RIDEAU VALLEY CONSERVATION AUTHORITY

Technical Memo

July 2, 2010

To: Bruce Reid, P.Eng. Director
Watershed Sciences and Engineering Services

From: Ferdous Ahmed, Ph.D., P.Eng.
Senior Water Resources Engineer

Subject: Blueberry Creek Flood Risk Mapping

Staff Involved: Stephanie Schreiner, Nazrul Howlader, Amanda Soutar, Ferdous Ahmed

This technical report summarizes the work done in support of the Flood Risk Mapping along a reach of Blueberry Creek, in the Tay River watershed, near the town of Perth. The mapping was done in-house by Rideau Valley Conservation Authority staff and was undertaken in accordance with the technical guidelines set out under the Canada-Ontario Flood Damage Reduction Program (FDRP) (MNR, 1984), and the technical guide for flood hazard delineation in Ontario (MNR, 2002) as approved for use by the Ontario Ministry of Natural Resources. A separate "documentation folder", containing all pertinent background information, data, and analyses, is available at the RVCA offices.

Introduction

In general, Conservation Authorities are expected to have knowledge about the extent of flood hazard areas adjacent to rivers, streams and lakes throughout their areas of jurisdiction, and to use that knowledge to protect people and property from the adverse effects of natural hazards. One tool for exercising this protection is the establishment of development regulations made under Section 28 of the Conservation Authorities Act. As of 2010 flood hazard areas have been delineated for a relatively small percentage of the watercourses and waterbodies in the RVCA area of jurisdiction. The RVCA is making progress, however, on the expansion of its flood hazard knowledge-base, applying the available resources according to a set of priorities that have been identified under leadership from the RVCA Planning Advisory and Regulatory Services program, based generally on a sense of where development pressures are greatest.

The need to update and extend the flood lines in this particular study area, Blueberry Creek, arose out of a requirement to define ‘intake protection zones’ (IPZ’s) for the municipal water supply system serving the Town of Perth, as part of the Mississippi-Rideau Drinking Water Source Protection Planning initiative. In accordance with the MOE technical guidance, the upstream limits of IPZ’s were to be defined by the travel time of pollutants along watercourses from potential sources to the intake location, and the lateral extent of the IPZ’s was to be based on Conservation Authority Section 28 regulation limits established in accordance with the ‘generic regulation’. It was necessary to extend the regulations limits mapping to at least as far as the upstream limit of the IPZ.

In preparing updated and extended flood lines, use has been made of new topographic mapping and imagery that was acquired as part of the Drinking Water Source Protection Planning program (RVCA, 2007a). A field survey of road crossings was also conducted. All this information has been used in the present study.

Several flood mapping studies were previously undertaken for the Tay River watershed, including a study by FENCO Consultants Ltd., in 1981. FENCO produced flood maps for the region between Glen Tay and the Tay Marsh. Also, a preliminary IPZ study in Perth, which included Blueberry Creek, was undertaken as part of the Drinking Water Source Protection Planning program (RVCA, 2007a). Currently, flood risk mapping of the Tay River from Glen Tay to the Christie Lake Outlet is being done in accordance with FDRP standards (MNR, 1984). Blueberry Creek was not mapped in detail in any of the above mentioned studies; consequently there is a need for a more up to date and comprehensive mapping study using the current day standards.

Aerial photographs were collected in May 2005, at a scale of 1:6000, and were used to generate a high quality Digital Terrain Model (DTM) by *Base Mapping Company Inc.*; see Figure 1 for the extent of the aerial photographs. Ground surveys were also completed in 2006 by RVCA staff to collect additional data on stream cross-sections, bridges and culverts. There is no flow measurement for Blueberry Creek. Therefore the design flows used in this study were estimated using the regional frequency analysis, also known as the regression method (MNR, 1984). For the mapping extent, as shown in Figure 1, there was sufficient topographical data available to meet the standards for ‘engineered’ floodplain mapping as prescribed by MNR (1984),

Study Area

The Blueberry Creek subwatershed is a part of the Tay River watershed. This creek, located northwest of the Town of Perth, has a drainage area of 38.52 km^2, is approximately 11 km in length, and ultimately drains into the Tay River (See Figure 2). The average gradient along the main creek is 0.0018m/m, while the west tributary of Blueberry creek has an average gradient of 0.0027 m/m. Approximately 50% of the subwatershed is covered by agricultural land and the remaining area is made up of wetlands and other land uses. The soil characteristics are described in previous studies (Seabrook, 2000).

Given that detailed topographic information is required to produce ‘engineered floodplain lines’, the study limits were determined by the extent of the aerial photography, as shown in Figure 1. At the downstream end of the creek the mapping completed in this study was tied to the existing mapping of the Tay River (FENCO, 1981). The following stream reaches were included in the study area and are shown in Figure 1:

- **Blueberry Cr, Reach 1 –** Flows from the northeast to the confluence with the ‘West Tributary’.
- **Blueberry Cr, Reach 2 –** Flows from the confluence of the ‘West Tributary’ and ‘Reach 1’ to the Tay River.
- **West Tributary –** A tributary to the west of the main branch, draining into Blueberry Creek.

Hydrological Analysis

The RVCA watershed is classified as a Zone-2 region under the 'Flood Hazard Criteria Zones' for Ontario and Conservation Authorities (MNR 2002); therefore the regulatory flood for the entire watershed is the 100-year return period flow.

Previous studies and other relevant reports were reviewed during the hydrologic investigation. This included flood risk maps that were produced for a section of Blueberry Creek by FENCO Consultants Ltd. in 1981, using the HYMO model. The 100 year simulated design flow for the creek was estimated at 26.54 m^3/s, using a 2-day snowmelt event. This design flow in the FENCO study is most probably an over-estimation and is approaching the maximum probable flood because the assumption of a 2-day snowmelt is overly conservative. Seabrook (2000) also produced three estimates of the 100-year flow on the creek using various regional regression techniques. The estimates ranged from 9.4 to 19.4 m^3/s and are shown, along with other design flow estimates, in Table 1. Also shown here is the estimate based on the statistical analysis on long-term synthetic runoff series generated by RVCA's Mike11 model (RVCA, 2007b); however, due to lack of sufficiently long flow record used in Mike11 calibration, this estimate cannot be considered superior to other estimates at this time.

In the absence of detailed site specific observed flow data, the regional frequency analysis method, also known as the regression method (MNR, 1984), was used in this most recent analysis to estimate the design flows. This empirical method is based on climate factors and watershed characteristics and produced flow estimates that were within the range of the previously estimated design flows (Table 1).

The flows for Blueberry Creek and its westerly tributary, estimated using the regional frequency analysis method (MNR, 1984), were finally selected for the purpose of flood mapping and are shown in Table 2.

Data Used for Flood Hazard Mapping

Design Flows: As discussed in the previous section, design flows were estimated for the catchments using the regional frequency analysis method (MNR, 1984). See Table 2 for more details.

Aerial photo: The aerial photography was collected in May 2005 at a scale of 1:6000. This high quality black and white photography clearly shows the rivers, creeks, land use, houses, buildings, roads, infrastructure, vegetation and other details.

DTM: Aerial photography was used to derive a high quality digital terrain model (DTM) for flood mapping purposes. Contour lines were drawn at 1.0 m intervals with 0.5 m interpolated lines. The mapping procedures were in accordance with the FDRP standard (MNR, 1984). Other standard layers showing houses, roads, depressions, etc. were also produced.

Cross-Sections: The cross sections were generated from the available high quality DTM using standard GIS software. For the most part this procedure captured the floodplain as well as most of the low flow channel in sufficient detail to be used for this floodplain mapping project. However, in some areas a ground survey was done to collect the stream thalweg or bottom definition to supplement the DTM-generated profile. The surveying was undertaken by RVCA staff in July-August of 2006.

Channel Roughness: Following standard procedures (Chow, 1959), the surface roughness of the channel under possible high water conditions was estimated from aerial photos and field inspections. The Manning's 'n' was generally 0.035 in the main channel, and varied from 0.05 to 0.08 for the floodplains. The 'n' value generally increases for those reaches with more vegetation. These values were consistent with those found appropriate in earlier studies (FENCO, 1981).

Bridges/Culverts: There are five bridge and culvert crossings within the study area (Table 4). These structures were included in the HEC-RAS model in order to account for the constriction of flow and the resulting change in water levels. The physical dimensions and other pertinent data of these structures were collected from the 'IPZ Delineation Study' (RVCA, 2007a). In 2006, during the IPZ study, RVCA staff conducted surveys of these structures.

The coefficients of contraction (C_c) and expansion (C_e) associated with bridges/culverts were estimated from available information using standard procedures (USACE, 1990, 2002).

Hydraulic Modeling

A steady-state hydraulic model was created for the study area, in accordance with standard procedures (MNR, 1984; USACE, 1990, 2002). The model was produced using HEC-RAS software (version 3.1.1) developed by the US Corps of Engineers (USACE, 2002). This one-dimensional steady-state model uses backwater computations, based on the energy equations.

The Blueberry Creek hydraulic model was produced using the cross-sections developed from the DTM. Distances between cross-sections along the stream centerline and distances between left and right overbanks were calculated using GIS software and then added to the model. The bridges and culverts were also inserted in the HEC-RAS model at the appropriate locations. The ineffective flow areas surrounding these structures were defined. At each cross-section the appropriate Manning's n value and contraction and expansion coefficients were entered.

Two combinations of the 1:100 and 1:2 year design flows were considered in the hydraulic model[1]. Each of the combinations is expected to give estimates of floods with a

[1] The joint probability of two independent events with recurrence intervals of 2 years and 100 years is 0.5% (joint recurrence interval of 200 years). Technically, there are more appropriate combinations for defining the true 1:100 year water surface elevations in the confluence area. What has been done here is a simplification which has perhaps added a negligibly small margin of conservatism to the resulting water surface elevations.

1% annual risk of being equaled or exceeded. The regulatory flood levels are defined by the maximum water levels produced by the two combinations. The two different flow scenarios considered in this study are as follows:

Scenario 1	The 1:100 year flow on Blueberry Creek and 1:2 year flow in the Tay River.
Scenario 2	The 1:2 year flow on Blueberry Creek and the 1:100 year flow in the Tay River.

The first scenario was modeled using the 1:100 year flow on Blueberry Creek. The downstream boundary condition would have ideally been extracted from a smaller flood event (e.g. 1:2 year) on the Tay River; however this information was unavailable. So, the bankfull water level was used as an approximation.

For the second scenario, the Blueberry Creek hydraulic model was set up and run using the 1:2 year design flows in the creek and the 1:100 year water level on the Tay River, from FENCO (1981).

The hydraulic parameters used for both scenarios are shown in Table 3. At the junction of the two reaches the water levels were forced to match as an internal boundary condition (USACE, 1990, 2002).

Once the hydraulic model was set up and run for the different scenarios, the computed water surface profiles and other parameters were scrutinized to assess the reasonableness of the simulation. Special attention was given to the computed water level and energy profiles near bridges and culverts. Adjustments of model parameters – mainly the channel resistance and contraction and expansion coefficients – were made as necessary.

It was determined that for approximately the first 1300 m of Blueberry Creek (running from the Tay River confluence) the flood level is governed by the backwater effect of the 1:100 year flow and the corresponding water level of the Tay River at the confluence. Further upstream, and on the west tributary, however, the 1:100 year flow on Blueberry Creek is the dominant event (producing the highest water levels).

The 1:100 year computed water surface elevations and other parameters for Blueberry Creek are shown in Table 5. The dominant flood event, or scenario producing the highest water level, is also listed. Water surface profiles and all cross-sections, from the HEC-RAS model, are included in Appendices A and B, for Scenarios 1 and 2 respectively.

Regulatory Flood Levels

As per Section 3 of the Provincial Policy Statement, under the Planning Act (MMAH, 2005), the regulatory flood for Zone 2 (including the RVCA watershed) is the 1:100 year flood event. Expected flood elevations associated with the 1:100 year flood event are therefore used to determine the Regulatory Flood Level (RFL).

Post-processing of the hydraulic model output, including the Computed Water Surface Elevation (CWSEL), was required because it is recognized that the numerical models can never be a perfect representation of real world hydraulic phenomena. To obtain the RFL, the following algorithm was used:

- By default, set RFL = CWSEL
- If the computed Energy Grade Level (EGL) exceeds the CWSEL by more than 3 cm, then set RFL = EGL
- If the RFL at any location is lower than the RFL at the next downstream section, then set the RFL = downstream RFL

When plotting the final water surface profile, both the computed water surface elevation and the computed energy grade levels were considered. The above also assures that the RFLs always decrease in the downstream direction. The flood levels for all cross-sections are presented in Table 5, along with the computed water surface elevations and energy grade lines.

Flood Prone Area Delineation

Once the RFLs are established, the plotting of the flood risk area is relatively straightforward using the topographical information (contour lines, spot elevations, etc.). Given the topographical information, the inundated area below the regulatory flood levels was manually delineated. The lines were visually inspected to identify and correct any anomalies, and to ensure that the lines conformed to hydraulic engineering principles. The flood lines were also verified by field visits.

Flood Risk Maps

Figures 3 gives an overview of the resultant flood maps and Figure 4 shows the May 2005 aerial photography overlaid by the flood risk area. More detailed digital maps are available on RVCA's GIS platform.

Public Consultation

There were four public consultations held on the following dates:

- September 29th, 2009 at the Smith Falls Legion,
- September 30th, 2009 at the municipal building in Oxford Mills,
- October 5th, 2009 at the RVCA offices in Manotick, and
- October 6th, 2009 at the Perth Legion.

The flood mapping for Blueberry Creek was presented along with mapping for other regions of the Rideau Valley watershed. The maps were explained to those who attended the meetings. Any questions were dealt with at the time and there were no outstanding issues that required follow-up, since all who attended the consultations were satisfied.

Project Deliverables

- ‘Blueberry Creek Flood Risk Mapping’ Report – including a detailed description of the hydrology, modeling procedures, and flood risk mapping procedures (this memo)
- Digital Flood Risk Maps – on RVCA’s GIS platform
- HEC-RAS model files
- The “documentation folder”

Closure

The hydrotechnical and cartographic procedures used in this study conform to both the FDRP standard (MNR, 1984) and the present day standards of flood hazard delineation, as per the MNR's Natural Hazard Technical Guide (MNR, 2002). The resulting regulatory flood lines are suitable for use in the RVCA's regulation limits mapping (referred to in Section 12 of Ontario regulation 174/06) and in municipal land use planning and development approval processes under the Planning Act. The water surface profiles will also be of valuable use in the flood forecasting and warning services of the RVCA.

LICENSED PROFESSIONAL ENGINEER
F. AHMED
100071164
July 2, 2010
PROVINCE OF ONTARIO

Stephanie Schreiner, BEng., MSc.
Engineering Assistant

Ferdous Ahmed, Ph.D., P.Eng.
Senior Water Resources Engineer

References:

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4. MNR (1984). Flood Plain Management in Ontario – Technical Guidelines. Ontario Ministry of Natural Resources, Conservation Authorities and Water Management Branch, Toronto.
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6. Pilon, P. J., and Harvey, D. (1993). CFA - Consolidated Frequency Analysis version 3.1. Environment Canada, Surveys and Information Systems Branch, Ottawa, March 1993.
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9. Seabrook Hydrotech and Associates. (2000). Tay River Watershed Plan: State of the Watershed. Hydrology and Hydraulics, Final report, prepared for RVCA, June 2000.
10. USACE (1990). HEC-2 - Water Surface Profiles - User's Manual. US Army Corps of Engineers, Hydrologic Engineering Center, Davis, CA, September 1990.
11. USACE (2002). HEC-RAS - River Analysis System - Hydraulic Reference Manual version 3.1, US Army Corps of Engineers, Hydrologic Engineering Center, Davis, CA, November 2002.

Table 1 – Comparison of Estimated 1:100 Year Design Flows for Blueberry Creek

		RVCA 2010	RVCA 2007b	FENCO 1981	Seabrook 2000		
					Regional Frequency Estimates		
Sub-watershed	Drainage Area	Regression Method*	Mike11 Model	HYMO Model	Index Flood Method	Watershed Classification Method	Preliminary Runoff Equations
	km^2	m^3/s		m^3/s	m^3/s	m^3/s	m^3/s
Blueberry Creek at confluence with the Tay River (Reach 1+Reach 2+West Trib.)	38.52	16.02	11.3	26.54	9.4	18.8	19.4
Blueberry Creek (Reach 1) at confluence with West Trib.	27.34	10.6	-	-	-	-	-
West Tributary at confluence with Blueberry Creek	9.42	5.32	-	-	-	-	-

*Also known as Regional Frequency Analysis (MNR, 1984)

Table 2 – Design Flows for Blueberry Creek, using the Regression Method (MNR, 1984)

Sub-watershed	Drainage Area	Design Flows 1:100 Year	Design Flows 1:2 Year
	km^2	m^3/s	m^3/s
Blueberry Creek at confluence with the Tay River (Reach 1+Reach 2+West Trib.)	38.52	16.02	4.99
Blueberry Creek (Reach 1) at confluence with West Trib.	27.34	10.6	3.12
West Tributary at confluence with Blueberry Creek	9.42	5.32	1.5

Table 3 – Hydraulic Parameters for Scenarios 1 & 2

	Design Flows (m^3/s)			Assumed Water Level of Tay River at Blueberry Creek Confluence (m)
	Reach 2*	Reach 1**	West Trib***	
Scenario 1 - 1:100 yr flow on Blueberry Creek	16.02	10.6	5.32	134.4
Scenario 2 - 1:2 yr flow on Blueberry Creek	4.99	3.12	1.5	136.18

*Blueberry Creek at confluence with the Tay River

**Blueberry Creek at confluence with West Tributary

***West Tributary at confluence with Blueberry Creek

Table 4 – Bridges and Culverts

Reach	Name	Bridges/ Culvert	Chainage	Deck Top	Low Chord	Deck Width	Source
			m	m	m	m	
West Tributary	Highway 511 Box Culvert	C	455	139.90	138.75	11.66	RVCA, 2006
Blueberry Creek - Reach 2	Christie Lake Road	B	215	135.95	135.46	11.22	
Blueberry Creek - Reach 2	Railway Bridge	B	425	139.42	137.65	9.50	
Blueberry Creek - Reach 2	Highway 7 Box Culvert	C	455	137.98	137.62	25.88	
Blueberry Creek - Reach 2	Highway 511 Box Culvert	C	1565	138.25	137.15	11.65	

Notation: B - Bridge, C - Culvert

Table 5 – Regulatory Flood Levels for 1:100 Year Flood Event

			Scenario 1 - 1:100 yr flow on Blueberry Creek				**Scenario 2** - 1:2 yr flow on Blueberry Creek					
Reach	**Chainage**	**Min Ch El**	**Flow**	**CWSEL**	**EGL**	**Sc. 1 RFL***	**Flow**	**CWSEL**	**EGL**	**Sc. 2 RFL***	**Scenario with Max WL**	**Final RFL****
	m	**m**	**m^3/s**	**m**	**m**	**m**	**m^3/s**	**m**	**m**	**m**		**m**
Blueberry Cr - Reach 2	425	Railway Bridge										
	440	133.54	16.02	135.18	135.25	135.25	4.99	136.19	136.19	136.19	2	136.19
	455	Hwy 7 Box Culvert										
	470	133.48	16.02	135.73	135.77	135.77	4.99	136.2	136.2	136.2	2	136.2
	670	133.95	16.02	135.82	135.83	135.82	4.99	136.2	136.2	136.2	2	136.2
	970	134.22	16.02	135.89	135.89	135.89	4.99	136.2	136.2	136.2	2	136.2
	1250	134.9	16.02	136.04	136.07	136.07	4.99	136.21	136.21	136.21	2	136.21
	1430	134.9	16.02	136.27	136.28	136.27	4.99	136.22	136.22	136.22	1	136.27
	1550	134.9	16.02	136.35	136.42	136.42	4.99	136.23	136.24	136.23	1	136.42
	1565	Hwy 511 Box Culvert										
	1580	134.95	16.02	136.4	136.46	136.46	4.99	136.24	136.25	136.24	1	136.46
	1750	135.44	16.02	136.77	136.99	136.99	4.99	136.18	136.43	136.43	1	136.99
	1940	135.9	16.02	137.32	137.34	137.32	4.99	136.9	136.91	136.9	1	137.32
	2340	136.85	16.02	137.81	137.87	137.87	4.99	137.54	137.58	137.58	1	137.87
Blueberry Cr Reach 1	2540	136.85	10.6	138.06	138.06	138.06	3.12	137.73	137.73	137.73	1	138.06
	3190	136.85	10.6	138.07	138.07	138.07	3.12	137.74	137.74	137.74	1	138.07
West Trib	300	136.22	5.32	138.06	138.06	138.06	1.5	137.73	137.73	137.73	1	138.06
	440	136.69	5.32	138.04	138.08	138.08	1.5	137.72	137.73	137.72	1	138.08
	455	Hwy 511 Box Culvert										
	470	136.61	5.32	138.08	138.11	138.11	1.5	137.73	137.73	137.73	1	138.11
	760	136.88	5.32	138.14	138.14	138.14	1.5	137.75	137.75	137.75	1	138.14
	1180	137.05	5.32	138.18	138.18	138.18	1.5	137.8	137.81	137.8	1	138.18

*Refer to the section on 'Regulatory Flood Levels' for information on how these values were computed
**The final Regulatory Flood Level (RFL) is the maximum of the two scenarios

Notation: Min Ch El – Minimum Channel Elevation; CWSEL – Computed Water Surface Elevation
EGL – Energy Grade Level; RFL – Regulatory Flood Level

Figure 1: Blueberry Creek Study Area

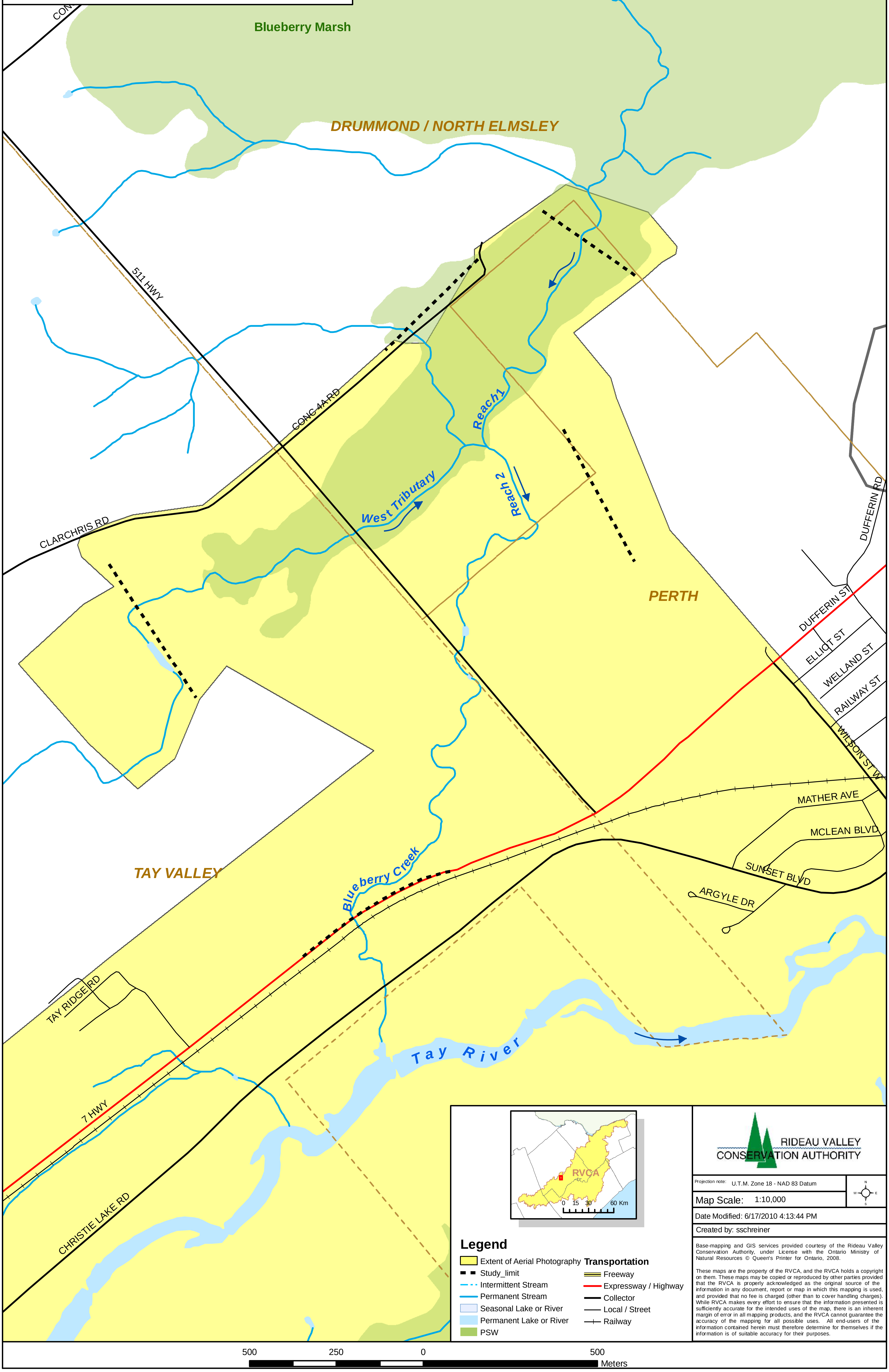
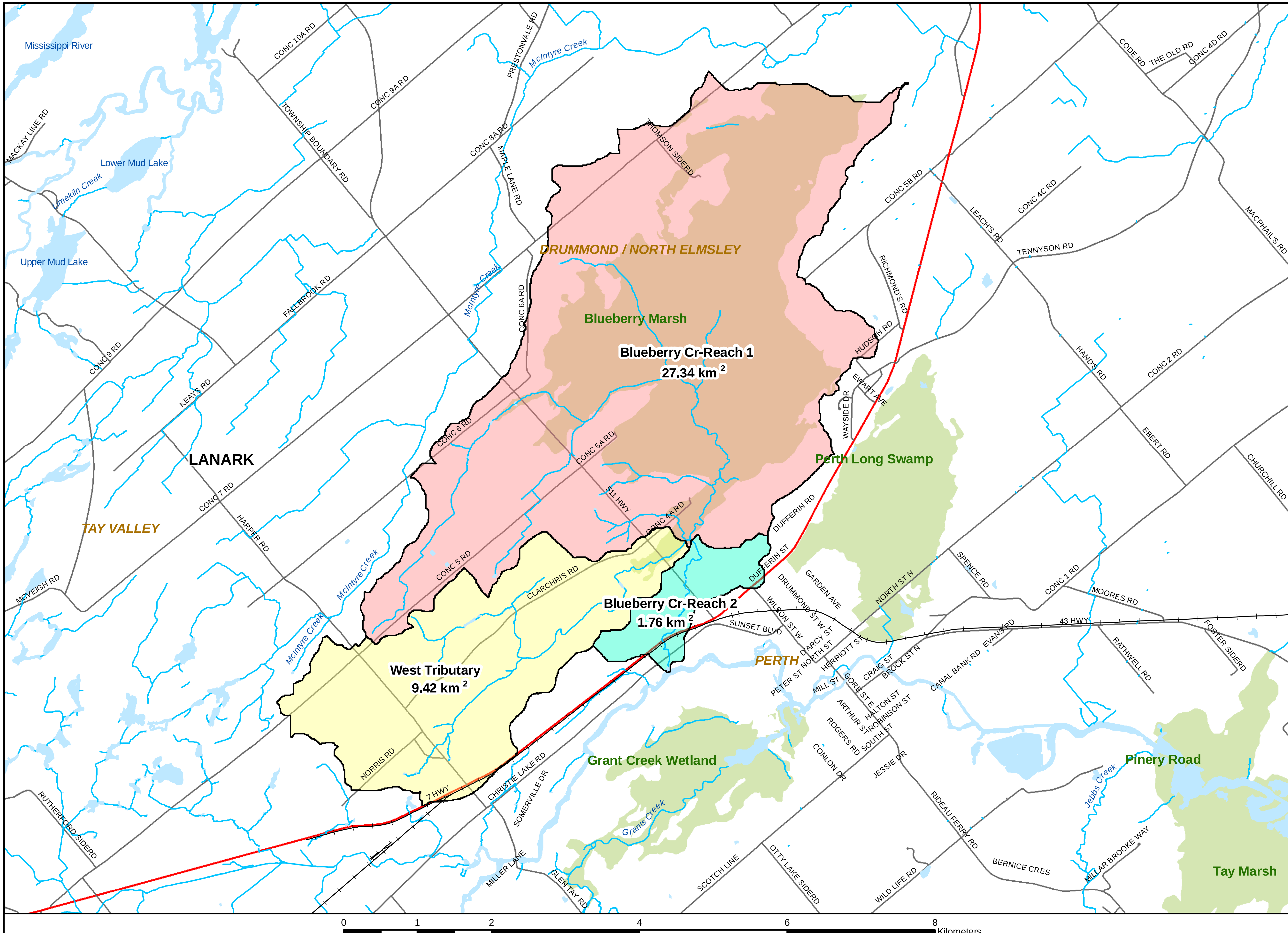


Figure 2: Blueberry Creek Sub-watersheds



Legend

- Permanent Stream
- Seasonal Lake or River
- Permanent Lake or River
- PSW

Subwatersheds

- Blueberry Cr-Reach 1
- Blueberry Cr-Reach 2
- West Tributary

Transportation

- Freeway
- Expressway / Highway
- Collector
- Railway

RIDEAU VALLEY CONSERVATION AUTHORITY

Map Scale: 1:50,000

Projection note: U.T.M. Zone 18 - NAD 83 Datum

File Location: \\rvca1server\sschreiner\Flood Mapping\Tay\Blueberry Creek\GIS\MXD\Fig2_subWatersheds_BC_Mar2010.mxd

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Figure 3: Summary of Flood Risk Mapping for Blueberry Creek

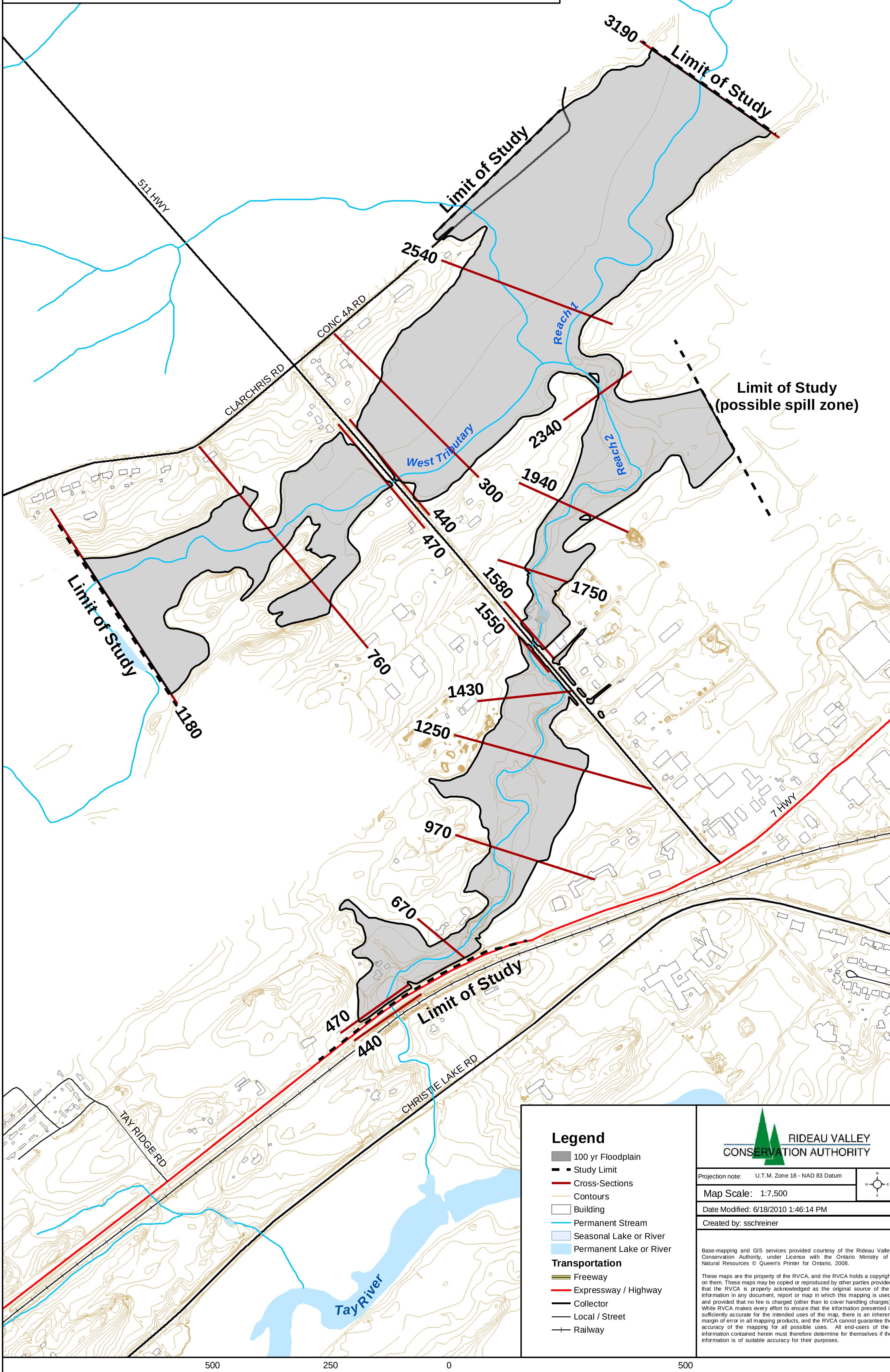
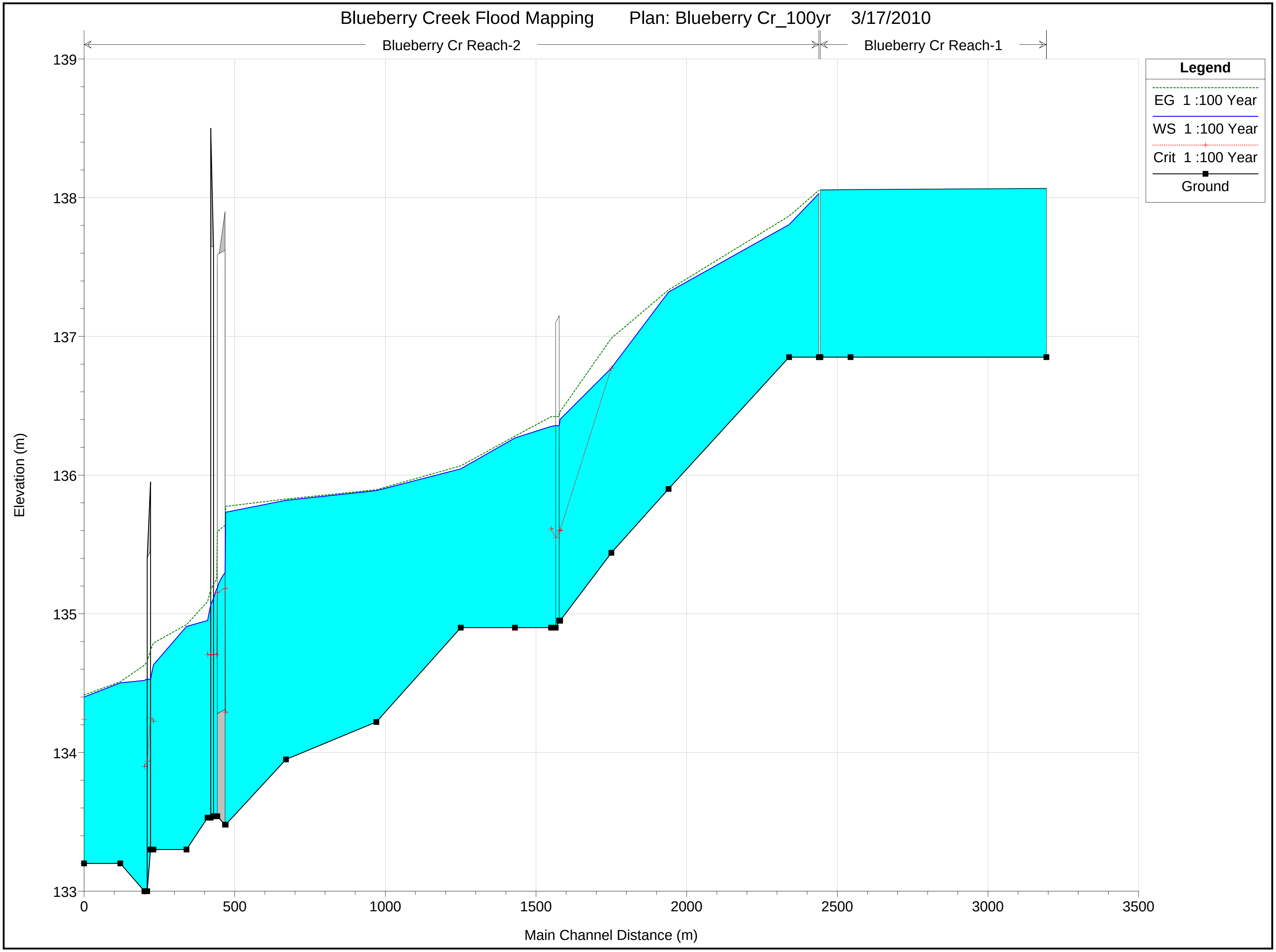


Figure 4: Flood Risk Mapping and Aerial Photo for Blueberry Creek

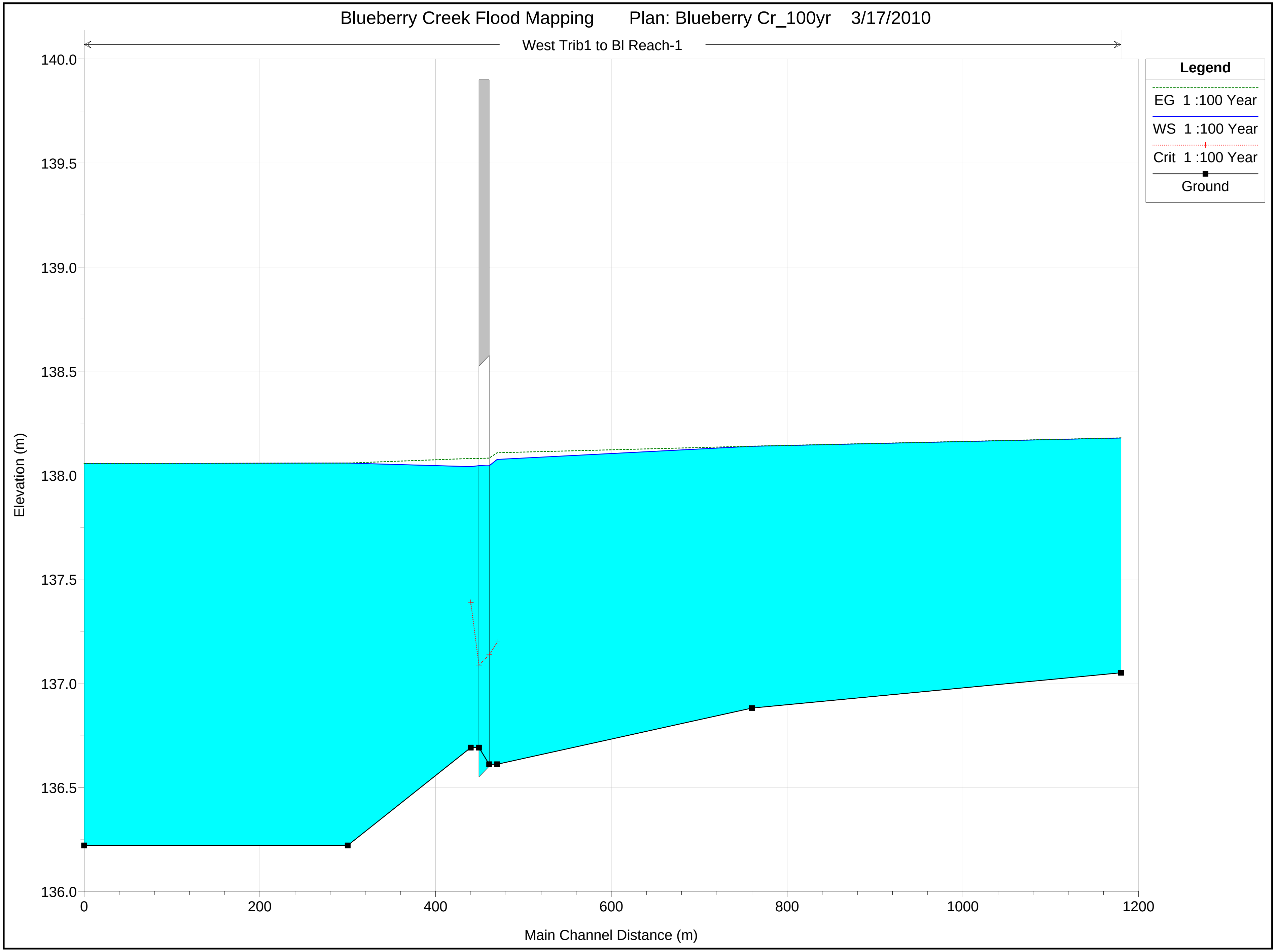
Appendix A

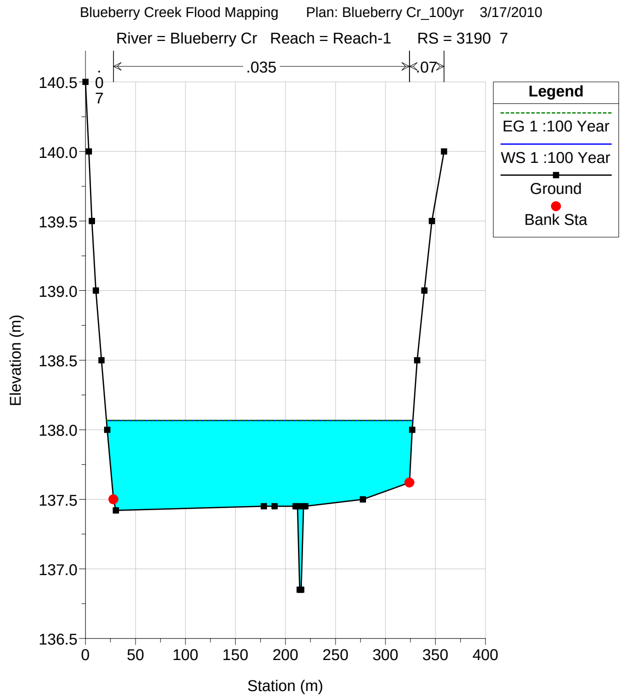
HEC-RAS Cross-Sections and Longitudinal Profiles for *Scenario 1 -*

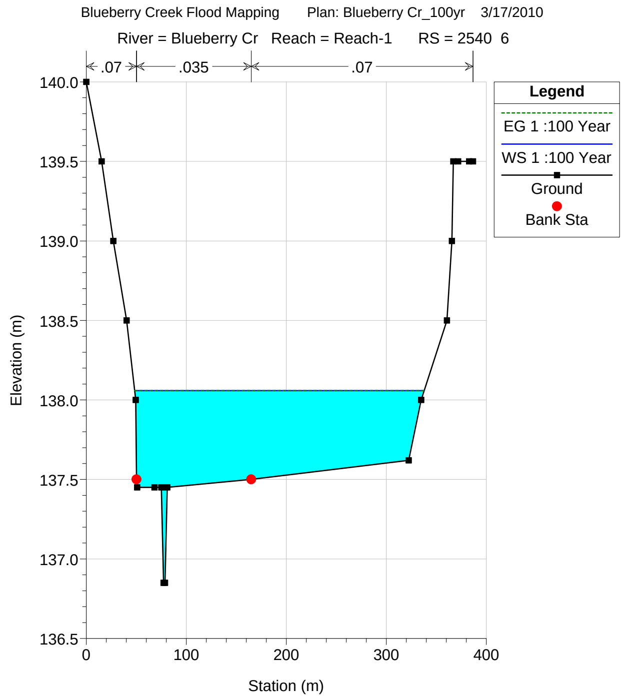
The 1:100 yr flow on Blueberry Creek and the 1:2 yr flow on the Tay River.

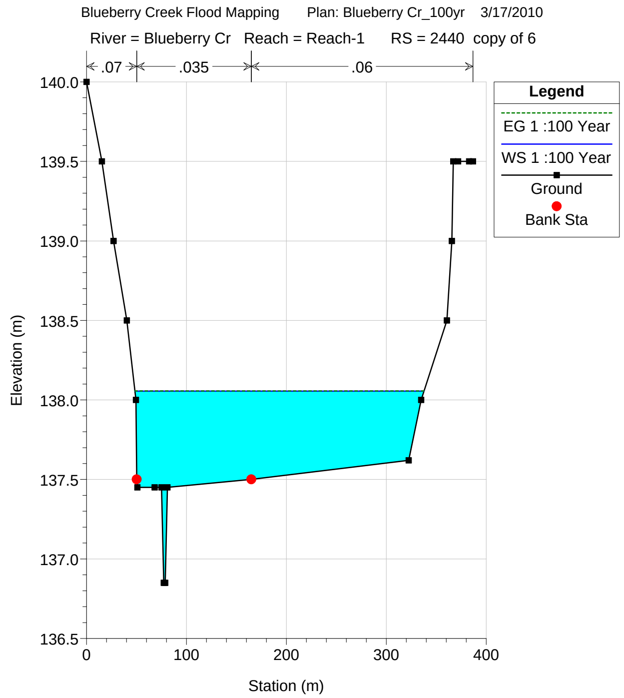


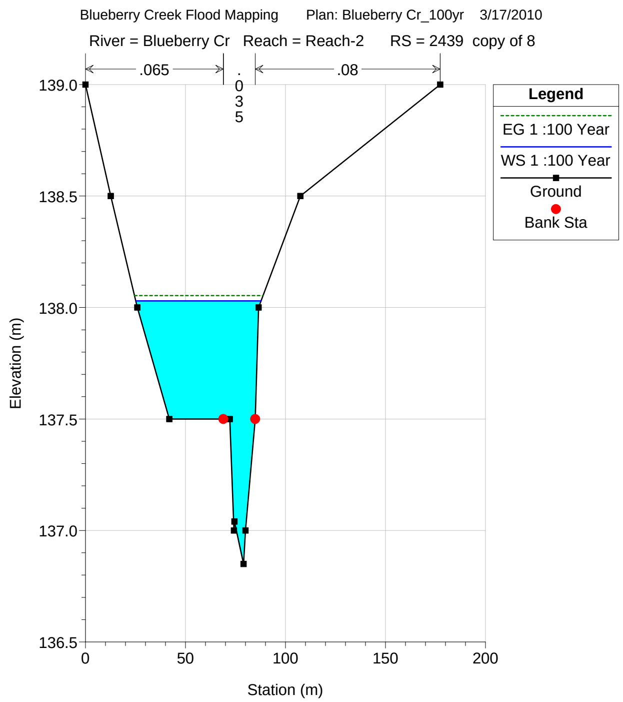
Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
Blueberry Cr Reach-2
Blueberry Cr Reach-1
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Elevation (m)
Main Channel Distance (m)
139
138
137
136
135
134
133
0
500
1000
1500
2000
2500
3000
3500

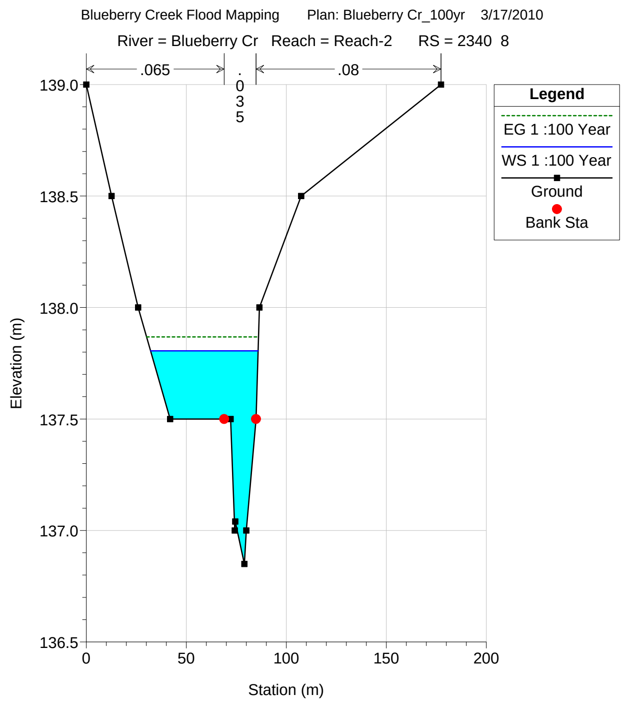

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
West Trib1 to Bl Reach-1
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Elevation (m)
140.0
139.5
139.0
138.5
138.0
137.5
137.0
136.5
136.0
0
200
400
600
800
1000
1200
Main Channel Distance (m)

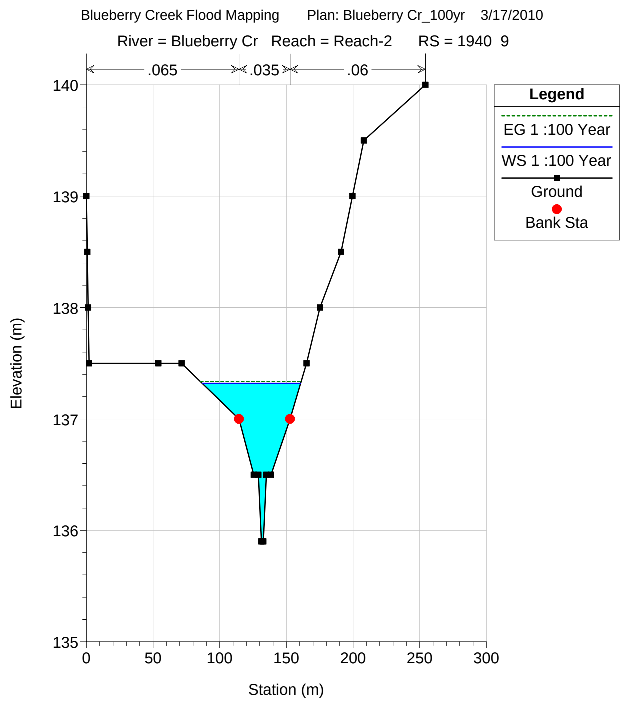

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-1 RS = 3190 7
.07
.035
.07
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

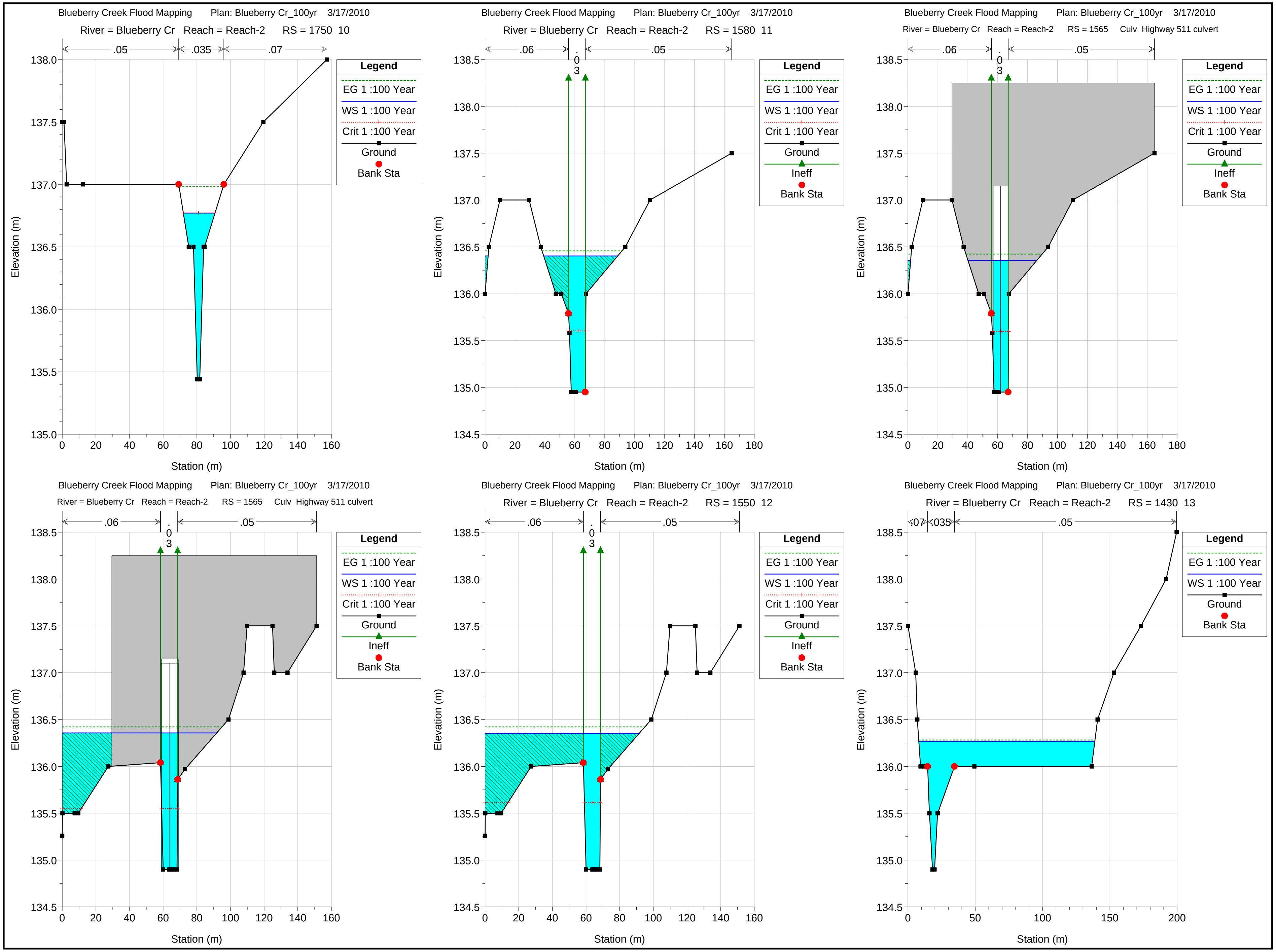

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-1 RS = 2540 6
.07
.035
.07
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

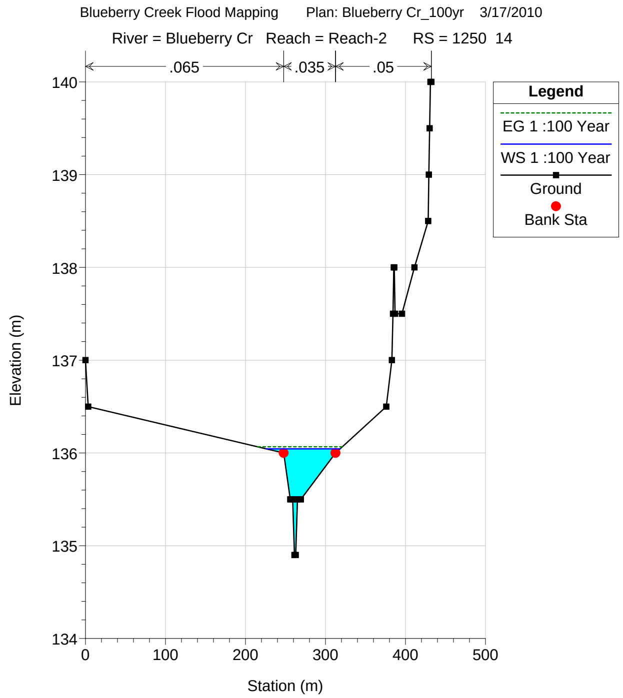

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-1 RS = 2440 copy of 6
.07
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

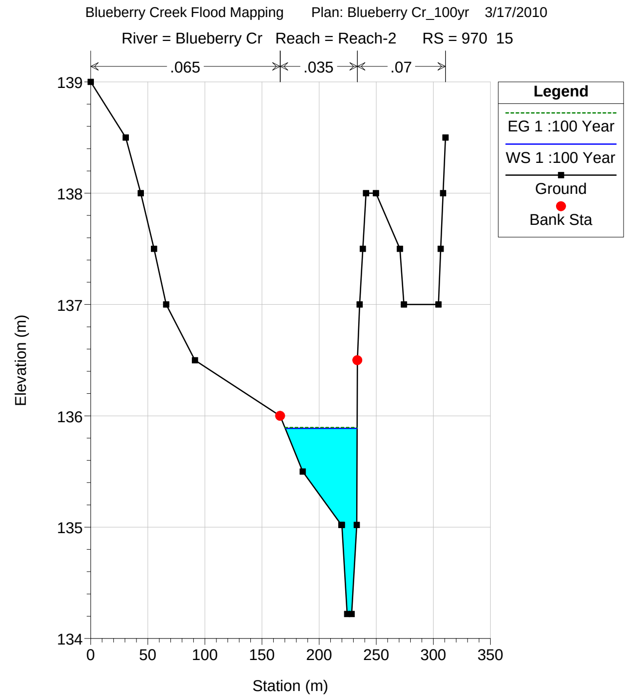

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 2439 copy of 8
.065
.035
.08
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

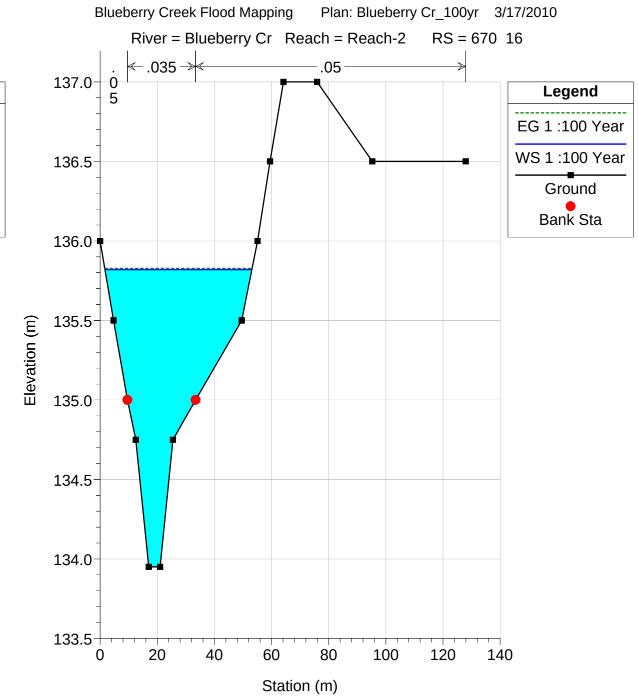

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 2340 8
.065
.035
.08
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

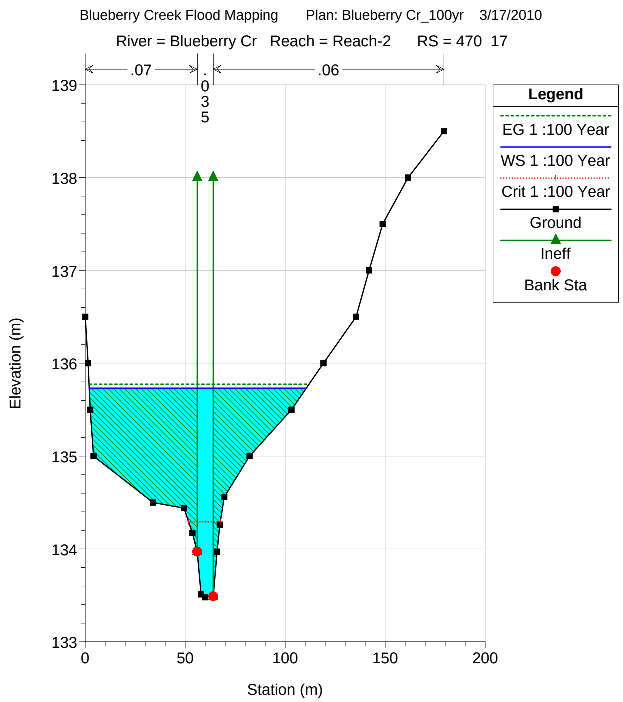

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1940 9
.065
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

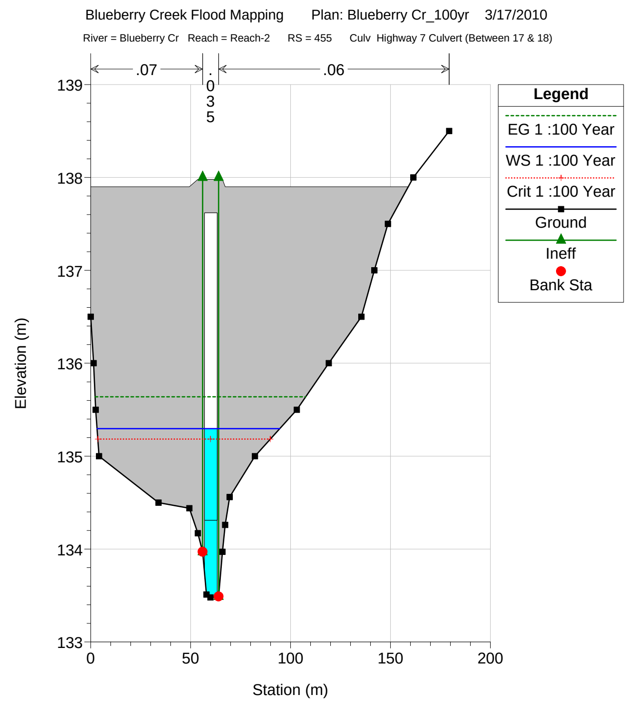

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1750 10
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1580 11
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1565 Culv Highway 511 culvert
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1565 Culv Highway 511 culvert
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1550 12
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1430 13
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

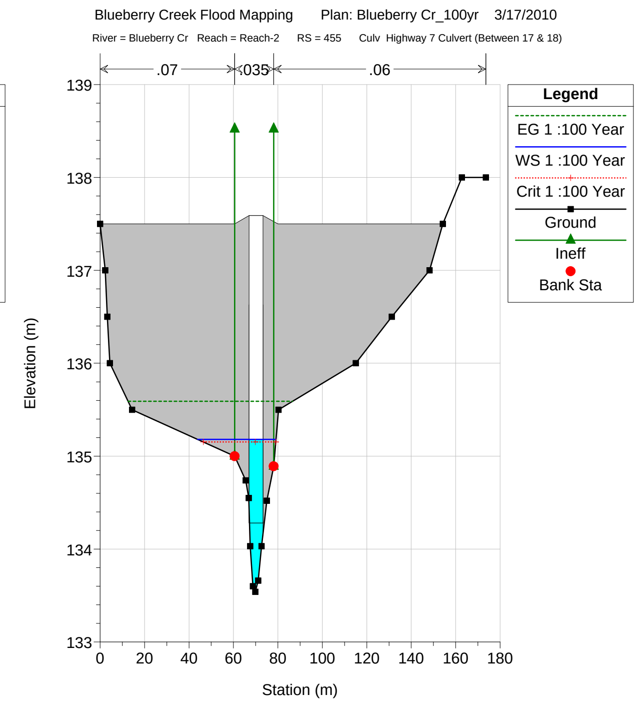

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 1250 14
.065
.035
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

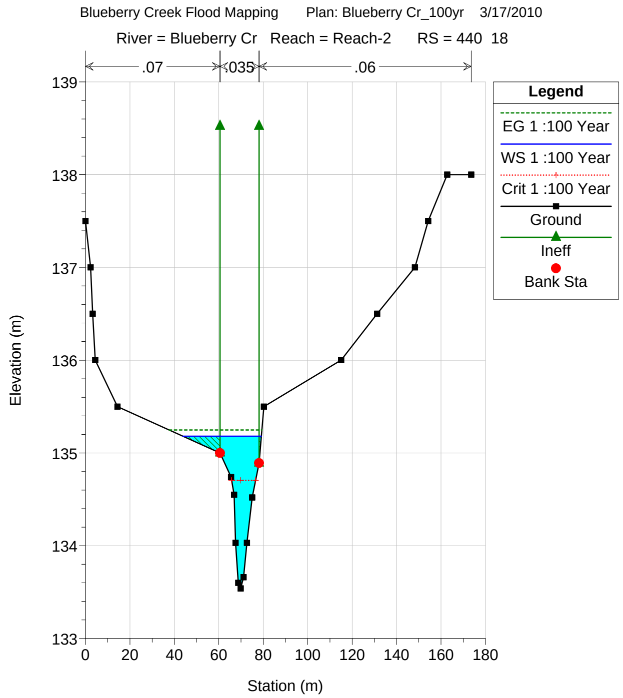

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 970 15
.065
.035
.07
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

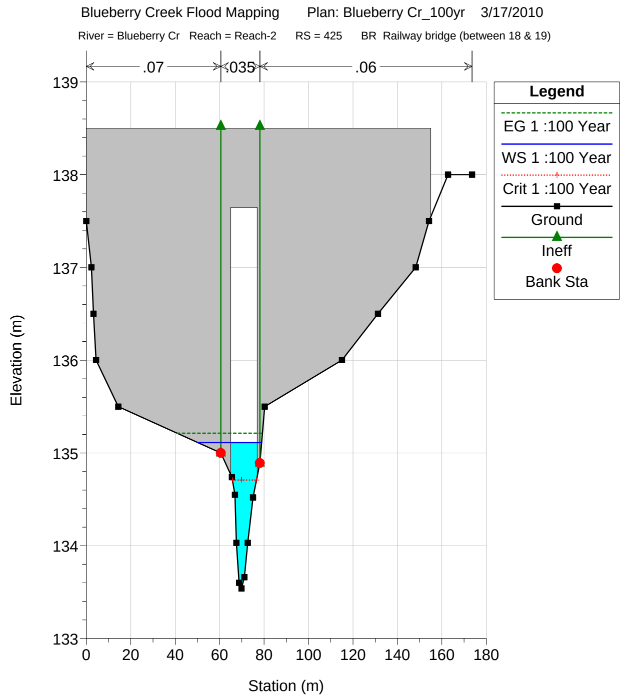

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 670 16
.05
.035
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

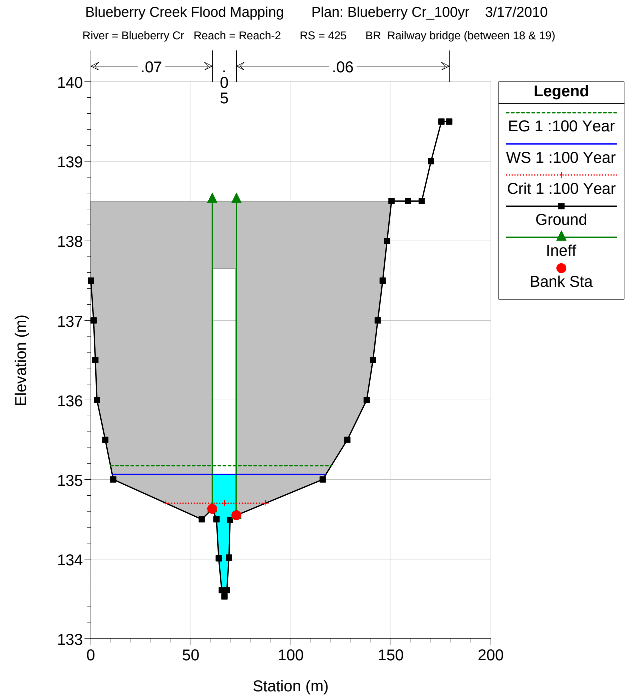

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 470 17
.07
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

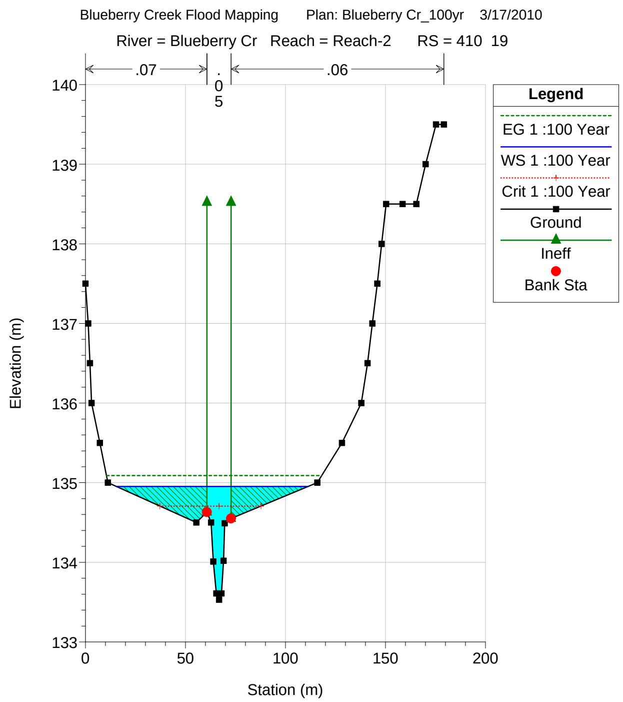

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 455 Culv Highway 7 Culvert (Between 17 & 18)
.07
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

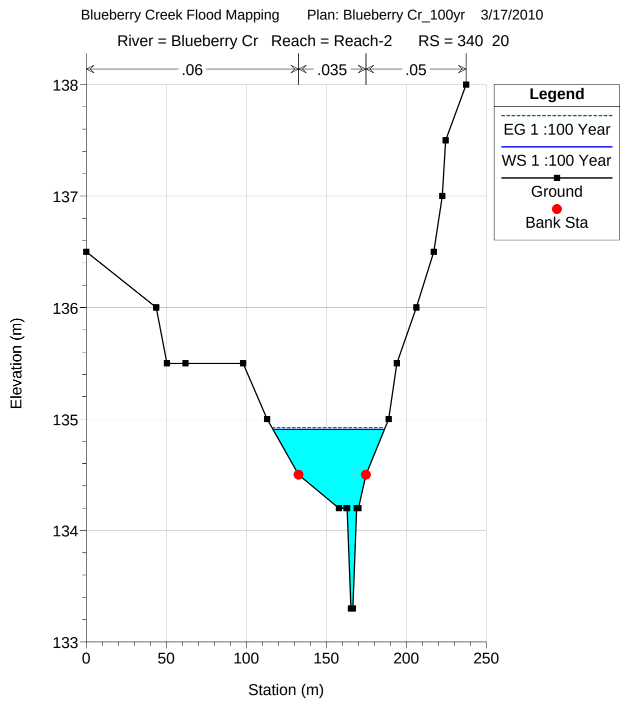

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 455 Culv Highway 7 Culvert (Between 17 & 18)
.07
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

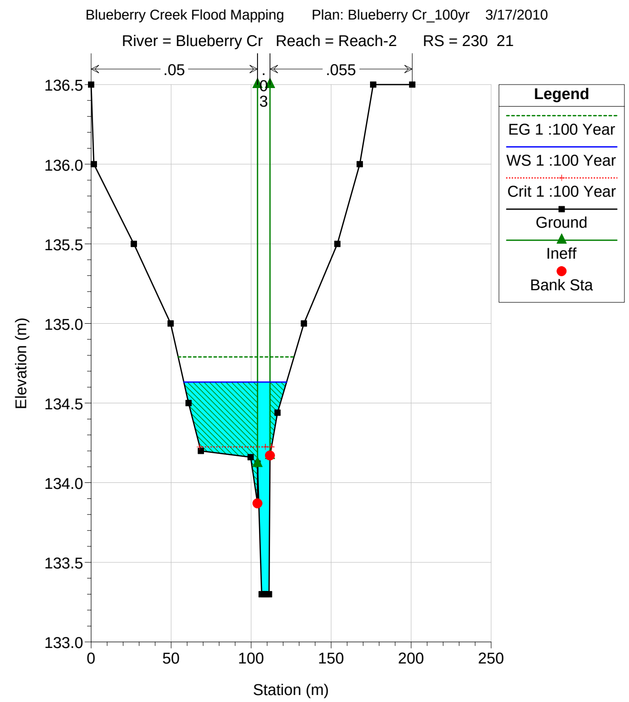

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 440 18
.07
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

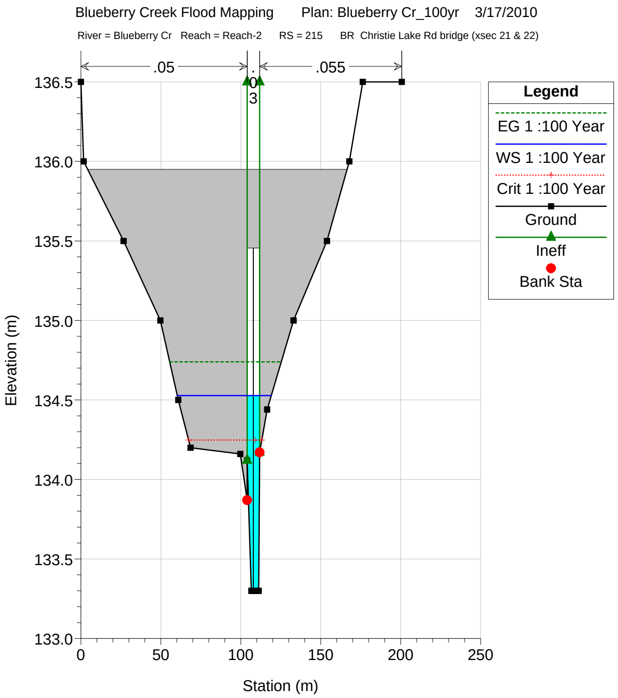

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 425 BR Railway bridge (between 18 & 19)
.07
.035
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

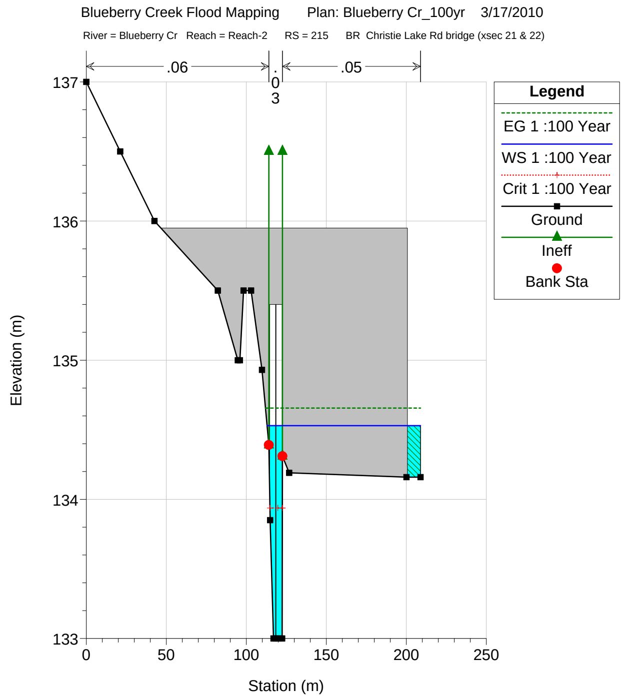

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 425 BR Railway bridge (between 18 & 19)
.07
.05
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

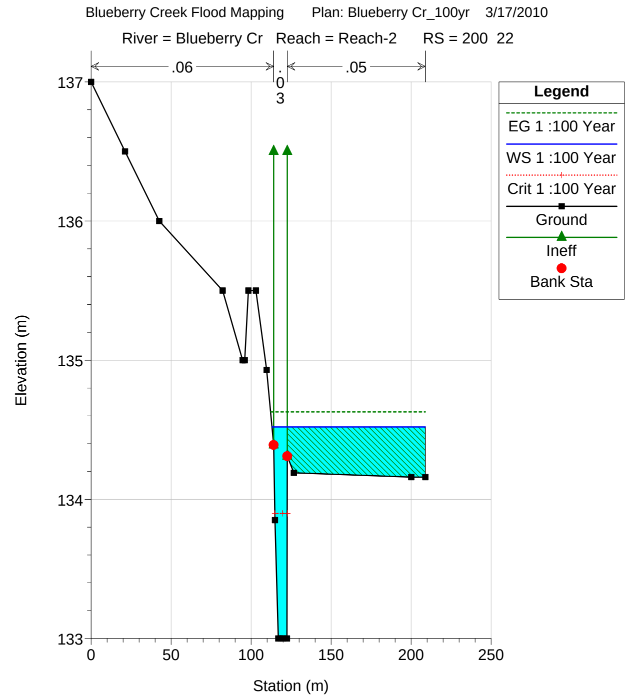

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 410 19
.07
.05
.06
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

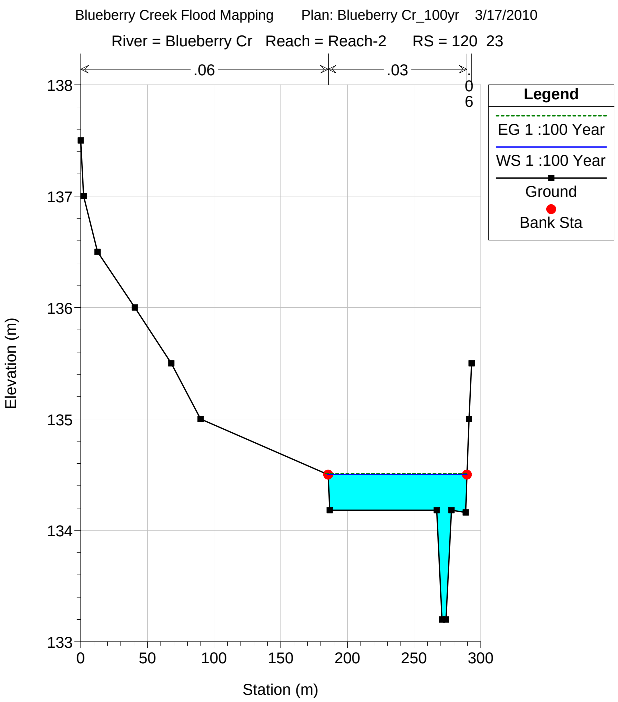

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 340 20
.06
.035
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

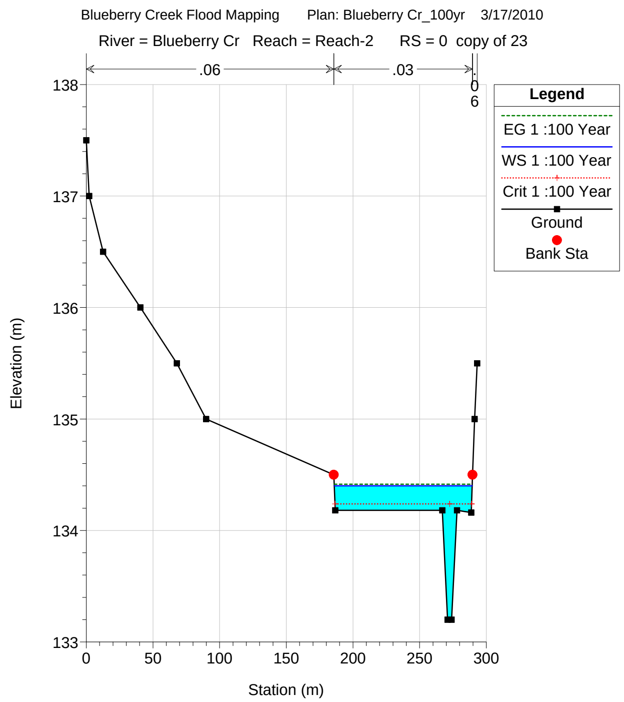

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 230 21
.05
.03
.055
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

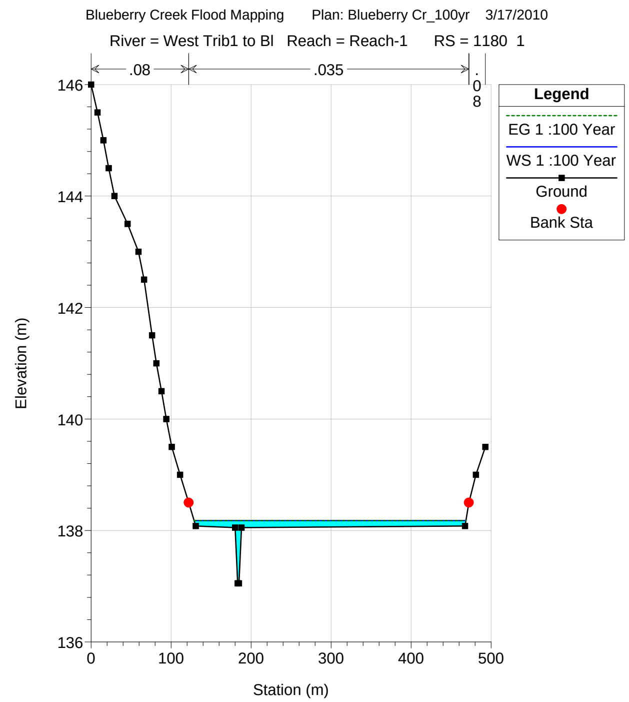

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 215 BR Christie Lake Rd bridge (xsec 21 & 22)
.05
.055
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

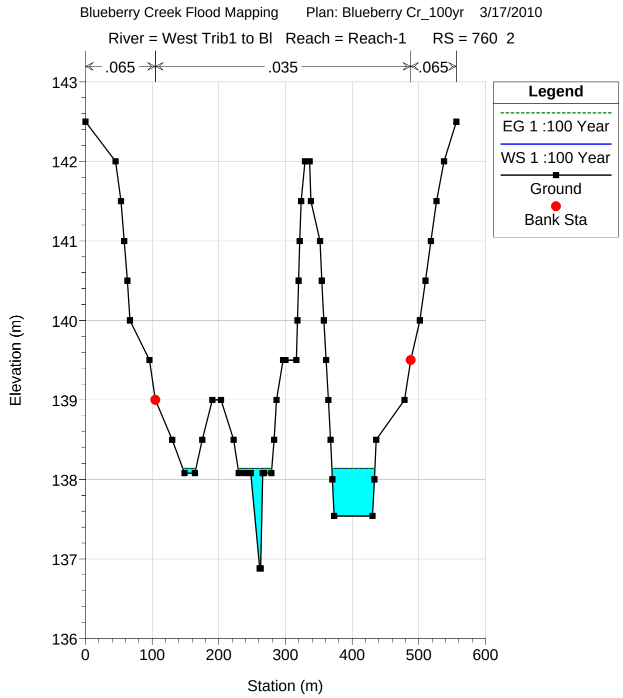

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 215 BR Christie Lake Rd bridge (xsec 21 & 22)
.06
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

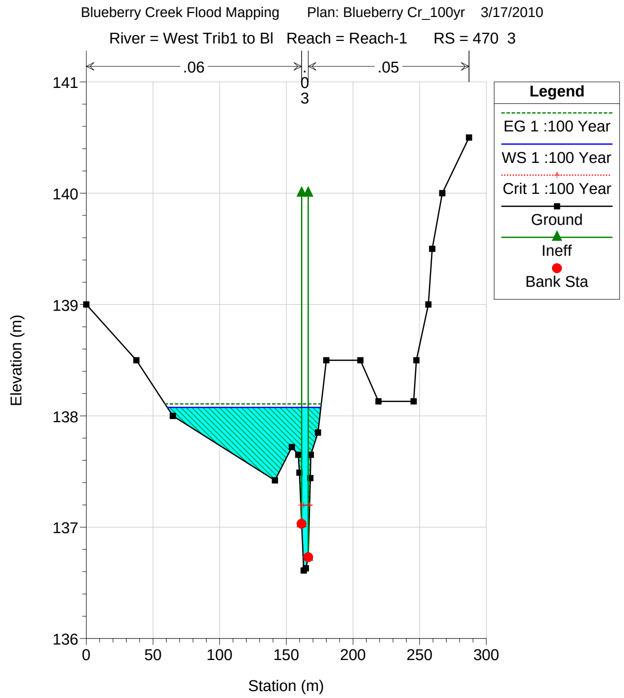

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 200 22
.06
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

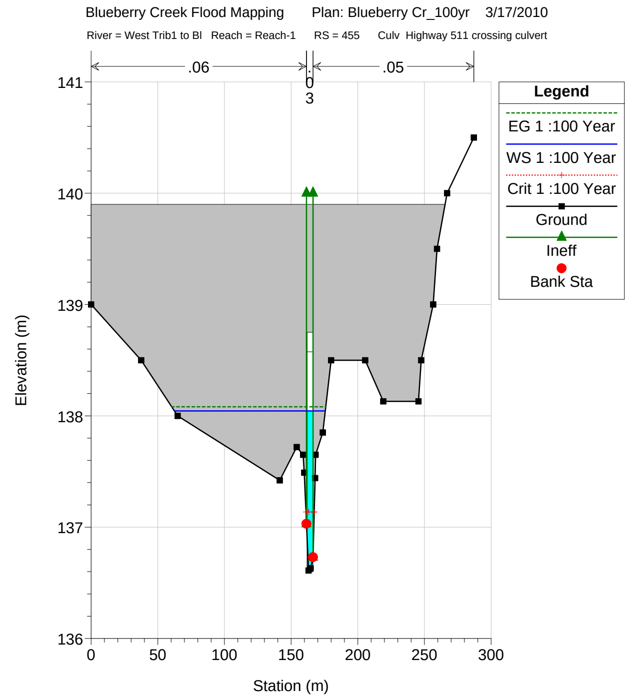

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 120 23
.06
.03
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

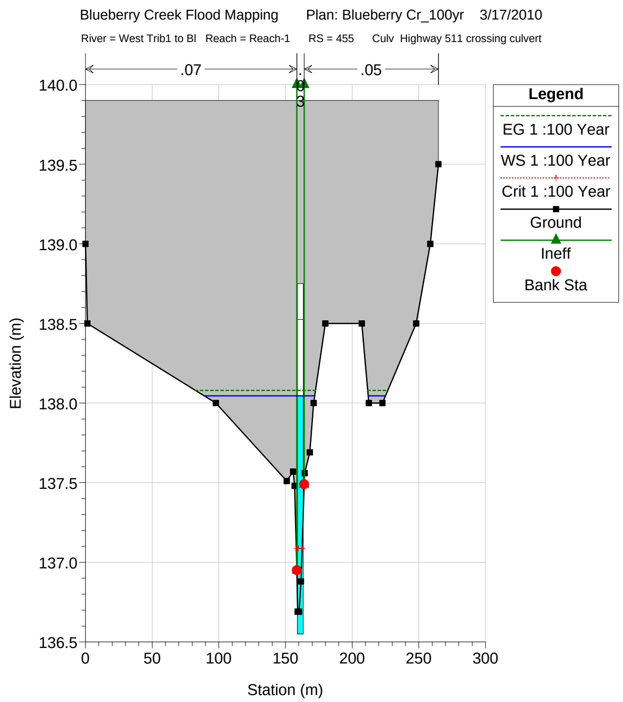

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = Blueberry Cr Reach = Reach-2 RS = 0 copy of 23
.06
.03
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

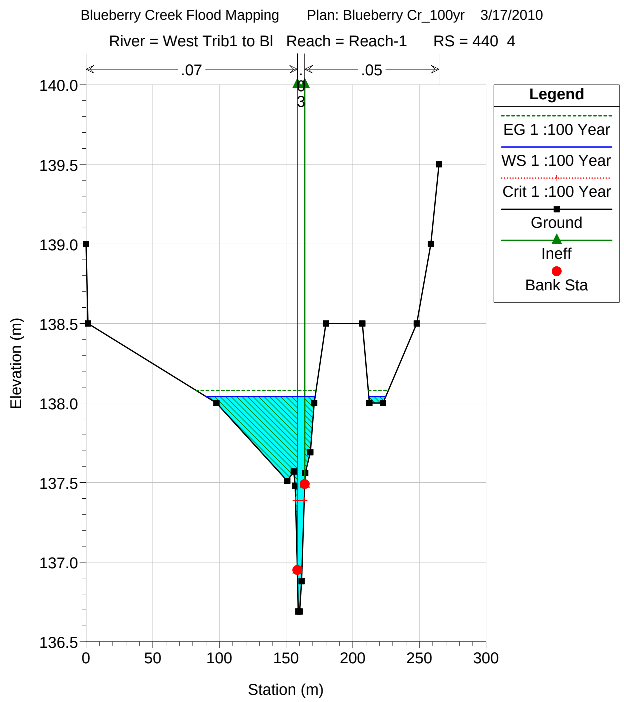

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 1180 1
.08
.035
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

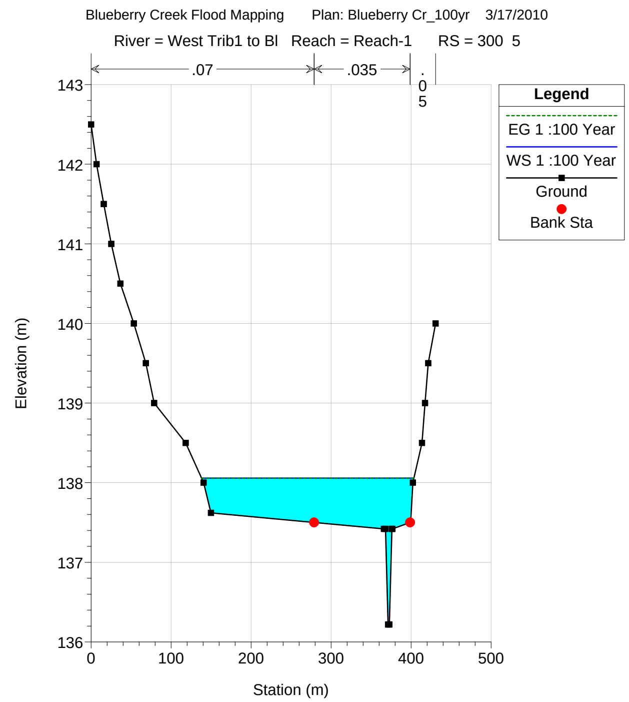

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 760 2
.065
.035
.065
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

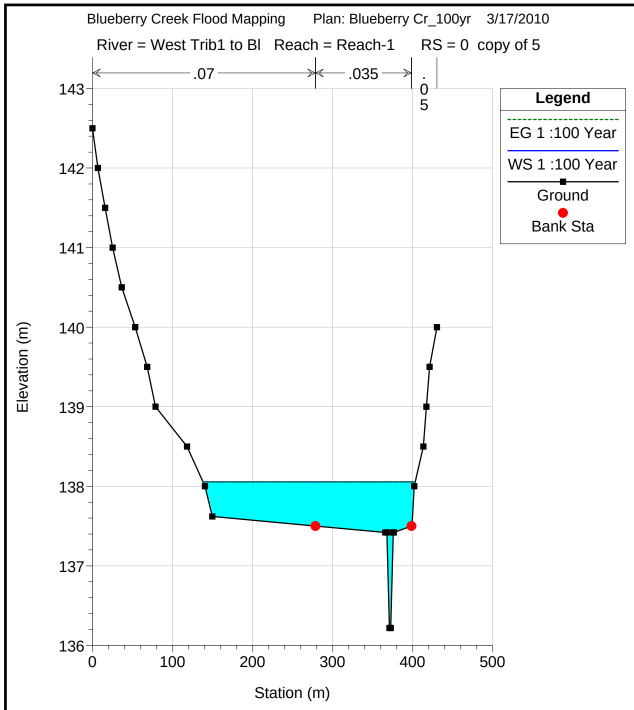

Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 470 3
.06
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 455 Culv Highway 511 crossing culvert
.06
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 455 Culv Highway 511 crossing culvert
.07
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 440 4
.07
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Crit 1 :100 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 300 5
.07
.035
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
Station (m)

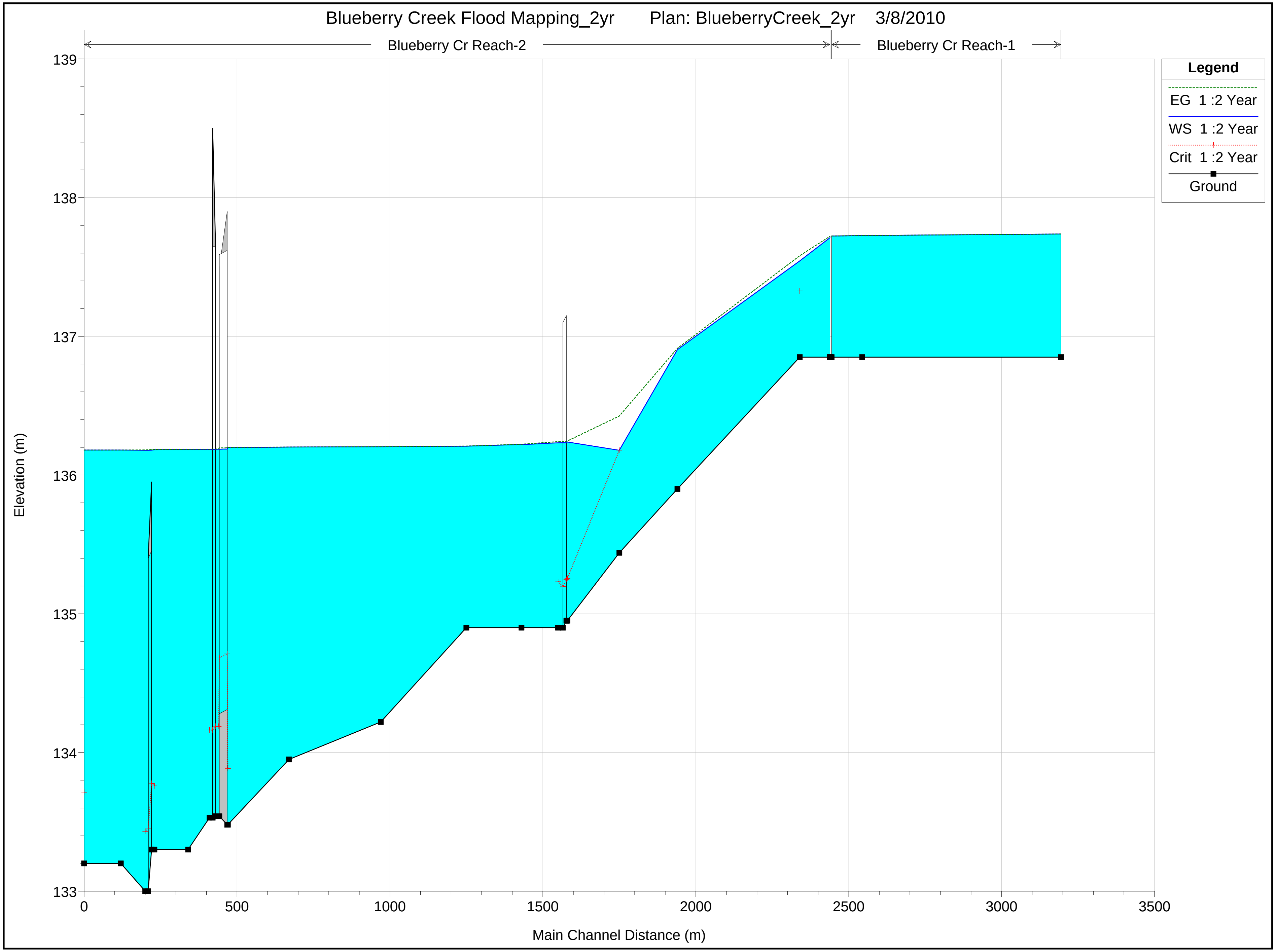


Blueberry Creek Flood Mapping Plan: Blueberry Cr_100yr 3/17/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 0 copy of 5
.07
.035
.05
Legend
EG 1 :100 Year
WS 1 :100 Year
Ground
Bank Sta
Elevation (m)
143
142
141
140
139
138
137
136
0
100
200
300
400
500
Station (m)

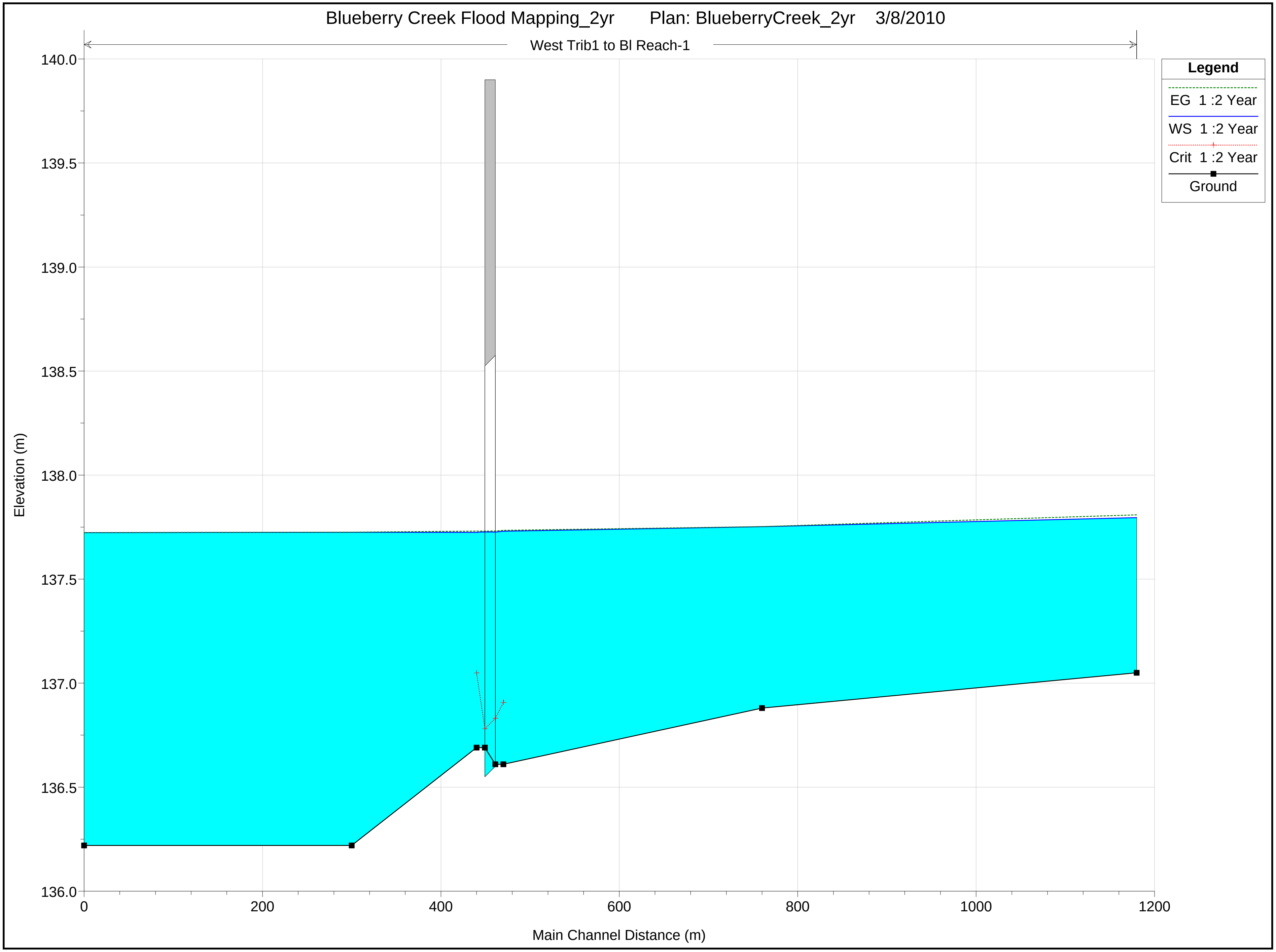
Appendix B

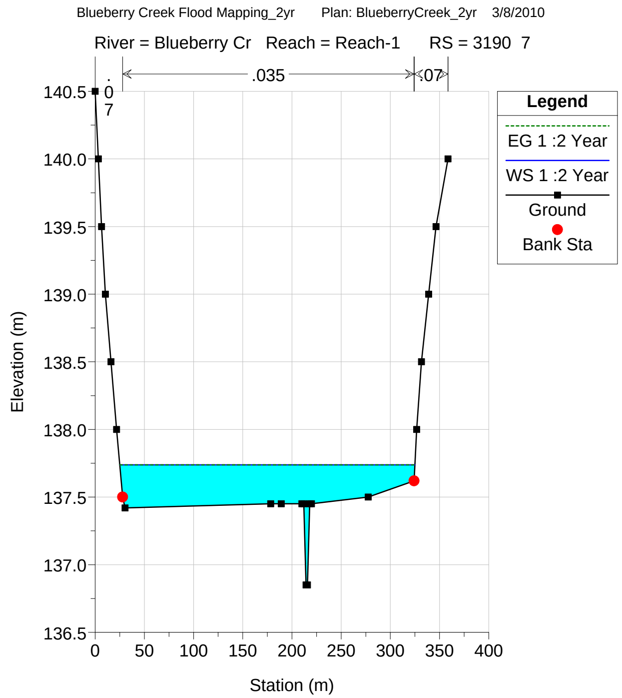
HEC-RAS Cross-Sections and Longitudinal Profiles for *Scenario 2* -

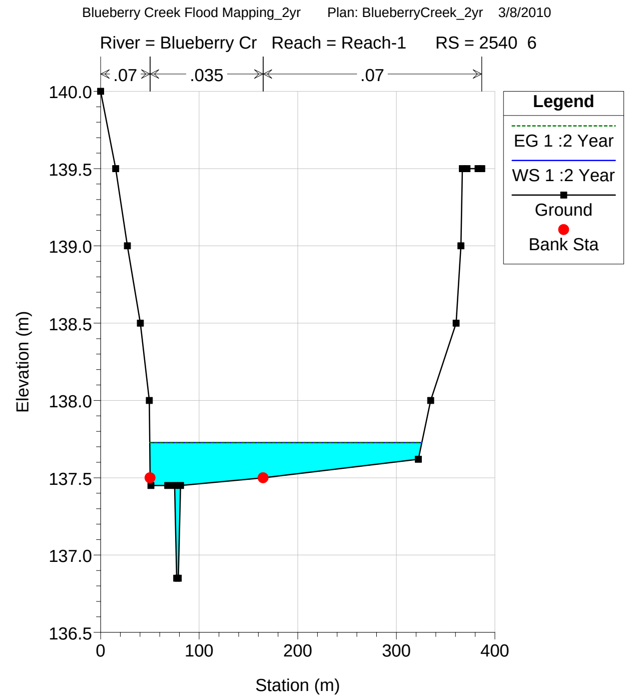
The 1:2 year flow on Blueberry Creek and the 1:100 year flow on the Tay River

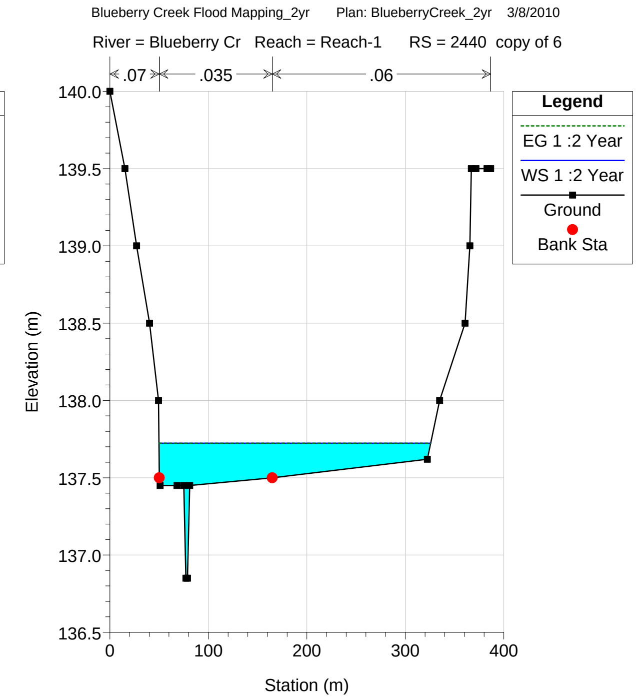


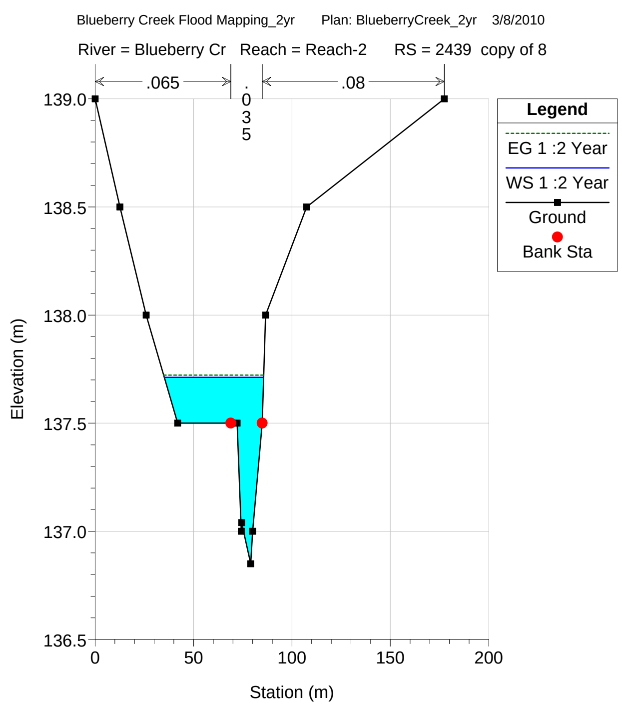
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
Blueberry Cr Reach-2
Blueberry Cr Reach-1
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Elevation (m)
139
138
137
136
135
134
133
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (m)

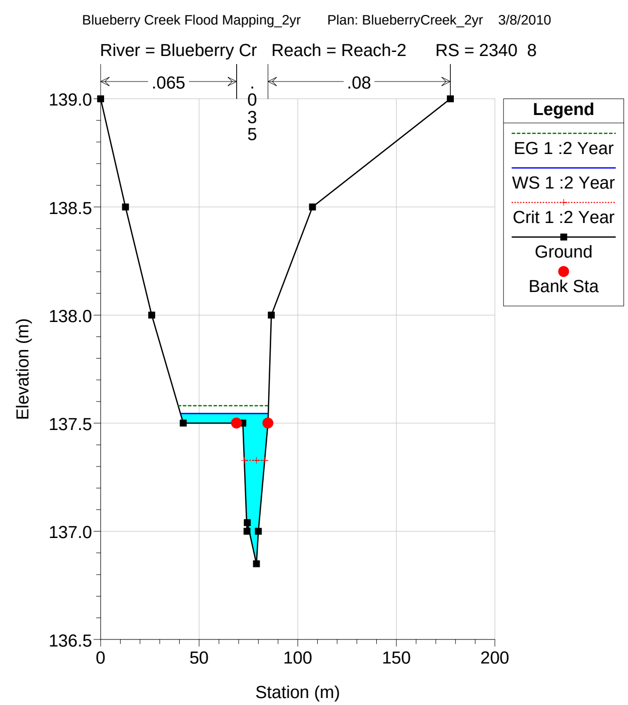

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
West Trib1 to Bl Reach-1
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Elevation (m)
140.0
139.5
139.0
138.5
138.0
137.5
137.0
136.5
136.0
0
200
400
600
800
1000
1200
Main Channel Distance (m)

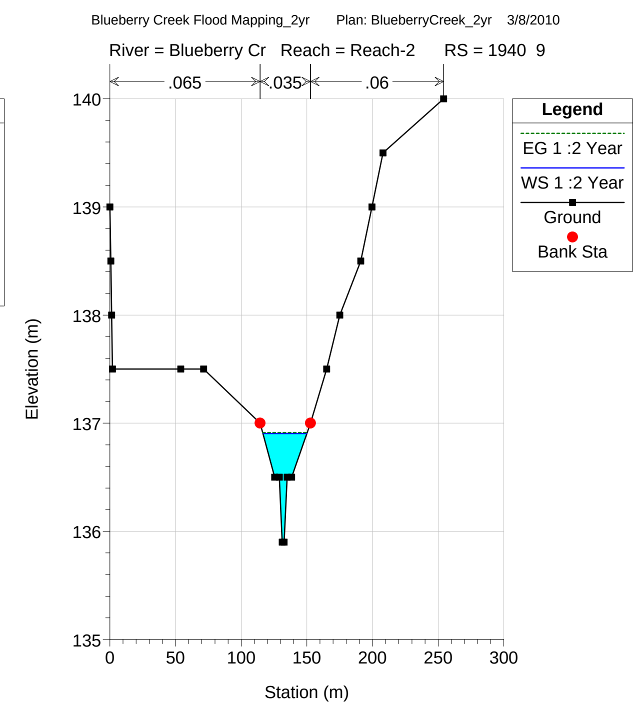

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-1 RS = 3190 7
.07
.035
.07
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

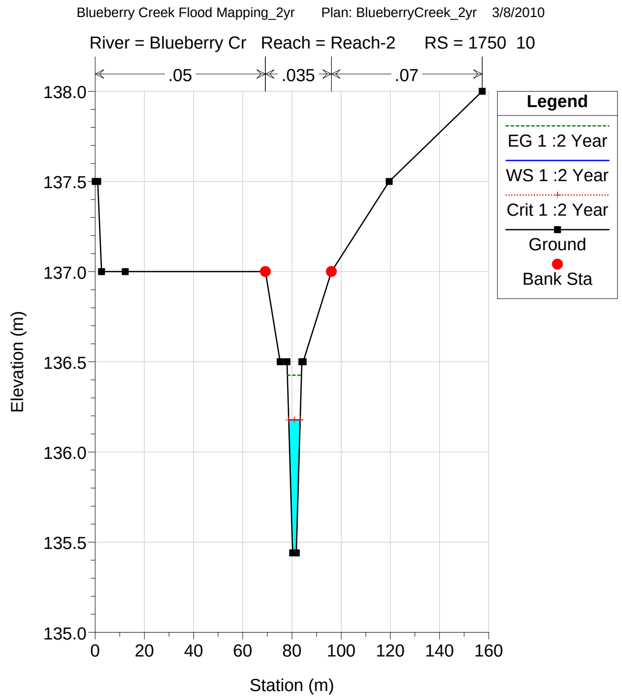

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-1 RS = 2540 6
.07
.035
.07
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

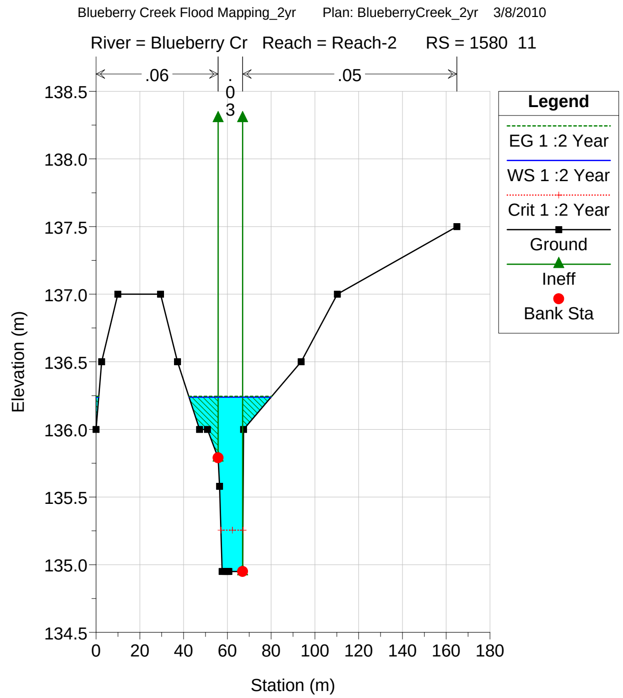

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-1 RS = 2440 copy of 6
.07
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

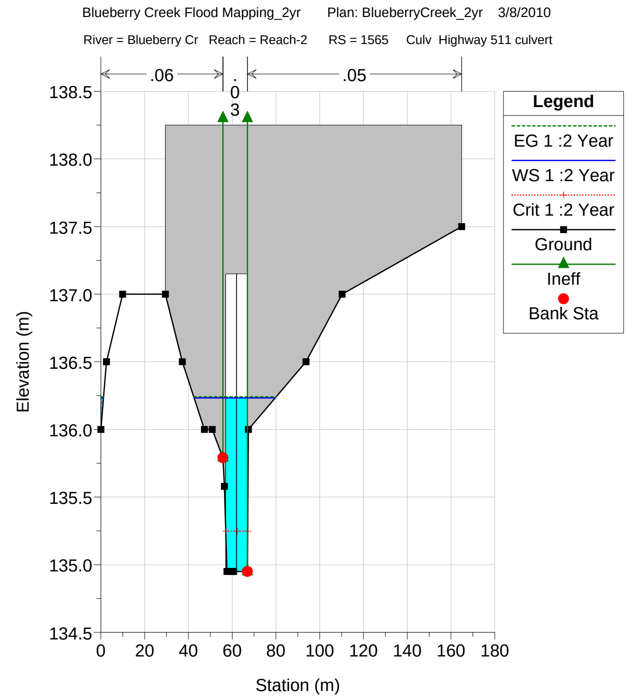

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 2439 copy of 8
.065
.035
.08
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

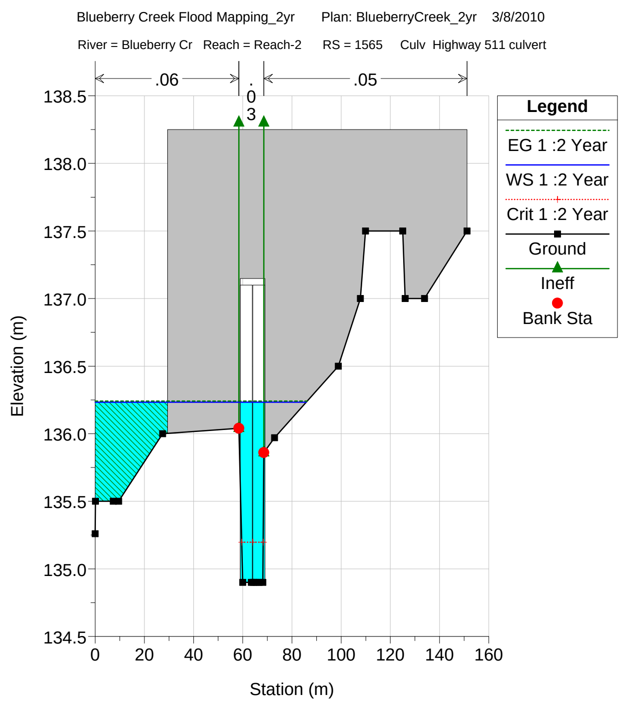

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 2340 8
.065
.035
.08
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

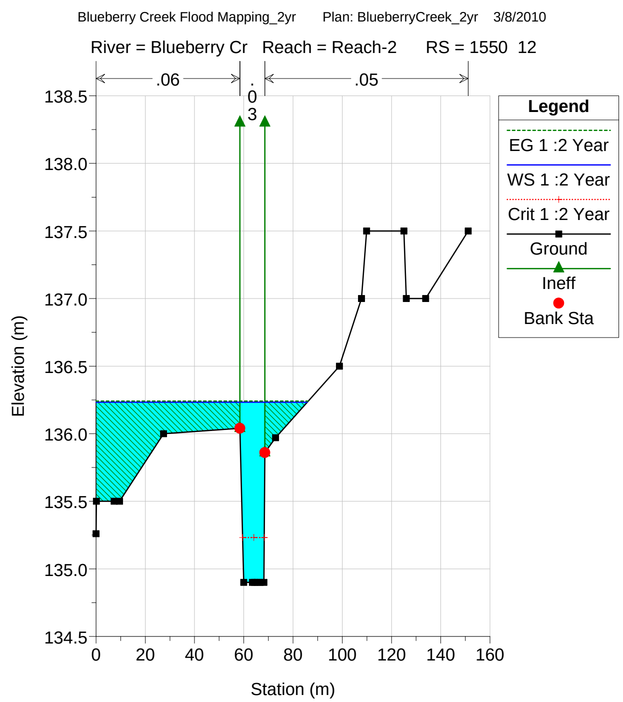

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1940 9
.065
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

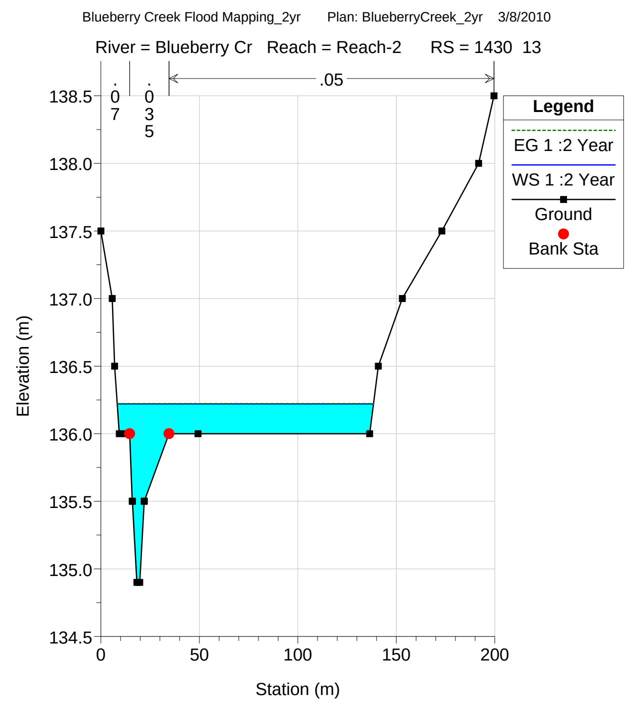

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1750 10
.05
.035
.07
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

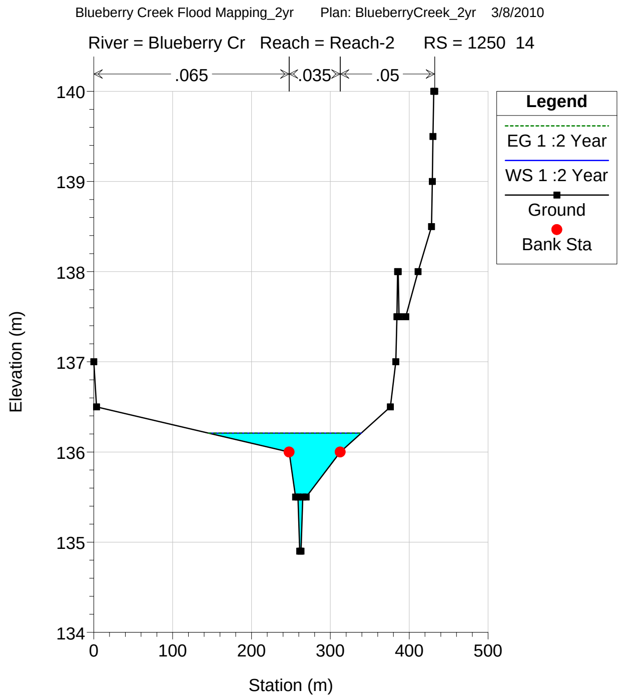

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1580 11
.06
.03
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

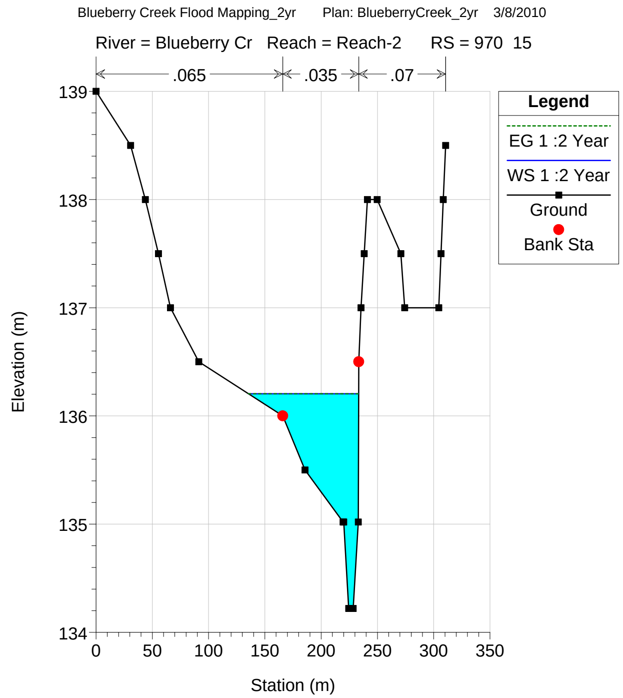

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1565 Culv Highway 511 culvert
.06
.03
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

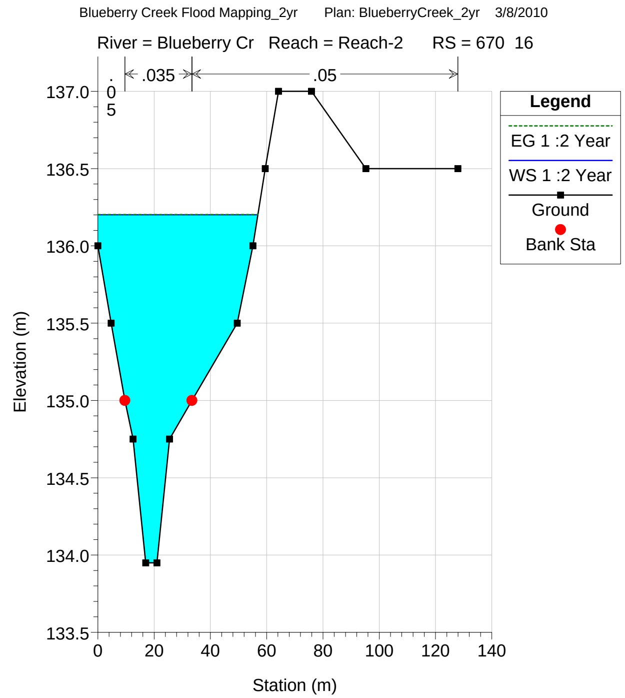

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1565 Culv Highway 511 culvert
.06
.03
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

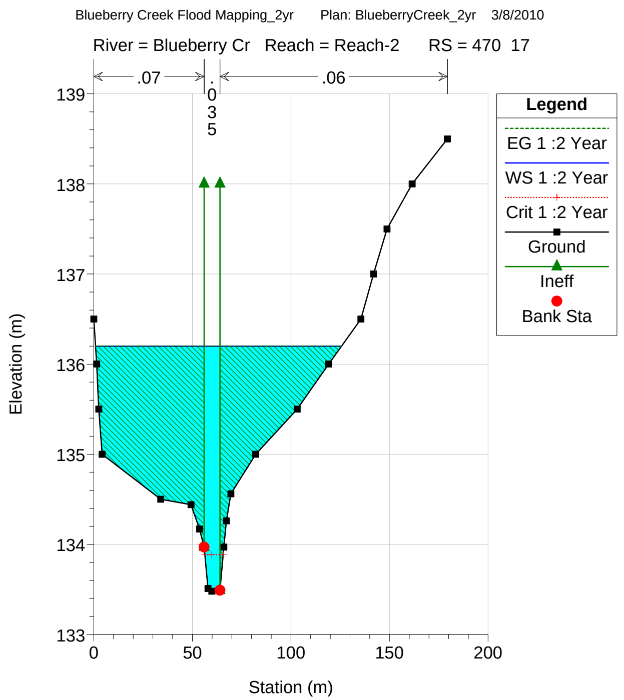

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1550 12
.06
.03
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

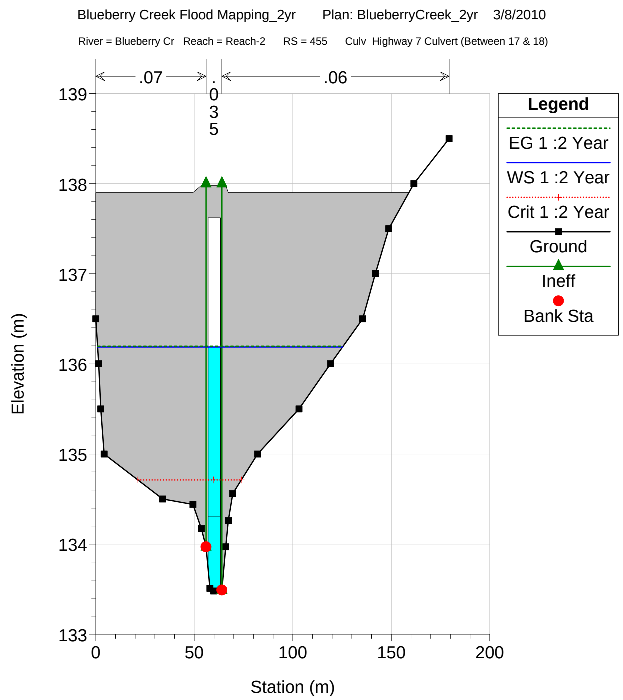

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1430 13
.07
.035
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

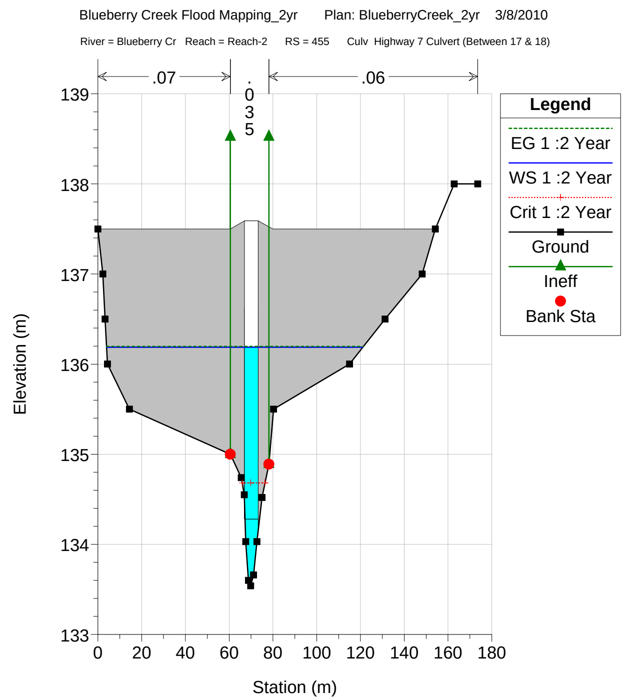

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 1250 14
.065
.035
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

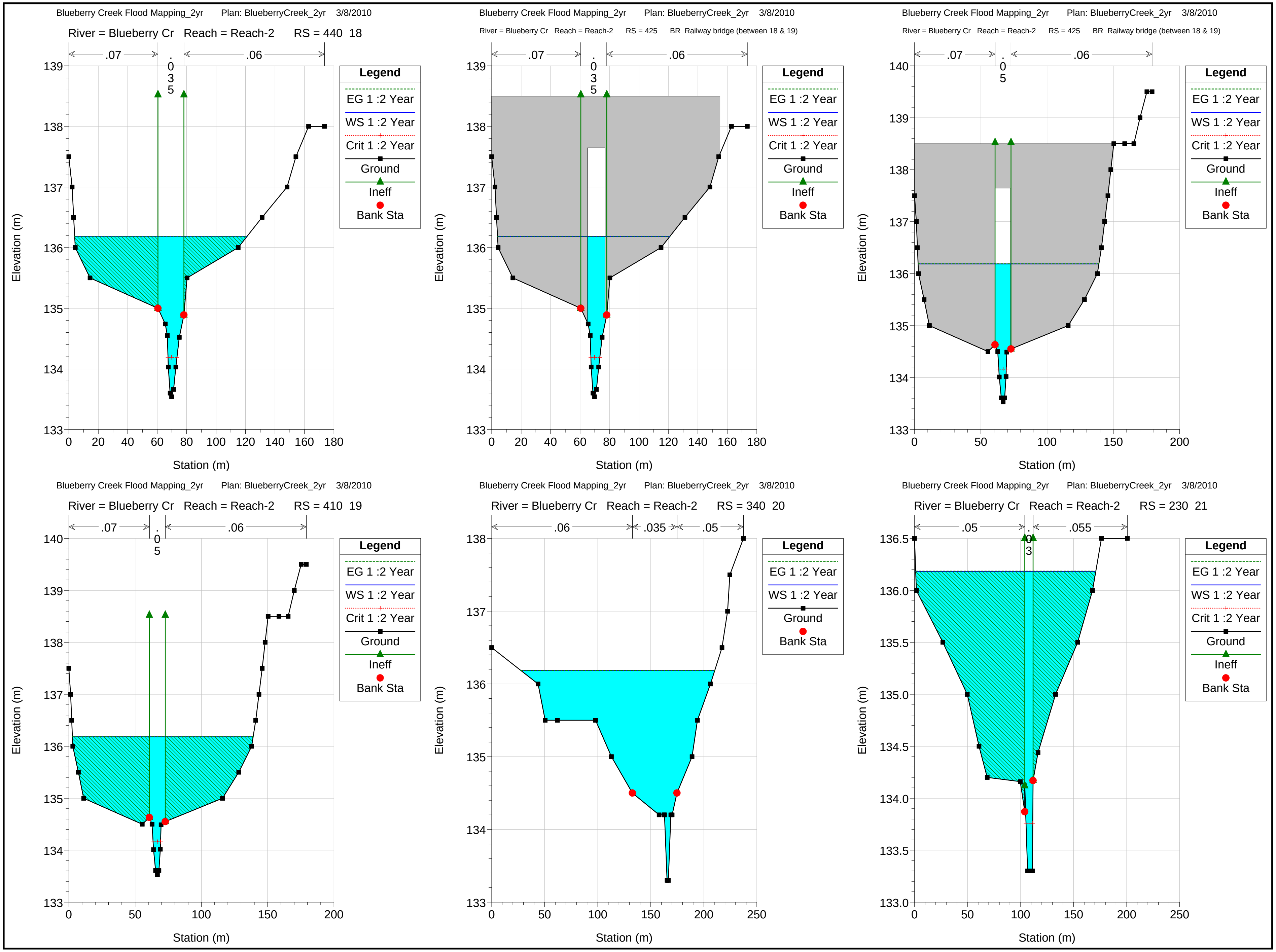

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 970 15
.065
.035
.07
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 670 16
.035
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

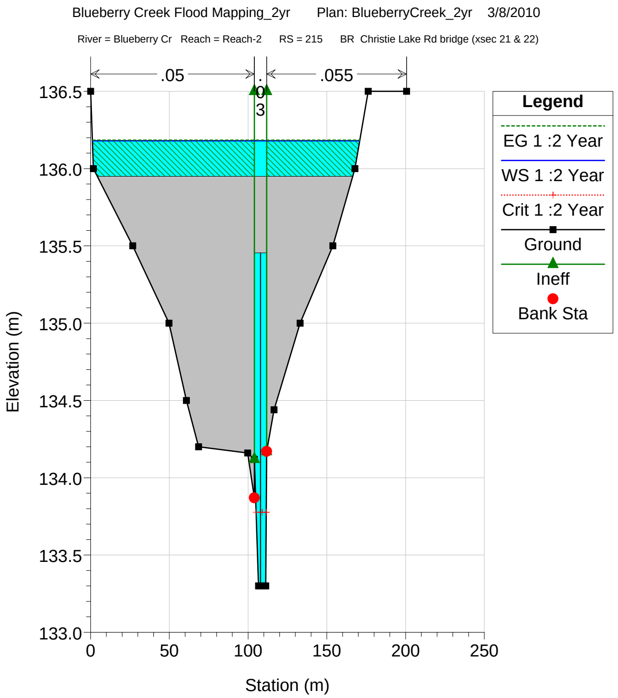

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 470 17
.07
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

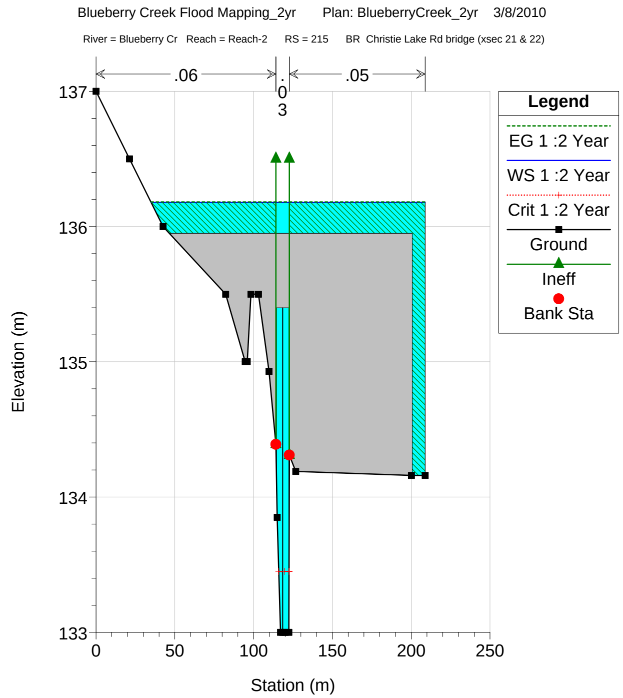

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 455 Culv Highway 7 Culvert (Between 17 & 18)
.07
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

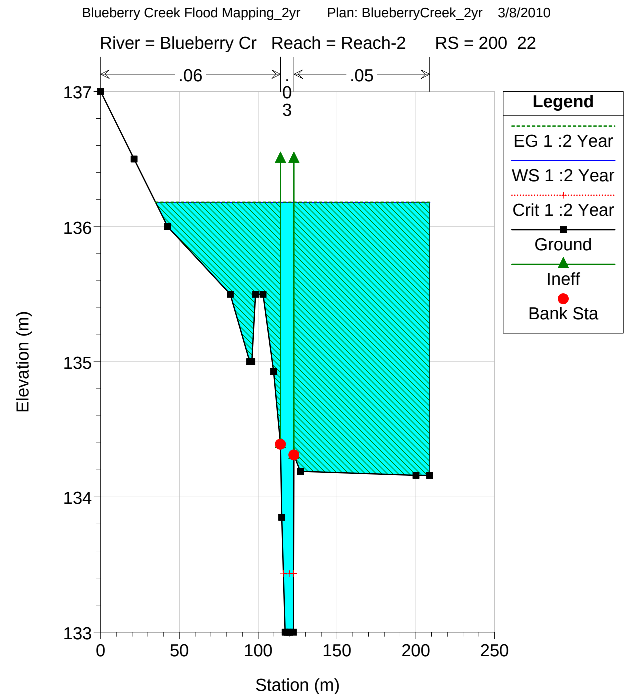

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 455 Culv Highway 7 Culvert (Between 17 & 18)
.07
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

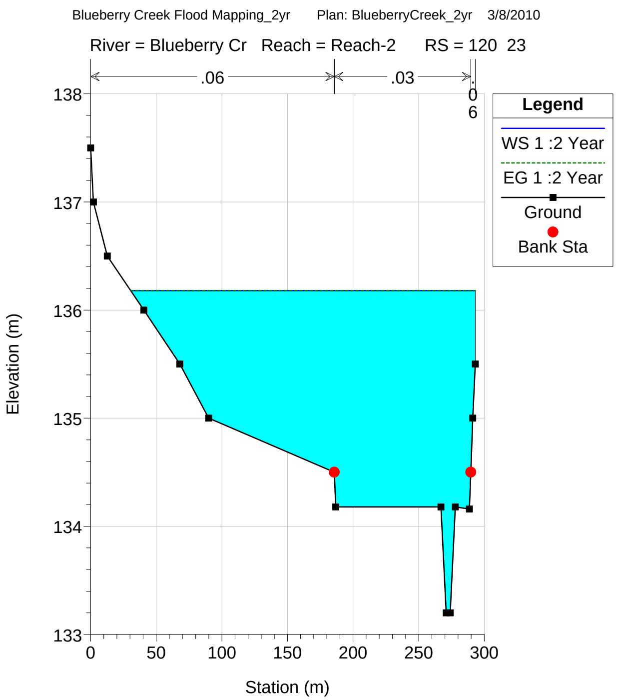


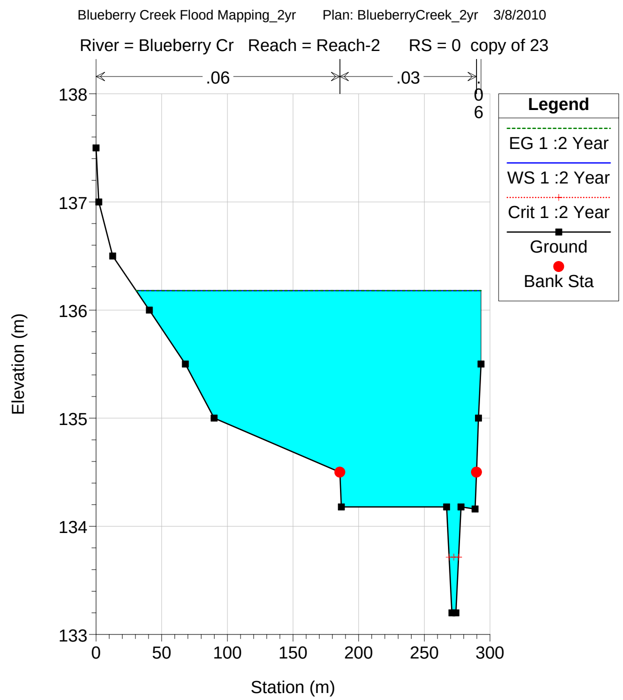
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 440 18
.07
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 425 BR Railway bridge (between 18 & 19)
.07
.035
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 425 BR Railway bridge (between 18 & 19)
.07
.05
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 410 19
.07
.05
.06
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 340 20
.06
.035
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)
Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 230 21
.05
.03
.055
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

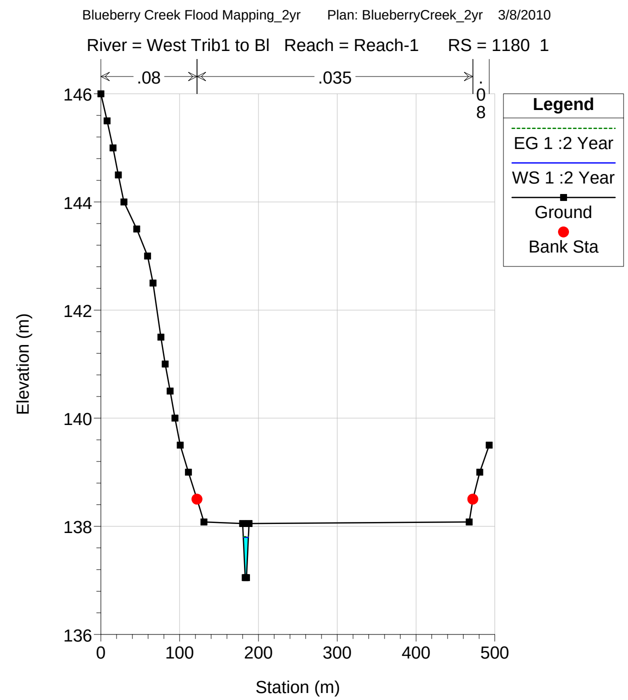

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 215 BR Christie Lake Rd bridge (xsec 21 & 22)
.05
.055
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

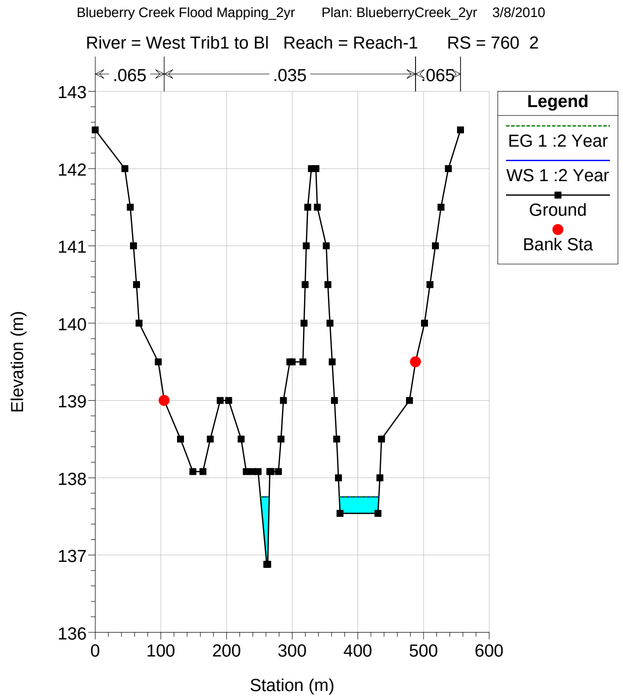

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 215 BR Christie Lake Rd bridge (xsec 21 & 22)
.06
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

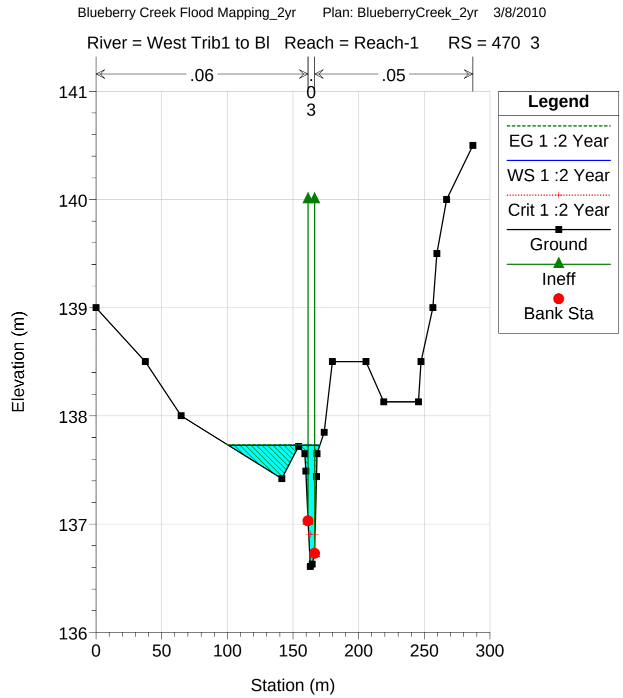

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 200 22
.06
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

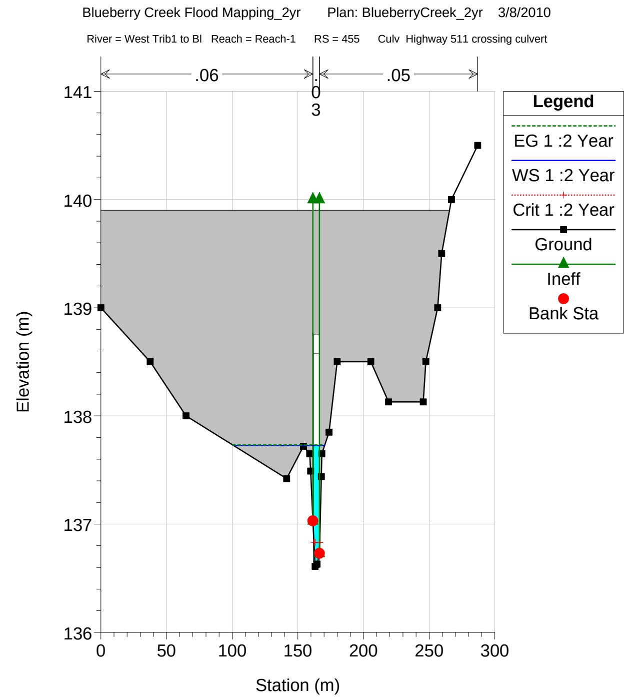

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 120 23
.06
.03
Legend
WS 1 :2 Year
EG 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

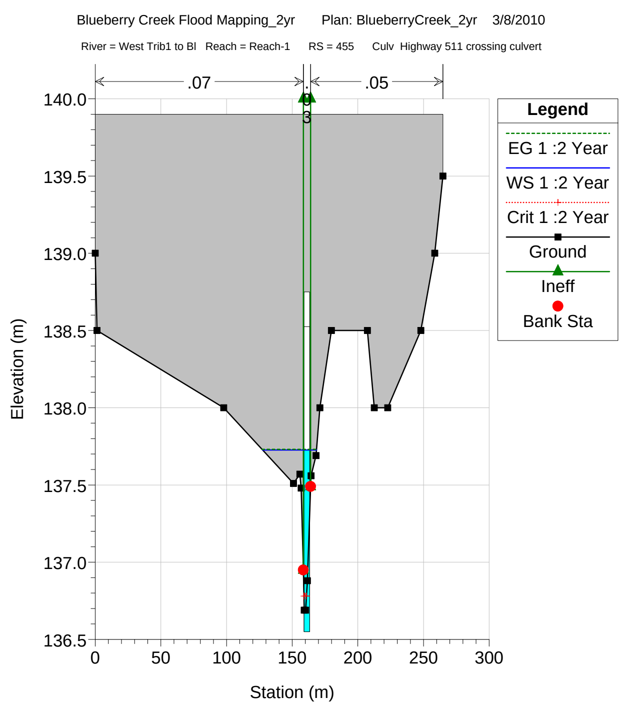

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = Blueberry Cr Reach = Reach-2 RS = 0 copy of 23
.06
.03
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

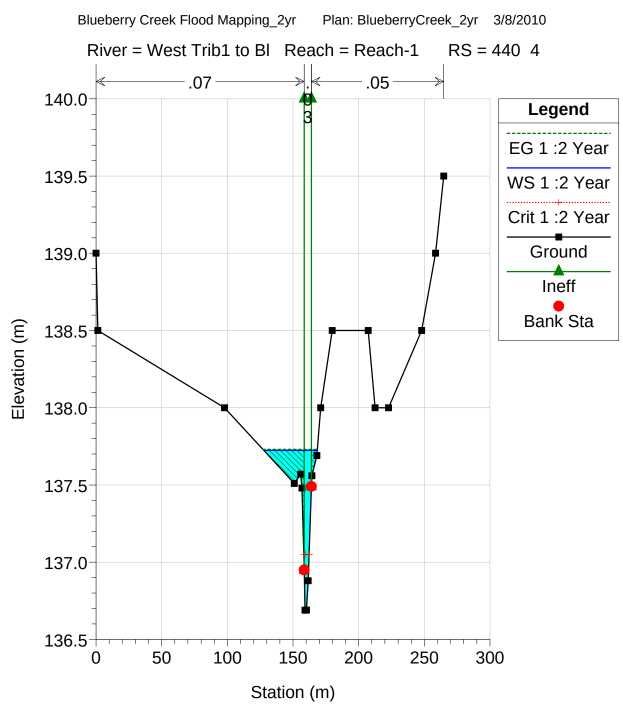

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 1180 1
.08
.035
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

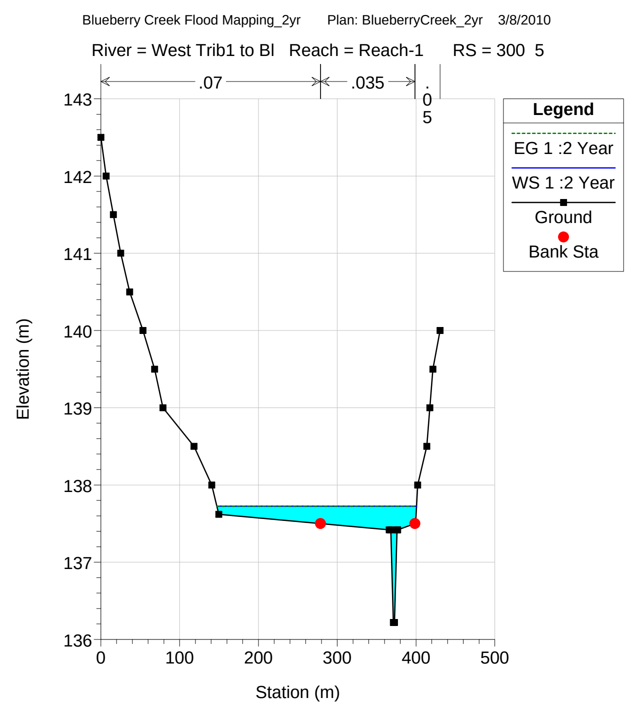

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 760 2
.065 .035 .065
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)

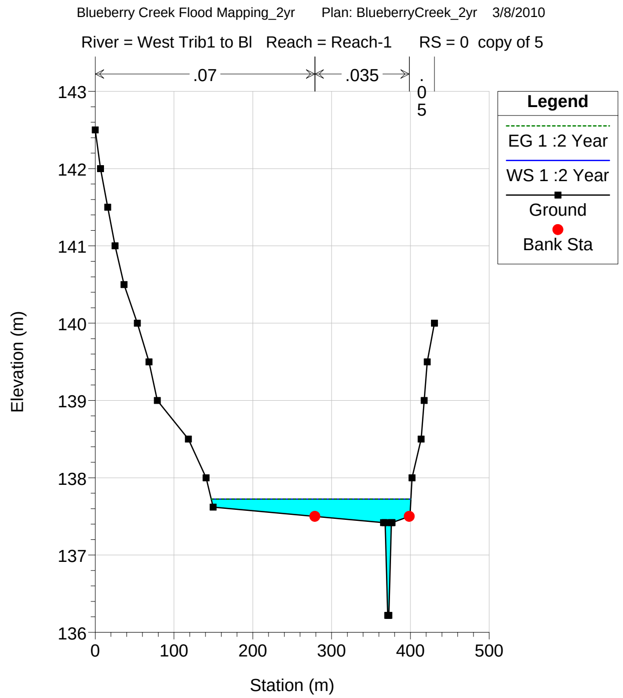

Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 470 3
.06 .05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 455 Culv Highway 511 crossing culvert
.06 .05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 455 Culv Highway 511 crossing culvert
.07 .05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 440 4
.07 .05
Legend
EG 1 :2 Year
WS 1 :2 Year
Crit 1 :2 Year
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 300 5
.07 .035
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
Station (m)



Blueberry Creek Flood Mapping_2yr Plan: BlueberryCreek_2yr 3/8/2010
River = West Trib1 to Bl Reach = Reach-1 RS = 0 copy of 5
.07
.035
.05
Legend
EG 1 :2 Year
WS 1 :2 Year
Ground
Bank Sta
Elevation (m)
143
142
141
140
139
138
137
136
0
100
200
300
400
500
Station (m)