HYDRAULIC REPORT

SOUTH TURNPIKE ROAD OVER MANSION ROAD BROOK

Town of Wallingford

May 2020

Prepared for:

Town of Wallingford
45 South Main Street
Wallingford, CT 06492

Prepared by:

Wengell, McDonnell & Costello, Inc.
Consulting Engineers
Newington, CT 06111
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Project Overview

Wengell, McDonnell & Costello Consulting Engineers (WMC) has been retained by the Town of Wallingford (Town), Connecticut to perform design and permitting services for rehabilitation of the South Turnpike Road crossing of the Mansion Road Brook. The existing crossing consists of twin 3-ft by 4-ft cast in place culverts, which also include 6-inch miters on the top corners of the openings. This structure dates to 1935. It is proposed to repair the structure. More severely damaged areas will be patched and then a spray liner will be applied to the entire interior of the culvert. The spray-on liner is anticipated to be up to a maximum of an inch thick.

The Mansion Road Brook has been studied by FEMA and has a regulatory Floodway at the culvert crossing. The proposed repairs will somewhat reduce the capacity of the culvert. The reduced culvert capacity will be compensated by placing a concrete facade on the inlet end of the culvert. The facade can be pre-cast or cast in place, and will have 45° beveled inlets into the openings – by improving the inlet efficiency, the loss of cross-sectional area is overcome, and there is actually minimal reduction to the water surface elevations, particularly more extreme flood events.

This Hydraulic Report has been prepared as supporting documentation for the project design and permitting. The report is comprehensive, as it is the only hydraulic report required for the project. This report addresses regulatory and design hydraulic modeling results; temporary conditions during construction, as well as DEEP Inland Fisheries interests.

For a culvert crossing scour is not applicable and is not addressed. However, some modification to the outlet is proposed, to prevent further undermining of the outlet end of the culvert. Note that the vertical datum used for the project survey and project hydraulic analyses reference to NAVD88.

Hydrologic Summary

The drainage area upstream of South Turnpike Road is found to be 0.94 MI^2, which places the crossing in the Small Class structure category, according to the 2000 ConnDOT *Drainage Manual* (Drainage Area less than 1 MI^2). The design frequency for Small structures, when a detailed analysis by FEMA has been done, is the 100-year (1% annual probability) flood event, with a goal of passing the design flood while also having a minimum of 1 foot of roadway freeboard. According to the New Haven County Flood Insurance Study (FIS), the culvert is located within a numbered FEMA flood zone. There is also a regulatory Floodway for the Mansion Road Brook.

Project hydrology is based on the current New Haven County FIS, dated May 16, 2017. For Mansion Road Brook, the FIS flow rates are listed in the table below.

Table 1: FIS Flow Rates

Return Frequency (Years)	Flow Rate (CFS)
10	115
50	215
100	330
500	660

The previous Town of Wallingford FIS adopted flow rates for the Mansion Road Brook based on studies done by the U.S. Geological Survey.

Hydraulics

HYDRAULIC MODEL DEVELOPMENT

FEMA Models

FIS Regulatory: The old Flood Insurance Study of the brook for the Town FIS is based on a U.S. Geological Survey (USGS) J635 water surface elevation computational software application from the mid-1980s. No model information was obtained for this project.

The J635 software had no separate subroutine for modeling culverts. The method of modeling bridges could be manipulated to create a culvert. However, no means of defining losses particular to culverts was available, and the accuracy of culverts modeled as bridges is questionable. In contrast, HEC-RAS has the culvert options defined in FHWA HDS-5 *Hydraulic Design of Highway Culverts* loaded into the culvert subroutine of the program.

Digital elevation data was obtained for the area around the culvert (See Figure 1) for use in the HEC-RAS Mapper tool. The FIS cross section locations were also downloaded to Mapper from FEMA, and cross sections for the model were obtained by overlaying sections at the FIS cross sections adjacent to the culvert crossing for extraction of the digital elevation information. Data for the culvert inverts was obtained from topographic survey performed for this project.

One option HEC-RAS does not have is the opportunity to create a user-defined culvert configuration, which is needed to accurately model the culvert at S. Turnpike, which has 6-inch miters at the top corners. In HEC-RAS this can be worked around by reducing the culvert dimensions to compensate for the loss in area due to the miters. The size of the culverts is further reduced for the proposed condition, due to the added liner thickness.

However, to verify the existing and proposed culvert configurations, the culverts are also analyzed using the FHWA HY-8 software. HY-8 was created as a software application of the information contained in HDS-5. HY-8 includes the option of a user-defined culvert shape, which allows for analysis of the true culvert configuration in the existing and proposed conditions, including the beveled inlet proposed for the rehabilitated culvert.

Existing Structures

The existing crossing is twin cast in place 3-ft high by 4-ft wide concrete box culverts, with 6-inch miters on the top corners. Both ends of the culvert are 90° walls. Upstream, the brook approaches the culvert from a sharp angle, and because of the sharp entrance angle and less than optimal inlet configuration, velocity drops at the inlet, and there are deposits of sand and sediment around the inlet. At the outlet a large scour hole has developed, and is threatening the downstream cutoff wall. Some use of stone and/or riprap is required to move the discharge away from the downstream end of the culvert.

The design and regulatory hydraulic models use the FIS regulatory flow rates. The start of the regulatory hydraulic model uses Known Elevations, taken from the FIS Floodway Table and brook profile.

Existing Condition Models

The Existing Condition model consists of cross sections and the structure in the reach of the brook near the culvert. Refer to the cross-section location plan in Appendix C. Manning's roughness coefficients were estimated for the observed conditions. The interior of the culvert is in poor condition, so the Manning's n values used are higher than normal. Ineffective flow limits were established at appropriate locations. Expansion and contraction coefficients are also revised from normal for the inlet, because of the jagged inlet condition. The outlet coefficient is left at the normal value.

Existing Design Model: Unencroached runs were performed for the 10-, 50-, 100-, and 500-year flood events.

Design analysis is run in the mixed flow regime; HEC-RAS calculates subcritical and supercritical profiles and selects the best alternative at each cross section. Starting water surface elevations for the design models utilizes the Normal Depth condition at both ends of the model. The slopes used are based on observation of the output from draft runs of the model, with the slope adjusted until the model output energy grade line slope is similar to the estimated slope and becomes nearly steady. The ends of the model are set far enough away from the culvert to allow for the water surface profile to merge to a true depth before reaching the culvert.

Existing Regulatory Model: Geometry for the Floodway model is identical to the Design model. Floodway widths for published cross sections are according to the Floodway Table in the FIS, which also correspond to the Floodway widths observed in the FIS. Intermediate cross section Floodway widths are based on scaling of the Floodway boundary on the FIRM maps.

Regulatory analysis is run in the subcritical flow regime; HEC-RAS calculates subcritical profiles only. For the initial calibration run the downstream end of the model is set to the published water surface elevations in the Floodway Table. For the other water surface elevations, the flood profile is used to estimate the 10-yr, 50-yr, and 500-yr water surface elevations. However, it is clear that a combination of the flood of the Quinnipiac River and the downstream crossing of the Wilbur Cross Parkway affects the water surface elevations at South Turnpike Road. For the remainder of the regulatory models, the downstream (starting) water surface elevations are based on the normal depth. Normally, this is the procedure for regulatory modeling, as it is the only way to truly verify the water surface profiles for the existing and proposed conditions. In tidal and backwater conditions the regulatory models frequently ingnore the downstream condition.

Proposed Structures

The proposed structure is edited from the Existing Condition model. This means editing of the existing culvert to show the proposed structure. The proposed structure dimensions are reduced by 0.08 feet all around. It is estimated that the maximum thickness of the liner is approximately 1-inch. A thickness of 0.08 feet equates to 0.96 inches. In HEC-RAS the beveled inlet allows for a reduction of the inlet head loss coefficient from 0.6 to 0.2, which results in improved hydraulics at the entrance to the culvert.

Proposed Condition Models

The Existing Condition model is amended to show the proposed culvert. In addition, the Manning's n value is reduced for the anticipated improvements associated with the spray-on inner coating. The inlet coefficient is reduced in anticipatation of the installation of a beveled inlet arrangement. The inlet face of the culvert will be amended by use of a precast concrete unit or a cast in place pouring to improve the inlet efficiency. This is needed to compensate for the reduced culvert dimensions from the lining.

Proposed Design Model: The geometry edits are made to the model. Design analysis is again run in the mixed flow regime; HEC-RAS calculates subcritical and supercritical profiles and selects the best alternative at each cross section.

Proposed Floodway Model: The Proposed Condition hydraulic model is re-run, with the same encroachment stations as for the Existing Condition model.

Floodway analysis is again run in the subcritical flow regime; HEC-RAS calculates subcritical profiles only.

Natural Condition Hydraulic Model

A Natural Condition model is provided. For the Natural Condition, all manmade effects are eliminated from the model, to see how much the manmade impacts affect water surface elevations. For the Natural Condition model, expansion and contraction coefficients are adjusted to the natural stream values. Ineffective flow areas associated with the removed structures are also omitted. DEEP hydraulic guidance wishes for the Proposed Condition to be within one foot of the Natural Condition.

Table 7 on page 13 compares the Natural Condition to the Proposed Condition and the effects of the proposed culvert on the Natural Condition. The Proposed Condition water surface elevations are not within one foot of the Natural Condition for the reach of the brook affected by the Proposed Condition. However, the increase is generally similar to the existing condition, so negative impacts are not anticipated.

HY-8 Models

As noted above, HEC-RAS does not allow for a user-defined culvert configuration. To ensure that the HEC-RAS results were reasonable, existing and proposed condition HY-* models were created. The true shape of the culvert is defined, and generally the manning's n and coefficient values applied in HEC-RAS are also used in the HY-8 models. However, the one instance where HY-8 does not allow flexibility is in definition of the contraction coefficient at the culvert inlet. It was necessary to select the projecting inlet option to address the poor inlet condition in the existing condition.

TEMPORARY CONDITIONS

Refer to the plans for details of the temporary condition. In summary, one of the boxes will be blocked during normal flow conditions and then repaired. In normal conditions, the average flow can be handled in a single box without any difficulty. This condition was modeled and only a slight increase in water surface elevation occurs. Once the first culvert is repaired te process is reversed.

TEMPORARY CONDITION ANALYSIS

Following the procedure described in Section 6, Appendix F of the *Drainage Manual*, it was estimated that for an expected in-stream construction duration of ±2 weeks, the temporary design frequency is the Spring Day flood event. In accordance with Section 6.15 of the ConnDOT *Drainage Manual*, the water handling plan was developed to provide guidance for the Construction Contractor. Installing cofferdams to an elevation below the recommended height or providing a hydraulic opening less than recommended width will provide reduced protection of the Contractor's work.

The hydraulic analyses indicate that the temporary condition will cause little change to the Spring Day water surface profile from existing conditions upstream of the culvert. Changes in the temporary condition are confined to the inlet reach just upstream of the proposed repairs. As there are no structures located near the culvert, the increase is not considered to present an impact to existing structures.

The top of cofferdam elevation is recommended to be one foot above the inlet elevation, which leaves significant freeboard for the design event. The top of the cofferdams is well below the adjacent roadways, and no impacts are anticipated due to the temporary condition.

Summary of Design Consistency

INLAND FISHERIES

DEEP Inland Fisheries reviewed this project and initially was satisfied with the proposed design. The standard TOY restriction (June 1 to September 30) is recommended for unconfined work in the stream. However, unconfined work is not proposed.

DEEP Fisheries wishes for the deep scour hole at the outlet to remain, as a habitat for various aquatic organisms. However, there is a concern for the scour hole undermining the outlet of the culvert and the roadway embankment. Therefore, it is proposed to use some large boulders, top-dressed with Standard riprap, to protect the outlet. The likely impact to the scour hole is to move it downstream slightly, further away from the outlet, but have the scour hole length be similar to the existing condition.

Summary of Regulatory Consistency

The following Regulatory criteria are applicable to the proposed structure:

10-Year Flood Encroached Event Analysis

The hydraulic analyses indicate that for the 10-year flow rate, the water surface profile upstream of the proposed structure will have a 0.1 to 0.2-foot decrease, in comparison to existing conditions. Refer to Table 3 on page 9 for a comparison of existing and proposed water surface elevations.

100-Year Flood Encroached Event Analysis

The hydraulic analyses indicate that for the 100-year flow rate, the proposed water surface profile upstream of the proposed culvert will have a 0.02-foot decrease, in comparison to existing conditions. Refer to Table 5 on page 11 for a comparison of existing and proposed water surface elevations.

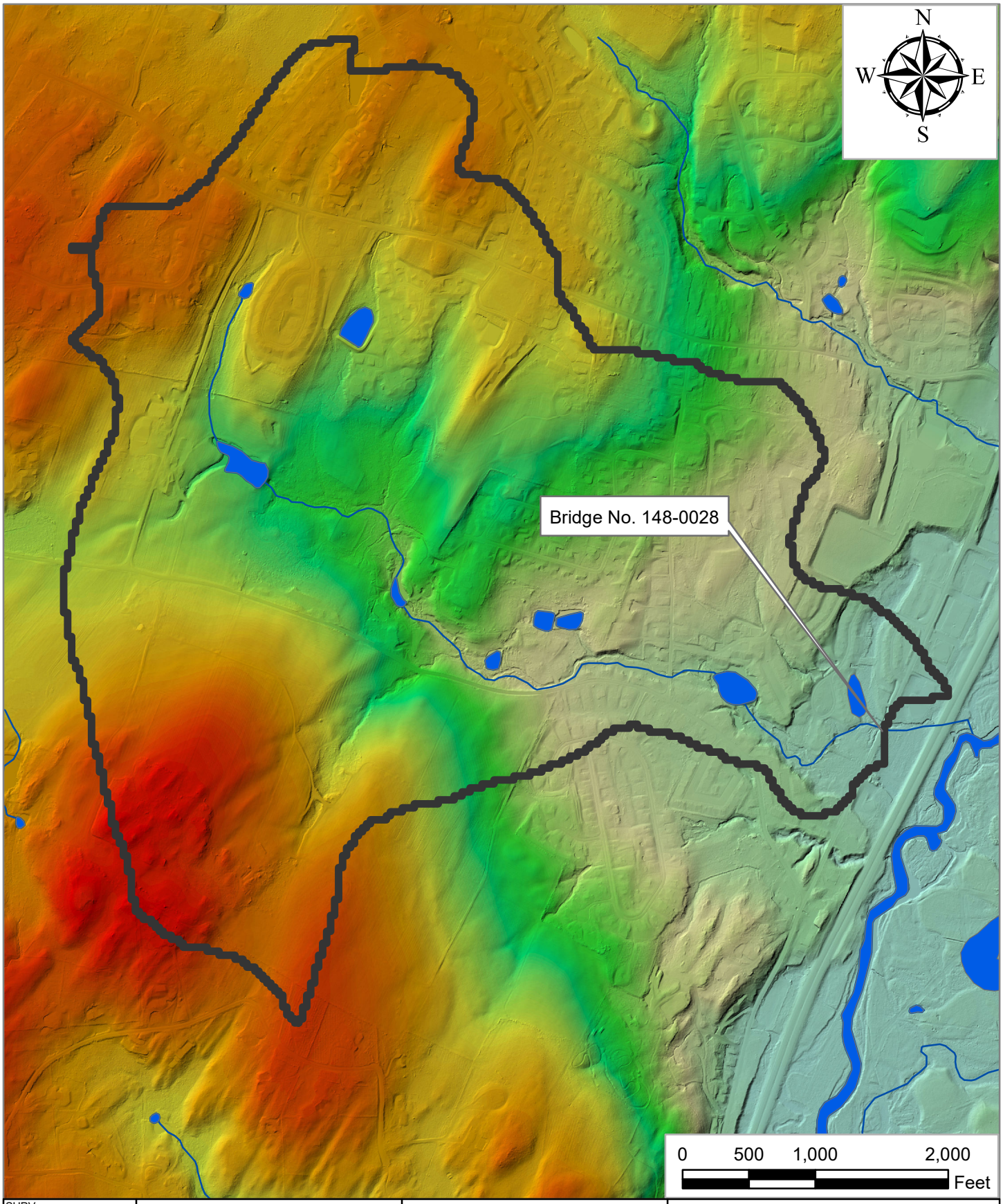
Summary of Scour Analysis

GENERAL BACKGROUND

A significant scour hole has been present over time at the outlet of the culvert. The significant drop at the outlet causes scour, or at least maintains the existing condition. The existing condition is not favorable for the culvert or the roadway embankment. However, as noted above, DEEP Inland Fisheries sees the scour hole as a positive for fish and other organisms in the stream, so an armored outlet, designed to normal standards, is not an option at this location.

MITIGATION

It is proposed to construction a rock protection arrangement that is essentially a ramp at the culvert outlet. Large (3-4 foot) boulders will be stacked 2-high at the outlet, and then dressed with standard riprap to fill voids and make a fairly smooth transition down to the stream bottom. This will protect the outlet and embankment without taking up a large segment of the stream channel. Over time, sediment will fill the voids between the rocks and cement the outlet arrangement in place.



SUPV.	SRM
DESIGN	MEF
DRAWN	MEF
CHECKED	
DATE	MAY 14, 2020

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DIGITAL ELEVATION MODEL

SO TURNPIKE RD OVER MANSION ROAD BRK
WALLINGFORD, CT

PROJECT	FILE NAME	NUMBER	REV.	SHEET	OF
S TURNPIKE	DRAINAGE AREA	16032	-	1	1

Table 2: Comparison; 100-Year Regulatory - Published, Existing, and Reproduced

Section ID[1]	FIS ID	CWSEL (FT-NAVD88)									
		Encroached					Unencroached				
		(1)	(2)	(3)	(2)-(1)	(3)-(1)	(4)	(5)	(6)	(5)-(4)	(6)-(4)
		Published FIS	Reproduced (Effective)	Existing (Amended)	Δ (FT)	Δ (FT)	Published FIS	Reproduced (Effective)	Existing (Amended)	Δ (FT)	Δ (FT)
875	F	31.7	N/A	31.0	-----	- 0.7	30.7	N/A	30.3	-----	- 0.4
860	E	31.7	N/A	31.0	-----	- 0.7	30.7	N/A	30.3	-----	- 0.4
845[1]	---	-----	N/A	31.0	-----	-----	-----	N/A	30.3	-----	-----
666	D	31.7	N/A	30.9	-----	- 0.8	30.7	N/A	30.3	-----	- 0.4
650	**South Turnpike Road Culvert**										
625	C	30.0	N/A	30.0	-----	0.0	29.0	N/A	29.0	-----	0.0
340	B	30.0	N/A	30.0	-----	0.0	29.0	N/A	29.0	-----	0.0

1. Sections added for HEC-RAS – not in effective model

Table 3: Comparison, 10-Year Regulatory Flood Event[2], Existing versus Proposed, Encroached & Unencroached Condition Elevations

Section ID[1]	FIS ID	CWSEL					
		Encroached			Unencroached		
		(1)	(2)	(2)-(1)	(3)	(4)	(4)-(3)
		Existing	Proposed	Δ (FT)	Existing	Proposed	Δ (FT)
875	F	25.82	25.68	- 0.14	25.82	25.68	- 0.14
860	E	25.83	25.69	- 0.14	25.83	25.69	- 0.14
845[1]	---	25.69	25.51	- 0.18	25.69	25.51	- 0.18
666	D	25.62	25.44	- 0.18	25.62	25.44	- 0.18
650	**South Turnpike Road Culvert**						
625	C	21.93	21.93	0.00	21.92	21.92	0.00
340	B	20.93	20.93	0.00	20.93	20.93	0.00

1. Sections added for HEC-RAS – not in effective model
2. Regulatory model with alternate starting WSEL

Table 4: Comparison; 10-Year Design Flood Event, Existing versus Proposed

Station ID	FIS ID	Condition				Comparison		
		Existing		Proposed				
		(1)	(2)	(3)	(4)	(3) - (1)	(4) - (2)	(4/2)-1
		WSEL (FT)	Velocity (FT/S)	WSEL (FT)	Velocity (FT/S)	WSEL (FT)	Velocity (FT/S)	Vel. Change (%)
875	F	25.82	2.55	25.68	2.79	- 0.14	0.24	9.4
860	E	25.83	1.91	25.69	2.05	- 0.14	0.14	7.3
845[1]	---	25.69	3.21	25.51	3.59	- 0.18	0.38	11.8
666	D	25.62	3.32	25.44	3.55	- 0.18	0.23	6.9
650	**South Turnpike Road Culvert**							
625	C	22.39	2.82	22.39	2.82	0.00	0.00	0.0
340	B	22.33	0.93	22.33	0.93	0.00	0.00	0.0

1. Sections added for HEC-RAS – not in effective model

Table 5: Comparison, 100-Year Regulatory Flood Event[2], Existing versus Proposed, Encroached & Unencroached Condition Elevations

Section ID[1]	FIS ID	CWSEL					
		Encroached			Unencroached		
		(1)	(2)	(2)-(1)	(3)	(4)	(4)-(3)
		Existing	Proposed	Δ (FT)	Existing	Proposed	Δ (FT)
875	F	30.34	30.32	- 0.02	30.16	30.33	0.17
860	E	30.34	30.32	- 0.02	30.16	30.33	0.17
845[1]	---	30.32	30.30	- 0.02	30.16	30.33	0.17
666	D	30.29	30.27	- 0.02	30.12	30.30	0.18
650	**South Turnpike Road Culvert**						
625	C	22.89	22.89	0.00	22.90	22.90	0.00
340	B	22.08	22.08	0.00	22.07	22.07	0.00

1. Sections added for HEC-RAS – not in effective model
2. Regulatory model with alternate starting WSEL

Table 6: Comparison, 100-Year Design Flood Event, Existing versus Proposed

Station ID	FIS ID	Condition				Comparison		
		Existing		Proposed				
		(1)	(2)	(3)	(4)	(3) - (1)	(4) - (2)	(4/2)-1
		WSEL (FT)	Velocity (FT/S)	WSEL (FT)	Velocity (FT/S)	WSEL (FT)	Velocity (FT/S)	Vel. Change (%)
875	F	30.16	1.14	30.33	1.06	0.17	- 0.08	- 7.0
860	E	30.16	0.93	30.33	0.88	0.17	- 0.05	- 5.4
845[1]	---	30.16	1.00	30.33	0.94	0.17	- 0.06	- 6.0
666	D	30.11	1.93	30.30	1.75	0.19	- 0.18	- 9.3
650	**South Turnpike Road Culvert**							
625	C	23.76	3.77	23.76	3.77	0.00	0.00	0.0
340	B	23.74	1.33	23.74	1.33	0.00	0.00	0.0

1. Section added for HEC-RAS – not in effective model

Table 7: Comparison, 100-Year Design Flood Event, Natural versus Proposed

Station ID	FIS ID	Condition				Comparison		
		Natural		Proposed				
		(1)	(2)	(3)	(4)	(3) - (1)	(4) - (2)	(4/2)-1
		WSEL (FT)	Velocity (FT/S)	WSEL (FT)	Velocity (FT/S)	WSEL (FT)	Velocity (FT/S)	Vel. Change (%)
875	F	26.77	4.66	30.33	1.06	3.56	- 3.60	- 77.3
860	E	26.80	3.47	30.33	0.88	3.53	- 2.59	- 74.6
845[1]	---	26.64	4.73	30.33	0.94	3.69	- 3.79	- 80.1
666	D	25.58	8.37	30.30	1.75	4.72	- 6.62	- 79.1
650	**South Turnpike Road Culvert**							
625	C	23.71	3.83	23.76	3.77	0.05	- 0.06	- 1.6
340	B	23.74	1.33	23.74	1.33	0.00	0.00	0.0

1. Sections added for HEC-RAS – not in effective model

Appendix A - Plans (Under Separate Cover)

WMC Consulting Engineers
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Appendix B - Maps

WMC Consulting Engineers
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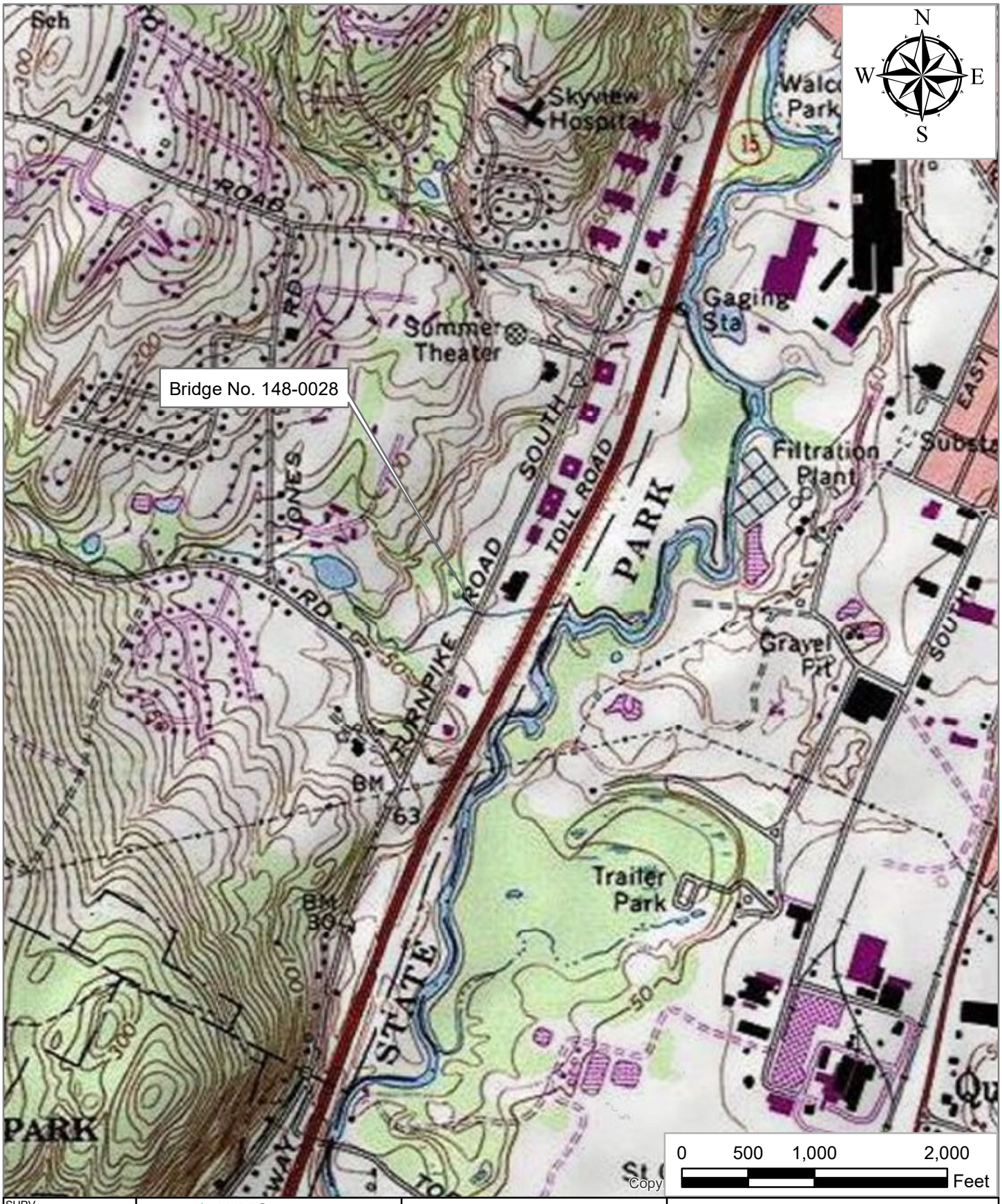
Appendix B Contents



SUPV.	SRM
DESIGN	MEF
DRAWN	MEF
CHECKED	
DATE	MAY 14, 2020

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LOCATION MAP

SO TURNPIKE RD OVER MANSION ROAD BRK
WALLINGFORD, CT

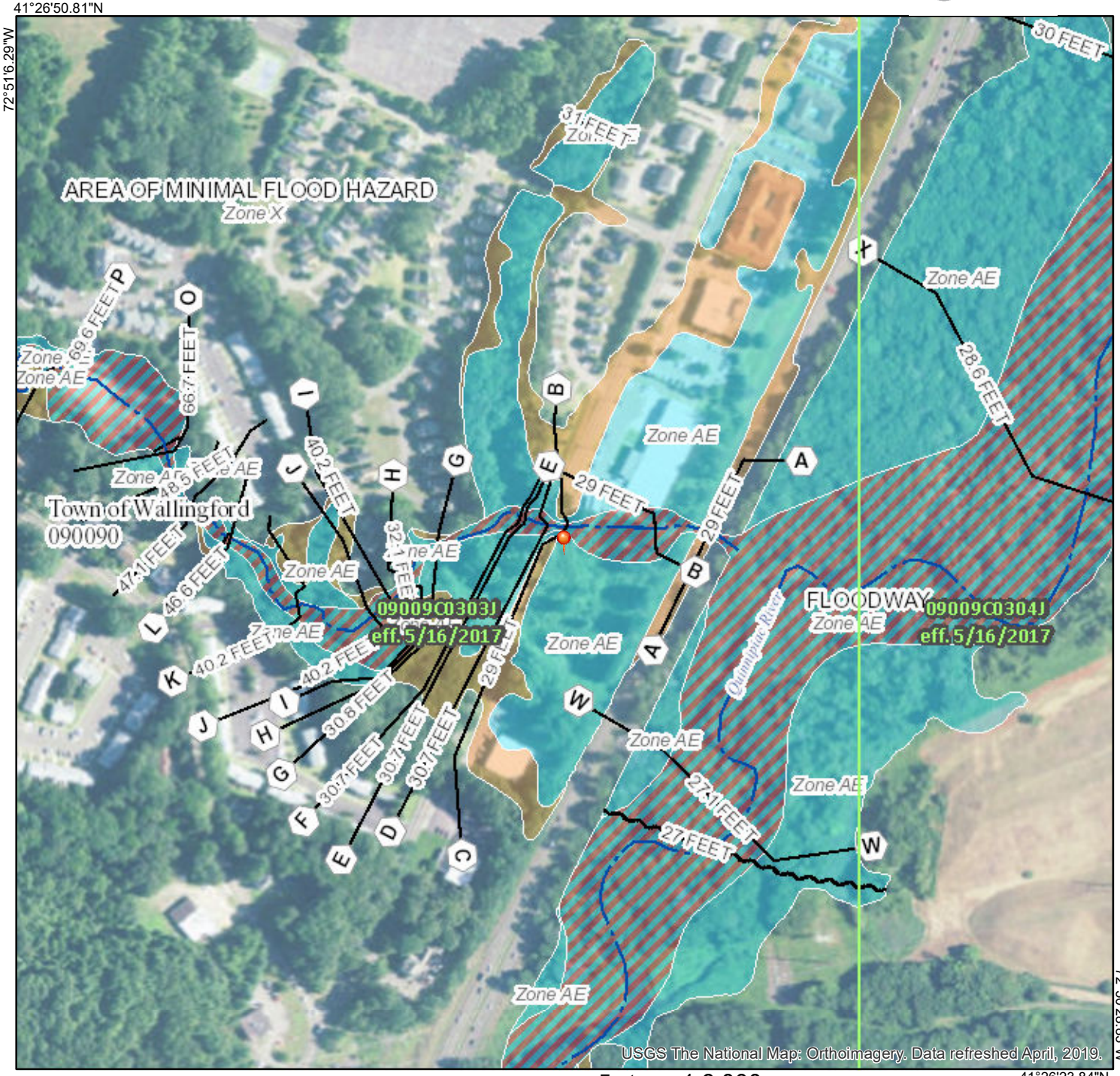
PROJECT	FILE NAME	NUMBER	REV.	SHEET	OF
S TURNPIKE	LOCATION MAP	16032	--	1	1

National Flood Hazard Layer FIRMette

FEMA

41°26'50.81"N

72°51'6.29"W



72°50'28.83"W

41°26'23.84"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2020 at 7:54:30 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

SUPV.	SRM
DESIGN	MEF
DRAWN	MEF
CHECKED	
DATE	MAY 14, 2020

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AERIAL MAP

SO TURNPIKE RD OVER MANSION ROAD BRK
WALLINGFORD, CT

PROJECT	FILE NAME	NUMBER	REV.	SHEET	OF
S TURNPIKE	LOCATION MAP	16032	--	1	1

SUPV.	SRM
DESIGN	MEF
DRAWN	MEF
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DRAINAGE AREA MAP

SO TURNPIKE RD OVER MANSION ROAD BRK
WALLINGFORD, CT

PROJECT	FILE NAME	NUMBER	REV.	SHEET	OF
S TURNPIKE	DRAINAGE AREA	16032	-	1	1

Appendix C - Hydraulic Data

WMC Consulting Engineers
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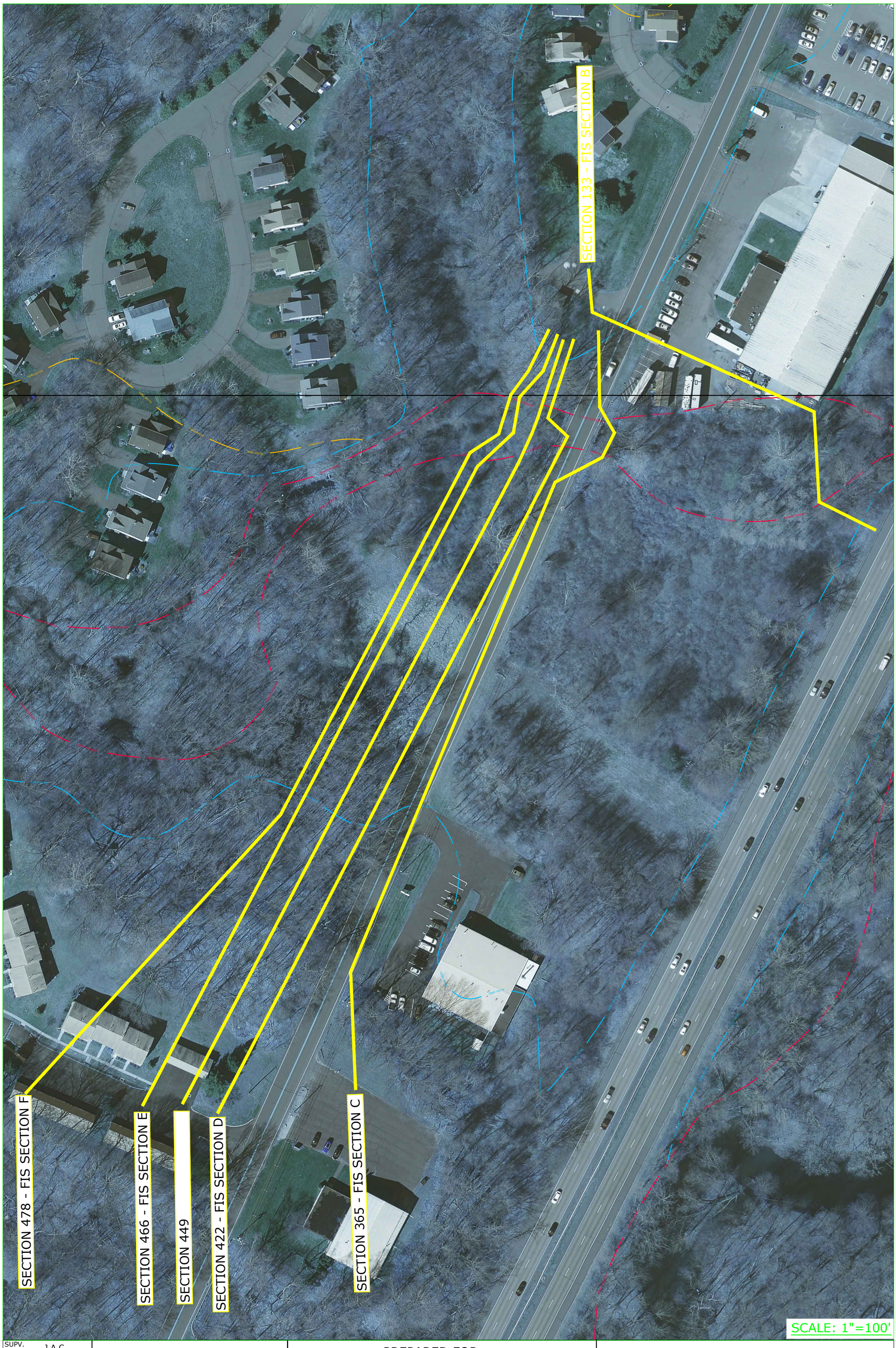
Appendix C - Contents



SUPV.	J.A.C.
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CHECKED	
DATE	5/15/2020

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PREPARED FOR:

TOWN OF WALLINGFORD

45 SOUTH MAIN STREET

WALLINGFORD, CT 06492

SOUTH TURNPIKE ROAD OVER MANSION ROAD BRK
CROSS SECTION MAP
FIS SECTIONS - FEMA MSC GIS

PROJECT	FILE NAME	NUMBER	REV.	SHEET	OF
SOUTH TURNPIKE ROAD OVER MANSION ROAD BROOK	HYDRAULIC REPORT – CROSS SECTION	16032	0	1	1

FHWA HY-8 HYDRAULIC MODELS

HY-8 Culvert Analysis Report

Project Notes

Project Title: South Turnpike Road over Mansion Road Brook Culvert Rehabilitation

Designer: M. Fanning, PE

Project Date: Wednesday, May 13, 2020

Notes: Repair and line twin 3 x 4 boxes – Existing Condition model

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 22.50 ft

Outlet Station: 41.50 ft

Outlet Elevation: 22.40 ft

Number of Barrels: 2

Culvert Notes: Culvert 1

Existing Twin culverts under So Turnpike Rd, Wallingford, CT

Culvert Data Summary - Culvert 1

Barrel Shape: User Defined – top corners mitered 6-inches

Barrel Span: 4.00 ft

Barrel Rise: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 0.0240 (bottom)

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting (poor condition in existing condition)

Inlet Depression: None

Table 1 - Culvert Summary Table: Culvert 1

Total Discharge (CFS)	Culvert Discharge (CFS)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
115.00	115.00	26.00	3.169	3.496	7-M2c	3.000	1.858	1.858	2.191	7.736	2.366
169.50	169.50	27.36	4.463	4.856	7-M2c	3.000	2.407	2.407	2.761	8.804	2.697
224.00	224.00	29.20	6.347	6.704	7-M2c	3.000	2.777	2.777	3.258	10.153	2.957
278.50	253.86	30.34	7.621	7.839	7-M2c	3.000	2.946	2.946	3.704	10.956	3.172
330.00	262.00	30.66	8.005	8.163	7-M2c	3.000	2.990	2.990	4.093	11.178	3.347
387.50	269.24	30.96	8.347	8.459	6-FFc	3.000	3.000	3.000	4.496	11.457	3.518
442.00	275.18	31.21	8.627	8.706	6-FFc	3.000	3.000	3.000	4.854	11.710	3.664
496.50	280.50	31.43	8.878	8.933	6-FFc	3.000	3.000	3.000	5.193	11.936	3.795
551.00	285.37	31.65	9.126	9.144	6-FFc	3.000	3.000	3.000	5.515	12.143	3.916
605.50	289.47	31.85	9.347	9.325	6-FFc	3.000	3.000	3.000	5.822	12.318	4.027
660.00	293.01	32.04	9.540	9.484	6-FFc	3.000	3.000	3.000	6.117	12.469	4.131

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Straight Culvert

Inlet Elevation (invert): 22.50 ft, Outlet Elevation (invert): 22.40 ft

Culvert Length: 41.50 ft, Culvert Slope: 0.0024

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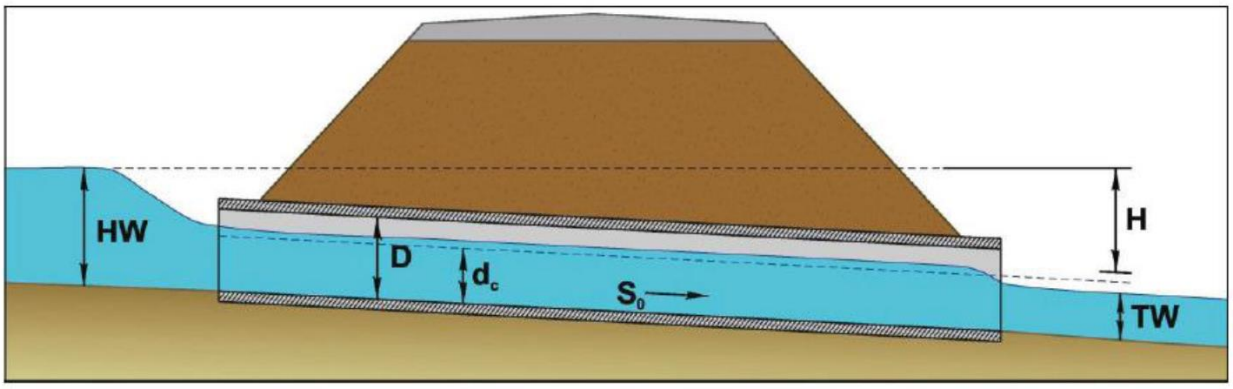
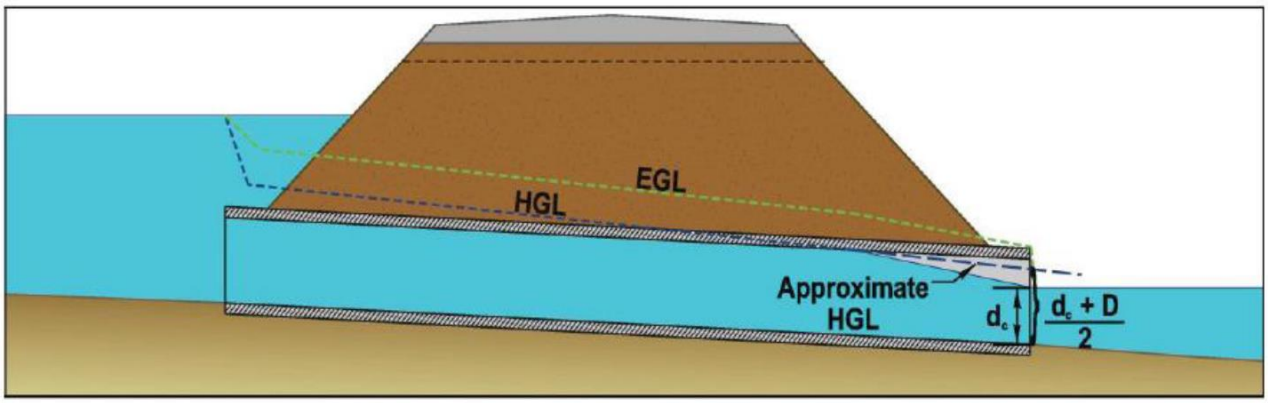
HY-8 Flow Type Numbers				
Flow Type	**Flow Control**	**Submerged Inlet HW>D**	**Submerged Outlet TW>D**	**Length Full**
1	Inlet	No	No	None
5	Inlet	Yes	No	None
2	Outlet	No	No	None
3	Outlet	No	No	None
4	Outlet	Yes	Yes	All
6	Outlet	Yes	No	Most
7	Outlet	Yes	No	Part

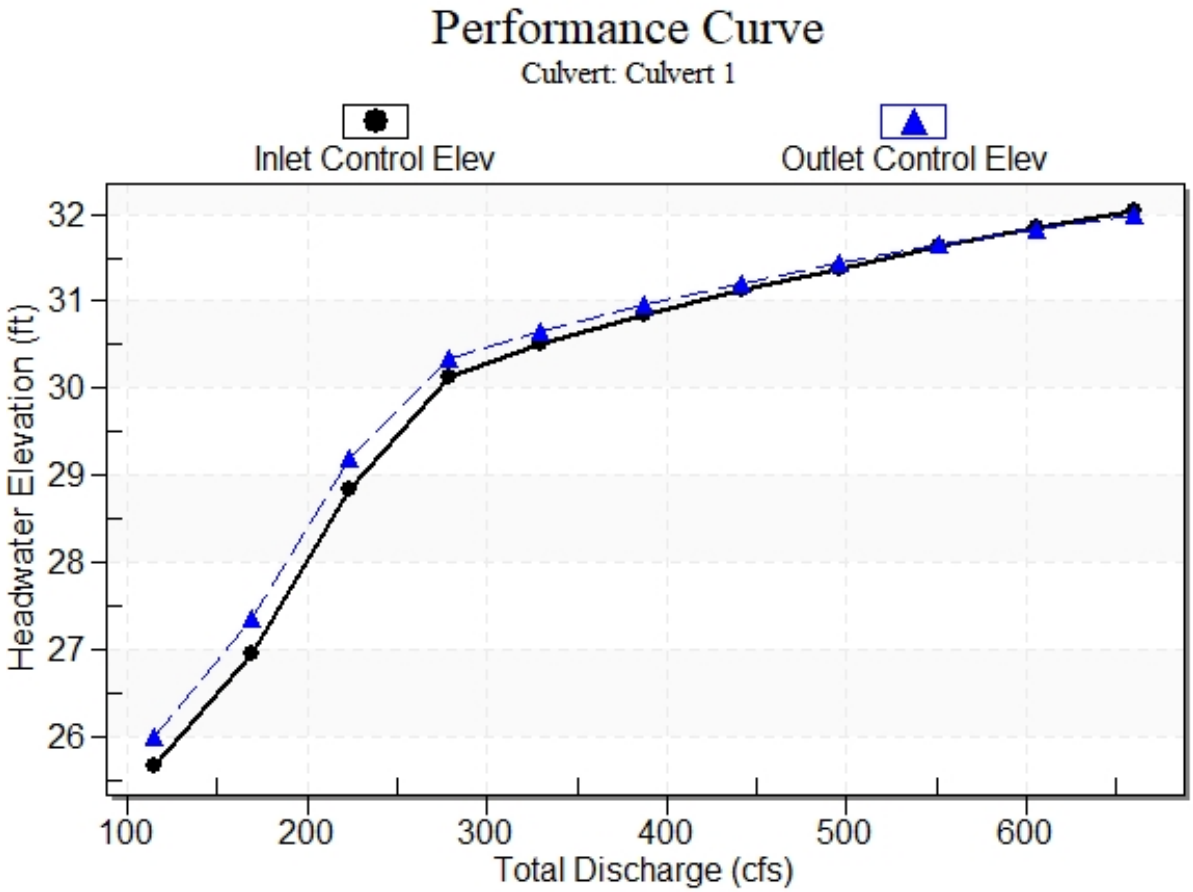
Flow Type 2



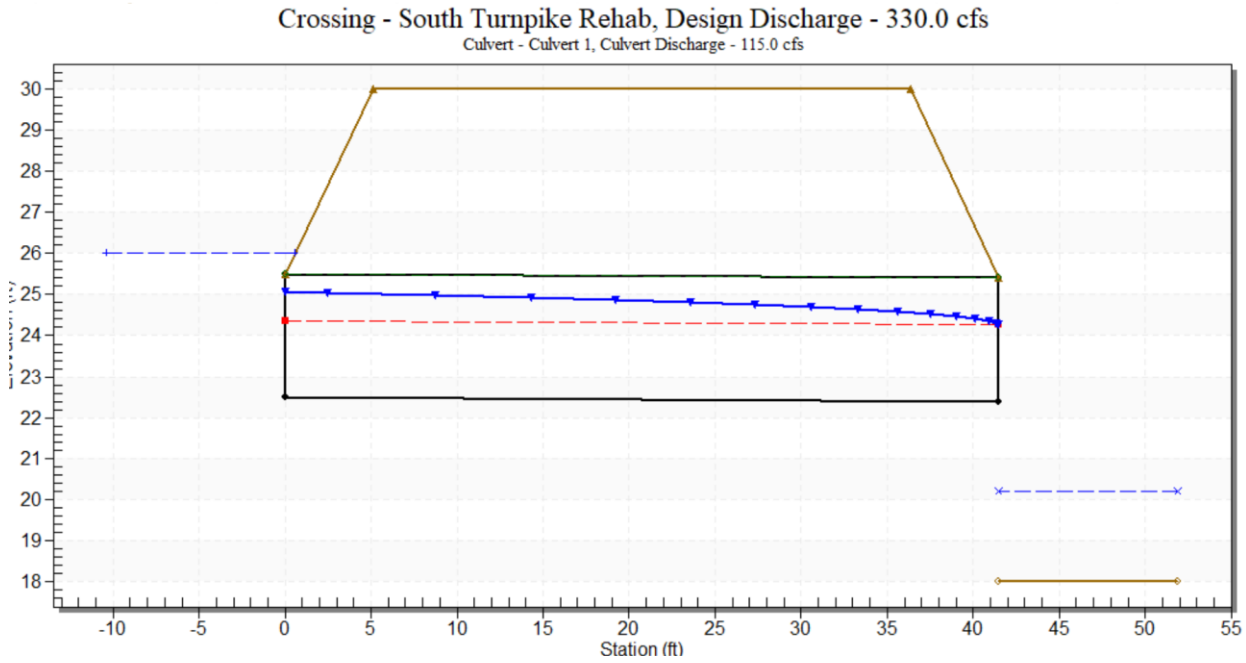
Flow Type 7

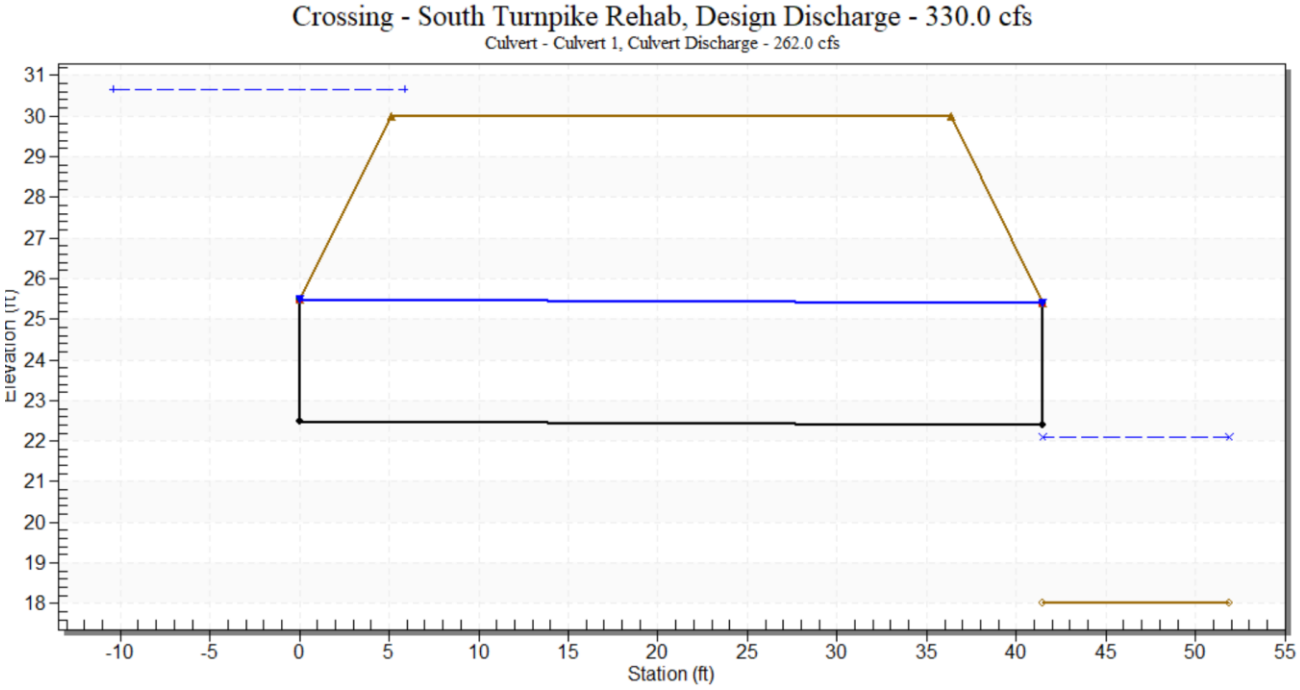


Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1





Roadway Data for Crossing: South Turnpike Rehab

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 41.50 ft

Crest Elevation: 30.00 ft

Roadway Surface: Paved

Roadway Top Width: 31.25 ft

Crossing Notes: South Turnpike Rehab

Flow approaches culvert inlets from extreme angle, nearly parallel to roadway. Inlet area is overgrown, and also has large quantities of road sand and natural material built up near inlet. Outlet has large drop, which has caused a significant scour hole. The scour hole has nearly exposed the cutoff wall, and should be addressed in the rehab project. DEEP fisheries want the scour hole to remain, so it can all be eliminated.

Crossing Discharge Data

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

Minimum Flow: 115 CFS (10-YR Return Event)

Design Flow: 330 CFS (100-YR Return Event)

Maximum Flow: 660 CFS (500-YR Return Event)

Table 2 - Summary of Culvert Flows at Crossing: South Turnpike Rehab

Headwater Elevation (ft)	Total Discharge (CFS)	Culvert 1 Discharge (CFS)	Roadway Discharge (CFS)	Iterations
26.00	115.00	115.00	0.00	1
27.36	169.50	169.50	0.00	1
29.20	224.00	224.00	0.00	1
30.34	278.50	253.86	24.52	6
30.66	330.00	262.00	67.96	5
30.96	387.50	269.24	118.12	4
31.21	442.00	275.18	166.74	4
31.43	496.50	280.50	215.97	4
31.65	551.00	285.37	265.60	4
31.85	605.50	289.47	316.00	4
32.04	660.00	293.01	366.96	4
30.00	245.19	245.19	0.00	Overtopping

Rating Curve Plot for Crossing: South Turnpike Rehab

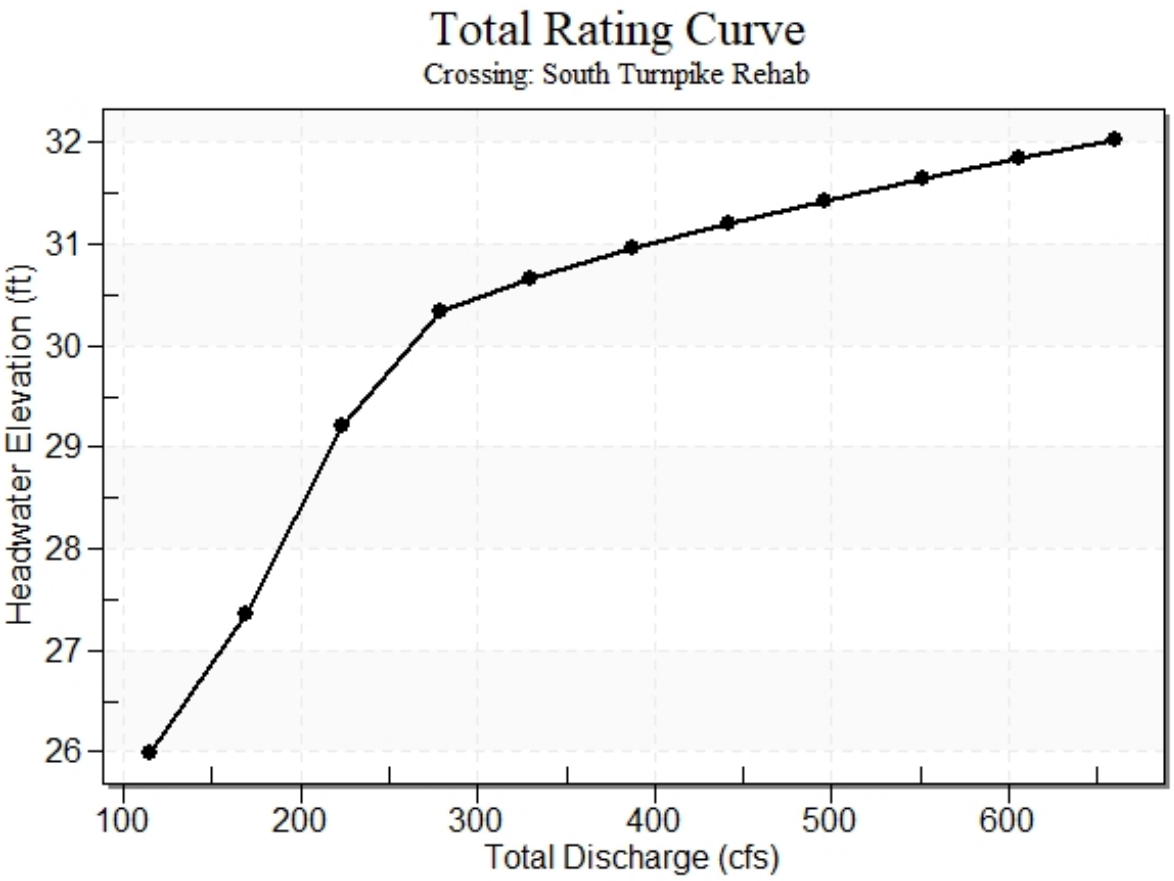


Table 3 - Downstream Channel Rating Curve (Crossing: South Turnpike Rehab)

Flow (CFS)	Water Surface Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
115.00	20.19	2.19	2.37	0.14	0.30
169.50	20.76	2.76	2.70	0.17	0.30
224.00	21.26	3.26	2.96	0.20	0.31
278.50	21.70	3.70	3.17	0.23	0.31
330.00	22.09	4.09	3.35	0.26	0.32
387.50	22.50	4.50	3.52	0.28	0.32
442.00	22.85	4.85	3.66	0.30	0.32
496.50	23.19	5.19	3.80	0.32	0.32
551.00	23.51	5.51	3.92	0.34	0.32
605.50	23.82	5.82	4.03	0.36	0.33
660.00	24.12	6.12	4.13	0.38	0.33

Tailwater Channel Data - South Turnpike Rehab

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

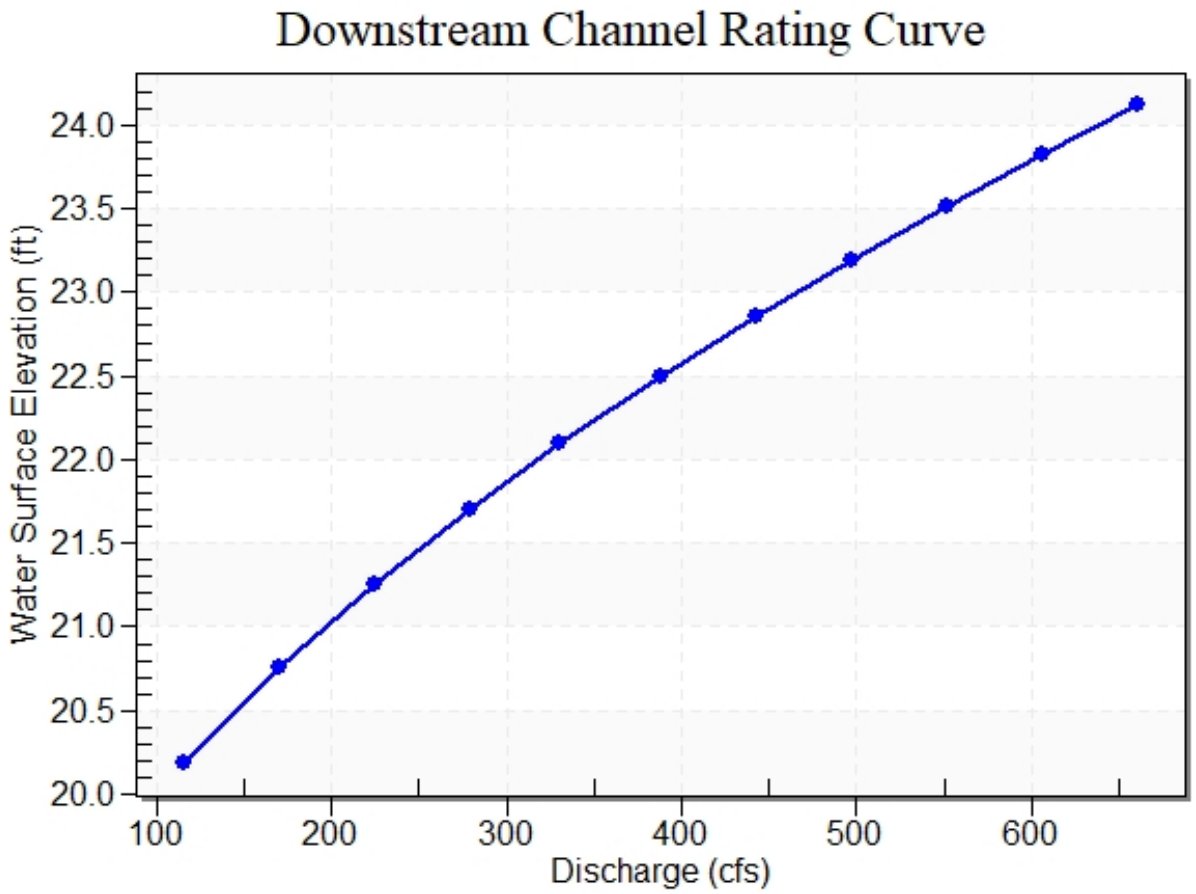
Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0010

Channel Manning's n: 0.0300

Channel Invert Elevation: 18.00 ft

Tailwater Rating Curve Plot for Crossing: South Turnpike Rehab



End

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Item C-3: Proposed Condition HY-8 Model Report

HY-8 Culvert Analysis Report

Project Notes

Project Title: South Turnpike Road over Mansion Road Brook Culvert Rehabilitation

Designer: M. Fanning, PE

Project Date: Wednesday, May 13, 2020

Notes: Repair and line twin 3 x 4 boxes – repaired condition model

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 22.58 ft

Outlet Station: 41.50 ft

Outlet Elevation: 22.48 ft

Number of Barrels: 2

Culvert Notes: Culvert 1

Proposed culvert under So. Turnpike RD., Wallingford, CT – with repairs and lining

Culvert Data Summary - Culvert 1

Barrel Shape: User Defined

Barrel Span: 3.85 ft

Barrel Rise: 2.85 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0100 (top and sides)

Manning's n: 0.0100 (bottom)

Culvert Type: Straight

Inlet Configuration: **Beveled Edge**

Inlet Depression: None

Table 1 - Culvert Summary Table: Culvert 1

Total Discharge (CFS)	Culvert Discharge (CFS)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
115.00	115.00	25.62	2.660	3.039	7-M2c	2.052	1.906	1.906	2.191	7.835	2.366
169.50	169.50	26.53	3.927	3.951	7-M2c	2.850	2.446	2.446	2.761	9.003	2.697
224.00	224.00	27.93	5.351	5.020	7-M2c	2.850	2.793	2.793	3.258	10.572	2.957
278.50	278.50	29.78	7.203	6.266	6-FFc	2.850	2.850	2.850	3.704	12.938	3.172
330.00	295.94	30.42	7.839	6.720	6-FFc	2.850	2.850	2.850	4.093	13.748	3.347
387.50	304.53	30.76	8.176	6.954	6-FFc	2.850	2.850	2.850	4.496	14.147	3.518
442.00	311.39	31.02	8.445	7.145	6-FFc	2.850	2.850	2.850	4.854	14.465	3.664
496.50	317.07	31.27	8.687	7.307	6-FFc	2.850	2.850	2.850	5.193	14.729	3.795
551.00	321.91	31.49	8.910	7.447	6-FFc	2.850	2.850	2.850	5.515	14.954	3.916
605.50	326.39	31.70	9.120	7.579	6-FFc	2.850	2.850	2.850	5.822	15.163	4.027
660.00	330.58	31.90	9.319	7.703	6-FFc	2.850	2.850	2.850	6.117	15.357	4.131

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Straight Culvert

Inlet Elevation (invert): 22.58 ft, Outlet Elevation (invert): 22.48 ft

Culvert Length: 41.50 ft, Culvert Slope: 0.0024

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Table 3.1. HY-8 Flow Type Numbers.

Flow Type	Flow Control	Submerged Inlet HW>D	Submerged Outlet TW>D	Length Full
1	Inlet	No	No	None
5	Inlet	Yes	No	None
2	Outlet	No	No	None
3	Outlet	No	No	None
4	Outlet	Yes	Yes	All
6	Outlet	Yes	No	Most
7	Outlet	Yes	No	Part

Flow Type 6

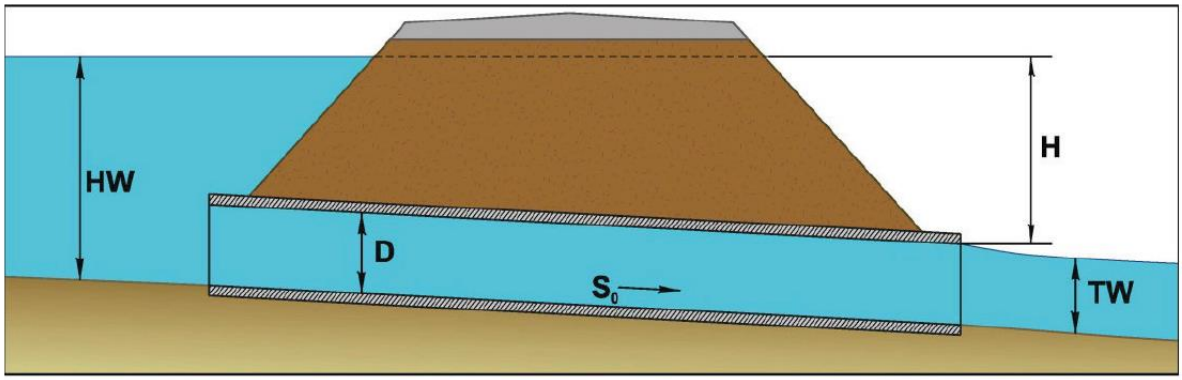
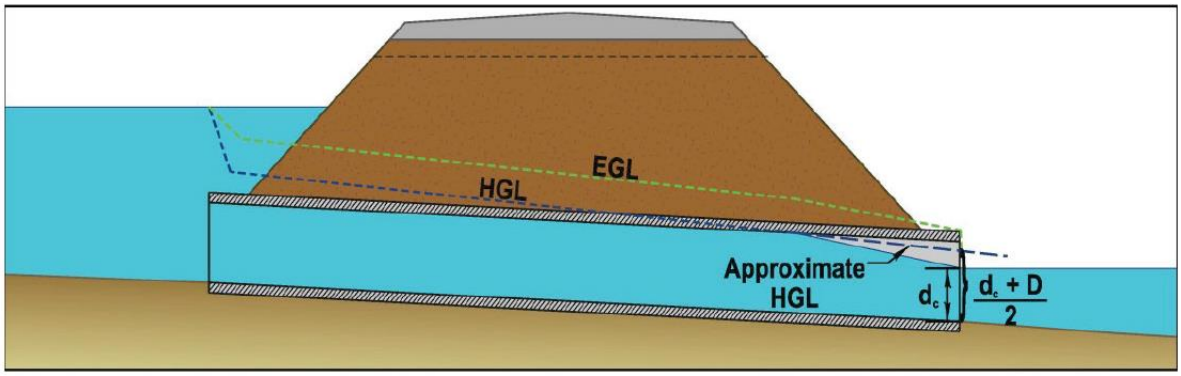
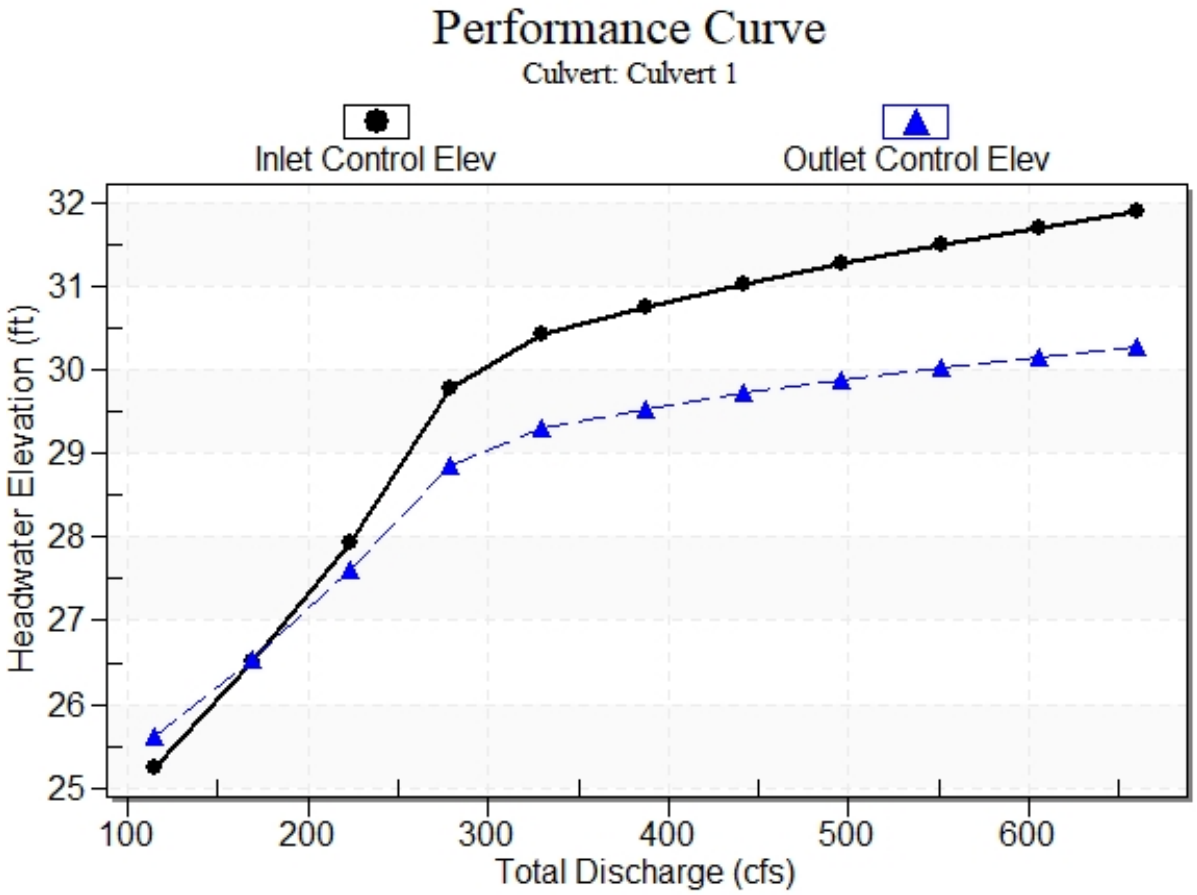


Figure 3.29. USGS flow type 4 and 6.

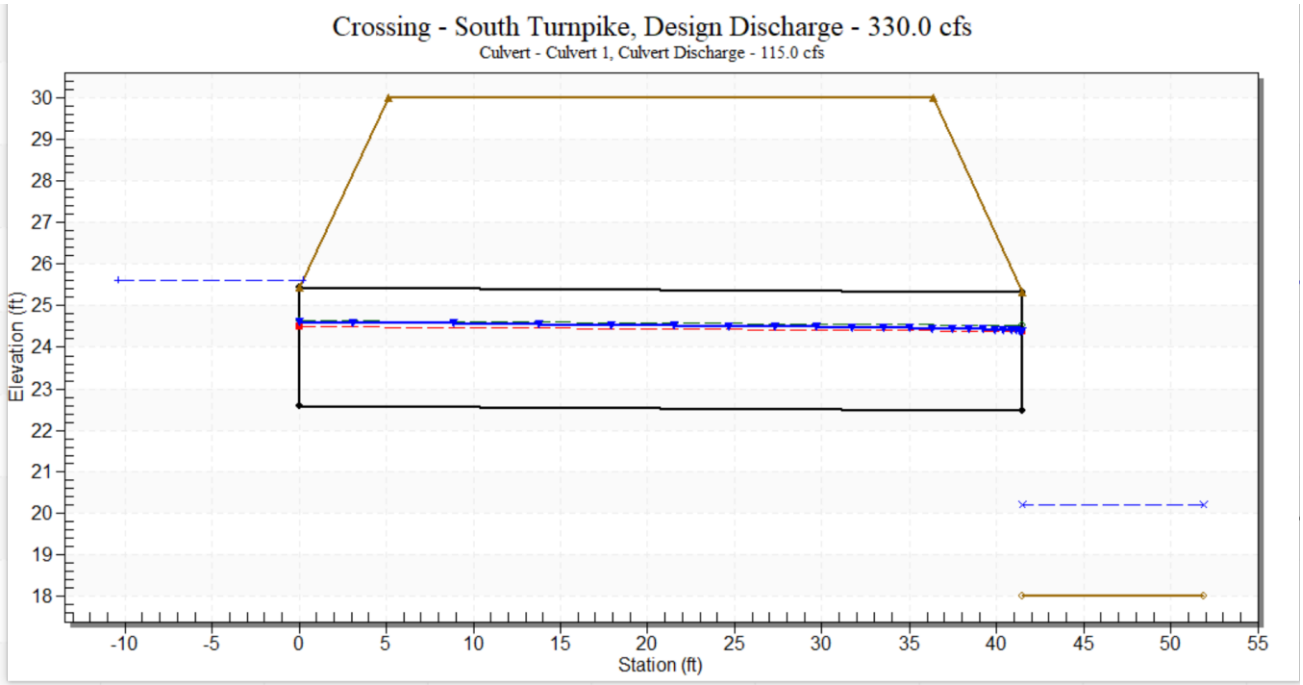
Flow Type 7

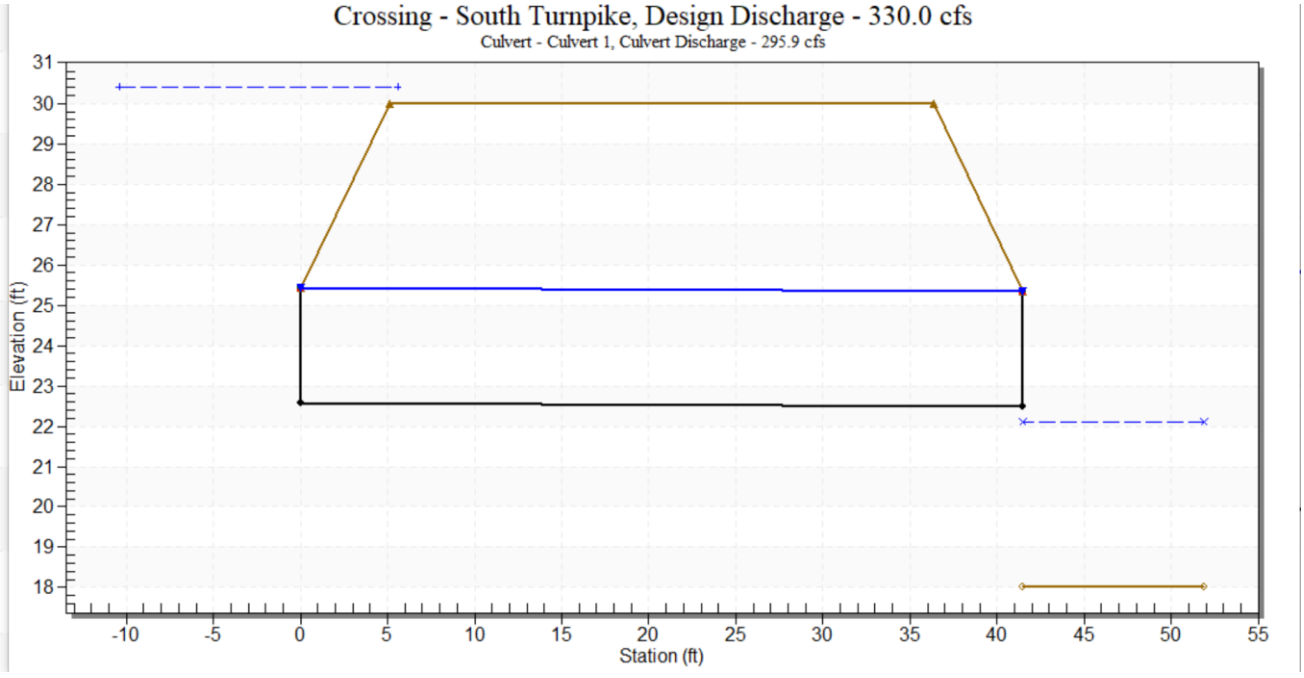


Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1





Roadway Data for Crossing: South Turnpike

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 41.50 ft

Crest Elevation: 30.00 ft

Roadway Surface: Paved

Roadway Top Width: 31.25 ft

Crossing Notes: South Turnpike

Repairs to culvert add approx. one inch to interior walls all around. Culvert size reduced to accommodate repairs. Also, anticipate placing a face of precast concrete with bevels on inlets to each culvert to improve inlet efficiency, to compensate for loss of culvert area.

Crossing Discharge Data

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

Minimum Flow: 115 CFS (10-YR Return Event)

Design Flow: 330 CFS (100-YR Return Event)

Maximum Flow: 660 CFS (500-YR Return Event)

Table 2 - Summary of Culvert Flows at Crossing: South Turnpike

Headwater Elevation (ft)	Total Discharge (CFS)	Culvert 1 Discharge (CFS)	Roadway Discharge (CFS)	Iterations
25.62	115.00	115.00	0.00	1
26.53	169.50	169.50	0.00	1
27.93	224.00	224.00	0.00	1
29.78	278.50	278.50	0.00	1
30.42	330.00	295.94	33.98	5
30.76	387.50	304.53	82.76	4
31.02	442.00	311.39	130.52	4
31.27	496.50	317.07	179.35	4
31.49	551.00	321.91	229.04	4
31.70	605.50	326.39	279.06	4
31.90	660.00	330.58	329.39	4
30.00	284.65	284.65	0.00	Overtopping

Rating Curve Plot for Crossing: South Turnpike

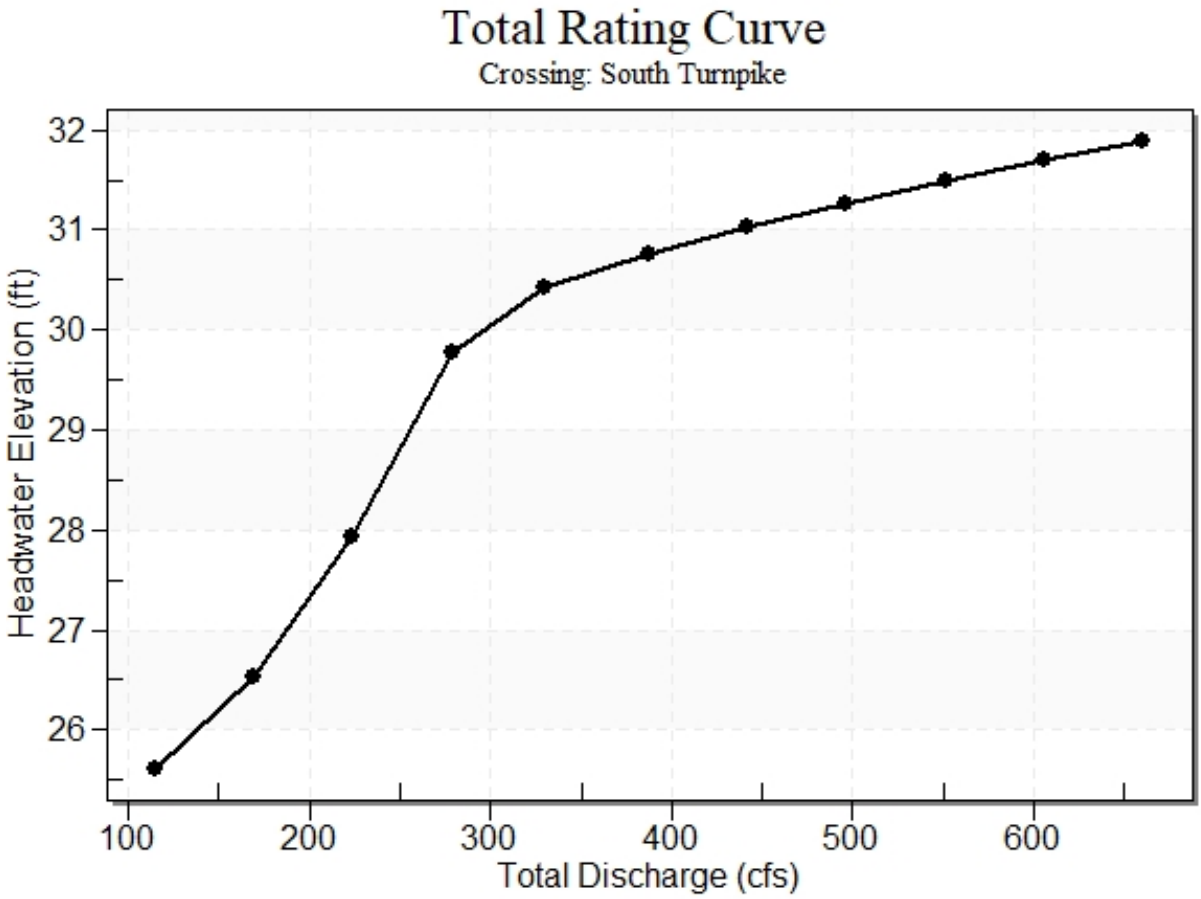


Table 3 - Downstream Channel Rating Curve (Crossing: South Turnpike)

Flow (CFS)	Water Surface Elevation (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
115.00	20.19	2.19	2.37	0.14	0.30
169.50	20.76	2.76	2.70	0.17	0.30
224.00	21.26	3.26	2.96	0.20	0.31
278.50	21.70	3.70	3.17	0.23	0.31
330.00	22.09	4.09	3.35	0.26	0.32
387.50	22.50	4.50	3.52	0.28	0.32
442.00	22.85	4.85	3.66	0.30	0.32
496.50	23.19	5.19	3.80	0.32	0.32
551.00	23.51	5.51	3.92	0.34	0.32
605.50	23.82	5.82	4.03	0.36	0.33
660.00	24.12	6.12	4.13	0.38	0.33

Tailwater Channel Data - South Turnpike

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

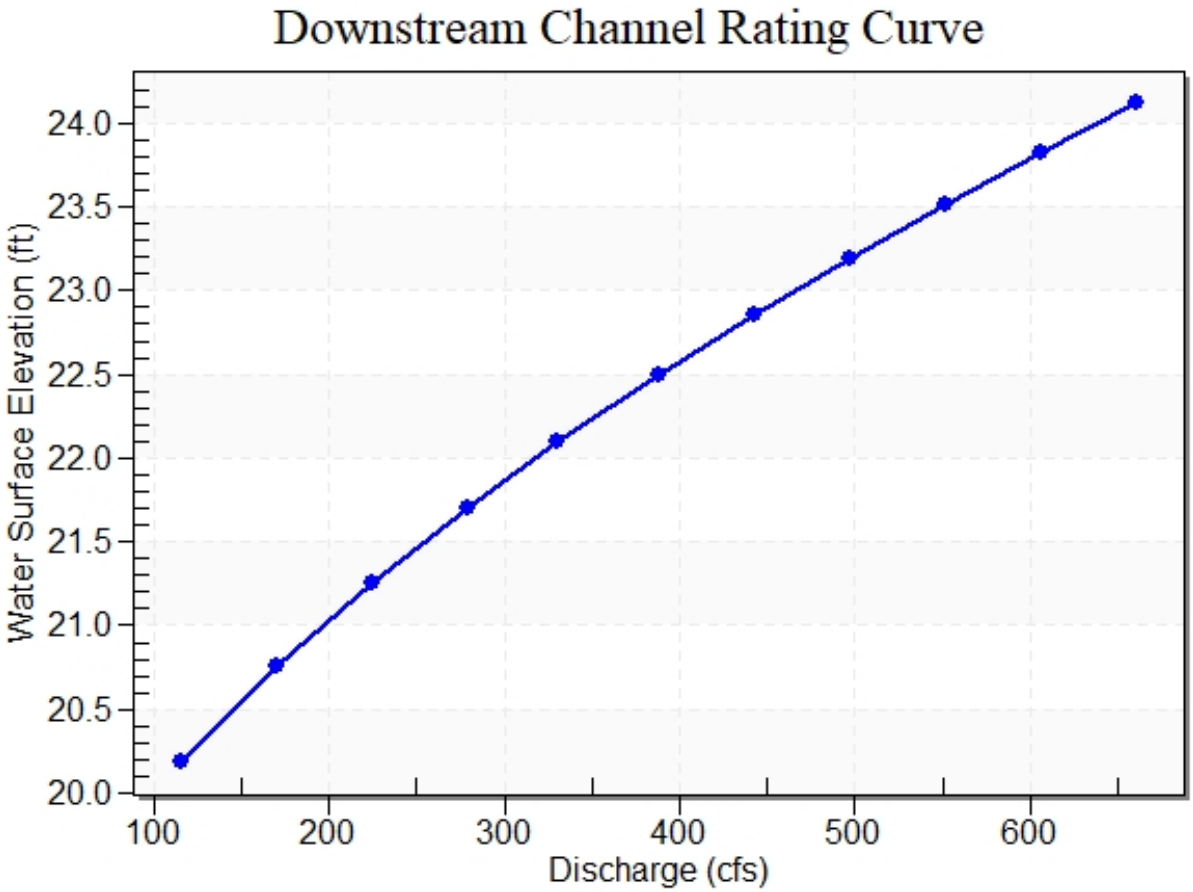
Side Slope (H:V): 1.00 (_:1)

Channel Slope: 0.0010

Channel Manning's n: 0.0300

Channel Invert Elevation: 18.00 ft

Tailwater Rating Curve Plot for Crossing: South Turnpike



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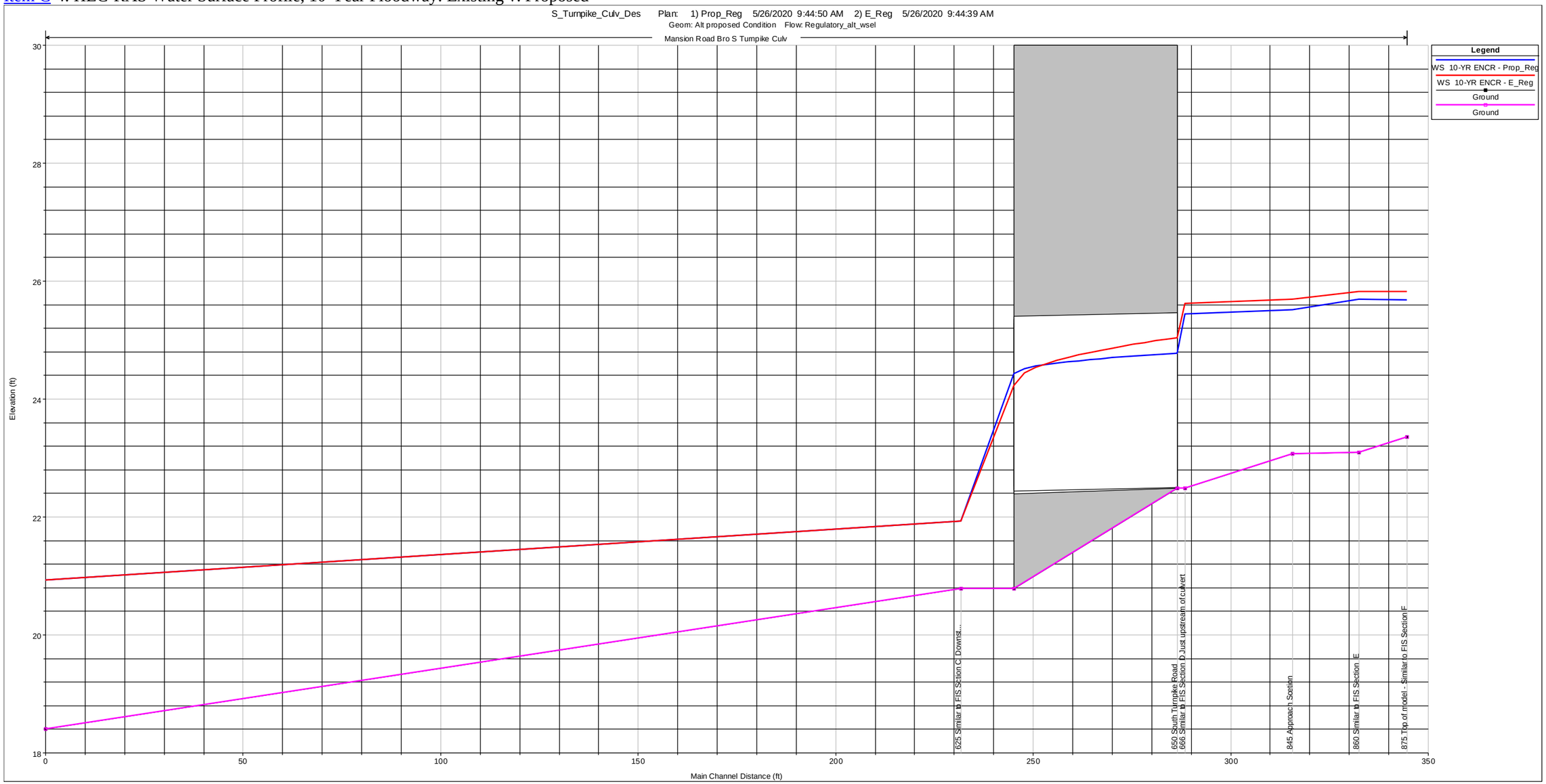
REGULATORY HYDRAULIC MODELS

Item C-4: HEC-RAS Water Surface Profile, 10-Year Floodway: Existing v. Proposed



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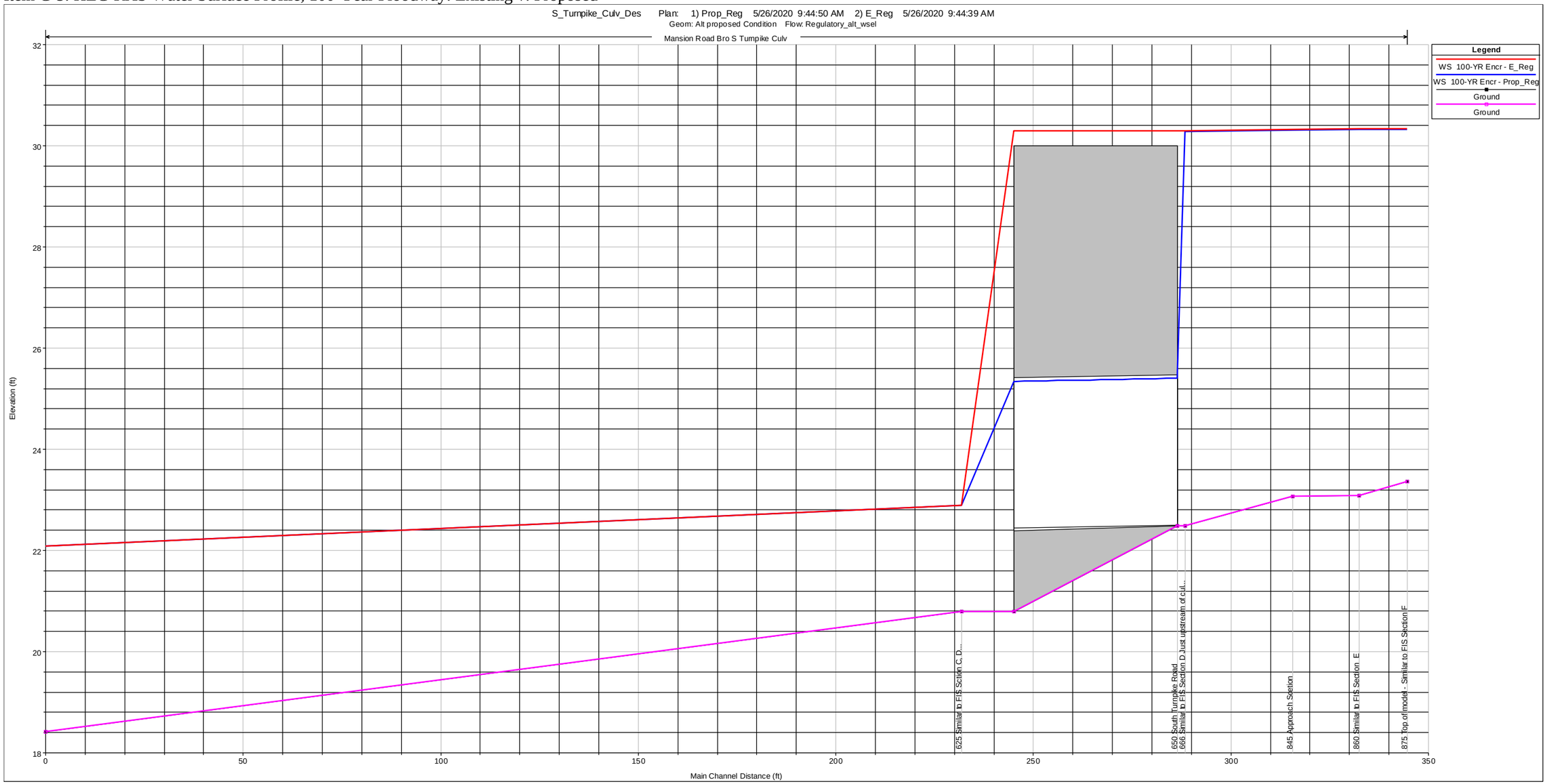
Item C-5: HEC-RAS Water Surface Profile, 100-Year Floodway: Existing v. Proposed



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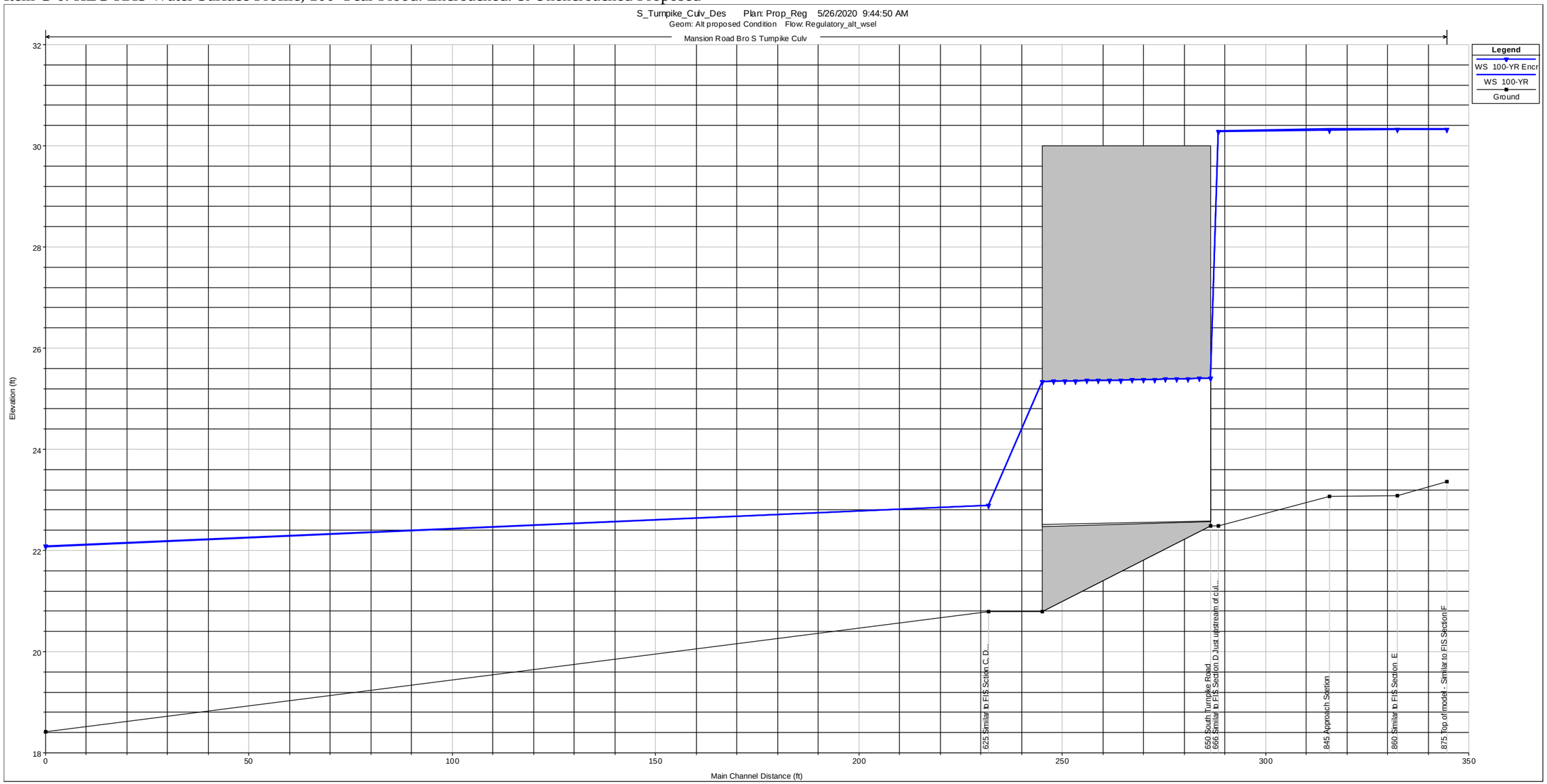
Item C-6: HEC-RAS Water Surface Profile, 100-Year Flood: Encroached. & Unencroached Proposed



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Item C-7: HEC-RAS Std. Summary Table 1, 10-Year Floodway: Existing and Proposed Condition

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 10-YR ENCR

Reload Data

Reach	River Sta	Profile	Plan	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)	
S Turnpike Culv	875	10-YR ENCR	E_Reg	115.00	23.36	25.82		25.90	0.001445	2.55	65.59	44.84	0.32
S Turnpike Culv	875	10-YR ENCR	Prop_Reg	115.00	23.36	25.68		25.78	0.001904	2.79	59.30	44.00	0.36
S Turnpike Culv	860	10-YR ENCR	E_Reg	115.00	23.09	25.83		25.88	0.000727	1.92	62.57	32.91	0.23
S Turnpike Culv	860	10-YR ENCR	Prop_Reg	115.00	23.09	25.69		25.75	0.000906	2.05	58.07	32.01	0.25
S Turnpike Culv	845	10-YR ENCR	E_Reg	115.00	23.07	25.69	24.90	25.85	0.002916	3.21	36.23	23.03	0.43
S Turnpike Culv	845	10-YR ENCR	Prop_Reg	115.00	23.07	25.51	24.90	25.71	0.004227	3.59	32.16	22.01	0.51
S Turnpike Culv	666	10-YR ENCR	E_Reg	115.00	22.49	25.62	24.16	25.79	0.001680	3.32	34.60	18.55	0.35
S Turnpike Culv	666	10-YR ENCR	Prop_Reg	115.00	22.49	25.44	24.16	25.63	0.002088	3.55	32.42	17.80	0.38
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	10-YR ENCR	E_Reg	115.00	20.79	21.93	21.81	22.29	0.013642	4.86	23.68	23.00	0.84
S Turnpike Culv	625	10-YR ENCR	Prop_Reg	115.00	20.79	21.93	21.81	22.29	0.013642	4.86	23.68	23.00	0.84
S Turnpike Culv	340	10-YR ENCR	E_Reg	115.00	18.41	20.93	20.26	21.02	0.002501	2.40	47.93	39.24	0.38
S Turnpike Culv	340	10-YR ENCR	Prop_Reg	115.00	18.41	20.93	20.26	21.02	0.002501	2.40	47.93	39.24	0.38

Total flow in cross section.

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Item C-8: HEC-RAS Std. Summary Table 1, 100-Year Floodway: Existing and Proposed Condition

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 100-YR Encr

Reload Data

Reach	River Sta	Profile	Plan	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)	
S Turnpike Culv	875	100-YR Encr	E_Reg	330.00	23.36	30.34		30.36	0.000115	1.57	396.20	82.00	0.11
S Turnpike Culv	875	100-YR Encr	Prop_Reg	330.00	23.36	30.32		30.34	0.000117	1.58	394.84	82.00	0.11
S Turnpike Culv	860	100-YR Encr	E_Reg	330.00	23.09	30.34		30.36	0.000086	1.39	378.79	82.00	0.09
S Turnpike Culv	860	100-YR Encr	Prop_Reg	330.00	23.09	30.32		30.34	0.000087	1.39	377.44	82.00	0.09
S Turnpike Culv	845	100-YR Encr	E_Reg	330.00	23.07	30.32	25.97	30.36	0.000165	1.82	300.48	72.00	0.13
S Turnpike Culv	845	100-YR Encr	Prop_Reg	330.00	23.07	30.30	25.97	30.34	0.000167	1.83	299.28	72.00	0.13
S Turnpike Culv	666	100-YR Encr	E_Reg	330.00	22.49	30.29	25.60	30.35	0.000221	2.08	243.14	78.75	0.14
S Turnpike Culv	666	100-YR Encr	Prop_Reg	330.00	22.49	30.27	25.60	30.33	0.000223	2.09	241.81	78.59	0.14
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	100-YR Encr	E_Reg	330.00	20.79	22.89	22.75	23.70	0.013666	7.19	45.92	23.00	0.90
S Turnpike Culv	625	100-YR Encr	Prop_Reg	330.00	20.79	22.89	22.75	23.70	0.013666	7.19	45.92	23.00	0.90
S Turnpike Culv	340	100-YR Encr	E_Reg	330.00	18.41	22.08	21.01	22.23	0.002501	3.12	107.63	84.23	0.41
S Turnpike Culv	340	100-YR Encr	Prop_Reg	330.00	18.41	22.08	21.02	22.23	0.002501	3.12	107.62	84.23	0.41

Total flow in cross section.

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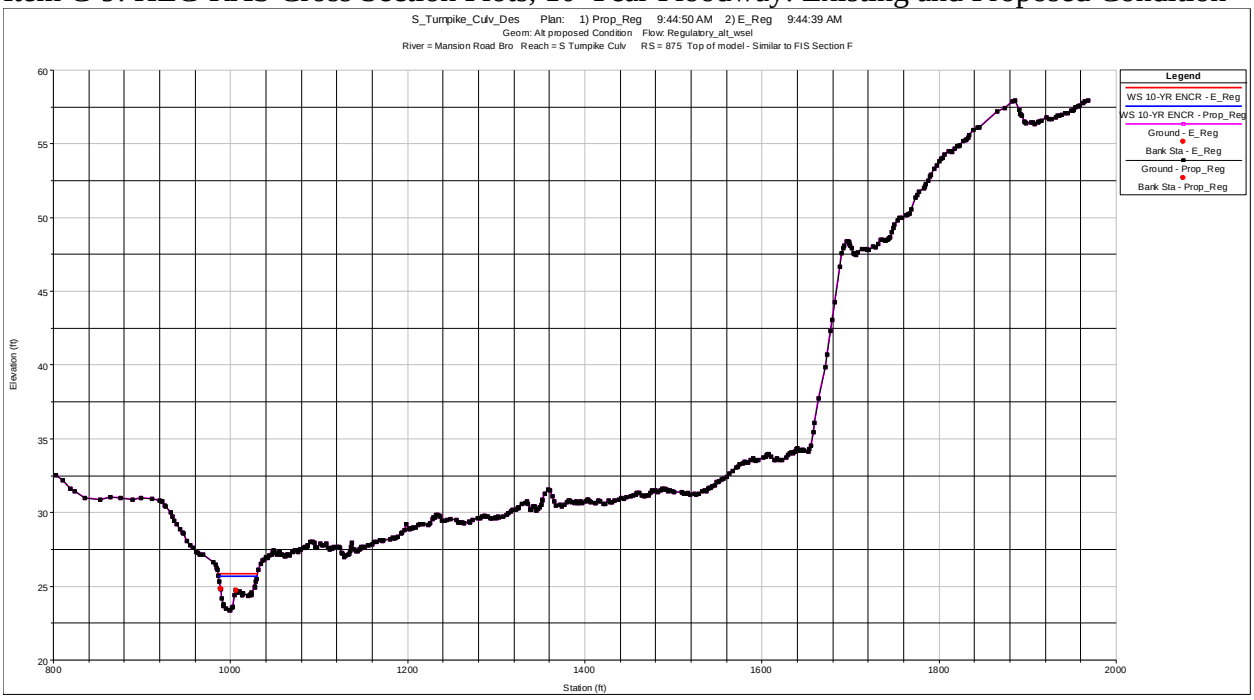
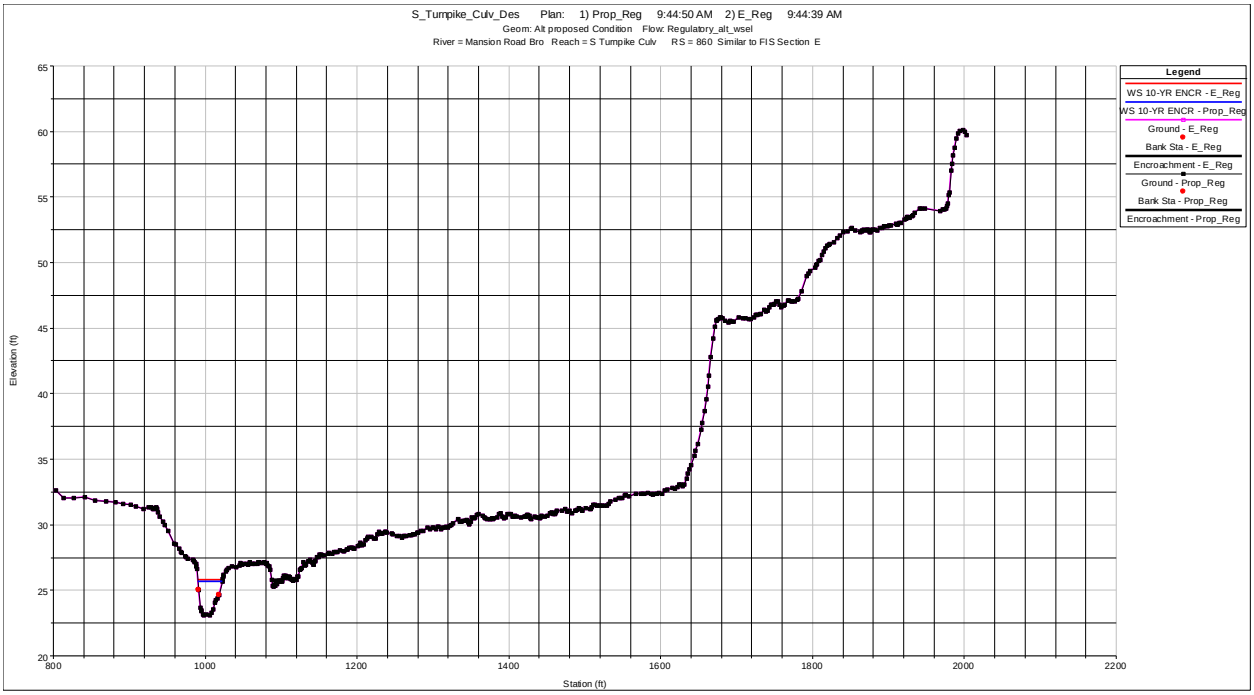
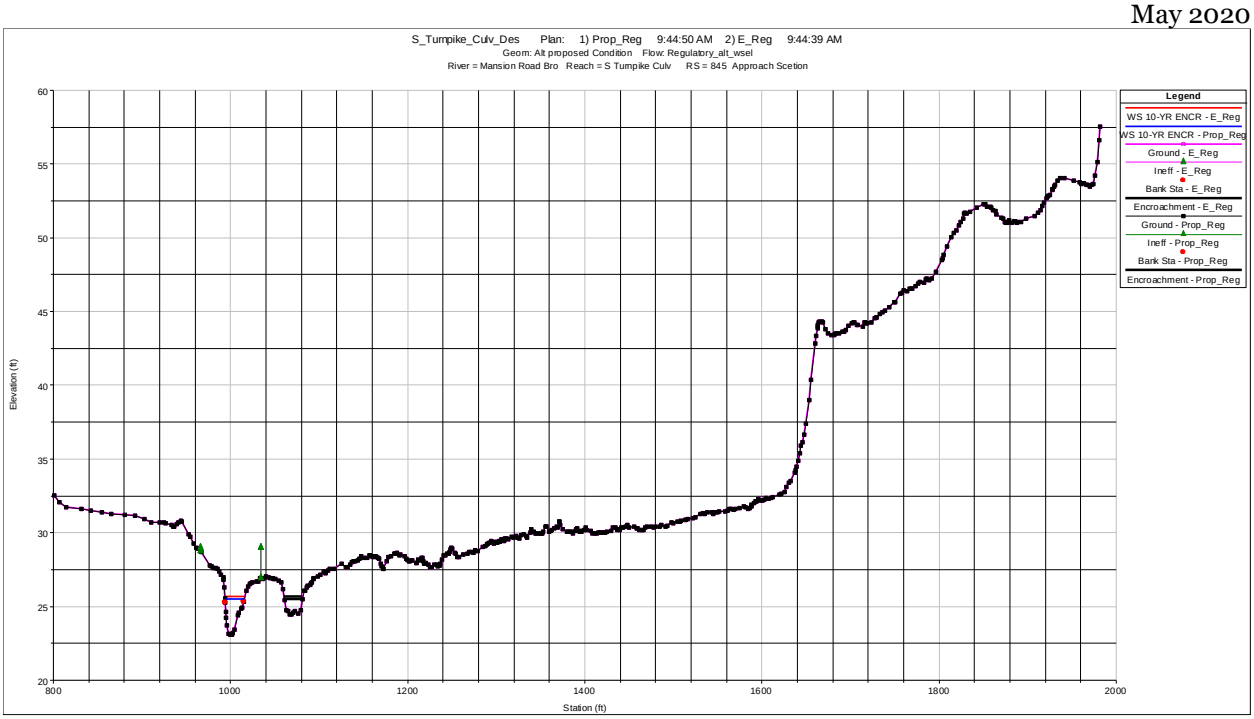
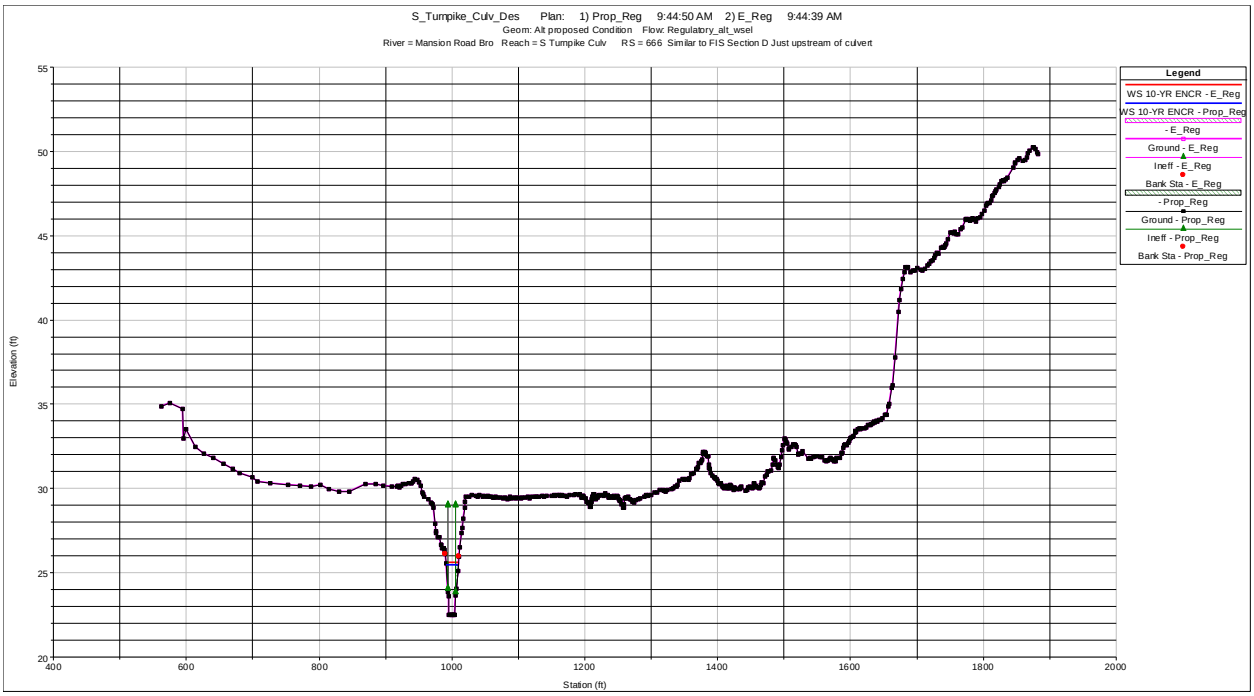
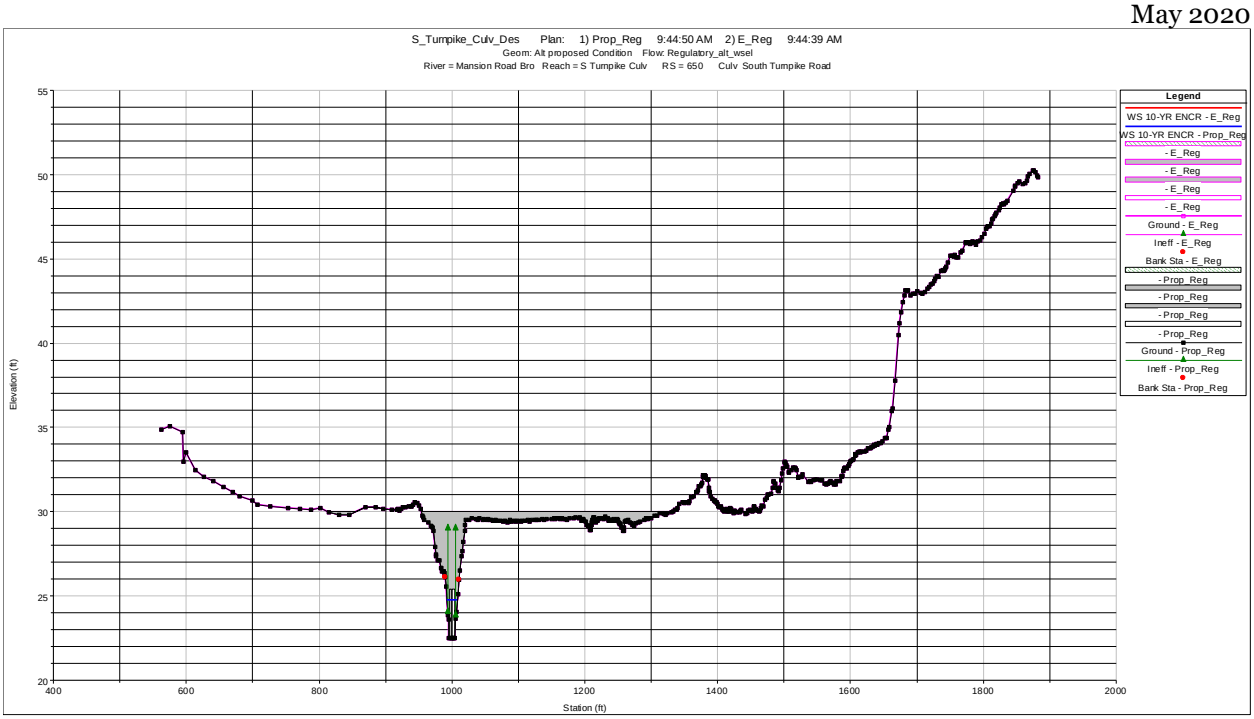
Item C-9: HEC-RAS Cross Section Plots, 10-Year Floodway: Existing and Proposed Condition

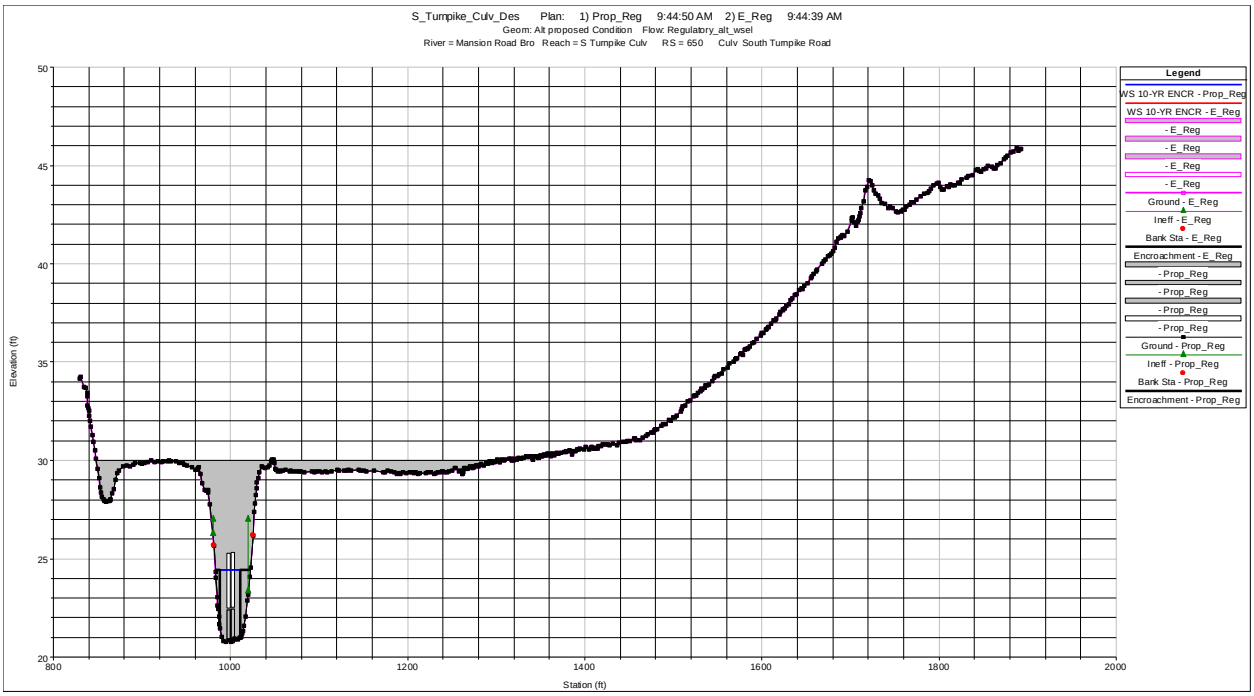


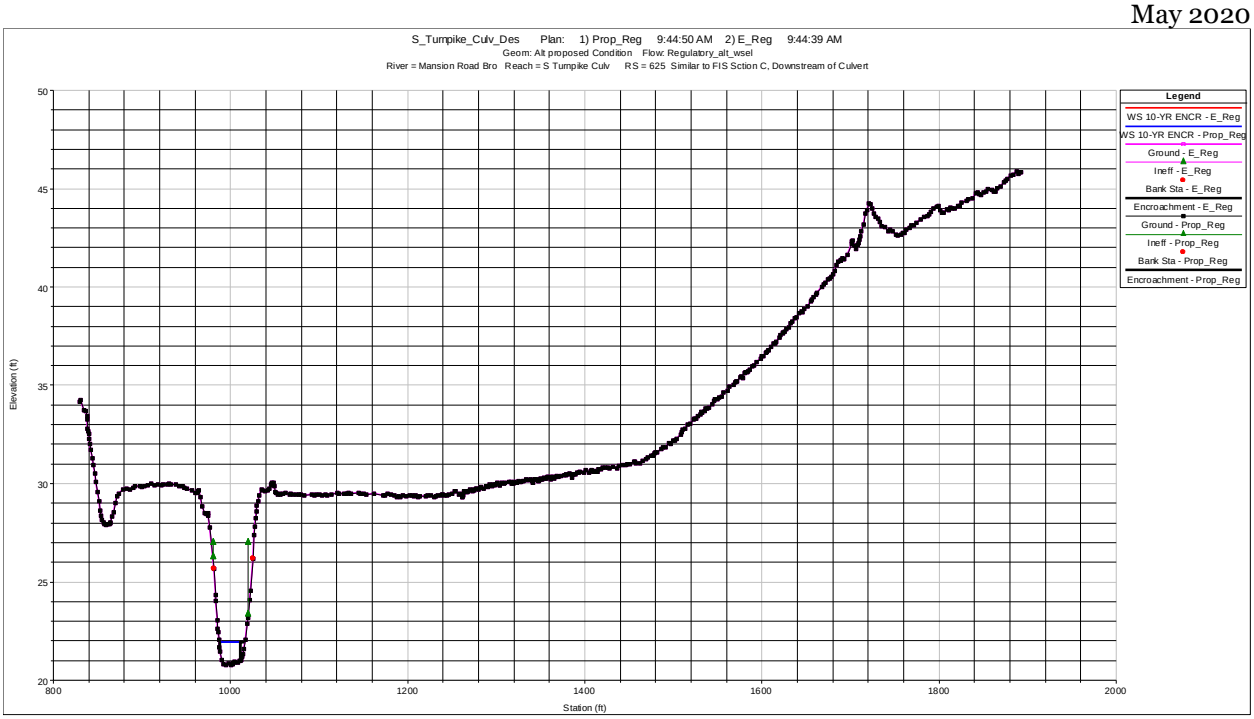


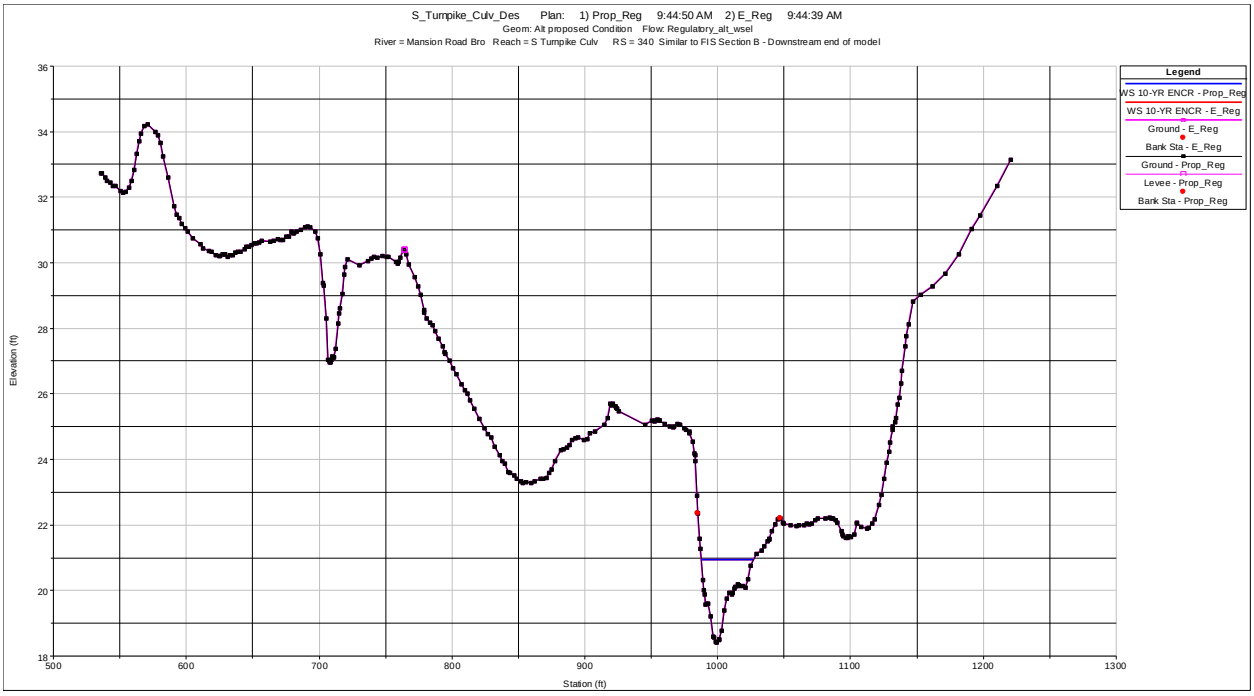

S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 845 Approach Scetion
Legend
WS 10-YR ENCR - E_Reg
WS 10-YR ENCR - Prop_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
Encroachment - E_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Encroachment - Prop_Reg
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 666 Similar to FIS Section D Just upstream of culvert
Legend
WS 10-YR ENCR - E_Reg
WS 10-YR ENCR - Prop_Reg
- E_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
- Prop_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 10-YR ENCR - E_Reg
WS 10-YR ENCR - Prop_Reg
- E_Reg
- E_Reg
- E_Reg
- E_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg


S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 10-YR ENCR - Prop_Reg
WS 10-YR ENCR - E_Reg
- E_Reg
- E_Reg
- E_Reg
- E_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
Encroachment - E_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Encroachment - Prop_Reg





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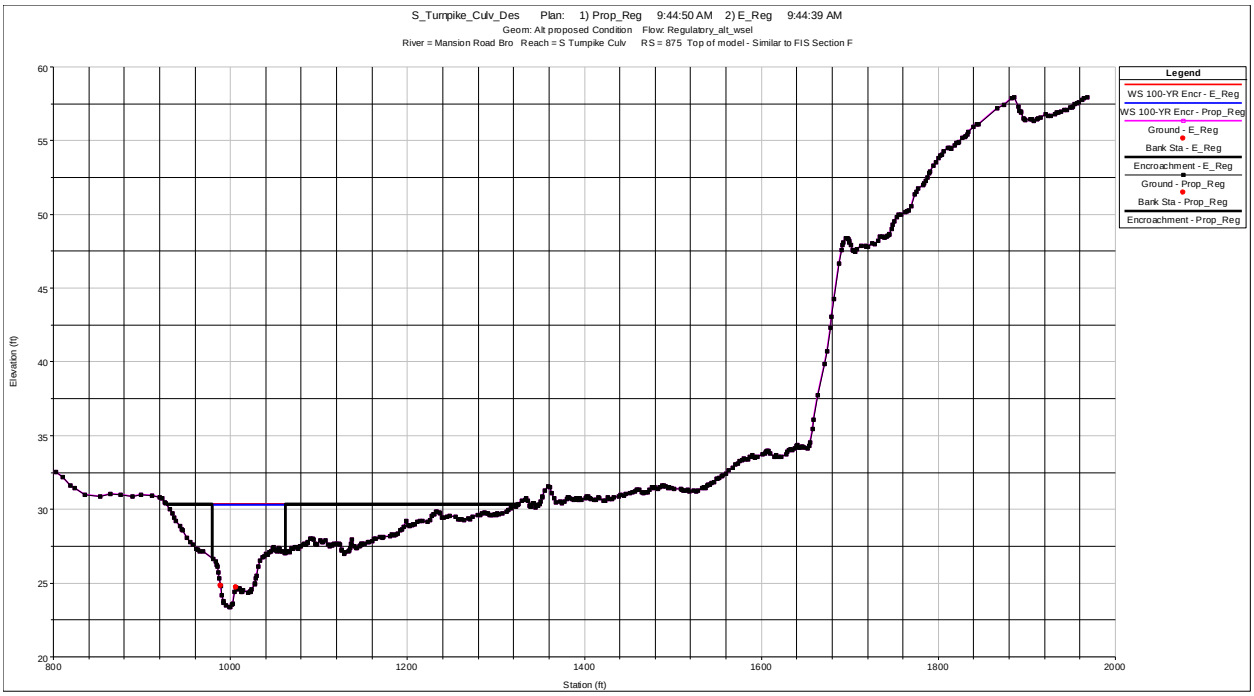
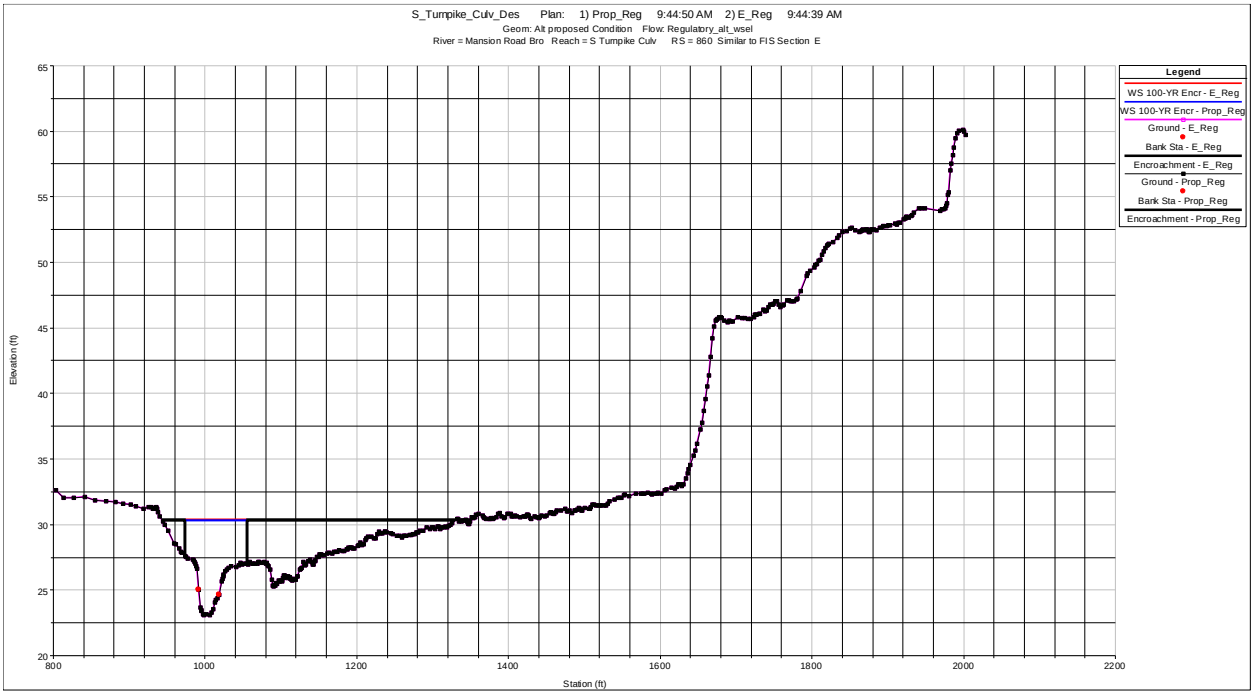
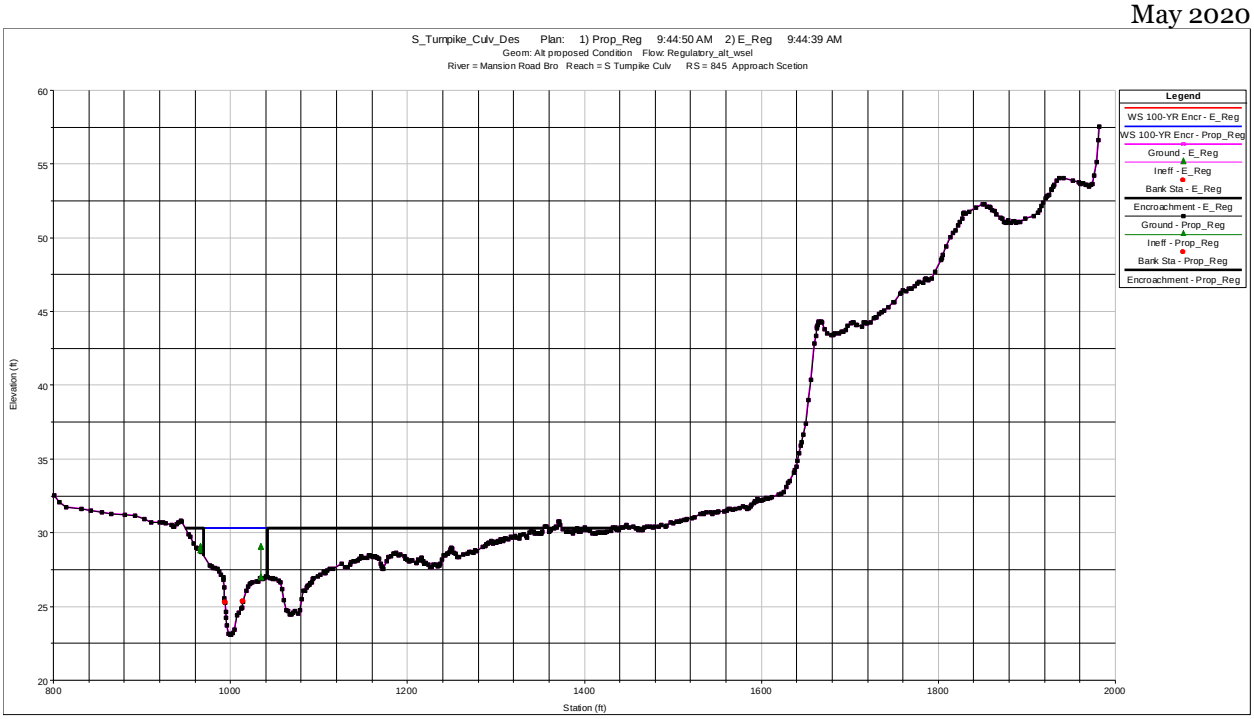
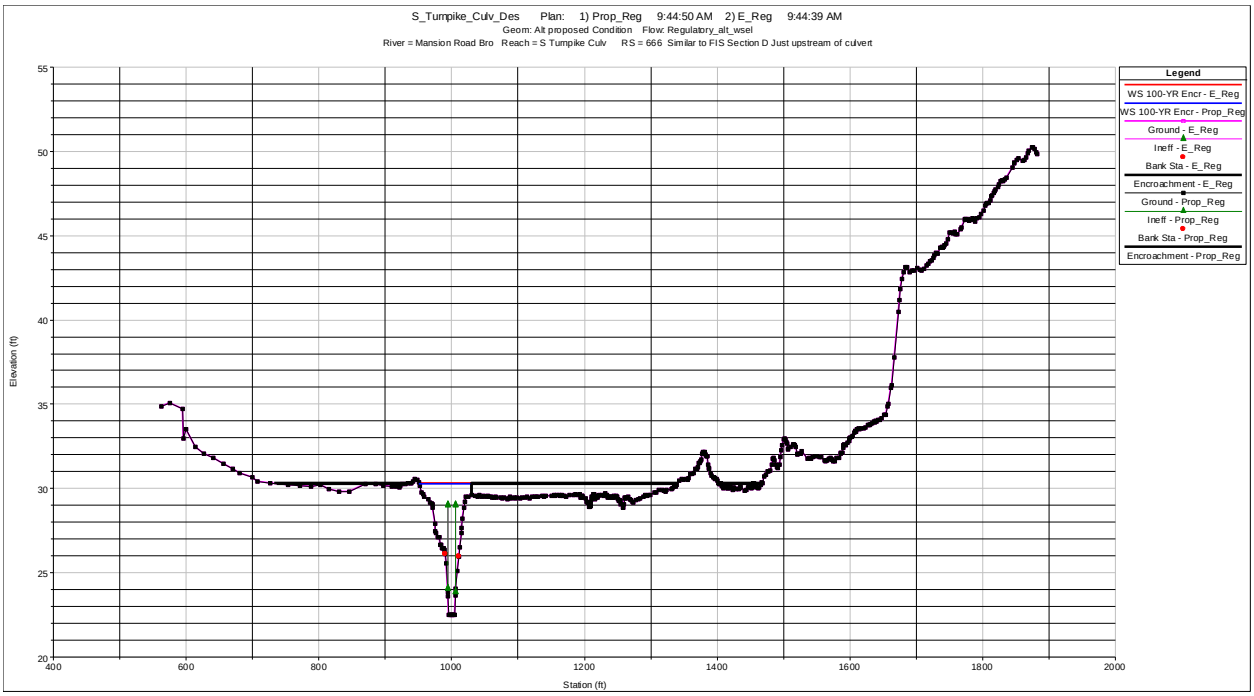
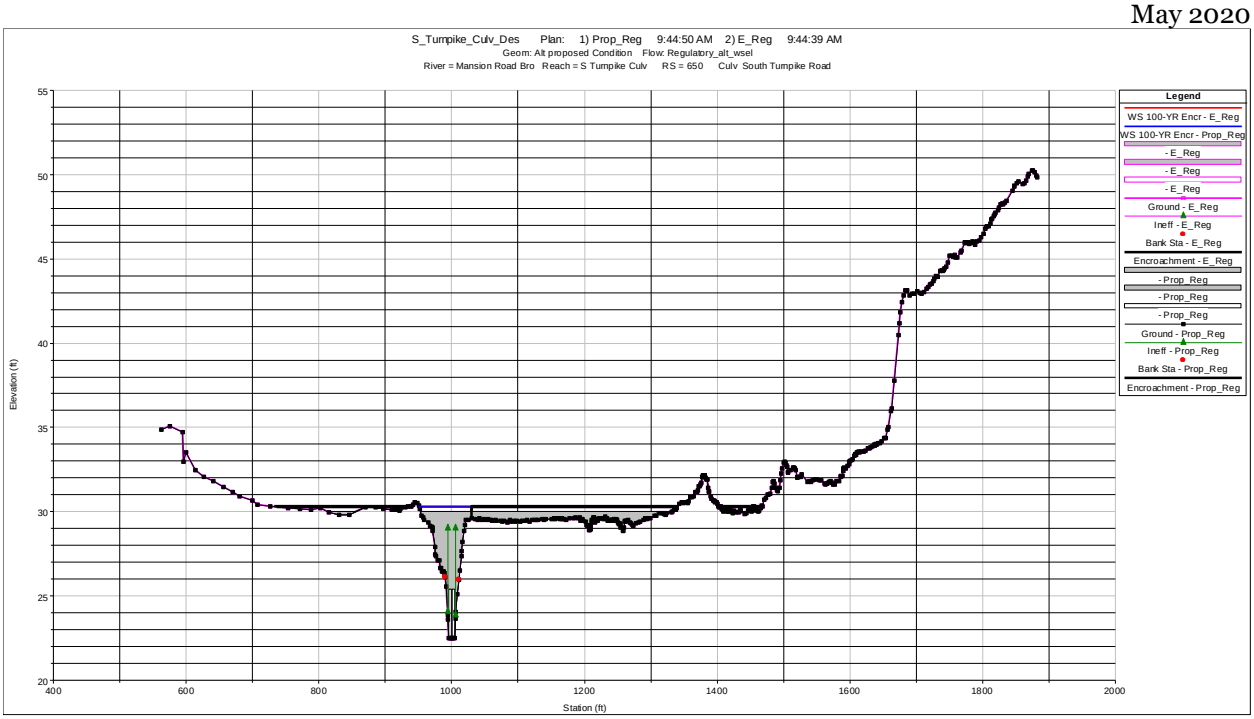
Item C-10: HEC-RAS Cross Section Plots, 100-Year Floodway: Existing and Proposed Condition

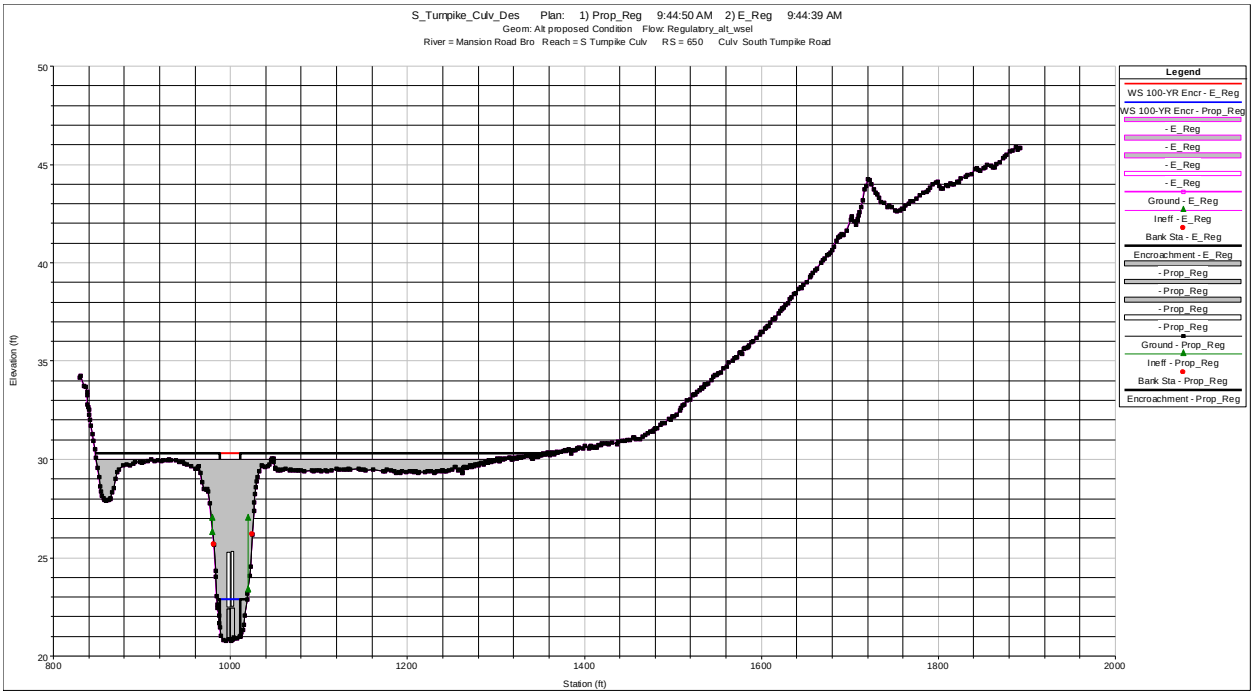


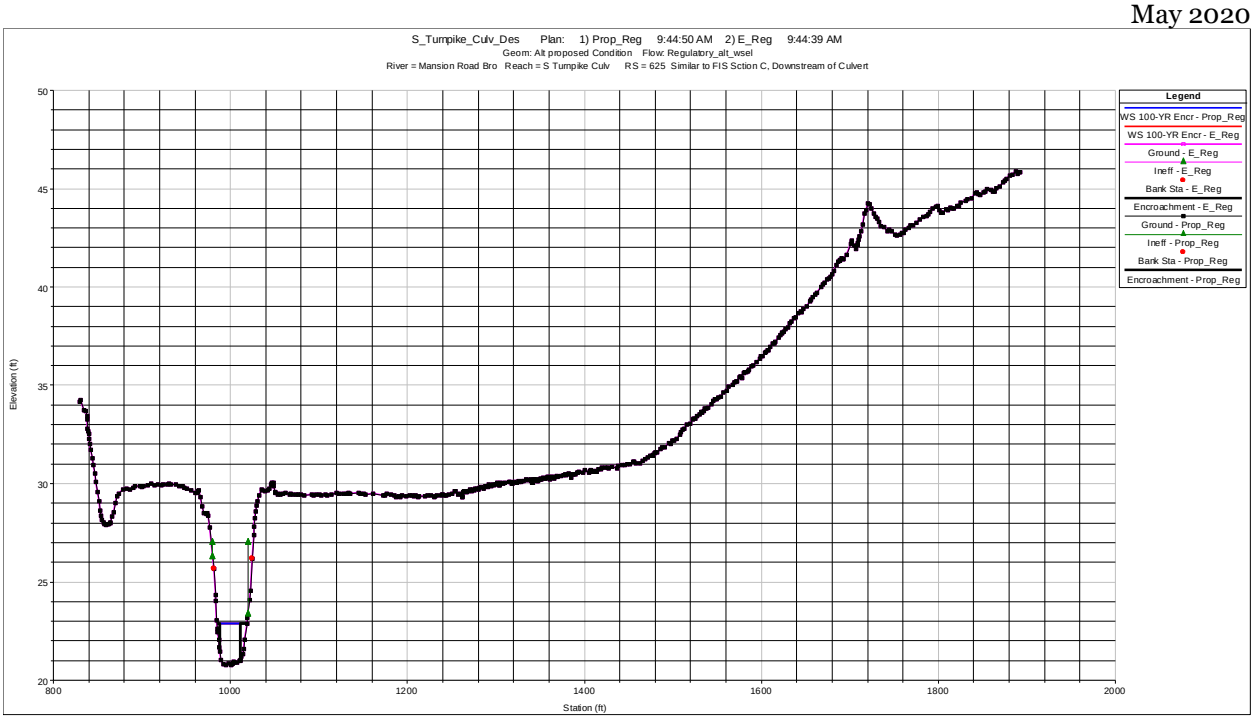


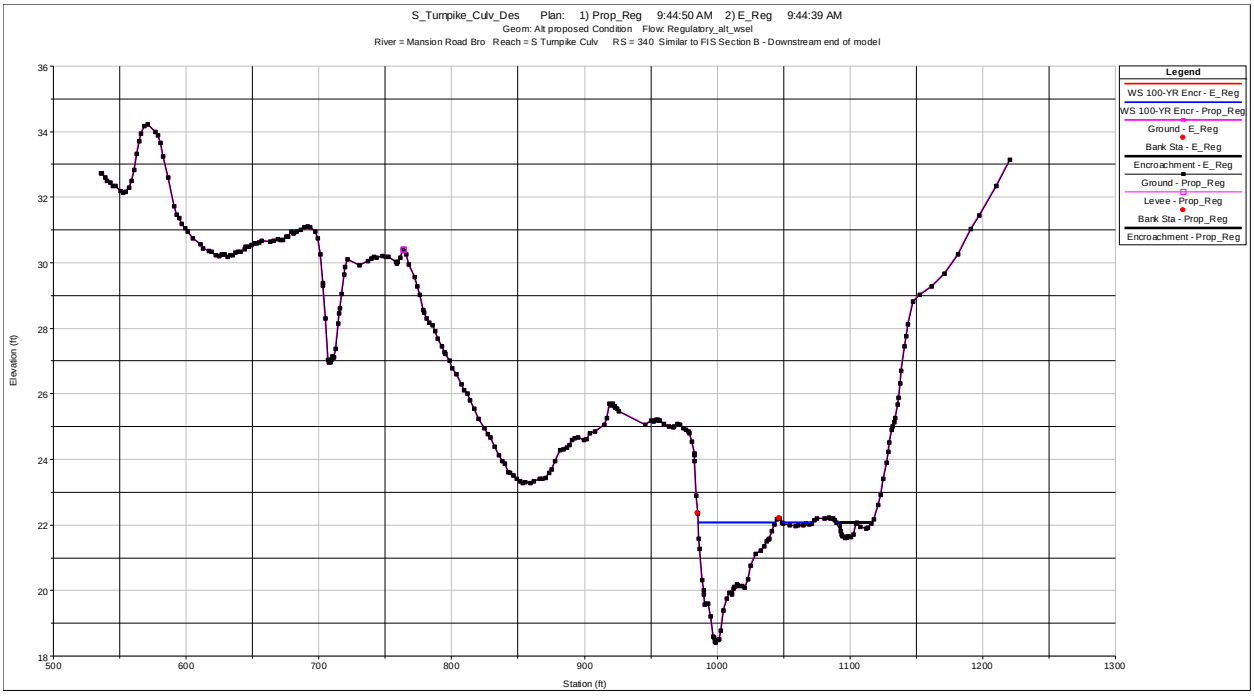

S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 845 Approach Scetion
Legend
WS 100-YR Encr - E_Reg
WS 100-YR Encr - Prop_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
Encroachment - E_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Encroachment - Prop_Reg
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 666 Similar to FIS Section D Just upstream of culvert
Legend
WS 100-YR Encr - E_Reg
WS 100-YR Encr - Prop_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
Encroachment - E_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Encroachment - Prop_Reg
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 100-YR Encr - E_Reg
WS 100-YR Encr - Prop_Reg
- E_Reg
- E_Reg
- E_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
Encroachment - E_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Encroachment - Prop_Reg


S_Turnpike_Culv_Des Plan: 1) Prop_Reg 9:44:50 AM 2) E_Reg 9:44:39 AM
Geom: Alt proposed Condition Flow: Regulatory_alt_wsel
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 100-YR Encr - E_Reg
WS 100-YR Encr - Prop_Reg
- E_Reg
- E_Reg
- E_Reg
- E_Reg
Ground - E_Reg
Ineff - E_Reg
Bank Sta - E_Reg
Encroachment - E_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
- Prop_Reg
Ground - Prop_Reg
Ineff - Prop_Reg
Bank Sta - Prop_Reg
Encroachment - Prop_Reg





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Item C-11: HEC-RAS Input Data - Proposed Regulatory Conditions Analysis

HEC-RAS 5.0.7 March 2019
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street

```
X        X  XXXXXX   XXXX          XXXX        XX       XXXX
X        X  X       X    X        X    X     X  X     X
X        X  X       X             X    X    X    X    X
XXXXXXX  XXXX    X          XXX   XXXX     XXXXXX   XXXX
X        X  X       X             X   X    X      X       X
X        X  X       X    X        X    X   X      X       X
X        X  XXXXXX   XXXX          X     X  X      X   XXXXX
```

PROJECT DATA
Project Title: S_Turnpike_Culv_Des
Project File : S_Turnpike_Culv_Des.prj
Run Date and Time: 5/26/2020 9:44:50 AM
Project in English units

PLAN DATA

Plan Title: Prop_Reg
Plan File : p:\Projects\16032 Wallingford - South Turnpike Road Bridge\H&D\HECRAS\Design\S_Turnpike_Culv_Des.p02

Geometry Title: Alt proposed Condition
Geometry File : p:\Projects\16032 Wallingford - South Turnpike Road Bridge\H&D\HECRAS\Design\S_Turnpike_Culv_Des.g04

Flow Title : Regulatory_alt_wsel
Flow File : p:\Projects\16032 Wallingford - South Turnpike Road Bridge\H&D\HECRAS\Design\S_Turnpike_Culv_Des.f02

Plan Description:
Proposed culvert reduces culvert size for miters at top of box plus the assumed ±one inch liner thickness

Plan Summary Information:
Number of: Cross Sections = 6 Multiple Openings = 0
Culverts = 1 Inline Structures = 0
Bridges = 0 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

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = Mansion Road Bro Reach = S Turnpike Culv

RS	Profile	Method	Value1	Value2
875	100-YR Encr	1	980	1062
860	100-YR Encr	1	974	1056
845	100-YR Encr	1	970	1042
666	100-YR Encr	1	946	1030
625	100-YR Encr	1	988	1011
340	100-YR Encr	1	925	109

FLOW DATA

Flow Title: Regulatory_alt_wsel
Flow File : p:\Projects\16032 Wallingford - South Turnpike Road Bridge\H&D\HECRAS\Design\S_Turnpike_Culv_Des.f02

Flow Data (cfs)

River	Reach	RS	10-YR	50-YR	100-YR	500-YR	10-YR ENCR	100-YR Encr
Mansion Rd Brk	S Turnpike	875	115	215	330	660	115	330

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mansion Road Bro	S Turnpike Culv	10-YR		Normal S = 0.0025
Mansion Road Bro	S Turnpike Culv	50-YR		Normal S = 0.0025
Mansion Road Bro	S Turnpike Culv	100-YR		Normal S = 0.0025
Mansion Road Bro	S Turnpike Culv	500-YR		Normal S = 0.0025
Mansion Road Bro	S Turnpike Culv	10-YR Encr		Normal S = 0.0025
Mansion Road Bro	S Turnpike Culv	100-YR Encr		Normal S = 0.0025

GEOMETRY DATA

Geometry Title: Alt proposed Condition
Geometry File : p:\Projects\16032 Wallingford - South Turnpike Road Bridge\H&D\HECRAS\Design\S_Turnpike_Culv_Des.g04

CROSS SECTION

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 875

INPUT
Description: Top of model - Similar to FIS Section F
Station Elevation Data num= 461

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
802.97	32.55	810.88	32.18	818.8	31.59	823.74	31.44	835.61	31
852.43	30.85	864.3	31.07	876.17	31	889.04	30.85	898.93	31
911.79	30.92	920	30.79	921.6	30.73	923.2	30.75	925.4	30.49
927.1	30.39	932.1	29.99	934.6	29.75	936.6	29.44	938.8	29.19
943.3	28.85	945.5	28.62	946.5	28.58	951	28.09	954.5	27.76
957.4	27.61	961.2	27.33	963.4	27.29	965.6	27.18	968.9	27.16
980.8	26.61	983.2	26.44	984.7	26.23	985	26.15	986.1	25.72
987.5	25.34	989	24.78	990.4	24.19	991.8	23.79	992.4	23.66
994.9	23.48	999	23.36	999.9	23.38	1001.8	23.52	1002.3	23.62
1004.4	24.41	1006.5	24.68	1008.6	24.6	1009.8	24.63	1010.7	24.61
1012.8	24.41	1013.4	24.43	1014.5	24.53	1020	24.36	1021.7	24.41
1022.5	24.47	1023.3	24.42	1024.1	24.55	1027.5	24.9	1027.9	25
1028.9	25.34	1029.6	25.47	1031.7	26.15	1033.8	26.52	1035.9	26.73
1038.5	26.83	1040	26.96	1042.2	26.95	1044.3	27.07	1046.4	27.13
1048	27.39	1048.5	27.42	1049.5	27.29	1050.9	27.29	1052.1	27.2
1052.4	27.15	1053.8	27.22	1055	27.36	1055.7	27.31	1056.7	27.13
1058.2	27.13	1061.1	27.05	1062.2	27.06	1062.5	27.1	1063.9	27.15
1065.4	27.16	1066.8	27.08	1069.3	27.39	1071.2	27.34	1072.6	27.44
1074	27.45	1076.5	27.32	1078.4	27.48	1079.8	27.5	1082.7	27.63
1083.7	27.65	1084.9	27.59	1085.8	27.61	1087.1	27.7	1087.5	27.77
1090	28.03	1091.5	27.99	1093	28.01	1094.3	27.94	1096	27.65
1096.6	27.62	1097.4	27.63	1101.9	27.87	1103.4	27.81	1104.8	27.81
1107.9	27.87	1110.2	27.63	1112.2	27.51	1114.7	27.55	1115.2	27.6
1117	27.68	1120.4	27.64	1122.6	27.67	1123.8	27.59	1125.5	27.25
1126	27.23	1128.3	27	1130	27.09	1133.2	27.17	1134.4	27.23
1135.1	27.4	1135.9	27.66	1137.3	27.93	1140.3	27.49	1141.9	27.37
1143.3	27.39	1146	27.48	1146.4	27.55	1147.7	27.65	1148.7	27.63
1149.2	27.68	1151.8	27.65	1155.1	27.76	1156.6	27.76	1160	27.84
1162.2	28.02	1164.5	28.01	1168.5	28.15	1171.4	28.06	1172.9	28.14

1180.3	28.19	1182.6	28.27	1184.8	28.22	1187.1	28.31	1189.2	28.35
1192.2	28.56	1193.8	28.62	1196.1	28.8	1198.4	29.21	1201.1	28.92
1202.5	28.88	1205.1	28.91	1206.2	28.97	1208.5	29	1211.4	29.13
1214.2	29.2	1217.3	29.21	1223.2	29.15	1225.5	29.28	1227.7	29.53
1229.2	29.65	1230.7	29.69	1232.3	29.82	1233.6	29.83	1236.3	29.77
1236.8	29.74	1239	29.43	1241.3	29.43	1244.9	29.52	1248.1	29.53
1254.8	29.48	1257.1	29.34	1258.8	29.31	1261.6	29.34	1263.9	29.29
1269.2	29.37	1270.7	29.34	1273.6	29.48	1279.3	29.59	1281.9	29.59
1284	29.71	1287	29.77	1288.7	29.74	1291	29.75	1293.2	29.62
1294.4	29.64	1296.5	29.59	1298.8	29.65	1300.3	29.64	1301.8	29.71
1303.3	29.69	1307.7	29.73	1312.1	29.84	1313.6	29.94	1316.6	30.05
1318.1	30.16	1322.3	30.19	1324	30.29	1324.9	30.29	1325.5	30.35
1329.4	30.57	1332.9	30.65	1334.4	30.73	1335.8	30.6	1338.4	30.24
1338.8	30.21	1339.5	30.2	1341.8	30.4	1342.9	30.39	1345.2	30.13
1347.5	30.27	1349.2	30.33	1350.7	30.54	1352	30.82	1352.4	30.86
1355.1	31.3	1358.7	31.58	1361	31.53	1363.3	31.08	1365.5	30.75
1367.8	30.45	1372.3	30.51	1374.4	30.41	1377.3	30.52	1380.3	30.69
1381.3	30.79	1382.6	30.81	1383.6	30.75	1385.9	30.72	1388.1	30.62
1390.4	30.74	1392.6	30.66	1393.6	30.66	1395.1	30.74	1397.1	30.66
1401	30.77	1402.5	30.86	1404.1	30.87	1406.2	30.78	1406.9	30.72
1411.4	30.64	1412.9	30.65	1415.8	30.8	1417	30.78	1421.3	30.56
1423.2	30.61	1426.5	30.79	1428.8	30.72	1431	30.7	1433.3	30.79
1438.5	30.88	1441	30.99	1444.6	30.95	1446.8	31.03	1451.4	31.12
1454.3	31.14	1457.3	31.24	1458.8	31.33	1460	31.35	1461.8	31.31
1464.7	31.15	1467.2	31.12	1469.4	31.18	1471.7	31.14	1473.6	31.34
1476.2	31.48	1478	31.42	1479.5	31.48	1483	31.38	1485.2	31.51
1487.5	31.59	1488.4	31.56	1490.2	31.61	1492	31.58	1494.3	31.44
1495.8	31.49	1498.8	31.47	1501	31.36	1509.1	31.36	1510.1	31.35
1512.3	31.25	1514.6	31.25	1516.6	31.32	1519.1	31.22	1523.7	31.29
1525.9	31.24	1528.2	31.25	1532.7	31.47	1535	31.53	1537.2	31.47
1538.8	31.59	1540.2	31.65	1541.7	31.66	1544	31.81	1546.5	31.85
1549.2	32.06	1550.4	32.06	1552	32.16	1554.7	32.22	1556	32.3
1560.1	32.44	1562.8	32.62	1567.3	32.82	1570.9	33.07	1573	33.1
1575.2	33.26	1578.2	33.34	1580.1	33.43	1581.8	33.38	1584.5	33.41
1587.2	33.56	1589.9	33.66	1591.4	33.56	1593	33.52	1595.4	33.54
1601.3	33.75	1604.1	33.81	1605.6	33.91	1606.2	33.98	1607	33.99
1607.8	33.98	1609.8	33.81	1614.3	33.59	1615.5	33.59	1616.9	33.65
1619.6	33.59	1622.5	33.59	1627.9	33.74	1629.6	33.91	1631.5	34.01
1633.3	34.06	1635.3	34.03	1637.4	34.14	1639.5	34.32	1640.4	34.34
1642.4	34.19	1643.3	34.19	1645.2	34.27	1646.3	34.27	1648	34.18
1652.3	34.13	1653.7	34.29	1655.1	34.51	1657.8	35.44	1659.3	36.06
1664	37.74	1671.3	39.87	1674	40.69	1677.8	42.34	1679.2	43.07
1681.8	44.28	1687.6	46.65	1690.3	47.59	1691.9	47.92	1693	48.1
1695.7	48.4	1697.6	48.37	1698.4	48.32	1699	48.24	1699.6	48.12
1701.2	47.94	1703.2	47.57	1703.9	47.5	1706.1	47.45	1708.4	47.64

1713.1 47.86 1717.4 47.87 1718.8 47.81 1720.2 47.82 1725.6 48.02
1728.3 47.96 1731.5 48.21 1733.7 48.52 1736.4 48.51 1738.6 48.43
1740 48.42 1741.5 48.51 1742.9 48.53 1744 48.59 1744.6 48.66
1746.9 48.99 1748.5 49.32 1749.9 49.53 1752.8 49.84 1755.4 49.96
1758.1 49.99 1762.7 50.17 1764.7 50.2 1766.3 50.28 1769 50.57
1773.6 51.35 1775.4 51.54 1777.1 51.77 1782.6 51.98 1783.9 52.1
1785.3 52.28 1788 52.53 1789.6 52.8 1790.7 52.92 1794.3 53.29
1797.2 53.53 1800.2 53.84 1802.3 54.02 1803.7 54.07 1806.1 54.27
1810.8 54.48 1812 54.51 1813.6 54.49 1815 54.43 1818 54.7
1820.7 54.83 1822.1 54.84 1823.3 54.89 1826.8 55.17 1829.8 55.23
1830.6 55.31 1832.8 55.45 1834.1 55.61 1839.1 55.95 1843.4 56.1
1845 56.1 1866 57.18 1874.2 57.45 1883.1 57.91 1885.8 57.92
1890.1 57.32 1891.9 57.03 1892.9 56.98 1893.8 56.89 1896.5 56.5
1897.2 56.45 1898.6 56.41 1903.8 56.48 1905.7 56.43 1907.4 56.34
1911.3 56.44 1912.8 56.53 1915.6 56.59 1921.2 56.79 1924.1 56.66
1926.9 56.68 1931.8 56.8 1934 56.91 1935.4 56.89 1938.2 56.94
1942.3 57.09 1945.4 57.09 1949.5 57.24 1951.1 57.23 1952.4 57.33
1954.1 57.51 1957.1 57.54 1958.9 57.6 1962.3 57.75 1964.3 57.88
1968.68 57.92

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
802.97	.075	989	.035	1006.5	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
989	1006.5	12.1	12.1	.1	.3

CROSS SECTION

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 860

INPUT
Description: Similar to FIS Section E
Station Elevation Data num= 461

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
803.46	32.62	813.85	32.04	826.55	32.04	841.55	32.12	855.4	31.87
869.25	31.79	881.95	31.71	892.33	31.62	901.57	31.54	908.49	31.37
918.88	31.21	925	31.31	928.8	31.33	930.7	31.22	932.3	31.21
933.8	31.29	935.4	31.29	935.9	31.35	936.9	31.19	938	30.92
940.2	30.6	944.5	30.23	946.6	29.96	951	29.56	959.6	28.55
961.5	28.48	966	28.2	968.2	27.95	969.2	27.87	973.5	27.58
975	27.53	977	27.38	983.4	27.31	984.9	27.27	986.3	27.16
987.7	27	988.6	26.83	989.1	26.6	991.5	25.01	994.3	23.66

994.8 23.48 995.2 23.39 997.2 23.14 997.9 23.09 1001.8 23.14
1006.1 23.09 1008.2 23.29 1010.2 23.56 1012.9 24.05 1014.3 24.24
1016.3 24.4 1018.3 24.65 1022.4 25.67 1023.2 25.83 1023.9 26.05
1024.5 26.19 1026.9 26.43 1028.3 26.56 1030.6 26.7 1034.7 26.8
1040.8 26.79 1044.9 26.9 1046.9 27.05 1048.5 26.95 1051 27.03
1054.3 27.02 1056.5 26.97 1057.2 26.99 1059.2 27.14 1062 27.02
1063.7 26.99 1065.6 27.03 1068.5 27.03 1069.9 27.12 1071.3 27.14
1074.1 27.09 1078.3 27.15 1079.8 27 1081.2 27.09 1082.6 26.9
1084.1 26.81 1085.4 26.54 1088.3 25.79 1089.5 25.36 1089.9 25.27
1091.1 25.4 1092.2 25.36 1093.9 25.52 1095 25.49 1096.8 25.71
1097.7 25.64 1098.7 25.65 1099.6 25.75 1101 25.69 1101.6 25.76
1102.3 25.91 1104 26.13 1105.4 26.11 1106.3 26.03 1106.9 26.02
1107.9 25.92 1109.8 26.05 1110.8 25.97 1111.3 25.99 1112.8 25.89
1113.1 25.83 1114.2 25.8 1115.4 25.71 1115.7 25.77 1116.3 25.78
1117.2 25.86 1119.9 25.8 1121.6 26.02 1122.2 26.03 1124.5 26.57
1126 26.63 1126.8 26.72 1129 27.12 1131.3 27 1131.9 26.92
1133 26.96 1135.9 27.22 1136.3 27.21 1138.2 27.33 1140.4 27.17
1141.4 27.08 1142.2 26.96 1142.7 26.94 1145 27.19 1145.5 27.29
1147.3 27.51 1149.5 27.56 1151.1 27.71 1152.6 27.72 1153.9 27.65
1156.4 27.67 1161.4 27.77 1163.2 27.87 1167.8 27.81 1170 27.94
1171.7 27.9 1174.6 27.94 1176.9 28.05 1181.4 27.98 1183.2 28.01
1186.5 28.13 1187.4 28.12 1189.4 28.22 1191.5 28.21 1192.8 28.26
1193.8 28.27 1195.1 28.19 1196.8 28.2 1201.2 28.34 1202.7 28.46
1204.2 28.65 1205.6 28.51 1206.5 28.46 1208.8 28.49 1211.5 28.83
1213 28.98 1214.5 29.05 1218.9 29.1 1222.4 28.92 1224.7 28.96
1227 29.27 1229.2 29.44 1230.7 29.33 1232.2 29.36 1233.8 29.31
1236.6 29.45 1237.6 29.47 1239.6 29.38 1245.5 29.36 1247.3 29.24
1252.9 29.16 1256.3 29.15 1259.5 29.03 1261.9 29.16 1263.1 29.17
1265.3 29.12 1269.8 29.19 1272 29.18 1274.3 29.25 1276.5 29.25
1278.8 29.41 1281 29.4 1283.3 29.52 1287.1 29.55 1292.3 29.79
1296 29.68 1299 29.78 1300.5 29.78 1303.5 29.66 1306.4 29.82
1307.8 29.82 1310.3 29.68 1312.5 29.81 1314.8 29.79 1317 29.85
1319.2 29.8 1321.5 29.94 1323.7 29.99 1326 30.13 1332.7 30.42
1333.2 30.41 1335 30.24 1337.6 30.26 1339.5 30.33 1342.1 30.32
1344 30.37 1345.1 30.3 1346.2 30.14 1347.2 30.07 1348 30.06
1349.5 30.22 1351.6 30.54 1354 30.51 1356 30.57 1357.5 30.73
1360.4 30.82 1365.9 30.67 1367.4 30.54 1368.7 30.47 1370.9 30.42
1374.8 30.44 1375.4 30.41 1377.7 30.47 1379.2 30.45 1380.7 30.5
1384.4 30.53 1386.7 30.81 1388.9 30.87 1391.2 30.65 1394.1 30.5
1395.4 30.55 1398.6 30.79 1400.2 30.84 1403 30.8 1404.7 30.65
1406 30.61 1408.6 30.68 1410.4 30.63 1415.9 30.57 1420.4 30.62
1421.7 30.6 1422.3 30.61 1423.8 30.72 1425.3 30.73 1426.8 30.66
1428.3 30.51 1429.8 30.41 1434.2 30.6 1436.2 30.55 1438.4 30.56
1440.1 30.51 1441.6 30.56 1443.3 30.68 1447.6 30.63 1450.5 30.71
1454.3 30.91 1454.9 30.89 1456.2 30.93 1457.9 30.89 1458.8 30.83

1460.4 30.83 1462.3 30.96 1463.3 31.07 1469.7 31.08 1474.6 31.21
1476.9 31.02 1478.6 31 1480.1 31.09 1483.7 30.91 1487.5 31.06
1488.2 31.05 1490.4 31.12 1492.7 31.26 1494.9 31.19 1496.4 31.09
1497.2 31.09 1500.8 31.29 1506.3 31.17 1507.5 31.22 1508.5 31.33
1511.2 31.51 1513.1 31.5 1515.3 31.43 1518.6 31.46 1520.4 31.44
1522.1 31.48 1526 31.45 1528.9 31.47 1531.2 31.58 1533.4 31.75
1540.2 31.88 1544.7 32.03 1547 32.06 1549.3 32.04 1552.6 32.22
1553.8 32.32 1558.5 32.19 1567.4 32.38 1574.2 32.33 1576.3 32.37
1578.7 32.36 1583.2 32.44 1587.7 32.38 1589.6 32.3 1592.3 32.37
1595.5 32.36 1597.4 32.41 1601.7 32.38 1605.8 32.62 1608.1 32.69
1615.3 32.79 1619.2 32.77 1621.7 32.89 1623.9 33.09 1626.6 33.08
1628.4 32.94 1630.7 33.06 1634 33.51 1635.9 33.92 1637.5 34.21
1639.9 34.54 1644.3 35.27 1645.8 35.62 1648.8 36.18 1653.3 37.25
1654.7 37.76 1657.8 38.67 1660 39.6 1662 40.52 1663.7 41.38
1666.3 42.82 1669 44.18 1671.3 45.09 1673.5 45.58 1674.1 45.63
1675.5 45.67 1678 45.8 1679.5 45.81 1681.5 45.76 1684.7 45.58
1688.9 45.45 1691.5 45.55 1693.4 45.48 1696 45.48 1702.7 45.8
1708.2 45.75 1711.7 45.77 1716.2 45.68 1718.7 45.68 1723.1 45.81
1725.2 45.98 1726.1 46.02 1726.9 46.01 1730.5 46.1 1731.9 46.06
1736.4 46.37 1738.6 46.29 1739.5 46.32 1740.9 46.31 1743.1 46.61
1745.4 46.78 1746.9 46.75 1748.4 46.78 1749.9 46.84 1752.1 47.02
1754.3 47.06 1756.6 46.76 1758.9 46.57 1761.8 46.72 1763.4 46.75
1767.8 47.11 1769.2 47.12 1772.2 47.01 1773.6 47.04 1776.2 47.03
1779.6 47.14 1781.1 47.25 1785.8 47.84 1792.6 48.98 1794.4 49.19
1797.1 49.38 1803.3 49.64 1804.8 49.79 1806.1 49.84 1808.4 50.13
1810.6 50.21 1812.9 50.6 1815.2 50.81 1817.4 51.11 1819.5 51.3
1821.1 51.32 1822.6 51.43 1828.1 51.57 1833.2 51.89 1835.5 52.08
1840 52.3 1846.3 52.39 1850.7 52.6 1852.2 52.61 1856.7 52.42
1862.5 52.31 1864.9 52.38 1865.5 52.45 1867 52.54 1869.4 52.42
1871.6 52.5 1872.9 52.5 1873.9 52.47 1875.5 52.3 1876.1 52.29
1877.4 52.46 1878.4 52.54 1879.8 52.49 1881.8 52.52 1885.2 52.47
1889.2 52.66 1892 52.61 1893.7 52.76 1894.2 52.77 1898.7 52.79
1901 52.84 1903.2 52.82 1909.9 52.94 1911.5 52.89 1912.3 52.91
1914.4 53 1916.8 53.04 1921.3 53.28 1923.3 53.34 1924.8 53.46
1925.8 53.48 1928.1 53.4 1930.7 53.56 1932.6 53.62 1934.9 53.81
1941.6 54.09 1943.9 54.15 1948.4 54.15 1968.7 53.9 1971 54.05
1973.7 54.05 1975.5 54.1 1976.7 54.29 1977.8 54.51 1979.6 55.18
1980 55.36 1983.1 56.99 1984 57.51 1985.5 58.2 1986.8 58.78
1989.1 59.49 1991.3 59.83 1993.6 60.02 1998.9 60.08 2000.4 59.96
2002.33 59.7

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
803.46 .075 991.5 .035 1018.3 .075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
991.5	1018.3	16.8	16.8	.1	.3

CROSS SECTION

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 845

INPUT
Description: Approach Scetion
Station Elevation Data num= 461

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800.99	32.55	806.92	32.1	814.84	31.73	831.66	31.59	842.54	31.51
854.41	31.37	865.29	31.29	881.12	31.22	892	31.14	902.89	30.92
910.8	30.7	920	30.71	924.4	30.69	926.6	30.62	933.1	30.51
935.3	30.41	936	30.41	939.6	30.59	941.2	30.71	943.9	30.8
944.7	30.76	952.6	29.91	954.8	29.75	958.4	29.28	961.3	29
963.5	28.93	967	28.72	976.5	27.77	978.7	27.71	980.8	27.59
983	27.59	985.2	27.54	987.3	27.38	989.5	27.14	991.7	26.98
992	26.82	992.8	26.27	993.5	25.53	993.9	25.25	994.6	24.62
995.1	24.23	996	23.71	998.1	23.16	999.6	23.07	1001.2	23.1
1002.7	23.22	1004.2	23.42	1008	24.38	1009.1	24.55	1012.6	24.84
1013.2	24.94	1014.7	25.33	1018	26.04	1020.3	26.38	1021.6	26.53
1022.5	26.6	1024.7	26.66	1029.7	26.67	1031.4	26.72	1033.6	26.94
1035.9	26.87	1038.1	26.9	1040.3	27.02	1042.5	27.01	1044.6	26.91
1047.4	26.9	1048.2	26.86	1050.8	26.87	1054.8	26.76	1056.8	26.61
1058.8	26.2	1060.8	25.42	1062.8	24.76	1064.8	24.72	1066.9	24.46
1068.9	24.45	1070.9	24.59	1072.9	24.68	1076.9	24.5	1078.9	24.77
1080.9	25.47	1082.9	26.04	1084	26.07	1086	26.3	1087.5	26.43
1089.5	26.46	1090.5	26.58	1091.7	26.64	1093.5	26.89	1094	26.93
1098.4	27.04	1101.3	27.15	1105.2	27.39	1106.9	27.26	1107.4	27.25
1109.7	27.43	1111.9	27.53	1116.4	27.56	1125.4	27.87	1129.9	27.67
1132.1	27.66	1135.1	27.85	1136.6	28	1138.8	28.08	1141.1	28.06
1144	28.15	1145.5	28.22	1147.8	28.41	1150	28.28	1154.5	28.31
1156.8	28.46	1157.4	28.47	1159.1	28.41	1160.4	28.42	1161.2	28.35
1163.6	28.41	1165	28.34	1166.5	28.32	1167.8	28.23	1169.5	27.9
1171	27.7	1172.2	27.57	1172.5	27.57	1176.6	28.07	1178.5	28.34
1181.5	28.41	1184.5	28.57	1185.5	28.61	1186	28.59	1187.5	28.66
1190.5	28.48	1192.1	28.5	1196.5	28.41	1198	28.22	1199.5	28.17
1201.2	28.05	1202.5	28.05	1204.1	28.14	1205.4	28.14	1209.8	27.94
1210.1	27.95	1212	28.19	1214.2	28.11	1216.1	28.29	1216.4	28.27
1217.6	28.05	1218.6	27.92	1220.8	27.96	1223.6	27.82	1225.3	27.67
1227.5	27.66	1229.7	27.85	1232.6	27.83	1234.1	27.75	1235.6	27.8
1236.3	27.78	1237.1	27.9	1238.6	28.2	1240.7	28.47	1242.9	28.46

1244.6 28.57 1246.1 28.6 1247.4 28.67 1248.3 28.85 1249.6 29
1250.7 28.92 1253 28.65 1254 28.61 1256.2 28.38 1258.1 28.35
1263 28.52 1267.5 28.6 1269.7 28.68 1272 28.69 1274.5 28.64
1276.5 28.8 1278.9 28.75 1284.8 29.05 1287.8 29.12 1289.3 29.21
1290.8 29.25 1292.3 29.35 1294.5 29.43 1296.8 29.29 1298.2 29.36
1299.1 29.33 1300.8 29.33 1302.6 29.43 1304.1 29.39 1305.6 29.53
1308.6 29.47 1309.5 29.53 1310 29.6 1311.5 29.62 1313.8 29.53
1317.1 29.71 1318.9 29.68 1321.9 29.8 1323.9 29.66 1326.1 29.59
1327.8 29.82 1331.1 29.88 1333.8 29.79 1335.2 29.67 1338.2 30
1339.6 30.22 1342.7 30.08 1344.2 29.94 1345.6 29.98 1348.4 29.93
1350.1 29.98 1350.9 29.96 1351.6 29.97 1352.8 30.09 1355.4 30.43
1356 30.44 1357.1 30.4 1359.9 30.08 1361.4 30.13 1362.2 30.2
1365.8 30.29 1367.9 30.41 1369 30.37 1370.8 30.74 1371.2 30.75
1372.3 30.55 1375.3 30.26 1379.7 30.08 1381.2 30.1 1383.1 30.06
1385.7 30.06 1387 29.98 1389.3 30.12 1390.1 30.22 1391.5 30.32
1393.8 30.09 1394.5 30.12 1396 30.09 1399 30.19 1400.5 30.34
1402 30.18 1406.4 30.12 1409 29.98 1411.8 29.93 1413.4 29.94
1415.3 30.02 1416.8 30.04 1418.6 30 1421.2 30.04 1423.1 30.01
1425.3 30.08 1429.8 30.13 1432.1 30.38 1434.6 30.35 1436.1 30.26
1436.6 30.2 1438.9 30.19 1441.1 30.33 1443.5 30.34 1446.4 30.4
1447.9 30.53 1450.1 30.34 1455.3 30.39 1458.3 30.3 1459.8 30.3
1461.4 30.21 1464.2 30.16 1465.9 30.2 1468.2 30.33 1470.4 30.41
1474.6 30.44 1477.6 30.35 1479.5 30.41 1484 30.42 1486.5 30.51
1491.3 30.43 1493 30.47 1497.5 30.7 1500 30.65 1504.3 30.75
1507.2 30.73 1508.7 30.79 1512.9 30.88 1514.6 30.88 1516.1 30.95
1521.6 30.98 1524.6 31.03 1531 31.25 1533.9 31.31 1535.4 31.28
1538.1 31.38 1542.6 31.41 1544.9 31.3 1547.1 31.36 1550.2 31.36
1551.6 31.43 1558.5 31.42 1560.9 31.48 1563.2 31.59 1564.9 31.62
1567.8 31.56 1570.1 31.63 1575.1 31.65 1579.4 31.79 1581.7 31.73
1584 31.6 1586.3 31.66 1587.8 31.8 1588.6 31.91 1591.2 32.01
1592.7 32.13 1593.2 32.11 1594.2 32.16 1595.5 32.32 1598.5 32.19
1600.2 32.18 1602.5 32.23 1604.8 32.38 1607.1 32.32 1610.3 32.35
1611.7 32.44 1619.6 32.61 1622 32.63 1625.6 32.78 1627.9 33.11
1630.2 33.38 1632.2 33.53 1637.2 34.09 1638 34.26 1639.5 34.47
1641 34.89 1642.4 35.41 1644.1 35.89 1645.4 36.12 1647.5 36.66
1649.8 37.42 1653.4 39.02 1655.6 40.4 1660.3 42.84 1661.5 43.33
1662.6 43.88 1662.9 43.98 1663.4 44.11 1664.4 44.29 1664.9 44.34
1667.4 44.34 1668.8 44.25 1671.4 43.79 1674.2 43.54 1678.8 43.42
1681.1 43.43 1681.9 43.45 1683.4 43.53 1687.3 43.52 1690.4 43.62
1692.7 43.64 1695 43.77 1697.3 44.02 1701 44.2 1703.3 44.27
1704.3 44.27 1706.8 44.07 1708.3 44.08 1713.5 43.97 1715.8 44.24
1717.1 44.25 1718.1 44.2 1719.2 44.19 1723.2 44.27 1727.4 44.54
1728.8 44.6 1729.7 44.59 1733.1 44.85 1736.1 44.93 1739 45.09
1743.6 45.27 1749.2 45.61 1750.5 45.66 1756.6 46.22 1758 46.28
1759.8 46.41 1763.9 46.36 1766.7 46.58 1769 46.53 1769.7 46.55

1773.6 46.74 1776 46.91 1778.3 47.02 1782.9 46.97 1785.2 47.2
1785.8 47.23 1787.3 47.2 1788.7 47.12 1792.1 47.23 1796.1 47.67
1802.8 48.52 1803.7 48.64 1804.8 48.84 1809.2 49.42 1813.6 50.05
1816.5 50.32 1819.5 50.51 1822.4 50.82 1824.5 51.09 1826.8 51.32
1828.2 51.65 1829.1 51.73 1830.7 51.66 1834.7 51.75 1842.6 52.05
1850 52.25 1852.3 52.26 1854.5 52.13 1857.6 52.08 1858.9 52.02
1861.1 51.86 1863.4 51.81 1865.1 51.61 1870 51.35 1872.2 51.29
1874.4 51.07 1875.6 51.01 1876.7 51 1877.1 51.06 1878.9 51.16
1881.6 51.02 1884.6 51.12 1885.5 51.12 1887.7 51.04 1889.1 51.08
1892.1 51.09 1898.1 51.28 1907.7 51.47 1912.1 51.71 1914.4 51.89
1916.6 52.17 1918.8 52.37 1921 52.66 1922.1 52.77 1923.2 52.87
1925.1 52.92 1927.7 53.22 1928.1 53.3 1929.6 53.48 1931.1 53.6
1933.7 53.9 1936.5 54.07 1941.6 54.04 1952.1 53.87 1958.7 53.75
1960.9 53.66 1963.1 53.71 1966.1 53.6 1967.6 53.6 1970.1 53.47
1972 53.58 1974.2 53.66 1976.4 54.22 1978.7 55.14 1980.9 56.64
1982.03 57.56

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
800.99 .075 993.9 .035 1014.7 .075

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
993.9 1014.7 27.2 27.2 27.2 .1 .3
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
800.99 966 29 F
1034 1982.03 29 F

CROSS SECTION

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 666

INPUT
Description: Similar to FIS Section D Just upstream of culvert
Station Elevation Data num= 474
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
563.14 34.85 575.69 35.07 594.51 34.7 596.08 32.97 600 33.52
613.33 32.49 626.67 32.08 640.78 31.83 655.69 31.49 669.8 31.16
680.78 30.91 699.61 30.65 707.45 30.43 726.27 30.32 752.94 30.21
770.98 30.17 788.24 30.09 801.98 30.2 814.84 29.94 830.67 29.82
845.51 29.82 870.24 30.27 885.08 30.27 896.95 30.14 910 30.11
916.6 30.1 918.7 30.15 920.8 30.08 922.9 30.18 925.7 30.24
929.9 30.26 934.7 30.33 938.3 30.31 939.4 30.33 941.9 30.43

944 30.59 948.2 30.53 950.4 30.38 952.4 30.17 955.2 29.78
956.8 29.66 958.3 29.5 964.8 29.36 967.9 29.14 970.2 29.1
970.7 29.04 971.8 28.84 974.7 27.93 975.8 27.46 976.5 27.34
979.1 27.1 981.3 27.09 983.4 26.68 984.1 26.65 985.6 26.48
987.2 26.48 987.8 26.44 988.7 26.35 990.2 26.1 991.8 25.56
994.3 23.84 994.8 23.62 995.74 22.49 996.4 22.49 998.6 22.49
999.4 22.49 1000.9 22.5 1001.3 22.5 1002.4 22.5 1002.9 22.5
1004.25 22.5 1005.6 23.66 1006.5 24.06 1009.1 25.13 1010.9 25.94
1012.4 26.5 1014.3 27.35 1015.3 27.68 1016.6 28.2 1018.9 28.88
1019.7 29.21 1021.2 29.53 1025.3 29.49 1030.3 29.59 1035.8 29.56
1038.8 29.5 1041.4 29.6 1045.9 29.52 1047.8 29.55 1052.5 29.49
1054.7 29.56 1056.9 29.5 1059.2 29.51 1061.4 29.44 1063.6 29.45
1065.8 29.5 1068 29.45 1073.3 29.47 1076.9 29.43 1079.3 29.45
1083.5 29.38 1085.8 29.4 1088 29.5 1089.8 29.39 1093.7 29.44
1095.8 29.42 1098.3 29.46 1103.5 29.4 1105.7 29.46 1110.8 29.44
1113.8 29.49 1116.8 29.41 1121.2 29.5 1125.7 29.5 1127.3 29.53
1130.3 29.5 1136.3 29.55 1139 29.51 1142.3 29.55 1150.1 29.56
1153.9 29.62 1155.8 29.58 1159 29.62 1161.7 29.6 1163.5 29.55
1165.8 29.6 1167.7 29.56 1170.3 29.57 1172.5 29.52 1177.1 29.61
1183.8 29.59 1186.1 29.68 1190.6 29.59 1192.7 29.68 1194.3 29.48
1195.8 29.47 1197 29.55 1197.3 29.53 1197.4 29.55 1198.7 29.44
1201.3 29.43 1203.2 29.21 1204.7 29.15 1205.6 29.18 1206.5 29.09
1207.6 28.92 1208.7 28.91 1209.1 28.97 1209.8 29.2 1210.6 29.38
1211 29.52 1212.1 29.53 1213.2 29.64 1214.1 29.67 1215.5 29.44
1216.5 29.36 1217 29.44 1218.4 29.55 1219.5 29.44 1220 29.55
1220.9 29.54 1222.3 29.62 1226.8 29.62 1228.3 29.57 1229.8 29.59
1231.3 29.72 1234.3 29.59 1235.6 29.52 1235.8 29.48 1237.2 29.45
1238.1 29.53 1239.9 29.53 1240.2 29.5 1241.7 29.47 1243.2 29.48
1244.1 29.54 1246.1 29.45 1248.4 29.57 1249.4 29.52 1250.6 29.37
1252 29.27 1252.7 29.31 1253.9 29.24 1255 29.05 1258 28.84
1258.5 28.87 1259.4 29.05 1260.7 29.39 1261.3 29.45 1262.4 29.42
1263 29.46 1263.9 29.45 1265.6 29.49 1268.3 29.36 1269.8 29.32
1272 29.2 1274.2 29.15 1277.2 29.29 1281.1 29.36 1283.3 29.43
1289 29.5 1292 29.59 1294.6 29.56 1296.4 29.61 1299.4 29.61
1305.3 29.78 1308.3 29.76 1312.7 29.91 1317.2 29.9 1319.5 29.84
1321.8 29.82 1324 29.89 1330.8 29.95 1333.1 30 1335.3 30.1
1337.9 30.13 1339.4 30.21 1342.3 30.45 1346.6 30.59 1349.7 30.54
1352.7 30.56 1355.7 30.53 1357.1 30.62 1360.1 30.88 1361.6 30.88
1364.2 30.94 1367.5 31.17 1369.3 31.15 1370.5 31.27 1371.9 31.5
1373.8 31.53 1374.9 31.61 1376 31.73 1377.9 32.08 1378.3 32.18
1380.8 32.16 1381.3 32.14 1382.3 32.03 1383.8 31.94 1385.1 31.94
1385.3 31.91 1386.7 31.42 1387.3 31.24 1388.2 31.15 1389.6 30.94
1391.9 30.78 1394.1 30.69 1395.6 30.68 1396.4 30.64 1397.1 30.55
1398.6 30.55 1400.1 30.45 1401.6 30.29 1402.8 30.24 1404.5 30.26
1405.4 30.3 1407.1 30.18 1407.7 30.11 1409 30.04 1410 30.02

1411.9 30.12 1413.4 30.14 1414.5 30.12 1415.6 30.03 1416.4 30
1419 30.22 1419.9 30.17 1421.3 30.01 1423.5 29.91 1425.2 30.05
1426.7 30.03 1428.5 29.94 1432.6 29.94 1434.1 29.99 1434.8 30.07
1435.6 30.09 1441.6 29.84 1444.5 29.9 1446.1 30.05 1448.4 30.09
1449.9 30.04 1451.9 30.03 1452.9 30.08 1454.2 30.27 1454.8 30.3
1455.2 30.3 1457.4 30.17 1457.8 30.12 1459.3 30.07 1462.2 30.03
1463.7 30.07 1465.2 30.2 1466.5 30.37 1468.2 30.29 1471.4 30.72
1473.3 30.8 1475.5 31.02 1477.1 31 1480 31.07 1482.3 31.41
1484.2 31.78 1484.6 31.81 1486.8 31.67 1489.1 31.41 1490.4 31.29
1491.3 31.24 1493.6 31.43 1495.9 31.86 1497.1 32.27 1498.1 32.57
1500.4 32.91 1501.4 32.98 1502.6 32.94 1503.7 32.77 1504.9 32.68
1506.7 32.38 1507.2 32.34 1511.1 32.49 1513.9 32.63 1516.2 32.63
1517 32.59 1518.4 32.45 1520.7 32.07 1521.5 32.02 1524.5 32.07
1525.9 32.06 1527.4 32.21 1536.3 31.76 1538.7 31.83 1541 31.79
1543.7 31.88 1546.7 31.93 1550 31.94 1554.5 31.86 1557.1 31.89
1561.5 31.68 1563.6 31.64 1564.5 31.67 1566.3 31.66 1568.1 31.79
1570.4 31.84 1571.9 31.74 1573.4 31.71 1574.8 31.63 1577.1 31.61
1579.3 31.81 1583.8 31.84 1586.1 32.09 1586.7 32.12 1588.2 32.13
1589.7 32.42 1590.6 32.56 1591.2 32.6 1594.1 32.59 1597.1 32.7
1598.6 32.83 1599.6 32.95 1600.9 33.02 1603 33.07 1604.2 33.13
1606.4 33.34 1607.5 33.4 1608.7 33.38 1610.9 33.52 1613.2 33.59
1614.9 33.53 1616.4 33.57 1620.8 33.57 1623.8 33.63 1626.8 33.76
1628.2 33.78 1629.7 33.76 1631.2 33.84 1633.5 33.85 1635.7 33.95
1637.1 33.93 1638.6 34.01 1640.3 33.97 1643.1 34.05 1644.8 34.06
1647.5 34.15 1651.5 34.37 1652.9 34.35 1653.8 34.39 1657.2 34.85
1658.3 35.03 1662.4 35.98 1662.8 36.1 1667.3 37.78 1672.8 40.46
1674.2 41.19 1676.3 41.83 1678.5 42.42 1680.8 42.85 1683 43.11
1684.6 43.09 1685.3 43.13 1686.1 43.11 1690.6 42.84 1693.5 42.94
1696.5 42.94 1700.9 43.06 1705.4 42.97 1707.8 42.95 1711.4 43.04
1715.8 43.25 1718.8 43.32 1721.3 43.49 1723.5 43.55 1725.8 43.66
1727.7 43.82 1730.3 43.98 1732.5 43.94 1736.6 44.29 1739.3 44.32
1740.2 44.29 1741.5 44.32 1742.5 44.42 1744.5 44.55 1747 44.77
1750.5 45.17 1752.8 45.18 1755 45.14 1757.4 45.23 1759.5 45.11
1761.8 45.09 1766.3 45.37 1768.5 45.48 1773 45.96 1773.7 45.99
1775.1 46.01 1778.2 45.98 1779.8 45.88 1782.6 45.94 1784.3 46.03
1786.5 45.98 1788.8 45.86 1791.5 46.03 1795.5 46.09 1797.8 46.27
1801.9 46.5 1804.5 46.79 1805.7 46.88 1806.8 46.95 1809 46.96
1811.3 47.1 1813.5 47.34 1814.4 47.41 1816.8 47.56 1818.3 47.62
1819.7 47.75 1823.1 47.88 1824.8 48.06 1827.2 48.25 1828.7 48.24
1830.1 48.28 1831.5 48.26 1833.1 48.34 1836 48.43 1845 49.06
1847.3 49.3 1848 49.35 1850.9 49.48 1853.9 49.57 1859.8 49.45
1863 49.49 1865.3 49.62 1867.5 49.88 1869.8 50.02 1874.3 50.22
1875.5 50.23 1878.8 50.16 1880.6 49.94 1882.76 49.83

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
563.14	.075	990.2	.035	1010.9	.075

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
990.2 1010.9 56.7 56.7 56.7 .4 .6
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
563.14	994	29	F
1006	1882.76	29	F

CULVERT

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 650

INPUT
Description: South Turnpike Road
Distance from Upstream XS = 2
Deck/Roadway Width = 41.42
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
500	30	1600	30

Upstream Bridge Cross Section Data
Station Elevation Data num= 474

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
563.14	34.85	575.69	35.07	594.51	34.7	596.08	32.97	600	33.52
613.33	32.49	626.67	32.08	640.78	31.83	655.69	31.49	669.8	31.16
680.78	30.91	699.61	30.65	707.45	30.43	726.27	30.32	752.94	30.21
770.98	30.17	788.24	30.09	801.98	30.2	814.84	29.94	830.67	29.82
845.51	29.82	870.24	30.27	885.08	30.27	896.95	30.14	910	30.11
916.6	30.1	918.7	30.15	920.8	30.08	922.9	30.18	925.7	30.24
929.9	30.26	934.7	30.33	938.3	30.31	939.4	30.33	941.9	30.43
944	30.59	948.2	30.53	950.4	30.38	952.4	30.17	955.2	29.78
956.8	29.66	958.3	29.5	964.8	29.36	967.9	29.14	970.2	29.1
970.7	29.04	971.8	28.84	974.7	27.93	975.8	27.46	976.5	27.34
979.1	27.1	981.3	27.09	983.4	26.68	984.1	26.65	985.6	26.48
987.2	26.48	987.8	26.44	988.7	26.35	990.2	26.1	991.8	25.56
994.3	23.84	994.8	23.62	995.74	22.49	996.4	22.49	998.6	22.49
999.4	22.49	1000.9	22.5	1001.3	22.5	1002.4	22.5	1002.9	22.5
1004.25	22.5	1005.6	23.66	1006.5	24.06	1009.1	25.13	1010.9	25.94
1012.4	26.5	1014.3	27.35	1015.3	27.68	1016.6	28.2	1018.9	28.88

1019.7 29.21 1021.2 29.53 1025.3 29.49 1030.3 29.59 1035.8 29.56
1038.8 29.5 1041.4 29.6 1045.9 29.52 1047.8 29.55 1052.5 29.49
1054.7 29.56 1056.9 29.5 1059.2 29.51 1061.4 29.44 1063.6 29.45
1065.8 29.5 1068 29.45 1073.3 29.47 1076.9 29.43 1079.3 29.45
1083.5 29.38 1085.8 29.4 1088 29.5 1089.8 29.39 1093.7 29.44
1095.8 29.42 1098.3 29.46 1103.5 29.4 1105.7 29.46 1110.8 29.44
1113.8 29.49 1116.8 29.41 1121.2 29.5 1125.7 29.5 1127.3 29.53
1130.3 29.5 1136.3 29.55 1139 29.51 1142.3 29.55 1150.1 29.56
1153.9 29.62 1155.8 29.58 1159 29.62 1161.7 29.6 1163.5 29.55
1165.8 29.6 1167.7 29.56 1170.3 29.57 1172.5 29.52 1177.1 29.61
1183.8 29.59 1186.1 29.68 1190.6 29.59 1192.7 29.68 1194.3 29.48
1195.8 29.47 1197 29.55 1197.3 29.53 1197.4 29.55 1198.7 29.44
1201.3 29.43 1203.2 29.21 1204.7 29.15 1205.6 29.18 1206.5 29.09
1207.6 28.92 1208.7 28.91 1209.1 28.97 1209.8 29.2 1210.6 29.38
1211 29.52 1212.1 29.53 1213.2 29.64 1214.1 29.67 1215.5 29.44
1216.5 29.36 1217 29.44 1218.4 29.55 1219.5 29.44 1220 29.55
1220.9 29.54 1222.3 29.62 1226.8 29.62 1228.3 29.57 1229.8 29.59
1231.3 29.72 1234.3 29.59 1235.6 29.52 1235.8 29.48 1237.2 29.45
1238.1 29.53 1239.9 29.53 1240.2 29.5 1241.7 29.47 1243.2 29.48
1244.1 29.54 1246.1 29.45 1248.4 29.57 1249.4 29.52 1250.6 29.37
1252 29.27 1252.7 29.31 1253.9 29.24 1255 29.05 1258 28.84
1258.5 28.87 1259.4 29.05 1260.7 29.39 1261.3 29.45 1262.4 29.42
1263 29.46 1263.9 29.45 1265.6 29.49 1268.3 29.36 1269.8 29.32
1272 29.2 1274.2 29.15 1277.2 29.29 1281.1 29.36 1283.3 29.43
1289 29.5 1292 29.59 1294.6 29.56 1296.4 29.61 1299.4 29.61
1305.3 29.78 1308.3 29.76 1312.7 29.91 1317.2 29.9 1319.5 29.84
1321.8 29.82 1324 29.89 1330.8 29.95 1333.1 30 1335.3 30.1
1337.9 30.13 1339.4 30.21 1342.3 30.45 1346.6 30.59 1349.7 30.54
1352.7 30.56 1355.7 30.53 1357.1 30.62 1360.1 30.88 1361.6 30.88
1364.2 30.94 1367.5 31.17 1369.3 31.15 1370.5 31.27 1371.9 31.5
1373.8 31.53 1374.9 31.61 1376 31.73 1377.9 32.08 1378.3 32.18
1380.8 32.16 1381.3 32.14 1382.3 32.03 1383.8 31.94 1385.1 31.94
1385.3 31.91 1386.7 31.42 1387.3 31.24 1388.2 31.15 1389.6 30.94
1391.9 30.78 1394.1 30.69 1395.6 30.68 1396.4 30.64 1397.1 30.55
1398.6 30.55 1400.1 30.45 1401.6 30.29 1402.8 30.24 1404.5 30.26
1405.4 30.3 1407.1 30.18 1407.7 30.11 1409 30.04 1410 30.02
1411.9 30.12 1413.4 30.14 1414.5 30.12 1415.6 30.03 1416.4 30
1419 30.22 1419.9 30.17 1421.3 30.01 1423.5 29.91 1425.2 30.05
1426.7 30.03 1428.5 29.94 1432.6 29.94 1434.1 29.99 1434.8 30.07
1435.6 30.09 1441.6 29.84 1444.5 29.9 1446.1 30.05 1448.4 30.09
1449.9 30.04 1451.9 30.03 1452.9 30.08 1454.2 30.27 1454.8 30.3
1455.2 30.3 1457.4 30.17 1457.8 30.12 1459.3 30.07 1462.2 30.03
1463.7 30.07 1465.2 30.2 1466.5 30.37 1468.2 30.29 1471.4 30.72
1473.3 30.8 1475.5 31.02 1477.1 31 1480 31.07 1482.3 31.41
1484.2 31.78 1484.6 31.81 1486.8 31.67 1489.1 31.41 1490.4 31.29

1491.3	31.24	1493.6	31.43	1495.9	31.86	1497.1	32.27	1498.1	32.57
1500.4	32.91	1501.4	32.98	1502.6	32.94	1503.7	32.77	1504.9	32.68
1506.7	32.38	1507.2	32.34	1511.1	32.49	1513.9	32.63	1516.2	32.63
1517	32.59	1518.4	32.45	1520.7	32.07	1521.5	32.02	1524.5	32.07
1525.9	32.06	1527.4	32.21	1536.3	31.76	1538.7	31.83	1541	31.79
1543.7	31.88	1546.7	31.93	1550	31.94	1554.5	31.86	1557.1	31.89
1561.5	31.68	1563.6	31.64	1564.5	31.67	1566.3	31.66	1568.1	31.79
1570.4	31.84	1571.9	31.74	1573.4	31.71	1574.8	31.63	1577.1	31.61
1579.3	31.81	1583.8	31.84	1586.1	32.09	1586.7	32.12	1588.2	32.13
1589.7	32.42	1590.6	32.56	1591.2	32.6	1594.1	32.59	1597.1	32.7
1598.6	32.83	1599.6	32.95	1600.9	33.02	1603	33.07	1604.2	33.13
1606.4	33.34	1607.5	33.4	1608.7	33.38	1610.9	33.52	1613.2	33.59
1614.9	33.53	1616.4	33.57	1620.8	33.57	1623.8	33.63	1626.8	33.76
1628.2	33.78	1629.7	33.76	1631.2	33.84	1633.5	33.85	1635.7	33.95
1637.1	33.93	1638.6	34.01	1640.3	33.97	1643.1	34.05	1644.8	34.06
1647.5	34.15	1651.5	34.37	1652.9	34.35	1653.8	34.39	1657.2	34.85
1658.3	35.03	1662.4	35.98	1662.8	36.1	1667.3	37.78	1672.8	40.46
1674.2	41.19	1676.3	41.83	1678.5	42.42	1680.8	42.85	1683	43.11
1684.6	43.09	1685.3	43.13	1686.1	43.11	1690.6	42.84	1693.5	42.94
1696.5	42.94	1700.9	43.06	1705.4	42.97	1707.8	42.95	1711.4	43.04
1715.8	43.25	1718.8	43.32	1721.3	43.49	1723.5	43.55	1725.8	43.66
1727.7	43.82	1730.3	43.98	1732.5	43.94	1736.6	44.29	1739.3	44.32
1740.2	44.29	1741.5	44.32	1742.5	44.42	1744.5	44.55	1747	44.77
1750.5	45.17	1752.8	45.18	1755	45.14	1757.4	45.23	1759.5	45.11
1761.8	45.09	1766.3	45.37	1768.5	45.48	1773	45.96	1773.7	45.99
1775.1	46.01	1778.2	45.98	1779.8	45.88	1782.6	45.94	1784.3	46.03
1786.5	45.98	1788.8	45.86	1791.5	46.03	1795.5	46.09	1797.8	46.27
1801.9	46.5	1804.5	46.79	1805.7	46.88	1806.8	46.95	1809	46.96
1811.3	47.1	1813.5	47.34	1814.4	47.41	1816.8	47.56	1818.3	47.62
1819.7	47.75	1823.1	47.88	1824.8	48.06	1827.2	48.25	1828.7	48.24
1830.1	48.28	1831.5	48.26	1833.1	48.34	1836	48.43	1845	49.06
1847.3	49.3	1848	49.35	1850.9	49.48	1853.9	49.57	1859.8	49.45
1863	49.49	1865.3	49.62	1867.5	49.88	1869.8	50.02	1874.3	50.22
1875.5	50.23	1878.8	50.16	1880.6	49.94	1882.76	49.83		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
563.14	.075	990.2	.024	1010.9	.075

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
990.2	1010.9	.4	.6

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
563.14	994	29	F
1006	1882.76	29	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
500	30	1600	30

Downstream Bridge Cross Section Data
Station Elevation Data num= 476

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
829.75	34.18	830.3	34.23	834.28	33.74	836.09	33.68	838.26	33.44
838.26	33.28	838.81	32.81	839.35	32.65	839.89	32.52	840.62	32.28
841.52	32	842.61	31.7	843.88	31.29	844.78	30.93	846.77	30.52
848.04	30.08	849.85	29.57	851.48	29.1	852.93	28.62	854.01	28.38
855.1	28.17	857.09	28.01	858	27.94	859.99	27.89	861.44	27.92
862.89	27.92	864	27.97	864.2	28.02	866.2	28.31	868.2	28.54
870.2	29	872.2	29.34	874.2	29.5	878.6	29.7	882.4	29.76
886.3	29.72	890.3	29.79	892.3	29.85	898.3	29.88	900.3	29.84
902.3	29.88	906.3	29.9	910.3	30	914.3	29.92	918.3	29.95
922.3	29.91	924.3	29.94	928.3	29.94	930.3	29.99	932.3	29.96
938.3	29.96	942.3	29.89	946.3	29.86	948.3	29.78	950.9	29.76
956	29.65	960.4	29.51	962	29.53	963.6	29.63	964.3	29.64
966.4	29.33	968.4	28.83	970.5	28.51	972.6	28.46	974.3	28.48
974.8	28.37	977	27.76	981.2	25.65	983.4	24.33	983.8	24.02
984.9	23.06	985.5	22.6	985.8	22.44	986.9	22.08	987.6	21.67
988.4	21.44	989.7	21.01	991.9	20.81	994.7	20.79	997.8	20.84
1000.4	20.79	1002.2	20.81	1002.4	20.85	1002.7	20.84	1004	20.94
1004.7	20.89	1008	20.92	1010.2	20.99	1011.1	20.98	1011.8	21.04
1012.8	21.21	1013.8	21.33	1014.9	21.59	1016.5	22.04	1018.9	22.87
1019.5	23.18	1021.9	24.07	1022.9	24.56	1025.2	26.17	1026.6	27.39
1027.2	27.79	1028	28.23	1029	28.6	1029.9	28.88	1030.9	29.12
1032.5	29.42	1035	29.7	1036.5	29.64	1039.4	29.62	1042.2	29.66
1043.6	29.73	1045.8	29.96	1046.5	29.92	1047.2	30.03	1048.5	30.04
1049.3	29.85	1050.7	29.57	1051.2	29.51	1053.2	29.46	1055	29.48
1056.5	29.44	1059.1	29.5	1062.1	29.52	1066.7	29.46	1068.3	29.5
1070.5	29.45	1074.9	29.46	1077	29.43	1079.2	29.45	1083.5	29.41
1092.2	29.43	1094.4	29.38	1096.6	29.44	1100.9	29.43	1103.1	29.38
1107.4	29.44	1109.5	29.41	1114.1	29.44	1120.2	29.53	1122.6	29.48
1127.9	29.49	1131.2	29.47	1133.4	29.52	1135.6	29.5	1144.7	29.54
1146.4	29.5	1150.8	29.5	1152.9	29.46	1161.6	29.5	1172.4	29.41
1174.6	29.42	1176.8	29.47	1181.1	29.46	1185.4	29.39	1187.5	29.33
1189.8	29.35	1192	29.33	1194.1	29.38	1198.5	29.35	1202.7	29.41
1205	29.41	1207.3	29.37	1209.3	29.38	1211.9	29.33	1213.6	29.35
1220.1	29.34	1222.3	29.38	1226.6	29.38	1230.3	29.32	1231.8	29.34
1233.7	29.41	1237.9	29.4	1238.9	29.45	1239.7	29.46	1241.8	29.41
1244.1	29.4	1246.3	29.45	1250.7	29.47	1253.2	29.62	1254.5	29.63

1257.5 29.43 1259 29.5 1261.7 29.31 1262 29.32 1262.6 29.39
1263.5 29.58 1263.9 29.61 1265 29.61 1266.5 29.57 1267.3 29.58
1268.4 29.6 1270.6 29.71 1272.8 29.62 1274 29.68 1275.5 29.65
1277 29.75 1278.5 29.75 1280 29.71 1281.5 29.8 1283 29.82
1286.1 29.75 1288.3 29.88 1289.1 29.89 1290.6 29.83 1292.1 29.96
1295.1 29.88 1296.6 29.96 1298.1 29.93 1299.6 29.95 1301.1 30.04
1303.7 29.91 1304.1 29.91 1305.6 30.04 1308.6 30 1310.1 30.06
1314.8 30.1 1316.1 30.09 1317.6 30.02 1319.2 30.02 1320.6 30.08
1323.6 30.03 1325.1 30.11 1326.6 30.07 1328.1 30.08 1329.6 30.14
1331.1 30.12 1334.1 30.21 1335.7 30.16 1338.7 30.2 1340.2 30.14
1341.3 30.06 1341.7 30.06 1343.2 30.22 1343.5 30.23 1345.7 30.22
1347.1 30.14 1347.9 30.13 1349.2 30.23 1350.2 30.25 1350.7 30.22
1351.8 30.22 1353.7 30.28 1355.2 30.24 1356.5 30.26 1358.2 30.34
1359 30.33 1361.2 30.22 1362.7 30.34 1363.4 30.34 1365.7 30.27
1367.2 30.35 1368.7 30.38 1370.2 30.33 1373.3 30.4 1376.6 30.42
1378.8 30.47 1379.3 30.45 1382.3 30.5 1383.2 30.48 1385.4 30.31
1386.9 30.47 1387.6 30.49 1389.9 30.48 1391.4 30.54 1392.9 30.55
1394.2 30.6 1398.6 30.55 1400.5 30.69 1405.2 30.54 1406.5 30.66
1407.4 30.68 1409.4 30.62 1411 30.64 1411.8 30.61 1414.1 30.61
1415.6 30.72 1418.6 30.75 1420.1 30.83 1423.1 30.8 1426.1 30.82
1427.6 30.79 1431.5 30.84 1436.7 30.79 1438.1 30.88 1442.5 30.94
1445.8 30.95 1448.1 31 1451.3 30.98 1455.7 31.1 1456.3 31.1
1457.8 31.03 1462.6 31.04 1465.4 31.15 1468.9 31.24 1471.1 31.34
1474.5 31.42 1477.1 31.43 1477.7 31.45 1479 31.56 1479.8 31.59
1482 31.59 1486.4 31.75 1488.1 31.85 1490.8 31.85 1495.2 32.07
1497.1 32.01 1499.6 32.18 1501.7 32.17 1504 32.27 1508.4 32.51
1509.2 32.62 1510.6 32.73 1512.8 32.78 1515.8 32.99 1519.4 33.03
1522.8 33.25 1523.8 33.29 1525.5 33.31 1527.3 33.43 1530.3 33.53
1531.9 33.63 1532.6 33.62 1534.9 33.71 1536.4 33.82 1537.9 33.82
1540 33.87 1543.6 34.03 1545.5 34.2 1547 34.28 1549.7 34.31
1551.5 34.39 1554.5 34.44 1556.7 34.64 1561.1 34.74 1563.3 34.93
1567.7 35.03 1569.6 35.15 1571.1 35.2 1572.1 35.2 1575.7 35.42
1576.5 35.43 1578.6 35.37 1580.2 35.63 1581 35.68 1583.1 35.65
1584.7 35.71 1586.1 35.81 1589.1 35.95 1590.6 35.99 1594.3 36.19
1598.8 36.37 1599.6 36.46 1601.3 36.48 1604.1 36.67 1605.5 36.69
1607.1 36.79 1607.7 36.8 1609.9 36.97 1613 37.12 1614.9 37.13
1616 37.23 1619.4 37.42 1621.1 37.55 1623.3 37.64 1623.5 37.67
1625.5 37.73 1627.7 37.86 1630 37.93 1632.5 38.17 1634.4 38.25
1637 38.41 1638.9 38.46 1642.1 38.69 1644.4 38.76 1645.6 38.73
1647.8 38.89 1651.2 39.02 1654.9 39.28 1656.4 39.35 1657.9 39.47
1660.9 39.61 1662.4 39.72 1667.8 40.01 1669.8 40.15 1671.3 40.21
1674.1 40.37 1676.5 40.43 1678.2 40.52 1680 40.64 1681.8 40.81
1684.5 41.11 1686.5 41.27 1688.5 41.31 1689.1 41.37 1690.6 41.46
1692.3 41.4 1692.8 41.4 1696.5 41.62 1701.2 42.19 1701.9 42.3
1702.6 42.36 1704.6 42.09 1706.6 41.91 1708.6 42.13 1709.3 42.23

1710.1 42.42 1711.1 42.57 1712.4 42.82 1714.7 43.19 1716.8 43.72
1718.4 43.9 1720.7 44.24 1722.7 44.2 1724.7 44 1726.7 43.75
1728.7 43.55 1730.8 43.47 1732.8 43.31 1734.8 43.1 1738.8 43.04
1742.8 42.83 1744.8 42.92 1747.7 42.84 1750.9 42.68 1753.2 42.62
1756.8 42.68 1758.6 42.75 1760.9 42.76 1762.9 42.91 1766.9 43.01
1768.9 43.13 1771.4 43.15 1774.8 43.25 1779.3 43.44 1783 43.55
1787 43.59 1789 43.68 1791 43.84 1793.4 43.97 1797.1 44.09
1799.1 44.1 1801.1 43.9 1803.1 43.76 1805.1 43.76 1809.1 43.96
1811.1 43.92 1813.2 44.04 1815.2 43.97 1817.2 44 1821.2 44.13
1823.2 44.14 1825.2 44.29 1830.6 44.36 1833.3 44.47 1837.3 44.5
1841.3 44.76 1843.3 44.81 1845.3 44.72 1847.3 44.67 1850.7 44.82
1853.4 44.86 1855.4 44.97 1859.4 44.94 1861.4 44.86 1863.4 44.83
1865.4 45.03 1869.4 45.09 1873.4 45.31 1875.5 45.39 1877.4 45.5
1881.2 45.67 1883.5 45.72 1887.5 45.88 1889.5 45.76 1891.5 45.82
1892.24 45.82

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
829.75 .075 981.2 .024 1025.2 .075

Bank Sta: Left Right Coeff Contr. Expan.
981.2 1025.2 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
829.75 980 27 F
1020 1892.24 27 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 = 31
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Abutments = 2

Abutment Data
Upstream num= 2
Sta Elev Sta Elev
995.75 22.49 999.75 22.49
Downstream num= 2
Sta Elev Sta Elev
995.75 22.39 999.75 22.39

Abutment Data
Upstream num= 2
Sta Elev Sta Elev
1000.25 22.5 1004.25 22.5
Downstream num= 2
Sta Elev Sta Elev
1000.25 22.44 1004.25 22.44

Number of Culverts = 2

Culvert Name Shape Rise Span
Culvert #1 Box 2.82 3.82
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef Exit Loss Coef
2 41.42 .01 .01 0 .2 1
Upstream Elevation = 22.57
Centerline Station = 997.765
Downstream Elevation = 22.47
Centerline Station = 997.765

Culvert Name Shape Rise Span
Culvert #2 Box 2.82 3.82
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef Exit Loss Coef
2 41.42 .011 .011 0 .2 1
Upstream Elevation = 22.58
Centerline Station = 1002.235
Downstream Elevation = 22.52
Centerline Station = 1002.235

CROSS SECTION

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 625

INPUT
Description: Similar to FIS Sction C, Downstream of Culvert
Station Elevation Data num= 476

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
829.75	34.18	830.3	34.23	834.28	33.74	836.09	33.68	838.26	33.44
838.26	33.28	838.81	32.81	839.35	32.65	839.89	32.52	840.62	32.28
841.52	32	842.61	31.7	843.88	31.29	844.78	30.93	846.77	30.52
848.04	30.08	849.85	29.57	851.48	29.1	852.93	28.62	854.01	28.38
855.1	28.17	857.09	28.01	858	27.94	859.99	27.89	861.44	27.92
862.89	27.92	864	27.97	864.2	28.02	866.2	28.31	868.2	28.54
870.2	29	872.2	29.34	874.2	29.5	878.6	29.7	882.4	29.76
886.3	29.72	890.3	29.79	892.3	29.85	898.3	29.88	900.3	29.84
902.3	29.88	906.3	29.9	910.3	30	914.3	29.92	918.3	29.95
922.3	29.91	924.3	29.94	928.3	29.94	930.3	29.99	932.3	29.96
938.3	29.96	942.3	29.89	946.3	29.86	948.3	29.78	950.9	29.76
956	29.65	960.4	29.51	962	29.53	963.6	29.63	964.3	29.64
966.4	29.33	968.4	28.83	970.5	28.51	972.6	28.46	974.3	28.48
974.8	28.37	977	27.76	981.2	25.65	983.4	24.33	983.8	24.02
984.9	23.06	985.5	22.6	985.8	22.44	986.9	22.08	987.6	21.67
988.4	21.44	989.7	21.01	991.9	20.81	994.7	20.79	997.8	20.84
1000.4	20.79	1002.2	20.81	1002.4	20.85	1002.7	20.84	1004	20.94
1004.7	20.89	1008	20.92	1010.2	20.99	1011.1	20.98	1011.8	21.04
1012.8	21.21	1013.8	21.33	1014.9	21.59	1016.5	22.04	1018.9	22.87
1019.5	23.18	1021.9	24.07	1022.9	24.56	1025.2	26.17	1026.6	27.39
1027.2	27.79	1028	28.23	1029	28.6	1029.9	28.88	1030.9	29.12
1032.5	29.42	1035	29.7	1036.5	29.64	1039.4	29.62	1042.2	29.66
1043.6	29.73	1045.8	29.96	1046.5	29.92	1047.2	30.03	1048.5	30.04
1049.3	29.85	1050.7	29.57	1051.2	29.51	1053.2	29.46	1055	29.48
1056.5	29.44	1059.1	29.5	1062.1	29.52	1066.7	29.46	1068.3	29.5
1070.5	29.45	1074.9	29.46	1077	29.43	1079.2	29.45	1083.5	29.41
1092.2	29.43	1094.4	29.38	1096.6	29.44	1100.9	29.43	1103.1	29.38
1107.4	29.44	1109.5	29.41	1114.1	29.44	1120.2	29.53	1122.6	29.48
1127.9	29.49	1131.2	29.47	1133.4	29.52	1135.6	29.5	1144.7	29.54
1146.4	29.5	1150.8	29.5	1152.9	29.46	1161.6	29.5	1172.4	29.41
1174.6	29.42	1176.8	29.47	1181.1	29.46	1185.4	29.39	1187.5	29.33
1189.8	29.35	1192	29.33	1194.1	29.38	1198.5	29.35	1202.7	29.41
1205	29.41	1207.3	29.37	1209.3	29.38	1211.9	29.33	1213.6	29.35
1220.1	29.34	1222.3	29.38	1226.6	29.38	1230.3	29.32	1231.8	29.34
1233.7	29.41	1237.9	29.4	1238.9	29.45	1239.7	29.46	1241.8	29.41
1244.1	29.4	1246.3	29.45	1250.7	29.47	1253.2	29.62	1254.5	29.63
1257.5	29.43	1259	29.5	1261.7	29.31	1262	29.32	1262.6	29.39
1263.5	29.58	1263.9	29.61	1265	29.61	1266.5	29.57	1267.3	29.58
1268.4	29.6	1270.6	29.71	1272.8	29.62	1274	29.68	1275.5	29.65
1277	29.75	1278.5	29.75	1280	29.71	1281.5	29.8	1283	29.82
1286.1	29.75	1288.3	29.88	1289.1	29.89	1290.6	29.83	1292.1	29.96
1295.1	29.88	1296.6	29.96	1298.1	29.93	1299.6	29.95	1301.1	30.04
1303.7	29.91	1304.1	29.91	1305.6	30.04	1308.6	30	1310.1	30.06
1314.8	30.1	1316.1	30.09	1317.6	30.02	1319.2	30.02	1320.6	30.08

1323.6 30.03 1325.1 30.11 1326.6 30.07 1328.1 30.08 1329.6 30.14
1331.1 30.12 1334.1 30.21 1335.7 30.16 1338.7 30.2 1340.2 30.14
1341.3 30.06 1341.7 30.06 1343.2 30.22 1343.5 30.23 1345.7 30.22
1347.1 30.14 1347.9 30.13 1349.2 30.23 1350.2 30.25 1350.7 30.22
1351.8 30.22 1353.7 30.28 1355.2 30.24 1356.5 30.26 1358.2 30.34
1359 30.33 1361.2 30.22 1362.7 30.34 1363.4 30.34 1365.7 30.27
1367.2 30.35 1368.7 30.38 1370.2 30.33 1373.3 30.4 1376.6 30.42
1378.8 30.47 1379.3 30.45 1382.3 30.5 1383.2 30.48 1385.4 30.31
1386.9 30.47 1387.6 30.49 1389.9 30.48 1391.4 30.54 1392.9 30.55
1394.2 30.6 1398.6 30.55 1400.5 30.69 1405.2 30.54 1406.5 30.66
1407.4 30.68 1409.4 30.62 1411 30.64 1411.8 30.61 1414.1 30.61
1415.6 30.72 1418.6 30.75 1420.1 30.83 1423.1 30.8 1426.1 30.82
1427.6 30.79 1431.5 30.84 1436.7 30.79 1438.1 30.88 1442.5 30.94
1445.8 30.95 1448.1 31 1451.3 30.98 1455.7 31.1 1456.3 31.1
1457.8 31.03 1462.6 31.04 1465.4 31.15 1468.9 31.24 1471.1 31.34
1474.5 31.42 1477.1 31.43 1477.7 31.45 1479 31.56 1479.8 31.59
1482 31.59 1486.4 31.75 1488.1 31.85 1490.8 31.85 1495.2 32.07
1497.1 32.01 1499.6 32.18 1501.7 32.17 1504 32.27 1508.4 32.51
1509.2 32.62 1510.6 32.73 1512.8 32.78 1515.8 32.99 1519.4 33.03
1522.8 33.25 1523.8 33.29 1525.5 33.31 1527.3 33.43 1530.3 33.53
1531.9 33.63 1532.6 33.62 1534.9 33.71 1536.4 33.82 1537.9 33.82
1540 33.87 1543.6 34.03 1545.5 34.2 1547 34.28 1549.7 34.31
1551.5 34.39 1554.5 34.44 1556.7 34.64 1561.1 34.74 1563.3 34.93
1567.7 35.03 1569.6 35.15 1571.1 35.2 1572.1 35.2 1575.7 35.42
1576.5 35.43 1578.6 35.37 1580.2 35.63 1581 35.68 1583.1 35.65
1584.7 35.71 1586.1 35.81 1589.1 35.95 1590.6 35.99 1594.3 36.19
1598.8 36.37 1599.6 36.46 1601.3 36.48 1604.1 36.67 1605.5 36.69
1607.1 36.79 1607.7 36.8 1609.9 36.97 1613 37.12 1614.9 37.13
1616 37.23 1619.4 37.42 1621.1 37.55 1623.3 37.64 1623.5 37.67
1625.5 37.73 1627.7 37.86 1630 37.93 1632.5 38.17 1634.4 38.25
1637 38.41 1638.9 38.46 1642.1 38.69 1644.4 38.76 1645.6 38.73
1647.8 38.89 1651.2 39.02 1654.9 39.28 1656.4 39.35 1657.9 39.47
1660.9 39.61 1662.4 39.72 1667.8 40.01 1669.8 40.15 1671.3 40.21
1674.1 40.37 1676.5 40.43 1678.2 40.52 1680 40.64 1681.8 40.81
1684.5 41.11 1686.5 41.27 1688.5 41.31 1689.1 41.37 1690.6 41.46
1692.3 41.4 1692.8 41.4 1696.5 41.62 1701.2 42.19 1701.9 42.3
1702.6 42.36 1704.6 42.09 1706.6 41.91 1708.6 42.13 1709.3 42.23
1710.1 42.42 1711.1 42.57 1712.4 42.82 1714.7 43.19 1716.8 43.72
1718.4 43.9 1720.7 44.24 1722.7 44.2 1724.7 44 1726.7 43.75
1728.7 43.55 1730.8 43.47 1732.8 43.31 1734.8 43.1 1738.8 43.04
1742.8 42.83 1744.8 42.92 1747.7 42.84 1750.9 42.68 1753.2 42.62
1756.8 42.68 1758.6 42.75 1760.9 42.76 1762.9 42.91 1766.9 43.01
1768.9 43.13 1771.4 43.15 1774.8 43.25 1779.3 43.44 1783 43.55
1787 43.59 1789 43.68 1791 43.84 1793.4 43.97 1797.1 44.09
1799.1 44.1 1801.1 43.9 1803.1 43.76 1805.1 43.76 1809.1 43.96

1811.1 43.92 1813.2 44.04 1815.2 43.97 1817.2 44 1821.2 44.13
1823.2 44.14 1825.2 44.29 1830.6 44.36 1833.3 44.47 1837.3 44.5
1841.3 44.76 1843.3 44.81 1845.3 44.72 1847.3 44.67 1850.7 44.82
1853.4 44.86 1855.4 44.97 1859.4 44.94 1861.4 44.86 1863.4 44.83
1865.4 45.03 1869.4 45.09 1873.4 45.31 1875.5 45.39 1877.4 45.5
1881.2 45.67 1883.5 45.72 1887.5 45.88 1889.5 45.76 1891.5 45.82
1892.24 45.82

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
829.75 .075 981.2 .035 1025.2 .075

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
981.2 1025.2 231.8 231.8 231.8 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
829.75 980 27 F
1020 1892.24 27 F

CROSS SECTION

RIVER: Mansion Road Bro
REACH: S Turnpike Culv RS: 340

INPUT
Description: Similar to FIS Section B - Downstream end of model
Station Elevation Data num= 295
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
536 32.73 536.6 32.72 538.8 32.59 540.6 32.5 542.6 32.44
544.6 32.35 546.6 32.35 550.7 32.2 552.7 32.14 554.7 32.16
556.7 32.29 558.7 32.51 560.7 32.84 562.7 33.33 564.7 33.72
566.2 33.93 568.7 34.18 570.8 34.22 576.8 34 578.8 33.89
580.8 33.65 582.8 33.25 586.3 32.6 590.8 31.72 592.8 31.46
594.9 31.36 596.9 31.19 599.3 31.05 600.9 30.94 604.9 30.75
610.9 30.56 612.9 30.45 616.9 30.36 618.9 30.33 622.4 30.23
624.6 30.2 625.2 30.2 627.1 30.25 628.5 30.25 629 30.25
631 30.18 633 30.24 635 30.24 637 30.32 639 30.33
641 30.33 643.8 30.42 645 30.48 647 30.49 649 30.55
651.2 30.59 653.1 30.59 655.1 30.62 657.1 30.68 663.1 30.64
666 30.67 669.1 30.73 671.1 30.7 673.1 30.7 675.2 30.79
677.1 30.81 679.1 30.95 680.8 30.9 681.2 30.9 683.2 30.95
686.4 31 689.2 31.08 691.2 31.11 693.2 31.08 697.2 30.95
699.2 30.75 701.2 30.25 703 29.39 703.2 29.31 705.2 28.29
706.9 27.03 707.7 26.95 708.3 26.99 708.5 26.97 709.2 27.03

709.8 27.13 710.7 27.08 711.3 27.11 712.6 27.37 714.3 28.15
715.1 28.45 715.8 28.62 717.4 29.05 718.9 29.63 719.5 29.86
721.7 30.11 730.5 29.92 737.1 30.06 739.3 30.14 741.5 30.19
743.7 30.16 748 30.21 750.6 30.17 752.4 30.19 758.2 30.03
759 29.98 759.7 30.02 761.1 30.15 763.4 30.41 764.2 30.37
765.6 30.26 767.8 29.95 772.2 29.55 774.4 29.29 776.3 29.03
778.8 28.56 779.3 28.48 781 28.31 783.2 28.16 785.4 28.09
787.6 27.91 789.7 27.69 792.9 27.45 794.4 27.28 795.1 27.23
798.5 27.01 800.7 26.79 803.5 26.6 807.3 26.28 809.6 26.12
811.7 26.01 813.9 25.79 817.1 25.54 820.5 25.24 824.7 24.95
827.1 24.77 829.3 24.66 832.2 24.39 835.8 24.12 838 23.94
839.8 23.86 842.4 23.62 843.7 23.58 846.8 23.52 849 23.4
851.9 23.33 853.4 23.28 855.6 23.3 859.4 23.28 862.2 23.34
866.6 23.41 868.5 23.4 871 23.43 873.2 23.59 875.3 23.7
877.6 23.95 881.9 24.29 884.1 24.31 886.6 24.37 888.5 24.45
890.7 24.58 892.9 24.65 895.1 24.67 899.5 24.59 901.7 24.63
903.9 24.79 907.8 24.84 914.9 25.06 917.1 25.26 919.2 25.69
919.9 25.65 921.4 25.69 922.9 25.62 923.6 25.56 924.4 25.54
925.8 25.47 945.6 25.06 950.5 25.19 952.2 25.17 953.1 25.18
954.4 25.22 955.3 25.22 956.2 25.19 956.6 25.19 960.2 25.07
963.7 25.01 966.8 24.99 967.5 25 969.9 25.09 971.3 25.05
971.9 25.06 974.7 24.96 976.3 24.89 978.4 24.84 978.9 24.81
981 24.55 982.7 24.17 982.9 24.14 983.2 23.96 984.5 22.88
985.3 22.36 986.4 21.59 986.9 21.27 988.9 20.31 989.7 20.02
990.1 19.88 990.9 19.58 992 19.6 992.9 19.59 994.9 19.2
996.9 18.6 997.6 18.56 998.4 18.45 998.9 18.41 1001 18.48
1001.3 18.52 1003 18.77 1005 19.38 1007 19.75 1009 19.94
1011 19.89 1011.4 19.92 1012.5 20.07 1013 20.11 1015 20.18
1015.7 20.17 1016.2 20.13 1019 20.13 1021 20.09 1023 20.35
1025 20.76 1029 21.12 1033 21.21 1035.3 21.34 1037.4 21.49
1038.6 21.56 1039.1 21.59 1041.1 21.82 1043.1 22.03 1045.1 22.16
1047.1 22.21 1049.1 22.08 1049.8 22.05 1054.8 21.98 1059.1 21.97
1061.1 22 1065.1 21.99 1067.1 22.04 1069.2 22.03 1071.2 22.04
1073.2 22.14 1075.2 22.2 1081.2 22.2 1084.2 22.22 1085.7 22.21
1087.2 22.19 1088.6 22.14 1090.1 22.07 1093.1 21.81 1093.9 21.7
1094.6 21.65 1096.2 21.6 1097.6 21.61 1098.4 21.65 1099.1 21.66
1100.5 21.63 1102.9 21.72 1104.7 22.04 1105.1 22.08 1108 21.95
1112.5 21.89 1113.9 21.91 1116.3 22.04 1118.4 22.18 1121.4 22.62
1123.1 22.91 1125.3 23.42 1127.5 23.9 1128.8 24.24 1129.8 24.52
1131.4 24.89 1132 25 1133.3 25.14 1134.3 25.27 1135.8 25.68
1136.5 25.89 1137.8 26.31 1138.7 26.71 1141 27.45 1142.2 27.77
1143.7 28.12 1147.34 28.82 1152.68 29.03 1161.91 29.29 1171.15 29.66
1181.53 30.25 1191.34 31.02 1197.69 31.45 1210.39 32.35 1220.86 33.14

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
536	.075	985.3	.035	1047.1	.075

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
985.3	1047.1	0	0	0	.1	.3

Left Levee Station= 764 Elevation= 30.42

SUMMARY OF MANNING'S N VALUES

River: Mansion Road Brook

Reach	River Sta.	n1	n2	n3
S Turnpike Culv	875	.075	.035	.075
S Turnpike Culv	860	.075	.035	.075
S Turnpike Culv	845	.075	.035	.075
S Turnpike Culv	666	.075	.035	.075
S Turnpike Culv	650	Culvert		
S Turnpike Culv	625	.075	.035	.075
S Turnpike Culv	340	.075	.035	.075

SUMMARY OF REACH LENGTHS

River: Mansion Road Brook

Reach	River Sta.	Left	Channel	Right
S Turnpike Culv	875	12.1	12.1	12.1
S Turnpike Culv	860	16.8	16.8	16.8
S Turnpike Culv	845	27.2	27.2	2
S Turnpike Culv	666	56.7	56.7	56.7
S Turnpike Culv	650	Culvert		
S Turnpike Culv	625	231.8	231.8	231.8
S Turnpike Culv	340	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mansion Road Brook

Reach	River Sta.	Contr.	Expan.
S Turnpike Culv	875	.1	.3
S Turnpike Culv	860	.1	.3
S Turnpike Culv	845	.1	.3
S Turnpike Culv	666	.4	.6
S Turnpike Culv	650	Culvert	
S Turnpike Culv	625	.3	.5
S Turnpike Culv	340	.1	.3

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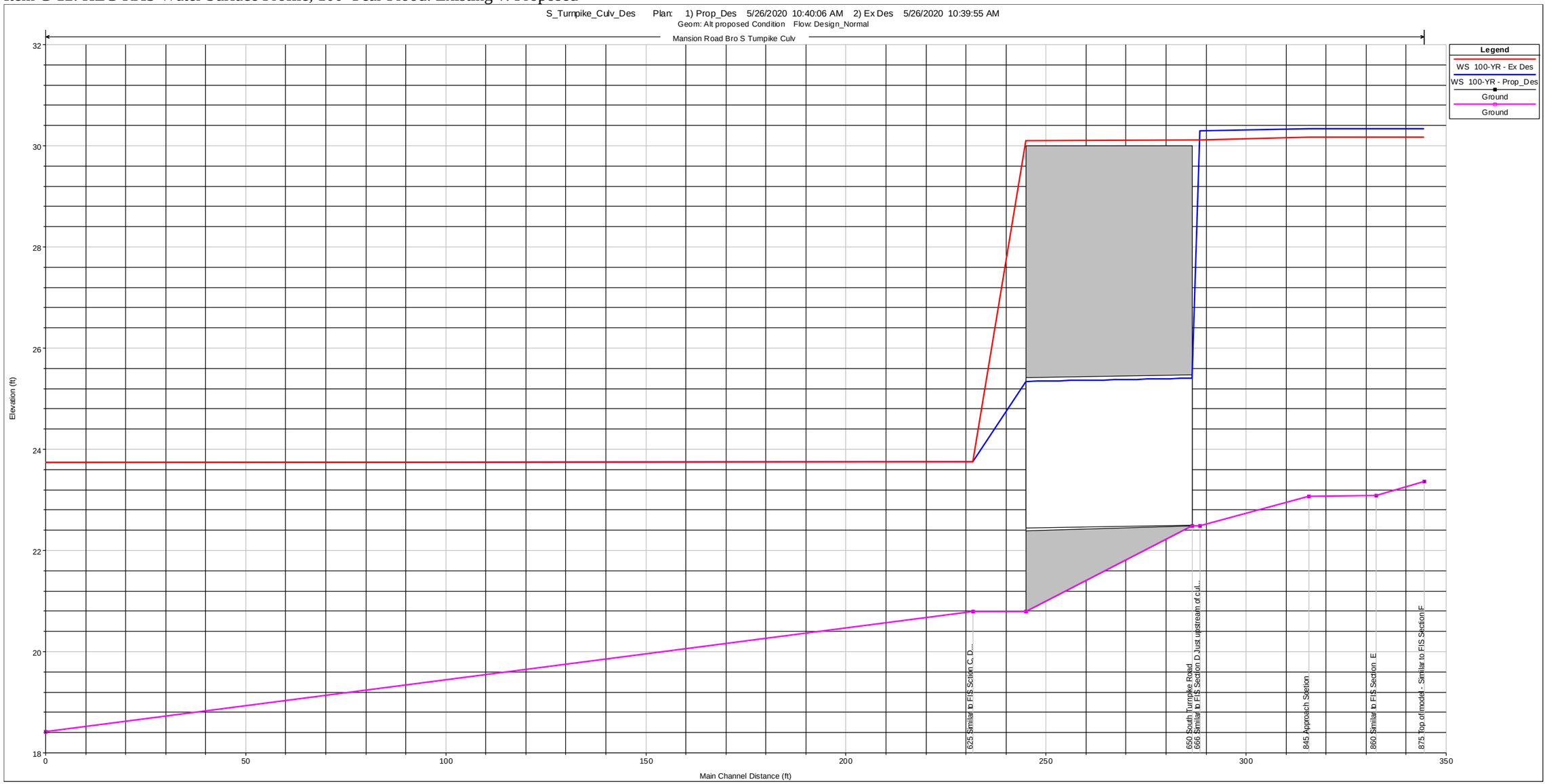
DESIGN HYDRAULIC INFORMATION

Item C-12: HEC-RAS Water Surface Profile, 100-Year Flood: Existing v. Proposed



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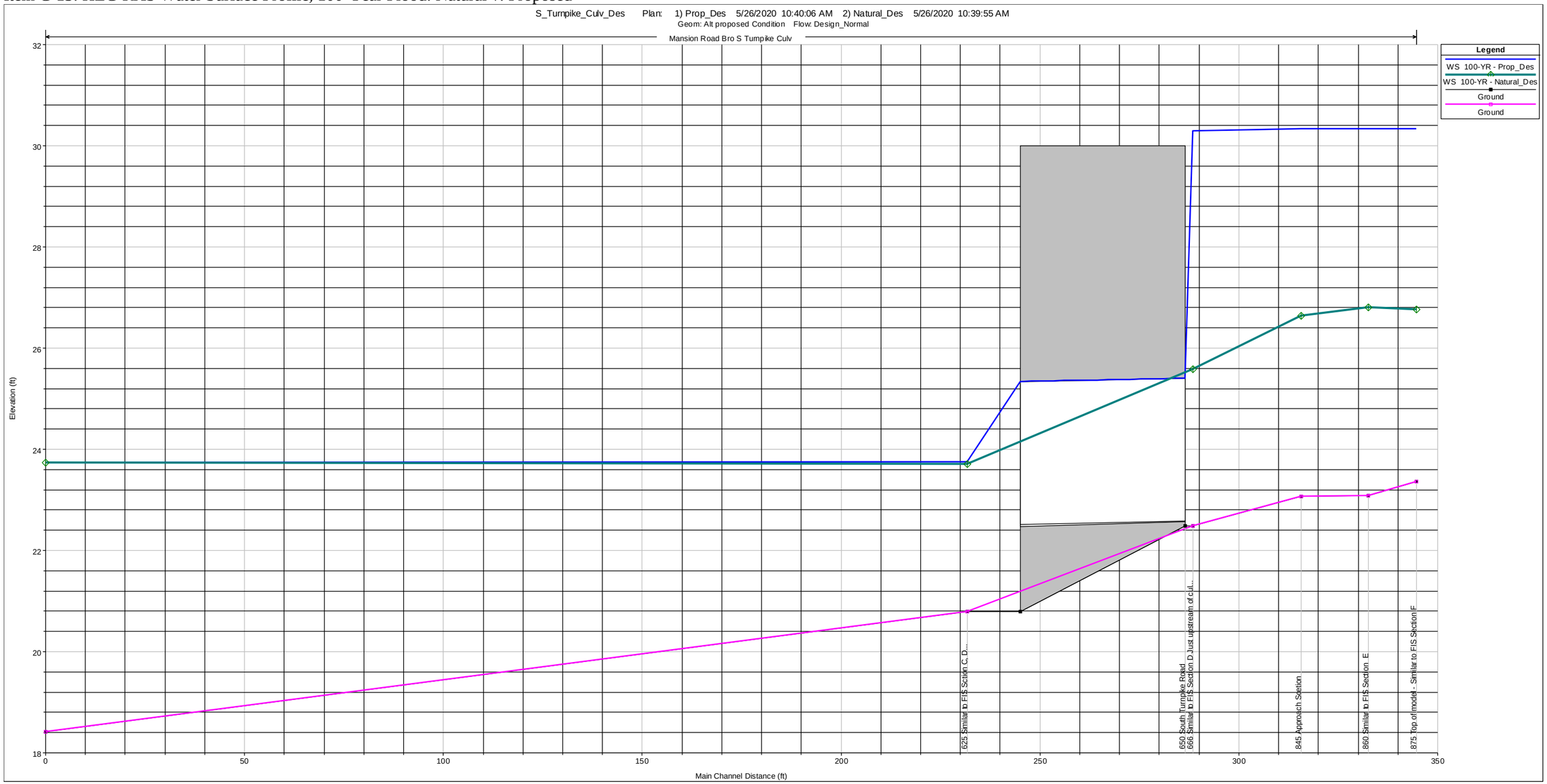
Item C-13: HEC-RAS Water Surface Profile, 100-Year Flood: Natural v. Proposed



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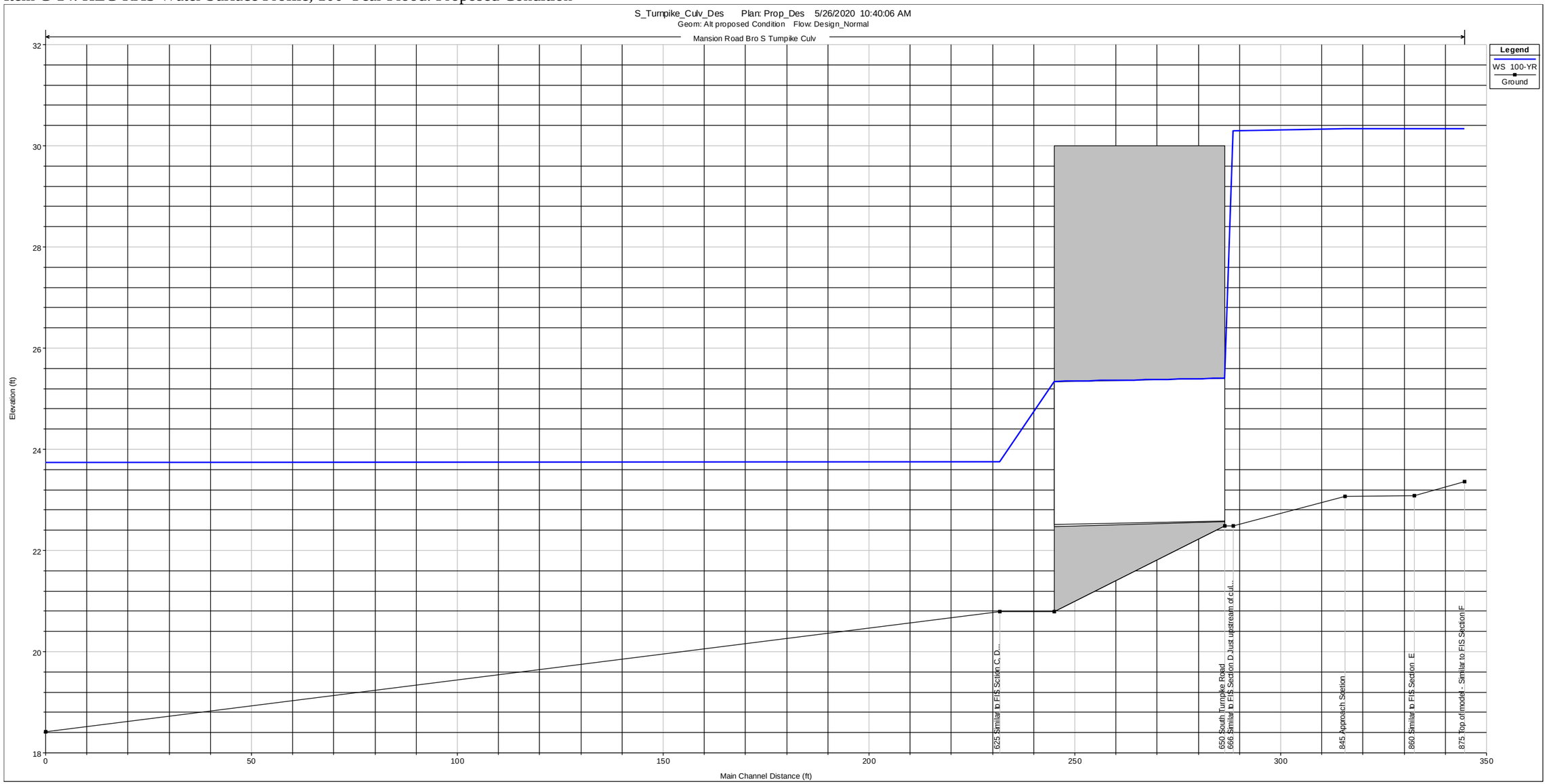
Item C-14: HEC-RAS Water Surface Profile, 100-Year Flood: Proposed Condition



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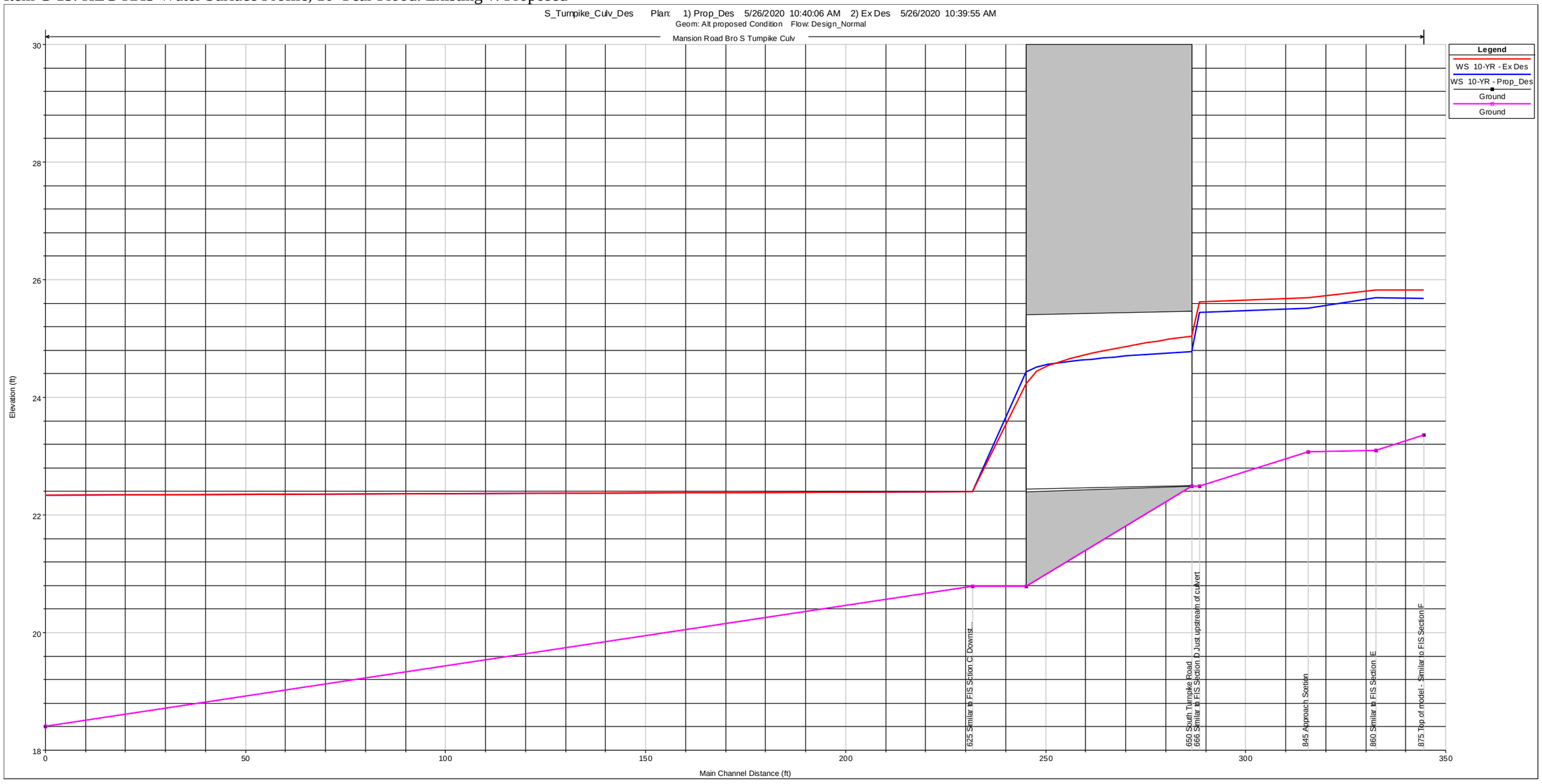
Item C-15: HEC-RAS Water Surface Profile, 10-Year Flood: Existing v. Proposed



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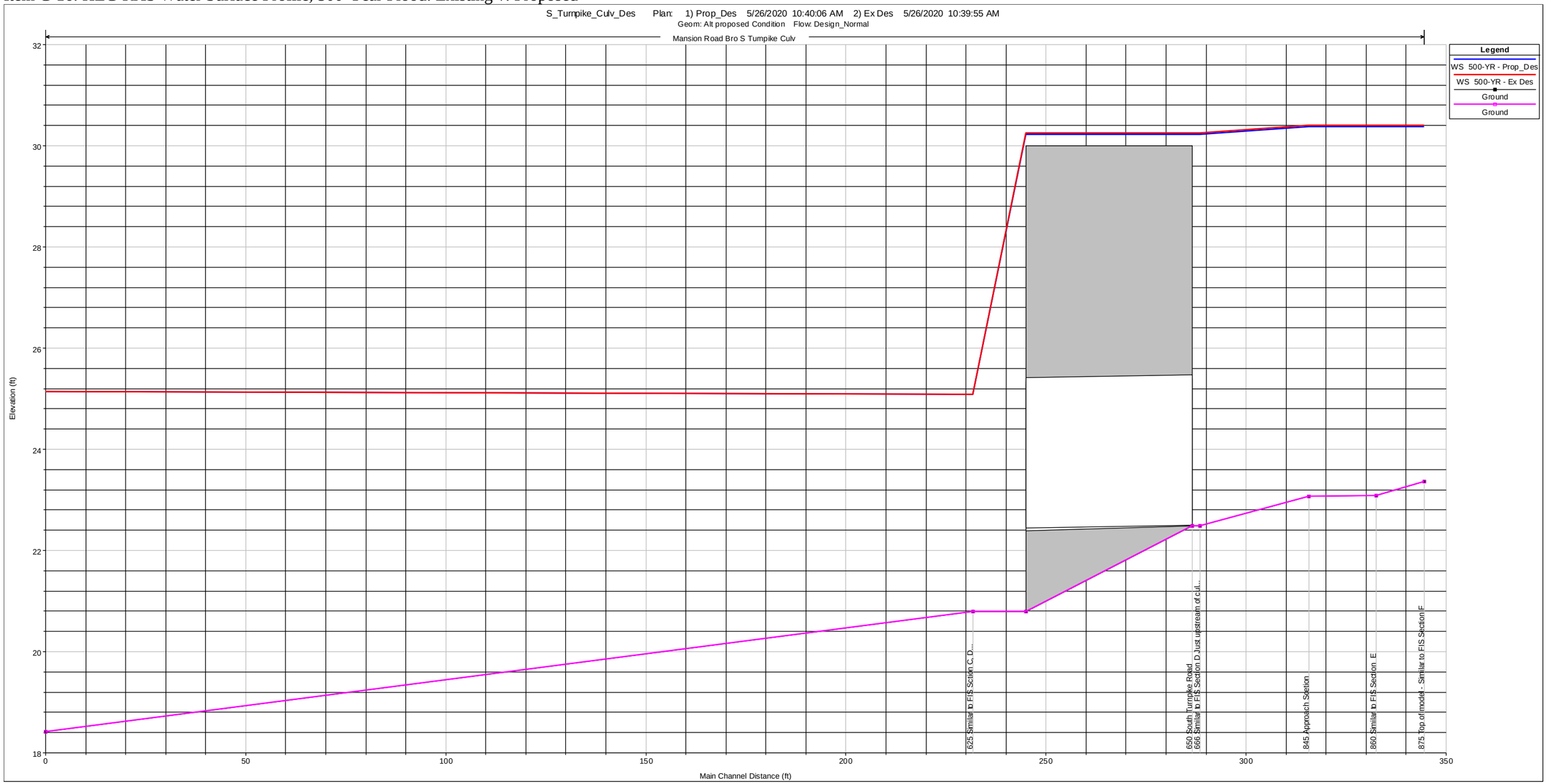
Item C-16: HEC-RAS Water Surface Profile, 500-Year Flood: Existing v. Proposed



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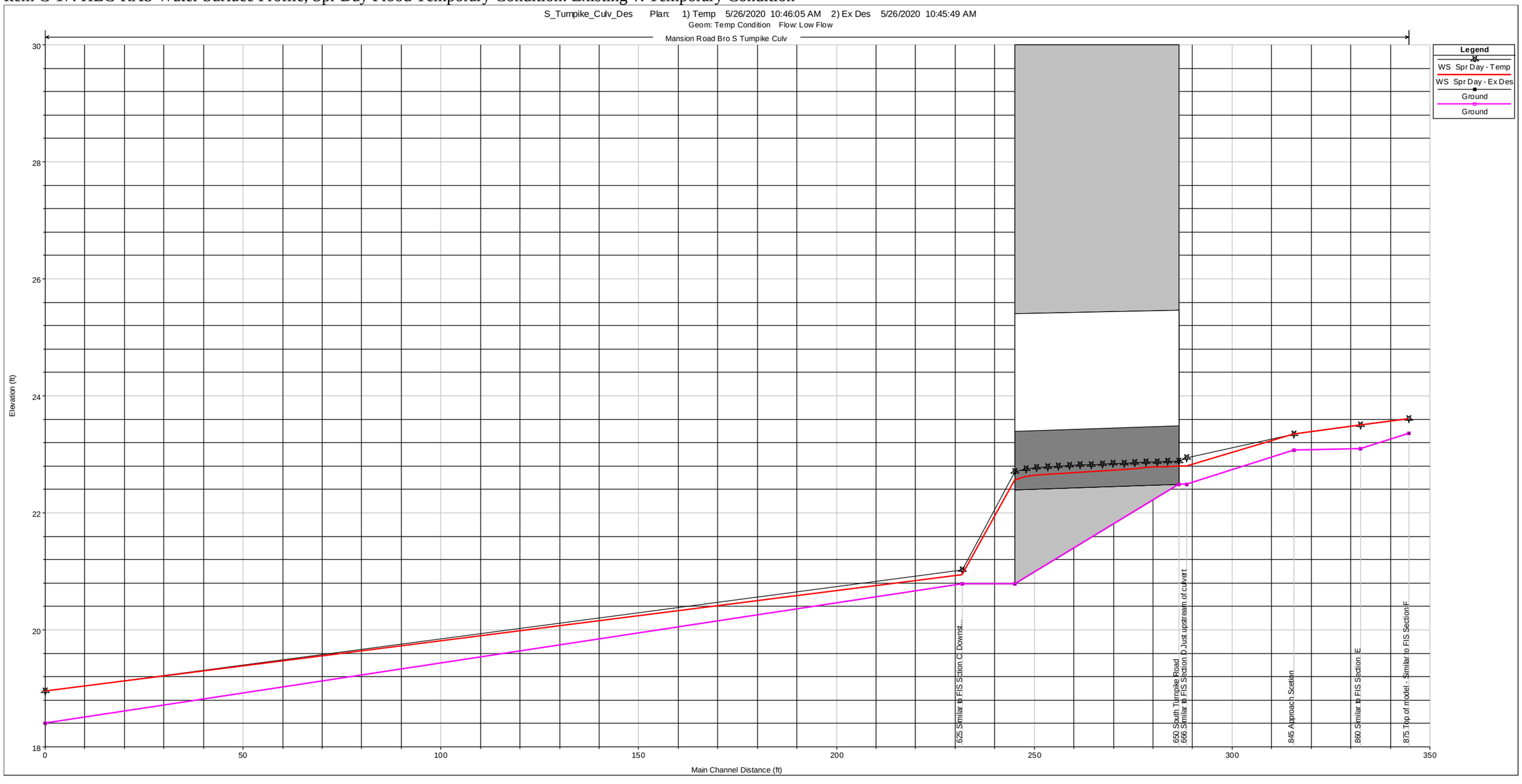
Item C-17: HEC-RAS Water Surface Profile, Spr Day Flood Temporary Condition: Existing v. Temporary Condition



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Item C-18: HEC-RAS Std. Summary Table 1, 2-Year Flood: Existing v. Proposed

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 2-YR

Reload Data

Reach	River Sta	Profile	Plan	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)	
S Turnpike Culv	875	2-YR	Prop_Des	30.00	23.36	24.29	24.11	24.45	0.009163	3.13	9.58	13.94	0.67
S Turnpike Culv	875	2-YR	Ex Des	30.00	23.36	24.29	24.11	24.45	0.009162	3.13	9.58	13.94	0.67
S Turnpike Culv	860	2-YR	Prop_Des	30.00	23.09	24.34		24.37	0.001429	1.48	20.29	22.65	0.28
S Turnpike Culv	860	2-YR	Ex Des	30.00	23.09	24.34		24.37	0.001429	1.48	20.29	22.65	0.28
S Turnpike Culv	845	2-YR	Prop_Des	30.00	23.07	23.97	23.97	24.28	0.021880	4.49	6.68	10.84	1.01
S Turnpike Culv	845	2-YR	Ex Des	30.00	23.07	23.97	23.97	24.28	0.021880	4.49	6.68	10.84	1.01
S Turnpike Culv	666	2-YR	Prop_Des	30.00	22.49	23.73	23.20	23.82	0.003527	2.50	12.02	11.20	0.42
S Turnpike Culv	666	2-YR	Ex Des	30.00	22.49	23.77	23.20	23.86	0.003149	2.40	12.52	11.40	0.40
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	2-YR	Prop_Des	30.00	20.79	21.26	21.26	21.44	0.023623	3.35	8.96	24.32	0.97
S Turnpike Culv	625	2-YR	Ex Des	30.00	20.79	21.26	21.26	21.44	0.023628	3.35	8.96	24.32	0.97
S Turnpike Culv	340	2-YR	Prop_Des	30.00	18.41	20.02	19.37	20.07	0.002500	1.75	17.11	22.41	0.35
S Turnpike Culv	340	2-YR	Ex Des	30.00	18.41	20.02	19.37	20.07	0.002500	1.75	17.11	22.41	0.35

Total flow in cross section.

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Item C-19: HEC-RAS Std. Summary Table 1, 10-Year Flood: Existing v. Proposed

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 10-YR

Reload Data

Reach	River Sta	Profile	Plan	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
S Turnpike Culv	875	10-YR	Prop_Des	115.00	23.36	25.68	24.91	25.78	0.001904	2.79	59.30	44.00	0.36
S Turnpike Culv	875	10-YR	Ex Des	115.00	23.36	25.82	24.91	25.90	0.001444	2.55	65.60	44.84	0.32
S Turnpike Culv	860	10-YR	Prop_Des	115.00	23.09	25.69		25.75	0.000899	2.05	60.00	42.01	0.25
S Turnpike Culv	860	10-YR	Ex Des	115.00	23.09	25.83		25.88	0.000716	1.91	66.47	51.74	0.23
S Turnpike Culv	845	10-YR	Prop_Des	115.00	23.07	25.51	24.90	25.71	0.004227	3.59	32.16	42.48	0.51
S Turnpike Culv	845	10-YR	Ex Des	115.00	23.07	25.69	24.90	25.85	0.002916	3.21	36.23	44.60	0.43
S Turnpike Culv	666	10-YR	Prop_Des	115.00	22.49	25.44	24.16	25.63	0.002088	3.55	32.42	17.80	0.38
S Turnpike Culv	666	10-YR	Ex Des	115.00	22.49	25.62	24.16	25.79	0.001680	3.32	34.60	18.55	0.35
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	10-YR	Prop_Des	115.00	20.79	22.39	21.78	22.51	0.003180	2.82	40.85	31.57	0.44
S Turnpike Culv	625	10-YR	Ex Des	115.00	20.79	22.39	21.78	22.52	0.003180	2.82	40.85	31.57	0.44
S Turnpike Culv	340	10-YR	Prop_Des	115.00	18.41	22.33	20.26	22.34	0.000200	0.93	144.28	134.06	0.12
S Turnpike Culv	340	10-YR	Ex Des	115.00	18.41	22.33	20.27	22.34	0.000200	0.93	144.28	134.06	0.12

Total flow in cross section.

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Item C-20: HEC-RAS Std. Summary Table 1, 50-Year Flood: Existing v. Proposed

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 50-YR Reload Data

Reach	River Sta	Profile	Plan	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
S Turnpike Culv	875	50-YR	Prop_Des	215.00	23.36	27.44	25.35	27.51	0.000621	2.47	171.91	131.23	0.23
S Turnpike Culv	875	50-YR	Ex Des	215.00	23.36	28.22	25.35	28.25	0.000241	1.75	317.39	231.49	0.15
S Turnpike Culv	860	50-YR	Prop_Des	215.00	23.09	27.46		27.50	0.000279	1.72	227.61	170.93	0.15
S Turnpike Culv	860	50-YR	Ex Des	215.00	23.09	28.23		28.25	0.000111	1.23	379.58	229.71	0.10
S Turnpike Culv	845	50-YR	Prop_Des	215.00	23.07	27.36	25.47	27.48	0.000959	2.89	91.46	120.29	0.28
S Turnpike Culv	845	50-YR	Ex Des	215.00	23.07	28.17	25.47	28.24	0.000411	2.18	136.44	217.43	0.19
S Turnpike Culv	666	50-YR	Prop_Des	215.00	22.49	27.18	24.88	27.44	0.001382	4.03	53.40	35.74	0.34
S Turnpike Culv	666	50-YR	Ex Des	215.00	22.49	28.03	24.88	28.21	0.000772	3.38	63.60	41.82	0.26
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	50-YR	Prop_Des	215.00	20.79	23.12	22.21	23.29	0.002709	3.31	64.91	34.54	0.43
S Turnpike Culv	625	50-YR	Ex Des	215.00	20.79	23.12	22.21	23.29	0.002709	3.31	64.91	34.54	0.43
S Turnpike Culv	340	50-YR	Prop_Des	215.00	18.41	23.08	20.65	23.10	0.000200	1.15	246.99	139.56	0.12
S Turnpike Culv	340	50-YR	Ex Des	215.00	18.41	23.08	20.64	23.10	0.000200	1.15	246.99	139.56	0.12

Total flow in cross section.

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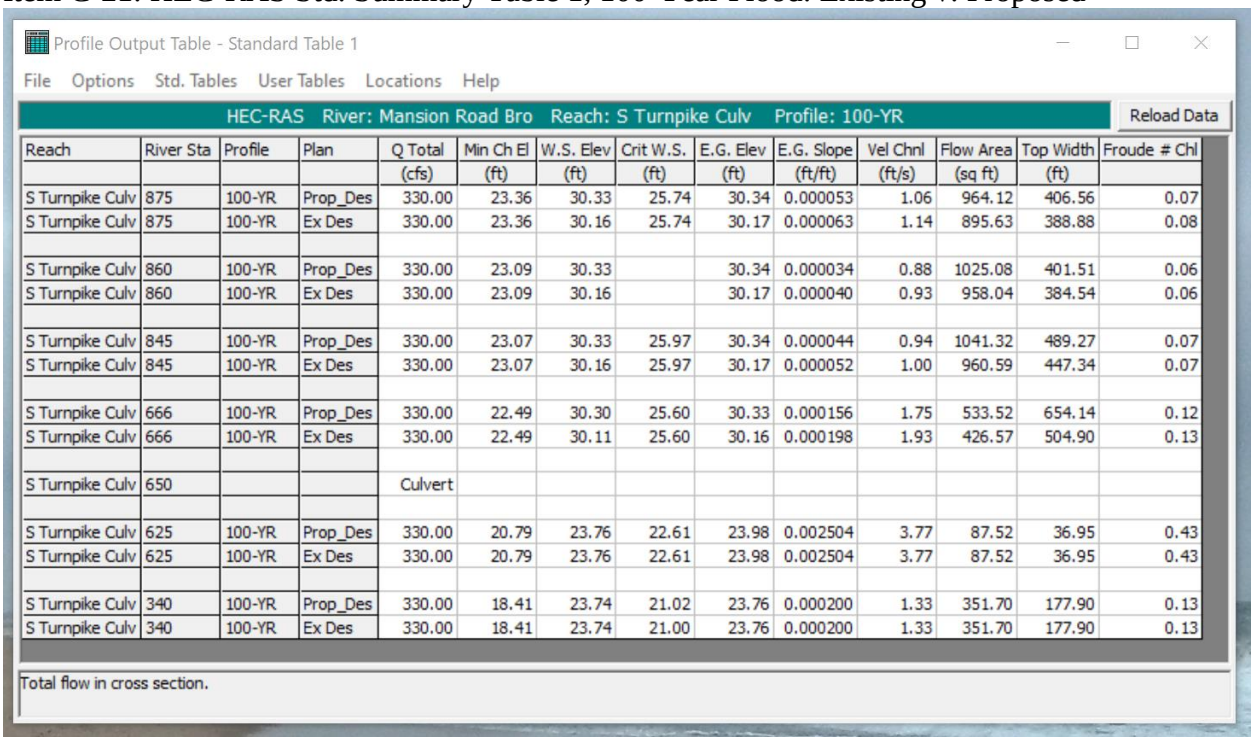
Item C-21: HEC-RAS Std. Summary Table 1, 100-Year Flood: Existing v. Proposed



Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 100-YR

Reload Data

Reach	River Sta	Profile	Plan	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
S Turnpike Culv	875	100-YR	Prop_Des	330.00	23.36	30.33	25.74	30.34	0.000053	1.06	964.12	406.56	0.07
S Turnpike Culv	875	100-YR	Ex Des	330.00	23.36	30.16	25.74	30.17	0.000063	1.14	895.63	388.88	0.08
S Turnpike Culv	860	100-YR	Prop_Des	330.00	23.09	30.33		30.34	0.000034	0.88	1025.08	401.51	0.06
S Turnpike Culv	860	100-YR	Ex Des	330.00	23.09	30.16		30.17	0.000040	0.93	958.04	384.54	0.06
S Turnpike Culv	845	100-YR	Prop_Des	330.00	23.07	30.33	25.97	30.34	0.000044	0.94	1041.32	489.27	0.07
S Turnpike Culv	845	100-YR	Ex Des	330.00	23.07	30.16	25.97	30.17	0.000052	1.00	960.59	447.34	0.07
S Turnpike Culv	666	100-YR	Prop_Des	330.00	22.49	30.30	25.60	30.33	0.000156	1.75	533.52	654.14	0.12
S Turnpike Culv	666	100-YR	Ex Des	330.00	22.49	30.11	25.60	30.16	0.000198	1.93	426.57	504.90	0.13
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	100-YR	Prop_Des	330.00	20.79	23.76	22.61	23.98	0.002504	3.77	87.52	36.95	0.43
S Turnpike Culv	625	100-YR	Ex Des	330.00	20.79	23.76	22.61	23.98	0.002504	3.77	87.52	36.95	0.43
S Turnpike Culv	340	100-YR	Prop_Des	330.00	18.41	23.74	21.02	23.76	0.000200	1.33	351.70	177.90	0.13
S Turnpike Culv	340	100-YR	Ex Des	330.00	18.41	23.74	21.00	23.76	0.000200	1.33	351.70	177.90	0.13

Total flow in cross section.

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Item C-22: HEC-RAS Std. Summary Table 1, 500-Year Flood: Existing v. Proposed

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 500-YR

Reload Data

Reach	River Sta	Profile	Plan	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
S Turnpike Culv	875	500-YR	Prop_Des	660.00	23.36	30.38	26.59	30.40	0.000201	2.08	982.99	409.42	0.14
S Turnpike Culv	875	500-YR	Ex Des	660.00	23.36	30.40	26.59	30.43	0.000195	2.06	993.38	412.07	0.14
S Turnpike Culv	860	500-YR	Prop_Des	660.00	23.09	30.38		30.40	0.000132	1.72	1043.93	405.98	0.12
S Turnpike Culv	860	500-YR	Ex Des	660.00	23.09	30.40		30.43	0.000129	1.71	1054.20	407.29	0.12
S Turnpike Culv	845	500-YR	Prop_Des	660.00	23.07	30.38	27.29	30.40	0.000167	1.84	1064.07	507.78	0.13
S Turnpike Culv	845	500-YR	Ex Des	660.00	23.07	30.40	27.29	30.42	0.000162	1.82	1077.06	515.80	0.13
S Turnpike Culv	666	500-YR	Prop_Des	660.00	22.49	30.22	27.28	30.38	0.000691	3.65	485.79	596.43	0.25
S Turnpike Culv	666	500-YR	Ex Des	660.00	22.49	30.26	27.28	30.40	0.000660	3.58	506.28	617.52	0.25
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	500-YR	Prop_Des	660.00	20.79	25.08	23.50	25.44	0.002486	4.84	136.27	41.49	0.45
S Turnpike Culv	625	500-YR	Ex Des	660.00	20.79	25.08	23.50	25.44	0.002486	4.84	136.27	41.49	0.45
S Turnpike Culv	340	500-YR	Prop_Des	660.00	18.41	25.13	21.84	25.17	0.000200	1.68	644.73	274.81	0.14
S Turnpike Culv	340	500-YR	Ex Des	660.00	18.41	25.13	21.83	25.17	0.000200	1.68	644.72	274.80	0.14

Total flow in cross section.

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Item C-23: HEC-RAS Std. Summary Table 1, 100-Year Flood: Natural v Proposed

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: 100-YR

Reload Data

Reach	River Sta	Profile	Plan	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)	
S Turnpike Culv	875	100-YR	Prop_Des	330.00	23.36	30.33	25.74	30.34	0.000053	1.06	964.12	406.56	0.07
S Turnpike Culv	875	100-YR	Natural_Des	330.00	23.36	26.77	25.74	27.02	0.002896	4.66	112.35	59.45	0.48
S Turnpike Culv	860	100-YR	Prop_Des	330.00	23.09	30.33		30.34	0.000034	0.88	1025.08	401.51	0.06
S Turnpike Culv	860	100-YR	Natural_Des	330.00	23.09	26.80		26.97	0.001460	3.47	137.11	95.78	0.34
S Turnpike Culv	845	100-YR	Prop_Des	330.00	23.07	30.33	25.97	30.34	0.000044	0.94	1041.32	489.27	0.07
S Turnpike Culv	845	100-YR	Natural_Des	330.00	23.07	26.64		26.93	0.003529	4.73	106.75	67.12	0.51
S Turnpike Culv	666	100-YR	Prop_Des	330.00	22.49	30.30	25.60	30.33	0.000156	1.75	533.52	654.14	0.12
S Turnpike Culv	666	100-YR	Natural_Des	330.00	22.49	25.58	25.58	26.67	0.016023	8.37	39.43	18.35	1.01
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	100-YR	Prop_Des	330.00	20.79	23.76	22.61	23.98	0.002504	3.77	87.52	36.95	0.43
S Turnpike Culv	625	100-YR	Natural_Des	330.00	20.79	23.71	22.61	23.94	0.002725	3.83	86.18	36.79	0.44
S Turnpike Culv	340	100-YR	Prop_Des	330.00	18.41	23.74	21.02	23.76	0.000200	1.33	351.70	177.90	0.13
S Turnpike Culv	340	100-YR	Natural_Des	330.00	18.41	23.74	21.02	23.76	0.000200	1.33	351.70	177.90	0.13

Total flow in cross section.

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Item C-24: HEC-RAS Std. Summary Table 1, Spr Day Flood, Existing v. Temporary

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Mansion Road Bro Reach: S Turnpike Culv Profile: Spr Day

Reload Data

Reach	River Sta	Profile	Plan	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)	
S Turnpike Culv	875	Spr Day	Temp	3.00	23.36	23.60	23.60	23.68	0.033327	2.20	1.36	9.00	1.00
S Turnpike Culv	875	Spr Day	Ex Des	3.00	23.36	23.60	23.60	23.68	0.033327	2.20	1.36	9.00	1.00
S Turnpike Culv	860	Spr Day	Temp	3.00	23.09	23.50	23.26	23.51	0.001035	0.63	4.75	15.02	0.20
S Turnpike Culv	860	Spr Day	Ex Des	3.00	23.09	23.50	23.26	23.51	0.001029	0.63	4.75	15.02	0.20
S Turnpike Culv	845	Spr Day	Temp	3.00	23.07	23.35	23.35	23.45	0.032480	2.51	1.19	6.30	1.02
S Turnpike Culv	845	Spr Day	Ex Des	3.00	23.07	23.35	23.35	23.45	0.032480	2.51	1.19	6.30	1.02
S Turnpike Culv	666	Spr Day	Temp	3.00	22.49	22.94	22.75	22.97	0.004899	1.52	1.97	4.76	0.42
S Turnpike Culv	666	Spr Day	Ex Des	3.00	22.49	22.80	22.65	22.82	0.003693	1.12	2.68	9.11	0.36
S Turnpike Culv	650			Culvert									
S Turnpike Culv	625	Spr Day	Temp	3.00	20.79	21.02	21.02	21.09	0.040198	2.09	1.44	11.62	1.05
S Turnpike Culv	625	Spr Day	Ex Des	3.00	20.79	20.94	20.94	20.99	0.041690	1.78	1.68	18.08	1.03
S Turnpike Culv	340	Spr Day	Temp	3.00	18.41	18.95	18.72	18.96	0.002501	1.06	2.82	7.83	0.31
S Turnpike Culv	340	Spr Day	Ex Des	3.00	18.41	18.95	18.72	18.96	0.002501	1.06	2.82	7.83	0.31

Total flow in cross section.

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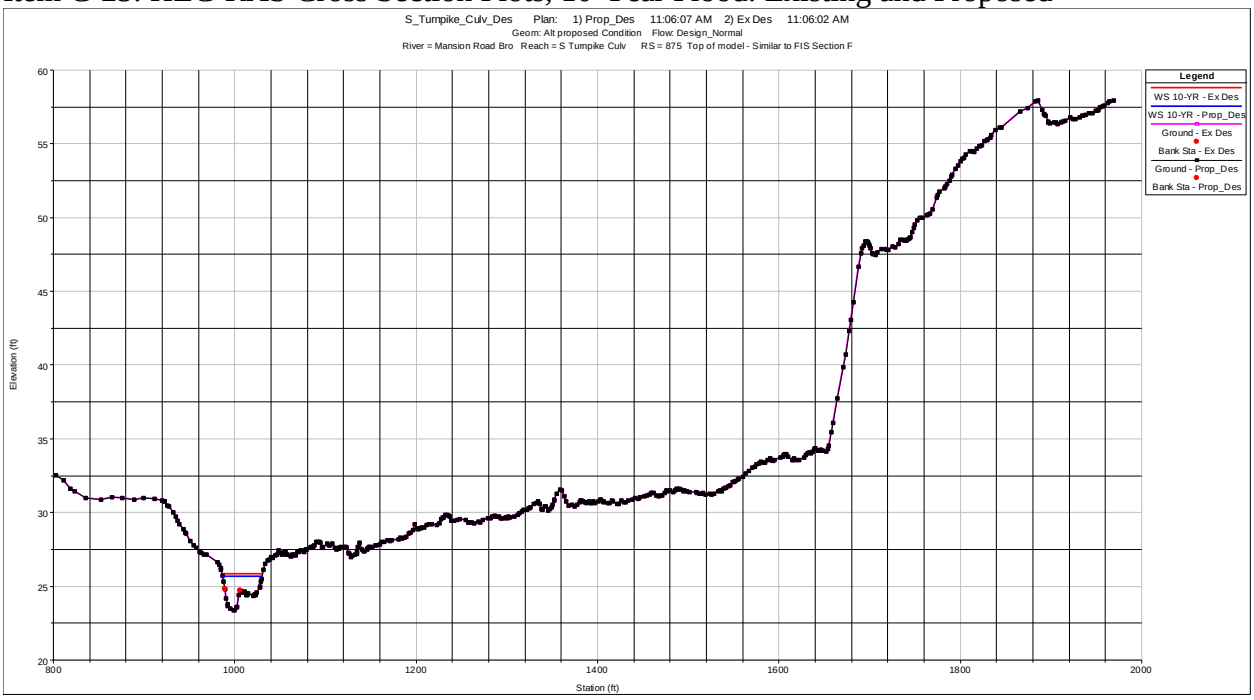
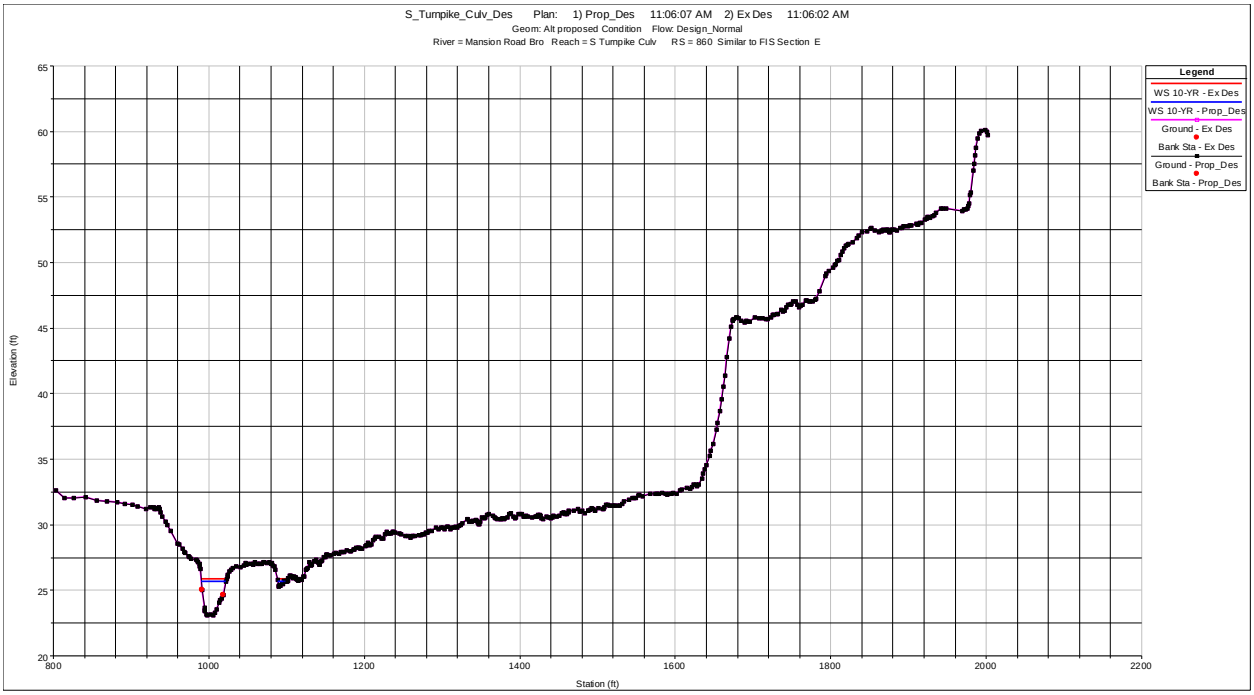
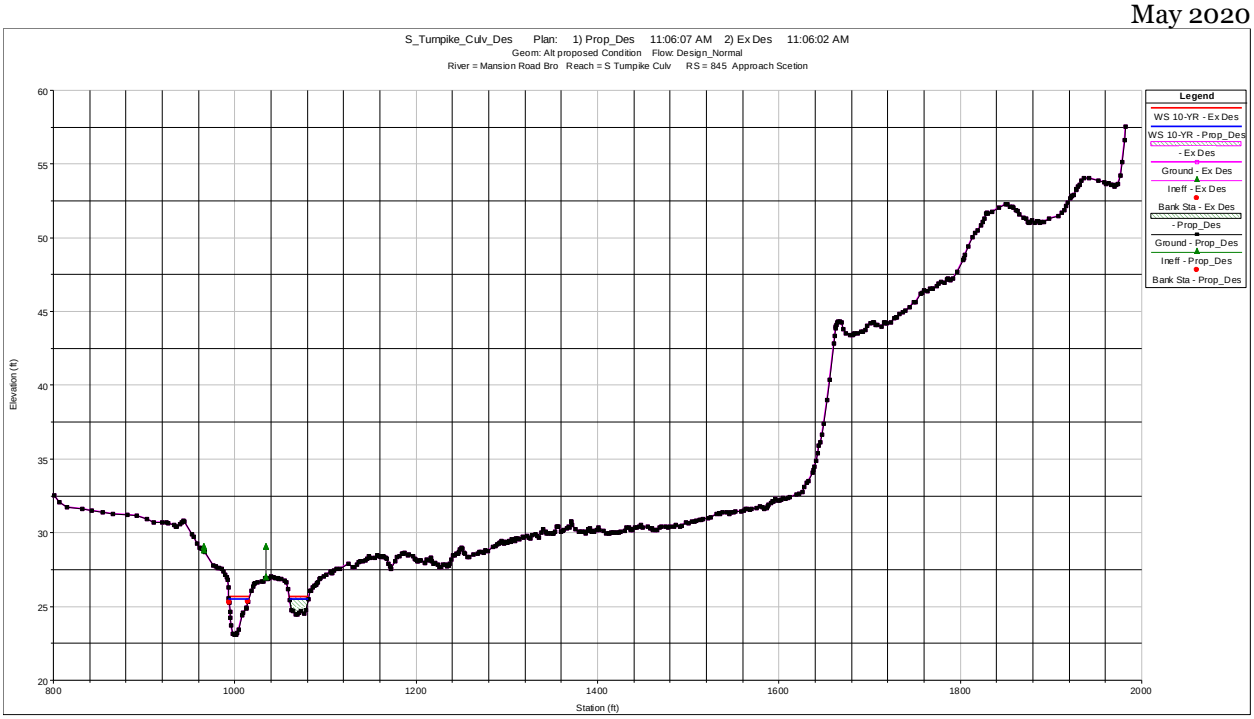
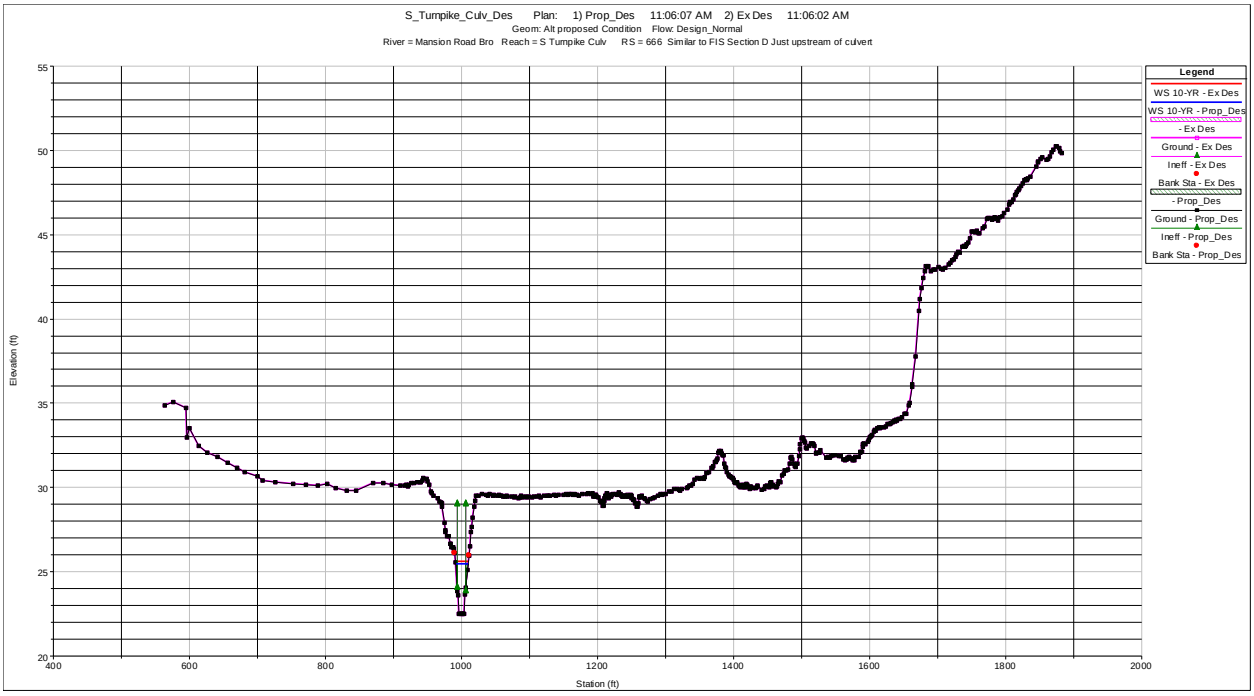
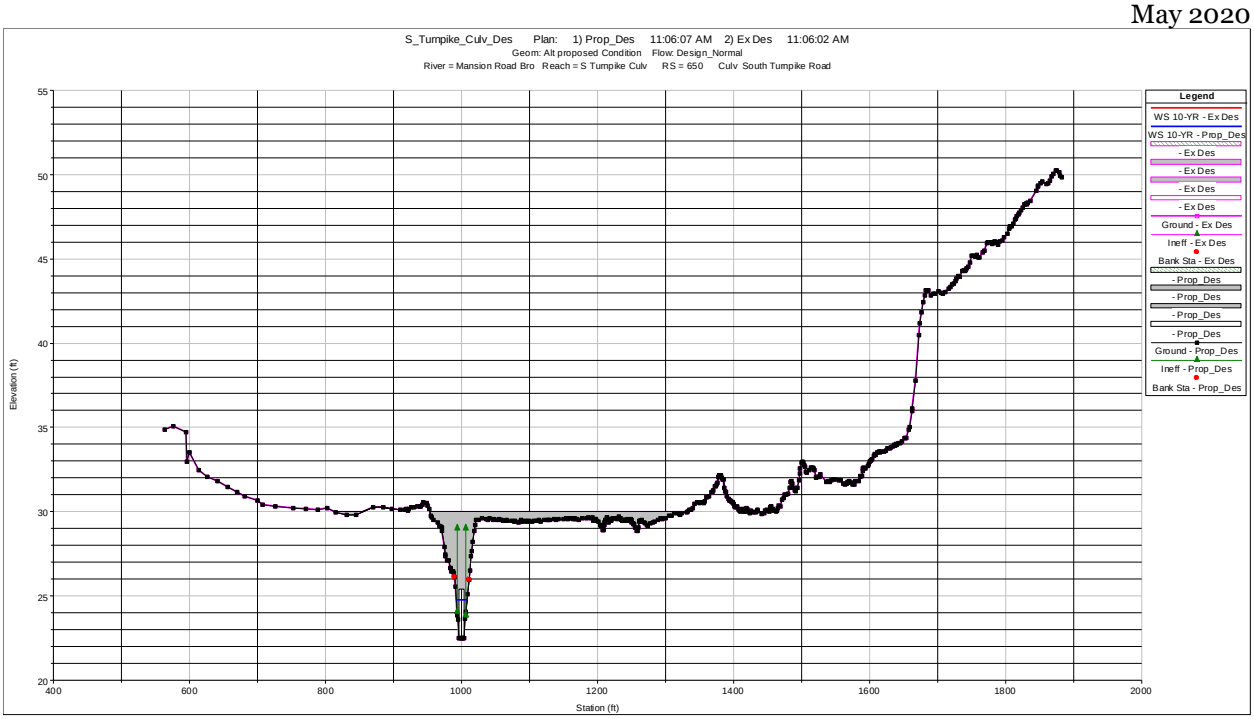
Item C-25: HEC-RAS Cross Section Plots, 10-Year Flood: Existing and Proposed

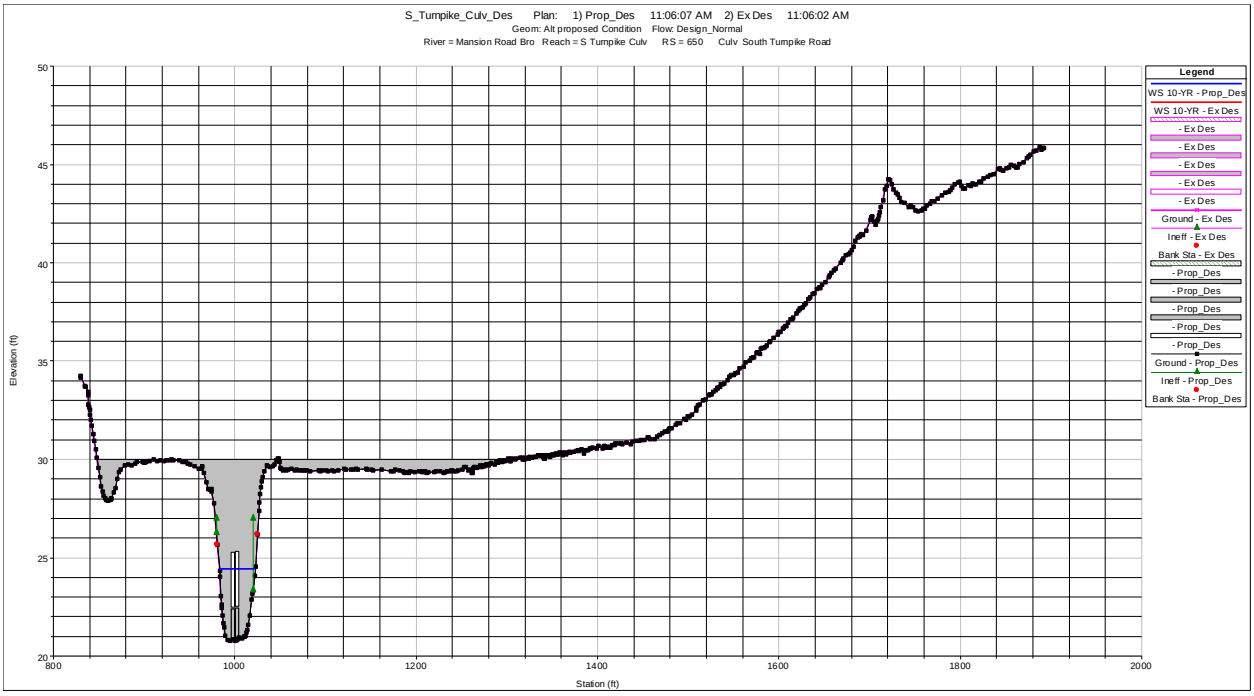


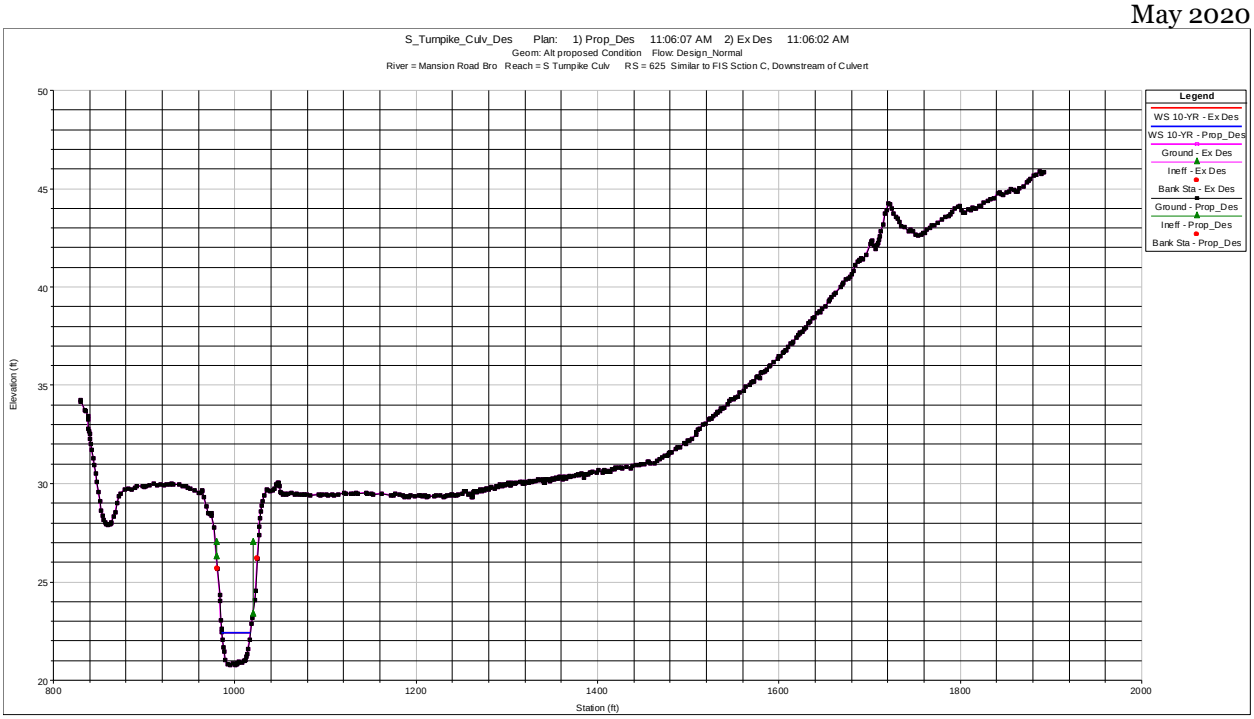


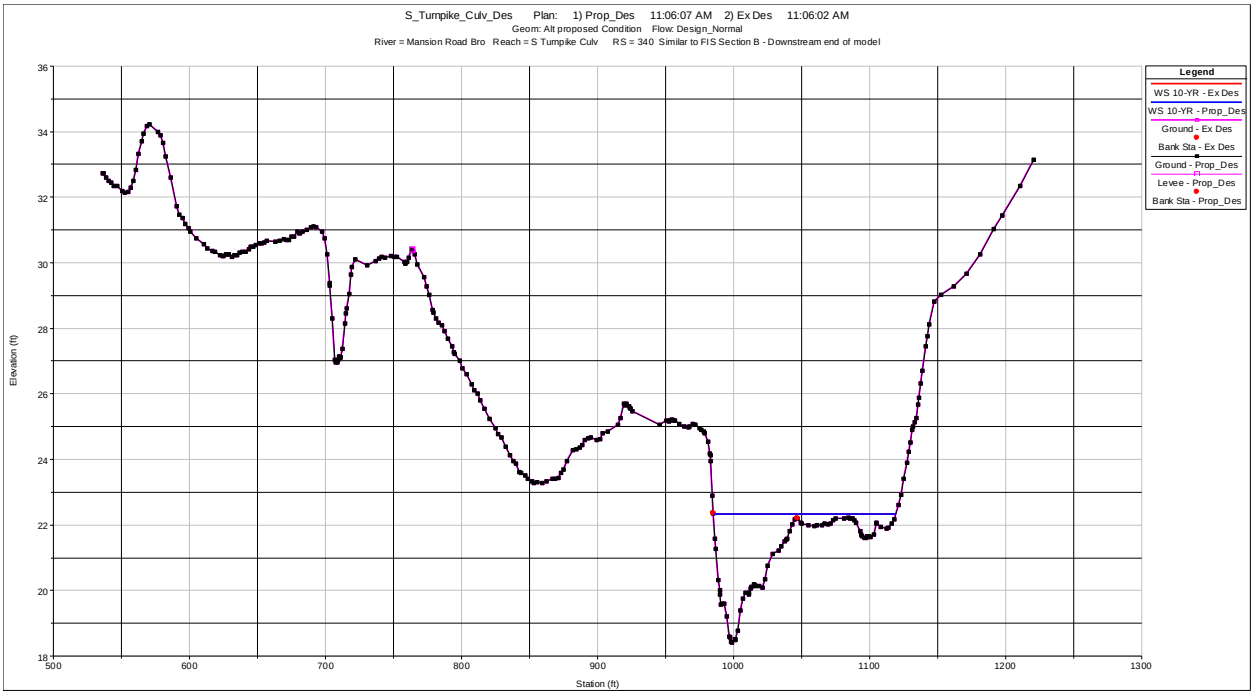

S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 845 Approach Scetion
Legend
WS 10-YR - Ex Des
WS 10-YR - Prop_Des
- Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
- Prop_Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 666 Similar to FIS Section D Just upstream of culvert
Legend
WS 10-YR - Ex Des
WS 10-YR - Prop_Des
- Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
- Prop_Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 10-YR - Ex Des
WS 10-YR - Prop_Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des


S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 10-YR - Prop_Des
WS 10-YR - Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des





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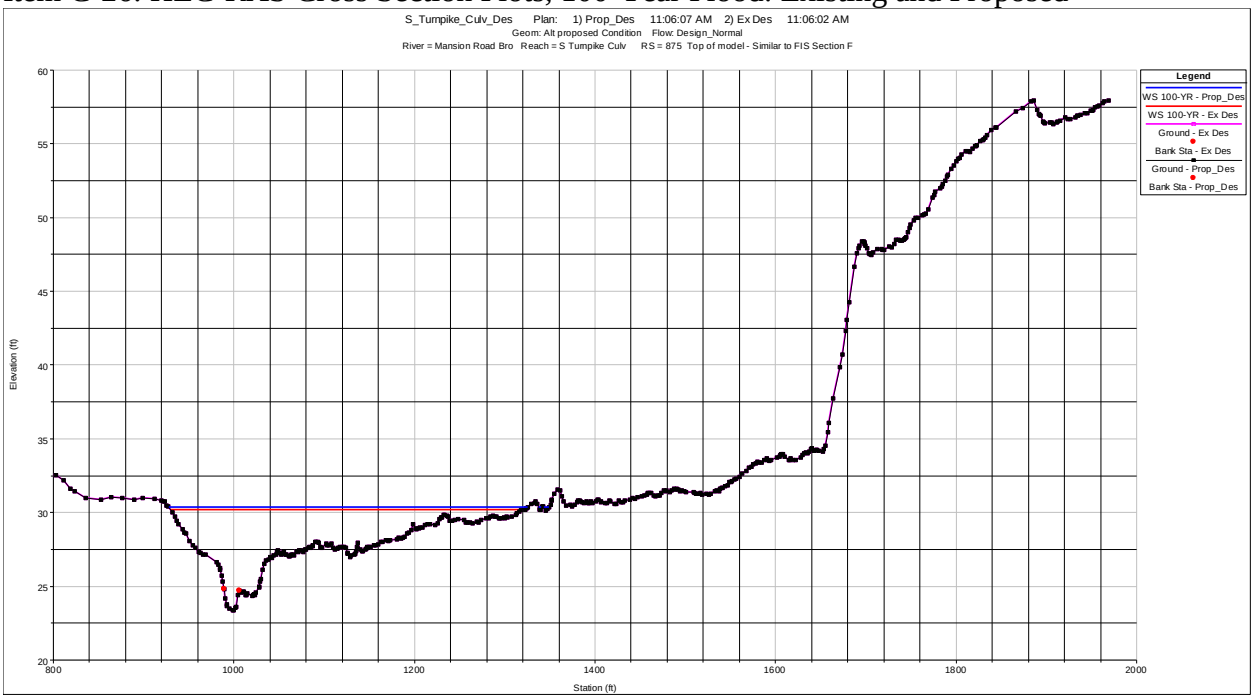
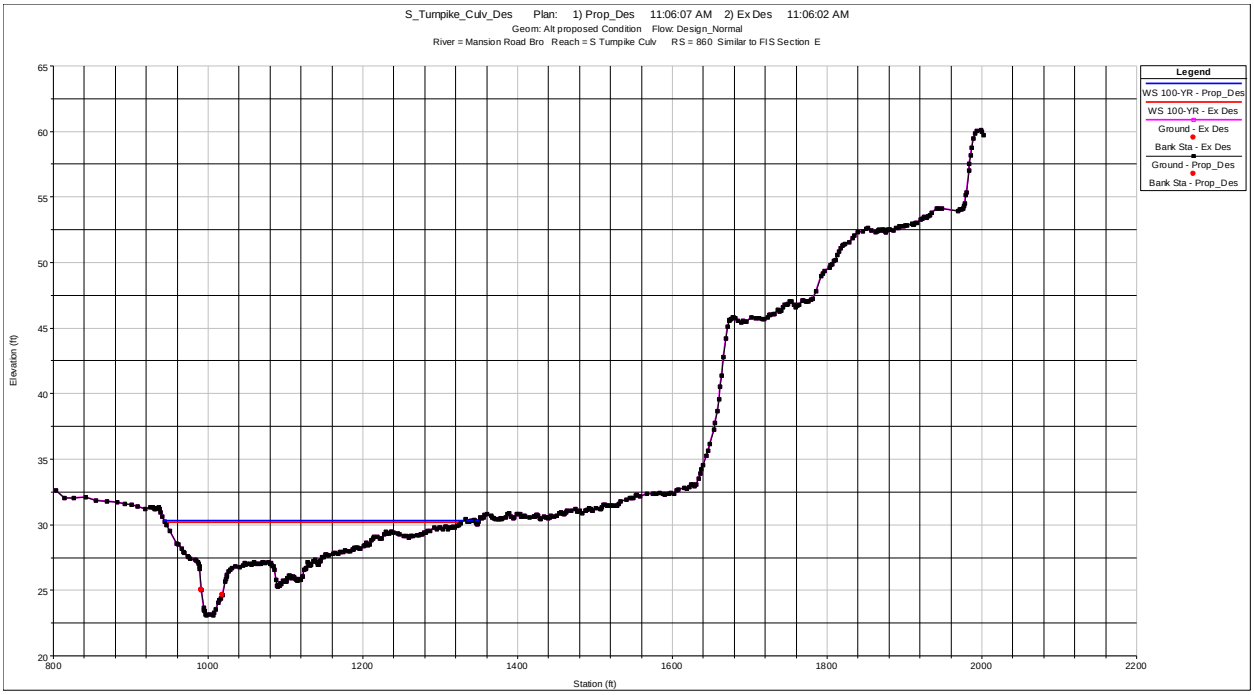
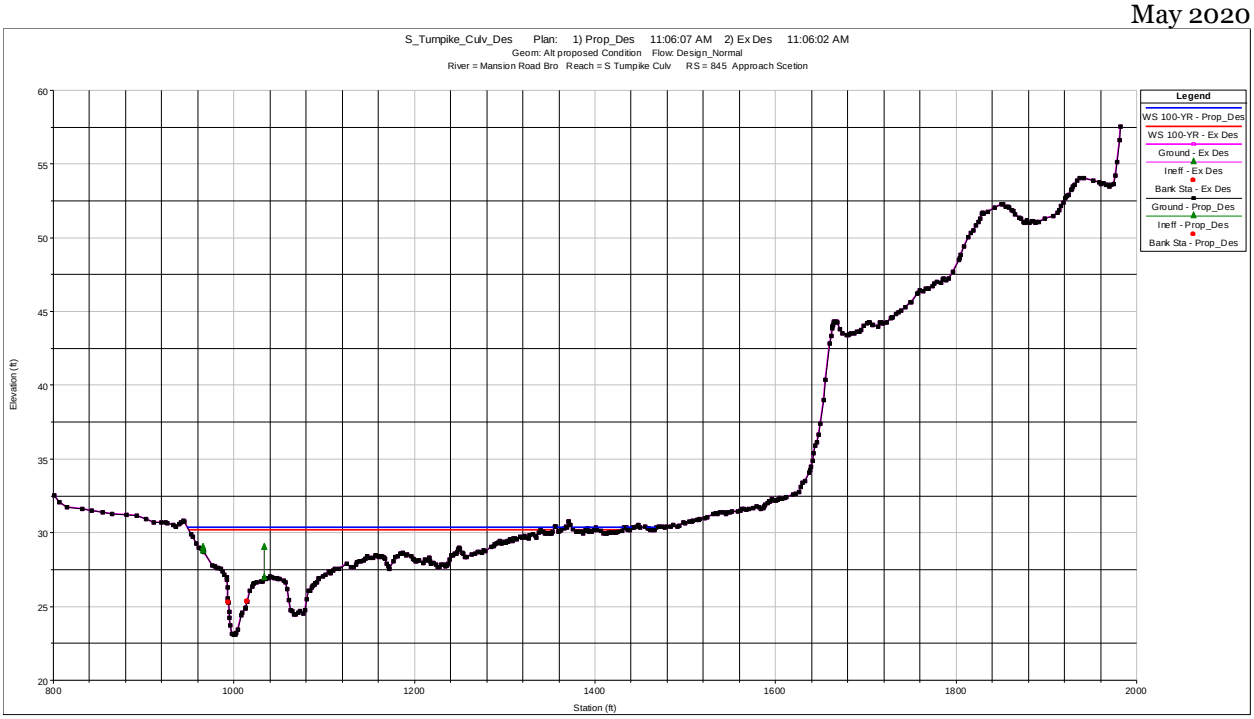
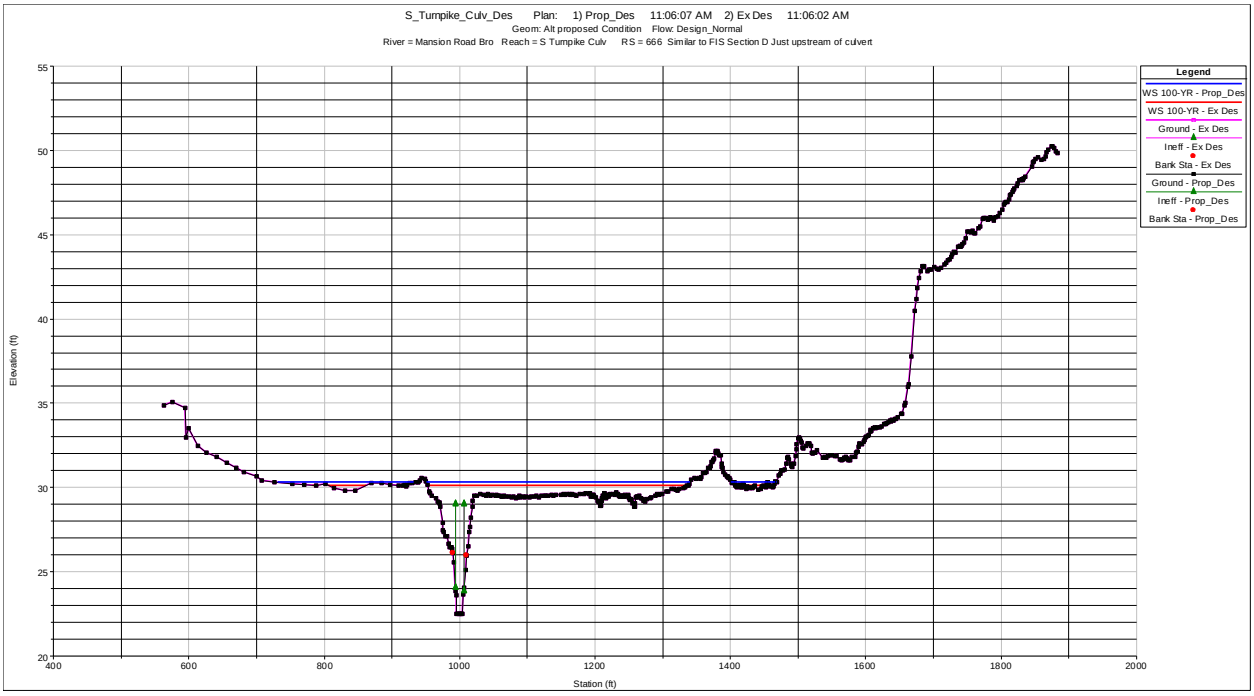
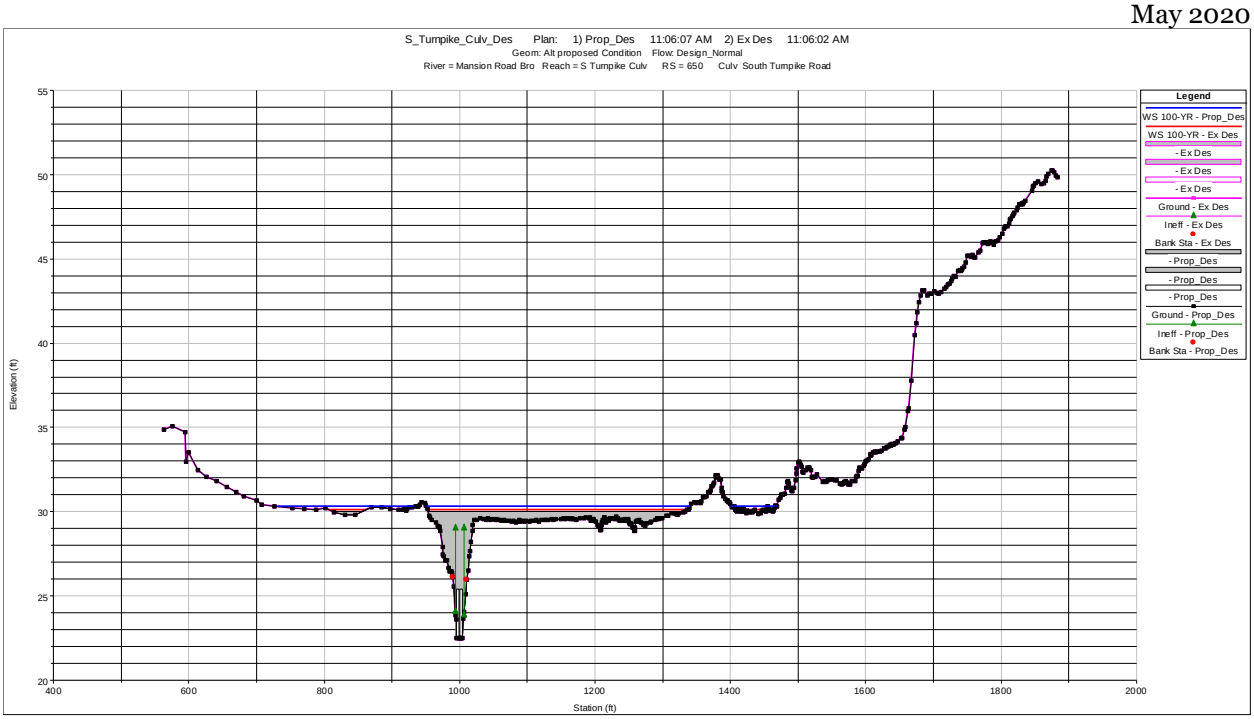
Item C-26: HEC-RAS Cross Section Plots, 100-Year Flood: Existing and Proposed

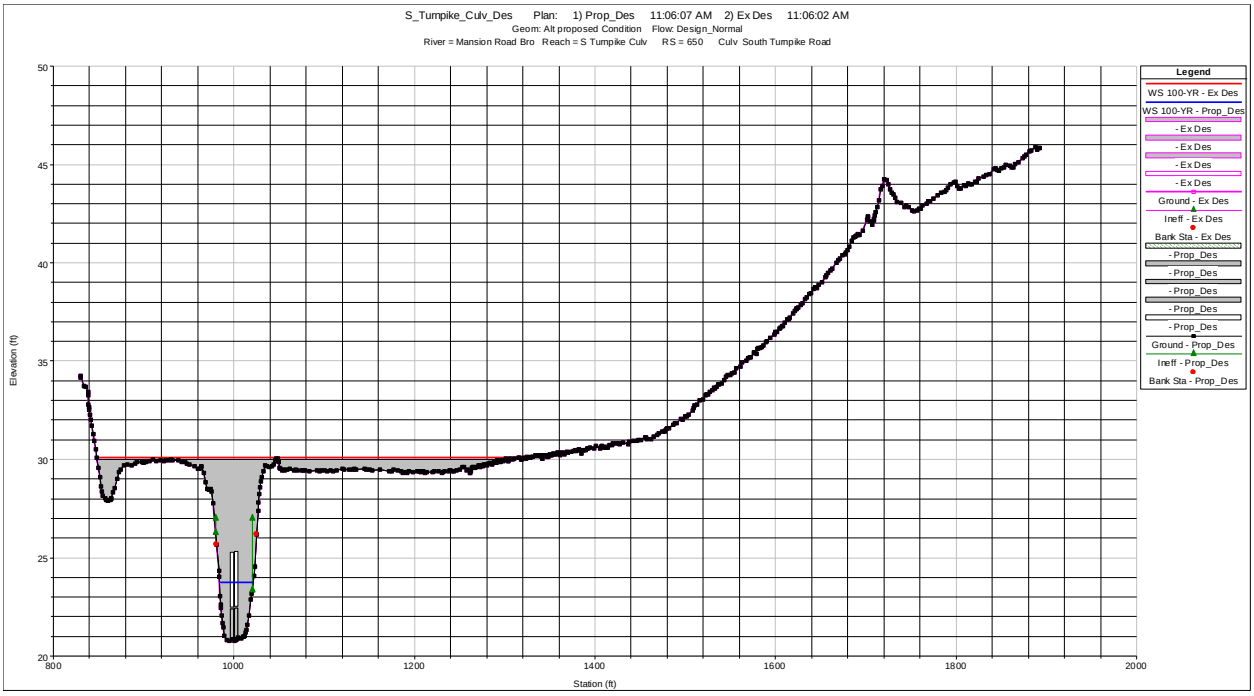


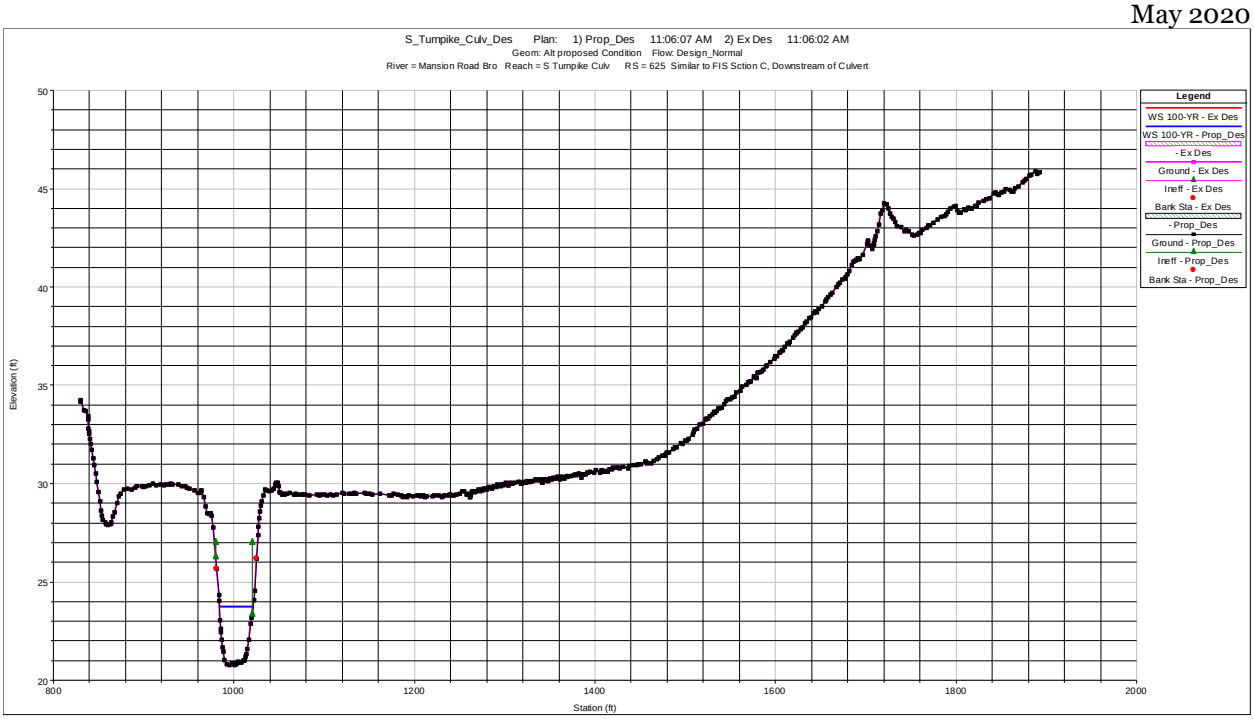


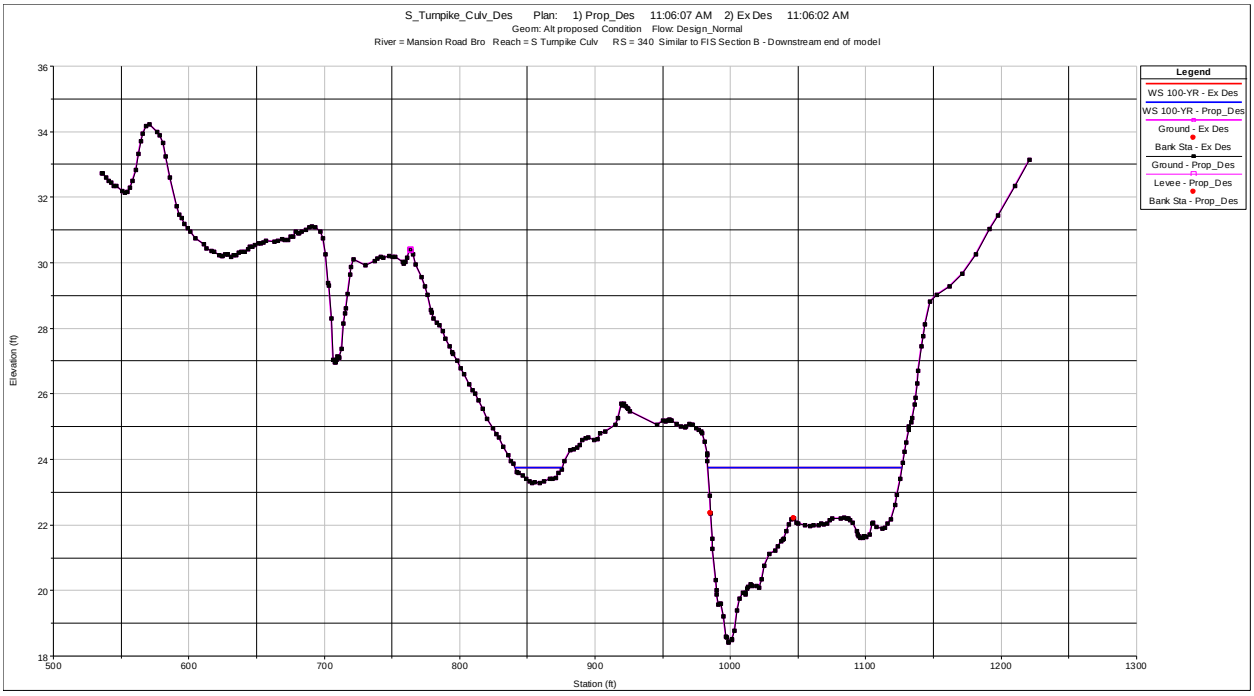

S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 845 Approach Scetion
Legend
WS 100-YR - Prop_Des
WS 100-YR - Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 666 Similar to FIS Section D Just upstream of culvert
Legend
WS 100-YR - Prop_Des
WS 100-YR - Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 100-YR - Prop_Des
WS 100-YR - Ex Des
- Ex Des
- Ex Des
- Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
- Prop_Des
- Prop_Des
- Prop_Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des


S_Turnpike_Culv_Des Plan: 1) Prop_Des 11:06:07 AM 2) Ex Des 11:06:02 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
Elevation (ft)
Station (ft)
Legend
WS 100-YR - Ex Des
WS 100-YR - Prop_Des
- Ex Des
- Ex Des
- Ex Des
- Ex Des
Ground - Ex Des
Ineff - Ex Des
Bank Sta - Ex Des
- Prop_Des
- Prop_Des
- Prop_Des
- Prop_Des
- Prop_Des
Ground - Prop_Des
Ineff - Prop_Des
Bank Sta - Prop_Des





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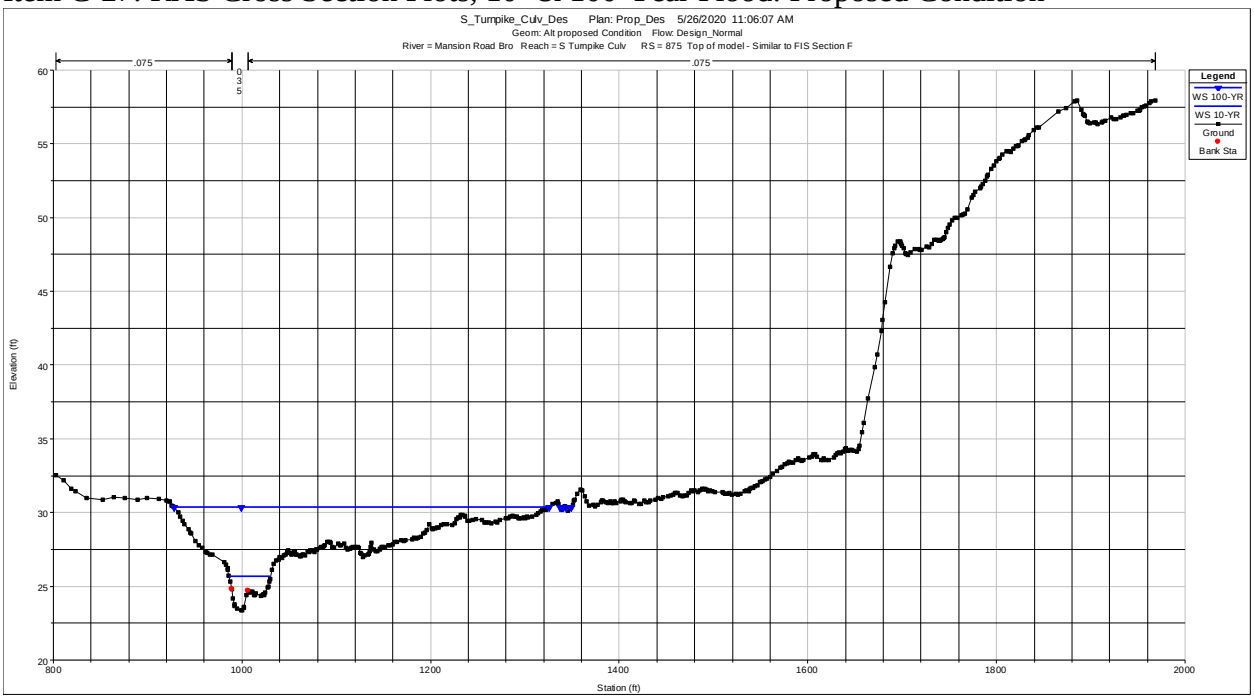
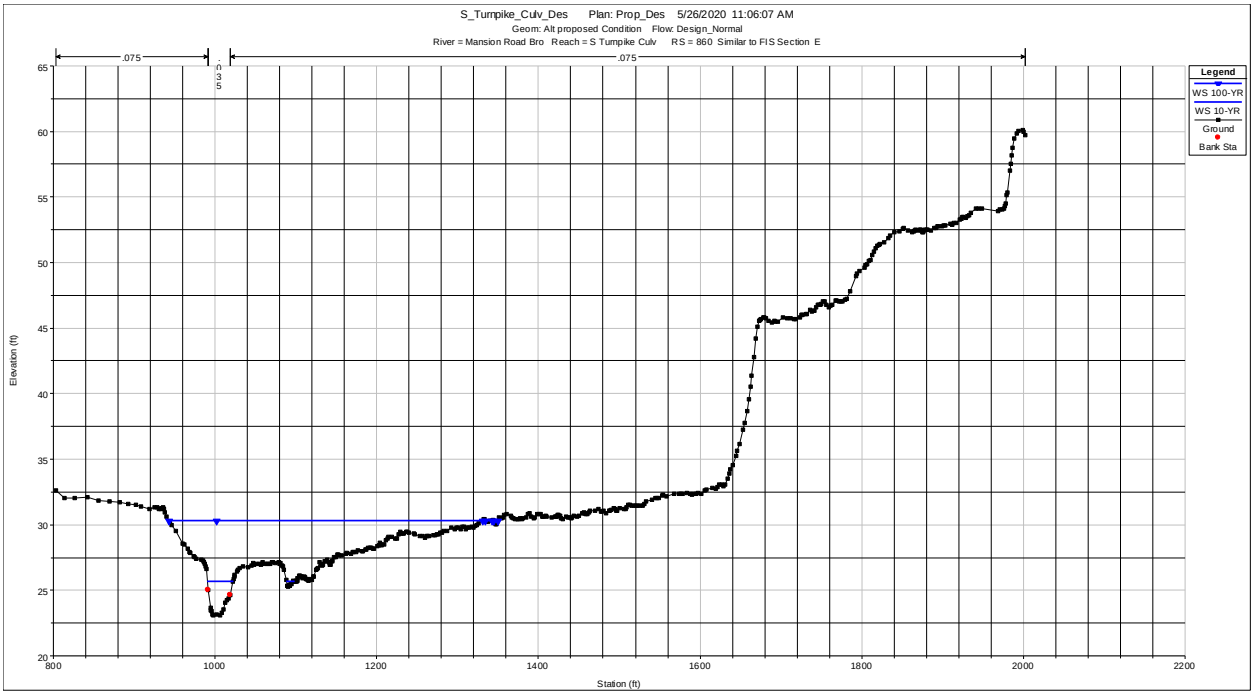
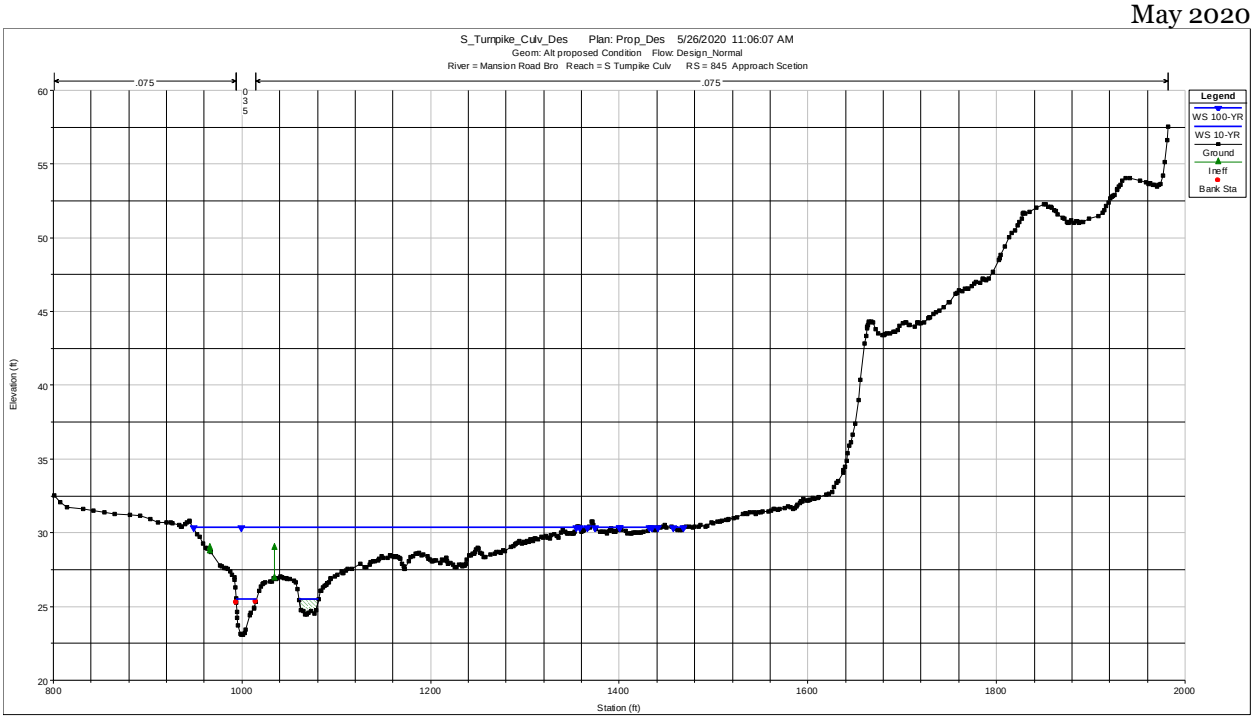
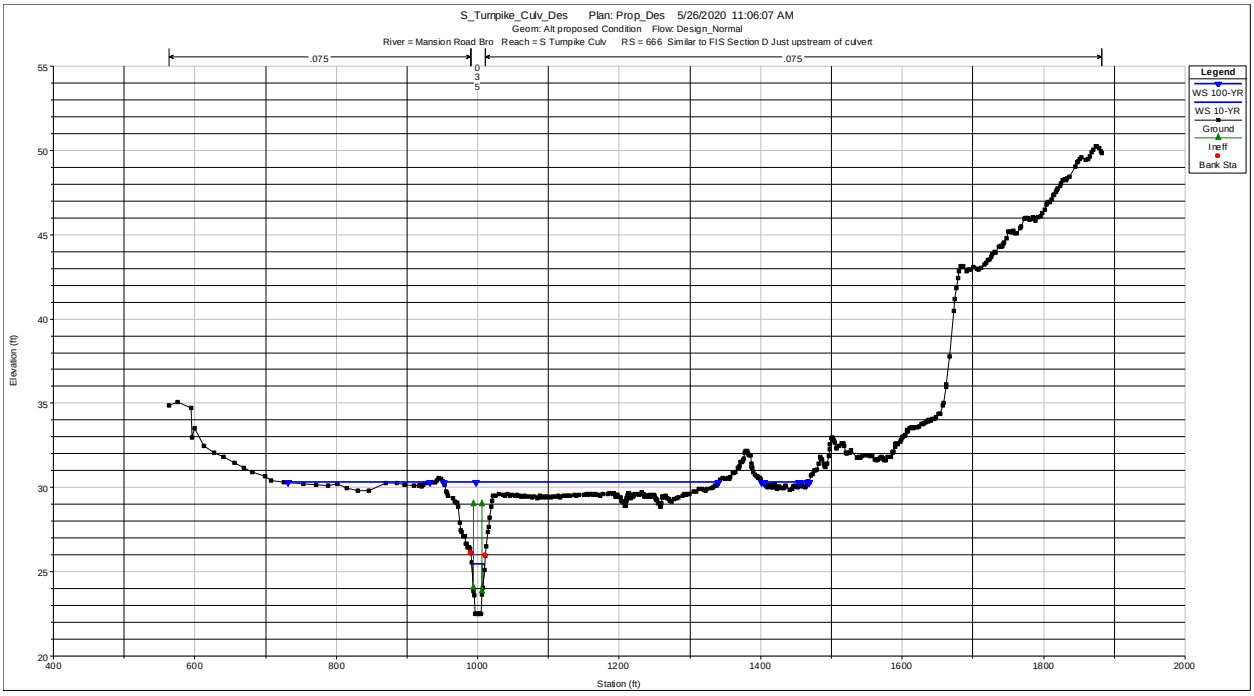
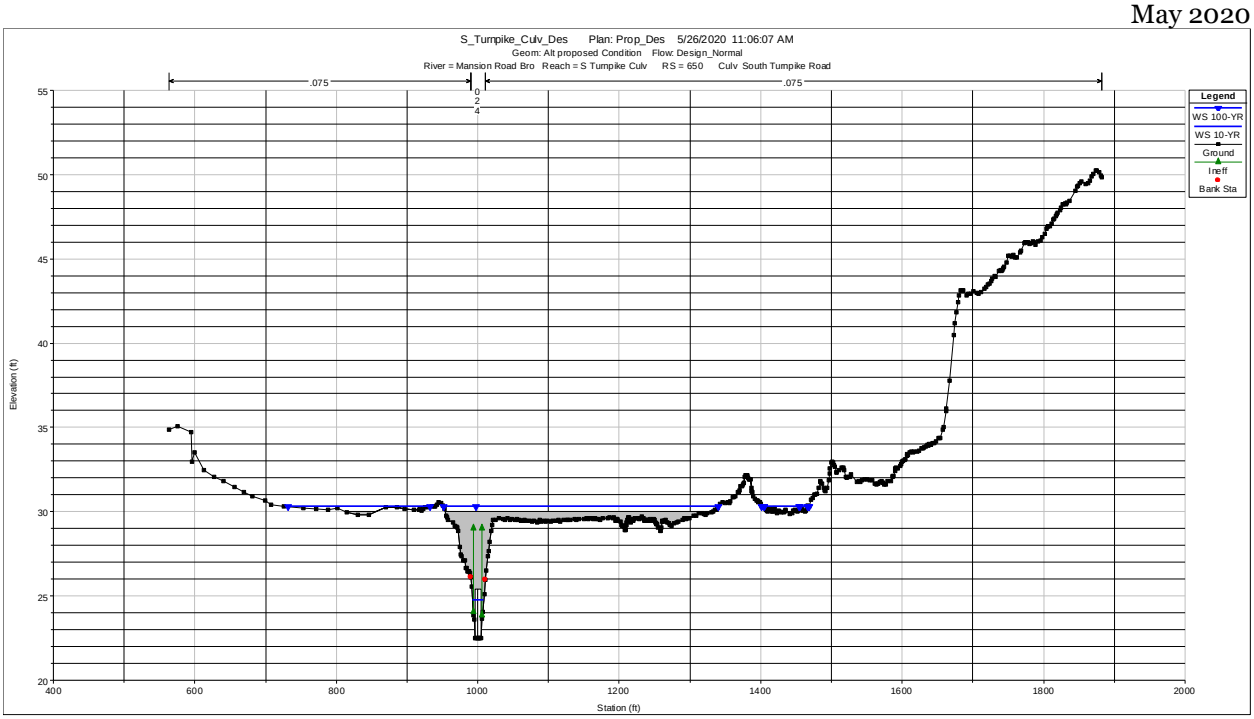
Item C-27: RAS Cross Section Plots, 10- & 100-Year Flood: Proposed Condition

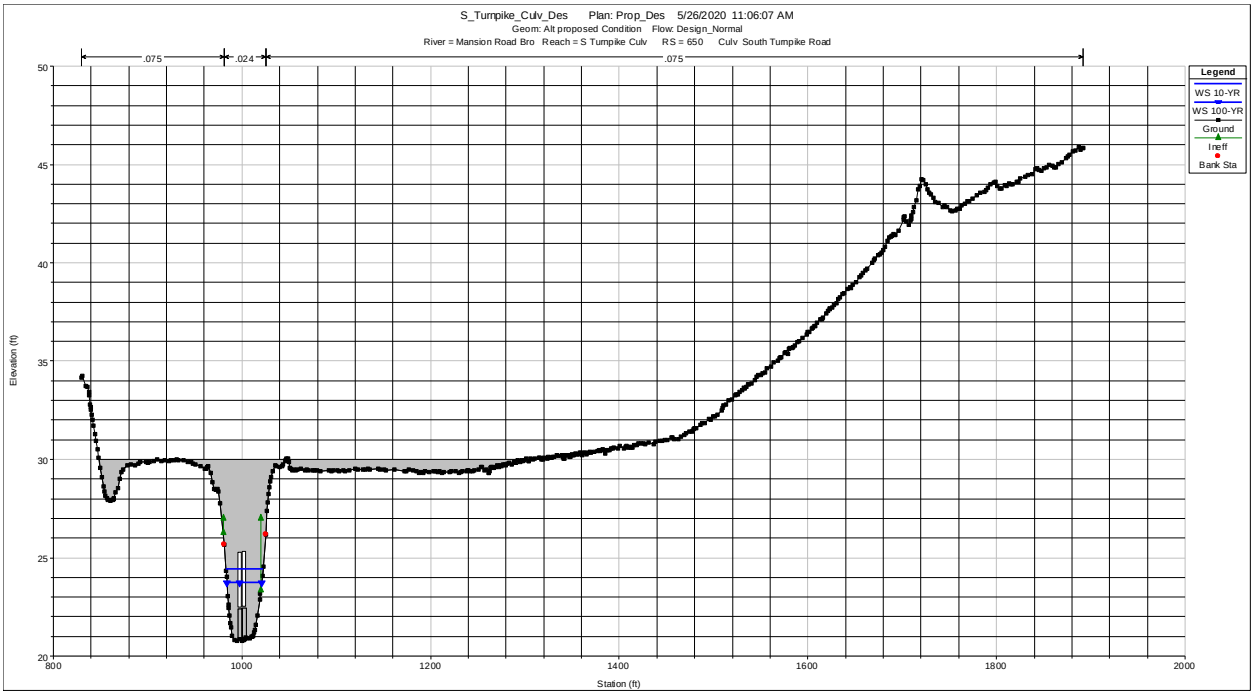


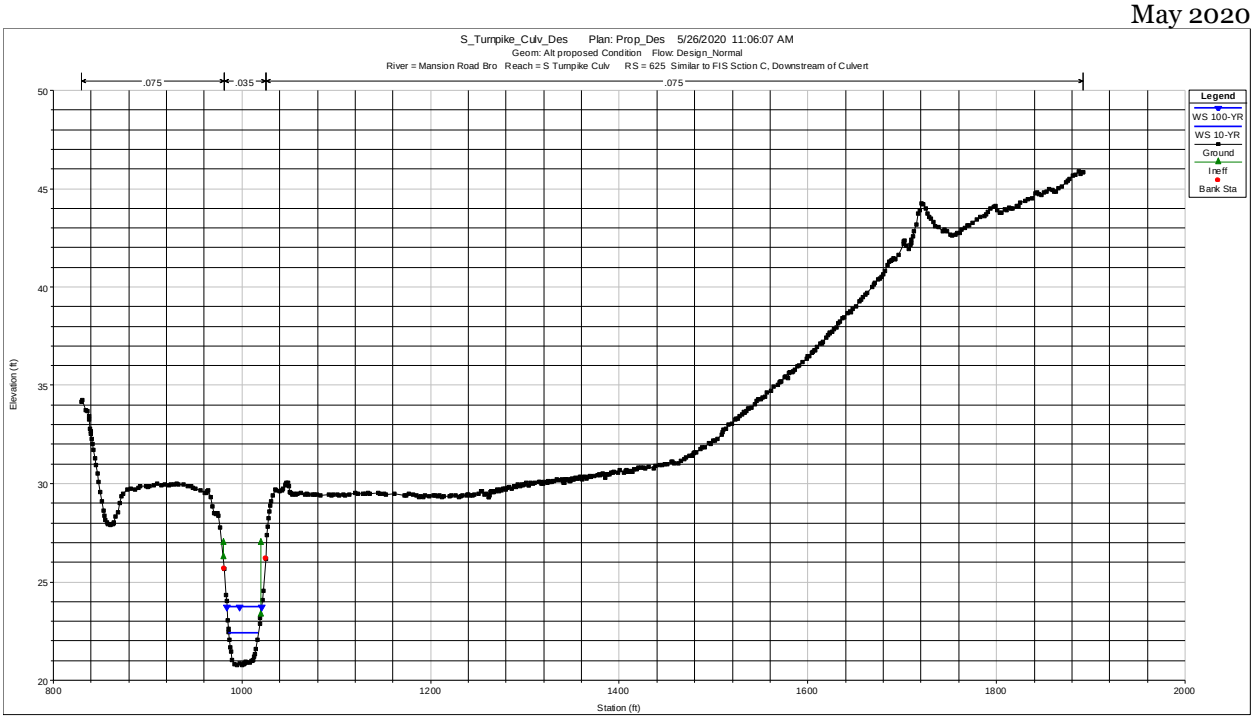


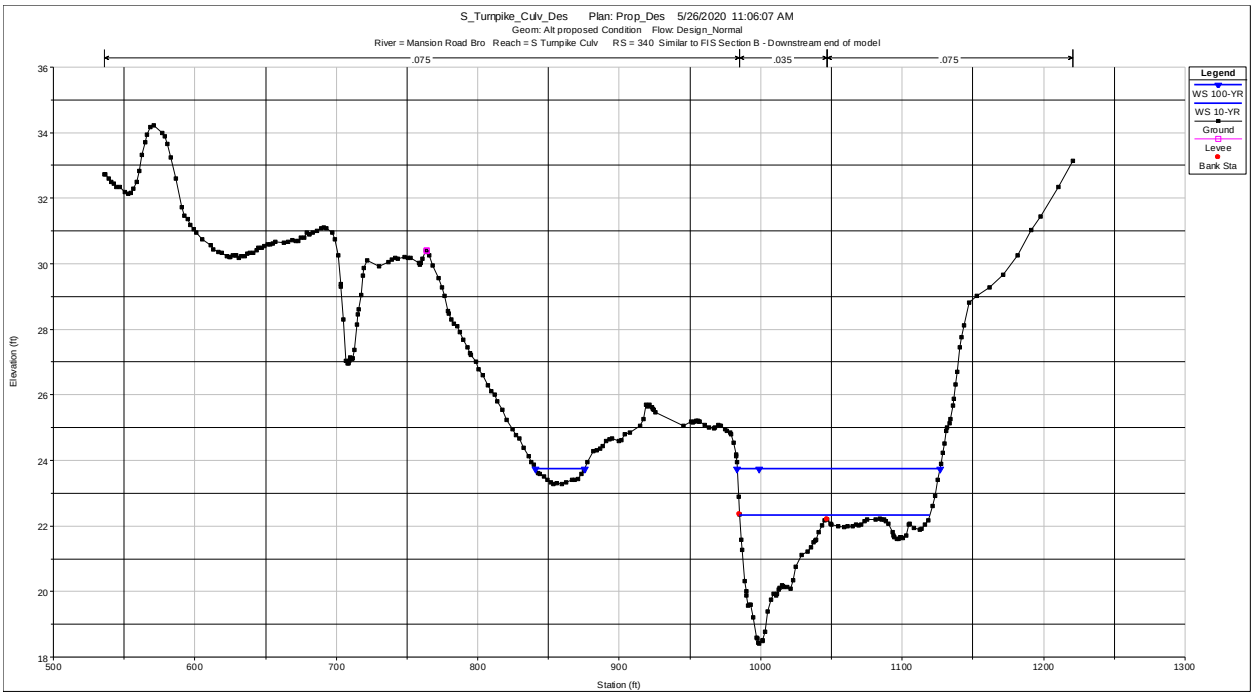

S_Turnpike_Culv_Des Plan: Prop_Des 5/26/2020 11:06:07 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 845 Approach Scetion
.075
.035
.075
Legend
WS 100-YR
WS 10-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
20
25
30
35
40
45
50
55
60
800
1000
1200
1400
1600
1800
2000


S_Turnpike_Culv_Des Plan: Prop_Des 5/26/2020 11:06:07 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 666 Similar to FIS Section D Just upstream of culvert
.075
.035
.075
Legend
WS 100-YR
WS 10-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
20
25
30
35
40
45
50
55
400
600
800
1000
1200
1400
1600
1800
2000


S_Turnpike_Culv_Des Plan: Prop_Des 5/26/2020 11:06:07 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
.075
.075
Legend
WS 100-YR
WS 10-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


S_Turnpike_Culv_Des Plan: Prop_Des 5/26/2020 11:06:07 AM
Geom: Alt proposed Condition Flow: Design_Normal
River = Mansion Road Bro Reach = S Turnpike Culv RS = 650 Culv South Turnpike Road
.075
.024
.075
Legend
WS 10-YR
WS 100-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)





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Appendix D - Photographs

WMC Consulting Engineers
Newington, CT
(860) 667-9624

Appendix D Contents

Photo 1: Culvert Inlet

Photo 2: Looking upstream

Photo 3: Downstream outlet

Photo 4: Looking downstream

Hydraulic Report
South Turnpike Road over Mansion Road Brook
Br. No. 148-0028
Town of Wallingford
May 2020

Appendix E – FEMA Information

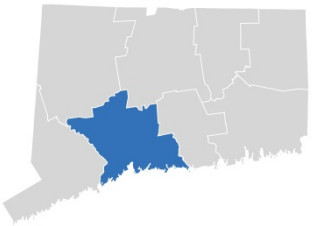
WMC Consulting Engineers
Newington, CT
(860) 667-9624

Appendix E Contents

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 10



NEW HAVEN COUNTY, CONNECTICUT

(ALL JURISDICTIONS)

COMMUNITY NAME	NUMBER
CITY OF ANSONIA	090071
TOWN OF BEACON FALLS	090072
TOWN OF BETHANY	090144
TOWN OF BRANFORD	090073
TOWN OF CHESHIRE	090074
CITY OF DERBY	090075
TOWN OF EAST HAVEN	090076
TOWN OF GUILFORD	090077
TOWN OF HAMDEN	090078
TOWN OF MADISON	090079
CITY OF MERIDEN	090081
TOWN OF MIDDLEBURY	090080
CITY OF MILFORD	090082
BOROUGH OF NAUGATUCK	090137
CITY OF NEW HAVEN	090084
TOWN OF NORTH BRANFORD	090085
TOWN OF NORTH HAVEN	090086
TOWN OF ORANGE	090087
TOWN OF OXFORD	090150

COMMUNITY NAME	NUMBER
TOWN OF PROSPECT	090151
TOWN OF SEYMOUR	090088
TOWN OF SOUTHBURY	090089
TOWN OF WALLINGFORD	090090
CITY OF WATERBURY	090091
CITY OF WEST HAVEN	090092
TOWN OF WOLCOTT	090093
TOWN OF WOODBRIDGE	090153
BOROUGH OF WOODMONT	090168

REVISED:

MAY 16, 2017

FLOOD INSURANCE STUDY NUMBER 09009CV001D

Version Number 2.3.3.2

FEMA

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Maloney Brook	At confluence with Farm River	1	255	*	425	532	761
Mansion Road Brook	At confluence with the Quinnipiac River	0.9	115	*	215	330	660
Meetinghouse Brook	At confluence with the Quinnipiac River	3.72	1,580	*	2,310	2,680	3,440
Meetinghouse Brook	At cross section I	1.93	1,170	*	1,660	1,900	2,400
Mill River	At Whitney Dam	36.4	2,970	4,030	4,940	5,950	8,780
Mill River	At Connolly Parkway	33.1	2,760	3,740	4,590	5,530	8,140
Mill River	Upstream of confluence with Shepard Brook	29.0	2,500	3,380	4,140	4,980	7,320
Mill River	At Clarks Pond Dam	25.0	2,240	3,020	3,690	4,440	6,490
Mill River	At USGS streamgage 01196620	24.5	2,200	2,970	3,630	4,370	6,390
Mill River	Upstream of confluence with Eaton Brook	22.0	2,030	2,740	3,340	4,020	5,860
Mill River	At River Road	19.0	1,820	2,450	2,980	3,580	5,210
Mill River	Upstream of confluence with Willow Brook	5.76	521	675	824	957	1,310
Mill River	Upstream of confluence with unnamed tributary near Old Lane Road	3.27	328	423	503	585	819
Mill River	At Mansion Road	1.74	205	263	311	360	506
Mill River	Upstream of unnamed tributary at Richards Corner	0.92	127	160	190	219	303
Mill River	At Wallingford Road	0.56	87	110	129	149	203

*Not calculated for this Flood Risk Project

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Mad River (Lower Reach)	Confluence with Naugatuck River	Sharon Road	USGS Floodflow Formulas (Weiss, 1975)	HEC-2 Water Surface Profiles Program (USACE, 1973)	November, 1977	AE	
Mad River (Upper Reach)	Corporate limits with Waterbury	Approximately 2,600 feet upstream of Mad River Hill Road	USGS Floodflow Formulas (Weiss, 1975) and later modified for reservoir storage	HEC-2 Water Surface Profiles Program (USACE, 1976)	April, 1980	AE	
Maloney Brook	Confluence with Farm River	Approximately 50 feet upsteam of Foxon Hill Road	USGS Regional Regression Equations (Ahearn, 2004) adjusted for urbanization (Sauer, USGS WSP 2207).	HEC-2 Water Surface Profiles Program (USACE, 1998)	October, 2000	AE	
Mansion Road Brook	Confluence with Quinnipiac River	Approximately 1,300 feet upstream of Jones Road	USGS Floodflow Formulas (Weiss, 1975)	Step-backwater computer program, E431 and J635 for areas with critical flow, (Shearman, 1976)	August, 1987	AE	
Meetinghouse Brook	Confluence with Quinnipiac River	Approximately 3,000 feet upstream of U.S. Route 5	Synthetic rainfall-runoff method, TR20 (NRCS, 1986)	Step-backwater computer model WSP2 (SCS, 1976)	April, 1977	AE	
Mill River	Lake Whitney Dam	Williamsburg Drive	Weighted flood-frequency estimates of gage data and USGS Regional Regression Equations (Ahearn, 2004)	HEC-RAS River Analysis System 4.1.0 (USACE, 2010)	July, 2014	AE	USGS Gage No. 01199620 was used in the hydrologic analysis.

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	238	24	237	1.4	29.0	29.0	30.0	1.0
B	340	168	1,192	0.3	29.0	29.0	30.0	1.0
C	625	23	147	2.2	29.0	29.0	30.0	1.0
D	666	84	345	1.0	30.7	30.7	31.7	1.0
E	860	82	400	0.8	30.7	30.7	31.7	1.0
F	875	82	387	0.8	30.7	30.7	31.7	1.0
G	1,150	27	94	3.5	30.8	30.8	31.7	0.9
H	1,285	141	64	5.2	32.1	32.1	32.3	0.2
I	1,322	279	2,221	0.2	40.2	40.2	41.2	1.0
J	1,355	184	1,194	0.3	40.2	40.2	41.2	1.0
K	1,705	60	244	1.4	40.2	40.2	41.2	1.0
L	1,990	24	92	3.6	46.6	46.6	47.6	1.0
M	2,130	34	91	3.6	47.1	47.1	47.8	0.7
N	2,220	19	40	8.2	48.5	48.5	48.5	0.0
O	2,295	53	94	3.5	66.7	66.7	67.7	1.0
P	2,670	21	73	4.6	69.6	69.6	69.6	0.0
Q	3,060	17	42	7.8	72.0	72.0	73.0	1.0
R	3,200	16	40	8.3	75.8	75.8	75.8	0.0
S	3,241	34	85	3.9	79.1	79.1	80.1	1.0
T	3,315	47	77	4.3	79.9	79.9	80.4	0.5
U	3,654	15	37	8.9	89.2	89.2	89.8	0.6
V	4,158	16	38	8.7	102.3	102.3	102.3	0.0
W	4,194	20	135	2.4	107.8	107.8	108.8	1.0
X	4,226	32	150	2.2	107.8	107.8	108.8	1.0
Y	4,507	16	42	3.8	114.0	114.0	114.9	0.9

[1]Feet above confluence with Quinnipiac River

South Turnpike Road

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

NEW HAVEN COUNTY, CONNECTICUT

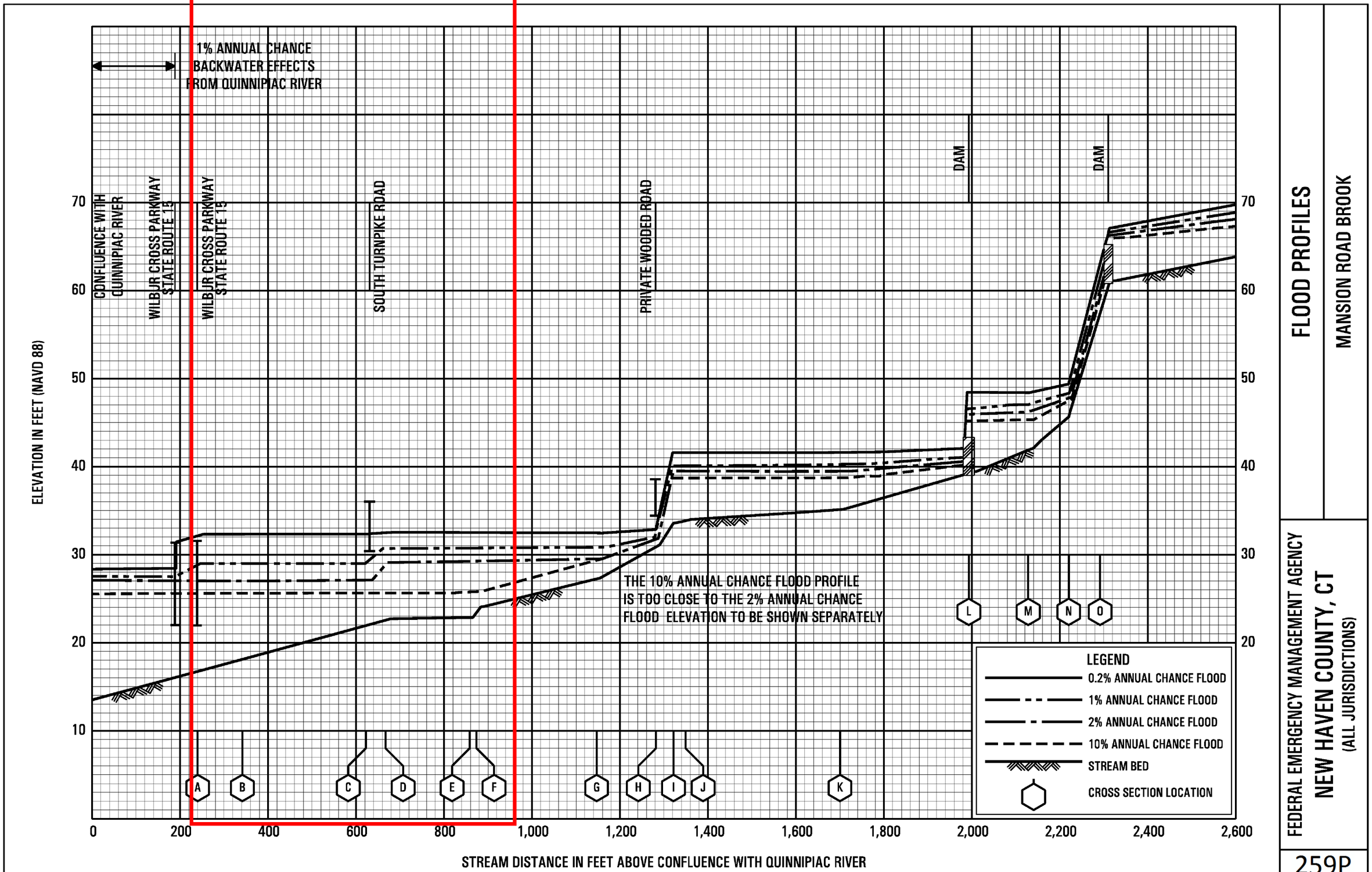
(ALL JURISDICTIONS)

FLOODWAY DATA

FLOODING SOURCE: MANSION ROAD BROOK

Table 28: Community Map History

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
City of Milford	10/18/1974	10/18/1974	08/02/1977	09/29/1978	08/15/1983 10/01/1983 07/02/1987 06/16/1992 11/06/1996 09/07/1999 12/17/2010 07/08/2013 05/16/2017
Borough of Naugatuck	06/28/1974	06/28/1974	02/18/1977	08/15/1979	12/17/2010
City of New Haven	06/07/1974	06/07/1974	09/10/1976	07/16/1980	05/02/1983 06/16/1992 12/17/2010 07/08/2013 05/16/2017
Town of North Branford	06/21/1974	06/21/1974	None	07/03/1978	12/17/2010 07/08/2013 05/16/2017
Town of North Haven	05/24/1974	05/24/1974	None	09/17/1980	05/01/1985 12/17/2010 07/08/2013 05/16/2017
Town of Orange	09/14/1973	09/14/1973	12/10/1976	03/18/1980	08/02/1995 12/17/2010 07/08/2013 05/16/2017
Town of Oxford	06/28/1974	06/28/1974	12/17/1976	12/04/1979	03/18/1991 12/17/2010
Town of Prospect	06/21/1974	06/21/1974	None	02/04/1977	05/16/1995 12/17/2010 05/16/2017
Town of Seymour	07/26/1974 01/07/1977	07/26/1974	None	07/03/1978	04/16/1991 12/17/2010 10/16/2013
Town of Southbury	02/08/1974	02/08/1974	10/17/1975	03/28/1980	12/11/1981 12/17/2010
Town of Wallingford	08/02/1974	08/02/1974	None	09/15/1978	06/04/1990 04/16/1991 09/07/2000 12/17/2010 05/16/2017
City of Waterbury	03/22/1974	03/22/1974	06/07/1977	11/01/1979	12/17/2010



FLOOD PROFILES

MANSION ROAD BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

NEW HAVEN COUNTY, CT

(ALL JURISDICTIONS)

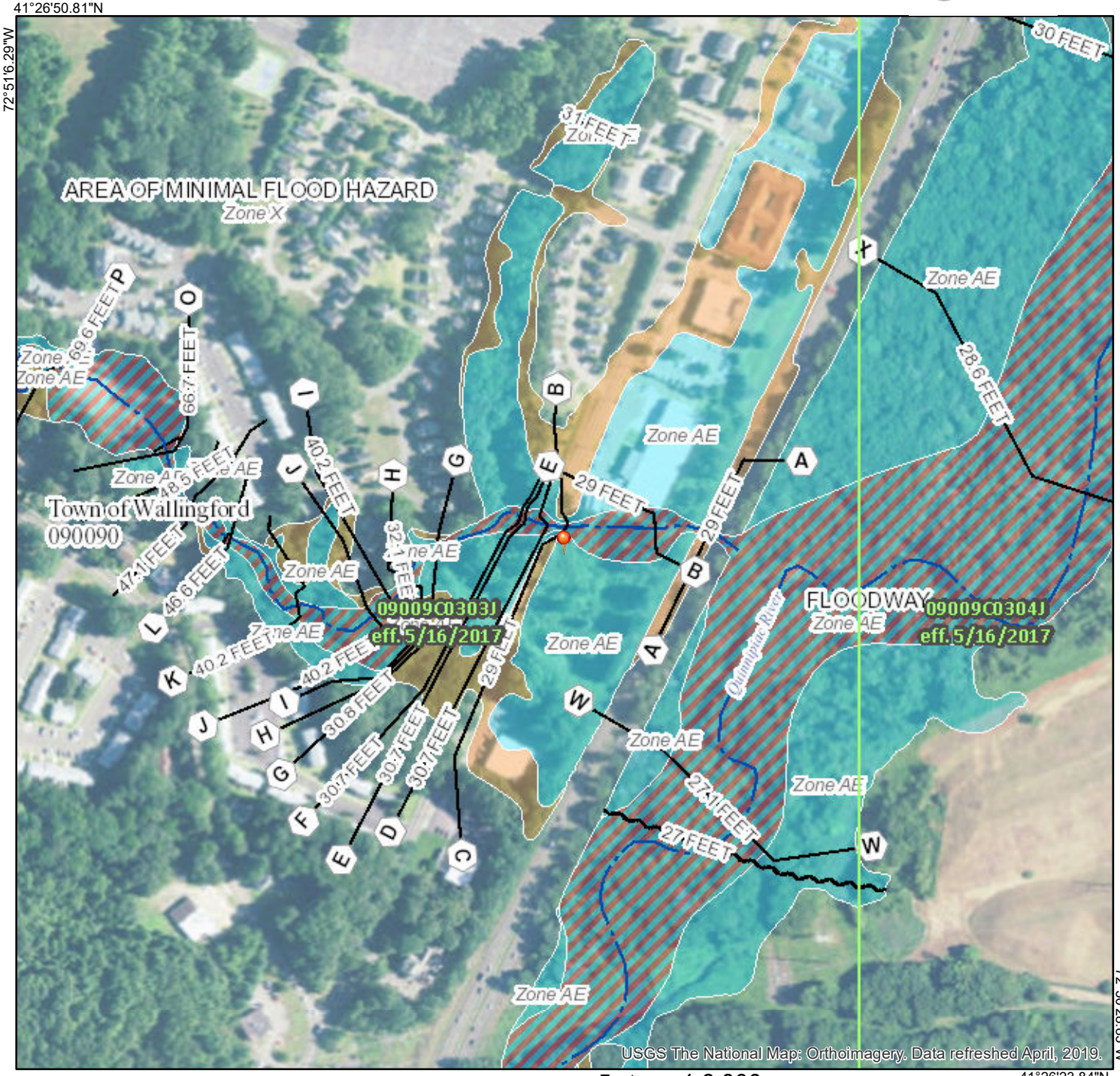
259P

National Flood Hazard Layer FIRMette

FEMA

41°26'50.81"N

72°51'6.29"W



72°50'28.83"W

41°26'23.84"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/12/2020 at 7:54:30 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.