

FINAL DESIGN
HYDRAULIC ANALYSIS
REPORT

October 2025

ST. MARY'S BRIDGE OVER
VIOLETTE BROOK

MAINEDOT
WIN 026083.00

Town of Van Buren
Aroostook County
Maine

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1.0 Background Information

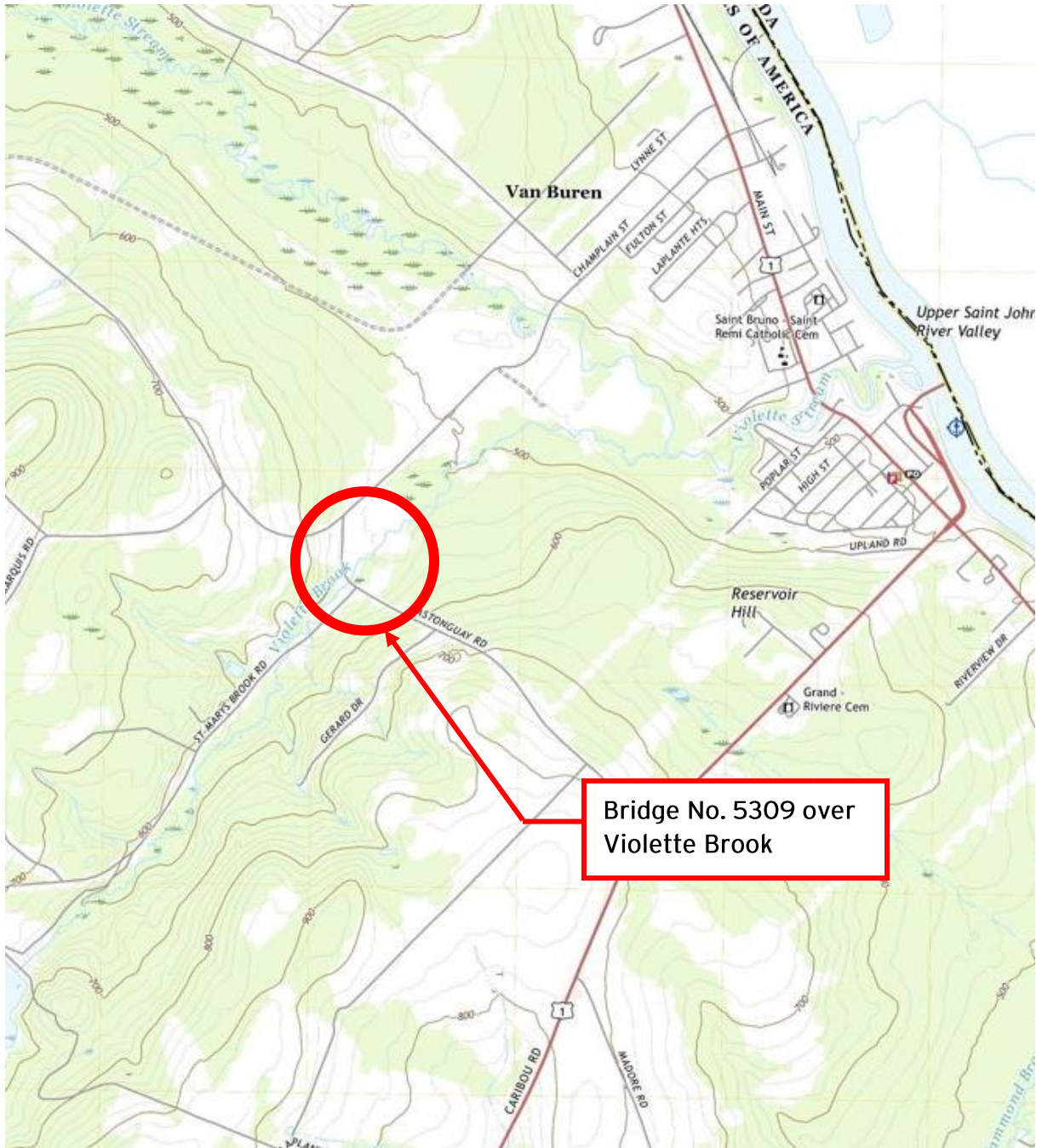
The following is a final design hydraulic analysis report for Bridge No. 5309, Castonguay Road over Violette Brook. Bridge No. 5309, located in the Town of Van Buren, in Aroostook County, Maine, carries two-lanes of Castonguay Road over Violette Brook. Originally built in 1958, Bridge No. 5309 services approximately 630 cars per day (2023).

Originally constructed in 1958, Bridge No. 5309 consists of a 58 foot long corrugated steel plate arch culvert with a 7.5 foot rise and a 26.9 foot span. At the crossing, Castonguay Road consists of a two-lane roadway, with a curb-to-curb width of 28 feet.

According to a 2023 inspection report, significant structural and channel deficiencies were identified at the bridge. The channel banks are severely eroded, with evidence of lateral migration resulting in gravel aggradation at the west footing and a scour hole formation at the east and south footings. The steel culvert exhibits advanced deterioration, including rust, section loss, and failure of the integral wingwalls. The structure has been rated as scour critical, with an overall condition rating of 2.

The proposed replacement involves removing the existing culvert and constructing a new single-span prestressed concrete girder bridge. The new bridge will feature an increased clear span of approximately 70 feet and a widened roadway section with an approximate curb-to-curb width of 30 feet. As part of the project, the main channel of Violette Brook will be regraded to stabilize flow and mitigate future scour within the project limits.

1.1. Location Map



1.2. Existing Data Review

- Site Photographs are provided in Appendix I.
- There is no USGS stream gage located within the vicinity of the project site.
- FEMA data is available for Violette Brook and is summarized in Table 1.
- Violette peak flows were calculated utilizing SIR 2015-4059 by MaineDOT. These values were used in the analysis and can be found in Table 1.

2.0 Hydrology

At Bridge No. 5309, Violette Brook has a watershed area of 12.4 square miles, as calculated by the USGS StreamStats program. The watershed is bounded by a series of ridgelines and hills. Aerial photography of the watershed shows that it mostly consists of forests with some pasteurized farmland and open fields. According to the USGS StreamStats website, the watershed contains approximately 7 percent storage area (combined waterbodies and wetland areas).

Violette Brook originates at the outfall of Violette Lake, a 22 acre reservoir located in Aroostook County, approximately 1.7 miles upstream of Bridge No. 5309. From the outfall, the watercourse travels north, at an average streambed slope of 0.0006 ft/ft, before reaching the subject culvert. After passing underneath Bridge No. 5309, Violette Brook continues to flow north until it discharging into Violette Stream, approximately a half mile downstream from the project site.

Violette Brook at the project location was previously analyzed as part of the FEMA Flood Insurance Study (FIS) for Aroostook County, effective date January 16, 2008. The FIS provides peak discharge estimates for the 10-, 50-, 100-, and 500-year storm events at the Castonguay Road crossing, where Violette Brook drains a contributing watershed area of approximately 12.8 square miles. The hydrologic analysis supporting the effective FEMA model was performed using a very high-level TR-20 hydrologic analysis of the watershed based on USGS quadrangle mapping and referenced historic rainfall depths to determine the flow rates. At the subject bridge, Violette Brook is listed within FEMA Zone AE, with a Base Flood Elevation (BFE) of 530 feet.

The recommended peak flows for the existing and proposed HEC-RAS analysis were provided by MaineDOT. These peak flows were developed using the USGS regression equations in the StreamStats Program. The regression analysis calculates peak flows for small ungaged streams and compares map-based to field-based variables (SIR 20154059 and SIR 20205092). The USGS regression equations use the watershed area and storage capacity as variables for calculating the peak flows. The MaineDOT hydrology calculations can be found in Appendix B. Table 1 lists the peak flows determined by MaineDOT along with the FEMA 100-year peak flow rate.

**Table 1: Peak Discharges at Bridge No. 5309
over Violette Brook**

Storm Event (Years)	Peak Discharge (cfs)
1.1	221
10	942
50	1,444
100	1,683
200	1,930
500	2,281
FEMA 100-Year*	875

*Used for comparison/calibration purposes only

3.0 Hydraulic Analysis

Hydraulic calculations for the project were performed using the U.S. Army Corps of Engineers HEC-RAS 6.2 computer program. HEC-RAS is capable of implementing a one-dimensional flow analysis to compute steady-flow and unsteady-flow water surface profiles. The program uses a graphical user interface to organize model characteristics and employ separate hydraulic analysis components, data storage and management capabilities, and graphics and reporting facilities.

To develop a hydraulic model of Violette Brook, a series of cross-sections were delineated along the watercourse. The model covers approximately 960 feet upstream and 1,070 feet downstream of the project site. The length of the project equates to approximately three times the measured FEMA 100-year floodplain width, exceeding FHWA's recommended guidance of twice the width. Where available, project specific field survey information was used. Outside of surveyed limits, available Light Detection and Ranging (LIDAR) data available from NOAA was used. All elevation data is in the NAVD 1988 vertical datum.

Within the extents of the hydraulic model, Violette Brook is a meandering watercourse, with shallow pools and wide floodplains. A Manning's Roughness Coefficient of 0.040 was used to represent the channel. Outside of the main channel's banks, a Manning's Roughness Coefficient of 0.055 was used to represent the undeveloped, scattered brush floodplain consistent with the HEC-RAS Hydraulic Reference Manual.

Values of 0.1 and 0.3 are used for contraction and expansion dynamic head losses, except at the bridge. At the bridge, where the flow area changes more suddenly, values of 0.3 and 0.5 are used.

The procedure used by the HEC-RAS program is based on the solution of the one-dimensional energy equation. The head loss in the energy equation is comprised of friction losses (utilizing Manning's equation) and contraction/expansion losses (coefficient multiplied by the change in velocity head). The HEC-RAS bridge-modeling approach utilizes the energy equation for low flow and high flows. Please note, the proposed bridge operated in low flow conditions only.

All profiles were run utilizing a mixed flow regime. The hydraulic model uses normal depth slope as the downstream boundary condition. The hydraulic analysis procedure used by the HEC-RAS program is based on the solution of the one-dimensional energy equation. The head loss in the energy equation is comprised of friction losses (utilizing Manning's equation) and contraction/expansion losses (coefficient multiplied by the change in velocity head).

3.1. Existing Conditions

An existing conditions model was developed using HEC-RAS to assess the existing hydraulic performance of the culvert. The model incorporates the existing culvert configuration, which consists of a 26.9 foot span and a 7.5 foot rise, providing a hydraulic opening of approximately 150 square feet.

The model was run for all six studied storm events. Results indicate that the culvert can convey the 1.1- and 10-year storm events with more than 3 feet of freeboard between the pipe crown and the water surface elevation. However, during the 50-year storm event, the model shows the culvert becoming fully inundated. The model also shows that the roadway overtopping along the approaches as well.

According to the MaineDOT Bridge Design Guide, culverts are required to maintain a headwater-to-structure depth ratio (HW/D) of less than 0.9 for the 50-year storm event. Under existing conditions, the modeled upstream water surface elevation (WSEL) during the 50-year event is 532.74 feet. Based on this elevation, the existing culvert yields a HW/D ratio of 1.0, which does not satisfy the MaineDOT design requirement.

Please note that at the existing culvert, the model computed a higher water surface elevation (WSEL) during the 100-year event (533.34 feet) compared to the 200-year event (533.21 feet). This outcome is attributed to a shift in the hydraulic flow regime at the culvert. Specifically, the model is set to compute based on energy-based flow conditions. For the 100-year event, the culvert flow was governed by an energy/weir flow condition, whereas the 200-year event transitioned to a pressure/weir flow condition. This change in flow type can result in lower calculated WSELs despite the higher magnitude of the design event.

The existing conditions hydraulic parameter summary can be found in Table 3. Output for all studied storm events, including cross-sections, water surface profiles and profile output tables is located in Appendix C.

3.2. Calibration

To evaluate the accuracy of the Existing Conditions model, a calibration run was performed using the 100-year peak discharge published in the FEMA FIS Report at the Castonguay Road crossing. Consistent with other storm event simulations, the model was run using a mixed flow regime and applied a normal depth boundary condition at the downstream end. The resulting water surface elevations were compared against the effective FEMA BFEs at the various lettered cross sections within the study reach. As summarized in Table 2 below, the modeled water surface elevations generally align well with the published FEMA BFEs, with all differences within 0.5 feet. The minor discrepancies are attributed to the use of more detailed and current topographic data developed for this project, in contrast to the coarser mapping and datasets used in the original FEMA study, which are now over 50 years old.

Table 2: FEMA BFE Comparison

Cross Section		FEMA BFE (ft NAVD88)	Existing Conditions FEMA 100-year (ft NAVD88)
FEMA Lettered Section	Nearest Existing Conditions River Station		
J	63	517.0	517.27
K	933	526.8	525.81
L	1508	530.4	530.94
M	1696	532.3	532.05

3.3. Proposed Conditions

The project proposes replacing the existing culvert with a single-span bridge designed to span the full width of the watercourse. The proposed bridge will provide a clear span of approximately 70 feet and a hydraulic opening of approximately 450 square feet. The bridge's low chord lowered to Elevation 530.04 feet.

The new structure will be supported by vertical wall abutments and will include sloped embankments graded at a 1.75H:1V slope down to the channel. These embankments will be stabilized with riprap to prevent erosion and maintain channel integrity.

The proposed model was evaluated for all six studied storm events. Results indicate that the proposed bridge can convey all events without inundating the low chord or overtopping the roadway.

According to the MaineDOT Bridge Design Guide, minor riverine bridges are recommended to provide a minimum of two (2) feet of clearance between the bottom of the superstructure and the computed WSEL. Additionally, the guide states that these bridges should ideally pass the 100-year event with at least one (1) foot of clearance. While the proposed bridge does not meet the recommended 2 feet of clearance for the 50- and 100-year storm events, it does provide 1.74 feet and 1.58 feet of clearance, respectively. These values exceed the minimum one-foot clearance recommended for the 100-year event.

To evaluate the proposed bridge's impact on the 100-year floodplain of Violette Brook, computed 100-year WSELs under proposed conditions were compared to existing conditions. Upstream of the bridge, between Section 2093 and Section 1508, the proposed WSELs range from 0.11 feet higher to 1.22 feet lower than existing. As the model approaches Bridge No. 5309, the proposed 100-year WSELs show a substantial reduction. At Section 1190 (the upstream approach section), the WSEL decreases by 5.42 feet, and at Section 1162 (the upstream bridge face), the reduction is 4.84 feet. These reductions are primarily attributed to more than doubling the bridge's hydraulic opening under the proposed conditions.

Immediately downstream of the bridge, the proposed model indicates increases in the 100-year WSELs of 0.47 feet at Section 1094 (downstream bridge face) and 0.66 feet at Section 1061. Further downstream, proposed WSELs converge with existing conditions. A summary of key hydraulic parameters under proposed conditions is provided in Table 3. Output for all studied storm events, including cross-sections, water surface profiles and profile output tables, is located in Appendix D.

Table 3: Hydraulic Analysis Summary

Summary of Hydraulic Data	Existing Conditions	Proposed Conditions
Low Chord Elevation (ft NAVD88)	531.68	530.04
Clear Span (ft)	26.9	70.0
Bridge Opening Area (sq. ft)	151	455
Ordinary High-Water Elevation (Q1.1) at US Bridge Face (ft NAVD 88) ¹	526.48	526.34
Ordinary High-Water Velocity (Q1.1) at DS Bridge Face (ft/s) ²	2.29	1.26
Q10 Headwater Elevation (ft NAVD88) ¹	529.46	527.91
Q50 Headwater Elevation (ft NAVD88) ¹	532.74	528.30
Q100 Headwater Elevation (ft NAVD88) ¹	533.31	528.46
Q200 Headwater Elevation (ft NAVD88) ¹	533.16	528.64
Q500 Headwater Elevation (ft NAVD88) ¹	533.39	528.99
Q10 Discharge Velocity (fps) ²	7.28	3.36
Q50 Discharge Velocity (fps) ²	11.09	4.82
Q100 Discharge Velocity (fps) ²	12.05	5.53
Q200 Discharge Velocity (fps) ²	12.60	6.22
Q500 Discharge Velocity (fps) ²	13.34	6.97
Q10 Clearance (ft) ³	2.23	2.13
Q50 Clearance (ft) ³	-1.06	1.74
Q100 Clearance (ft) ³	-1.63	1.58
Q200 Clearance (ft) ³	-1.48	1.40
Q500 Clearance (ft) ³	-1.71	1.05

- Note: 1. Headwater Elevation is taken at Section 1131 BR U.
2. Discharge Velocity is taken at Section 1131 BR D.
3. Negative Clearances indicate that the low chord of the bridge is submerged.

4.0 Scour Analysis

A scour analysis was performed based on equations from FHWA's HEC-18 (Fifth Edition) Manual. The 100-year and 500-year events serve as the scour design and check events for the proposed bridge, respectively, since the hydraulic design event is the 50-year flood in accordance with HEC-18 and MaineDOT's Bridge Design Guide. Previous inspection reports do not depict the channel's characteristics; thus USDA Web Soil Survey website was accessed to provide the streambed material for the site. Based on the website, the site consists of Winooski silt loam. The D50 of the streambed material was estimated to be approximately 0.063 mm, which is less than the HEC-18 recommended minimum of 0.2 mm. A copy of the USDA Web Soil Survey can be found in Appendix H.

In accordance with FHWA's HEC-18 and TechBrief HIF-19-007, abutment scour was calculated only using the NCHRP 24-20 method. The NCHRP method differs from the traditional method by computing total scour directly instead of requiring separate computations for contraction and local abutment scour. In accordance with Section 8 of the HEC-18 manual, the hydraulic parameters required by the NCHRP method were obtained from the project's HEC-RAS model.

The scour analysis was performed on the proposed conditions model. Scour depths for the proposed conditions model is summarized in Table 4. The scour calculations can be found in Appendix E.

Table 4: Scour Depths at Bridge No. 5309

Event	Location	Ground Elevation (ft NAVD88)	NCHRP Total Scour (ft)	Scour Bottom Elevation (ft NAVD88)
500-Year	Left Abutment	527.54	7.53	520.01
	Right Abutment	528.24	7.07	521.17
100-Year	Left Abutment	527.54	2.83	524.71
	Right Abutment	528.24	1.08	527.16

Notes:

1. Left = Northern, Right = Southern
2. The calculations do not account for any proposed scour protection such as riprap.

5.0 Scour Countermeasure Analysis

As part of the proposed alternative, the channel banks will be lined with riprap, through the bridge and extending throughout the channel modifications. The riprap sizing analysis was performed based on equations from FHWA publication HEC-23 (Third Edition), Design Guideline 4 for Riprap Revetment. Design Guideline 14 for Rock Riprap at Bridge Abutments was also used to confirm riprap sizing. The 100- and 500-year storm events were used to riprap sizing calculations. Based on the calculations, riprap with a minimum D50 of 6 inches will provide the acceptable abutment protection from scour and erosion. The scour countermeasure calculations can be found in Appendix G.

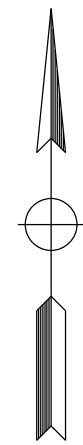
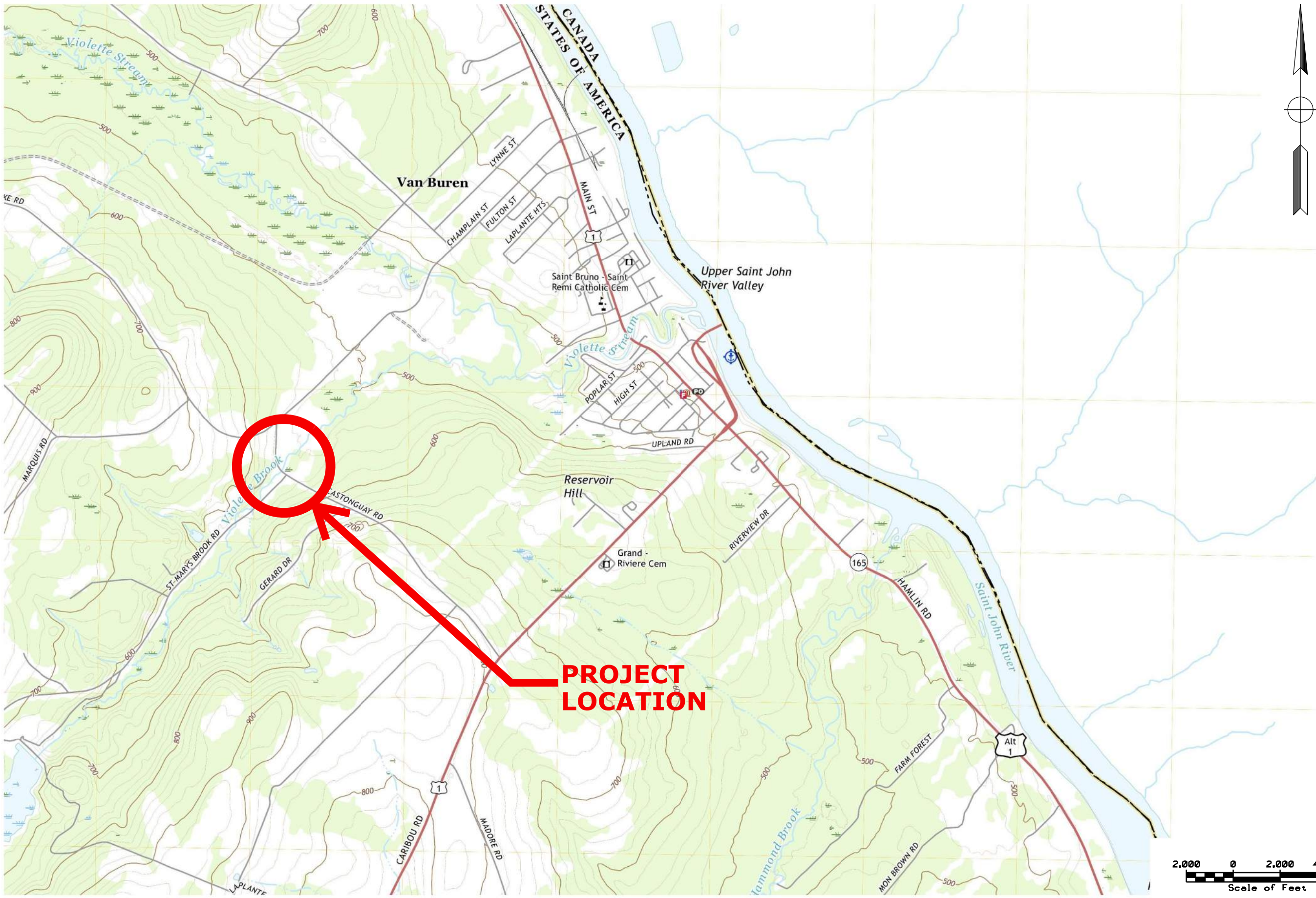
6.0 Summary

The project proposes the replacement of Bridge No. 5309, St. Mary's Bridge, which carries Castonguay Road over Violette Brook in the Town of Van Buren, Maine. The existing culvert structure will be replaced with a single-span superstructure supported on vertical abutments. The proposed bridge will provide a clear span of 70 feet, fully spanning the channel. As part of the design, Violette Brook will be realigned within the bridge limits to improve channel hydraulics and accommodate the new structure. The surrounding embankments will be regraded to match the revised channel alignment and expanded bridge footprint. To mitigate future bank erosion, the regraded slopes will be stabilized with riprap.

The proposed bridge design is not compliant with the MaineDOT Bridge Design Guide clearance requirements, as it doesn't provide the required clearance of 2 feet, during the 50- and 100-year storm events. The bridge will provide clearance of 1.41 feet for the 50-year storm event and 1.16 feet for the 100-year storm event. Replacing the existing culvert with the bridge will reduce 100-year WSELs up to 5.42 feet. Downstream of the bridge, water surface elevations are shown to converge within the model limits for all storm events. The proposed model does not show any adverse impacts to downstream property owners.

APPENDIX A

Project Location Map



HNTB

STATE OF MAINE DEPARTMENT OF TRANSPORTATION		BRIDGE NO. 5309	
		SHEET NUMBER FIG - 01	
ST. MARY'S BRIDGE OVER VIOLETTE BROOK TOWNSHIP OF VAN BUREN ARROOSTOOK COUNTY		LOCATION MAP	
PROJ. MANAGER KAM	BY KAM	DATE 01/24	SIGNATURE
CHECKED-REVIEWED	DESIGNS-DETAILED	DESIGNS-DETAILED	P.E. NUMBER
REVISIONS 1	REVISIONS 2	REVISIONS 3	DATE
REVISIONS 4	FIELD CHANGES		

APPENDIX B

Hydrologic Analysis

MaineDOT Hydrology Calculations

WIN:	22624.00
Town:	Van Buren
Route No.:	Castonguay Rd
Asset ID:	5309
Lat:	47.1510
Long:	-67.9688

Project Name:	Van Buren St Mary's Bridge
Stream Name:	Violette Stream
Bridge Name:	St Mary's
Analysis by:	DFB
Date:	8/15/2017

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999 & Lombard/Hodgkins, 2015)

Enter data in blue cells only!

	km ²	mi ²	ac
A	32.12	12.40	7936.0
W	2.31	0.9	569.8

Enter data in [mi²]

Watershed Area *DRNAREA*
Wetlands area (by NWI)

P _c	574745	5219438
County	Aroostook N	
pptA	36.1	
SG	0.06	

watershed centroid (E, N; UTM 19N; meters)

choose county from drop-down menu

mean annual precipitation (inches; by look-up)

sand & gravel aquifer as decimal fraction of watershed A

A (km ²)	32.12
W (%)	7.18

Conf Lvl

NWI Wetlands % *STORNWI*

Worksheet prepared by:

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207-557-1052

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ver. 2017 Jun. 09

References:

Hodgkins, G.A., 1999.
Estimating the magnitude of peak flows for streams
in Maine for selected recurrence intervals
WRIR 99-4008, USGS Augusta, ME

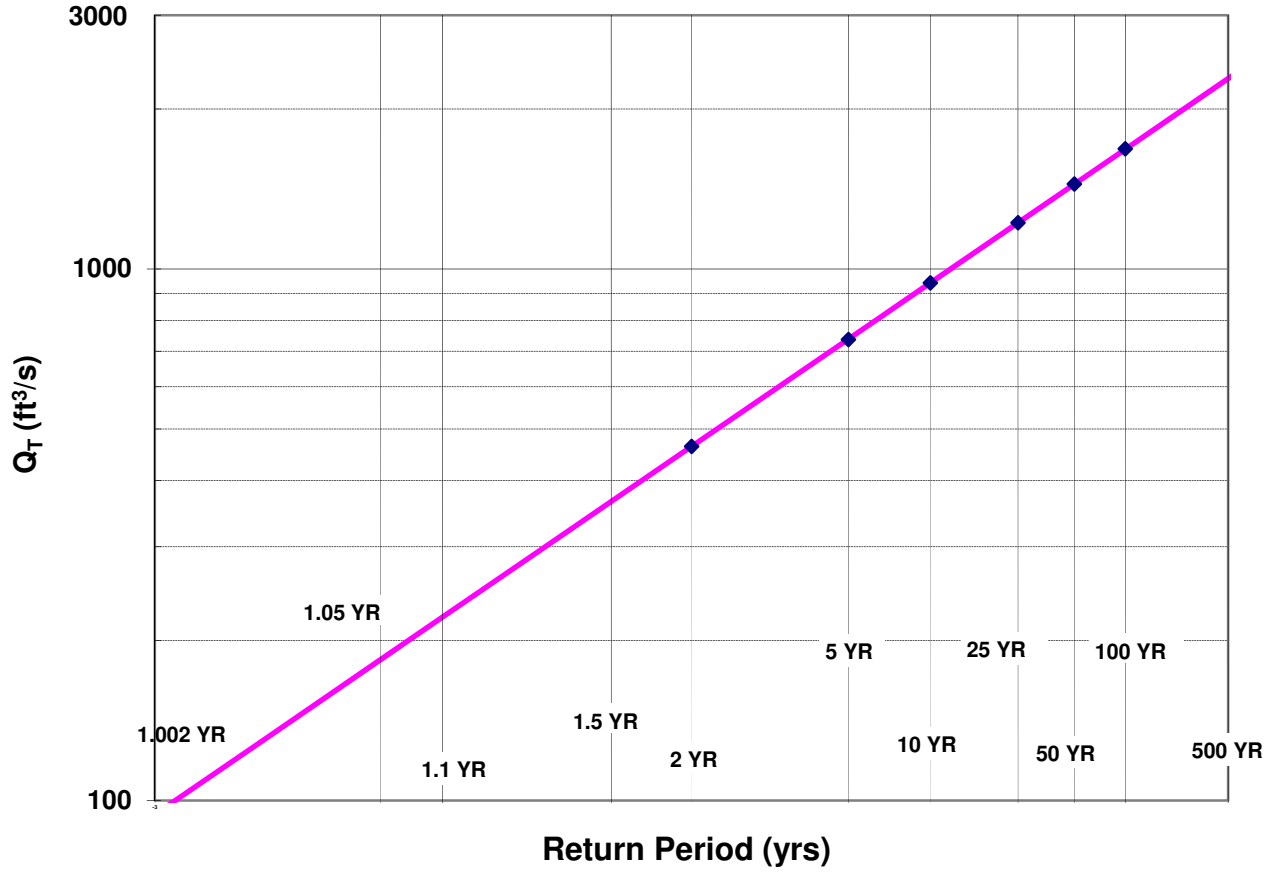
Lombard, P.J. & G.A. Hodgkins, 2015.
Peak flow regression equations for small, ungaged streams in
Maine - Comparing map-based to field-based variables
SIR 2015-4059, USGS, Augusta, ME

Ret Pd T (yr)	Peak Flow Estimate		
	Lower	Q _T (m ³ /s)	Upper
1.1		6.27	
2		13.13	
5		20.85	
10		26.68	
25		34.61	
50		40.90	
100		47.65	
500		64.59	

Q _T (ft ³ /s)
221.3
463.5
736.4
942.1
1222.0
1444.2
1682.5
2280.5

$$Q_T = b \times A^a \times 10^{-wW}$$

Log-Normal Probability Plot



WIN:	22624.00
Town:	Van Buren
Route No.:	Castonguay Rd
Asset ID:	5309
Lat:	47.15100
Long:	-67.96876

Project Name:	Van Buren St Mary's Bridge
Stream Name:	Violette Stream
Bridge Name:	St Mary's
Analysis by:	DFB
Date:	8/15/2017

DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED

MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013)

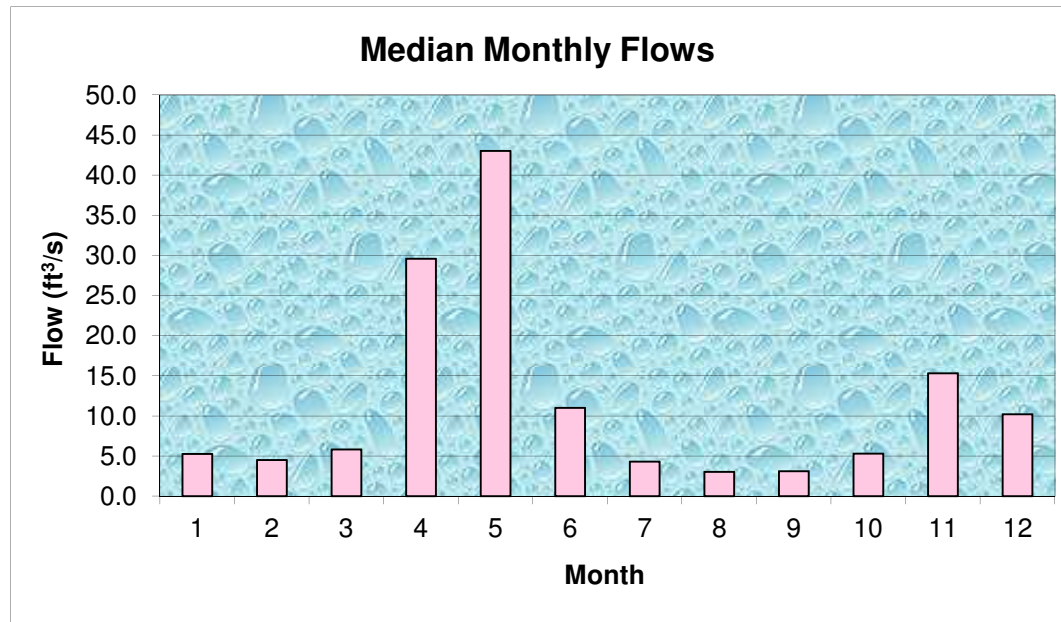
Value	Variable	Explanation
12.40	A	Area (mi ²)
574745	P _c	Watershed centroid (E,N; UTM; Zone 19; meters)
185.32	DIST	Distance from Coastal reference line (mi)
36.1	pptA	Mean Annual Precipitation (inches)
0.06	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q _{median} (ft ³ /s)	(m ³ /s)
Jan	5.26	0.1490
Feb	4.53	0.1284
Mar	5.84	0.1655
Apr	29.59	0.8386
May	43.03	1.2194
Jun	11.02	0.3123
Jul	4.33	0.1228
Aug	3.03	0.0858
Sep	3.12	0.0884
Oct	5.31	0.1504
Nov	15.31	0.4338
Dec	10.21	0.2894

Q _{bf}	73.0
ann avg	22.5
ann med	9.8
Q _{1.002}	94.1
Q _{1.01}	127.5
Q _{1.05}	183.9
Q _{bf}	174.7

assume v = 4ft/s

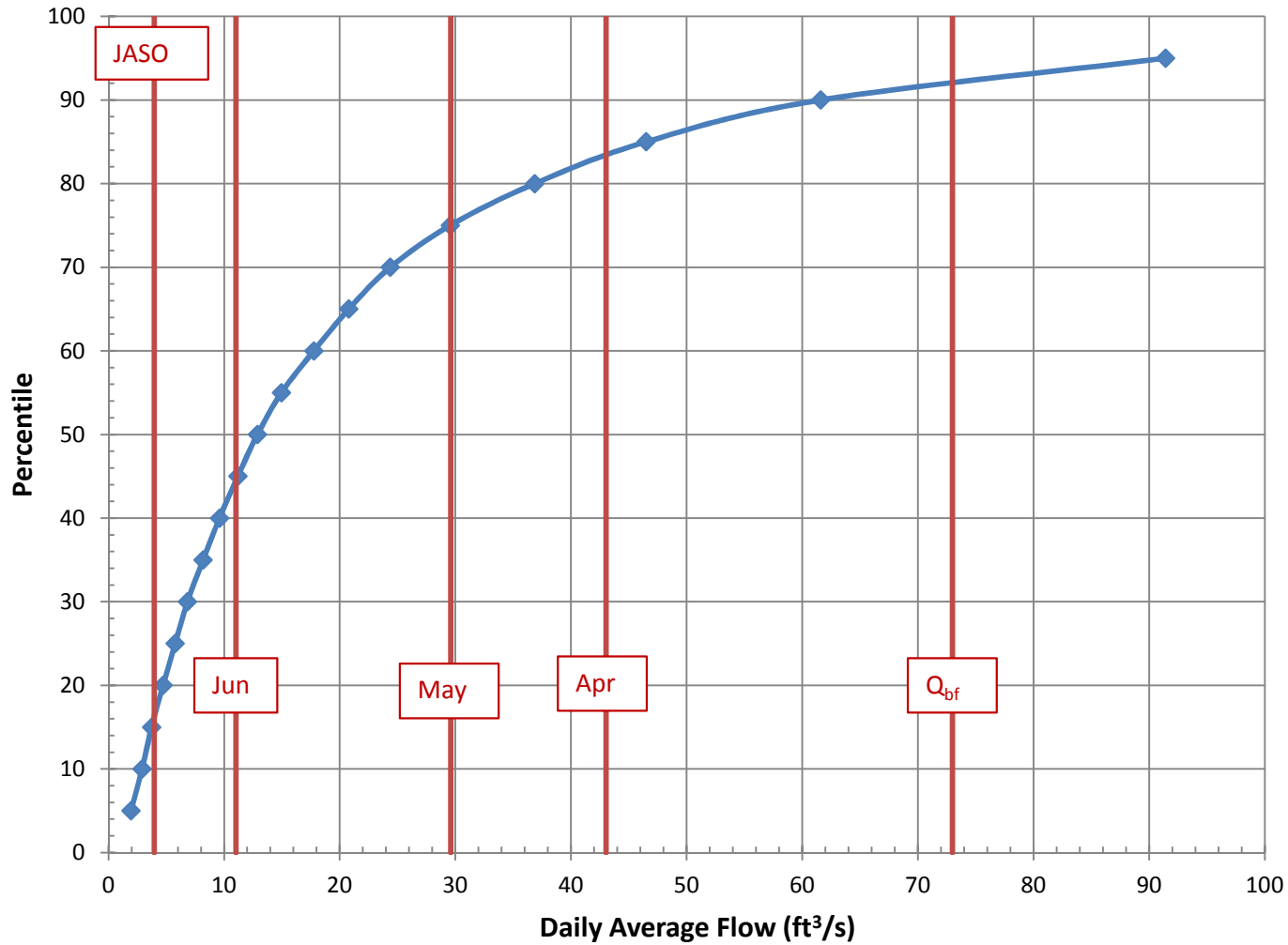
W _{bf}	31.2	estimated bankfull width (ft)
d _{bf}	1.4	estimated bankfull depth (ft)
A _{bf}	39.7	estimated bankfull flow area (ft ²)



References

Dudley, R.W., 2013. FY2013 Progress Report - Phase 1 ..., USFWS QRP Project
 Dudley, R.W., 2004. Estimating Monthly Streamflows ..., SIR 2004-5026

Daily Average Flow Distribution



Daily Avg Flow Dist

$A_{ws} = (mi^2)$ 12.4

Q (ft³/s)

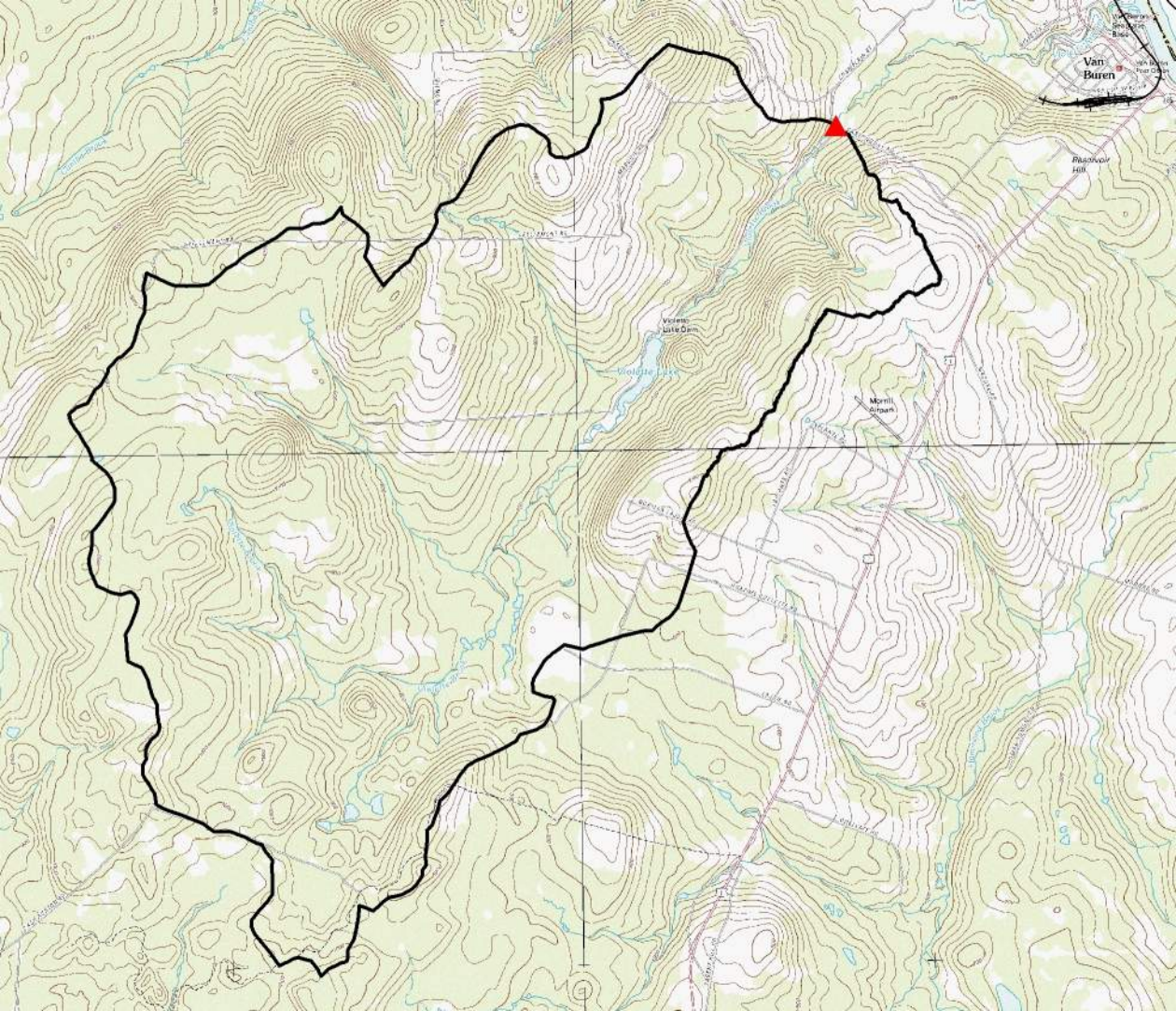
Pctl	Median	84 th pctl
5	1.95	3.14
10	2.90	4.36
15	3.73	5.44
20	4.72	6.60
25	5.77	7.74
30	6.83	8.81
35	8.18	10.07
40	9.60	11.58
45	11.19	13.10
50	12.88	15.46
55	14.96	18.00
60	17.76	21.12
65	20.78	24.61
70	24.38	28.71
75	29.55	34.53
80	36.86	41.23
85	46.50	52.83
90	61.60	70.94
95	91.42	110.32

Q_{bf} 73.0

$Q_{1.002}$ 94.1

$Q_{1.1}$ 221.3

Q_2 463.5



Van Buren 22624 Castonguay Rd @ Violette Stream Br # 5309

Region ID:

ME

Workspace ID:

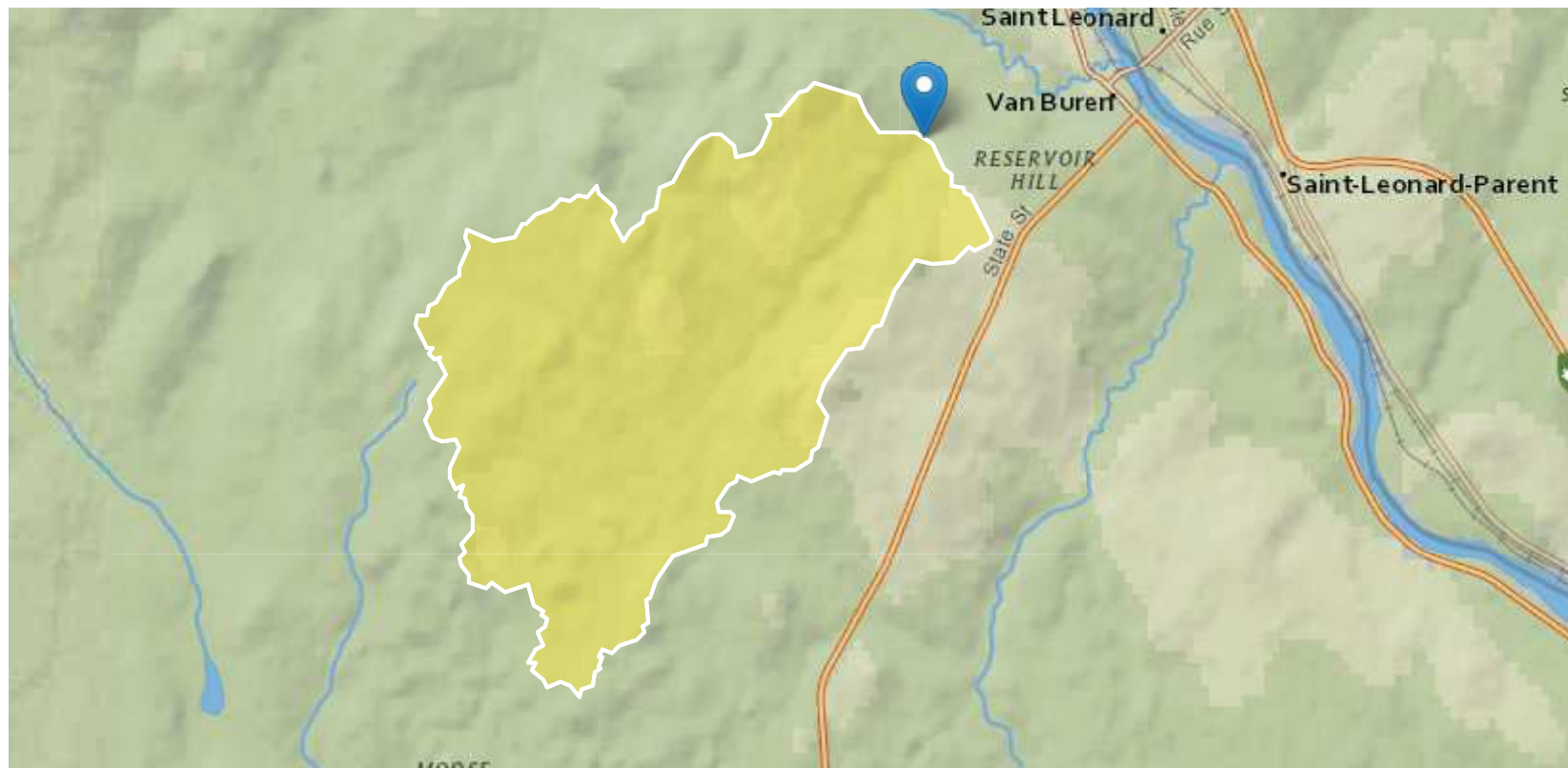
ME20170314092200008000

Clicked Point (Latitude, Longitude):

47.15107, -67.96883

Time:

2017-03-14 11:23:16 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	12.4	square miles
STORNWI	Percentage of storage (combined water bodies and wetlands) from the National Wetlands Inventory	7.18	percent
ELEV	Mean Basin Elevation	868.3	feet
PRECIP	Mean Annual Precipitation	38	inches
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	5.65	percent
COASTDIST	Shortest distance from the coastline to the basin centroid	187	miles
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	574745.04	State plane coordinates
CENTROIDY	Basin centroid vertical (y) location in state plane units	5219437.92	State plane coordinates
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0.057	dimensionless
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.23	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	1.59	percent
LC06WATER	Percent of open water, class 11, from NLCD 2006	0.35	percent
ELEVMAX	Maximum basin elevation	1124.5	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	8.18	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	0.0381	percent

Peak-Flow Statistics Parameters [100 Percent (NaN square miles) Statewide Peak Flow Full GT 12sqmi WRI 99 4008]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
-----------------------	-----------------------	--------------	--------------	------------------	------------------

DRNAREA	Drainage Area	12.4	square miles	0.93	1653
STORNWI	Percentage of Storage from NWI	7.18	percent	0.7	26.7

Peak-Flow Statistics Flow Report [100 Percent (NaN square miles) Statewide Peak Flow Full GT 12sqmi WRI 99 4008]

Statistic	Value	Unit	Average standard error (of either estimate or prediction)	Equivalent years of record	Lower Prediction Interval	Upper Prediction Interval
2 Year Peak Flood	463	ft ³ /s	35.1	1.8	258	834
5 Year Peak Flood	736	ft ³ /s	36.1	2.5	405	1340
10 Year Peak Flood	942	ft ³ /s	36.8	3.2	510	1740
25 Year Peak Flood	1220	ft ³ /s	38.6	4.1	645	2320
50 Year Peak Flood	1440	ft ³ /s	39.9	4.8	746	2800
100 Year Peak Flood	1680	ft ³ /s	41.2	5.4	850	3330
500 Year Peak Flood	2280	ft ³ /s	44.9	6.4	1090	4790

Peak-Flow Statistics Citations

Hodgkins, G. A.,1999, Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals: U.S. Geological Survey Water-Resources Investigations Report 99-4008, 45 p. (<http://me.water.usgs.gov/99-4008.pdf>)

Corresponding FEMA Data

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevation (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum (NAVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map is Universal Transverse Mercator (UTM) zone 19. The **horizontal datum** is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by the Maine GIS Data Catalog. The digital files were created in 2001 and are suitable for applications requiring a 1:12000 map scale.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

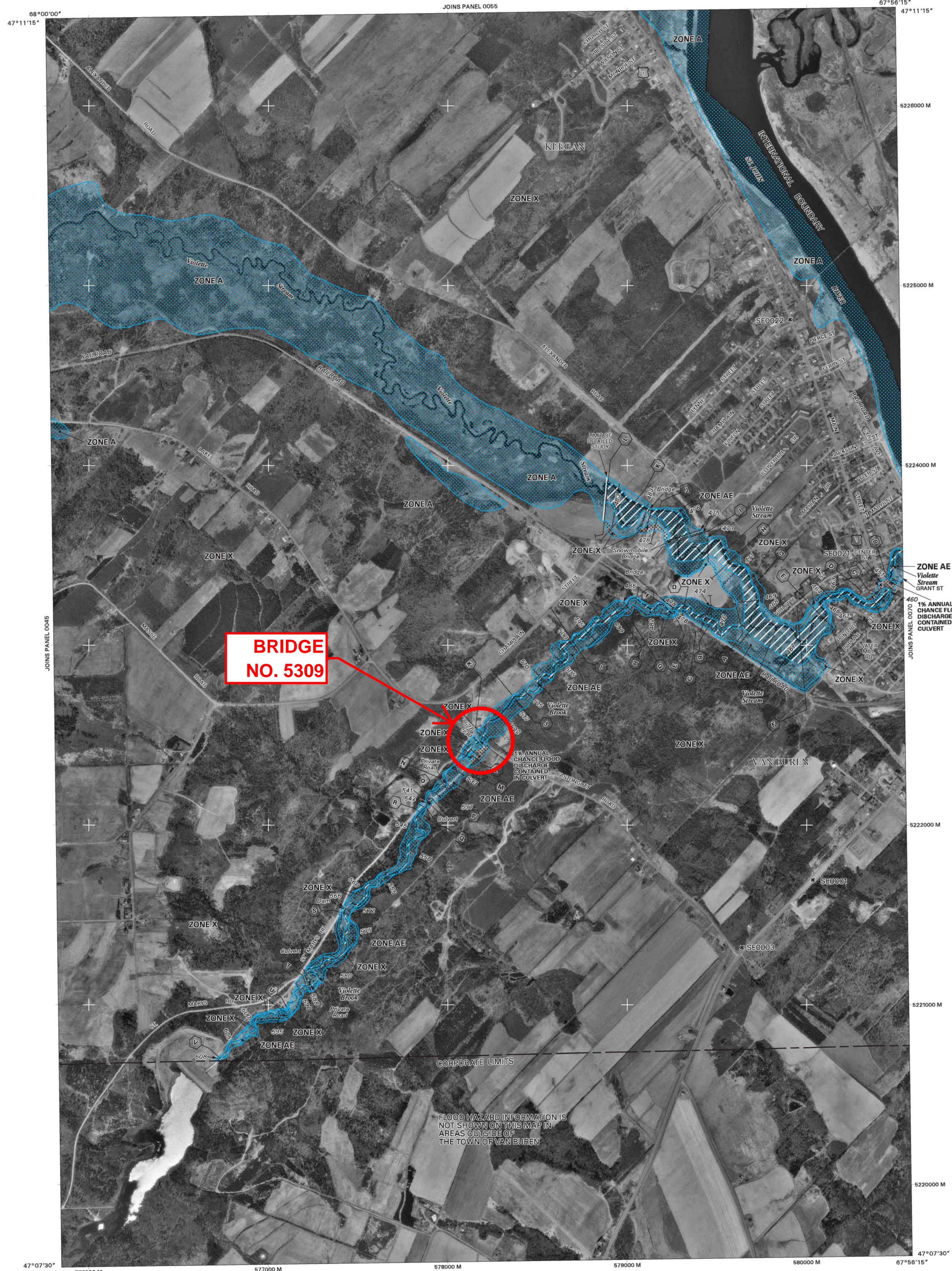
Please refer to the separately printed **Map Index** for an overview map showing the layout of map panels for this jurisdiction.

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL may be available. Contact the **FEMA Map Service Center** at the following phone numbers and internet address for information on all related products available from FEMA:

Phone: 800-358-9616
FAX: 800-358-9620
<http://msc.fema.gov/>

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip/>

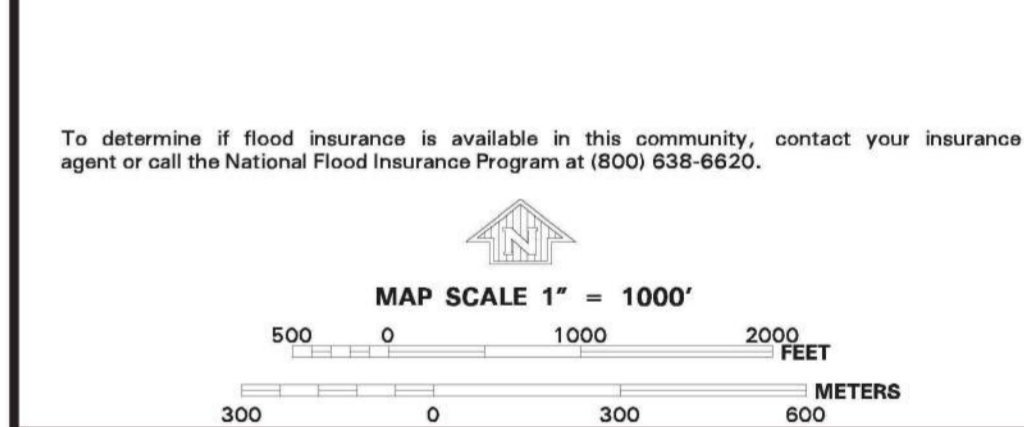
This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report may reflect stream channel distances that differ from what is shown on this map.



LEGEND

- SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT
- 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** Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently deactivated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.
- ZONE A99** Area to be protected from 1% annual chance flood event 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.
- 1% annual chance floodplain boundary
- 0.2% annual chance 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 velocities.
- 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
- Cross Section Line
- Transect Line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid values, zone 19
- 5000-foot grid ticks
- Bench mark (see explanation in Notes to Users section of this FIRM panel).
- River Mile
- MAP REPOSITORY
Town Office Building, 51 Main Street, Suite 101, Van Buren, ME 04785
(Maps available for reference only, not for distribution.)
- INITIAL IDENTIFICATION
JUNE 14, 1974
FLOOD HAZARD BOUNDARY MAP REVISIONS
SEPTEMBER 24, 1976
FLOOD INSURANCE RATE MAP EFFECTIVE
MARCH 18, 1988
FLOOD INSURANCE RATE MAP REVISIONS
JANUARY 16, 2008; to add base flood elevations, to change zone designations, to update map format, to update roads and road names, to reflect updated topographic information.



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0065C

FIRM
FLOOD INSURANCE RATE MAP
TOWN OF
VAN BUREN,
MAINE
AROSTOOK COUNTY
PANEL 65 OF 70
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
VAN BUREN, TOWN OF	230038	0065	C

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
2300360065C

MAP REVISED:
JANUARY 16, 2008

Federal Emergency Management Agency

FLOOD INSURANCE STUDY



**TOWN OF VAN BUREN,
MAINE
AROOSTOOK COUNTY**

REVISED:
JANUARY 16, 2008



Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
230036V000A

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (sq. mi.)	Peak Discharges (cubic feet per second (cfs))			
		<u>10-Percent- Annual-chance</u>	<u>2-Percent- Annual-chance</u>	<u>1-Percent- Annual-chance</u>	<u>0.2-Percent- Annual-chance</u>
VIOLETTE STREAM					
Bangor and Aroostook Railroad	65.1	3,740	5,885	6,950	9,525
U.S. Route 1, Main Street	65.0	3,735	5,880	6,940	9,520
Champlain Street	50.7	3,125	5,155	6,160	8,600
VIOLETTE BROOK					
Old Railroad Grade	13.5	625	885	1,020	1,290
Castonguay Road	12.8	585	775	875	1,065
Private Road	12.6	575	750	840	1,015
St. Mary's Road	12.4	560	715	795	945
Private Road	10.7	465	505	525	565

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

NRCS's Computer Program for Water Surface Profiles (WSP2) (Reference 4) provided information on elevation, discharge, flow area, and flooded area at specified locations along stream valleys. The program can compute up to 15 water surface profiles in one pass through the watershed. It uses the standard step method, with some modifications, to compute profiles between valley cross sections. At a road crossing, it calculates head loss through a bridge opening, culverts, or a combination of both. It can compute flow profiles for subcritical and critical flow.

NRCS conducted field surveys to obtain cross section data for Violette Stream and Violette Brook. All bridges, dams, and culverts were surveyed to obtain elevation data and structural geometry. Roughness coefficients (Manning's "n") for all flooding sources were estimated by field inspection at each cross section. The ranges of values for the roughness coefficients are shown below in Table 2, Manning's "n" Coefficients.

Table 2. Manning's "n" Coefficients

<u>Source</u>	<u>Channel</u>	<u>Overbanks</u>
Violette Stream	0.045 – 0.055	0.055 – 0.095
Violette Brook	0.040 – 0.065	0.055 – 0.095

The boundaries of the 1- and 0.2-percent-annual-chance floods were delineated from elevations determined at each cross section. Between cross sections, the flood boundaries were interpolated using topographic maps at a scale of 1:24,000 and contour interval of 20 feet, and aerial photography.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM.

The hydraulic analyses for this study were based on unobstructed flow. The analyses did not consider the effect of ice jams. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD or to obtain current elevation, description, and/or location information for benchmarks shown on this map visit the National Geodetic Survey (NGS) website at www.ngs.noaa.gov, or contact the NGS at the following address:

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

Fax: (301) 713-4172, or
 Telephone: (301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
Violette Brook								
A	250	30	157	6.8	467.7	465.7 ²	466.6	0.9
B	1,125	109	240	6.1	473.1	473.1	473.9	0.8
C	1,245	125	344	3.7	474.0	474.0	475.0	1.0
D	1,965	92	313	3.6	477.5	477.5	478.3	0.8
E	2,230	30	152	6.7	478.6	478.6	479.4	0.8
F	2,510	74	250	4.9	480.7	480.7	481.5	0.8
G	3,135	40	224	4.5	483.8	483.8	484.5	0.7
H	3,620	82	243	4.9	488.6	488.6	489.4	0.8
I	4,738	89	234	5.4	499.6	499.6	500.5	0.9
J	6,723	61	212	5.3	517.0	517.0	518.0	1.0
K	7,692	53	170	6.4	526.8	526.8	527.4	0.6
L	8,152	54	315	2.8	530.4	530.4	530.8	0.4
M	8,442	25	130	6.6	532.3	532.3	533.2	0.9
N	9,004	41	164	5.6	537.6	537.6	537.9	0.3
O	9,280	33	136	6.3	539.4	539.4	540.1	0.7
P	9,493	24	126	6.3	540.8	540.8	541.7	0.9
Q	9,673	27	142	6.2	542.0	542.0	543.0	1.0
R	9,803	36	155	5.3	542.7	542.7	543.6	0.9
S	12,775	66	442	1.8	572.0	572.0	572.1	0.1
T	14,907	39	192	3.5	589.0	589.0	590.0	1.0
U	15,605	21	98	5.3	593.5	593.5	594.5	1.0
V	17,466	26	105	4.8	607.8	607.8	608.6	0.8

PROJECT AREA →

¹ Feet above confluence with Violette Stream

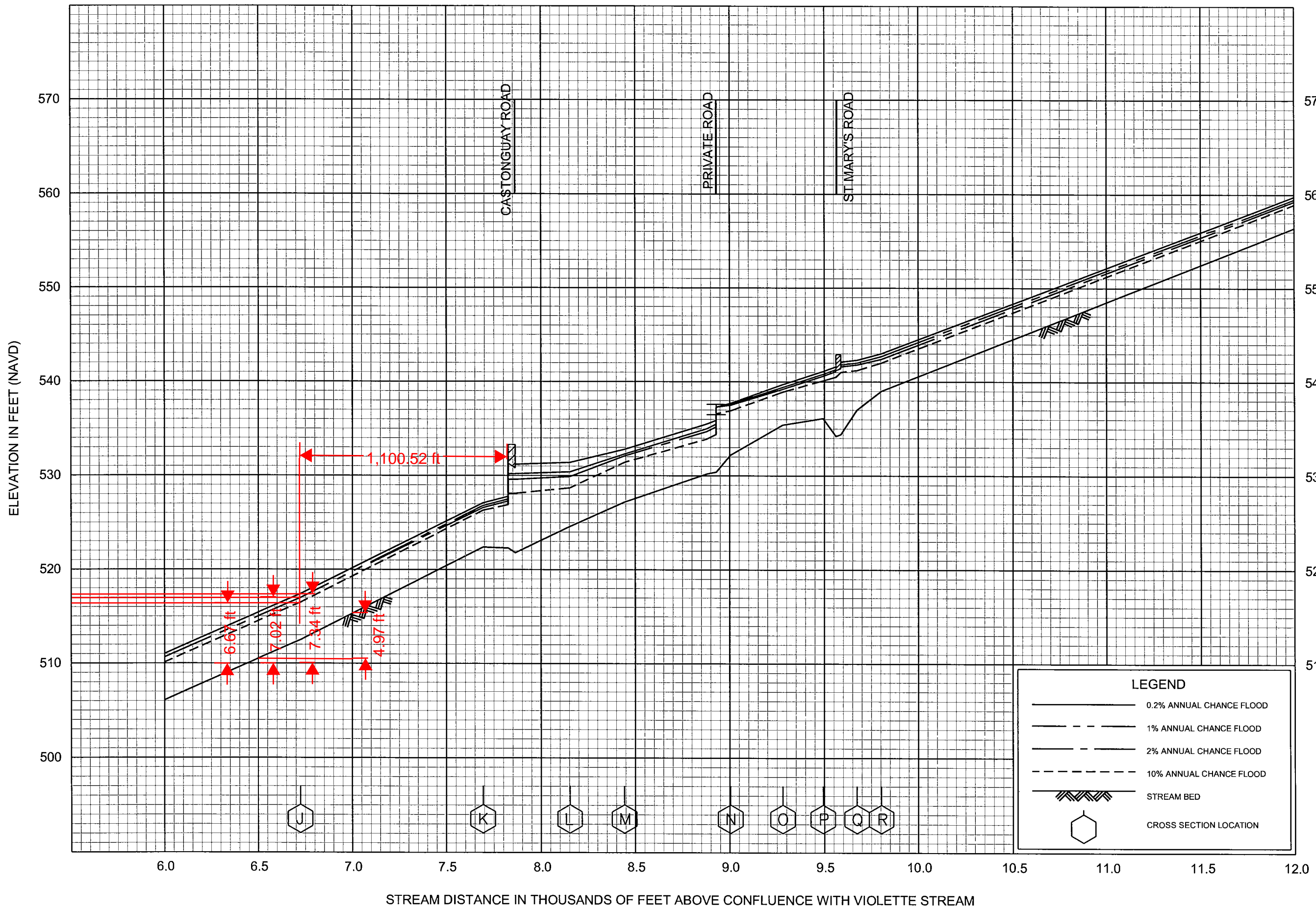
² Elevation computed without consideration of backwater effects from Violette Stream

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
TOWN OF VAN BUREN
 (AROOSTOOK COUNTY, ME)

FLOODWAY DATA

VIOLETTE BROOK

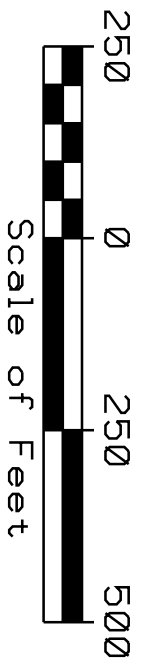
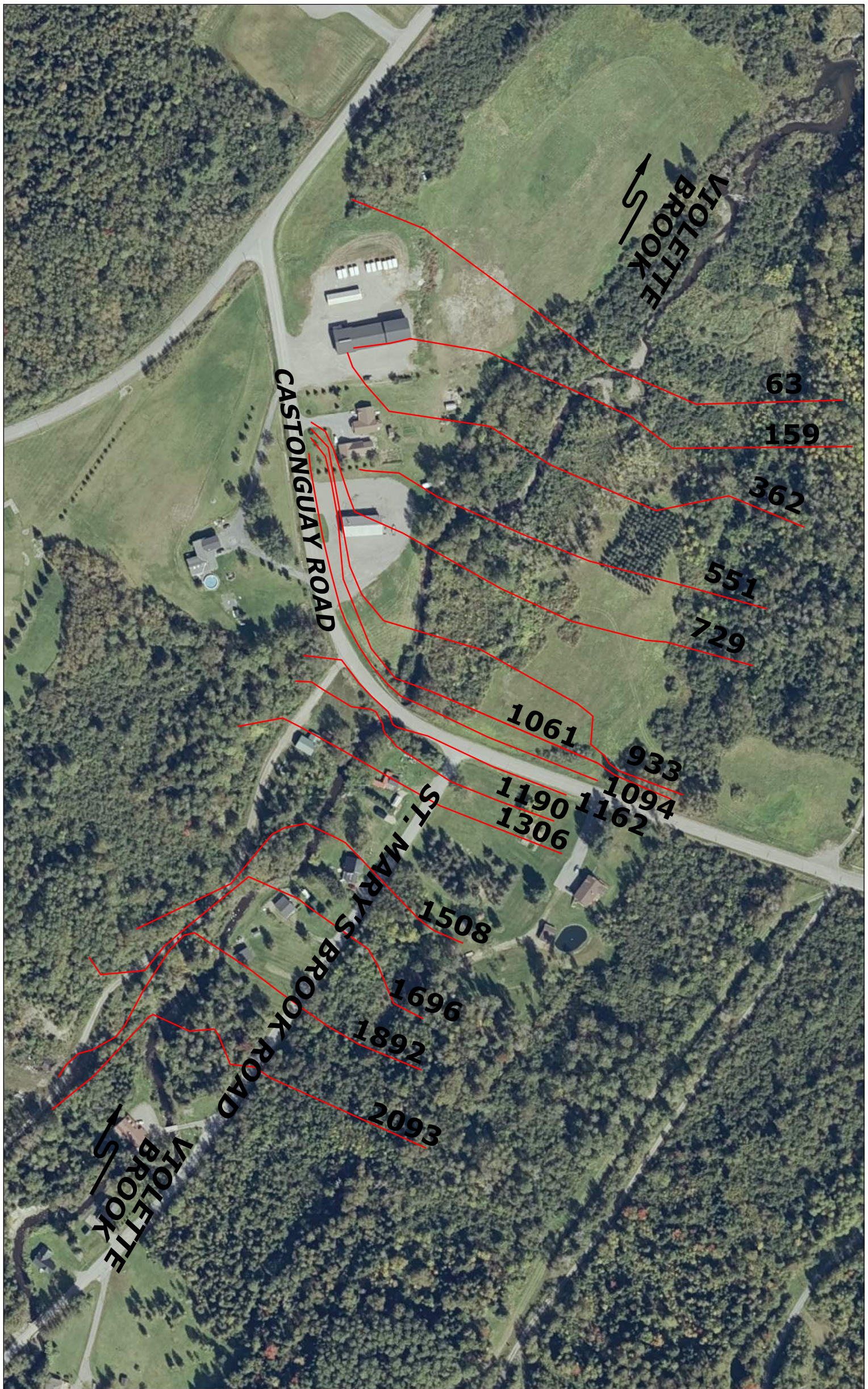


FLOOD PROFILES
VIOLETTE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY
TOWN OF VAN BUREN, ME
(AROOSTOCK CO.)

APPENDIX C

Existing Hec-Ras Analysis



HNTB

FIG -02

ST. MARY'S BRIDGE OVER
VIOLETTE BROOK
TOWN OF VAN BUREN AROOSTOOK COUNTY
CROSS-SECTION MAP

PROJ. MANAGER	PROJ.MANAGER\$	BY	DATE
DESIGN-DETAILED		KAM	12/23
CHECKED-REVIEWED		SCF	12/23
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

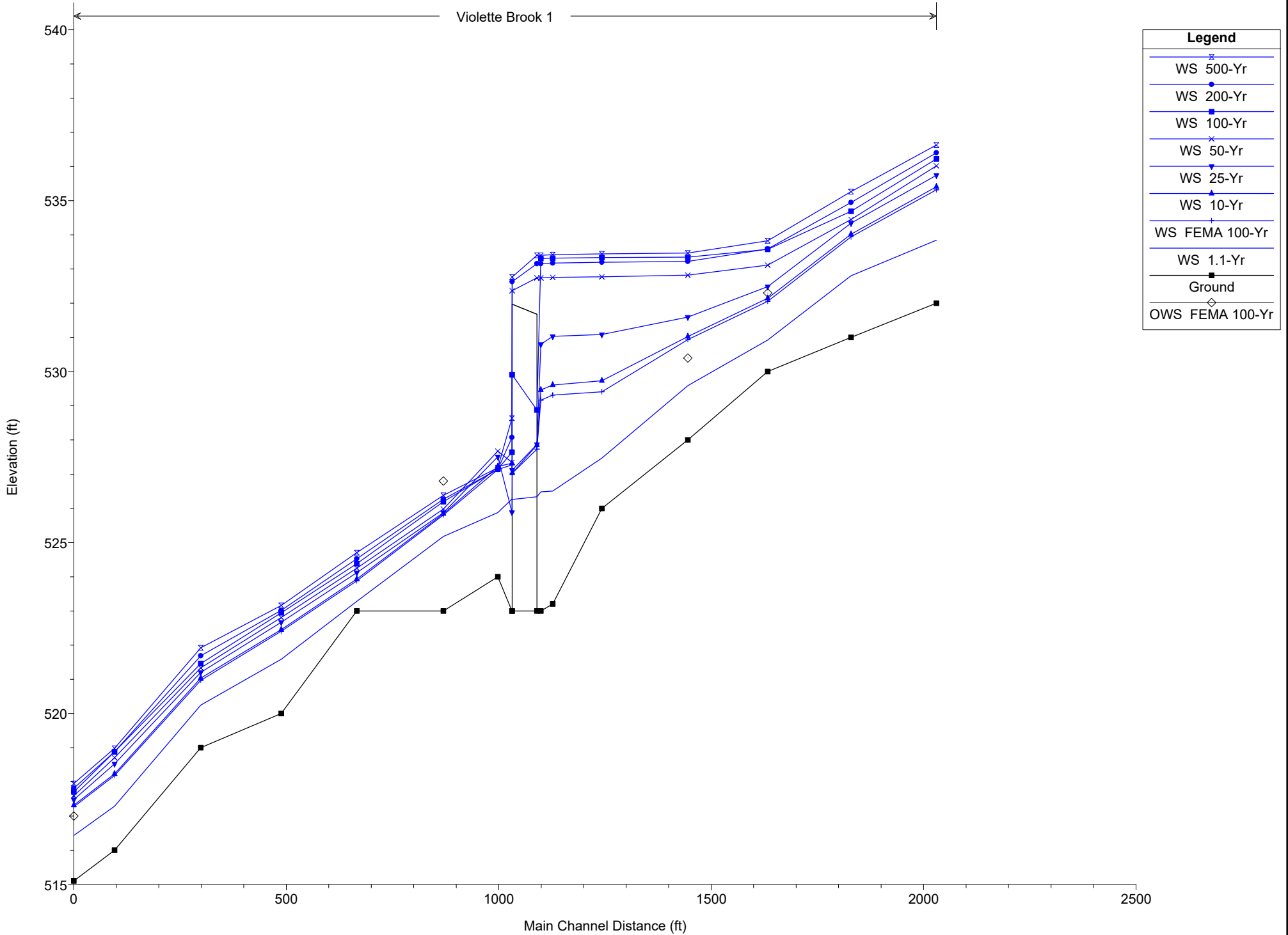
SIGNATURE	_____
P.E. NUMBER	_____
DATE	_____

STATE OF MAINE	
DEPARTMENT OF TRANSPORTATION	
WIN	
BRIDGE NO. 5309	

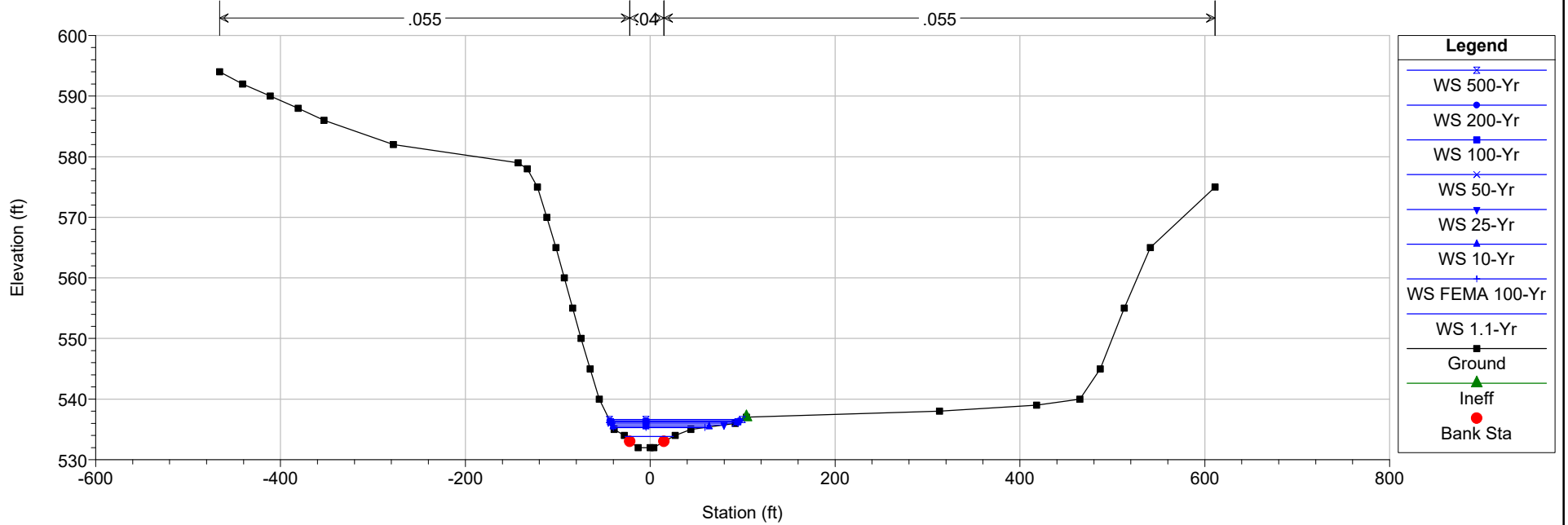
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	2093	1.1-Yr	221.00	532.00	533.85	533.32	534.05	0.005309	3.66	64.87	52.27	0.51
1	2093	10-Yr	942.00	532.00	535.41	534.97	536.04	0.007432	6.85	180.21	103.93	0.68
1	2093	25-Yr	1222.00	532.00	535.75	535.43	536.51	0.008189	7.70	218.11	121.17	0.73
1	2093	50-Yr	1444.00	532.00	536.02	535.77	536.85	0.008228	8.12	253.13	134.49	0.74
1	2093	100-Yr	1683.00	532.00	536.22	536.13	537.14	0.008712	8.65	280.87	137.59	0.77
1	2093	200-Yr	1930.00	532.00	536.40	536.35	537.41	0.009305	9.21	305.74	140.31	0.80
1	2093	500-Yr	2281.00	532.00	536.63	536.63	537.78	0.010137	9.96	337.74	143.73	0.84
1	2093	FEMA 100-Yr	875.00	532.00	535.32	534.84	535.91	0.007235	6.63	170.78	99.18	0.67
1	1892	1.1-Yr	221.00	531.00	532.80		532.93	0.005658	2.83	78.05	76.18	0.49
1	1892	10-Yr	942.00	531.00	534.02	533.51	534.35	0.008584	4.58	205.83	133.71	0.65
1	1892	25-Yr	1222.00	531.00	534.34	533.80	534.71	0.008600	4.87	251.00	148.82	0.66
1	1892	50-Yr	1444.00	531.00	534.45	534.45	534.90	0.010177	5.40	267.36	153.92	0.72
1	1892	100-Yr	1683.00	531.00	534.69	534.69	535.16	0.009685	5.50	306.16	165.41	0.71
1	1892	200-Yr	1930.00	531.00	534.95		535.42	0.008921	5.51	350.53	177.63	0.69
1	1892	500-Yr	2281.00	531.00	535.26	534.63	535.75	0.008090	5.60	407.66	187.91	0.67
1	1892	FEMA 100-Yr	875.00	531.00	533.94	533.43	534.25	0.008513	4.48	195.13	129.87	0.64
1	1696	1.1-Yr	221.00	530.00	530.93	530.82	531.14	0.016800	3.72	59.38	87.29	0.80
1	1696	10-Yr	942.00	530.00	532.15	531.78	532.59	0.009164	5.39	183.63	114.42	0.70
1	1696	25-Yr	1222.00	530.00	532.49	532.05	533.00	0.008587	5.84	223.95	121.41	0.69
1	1696	50-Yr	1444.00	530.00	533.11	532.28	533.52	0.005006	5.27	304.46	140.74	0.55
1	1696	100-Yr	1683.00	530.00	533.58	532.48	533.97	0.003982	5.19	377.63	176.46	0.50
1	1696	200-Yr	1930.00	530.00	533.59	532.69	534.10	0.005164	5.93	379.85	177.44	0.57
1	1696	500-Yr	2281.00	530.00	533.83	532.95	534.42	0.005532	6.43	425.17	196.22	0.60
1	1696	FEMA 100-Yr	875.00	530.00	532.05	531.71	532.48	0.009389	5.28	173.35	112.56	0.70
1	1508	1.1-Yr	221.00	528.00	529.59		529.70	0.004216	2.64	83.73	72.98	0.43
1	1508	10-Yr	942.00	528.00	531.03		531.35	0.004732	4.62	217.12	116.49	0.52
1	1508	25-Yr	1222.00	528.00	531.59		531.93	0.003736	4.72	290.78	142.29	0.48
1	1508	50-Yr	1444.00	528.00	532.82		533.00	0.001401	3.63	503.82	207.86	0.31
1	1508	100-Yr	1683.00	528.00	533.35		533.53	0.001202	3.64	675.28	385.42	0.29
1	1508	200-Yr	1930.00	528.00	533.22		533.48	0.001825	4.40	625.84	383.42	0.36
1	1508	500-Yr	2281.00	528.00	533.47		533.76	0.001934	4.69	721.97	387.29	0.37
1	1508	FEMA 100-Yr	875.00	528.00	530.94		531.24	0.004661	4.47	206.82	113.19	0.51
1	1306	1.1-Yr	221.00	526.00	527.47	527.47	527.96	0.024089	5.64	39.20	40.36	1.01
1	1306	10-Yr	942.00	526.00	529.73		530.18	0.007164	5.33	176.75	79.61	0.63
1	1306	25-Yr	1222.00	526.00	531.09		531.32	0.002244	4.00	366.74	236.58	0.38
1	1306	50-Yr	1444.00	526.00	532.77		532.83	0.000418	2.25	1093.62	555.39	0.18
1	1306	100-Yr	1683.00	526.00	533.34		533.38	0.000306	2.07	1417.27	582.42	0.15
1	1306	200-Yr	1930.00	526.00	533.20		533.26	0.000466	2.51	1336.57	580.45	0.19
1	1306	500-Yr	2281.00	526.00	533.45		533.52	0.000502	2.68	1481.87	583.98	0.20
1	1306	FEMA 100-Yr	875.00	526.00	529.41		529.92	0.009386	5.77	151.61	74.22	0.71
1	1190	1.1-Yr	221.00	523.20	526.51	525.10	526.59	0.001285	2.45	106.00	58.39	0.27
1	1190	10-Yr	942.00	523.20	529.61		529.82	0.001248	4.10	313.62	94.32	0.30
1	1190	25-Yr	1222.00	523.20	531.03		531.16	0.000690	3.54	707.06	401.54	0.23
1	1190	50-Yr	1444.00	523.20	532.76		532.79	0.000188	2.14	1512.21	548.95	0.13
1	1190	100-Yr	1683.00	523.20	533.32		533.35	0.000157	2.04	1834.53	580.22	0.12
1	1190	200-Yr	1930.00	523.20	533.18		533.22	0.000234	2.46	1750.23	578.13	0.14
1	1190	500-Yr	2281.00	523.20	533.42		533.47	0.000266	2.67	1892.76	581.66	0.15
1	1190	FEMA 100-Yr	875.00	523.20	529.31		529.52	0.001280	4.01	287.70	81.78	0.31
1	1162	1.1-Yr	221.00	523.00	526.48	524.59	526.56	0.000907	2.31	98.13	41.79	0.23
1	1162	10-Yr	942.00	523.00	529.46	526.52	529.77	0.001448	4.60	228.43	115.12	0.33
1	1162	25-Yr	1222.00	523.00	530.80	527.04	531.12	0.001164	4.72	291.24	304.60	0.31
1	1162	50-Yr	1444.00	523.00	532.74	527.55	532.78	0.000198	2.26	1434.06	535.72	0.13
1	1162	100-Yr	1683.00	523.00	533.31	528.11	533.34	0.000167	2.16	1744.19	555.81	0.12
1	1162	200-Yr	1930.00	523.00	533.16	528.50	533.21	0.000248	2.60	1660.25	551.48	0.15
1	1162	500-Yr	2281.00	523.00	533.40	528.99	533.46	0.000285	2.84	1795.06	558.41	0.16
1	1162	FEMA 100-Yr	875.00	523.00	529.17	526.37	529.47	0.001507	4.54	214.44	92.75	0.33
1	1131		Bridge									
1	1094	1.1-Yr	221.00	523.00	526.28	524.28	526.36	0.000815	2.29	99.23	177.04	0.23
1	1094	10-Yr	942.00	523.00	527.32	526.21	528.12	0.005657	7.28	133.21	285.56	0.62
1	1094	25-Yr	1222.00	523.00	525.89	526.80	529.09	0.038832	14.47	86.57	145.70	1.52
1	1094	50-Yr	1444.00	523.00	527.34	527.22	529.21	0.013059	11.09	133.93	288.42	0.95
1	1094	100-Yr	1683.00	523.00	527.65	527.65	529.85	0.014059	12.05	143.75	327.32	0.99
1	1094	200-Yr	1930.00	523.00	528.07	528.07	530.48	0.013651	12.60	157.64	374.14	0.99
1	1094	500-Yr	2281.00	523.00	528.64	528.64	531.33	0.013263	13.34	176.00	383.07	1.00
1	1094	FEMA 100-Yr	875.00	523.00	527.27	526.09	527.98	0.005079	6.84	131.60	279.22	0.59
1	1061	1.1-Yr	221.00	524.00	525.88		526.21	0.009297	4.86	54.78	56.70	0.68
1	1061	10-Yr	942.00	524.00	527.23	527.23	527.75	0.009250	7.31	257.12	271.00	0.75

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	1061	25-Yr	1222.00	524.00	527.51	527.51	528.01	0.008702	7.54	344.12	337.61	0.74
1	1061	50-Yr	1444.00	524.00	527.68	527.68	528.18	0.008784	7.83	401.95	375.41	0.75
1	1061	100-Yr	1683.00	524.00	527.15	527.81	529.08	0.034544	13.87	236.64	252.79	1.45
1	1061	200-Yr	1930.00	524.00	527.14	527.86	529.71	0.046009	15.98	235.03	251.29	1.67
1	1061	500-Yr	2281.00	524.00	527.19	527.96	530.47	0.058603	18.23	246.89	262.06	1.89
1	1061	FEMA 100-Yr	875.00	524.00	527.13	527.13	527.67	0.009640	7.30	232.60	249.03	0.76
1	933	1.1-Yr	221.00	523.00	525.18	524.55	525.37	0.004260	3.73	96.85	266.05	0.47
1	933	10-Yr	942.00	523.00	525.84	525.84	526.19	0.008712	6.50	331.03	436.67	0.71
1	933	25-Yr	1222.00	523.00	525.87	526.02	526.40	0.013469	8.15	344.02	444.22	0.89
1	933	50-Yr	1444.00	523.00	525.98	526.12	526.53	0.013980	8.53	392.70	471.44	0.91
1	933	100-Yr	1683.00	523.00	526.20	526.20	526.59	0.010193	7.67	497.67	484.58	0.79
1	933	200-Yr	1930.00	523.00	526.27	526.27	526.70	0.011139	8.14	532.10	487.31	0.83
1	933	500-Yr	2281.00	523.00	526.38	526.38	526.85	0.011717	8.56	588.51	491.75	0.85
1	933	FEMA 100-Yr	875.00	523.00	525.81	525.79	526.14	0.008369	6.31	315.14	427.25	0.70
1	729	1.1-Yr	221.00	523.00	523.28	523.28	523.42	0.037008	3.00	73.74	271.51	1.01
1	729	10-Yr	942.00	523.00	523.93	523.73	524.13	0.011492	3.59	262.04	305.45	0.68
1	729	25-Yr	1222.00	523.00	524.12	523.86	524.34	0.009901	3.78	346.10	543.89	0.66
1	729	50-Yr	1444.00	523.00	524.25	523.96	524.47	0.008792	3.85	418.18	551.65	0.63
1	729	100-Yr	1683.00	523.00	524.38	524.13	524.60	0.007931	3.93	490.64	559.35	0.61
1	729	200-Yr	1930.00	523.00	524.52	524.23	524.74	0.006924	3.94	571.79	567.84	0.58
1	729	500-Yr	2281.00	523.00	524.70	524.33	524.93	0.006107	4.00	675.23	578.49	0.55
1	729	FEMA 100-Yr	875.00	523.00	523.88	523.70	524.07	0.012172	3.56	245.48	302.62	0.70
1	551	1.1-Yr	221.00	520.00	521.58	521.35	521.66	0.004162	2.80	131.05	201.55	0.44
1	551	10-Yr	942.00	520.00	522.45		522.64	0.006301	4.88	336.58	295.65	0.59
1	551	25-Yr	1222.00	520.00	522.67		522.89	0.006717	5.38	405.85	330.81	0.62
1	551	50-Yr	1444.00	520.00	522.81		523.05	0.007184	5.77	452.63	352.58	0.65
1	551	100-Yr	1683.00	520.00	522.95		523.22	0.007561	6.14	502.29	374.30	0.67
1	551	200-Yr	1930.00	520.00	523.01		523.34	0.008832	6.75	528.59	386.79	0.72
1	551	500-Yr	2281.00	520.00	523.16		523.54	0.010059	7.46	587.40	424.63	0.78
1	551	FEMA 100-Yr	875.00	520.00	522.40		522.58	0.006007	4.69	323.07	288.29	0.57
1	362	1.1-Yr	221.00	519.00	520.24	520.24	520.47	0.011990	4.13	78.61	207.88	0.72
1	362	10-Yr	942.00	519.00	521.03	520.92	521.30	0.010282	5.60	310.08	378.41	0.73
1	362	25-Yr	1222.00	519.00	521.20		521.50	0.010600	6.03	376.89	420.23	0.75
1	362	50-Yr	1444.00	519.00	521.33		521.64	0.010414	6.24	433.63	452.73	0.76
1	362	100-Yr	1683.00	519.00	521.46		521.77	0.010208	6.42	494.16	485.01	0.76
1	362	200-Yr	1930.00	519.00	521.69		521.95	0.007876	6.02	612.08	542.39	0.67
1	362	500-Yr	2281.00	519.00	521.92		522.16	0.006731	5.91	745.52	600.76	0.63
1	362	FEMA 100-Yr	875.00	519.00	520.97	520.88	521.24	0.010888	5.62	285.16	362.79	0.75
1	159	1.1-Yr	221.00	516.00	517.29	516.98	517.45	0.008407	3.23	68.33	73.74	0.59
1	159	10-Yr	942.00	516.00	518.23	518.23	518.83	0.014434	6.26	168.07	196.90	0.86
1	159	25-Yr	1222.00	516.00	518.53	518.53	519.14	0.012574	6.51	232.12	239.46	0.82
1	159	50-Yr	1444.00	516.00	518.70	518.70	519.34	0.012143	6.78	276.71	265.09	0.82
1	159	100-Yr	1683.00	516.00	518.88	518.88	519.54	0.011635	7.00	325.87	290.74	0.81
1	159	200-Yr	1930.00	516.00	518.88	518.88	519.74	0.015265	8.02	326.22	290.92	0.93
1	159	500-Yr	2281.00	516.00	518.98	518.98	520.01	0.017673	8.87	355.83	305.32	1.01
1	159	FEMA 100-Yr	875.00	516.00	518.19	518.14	518.74	0.013886	6.03	159.10	190.18	0.84
1	63	1.1-Yr	221.00	515.10	516.43	516.17	516.57	0.009952	2.97	74.40	103.61	0.62
1	63	10-Yr	942.00	515.10	517.31	517.21	517.59	0.009951	4.43	268.94	411.55	0.68
1	63	25-Yr	1222.00	515.10	517.48	517.38	517.79	0.009947	4.79	337.87	432.62	0.70
1	63	50-Yr	1444.00	515.10	517.59	517.49	517.92	0.009946	5.03	388.23	447.38	0.70
1	63	100-Yr	1683.00	515.10	517.71	517.58	518.05	0.009942	5.27	439.54	461.94	0.71
1	63	200-Yr	1930.00	515.10	517.81	517.68	518.18	0.009945	5.49	489.99	475.82	0.72
1	63	500-Yr	2281.00	515.10	517.95	517.81	518.35	0.009958	5.78	558.15	493.95	0.73
1	63	FEMA 100-Yr	875.00	515.10	517.27	517.16	517.54	0.009954	4.33	251.15	405.93	0.68

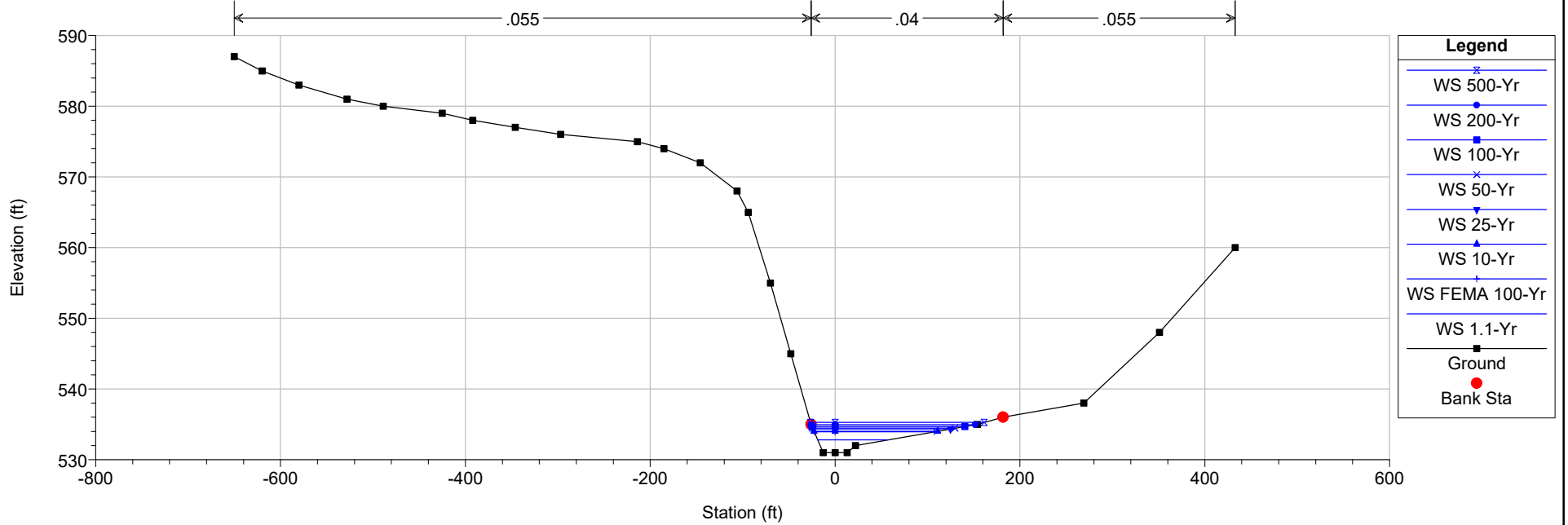
Violette Brook 1



_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024
RS = 2093

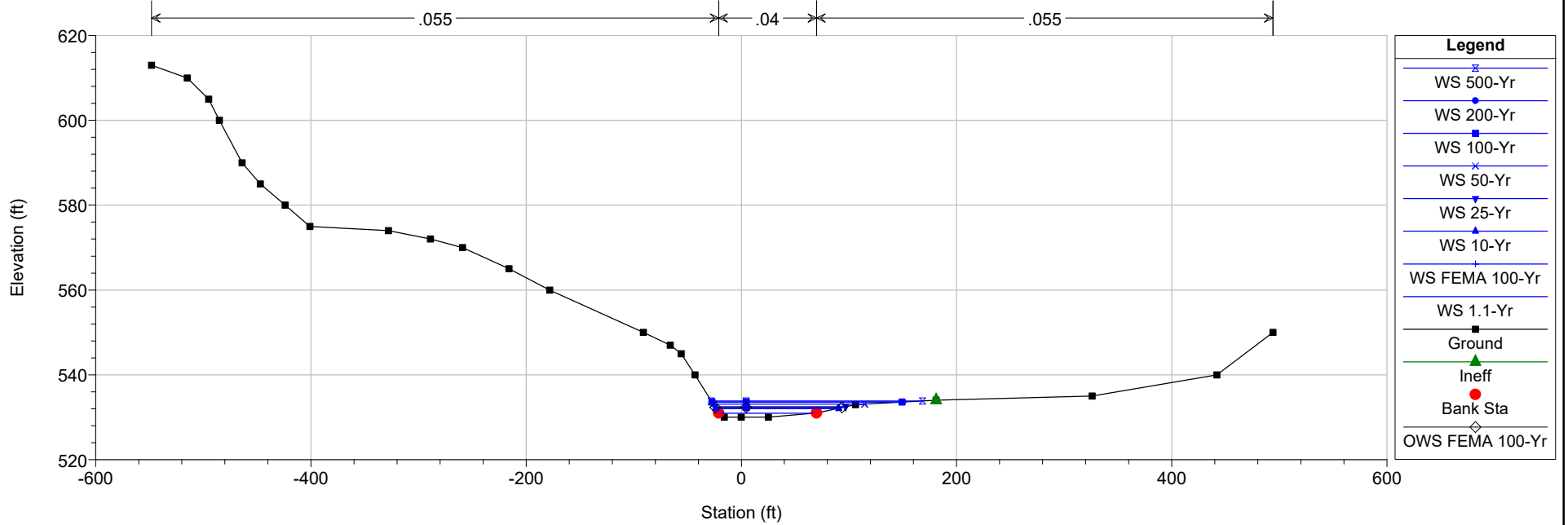


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RS = 1892



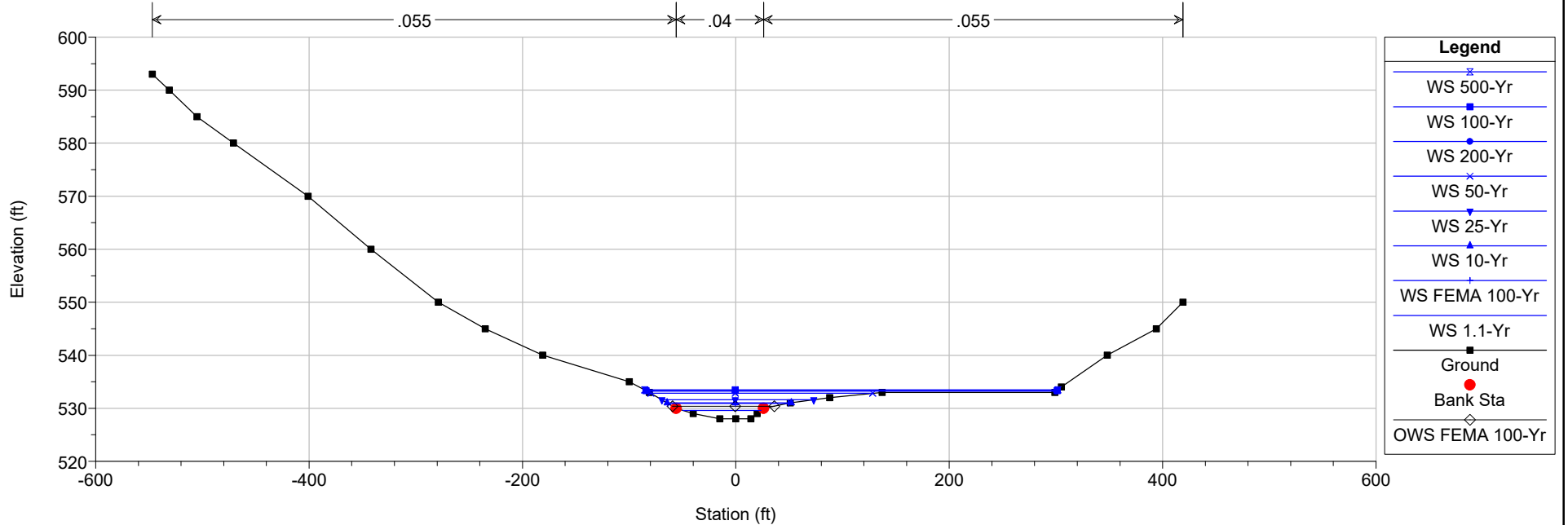
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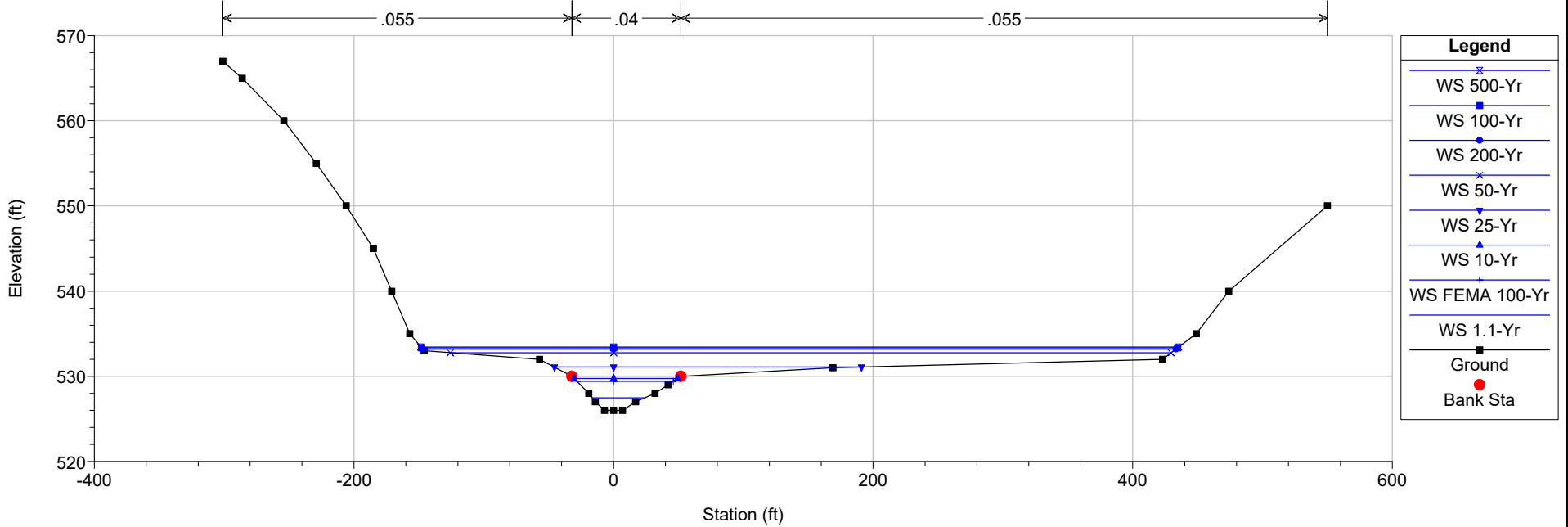


_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024

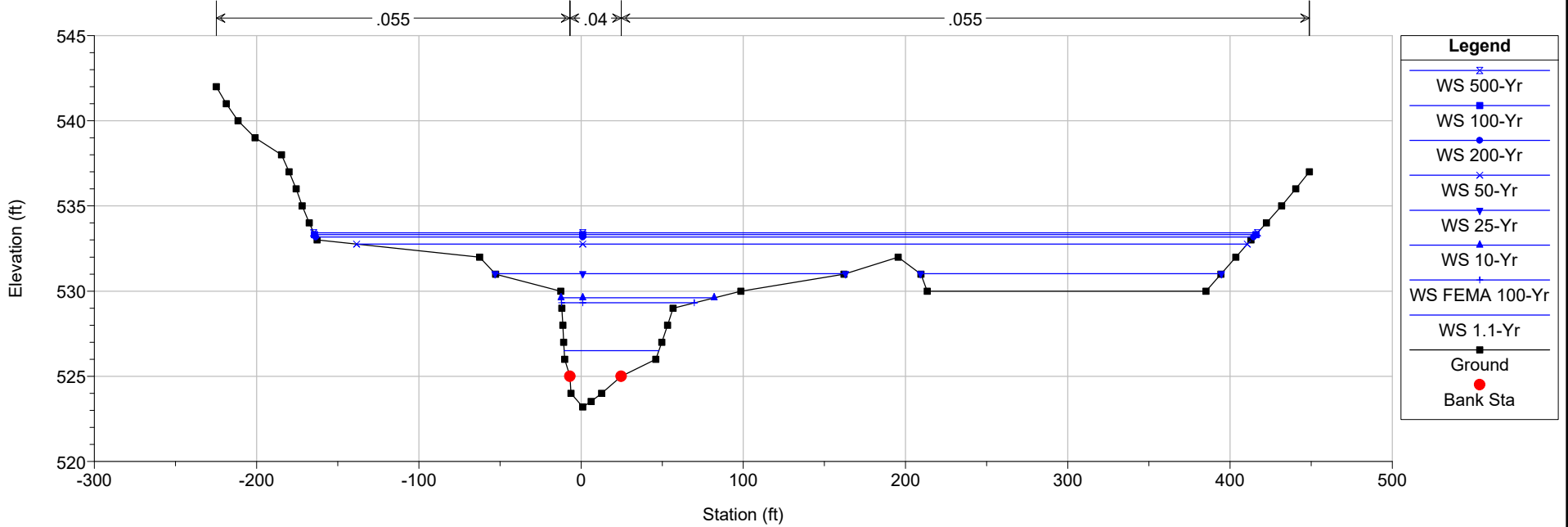
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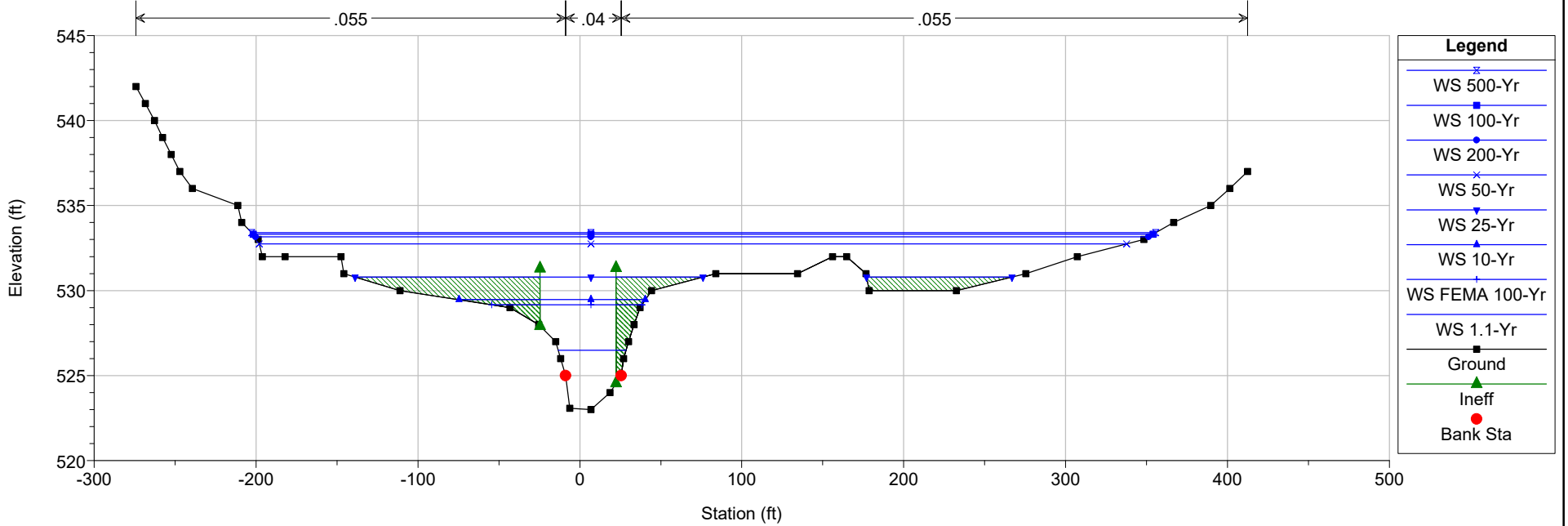
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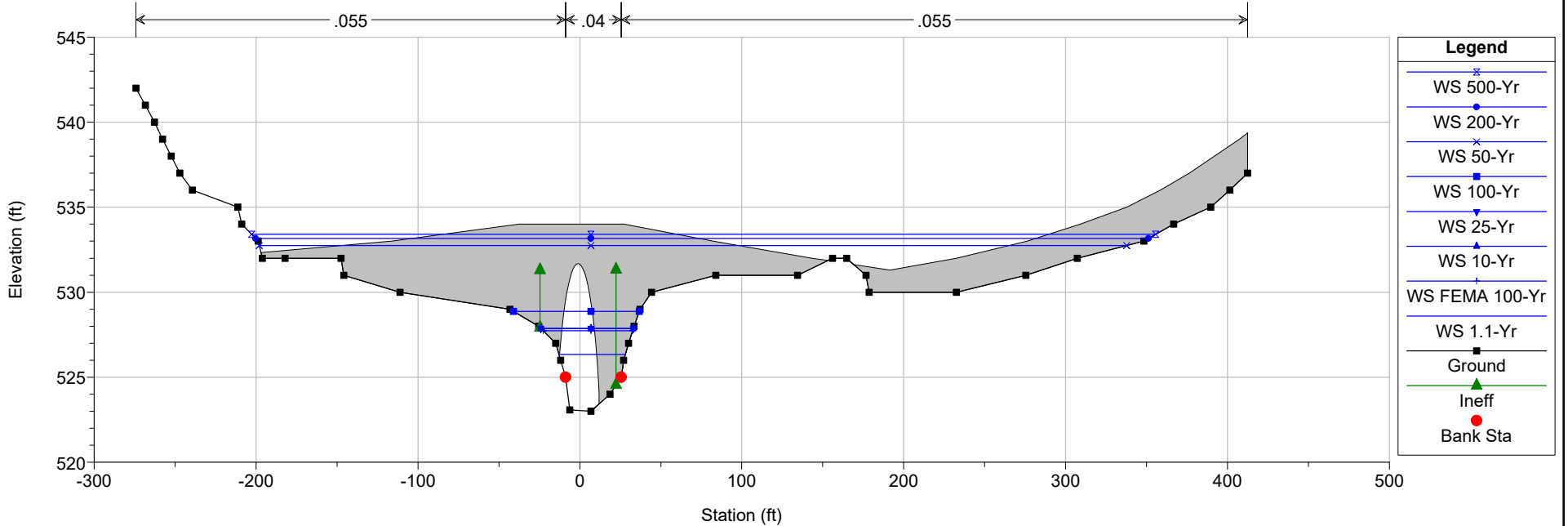
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RS = 1190 Approach



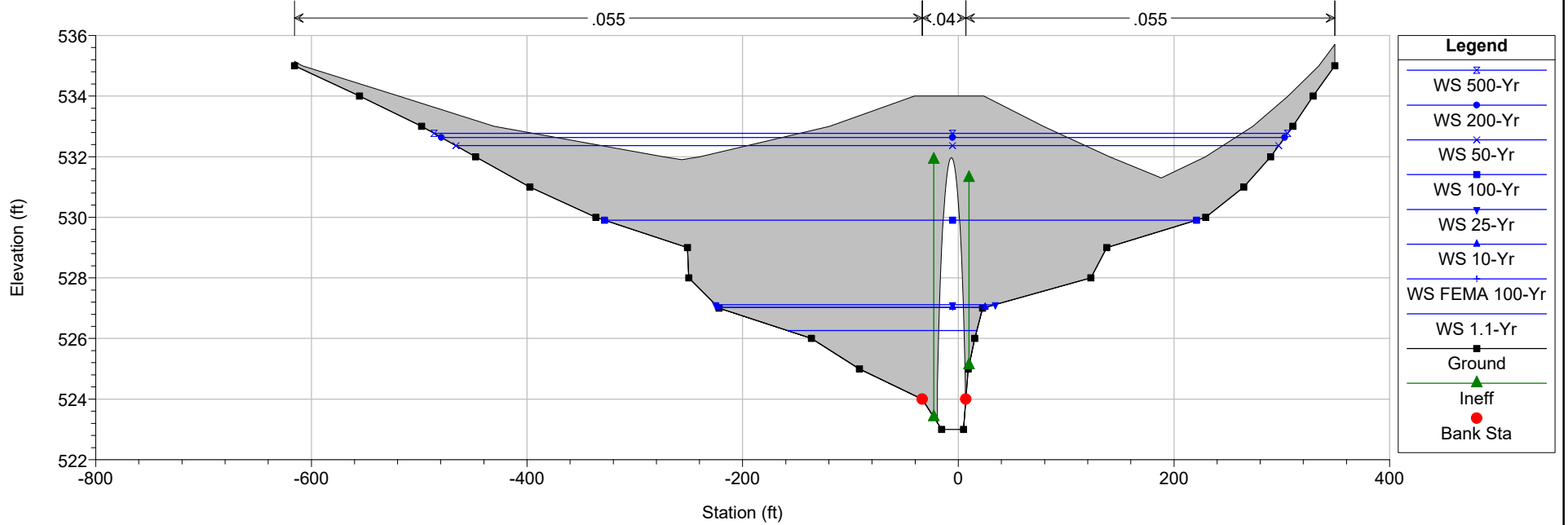
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 RS = 1162 Upstream Face



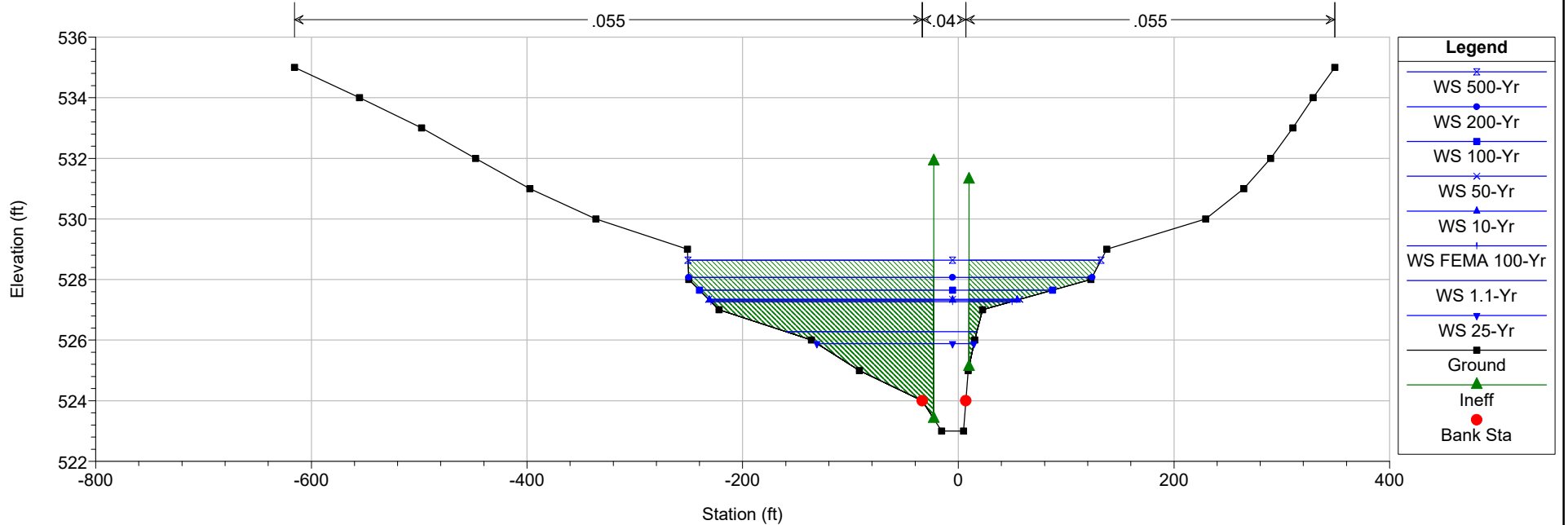
_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024
 RS = 1131 BR



_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024
RS = 1131 BR

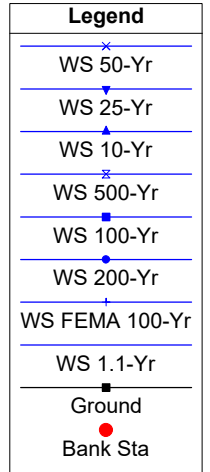
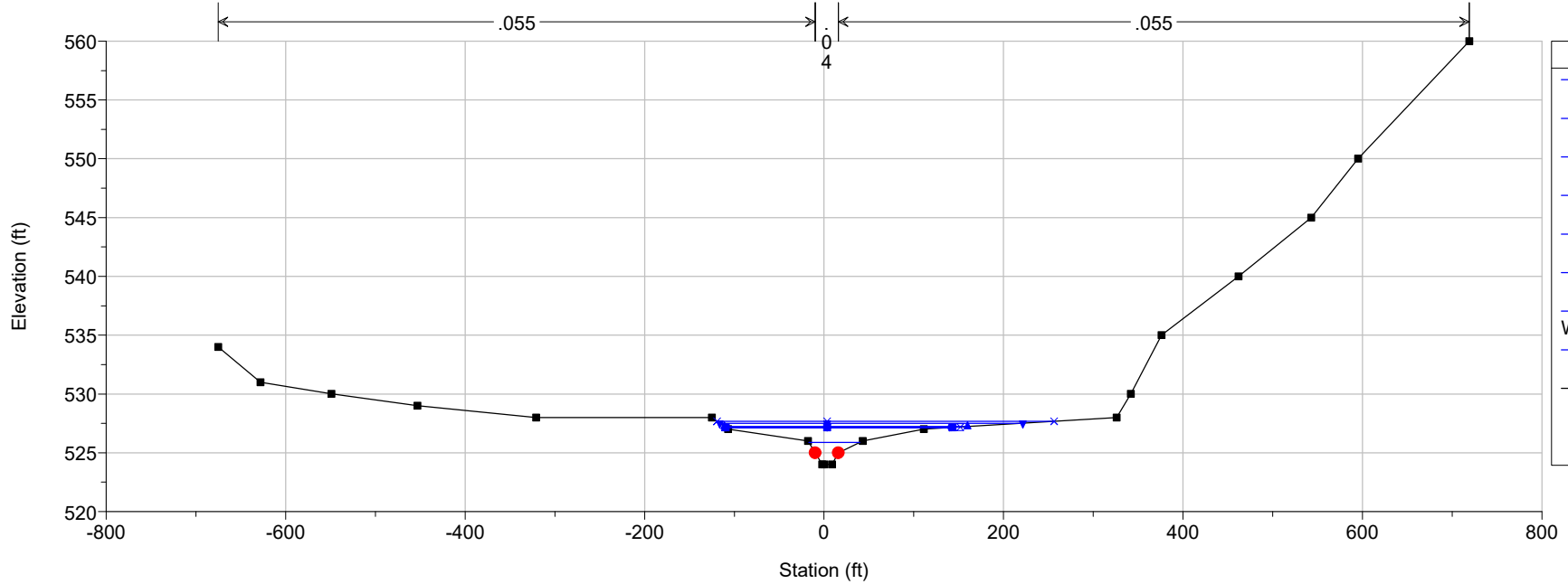


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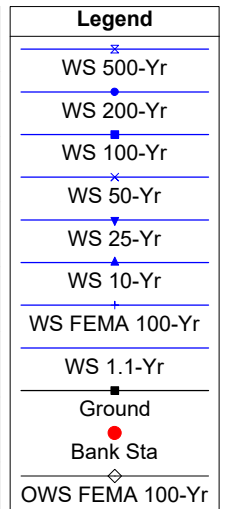
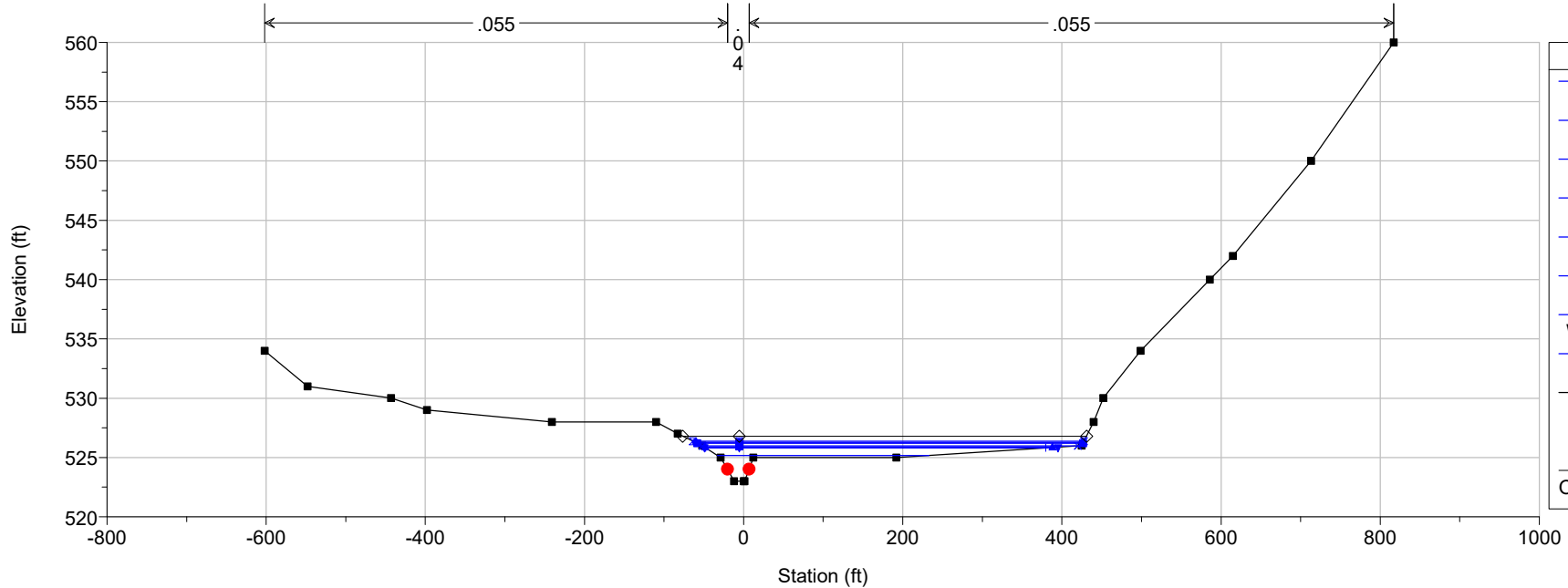
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RS = 1061

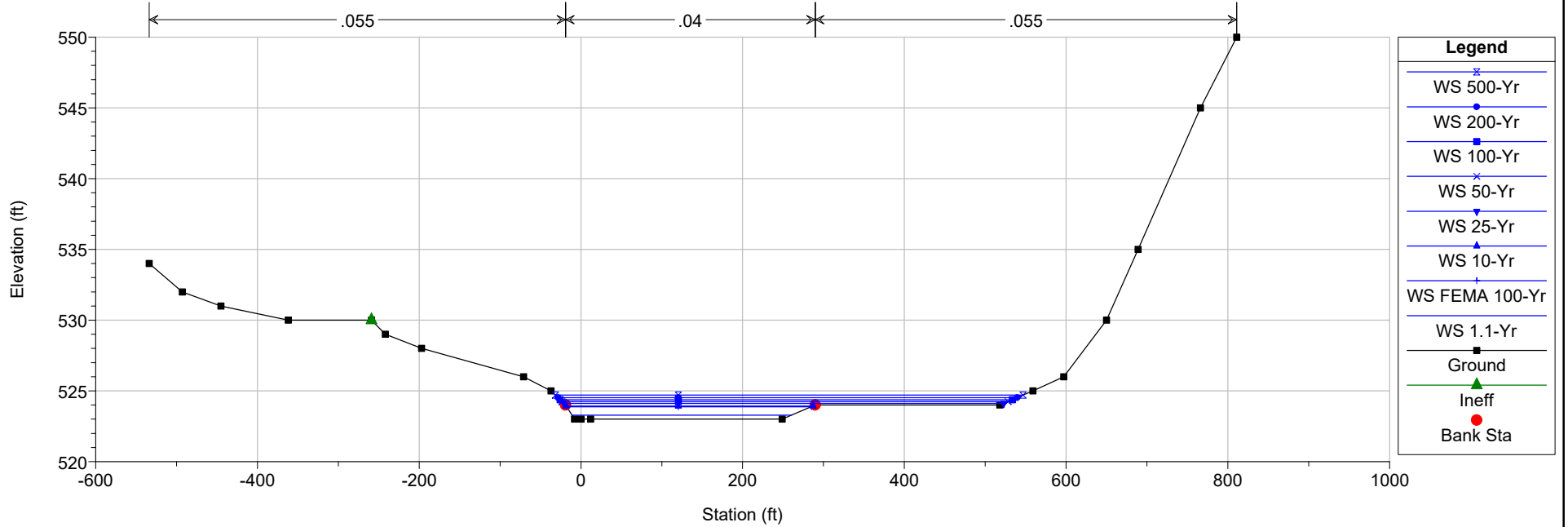


_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024

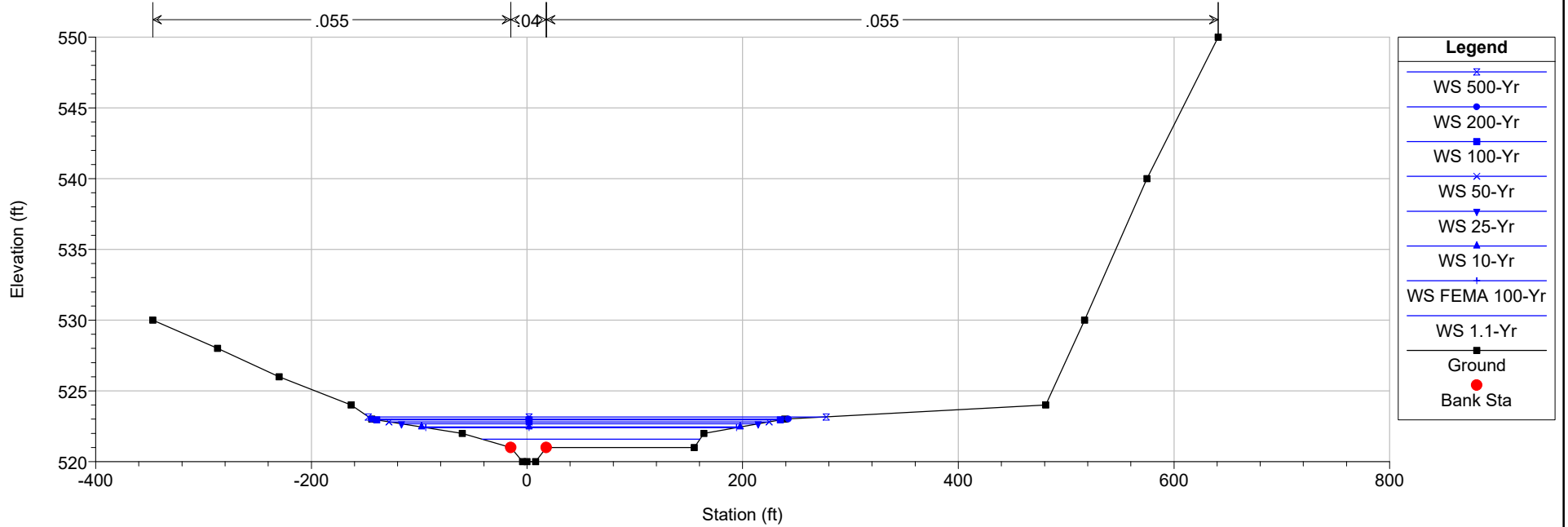
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_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024
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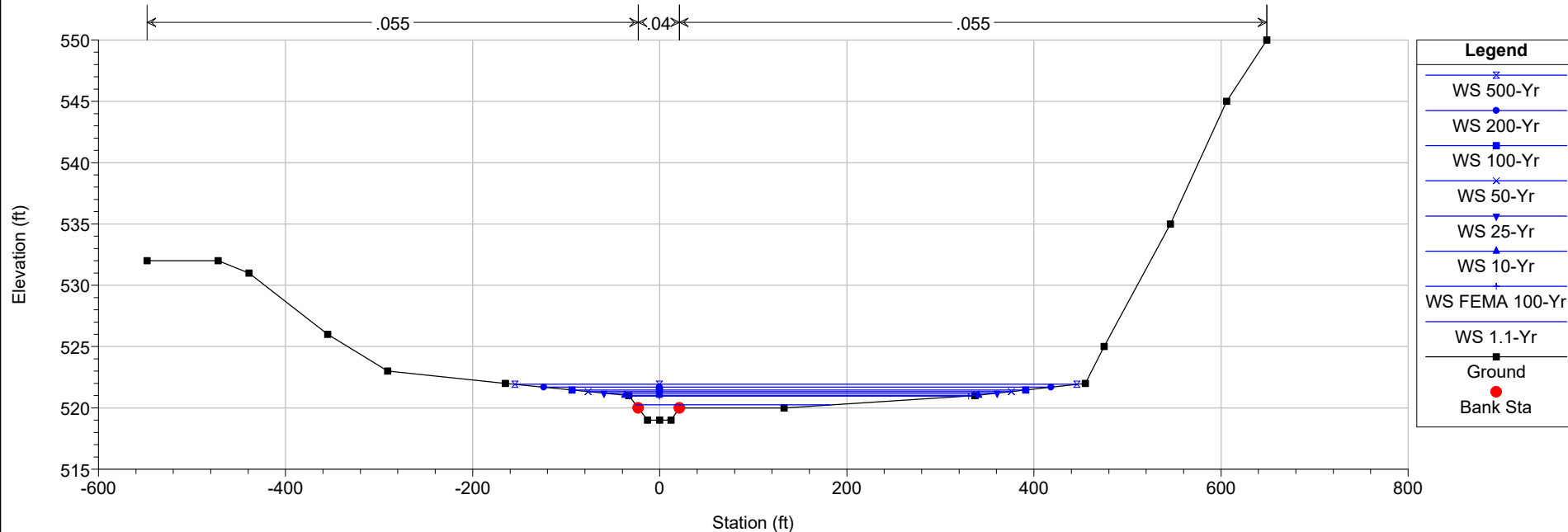


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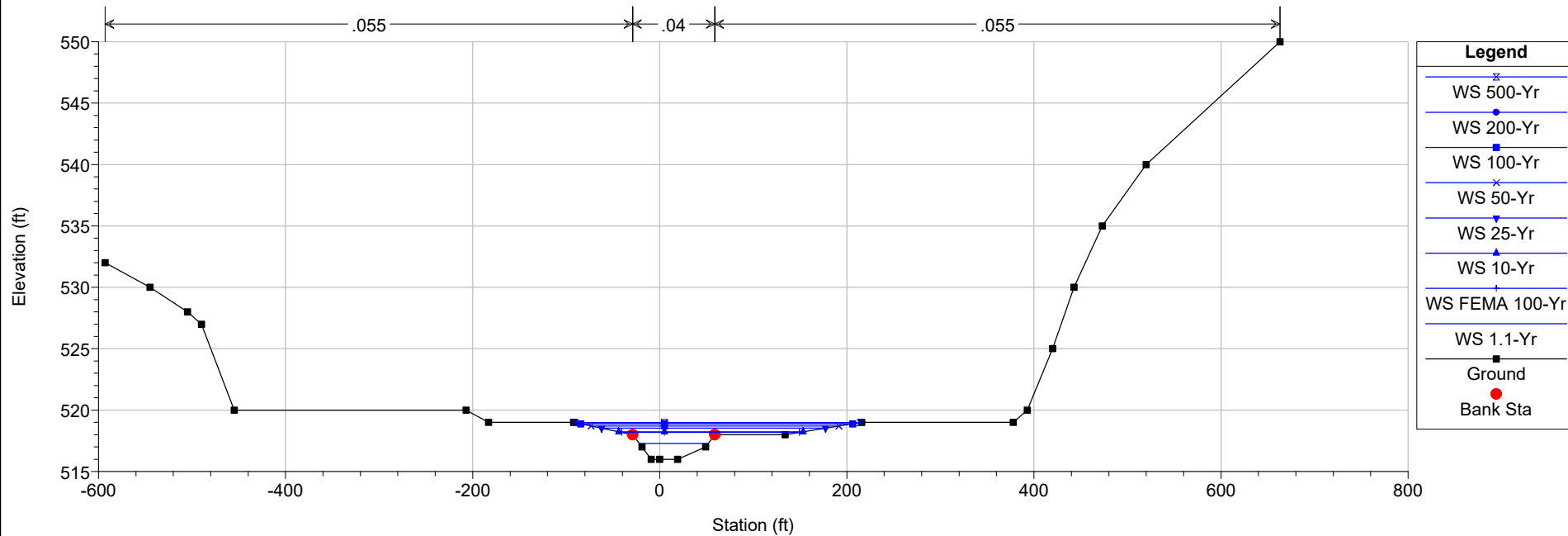
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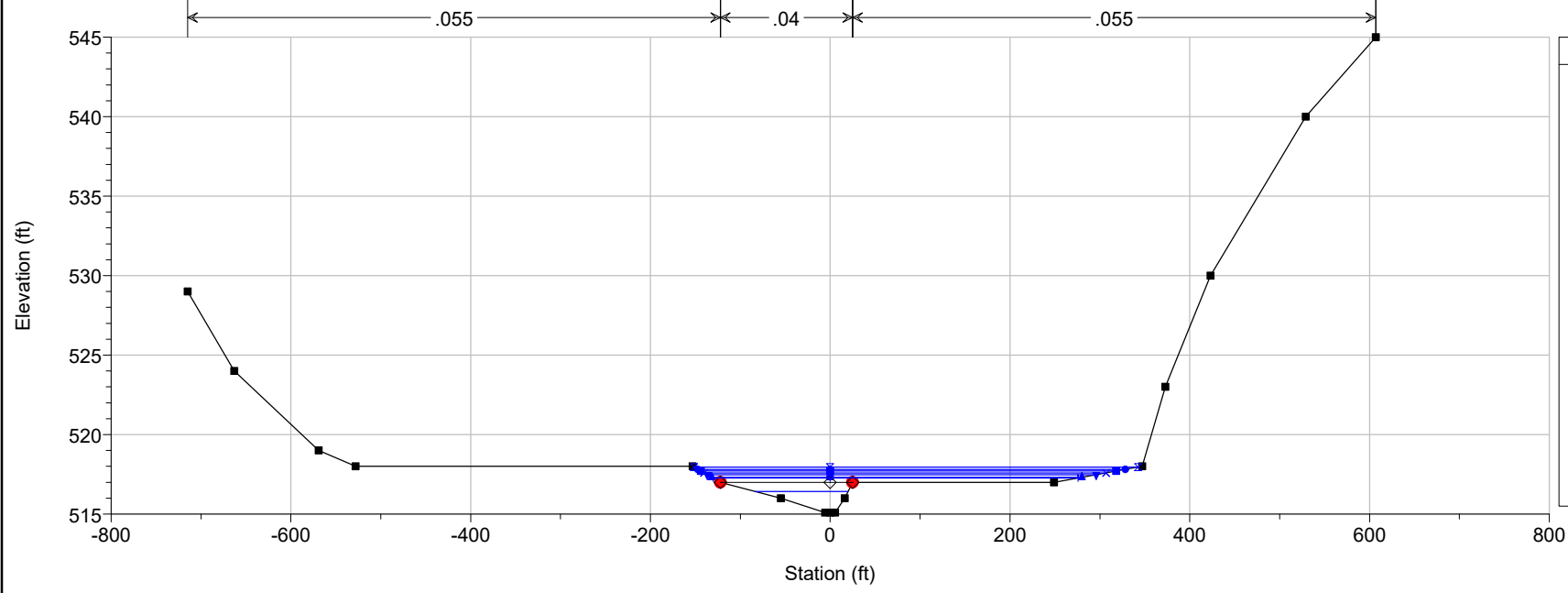
RS = 362



_67328_MaineDOT_VanBuren Plan: Existing_Conditions 5/16/2024

RS = 159





Legend

- WS 500-Yr
- WS 200-Yr
- WS 100-Yr
- WS 50-Yr
- WS 25-Yr
- WS 10-Yr
- WS FEMA 100-Yr
- WS 1.1-Yr
- Ground
- Bank Sta
- OWS FEMA 100-Yr

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X X XXXXX XXXX XXXX XX XXXX
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PROJECT DATA
Project Title: _67328_MaineDOT_VanBuren
Project File : _67328_MaineDOT_Van.prj
Run Date and Time: 5/16/2024 11:38:21 PM

Project in English units

PLAN DATA

Plan Title: Existing_Conditions
Plan File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.p01

Geometry Title: Existing_Geometry
Geometry File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.g01

Flow Title : MaineDOT_Flows
Flow File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.f01

Plan Summary Information:
Number of: Cross Sections = 15 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 1 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: MaineDOT_Flows
Flow File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.f01

Flow Data (cfs)

* River	Reach	RS	*	1.1-Yr	10-Yr	25-Yr	50-Yr	100-Yr	200-Yr	500-Yr	FEMA 100-Yr	*
* Violette Brook	1	2093	*	221	942	1222	1444	1683	1930	2281	875	*

Boundary Conditions

* River	Reach	Profile	*	Upstream	Downstream	*
* Violette Brook	1	1.1-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	10-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	25-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	50-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	100-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	200-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	500-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*

Observed Water Surface Marks

* River	Reach	RS	*	1.1-Yr	10-Yr	25-Yr	50-Yr	100-Yr	200-Yr	500-Yr	FEMA 100-Yr	*
* Violette Brook	1	1696	*								532.3	*
* Violette Brook	1	1508	*								530.4	*
* Violette Brook	1	933	*								526.8	*
* Violette Brook	1	63	*								517	*

GEOMETRY DATA

Geometry Title: Existing_Geometry
Geometry File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.g01

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 2093

INPUT
 Description:
 Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-466	594	-441	592	-411	590	-381	588	-353	586
-278	582	-143	579	-133	578	-122	575	-112	570
-102	565	-93	560	-84	555	-75	550	-65	545
-55	540	-39	535	-28	534	-22	533	-13	532
0	532	4	532	15	533	27	534	44	535
92	536	104	537	313	538	418	539	465	540
487	545	513	555	541	565	611	575		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-466	.055	-22	.04	15	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -22 15 203 201 196 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
104	611	537	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1892

INPUT
 Description:
 Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-650	587	-620	585	-580	583	-528	581	-489	580
-425	579	-392	578	-346	577	-297	576	-214	575
-185	574	-146	572	-106	568	-94	565	-70	555
-48	545	-26	535	-13	531	0	531	13	531
22	532	154	535	182	536	269	538	351	548
433	560								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-650	.055	-26	.04	182	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -26 182 192 196 257 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
181	494	534	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1696

INPUT
 Description:
 Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-548	613	-515	610	-495	605	-485	600	-464	590
-447	585	-424	580	-401	575	-328	574	-289	572
-259	570	-216	565	-178	560	-91	550	-66	547
-56	545	-43	540	-21	531	-16	530	0	530
25	530	70	531	106	533	181	534	326	535
442	540	494	550						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-548	.055	-21	.04	70	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -21 70 180 188 190 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
181	494	534	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1508

INPUT
 Description:
 Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-547	593	-531	590	-505	585	-471	580	-401	570
-342	560	-279	550	-235	545	-181	540	-100	535
-81	533	-56	530	-40	529	-15	528	0	528
14	528	20	529	26	530	51	531	88	532
137	533	299	533	305	534	348	540	394	545
419	550								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-547	.055	-56	.04	26	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -56 26 195 202 189 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
181	494	534	F

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1306

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-301	567	-286	565	-254	560	-229	555	-206	550
-185	545	-171	540	-157	535	-146	533	-57	532
-32	530	-19	528	-14	527	-7	526	0	526
7	526	17	527	32	528	42	529	52	530
169	531	423	532	449	535	474	540	550	550

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-301	.055	-32	.04	52	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-32	52	130.5	116	108.75	.1	.3
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CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1190

INPUT
Description: Approach
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-224.78	542	-218.77	541	-211.5	540	-200.9	539	-184.7	538
-179.9	537	-175.7	536	-171.9	535	-167.6	534	-162.7	533
-62.5	532	-52.7	531	-12.6	530	-11.8	529	-11.3	528
-10.7	527	-10.1	526	-6.8	525	-6.2	524	1.1	523.2
6.2	523.52	12.6	524	24.8	525	46.1	526	49.8	527
53.3	528	56.7	529	98.5	530	162	531	195.4	532
209.5	531	213.3	530	385.2	530	394.4	531	403.6	532
412.9	533	422.4	534	431.8	535	440.5	536	448.8	537

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-224.78	.055	-6.8	.04	24.8	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-6.8	24.8	31.5	28	26.25	.1	.3
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CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1162

INPUT
Description: Upstream Face
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-274.2	542	-268.4	541	-262.7	540	-257.7	539	-252.4	538
-247.1	537	-239.4	536	-211.3	535	-208.8	534	-198.7	533
-196.1	532	-182	532	-147.6	532	-145.7	531	-111.1	530
-43.2	529	-25.5	528	-14.9	527	-11.9	526	-8.8	525
-6.3	523.08	6.8	523	18.6	524	25.5	525	27	526
30	527	33.5	528	37.1	529	44.3	530	83.9	531
134.5	531	156.1	532	164.7	532	176.7	531	178.6	530
232.6	530	275.5	531	307.2	532	348.3	533	366.7	534
389.6	535	401.4	536	412.4	537				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-274.2	.055	-8.8	.04	25.5	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-8.8	25.5	52	68	75	.3	.5
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Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-274.2	-24.6	531.3	F
22.4	412.4	531.33	F

BRIDGE

RIVER: Violette Brook
REACH: 1 RS: 1131

INPUT
Description:
Distance from Upstream XS = 9
Deck/Roadway Width = 58.5
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates num= 56

Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
-654.11	536	-605.01	535	-515.71	534				
-427.21	533	-269.81	532	-253.11	531.9				
-236.41	532	-116.11	533	-37.41	534				
-14.1	534	-14.1	534	524.18	-13.1	534	525.69		
-12.1	534	526.89	-11.1	534	527.86	-10.1	534	528.68	
-9.1	534	529.37	-8.1	534	529.95	-7.1	534	530.43	

-6.1	534	530.82	-5.1	534	531.14	-4.1	534	531.37
-3.1	534	531.54	-2.1	534	531.65	-1.1	534	531.68
-.1	534	531.65	.9	534	531.54	1.9	534	531.37
2.9	534	531.14	3.9	534	530.82	4.9	534	530.43
5.9	534	529.95	6.9	534	529.37	7.9	534	528.68
8.9	534	527.86	9.9	534	526.89	10.9	534	525.69
11.9	534	524.18	11.9	534		27.09	534	
82.19	533		143.69	532		191.49	531.3	
232.39	532		276.39	533		309.09	534	
337.79	535		358.59	536		376.49	537	
391.89	538		407.39	539		420.79	540	
435.19	541		447.89	542		461.39	543	
478.09	544		493.89	545				

Upstream Bridge Cross Section Data

Station Elevation Data		Data		num= 43		Sta		Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-274.2	542	-268.4	541	-262.7	540	-257.7	539	-252.4	538
-247.1	537	-239.4	536	-211.3	535	-208.8	534	-198.7	533
-196.1	532	-182	532	-147.6	532	-145.7	531	-111.1	530
-43.2	529	-25.5	528	-14.9	527	-11.9	526	-8.8	525
-6.3	523.08	6.8	523	18.6	524	25.5	525	27	526
30	527	33.5	528	37.1	529	44.3	530	83.9	531
134.5	531	156.1	532	164.7	532	176.7	531	178.6	530
232.6	530	275.5	531	307.2	532	348.3	533	366.7	534
389.6	535	401.4	536	412.4	537				

Manning's n Values

Sta		n Val		num= 3		Sta		n Val	
-274.2	.055	-8.8	.04	25.5	.055				

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	-8.8	25.5	.3	.5	

Ineffective Flow

Sta L		Sta R		Elev		Permanent	
-274.2	-24.6	531.3	F				
22.4	412.4	531.33	F				

Downstream Deck/Roadway Coordinates

num= 56		Sta Hi Cord		Lo Cord		Sta Hi Cord		Lo Cord	
-657.4	536	-608.3	535	-519	534				
-430.5	533	-273.1	532	-256.4	531.9				
-239.7	532	-119.4	533	-40.7	534				
-19.4	534	-19.4	534	524.47	-18.4	534	525.98		
-17.4	534	527.18	-16.4	534	528.15	-15.4	534	528.97	
-14.4	534	529.66	-13.4	534	530.24	-12.4	534	530.72	
-11.4	534	531.11	-10.4	534	531.43	-9.4	534	531.66	
-8.4	534	531.83	-7.4	534	531.94	-6.4	534	531.97	
-5.4	534	531.94	-4.4	534	531.83	-3.4	534	531.66	
-2.4	534	531.43	-1.4	534	531.11	-.4	534	530.72	
.6	534	530.24	1.6	534	529.66	2.6	534	528.97	
3.6	534	528.15	4.6	534	527.18	5.6	534	525.98	
6.6	534	524.47	6.6	534		23.8	534		
78.9	533	140.4	532	188.2	531.3				
229.1	532	273.1	533	305.8	534				
334.5	535	355.3	536	373.2	537				
388.6	538	404.1	539	417.5	540				
431.9	541	444.6	542	458.1	543				
474.8	544	490.6	545						

Downstream Bridge Cross Section Data

Station Elevation Data		Data		num= 26		Sta		Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-615.6	535	-555.3	534	-497.8	533	-447.6	532	-397.4	531
-336	530	-251.1	529	-250	528	-221.8	527	-136.2	526
-91.7	525	-33.3	524	-15.4	523	4.9	523	7	524
9.1	525	15.3	526	22.5	527	123	528	137.7	529
229.5	530	264.7	531	289.6	532	310.2	533	329.1	534
349.2	535								

Manning's n Values

Sta		n Val		num= 3		Sta		n Val	
-615.6	.055	-33.3	.04	7	.055				

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	-33.3	7	.3	.5	

Ineffective Flow

Sta L		Sta R		Elev		Permanent	
-615.6	-22.65	531.9	F				
9.85	349.2	531.3	F				

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
 Add Friction component to Momentum
 Do not add Weight component to Momentum
 Class B flow critical depth computations use critical depth
 inside the bridge at the upstream end
 Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1094

INPUT

Description: Downstream Face

Station Elevation Data		num= 26	
Sta	Elev	Sta	Elev
-615.6	535	-555.3	534
-336	530	-251.1	529
-91.7	525	-33.3	524
9.1	525	15.3	526
229.5	530	264.7	531
349.2	535		

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
-615.6	.055	-33.3	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-33.3	7	33	33	33	.3		.5

Ineffective Flow		num= 2	
Sta L	Sta R	Elev	Permanent
-615.6	-22.65	531.9	F
9.85	349.2	531.3	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1061

INPUT

Description:

Station Elevation Data		num= 22	
Sta	Elev	Sta	Elev
-675	534	-628	531
-125	528	-107	527
0	524	9	524
326	528	342	530
595	550	719	560

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
-675	.055	-10	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-10	16	134	128	183	.1		.3

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 933

INPUT

Description:

Station Elevation Data		num= 24	
Sta	Elev	Sta	Elev
-602	534	-548	531
-110	528	-83	527
-12	523	0	523
192	525	425	526
586	540	615	542

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
-602	.055	-20	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-20	7	206	204	195	.1		.3

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 729

INPUT

Description:

Station Elevation Data		num= 22	
Sta	Elev	Sta	Elev
-534	534	-493	532
-242	529	-197	528
-8	523	0	523
518	524	559	525
766	545	811	550

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val

Sta n Val Sta n Val Sta n Val

 -534 .055 -19 .04 290 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -19 290 123 178 193 .1 .3
 Ineffective Flow num= 1
 Sta L Sta R Elev Permanent
 -534 -259 530 F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 551

INPUT
 Description:
 Station Elevation Data num= 18
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 -347 530 -287 528 -230 526 -163 524 -144 523
 -60 522 -15 521 -4 520 0 520 8 520
 18 521 155 521 164 522 239 523 481 524
 517 530 575 540 641 550

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 -347 .055 -15 .04 18 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -15 18 155 189 152 .1 .3

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 362

INPUT
 Description:
 Station Elevation Data num= 19
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 -548 532 -472 532 -439 531 -355 526 -291 523
 -165 522 -33 521 -23 520 -13 519 0 519
 12 519 21 520 133 520 337 521 455 522
 475 525 546 535 606 545 649 550

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 -548 .055 -23 .04 21 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -23 21 204 203 200 .1 .3

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 159

INPUT
 Description:
 Station Elevation Data num= 24
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 -593 532 -545 530 -505 528 -490 527 -455 520
 -207 520 -183 519 -92 519 -29 518 -19 517
 -9 516 0 516 19 516 49 517 59 518
 134 518 216 519 378 519 393 520 420 525
 443 530 473 535 520 540 663 550

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 -593 .055 -29 .04 59 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -29 59 98 96 88 .1 .3

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 63

INPUT
 Description:
 Station Elevation Data num= 18
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 -715 529 -663 524 -569 519 -528 518 -153 518
 -122 517 -55 516 -5.8 515.1 0 515.1 5.3 515.1
 16 516 25 517 249 517 347 518 373 523
 423 530 529 540 607 545

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 -715 .055 -122 .04 25 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -122 25 0 0 0 .1 .3

SUMMARY OF MANNING'S N VALUES

River:Violette Brook

* Reach	* River Sta.	* n1	* n2	* n3
*1	* 2093	* .055*	* .04*	* .055*
*1	* 1892	* .055*	* .04*	* .055*
*1	* 1696	* .055*	* .04*	* .055*
*1	* 1508	* .055*	* .04*	* .055*
*1	* 1306	* .055*	* .04*	* .055*
*1	* 1190	* .055*	* .04*	* .055*
*1	* 1162	* .055*	* .04*	* .055*
*1	* 1131	*Bridge	*	*
*1	* 1094	* .055*	* .04*	* .055*
*1	* 1061	* .055*	* .04*	* .055*
*1	* 933	* .055*	* .04*	* .055*
*1	* 729	* .055*	* .04*	* .055*
*1	* 551	* .055*	* .04*	* .055*
*1	* 362	* .055*	* .04*	* .055*
*1	* 159	* .055*	* .04*	* .055*
*1	* 63	* .055*	* .04*	* .055*

SUMMARY OF REACH LENGTHS

River: Violette Brook

* Reach	* River Sta.	* Left	* Channel	* Right
*1	* 2093	* 203*	* 201*	* 196*
*1	* 1892	* 192*	* 196*	* 257*
*1	* 1696	* 180*	* 188*	* 190*
*1	* 1508	* 195*	* 202*	* 189*
*1	* 1306	* 130.5*	* 116*	* 108.75*
*1	* 1190	* 31.5*	* 28*	* 26.25*
*1	* 1162	* 52*	* 68*	* 75*
*1	* 1131	*Bridge	*	*
*1	* 1094	* 33*	* 33*	* 33*
*1	* 1061	* 134*	* 128*	* 183*
*1	* 933	* 206*	* 204*	* 195*
*1	* 729	* 123*	* 178*	* 193*
*1	* 551	* 155*	* 189*	* 152*
*1	* 362	* 204*	* 203*	* 200*
*1	* 159	* 98*	* 96*	* 88*
*1	* 63	* 0*	* 0*	* 0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Violette Brook

* Reach	* River Sta.	* Contr.	* Expan.
*1	* 2093	* .1*	* .3*
*1	* 1892	* .1*	* .3*
*1	* 1696	* .1*	* .3*
*1	* 1508	* .1*	* .3*
*1	* 1306	* .1*	* .3*
*1	* 1190	* .1*	* .3*
*1	* 1162	* .3*	* .5*
*1	* 1131	*Bridge	*
*1	* 1094	* .3*	* .5*
*1	* 1061	* .1*	* .3*
*1	* 933	* .1*	* .3*
*1	* 729	* .1*	* .3*
*1	* 551	* .1*	* .3*
*1	* 362	* .1*	* .3*
*1	* 159	* .1*	* .3*
*1	* 63	* .1*	* .3*

APPENDIX D

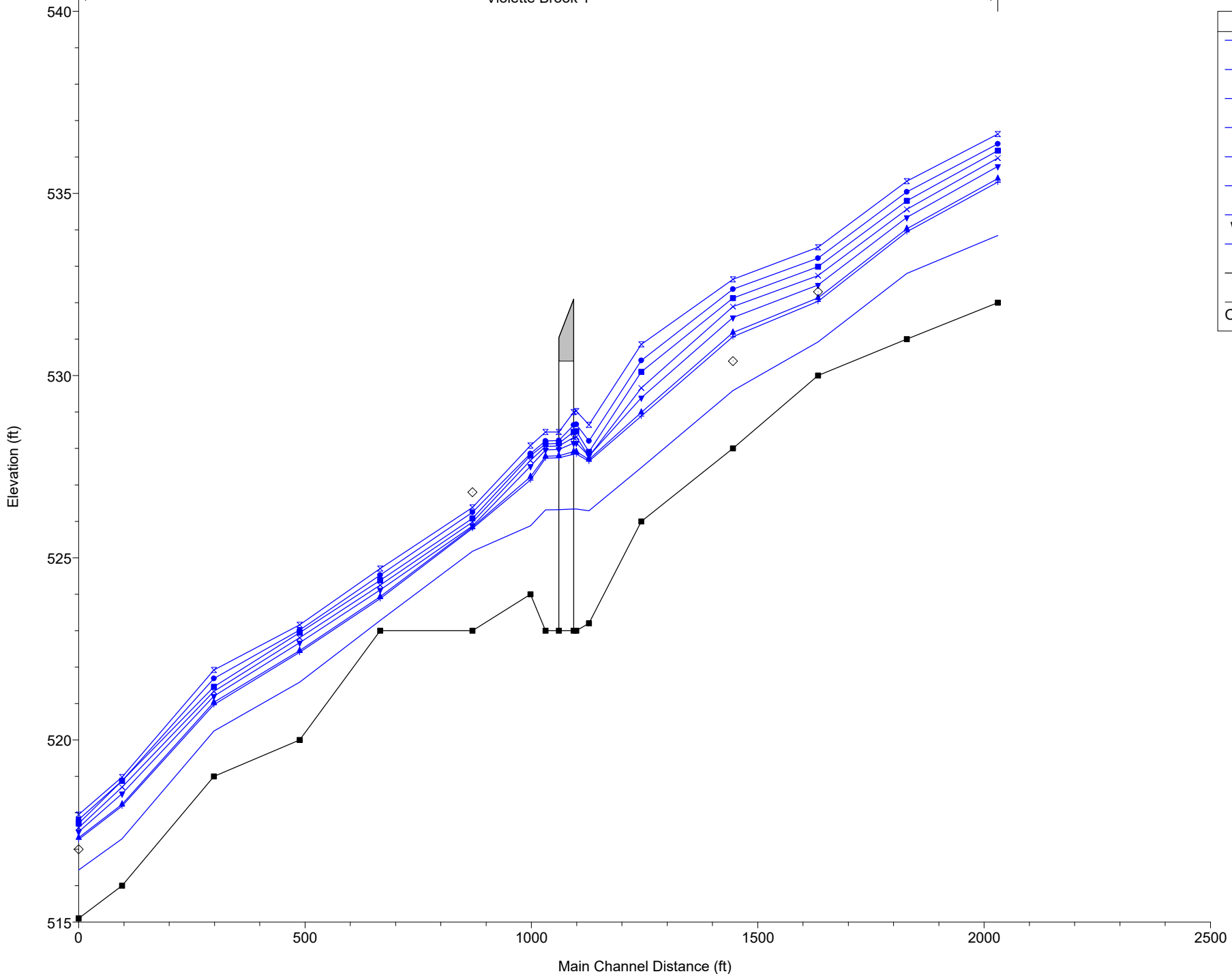
Proposed HEC-RAS Analysis

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	2093	1.1-Yr	221.00	532.00	533.85	533.32	534.05	0.005306	3.66	64.88	52.28	0.51
1	2093	10-Yr	942.00	532.00	535.41	534.97	536.04	0.007458	6.86	179.94	103.80	0.68
1	2093	25-Yr	1222.00	532.00	535.75	535.43	536.51	0.008189	7.70	218.12	121.18	0.73
1	2093	50-Yr	1444.00	532.00	535.97	535.77	536.84	0.008733	8.29	246.55	132.65	0.76
1	2093	100-Yr	1683.00	532.00	536.18	536.13	537.13	0.009220	8.83	274.37	136.87	0.79
1	2093	200-Yr	1930.00	532.00	536.36	536.35	537.41	0.009782	9.38	299.61	139.64	0.82
1	2093	500-Yr	2281.00	532.00	536.63	536.63	537.78	0.010137	9.96	337.74	143.73	0.84
1	2093	FEMA 100-Yr	875.00	532.00	535.31	534.84	535.91	0.007262	6.64	170.49	99.03	0.67
1	1892	1.1-Yr	221.00	531.00	532.80		532.93	0.005669	2.83	77.99	76.14	0.49
1	1892	10-Yr	942.00	531.00	534.03	533.51	534.35	0.008468	4.55	206.91	134.09	0.65
1	1892	25-Yr	1222.00	531.00	534.34	533.81	534.71	0.008601	4.87	250.99	148.81	0.66
1	1892	50-Yr	1444.00	531.00	534.57	534.02	534.96	0.008526	5.05	286.01	159.55	0.66
1	1892	100-Yr	1683.00	531.00	534.80	534.21	535.22	0.008314	5.19	324.45	170.55	0.66
1	1892	200-Yr	1930.00	531.00	535.04	534.40	535.47	0.007860	5.26	366.97	181.25	0.65
1	1892	500-Yr	2281.00	531.00	535.34	534.63	535.79	0.007343	5.41	421.56	190.13	0.64
1	1892	FEMA 100-Yr	875.00	531.00	533.95	533.43	534.26	0.008377	4.46	196.33	130.31	0.64
1	1696	1.1-Yr	221.00	530.00	530.93	530.82	531.14	0.016724	3.72	59.48	87.34	0.79
1	1696	10-Yr	942.00	530.00	532.13	531.78	532.58	0.009414	5.44	181.98	114.12	0.70
1	1696	25-Yr	1222.00	530.00	532.49	532.05	533.00	0.008588	5.84	223.94	121.40	0.69
1	1696	50-Yr	1444.00	530.00	532.74	532.28	533.30	0.008153	6.12	255.72	126.64	0.69
1	1696	100-Yr	1683.00	530.00	532.99	532.48	533.60	0.007893	6.42	287.68	131.70	0.69
1	1696	200-Yr	1930.00	530.00	533.23	532.69	533.90	0.007838	6.76	320.56	149.33	0.69
1	1696	500-Yr	2281.00	530.00	533.52	532.95	534.27	0.007766	7.17	368.34	172.34	0.70
1	1696	FEMA 100-Yr	875.00	530.00	532.04	531.71	532.47	0.009687	5.33	171.56	112.24	0.71
1	1508	1.1-Yr	221.00	528.00	529.59		529.70	0.004234	2.64	83.61	72.94	0.44
1	1508	10-Yr	942.00	528.00	531.18		531.46	0.003808	4.31	235.60	123.47	0.47
1	1508	25-Yr	1222.00	528.00	531.59		531.92	0.003742	4.72	290.61	142.24	0.48
1	1508	50-Yr	1444.00	528.00	531.89		532.26	0.003658	4.97	335.51	155.90	0.48
1	1508	100-Yr	1683.00	528.00	532.13		532.54	0.003840	5.33	373.18	168.00	0.50
1	1508	200-Yr	1930.00	528.00	532.37		532.82	0.003915	5.63	415.59	181.90	0.51
1	1508	500-Yr	2281.00	528.00	532.64		533.16	0.004168	6.08	466.96	197.42	0.53
1	1508	FEMA 100-Yr	875.00	528.00	531.07		531.34	0.003828	4.20	222.40	118.52	0.47
1	1306	1.1-Yr	221.00	526.00	527.47	527.47	527.96	0.023750	5.61	39.41	40.46	1.00
1	1306	10-Yr	942.00	526.00	528.99	528.99	529.92	0.019608	7.71	122.21	67.37	1.01
1	1306	25-Yr	1222.00	526.00	529.39	529.39	530.42	0.018726	8.13	150.35	73.94	1.00
1	1306	50-Yr	1444.00	526.00	529.66	529.66	530.77	0.018454	8.45	170.87	78.39	1.01
1	1306	100-Yr	1683.00	526.00	530.10	529.92	531.13	0.014479	8.13	207.78	97.26	0.91
1	1306	200-Yr	1930.00	526.00	530.41	530.22	531.46	0.012645	8.22	244.44	137.68	0.87
1	1306	500-Yr	2281.00	526.00	530.86	530.68	531.86	0.010202	8.15	318.47	195.27	0.80
1	1306	FEMA 100-Yr	875.00	526.00	528.89	528.89	529.78	0.019846	7.59	115.29	65.65	1.01
1	1190	1.1-Yr	221.00	523.20	526.29	525.10	526.40	0.001812	2.74	93.42	57.46	0.32
1	1190	10-Yr	942.00	523.20	527.70	526.85	528.25	0.005379	6.47	178.25	63.35	0.59
1	1190	25-Yr	1222.00	523.20	527.79	527.29	528.66	0.008198	8.13	184.50	63.76	0.73
1	1190	50-Yr	1444.00	523.20	527.78	527.61	529.01	0.011560	9.63	183.87	63.71	0.87
1	1190	100-Yr	1683.00	523.20	527.90	527.90	529.44	0.013954	10.80	191.58	64.21	0.96
1	1190	200-Yr	1930.00	523.20	528.21	528.21	529.87	0.013888	11.32	211.04	65.40	0.97
1	1190	500-Yr	2281.00	523.20	528.65	528.65	530.44	0.013287	11.83	240.62	67.14	0.96
1	1190	FEMA 100-Yr	875.00	523.20	527.65	526.75	528.14	0.004855	6.10	175.47	63.17	0.56
1	1162	1.1-Yr	221.00	523.00	526.34	523.83	526.36	0.000206	1.15	195.23	64.69	0.11
1	1162	10-Yr	942.00	523.00	527.92	525.10	528.08	0.000965	3.24	302.78	73.09	0.26
1	1162	25-Yr	1222.00	523.00	528.16	525.48	528.40	0.001373	3.99	320.48	74.68	0.31
1	1162	50-Yr	1444.00	523.00	528.31	525.76	528.63	0.001721	4.56	332.46	75.74	0.35
1	1162	100-Yr	1683.00	523.00	528.47	526.05	528.88	0.002104	5.14	344.58	76.80	0.39
1	1162	200-Yr	1930.00	523.00	528.66	526.32	529.15	0.002451	5.68	358.98	78.05	0.43
1	1162	500-Yr	2281.00	523.00	529.02	526.70	529.62	0.002739	6.26	386.98	82.10	0.46
1	1162	FEMA 100-Yr	875.00	523.00	527.85	525.01	527.99	0.000875	3.05	297.78	72.63	0.25
1	1131		Bridge									
1	1094	1.1-Yr	221.00	523.00	526.31		526.34	0.000296	1.34	200.03	180.34	0.14
1	1094	10-Yr	942.00	523.00	527.79		527.94	0.001235	3.56	333.73	345.66	0.29
1	1094	25-Yr	1222.00	523.00	527.96		528.20	0.001791	4.40	350.92	368.11	0.36
1	1094	50-Yr	1444.00	523.00	528.05		528.37	0.002316	5.07	360.05	373.87	0.41
1	1094	100-Yr	1683.00	523.00	528.12		528.53	0.002977	5.80	366.80	374.95	0.46
1	1094	200-Yr	1930.00	523.00	528.20		528.72	0.003672	6.52	374.71	376.22	0.52
1	1094	500-Yr	2281.00	523.00	528.45		529.09	0.004236	7.23	399.19	380.14	0.56
1	1094	FEMA 100-Yr	875.00	523.00	527.73		527.87	0.001119	3.36	328.24	338.48	0.28
1	1061	1.1-Yr	221.00	524.00	525.88		526.21	0.009297	4.86	54.78	56.70	0.68
1	1061	10-Yr	942.00	524.00	527.23	527.23	527.75	0.009250	7.31	257.12	271.00	0.75

HEC-RAS Plan: Proposed_70ft River: Violette Brook Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	1061	25-Yr	1222.00	524.00	527.51	527.51	528.01	0.008702	7.54	344.12	337.61	0.74
1	1061	50-Yr	1444.00	524.00	527.68	527.68	528.18	0.008784	7.83	401.95	375.41	0.75
1	1061	100-Yr	1683.00	524.00	527.81	527.81	528.34	0.009245	8.23	452.95	405.83	0.77
1	1061	200-Yr	1930.00	524.00	527.86	527.86	528.49	0.010919	9.04	476.03	418.87	0.84
1	1061	500-Yr	2281.00	524.00	528.08	527.96	528.83	0.012439	10.04	589.06	658.38	0.91
1	1061	FEMA 100-Yr	875.00	524.00	527.13	527.13	527.67	0.009640	7.30	232.60	249.03	0.76
1	933	1.1-Yr	221.00	523.00	525.18	524.55	525.37	0.004260	3.73	96.85	266.05	0.47
1	933	10-Yr	942.00	523.00	525.84	525.84	526.19	0.008712	6.50	331.03	436.67	0.71
1	933	25-Yr	1222.00	523.00	525.87	526.02	526.40	0.013469	8.15	344.02	444.22	0.89
1	933	50-Yr	1444.00	523.00	525.98	526.12	526.53	0.013980	8.53	392.70	471.44	0.91
1	933	100-Yr	1683.00	523.00	526.08	526.20	526.63	0.014008	8.75	442.49	480.18	0.92
1	933	200-Yr	1930.00	523.00	526.25	526.27	526.70	0.011755	8.32	521.91	486.50	0.85
1	933	500-Yr	2281.00	523.00	526.38	526.38	526.85	0.011717	8.56	588.51	491.75	0.85
1	933	FEMA 100-Yr	875.00	523.00	525.81	525.79	526.14	0.008369	6.31	315.14	427.25	0.70
1	729	1.1-Yr	221.00	523.00	523.28	523.28	523.42	0.037008	3.00	73.74	271.51	1.01
1	729	10-Yr	942.00	523.00	523.93	523.73	524.13	0.011492	3.59	262.04	305.45	0.68
1	729	25-Yr	1222.00	523.00	524.12	523.86	524.34	0.009901	3.78	346.10	543.89	0.66
1	729	50-Yr	1444.00	523.00	524.25	523.96	524.47	0.008792	3.85	418.18	551.65	0.63
1	729	100-Yr	1683.00	523.00	524.38	524.13	524.60	0.007931	3.93	490.64	559.35	0.61
1	729	200-Yr	1930.00	523.00	524.52	524.23	524.74	0.006924	3.94	571.79	567.84	0.58
1	729	500-Yr	2281.00	523.00	524.70	524.33	524.93	0.006107	4.00	675.23	578.49	0.55
1	729	FEMA 100-Yr	875.00	523.00	523.88	523.70	524.07	0.012172	3.56	245.48	302.62	0.70
1	551	1.1-Yr	221.00	520.00	521.58	521.35	521.66	0.004162	2.80	131.05	201.55	0.44
1	551	10-Yr	942.00	520.00	522.45		522.64	0.006301	4.88	336.58	295.65	0.59
1	551	25-Yr	1222.00	520.00	522.67		522.89	0.006717	5.38	405.85	330.81	0.62
1	551	50-Yr	1444.00	520.00	522.81		523.05	0.007184	5.77	452.63	352.58	0.65
1	551	100-Yr	1683.00	520.00	522.95		523.22	0.007561	6.14	502.29	374.30	0.67
1	551	200-Yr	1930.00	520.00	523.01		523.34	0.008832	6.75	528.59	386.79	0.72
1	551	500-Yr	2281.00	520.00	523.16		523.54	0.010059	7.46	587.40	424.63	0.78
1	551	FEMA 100-Yr	875.00	520.00	522.40		522.58	0.006007	4.69	323.07	288.29	0.57
1	362	1.1-Yr	221.00	519.00	520.24	520.24	520.47	0.011990	4.13	78.61	207.88	0.72
1	362	10-Yr	942.00	519.00	521.03	520.92	521.30	0.010282	5.60	310.08	378.41	0.73
1	362	25-Yr	1222.00	519.00	521.20		521.50	0.010600	6.03	376.89	420.23	0.75
1	362	50-Yr	1444.00	519.00	521.33		521.64	0.010414	6.24	433.63	452.73	0.76
1	362	100-Yr	1683.00	519.00	521.46		521.77	0.010208	6.42	494.16	485.01	0.76
1	362	200-Yr	1930.00	519.00	521.69		521.95	0.007876	6.02	612.08	542.39	0.67
1	362	500-Yr	2281.00	519.00	521.92		522.16	0.006731	5.91	745.52	600.76	0.63
1	362	FEMA 100-Yr	875.00	519.00	520.97	520.88	521.24	0.010888	5.62	285.16	362.79	0.75
1	159	1.1-Yr	221.00	516.00	517.29	516.98	517.45	0.008407	3.23	68.33	73.74	0.59
1	159	10-Yr	942.00	516.00	518.23	518.23	518.83	0.014434	6.26	168.07	196.90	0.86
1	159	25-Yr	1222.00	516.00	518.53	518.53	519.14	0.012574	6.51	232.12	239.46	0.82
1	159	50-Yr	1444.00	516.00	518.70	518.70	519.34	0.012143	6.78	276.71	265.09	0.82
1	159	100-Yr	1683.00	516.00	518.88	518.88	519.54	0.011635	7.00	325.87	290.74	0.81
1	159	200-Yr	1930.00	516.00	518.88	518.88	519.74	0.015265	8.02	326.22	290.92	0.93
1	159	500-Yr	2281.00	516.00	518.98	518.98	520.01	0.017673	8.87	355.83	305.32	1.01
1	159	FEMA 100-Yr	875.00	516.00	518.19	518.14	518.74	0.013886	6.03	159.10	190.18	0.84
1	63	1.1-Yr	221.00	515.10	516.43	516.17	516.57	0.009952	2.97	74.40	103.61	0.62
1	63	10-Yr	942.00	515.10	517.31	517.21	517.59	0.009951	4.43	268.94	411.55	0.68
1	63	25-Yr	1222.00	515.10	517.48	517.38	517.79	0.009947	4.79	337.87	432.62	0.70
1	63	50-Yr	1444.00	515.10	517.59	517.49	517.92	0.009946	5.03	388.23	447.38	0.70
1	63	100-Yr	1683.00	515.10	517.71	517.58	518.05	0.009942	5.27	439.54	461.94	0.71
1	63	200-Yr	1930.00	515.10	517.81	517.68	518.18	0.009945	5.49	489.99	475.82	0.72
1	63	500-Yr	2281.00	515.10	517.95	517.81	518.35	0.009958	5.78	558.15	493.95	0.73
1	63	FEMA 100-Yr	875.00	515.10	517.27	517.16	517.54	0.009954	4.33	251.15	405.93	0.68

Violette Brook 1

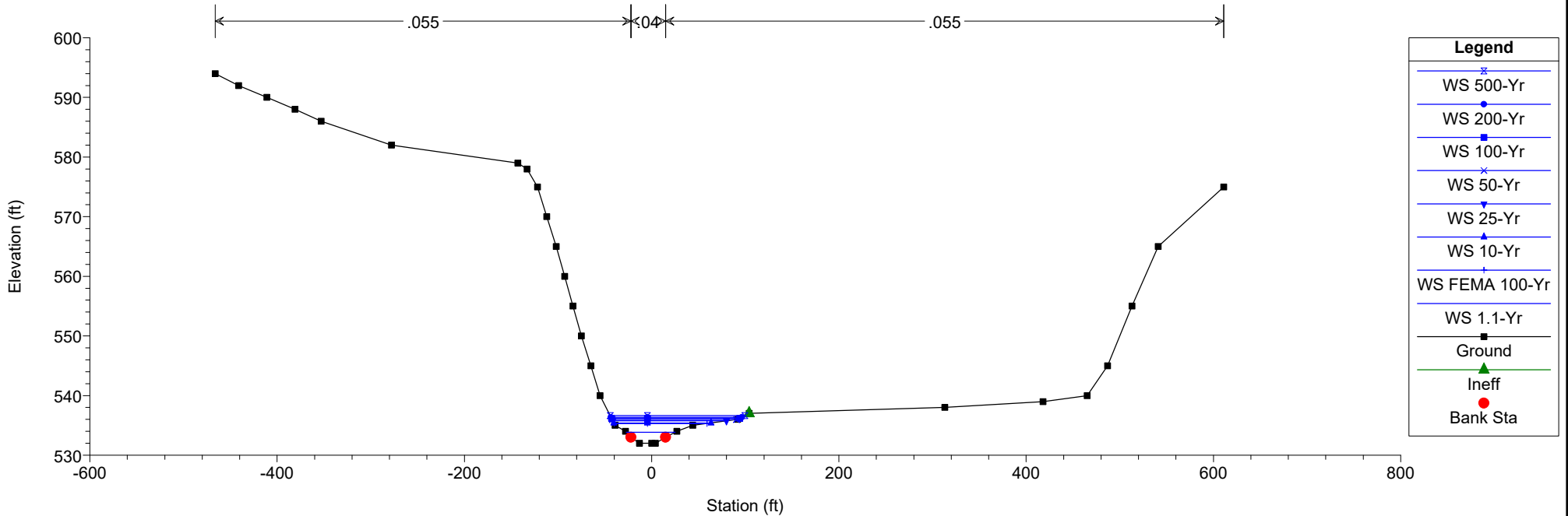


Legend	
WS 500-Yr	(Blue line with 'x' marker)
WS 200-Yr	(Blue line with circle marker)
WS 100-Yr	(Blue line with square marker)
WS 50-Yr	(Blue line with 'x' marker)
WS 25-Yr	(Blue line with inverted triangle marker)
WS 10-Yr	(Blue line with triangle marker)
WS FEMA 100-Yr	(Blue line with '+' marker)
WS 1.1-Yr	(Black line with square marker)
Ground	(Black line with square marker)
OWS FEMA 100-Yr	(Black line with diamond marker)

_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

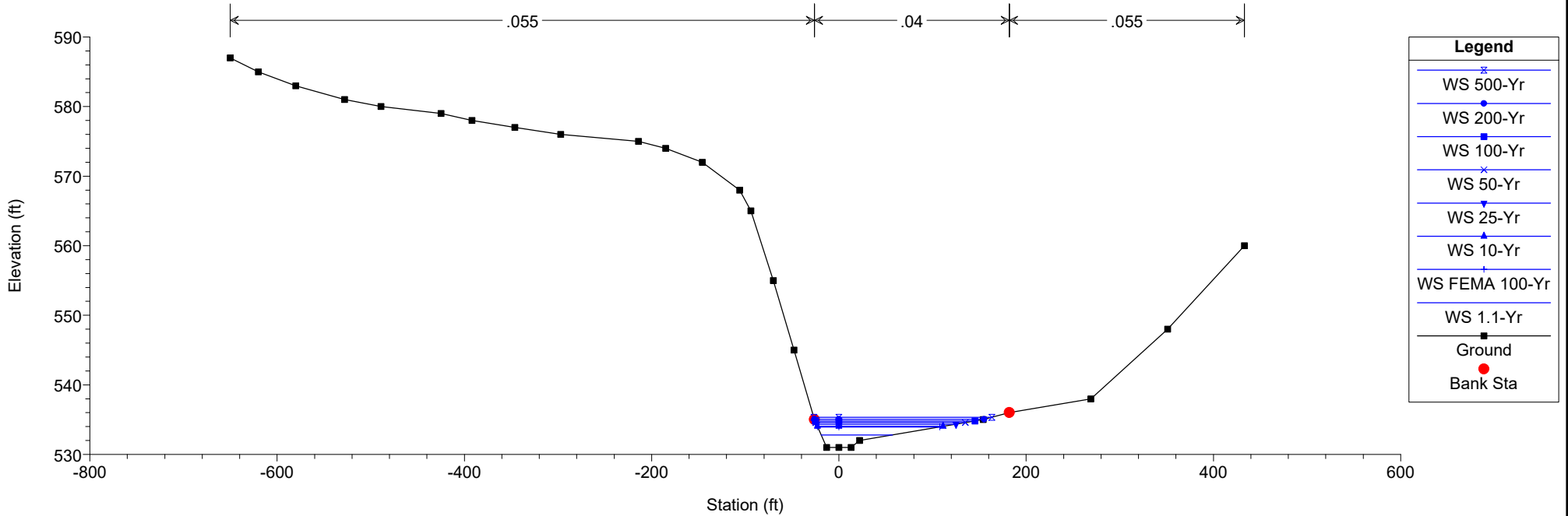
River = Violette Brook Reach = 1 RS = 2093



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

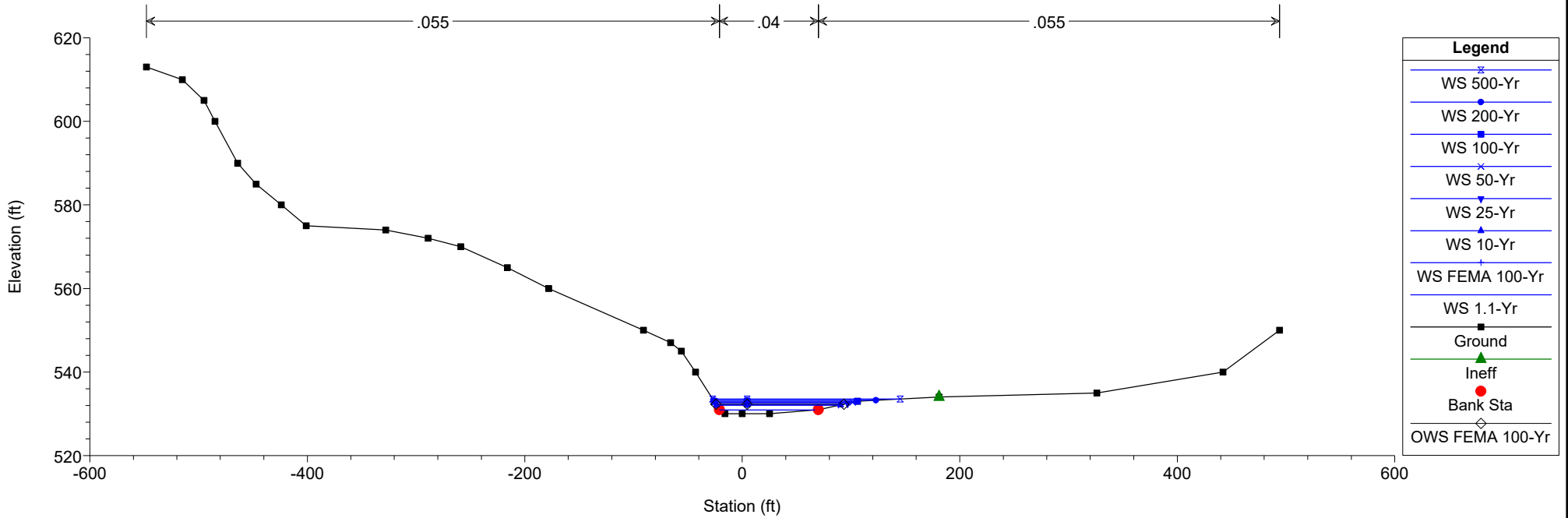
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_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

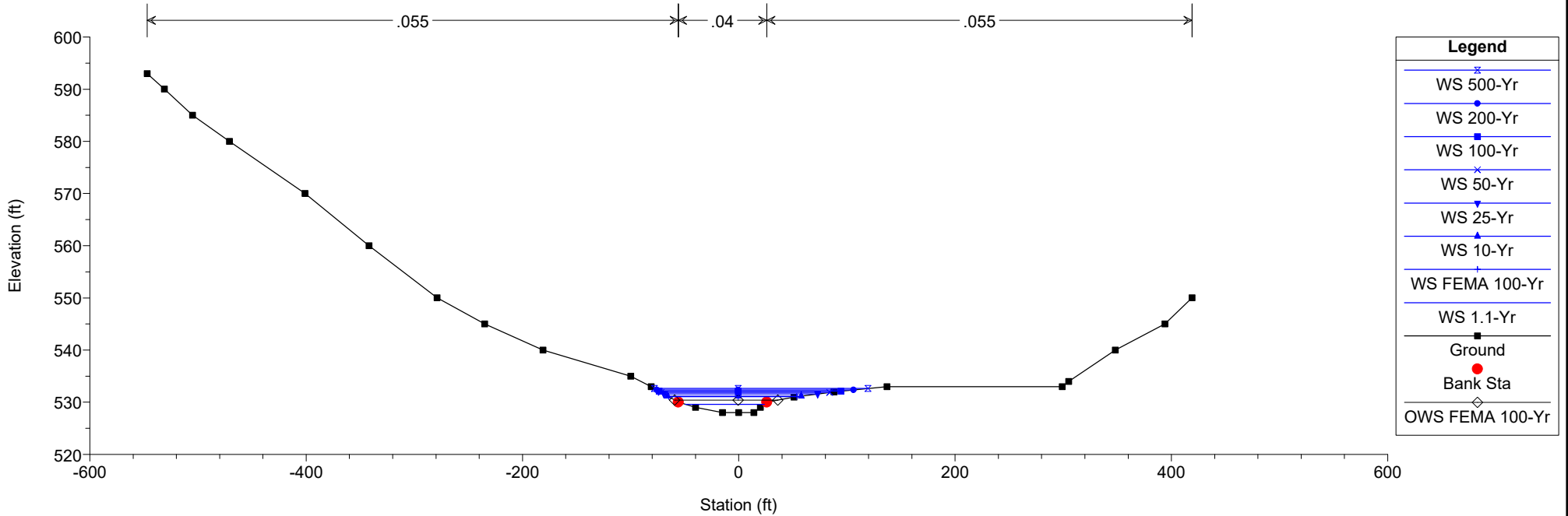
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_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

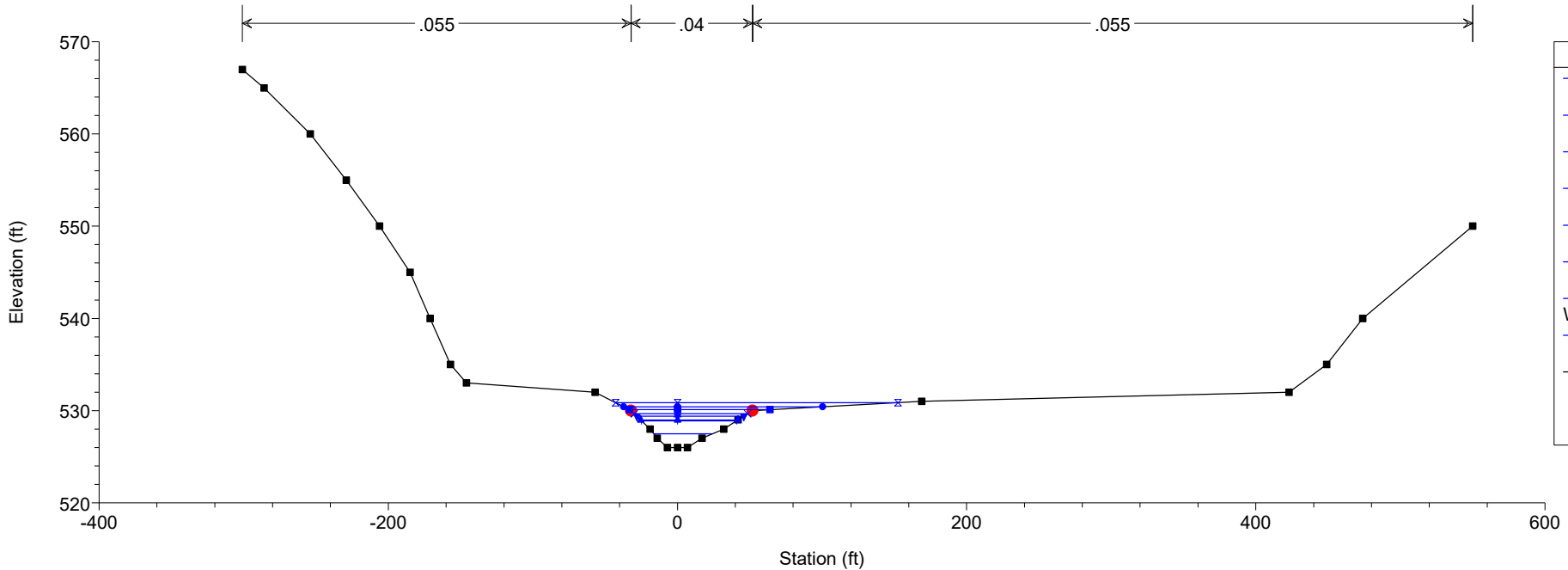
River = Violette Brook Reach = 1 RS = 1508



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

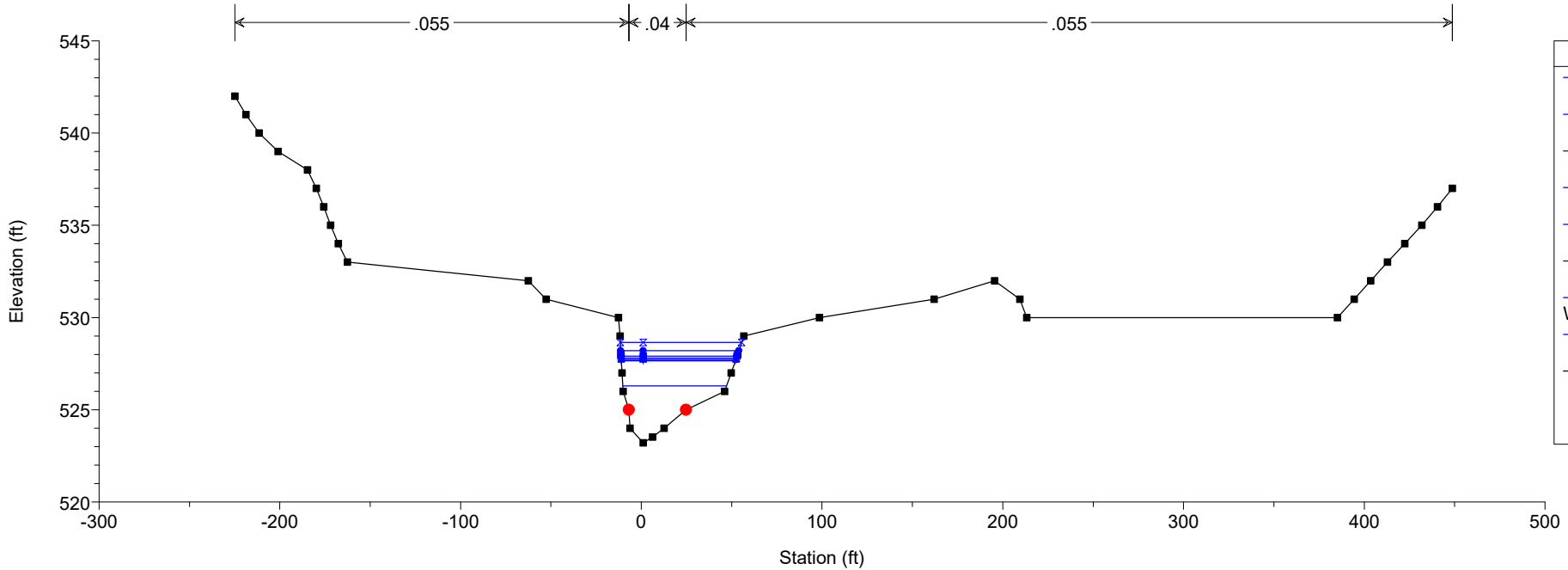
River = Violette Brook Reach = 1 RS = 1306



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

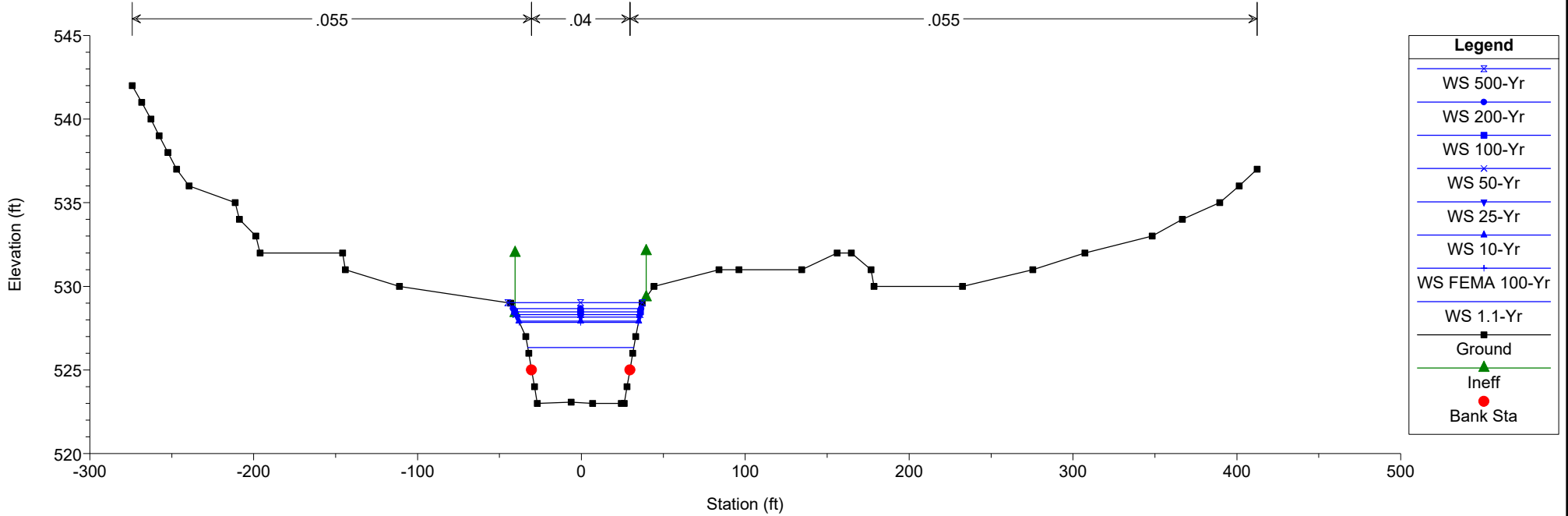
River = Violette Brook Reach = 1 RS = 1190 Approach



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

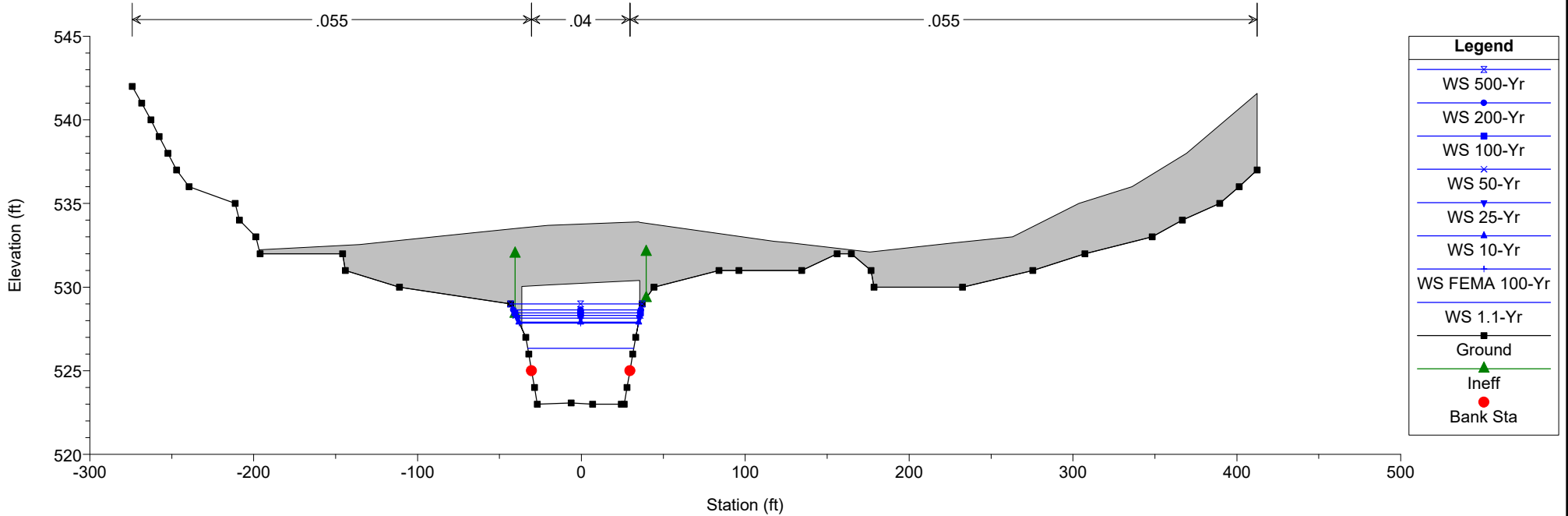
River = Violette Brook Reach = 1 RS = 1162 Upstream Face



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

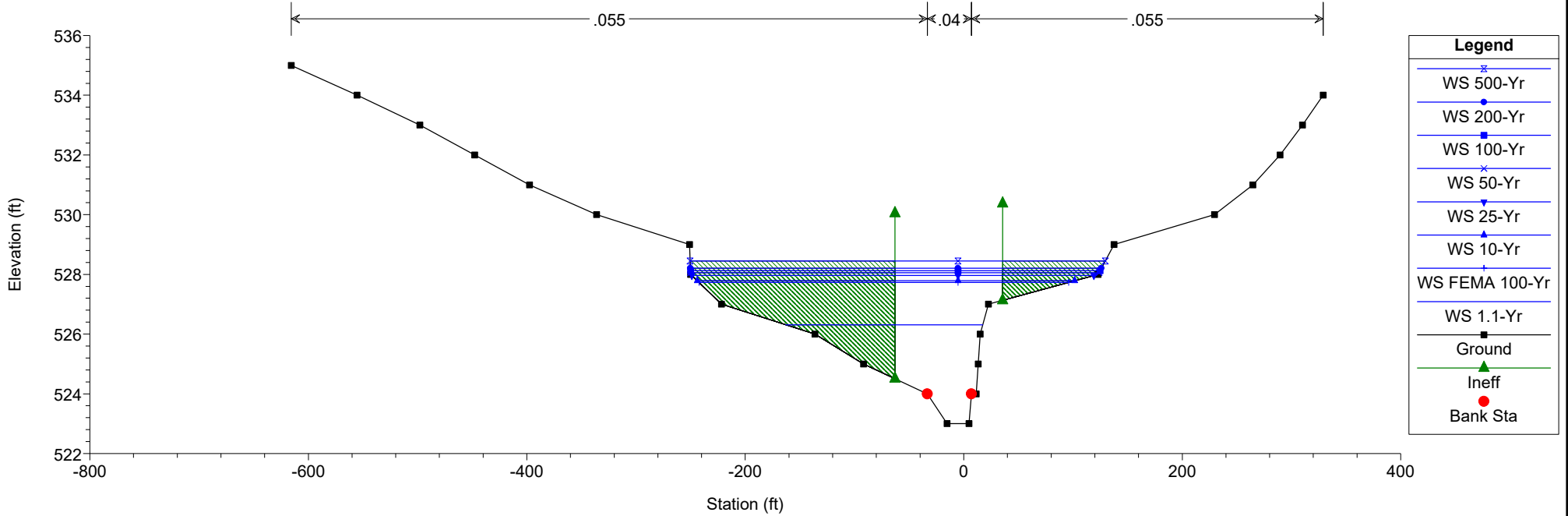
Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

River = Violette Brook Reach = 1 RS = 1131 BR



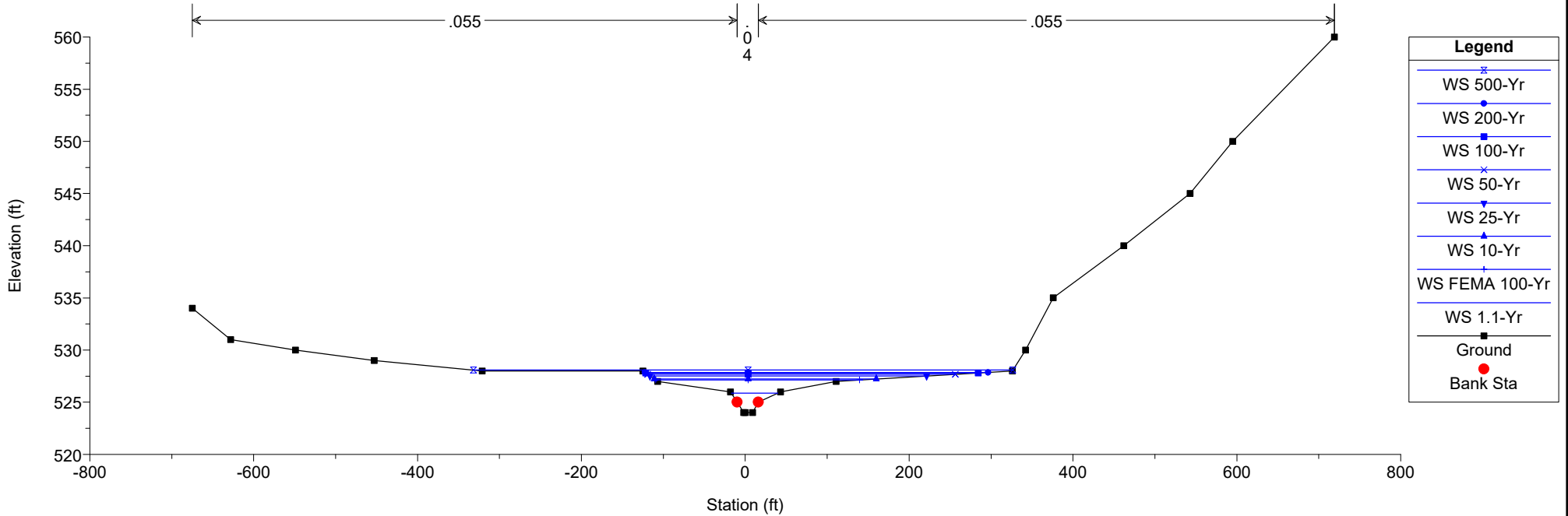
_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows
River = Violette Brook Reach = 1 RS = 1094 Downstream Face



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

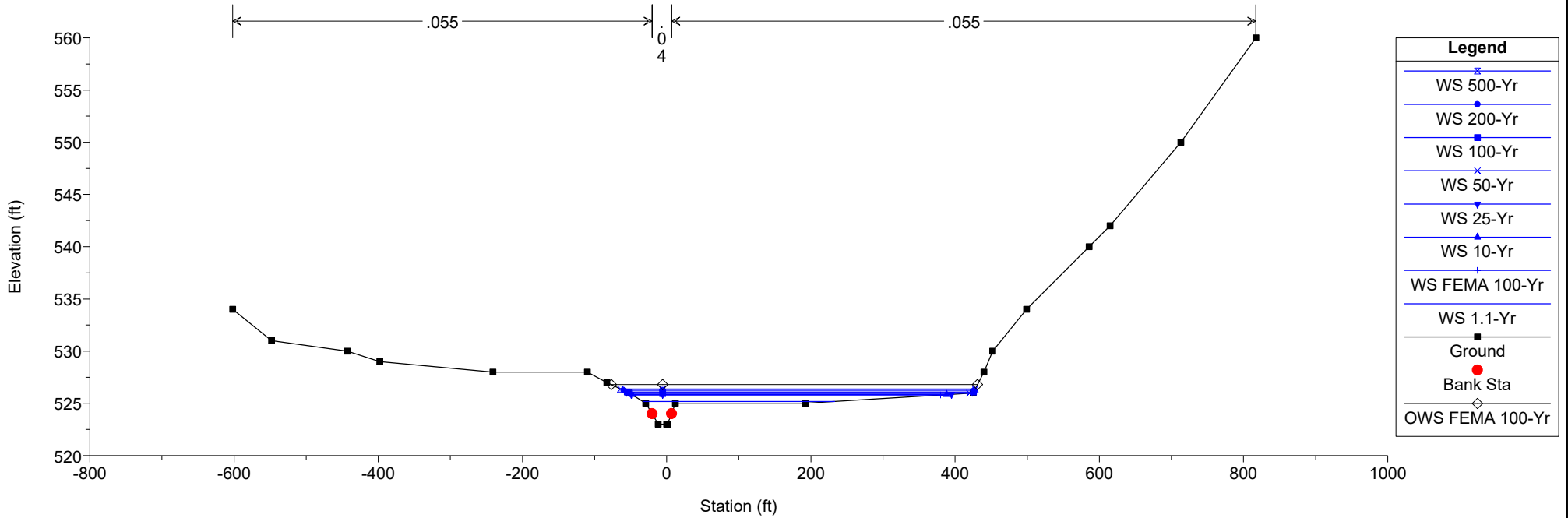
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River = Violette Brook Reach = 1 RS = 1061



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

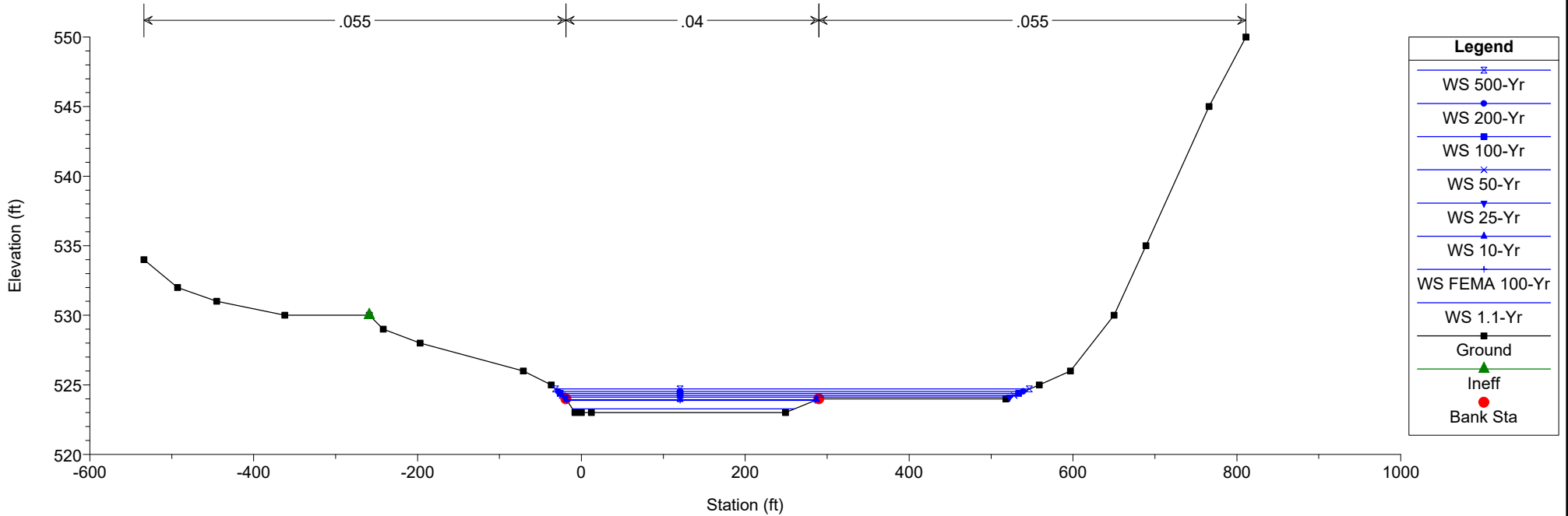
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_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

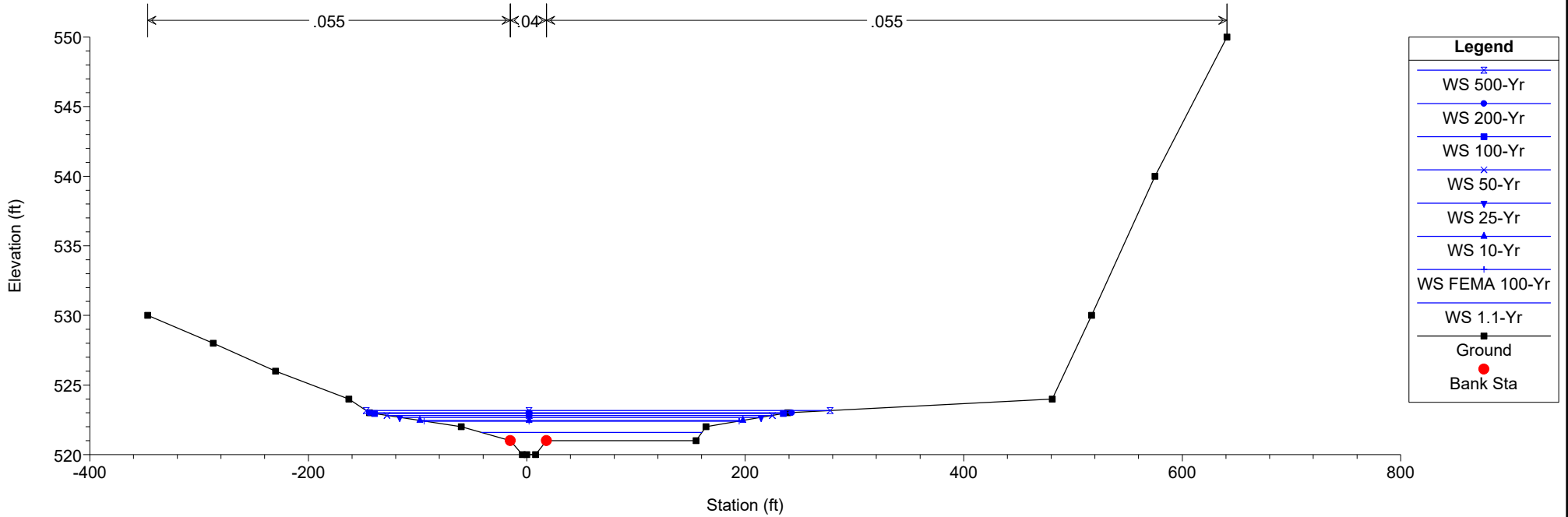
River = Violette Brook Reach = 1 RS = 729



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

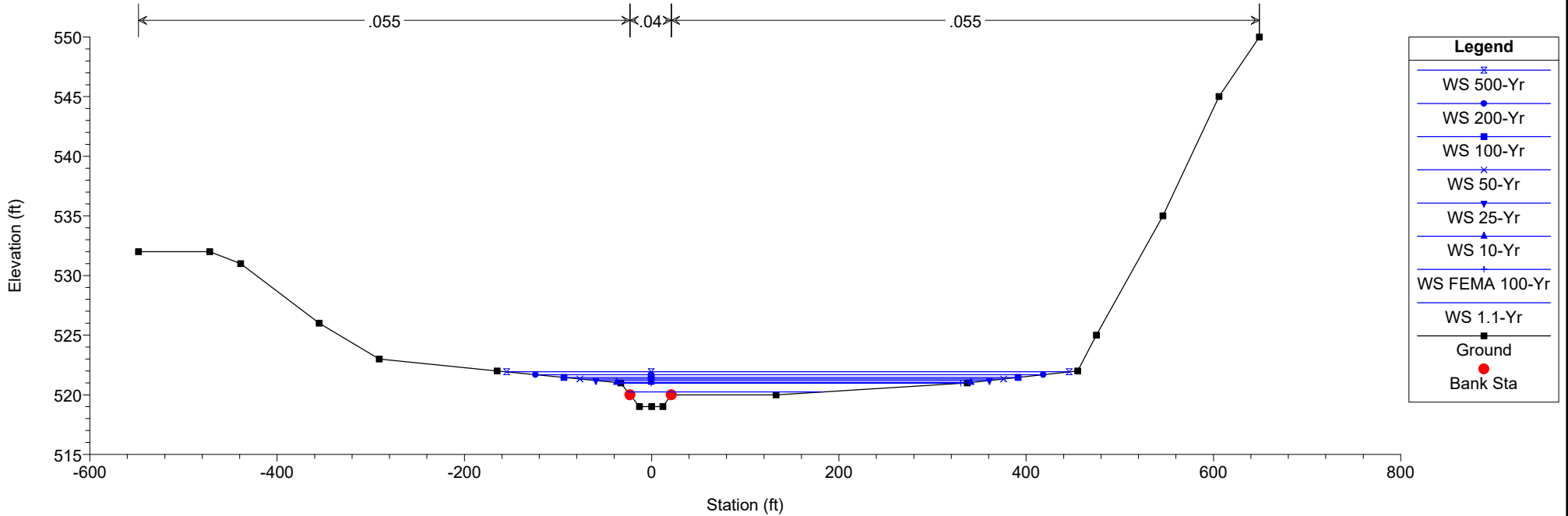
River = Violette Brook Reach = 1 RS = 551



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

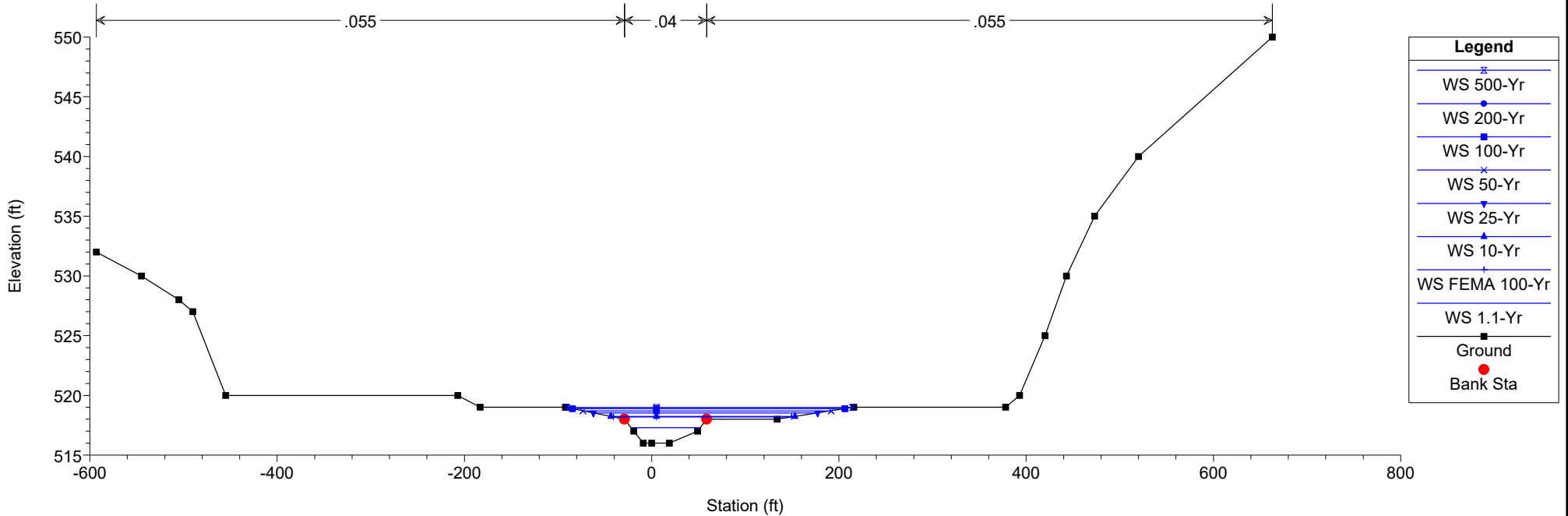
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_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

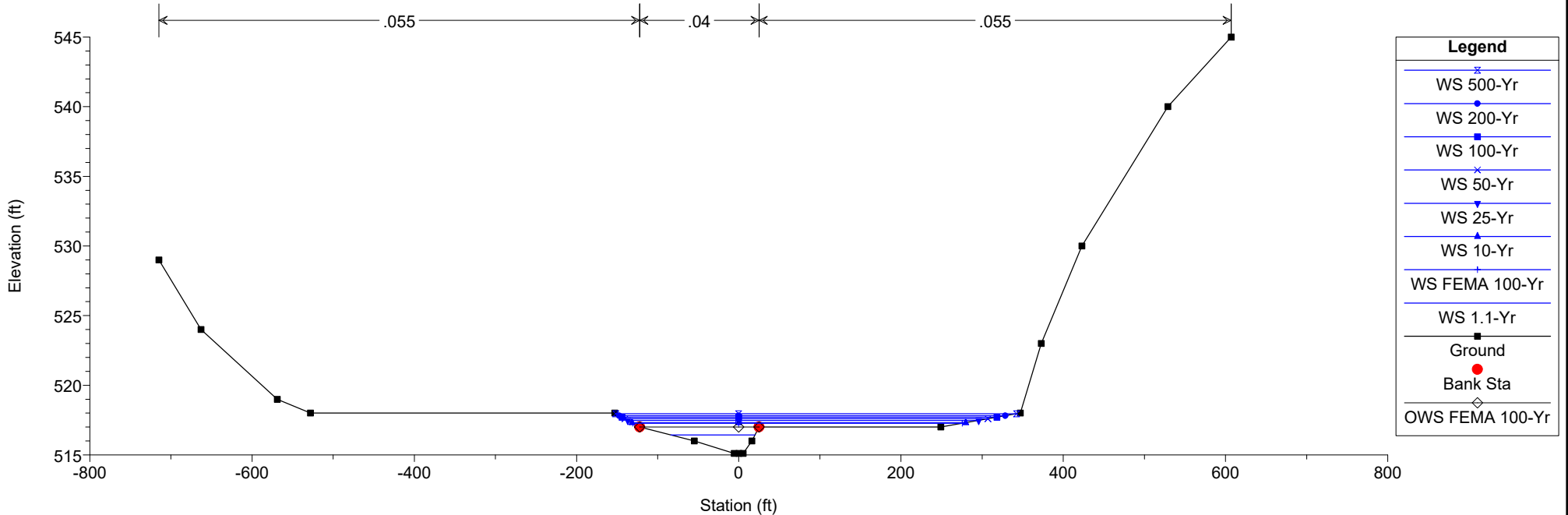
River = Violette Brook Reach = 1 RS = 159



_67328_MaineDOT_VanBuren Plan: Proposed_Conditions_70ft 10/10/2025

Geom: Proposed_Geometry_70ft Flow: MaineDOT_Flows

River = Violette Brook Reach = 1 RS = 63



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Project in English units

PLAN DATA

Plan Title: Proposed_Conditions_70ft
Plan File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.p03

Geometry Title: Proposed_Geometry_70ft
Geometry File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.g06

Flow Title : MaineDOT_Flows
Flow File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.f01

Plan Summary Information:
Number of: Cross Sections = 15 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 1 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: MaineDOT_Flows
Flow File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.f01

Flow Data (cfs)

* River	Reach	RS	*	1.1-Yr	10-Yr	25-Yr	50-Yr	100-Yr	200-Yr	500-Yr	FEMA 100-Yr	*
* Violette Brook	1	2093	*	221	942	1222	1444	1683	1930	2281	875	*

Boundary Conditions

* River	Reach	Profile	*	Upstream	Downstream	*
* Violette Brook	1	1.1-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	10-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	25-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	50-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	100-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	200-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*
* Violette Brook	1	500-Yr	*	Normal S = 0.00912	Normal S = 0.00994	*

Observed Water Surface Marks

* River	Reach	RS	*	1.1-Yr	10-Yr	25-Yr	50-Yr	100-Yr	200-Yr	500-Yr	FEMA 100-Yr	*
* Violette Brook	1	1696	*								532.3	*
* Violette Brook	1	1508	*								530.4	*
* Violette Brook	1	933	*								526.8	*
* Violette Brook	1	63	*								517	*

GEOMETRY DATA

Geometry Title: Proposed_Geometry_70ft
Geometry File : w:\Jobs\Water Resources Models\67328_MaineDOT_VanBuren\HEC-RAS_67328_MaineDOT_Van.g06

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 2093

INPUT
 Description:
 Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-466	594	-441	592	-411	590	-381	588	-353	586
-278	582	-143	579	-133	578	-122	575	-112	570
-102	565	-93	560	-84	555	-75	550	-65	545
-55	540	-39	535	-28	534	-22	533	-13	532
0	532	4	532	15	533	27	534	44	535
92	536	104	537	313	538	418	539	465	540
487	545	513	555	541	565	611	575		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-466	.055	-22	.04	15	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -22 15 203 201 196 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
104	611	537	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1892

INPUT
 Description:
 Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-650	587	-620	585	-580	583	-528	581	-489	580
-425	579	-392	578	-346	577	-297	576	-214	575
-185	574	-146	572	-106	568	-94	565	-70	555
-48	545	-26	535	-13	531	0	531	13	531
22	532	154	535	182	536	269	538	351	548
433	560								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-650	.055	-26	.04	182	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -26 182 192 196 257 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
181	494	534	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1696

INPUT
 Description:
 Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-548	613	-515	610	-495	605	-485	600	-464	590
-447	585	-424	580	-401	575	-328	574	-289	572
-259	570	-216	565	-178	560	-91	550	-66	547
-56	545	-43	540	-21	531	-16	530	0	530
25	530	70	531	106	533	181	534	326	535
442	540	494	550						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-548	.055	-21	.04	70	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -21 70 180 188 190 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
181	494	534	F

CROSS SECTION

RIVER: Violette Brook
 REACH: 1 RS: 1508

INPUT
 Description:
 Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-547	593	-531	590	-505	585	-471	580	-401	570
-342	560	-279	550	-235	545	-181	540	-100	535
-81	533	-56	530	-40	529	-15	528	0	528
14	528	20	529	26	530	51	531	88	532
137	533	299	533	305	534	348	540	394	545
419	550								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-547	.055	-56	.04	26	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -56 26 195 202 189 .1 .3
 Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
181	494	534	F

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1306

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-301	567	-286	565	-254	560	-229	555	-206	550
-185	545	-171	540	-157	535	-146	533	-57	532
-32	530	-19	528	-14	527	-7	526	0	526
7	526	17	527	32	528	42	529	52	530
169	531	423	532	449	535	474	540	550	550

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-301	.055	-32	.04	52	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-32	52	130.5	116	108.75	.1	.3
-----	----	-------	-----	--------	----	----

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1190

INPUT
Description: Approach
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-224.78	542	-218.77	541	-211.5	540	-200.9	539	-184.7	538
-179.9	537	-175.7	536	-171.9	535	-167.6	534	-162.7	533
-62.5	532	-52.7	531	-12.6	530	-11.8	529	-11.3	528
-10.7	527	-10.1	526	-6.8	525	-6.2	524	1.1	523.2
6.2	523.52	12.6	524	24.8	525	46.1	526	49.8	527
53.3	528	56.7	529	98.5	530	162	531	195.4	532
209.5	531	213.3	530	385.2	530	394.4	531	403.6	532
412.9	533	422.4	534	431.8	535	440.5	536	448.8	537

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-224.78	.055	-6.8	.04	24.8	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-6.8	24.8	31.5	28	26.25	.1	.3
------	------	------	----	-------	----	----

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1162

INPUT
Description: Upstream Face
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-274.2	542	-268.4	541	-262.7	540	-257.7	539	-252.4	538
-247.1	537	-239.4	536	-211.3	535	-208.8	534	-198.7	533
-196.1	532	-145.82	532	-144.07	531	-111.1	530	-43.2	529
-33.92	527	-32.17	526	-30.42	525	-28.67	524	-26.92	523
-6.3	523.08	6.8	523	24.25	523	26.08	523	27.83	524
29.58	525	31.33	526	33.08	527	37.1	529	44.3	530
83.9	531	96.14	531	134.5	531	156.1	532	164.7	532
176.7	531	178.6	530	232.6	530	275.5	531	307.2	532
348.3	533	366.7	534	389.6	535	401.4	536	412.4	537

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-274.2	.055	-30.42	.04	29.58	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-30.42	29.58	52	68	75	.3	.5
--------	-------	----	----	----	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-274.2	-40.42	532	T
39.58	412.4	532.1	T

BRIDGE

RIVER: Violette Brook
REACH: 1 RS: 1131

INPUT
Description:
Distance from Upstream XS = 5.5
Deck/Roadway Width = 33
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates num= 26

Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
-677.59	536	-624.52	535	-559.4	534				
-484.53	533	-323.71	532	-247.92	531.68				
-197.92	532.22	-135.42	532.55	-67.92	533.23				
-36.42	533.54	-36.42	533.54	530.04	-20.42	533.7	530.13		
35.02	533.9	530.4	35.58	533.87	530.4	35.58	533.87		
117.58	532.74	126.03	532.66	176.03	532.1				

226.03	532.63	263.19	533	303.6	535
335.99	536	369.33	538	429.31	543
496.11	547	528.74	550		

Upstream Bridge Cross Section Data

Station Elevation Data num= 45									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

-274.2	542	-268.4	541	-262.7	540	-257.7	539	-252.4	538
-247.1	537	-239.4	536	-211.3	535	-208.8	534	-198.7	533
-196.1	532	-145.82	532	-144.07	531	-111.1	530	-43.2	529
-33.92	527	-32.17	526	-30.42	525	-28.67	524	-26.92	523
-6.3	523.08	6.8	523	24.25	523	26.08	523	27.83	524
29.58	525	31.33	526	33.08	527	37.1	529	44.3	530
83.9	531	96.14	531	134.5	531	156.1	532	164.7	532
176.7	531	178.6	530	232.6	530	275.5	531	307.2	532
348.3	533	366.7	534	389.6	535	401.4	536	412.4	537

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val

-274.2	.055	-30.42	.04	29.58	.055

Bank Sta: Left	Right	Coeff	Contr.	Expan.
-30.42	29.58		.3	.5

Ineffective Flow num= 2				
Sta L	Sta R	Elev	Permanent	
-274.2	-40.42	532	T	
39.58	412.4	532.1	T	

Downstream Deck/Roadway Coordinates

num= 26									
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord

-712.4	536			-659.36	535			-626.5	534
-520.22	533			-463.75	532			-411.75	531
-236.26	531.68			-186.26	532.22			-148.76	532.55
-81.26	533.23			-49.76	533.54			-49.76	533.54
-33.76	533.7	530.13	21.68	533.9	530.4	22.24	533.87	530.4	
22.24	533.87			104.24	532.74			137.69	532.66
187.69	532.1			237.69	532.63			274.96	533
313.46	535			378.56	538			436.86	543
502.67	547			532.67	550				

Downstream Bridge Cross Section Data

Station Elevation Data num= 26									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

-615.6	535	-555.3	534	-497.8	533	-447.6	532	-397.4	531
-336	530	-251.1	529	-250	528	-221.8	527	-136.2	526
-91.7	525	-33.3	524	-15.4	523	4.9	523	7	524
11.49	524	13.24	525	14.99	526	22.5	527	123	528
137.7	529	229.5	530	264.7	531	289.6	532	310.2	533
329.1	534								

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val

-615.6	.055	-33.3	.04	7	.055

Bank Sta: Left	Right	Coeff	Contr.	Expan.
-33.3	7		.3	.5

Ineffective Flow num= 2				
Sta L	Sta R	Elev	Permanent	
-615.6	-63.01	530.04	T	
35.49	329.1	530.37	T	

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
 Downstream Embankment side slope = 0 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow = .98
 Elevation at which weir flow begins =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy
 Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters

Add Friction component to Momentum
 Do not add Weight component to Momentum
 Class B flow critical depth computations use critical depth
 inside the bridge at the upstream end
 Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Violette Brook

REACH: 1 RS: 1094

INPUT

Description: Downstream Face

Station Elevation Data num= 26									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

-615.6	535	-555.3	534	-497.8	533	-447.6	532	-397.4	531
-336	530	-251.1	529	-250	528	-221.8	527	-136.2	526
-91.7	525	-33.3	524	-15.4	523	4.9	523	7	524
11.49	524	13.24	525	14.99	526	22.5	527	123	528

137.7 529 229.5 530 264.7 531 289.6 532 310.2 533
329.1 534

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-615.6 .055 -33.3 .04 7 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-33.3 7 33 33 33 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
-615.6 -63.01 530.04 T
35.49 329.1 530.37 T

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 1061

INPUT
Description:
Station Elevation Data num= 22
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-675 534 -628 531 -549 530 -453 529 -321 528
-125 528 -107 527 -18 526 -10 525 -2 524
0 524 9 524 16 525 43 526 111 527
326 528 342 530 376 535 462 540 543 545
595 550 719 560

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-675 .055 -10 .04 16 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-10 16 134 128 183 .1 .3

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 933

INPUT
Description:
Station Elevation Data num= 24
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-602 534 -548 531 -443 530 -398 529 -241 528
-110 528 -83 527 -52 526 -29 525 -20 524
-12 523 0 523 1 523 7 524 12 525
192 525 425 526 440 528 452 530 499 534
586 540 615 542 713 550 817 560

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-602 .055 -20 .04 7 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-20 7 206 204 195 .1 .3

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 729

INPUT
Description:
Station Elevation Data num= 22
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-534 534 -493 532 -445 531 -362 530 -259 530
-242 529 -197 528 -71 526 -37 525 -19 524
-8 523 0 523 12 523 249 523 290 524
518 524 559 525 597 526 650 530 689 535
766 545 811 550

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-534 .055 -19 .04 290 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-19 290 123 178 193 .1 .3
Ineffective Flow num= 1
Sta L Sta R Elev Permanent
-534 -259 530 F

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 551

INPUT
Description:
Station Elevation Data num= 18
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-347 530 -287 528 -230 526 -163 524 -144 523
-60 522 -15 521 -4 520 0 520 8 520

18 521 155 521 164 522 239 523 481 524
517 530 575 540 641 550

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-347 .055 -15 .04 18 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-15 18 155 189 152 .1 .3

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 362

INPUT
Description:
Station Elevation Data num= 19
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-548 532 -472 532 -439 531 -355 526 -291 523
-165 522 -33 521 -23 520 -13 519 0 519
12 519 21 520 133 520 337 521 455 522
475 525 546 535 606 545 649 550

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-548 .055 -23 .04 21 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-23 21 204 203 200 .1 .3

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 159

INPUT
Description:
Station Elevation Data num= 24
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-593 532 -545 530 -505 528 -490 527 -455 520
-207 520 -183 519 -92 519 -29 518 -19 517
-9 516 0 516 19 516 49 517 59 518
134 518 216 519 378 519 393 520 420 525
443 530 473 535 520 540 663 550

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-593 .055 -29 .04 59 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-29 59 98 96 88 .1 .3

CROSS SECTION

RIVER: Violette Brook
REACH: 1 RS: 63

INPUT
Description:
Station Elevation Data num= 18
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

-715 529 -663 524 -569 519 -528 518 -153 518
-122 517 -55 516 -5.8 515.1 0 515.1 5.3 515.1
16 516 25 517 249 517 347 518 373 523
423 530 529 540 607 545

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val

-715 .055 -122 .04 25 .055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-122 25 0 0 0 .1 .3

SUMMARY OF MANNING'S N VALUES

River:Violette Brook

* Reach * River Sta. * n1 * n2 * n3 *

*1 * 2093 * .055* .04* .055*
*1 * 1892 * .055* .04* .055*
*1 * 1696 * .055* .04* .055*
*1 * 1508 * .055* .04* .055*
*1 * 1306 * .055* .04* .055*
*1 * 1190 * .055* .04* .055*
*1 * 1162 * .055* .04* .055*
*1 * 1131 *Bridge * * *
*1 * 1094 * .055* .04* .055*
*1 * 1061 * .055* .04* .055*
*1 * 933 * .055* .04* .055*
*1 * 729 * .055* .04* .055*
*1 * 551 * .055* .04* .055*
*1 * 362 * .055* .04* .055*

```

*1      * 159      * .055* .04* .055*
*1      * 63       * .055* .04* .055*
*****

```

SUMMARY OF REACH LENGTHS

River: Violette Brook

```

*****
* Reach * River Sta. * Left * Channel * Right *
*****
*1      * 2093      * 203* 201* 196*
*1      * 1892      * 192* 196* 257*
*1      * 1696      * 180* 188* 190*
*1      * 1508      * 195* 202* 189*
*1      * 1306      * 130.5* 116* 108.75*
*1      * 1190      * 31.5* 28* 26.25*
*1      * 1162      * 52* 68* 75*
*1      * 1131      * *Bridge * *
*1      * 1094      * 33* 33* 33*
*1      * 1061      * 134* 128* 183*
*1      * 933       * 206* 204* 195*
*1      * 729       * 123* 178* 193*
*1      * 551       * 155* 189* 152*
*1      * 362       * 204* 203* 200*
*1      * 159       * 98* 96* 88*
*1      * 63        * 0* 0* 0*
*****

```

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Violette Brook

```

*****
* Reach * River Sta. * Contr. * Expan. *
*****
*1      * 2093      * .1* .3*
*1      * 1892      * .1* .3*
*1      * 1696      * .1* .3*
*1      * 1508      * .1* .3*
*1      * 1306      * .1* .3*
*1      * 1190      * .1* .3*
*1      * 1162      * .3* .5*
*1      * 1131      * *Bridge * *
*1      * 1094      * .3* .5*
*1      * 1061      * .1* .3*
*1      * 933       * .1* .3*
*1      * 729       * .1* .3*
*1      * 551       * .1* .3*
*1      * 362       * .1* .3*
*1      * 159       * .1* .3*
*1      * 63        * .1* .3*
*****

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APPENDIX E

Scour Analysis



For St. Mary's Bridge over Violette Brook	Made by KAM	Date 01/30/24	Job No. 67328.00
	Checked by SCF	Date 01/31/24	Sheet No. 1 of 5
	Backchecked by AC	Date 07/30/25	

Summary of Scour Analysis Results

Abutment Scour			
Storm Event	Streambed Material	Abutment Location	NCHRP Total Scour (ft)
500-Year	D ₅₀ = 0.2 mm	Left	7.53
		Right	7.07
100-Year	D ₅₀ = 0.2 mm	Left	2.83
		Right	1.08

Notes:

1. Left=Northern, Right = Southern

National Cooperative Highway Research Program (NCHRP) 24-20 Abutment Scour Analysis

Check Event: 500-Year

Abutment Location	Floodplain Limit Station	Abutment Station	L (ft)	Channel Bank Station	B _f (ft)	L/B _f (%)	Contraction Scour Type	Set-Back Length (ft)	y ₀ (ft)	Set-Back Ratio	Velocity Calculation Method
Left (North)	-44.82	-36.42	8.4	-32.17	12.65	66.4%	Clear-Water	4.25	1.45	2.93	Q/A of Bridge
Right (South)	37.27	35.58	1.69	31.33	5.94	28.5%	Clear-Water	4.25	0.75	5.67	QA of Overbank

Live-Bed Scour

Abutment Location	Q _{Bridge} (cfs)	A _{Bridge} (ft ²)	V _{Bridge} (ft/s)	V _{Approach} (ft/s)	y ₁ (ft)	q ₁ (cfs/ft)	Bridge Opening Width (ft)	q _{2c} (cfs/ft)	q _{2c} /q ₁	y _c (ft)	α _A	y _{max} (ft)
Left (North)	2,281	380.05	6.00	8.15	3.32	N/A	70.00	N/A	N/A	N/A		N/A
Right (South)	2,281	380.05	6.00	8.15	2.62	N/A	70.00	N/A	N/A	N/A		N/A

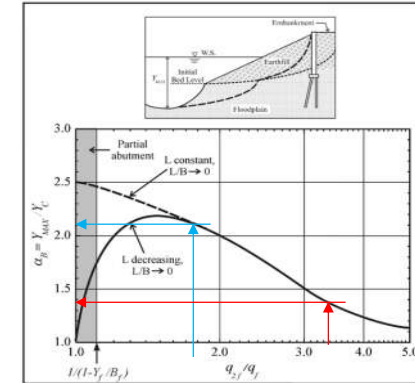


Figure 8.11. Scour amplification factor for spill-through abutments and clear-water conditions (NCHRP 2010b).

Clear-Water Scour

Abutment Location	WSEL at Bridge	Low Chord Elevation	Streambed Elevation at Abutment	Depth of Flow at Abutment (ft)	Q _{Bridge} (cfs)	A _{Bridge} (ft ²)	V _{Bridge} (ft/s)	q _{2f} (cfs/ft)	Upstream Floodplain Depth (ft)	q _f (cfs/ft)	q _{2f} /q _f	K _u	D ₅₀ (mm)	D ₅₀ (ft)	y _c (ft)	α _B	y _{max} (ft)
Left (North)	528.99	530.04	527.54	1.45	2,281	380.05	6.00	8.7027	0.43	2.58	3.37	11.17	0.20	0.00	6.55	1.37	8.98
Right (South)	528.99	530.04	528.24	0.75	2,281	380.05	6.00	4.5014	0.43	2.58	1.74	11.17	0.20	0.00	3.72	2.1	7.82

Total Scour

Abutment Location	y _{max} (ft)	WSEL at Bridge	Low Chord Elevation	Streambed Elevation at Abutment	y ₀ (ft)	y _s (ft)
Left (North)	8.98	528.99	530.04	527.54	1.45	7.53
Right (South)	7.82	528.99	530.04	528.24	0.75	7.07

Equations:

$$y_s = y_{max} - y_0$$

Live-Bed

$$y_{max} = \alpha_a y_c$$

$$y_c = y_1 (q_{2c}/q_1)^{6/7}$$

Clear-Water

$$y_{max} = \alpha_b y_c$$

$$y_c = (q_{2f}/K_u D_{50})^{1/3, 6/7}$$

Legend

α _A	Amplification factor for live-bed conditions
α _B	Amplification factor for clear-water conditions
A _{Bridge}	Bridge Open Area, ft ²
B _f	Floodplain width, ft
D ₅₀	Particle size with 50 percent finer, ft
K _u	11.17 English units
L	Embankment Length, ft
q ₁	Upstream channel unit discharge, ft ² /s
q _{2c}	Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft ² /s
q _{2f}	Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft ² /s
Q _{Bridge}	Discharge through the bridge from HEC-RAS tables, cfs
q _f	Unit discharge in the floodplain upstream of the bridge, ft ² /s
y ₀	Flow depth prior to scour, ft
y ₁	Upstream channel flow depth, ft
y _c	Flow depth including live-bed or clear-water contraction scour, ft
y _{max}	Max. flow depth resulting from abutment scour, ft
y _s	Abutment scour depth, ft

National Cooperative Highway Research Program (NCHRP) 24-20 Abutment Scour Analysis

Design Event: 100-Year

Abutment Location	Floodplain Limit Station	Abutment Station	L (ft)	Channel Bank Station	B _f (ft)	L/B _f (%)	Contraction Scour Type	Set-Back Length (ft)	y ₀ (ft)	Set-Back Ratio	Velocity Calculation Method
Left (North)	-40.76	-36.42	4.34	-32.17	8.59	50.5%	Clear-Water	4.25	0.92	4.62	Q/A of Bridge
Right (South)	36.04	35.58	0.46	31.33	4.71	9.8%	Clear-Water	4.25	0.22	19.32	QA of Overbank

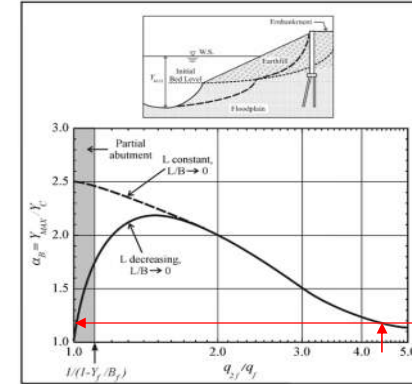


Figure B.11. Scour amplification factor for spill-through abutments and clear-water conditions (NCHRP 2010b).

Live-Bed Scour

Abutment Location	Q _{Bridge} (cfs)	A _{Bridge} (ft ²)	V _{Bridge} (ft/s)	V _{Approach} (ft/s)	y ₁ (ft)	q ₁ (cfs/ft)	Bridge Opening Width (ft)	q _{2c} (cfs/ft)	q _{2c} /q ₁	y _c (ft)	α _A	y _{max} (ft)
Left (North)	1,683	341.40	4.93	8.13	2.56	N/A	70.00	N/A	N/A	N/A		N/A
Right (South)	1,683	341.40	4.93	8.13	1.86	N/A	70.00	N/A	N/A	N/A		N/A

Clear-Water Scour

Abutment Location	WSEL at Bridge	Low Chord Elevation	Streambed Elevation at Abutment	Depth of Flow at Abutment (ft)	Q _{Bridge} (cfs)	A _{Bridge} (ft ²)	V _{Bridge} (ft/s)	q _{2f} (cfs/ft)	Upstream Floodplain Depth (ft)	q _f (cfs/ft)	q _{2f} /q _f	K _u	D ₅₀ (mm)	D ₅₀ (ft)	y _c (ft)	α _B	y _{max} (ft)
Left (North)	528.46	530.04	527.54	0.92	1,683	341.40	4.93	4.535	0.05	0.246	18.40	11.17	0.20	0.0007	3.75	1	3.75
Right (South)	528.46	530.04	528.24	0.22	1,683	341.40	4.93	1.085	0.05	0.246	4.40	11.17	0.20	0.0007	1.10	1.18	1.30

Total Scour

Abutment Location	y _{max} (ft)	WSEL at Bridge	Low Chord Elevation	Streambed Elevation at Abutment	y ₀ (ft)	y _s (ft)
Left (North)	3.75	528.46	530.04	527.54	0.92	2.83
Right (South)	1.30	528.46	530.04	528.24	0.22	1.08

Legend

α _A	Amplification factor for live-bed conditions
α _B	Amplification factor for clear-water conditions
A _{Bridge}	Bridge Open Area, ft ²
B _f	Floodplain width, ft
D ₅₀	Particle size with 50 percent finer, ft
K _u	11.17 English units
L	Embankment Length, ft
q ₁	Upstream channel unit discharge, ft ² /s
q _{2c}	Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft ² /s
q _{2f}	Unit discharge in the constricted opening accounting for non-uniform flow distribution, ft ² /s
Q _{Bridge}	Discharge through the bridge from HEC-RAS tables, cfs
q _f	Unit discharge in the floodplain upstream of the bridge, ft ² /s
y ₀	Flow depth prior to scour, ft
y ₁	Upstream channel flow depth, ft
y _c	Flow depth including live-bed or clear-water contraction scour, ft
y _{max}	Max. flow depth resulting from abutment scour, ft
y _s	Abutment scour depth, ft

Equations:

$$y_s = y_{max} - y_0$$

Live-Bed

$$y_{max} = \alpha_A y_c$$

$$y_c = y_1 (q_{2c}/q_1)^{6/7}$$

Clear-Water

$$y_{max} = \alpha_B y_c$$

$$y_c = (q_{2f}/K_u D_{50})^{1/3,6/7}$$



Made by		KAM	Date	01/30/24	Job No.	67328
Checked by		SCF	Date	01/31/24	Sheet No.	4 of 5
Backchecked by		AC	Date	07/30/25		

For St. Mary's Bridge over Violette Brook

Plan: PC Violette Brook 1 RS: 1306 Profile: 500-Yr		Approach			
E.G. Elev (ft)	531.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1	Wt. n-Val.	0.055	0.04	0.055
W.S. Elev (ft)	530.86	Reach Len. (ft)	130.5	116	108.75
Crit W.S. (ft)	530.68	Flow Area (sq ft)	4.61	270.67	43.19
E.G. Slope (ft/ft)	0.010202	Area (sq ft)	4.61	270.67	43.19
Q Total (cfs)	2281	Flow (cfs)	7.15	2206.76	67.09
Top Width (ft)	195.27	Top Width (ft)	10.74	84	100.53
Vel Total (ft/s)	7.16	Avg. Vel. (ft/s)	1.55	8.15	1.55
Max Chl Dpth (ft)	4.86	Hydr. Depth (ft)	0.430	3.220	0.430
Conv. Total (cfs)	22583.3	Conv. (cfs)	70.800	21848.200	664.300
Length Wtd. (ft)	115.37	Wetted Per. (ft)	10.77	84.51	100.53
Min Ch El (ft)	526	Shear (lb/sq ft)	0.27	2.04	0.27
Alpha	1.26	Stream Power (lb/ft s)	0.42	16.63	0.43
Frctn Loss (ft)	1.34	Cum Volume (acre-ft)	1.85	5.87	8.17
C & E Loss (ft)	0.08	Cum SA (acres)	2.25	2.58	7.6

S1 =

= Q1
= W1
= V1
= Y1

Plan: PC Violette Brook 1 RS: 1162 Profile: 500-Yr		U/S Face			
E.G. Elev (ft)	529.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.055	0.04	0.055
W.S. Elev (ft)	529.02	Reach Len. (ft)	5.5	5.5	5.5
Crit W.S. (ft)	526.7	Flow Area (sq ft)	19.19	353.09	14.7
E.G. Slope (ft/ft)	0.002739	Area (sq ft)	20.11	353.09	14.7
Q Total (cfs)	2281	Flow (cfs)	40.09	2211.41	29.5
Top Width (ft)	82.1	Top Width (ft)	14.4	60	7.69
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	2.09	6.26	2.01
Max Chl Dpth (ft)	6.02	Hydr. Depth (ft)	1.92	5.88	1.91
Conv. Total (cfs)	43585.6	Conv. (cfs)	766	42255.9	563.7
Length Wtd. (ft)	5.5	Wetted Per. (ft)	10.68	61.06	8.7
Min Ch El (ft)	523	Shear (lb/sq ft)	0.31	0.99	0.29
Alpha	1.1	Stream Power (lb/ft s)	0.64	6.19	0.58
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	1.82	5.15	7.99
C & E Loss (ft)	0	Cum SA (acres)	2.22	2.39	7.42

Plan: PC Violette Brook 1 RS: 1131 BR U Profile: 500-Yr					
E.G. Elev (ft)	529.6	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.055	0.04	0.055
W.S. Elev (ft)	528.99	Reach Len. (ft)	33	33	33
Crit W.S. (ft)	526.71	Flow Area (sq ft)	14.8	351.34	13.91
E.G. Slope (ft/ft)	0.002804	Area (sq ft)	14.8	351.34	13.91
Q Total (cfs)	2281	Flow (cfs)	31.78	2219.36	29.86
Top Width (ft)	72	Top Width (ft)	6	60	6
Vel Total (ft/s)	6	Avg. Vel. (ft/s)	2.15	6.32	2.15
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	2.47	5.86	2.32
Conv. Total (cfs)	43072.6	Conv. (cfs)	600.1	41908.7	563.9
Length Wtd. (ft)	33	Wetted Per. (ft)	8.04	61.06	7.57
Min Ch El (ft)	523	Shear (lb/sq ft)	0.32	1.01	0.32
Alpha	1.08	Stream Power (lb/ft s)	0.69	6.36	0.69
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	1.81	5.11	7.99
C & E Loss (ft)	0.1	Cum SA (acres)	2.22	2.39	7.42

= Q2
= W2
= Y0

Plan: PC Violette Brook 1 RS: 1131 Profile: 500-Yr				
E.G. US. (ft)	529.62	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	529.02	E.G. Elev (ft)	529.6	529.38
Q Total (cfs)	2281	W.S. Elev (ft)	528.99	528.45
Q Bridge (cfs)	2281	Crit W.S. (ft)	526.71	527.27
Q Weir (cfs)		Max Chl Dpth (ft)	5.99	5.45
Weir Sta Lft (ft)		Vel Total (ft/s)	6	6.97
Weir Sta Rgt (ft)		Flow Area (sq ft)	380.05	327.04
Weir Submerg		Froude # Chl	0.45	0.58
Weir Max Depth (ft)		Specif Force (cu ft)	1511.48	1314.22
Min El Weir Flow (ft)	532.11	Hydr Depth (ft)	5.28	4.54
Min El Prs (ft)	530.37	W.P. Total (ft)	76.68	78.51
Delta EG (ft)	0.53	Conv. Total (cfs)	43072.6	30081.2
Delta WS (ft)	0.57	Top Width (ft)	72	72
BR Open Area (sq ft)	452.55	Frctn Loss (ft)	0.13	0.14
BR Open Vel (ft/s)	6.97	C & E Loss (ft)	0.1	0.14
BR Sluice Coef		Shear Total (lb/sq ft)	0.87	1.5
BR Sel Method	Energy only	Power Total (lb/ft s)	5.21	10.43



For St. Mary's Bridge over Violette Brook

Made by	KAM	Date	01/30/24	Job No.	67328
Checked by	SCF	Date	01/31/24	Sheet No.	5 of 5
Backchecked by	AC	Date	07/30/25		

Plan: PC Violette Brook 1 RS: 1306 Profile: 100-Yr

Element	Left OB	Channel	Right OB	Approach
E.G. Elev (ft)	531.13			
Vel Head (ft)	1.03	Wt. n-Val.	0.055	0.04 0.055
W.S. Elev (ft)	530.1	Reach Len. (ft)	130.5	116 108.75
Crit W.S. (ft)	529.92	Flow Area (sq ft)	0.07	207.1 0.61
E.G. Slope (ft/ft)	0.014479	Area (sq ft)	0.07	207.1 0.61
Q Total (cfs)	1683	Flow (cfs)	0.03	1682.7 0.27 = Q1
Top Width (ft)	97.26	Top Width (ft)	1.28	84 11.98 = W1
Vel Total (ft/s)	8.1	Avg. Vel. (ft/s)	0.45	8.13 0.45 = V1
Max Chl Dpth (ft)	4.1	Hydr. Depth (ft)	0.050	2.470 0.050 = Y1
Conv. Total (cfs)	13986.7	Conv. (cfs)	0.200	13984.200 2.300
Length Wtd. (ft)	115.53	Wetted Per. (ft)	1.28	84.51 11.98
Min Ch El (ft)	526	Shear (lb/sq ft)	0.05	2.22 0.05
Alpha	1.01	Stream Power (lb/ft s)	0.02	18 0.02
Frctn Loss (ft)	1.64	Cum Volume (acre-ft)	1.34	5.04 6.08
C & E Loss (ft)	0.05	Cum SA (acres)	1.48	2.58 6.87

Plan: PC Violette Brook 1 RS: 1162 Profile: 100-Yr

Element	Left OB	Channel	Right OB	U/S Face
E.G. Elev (ft)	528.88			
Vel Head (ft)	0.4	Wt. n-Val.	0.055	0.04 0.055
W.S. Elev (ft)	528.47	Reach Len. (ft)	5.5	5.5 5.5
Crit W.S. (ft)	526.05	Flow Area (sq ft)	13.68	320.06 10.84
E.G. Slope (ft/ft)	0.002104	Area (sq ft)	13.69	320.06 10.84
Q Total (cfs)	1683	Flow (cfs)	20	1645.58 17.42 = Q1
Top Width (ft)	76.8	Top Width (ft)	10.34	60 6.46 = W1
Vel Total (ft/s)	4.88	Avg. Vel. (ft/s)	1.46	5.14 1.61 = V1
Max Chl Dpth (ft)	5.47	Hydr. Depth (ft)	1.37	5.33 1.68 = Y1
Conv. Total (cfs)	36691.4	Conv. (cfs)	436	35875.7 379.8
Length Wtd. (ft)	5.5	Wetted Per. (ft)	10.68	61.06 7.34
Min Ch El (ft)	523	Shear (lb/sq ft)	0.17	0.69 0.19
Alpha	1.09	Stream Power (lb/ft s)	0.25	3.54 0.31
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.32	4.45 5.98
C & E Loss (ft)	0	Cum SA (acres)	1.46	2.39 6.81

Plan: PC Violette Brook 1 RS: 1131 BR U Profile: 100-Yr

Element	Left OB	Channel	Right OB	
E.G. Elev (ft)	528.86			
Vel Head (ft)	0.41	Wt. n-Val.	0.055	0.04 0.055
W.S. Elev (ft)	528.46	Reach Len. (ft)	33	33 33
Crit W.S. (ft)	526.05	Flow Area (sq ft)	11.57	319.14 10.69
E.G. Slope (ft/ft)	0.002126	Area (sq ft)	11.57	319.14 10.69
Q Total (cfs)	1683	Flow (cfs)	19.24	1646.15 17.61 = Q2
Top Width (ft)	72	Top Width (ft)	6	60 6 = W2
Vel Total (ft/s)	4.93	Avg. Vel. (ft/s)	1.66	5.16 1.65 = Y0
Max Chl Dpth (ft)	5.46	Hydr. Depth (ft)	1.93	5.32 1.78
Conv. Total (cfs)	36502.6	Conv. (cfs)	417.3	35703.4 381.8
Length Wtd. (ft)	33	Wetted Per. (ft)	7.51	61.06 7.04
Min Ch El (ft)	523	Shear (lb/sq ft)	0.2	0.69 0.2
Alpha	1.07	Stream Power (lb/ft s)	0.34	3.58 0.33
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	1.32	4.41 5.98
C & E Loss (ft)	0.05	Cum SA (acres)	1.46	2.39 6.81

Plan: PC Violette Brook 1 RS: 1131 Profile: 100-Yr

Element	Inside BR US	Inside BR DS
E.G. US. (ft)	528.88	
W.S. US. (ft)	528.47	E.G. Elev (ft) 528.86 528.72
Q Total (cfs)	1683	W.S. Elev (ft) 528.46 528.14
Q Bridge (cfs)	1683	Crit W.S. (ft) 526.05 526.55
Q Weir (cfs)		Max Chl Dpth (ft) 5.46 5.14
Weir Sta Lft (ft)		Vel Total (ft/s) 4.93 5.53
Weir Sta Rgt (ft)		Flow Area (sq ft) 341.4 304.53
Weir Submerg		Froude # Chl 0.39 0.47
Weir Max Depth (ft)		Specif Force (cu ft) 1143.8 994.02
Min El Weir Flow (ft)	532.11	Hydr Depth (ft) 4.74 4.23
Min El Prs (ft)	530.37	W.P. Total (ft) 75.61 77.88
Delta EG (ft)	0.34	Conv. Total (cfs) 36502.6 26944.1
Delta WS (ft)	0.35	Top Width (ft) 72 72
BR Open Area (sq ft)	452.55	Frctn Loss (ft) 0.09 0.1
BR Open Vel (ft/s)	5.53	C & E Loss (ft) 0.05 0.08
BR Sluice Coef		Shear Total (lb/sq ft) 0.6 0.95
BR Sel Method	Energy only	Power Total (lb/ft s) 2.95 5.26

APPENDIX F

Scour Countermeasure Analysis

FHWA HEC-23 Design Guideline 4 - Riprap Revetment

Design Storm: 100-Year

HEC-RAS Section	Bank Location	C _v	Embankment Slope (ft/ft)	K ₁	C _s	S _f	V (ft/s)	g (ft/s ²)	y (ft)	S _g	C _T	Rc (ft)
1162 (US Bridge Face)	Straight Channel	1.00	1.75:1	0.72	0.3	1.1	5.26	32.2	5.49	2.65	1.00	9999.00
1094 (DS Bridge Face)	Straight Channel	1.00	1.75:1	0.72	0.3	1.1	6.01	32.2	4.67	2.65	1.00	9999.00

HEC-RAS Section	W _w (ft)	V _{DES} (ft/s)	D ₃₀ (ft)	D ₅₀ (ft)	D ₅₀ (in)	Design D ₅₀ (in)
1162 (US Bridge Face)	--	5.3	0.14	0.17	2.1	6
1094 (DS Bridge Face)	--	6.0	0.21	0.25	3.0	6

Check Storm: 500-Year

HEC-RAS Section	Bank Location	C _v	Embankment Slope (ft/ft)	K ₁	C _s	S _f	V (ft/s)	g (ft/s ²)	y (ft)	S _g	C _T	Rc (ft)
1162 (US Bridge Face)	Straight Channel	1.00	1.75:1	0.72	0.3	1	6.40	32.2	6.61	2.65	1.00	9999.00
1094 (DS Bridge Face)	Straight Channel	1.00	1.75:1	0.72	0.3	1	7.48	32.2	2.73	2.65	1.00	9999.00

HEC-RAS Section	W _w (ft)	V _{DES} (ft/s)	D ₃₀ (ft)	D ₅₀ (ft)	D ₅₀ (in)	Design D ₅₀ (in)
1162 (US Bridge Face)	---	6.40	0.20	0.25	2.9	6
1094 (DS Bridge Face)	---	7.48	0.38	0.45	5.4	6

Legend	
C _v	Velocity Distribution Coefficient Straight Channel: 1.0 Inside Bend: 1.0 Outside Bend: 1.283 - 0.2 * LOG(R _c /W)
R _c	Centerline Radius of Channel
W	Width of Water Surface At Upstream End of Bend
C _s	Stability Coefficient Angular Rock: 0.30 Rounded Rock: 0.375
S _f	Safety Factor (> 1.0)
C _T	Blanket Thickness Coefficient (Assumed 1.0)
S _r	Specific Gravity of Rock Riprap (Assume 2.65)
V	Characteristic Average Velocity in the Contracted Section (ft/s)
g	Gravitational Acceleration (32.2 ft/s ²)
y	Depth of Flow in the Contracted Bridge Opening (ft)
V _{DES}	Characteristic Velocity for Design (ft/s)
K ₁	Side Slope Correction Factor
D ₃₀	Particle Size for Which 30% is Finer By Weight(ft)
D ₅₀	Median Stone Diameter (ft) (D ₅₀ = 1.2 * D ₃₀)

Equations:

$$d_{30} = y(S_f C_s C_v C_T) \left[\frac{(V_{des})}{\sqrt{K_1(S_g - 1)gy}} \right]^{2.5}$$

$$K_1 = \sqrt{1 - \left(\frac{\sin(\theta - 14^\circ)}{\sin(32^\circ)} \right)^{1.6}}$$

$$V_{des} = V_{avg}(1.74 - 0.52\log(R_c/W))$$

$$V_{des} = V_{avg} \text{ for } R_c/W > 26$$

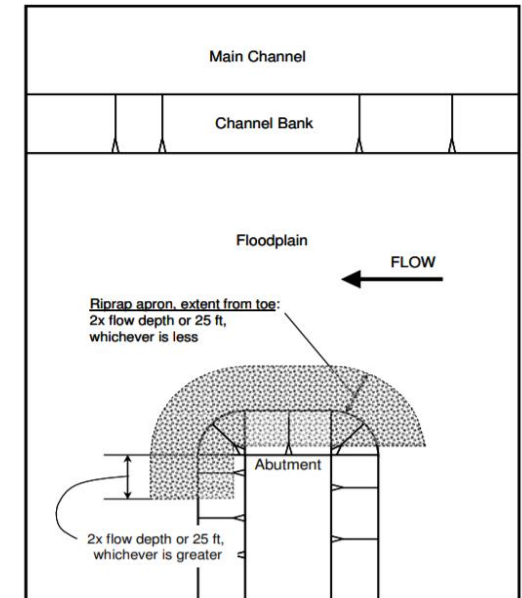
FHWA HEC-23 Design Guideline 14 - Rock Riprap at Bridge Abutments

Design Storm: 1% Chance Event													
Abutment Location	Abutment Cross Section Location	Abutment Type	K	S _g	V (ft/s)	g (ft/s ²)	WSEL (ft NAVD88)	Abutment Toe Elevation (ft NAVD88)	y (ft)	Froude Number	D ₅₀ (ft)	D ₅₀ (in)	Design D ₅₀ (in)
North	Left	Vertical Wall	1.02	2.65	3.69	32.2	528.46	527.54	0.92	0.68	0.26	3.1	6
South	Right	Vertical Wall	0.69	2.65	3.06	32.2	528.46	528.24	0.22	1.15	0.10	1.1	6

Design Storm: 0.2% Chance Event													
Abutment Location	Abutment Cross Section Location	Abutment Type	K	S _g	V (ft/s)	g (ft/s ²)	WSEL (ft NAVD88)	Abutment Toe Elevation (ft NAVD88)	y (ft)	Froude Number	D ₅₀ (ft)	D ₅₀ (in)	Design D ₅₀ (in)
North	Left	Vertical Wall	1.02	2.65	4.67	32.2	529.99	527.54	2.45	0.53	0.42	5.0	6
South	Right	Vertical Wall	1.02	2.65	3.95	32.2	529.99	528.24	1.75	0.53	0.30	3.6	6

Riprap Extents

Design Event	Abutment Location	Horizontal Extents Into Floodplain (ft)	Horizontal Extents Along Downstream Face (ft)
1% Chance Event	North	1.84	25.00
	South	0.44	25.00
0.2% Chance Event	North	4.90	25.00
	South	3.50	25.00



Legend	
K	For Froude # ≤ 0.80: 0.89 for Spill-Through Abutment 1.02 for Vertical Wall Abutment For Froude # > 0.80: 0.61 for Spill-Through Abutment 0.69 for Vertical Wall Abutment
S _g	Specific Gravity of Rock Riprap (Assume 2.65)
V	Characteristic Average Velocity in the Contracted Section (ft/s)
g	Gravitational Acceleration (32.2 ft/s ²)
y	Depth of Flow in the Contracted Bridge Opening (ft)
D ₅₀	Median Stone Diameter (ft)

Equations:

$$\frac{D_{50}}{y} = \frac{K}{(S_g - 1)} \left[\frac{V^2}{gy} \right] \text{ when } Fr \leq 0.80$$

$$\frac{D_{50}}{y} = \frac{K}{(S_g - 1)} \left[\frac{V^2}{gy} \right]^{0.14} \text{ when } Fr > 0.80$$

APPENDIX G

2023 Highway Bridge Inspection Report

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Inspection Type(s): Routine

Bridge Name: ST MARYS

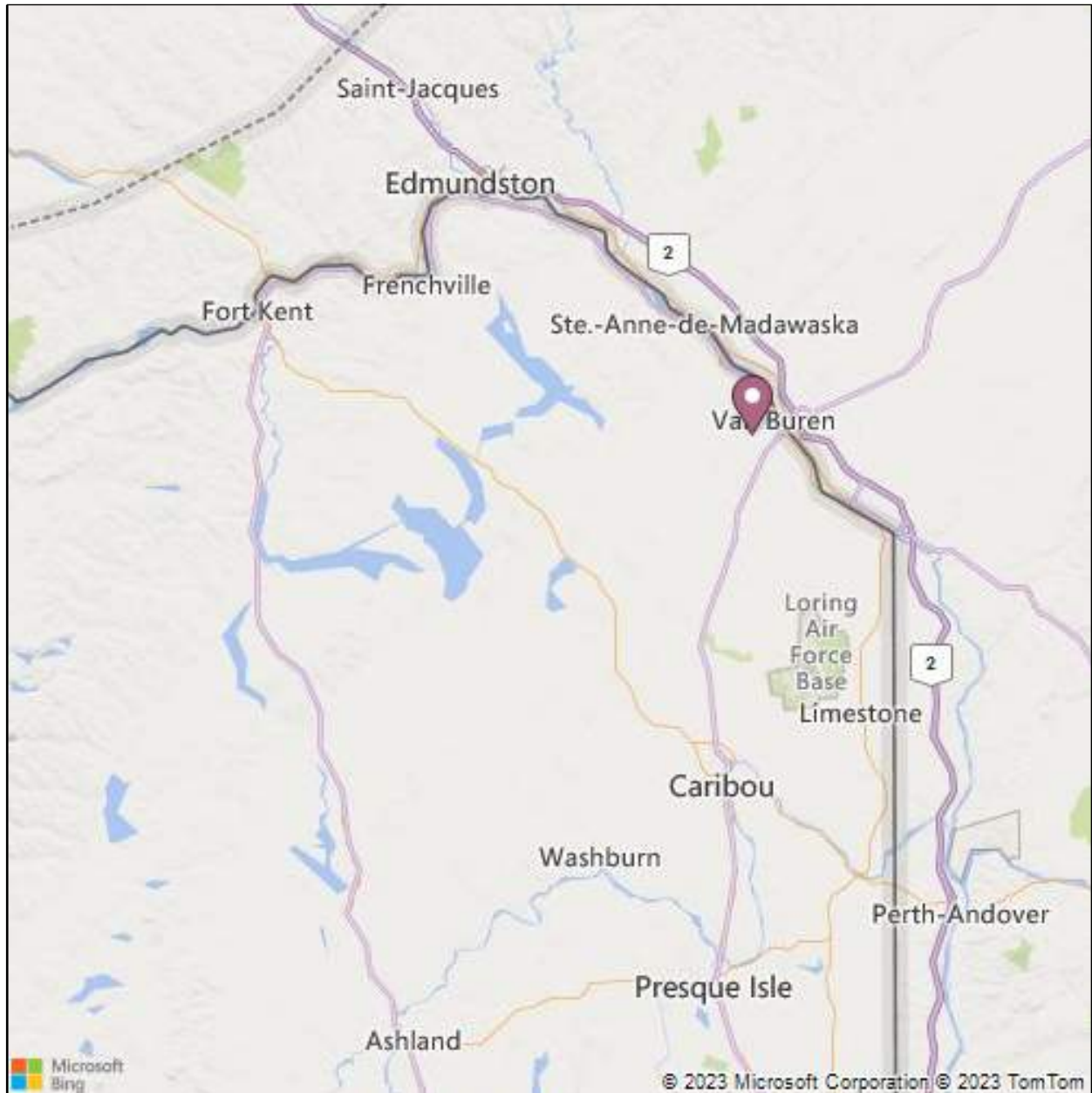
Town: Van Buren



Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report



Latitude: 47.15099

Longitude: -67.96876

Inspector: Hannum, Jamie
 Inspection Date: 10/11/2023

Structure Number: 5309
 Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report
National Bridge Inventory

Status: 1 - SD

Bridge Name: ST MARYS

Sufficiency Rating: 40.7

Inspections

(90) INSPECTION DATE	& (91) DESIGNATED INSPECTION FREQUENCY	12	10/11/2023
(92) CRITICAL FEATURE INSPECTION	& (93) CFI DATE		
(92A) FRACTURE CRITICAL DETAIL		N	
(92B) UNDERWATER INSPECTION		N	
(92C) OTHER SPECIAL INSPECTION		N	

Identification

(1) STATE CODE	231 - Maine
(8) STRUCTURE NUMBER	5309
(5) INVENTORY ROUTE	
(5A) RECORD TYPE	1: Route carried "on" the structure
(5B) ROUTE SIGNING PREFIX	4 - COUNTY HIGHWAY
(5C) DESIGNATED LEVEL OF SERVICE	0 - None
(5) INVENTORY ROUTE	0
(5) INVENTORY ROUTE	0 - NOT APPLICABLE
(2) HIGHWAY AGENCY DISTRICT	05 - Northern
(3) COUNTY CODE	003 Aroostook
(4) PLACE CODE	78570
(6) FEATURES INTERSECTED	VIOLETTE BROOK
(7) FACILITY CARRIED	CASTONGUAY RD
(9) LOCATION	1.1 MI NW JCT US 1
(11) MILEPOINT	4.980
(12) BASE HIGHWAY NETWORK	Inventory Route is not on the Base Network
(13) LRS INVENTORY ROUTE, SUBROUTE	
(13A) LRS INVENTORY ROUTE	0000300342
(13B) SUBROUTE NUMBER	00
(16) LATITUDE	47.15099
(17) LONGITUDE	-67.96876
(98A) BORDER BRIDGE CODE	
(98B) PERCENT RESPONSIBILITY	0
(99) BORDER BRIDGE STRUCT NO.	n/a

Structure Type and Material

(43) STRUCTURE TYPE, MAIN	
(43A) KIND OF MATERIAL/DESIGN	3 - Steel
(43B) TYPE OF DESIGN/CONSTR	19 - Culvert (includes frame culverts)
(44) STRUCTURE TYPE, APPROACH SPANS	
(44A) KIND OF MATERIAL/DESIGN	0 - Other
(44B) TYPE OF DESIGN/CONSTRUCTION	00 - Other
(45) NUMBER OF SPANS IN MAIN UNIT	1
(46) NUMBER OF APPROACH SPANS	0
(107) DECK STRUCTURE TYPE	N - Not Applicable
(108) WEARING SURFACE/PROTECTIVE SYSTEMS	
(108A) WEARING SURFACE	N - NA
(108B) DECK MEMBRANE	N - NA
(108C) DECK PROTECTION	N - NA

Age of Service

(27) YEAR BUILT	1958
(106) YEAR RECONSTRUCTED	0
(42) TYPE OF SERVICE	
(42A) TYPE OF SERVICE ON BRIDGE	1 - Highway
(42B) TYPE OF SERVICE UNDER BRIDGE	5 - Waterway
(28) LANES	
(28A) LANES ON THE STRUCTURE	02
(28B) LANES UNDER THE STRUCTURE	00

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

(29) AVERAGE DAILY TRAFFIC	380
(30) YEAR OF AVERAGE DAILY TRAFFIC	2016
(109) AVERAGE DAILY TRUCK TRAFFIC	5
(19) BYPASS DETOUR LENGTH	3

Geometric Data

(48) LENGTH OF MAXIMUM SPAN (ft.)	26.9
(49) STRUCTURE LENGTH (ft.)	26.9
(50) CURB/SIDEWALK WIDTHS	
(50A) LEFT CURB SIDEWALK (ft.)	0
(50B) RIGHT CURB SIDEWALK (ft.)	0
(51) BRDG RDWY WIDTH CURB-TO-CURB (ft.)	0
(52) DECK WIDTH, OUT-TO-OUT (ft.)	0
(32) APPROACH ROADWAY WIDTH (ft.)	24.0
(33) BRIDGE MEDIAN	0 - No median
(34) SKEW (deg.)	15
(35) STRUCTURE FLARED	0 - No flare
(10) INV RTE, MIN VERT CLEARANCE (ft.)	328.05
(47) TOTAL HORIZONTAL CLEARANCE (ft.)	28.0
(53) VERTICAL CLEARANCE OVER BRIDGE ROADWAY (ft.)	327.76
(54) MIN VERTICAL UNDERCLEARANCE	
(54A) REFERENCE FEATURE	N - Feature not a highway or railroad
(54B) MIN VERTICAL UNDERCLEARANCE (ft.)	0
(55) MIN LATERAL UNDER CLEARANCE RIGHT	
(55A) REFERENCE FEATURE	N - Feature not a highway or railroad
(55B) MIN LATERAL UNDER CLEARANCE RIGHT (ft.)	327.76
(56) MIN LATERAL UNDER CLEARANCE (ft.)	99.9

Classification

(112) NBIS BRIDGE LENGTH	Yes
(104) HIGHWAY SYSTEM OF THE INVENTORY ROUTE	0 - Structure/Route is NOT on NHS
(26) FUNCTIONAL CLASSIFICATION OF INVENTORY ROUTE	08 - Rural - Minor Collector
(100) STRAHNET HIGHWAY DESIGNATION	Not a STRAHNET route
(101) PARALLEL STRUCTURE DESIGNATION	N - No parallel structure
(102) DIRECTION OF TRAFFIC	2-way traffic
(103) TEMP STRUCTURE	
(105) FEDERAL LANDS HIGHWAYS	Not Applicable
(110) DESIGNATED NATIONAL NETWORK	Inventory route not on network
(20) TOLL	3 - On Free Road
(21) MAINTENANCE RESPONSIBILITY	01 - State Highway Agency
(22) OWNER	01 - State Highway Agency
(37) HISTORICAL SIGNIFICANCE	4 - Not determinable

Condition

(58) DECK	N - Not Applicable
(59) SUPERSTRUCTURE	N - Not Applicable
(60) SUBSTRUCTURE	N - Not Applicable
(61) CHANNEL & CHANNEL PROTECTION	5 - Bank eroded.. major damage
(62) CULVERT	2 - Integral wingwalls collapsed

Load Rating and Posting

(31) DESIGN LOAD	0 - Unknown
(63) METHOD USED TO DETERMINE OPERATING RATING	8 - Load and Resistance Factor Rating (LRFR) rating report by rating factor (RF) method using HL-93 loadings.
(64) OPERATING RATING	2.99
(65) METHOD USED TO DETERMINE INVENTORY RATING	8 - Load and Resistance Factor Rating (LRFR) rating report by rating factor (RF) method using HL-93 loadings.
(66) INVENTORY RATING	1.99
(70) BRIDGE POSTING	5 - Equal to or above legal loads
(41) STRUCTURE OPEN/POSTED/CLOSED	A - Open

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Appraisal

(67) STRUCTURAL EVALUATION	2
(68) DECK GEOMETRY	N
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL	N
(71) WATERWAY ADEQUACY	9 - Bridge Above Flood Water Elevations
(72) APPROACH ROADWAY ALIGNMENT	6 - Equal to present minimum criteria
(36) TRAFFIC SAFETY FEATURE	
36A) BRIDGE RAILINGS:	0 - Does not meet acceptable standards/safety feature is required
36B) TRANSITIONS:	0 - Does not meet acceptable standards/safety feature is required
36C) APPROACH GUARDRAIL	0 - Does not meet acceptable standards/safety feature is required
36D) APPROACH GUARDRAIL ENDS	0 - Does not meet acceptable standards/safety feature is required
(113) SCOUR CRITICAL BRIDGES	2 - Immediate action required

Proposed Improvements

(75) TYPE OF WORK	
(75A) TYPE OF WORK PROPOSED	
(75B) WORK DONE BY	
(76) LENGTH OF STRUCTURE IMPROVEMENT (ft.)	
(94) BRIDGE IMPROVEMENT COST (\$K)	
(95) ROADWAY IMPROVEMENT COST (\$K)	
(96) TOTAL PROJECT COST	
(97) YEAR OF IMPROVEMENT COST ESTIMATE	
(114) FUTURE ADT	608
(115) YEAR OF FUTURE ADT	2036

Navigation Data

(38) NAVIGATION CONTROL	0 - No navigation control on waterway (bridge permit not required)
(111) PIER OR ABUTMENT PROTECTION	
(39) NAV VERT CLEARANCE	0
(116) MIN NAVIGATION VERT CLEARANCE, VERT LIFT BRIDGE	0
(40) NAV HORIZONTAL CLEARANCE	0

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

7.1 Component Condition Ratings

(B.C.05) Bridge Railings	4
(B.C.06) Bridge Railing Transitions	4
(B.C.07) Bridge Bearings	N
(B.C.07) Bridge Joints	N
Bridge Joint Seal	N

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Inspection Notes

Structure Number: 5309

Town: Van Buren

Structure Name: ST MARYS

Structure Notes

1958 Single span steel bolted structural plate arch on concrete footings. Plate Thickness = 0.280"

Wearing Surface

Roadway surface above culvert has minor cracking at centerline and within the lanes.
No settlement noted.

Deck

NBI Item 58: N

Superstructure

NBI Item 59: N

Substructure

NBI Item 60: N

Culvert

NBI Item 62: 2

Culvert is a 2 because the NBI 113=2, culvert would otherwise be rated a NBI Item (62) = 4
North west corner of culvert at Downstream end is failing and is folding down.
Failure does not appear to be from rust and unzipping.
Just above this corner is a guardrail post that is completely unseated.

Inspector: Hannum, Jamie

Structure Number: 5309

Inspection Date: 10/11/2023

Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Concrete footings have some cracking and moderate scaling at waterline and up stream SW corner.

Poor stream alignment is directed at the up stream NW end of footing which is exposed 36"+.

Steel culvert has full loss of galvanization just above the spring-line with minor rusting.

There is a deep scour hole along the east footing with undermine previously measured as 3" high X 20' long, but may have partially infilled at this time.

Channel

NBI Item 61: 5

Channel has lateral migration causing gravel aggradation along the West footing area and with the stream hitting East footing, causing scour and undermine.

Other

Pavement is marked out for the construction limits.

Special Inspection

Monitoring

Pontis Notes

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

	Environment	Total Quantity	Units	Condition State 1	Condition State 2	Condition State 3	Condition State 4
240-Steel Culvert	2 - Low	58	ft.	0	28	30	0

Inspector: Hannum, Jamie
 Inspection Date: 10/11/2023

Structure Number: 5309
 Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Over Limit Report

Bridge #: 5309
 Bridge Name: ST MARYS
 Owner: 01 - State Highway Agency
 Co-Owner: N Not applicable
 Region: 05 - Northern

Town1: Van Buren
 Town2:
 Maintainer: 01 - State Highway Agency
 Co-Maintainer: N Not applicable

Vertical Clearance - Under

Left, Center, and Right is based on the direction of travel

Roadway - Heading North or East

Actual Heights in Feet-Inches

Date Measured:

	Left	Center	Right	Posted	Deficient Sign
Main: VIOLETTE BROOK	-	-	-	Main -	
Other:	-	-	-	Other -	
Ramps:	-	-	-	Ramp -	

Roadway - Heading South or West

Actual Heights in Feet-Inches

Date Measured:

	Left	Center	Right	Posted	Deficient Sign
Main: VIOLETTE BROOK	-	-	-	Main -	
Other:	-	-	-	Other -	
Ramps:	-	-	-	Ramp -	

Vertical Clearance - Portal

Roadway: CASTONGUAY RD

Heading North or East

Actual Heights in Feet-Inches

Date Measured:

	Left	Center	Right	Posted	Deficient Sign
	-	-	-	Portal -	

Heading South or West

Actual Heights in Feet-Inches

Date Measured:

	Left	Center	Right	Posted	Deficient Sign
	-	-	-	Portal -	

Permitting

Pointer

Red Flag Comments

Heading North Height: -
 Heading South Height: -
 Left Ramp Height: -
 Right Ramp Height: -
 Portal North Height: -
 Portal South Height: -
 Other Road Height: -

Bridge Width: 0 ft
 Roadway Width: 24.0 ft

Underclearance heights are signed if less than 14 ft 6 in
 Check with Maine Turnpike Authority for load heights over 13 ft 6 in
 Always check 511

Load Restrictions

Posted _____ tons Date posted:
 Posted One Truck at a Time
 Posted for 4 axle only
 Operating Load Rating 2.99
 Permit Load Ratings _____ axles
 _____ axles

Inspector: Hannum, Jamie

Structure Number: 5309

Inspection Date: 10/11/2023

Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

axles

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Underwater Dive Inspection Report

Structure Number: 5309

Bridge Name: ST MARYS

Town 1: 03610 - Van Buren

Town 2:

Division: Presque Isle

DiveID: 3737

Tidal:

Location: 1.1 MI NW JCT US 1

Photos:

Tide Information:

Dive Entry Location:

Scour:

Comments/Hazards:

Streambed Description:

Channel Description:

Substructure Description:

Inspection Team:

Role:

Dive Conditions:

Time: Entry: AM/PM

Time: Exit: AM/PM

Water Temp:

Visibility (ft):

Max Depth (ft):

Current:

Weather:

Underwater Inspection Date:

Channel Condition:

Substr/Culvert Condition:

Inspection Cycle:

Ratings Comments:

Inspector: Jamie Hannum
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Pictures



PHOTO 1

Description Roadway looking west



PHOTO 2

Description Looking up stream

Inspector: Jamie Hannum
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Pictures



PHOTO 3

Description Failing top plate at the down stream end



PHOTO 4

Description Gravel deposits along the east side

Inspector: Jamie Hannum
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Pictures



PHOTO 5

Description Looking down stream at the failing top plate

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Maintenance Work Items

Structure Number: 5309

Structure Name: ST MARYS

Town: 03610

Owner: Hannum, Jamie

Type	Work Item	Priority	Notes
Maintenance	Rehab Culvert		DS folded end plate
Maintenance	Repair Scour		Repair scour and undermine along the east footing
Safety	Repair Approach Guardrail		

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

MaineDOT NBIS Bridge Safety Inspection JSA

Inspector: Hannum, Jamie
Team Lead: Jamie Hannum

Structure Number: 5309
Structure Name: ST MARYS
Town: Van Buren

Additional Team Members/Visitors:

- 1.)
- 2.)
- 3.)
- 4.)
- 5.)
- 6.)
- 7.)
- 8.)
- 9.)

Job being performed:

Bridge Inspection

Potential Hazard:

☑ Exposure to traffic

Potential Hazard:

☑ Steep slopes and uneven working areas
(rip rap, mud, loose fill, etc)

Potential Hazard:

☑ Chipped Concrete or Steel (hand tools only)

Potential Hazard:

☑ 6' Vertical drops

Potential Hazard:

☑ Water Hazards

- ☑ Water depth under 1 foot
- ☑ Water depth 1 to 4 feet
- ☐ Water depth over 4 feet
- ☐ Water flow calm/slow moving
- ☐ Water flow visible/not rapid
- ☑ Water flow rapid with some short falls
- ☐ Tidal Water

Controls:

- ☑ Parked off road with strobe
- ☑ Less than 1 hour on bridge
- ☑ Wear standard reflective clothing and hard hat
- ☐ Spotter ☐ Traffic Control Crew

Controls:

- ☑ Wear appropriate, prudent footwear
- ☐ Rope or fall protection

Controls:

- ☑ Wear appropriate, prudent eye/hand protection

Controls:

- ☑ Stay away from areas

Controls:

- ☑ Evaluate Water Hazard conditions
- ☑ Use/Wear appropriate PPE
- ☐ Buddy System

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Potential Hazard:

Insects, Poison Ivy, or other environmental hazards

Potential Hazard:

Lead paint and Avian excrement

Potential Hazard:

Heavy Manual Lifting

Potential Hazard:

DCS, Lung Expansion

Potential Hazard:

Entanglement U/W

Potential Hazard:

Boat Traffic

Potential Hazard:

Cold Water

Potential Hazard:

Live Boating

Other Potential Hazards:

Controls:

Apply insect repellent and/or sunscreen
 Protect skin with appropriate, prudent clothing

Controls:

Wear gloves, do not scrape

Controls:

Ask for assistance in donning dive gear, lifting equipment

Controls:

Ascend slowly, use computers, Safety Stops (15' mark for 3 min.)

Controls:

Use knife, Comm gear

Controls:

Fly Dive Flag, user spotter, contact bridge on Chan. 13

Controls:

Use adequate dry suit underwear for water temperature

Controls:

Keep track of divers, avoid powering during drop-off/pick-up

Other Controls:

Inspector: Hannum, Jamie

Structure Number: 5309

Inspection Date: 10/11/2023

Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Safety Equipment Required:

- Hard hat
- Vest
- Glasses
- Gloves
- PFD
- Rain Gear
- Bug Spray
- Sunscreen
- First Aid
- O2
- AED
- Comm Gear
- Cell Phone
- Boat

- Throw Ring
- Throw Rope
- Positioning Device

Emergency Action Plan:

- Call 911
- First Aid Kit
- Fall Rescue Plan
- Water Rescue Plan
- Dan 1-919-684-9111
- USCG 741-5465

Other Safety Equipment:

Other Emergency Action Plan:

I certify that the MaineDOT NBIS Bridge Safety Inspection JSA has been completed according to all proper procedures required by the Maine Department of Transportation.

Complete Jamie Hannum

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Bridge Components

Bridge #: 5309
 Bridge Name: ST MARYS
 Owner: 01 - State Highway Agency
 Co-Owner: N Not applicable
 Region: 05 - Northern

Town1: Van Buren
 Town2:
 Maintainer: 01 - State Highway Agency
 Co-Maintainer: N Not applicable

Deck

<u>Joint Seal Type/MFG:</u>	<u>Joint Types:</u>	<u>Joint HDR Mat:</u>	<u>Other:</u>	<u>Rebar Type:</u>
<input type="checkbox"/> Emseal	<input type="checkbox"/> Finger	<input type="checkbox"/> Sliding	<input type="checkbox"/> Concrete	<input type="checkbox"/> Curtain
<input type="checkbox"/> V Seal	<input type="checkbox"/> Asphaltic Plug	<input type="checkbox"/> Transflex	<input type="checkbox"/> Delcrete	<input type="checkbox"/> Troughs
<input type="checkbox"/> Watson Bowman	<input type="checkbox"/> Compression	<input type="checkbox"/> Open	<input type="checkbox"/> Elastomeric	<input type="checkbox"/> Armor
<input type="checkbox"/> Hot Rubber	<input type="checkbox"/> Modular	<input type="checkbox"/> LP Concrete	<input type="checkbox"/> Phoscrete	
<input type="checkbox"/> Pour-in-Place	<input type="checkbox"/> Gland	<input type="checkbox"/> Plycrete		
<input type="checkbox"/> DS Brown	<input type="checkbox"/> Waybo Crete			

Superstructure

<u>Left Side Rail:</u>			<u>Right Side Rail:</u>		
Material	Steel	<input type="checkbox"/> Retrofit	Material	Steel	<input type="checkbox"/> Retrofit
Shape	Guardrail	<input type="checkbox"/> Safety Walk	Shape	Guardrail	<input type="checkbox"/> Safety Walk
Attached To	Ground	<input type="checkbox"/> Pales	Attached To	Ground	<input type="checkbox"/> Pales
Number of Bars	0	<input type="checkbox"/> Snow Fence	Number of Bars	0	<input type="checkbox"/> Snow Fence
Extra Height	N		Extra Height	N	

<u>Bearing Type Quantity:</u>	<u>Fatigue Prone Detail:</u>		
<input type="checkbox"/> Disk	<input type="checkbox"/> Elastomeric	<input type="checkbox"/> Narrow Cover Plate - Sq End Welded	<input type="checkbox"/> Narrow Cover Plate - Tapered End Welded
<input type="checkbox"/> Pot	<input type="checkbox"/> Rocker	<input type="checkbox"/> Narrow Cover Plate - Sq End w/o Weld	<input type="checkbox"/> Narrow Cover Plate - Tapered End w/o Weld
<input type="checkbox"/> Roller	<input type="checkbox"/> Sliding Plate	<input type="checkbox"/> Wide Cover Plate - Sq End Welded	<input type="checkbox"/> Longitudinal Stiffener - Welded with Radius
<u>Other:</u>		<input type="checkbox"/> Wide Cover Plate - Sq End w/o Weld	<input type="checkbox"/> Longitudinal Stiffener - Welded w/o Radius
<input type="checkbox"/> Pin Quantity		<input type="checkbox"/> Lateral Connection Plate - Welded	<input type="checkbox"/> Hoan Detail
<input type="checkbox"/> Pin and Link Quantity			

Substructure

- Pier Collars
- Abutment Collars
- Wood Piles
- Steel Piles
- Blocked Bridge

Retaining Wall Type:

Other

- Confined Space
- Bridge Lighting
- Cat Walk
- Navigational Lighting
- Signs Attached

General Notes

Inspector: Hannum, Jamie
Inspection Date: 10/11/2023

Structure Number: 5309
Facility Carried: CASTONGUAY RD

Highway Bridge Inspection Report

Critical Finding Form

Critical Finding History

Bridge #: 5309
Bridge Name: ST MARYS
Owner: 01 - State Highway Agency
Co-Owner: N Not applicable
CF on NSTM Member ?

Date of Discovery

Bridge Operational Status Due to CF(s)

General Cause of CF(s)

Detailed Description of Critical Finding

If "Other" Selected, Please Explain

Immediate Action(s)
Taken to Address Critical Finding?

Conclusion

Is the Critical Finding Resolved ?

Date Resolved

Which NBI general condition rating is affected ?

Detail the response type, resolution, timelines and long term plan for the bridge

Date (or anticipated date) of Permanent Resolution

Critical Finding Reference

FHWA criteria for reporting Critical Findings

FHWA shall be notified within 24 hours of any critical finding and the activities taken, underway, or planned to resolve or monitor the critical finding. Update FHWA regularly or as requested on the status of each critical finding until it is resolved. Monthly make available the information to provide a written report to FHWA with a summary of the status of the resolutions for each critical finding identified within that month or unresolved from previous months.

Maine DOT Critical Finding notification procedure

The following procedures are to be used when a critical inspection finding is reported by the Bridge Inspector, Bridge Maintenance Manager, or other source when the Deck, Superstructure, or Substructure or Culvert having a NBI rating of 2 or less.

1. The Bridge Inspector or Bridge Manager shall report any finding that may be of a critical nature to their immediate supervisor, the Assistant Bridge Maintenance Engineer, and the Bridge Maintenance Engineer.
2. The Assistant Bridge Maintenance Engineer or the Bridge Maintenance Engineer will assess the finding and take the appropriate action.
3. If the action requires restricting or closing the bridge, the following will be notified:

- Director of Maintenance and Operations
- Division Engineer
- Permit Section
- Federal Highway Bridge Engineer

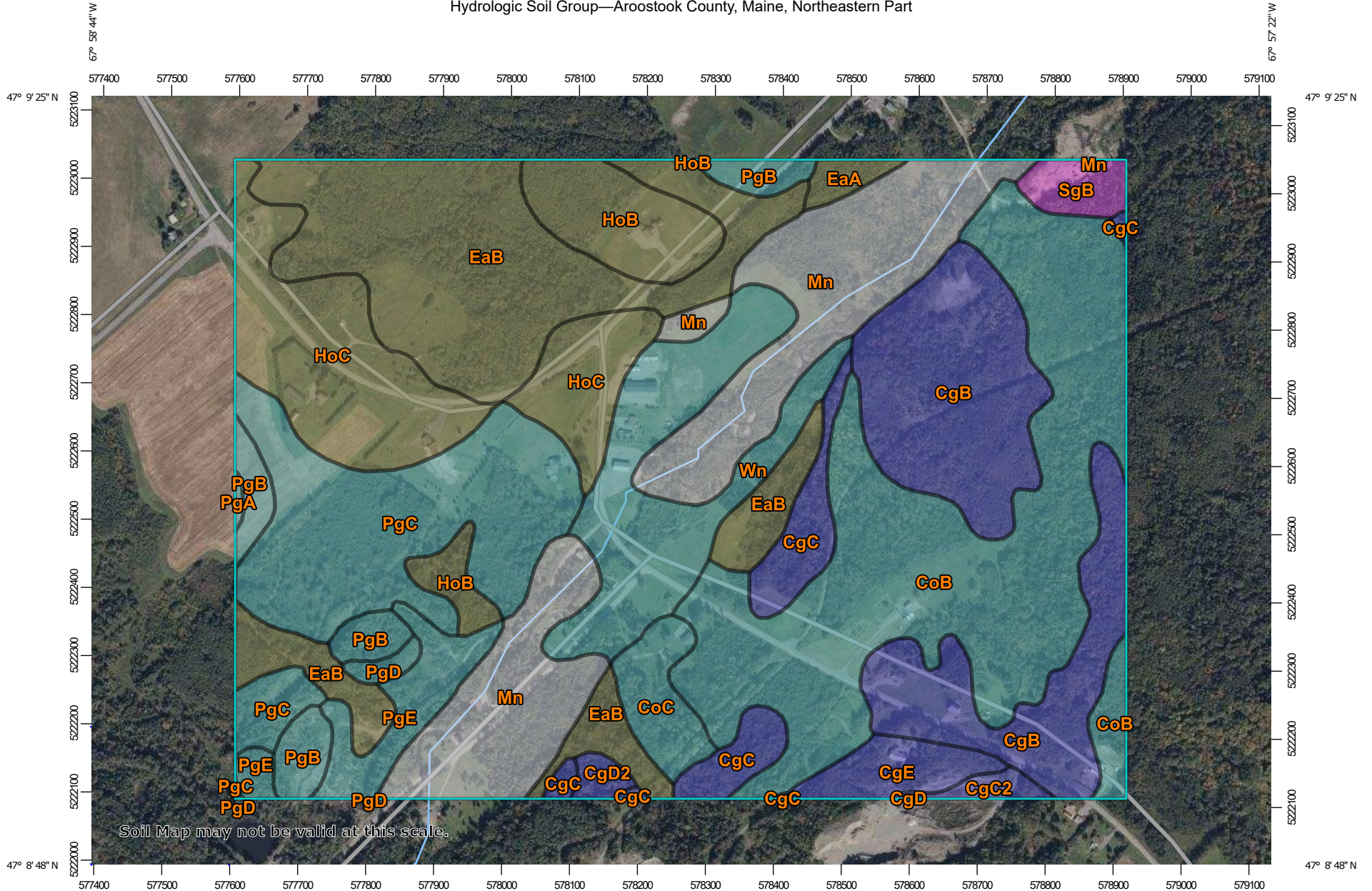
1. If the bridge is not under State jurisdiction, the bridge owner will be notified by the Bridge Inspector, Bridge Maintenance Manager, Assistant Bridge Maintenance Engineer, or the Bridge Maintenance Engineer by telephone or in writing, depending on the urgency.
2. Follow-up on action taken by the bridge owner will be made depending on the seriousness of the findings as determined by the Assistant Bridge Maintenance Engineer or the Bridge Maintenance Engineer.
3. Bridges under State jurisdiction will be restricted and/or repaired through the direction of the Assistant Bridge Maintenance Engineer.
4. Reports of deficiencies (critical or otherwise) from other sources will be handled in the same manner.

Note: A critical finding is a major defect in the superstructure or substructure which, if not repaired immediately, may require the closing or partial closing of a bridge, and could lead to the total collapse of the structure. Repairs should be completed within a few days.

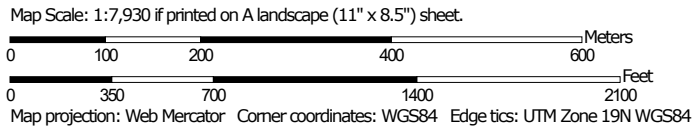
APPENDIX H

USDA Web Soil Survey

Hydrologic Soil Group—Aroostook County, Maine, Northeastern Part




Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines

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

Soil Rating Points






-  A
-  A/D
-  B
-  B/D

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


Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Aroostook County, Maine, Northeastern Part
 Survey Area Data: Version 25, Sep 5, 2023

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

Date(s) aerial images were photographed: Jul 24, 2021—Sep 20, 2021

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CgB	Caribou gravelly loam, 2 to 8 percent slopes	B	35.8	11.7%
CgC	Caribou gravelly loam, 8 to 15 percent slopes	B	8.2	2.7%
CgC2	Caribou gravelly loam, 8 to 15 percent slopes, eroded	B	1.3	0.4%
CgD	Caribou gravelly loam, 15 to 25 percent slopes	B	0.1	0.0%
CgD2	Caribou gravelly loam, 15 to 25 percent slopes, eroded	B	1.1	0.4%
CgE	Caribou gravelly loam, 25 to 45 percent slopes	B	4.5	1.5%
CoB	Conant silt loam, 2 to 8 percent slopes	C	58.1	19.0%
CoC	Conant silt loam, 8 to 15 percent slopes	C	5.1	1.7%
EaA	Easton-Burnham complex, 0 to 3 percent slopes, very stony	C/D	1.5	0.5%
EaB	Easton-Burnham complex, 3 to 8 percent slopes, very stony	C/D	45.8	15.0%
HoB	Howland gravelly loam, 3 to 8 percent slopes	C/D	11.0	3.6%
HoC	Howland gravelly loam, 8 to 15 percent slopes	C/D	25.8	8.4%
Mn	Mixed alluvial land		37.1	12.2%
PgA	Plaisted gravelly loam, 0 to 3 percent slopes	C	0.2	0.1%
PgB	Plaisted gravelly loam, 3 to 8 percent slopes	C	7.5	2.4%
PgC	Plaisted gravelly loam, 8 to 15 percent slopes	C	30.4	10.0%
PgD	Plaisted gravelly loam, 15 to 30 percent slopes	C	0.9	0.3%
PgE	Plaisted gravelly loam, 30 to 60 percent slopes	C	7.3	2.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
SgB	Stetson gravelly loam, 2 to 8 percent slopes	A	2.8	0.9%
Wn	Winooski silt loam	C	20.5	6.7%
Totals for Area of Interest			305.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX I

Site Photographs



Photo 1: Approach roadway looking southeast towards Bridge No. 5309.



Photo 2: Looking downstream from Bridge No. 5309.



Photo 3: Looking downstream from Bridge No. 5309.



Photo 4: View of approach roadway looking north.



Photo 5: View of downstream bridge section from right bank.



Photo 6: Looking upstream from bridge face.



Photo 7: Looking downstream through Bridge 5309 at sediment buildup.



Photo 8: Looking southeast at guiderail on top of bridge.