 Washington County" Prepared by: MaineDOT, dated May 1978, Sheets 3 through 8 of 18
13. Ground Survey started by MaineDOT and completed by WSP, December 2024
14. MaineDOT Bridge Design Guide, August 2003 (Updated June 2018)
15. Land Use Districts and Standards for Areas Served by the Maine Land Use Planning Commission, Chapter 10 of the Commission's Rules and Standards, Maine Department of Agriculture, Conservation and Forestry, Initially Adopted January 12, 1977, Latest Revisions January 29, 2025

2D Hydraulic Modeling Existing Conditions Results

Existing 1.1-Year Flood Event Velocities with Flow Vectors

Profile - Meadow Brook

Existing Conditions: Q1.1, Q10, Q25, Q50, & Q100



Arc 4, EX Q1.1 (SRH-2D)\Water_Elev_ft

Arc 4, EX Q10 (SRH-2D)\Water_Elev_ft

Arc 4, EX Q100 (SRH-2D)\Water_Elev_ft

Arc 4, EX Q50 (SRH-2D)\Water_Elev_ft

Arc 4, Z

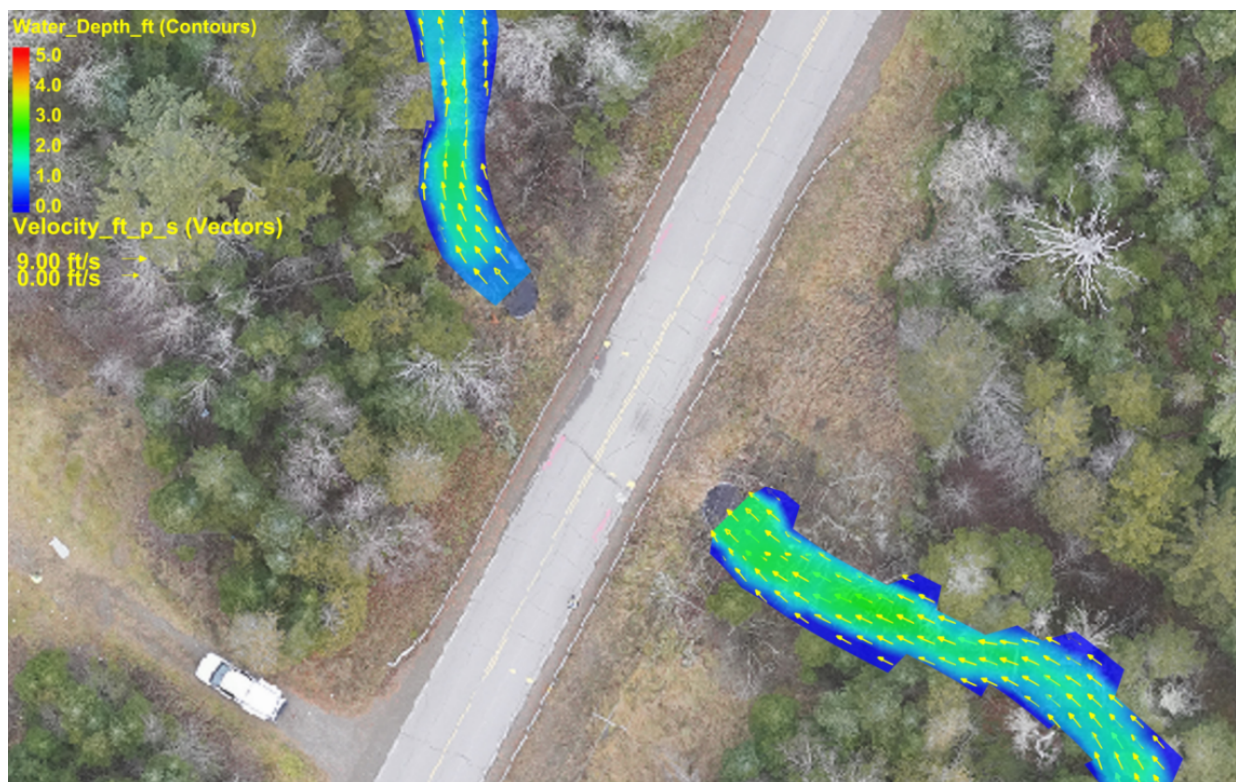
Arc 4, EX Q25 (SRH-2D)\Water_Elev_ft

Arc 4, EX Q500 (SRH-2D)\Water_Elev_ft

Existing 1.1-Year Flood Event Velocities with Flow Vectors



Domain

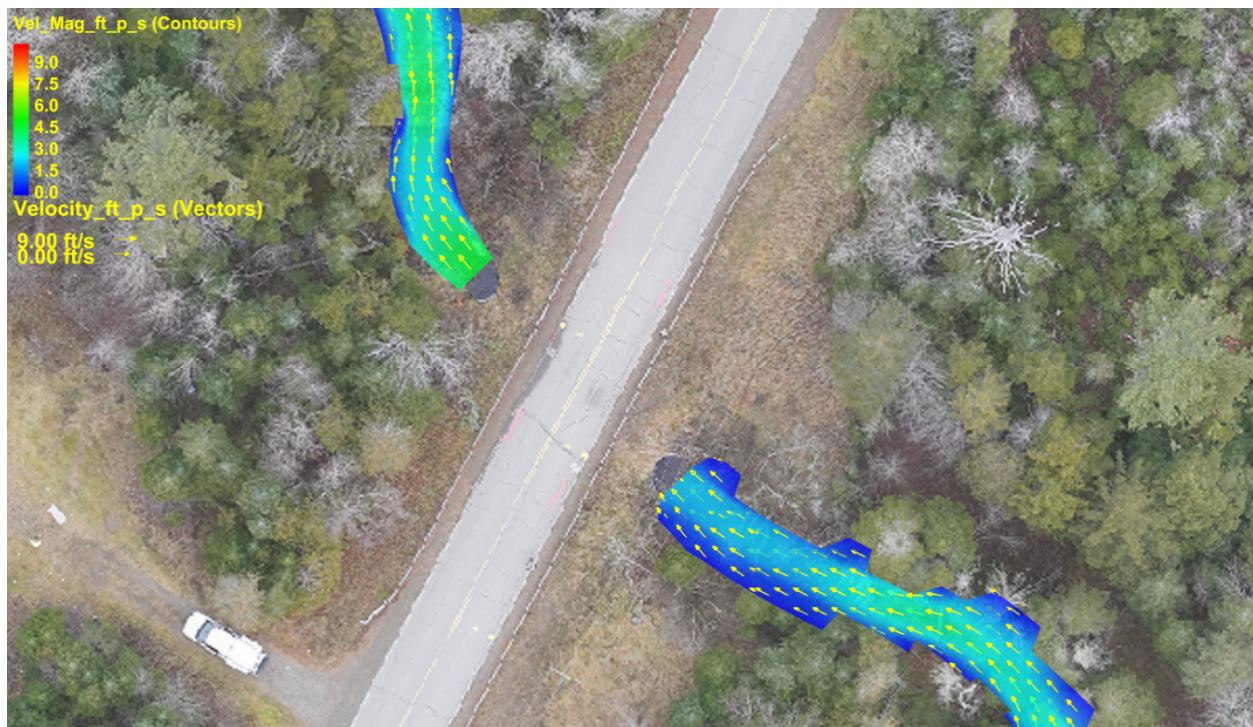


Bridge

Existing 1.1-Year Flood Event Velocities with Flow Vectors



Domain

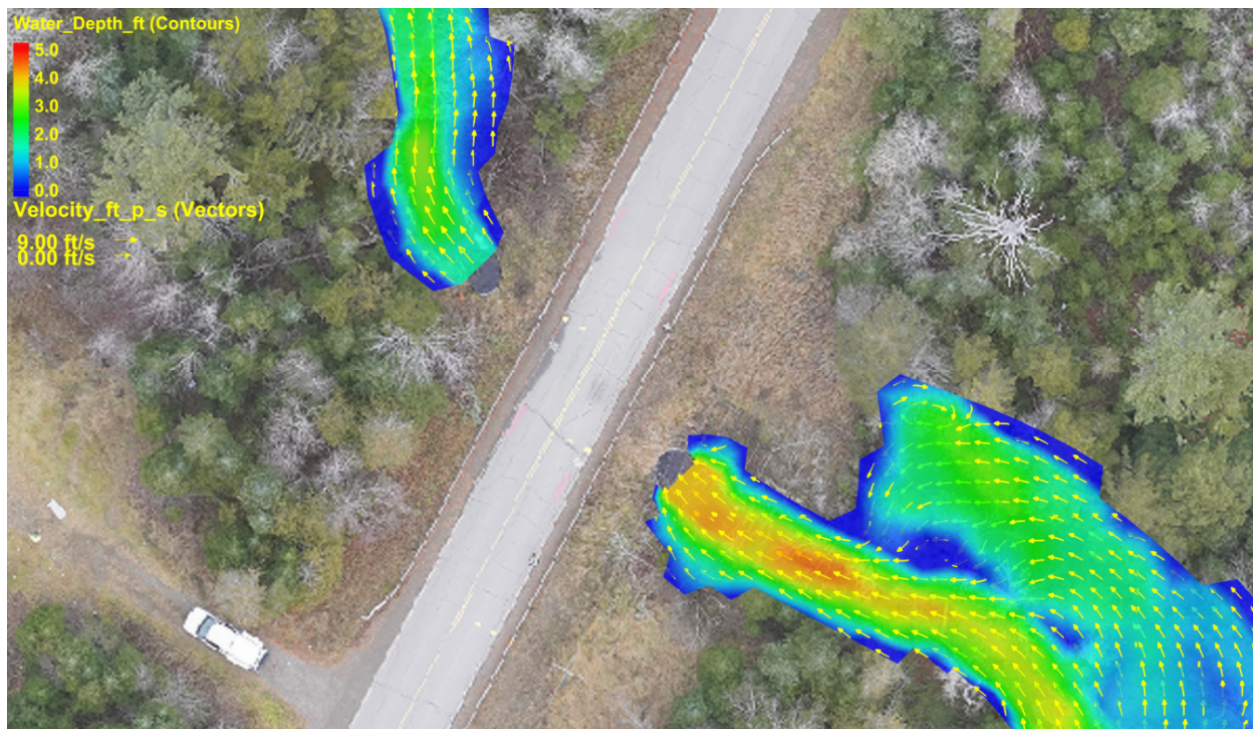


Bridge

Existing 50-Year Flood Event Water Depths with Flow Vectors



Domain

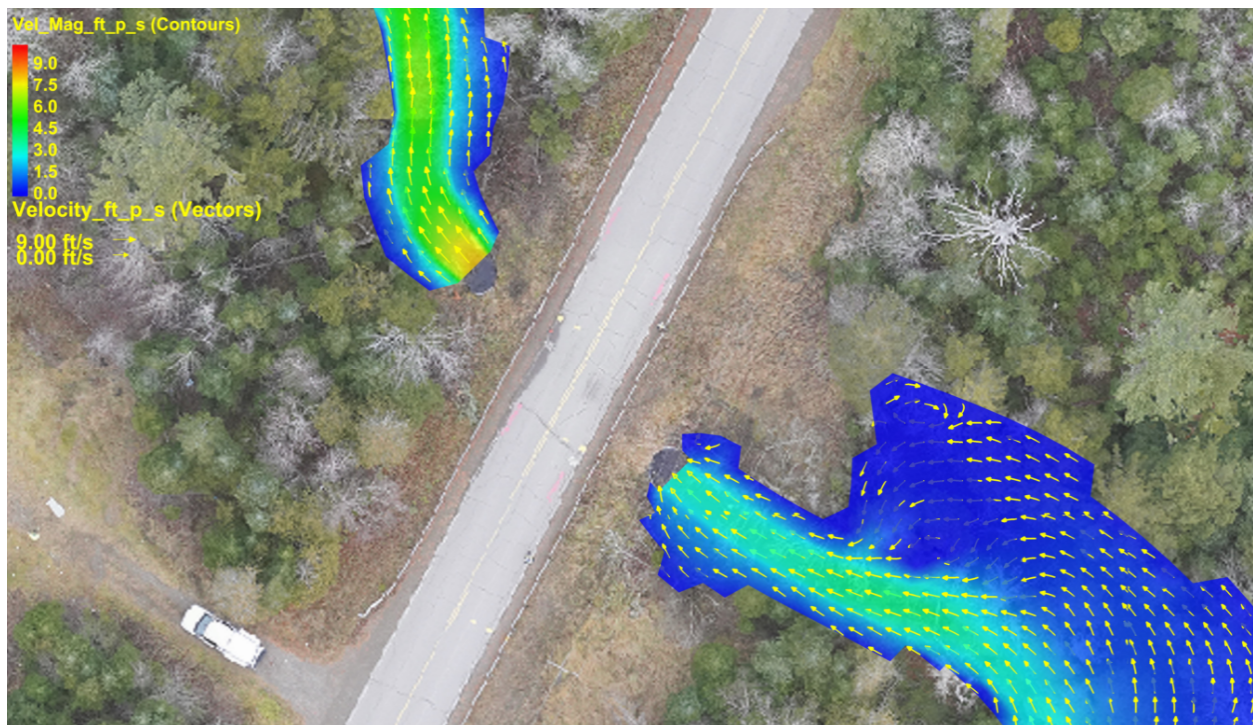


Bridge

Existing 100-Year Flood Event Water Depths with Flow Vectors



Domain

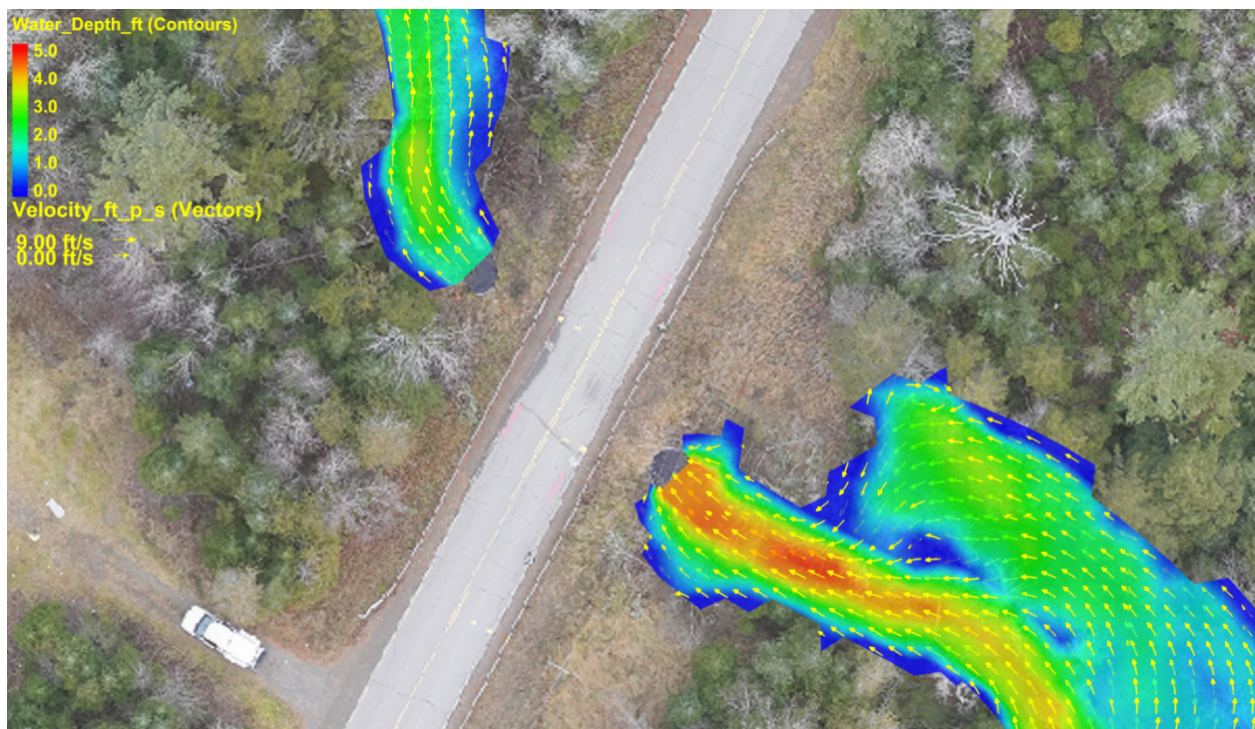


Bridge

Existing 100-Year Flood Event Water Depths with Flow Vectors



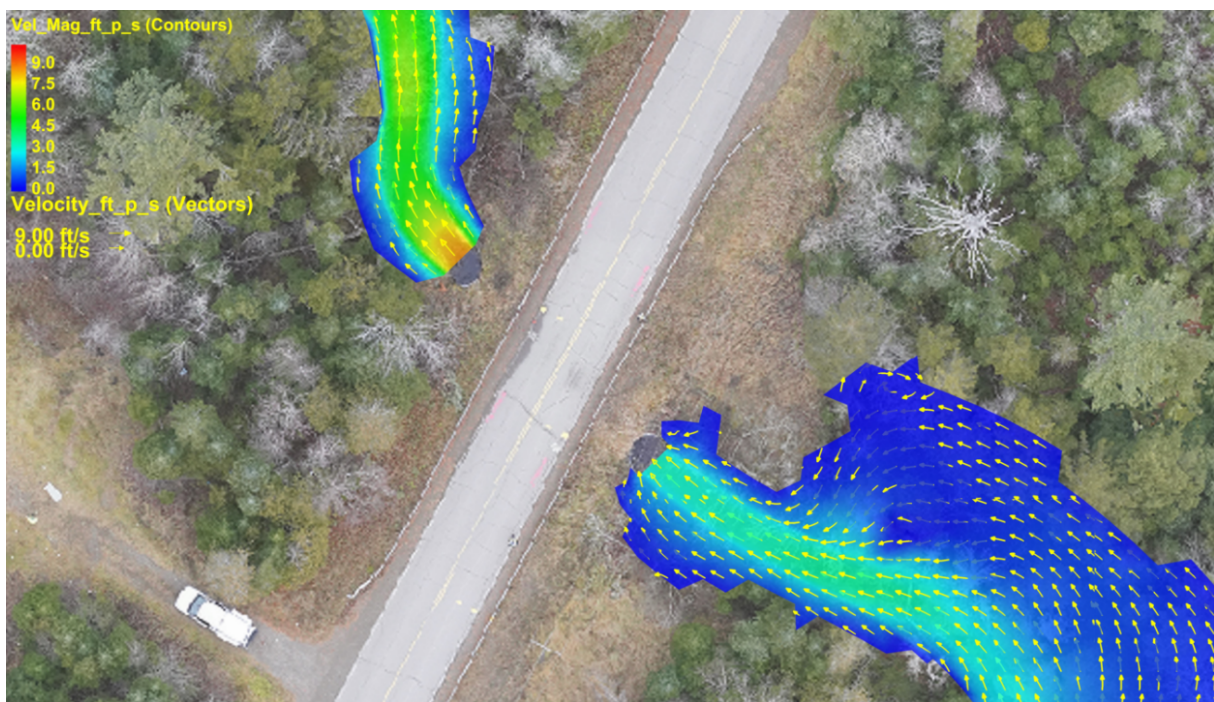
Domain



Bridge



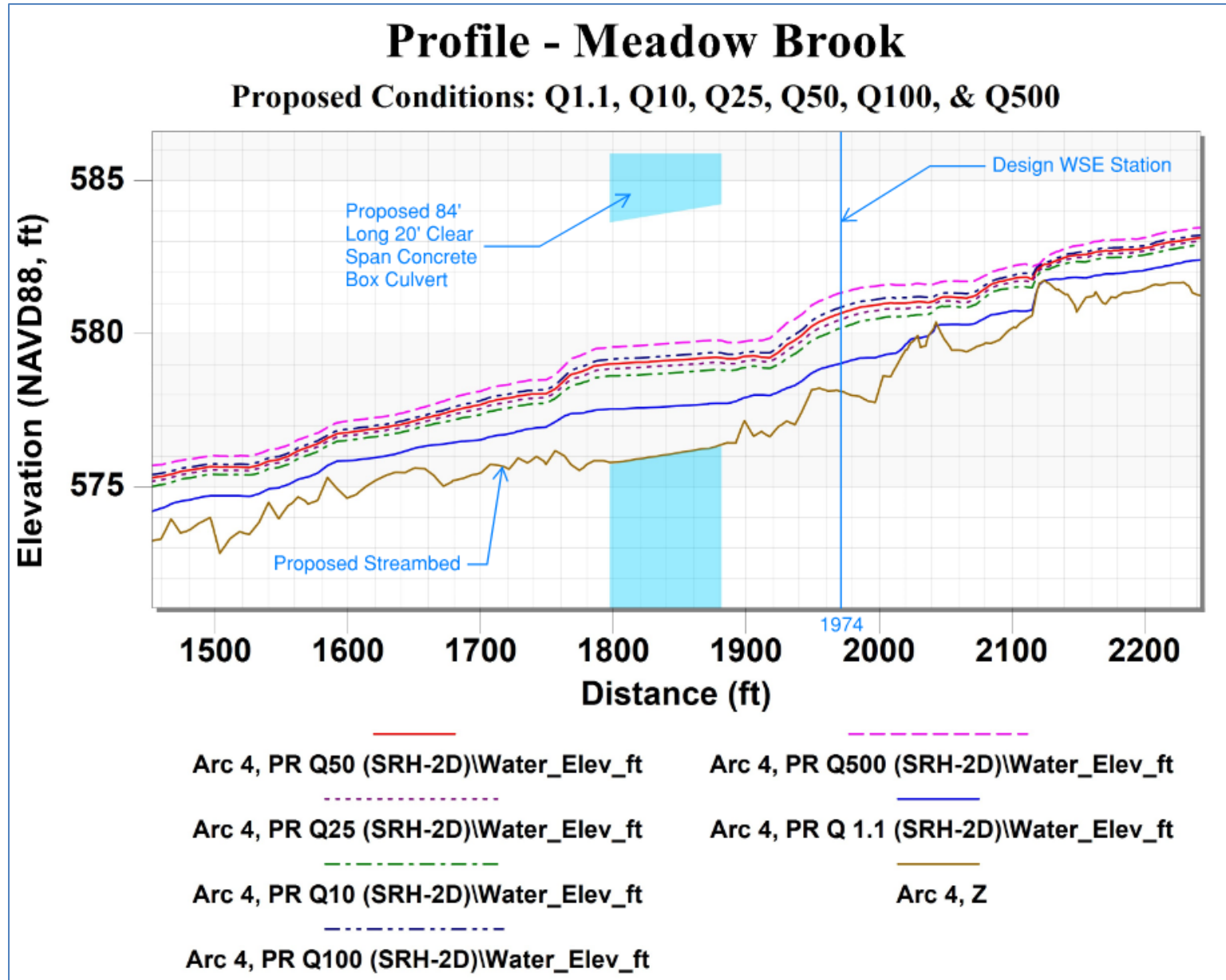
Domain



Bridge

2D Hydraulic Modeling Proposed Conditions Results

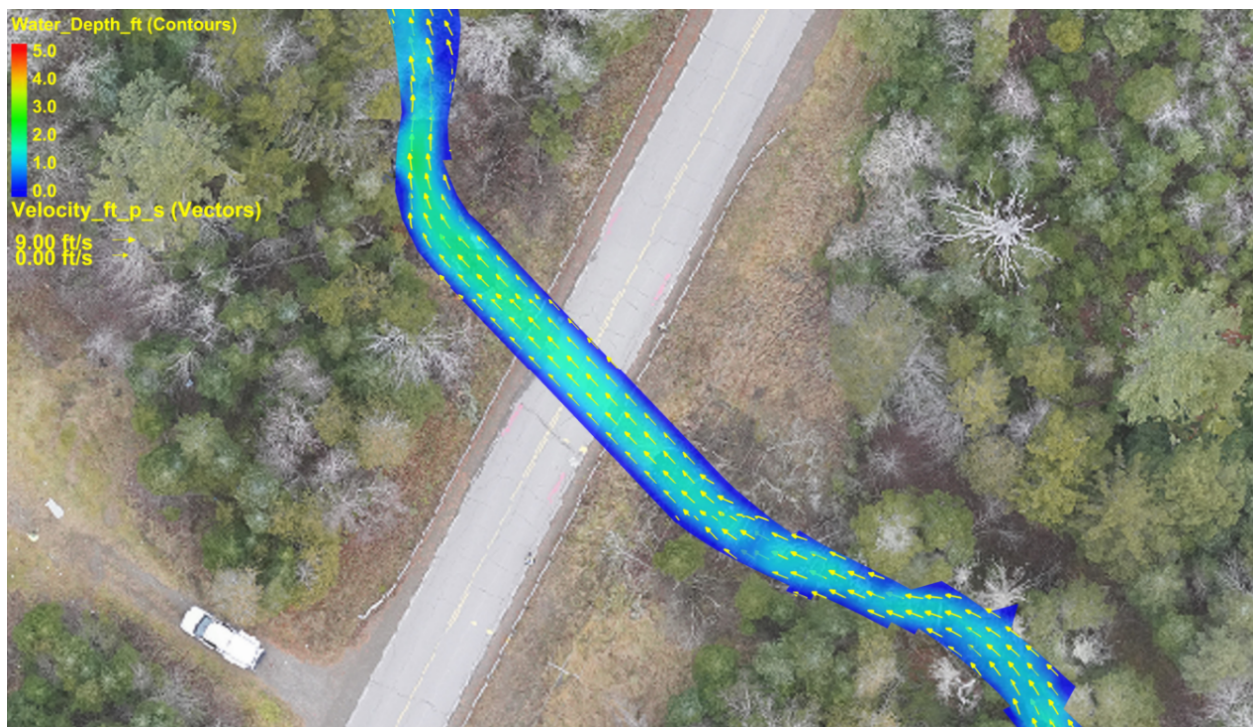
Proposed Conditions Water Surface Elevation Profiles



Proposed 1.1-Year Flood Event Water Depths with Flow Vectors



Domain

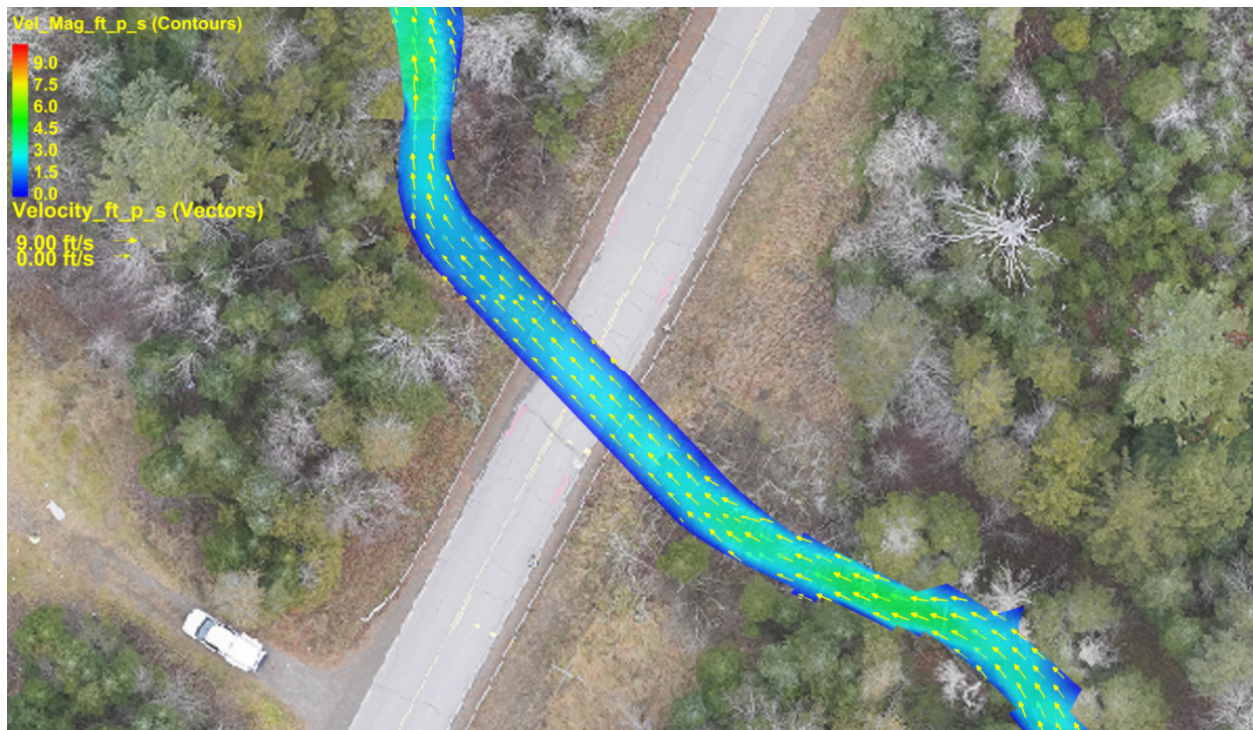


Bridge

Proposed 1.1-Year Flood Event Velocities with Flow Vectors



Domain

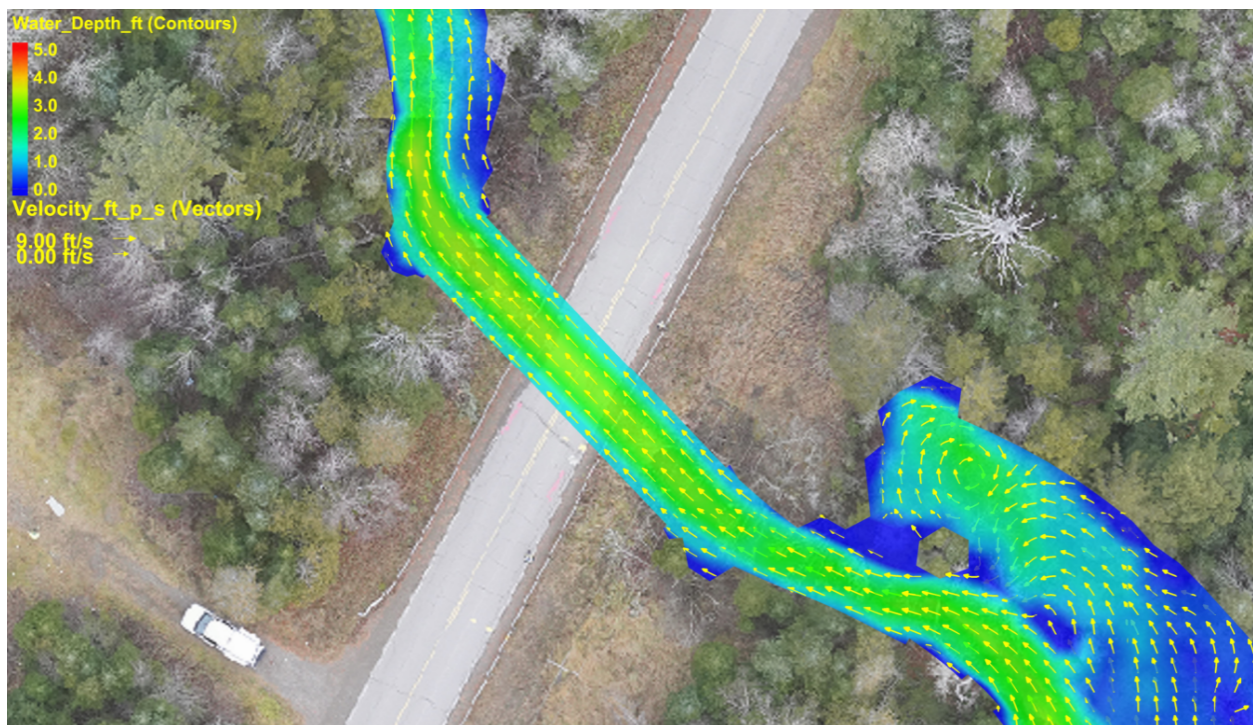


Bridge

Proposed 100-Year Flood Event Velocities with Flow Vectors



Domain

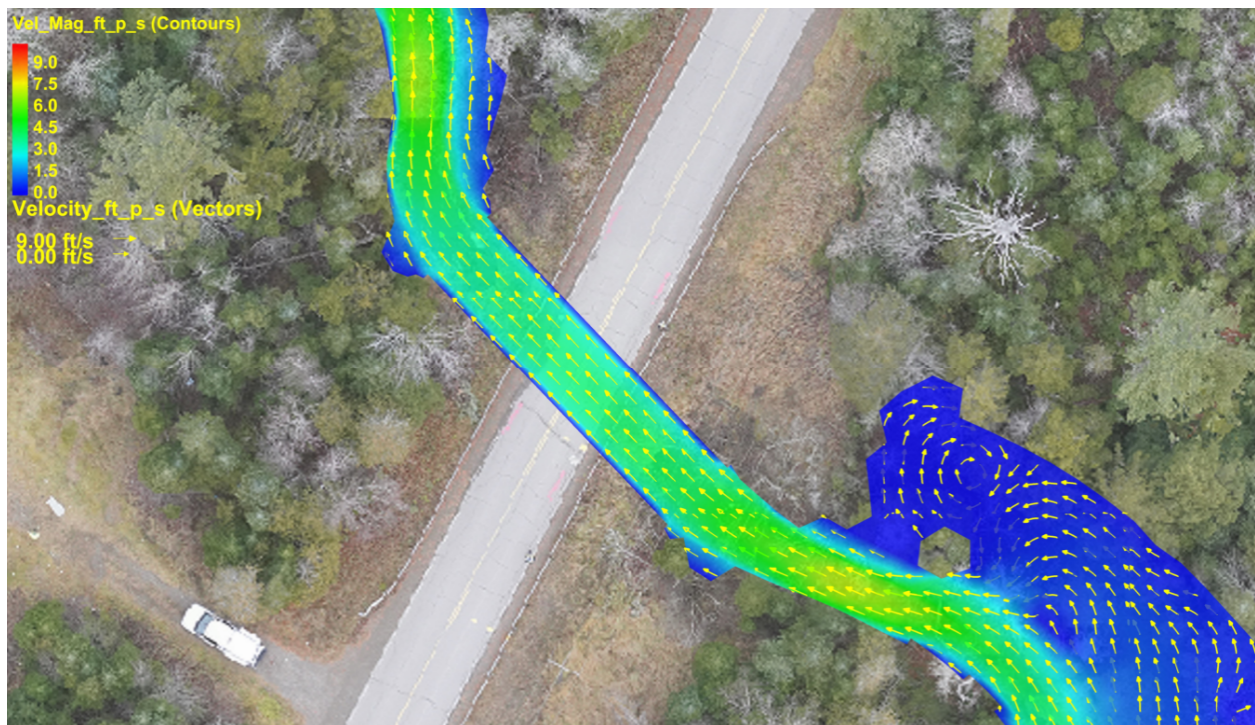


Bridge

Proposed 100-Year Flood Event Velocities with Flow Vectors



Domain

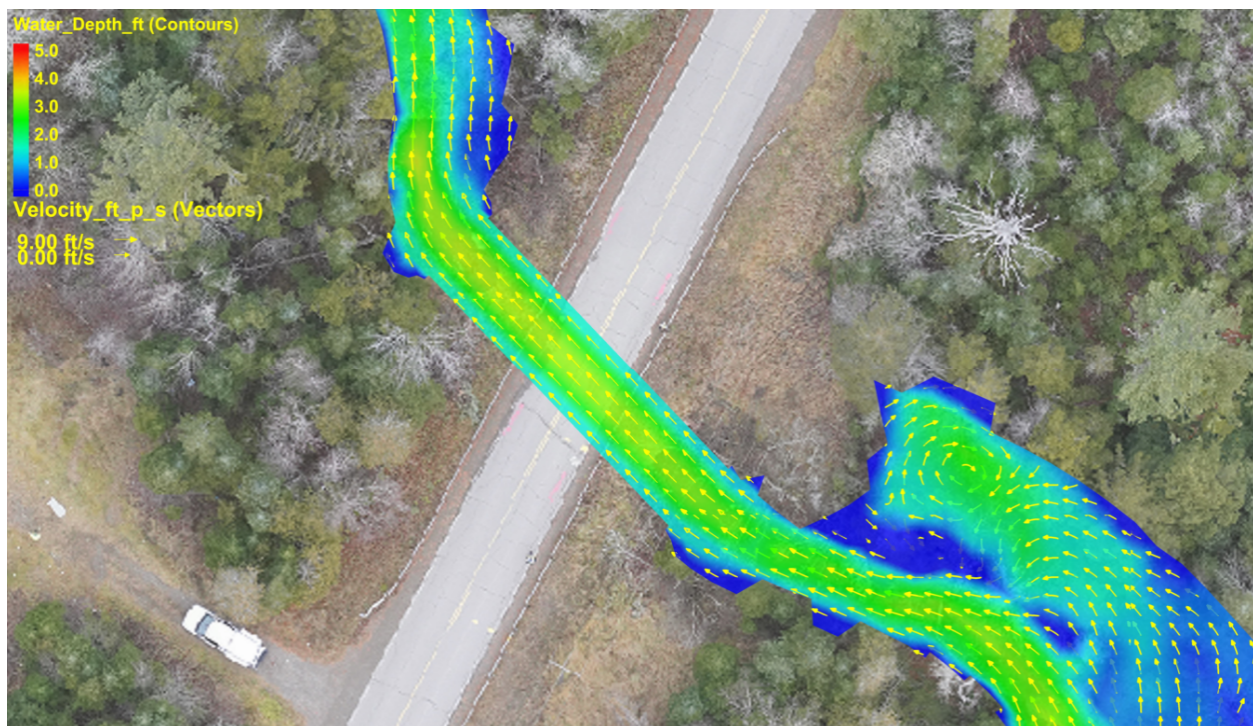


Bridge

Proposed 100-Year Flood Event Velocities with Flow Vectors



Domain

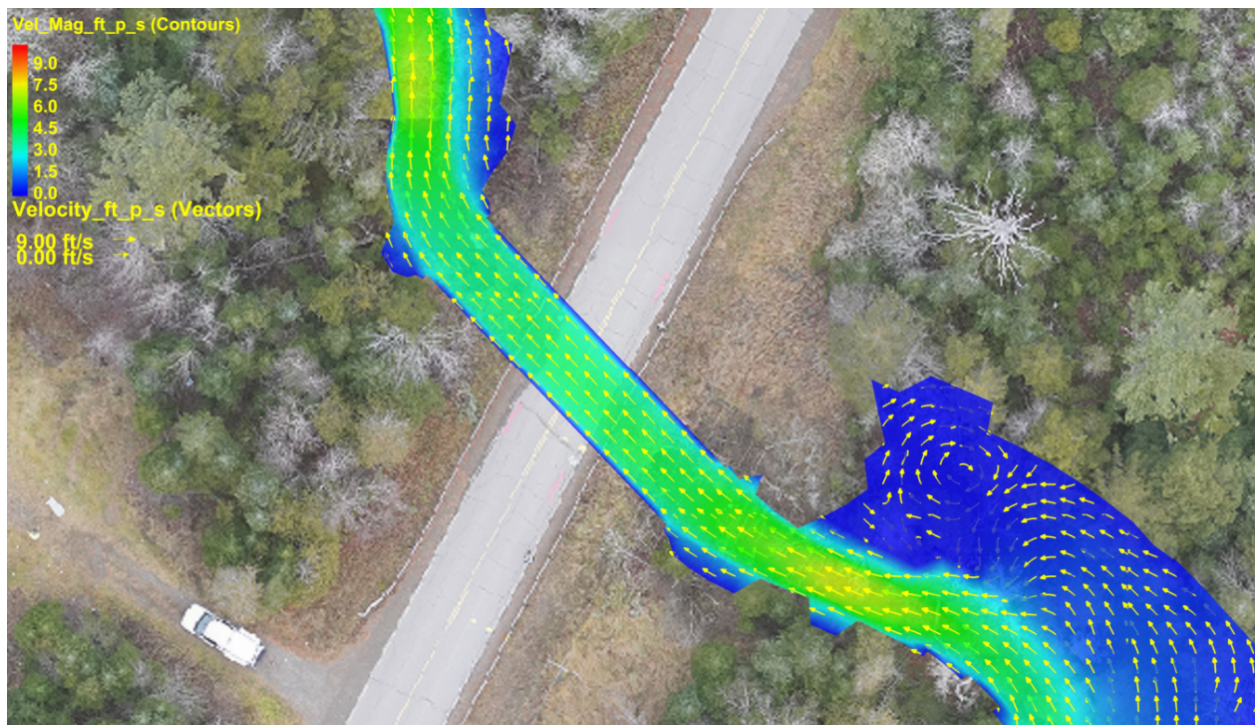


Bridge

Proposed 100-Year Flood Event Velocities with Flow Vectors



Domain



Bridge

Proposed vs Existing Conditions Water Surface Elevation Profiles

