HYDRAULIC REPORT

PROJECT ROUTE:	Interstate 55 (Stevenson Expressway)
SECTION:	n/a
LIMITS:	Station 618+00 to Station 630+00
WATERWAY CROSSING:	Flag Creek
MUNICIPALITY/COUNTY:	Indian Head Park/Cook County
JOB NUMBER:	P-91-762-10
EXISTING STRUCTURE NO.:	016-0003
PROPOSED STRUCTURE NO.:	n/a

Prepared for:

Illinois Department of Transportation
201 West Center Court
Schaumburg, Illinois 6019-1096
Job No. P-91-762-10

Prepared by:

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CBBEL Project No. 11-203.00001

FINAL
February 2017

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SECTION 1

NARRATIVE

SECTION 1

NARRATIVE

A. PROJECT DESCRIPTION

The Illinois Department of Transportation (IDOT) is currently preparing a Preliminary Engineering and Environmental Study (Phase 1) for the Interstate 55 (I-55) Managed Lanes Project. The project study area includes the I-55 corridor (Stevenson Expressway) from I-355 to I-90/94 at the east.

This project is proposed to add one managed lane in each direction within the existing median of the expressway. The term 'Managed Lanes' includes the implementation of travel lanes for High Occupancy Vehicle (HOV), High Occupancy Toll (HOT), Congestion Pricing, as well as other concepts to improve the overall flow of traffic. This project has been identified in the Chicago Metropolitan Area for Planning (CMAP) Go To 2040 Plan as a priority project.

This report requested by IDOT is to evaluate an existing bridge carrying I-55 over Flag Creek and Wolf Road, Structure Number 016-0003. The bridge is located in Indian Head Park, Cook County, Illinois. The subject 5-span steel bridge is located between South County Line Road and I-294. The total drainage area to the bridge is approximately 13.65 square miles. Refer to Exhibit 4.1 for the project location shown on the USGS Quadrangle Map.

B. DESCRIPTION OF EXISTING STRUCTURE AND FLOODPLAIN

SITE DESCRIPTION

The upstream limit of the study is located approximately 2675' northwest of the I-55 crossing. Flag Creek flows southerly through an open vegetated area in Indian Head Park in Cook County. The Creek crosses beneath the Joliet Road bridge, Structure Number 016-0393, located 1980 feet upstream of the I-55 crossing. Flag Creek then crosses under the 70th Place single-span bridge, Structure Number 016-1063, located 40 feet upstream of the I-55 bridge. Refer to Exhibit 4.1 for the general project location.

Downstream of I-55, Flag Creek jogs to the southeast. 270 feet downstream of the I-55 crossing, Flag Creek crosses under the 2-span bridge carrying Wolf Road, Structure Number 016-3016. After passing under Wolf Road, Flag Creek continues flowing southeast. Approximately 860 feet southeast of the I-55 crossing Flag Creek crosses under 72nd Street via double arch culverts. The study limits extend 1860 feet downstream of the I-55 culvert.

STRUCTURE DESCRIPTION

The existing bridge structure carrying I-55 (Stevenson Expressway) over Flag Creek and Wolf Road is located 5,350 feet northeast of County Line Road and 1,200 feet west of I-294. It was originally constructed as part of F.A.I. Route 55 Section 0202-602-HB, Project I-55-7(64)272, dated 1962. The bridge was reconstructed as part of FAI Route 55 Project NHI-55-7(187)275, dated 1995. Historic plan excerpts are provided in Section 8. The structure is noted as IDOT structure number 016-0003.

The structure is a five-span steel bridge crossing both Flag Creek and Wolf Road, which is parallel to the Creek in this area. It crosses with no skew relative to the expressway or the Creek. According to the survey the structure width is 143' out to out deck. The length is 276.5' face to face and the span lengths from west to east are 39.3' – 67.5' – 63.4' – 67.6' – 38.7'. There are concrete slopewalls at 2H:1V slope under the bridge as shown on the Bridge Cross Section Plots in Section 11.

Lin Engineering performed an inspection of the current conditions for the existing bridge in the fall of 2015. The report notes that the bridge is in overall good condition but may need rehabilitation for the substructure and expansion joints, and is suitable for reuse with minor repairs. This inspection report is to be found in the project report.

FLOODPLAIN DESCRIPTION

At the I-55 crossing, Flag Creek drains approximately 13.65 square miles of area that is comprised of a mix of residential and commercial properties. The Flag Creek channel is found to be between 75' and 125' in width and consists of a consistent cross section throughout the study limits. The channel consists of a silty bottom with trees and brush on the banks. The floodplain near the crossing includes the Wolf Road ROW, and beyond that is typically mowed grass that extends into industrial properties and residential yards.

There is a mapped Federal Emergency Management Agency (FEMA) floodplain and floodway for Flag Creek, extending upstream and downstream of the subject crossing. The Flag Creek floodplain is mapped as Zone AE by FEMA with defined base flood elevations. The Flood Insurance Rate Map (FIRM) Panel No. 17031C0469J for Cook County, Illinois and Incorporated Areas, effective August 19, 2008 is included in Section 4 as Exhibit 4.4

C. FIELD OBSERVATIONS

The Flag Creek field survey was performed by Lin Engineering in November 2012. CBBEL made a follow up site visit in November 2013. Upstream of the crossing under I-55, the overbank condition of the creek is mowed grass and the channel banks are lined with trees and brush. The streambed consists of exposed dirt, observed as clean and silty. Downstream of the

crossing, the creek consists of a clean, rocky channel also lined with trees and brush, with the overbank again as mowed grass. Approximately 950 feet downstream of the crossing, the floodplain turns into woods with no discernible limit for the edge of the floodplain. Photographs are included in Section 5.

D. HISTORICAL OBSERVATIONS/RECORDS

IDOT provided pavement flooding records that indicate flooding on the I-55 pavement at Wolf Road occurred on June 7, 1993. The pavement was listed as passable. There is no indication of the cause of the flooding, and based on gage data discussed below, Flag Creek is not believed to be the source of this flooding. Flooding records are provided in Section 20.

The 1964 Hydrologic Investigations Atlas HA-86 (Hinsdale), prepared by the United States Geological Survey (USGS) in cooperation with the Northeastern Illinois Metropolitan Area Planning Commission, is plotted on a 1953 USGS base map that predates the construction of I-55 and I-294. The portion of HA-86 showing the project area is provided as Exhibit 4.2, and the 1980 USGS Quadrangle map is provided as Exhibit 4.1. By comparing the two maps, the relocation of Flag Creek can be observed. Previously, Flag Creek flowed easterly through the existing twin box culvert structure under Wolf Road located north of I-55. Now, that Wolf Road culvert structure serves only to provide a local outlet toward relocated Flag Creek to the west.

The HA includes only the extreme storm events from October 1954, July 1957, and September 1961 with only the October 1954 and September 1961 floods mapped on the Flag Creek flood profile as shown on Exhibit 4.3. The flood profile in the vicinity of the I-55 crossing indicates a record storm level of approximately 636.0 NGVD 29 for the October 1954 event at the upstream Joliet Road (US Highway 66) crossing. The water surface elevation at the approximate location of I-55 is lower, at 634.0 NGVD 29 (= 633.7 NAVD 88). It is clear on the HA flood profile that between the 1954 and 1961 the channel location changed as compared to the roadways, with "End of channel improvement" noted downstream of Wolf Road on the 1961 profile.

This 1954 high water elevation of approximately 633.7 is well below the low beam elevation of the subject bridge (low beam = 646.33') and low pavement elevation in the floodplain of 646.34', all NAVD 88.

There are no current and functioning stream gages located in the project area. Stream gage USGS 05533000 FLAG CREEK NEAR WILLOW SPRINGS, IL is identified to be the only gage found on Flag Creek and is approximately 2 river miles downstream of the project vicinity. The drainage area at the gage is 16.5 square miles, whereas the drainage area at the project location is 13.65 square miles. The gage was established in 1949 and is currently active. The gage datum is 606.36 (NGVD29) and the peak gage height of 13.71 feet was recorded on September 14, 1961. The projected peak water surface elevation is therefore 606.36 + 13.71 = 620.07 and corresponds with a discharge of 2,680 cfs. Based on the USGS Gage Peak Streamflow Data

provided in Section 6, the June 7, 1993 flow in Flag Creek was only 791 cfs, which is well below the peak events of many other years.

E. OTHER STUDIES & AFFECTED AGENCIES

According to Federal Emergency Management Agency (FEMA) FIRM 17031C0469J for Cook County and Incorporated Areas, effective August 19, 2008, Flag Creek is mapped as Zone AE Special Flood Hazard Area (SFHA) with defined Base Flood Elevations at the proposed project site. The FIRM has been provided as Exhibit 4-3 in Section 4.

FEMA also retains a Flood Insurance Study, FIS 17031CV001G for Cook County and Incorporated Areas, revised August 19, 2008. Referring to the Cross Section Location Map in Section 9, five FIS cross sections were plotted off of the FIRM portraying their respective locations (cross sections A, H, I, J, and K).

In reviewing notes from Illinois State Water Survey (ISWS), it is believed that the effective regulatory model encompassing Cross Sections H-I is missing. A LOMR was completed and made effective that impacted the reach between cross sections H-I, unknown to what extent. Please refer to Section 20 for notes from the ISWS on this issue.

It should be noted that the WSP-2 model titled "MAIN STEM OF FLAGG CREEK" dated 22 Feb 80, matches the results of the published elevations for cross sections H and J. Regulatory cross section I does not correspond any cross section found in the WSP-2 model. The WSP-2 model does not include the 72nd Street, Wolf Road, I-55, or Joliet Road structures. It was found that that there are reach length issues with the WSP-2 model. The lengths found in the 1980 model do not match up with their published locations based on current stream alignment. For example, the total length from FIS cross section K (FC 039) to FIS cross section H (FC 033) in the WSP-2 is 1810', while per the FIRM, it is approximately 2860'. Therefore, the location of WSP-2 cross section Z cannot be accurately determined, as shown on the Google Earth exhibit at the end of Section 13.A. (The published locations are found in Section 4, and the modeled locations can be found in Section 13.A.) Since the flows and elevations found in the 1980 WSP-2 model match those of the published information at FIS cross section H, it is still utilized as the source of starting water surface elevations and flows.

In 2008 CBBEL submitted the 71st St. over Flag Creek Hydraulic Report to the Village of Burr Ridge, containing a full hydrologic and hydraulic analysis for the proposed 71st St. Bridge over Flag Creek. As part of this study CBBEL requested the current regulatory model from FEMA, and FEMA was unable to locate the regulatory model. 71st St. runs parallel to I-55 and is located approximately 75 ft. south (downstream) of the downstream face of the I-55 bridge over Flag Creek. It should be noted that the proposed 71st Street bridge has not been constructed as of the date of this report. The majority of the 2008 report provides redundant information that

has been updated as part of this current report, therefore the 2008 report has only been referenced and excerpts are not provided.

Another hydraulic report prepared by Hampton, Lenzini and Renwick Inc. (HLR) was completed in 2011 for the Joliet Road bridge over Flag Creek. This report performed detailed hydraulic analysis from just downstream of the 70th Place bridge to downstream of the I-294 crossing over Flag Creek, and was completed in NAVD 88. HLR's cross sections were inserted into the hydraulic analysis of I-55 over Flag Creek, in lieu of additional upstream survey. Since the proposed project has yet to be constructed, the HLR existing conditions were used. The HLR study appears to have utilized the FIS profiles near WSP-2 cross section X for their starting water surface elevations. The CBBEL model starts farther downstream, adding the missing bridges and correcting reach lengths. Once these corrections are included, the water surface profiles in the current CBBEL study are higher than those in the HLR report. See the 100-year comparison table at the beginning of Section 13 for the relative differences in base flood elevations.

F. DATUM CORRELATION

A stream survey was conducted by Lin Engineering with cross sections taken along Flag Creek. The Cross Section Location Map found in Section 9 shows the cross section locations and topography along the entire length of the hydraulic modeling. The North American Vertical Datum 1988 (NAVD 88) is the basis for the survey. Because the FEMA regulatory model used the National Geodetic Vertical Datum 1929 (NGVD 29), all cross sections transferred into the HEC-RAS model were converted to NAVD 88 by subtracting 0.28' from the given WSP-2 elevations. Supporting documentation from the NOAA VERTCON website is provided in Section 18. Since the 2011 HLR Study was done in NAVD 88 no additional conversion was needed.

G. SENSITIVE FLOOD RECEPTORS

Nine (9) potential flood receptors were identified upstream of I-55, as shown on the Cross Section Location Map in Section 9. The structure locations and low opening elevations taken from the 2011 HLR study are listed on Table G-1 below.

Sensitive Flood Receptor #	Low Opening Elevation
1	644.16
2	639.10
3 *	635.62
4	638.97
5 *	635.71
6	638.55
7 *	634.50

8	637.46
9 *	633.69

Table G-1 Sensitive Flood Receptors (*-indicates structure is located within the modeled floodplain)

Four of the subject potential flood receptors are located within the floodplain limits by elevation, as indicated by asterisks. The remaining five potential flood receptors are located just outside the floodplain limits.

H. HYDROLOGIC METHODOLOGY

This section summarizes the hydrologic methodology used to determine the peak flow rates for Flag Creek at the location of the I-55 crossing. The Flood Insurance Study (FIS) of Cook County, Illinois and Incorporated Areas, 17031CV001G and matching WSP-2 model were used to as the source of the peak flow rates for the 13.65 square mile watershed. The summary of these flow rates is found in Table H-1. The 1995 bridge reconstruction plans provided in Section 10 include a WIT showing flows that match the cross section 'X' flows listed below from the regulatory WSP-2 model, which is located at the downstream face of the I-55 bridge over Flag Creek. While the FIS model shows the change in flows downstream of I-55 bridge, the CBBEL model approach contains the change in flows upstream of the bridge. This approach is conservative and appropriate because of the tributary area entering Flag Creek just upstream of I-55 via the twin 10' (W) x 5' (H) box culvert structure under Wolf Road. The Stantec 2016 Existing Drainage Plan (EDP) sheet provided in Section 20.C shows the drainage flow paths in this area.

Location and Analysis Method	10-year Peak Flow (cfs)	50-year Peak Flow (cfs)	100-year Peak Flow (cfs)	500-year Peak Flow (cfs)
Flag Creek at Wolf Road, from FIS Summary of Discharges	1,260	2,000	2,400	3,350
Flag Creek discharge at cross section 'X', from Regulatory WSP-2	1,310	2,100	2,500	3,550

Table H-1 Peak Flow Summary

I. HYDRAULIC METHODOLOGY

Along with the issues discussed in Section E, the WSP-2 that corresponds to the FIS model does not include the existing subject structure over Flag Creek. Since there are multiple issues with the regulatory model, it is recommended that only one design WIT be prepared for this report.

The starting water surface elevations were taken from FIS cross section H (WSP-2 cross section FC 033). This FIS cross section is the included in the HEC-RAS model as the downstream cross section the model. The paper input and output of this WSP-2 is provided in Section 13.A.

Location and Analysis Method	10-year WSE (ft)	50-year WSE (ft)	100-year WSE (ft)	500-year WSE (ft)
FIS Cross Section "H", WSP-2 Cross Section FC033	628.52	629.02	629.42	630.22

Table I-1 Starting Water Surface Elevation Summary (NAVD 88)

Manning's n-values were obtained from the FIS cross sections. Manning's n-values for the additional Flag Creek cross sections were taken from the 2011 HLR report. These n-values were re-verified using field notes, aerial photography, and photographs. Base values for 'n' were adjusted using the FHWA methodology presented in Chapter 5 of the IDOT Drainage Manual, as follows:

$$n = (n_b + n_1 + n_2 + n_3 + n_4)*m.$$

Cobble Lined Channel

The cobble lined channel consists of a mixture of silt and light rocks, and has minor irregularities, alternates occasionally, minor obstructions, small vegetation, and minor meandering. Therefore,

$$n = (0.038 + 0.005+ 0.005 + 0.005 + 0.01)*(1) = 0.063$$

Heavy Vegetation

The floodplain with heavy vegetation consists of a mixture of silt and light rocks, and has minor irregularities, alternates occasionally, minor obstructions, large vegetation, and minor meandering. Therefore,

$$n = (0.038 + 0.005 + 0.0 + 0.005 + 0.032)*(1) = 0.080$$

Paved Surface

The floodplain that consists of a paved surface, no overgrowth, has no irregularity, negligible obstructions, and no vegetation. Therefore,

$$n = (0.013+ 0.00+ 0.000 + 0.000 + 0.000)*(1) = 0.013$$

Open Area with Dense Grass Cover

The floodplain with dense grass consists of a mixture of silt ground, and has minor irregularities, alternates occasionally, negligible obstructions, medium vegetation, and minor meandering. Therefore,

$$n = (0.025 + 0.0025 + 0.0 + 0.0025 + 0.02)*(1) = 0.050$$

Open Area with Light Grass Cover

The floodplain with dense grass consists of a mixture of silt ground, and has minor irregularities, alternates occasionally, negligible obstructions, small vegetation, and minor meandering. Therefore,

$$n = (0.018 + 0.001+ 0.0 + 0.001 + 0.01)*(1) = 0.030$$

Unpaved Commercial Property

The floodplain with unpaved surface, and has minor irregularities, alternates occasionally, appreciable obstructions, small vegetation, and minor meandering. Therefore,

$$n = (0.03 + 0.005+ 0.0 + 0.03 + 0.005)*(1) = 0.070$$

A comparison of the Manning's n-values at the FIS cross sections for each model is provided near the front of Section 13.

Contraction and expansion ratios and coefficients were determined in accordance with the IDOT Drainage Manual and HEC-RAS Hydraulic Reference Manual. Supporting documentation for the expansion ratio and ineffective area limits are provided at the front of Section 13.

J. SUMMARY OF FIS MODEL AND DUPLICATE MODEL

For comparison's sake, the WSP-2 with the starting water surface elevations and flows was input into HEC-RAS. With the known issues for this model, including missing LOMR data, missing structures, and reach length discrepancies as discussed in Section E above, it was anticipated to have issues duplicating the results of the WSP-2 model. The hardcopy of the FEMA WSP-2 model is provided in Section 13.A. The HEC-RAS plan titled FIS_29 is the exact duplicate of the WSP-2 model. This duplicate model's results did not match the FEMA results, and were greater than 1.0' higher than that of the paper WSP-2 model. To adjust for this discrepancy, a plan titled Mod FIS 29 was created, wherein the Manning's n-values were modified to account for the WSEL differences. By adjusting the Manning's n-values for the cross sections, the model was calibrated to match the WSP-2 water surface elevations within 0.20' for the majority of cross sections and storms. These models were prepared for comparison purposes only. The input/output and a summary table of differences are provided in Section 13.B, for the modified version only.

The Design Existing model results are higher than the published FIS results due to the addition of the 72nd Street, Wolf Road, I-55, and Joliet Road structures and the correction of the reach lengths. Summary tables comparing the results of the WSP-2 vs. the HEC-RAS converted vs. the HEC-RAS modified vs. the HEC-RAS existing conditions (including surveyed cross sections) are provided at the beginning of Section 13. Considering that the Existing model results in higher flood profiles, and corrects the issues with the regulatory model cited above, the use of the Existing model for design and future permitting is justified.

K. SUMMARY OF EXISTING CONDITIONS HYDRAULIC ANALYSIS

A new HEC-RAS plan, titled Existing, was created to represent exiting conditions at the I-55 crossing over Flag Creek. The existing conditions hydraulic analysis consists of surveyed cross sections, along with additional cross sections taken from the 2011 HLR Joliet Road over Flag Creek Hydraulic Report and FIS cross sections whose location can be verified. All existing structures within the study limits, both upstream and downstream, are included in the existing conditions model.

Proper ineffective areas were added into this existing plan based on contraction/expansion cones from each structure. Due to the close proximity between structures, many of these contraction/expansion cones intersect and overlap with each other. Also due to the variations in ineffective elevations and creek geometry, there are transitions in the effective areas for cross sections. In XS 10 and 11 on the east (left) side, the Wolf Road roadside ditch drains to the north. This ditch begins near the Wolf Road intersection with 71st Street/Ramp at approximate elevation 632 and flows north, in the opposite direction of Flag Creek flow. Therefore, the flow area in the ditch below elevation 632 is conservatively considered as ineffective. Also, the low area associated with the unnamed tributary entering Flag Creek upstream of I-55 from the east, and the effects of the Creek curvature are reflected by a tighter contraction cone than the standard 1:1 ratio on the left. In addition, the contraction/expansion cones for both 70th Place and I-55 apply at separate elevations.

The Cross Section Location Map can be found in Section 9 and presents the location of all cross sections, existing culverts, and existing bridges used in the model. The high water elevation for the Waterway Information Table (WIT) was obtained from the existing conditions plan in the HEC-RAS hydraulic model. The WIT and supporting calculations are provided in Section 2. Input/output for this existing plan are provided in Section 13.C.

The original 1963 Project I-55-7(62)272 plans show a proposed 48” RCP culvert crossing under I-55 at Station 1144+25. This culvert was not found by the surveyors, nor during Stantec field visits. Drainage for the area is provided by the existing twin box culverts under Wolf Road to the west as shown on the EDP in Section 20.C. The 72” x 44” CMPA culvert located under Ramp D

located south of I-55 is buried and proposed to be cleaned. The CMPA culvert is in a backwater area and provides no conveyance of Flagg Creek overflow downstream of I-55.

L. SUMMARY OF NATURAL CONDITIONS HYDRAULIC ANALYSIS

A HEC-RAS plan, titled Natural, was created to reflect the natural profile of the stream. The geometry information for the bridge carrying I-55 was removed. Because Flag Creek was relocated to its current position in the original design of I-55, the highway embankment was left in place as the 'natural' condition for the creek. The contraction and expansion coefficients and ineffective areas were verified and the natural water surface elevations determined for the Waterway Information Table. Input/output for this natural plan are provided in Section 13.D.

M. PROPOSED STRUCTURE ANALYSIS

There are no proposed improvements to the existing bridge as part of this project. Minor repair including rehabilitation of the substructure and expansion joints may be performed, which will not impact the hydraulics of the existing structure. See the Technical Memorandum in Section 20 for details of the bridge inspection and recommended repairs.

N. SCOUR ANALYSIS

Scour analysis for the existing bridge is included in Section 14. As shown on the historic plans provided in Section 10, both abutments are protected by concrete-lined spillthrough slopewalls. In addition, the east bank of the channel is also protected by a concrete slopewall. Therefore, the abutments are not subject to scour.

Contraction and pier scour calculations have been performed using spreadsheets incorporating the formulas from the current 2012 5th Edition of HEC-18. Only Pier 3 is within the channel. The eastern piers, Piers 1 and 2, are in the overbank and partially protected from channel scour by the channel slopewall and adjacent roadway pavements. However, in accordance with conservative design per the IDOT Drainage Manual, the scour depths for all piers are based on channel flows and velocities. The western pier, Pier 4, is embedded within the concrete slopewall and not subject to scour. Scour results are shown below in Table N-1.

	East (Left) Abutment	Pier 1	Pier 2	Pier 3	Pier 4	West (Right) Abutment
100 Year	-	5.13	5.13	5.13	-	-
500 Year	-	6.89	6.89	6.89	-	-

Note: Pier Scour includes contraction scour at each pier (0.83' for the 100-year event and 2.14' for the 500-year event). Pier 4 is embedded in concrete slopewall.

Table N-1 Scour Depth Summary

The calculations show that the total scour depth for the major storm events is shallow; and the concrete slopewalls minimize the potential for scour. Scour calculations and input values from HEC-RAS are provided in Section 14.

O. COMPENSATORY STORAGE

Section 1-302.03 of the IDOT Drainage Manual states that compensatory storage "facilities shall be provided whenever fill in the floodway is proposed and the hydraulic analysis indicates that there is a significant change in flood stage and/or velocity that will cause or contribute to flood damage." There is no work proposed below the 100-year elevation that would require compensatory storage. No compensatory storage is required.

P. IDNR-OWR FLOODWAY CONSTRUCTION PERMIT REQUIREMENTS

Flag Creek has regulatory floodway. Based on the current scope of the project there are no proposed modifications to the existing structure nor is there any proposed work below the 100-year floodplain other than minor repairs. Under the Part 3708 Rules, Section 3708.30 b), repair or maintenance of structures in existence as of November 18, 1987 are specifically exempt from requiring a permit. Based on the proposed scope of the project no permit is required.

Q. FREEBOARD/CLEARANCE

The IDOT Drainage Manual dated July 2011 states that a flood frequency of 50 year should be used for design purposes. The existing crossing was analyzed for the 50 year storm event, and checked for the 10 year, 100 year, and 500 year storm events. The Design Headwater Elevation (HWE) is based on the 50-year event and is shown on the Waterway Information Table located in Section 2.

Freeboard is calculated as the distance from the Existing Design HWE to the lowest edge of pavement of the roadway within the floodplain. The IDOT freeboard policy requires a minimum

freeboard distance of 3 feet for the 50-year storm event. The existing structure provides 11.84 feet of freeboard for the 50-year event, meeting the IDOT freeboard requirement.

Clearance is calculated as the distance from the Natural Design HWE to the low beam elevation within the floodplain. The IDOT clearance policy requires that the minimum clearance must be 2 feet for the 50-year storm event, and also the all-time WSE must be at or below the low beam elevation of the bridge. The existing structure provides 12.51 feet of clearance between the Natural Design HWE and the low beam elevation. The all-time WSE at the bridge is approximately 634.0 NGVD 29 (633.7 NAVD 88) recorded in October 1954, approximately 12.63 feet below the low beam elevation. Both of these findings demonstrate that the existing bridge meets the IDOT requirements for clearance.

R. CONCLUSION

The Hydraulic analysis has determined that the existing I-55 five-span bridge over Flag Creek meets IDOT Drainage Manual criteria for freeboard and clearance. There are no proposed modifications to this structure, other than minor repair or rehabilitation. No floodway construction permit and no compensatory storage volume are required for this project.

Tab 2

SECTION 2

WATERWAY INFORMATION TABLE AND SUPPORTING CALCULATIONS

Illinois Department of Transportation

DESIGN Bridge Waterway Information Table

Route: Interstate 55 (Stevenson Expressway)
Waterway: Flag Creek
Section:
County: Cook

Existing SN: 016-0003
Proposed SN: -
Prepared by: EMB Date: 9/28/2016
Checked by: IAD Date: 9/28/2016

Existing Overtopping Elev. = 647.39 at Sta. 3077+00 (NB BL)

Drainage Area = 13.65 square miles

Proposed Overtopping Elev. = N/A at Sta. N/A

Flood Event	Freq. Yr.	Discharge ft^3/s	Waterway Opening - ft^2		Natural H.W.E. - ft	Head - ft		Headwater Elevation – ft	
			Existing	Proposed		Existing	Proposed	Existing	Proposed
	10	1310	624	N/A	631.6	0.6	N/A	632.2	N/A
Design	50	2100	989	N/A	633.8	0.7	N/A	634.5	N/A
Base	100	2500	1122	N/A	634.5	0.8	N/A	635.3	N/A
Scour Design Check	500 year used as design Check			N/A	-	-	N/A	-	N/A
Overtop Existing	>500	-	-	N/A	-	-	N/A	-	N/A
Overtop Proposed	>500	-	-	N/A	-	-	N/A	-	N/A
Max. Calc.	500	3550	1367	N/A	635.6	0.8	N/A	636.4	N/A

Datum: NAVD 88

All-Time H.W.E. & Date: 633.7 ft. October 1954 (NAVD 88)
Surveyed Normal Water Level: 624.11 ft. 11-30-2012

10-Year Velocity through Existing Structure = 2 ft/s
10-Year Velocity through Proposed Structure = - ft/s
2-Yr. Flow Rate = 292 ft^3/s

EXISTING STRUCTURE

Type: 5- Span Steel Bridge
Length/Width: Width= 143' Length=276.5' Face to Face
Spans/Cells: 5 @ 39.3’ - 67.5’ – 63.4’ – 67.6 – 38.7’
Low Chord: 646.33 @ 5073+61 (SB BL)
Skew: 0 (relative to road)
Clearance: 12.51’
Bridge Flow Line: 621.8’ (u/s) 623.3’ (d/s)
Low E.O.P: 646.34 @ 5079+00 (SB BL)
Freeboard: 11.84’
Culvert Inverts: - (u/s) - (d/s)

PROPOSED STRUCTURE

Type: There are no proposed modifications to the
Length Of Span: existing structure.
Spans: -
Low Chord: -
Skew: - (relative to road)
Clearance: -
Bridge Flow Line: - (u/s) (d/s)
Low E.O.P: -
Freeboard: -

NOTE: THERE ARE NO PROPOSED MODFICATIONS TO THE EXISTING STRUCTURE.

BACK-UP CALCULATIONS FOR WIT

Route: **I-55** Computed: EMB Date: 9/28/2016

Waterway: **Flag Creek** Checked: IAD Date: 9/28/2016

Calculate Created Head

Frequency	Natural H.W.E. (ft)[1]		Greatest Created Head (ft)[2] Upstream of Culvert	Existing Headwater Elevation (ft)[2] @ Upstream Face
	U/S Face of Structure	Approach Sect. (5' U/S)	From Summary Tables Comparing Natural WSE to Existing WSE	
10-year	631.6	631.6	0.6	632.2
50-year	633.8	633.8	0.7	634.5
100-year	634.5	634.5	0.8	635.3
500-year	635.6	635.6	0.8	636.4

(1) The natural highwater elevation is the water surface elevation at the upstream side of the crossing as modeled in the stream natural condition, without the structure.

(2) The created head is calculated at the cross section upstream of the bridge/culvert which has the greatest difference between the natural and proposed conditions. This difference in elevation is then added to the Natural H.W.E. at the U/S face of the structure. This method of calcuating created head is only required for bridges and some major culvert crossings. Also, the preferred created head should never be negative. headwater elevations = The natural highwater elevation + the created head

CALCULATE FREEBOARD AND CLEARANCE

Low Road Elevation (ft)[3]			
Existing	Station	Proposed	Station
646.34	5079+00 (SB BL)	N/A	N/A
Low Beam Elevation (ft)			
Existing	Station	Proposed	Station
646.33	5073+61 (SB BL)	n/a	n/a
Existing Freeboard (ft)			
10-year	50-year[4]	100-year	500-year
14.15	11.84	11.00	9.93
Natural Clearance (ft)			
10-year	50-year[5]	100-year	500-year
14.75	12.51	11.79	10.74

(3) Low road elevation is calculated at the edge of pavement, and on the low side of the roadway.

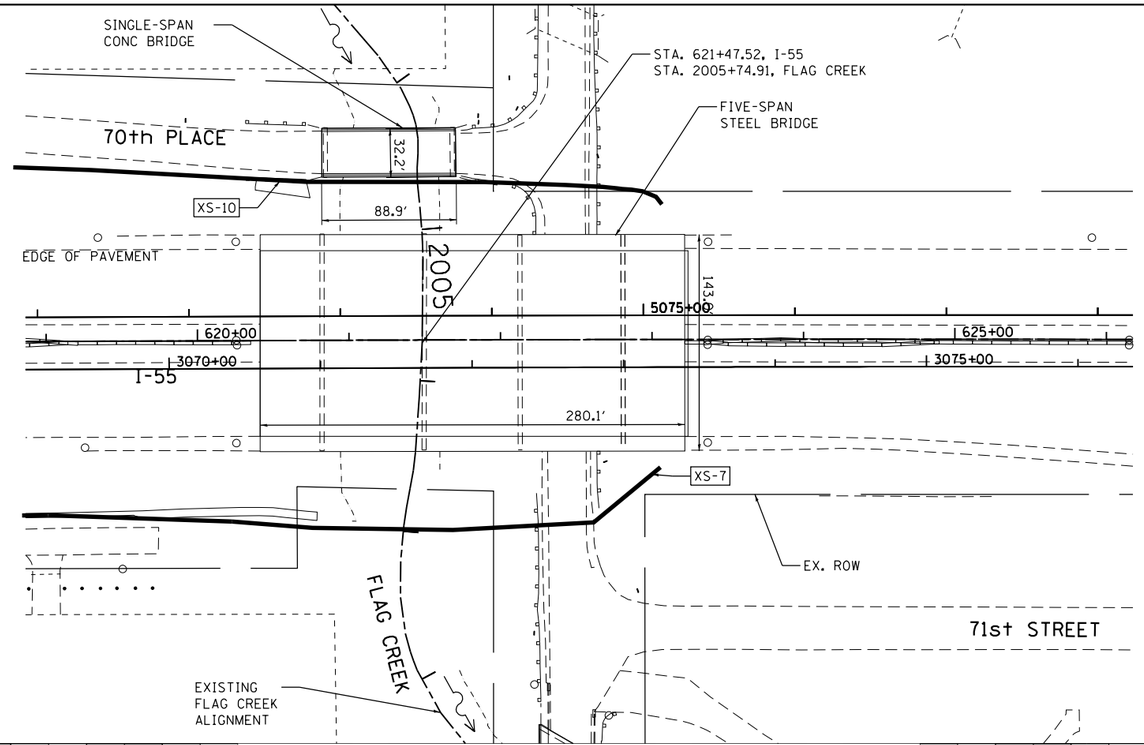
(4) Freeboard is calculated from the 50-year design headwater elevation to the proposed low road elevation in the floodplain.

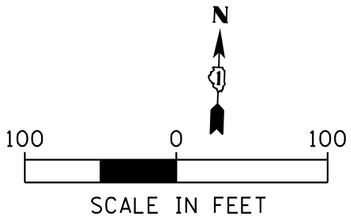
(5) Vertical clearance is calculated from the 50-year natural high-water elevation to the proposed low chord (beam) bridge elevation (2 ft minimum requirement)

CALCULATE EFFECTIVE WATERWAY OPENING AREA

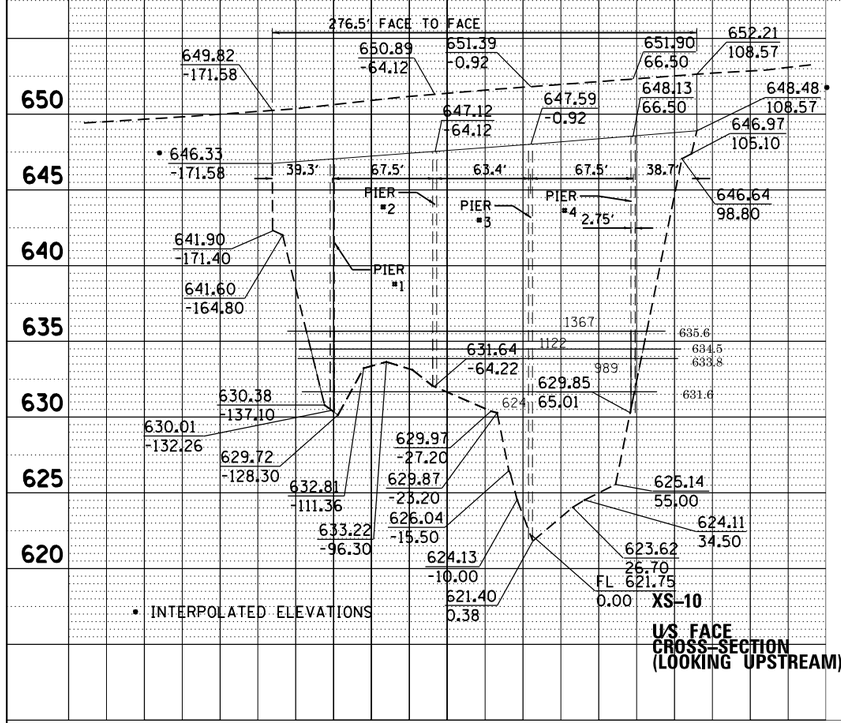
Structure Length (ft)	
Existing	Proposed
282.4	N/A

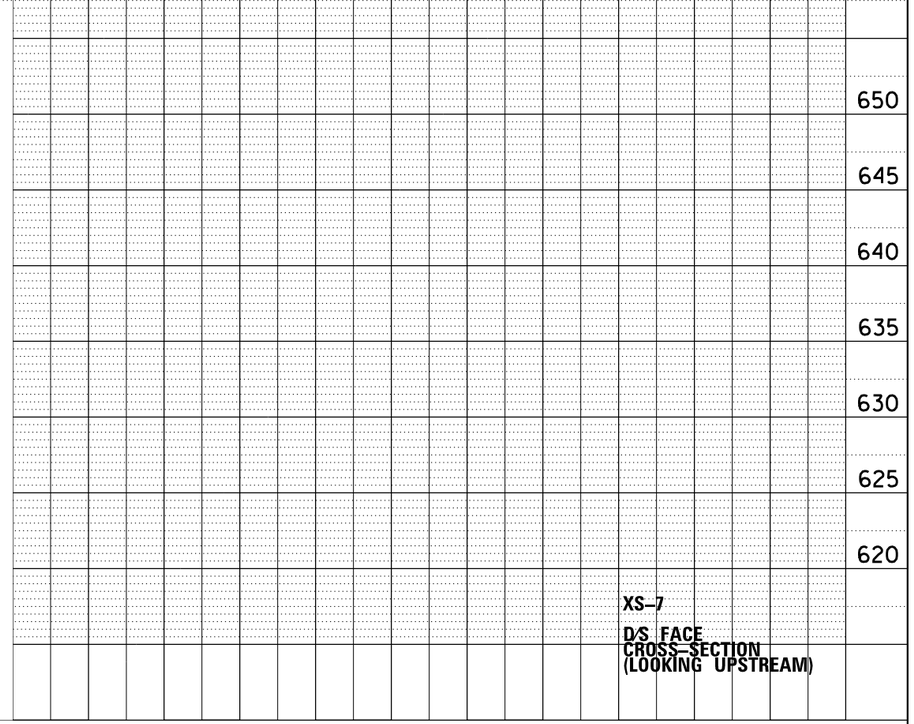
Waterway Opening Area (ft^2)		
Frequency	Existing	Proposed
10-year	624.00	N/A
50-year	988.97	N/A
100-year	1155.25	N/A
500-year	1366.80	N/A





NOTE:
WATER SURFACE ELEVATION AS SURVEYED
BY CBBEL DATED: 11-12-12 AND 11-30-12





PLAN: SURVEYED — DATE; PLOTTED — BY; ALIGNMENT CHECKED; R/T. OF WAY CHECKED; CADD FILE NAME; NOTE BOOK; NO.

PROFILE: SURVEYED; PLOTTED; GRADES CHECKED; B.M. NOTED; STRUCTURE NOTATIONS CHKD; NOTE BOOK; NO.

FILE NAME = N:\Idot\110203.00001\Drain\P1110203-FLOW_AREA.dgn	USER NAME = eburke	DESIGNED - EB	REVISED -
		DRAWN - MYG	REVISED -
Default	PLOT SCALE = 100.0000 ' / in.	CHECKED - IAD	REVISED -
	PLOT DATE = 9/27/2016	DATE - 9/27/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

FLOW AREAS FOR
I-55 OVER FLAG CREEK

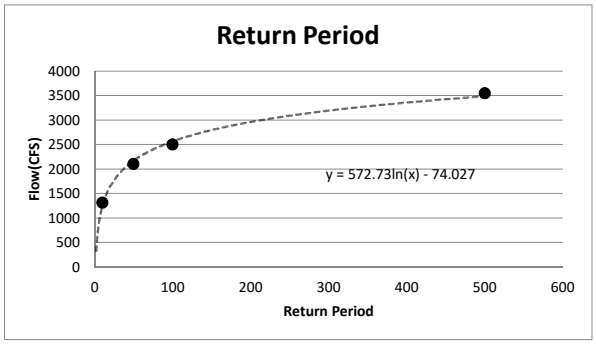
SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

Regression Equation - Solve for Q for 2 Year event
I-55 over Flagg Creek

Input Data	
Return Period	Actual Q
10	1310
50	2100
100	2500
500	3550

Calculated Data		
Return Period	Actual Q	Calculated Q
2	-	291.77
10	1310	1141.12
50	2100	1990.46
100	2500	2356.26
500	3550	3205.61



BACK-UP CALCULATIONS FOR WIT

Route: **I-55**

Waterway: **Flag Creek**

SUMMARY TABLE COMPARING 10-YEAR NATURAL WSE TO EXISTING WSE			
Cross Section	Natural Condition WSE	Existing Condition WSE	WSE Difference
4240	632.72	633.13	0.41
3755	632.58	633.02	0.44
3380	632.5	632.95	0.45
3327	632.46	632.91	0.45
3288	632.46	632.91	0.45
3245	BRIDGE		
3206	632.4	632.87	0.47
3148	632.39	632.85	0.46
3081	632.38	632.84	0.46
2765	632.25	632.74	0.49
2542	632.19	632.69	0.50
12.1	632	632.54	0.54
12	631.98	632.53	0.55
11	631.83	632.41	0.58
10.5	BRIDGE		
10	631.63	632.23	0.60
9.5	631.6	632.21	0.61
9	631.58	632.19	0.61
8.5	BRIDGE		
8	631.52	631.53	0.01
7	631.46	631.46	0
6	631.27	631.27	0
5.5	BRIDGE		
5	630.97	630.97	0
4	630.41	630.41	0
3.5	BRIDGE		
3	630.05	630.05	0
2	629.58	629.58	0
1	629.06	629.06	0
0.5	628.52	628.52	0

BACK-UP CALCULATIONS FOR WIT

Route: **I-55**

Waterway: **Flag Creek**

SUMMARY TABLE COMPARING 50-YEAR NATURAL WSE TO EXISTING WSE			
Cross Section	Natural Condition WSE	Existing Condition WSE	WSE Difference
4240	634.79	635.22	0.43
3755	634.73	635.19	0.46
3380	634.62	635.1	0.48
3327	634.56	635.04	0.48
3288	634.55	635.03	0.48
3245	BRIDGE		
3206	634.49	634.98	0.49
3148	634.47	634.97	0.50
3081	634.46	634.96	0.50
2765	634.37	634.9	0.53
2542	634.28	634.81	0.53
12.1	634.07	634.65	0.58
12	634.07	634.65	0.58
11	633.95	634.57	0.62
10.5	BRIDGE		
10	633.87	634.54	0.67
9.5	633.83	634.5	0.67
9	633.82	634.5	0.68
8.5	BRIDGE		
8	633.78	633.78	0
7	633.72	633.72	0
6	633.56	633.56	0
5.5	BRIDGE		
5	632.67	632.67	0
4	631.93	631.93	0
3.5	BRIDGE		
3	631.18	631.18	0
2	630.45	630.45	0
1	629.7	629.7	0
0.5	629.02	629.02	0

BACK-UP CALCULATIONS FOR WIT

Route: **I-55**

Waterway: **Flag Creek**

SUMMARY TABLE COMPARING 100-YEAR NATURAL WSE TO EXISTING WSE			
Cross Section	Natural Condition WSE	Existing Condition WSE	WSE Difference
4240	635.51	636.05	0.54
3755	635.48	636.05	0.57
3380	635.36	635.96	0.60
3327	635.28	635.88	0.60
3288	635.27	635.87	0.60
3245	BRIDGE		
3206	635.2	635.75	0.55
3148	635.18	635.73	0.55
3081	635.16	635.72	0.56
2765	635.1	635.7	0.60
2542	634.98	635.69	0.71
12.1	634.75	635.51	0.76
12	634.75	635.51	0.76
11	634.65	635.45	0.80
10.5	BRIDGE		
10	634.6	635.27	0.67
9.5	634.55	635.22	0.67
9	634.54	635.22	0.68
8.5	BRIDGE		
8	634.5	634.5	0
7	634.44	634.44	0
6	634.34	634.34	0
5.5	BRIDGE		
5	633.45	633.45	0
4	632.69	632.69	0
3.5	BRIDGE		
3	631.67	631.67	0
2	630.84	630.84	0
1	630.04	630.04	0
0.5	629.42	629.42	0

BACK-UP CALCULATIONS FOR WIT

Route: **I-55**

Waterway: **Flag Creek**

SUMMARY TABLE COMPARING 500-YEAR NATURAL WSE TO EXISTING WSE			
Cross Section	Natural Condition WSE	Existing Condition WSE	WSE Difference
4240	636.7	637.3	0.60
3755	636.72	637.33	0.61
3380	636.58	637.22	0.64
3327	636.43	637.08	0.65
3288	636.42	637.08	0.66
3245	BRIDGE		
3206	636.17	636.8	0.63
3148	636.14	636.78	0.64
3081	636.13	636.77	0.64
2765	636.11	636.79	0.68
2542	636.09	636.77	0.68
12.1	635.79	636.57	0.78
12	635.79	636.56	0.77
11	635.69	636.51	0.82
10.5	BRIDGE		
10	635.67	636.33	0.66
9.5	635.59	636.28	0.69
9	635.59	636.27	0.68
8.5	BRIDGE		
8	635.54	635.54	0
7	635.47	635.47	0
6	635.39	635.39	0
5.5	BRIDGE		
5	634.94	634.94	0
4	634.03	634.03	0
3.5	BRIDGE		
3	632.68	632.68	0
2	631.72	631.72	0
1	630.8	630.8	0
0.5	630.22	630.22	0

Tab 3

SECTION 3

HYDRAULIC REPORT DATA SHEETS

Illinois Department of Transportation

Hydraulic Report Data Sheets

Route	Interstate 55	P or D #	P-91-762-10
Section	Flag Creek	PTB #	158-002
County	Cook		
Exist SN	016-0003		
Prop SN	n/a		

General Information

1. Name of the Stream: Flag Creek

2. Location of the Structure: SE ¼ of the SE ¼ of Section 19 Township 38N Range 12E of the 3rd P.M.

3. Hydraulic Report Prepared By: ☒ Consultant Christopher B. Burke Engineering, Ltd.
   ☐ District

4. Hydraulic Report Approval Authority: ☒ District – Post PDF of HR to BBS Hydraulics SharePoint Server
   ☐ BBS Hydraulics - Submit 2 hard copies of HR to BBS Hydraulics

Site Design Data

5. Drainage Area (sq. mi.): 13.65 sq. mi.

6. Highway Classification:
   ☐ Rural ☒ Principal Arterial
   ☒ Urban ☐ Minor Arterial
   ☐ Other ☐ Collector
   ☐ Local

7. Design Frequency: ☐ 30 yr ☒ 50 Yr. ☐ Other

8. Number of Waterway Information Tables (WIT): 1
   If more than one, explain:

Hydrologic & Hydraulic Analysis

9. Hydrology Modeling (check all that apply): ☐ USGS/Stream Stats ☒ FIS ☐ Gage Data
   ☐ Other

10. Hydraulic Modeling (check all that apply):
    a. Method: ☒ HEC-RAS ☐ WSPRO ☐ Other
    b. Manning's "n" values determined as per IDOT DM CH.5? ☒ Yes ☐ No
       If no, explain:
    c. Source of Starting WSE: FIS
    d. Non- IDOT encroachments in Survey? ☒ Yes ☐ No
       If yes, are they accounted for? ☒ Yes ☐ No
    e. Does the Tailwater Control? ☐ Yes ☒ No
       If yes, list:

f. Were the Expansion/Contraction cones properly addressed? ☒ Yes ☐ No ☐ N/A
If No or N/A, explain:

g. What Expansion and Contraction Rates were used? Expansion: 2(X:1)
Contraction 1(X:1)

IDNR – OWR Floodway Permit

11. Is area experiencing urbanization or expected to urbanize within 10 years? ☒ Yes ☐ No

12. Are there any sensitive flood receptors located upstream within possible backwater influence? ☒ Yes ☐ No
If yes, list and describe critical upstream flood damageable properties and their elevations.
There are 9 total. See XSC location map for their locations. 1-644.16, 2-639.1, 3-635.62, 4-638.97, 5-635.71, 6-638.55, 7-634.5' 8-637.46' 9-633.69

13. Is there any History of Flooding or Overtopping problems? ☐ Yes ☒ No
Sources of Observed Highwater:
Hydrologic Atlas Hinsdale Quadrangle, HA-86. Elev. 634.0 NGVD 29 = 633.7 NAVD 88.

14. Is the structure hydraulically connected to or within the floodway of an IDNR-OWR designated Public Body of Water? ☐ Yes ☒ No

15. Required IDNR - OWR Permit type:
☐ Individual ☐ SWP #2 ☐ SWP #12 ☐ Floodway
☒ None ☐ Other

Proposed Structure Data

16. Project Scope (check all that apply):
a. ☐ Complete Replacement
b. ☐ Superstructure Replacement
c: ☐ Superstructure Widening; Length of Pier Extension in the water:
U/S D/S
d. ☒ Bridge (Existing Bridge to remain as is.) ☐ Culvert
e. ☐ New Alignment
f. Work Planned Below Q_{100} HWE? ☐ Yes ☐ No
g. ☐ Profile Raise

17. If a bridge is proposed, supply:
Flow line elevation (ft):
Preliminary low beam elevation (ft):
Width of deck (ft):
Total length from face to face of abutment (ft)
Abutment type:
Skew (degrees):
Number of spans:

18. If a culvert is proposed, supply:
Type and size: N/A
Upstream invert elevation (ft): N/A
Downstream invert elevation (ft): N/A
Length (ft): N/A
Entrance type: N/A
Skew (degrees): N/A

19. If a three-sided structure is proposed, supply:
Flow line elevation (ft): N/A
Skew (degrees): N/A

Span (ft): N/A Length (ft): N/A
Height (ft): N/A Number of spans: N/A

20. a. Is the IDOT Clearance Policy Met? ☒ Yes ☐ No ☐ NA Value (ft): 12.51
b. Is the IDOT Freeboard Policy Met? ☒ Yes ☐ No ☐ NA Value (ft): 11.84

21. Type of streambed soil : ☐ Clay ☒ Silt ☐ Sand ☐ Loam ☐ _____

22. Scour/ Migration Problems: None
Comments:

Ice Concerns: None
Comments:

Debris Concerns: None
Comments:

Countermeasures Proposed:

Existing Structure Data

		Joliet Rd Structure U/S	70th PL Structure U/S	I-55 Subject Structure	Wolf Rd Structure D/S	72nd St Structure D/S
23.	Distance from proposed structure: (ft.)	1518	35	0	268	1005
24.	Type of structure:	2-Span concrete bridge	1-Span Concrete Bridge	5-Span Steel Bridge	2-Span Concrete Bridge	Double Arch Culvert
25.	Low beam elevation:	635.52	627.98	646.33	629.03	632.91
26.	Flow line elevation:	621.30	619.25	621.75	621.94	622.5
27.	Maximum known high water elevation:	635.7	633.9	633.7	633.1	632.7
28.	Date of maximum high water:	Oct, 1954	Oct, 1954	Oct, 1954	Oct, 1954	Oct, 1954
29.	Cause (backwater, headwater, etc.):	Unknown	Unknown	Unknown	Unknown	Unknown
30.	Does structure carry entire design flood flow?	Yes	No	Yes	Yes	Yes
	If not, state area of additional waterway opening: (ft^2)	N/A	390	N/A	N/A	N/A
31.	Type and size of existing overflow structures:	N/A	Roadway Overtoppin	N/A	N/A	N/A
32.	Has adverse scour occurred under or adjacent to the structure?	No	No	No	No	No
33.	Classify type of scour and/or aggradation / degradation:	N/A	N/A	N/A	N/A	N/A

Required Additional Data

34. Deviations from the General Procedures presented in IDOT DM CH. 2, CH.6, and CH.7:

No.

35. Information regarding high water from other streams, reservoirs, flood control projects, proposed channel changes, or other controls affecting proposed waterway area:

N/A

36. Site Inspection made by: Christopher B. Burke Engineering, Ltd. Date: November 2013

Remarks:
Inspected by Edmund Burke.

37. Prepared by: Edmund M. Burke Date September 2016

Signed (QA/QC): Irene A Dailey Date 09/28/16

Hydraulic Report Checklist

The District or Consultant should complete the following checklist before submitting the Hydraulic Report for approval.

1. ☒ Title Page
2. ☒ Table of Contents
3. ☒ Narrative - (as outlined in Section 2-601.01 Item #3)
4. ☒ Waterway Information Table (WIT) - (as outlined in Section 2-601.01 Item #4)
5. ☒ Hydraulic Report Data Sheets
6. ☒ Location Map - should show the subject structure along with nearby location defining landmarks (cities, roads, highways, etc.)
7. ☒ USGS Hydraulic Investigation Map (District 1 only)
8. ☒ Photographs - (Minimum: U/S & D/S Structure Faces, Up & Down Channel, Up & Down Roadway Across Structure)
9. ☐ Hydrology (map and calculations)
10. ☒ Streambed Profile
11. ☒ Roadway Profile (existing and proposed)
12. ☒ Cross Section Plots - with plan layout preferably overlayed upon an aerial photo with the contours
13. ☒ Bridge Opening Plots
14. ☒ Natural Condition Analysis
15. ☒ Existing Condition Analysis
16. ☐ Proposed Condition Analysis

When HEC-RAS modeling is being used, ALL Plans (Natural, Existing, & Proposed) shall be included in ONE Project File.

17. ☒ Scour Analysis – Existing and Proposed Conditions
18. ☐ Compensatory Storage Calculations (if required)
19. ☒ Survey Notes (if available, No Electronic Point Files)
20. ☒ Correspondence Notes
21. ☒ CD with Project Files (Include pdf copy of the Hydraulic Report)

Tab 4

SECTION 4

LOCATION MAP/USGS HYDROLOGIC INVESTIGATIONS ATLAS /REGULATORY FLOOD MAPS

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

JOLIET ROAD
70th PLACE
FLAG CREEK CROSSING AT I-55 STA. 621+75
WOLF ROAD
72nd STREET

CLIENT:
ILLINOIS DEPARTMENT OF TRANSPORTATION

TITLE:
GENERAL LOCATION DRAINAGE MAP
FLAG CREEK
HINSDALE QUADRANGLE
BASE MAP (USGS) 1980

PROJ. NO. 110203.00001
DATE: 5/8/2013
SHEET 1 OF 1
DRAWING NO.
EXH 4.1

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600 · Rosemont, Illinois 60018 · (847) 823-0500

DSGN.			SCALE:	1:0
DWN.			AUTHOR:	MDH
CHKD.			PLOT DATE:	4/18/2014
FILE:	Flag GLDM			

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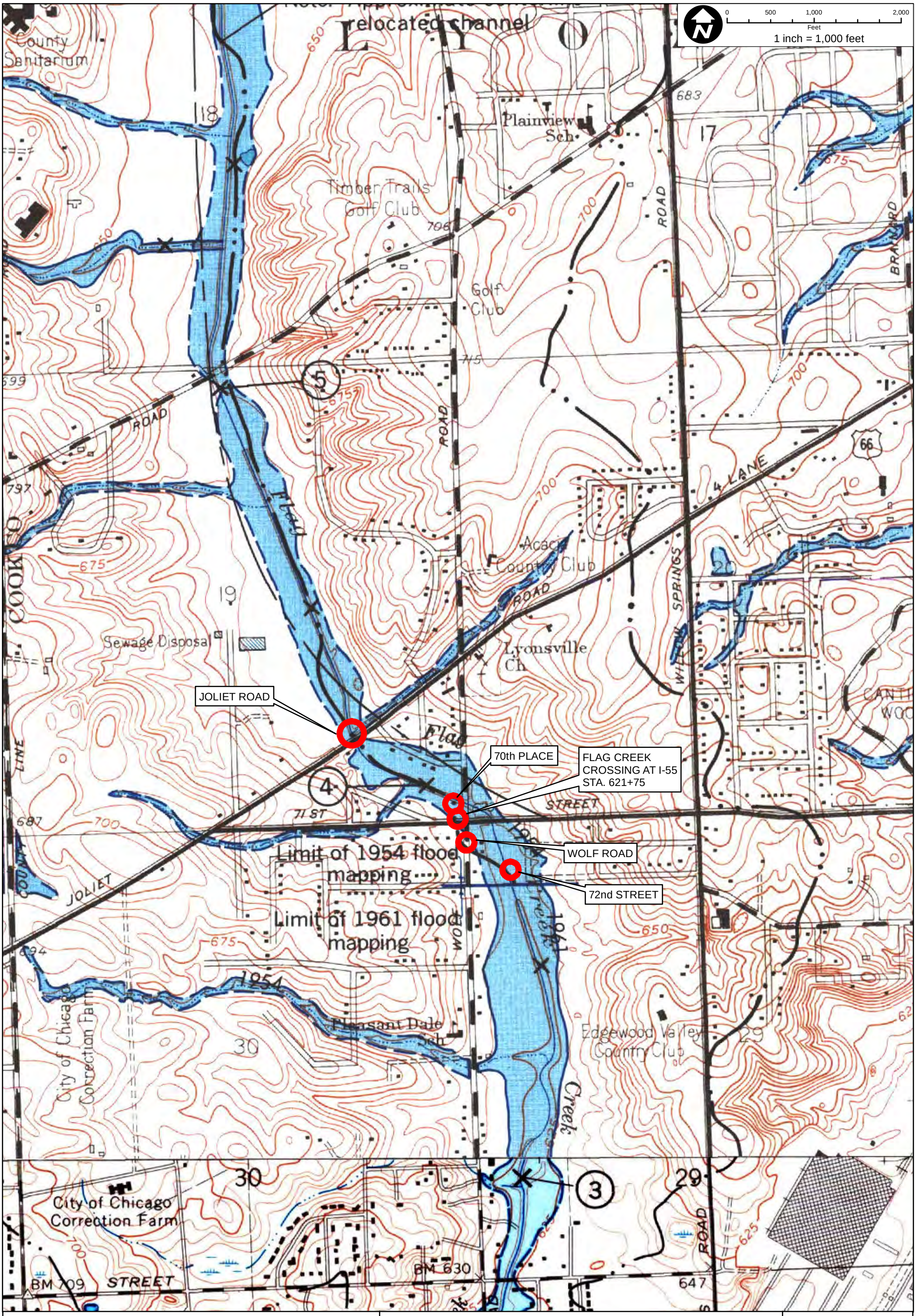

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CLIENT:

ILLINOIS DEPARTMENT OF TRANSPORTATION

TITLE:

USGS HYDROLOGIC INVESTIGATIONS ATLAS
FLOODS IN HINSDALE QUADRANGLE
HA-86 1964
FLAG CREEK

PROJ. NO.	110203.00001
DATE:	5/8/2013
SHEET	1 OF 1
DRAWING NO.	EXH 4.2

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600 · Rosemont, Illinois 60018 · (847) 823-0500

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CHKD.			PLOT DATE:	2/19/2016
FILE:	Flag HADM			

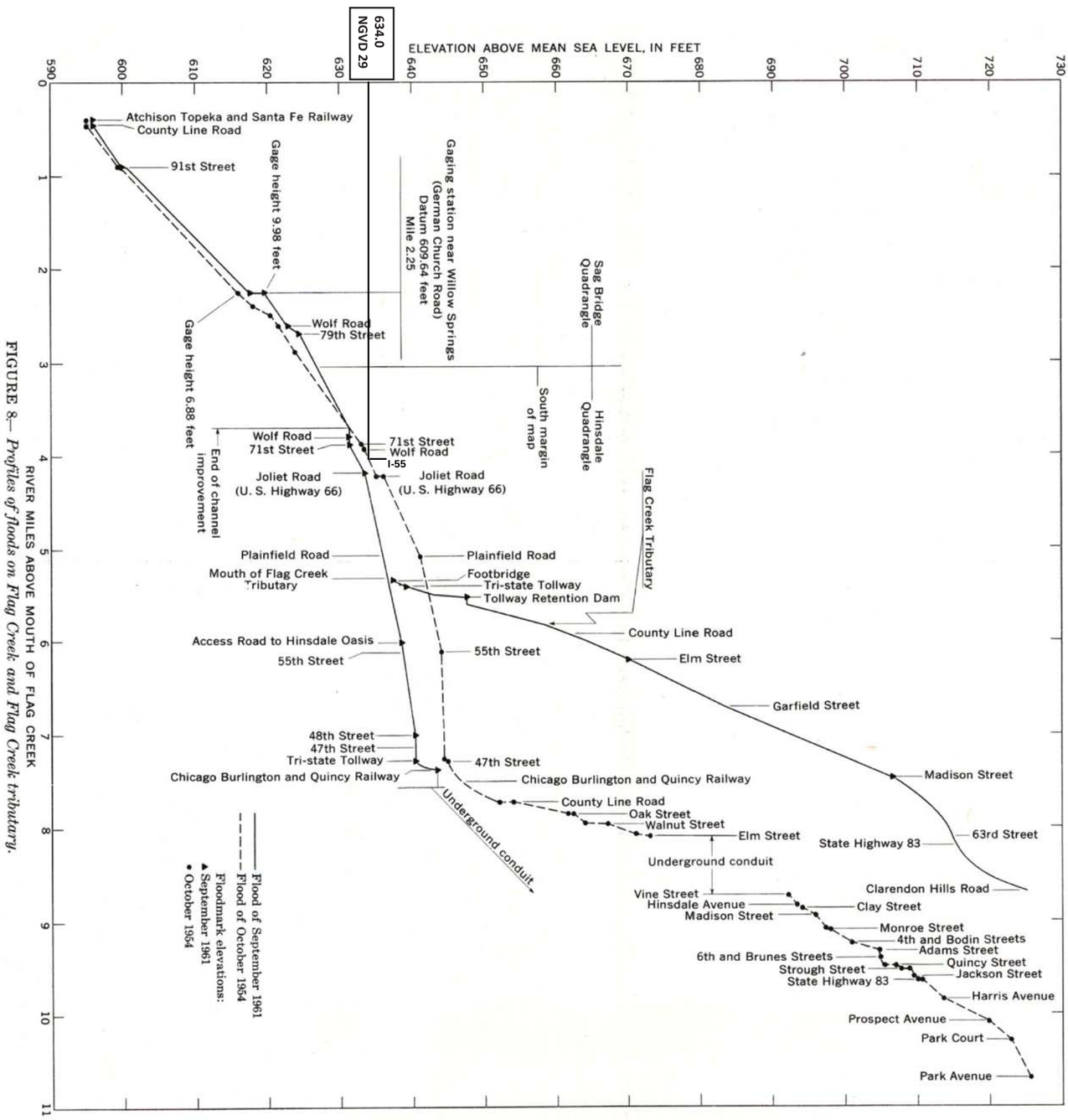

FIGURE 8.— *Profiles of floods on Flag Creek and Flag Creek tributary.*

CLIENT:
ILLINOIS DEPARTMENT OF TRANSPORTATION

TITLE:
USGS HYDROLOGIC INVESTIGATIONS ATLAS
PROFILE OF FLOODS ON FLAG CREEK
HA-86
FLAG CREEK

PROJ. NO.	110203.00001
DATE:	5/8/2013
SHEET	1 OF 1
DRAWING NO.	EXH 4.3

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600 · Rosemont, Illinois 60018 · (847) 823-0500

DSGN.			SCALE:	1:12,000
DWN.			AUTHOR:	MDH
CHKD.			PLOT DATE:	4/18/2014
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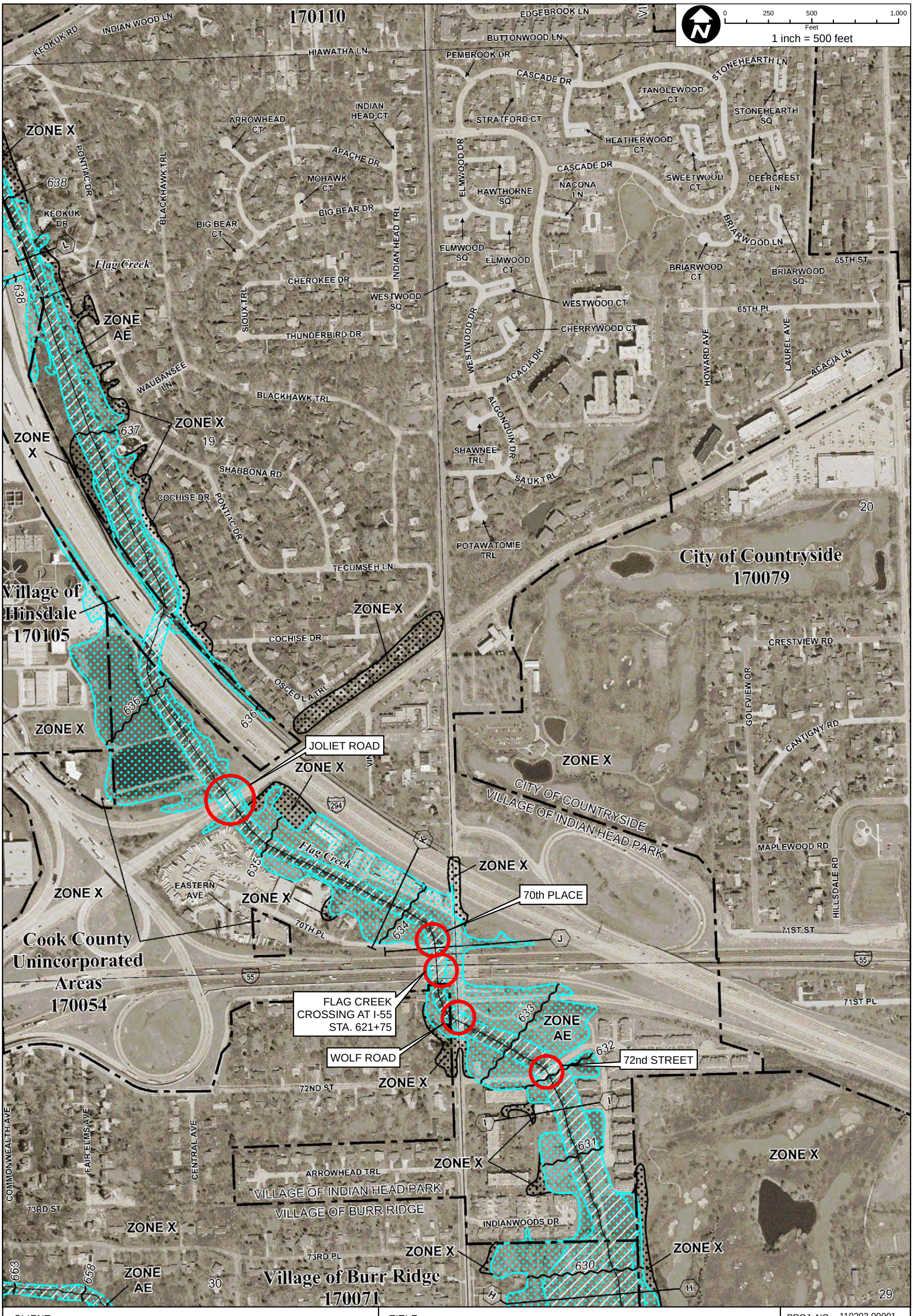

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CLIENT:

ILLINOIS DEPARTMENT OF TRANSPORTATION

TITLE:

FLOOD INSURANCE RATE MAP
FLAG CREEK
COOK COUNTY AND INCORPORATED AREAS
PANELS 0469, BASE MAP (FEMA), 2008

PROJ. NO.	110203.00001
DATE:	5/8/2013
SHEET	1 OF 1
DRAWING NO.	EXH 4.4

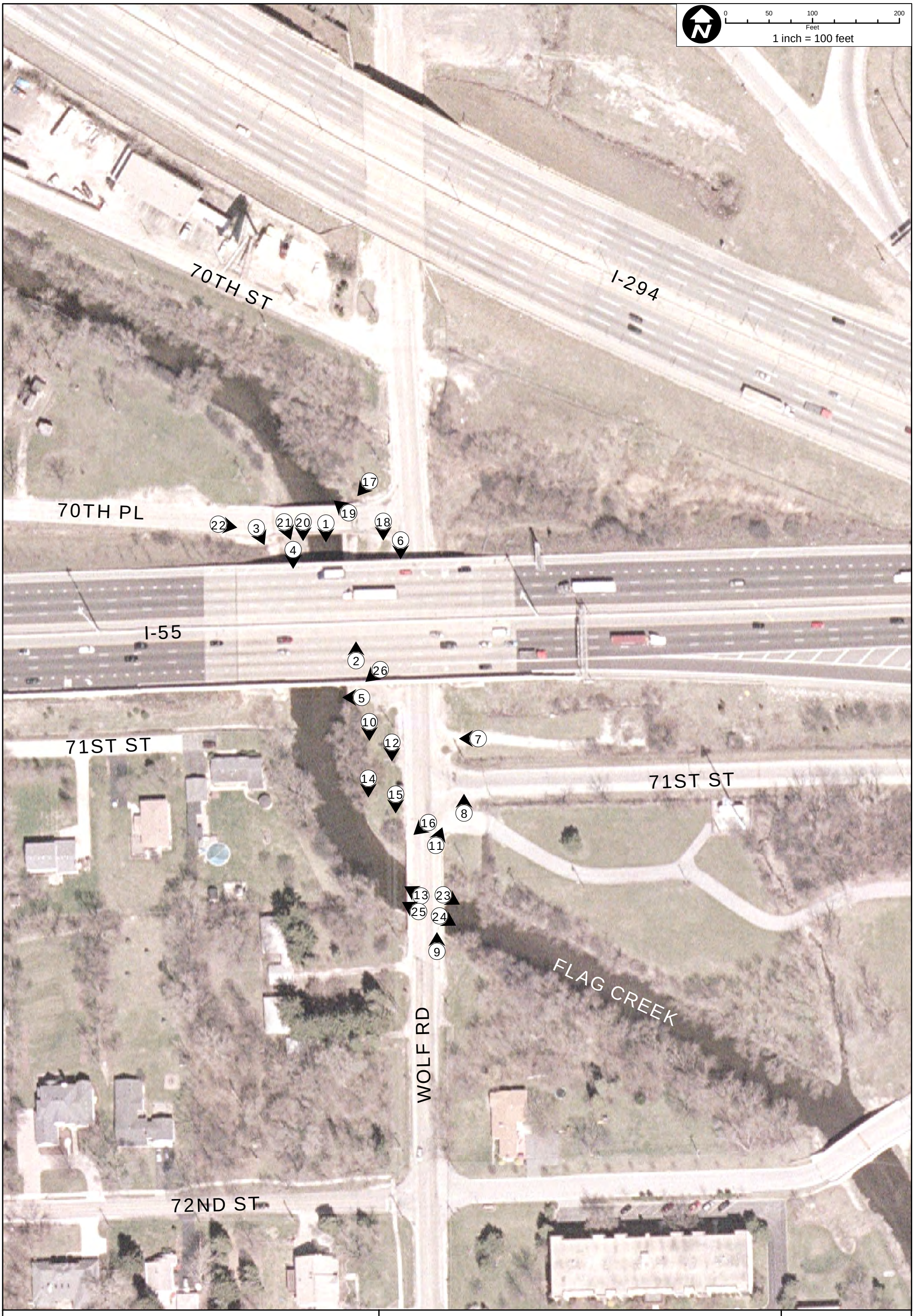
CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600 · Rosemont, Illinois 60018 · (847) 823-0500

DSGN.			SCALE:	1:6,000
DWN.			AUTHOR:	MDH
CHKD.			PLOT DATE:	4/18/2014
FILE:	Flag FIRM			

Tab 5

SECTION 5

PHOTOGRAPHS



CLIENT:

ILLINOIS DEPARTMENT OF TRANSPORTATION

TITLE:

PHOTOGRAPH LOCATION MAP FLAG CREEK

PROJ. NO.	110203.00001
DATE:	5/8/2013
SHEET	1 OF 1
DRAWING NO.	EXH 5

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600 · Rosemont, Illinois 60018 · (847) 823-0500

DSGN.			SCALE:	1:0
DWN.			AUTHOR:	MDH
CHKD.			PLOT DATE:	1/17/2014
FILE:	Flag PHOTO			

Path: N:\ldot\110203.00001\GIS\Exhibits\Flag Creek\Flag PHOTO.mxd

Refer to Photograph Location Map for locations of Photos

1. 70th Place Bridge looking South at I-55 Bridge over Flag Creek

2. East concrete slopewall under I-55 Bridge, looking North

Refer to Photograph Location Map for locations of Photos

3. 70th Place Bridge looking South-Southeast at I-55 Bridge over Flag Creek

4. Flag Creek under I-55, looking South, main channel

Refer to Photograph Location Map for locations of Photos

5. West embankment/floodplain of Flag Creek just South of I-55

6. Wolf Road looking South under I-55 Bridge

Refer to Photograph Location Map for locations of Photos

7. Access road looking West at Wolf Road and I-55 Bridge

8. Intersection of Wolf Road and 71st Street, looking North at I-55 Bridge

Refer to Photograph Location Map for locations of Photos

9. Wolf Road Bridge over Flag Creek, looking North

10. Wolf Road looking South at 71st Street intersection

Refer to Photograph Location Map for locations of Photos

11. 71st Street and access road, looking North-Northeast

12. Wolf Road looking South at 71st Street intersection and Wolf Road Bridge over Flag Creek

Refer to Photograph Location Map for locations of Photos

13. Flag Creek looing upstream, northwest from Wolf Road Bridge

14. Flag Creek eastern floodplain South of I-55 Bridge

Refer to Photograph Location Map for locations of Photos

15. Wolf Road looking South at bridge over Flag Creek

16. Wolf Road Bridge over Flag Creek

Refer to Photograph Location Map for locations of Photos

17. Debris pileup under 70th Place Bridge, looking South downstream

18. Looking South downstream at concrete slopewall under I-55 Bridge

Refer to Photograph Location Map for locations of Photos

19. Flag Creek looking upstream, northeast from 70th Place Bridge

20. Looking South under I-55 Bridge from 70th Place Bridge

Refer to Photograph Location Map for locations of Photos

21. Flag Creek looking South downstream under I-55 Bridge in low-flow condition

22. Paved ditch outlet to Flag Creek along South side of 70th Place looking east.

Refer to Photograph Location Map for locations of Photos

23. Flag Creek looking downstream, southeast from Wolf Road Bridge

24. Flag Creek floodplain just East of Wolf Road Bridge

Refer to Photograph Location Map for locations of Photos

25. Flag Creek Looking northwest upstream from Wolf Road Bridge.

26. Flag Creek looking downstream, southeast, from under I-55 Bridge.

Tab 6

SECTION 6

HYDROLOGY

FLOOD INSURANCE STUDY

COOK COUNTY, ILLINOIS
AND INCORPORATED AREAS

Volume 1 of 5

COMMUNITY NAME	COMMUNITY NUMBER
ALSIP, VILLAGE OF	170055
ARLINGTON HEIGHTS, VILLAGE OF	170056
BARRINGTON, VILLAGE OF	170057
BARRINGTON HILLS, VILLAGE OF	170058
BARTLETT, VILLAGE OF	170059
BEDFORD PARK, VILLAGE OF	171007
BELLWOOD, VILLAGE OF	170061
BENSENVILLE, VILLAGE OF	170200
* BERKELEY, VILLAGE OF	171039
* BERWYN, CITY OF	171036
BLUE ISLAND, CITY OF	170064
BRIDGEVIEW, VILLAGE OF	170065
BROADVIEW, VILLAGE OF	170067
BROOKFIELD, VILLAGE OF	170066
BUFFALO GROVE, VILLAGE OF	170068
* BURBANK, CITY OF	170069
BURNHAM, VILLAGE OF	170070
BURR RIDGE, VILLAGE OF	170071
CALUMET CITY, CITY OF	170072
CALUMET PARK, VILLAGE OF	170073
CHICAGO CITY OF	170074
CHICAGO HEIGHTS, VILLAGE OF	170075
CHICAGO RIDGE, VILLAGE OF	170076
* CICERO, TOWN OF	170077
COOK COUNTY (UNINCORPORATED AREAS)	170054
COUNTRY CLUB HILLS, CITY OF	170078
COUNTRYSIDE, CITY OF	170079
CRESTWOOD, VILLAGE OF	170080
* DEER PARK, VILLAGE OF	171028
DEERFIELD, VILLAGE OF	170361
DES PLAINES, CITY OF	170081
DIXMOOR, VILLAGE OF	170082
DOLTON, VILLAGE OF	170083
* EAST DUNDEE, VILLAGE OF	170323
EAST HAZEL CREST, VILLAGE OF	170085
ELGIN, CITY OF	170087
ELK GROVE VILLAGE, VILLAGE OF	170088
* ELMHURST, CITY OF	170205
ELMWOOD PARK, VILLAGE OF	170089
EVANSTON, CITY OF	170090
* EVERGREEN PARK, VILLAGE OF	170733
FLOSSMOOR, VILLAGE OF	170091
FORD HEIGHTS, VILLAGE OF	170084
FOREST PARK, VILLAGE OF	170092
FOREST VIEW, VILLAGE OF	170093
* FRANKFORT, VILLAGE OF	170701
FRANKLIN PARK, VILLAGE OF	170094
GLENCOE, VILLAGE OF	170095
GLENVIEW, VILLAGE OF	170096
GLENWOOD, VILLAGE OF	170097
GOLF, VILLAGE OF	170098
HANOVER PARK, VILLAGE OF	170099
HARVEY, CITY OF	170100
* HARWOOD HEIGHTS, VILLAGE OF	170101
HAZEL CREST, VILLAGE OF	170102
HICKORY HILLS, CITY OF	170103
HILLSIDE, VILLAGE OF	170104
HINSDALE, VILLAGE OF	170105
HODGKINS, VILLAGE OF	170106
HOFFMAN ESTATES, VILLAGE OF	170107
* HOMETOWN, CITY OF	171040
HOMEWOOD, VILLAGE OF	170109
INDIAN HEAD PARK, VILLAGE OF	170110
INVERNESS, VILLAGE OF	170111
JUSTICE, VILLAGE OF	170112
KENILWORTH, VILLAGE OF	170113
LA GRANGE, VILLAGE OF	170114
LA GRANGE PARK, VILLAGE OF	170115
LANSING, VILLAGE OF	170116
LEMONT, VILLAGE OF	170117
LINCOLNWOOD, VILLAGE OF	171001
LYNWOOD, VILLAGE OF	170119
LYONS, VILLAGE OF	170120
MARKHAM, CITY OF	175169
MATTESON, VILLAGE OF	170123
MAYWOOD, VILLAGE OF	170124
MCCOOK, VILLAGE OF	170121
MELROSE PARK, VILLAGE OF	170125
MERRIONETTE PARK, VILLAGE OF	170126
MIDLOTHIAN, VILLAGE OF	170127
MORTON GROVE, VILLAGE OF	170128
MOUNT PROSPECT, VILLAGE OF	170129
NILES, VILLAGE OF	170130
* NORRIDGE, VILLAGE OF	170131
NORTH RIVERSIDE, VILLAGE OF	170135
NORTHBROOK, VILLAG EOF	170132
NORTHFIELD, VILLAGE OF	170133
NORTHLAKE, CITY OF	170134
* OAKBROOK, VILLAGE OF	170214
OAK FOREST, CITY OF	170136
OAK LAWN, VILLAGE OF	170137
* OAK PARK, VILLAGE OF	171037
OLYMPIA FIELDS, VILLAGE OF	170139
ORLAND HILLS, VILLAGE OF	170172
ORLAND PARK, VILLAGE OF	170140
PALATINE, VILLAGE OF	175170
PALOS HEIGHTS, CITY OF	170142
PALOS HILLS, CITY OF	170143
PALOS PARK, VILLAGE OF	170144
PARK FOREST, VILLAGE OF	170145
PARK RIDGE, CITY OF	170146
* PHOENIX, CITY OF	170147
POSEN, VILLAGE OF	170148
PROSPECT HEIGHTS, CITY OF	170919
RICHTON PARK, VILLAGE OF	170149
RIVER FOREST, VILLAGE OF	170151
RIVER GROVE, VILLAGE OF	170152
RIVERDALE, VILLAGE OF	170150
RIVERSIDE VILLAGE OF	170153
ROBBINS, VILLAGE OF	170154
ROLLING MEADOWS, CITY OF	170155
* ROSELLE, VILLAGE OF	170216
ROSEMONT, VILLAGE OF	170156
SAUK VILLAGE, VILLAGE OF	170157
SCHAUMBURG, VILLAGE OF	170158
SCHILLER PARK, VILLAGE OF	170159
SKOKIE, VILLAGE OF	171000
SOUTH BARRINGTON, VILLAGE OF	170161
SOUTH CHICAGO HEIGHTS, VILLAGE OF	170162
SOUTH HOLLAND, VILLAGE OF	170163
STEGER, VILLAGE OF	170713
STICKNEY, VILLAGE OF	170164
STONE PARK, VILLAGE OF	170165
STREAMWOOD, VILLAGE OF	170166
SUMMIT, VILLAGE OF	170167
THORNTON, VILLAGE OF	170168
TINLEY PARK, VILLAGE OF	170169
UNIVERSITY PARK, VILLAGE OF	170708
WESTCHESTER, VILLAGE OF	170170
WESTERN SPRINGS, VILLAGE OF	170171
WHEELING, VILLAGE OF	170173
WILLOW SPRINGS, VILLAGE OF	170174
WILMETTE, VILLAGE OF	170175
WINNETKA, VILLAGE OF	170176
WORTH, VILLAGE OF	170177

* NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED WITHIN COOK COUNTY

REVISED: AUGUST 19, 2008

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
17031CV001G

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the Community Map Repository. It is advisable to contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the Community Map Repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: November 6, 2000

Revised FIS Report Dates: December 20, 2002
February 4, 2004
June 2, 2005
November 16, 2006
April 16, 2007
August 19, 2008

occurred in 1986 and 2004, with crests at 11.95 feet and 11.76 feet, respectively (Reference 134).

Flooding along the West Branch, DuPage River in Hanover Park is frequent and severe. Rapid urbanization in the drainage areas since 1960 has led to increasing stormwater runoff, while at the same time, development in the floodplain in the north portion of the village has obstructed overbank flows during floods, raising water-surface elevations in the vicinity and generally worsening the damage conditions. A major storm in October 1954 caused record flooding in the Chicago area, but Hanover Park was sparsely developed at that time. Other significant floods occurred on June 10, 1967, and on September 6, 1970, when an estimated 2.7 inches of rain fell in the drainage areas. Peak discharges at the crest stage gage at Lake Street on the river reached 570 cfs in 1967 and 450 cfs in 1970. Damages in Hanover Park resulting from the 1970 flood were estimated at $470,000. In addition to flooding due to major storms, more frequent flooding occurs due to high waters in the river blocking storm sewer outlets and causing basement flooding (Reference 135). Data obtained from the recording gage located on the river near North Avenue in the village of Bartlett indicated that the June 1967 flood had a 1-percent-annual-chance recurrence interval (Reference 136).

The Little Calumet River in Calumet City, Illinois, has had severe flooding in June 1981, December 1982, November 1990, and July 1996. The highest flood of record occurred in November 1990 when the river reached a stage between 20 and 21 feet. This flood was below the 1-percent-annual-chance recurrence interval.

The most severe historic floods on Flag Creek near Indian Head Park, and their approximate recurrence intervals (annual chance of exceedence) can be documented from USGS gage records for Flag Creek at the Willow Springs gage downstream of Indian Head Park. This gage (No. 05533000, drainage area 16.5 square miles) was established in 1949. Table 9, "Historical Flood Data (Flag Creek)" summarizes peak discharges and river stages for Flag Creek at Willow Springs (Reference 132).

Table 9 - Historical Flood Data (Flag Creek)

Flag Creek at Willow Springs, Illinois - USGS Gage Number 05533000

Datum of gage is 606.08 ft above NAVD 88

Flood Stage: N/A

Date	Peak Streamflow (cfs)	River Stage (feet)
September 14, 1961	2,680	13.71
July 18, 1996	2300	10.37
June 13, 1976	2230	10.22
July 2, 1983	1960	9.86
May 9, 1990	1910	9.87

N/A = Data not available

Table 14 - Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
East Pond and West Pond					
Approximately 500 feet north of 179th street	0.3	*	*	82	*
Elk Grove Boulevard Drainage Ditch					
At the mouth	1.7	125	200	233	325
Just downstream of Elk Grove Boulevard	1.5	104	164	194	295
Approximately 100 feet downstream of Ridge Avenue	1.3	80	125	148	205
Approximately 100 feet downstream of Victoria Lane	1.1	76	120	142	202
Approximately 100 feet downstream of Crest Avenue	0.9	59	93	110	156
Approximately 100 feet downstream of Love Street	0.5	34	54	64	89
Approximately 100 feet downstream of Tonne Road	0.2	14	23	27	39
Farmer's Creek					
At confluence with Des Plaines River	5.0	317	505	643	1,987
At Ballard Road	2.6	52	85	106	474
Farrington Ditch					
At Checker Road	0.6	95	162	200	290
Feehanville Ditch					
Just downstream of Wolf Road	1.2	158	268	317	443
Filsen Park Ditch					
At confluence with 76th Avenue Ditch	0.9	124	219	275	399
Flag Creek					
At the mouth	18.1	1,660	2,650	3,180	4,500
At 83rd Street (German Church Road)	15.6	1,450	2,330	2,770	3,900
At a point approximately 900 feet upstream of 79th Street Ditch	15.3	1,420	2,300	2,720	3,850
At Wolf Road	13.7	1,260	2,000	2,400	3,350
At a point approximately 0.25 mile upstream of confluence					

* Data not available

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE (FEET)
Flag Creek								
A	3,000[3]	327	1,174	2.7	598.7	598.7	598.8	0.1
B	3,830[3]	100[2]	1,351	2.1	601.5	601.5	601.5	0.0
C	5,175[3]	420	1,233	2.3	603.4	603.4	603.5	0.1
D	8,330[3]	592	2,313	1.2	607.9	607.9	608.0	0.1
E	8,850[3]	545	2,400	1.2	608.9	608.9	609.0	0.1
F	11,620[3]	203	962	2.9	618.9	618.9	619.0	0.1
G	14,475[3]	221	973	2.8	625.1	625.1	625.2	0.1
H	17,900[3]	579	1,687	1.5	629.4	629.4	629.5	0.1
I	19,000[3]	163	985	2.9	631.5	631.5	631.6	0.1
J	20,370[3]	105	803	3.1	633.2	633.2	633.3	0.1
K	20,780[3]	80	605	4.0	634.0	634.0	634.1	0.1
L	25,280[3]	91	805	2.9	637.3	637.3	637.4	0.1
M	27,640[3]	78	624	3.3	639.2	639.2	639.3	0.1
N	29,540[3]	89	701	1.7	639.9	639.9	640.0	0.1
O	30,870[3]	50	469	2.5	640.4	640.4	640.5	0.1
P	31,970[3]	50	454	2.4	640.8	640.8	640.9	0.1
Q	32,490[3]	82	663	1.5	640.9	640.9	641.0	0.1
R	33,330[3]	35	296	3.4	641.7	641.7	641.8	0.1
S	34,650[3]	142	674	1.2	642.0	642.0	642.1	0.1
T	35,720[3]	68	564	1.3	642.1	642.1	642.2	0.1
U	36,680[3]	373	1,136	0.7	642.2	642.2	642.3	0.1
V	37,630[3]	97	631	1.2	642.2	642.2	642.3	0.1

[2] Floodway width reflects constricted section, see FIRM panel for regulatory floodway
[3] Feet above mouth at Des Plaines River

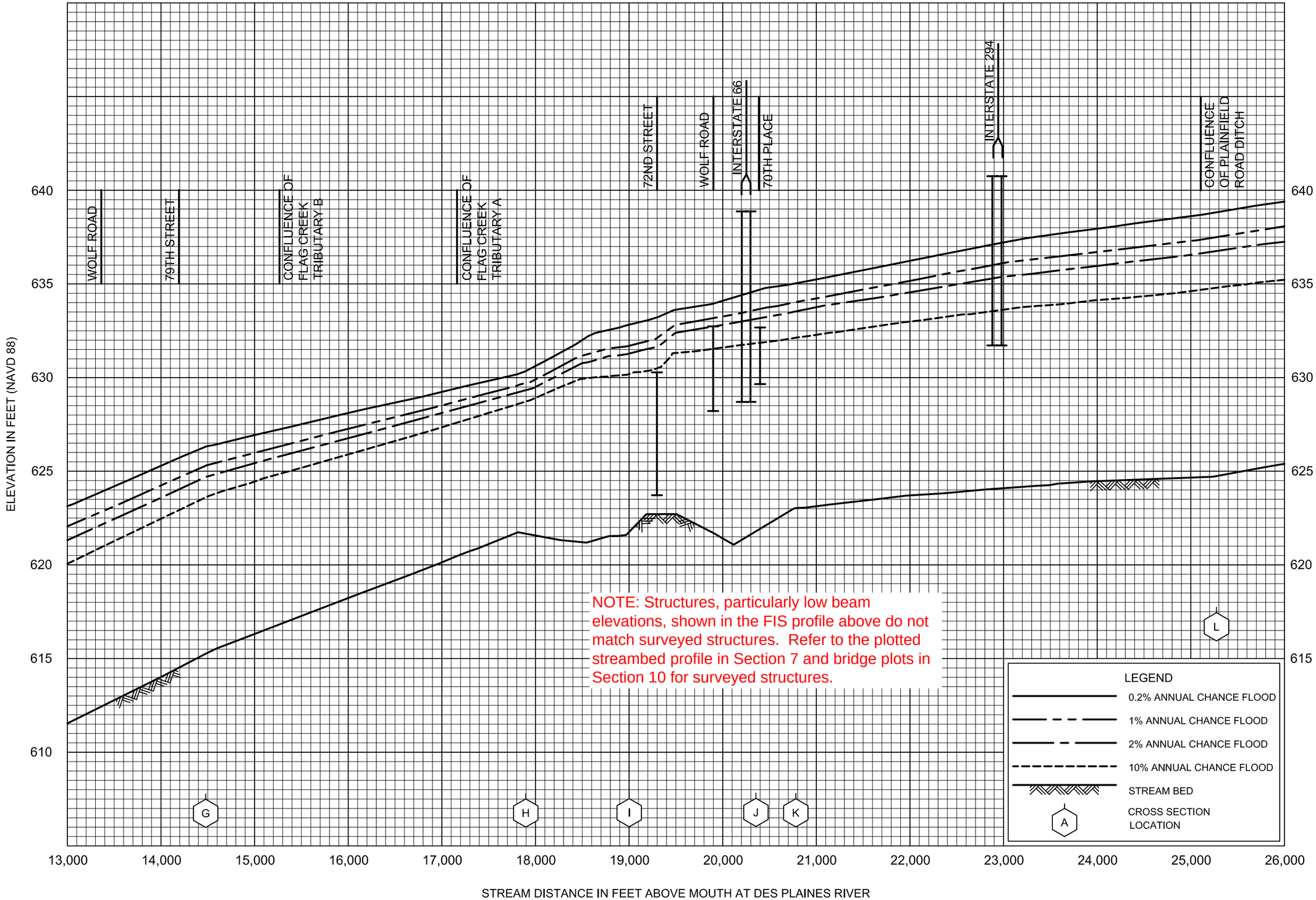
TABLE 19

FEDERAL EMERGENCY MANAGEMENT AGENCY

COOK COUNTY, IL AND INCORPORATED AREAS

FLOODWAY DATA

FLAG CREEK



FLOOD PROFILES

FLAG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COOK COUNTY, IL

AND INCORPORATED AREAS

134P

National Water Information System: Web Interface

USGS Water Resources

Data Category: Surface Water | Geographic Area: United States | GO

Click forNews Bulletins

Peak Streamflow for the Nation

USGS 05533000 FLAG CREEK NEAR WILLOW SPRINGS, IL

Available data for this site: Surface-water: Peak streamflow | GO

Cook County, Illinois
Hydrologic Unit Code 07120004
Latitude 41°44'20", Longitude 87°53'47" NAD83
Drainage area 16.5 square miles
Contributing drainage area 16.5 square miles
Gage datum 606.36 feet above NGVD29

Output formats

Table
Graph
Tab-separated file
peakfq (watstore) format
Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1951	Sep. 26, 1951	4.59	540
1952	Nov. 13, 1951	4.07	398
1953	Jun. 10, 1953	3.61	306
1954	Mar. 25, 1954	5.42	770
1955	Oct. 10, 1954	6.88	1,300
1956	May 11, 1956	3.57	285

1957	Jul. 13, 1957	6.89	1,350
1958	Jun. 13, 1958	3.96	388[E]
1959	Apr. 28, 1959	7.53	1,550
1960	Jan. 12, 1960	9.23	800
1961	Sep. 14, 1961	13.71	2,680
1962	Mar. 19, 1962	7.88	344[E]
1963	Apr. 30, 1963	7.95	367
1964	Apr. 06, 1964	9.10	375
1965	Sep. 09, 1965	6.99	576
1966	May 12, 1966	8.98	975
1967	Apr. 01, 1967	7.79	816[D]
1968	Aug. 17, 1968	7.26	648
1969	Apr. 17, 1969	7.88	803
1970	Jun. 21, 1970	6.52	400
1971	Feb. 18, 1971	5.34[2]	188[E]
1972	Aug. 26, 1972	7.95	830
1973	Dec. 30, 1972	7.83	786
1974	Apr. 03, 1974	7.22	696
1975	Apr. 18, 1975	9.70	1,630
1976	Jun. 13, 1976	10.22	2,230[D]
1977	Aug. 08, 1977	6.89	560
1978	Jul. 21, 1978	6.94	575
1979	Apr. 12, 1979	8.02	967
1980	Jul. 21, 1980	6.46	439
1981	Jun. 13, 1981	7.64	823
1982	Mar. 13, 1982	7.65	826
1983	Jul. 02, 1983	9.86	1,960
1984	Mar. 15, 1984	7.22	670[D]
1985	Mar. 04, 1985	8.89	1,390
1986	Sep. 26, 1986	7.12	636
1987	Aug. 26, 1987	7.93	939
1988	Apr. 06, 1988	7.47	759[E]
1989	Sep. 01, 1989	7.48	708[E]
1990	May 09, 1990	9.87	1,910

1991	Nov. 27, 1990	9.02	1,470
1992	Sep. 09, 1992	8.10	1,100[C,E]
1993	Jun. 07, 1993	8.13	791[C]
1994	Aug. 11, 1994	7.31	569[C]
1995	Jan. 14, 1995	7.30	567[C,E]
1996	Jul. 18, 1996	10.37	2,300[C]
1997	Feb. 21, 1997	9.34	1,540[C]
1998	Sep. 07, 1998	8.71	1,160[C]
1999	Apr. 09, 1999	8.03	860[C]
2000	Apr. 20, 2000	7.29	633[C]
2001	Aug. 02, 2001	7.68	745[C]
2002	Oct. 13, 2001	8.30	962[C]
2003	May 09, 2003	7.16	600[C]
2004	Aug. 28, 2004	7.82	790[C]
2005	Jan. 13, 2005	7.50	692[C,E]
2006	Aug. 10, 2006	6.82	559[C]
2007	Oct. 03, 2006	9.00	1,490[C]
2008	Sep. 14, 2008	8.85	1,240[C]
2009	Dec. 27, 2008	9.01	1,330[C]
2010	Jul. 24, 2010	10.36	2,350[C]
2011	Jun. 09, 2011	9.02	1,580[C]
2012	Aug. 26, 2012	8.32	1,210[C]
2013	Apr. 18, 2013	10.57	2,610[C]

?

Peak Gage-Height Qualification Codes.

- 2 -- Gage height not the maximum for the year

?

Peak Streamflow Qualification Codes.

- C -- All or part of the record affected by Urbanization, Mining, Agricultural changes, Channelization, or other
- D -- Base Discharge changed during this year
- E -- Only Annual Maximum Peak available for this year

Questions about sites/data?
Feedback on this web site
Automated retrievals
Help
Data Tips
Explanation of terms
Subscribe for system changes
News

Accessibility Plug-Ins FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey

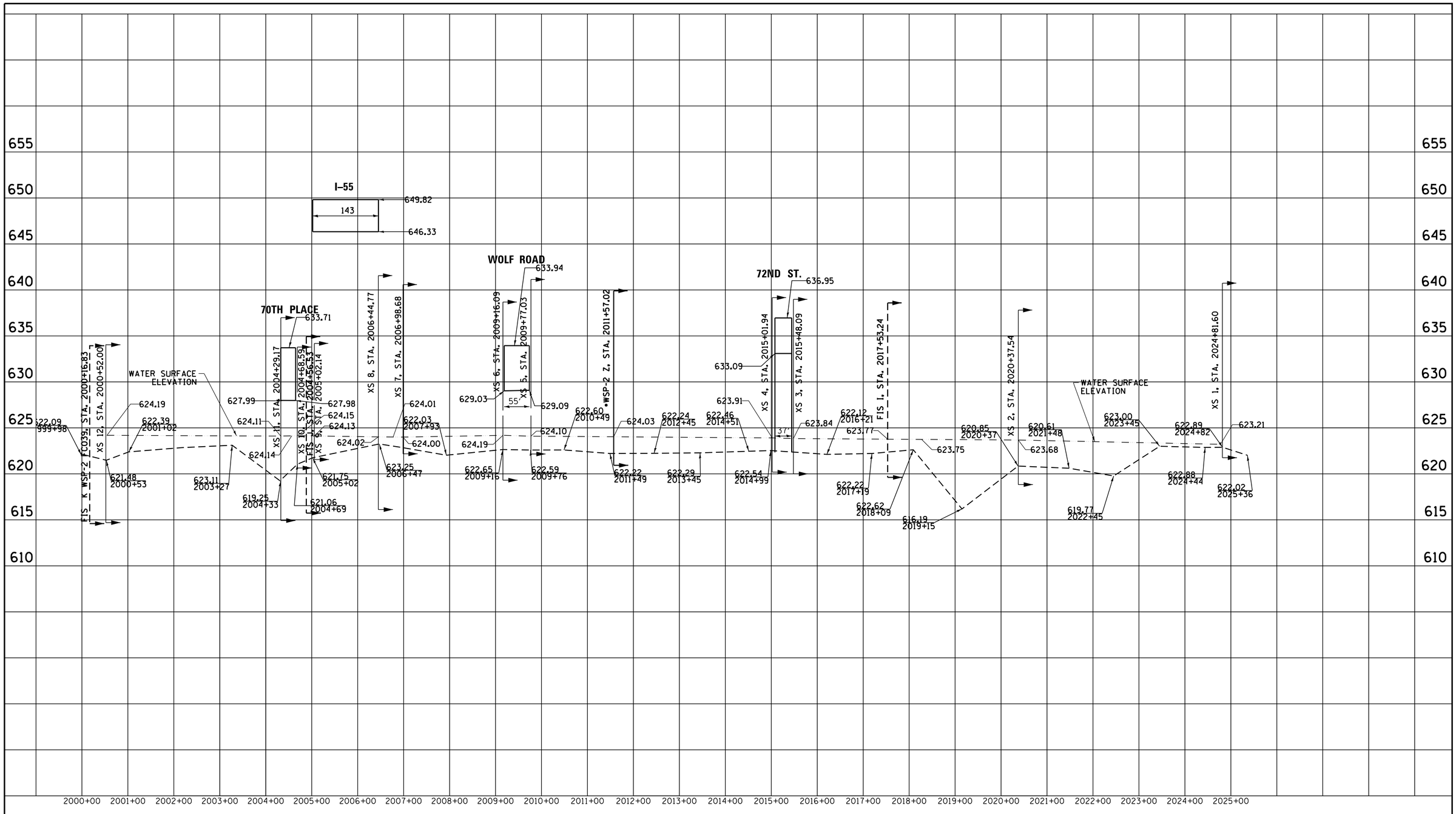
Title: Surface Water for USA: Peak Streamflow
URL: http://nwis.waterdata.usgs.gov/nwis/peak?

Page Contact Information: USGS Water Data Support Team
Page Last Modified: 2014-04-16 22:20:44 EDT
0.32 0.32 nadww01

Tab 7

SECTION 7

STREAMBED PROFILE



*-THE LOCATION OF FIS CROSS SECTION Z COULD NOT BE VERIFIED.THEREFORE THE APPROXMATE LOCATION IS SHOWN

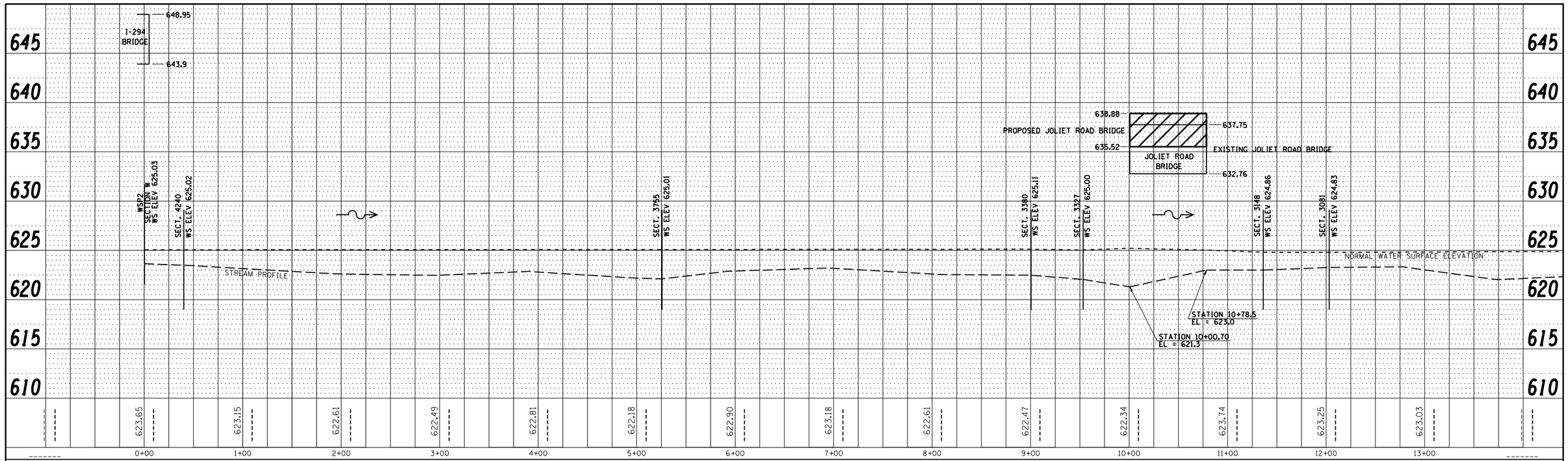
ROUTE	INTERSTATE 55
SECTION	
WATERCOURSE	FLAG CREEK
EXISTING S.N.	
SCALE:	1" = 100' HOR, 1" = 5' VERT
PLOTTED BY:	MYG DATE: 8/19/15
CHECKED BY:	EMB DATE: 8/19/15
SURVEY DATE:	11/30/12, 12/5/12

FILE NAME = N:\Idot\110203.0000\CADD\Sheets\P1110203-sht-dr-npr-f03.dgn

EXCERPT FROM 2011 HLR HYDRAULIC REPORT JOLIET ROAD OVER FLAGG CREEK

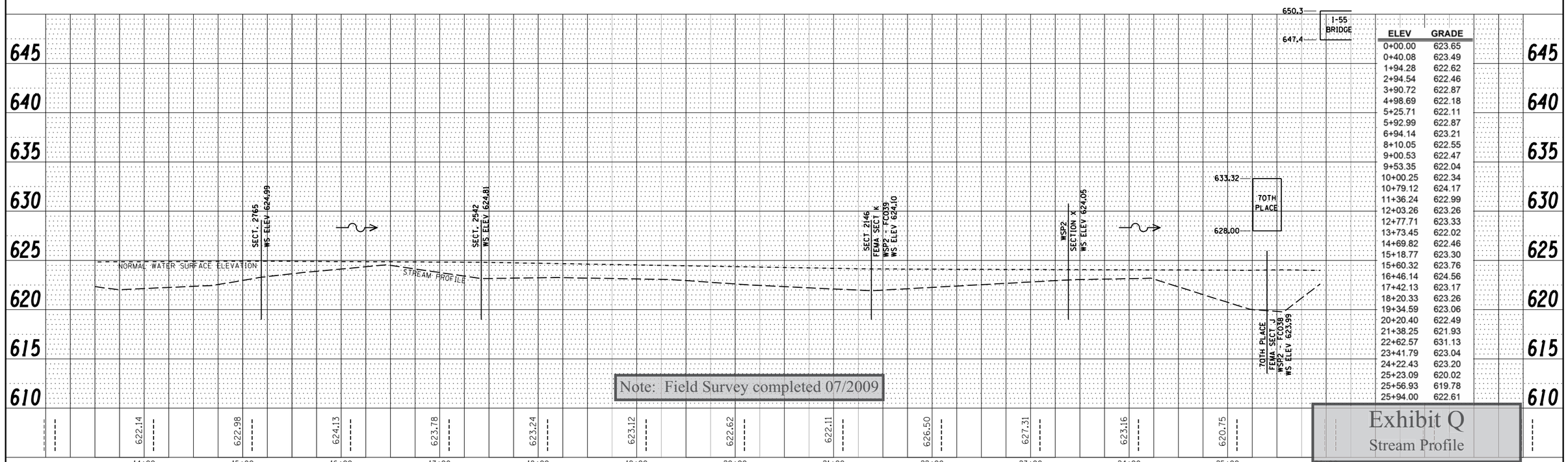
PLAN

BY	DATE
SURVEYED	
PLOTTED	
ALIGNMENT CHECKED	
RT. OF WAY CHECKED	
CADD FILE NAME	
NOTE BOOK	
NO.	



PROFILE

BY	DATE
SURVEYED	
PLOTTED	
CROSS SECTIONS CHECKED	
B.M. NOTED	
STRUCTURE NOTATNS CHKD	
NOTE BOOK	
NO.	



ELEV	GRADE
0+00.00	623.65
0+40.08	623.49
1+94.28	622.62
2+94.54	622.46
3+90.72	622.87
4+98.69	622.18
5+25.71	622.11
5+92.99	622.87
6+94.14	623.21
8+10.05	622.55
9+00.53	622.47
9+53.35	622.04
10+00.25	622.34
10+79.12	624.17
11+36.24	622.99
12+03.26	623.26
12+77.71	623.33
13+73.45	622.02
14+69.82	622.46
15+18.77	623.30
15+60.32	623.76
16+46.14	624.56
17+42.13	623.17
18+20.33	623.26
19+34.59	623.06
20+20.40	622.49
21+38.25	621.93
22+62.57	631.13
23+41.79	623.04
24+22.43	623.20
25+23.09	620.02
25+56.93	619.78
25+94.00	622.61

Note: Field Survey completed 07/2009

Exhibit Q
Stream Profile

FILE NAME = $FILE1$	USER NAME = $USER$	DESIGNED - RGN	REVISED -
		DRAWN - RGN	REVISED -
	PLOT SCALE = $SCALE$	CHECKED - CM	REVISED -
	PLOT DATE = $DATE$	DATE - 8/13/2009	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

JOLIET ROAD OVER FLAGG CREEK
STREAM PROFILE

1"=50'H 1"=10'V | SHEET NO. 1 OF 1 SHEETS | STA. 0+00 TO STA. 16+00

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

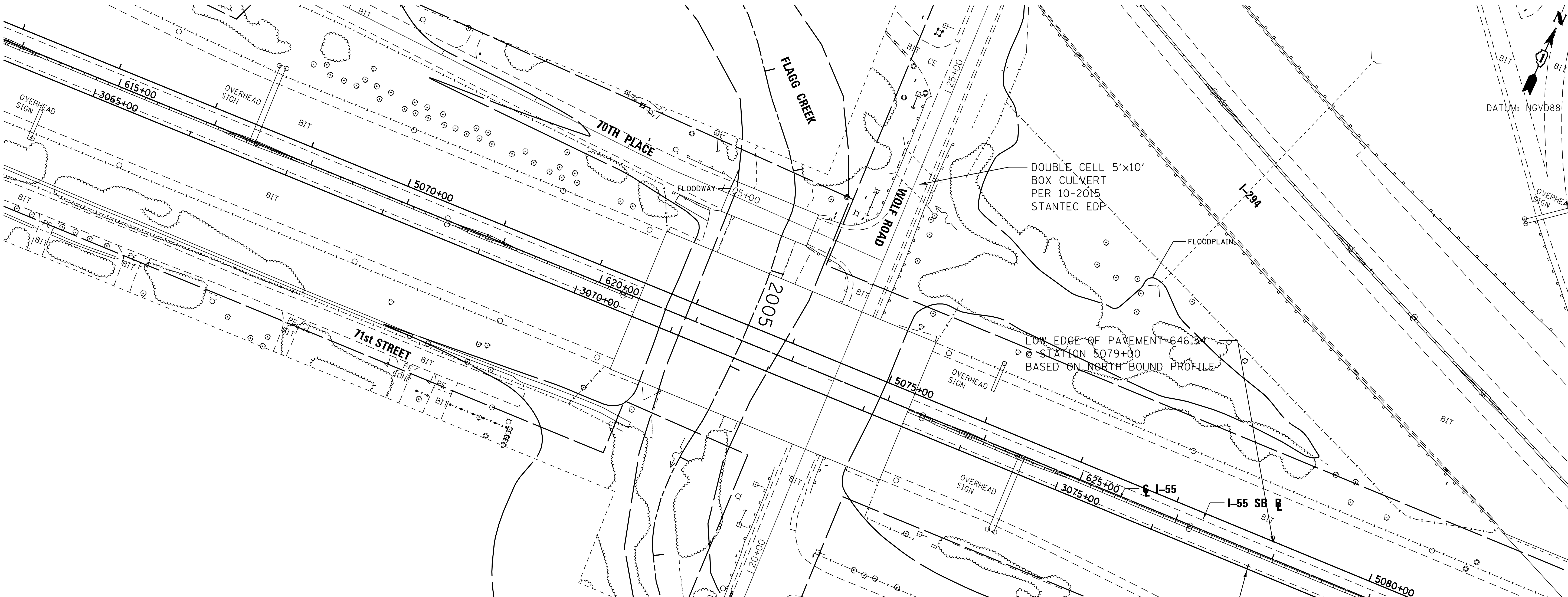
CONTRACT NO. _____

ILLINOIS FED. AID PROJECT

TAB 8

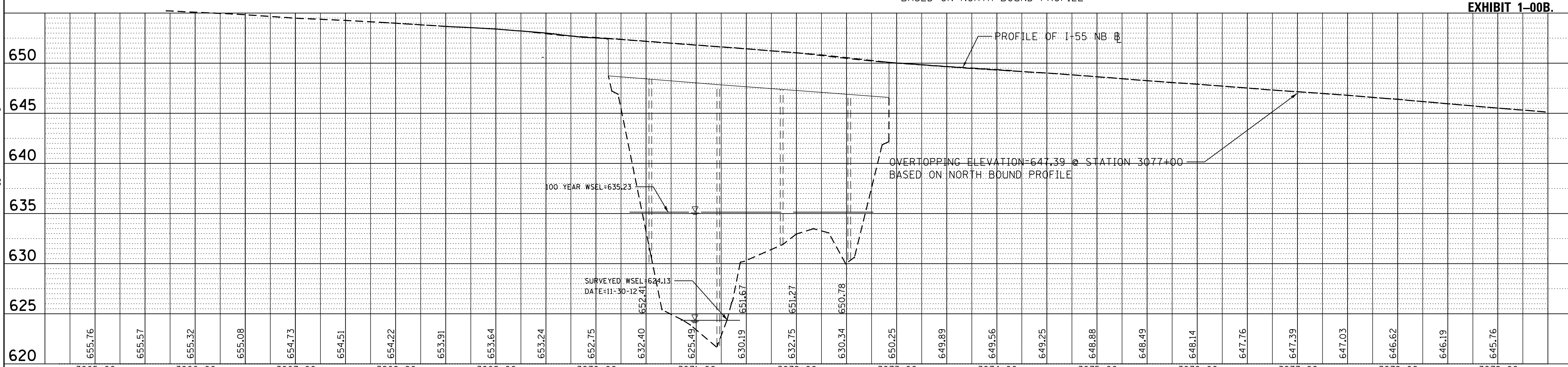
SECTION 8

ROADWAY PLAN AND PROFILE



PROFILE SOURCE: STANTEC EXISTING NORTHBOUND PGL

EXHIBIT 1–00B.



USER NAME = eburke	DESIGNED - EDB	REVISED -	
	DRAWN - MYG	REVISED -	
PLOT SCALE = 100.0000 ' / in.	CHECKED - IAD	REVISED -	
PLOT DATE = 9/23/2016	DATE - 9/23/2016	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

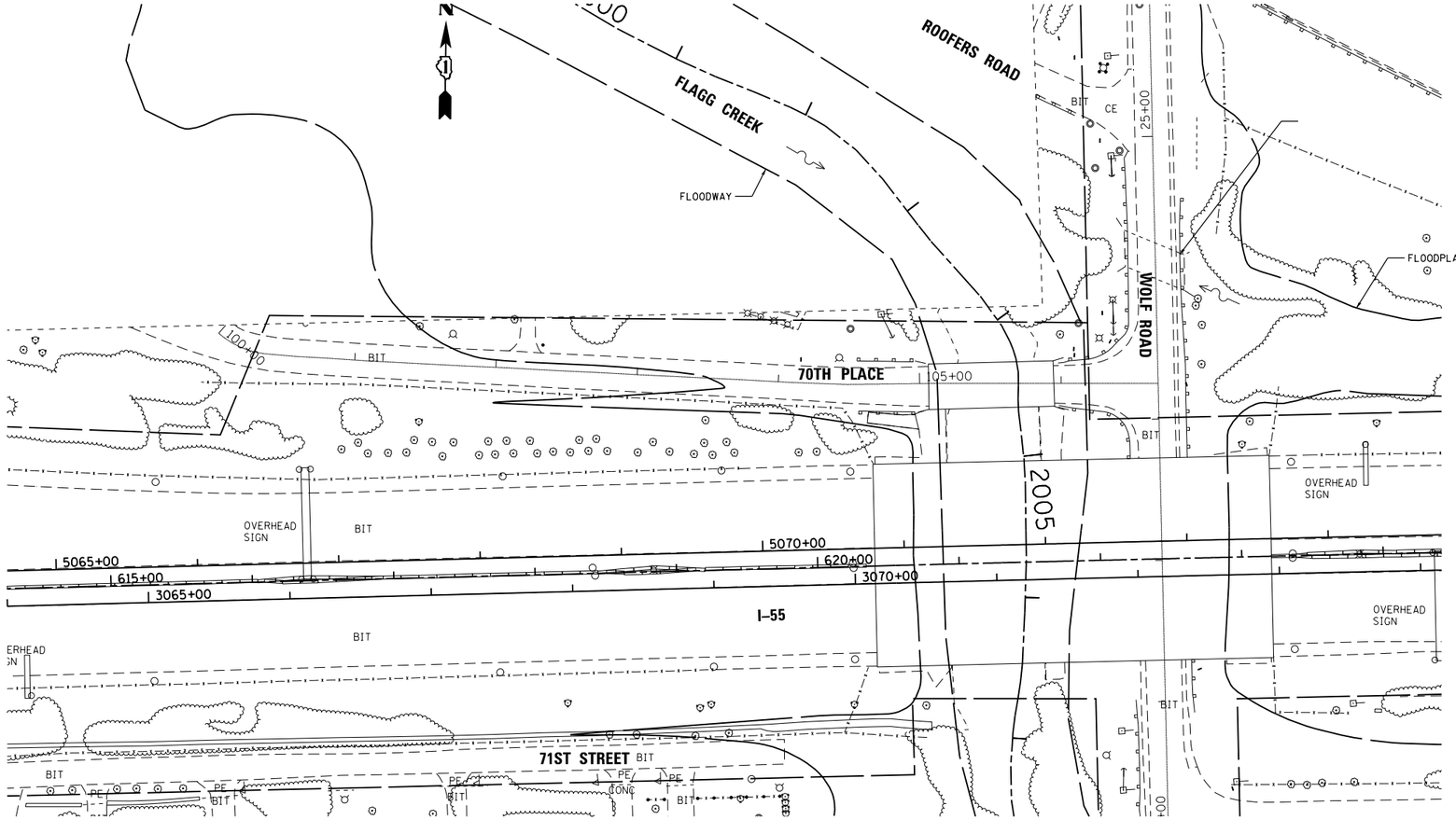
I-55 MANAGED LANE STUDY
I-55 – PLAN AND PROFILE

SCALE: $SCALE | SHEET OF SHEETS | STA. TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
$FAI	$SECTION	$COUNTY	$TOTAL	
		CONTRACT NO. $CONTRACT		
	ILLINOIS	FED. AID PROJECT		

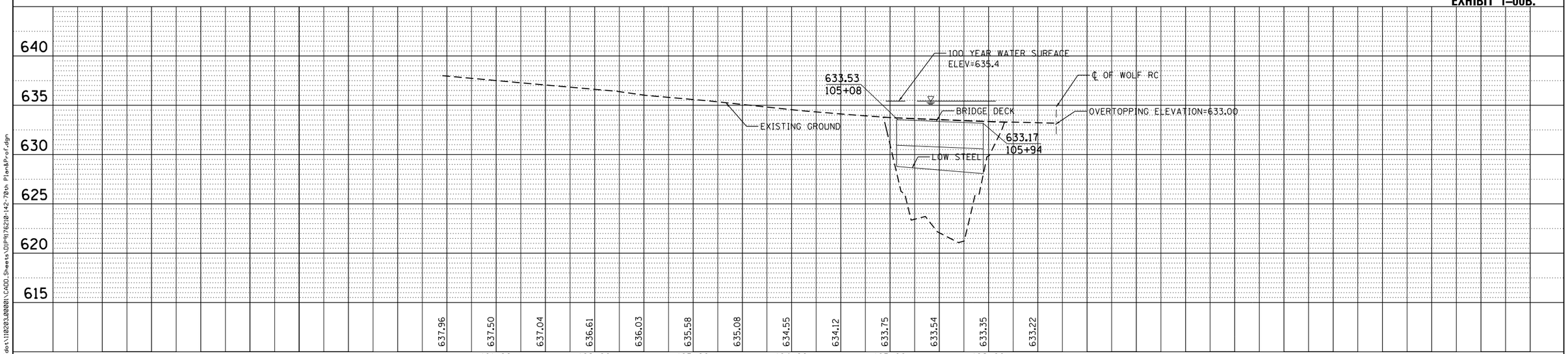
FILE NAME = N:\Idot\110203.00001\CADD_Sheets\DIP9176210-150-EB Flagg Creek Plan&Prof.dgn

Default



DATUM: NGVD88

EXHIBIT 1–00B.



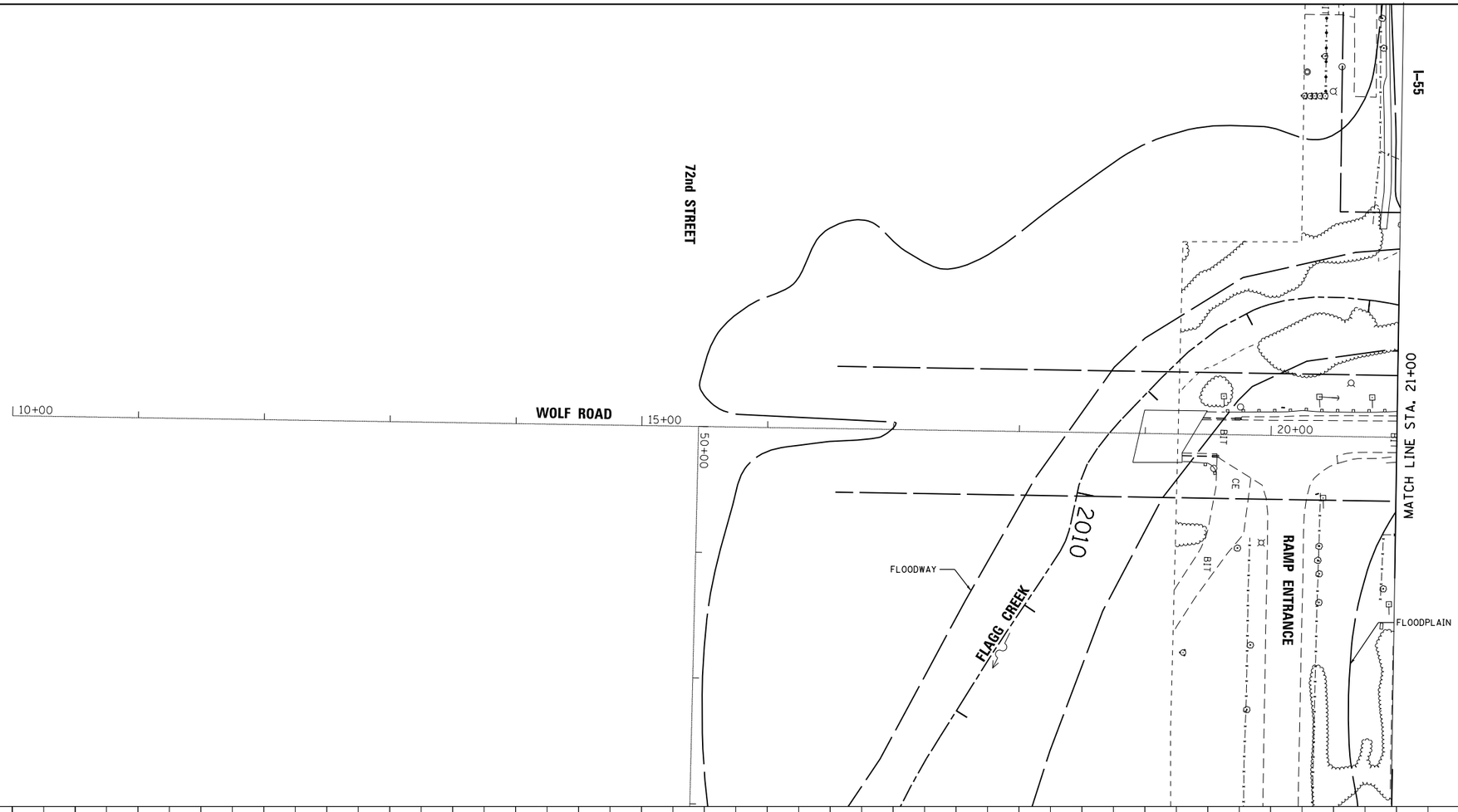
I-55 MANAGED LANE PROJECT	USER NAME = eburke	DESIGNED - EDB	REVISED -	**STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION**	**I–55 MANAGED LANE STUDY** 70th PLACE – PLAN AND PROFILE
		DRAWN - MYG	REVISED -		
	PLOT SCALE = $SCALE$	CHECKED - IAD	REVISED -		SCALE: 100' SHEET OF SHEETS STA. TO STA.
	PLOT DATE = 2/22/2016	DATE - 2/22/2016	REVISED -		

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
$FAI	$SECTION	$COUNTY	$TOTAL	
		CONTRACT NO. $CONTRACT		
	ILLINOIS FED. AID PROJECT			

FILE NAME = N:\dot\110203.00001\CADD_Sheets\DIP9176210-142-70th Plan&Prof.dgn

Default

DATUM: NGVD88



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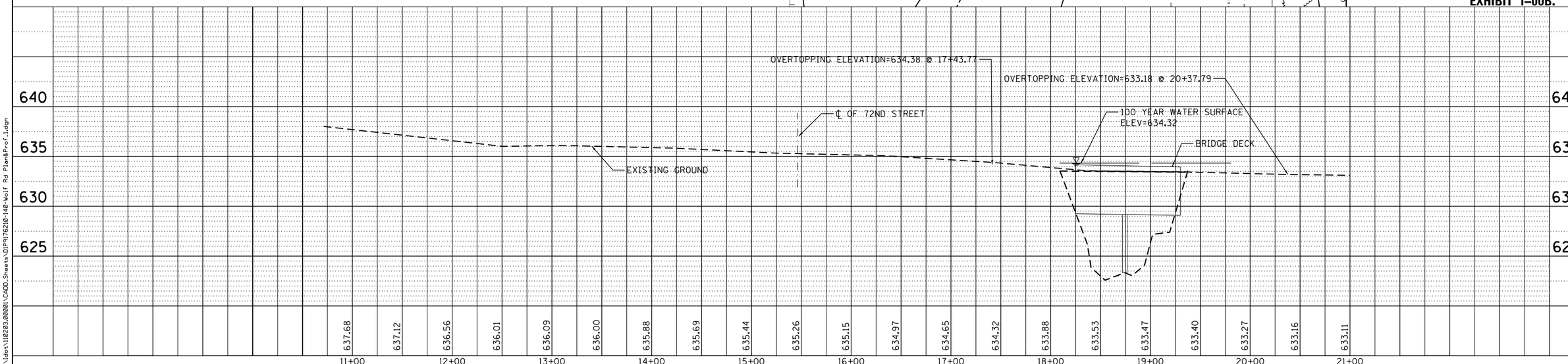

USER NAME = eburke	DESIGNED - EDB	REVISED -	
	DRAWN - MYG	REVISED -	
PLOT SCALE = $SCALE$	CHECKED - IAD	REVISED -	
PLOT DATE = 2/22/2016	DATE - 2/22/2016	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-55 MANAGED LANE STUDY
WOLF ROAD – PLAN AND PROFILE

SCALE: 100' | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
$FAI	$SECTION	$COUNTY	$TOTAL	
		CONTRACT NO. $CONTRACT		
	ILLINOIS FED. AID PROJECT			

FILE NAME = N:\Idot\110203.00001\CADD_Sheets\DIP\176218-140-Wolf Rd Plan&Prof_1.dgn

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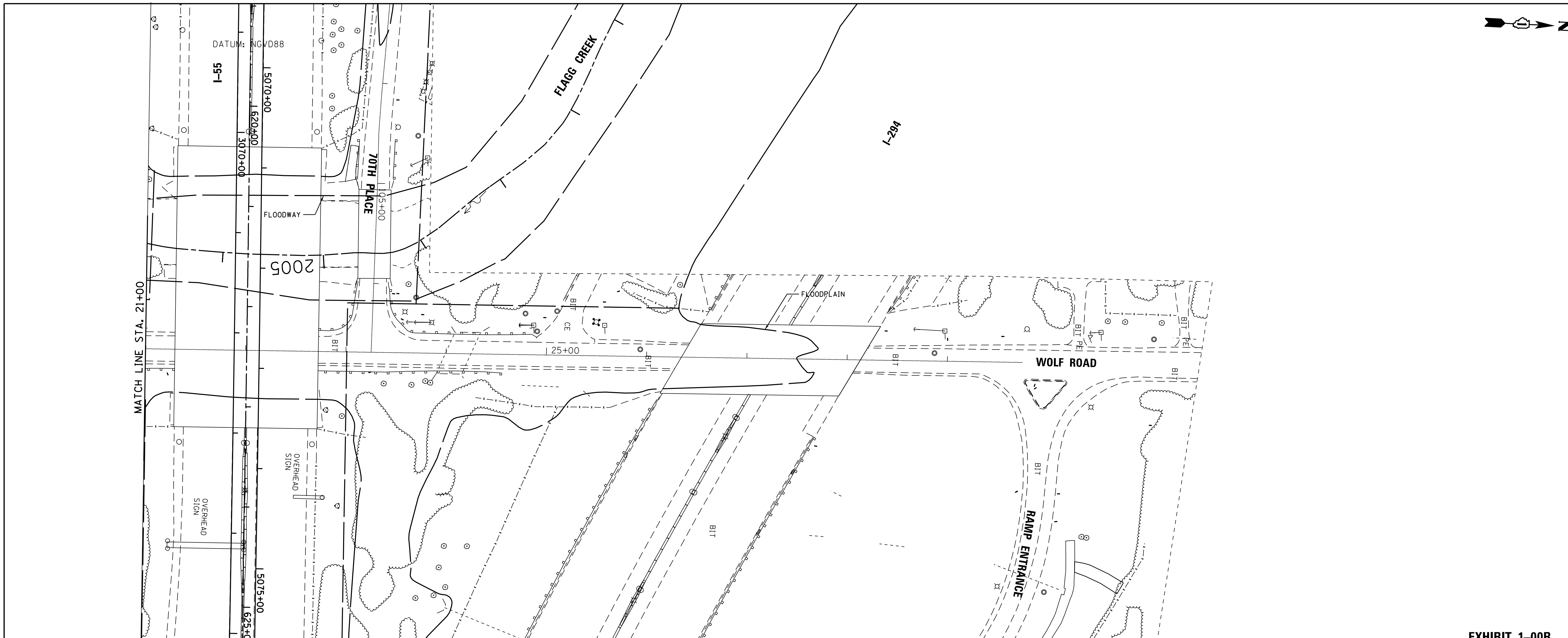
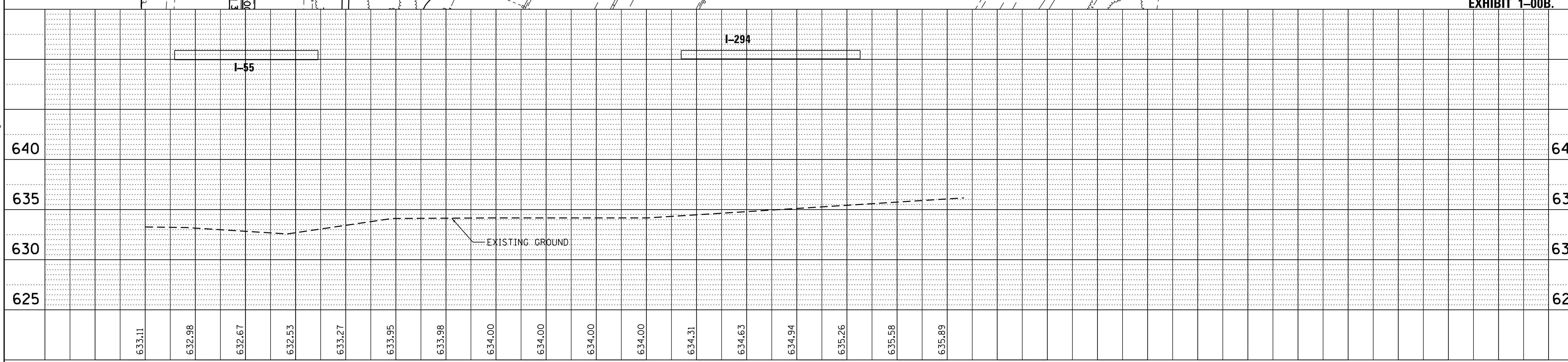


EXHIBIT 1-00B.



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I-55 MANAGED LANE PROJECT

USER NAME = eburke	DESIGNED - EDB	REVISED -
	DRAWN - MYG	REVISED -
PLOT SCALE = $SCALE$	CHECKED - IAD	REVISED -
PLOT DATE = 2/22/2016	DATE - 2/22/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-55 MANAGED LANE STUDY
WOLF ROAD - PLAN AND PROFILE

SCALE: 100' | SHEET OF SHEETS | STA. TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
$FAI	$SECTION	$COUNTY	$TOTAL	
		CONTRACT NO. $CONTRACT		
		ILLINOIS FED. AID PROJECT		

Default

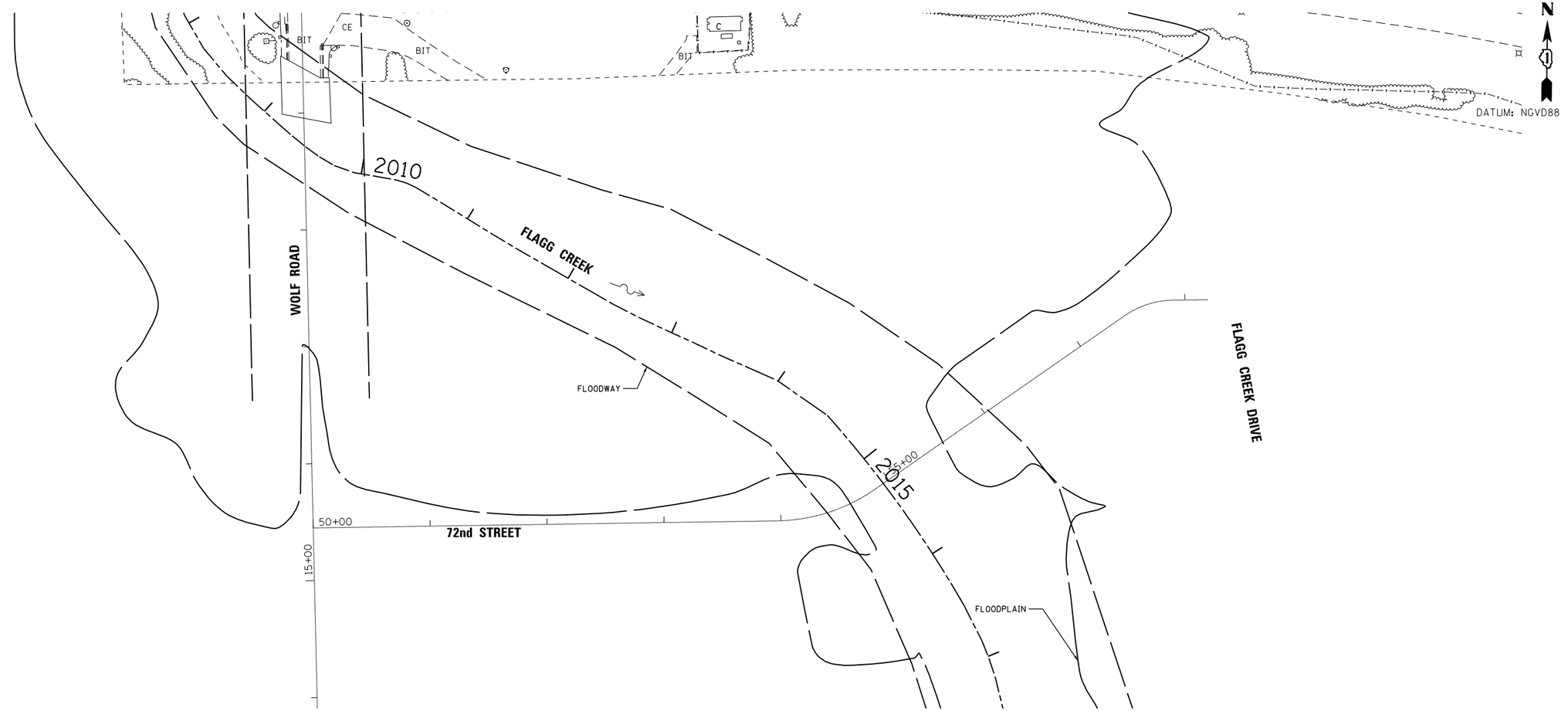
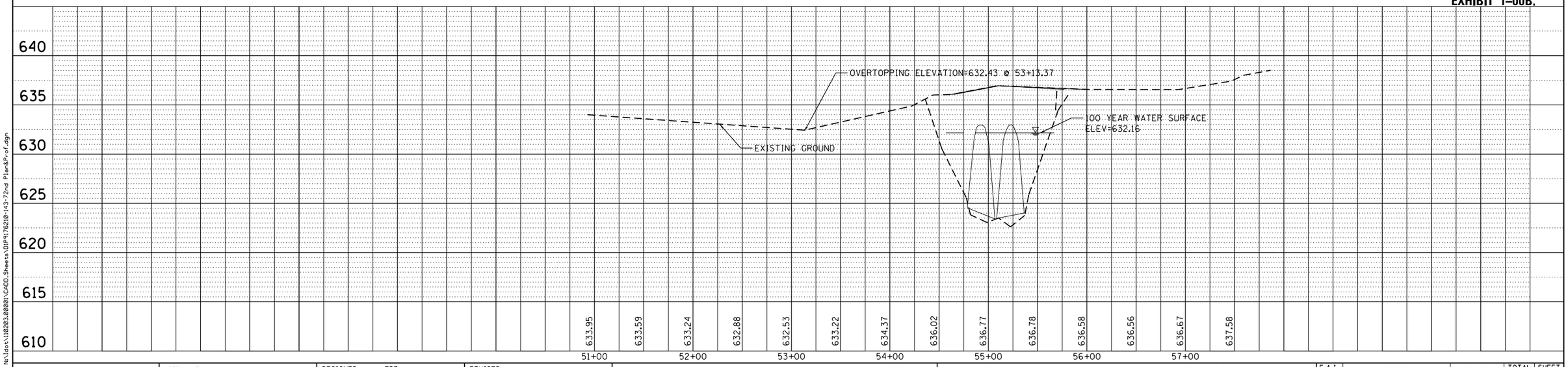


EXHIBIT 1–00B.



USER NAME = eburke	DESIGNED - EDB	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
	DRAWN - MYG	REVISED -	
PLOT SCALE = $SCALE$	CHECKED - IAD	REVISED -	
PLOT DATE = 2/22/2016	DATE - 2/22/2016	REVISED -	

I-55 MANAGED LANE PROJECT

I-55 MANAGED LANE STUDY
72nd STREET – PLAN AND PROFILE

SCALE: 100' | SHEET OF SHEETS | STA. TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
$FAI	$SECTION	$COUNTY	$TOTAL	

CONTRACT NO. $CONTRACT

ILLINOIS FED. AID PROJECT

FILE NAME = N:\Idot\118203.00001\CADD\Sheets\DIP9176210-143-72nd Plan&Prof.dgn

Default

TAB 9

SECTION 9

CROSS SECTION LOCATION MAP AND STREAM CROSS SECTION PLOTS FACING DOWNSTREAM

200 0 200
SCALE IN FEET

N

XS 4240 2509' US OF I-55
XS 3755 2024' US OF I-55
XS 3380 1649' US OF I-55
XS 3327 1596' US OF I-55
XS 3288 1557' US OF I-55
XS 3206 1475' US OF I-55
XS 3148 1417' US OF I-55
XS 3081 1401' US OF I-55
XS 2765 973' US OF I-55
XS 2542 850' US OF I-55
XS 12 450' US OF I-55
XS 11 73' US OF I-55
XS 10 35' US OF I-55
XS 8 DS FACE OF I-55
XS 9 US FACE OF I-55
XS 7 52' DS OF I-55
XS 4 805' DS OF I-55
XS 3 908' DS OF I-55
XS 2 1393' DS OF I-55
XS 1 1838' DS OF I-55
XS 6 271' DS OF I-55
XS 5 330' DS OF I-55

STR 1
STR 2
STR 3
STR 4
STR 5
STR 6
STR 7
STR 8
STR 9

JOLIET ROAD
WOLF ROAD
I-294
I-55
FLAG CREEK
70th PLACE
71st STREET
72nd STREET
FLOODPLAIN
FLOODWAY

LEGEND:

- REGULATORY WSP-2 CROSS SECTION WITH NEC-RW CROSS SECTION NAME
- FIS CROSS SECTION FROM FIRM
- XS2342 — SURVEYED CROSS SECTION FROM 2011 JOLIET ROAD STUDY (BY OTHERS)
- XS 6 — SURVEYED CROSS SECTION
- STR # — SENSITIVE FLOOD RECEPTORS PER 2011 HLR REPORT. ELEVATIONS PROVIDED ON NEXT PAGE
- FLOODWAY LIMIT FROM FIRM
- FLOODPLAIN LIMIT BY ELEVATION
- INEFFECTIVE CONES: 2:1 EXPANSION CONE 1:1 CONTRACTION CONES.

*-THE LOCATION OF FIS CROSS SECTION Z COULD NOT BE VERIFIED.THEREFORE THE APPROXMATE LOCATION IS SHOWN

CROSS SECTION LOCATION MAP

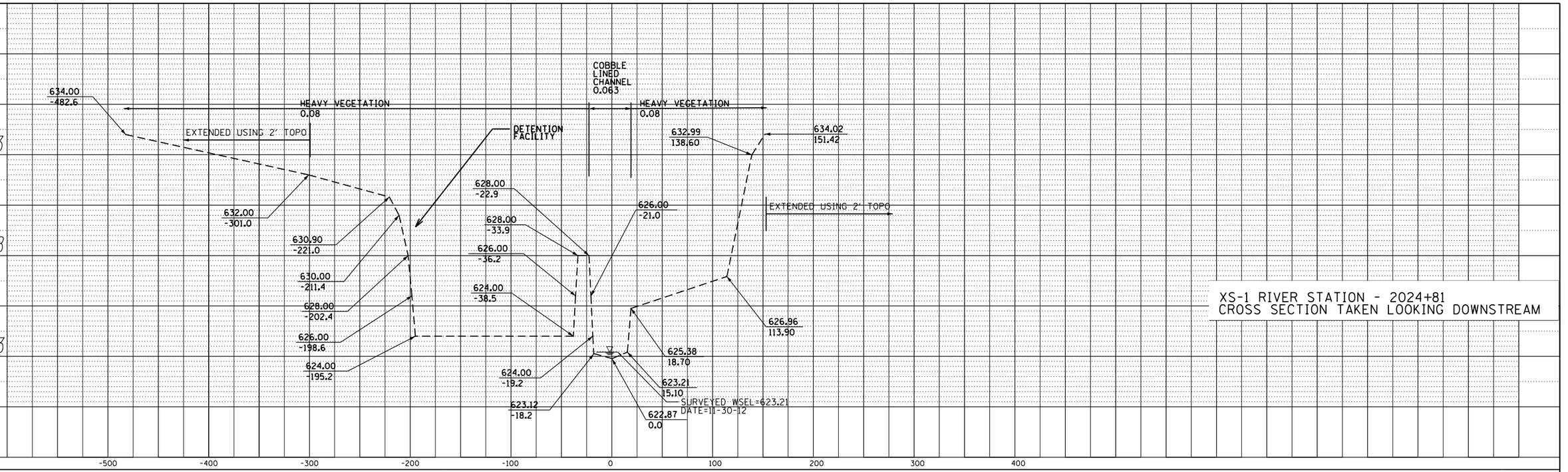
ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1" = 200'
PLOTTED BY: MYG DATE: 9/23/2016
CHECKED BY: EMB DATE: 9/23/2016
SURVEY DATE: 11-30-12, 12-5-12

FILE NAME = N:\Idot\110203.00001\CADD_Sheets\P1110203-sht-drnpln03.dgn

Structure No.	Structure Location	Flow	Offset	Low Elevation Opening	Comment
1	900 ft	U/S	West	644.16	Flagg Creek Water Reclemation District - Sand Filter Building
2	450 ft	U/S	West	639.1	Flagg Creek Water Reclemation District
3	300 ft	D/S	East	635.62	Commercial
4	475 ft	D/S	West	638.97	Commercial
5	550 ft	D/S	East	635.71	Commercial
6	600 ft	D/S	West	638.55	Commercial
7	800 ft	D/S	East	634.5	Commercial
8	915 ft	D/S	West	637.46	Residential
9	1150 ft	D/S	East	633.69	Commercial

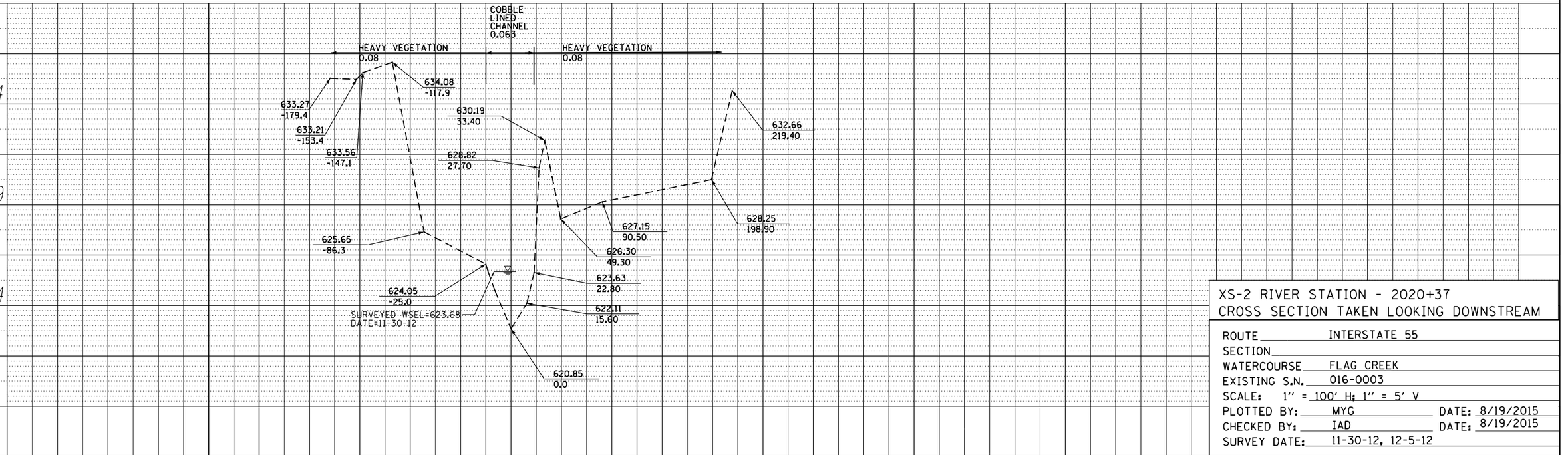
EXCERPT FROM 2011 HLR HYDRAULIC REPORT
FOR JOLIET ROAD OVER FLAGG CREEK

Exhibit I
Sensitive Flood Receptors



XS-1 RIVER STATION - 2024+81
CROSS SECTION TAKEN LOOKING DOWNSTREAM

PLAN
NOTE BOOK
NO.
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
BY
DATE



XS-2 RIVER STATION - 2020+37
CROSS SECTION TAKEN LOOKING DOWNSTREAM

ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1'' = 100' H; 1'' = 5' V
PLOTTED BY: MYG DATE: 8/19/2015
CHECKED BY: IAD DATE: 8/19/2015
SURVEY DATE: 11-30-12, 12-5-12

PROFILE
NOTE BOOK
NO.
SURVEYED
PLOTTED
ALIGNMENT CHECKED
R.O.W. NOTED
STRUCTURE NOTATNS CHKD
BY
DATE

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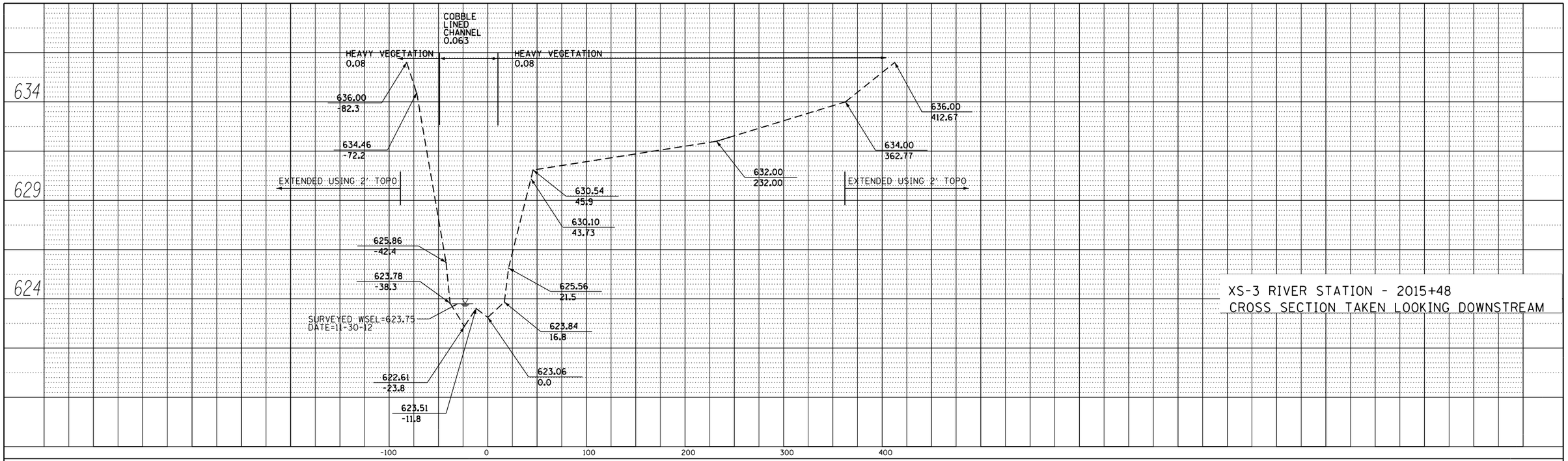
Default	PLOT DATE = 8/19/2015	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS-SECTIONS
FLAG CREEK

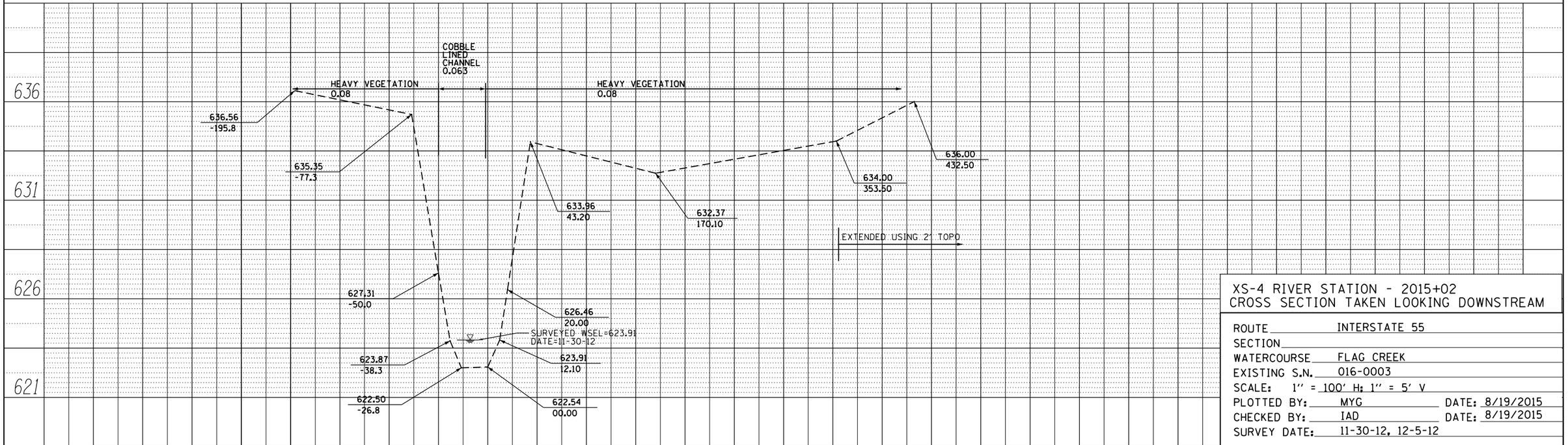
SCALE: 100'H 5'V | SHEET 1 OF 7 SHEETS

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		



PLAN | SURVEYED | PLOTTED | ALIGNMENT CHECKED | RT. OF WAY CHECKED | CADD FILE NAME | NOTE BOOK | NO. | BY | DATE

XS-3 RIVER STATION - 2015+48
CROSS SECTION TAKEN LOOKING DOWNSTREAM



PROFILE | SURVEYED | PLOTTED | ALIGNMENT CHECKED | R/W, NOTED | STRUCTURE NOTATNS CHKD | NOTE BOOK | NO. | BY | DATE

XS-4 RIVER STATION - 2015+02
CROSS SECTION TAKEN LOOKING DOWNSTREAM

ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1'' = 100' H; 1'' = 5' V
PLOTTED BY: MYG DATE: 8/19/2015
CHECKED BY: IAD DATE: 8/19/2015
SURVEY DATE: 11-30-12, 12-5-12

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	PLOT SCALE = 100'	CHECKED - IAD	REVISED -
Default	PLOT DATE = 8/19/2015	DATE -	REVISED -

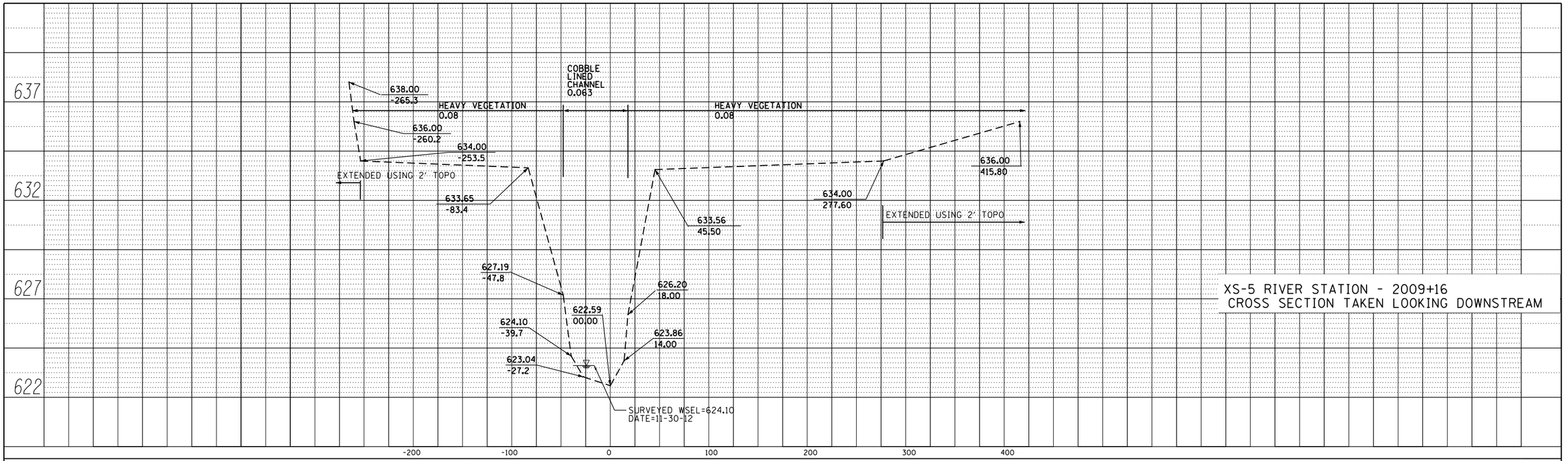
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS-SECTIONS
FLAG CREEK

SCALE: 100'H 5'V | SHEET 2 OF 7 SHEETS

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

CONTRACT NO.
ILLINOIS FED. AID PROJECT



XS-5 RIVER STATION - 2009+16
CROSS SECTION TAKEN LOOKING DOWNSTREAM

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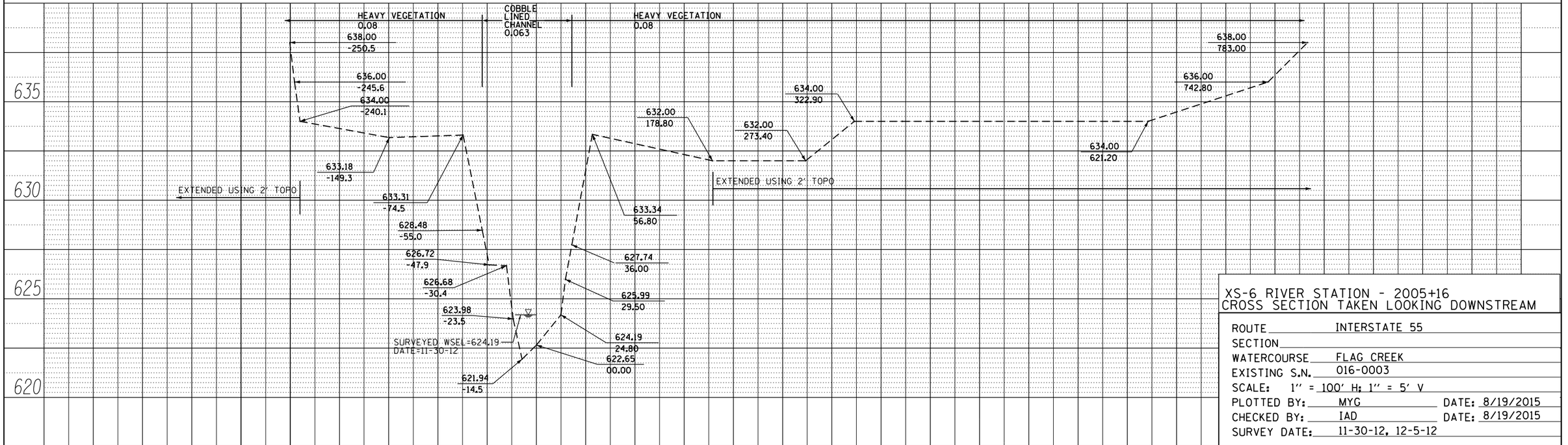
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE



XS-6 RIVER STATION - 2005+16
CROSS SECTION TAKEN LOOKING DOWNSTREAM

PROFILE
SURVEYED
PLOTTED
ALIGNMENT CHECKED
ELM. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1'' = 100' H; 1'' = 5' V
PLOTTED BY: MYG DATE: 8/19/2015
CHECKED BY: IAD DATE: 8/19/2015
SURVEY DATE: 11-30-12, 12-5-12

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Default	PLOT DATE = 8/19/2015	DATE -	REVISED -

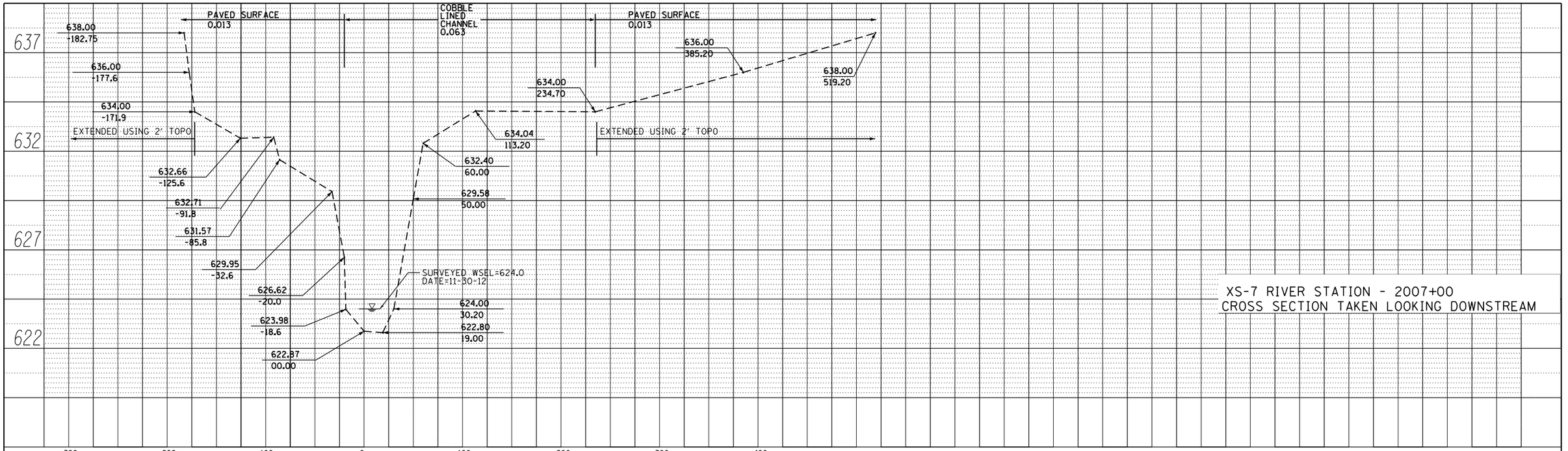
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS-SECTIONS
FLAG CREEK

SCALE: 100'H 5'V | SHEET 3 OF 7 SHEETS

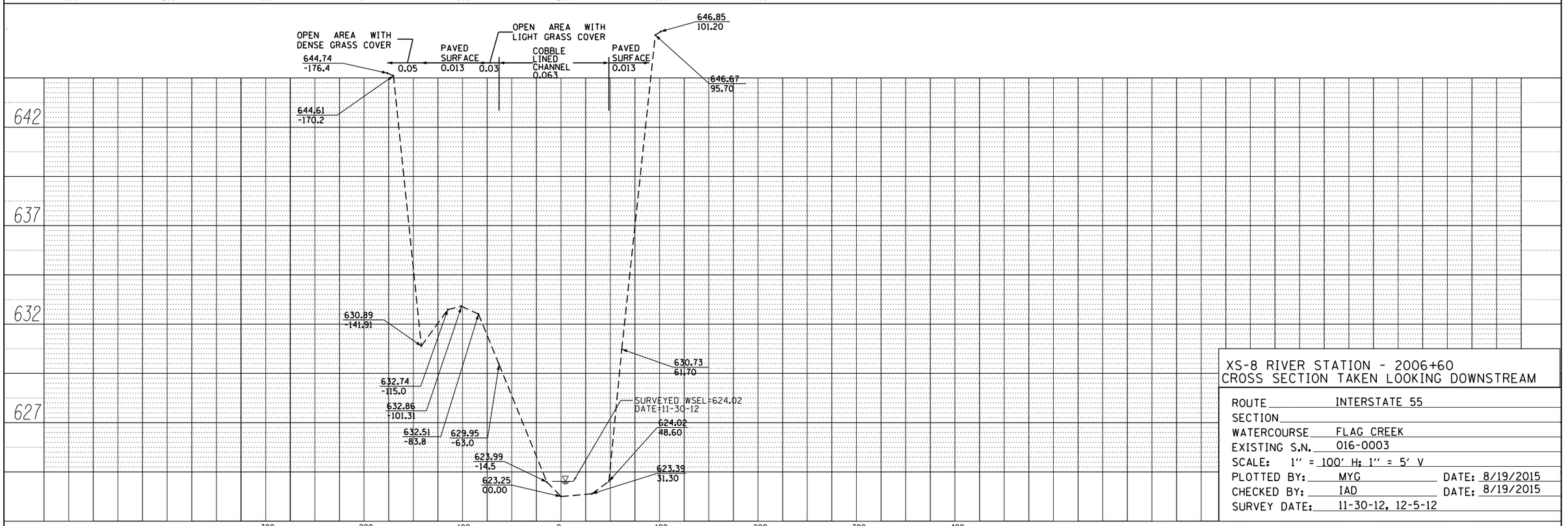
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

CONTRACT NO.
ILLINOIS FED. AID PROJECT



XS-7 RIVER STATION - 2007+00
CROSS SECTION TAKEN LOOKING DOWNSTREAM

PLAN
SURVEYED
PLOTTED
JURISDICTIONAL
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE



XS-8 RIVER STATION - 2006+60
CROSS SECTION TAKEN LOOKING DOWNSTREAM

PROFILE
SURVEYED
PLOTTED
JURISDICTIONAL
BKM. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1'' = 100' H; 1'' = 5' V
PLOTTED BY: MYG DATE: 8/19/2015
CHECKED BY: IAD DATE: 8/19/2015
SURVEY DATE: 11-30-12, 12-5-12

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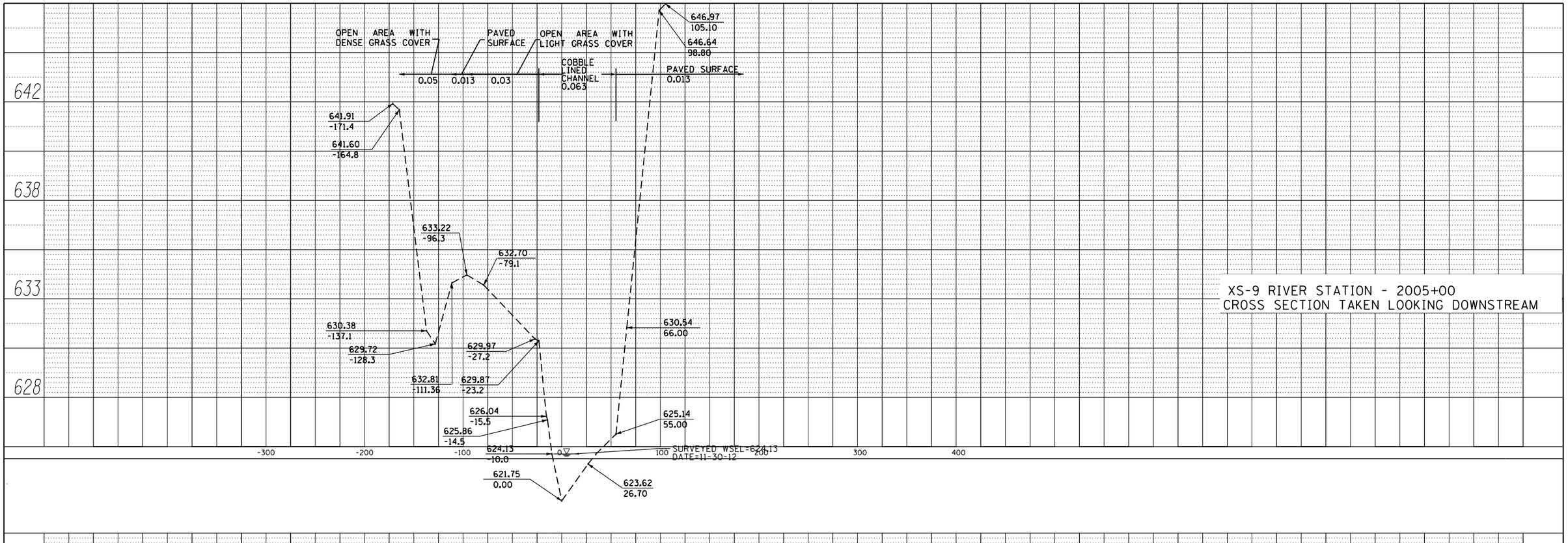
Default	PLOT DATE = 8/19/2015	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

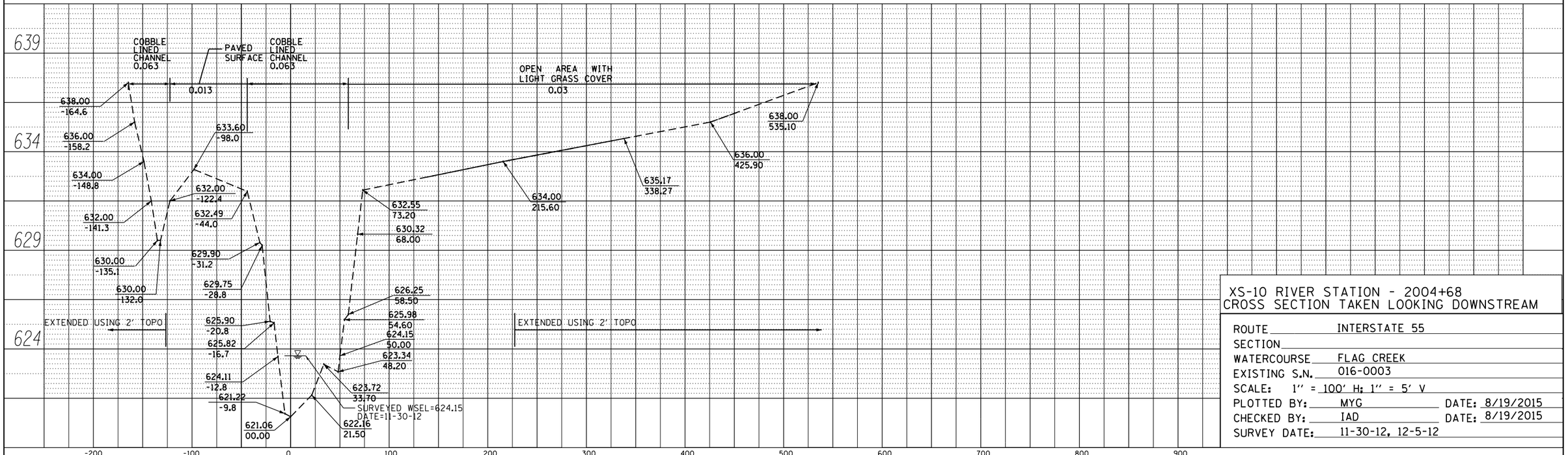
CROSS-SECTIONS
FLAG CREEK

SCALE: 100'H 5'V | SHEET 4 OF 7 SHEETS

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		



XS-9 RIVER STATION - 2005+00
CROSS SECTION TAKEN LOOKING DOWNSTREAM



XS-10 RIVER STATION - 2004+68
CROSS SECTION TAKEN LOOKING DOWNSTREAM

ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1'' = 100' H; 1'' = 5' V
PLOTTED BY: MYG DATE: 8/19/2015
CHECKED BY: IAD DATE: 8/19/2015
SURVEY DATE: 11-30-12, 12-5-12

PLAN: SURVEYED; PLOTTED; ALIGNMENT CHECKED; RT. OF WAY CHECKED; CADD FILE NAME; NOTE BOOK; NO.; BY; DATE

PROFILE: SURVEYED; PLOTTED; GRADE CHECKED; R.M. NOTED; STRUCTURE NOTATNS CHKD; NOTE BOOK; NO.; BY; DATE

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		DRAWN - MYG	REVISED -
	PLOT SCALE = 100'	CHECKED - IAD	REVISED -
Default	PLOT DATE = 8/19/2015	DATE -	REVISED -

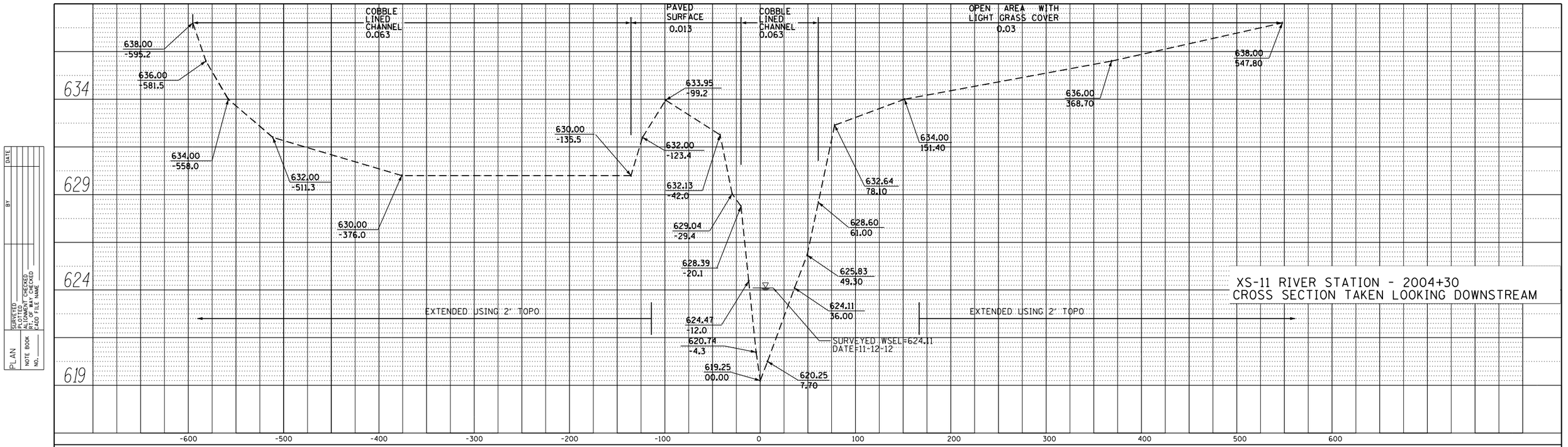
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS-SECTIONS
FLAG CREEK

SCALE: 100'H 5'V | SHEET 5 OF 7 SHEETS

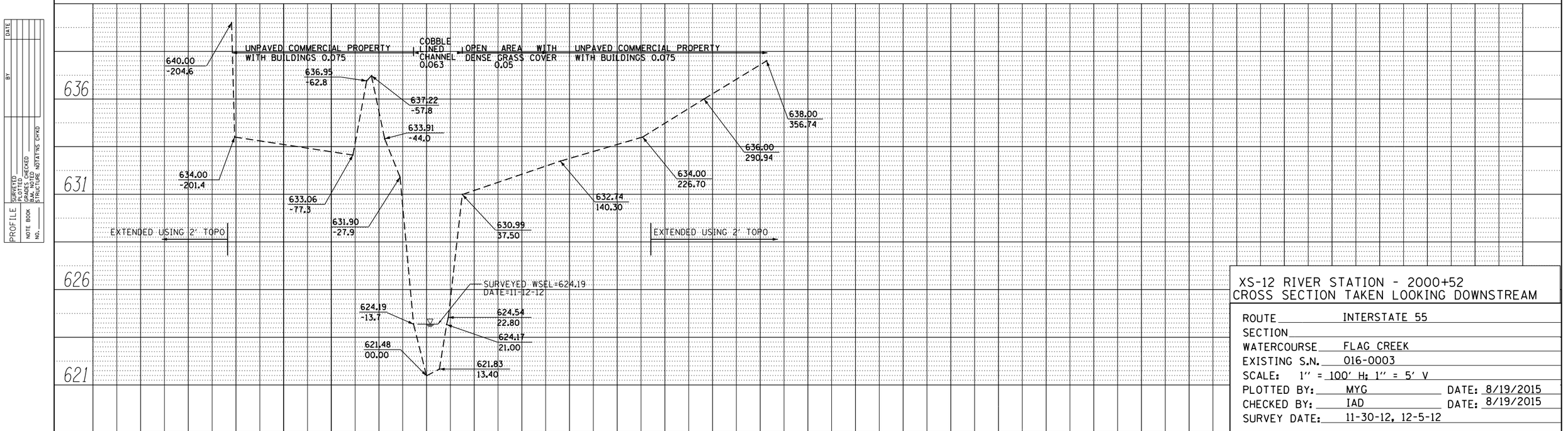
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

CONTRACT NO.
ILLINOIS FED. AID PROJECT



XS-11 RIVER STATION - 2004+30
CROSS SECTION TAKEN LOOKING DOWNSTREAM

PLAN
SURVEYED
PLOTTED
CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE



XS-12 RIVER STATION - 2000+52
CROSS SECTION TAKEN LOOKING DOWNSTREAM

PROFILE
SURVEYED
PLOTTED
CHECKED
R.W. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE

ROUTE INTERSTATE 55
SECTION
WATERCOURSE FLAG CREEK
EXISTING S.N. 016-0003
SCALE: 1'' = 100' H; 1'' = 5' V
PLOTTED BY: MYG DATE: 8/19/2015
CHECKED BY: IAD DATE: 8/19/2015
SURVEY DATE: 11-30-12, 12-5-12

FILE NAME = N:\Idot\110203.0000\CADD_Sheets\P1110203-sht-xssht1.dgn	USER NAME = Mgoldenberg	DESIGNED - EMB	REVISED -
		DRAWN - MYG	REVISED -
	PLOT SCALE = 100'	CHECKED - IAD	REVISED -
Default	PLOT DATE = 8/19/2015	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CROSS-SECTIONS
FLAG CREEK

SCALE: 100'H 5'V | SHEET 6 OF 7 SHEETS

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

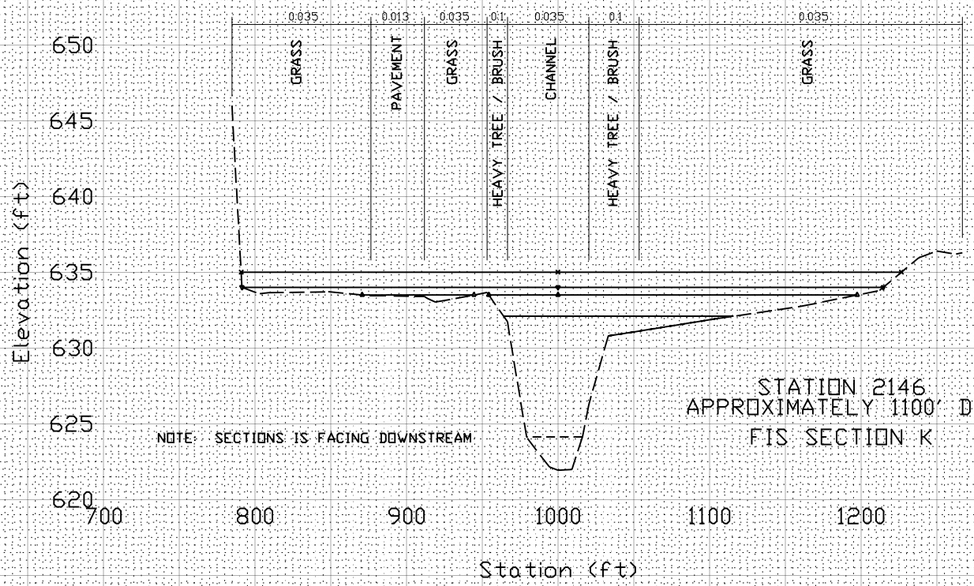
EXCERPT FROM 2011 HLR HYDRAULIC REPORT JOLIET ROAD OVER FLAGG CREEK

CONTRACT NO. ___

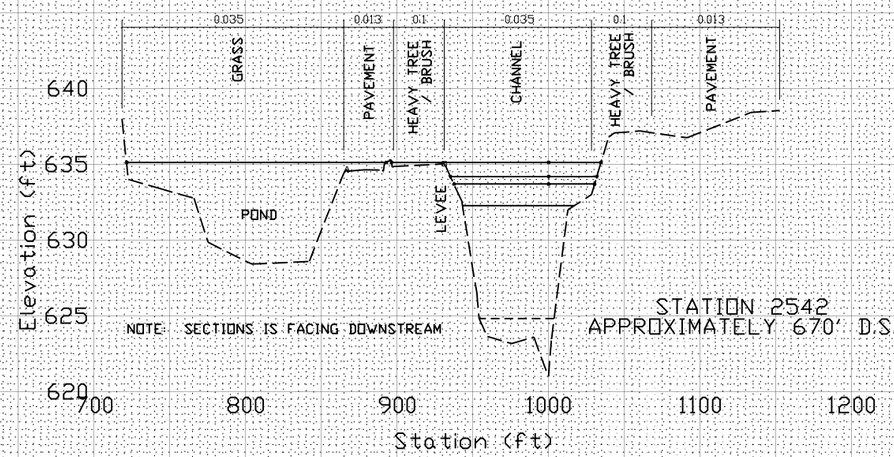
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.

STA. _____ TO STA. _____

FED. ROAD DIST. NO. _ | ILLINOIS | FED. AID PROJECT



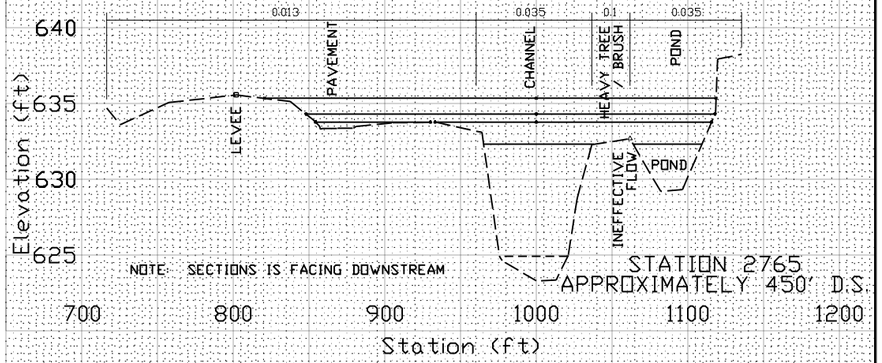
Station	Elev.
784.86	646.00
791.46	634.00
803.26	633.58
809.05	633.64
848.34	633.72
876.46	633.44
889.29	633.44
891.55	633.43
911.87	633.40
913.90	633.26
919.04	633.03
953.20	633.66
966.79	631.74
979.40	624.10
994.43	622.15
1000.00	621.93
1009.15	621.98
1016.18	624.15
1020.40	626.27
1033.14	630.79
1104.24	631.93
1161.10	632.77
1212.24	633.80
1238.02	635.95
1249.88	636.40
1262.70	636.20
1266.91	636.28



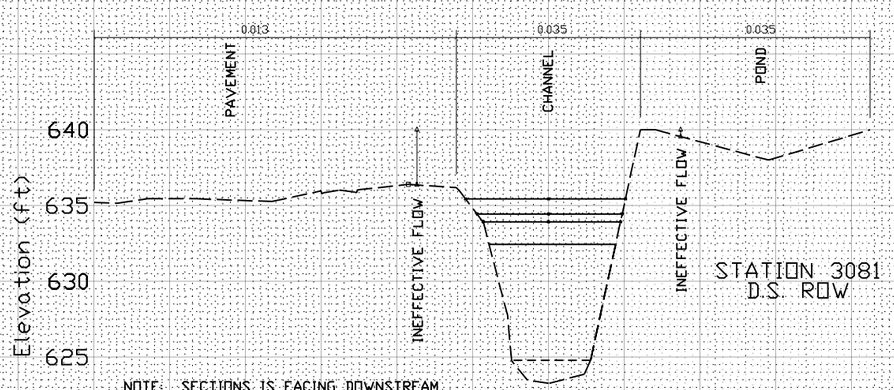
Station	Elev.
718.48	638.00
722.68	634.00
742.28	633.43
765.89	632.76
775.21	629.85
804.17	628.41
842.10	628.60
864.81	634.40
865.66	634.51
866.87	634.66
867.40	634.46
868.39	634.55
878.45	634.63
890.05	634.61
890.87	634.54
891.56	635.03
895.89	635.30
896.81	634.80
897.62	634.84
931.16	635.03
932.49	634.77
942.56	632.61
952.68	626.51
954.07	624.81
959.68	623.62
975.70	623.17
990.36	623.59
1000.00	620.99
1001.90	623.47
1012.76	632.00
1028.26	633.00
1039.67	636.78
1043.28	637.06
1060.18	637.19
1091.44	636.74
1133.41	638.41
1152.48	638.55

Legend

- WS 500-year
- WS 100-year
- WS 50-year
- WS 10-year
- WS NORMAL



Station	Elev.
716.52	634.71
725.47	633.61
757.57	635.08
801.99	635.58
837.63	635.14
852.74	633.93
856.99	633.50
857.56	633.30
858.55	633.35
868.90	633.37
879.37	633.37
881.01	633.48
905.23	633.74
932.95	633.78
933.78	633.76
964.28	633.11
975.88	624.88
977.62	624.63
1000.00	623.30
1013.14	623.35
1021.19	624.99
1027.01	628.73
1036.70	632.30
1061.92	632.69
1082.27	629.20
1096.47	629.33
1118.40	634.39
1119.80	637.94
1135.48	638.26



Station	Elev.
700.12	635.21
715.59	635.15
735.43	635.46
767.31	635.45
817.37	635.27
849.72	635.97
850.32	635.78
851.31	635.85
861.89	636.02
872.17	635.89
873.24	635.84
873.77	636.03
907.47	636.40
939.20	636.19
941.74	635.89
956.98	633.91
973.01	627.76
975.66	624.76
985.89	623.49
1000.00	623.26
1023.58	623.87
1027.81	624.83
1060.60	640.00
1070.47	640.00
1145.38	638.00
1212.12	640.00

Note: Field Survey completed 07/2009

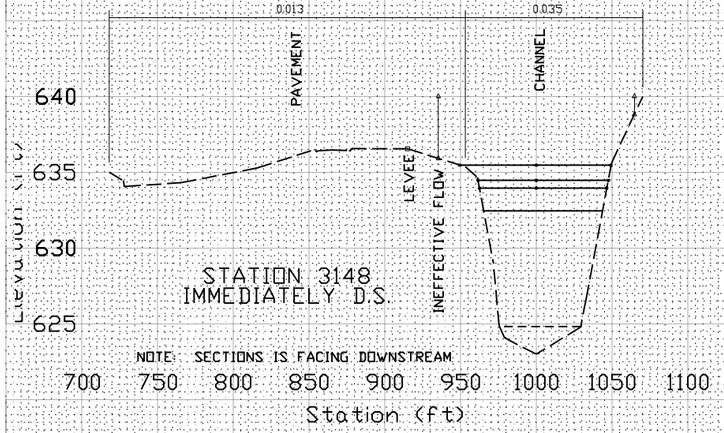
Exhibit P
Surveyed Cross Sections

CONTRACT NO. ___

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
---	---	---	---	---

STA. _____ TO STA. _____

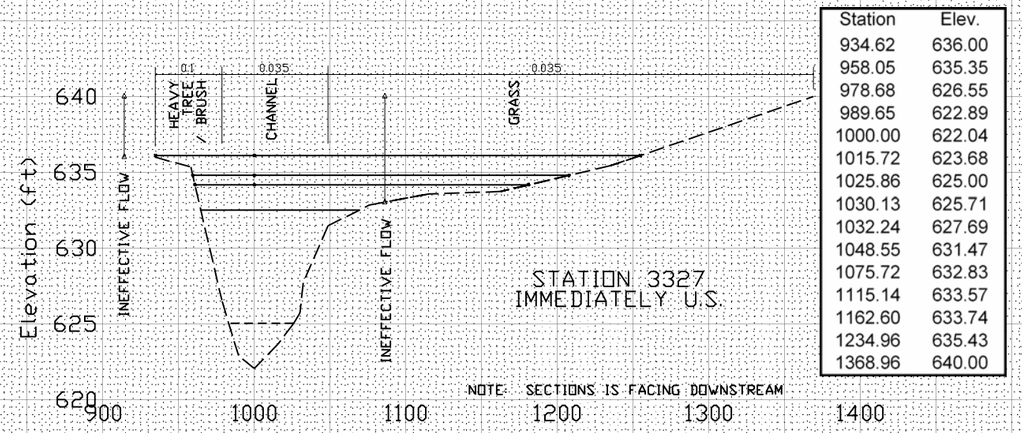
FED. ROAD DIST. NO. _ | ILLINOIS | FED. AID PROJECT



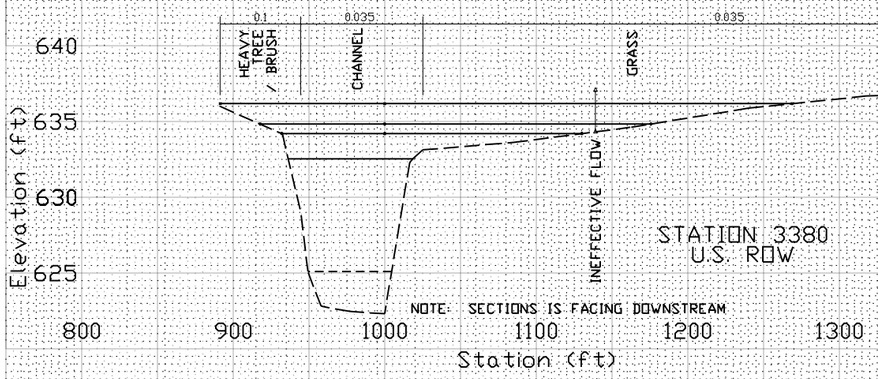
Station	Elev.
718.10	634.99
727.55	634.44
728.22	634.03
729.09	634.06
765.83	634.32
815.81	635.28
854.35	636.52
854.94	636.33
856.00	636.42
865.25	636.46
876.37	636.44
877.36	636.39
877.96	636.57
915.13	636.55
953.12	635.36
961.25	634.66
971.90	628.97
975.59	624.86
979.02	624.08
1000.00	622.99
1029.42	624.77
1032.82	626.60
1049.64	635.61
1070.41	640.00

Legend

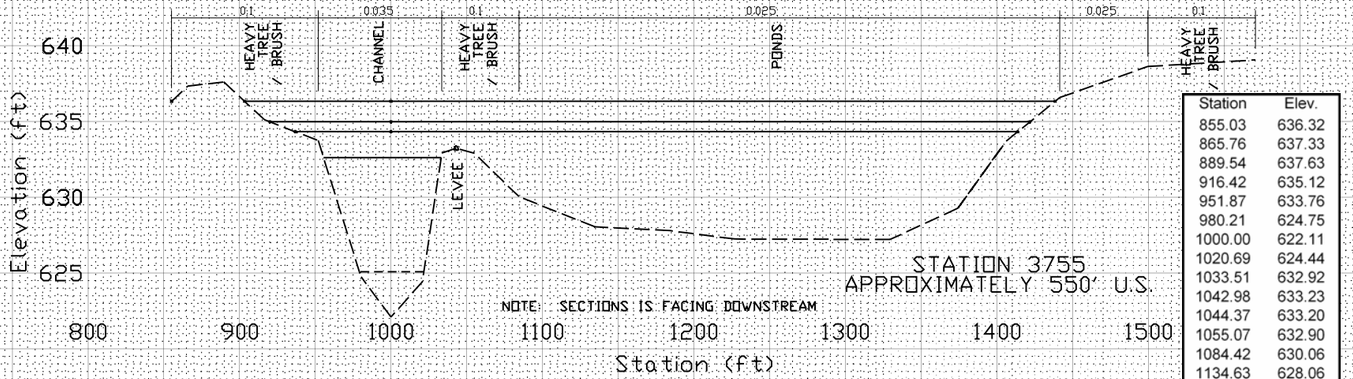
- WS 500-year
- WS 100-year
- WS 50-year
- WS 10-year
- WS NORMAL



Station	Elev.
934.62	636.00
958.05	635.35
978.68	626.55
989.65	622.89
1000.00	622.04
1015.72	623.68
1025.86	625.00
1030.13	625.71
1032.24	627.69
1048.55	631.47
1075.72	632.83
1115.14	633.57
1162.60	633.74
1234.96	635.43
1368.96	640.00



Station	Elev.
891.40	636.00
932.57	634.18
944.50	629.13
949.28	625.11
958.01	622.82
977.15	622.47
1000.00	622.32
1016.57	632.30
1019.06	632.59
1025.27	633.14
1067.43	633.49
1084.68	633.63
1162.07	634.62
1240.18	635.88
1317.76	636.69
1395.69	637.08



Station	Elev.
855.03	636.32
865.76	637.33
889.54	637.63
916.42	635.12
951.87	633.76
980.21	624.75
1000.00	622.11
1020.69	624.44
1033.51	632.92
1042.98	633.23
1044.37	633.20
1055.07	632.90
1084.42	630.06
1134.63	628.06
1184.29	627.80
1226.86	627.25
1288.87	627.24
1329.26	627.22
1374.09	629.29
1405.91	633.70
1441.25	636.58
1499.51	638.63
1570.41	639.07

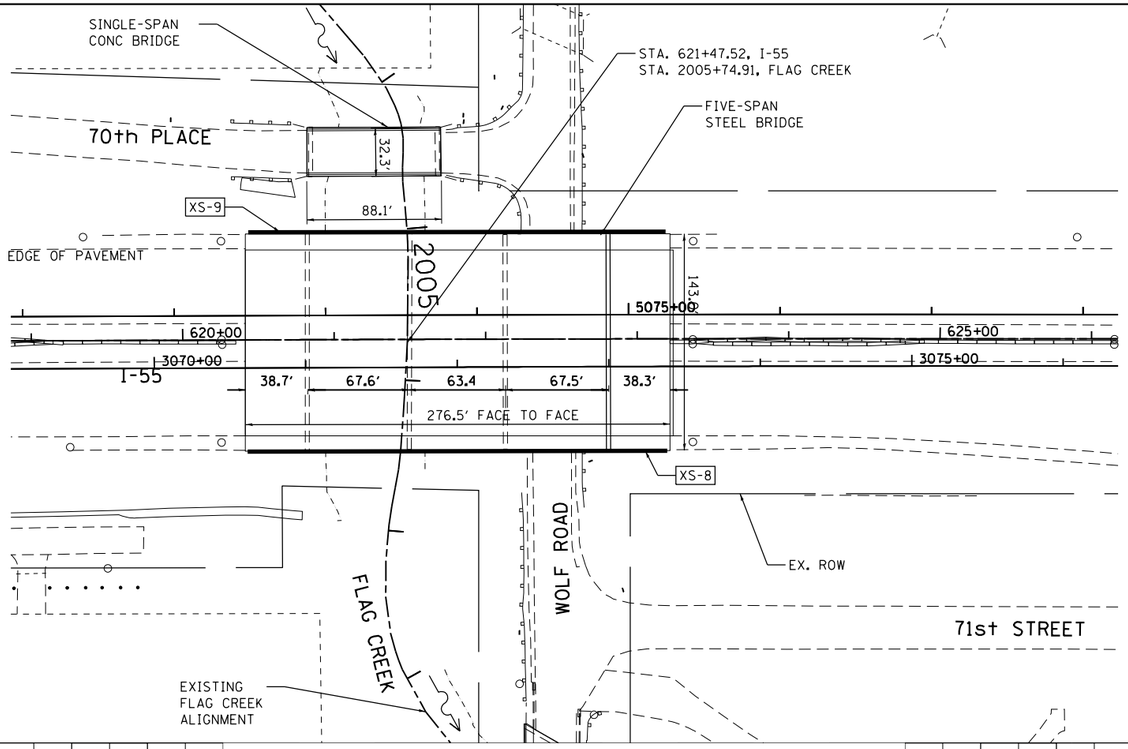
Note: Field Survey completed 07/2009

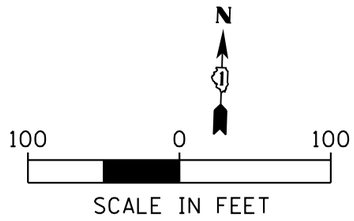
Exhibit P
Surveyed Cross Sections

TAB 10

SECTION 10

BRIDGE LAYOUT / PLAN DRAWING PLOTS

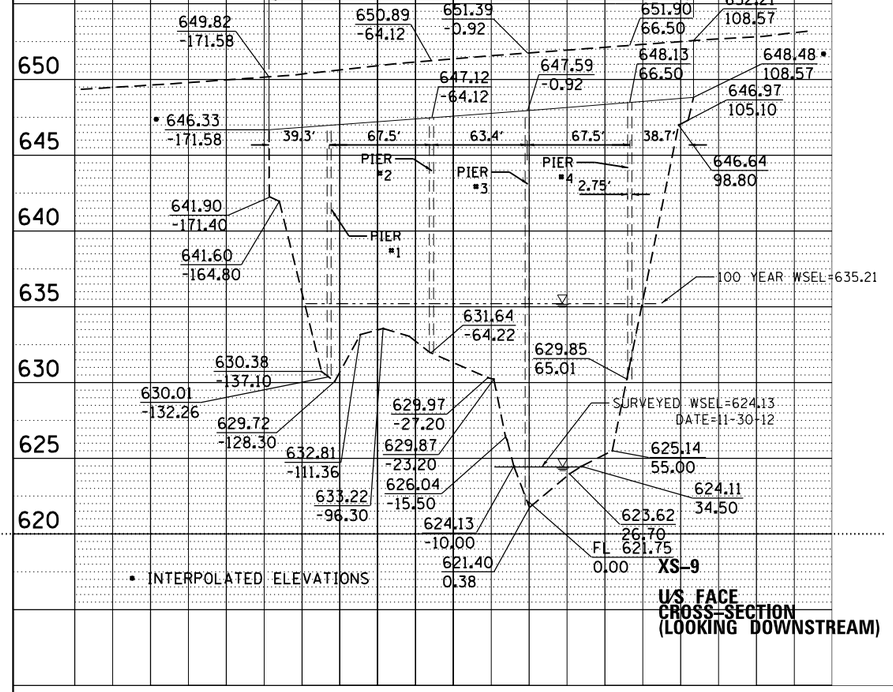




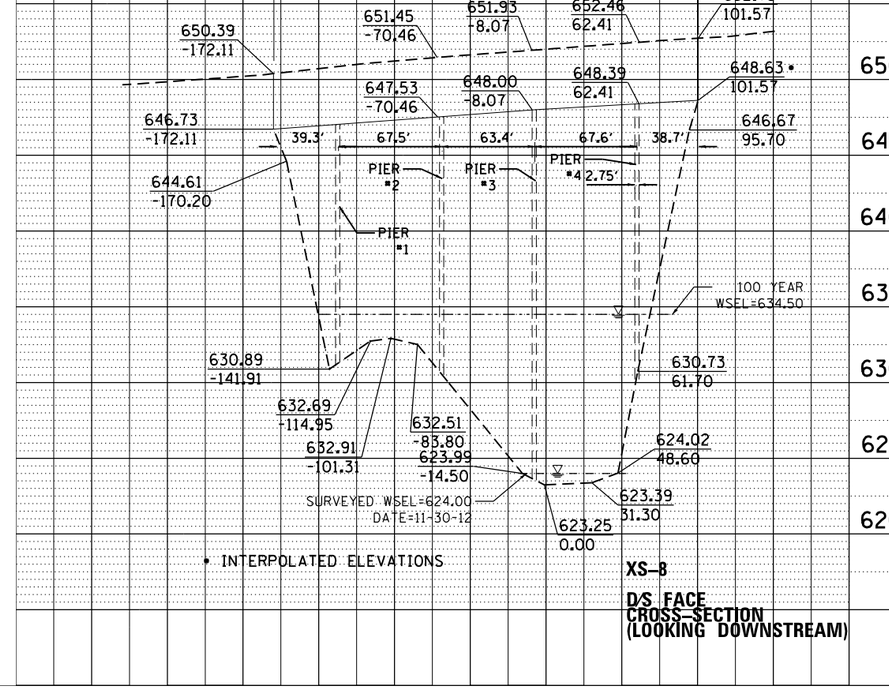
NOTE:
WATER SURFACE ELEVATION AS SURVEYED
BY CBBEL DATED:11-30-12

PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
PROFILE CHECKED
BM. NOTED
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE



XS-9
U/S FACE
CROSS-SECTION
(LOOKING DOWNSTREAM)



XS-8
D/S FACE
CROSS-SECTION
(LOOKING DOWNSTREAM)

FILE NAME = N:\ldot\110203.00001\CADD_Sheets\P1110203-sht-detail08_1.dgn	USER NAME = eburke	DESIGNED - EB	REVISED -
		DRAWN - MYG	REVISED -
Default	PLOT SCALE = 100.0000 ' / in.	CHECKED - IAD	REVISED -
	PLOT DATE = 9/28/2016	DATE - 9/28/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

BRIDGE LAYOUT /PLAN DRAWING PLOTS
I-55 OVER FLAG CREEK

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

INDEX OF SHEETS

'B'	
1	COVER SHEET
2	TYPICAL SECTIONS
3	SUMMARY OF QUANTITIES, GENERAL NOTES AND NAME PLATES
4	PLAN AND PROFILE - MAINLINE
5	PLAN AND PROFILE - FRONTAGE ROADS 1 AND 5
6	PLAN AND PROFILE, 70th PLACE
7	TEST BORINGS
8	GENERAL PLAN AND ELEVATION
9	ABUTMENT DETAILS
10	WINGWALL AND MISCELLANEOUS ABUTMENT DETAIL
11	PIERS 1 AND 5
12	PIERS 2 AND 6
13	PIERS 3 AND 7
14	PIERS 4 AND 8
15	SUPERSTRUCTURE - SLAB DETAILS
16	THEORETICAL GRADE ELEVATIONS AND MISCELLANEOUS DETAILS
17	SUPERSTRUCTURE - FRAMING PLAN
18	BEARINGS AND EXPANSION GUARD DETAILS AT WEST ABUTMENT
18A	SLIDING PLATE EXPANSION GUARD DETAIL AT EAST ABUTMENT
19	ALUMINUM HANDRAIL AND PARAPET DETAILS
19A	METAL HANDRAIL DETAILS
20	STEEL PLATE BEAM GUARD RAIL POST SPACING
21	GENERAL PLAN, ELEVATION AND DECK DETAILS - 70th PLACE
22	ABUTMENT DETAILS, 70th PLACE
23	LOCATION OF BORROW FURNISHED BY THE STATE
24 - 25 B	LOCATION OF BORROW CROSS SECTIONS
26 - 27	MAINLINE CROSS SECTIONS (FRONTAGE ROAD NO. 1 INCLUDED)
28	CROSS SECTIONS - FRONTAGE ROAD NO. 5
29 - 30	CROSS SECTIONS - 70th PLACE
31	STD 1607-3
32	STD 1386-2 STD 2183-1
33	STD 1972-1 STD 2114 STD 1971-5 STD 1838-2
34	STD 2135 STD 1527-2 STD 1516-5
35	STD 10-SS 504
36-38	CRITICAL PATH SCHEDULE
39-40	CRITICAL PATH SCHEDULE DESCRIPTION

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS
PLANS FOR PROPOSED
FEDERAL AID HIGHWAY

F.A.I. ROUTE 55 SEC. 0202-602-HB

FLAG CREEK AND WOLF ROAD OVERPASS

SOUTHWEST EXPRESSWAY

PROJECT I-55-7(64)272

COOK COUNTY

FEDERAL AID PROJECT NO.	SEC.	COUNTY	TOTAL SHEETS	SHEET NO.
FAI 55	0202-602-HB	COOK	40	1
FED. ROAD DIST. NO. 7	ILLINOIS	PROJECT I-55-7(64)272		

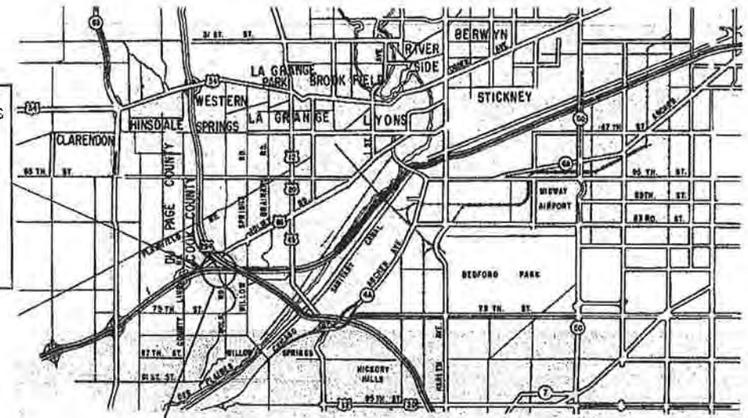
LOCATION OF SECTION INDICATED THUS:-

APPROVED
FOR STRUCTURAL ADEQUACY ONLY
W.E. Bauman 12/20/62
Engineer of Design

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS
SUBMITTED 12-14-62 Marshall Sulzer DISTRICT ENGINEER
EXAMINED December 31, 1962 ENGINEER OF ROAD PLANS AND CONTRACTS
PASSED December 31, 1962 ENGINEER OF DESIGN
APPROVED December 31, 1962 CHIEF HIGHWAY ENGINEER
APPROVED December 31, 1962 DIRECTOR

SECTION 0202-602 HB

THE WORK UNDER THIS SECTION INCLUDES THE COMPLETE CONSTRUCTION OF THE 5-SPAN WF BEAM STRUCTURE CARRYING F.A.I. ROUTE 55 (SOUTHWEST EXPRESSWAY) OVER WOLF ROAD AND FLAG CREEK AT STATION 1140+41.64, SPANS 40'-4", 67'-6", 63'-3", 67'-6" AND 40'-4"; THE SINGLE SPAN PRESTRESSED CONCRETE I BEAM BRIDGE CARRYING 70th PLACE OVER FLAG CREEK; FRONTAGE ROADS NO. 1 AND NO. 5 AND 70th PLACE IMPROVEMENTS AND ALL APPURTENANT AND COLLATERAL WORK NECESSARY TO COMPLETE THE PROJECT AS SPECIFIED IN THE STANDARD SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS.



N

EXPRESS 10

GROSS LENGTH OF PROJECT	282.41 FT.	(0.0535 MILES)
NET LENGTH OF PROJECT	282.41 FT.	(0.0535 MILES)

PLANS PREPARED BY
DE LEUW, CATHER & CO.
ENGINEERS CHICAGO.

REVIEWED BY: [signature] 12-18-62 EXPRESSWAY DESIGN ENGINEER
EXAMINED BY: [signature] 12-14-62 DISTRICT CONSTRUCTION ENGR.
EXAMINED BY: Robert E. Kraut 12-14-62 EXPRESSWAY ENGINEER
ENTIRE SECTION INSPECTED AND APPROVED AS TO POLICY
BY: Marshall Sulzer 12-14-62 DISTRICT ENGINEER

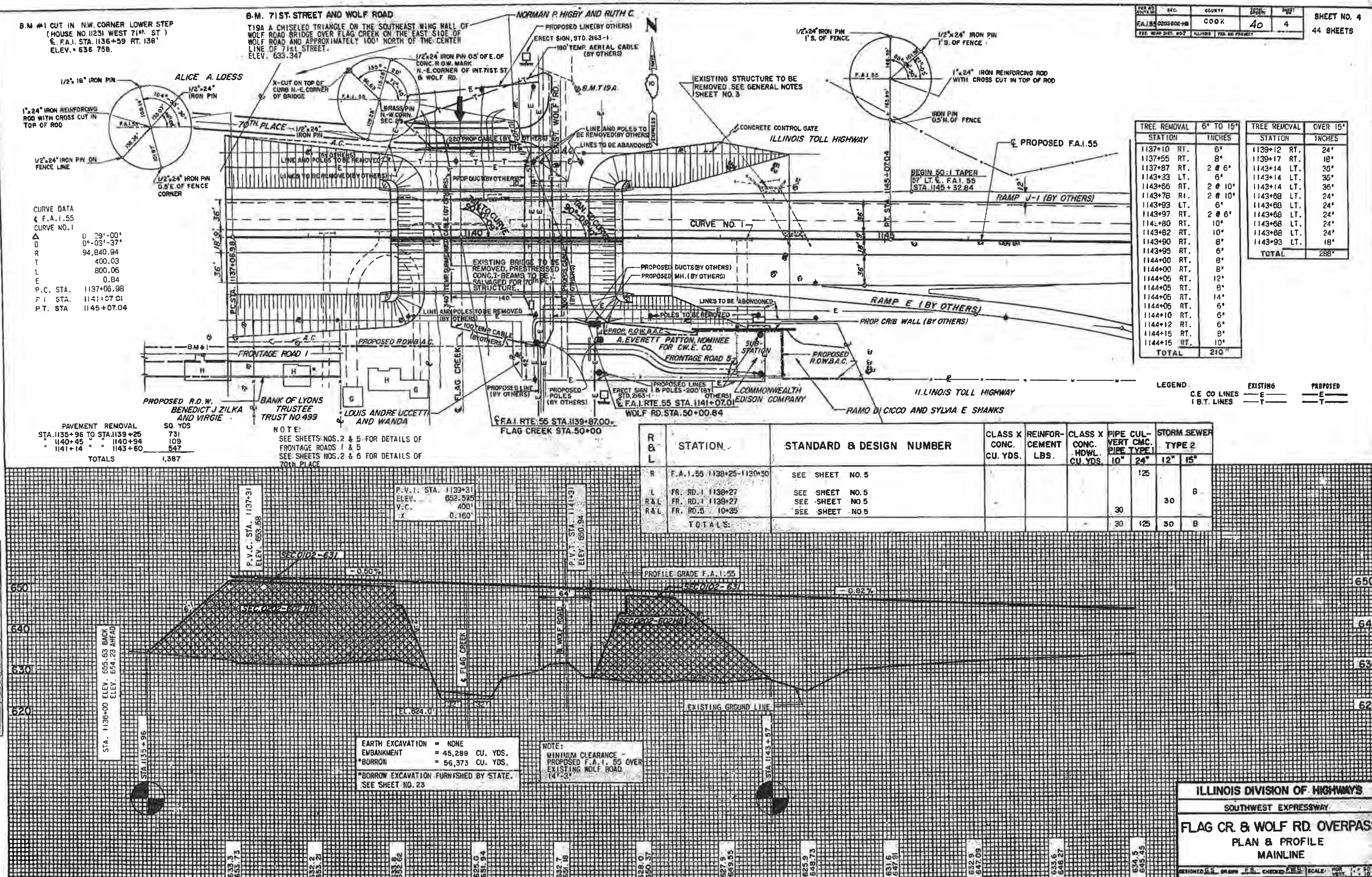
DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
APPROVED
DIVISION ENGINEER DATE

JOB NO 22795
Revision 12-20-62 Removed "B" section and all references thereto. W.E.B.

COOK COUNTY SECTION 0202- F.A.I. ROUTE 55

FED. AID ROUTE NO.	SEC.	COUNTY	TOTAL SHEETS	SHEET NO.
F.A.I. 55	0203-602-HB	COOK	40	4

SHEET NO. 4
44 SHEETS



CURVE DATA
℄ F.A.I. 55
CURVE NO. 1

Δ	0 29'-00"
D	0°-03'-37"
R	94,840.94
T	400.03
L	800.06
E	0.84
P.C. STA.	1137+06.98
P.I. STA.	1141+07.01
P.T. STA.	1145+07.04

PAVEMENT REMOVAL	SQ. YDS
STA. 1135+96 TO STA. 1139+25	731
" 1140+45 " " 1140+94	109
" 1141+14 " " 1143+60	547
TOTALS	1,387

NOTE:
SEE SHEETS NOS. 2 & 5 FOR DETAILS OF FRONTAGE ROADS 1 & 5
SEE SHEETS NOS. 2 & 6 FOR DETAILS OF 70th PLACE

TREE REMOVAL STATION	6" TO 15" INCHES
1137+10 RT.	6"
1137+55 RT.	8"
1137+87 RT.	2 @ 6"
1143+33 LT.	6"
1143+66 RT.	2 @ 10"
1143+78 RT.	2 @ 10"
1143+93 LT.	6"
1143+97 RT.	2 @ 6"
1143+80 RT.	10"
1143+82 RT.	10"
1143+90 RT.	8"
1143+95 RT.	6"
1144+00 RT.	8"
1144+00 RT.	8"
1144+05 RT.	12"
1144+05 RT.	8"
1144+05 RT.	14"
1144+05 RT.	6"
1144+10 RT.	6"
1144+12 RT.	6"
1144+15 RT.	8"
1144+15 RT.	10"
TOTAL	210"

TREE REMOVAL STATION	OVER 15" INCHES
1139+12 RT.	24"
1139+17 RT.	18"
1143+14 LT.	30"
1143+14 LT.	36"
1143+14 LT.	36"
1143+68 LT.	24"
1143+68 LT.	24"
1143+68 LT.	24"
1143+68 LT.	24"
1143+68 LT.	24"
1143+93 LT.	18"
TOTAL	288"

LEGEND

	EXISTING	PROPOSED
C.E. CO LINES	—E—	—E—
I.B.T. LINES	—T—	—T—

R & L	STATION	STANDARD & DESIGN NUMBER	CLASS X CONC. CU. YDS.	REINFORCEMENT LBS.	CLASS X CONC. HDWL. CU. YDS.	PIPE CULVERT CMC. PIPE TYPE 1 10"	PIPE CULVERT CMC. PIPE TYPE 1 24"	STORM SEWER TYPE 2 12"	STORM SEWER TYPE 2 15"
R	F.A.I. 55 1138+25-1139+50	SEE SHEET NO. 5					125		
L	FR. RD. 1 1138+27	SEE SHEET NO. 5							8
R&L	FR. RD. 1 1138+27	SEE SHEET NO. 5						30	
R&L	FR. RD. 5 10+35	SEE SHEET NO. 5				30			
	TOTALS:				-	30	125	30	8

EARTH EXCAVATION	= NONE
EMBANKMENT	= 45,289 CU. YDS.
*BORROW	= 56,373 CU. YDS.

*BORROW EXCAVATION FURNISHED BY STATE. SEE SHEET NO. 23

ILLINOIS DIVISION OF HIGHWAYS
SOUTHWEST EXPRESSWAY
FLAG CR. & WOLF RD. OVERPASS
PLAN & PROFILE
MAINLINE

JOB NO 1179

SECT. NO.	ROUTE	COUNTY	TOTAL SHEETS	SHEET NO.
I-88	0302-103	COOK	40	8

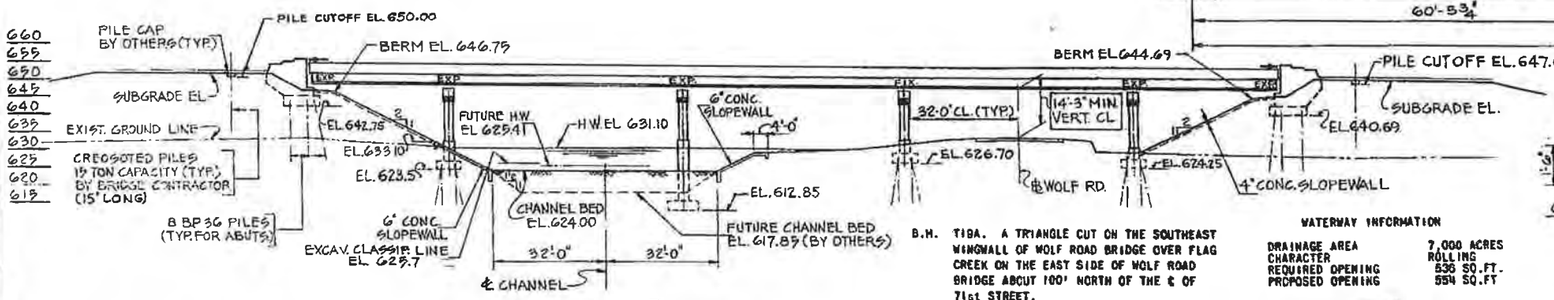
SHEET NO. 8
44 SHEETS

STA. 49+00 EL. 633.0' — STA. 50+00 EL. 632.76 — STA. 51+00 EL. 632.68

PROFILE EXIST. WOLF RD. ℄

P.V.C. STA. 1137+31 — P.V.I. STA. 1139+31, EL. 652.575, VC = 400', X = .160' — P.V.T. STA. 1141+31 — −.50% — −.819%

PROFILE GRADE F.A.I. 55



ELEVATION

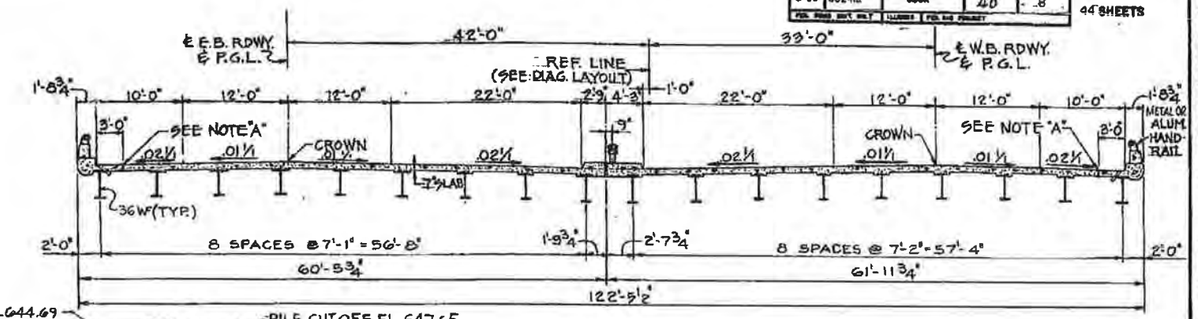
SCALE: 1" = 20'

FOR CONTINUATION OF SLOPEWALL SEE SHT. 21

B.H. TIBA. A TRIANGLE CUT ON THE SOUTHEAST WINGWALL OF WOLF ROAD BRIDGE OVER FLAG CREEK ON THE EAST SIDE OF WOLF ROAD BRIDGE ABOUT 100' NORTH OF THE ℄ OF 71st STREET. EL. 633.347

WATERWAY INFORMATION

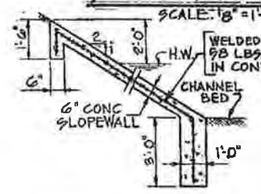
DRAINAGE AREA	7,000 ACRES
CHARACTER	ROLLING
REQUIRED OPENING	536 SQ. FT.
PROPOSED OPENING	554 SQ. FT.



NOTE "A": LONGITUDINAL BONDED CONST. JT. (DO NOT EDGE)

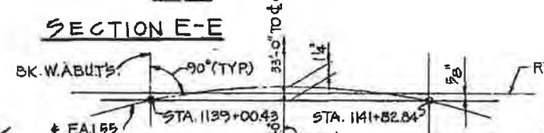
SECTION A-A

SCALE: 1" = 1'-0"



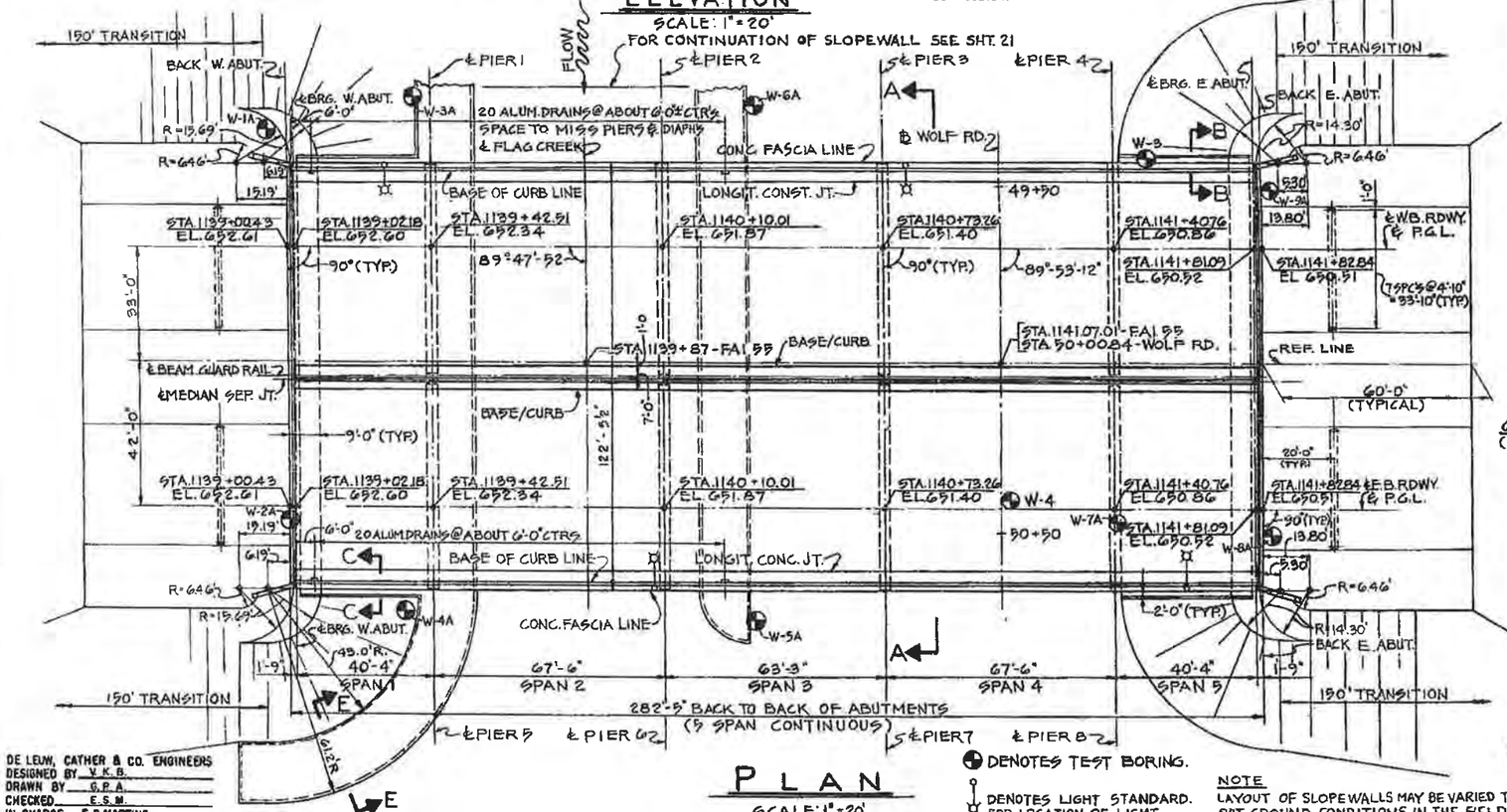
WELDED WIRE FABRIC 6"×6" MESH #4 WIRES 58 LBS. PER 100 SQ. FT. COST INCLUDED IN CONTRACT UNIT PRICE FOR SLOPEWALL

SECTION E-E



DIAGRAMMATIC LAYOUT
NOT TO SCALE

LOCATION PLAN



PLAN

SCALE: 1" = 20'

⊕ DENOTES TEST BORING.

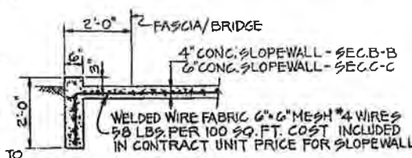
DENOTES LIGHT STANDARD. FOR LOCATION OF LIGHT STANDARDS SEE SH. 19.

NOTE
LAYOUT OF SLOPEWALLS MAY BE VARIED TO SUIT GROUND CONDITIONS IN THE FIELD AS DIRECTED BY THE ENGINEER.

BILL OF MATERIAL

ITEM	UNIT	QUANTITY
CLASS A EXCAVATION FOR STRUCTURE	CU. YD.	33
CLASS B EXCAVATION FOR STRUCTURE	CU. YD.	139
FURNISHING CREOSOTED PILES UP TO 20 FT.	LIN. FT.	480
DRIVING TIMBER PILES	LIN. FT.	480
SLOPE WALL 4 INCH	SQ. YD.	589
SLOPEWALL 6 INCH *	SQ. YD.	1816

* INCLUDES SLOPEWALL DETAILED ON SH. 21.



WELDED WIRE FABRIC 6"×6" MESH #4 WIRES 58 LBS. PER 100 SQ. FT. COST INCLUDED IN CONTRACT UNIT PRICE FOR SLOPEWALL.

SECTION B-B
SECTION C-C

NOTES:
DESIGN LOADING: A.A.S.H.O. H 20 S16.
DESIGN STRESSES:
f_c = 1400 PSI SUPERSTRUCTURE AND SUBSTRUCTURE.
f_c = 1000 PSI SUBSTRUCTURE WITH EARTH PRESSURE.
f_s = 20,000 PSI REINFORCEMENT BARS.
f_s = 20,000 PSI STRUCTURAL STEEL A-36.
v = 75 PSI SHEAR IN FOOTINGS.
A-36 STEEL TO BE USED FOR ALL STRINGERS & SPLICES; A-36 STEEL FOR ALL OTHER MEMBERS ALSO.

DE LEUW, CATHER & CO. ENGINEERS
DESIGNED BY V. K. B.
DRAWN BY G. P. A.
CHECKED E. S. M.
IN CHARGE E. S. MARTINS
APPROVED L. N. RIAN

JOB NO. 1179

ILLINOIS DIVISION OF HIGHWAYS
SOUTHWEST EXPRESSWAY
FLAG CR. & WOLF RD. OVERPASS
GENERAL PLAN AND ELEVATION
STATION 1140+41.64
SCALE: — DATE:

Revision 12-20-62 Removed "F" section designation from title block. Removed design unit stresses for A-7 steel. M.L.K.

FED. AID ROUTE NO.	SEC.	COUNTY	TOTAL SHEETS	SHEET NO.
I-55	0202-602-HB	COOK	40	7
FED. ROAD DIST. NO. 7	ILLINOIS	FED. AID PROJECT I-55-7(64)178		

SHEET NO. 7
44 SHEETS

TEST BORING NO. W-1A
STATION 1138+94
OFFSET 66.5 FT. LT.

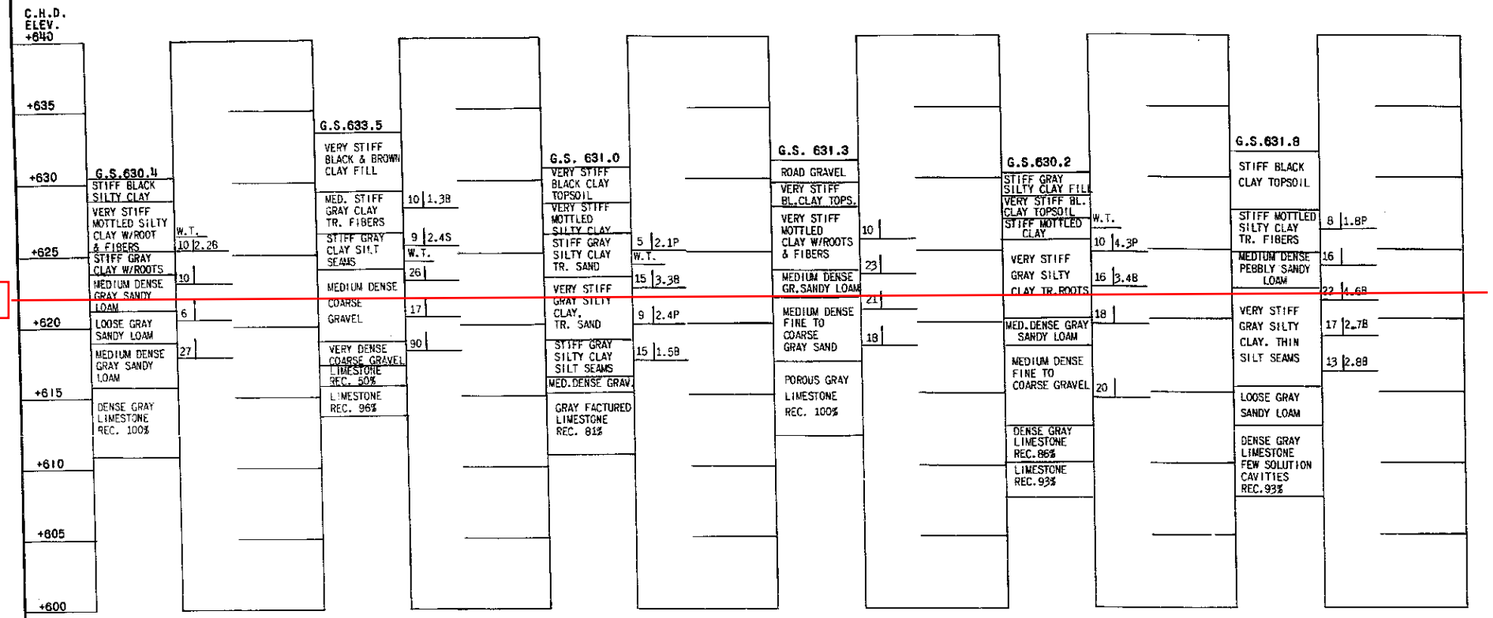
TEST BORING NO. W-2A
STATION 1139+00
OFFSET 44 FT. RT.

TEST BORING NO. W-3A
STATION 1139+37
OFFSET 76.5 FT. LT.

TEST BORING NO. W-4A
STATION 1139+34
OFFSET 72 FT. RT.

TEST BORING NO. W-5A
STATION 1140+36
OFFSET 74.5 FT. RT.

TEST BORING NO. W-6A
STATION 1140+36
OFFSET 73.5 FT. LT.



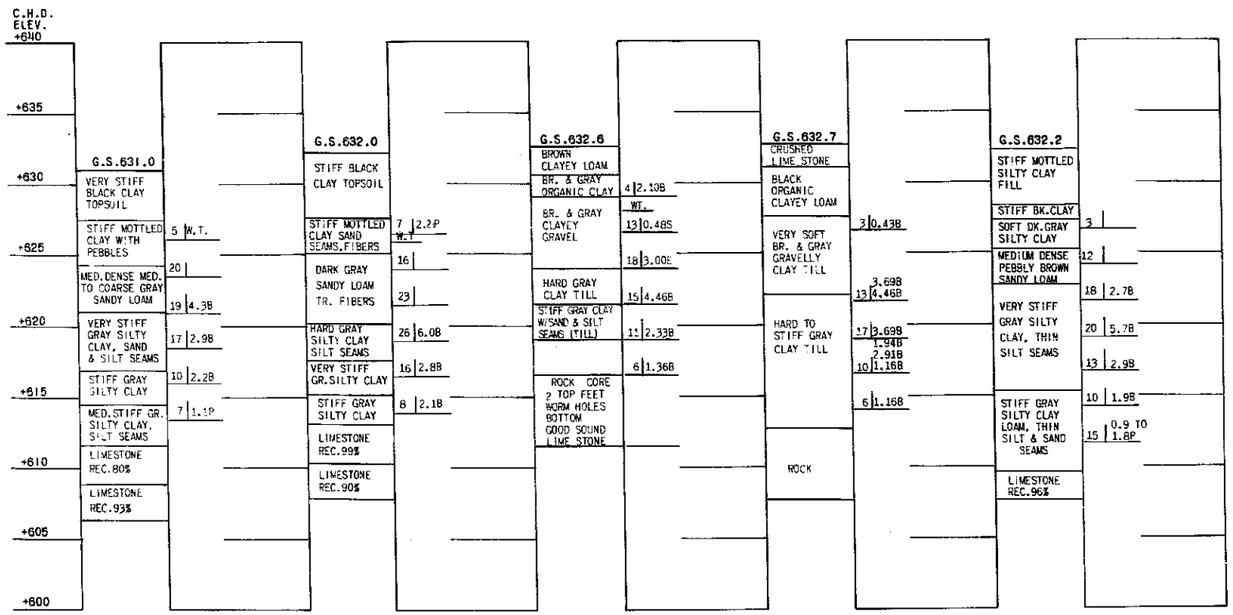
TEST BORING NO. W-7A
STATION 1141+42
OFFSET 46 FT. RT.

TEST BORING NO. W-8A
STATION 1141+86
OFFSET 47 FT. RT.

TEST BORING NO. W-4
STATION 1141+10
OFFSET 38.5 FT. RT.

TEST BORING NO. W-3
STATION 1141+50.5
OFFSET 62 FT. LT.

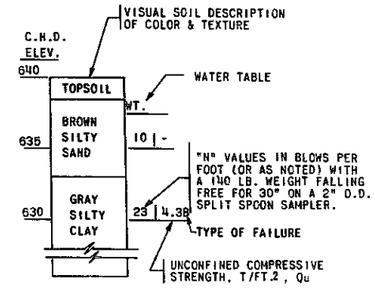
TEST BORING NO. W-9A
STATION 1141+88
OFFSET 50 FT. LT.



DE LEUW, CATHER & CO. ENGINEERS
DESIGNED BY M.H. SALISBURY
DRAWN BY J.L. PARAL
CHECKED M.H. SALISBURY
IN CHARGE E.S. MARTINS
APPROVED L.N. RIAN

JOB NO. 1179

TEST BORING LOG GENERAL NOTES



CONSISTENCY	N-VALUES	Qu-VALUES
VERY SOFT	0 - 2	0 - 0.25
SOFT	2 - 4	0.25 - 0.50
MEDIUM	4 - 8	0.50 -- 1.00
STIFF	8 - 15	1.00 - 2.00
VERY STIFF	15 - 30	2.00 - 4.00
HARD	OVER 30	OVER 4.00

RELATIVE DENSITY	N-VALUES
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM	10 - 30
DENSE	30 - 50
VERY DENSE	OVER . 50

TYPE OF FAILURE

B = BULGE
S = SHEAR
E = ESTIMATED
P = PENETROMETER

TEST BORING LOGS AND TEST DATA WERE FURNISHED BY THE ILLINOIS DIVISION OF HIGHWAYS.

ILLINOIS DIVISION OF HIGHWAYS
SOUTHWEST EXPRESSWAY
FLAG CR. & WOLF RD. OVERPASS
TEST BORINGS

SCALE: NO SCALE | DATE

FA RTE	SECTION	COUNTY	TOTAL SHEET NO.	SHEET NO.
FA. I-55	**	COOK	280	1
F.H.W.A. REG.		U.S. ROUTE	PROJECT NHI-55-7(187)275	

**(0101, 0101-639 & 0102-631)R &
(0101-601HB & 0202-602HB)R

D-91-339-93

LOCATION OF SECTION INDICATED THUS: - ■ -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

PLANS FOR PROPOSED
FEDERAL AID HIGHWAY

FOR INDEX OF SHEETS, SEE DRAWING NO. 2

SCALES: { LIGHTING PLAN 1 INCH = 50 FT.
PROFILE HOR. 1 INCH = 50 FT.
PROFILE VERT 1 INCH = 5 FT.
CROSS-SECTIONS 1 INCH = 10 FT.

FAI ROUTE 55 (STEVENSON EXPRESSWAY)

COUNTY LINE ROAD TO WILLOW SPRINGS ROAD

FOR UNDERGROUND UTILITY LOCATIONS CALL J.U.L.I.E. 1-800-892-0123 TOLL FREE

SECTION (0101, 0101-639 & 0102-631)R & (0101-601HB & 0202-602HB)R
PROJECT: NHI-55-7(187)275
COOK COUNTY
C-91-115-94

SCOPE OF WORK

1. RECONSTRUCT WB I-55 FROM COUNTY LINE ROAD TO RAMP AB
2. CONSTRUCT OUTER AUXILIARY LANE BETWEEN RAMPS ALONG EB AND WB I-55 FROM COUNTY LINE ROAD TO I-294
3. PROVIDE PAVED MEDIAN WITH CONCRETE MEDIAN BARRIER FROMRAMP ABTO EAST PROJECT LIMITS.
4. RESURFACE EB AND WB I-55 FROM COUNTY LINE ROAD TO EAST PROJECT LIMITS
5. RESTRIPE WB JOLIET ROAD
6. RECONSTRUCT BRIDGES
   A. WB I-55 OVER EB JOILIET ROAD
   B. I-55 OVER WOLF ROAD AND FLAGG CREEK
7. CONSTRUCT RETAINING WALLS AT BRIDGE OVER FLAGG CREEK
8. CONSTRUCT NOISE ABATEMENT WALL ON SOUTH SIDE FROM RAMP AB TO RAMP J
9. PERFORM VARIOUS GRADING, DRAINAGE, SIGNING, LIGHTING, SURVEILANCE, AND LANDSCAPING IMPROVEMENTS

DESIGN DESIGNATION

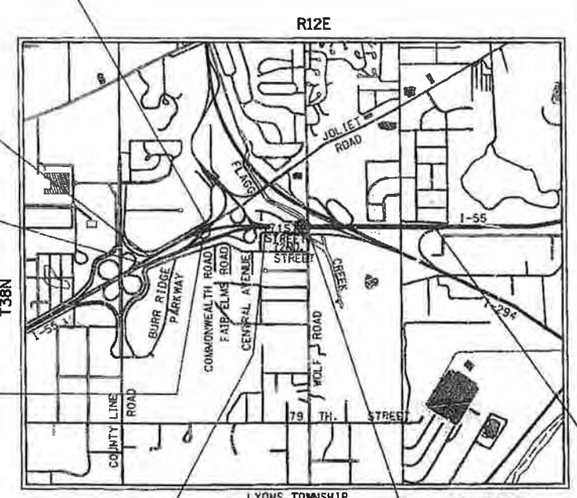
6600 (10) TRUNK (PCC-20) - WB
7000 (10) TRUNK (PCC-20) - EB

PROJECT LOCATED IN THE VILLAGES OF INDIAN HEAD PARK, COUNTRYSIDE AND BURR RIDGE.

IMPROVEMENT ENDS
STA. 1116+00 JOLIET ROAD

IMPROVEMENT BEGINS
STA. 1095+00 WB ℄

IMPROVEMENT BEGINS
STA. 1095+00.00 EB ℄



LOCATION MAP
SCALE : 1" = 0.40 MILES

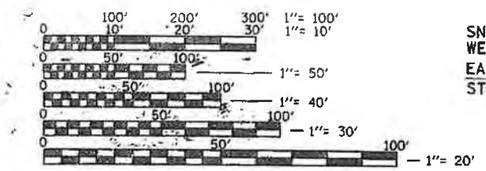
SN 016-0001
WESTBOUND INTERSTATE 55 OVER
EASTBOUND JOLIET ROAD
STA. 1112+81.01 WB ℄

SN 016-0003
INTERSTATE 55 OVER
WOLF ROAD AND FLAGG CREEK
STA. 1141+07.01 M/L ℄

IMPROVEMENT ENDS
STA. 1176+00.00 M/L ℄

STATION EQUATION
STA. 1129+76.71 WB I-55 (BACK) =
STA. 1128+90.50 M/L I-55 (AHEAD)
STA. 1128+90.50 EB I-55 (BACK)

POSTED SPEED LIMIT = 55 MPH (I-55 EB)
= 55 MPH (I-55 WB)
AVERAGE DAILY TRAFFIC = 62,700 VPD (I-55 EB) 1990
64,600 VPD (I-55 WB) 1990



FULL SIZE PLANS HAVE BEEN PREPARED USING STANDARD ENGINEERING SCALES, REDUCED SIZED PLANS WILL NOT CONFORM TO STANDARD SCALES, IN MAKING MEASUREMENTS ON REDUCED PLANS, THE ABOVE SCALES MAY BE USED.

CONTRACT NO. 82686

PLANS PREPARED BY:
GANNETT FLEMING, INC.
222 S. RIVERSIDE PLAZA
SUITE 1860
CHICAGO, ILLINOIS 60606

JAMES M. BAUER — DESIGNED — LICENSED PROFESSIONAL ENGINEER — ILLINOIS
DATE: 11-3-96
LICENSE EXPIRES: 11-30-95
PAGES: 1-97, 172, 173, 241-244, 251-280

PIJUSH K. CHATTERJEE — DESIGNED — REGISTERED PROFESSIONAL ENGINEER — STATE OF ILLINOIS
DATE: 10-30-95
LICENSE EXPIRES: 11-30-95
PAGES: 174 TO 223 & 223a thru 223e

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUBMITTED Oct. 30, 1995 — DISTRICT ENGINEER
EXAMINED _____ 19____ — ENGINEER OF PLANS AND CONTRACTS
PASSED December 15 1995 — ENGINEER OF DESIGN
APPROVED December 15 1995 — DIRECTOR DIVISION OF HIGHWAYS

PRINTED UNDER THE AUTHORITY OF THE STATE OF ILLINOIS

NET LENGTH OF IMPROVEMENT I-55 - 8,100.00 FEET = 1.534 MILES.
NET LENGTH OF IMPROVEMENT EB JOLIET ROAD - 1401.92 FEET = 0.266 MILES.
NET LENGTH OF IMPROVEMENT WB JOLIET ROAD - 1401.95 FEET = 0.266 MILES

IDOT CONSULTANT PROJECT ENGINEER: MR. RICK YOUNG /(708) 705-4232

B.M. * 5X: "X" chisled in top of Southwest bolt of lightpole #SEF1 at the entrance ramp of I-294 North to I-55 South. Elev. 657.17

Existing Structure: S.N. 016-0003 is a 5 span, 282'-5" bk. to bk. of abutments bridge on stub abutments. Built as F.A.I. Rte.55, Sec. 0202-602-HB in 1963. Superstructure is 122'-5½" o. to o. R.C. slab with continuous W36 steel beams. Traffic shall be maintained during the rehabilitation by stage construction. No Salvage, except the existing aluminum handrail shall be removed and delivered to the District maintenance yard, as directed by the Engineer.

NOTES:

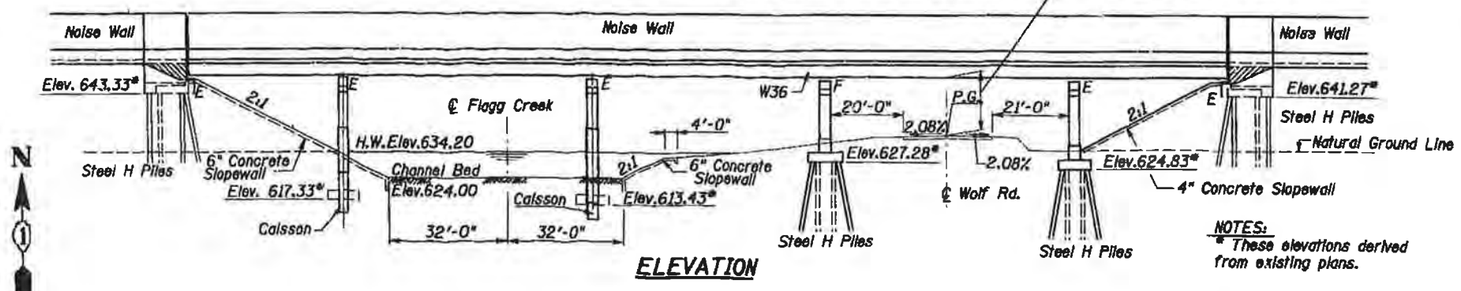
If the contractor chooses to alter the temporary cantilevered sheet piling design requirements shown on the plans for lesser design requirements, then full design submittals with the required seals will be expected by the Department, for review and approval.

● Remove, clean and relocate the existing name plates next to the new name plate. Cost included in Name Plate, each.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55	* *	COOK	200	139
STA.		TO STA.		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

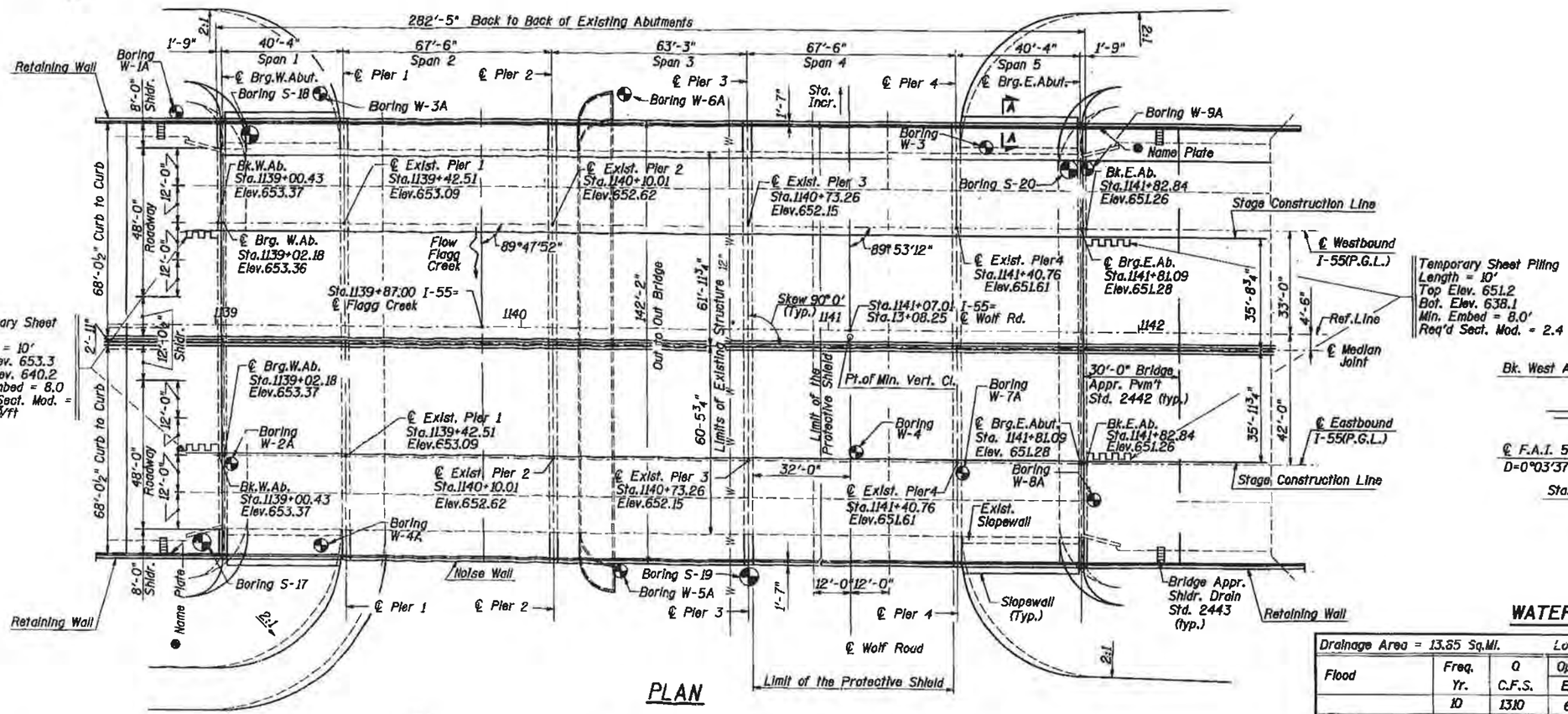
* * (0101, 0101-639 & 0102-631IR & (0101-601HB & 0202-602-HBIR

Sheet 1 of 33

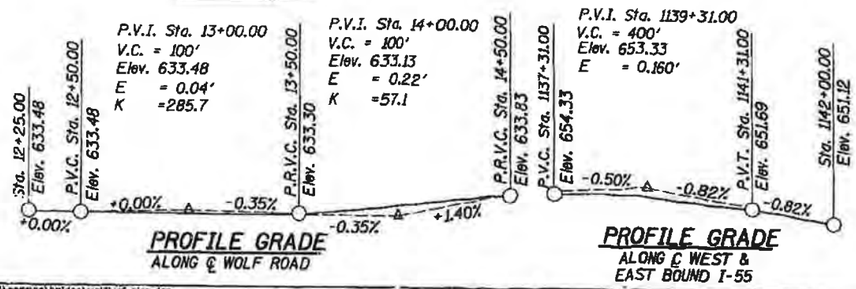


ELEVATION

NOTES:
* These elevations derived from existing plans.

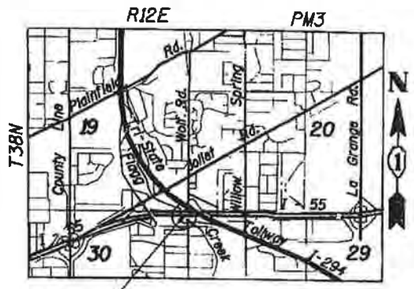


PLAN



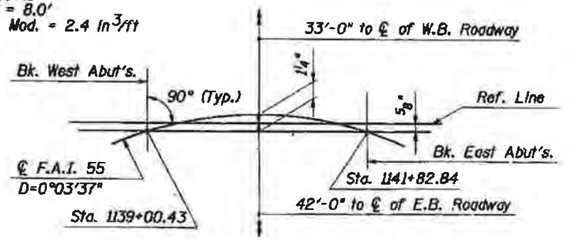
PROFILE GRADE
ALONG ℄ WOLF ROAD

PROFILE GRADE
ALONG ℄ WEST & EAST BOUND I-55



LOCATION SKETCH

CURVE (40)
P.I. Sta. = 1141+07.00
Δ = 0° 29' 00"
D = 0° 03' 37"
R = 94840.94'
T = 400.03'
L = 800.06'
E = 0.84'
SE = Normal Crown



DIAGRAMMATIC LAYOUT

WATERWAY INFORMATION

Drainage Area = 13.85 Sq.Mi. Low Grade Elev. = 651.20 ● Sta. 1141 + 82.84

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head-Ft. Exist.	Head-Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	1310	648.0	648.0	632.00	0.00	0.00	632.00	632.00
Design	50	2100	835.0	835.0	633.20	0.00	0.00	633.20	633.20
Base	100	2500	913.0	913.0	633.60	0.00	0.00	633.60	633.60
Max. Calc.	500								

APPROVED
FOR STRUCTURAL ADEQUACY ONLY
Ralph E. Anderson
Engineer of Bridges and Structures

THOMAS G. LEECH 061-005148 REGISTERED STRUCTURAL ENGINEER ILLINOIS
Nov. 3, 1995
LICENSE EXPIRES NOV. 30, 1996

REVISIONS	
Name	Date

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
GENERAL PLAN AND ELEVATION
I-55 OVER WOLF ROAD & FLAGG CREEK
COOK COUNTY
F.A.I. RTE. 55 STRUC. NO. 016-0003
SCALE: NONE DRAWN BY: JHF
DATE: NOV. 1995 CHECKED BY: GAS
GANNETT FLEMING, INC.
Chicago, Illinois

DATE: 24-Oct-95 14:14

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55	∘ ∘	COOK	31	16
STA.		TO STA.		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

∘ ∘ (0101-601-HB & 0202-602-HB)F Sheet F16 of 30

GENERAL NOTES

1. Fasteners shall be high strength bolts. Bolts $\frac{3}{4}$" ϕ, open holes $\frac{13}{16}$" ϕ, unless otherwise noted.

2. Calculated weight of Structural Steel =117,022 lbs.
   Structural Steel (M270, Grade 36): 117,022 lbs.

3. The Inorganic Zinc rich Primer/Acrylic/Acrylic paint system shall be used for shop and field painting of new Structural Steel except where otherwise noted. The color of the Acrylic finish coat shall be Munsell No. 2.5 YR 3/4, Reddish Brown.

* 4. Field welding of construction accessories will not be permitted to the bottom flange of beams or girders nor to the top flange for a distance equal to one-fourth the span length each way from the pier supports. Field welding in other areas will be permitted only when approved by the Engineer.

* 5. Anchor bolts shall be set before bolting diaphragms over supports.

6. The main load carrying member components subject to tensile stress shall conform to the Supplemental Requirements for Notch Toughness Zone 2. These components are the wide flange beams and all splice plate material except fill plates.

* 7. Reinforcement bars shall conform to the requirements of AASHTO M-31, M-42 or M-53 Grade 60.

* 8. Slope wall shall be reinforced with welded wire fabric, 6" x 6" - W4.0 x W4.0, weighing 58 lbs. per 100 sq. ft.

9. Plan dimensions and details relative to existing structure have been taken from existing plans and are subject to nominal construction variations. It shall be the Contractor's responsibility to verify such dimensions and details in the field and make necessary approved adjustments prior to construction or ordering of materials. Such variations shall not be cause for additional compensation for a change in the scope of the work, however, the Contractor will be paid for the quantity actually furnished at the unit price bid for the work.

10. Existing Plan elevations (dated 1962) plus a correction of +0.58' = New Plan Elevations (dated 1995).

11. Bearing seat surfaces shall be constructed or adjusted to the designated elevations within a tolerance of 1/8 inch. Adjustment shall be made either by grinding the surface or by shimming the bearing. Two 1/8" adjusting shims, of the dimension of the bottom bearing plate, shall be provided for each bearing in addition to all other plates or shims.

* 12. The contractor shall drive 4 steel test piles in a permanent location, one at each abutment and one at Piers 3 and 4, as directed by the Engineer before ordering the remainder of piles.

* 13. Bridge Seat Sealer shall be applied to the seat area of the west and east abutment.

* 14. Cost of Removal of Existing Handrail and Existing Wearing Surface is incidental to "Removal of Existing Concrete Deck".

* 15. For quantity of Temporary Concrete Barrier see Roadway Plans.

TOTAL BILL OF MATERIAL

ITEM	UNIT	STAGE I	STAGE II	TOTAL
Furnishing Structural Steel	L. Sum	0.08	0.09	0.17
Furnishing Elastomeric Bearing Assembly.Type II	Each	10	10	20
Furnishing Elastomeric Bearing Assembly.Type III	Each	10	10	20
Field Measurements	L. Sum			0.5

DESIGN SPECIFICATIONS

1992 AASHTO Specifications with 1993 and 1994 Interim Specifications

LOADING

Dead Loads:
Includes 25 psf for Future Wearing Surface.

Live Loads:
HS20-44 or Alternate Military Load.

SEISMIC DATA

Seismic Performance Category (SPC) = A
Bedrock Acceleration Coefficient = 0.04g
Site Coefficient (S) = 1.0

DESIGN STRESSES

Superstructure: f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fs = 20,000 psi (Structural Steel, M270 Grade 36)

Substructure: f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

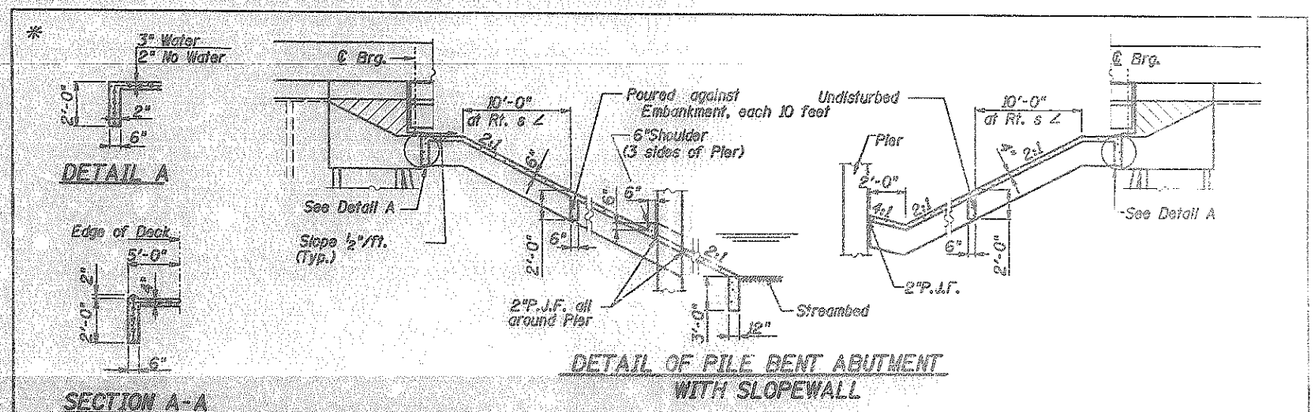
STATION 1141+07.01
BUILT 1996 BY
STATE OF ILLINOIS
F.A.I. RT. 55 SEC. 0202-602HB
F.A. PROJ. STPI-88-7 (165)276
LOADING HS20
STR. NO. 016-0003

* NAME PLATE DETAIL

* STANDARDS

2113 Name Plate for Bridges

*



DETAIL OF PILE BENT ABUTMENT WITH SLOPEWALL

Note: All material marked with an * is for information only.

REVISIONS	
Name	Date

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
GENERAL NOTES & BILL OF MATERIAL
I-55 OVER WOLF ROAD & FLAGG CREEK
COOK COUNTY
F.A.I. RTE. 55 STRUC. NO. 016-0003
SCALE: NONE DRAWN BY: JHF
DATE: SEPT. 1995 CHECKED BY: GAS

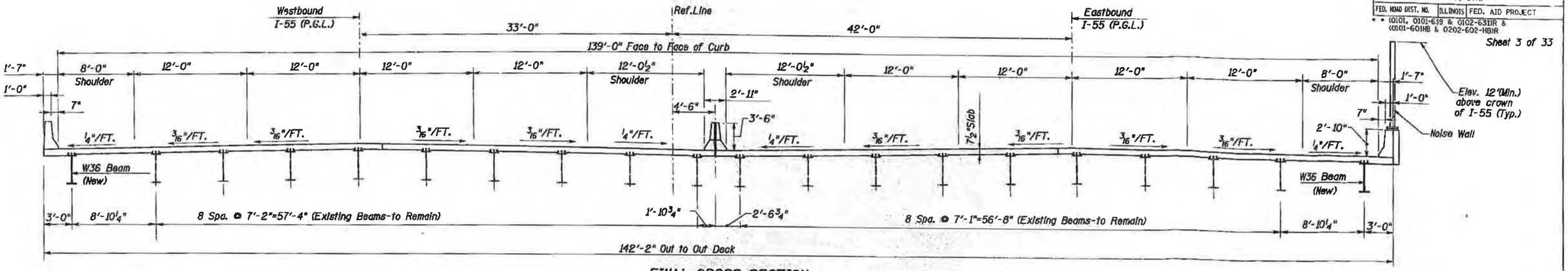
GANNETT FLEMING, INC.
Chicago, Illinois

DATE: 2-Oct-95 09:04

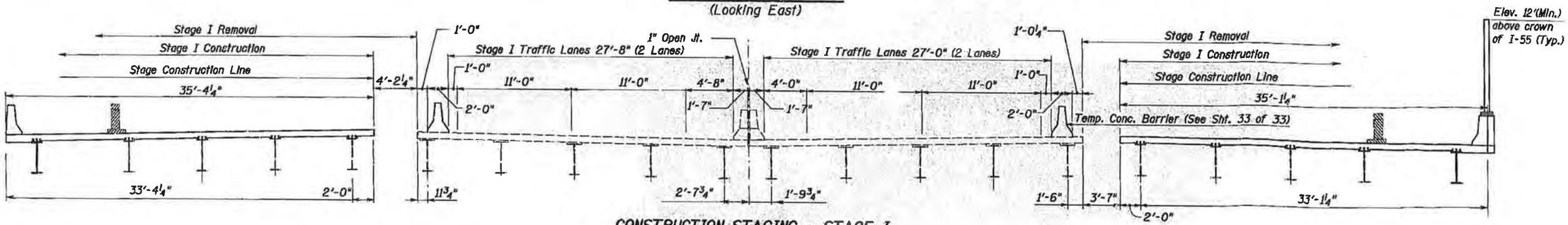
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55	* *	COOK	280	141
STA.		TO STA.		
FED. ROAD DIST. NO.	ILLINOIS	FED. AID PROJECT		

* * (0101, 0101-639 & 0102-631IR & (0101-601HB & 0202-602-HBIR

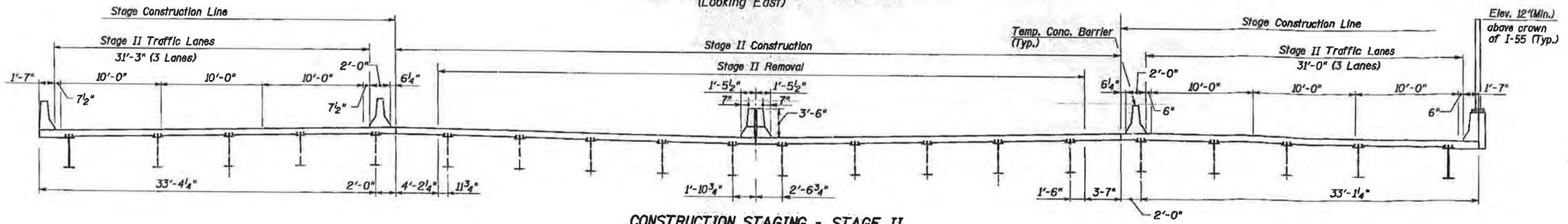
Sheet 3 of 33



FINAL CROSS SECTION
(Looking East)



CONSTRUCTION STAGING - STAGE I
(Looking East)



CONSTRUCTION STAGING - STAGE II
(Looking East)

BRIDGE CONSTRUCTION SEQUENCE

1. Implement Stage I Traffic Control. Install temporary concrete barrier in accordance with Standard R-27 on Sheet 33 of 33.
2. Stage I
   a. Install temporary sheeting
   b. Remove existing deck (Existing beams to remain)
   c. Remove existing abutment backwall to the top of beam seat and remove existing wing to 3' below profile grade
   d. Reset existing bearings at Piers 1, 2 and 4
   e. Construct new portions of abutment and pier
   f. Erect new beams and cast new deck and parapet
3. Implement Stage II Traffic Control.
4. Stage II
   a. Remove existing deck (Existing beams to remain)
   b. Remove existing abutment backwall to the top of beam seat and remove existing wing to 3' below profile grade
   c. Reset existing bearings at Piers 1, 2 and 4
   d. Construct new abutment and pier
   e. Erect new beams and cast new deck and parapet
   f. Remove temporary sheeting

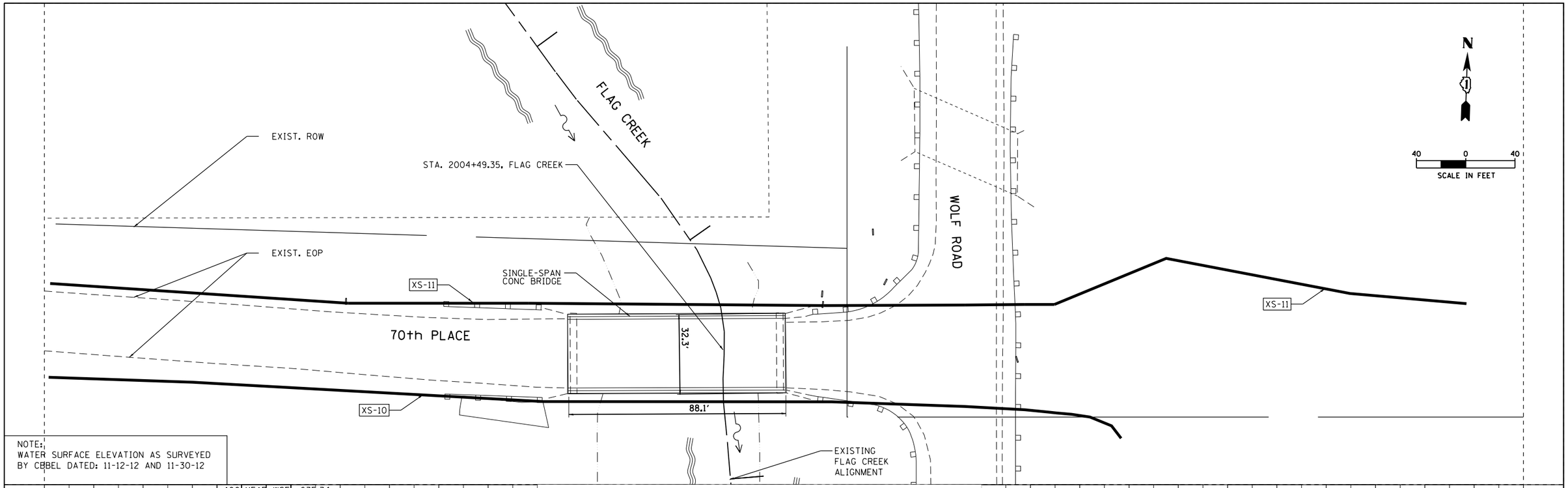
REVISIONS	
Name	Date

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
BRIDGE CONSTRUCTION SEQUENCE
I-55 OVER WOLF ROAD & FLAGG CREEK

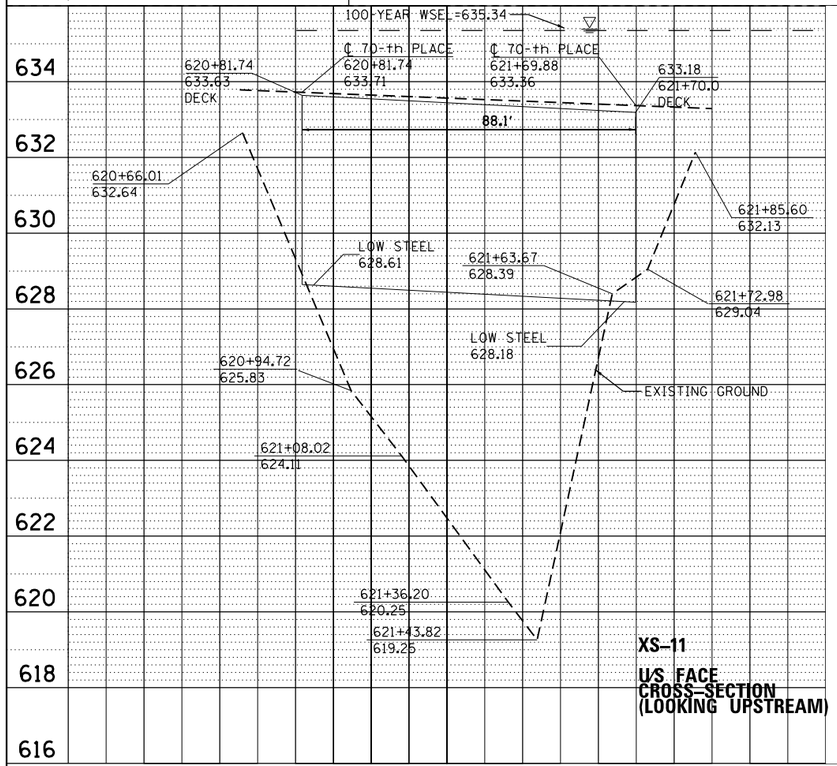
COOK COUNTY
F.A.I. RTE. 55
STRUC. NO. 016-0003
SCALE: NONE
DRAWN BY: EMT
DATE: NOV. 1995
CHECKED BY: LRL

GANNETT FLEMING, INC.
Chicago, Illinois

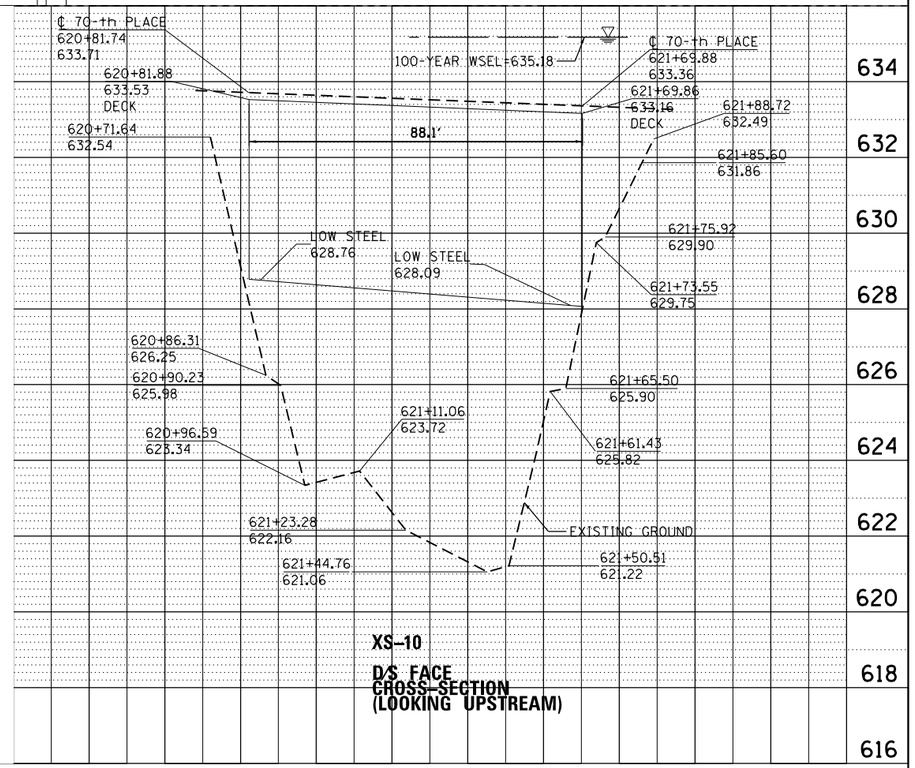
17-Nov-95 15:28



NOTE:
WATER SURFACE ELEVATION AS SURVEYED
BY CBBEL DATED: 11-12-12 AND 11-30-12



XS–11
U/S FACE
CROSS–SECTION
(LOOKING UPSTREAM)



XS–10
D/S FACE
CROSS–SECTION
(LOOKING UPSTREAM)

PLAN: SURVEYED, PLOTTED, ALIGNMENT CHECKED, RELEASED, CADD FILE NAME; NOTE BOOK, NO.; BY, DATE

PROFILE: SURVEYED, PLOTTED, GRADES CHECKED, RELEASED, STRUCTURE NO(S)/NAME CHKD; NOTE BOOK, NO.; BY, DATE

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Default		DRAWN - MYG	REVISED -
	PLOT SCALE = $SCALE$	CHECKED - IAD	REVISED -
	PLOT DATE = 9/28/2016	DATE - 9/28/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

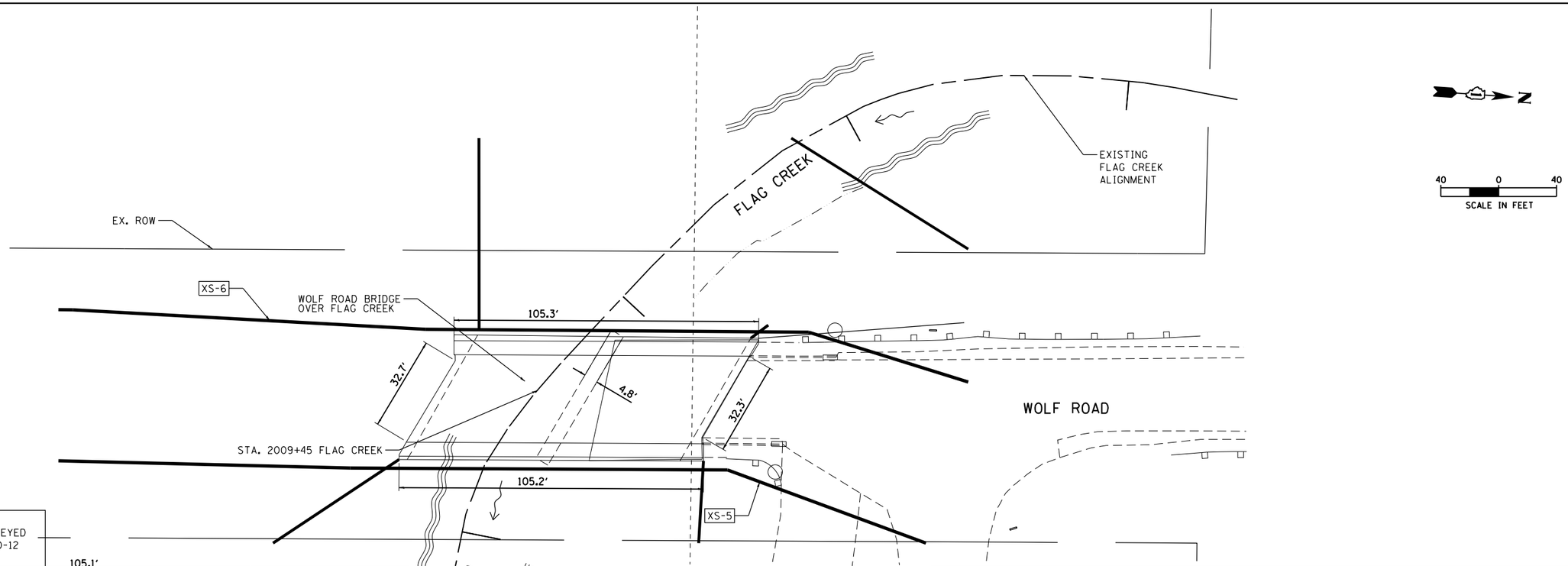
BRIDGE LAYOUT /PLAN DRAWING PLOTS
70th PLACE BRIDGE OVER FLAG CREEK

SCALE: 1"=40' | SHEET OF SHEETS | STA. | TO STA.

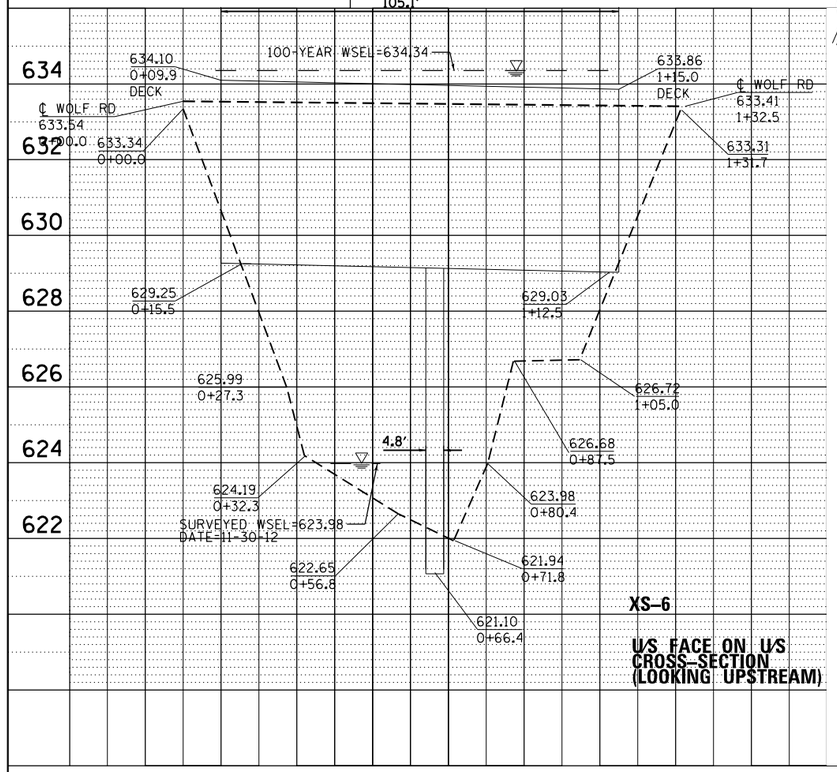
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

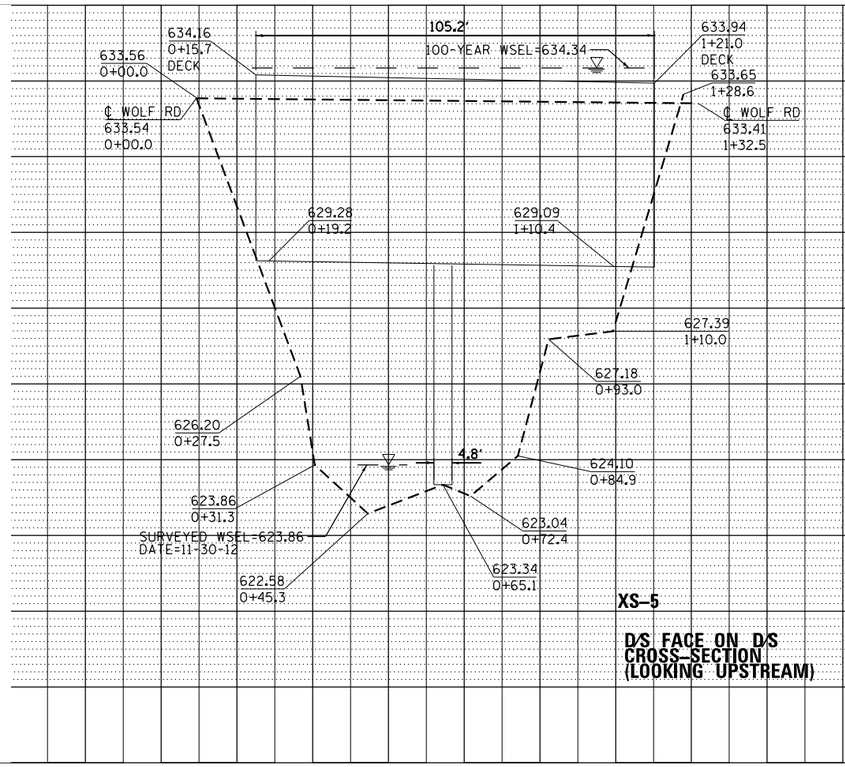
PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RP & PI MARKS CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
GRADES CHECKED
ALIGNMENT CHKD
STRUCTURE NOTATNS CHKD
NOTE BOOK
NO.
BY
DATE



NOTE:
WATER SURFACE ELEVATION AS SURVEYED
BY CBBEL DATED: 11-12-12 AND 11-30-12





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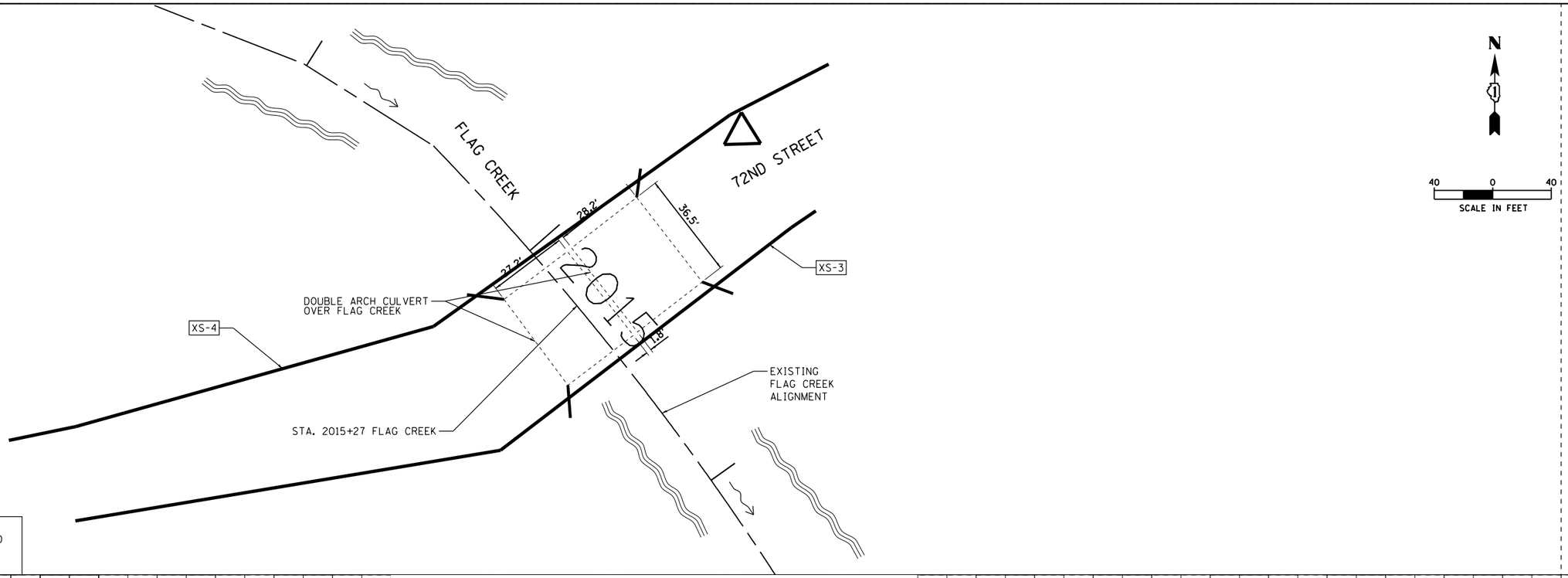
	PLOT DATE = 9/28/2016	DATE - 9/28/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

BRIDGE LAYOUT /PLAN DRAWING PLOTS
WOLF ROAD BRIDGE OVER FLAG CREEK

SCALE: 1"=40' | SHEET OF SHEETS | STA. | TO STA.

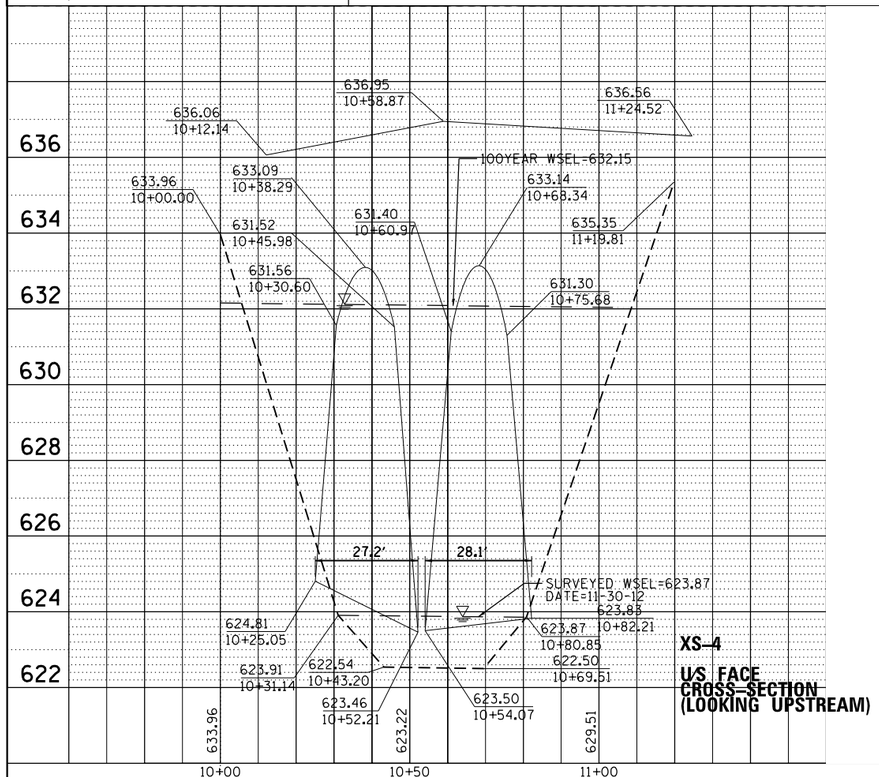
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			



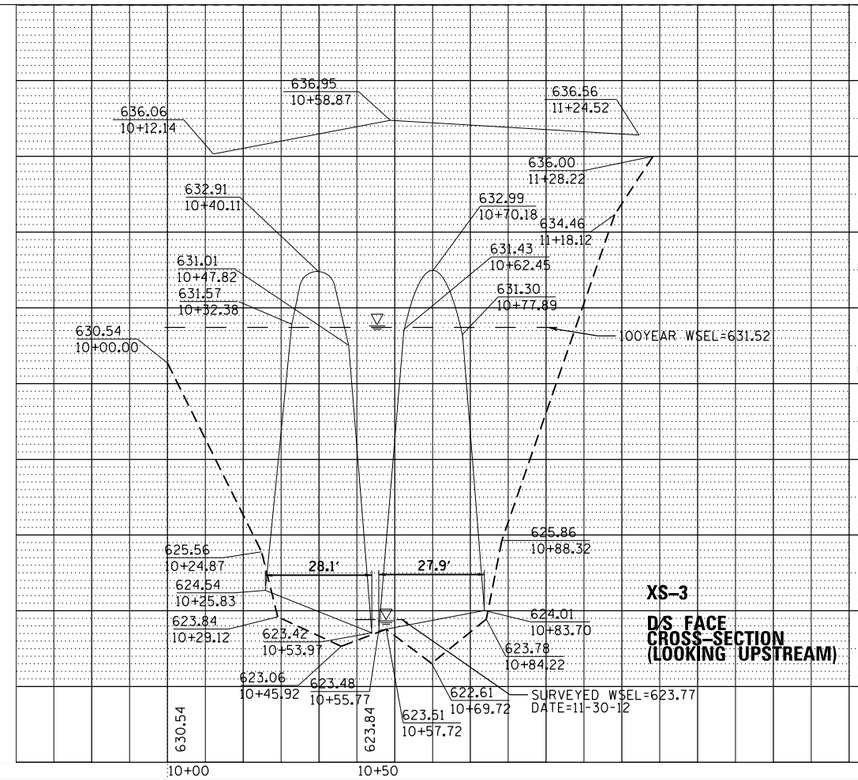
NOTE:
WATER SURFACE ELEVATION AS SURVEYED
BY CBBEL DATED: 11-12-12 AND 11-30-12

PLAN
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
BY
DATE

PROFILE
SURVEYED
PLOTTED
GRADES CHECKED
B.M. NOTED
STRUCTURE NOTATIONS CHKD
NOTE BOOK
NO.
BY
DATE



XS-4
U/S FACE
CROSS-SECTION
(LOOKING UPSTREAM)



XS-3
D/S FACE
CROSS-SECTION
(LOOKING UPSTREAM)

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		DRAWN - MYG	REVISED -
Default	PLOT SCALE = $SCALE$	CHECKED - IAD	REVISED -
	PLOT DATE = 9/28/2016	DATE - 9/28/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

BRIDGE LAYOUT /PLAN DRAWING PLOTS
72nd STREET ARCH CULVERT OVER FLAG CREEK

SCALE: 1"=40' | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

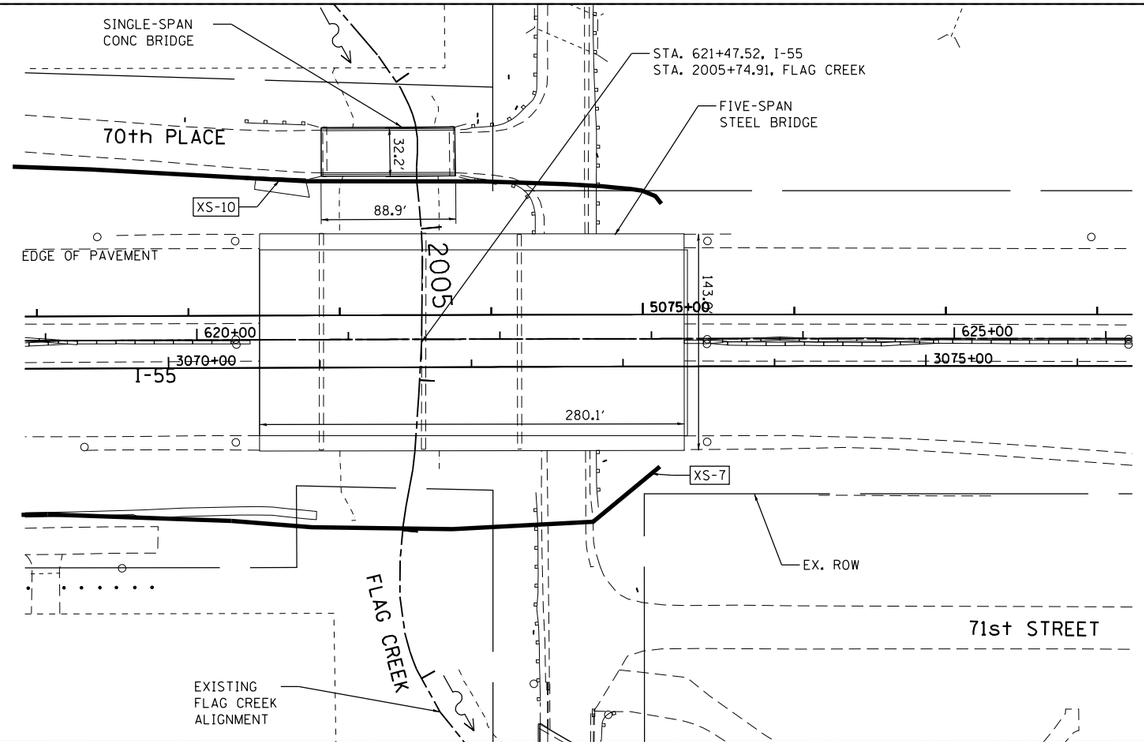
TAB 11

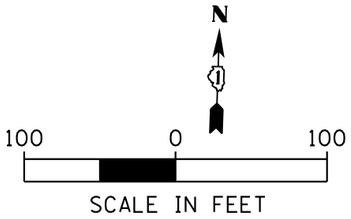
SECTION 11

BRIDGE CROSS SECTION PLOTS – EXISTING CONDITIONS

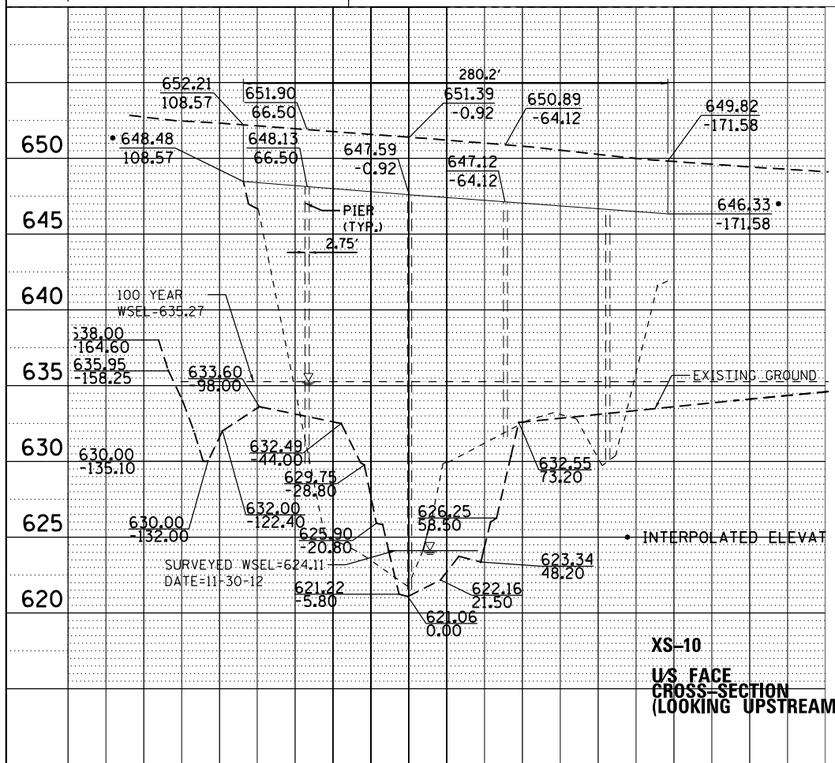
PLAN
SURVEYED
ADDED
ALIGNMENT CHECKED
R.T. OF WAY CHECKED
GRADE FILE NAME
NOTE BOOK
NO.
DATE
BY

PROFILE
SURVEYED
ADDED
GRADES CHECKED
B.M. NOTED
STRUCTURE NO.
FA RTE NO.
DATE
BY

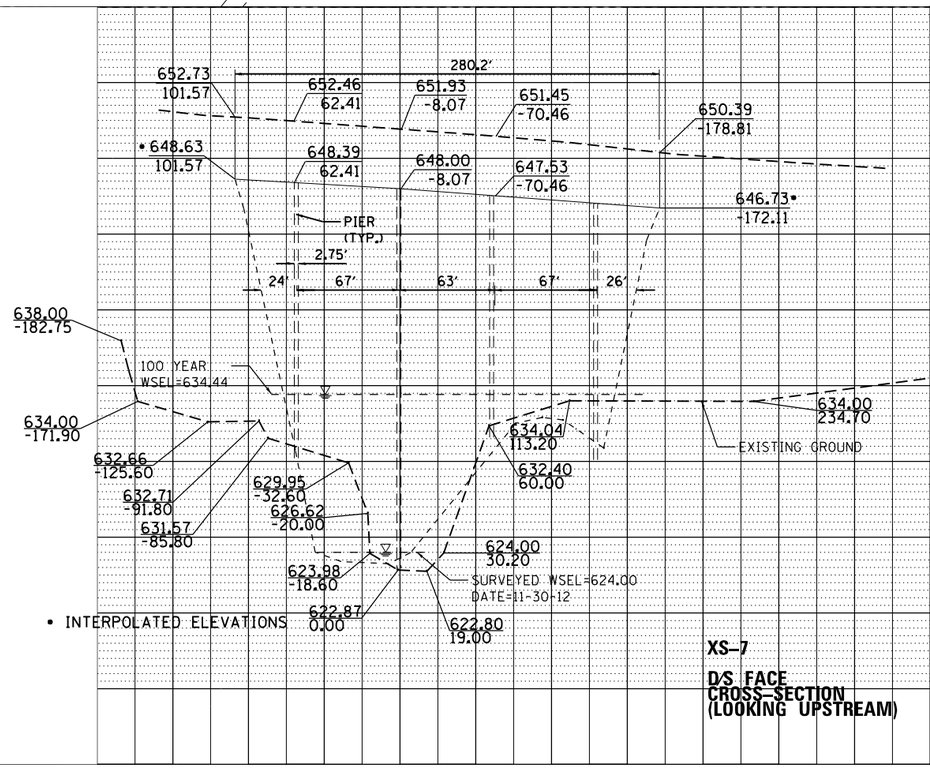




NOTE:
WATER SURFACE ELEVATION AS SURVEYED
BY CBBEL DATED: 11-12-12 AND 11-30-12



XS-10
U/S FACE
CROSS-SECTION
(LOOKING UPSTREAM)



XS-7
D/S FACE
CROSS-SECTION
(LOOKING UPSTREAM)

FILE NAME = N:\ldot\110203.00001\CADD_Sheets\P1110203-sht-detail08.dgn	USER NAME = eburke	DESIGNED - EB	REVISED -
Default	PLOT SCALE = $SCALE$	DRAWN - MYG	REVISED -
	PLOT DATE = 9/28/2016	CHECKED - IAD	REVISED -
		DATE - 9/28/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

BRIDGE LAYOUT /PLAN DRAWING PLOTS
I-55 OVER FLAG CREEK

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

TAB 12

SECTION 12

BRIDGE CROSS SECTION PLOTS – PROPOSED CONDITIONS

BRIDGE CROSS SECTION PLOTS – PROPOSED CONDITIONS

There are no proposed modifications to the existing culvert.
Please refer to Section 11 for the existing culvert plots.

TAB 13

SECTION 13

HYDRAULIC ANALYSIS

10 Year Event

	Paper WSP-2	WSP-2 Duplicate	Mod WSP-2	Existing Model
4240	-	-	-	633.13
3755	-	-	-	633.02
3380	-	-	-	632.95
3327	-	-	-	632.91
3288	-	-	-	632.91
3245	Joliet Road Bridge			
3206	-	-	-	632.87
3148	-	-	-	632.85
3081	-	-	-	632.84
2765	-	-	-	632.74
2542	-	-	-	632.69
12.1	632.12	633.23	631.98	632.54
12	-	-	-	632.53
11	-	-	-	632.41
10.5	70th Place Bridge			
10	-	-	-	632.23
9.5	631.62	633.00	631.45	632.21
9	-	-	-	632.19
8.5	I-55 Bridge			
8	-	-	-	631.53
7	-	-	-	631.46
6	-	-	-	631.27
5.5	Wolf Road Bridge			
5	-	-	-	630.97
4.1	631.02	630.58	630.93	-
4				630.41
3.5	72nd Street Bridge			
3	-	-	-	630.05
2	-	-	-	629.58
1	-	-	-	629.06
0.5	628.52	628.52	628.52	628.52

Note: Elevations in NAVD 88 (NAVD88=NGVD29-0.28')

50 Year Event

River Sta	Paper WSP-2	WSP-2 Duplicate	Mod WSP-2	Existing Model
4240	-	-	-	635.22
3755	-	-	-	635.19
3380	-	-	-	635.1
3327	-	-	-	635.04
3288	-	-	-	635.03
3245	Joliet Road Bridge			
3206	-	-	-	634.98
3148	-	-	-	634.97
3081	-	-	-	634.96
2765	-	-	-	634.9
2542	-	-	-	634.81
12.1	633.42	634.93	633.48	634.65
12	-	-	-	634.65
11	-	-	-	634.57
10.5	70th Place Bridge			
10	-	-	-	634.54
9.5	632.82	634.67	632.77	634.5
9	-	-	-	634.5
8.5	I-55 Bridge			
8	-	-	-	633.78
7	-	-	-	633.72
6	-	-	-	633.56
5.5	Wolf Road Bridge			
5	-	-	-	632.67
4.1	632.02	631.53	631.92	-
4	-	-	-	631.93
3.5	72nd Street Bridge			
3	-	-	-	631.18
2	-	-	-	630.45
1	-	-	-	629.7
0.5	629.02	629.02	629.02	629.02

Note: Elevations in NAVD 88 (NAVD88=NGVD29-0.28')

100 Year Event

River Sta	FIS (WSP-2) XS Name	FIS Table 19 Reg. Elev.	22 Feb 80 Paper WSP-2	WSP-2 Duplicate	Mod WSP-2	2011 HLR Model, NAVD 88	2016 CBBEL Existing Model	Δ, CBBEL - HLR	
4240			-	-	-	634.97	636.05	1.08	
3755			-	-	-	634.90	636.05	1.14	
3380			-	-	-	634.75	635.96	1.20	
3327			-	-	-	634.66	635.88	1.21	
3288			-	-	-	634.66	635.87	1.20	
3245			Joliet Road Bridge						
3206			-	-	-	634.39	635.75	1.35	
3148			-	-	-	634.36	635.73	1.37	
3081			-	-	-	634.34	635.72	1.38	
2765			-	-	-	634.19	635.70	1.50	
2542			-	-	-	634.06	635.69	1.62	
12.1	K (FC 039)	634.0	634.02	635.29	634.10	633.85	635.51	1.65	Approx. HLR XS 2146
12			-	-	-	-	635.51	-	
11			-	-	-	633.82	635.45	1.63	Approx. HLR XS 1762
10.5			70th Place Bridge						
10			-	-	-	-	635.27	-	
9.5	J (X)	633.2	633.22	634.97	633.34	633.6	635.22	1.62	Approx. HLR starting XS 1728
9			-	-	-	n/a	635.22		
8.5			I-55 Bridge						
8			-	-	-	n/a	634.5		
7			-	-	-	n/a	634.44		
6			-	-	-	n/a	634.34		
5.5			Wolf Road Bridge						
5			-	-	-	n/a	633.45		
4.1	(Z)		632.02	631.92	632.31	n/a	-		
4			-	-	-	n/a	632.69		
3.5			72nd Street Bridge						
3			-	-	-	n/a	631.67		
2			-	-	-	n/a	630.84		
1			-	-	-	n/a	630.04		
0.5	H (FC 033)	629.4	629.42	629.42	629.42	n/a	629.42		

Note: Elevations in NAVD 88 (NAVD88=NGVD29-0.28')

500 Year Event

River Sta	Paper WSP-2	WSP-2 Duplicate	Mod WSP-2	Existing Model
4240	-	-	-	637.3
3755	-	-	-	637.33
3380	-	-	-	637.22
3327	-	-	-	637.08
3288	-	-	-	637.08
3245	Joliet Road Bridge			
3206	-	-	-	636.8
3148	-	-	-	636.78
3081	-	-	-	636.77
2765	-	-	-	636.79
2542	-	-	-	636.77
12.1	635.02	636.11	635.43	636.57
12	-	-	-	636.56
11	-	-	-	636.51
10.5	70th Place Bridge			
10	-	-	-	636.33
9.5	634.22	635.65	634.63	636.28
9	-	-	-	636.27
8.5	I-55 Bridge			
8	-	-	-	635.54
7	-	-	-	635.47
6	-	-	-	635.39
5.5	Wolf Road Bridge			
5	-	-	-	634.94
4.1	633.12	632.75	633.13	-
4	-	-	-	634.03
3.5	72nd Street Bridge			
3	-	-	-	632.68
2	-	-	-	631.72
1	-	-	-	630.8
0.5	630.22	630.22	630.22	630.22

Note: Elevations in NAVD 88 (NAVD88=NGVD29-0.28')

Manning's n Comparison

	WSP-2			Mod FIS			Existing Model		
Cross Section	LOB	Channel	ROB	LOB	Channel	ROB	LOB	Channel	ROB
12.1	0.075	0.05	0.075	0.05	0.05	0.05	0.075	0.05	0.075
9.5	0.08	0.063	0.08	0.077	0.077	0.077	0.08	0.063	0.08
4.1	0.08	0.063	0.08	0.09	0.075	0.09	-	-	-
0.5	0.08	0.063	0.08	0.09	0.073	0.09	0.08	0.063	0.08

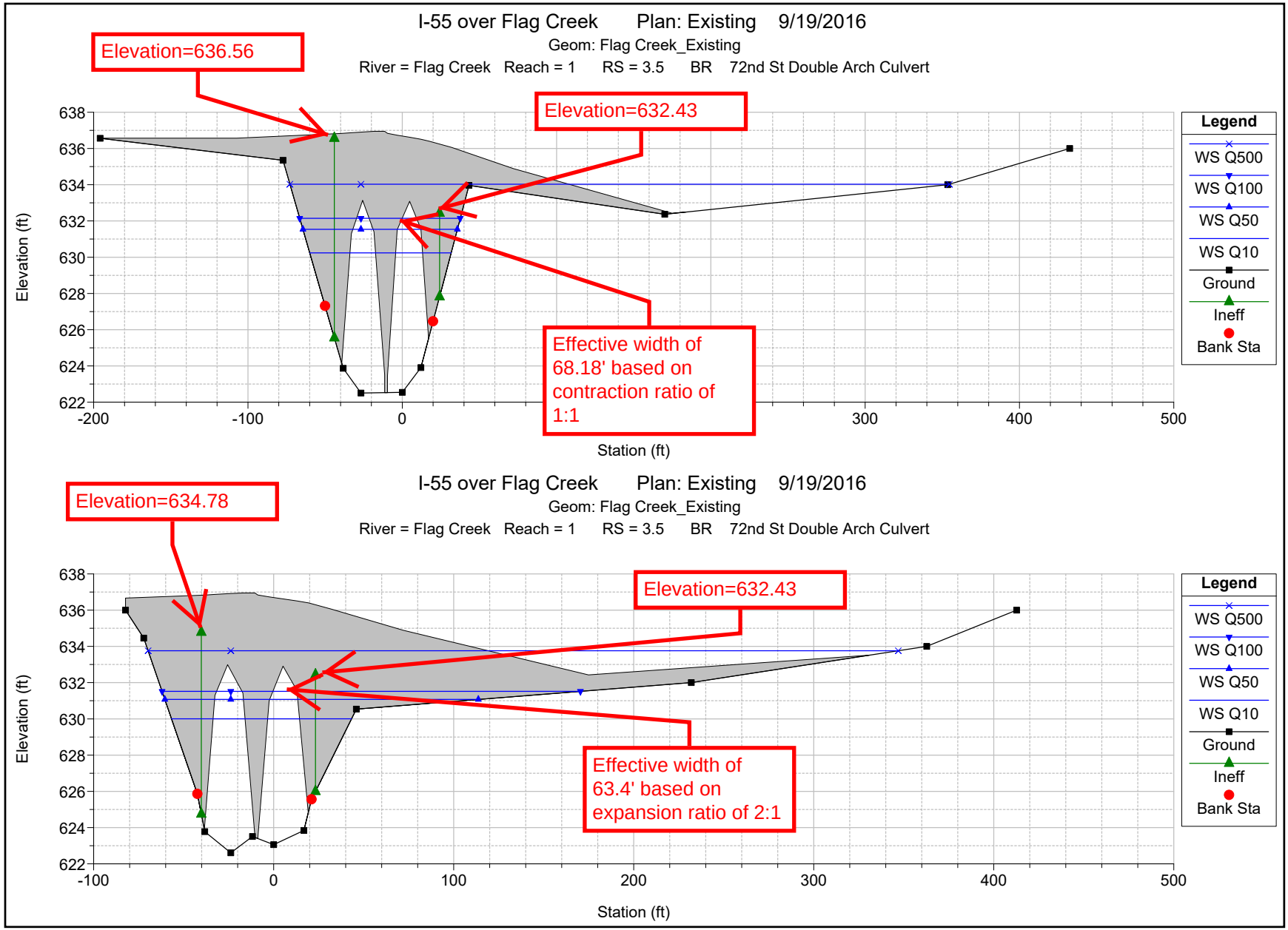
Project #:	11-0203.00001		
Stream:	Flag Creek		
Route:	I-55		
By:	EMB	Ck:	IAD
Date:	8/16/2016		9/19/2016
Structure:	72nd Street		

Structure Opening Width:	57.18
Expansion Ratio:	2
Contraction Ratio:	1

Top of Structure Opening D/S:	Left	Right
	632.99	632.91

	Upstream	Downstream
Left Overtopping	636.56	634.78
Right Overtopping	632.43	632.43

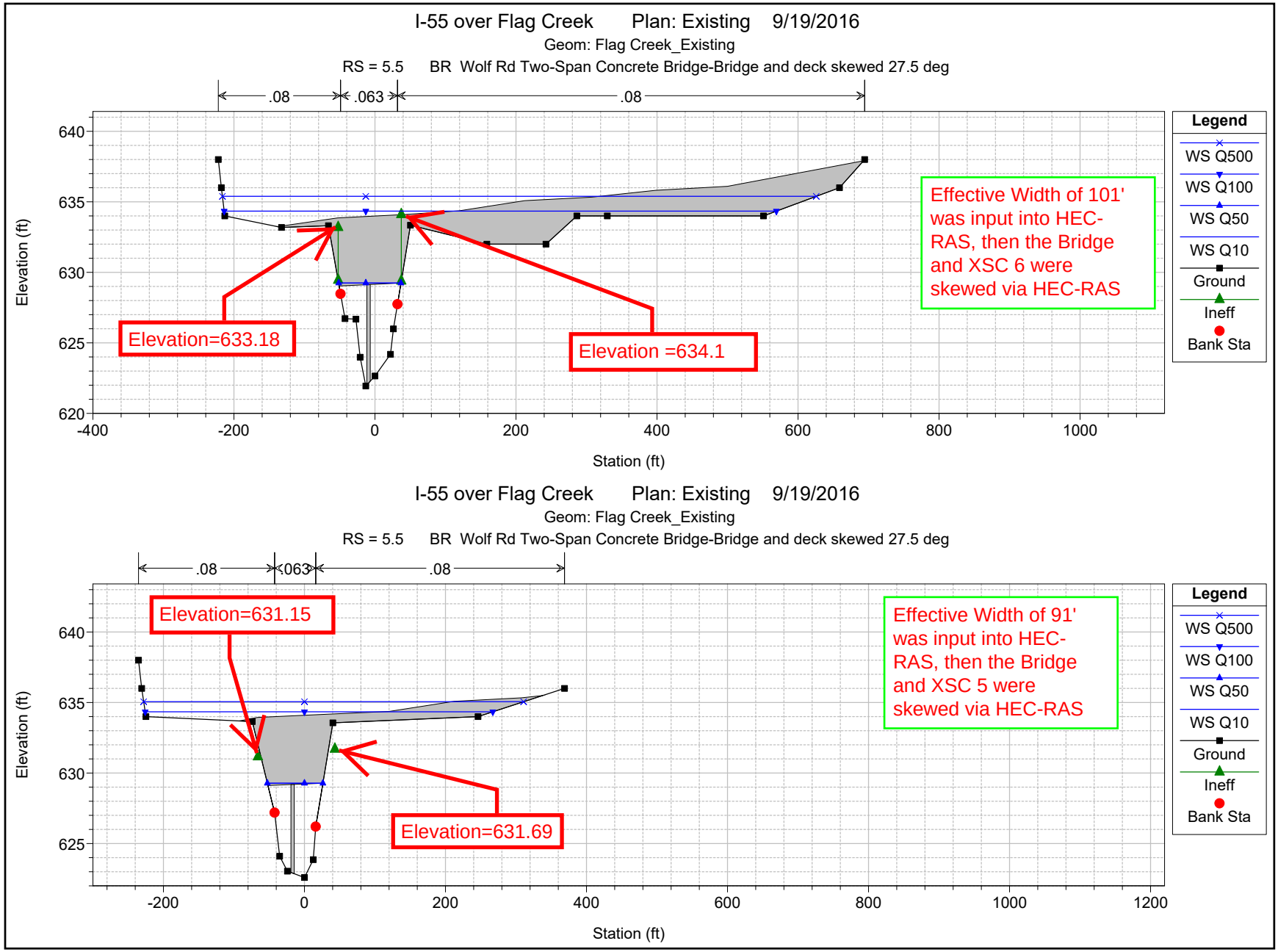
HEC-RAS Station	Distance To Structure	Effective Opening	Notes
5	530.3	1117.78	Wider than Channel Width
4	5.5	68.18	-
3.5 72nd Street	-	57.18	-
3	6.22	63.4	-
2	496.42	553.6	Wider than Channel Width


I-55 over Flag Creek Plan: Existing 9/19/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3.5 BR 72nd St Double Arch Culvert
Elevation=636.56
Elevation=632.43
Effective width of 68.18' based on contraction ratio of 1:1
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/19/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3.5 BR 72nd St Double Arch Culvert
Elevation=634.78
Elevation=632.43
Effective width of 63.4' based on expansion ratio of 2:1
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta

Project #:	11-0203.00001		
Stream:	Flag Creek		
Route:	I-55		
By:	EMB	Ck:	IAD
Date:	8/16/2016		9/19/2016
Structure:	Wolf Road		
Structure Opening Width:	97	U/S	
	91	D/S	
Expansion Ratio:	2		
Contraction Ratio:	1		
Top of Structure Opening D/S:	Left	Right	
	629.12	629.28	

	Upstream	Downstream
Left Overtopping	633.18	631.15
Right Overtopping	634.1	631.69

HEC-RAS Station	Distance To Structure	Effective Opening	Notes
7	221.8	540.6	Wider than Channel Width
6	2	101	Cross Section Skewed in HEC-RAS
5.5 Wolf Road	-	91	Cross Section Skewed in HEC-RAS
5	18.2	109.2	Cross Section Skewed in HEC-RAS
4	543	634	Wider than Channel Width

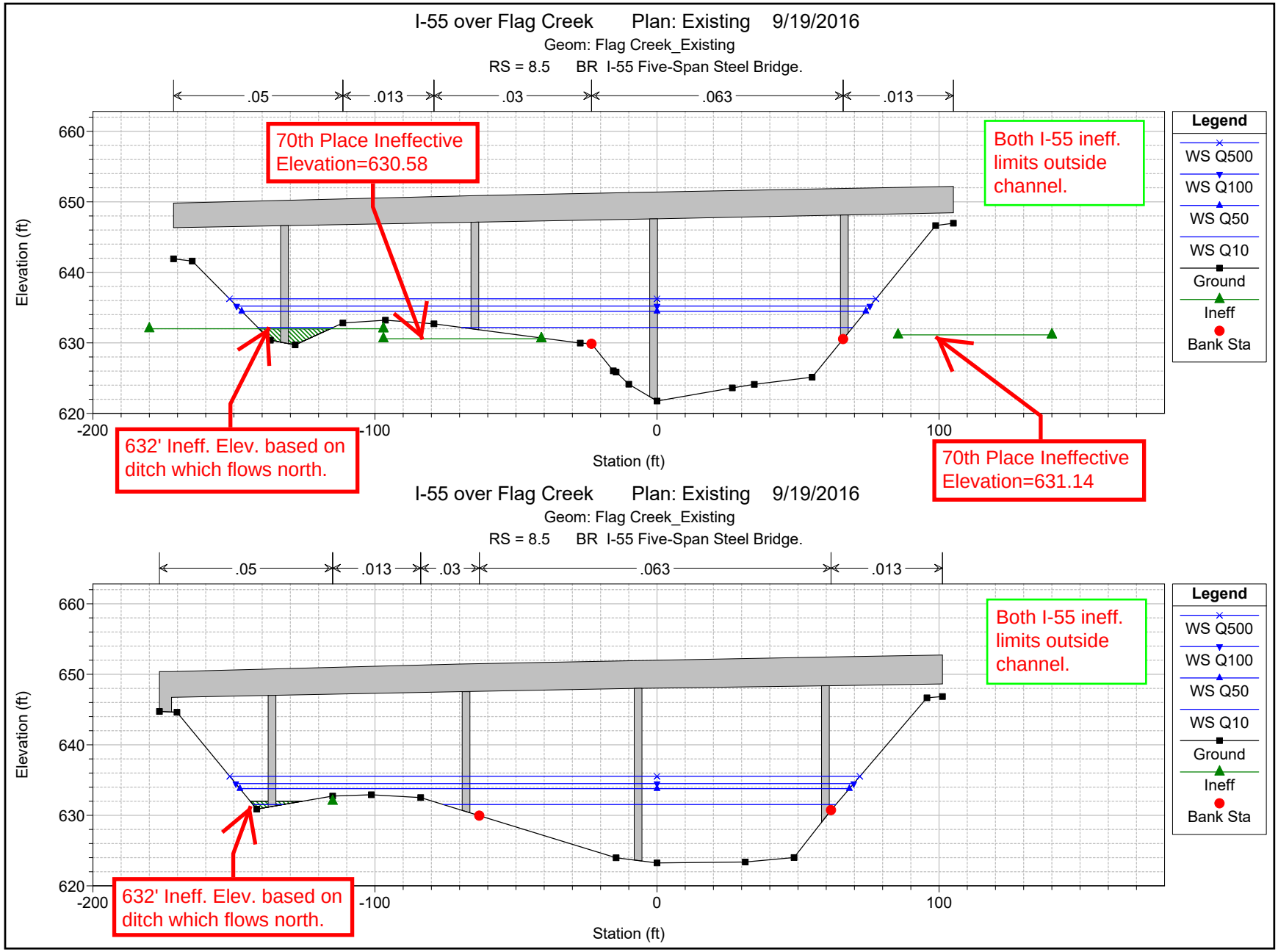


1 in Horiz. = 200 ft 1 in Vert. = 10 ft

Project #:	11-0203.00001		
Stream:	Flag Creek		
Route:	I-55		
By:	EMB	Ck:	IAD
Date:	8/16/2016		9/19/2016
Structure:	I-55		
Structure Opening Width:	274	U/S	
	272	D/S	
Expansion Ratio:	2		
Contraction Ratio:	1		
Top of Structure Opening D/S:	Left	Right	
	646.73	648.63	

	Upstream	Downstream
Left Overtopping	650.39	648.56
Right Overtopping	652.73	650.68

HEC-RAS Station	Distance To Structure	Effective Opening	Notes
11	74.3	422.6	-
10	36	346	-
9.5	35	344	Left ineffective wider than channel width and 70th Place extends into XSC 9. 632' ineffective placed to prevent flow in dtich which flows to the north.
9	1	276	Ineff. limits outside channel and 70th Place extends into XSC 9. 632' ineffective placed to prevent flow in dtich which flows to the north.
8.5 I-55 Bridge	-	272	-
8	1.4	273.4	Both ineff. limits outside channel. 632' ineffective placed to prevent flow in ditch which flows to the north.
7	52.9	324.9	Left ineffective limits outside channel
6	272.7	544.7	Wider than Channel Width

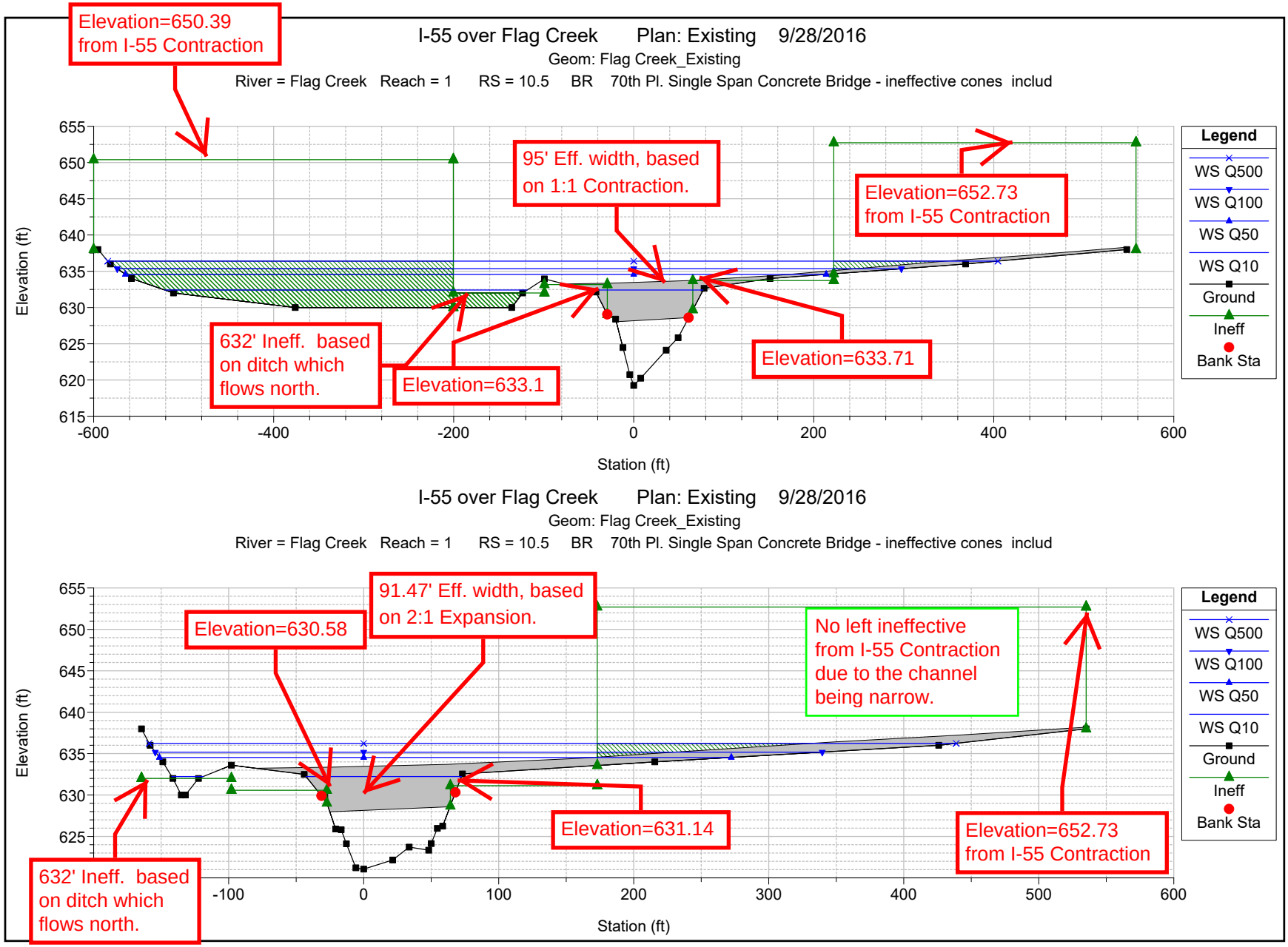


1 in Horiz. = 50 ft 1 in Vert. = 20 ft

Project #:	11-0203.00001		
Stream:	Flag Creek		
Route:	I-55		
By:	EMB	Ck:	IAD
Date:	8/16/2016		9/19/2016
Structure:	70th Place		
Structure Opening Width:	88	U/S	
	89	D/S	
Expansion Ratio:	2		
Contraction Ratio:	1		
Top of Structure Opening D/S:	Left	Right	
	627.98	628.57	

	Upstream	Downstream
Left Overtopping	633.17	630.58
Right Overtopping	633.71	631.14

HEC-RAS Station	Distance To Structure	Effective Opening	Notes
12	380.77	849.54	Wider than Channel Width
11	3.5	95	overlaps with I-55 Ineffectives
10.5 70th Place Bridge	-	89	-
10	2.47	91.47	632' ineffective placed to prevent flow in dtich which flows to the north.
9.5	3.47	92.47	
9	37.47	126.47	632' Ineffective placed to prevent flow in dtich which flowing to the north.


Elevation=650.39
from I-55 Contraction
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 10.5 BR 70th Pl. Single Span Concrete Bridge - ineffective cones includ
95' Eff. width, based
on 1:1 Contraction.
Elevation=652.73
from I-55 Contraction
632' Ineff. based
on ditch which
flows north.
Elevation=633.1
Elevation=633.71
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 10.5 BR 70th Pl. Single Span Concrete Bridge - ineffective cones includ
91.47' Eff. width, based
on 2:1 Expansion.
Elevation=630.58
No left ineffective
from I-55 Contraction
due to the channel
being narrow.
Elevation=631.14
Elevation=652.73
from I-55 Contraction
632' Ineff. based
on ditch which
flows north.
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

Expansion Reach Lengths

In some types of studies, a high level of sophistication in the evaluation of the transition reach lengths is not justified. For such studies, and for a starting point in more detailed studies, Table B-2 offers ranges of expansion ratios, which can be used for different degrees of constriction, different slopes, and different ratios of overbank roughness to main channel roughness. Once an expansion ratio is selected, the distance to the downstream end of the expansion reach (the distance Le on Figure B-1) is found by multiplying the expansion ratio by the average obstruction length (the average of the distances A to B and C to D from Figure B-1). The average obstruction length is half of the total reduction in floodplain width caused by the two bridge approach embankments. In Table B-2, b/B is the ratio of the bridge opening width to the total floodplain width, nob is the Manning n value for the overbank, nc is the n value for the main channel, and S is the longitudinal slope. The values in the interior of the table are the ranges of the expansion ratio. For each range, the higher value is typically associated with a higher discharge.

Table B-2 Ranges of Expansion Ratios

		nob / nc = 1	nob / nc = 2	nob / nc = 4
b/B = 0.10	S = 1 ft/mile	1.4 – 3.6	1.3 – 3.0	1.2 – 2.1
	5 ft/mile	1.0 – 2.5	0.8 – 2.0	0.8 – 2.0
	10 ft/mile	1.0 – 2.2	0.8 – 2.0	0.8 – 2.0
b/B = 0.25	S = 1 ft/mile	1.6 – 3.0	1.4 – 2.5	1.2 – 2.0
	5 ft/mile	1.5 – 2.5	1.3 – 2.0	1.3 – 2.0
	10 ft/mile	1.5 – 2.0	1.3 – 2.0	1.3 – 2.0
b/B = 0.50	S = 1 ft/mile	1.4 – 2.6	1.3 – 1.9	1.2 – 1.4
	5 ft/mile	1.3 – 2.1	1.2 – 1.6	1.0 – 1.4
	10 ft/mile	1.3 – 2.0	1.2 – 1.5	1.0 – 1.4

Use expansion ratio = 2.0.

The ranges in Table B-2, as well as the ranges of other parameters to be presented later in this appendix, capture the ranges of the idealized model data from this study. Another way of establishing reasonable ranges would be to compute statistical confidence limits (such as 95% confidence limits) for the regression equations. Confidence limits in multiple linear regression equations have a different value for every combination of values of the independent variables (Haan, 1977). The computation of these limits entails much more work and has a more restricted range of applicability than the corresponding limits for a regression, which is based on only one independent variable. The confidence limits were, therefore, not computed in this study.

Extrapolation of expansion ratios for constriction ratios, slopes or roughness ratios outside of the ranges used in this table should be done with care. The expansion ratio should not exceed 4:1, nor

b = XS 5.5 BR U bridge opening width @ Q100 = 325'.
B = XS 7 FP width @ Q100 = 441'.
b/B = 0.74. Use ratios for b/B = 0.50.
S = .000639 U/S ft/ft = 3.4 ft/mile; = .001293 D/S ft/ft = 6.8 ft/mile. Use 5 ft/mile.
nob/nc = 0.08/0.063 = 1.27:1. Use 1:1.

HEC-RAS Plan: Ex River: Flag Creek Reach: 1 Profile: Q100

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	3327	Q100	636.00	635.87	627.82	0.01	0.01	351.07	0.39	2399.61		2.86
1	3288	Q100	635.98	635.87	627.54			86.69		2400.00		2.68
1	3245 BR U	Q100	635.98	635.52	627.64			83.69		2400.00		2.89
1	3245 BR D	Q100	635.87	635.52	628.48			83.50		2400.00		3.10
1	3206	Q100	635.87	635.75	628.25	0.02	0.00	86.50		2400.00		2.89
1	3148	Q100	635.86	635.73	627.70	0.02	0.00	108.92		2400.00		2.89
1	12	Q100	635.62	635.50		0.09	0.04	459.66	196.06	2018.18	185.76	2.91
1	11	Q100	635.48	635.45	626.04	0.00	0.02	884.41	819.73	1339.97	240.30	1.30
1	10.5 BR U	Q100	635.46	635.38	626.04	0.03	0.04	822.71	1613.24	586.06	200.70	1.05
1	10.5 BR D	Q100	635.39	635.19	626.11	0.00	0.09	384.88	1329.37	860.83	209.81	1.47
1	10	Q100	635.30	635.27	626.12	0.00	0.01	504.03	553.36	1588.60	258.04	1.44
1	9.5	Q100	635.30	635.24	626.41	0.02	0.00	489.41	1040.81	912.50	546.69	0.94
1	9	Q100	635.27	635.22	627.04			224.59	752.92	1681.49	65.59	1.76
1	8.5 BR U	Q100	635.27	635.21	627.19			213.53	851.14	1612.62	36.24	1.77
1	8.5 BR D	Q100	634.56	634.50	627.03			208.08	355.57	2091.92	52.51	1.89
1	8	Q100	634.55	634.50		0.01	0.01	219.09	355.63	2100.53	43.83	1.82
1	7	Q100	634.53	634.44	627.46	0.09	0.00	441.28	987.64	1277.28	235.08	1.61
1	6	Q100	634.44	634.34	627.67			783.16	100.15	2097.66	302.19	2.68
1	5.5 BR U	Q100	634.43	634.34	627.98			325.21	327.16	2147.69	23.97	5.84
1	5.5 BR D	Q100	634.43	634.34	627.70			332.71	343.02	2100.57	55.23	6.51
1	5	Q100	633.66	633.45	627.39	0.72	0.01	113.02	135.17	2231.35	133.48	3.85
1	4	Q100	632.93	632.69	626.93	0.02	0.12	168.34		2409.59	90.41	4.01
1	3.5 BR U	Q100	632.79	632.15	627.10	0.52	0.02	17.54		2472.90		6.43
1	3.5 BR D	Q100	632.24	631.52	627.33	0.03	0.18	27.53		2472.90		6.84
1	3	Q100	632.03	631.67	627.12	0.93	0.10	251.96		2461.59	38.41	4.86
1	2	Q100	631.00	630.84		0.81	0.00	316.72	867.68	1547.99	84.33	3.73

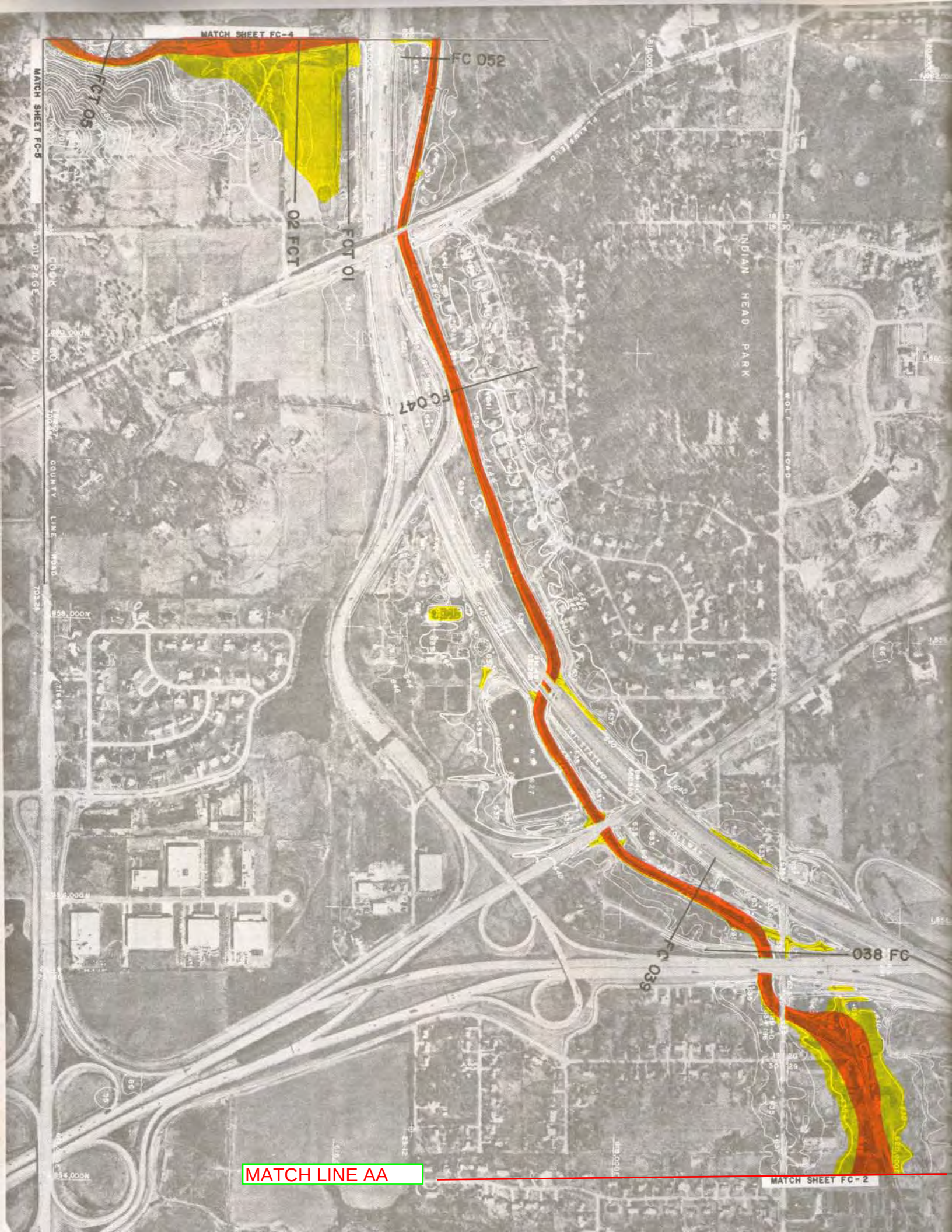
HEC-RAS Plan: Ex River: Flag Creek Reach: 1 Profile: Q100

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q100	2400.00	623.49	636.05	628.25	636.16	0.000218	2.73	1043.98	639.19	0.16
1	3755	Q100	2400.00	622.11	636.04	628.03	636.08	0.000084	1.72	1937.01	528.14	0.10
1	3380	Q100	2400.00	622.32	635.95		636.02	0.000240	2.24	1229.14	354.16	0.12
1	3327	Q100	2400.00	622.04	635.87	627.82	636.00	0.000572	2.86	841.44	351.07	0.16
1	3288	Q100	2400.00	621.30	635.87	627.54	635.98	0.000216	2.68	894.56	86.69	0.15
1	3245		Bridge									
1	3206	Q100	2400.00	623.00	635.75	628.25	635.87	0.000268	2.89	831.52	86.50	0.16
1	3148	Q100	2400.00	622.99	635.73	627.70	635.86	0.000267	2.89	831.00	108.92	0.17
1	3081	Q100	2400.00	623.26	635.72	627.69	635.84	0.000278	2.75	871.72	108.33	0.17
1	2765	Q100	2400.00	623.30	635.69	628.22	635.76	0.000145	2.26	1310.18	418.05	0.13
1	2542	Q100	2400.00	620.99	635.68	627.45	635.72	0.000105	1.85	1596.78	315.46	0.11
1	12.1	Q100	2400.00	622.92	635.51		635.64	0.000568	3.10	1107.68	347.07	0.18
1	12	Q100	2400.00	621.48	635.50		635.62	0.000444	2.91	1169.66	459.66	0.16
1	11	Q100	2400.00	619.25	635.45	626.04	635.48	0.000122	1.30	2019.69	884.41	0.07
1	10.5		Bridge									
1	10	Q100	2400.00	621.06	635.27	626.12	635.30	0.000156	1.44	1683.93	504.03	0.08
1	9.5	Q100	2500.00	621.02	635.24	626.41	635.30	0.006926	0.94	1648.75	489.41	0.05
1	9	Q100	2500.00	621.75	635.22	627.04	635.27	0.000246	1.76	1379.71	224.59	0.09
1	8.5		Bridge									
1	8	Q100	2500.00	623.25	634.50		634.55	0.000314	1.82	1365.58	219.09	0.11
1	7	Q100	2500.00	622.80	634.44	627.46	634.53	0.000241	1.61	1213.69	441.28	0.09
1	6	Q100	2500.00	621.94	634.34	627.67	634.44	0.000639	2.68	1576.20	783.16	0.15
1	5.5		Bridge									
1	5	Q100	2500.00	622.59	633.45	627.39	633.66	0.001293	3.85	762.26	113.02	0.22
1	4	Q100	2500.00	622.50	632.69	626.93	632.93	0.001484	4.01	670.47	168.34	0.23
1	3.5		Bridge									
1	3	Q100	2500.00	622.61	631.67	627.12	632.03	0.002573	4.86	519.37	251.96	0.30
1	2	Q100	2500.00	620.85	630.84		631.00	0.001412	3.73	978.60	316.72	0.22
1	1	Q100	2500.00	622.89	630.04		630.18	0.002496	4.10	1037.85	338.30	0.28
1	0.5	Q100	2500.00	621.72	629.42	627.85	629.46	0.001323	2.78	1916.73	803.44	0.20

TAB A

SECTION 13.A

BASELINE (FEMA) WSP-2 MODEL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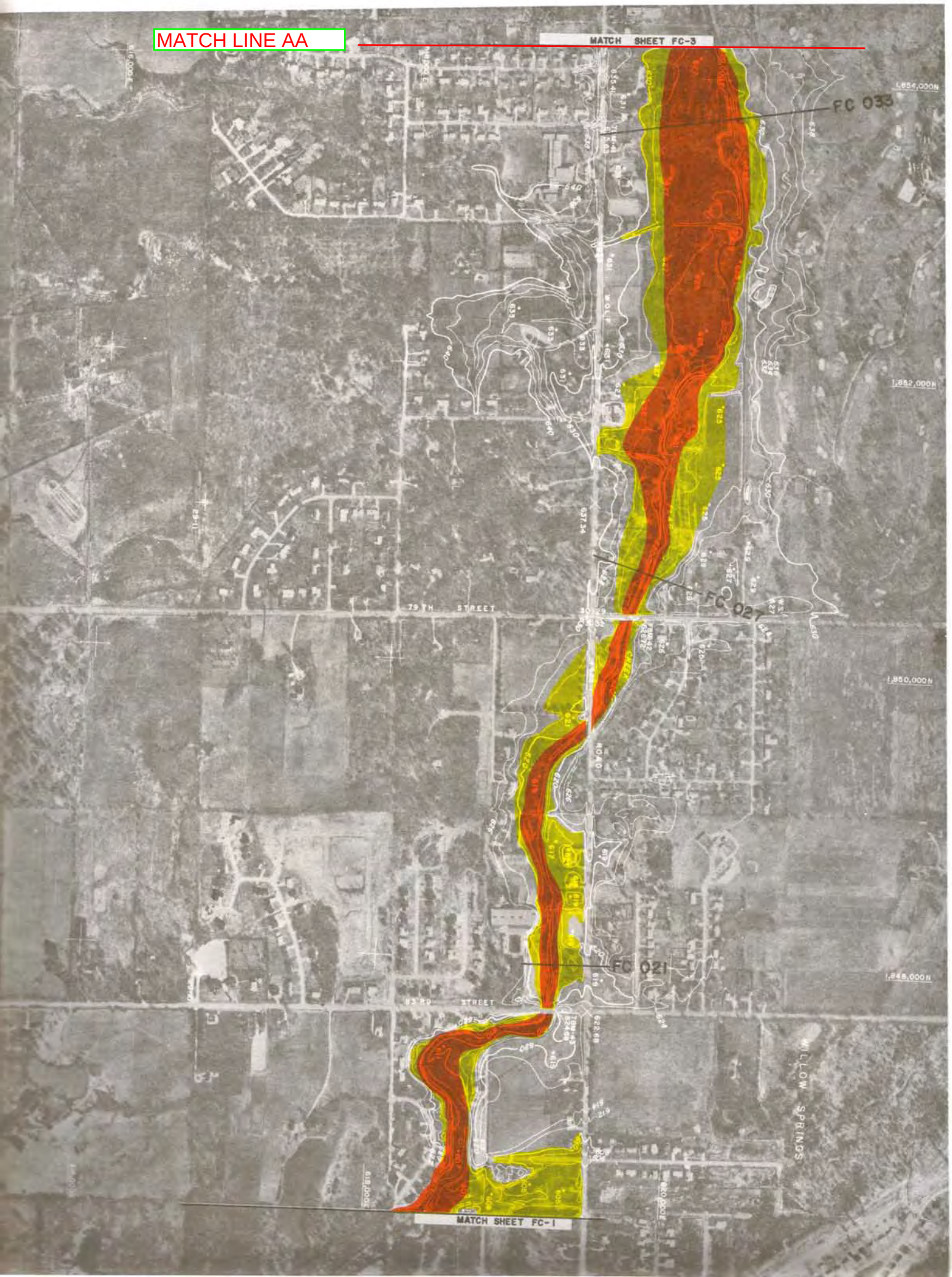
MATCH SHEET FC-5
FC 052
FCT 05
02 FCT
FCT 01
FC 047
INDIAN HEAD PARK
COOK
COUNTY
LINE
ROAD
038 FC
FC 039
MATCH LINE AA
MATCH SHEET FC-2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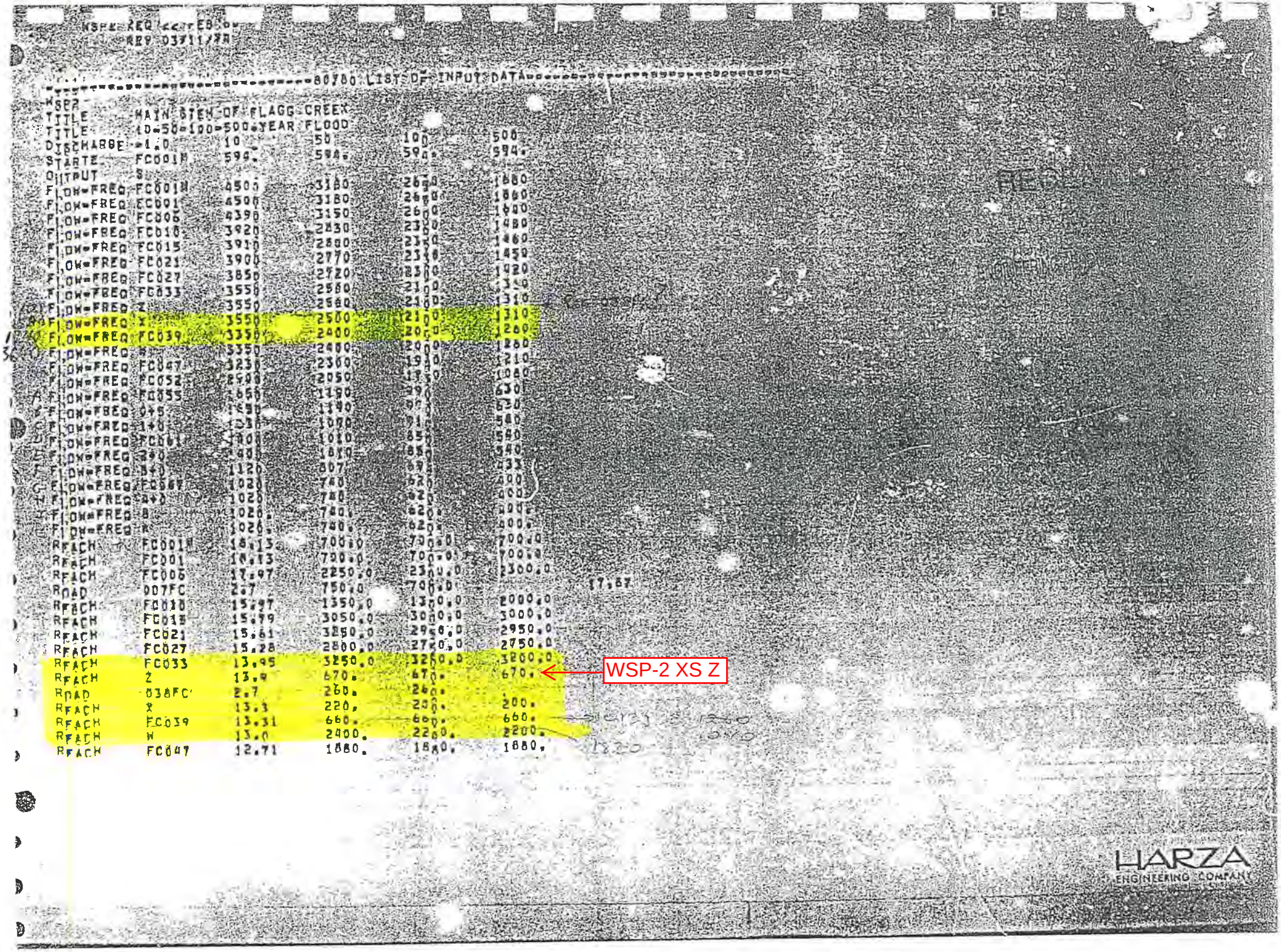
FC 033
FC 027
FC 021
79 TH STREET
83 RD STREET
MILLOW SPRINGS
MATCH SHEET FC-1


WSP-2 XS Z
HARZA
ENGINEERING COMPANY

```
                                           MAIN STEM DESPLAINES CREEK
   HSPR XEQ 22 FEB 80                    10-50-100-500-YEAR FLOOD
          REV 03/11/78

---------------------------------80/80 LIST OF INPUT DATA------------------------------------
                                            176.        627.3        208.0        626.0FC027   2 9
           100.0        627.0           338.0        626.0        249.0        624.3FC027   3 9
           218.0        626.2           348.0        621.1        357.0        616.5FC027   4 9
           300.0        622.2           370.0        615.9        376.0        615.8FC027   5 9
           344.0        619.6           391.0        621.9        488.0        622.4FC027   6 9
           382.0        616.5           348.0        625.0        590.0        626.1FC027   7 9
           500.0        622.5           687.0        629.8        698.0        630.9FC027   8 9
           655.0        627.9                                                     FC027   7 9
           718.0        631.8
 ENDTABLE
 SEGMENT      FC033        1           D            678.
 NVALUE       0.080
 SEGMENT      FC033        2           C            790.
 NVALUE       0.063
 SEGMENT      FC033        3           D            1598.
 NVALUE       0.080
 SECTION      FC033
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           300.0        633.3        460.0        631.6        500.0        629.2FC033   2 9
           575.0        627.7        600.0        627.9        675.0        626.5FC033   3 9
           680.0        625.0        680.0        622.0        690.0        622.2FC033   4 9
           695.0        622.0        690.0        623.0        764.0        626.2FC033   5 9
           800.0        626.5        900.0        627.1       1000.0        627.5FC033   6 9
          1100.0        627.4       1200.0        621.0       1300.0        630.1FC033   7 9
          1000.0        630.9       1500.0        631.45      1586.         633.0FC033   8 9
          1598.9        633.5                                                     FC033   9 9
 ENDTABLE
 SEGMENT      Z            1           H            198.
 NVALUE       0.08
 SEGMENT      Z            2           C            248.
 NVALUE       0.063
 SEGMENT      Z            3           H            408.
 NVALUE       0.08
 SECTION      Z
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            0.          631.1         100.         633.5         190.         629.1
           20X.         E24.8         218.         620.3         228.         624.8
           240.         630.1         290.         631.4         400.         635.0
 ENDTABLE
 BPR          038FC        8           3.           2.7          0.6
 GIRDER       629.3        628.5       10.0         624.5        600.0        620.5
              519.0        633.7       519.0
              600.0        633.7
 ENDTABLE
 SECTION      038FC                                                 634.0038FC   1 9
                     0.0        633.7        430.0        633.7        447.0
```

Boom, skew, soff, weir

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REV:03/11/10

LIST OF INPUT DATA

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ENDTABLE
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SEGMENT   W                      N       168.
NVALUE    0.06       3.
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NVALUE    0.06
SECTION   W
          -200.      639.        -199.    639.      -198.    639.
          0.         635.8       50.      635.0     74.      626.8
```

ANK										
ZERO DAMG										
	1	623.7	994.2	1420.0	66.33	.00	.00	10.00	620.2	.00284
	2	624.9	980.8	2300.0	19.20	.00	.00	50.00	622.3	.00292
	3	625.3	1877.2	2720.0	20.38	.00	.00	100.00	622.7	.00255
	4	626.3	1500.3	3850.0	28.81	.00	.00	500.00	623.2	.00224

SEGMENT TABLE FOR SECTION FC027

CSM		TOTAL	SEG NO 1 D	2 C	3 D
1	DISCHARGE CFS	1420.	161.	1079.	204.
93.	VELOCITY FPS	3.22	1.20	3.51	1.18
2	DISCHARGE CFS	2300.	362.	1394.	544.
151.	VELOCITY FPS	3.25	1.57	3.93	1.53
3	DISCHARGE CFS	2720.	475.	1543.	702.
178.	VELOCITY FPS	3.32	1.73	3.11	1.64
4	DISCHARGE CFS	3850.	733.	1911.	1206.
252.	VELOCITY FPS	3.39	1.76	3.54	1.65
1	ELEV 623.7 KD	27187.	3864	20908.	3815.
2	ELEV 624.9 KD	45650.	7009.	28026.	10617.
3	ELEV 625.3 KD	55975.	9253.	33601.	13120.
4	ELEV 626.3 KD	77073.	14834.	38770.	24369.

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MAIN STEM OF FLAGG CREEK
10&50-100-500 YEAR FLOOD

RATING TABLE FOR SECTION FC033 DAM 13.9

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	CHANNEL	NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	622.0	0.0	0.0						
BANK FULL	626.2	81.1	811.4	.00	.00	.00			
ZERO DAMG	626.2	81.1	811.4	.00	.00	.00			
1	628.8	1204.8	1310.0	53.02	.00	.00	10.00	627.2	.00134
2	629.3	1627.4	2100.0	56.83	.00	.00	50.00	627.6	.00147
3	629.7	1885.9	2500.0	58.87	.00	.00	100.00	627.7	.00139
4	630.5	2640.4	3550.0	67.36	.00	.00	500.00	627.9	.00114

SEGMENT TABLE FOR SECTION FC033

CSM		TOTAL	SEG NO 1 D	2 C	3 D
1	DISCHARGE CFS	1310.	160.	365.	785.
94.	VELOCITY FPS	1.59	.79	2.47	.92
2	DISCHARGE CFS	2100.	291.	459.	1350.
151.	VELOCITY FPS	1.68	.98	2.82	1.16

HARZA ENGINEERING COMPANY

MAIN STEM OF FLAGG CREEK
100-YEAR FLOOD

RATING TABLE FOR SECTION 2 DAS 13.8

	ELEV	AREA	CFS	ACRES FLOODED DAHABE	ACRES FLOODED CHANNEL	ACRES FLOODED NONDAH	COM ELEV	COM STORE	ORIF ELEV	FRICTION STORE
	624.3	20.8	0.0							
BANKFULL	629.1	135.4	898.4	.00	.00	.00				
3	631.3	351.3	1310.0	.00	.00	3.79	10.00	520.8	630.1	600.0
4	632.3	569.9	2100.0	.00	.00	8.00	50.00	630.1	600.0	600.0
5	632.6	698.7	2500.0	.00	.00	9.62	100.00	630.7	600.0	600.0
6	633.4	1018.7	3550.0	.00	.00	10.1	500.00	631.6	600.0	600.0

SEGMENT TABLE FOR SECTION 2

COM	TOTAL	SEG NO 1	SEG NO 2	SEG NO 3
		1	2	N
1	DISCHARGE CFS	1310.	75.	12836.	11.
94.	VELOCITY FPS	3.40	1.01	4.42	.94
2	DISCHARGE CFS	2190.	287.	1765.	513.
151.	VELOCITY FPS	5.20	1.29	5.60	1.44
3	DISCHARGE CFS	2500.	399.	1920.	180.
186.	VELOCITY FPS	5.27	1.57	5.81	1.61
4	DISCHARGE CFS	3530.	1077.	2318.	156.
255.	VELOCITY FPS	5.22	1.93	6.26	1.76

1	ELEV 631.1	KD	19799.	1090.	18577.	132.
2	ELEV 632.3	KD	29089.	3918.	24481.	690.
3	ELEV 632.6	KD	33878.	6048.	26819.	1011.
4	ELEV 633.4	KD	49403.	14654.	32601.	2148.

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.0000 .0000 .0000 CAREA= 232.43 FLOW= 1310.00 CHEIR= .00
DCRIT= -1.00 NSCRIT= CAREA= 232.43 FLOW= 1310.00 CHEIR= .00
ELEVB= 631.79 EHSBD= 631.91 HDLOSS= .08
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ELEVB= 632.86 EHSBD= 632.78 HDLOSS= .06
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DCRIT= -1.00 NSCRIT= CAREA= 232.43 FLOW= 3550.00 CHEIR= .48
ELEVB= 634.10 EHSBD= 633.98 HDLOSS= .12

WSPE XEQ 22 F 80
REV 03711/74

MAIN STEM OF FLAGG CREEK
10-50-100-500 YEAR FLOOD

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ROAD SECTION DISCH

NO.	HH	CFS	HL	O	ODH
0	632.09	.00	.00	.00	.00
1	631.79	1310.00	.02	631.71	10.00
2	632.88	2100.00	.06	632.78	50.00
3	633.28	2500.00	.08	633.15	100.00
4	634.10	3550.00	.12	633.98	500.00

HIN ROAD ELEVATION = 633.30

BRIDGE TYPE 2 BRIDGE BOTTOM ELEVATION = 626.50 OPENING NO. = 1

WSPE XEQ 22 F 80
REV 03711/74

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MAIN STEM OF FLAGG CREEK
10-50-100-500 YEAR FLOOD

RATING TABLE FOR SECTION X DAM 13.3

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NONDAM	C&M	CRIT ELEV	FRICTION SLOPE
0	621.3	0.0	0.0						
BANK FULL	625.2	116.0	482.6	.00	.00	.00			
1	631.9	637.6	1310.0	.00	.00	.20	10.00	625.7	.00060
2	633.1	810.9	2100.0	.00	.00	.47	50.00	626.7	.00090
3	633.5	898.8	2500.0	.00	.00	.61	100.00	627.1	.00106
4	634.5	1138.1	3550.0	.00	.00	.99	500.00	628.1	.00160

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SEGMENT TABLE FOR SECTION X[illegible]

CSM		TOTAL	SEG NO 1 H	2 C	3 H
1	DISCHARGE CFS	1310.	6.	1259.	45.
98.	VELOCITY FPS	2.?7	.38	2.80	.90
2	DISCHARGE CFS	2100.	46.	1980.	76.
150.	VELOCITY FPS	2.92	.50	2.99	1.04
3	DISCHARGE CFS	2500.	61.	2323.	96.
188.	VELOCITY FPS	3.24	.70	3.33	1.11
4	DISCHARGE CFS	3350.	219.	3166.	165.
267.	VELOCITY FPS	3.90	.91	4.11	1.30
1	ELEV 631.9 KD	53335.	62.	51609.	1805.
2	ELEV 633.1 KD	69677.	1207.	65878.	2518.
3	ELEV 633.8 KD	76534.	2207.	71488.	2904.
4	ELEV 634.9 KD	94878.	5827.	84636.	4414.

MAIN STEM OF FLAG CREEK
10-50-100-500 YEAR FLOOD

RATING TABLE FOR SECTION FC039 DAM 1333

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	623.2	0.0	0.0						
BANK-FULL	632.1	423.7	1220.0	.00	.00	.00			
ZERO DAMG	632.1	423.7	1220.0	.00	.00	.00			
1	632.4	446.3	1260.0	1.16	.00	.00	10.00	627.3	.00083
2	633.7	599.3	2000.0	2.81	.00	.00	50.00	628.3	.00109
3	634.3	689.3	2400.0	4.01	.00	.00	100.00	628.8	.00123
4	635.3	1052.8	3350.0	5.87	.00	.00	500.00	629.8	.00133

SEGMENT TABLE FOR SECTION FC039

CSM		TOTAL	SEG NO 1 D	2 C	3 D
1	DISCHARGE CFS	1260.	0.	1259.	1.
95.	VELOCITY FPS	2.80	.00	2.84	.38
2	DISCHARGE CFS	2000.	7.	1969.	24.
150.	VELOCITY FPS	3.64	.30	3.65	.63
3	DISCHARGE CFS	2400.	22.	2332.	45.
180.	VELOCITY FPS	4.00	.42	4.05	.78
4	DISCHARGE CFS	3350.	223.	2987.	139.
252.	VELOCITY FPS	4.36	.85	4.56	1.00
1	ELEV 632.4 KD	43766.	1.	43760.	5.
2	ELEV 633.7 KD	60205.	27.	59637.	541.

MAIN STEM OF FLAGG CREEK
10-50-100-500 YEAR FLOOD

RATING TABLE FOR SECTION H DA= 13.0

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	624.0	0.0	0.0						
1	630.9	878.9	1268.8	.00	.00	.00	100.00	628.1	.00007
BANK FULL	635.0	1272.6	3674.7	.00	.00	.76			
2	639.0	1707.8	12000.0	.00	.00	2.76	50.00	628.6	.00001
3	643.0	2191.1	24000.0	.00	.00	5.08	100.00	628.8	.00000
4	647.0	2680.8	33598.0	.00	.00	18.33	500.00	630.8	.00007

DISCHARGE TABLE FOR SECTION H

CSM	TOTAL	REG NO.
0.	1260.	0.
DISCHARGE CFS	1260.	0.
17. VELOCITY FPS	2.18	.00
2. DISCHARGE CFS	2800.	0.
158. VELOCITY FPS	2.48	.21
3. DISCHARGE CFS	24000.	1.
189. VELOCITY FPS	2.80	.19
8. DISCHARGE CFS	33600.	42.
258. VELOCITY FPS	3.23	.58

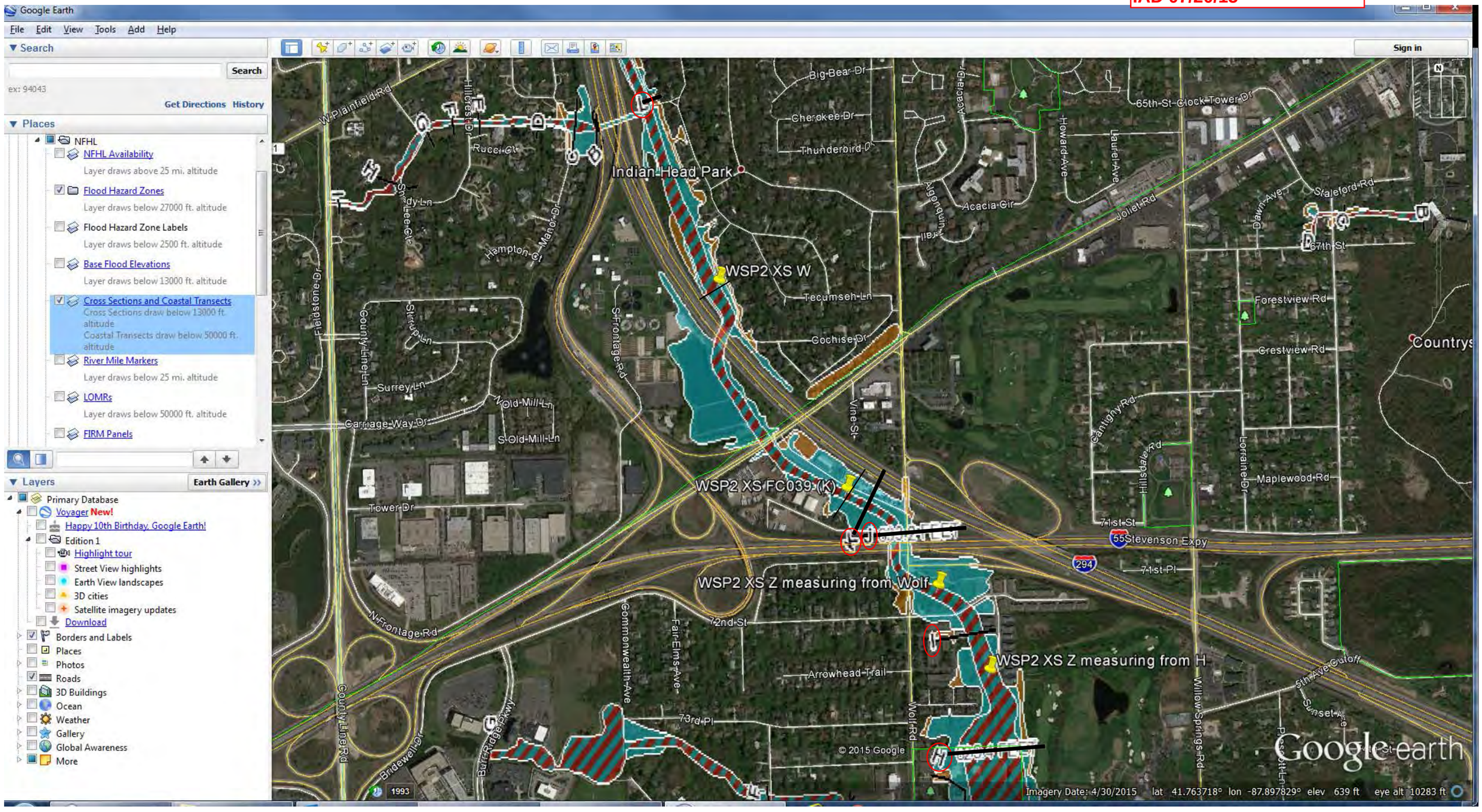
1	ELEV	630.0	KO	88639.	1.	88636.	1.
2	ELEV	633.8	KO	70207.	160.	70048.	2.
3	ELEV	636.3	KO	81713.	1038.	80647.	28.
4	ELEV	637.8	KO	109883.	3874.	102573.	1356.

MAIN STEM OF FLAGG CREEK
10-50-100-500 YEAR FLOOD

RATING TABLE FOR SECTION FC047 DA= 12.7

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	625.0	0.0	0.0						
BANK FULL	632.2	1340.2	876.7	.00	.00	.00			

FLAGG CREEK AT I-55
IDOT 11-0203
IAD 07/20/15



Note: Approximate locations of 1980 WSP2 cross sections W & FC 039 (K) determined using WSP2 reach lengths between FC 047 (L) and 038 FC (J). Location of WSP2 XS Z not possible to determine, as there is insufficient reach length in model vs. real world, between WSP2 XS 038 FC (J) & FC 033 (H). FIS XS I comes from a 2000 LOMR model that is not available.

TAB B

SECTION 13.B

MOD. FIS DUPLICATE (NGVD 29)

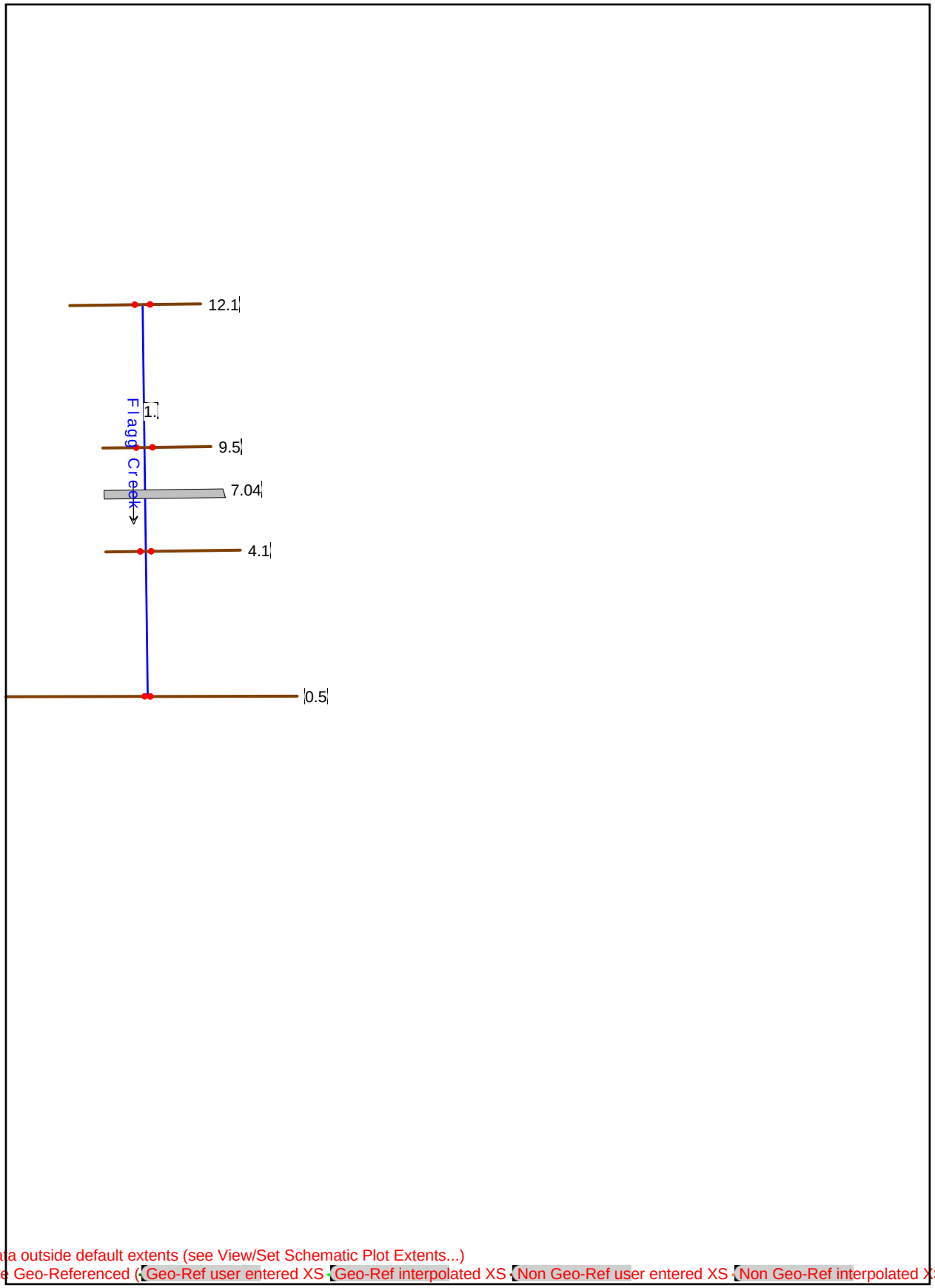
10 Year			
Cross Section	**Regulatory WSP-2 Output**	**Mod. HEC-RAS Duplicate**	**Difference**
FC033	**628.8**	**628.8**	**0.0**
Z	631.3	631.21	-0.1
X	631.9	631.72	-0.2
FC039	632.4	632.26	-0.1

50 Year			
Cross Section	**Regulatory WSP-2 Output**	**Mod. HEC-RAS Duplicate**	**Difference**
FC033	629.3	629.3	0.0
Z	632.3	632.2	-0.1
X	633.1	633.05	-0.1
FC039	633.7	633.76	0.1

100 Year			
Cross Section	**Regulatory WSP-2 Output**	**Mod. HEC-RAS Duplicate**	**Difference**
FC033	629.7	629.7	0.0
Z	632.6	632.59	0.0
X	633.5	633.62	0.1
FC039	634.3	634.38	0.1

500 Year			
Cross Section	**Regulatory WSP-2 Output**	**Mod. HEC-RAS Duplicate**	**Difference**
FC033	630.5	630.5	0.0
Z	633.4	633.41	0.0
X	634.5	634.91	0.4
FC039	635.3	635.71	0.4

Note: All Elevations in NGVD 1929



Some schematic data outside default extents (see View/Set Schematic Plot Extents...)
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: I-55 over Flag Creek
Project File : I-55OveFlagCreek.prj
Run Date and Time: 7/20/2015 3:36:58 PM

Project in English units

Project Description:
2015 CBBEL Hydraulic Report for I-55 Over Flag Creek. All Models ran in NAVD 88. Conversion from NAVD 88 to NGVD 29= NGVD 29-0.28.

PLAN DATA

Plan Title: Mod. FIS_29
Plan File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek\I-55OveFlagCreek.p06

Geometry Title: Mod_FIS
Geometry File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek\I-55OveFlagCreek.g05

Flow Title : WSP-2 Flows_29
Flow File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek\I-55OveFlagCreek.f01

Plan Description:
WSP-2 Cross section duplicated into HEC-RAS. Manning's N addjusted to match the results of the published WSP-2. Elevations all in NGVD 29

Plan Summary Information:

Number of:	Cross Sections	= 4	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

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

Computation Options
- Critical depth computed only where necessary
- Conveyance Calculation Method: At breaks in n values only
- Friction Slope Method: Program Selects Appropriate method
- Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: WSP-2 Flows_29
Flow File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek\I-55OveFlagCreek.f01

Flow Data (cfs)

River	Reach	RS	Q10	Q50	Q100	Q500
Flagg Creek	1.	12.1	1260	2000	2400	3350
Flagg Creek	1.	9.5	1310	2100	2500	3550

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Flagg Creek	1.	Q10		Known WS = 628.8
Flagg Creek	1.	Q50		Known WS = 629.3
Flagg Creek	1.	Q100		Known WS = 629.7
Flagg Creek	1.	Q500		Known WS = 630.5

GEOMETRY DATA

Geometry Title: Mod_FIS
Geometry File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek\I-55OveFlagCreek.g05

CROSS SECTION

RIVER: Flagg Creek
REACH: 1. RS: 12.1

INPUT
Description: FC 39
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	639.4	80	633.9	100	633.8	160	634.8	215	634.7
233	633.3	245	625.6	254	624.2	260	624.6	267	624.4
274	623.2	282	623.9	290	625.6	304	632.1	400	635.8
500	638.3	541	639.3	594	641	605	641.3		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	233	.05	304	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
233	304	660	660	0	0

CROSS SECTION

RIVER: Flagg Creek
REACH: 1. RS: 9.5

INPUT
Description: FIS X
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
    -200     636    -199     636    -198     636       0   633.1      70     631
      85   625.3     115   621.3     145   625.2     160   632.2     200   634.9
     300     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    -200    .077      70    .077     145    .077

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           70     145             480     480     480              0       0

BRIDGE


RIVER: Flagg Creek
REACH: 1.                RS: 7.04

INPUT
Description: 70th Place from FIS
Distance from Upstream XS =     196
Deck/Roadway Width        =      40
Weir Coefficient          =     2.7
Upstream  Deck/Roadway Coordinates
    num=      15
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   633.7             430   633.7             442     634
     453   633.7             494   633.2             515   633.5
     519   633.7             519   628.5             519   633.7   628.5
     600   633.7   628.5     603   633.9             700   634.9
     800     636             900   639.9            1000   637.8

Upstream Bridge Cross Section Data
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   633.7     430   633.7     442     634     453   633.7     494   633.2
     515   633.5     519   633.7     519   628.5     519   626.7     527   625.5
     534   623.4     544     622     559   622.5     559   622.8     569   622.8
     584     624     594   625.5     600   626.7     600   628.5     600   633.7
     603   633.9     700   634.9     800     636     900   639.9    1000   637.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .012     519    .012     600    .012

Bank Sta: Left   Right    Coeff Contr.   Expan.
          519     600             0        0

Downstream  Deck/Roadway Coordinates
    num=      15
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   633.7             430   633.7             442     634
     453   633.7             494   633.2             515   633.5
     519   633.7             519   628.5             519   633.7   628.5
     600   633.7   628.5     603   633.9             700   634.9
     800     636             900   639.9            1000   637.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   633.7     430   633.7     442     634     453   633.7     494   633.2
     515   633.5     519   633.7     519   628.5     519   626.7     527   625.5
     534   623.4     544     622     559   622.5     559   622.8     569   622.8
     584     624     594   625.5     600   626.7     600   628.5     600   633.7
     603   633.9     700   634.9     800     636     900   639.9    1000   637.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .012     519    .012     600    .012

Bank Sta: Left   Right    Coeff Contr.   Expan.
          519     600             0        0
```

```
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         =   633.2
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

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

CROSS SECTION


RIVER: Flagg Creek
REACH: 1.                RS: 4.1

INPUT
Description: FIS Z
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -222     635    -221     632    -220     635       0   631.1     100   635.5
     190   629.1     204   624.8     218   624.3     228   624.8     240   630.1
     290   632.4     400     635

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    -222     .09     190    .075     240     .09

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           190     240              670     670     670              0       0

CROSS SECTION


RIVER: Flagg Creek
REACH: 1.                RS: 0.5

INPUT
Description: FIS 33
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   641.7     100   638.9     200   635.6     300   633.3     400   631.6
     500   629.2     545   627.7     600   627.5     678   626.5     680     625
     686     622     690   622.2     695   622.4     698     623     704   626.2
     800   626.5     900   627.1    1000   627.5    1100   627.4    1200   627.8
    1300   630.1    1400   630.9    1500   631.8    1586     633  1598.9   633.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .09     678    .073     704     .09

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           678     704                0       0       0              0       0
```

SUMMARY OF MANNING'S N VALUES

River:Flagg Creek

Reach	River Sta.	n1	n2	n3
1.	12.1	.05	.05	.05
1.	9.5	.077	.077	.077
1.	7.04	Bridge		
1.	4.1	.09	.075	.09
1.	0.5	.09	.073	.09

SUMMARY OF REACH LENGTHS

River: Flagg Creek

Reach	River Sta.	Left	Channel	Right
1.	12.1	660	660	660
1.	9.5	480	480	480
1.	7.04	Bridge		
1.	4.1	670	670	670
1.	0.5	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Flagg Creek

Reach	River Sta.	Contr.	Expan.
1.	12.1	0	0
1.	9.5	0	0
1.	7.04	Bridge	
1.	4.1	0	0
1.	0.5	0	0

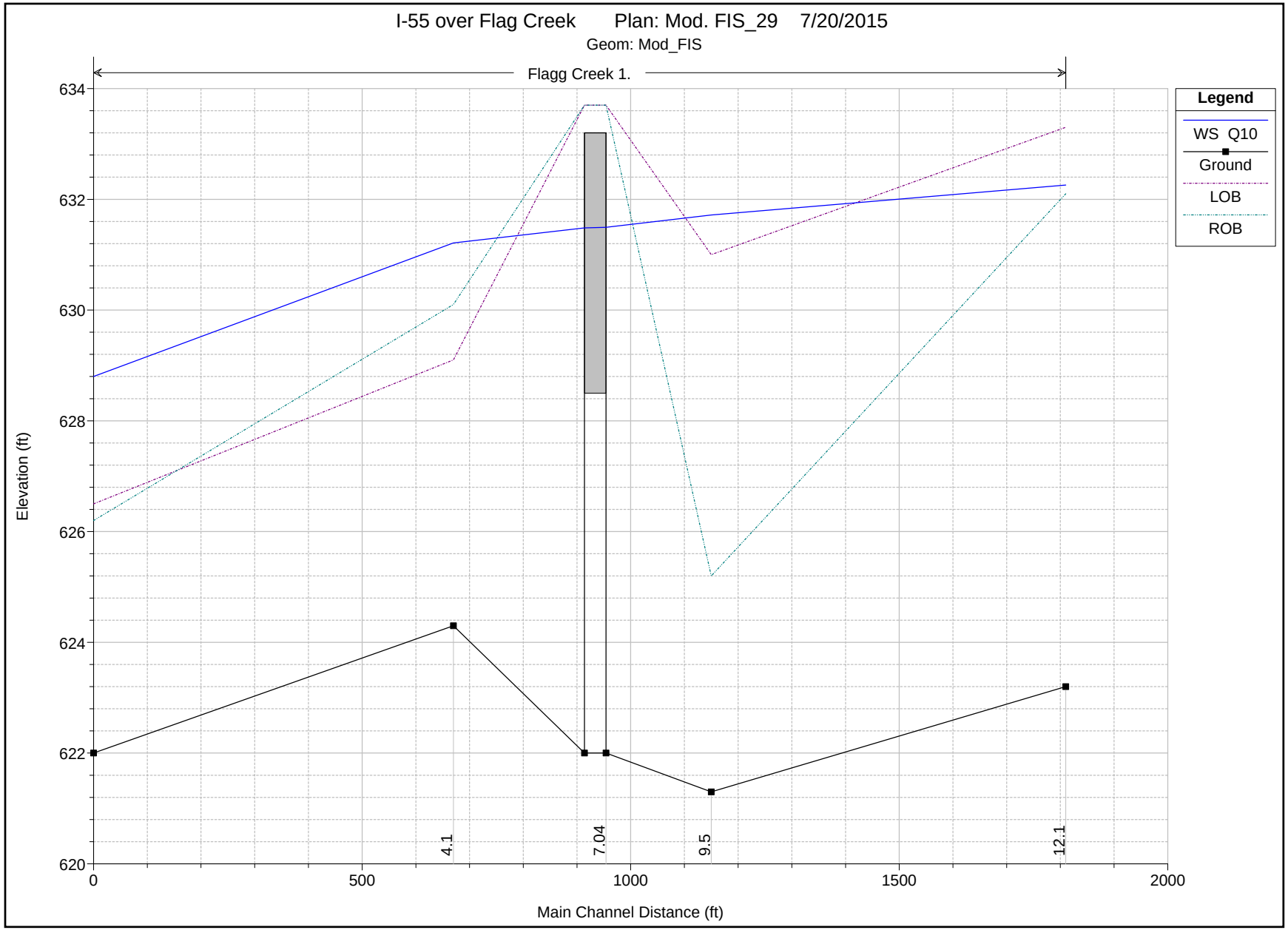
10-Year

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q10

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1.	12.1	Q10	1260.00	623.20	632.26		632.39	0.000857	2.87	439.14	73.46	0.20
1.	9.5	Q10	1310.00	621.30	631.72	625.74	631.79	0.000945	2.24	614.05	112.85	0.14
1.	7.04		Bridge									
1.	4.1	Q10	1310.00	624.30	631.21		631.55	0.006493	4.74	310.16	112.90	0.36
1.	0.5	Q10	1310.00	622.00	628.80	627.75	628.83	0.001638	2.41	1227.18	731.48	0.18

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q10

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1.	12.1	Q10	632.39	632.26	0.13	0.59	0.00		1259.95	0.05	73.46
1.	9.5	Q10	631.79	631.72	0.08	0.12	0.00	2.56	1251.88	55.56	112.85
1.	7.04		Bridge								
1.	4.1	Q10	631.55	631.21	0.33	2.72	0.00	43.38	1254.50	12.12	112.90
1.	0.5	Q10	628.83	628.80	0.03			183.49	339.42	787.09	731.48


I-55 over Flag Creek Plan: Mod. FIS_29 7/20/2015
Geom: Mod_FIS
Flagg Creek 1.
Legend
WS Q10
Ground
LOB
ROB
Elevation (ft)
634
632
630
628
626
624
622
620
0
500
1000
1500
2000
Main Channel Distance (ft)
4.1
7.04
9.5
12.1

Errors Warnings and Notes for Plan : Mod FIS

Location:	River: Flagg Creek Reach: 1. RS: 9.5 Profile: Q10
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 7.04 Profile: Q10 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 4.1 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
	This may indicate the need for additional cross sections.

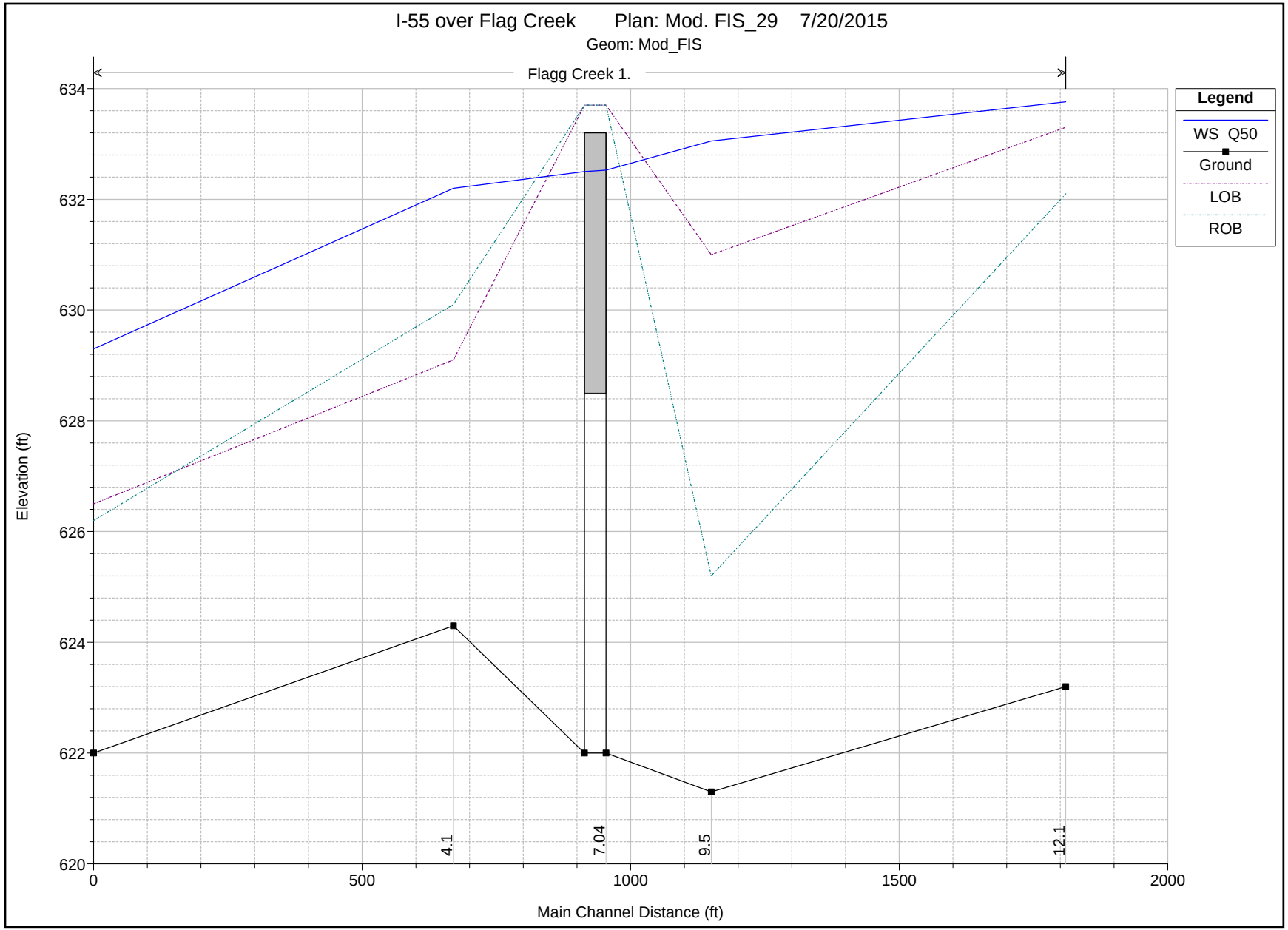
50-Year

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q50

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1.	12.1	Q50	2000.00	623.20	633.76		633.96	0.001054	3.61	581.89	120.02	0.23
1.	9.5	Q50	2100.00	621.30	633.05	626.67	633.18	0.001337	2.97	801.30	171.11	0.18
1.	7.04		Bridge									
1.	4.1	Q50	2100.00	624.30	632.20		632.68	0.007967	5.88	477.27	226.31	0.41
1.	0.5	Q50	2100.00	622.00	629.30	628.05	629.34	0.001986	2.82	1602.16	769.38	0.20

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q50

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1.	12.1	Q50	633.96	633.76	0.20	0.78	0.00	0.49	1969.01	30.50	120.02
1.	9.5	Q50	633.18	633.05	0.13	0.19	0.00	50.49	1959.60	89.92	171.11
1.	7.04		Bridge								
1.	4.1	Q50	632.68	632.20	0.48	3.33	0.00	180.27	1846.90	72.83	226.31
1.	0.5	Q50	629.34	629.30	0.04			327.43	433.04	1339.54	769.38


I-55 over Flag Creek Plan: Mod. FIS_29 7/20/2015
Geom: Mod_FIS
Flagg Creek 1.
Legend
WS Q50
Ground
LOB
ROB
Elevation (ft)
634
632
630
628
626
624
622
620
0
500
1000
1500
2000
Main Channel Distance (ft)
4.1
7.04
9.5
12.1

Errors Warnings and Notes for Plan : Mod FIS

Location:	River: Flagg Creek Reach: 1. RS: 9.5 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 7.04 Profile: Q50 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 4.1 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
	This may indicate the need for additional cross sections.

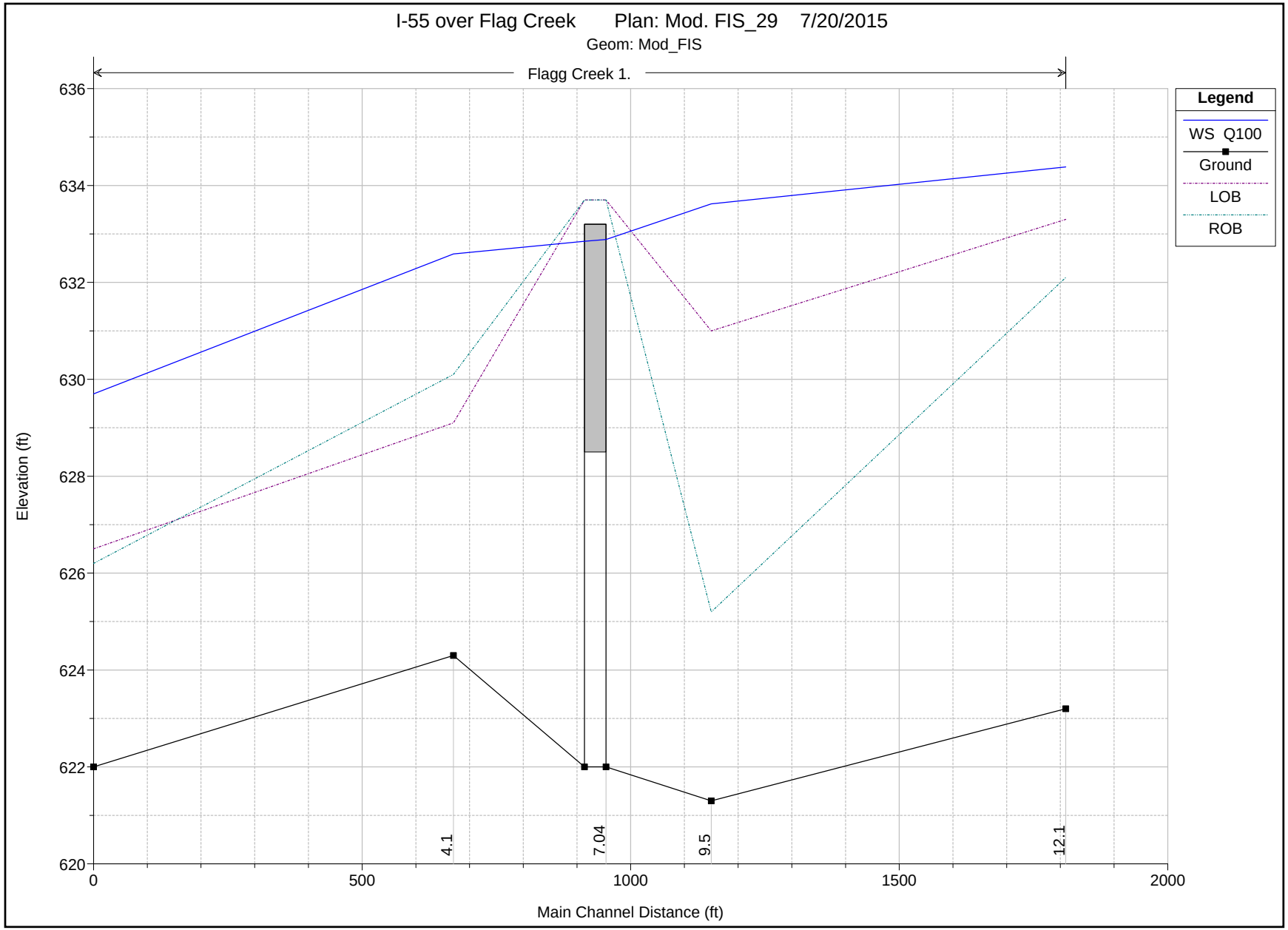
100-Year

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q100

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1.	12.1	Q100	2400.00	623.20	634.38		634.61	0.001119	3.92	686.69	206.21	0.24
1.	9.5	Q100	2500.00	621.30	633.62	627.07	633.77	0.001480	3.25	910.88	216.64	0.19
1.	7.04		Bridge									
1.	4.1	Q100	2500.00	624.30	632.59		633.11	0.008363	6.27	574.36	275.12	0.43
1.	0.5	Q100	2500.00	622.00	629.70	628.16	629.74	0.001693	2.72	1916.75	803.44	0.19

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q100

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1.	12.1	Q100	634.61	634.38	0.23	0.84	0.00	16.41	2310.17	73.42	206.21
1.	9.5	Q100	633.77	633.62	0.15	0.23	0.00	95.99	2287.27	116.74	216.64
1.	7.04		Bridge								
1.	4.1	Q100	633.11	632.59	0.52	3.37	0.00	295.37	2091.49	113.14	275.12
1.	0.5	Q100	629.74	629.70	0.04			410.75	445.93	1643.32	803.44


I-55 over Flag Creek Plan: Mod. FIS_29 7/20/2015
Geom: Mod_FIS
Flagg Creek 1.
Legend
WS Q100
Ground
LOB
ROB
Elevation (ft)
636
634
632
630
628
626
624
622
620
0
500
1000
1500
2000
Main Channel Distance (ft)
4.1
7.04
9.5
12.1

Errors Warnings and Notes for Plan : Mod FIS

Location:	River: Flagg Creek Reach: 1. RS: 12.1 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Location:	River: Flagg Creek Reach: 1. RS: 9.5 Profile: Q100
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 7.04 Profile: Q100 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 4.1 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
	This may indicate the need for additional cross sections.

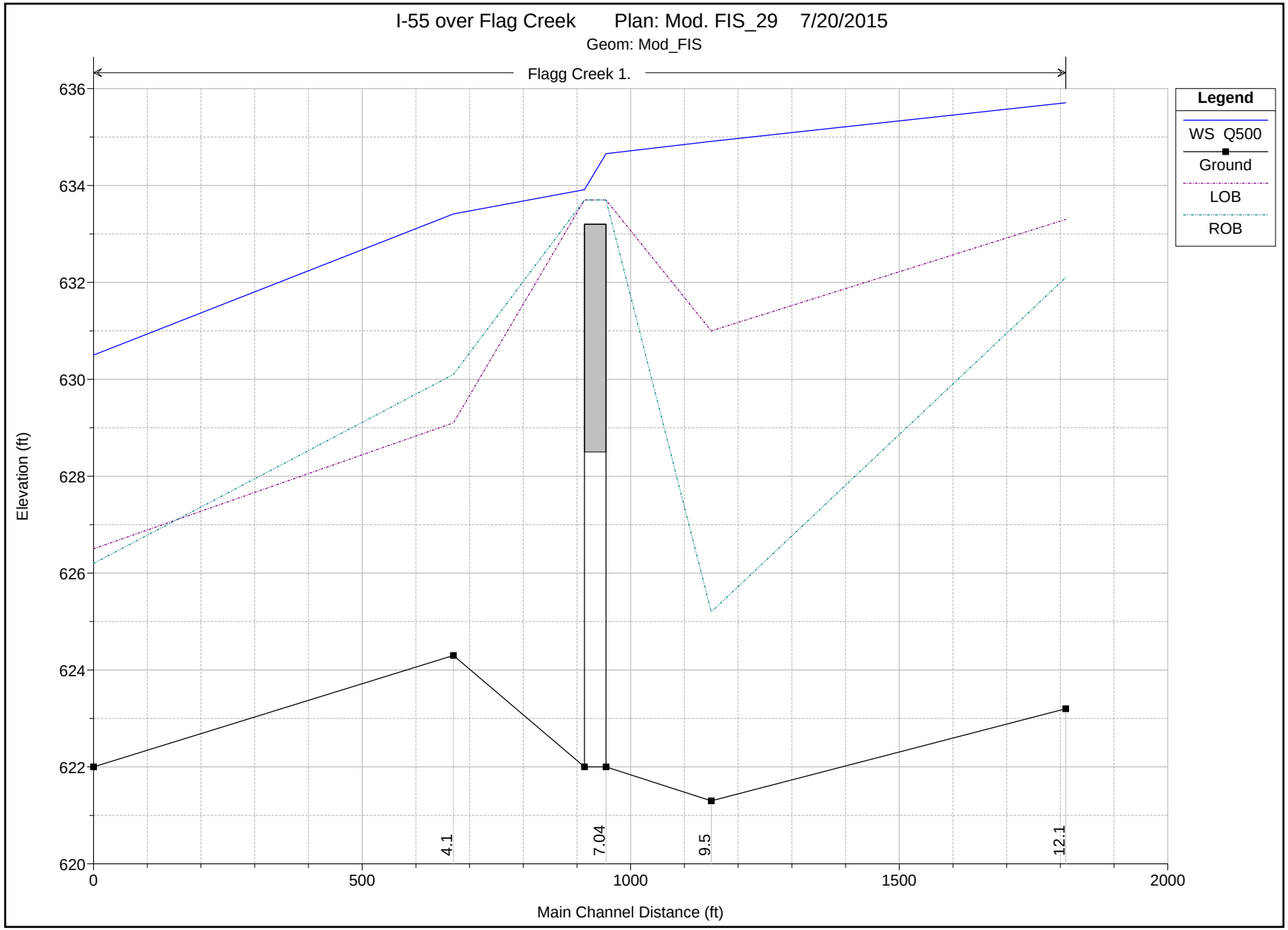
500-Year

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q500

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1.	12.1	Q500	3350.00	623.20	635.71		635.94	0.001041	4.18	1080.32	343.87	0.24
1.	9.5	Q500	3550.00	621.30	634.91	628.07	635.10	0.001653	3.75	1259.11	324.49	0.20
1.	7.04		Bridge									
1.	4.1	Q500	3550.00	624.30	633.41		633.98	0.008763	6.94	848.08	387.61	0.45
1.	0.5	Q500	3550.00	622.00	630.50	628.39	630.54	0.001510	2.78	2593.26	904.17	0.18

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1. Profile: Q500

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1.	12.1	Q500	635.94	635.71	0.23	0.84	0.00	257.78	2852.51	239.71	343.87
1.	9.5	Q500	635.10	634.91	0.19	0.22	0.00	336.52	2996.63	216.85	324.49
1.	7.04		Bridge								
1.	4.1	Q500	633.98	633.41	0.56	3.44	0.00	698.14	2600.81	251.05	387.61
1.	0.5	Q500	630.54	630.50	0.04			646.04	513.86	2390.11	904.17


I-55 over Flag Creek Plan: Mod. FIS_29 7/20/2015
Geom: Mod_FIS
Flagg Creek 1.
Legend
WS Q500
Ground
LOB
ROB
Elevation (ft)
636
634
632
630
628
626
624
622
620
0
500
1000
1500
2000
Main Channel Distance (ft)
4.1
7.04
9.5
12.1

Errors Warnings and Notes for Plan : Mod FIS

Location:	River: Flagg Creek Reach: 1. RS: 9.5 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Location:	River: Flagg Creek Reach: 1. RS: 7.04 Profile: Q500 Upstream
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water
	surface was used.
Location:	River: Flagg Creek Reach: 1. RS: 7.04 Profile: Q500 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water
	surface was used.
Location:	River: Flagg Creek Reach: 1. RS: 4.1 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
	or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
	This may indicate the need for additional cross sections.

Structure Tables

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1.

Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)
1.	7.04	Q10	631.79	628.50	384.70		1310.00	633.21		0.24
1.	7.04	Q50	633.18	628.50	384.70		2100.00	633.21		0.51
1.	7.04	Q100	633.77	628.50	384.70		2500.00	633.21		0.67
1.	7.04	Q500	635.10	628.50	384.70		3550.00	633.21		1.12

HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1.

Reach	River Sta	Profile	E.G. US.	W.S. US.	Br Sel Method	Energy EG	Momen. EG	Yarnell EG	WSPRO EG	Prs O EG	Prs/Wr EG	Energy/Wr EG
			(ft)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1.	7.04	Q10	631.79	631.72	Energy only	631.79						
1.	7.04	Q50	633.18	633.05	Energy only	633.18						
1.	7.04	Q100	633.77	633.62	Energy only	633.77						
1.	7.04	Q500	635.10	634.91	Energy only	635.10						

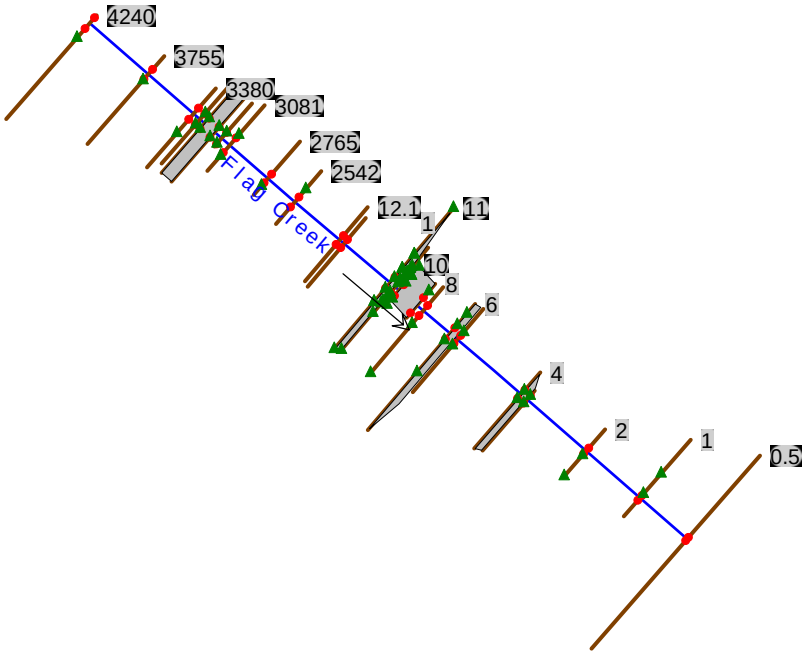
HEC-RAS Plan: Mod FIS River: Flagg Creek Reach: 1.

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1.	12.1	Q10	632.39	632.26		0.59	0.00	73.46		1259.95	0.05	2.87
1.	12.1	Q50	633.96	633.76		0.78	0.00	120.02	0.49	1969.01	30.50	3.61
1.	12.1	Q100	634.61	634.38		0.84	0.00	206.21	16.41	2310.17	73.42	3.92
1.	12.1	Q500	635.94	635.71		0.84	0.00	343.87	257.78	2852.51	239.71	4.18
1.	9.5	Q10	631.79	631.72	625.74	0.12	0.00	112.85	2.56	1251.88	55.56	2.24
1.	9.5	Q50	633.18	633.05	626.67	0.19	0.00	171.11	50.49	1959.60	89.92	2.97
1.	9.5	Q100	633.77	633.62	627.07	0.23	0.00	216.64	95.99	2287.27	116.74	3.25
1.	9.5	Q500	635.10	634.91	628.07	0.22	0.00	324.49	336.52	2996.63	216.85	3.75
1.	7.04 BR U	Q10	631.67	631.49	625.55	0.01	0.00			1310.00		3.41
1.	7.04 BR U	Q50	632.99	632.53	626.48	0.03	0.00			2100.00		5.46
1.	7.04 BR U	Q100	633.54	632.88	626.85	0.04	0.00			2500.00		6.50
1.	7.04 BR U	Q500	634.88	634.66	627.67	0.04	0.00	676.28	1466.15	2036.38	47.47	4.41
1.	7.04 BR D	Q10	631.66	631.48	625.55	0.12	0.00			1310.00		3.41
1.	7.04 BR D	Q50	632.96	632.50	626.48	0.29	0.00			2100.00		5.46
1.	7.04 BR D	Q100	633.50	632.85	626.85	0.40	0.00			2500.00		6.50
1.	7.04 BR D	Q500	634.85	633.91	627.67	0.87	0.00	597.72	304.99	3244.62	0.38	8.07
1.	4.1	Q10	631.55	631.21		2.72	0.00	112.90	43.38	1254.50	12.12	4.74
1.	4.1	Q50	632.68	632.20		3.33	0.00	226.31	180.27	1846.90	72.83	5.88
1.	4.1	Q100	633.11	632.59		3.37	0.00	275.12	295.37	2091.49	113.14	6.27
1.	4.1	Q500	633.98	633.41		3.44	0.00	387.61	698.14	2600.81	251.05	6.94
1.	0.5	Q10	628.83	628.80	627.75			731.48	183.49	339.42	787.09	2.41
1.	0.5	Q50	629.34	629.30	628.05			769.38	327.43	433.04	1339.54	2.82
1.	0.5	Q100	629.74	629.70	628.16			803.44	410.75	445.93	1643.32	2.72
1.	0.5	Q500	630.54	630.50	628.39			904.17	646.04	513.86	2390.11	2.78

TAB C

SECTION 13.C

EXISTING CONDITIONS



Some schematic data outside default extents (see View/Set Schematic Plot Extents...)
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: I-55 over Flag Creek
Project File : I-55OveFlagCreek.prj
Run Date and Time: 9/28/2016 9:55:55 AM

Project in English units

Project Description:
2016 CBBEL Hydraulic Report for I-55 Over Flag Creek. All Models run in NAVD 88. Conversion from NAVD 88 = NGVD 29 - 0.28'.

PLAN DATA

Plan Title: Existing
Plan File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.p02

Geometry Title: Flag Creek_Existing
Geometry File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.g01

Flow Title : Existing_Flow
Flow File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.f03

Plan Description:
Existing conditions for I-55 over Flag Creek. Cross sections 1-12 based on 2012 CBBEL surveyed cross sections. Cross sections 241-4240 from 2011 HLR Cross sections. Surveyed structures for I-55/Wolf Road/72nd Street from 2012 CBBEL Survey. Joliet Road provided from 2011 HLR Report. FIS cross sections whose location could be properly verified were included. Starting water surface elevations and flows provided from WSP-2 regulatory model. All elevations provided in this model are in NAVD 88.

Plan Summary Information:

Number of:	Cross Sections	= 25	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 5	Lateral Structures	=	0

Computational Information

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

Computation Options

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

FLOW DATA

Flow Title: Existing_Flow
Flow File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.f03

Flow Data (cfs)

River	Reach	RS	Q10	Q50	Q100	Q500
Flag Creek	1	4240	1260	2000	2400	3350
Flag Creek	1	9.5	1310	2100	2500	3550

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Flag Creek	1	Q10		Known WS = 628.52
Flag Creek	1	Q50		Known WS = 629.02
Flag Creek	1	Q100		Known WS = 629.42
Flag Creek	1	Q500		Known WS = 630.22

GEOMETRY DATA

Geometry Title: Flag Creek_Existing
Geometry File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.g01

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 4240

INPUT
Description: Surveyed Cross Section
Just Downstream of I-294
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
943.02	647.412	943.48	640.344	963.35	633.911	971.53	631.283	985.77	625.018
989.08	624.043	1000	623.49	1013.98	623.654	1017.05	624.678	1034.49	624.84
1053.07	633.246	1060.13	633.409	1069	633.187	1083.3	633.804	1093.69	633.873
1108.87	633.761	1176.51	633.478	1245.68	635.723	1246.42	634.241	1280.74	634.556
1340.09	635.013	1406.16	635.549	1469.2	635.767	1507.24	635.917	1508.17	636.574
1531.03	636.89	1560	636	1643	636	1802	638		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
943.02	.1	963.35	.035	1053.07	.1	1246.42	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
963.35	1053.07	485	485	.1	.3

```
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 1129.87    1802              F
Right Levee     Station= 1245.69      Elevation=  635.72

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3755

INPUT
Description: Surveyed Cross Section
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     842     638  855.03 636.316  865.76 637.331  889.54 637.627  916.42 635.116
  951.87  633.76  980.21 624.746    1000 622.109 1020.69 624.438 1033.51 632.917
 1042.98 633.232 1044.37 633.199 1055.07 632.903 1084.42 630.058 1134.63 628.059
 1184.29 627.801 1226.86 627.254 1288.87 627.235 1329.26 627.215 1374.09 629.294
 1405.91 633.702 1441.25 636.583 1499.51 638.633 1570.41 639.073

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     842      .1  951.87    .035 1033.51      .1 1084.42    .025 1441.25    .025
 1499.51      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        951.87 1033.51              375     375     375             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 1042.98 1570.41  633.25       T
Right Levee     Station= 1042.98      Elevation= 633.232

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3380

INPUT
Description: Survey Cross Section
North ROW of Joliet Road
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   768.8     638   891.4     636  932.57 634.184   944.5 629.132  949.28 625.111
  958.01 622.816  977.15 622.471    1000 622.319 1016.57   632.3 1019.06 632.586
 1025.27  633.14 1067.43 633.486 1084.68 633.627 1162.07 634.615 1240.18 635.884
 1317.76 636.687 1395.69 637.077    1422     644

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   768.8      .1   944.5    .035 1025.27    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        932.57 1025.27               53      53      53             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1139.1    1422              F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3327

INPUT
Description: Surveyed Cross Section
Upstream Face of Joliet Road
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  738.62     638     890     636     922     634     928     632  934.62     636
```

```
  958.05 635.351  978.68 626.551  989.65 622.889    1000 622.043 1015.72 623.677
 1025.86 624.995 1030.13 625.714 1032.24 627.688 1048.55  631.47 1075.72 632.828
 1115.14 633.565  1162.6 633.736 1234.96 635.425 1368.96     640

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  738.62      .1  978.68    .035 1048.55    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        958.05 1048.55               39      39      39             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  738.62  954.07   637.5       F
 1046.13 1368.96   637.5       F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3288

INPUT
Description: Upstream Face of the Joliet Road Bridge
The chanel section was
             adjusted for the 7.3 degree skew.
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
  956.66   636.4  956.66     631  961.61   630.7  979.96   621.3  984.13   622.3
  993.06   622.7    1000   624.3 1015.28   624.2 1025.59   624.7 1038.49   630.7
 1043.35     631 1043.35   636.3 1100.87  637.92 1150.18  638.15 1200.49   638.4
 1252.04  638.69 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035  956.66    .035 1043.35    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        956.66 1043.35               82      82      82             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5  956.66   637.5       F
 1043.35 1409.21  637.75       F
Skew Angle = 7.3

BRIDGE


RIVER: Flag Creek
REACH: 1                  RS: 3245

INPUT
Description: Joliet Road from 2011 HLR Study
Distance from Upstream XS =       1
Deck/Roadway Width        =      80
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      22
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   350.4  642.62           450.4  640.56           550.4  638.97
   650.4  638.06           750.4  637.71           800.4  637.87
   850.4  638.33           900.4  639.01           950.4   639.5
     954  639.51  635.52    1000  639.75  635.52  1046.3  639.75  635.52
  1050.4  639.75          1100.4  639.52          1150.4  639.27
  1200.4  639.04          1250.4  638.99          1300.4  639.15
  1350.4  639.61          1450.4  641.27          1550.4  643.51
  1650.4  646.59

Upstream Bridge Cross Section Data
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
  956.66   636.4  956.66     631  961.61   630.7  979.96   621.3  984.13   622.3
  993.06   622.7    1000   624.3 1015.28   624.2 1025.59   624.7 1038.49   630.7
 1043.35     631 1043.35   636.3 1100.87  637.92 1150.18  638.15 1200.49   638.4
 1252.04  638.69 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035  956.66    .035 1043.35    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        956.66 1043.35             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5  956.66   637.5       F
 1043.35 1409.21  637.75       F
Skew Angle = 7.3

Downstream  Deck/Roadway Coordinates
    num=      22
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   350.4  642.62           450.4  640.56           550.4  638.97
   650.4  638.06           750.4  637.71           800.4  637.87
   850.4  638.33           900.4  639.01           950.4   639.5
     954  639.51  635.52    1000  639.75  635.52  1046.3  639.75  635.52
  1050.4  639.75          1100.4  639.52          1150.4  639.27
  1200.4  639.04          1250.4  638.99          1300.4  639.15
  1350.4  639.61          1450.4  641.27          1550.4  643.51
  1650.4  646.59

Downstream Bridge Cross Section Data
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
   956.8   637.1   956.8   631.1   961.3   630.9   974.3   625.4   983.2   625.4
  1000.2     623    1005   624.2  1025.3   624.1  1038.3   630.9  1043.3   631.7
  1043.3   636.7 1100.87  637.92 1150.18  638.15 1200.49   638.4 1252.04  638.69
 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035   956.8    .035  1043.3    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
         956.8  1043.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5   956.8   637.5       F
  1043.3 1409.21  637.75       F

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

Number of Piers =  1

Pier Data
Pier Station     Upstream=    1000    Downstream=    1000
Upstream     num=       2
    Width   Elev    Width   Elev
        3     620        3  635.52
Downstream     num=       2
    Width   Elev    Width   Elev
        3     620        3  635.52

Number of Bridge Coefficient Sets =  1
```

```
Low Flow Methods and Data
       Energy
       Momentum              Cd   =       2
       Yarnell               KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3206

INPUT
Description: Downstream Face of Joliet Road Bridge
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
   956.8   637.1   956.8   631.1   961.3   630.9   974.3   625.4   983.2   625.4
  1000.2     623    1005   624.2  1025.3   624.1  1038.3   630.9  1043.3   631.7
  1043.3   636.7 1100.87  637.92 1150.18  638.15 1200.49   638.4 1252.04  638.69
 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035   956.8    .035  1043.3    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         956.8  1043.3               58      58      58             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5   956.8   637.5       F
  1043.3 1409.21  637.75       F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3148

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report
             (2)
Downstream Face of Joliet Road
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     714     638   718.1  634.99  727.55 634.439  728.22 634.025  729.09 634.056
  765.83 634.321  815.81  635.28  854.35 636.521  854.94 636.328     856 636.417
  865.25 636.464  876.37 636.435  877.36 636.392  877.96 636.571  915.13 636.548
  953.12  635.36  961.25 634.658   971.9 628.969  975.59 624.863  979.02 624.082
    1000 622.988 1029.42 624.774 1032.82 626.596 1049.64 635.605 1070.41     640

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
     714    .013  953.12    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        953.12 1049.64               67      67      67             .1       .3
Ineffective Flow     num=       2
```

```
   Sta L   Sta R    Elev  Permanent
     714  954.07   637.5       F
 1046.13 1070.41   637.5       F
Left Levee      Station=  915.13      Elevation= 636.548

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3081

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report (3081)
South
             ROW of Joliet Road
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  668.73     640  700.12 635.213  715.59  635.15  735.43 635.461  767.31 635.449
  817.37  635.27  849.72 635.974  850.32  635.78  851.31 635.845  861.89 636.024
  872.17 635.891  873.24 635.837  873.77 636.034  907.47 636.397   939.2 636.187
  941.74 635.886  956.98 633.907  973.01 627.756  975.66 624.761  985.89 623.489
    1000 623.264 1023.58 623.869 1027.81 624.827  1060.6     640 1070.47     640
 1145.38     638 1212.12     640

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  668.73    .013   939.2    .035  1060.6    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         939.2  1060.6              316     316     316             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  668.73  913.07              F
 1087.13 1212.12              F
Left Levee      Station=  907.47      Elevation= 636.397

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 2765

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report
             (2765)
Approximatley 450' Downstream
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     695     638     696     636  716.52  634.71 725.473  633.61  757.57 635.078
  801.99 635.575  837.63 635.143  852.74 633.931  856.99 633.503  857.56 633.302
  858.55 633.354   868.9 633.369  879.37 633.365  881.01 633.481  905.23 633.742
  932.95 633.777  933.78 633.764  964.28 633.109  975.88 624.879  977.62 624.631
    1000 623.299 1013.14 623.352 1021.19 624.989 1027.01 628.729  1036.7 632.295
 1061.92  632.69 1082.27 629.198 1096.47 629.329  1118.4 634.385  1119.8 637.943
 1135.48  638.26

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     695    .013  964.28    .035  1036.7      .1 1061.92    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        964.28  1036.7              223     223     223             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 1061.92 1135.48  632.69       T
Left Levee      Station=  801.99      Elevation=  635.58

CROSS SECTION


RIVER: Flag Creek
```

REACH: 1 RS: 2542

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report (2542)
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
718.48	638	722.68	634	742.28	633.429	765.89	632.763	775.21	629.851
804.17	628.408	842.1	628.598	864.81	634.4	865.66	634.506	866.87	634.656
867.4	634.463	868.39	634.553	878.45	634.629	890.05	634.609	890.87	634.544
891.56	635.027	895.89	635.295	896.81	634.798	897.62	634.844	931.16	635.029
932.49	634.773	942.56	632.614	952.68	626.51	954.07	624.809	959.68	623.62
975.7	623.167	990.36	623.587	1000	620.992	1001.9	623.468	1012.76	632
1028.26	632.995	1039.67	636.779	1043.28	637.063	1060.18	637.19	1091.44	636.739
1133.41	638.407	1152.48	638.552						

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
718.48	.035	864.81	.013	897.62	.1	931.16	.035	1028.26	.1
1039.67	.013								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
931.16	1012.76	367.73	367.73	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
718.48	866.87	634.656	F

Left Levee Station= 931.16 Elevation= 635.029

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 12.1

INPUT
Description: FIS Cross Section FC039
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-274	639.12	-194	633.62	-174	633.52	-114	634.52	-59	634.42
-41	633.02	-29	625.32	-20	623.92	-14	624.32	-7	624.12
0	622.92	8	623.62	16	625.32	30	631.82	126	635.52
226	638.02	267	639.02	320	640.72	331	641.02		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-274	.075	-41	.05	30	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-41	30	34.5	35.17	20	.1	.3

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 12

INPUT
Description: XS 12, 377' Upstream of North face of 70th Pl Bridge
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-204.6	640	-201.4	634	-77.3	633.06	-62.8	636.95	-57.8	637.22
-44	633.91	-27.9	631.9	-13.7	624.19	0	621.48	13.4	621.83
21	624.17	22.8	624.54	37.5	630.99	140.3	632.74	226.7	634
290.94	636	356.74	638						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-204.6	.075	-27.9	.05	37.5	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-27.9	37.5	881	377.27	3.5	.3	.5

Ineffective Flow num= 1

```
   Sta L   Sta R    Elev  Permanent
    78.8  356.74               F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 11

INPUT
Description: XS 11, Upstream (North) face of 70th Pl Bridge, mod ineff iad
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -595.2     638  -581.5     636    -558     634  -511.3     632    -376     630
  -135.5     630  -123.4     632   -99.2  633.95     -42  632.13   -29.4  629.04
   -20.1  628.39     -12 624.468    -4.3  620.74       0  619.25     7.7  620.25
      36  624.11    49.3  625.83      61 628.597    78.1  632.64   151.4     634
   368.7     636   547.8     638

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -595.2    .063  -123.4    .013     -42    .063    78.1     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -29.4      61                53    38.3      50             .3       .5
Ineffective Flow     num=       5
   Sta L   Sta R    Elev  Permanent
   -99.2   -29.4  633.17       F
    65.6   222.2  633.71       F
   222.2     558  652.73       F
    -600  -200.4  650.39       F
  -200.4   -99.2     632       T

BRIDGE


RIVER: Flag Creek
REACH: 1                 RS: 10.5

INPUT
Description: 70th Pl. Single Span Concrete Bridge - ineffective cones  include
             ineffective limits from downstream I-55 bridge, and from roadside
             ditch along Wolf Road.  Large leftside upstream ineffective area
             is remnant backwater floodplain at XS 11.
Distance from Upstream XS =     3.5
Deck/Roadway Width        =  32.333
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -105  633.17     620     -25  633.36  627.99      62  633.71  628.61
     160  634.44     620   254.5  635.44     620   347.7  636.41     620
   437.7   637.2     620   534.3  638.18     620   626.3  639.08     620

Upstream Bridge Cross Section Data
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -595.2     638  -581.5     636    -558     634  -511.3     632    -376     630
  -135.5     630  -123.4     632   -99.2  633.95     -42  632.13   -29.4  629.04
   -20.1  628.39     -12 624.468    -4.3  620.74       0  619.25     7.7  620.25
      36  624.11    49.3  625.83      61 628.597    78.1  632.64   151.4     634
   368.7     636   547.8     638

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -595.2    .063  -123.4    .013     -42    .063    78.1     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -29.4      61             .3       .5
Ineffective Flow     num=       5
   Sta L   Sta R    Elev  Permanent
```

```
   -99.2   -29.4  633.17       F
    65.6   222.2  633.71       F
   222.2     558  652.73       F
    -600  -200.4  650.39       F
  -200.4   -99.2     632       T

Downstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -105  633.17     620     -25  633.36  627.98      62  633.71  628.57
     160  634.44     620   254.5  635.44     620   347.7  636.41     620
   437.7   637.2     620   534.3  638.18     620   626.3  639.08     620

Downstream Bridge Cross Section Data
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -164.6     638  -158.2     636  -148.8     634  -141.3     632  -135.1     630
    -132     630  -122.4     632     -98   633.6     -44  632.49   -31.2   629.9
   -28.8  629.75   -20.8   625.9   -16.7  625.82   -12.8  624.11    -5.8  621.22
       0  621.06    21.5  622.16    33.7  623.72    48.2  623.34      50  624.15
    54.6  625.98    58.5  626.25      68 630.321    73.2  632.55   215.6     634
   425.9     636   535.1     638

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -164.6    .063  -122.4    .013     -44    .063      68     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -31.2      68            .3       .5
Ineffective Flow     num=       4
   Sta L   Sta R    Elev  Permanent
   -27.3     -98  630.58       F
   64.17     173  631.14       F
     173   535.1   652.7       F
     -98  -164.6     632       T

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

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       0
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 10

INPUT
```

Description: XS 10, Downstream (South) face of 70th Pl Bridge
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-164.6	638	-158.2	636	-148.8	634	-141.3	632	-135.1	630
-132	630	-122.4	632	-98	633.6	-44	632.49	-31.2	629.9
-28.8	629.75	-20.8	625.9	-16.7	625.82	-12.8	624.11	-5.8	621.22
0	621.06	21.5	622.16	33.7	623.72	48.2	623.34	50	624.15
54.6	625.98	58.5	626.25	68	630.321	73.2	632.55	215.6	634
425.9	636	535.1	638						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-164.6	.063	-122.4	.013	-44	.063	68	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-31.2	68	1	1	.3	.5

Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-27.3	-98	630.58	F
64.17	173	631.14	F
173	535.1	652.7	F
-98	-164.6	632	T

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 9.5

INPUT
Description: FIS Cross section J WSP-2 Cross Section X Converted to NAVD 88
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-320	638	-315	635.72	-314	636.12	-313	635.72	-115	632.82
-45	630.72	-30	625.02	0	621.02	30	623.52	44	631.92
91	634.62	193	631.72	213	636				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-320	.08	-45	.063	44	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-45	44	22	34	.3	.5

Ineffective Flow num= 5

Sta L	Sta R	Elev	Permanent
64.67	134	631.14	F
-45	-27.8	630.58	F
-148	-98	632	T
-172	-320	650.39	F
172	213	652.73	F

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 9

INPUT
Description: XS 9, Upstream (North) face of I-55 Bridge
Manning's n-values
adjusted to reflect roadside ditch to left and gravel area to
right of Wolf Road.
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-171.4	641.91	-164.8	641.6	-137.1	630.38	-128.3	629.72	-111.36	632.81
-96.3	633.22	-79.1	632.7	-27.2	629.97	-23.2	629.87	-15.5	626.04
-14.5	625.86	-10	624.13	0	621.75	26.7	623.62	34.5	624.11
55	625.14	66	630.54	98.8	646.64	105.1	646.97		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

```
  -171.4     .05 -111.36    .013   -79.1     .03   -23.2    .063      66    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -23.2      66              145   145.4     145             .3       .5
Ineffective Flow     num=       3
   Sta L   Sta R    Elev  Permanent
    -180     -97     632       T
     -97     -41  630.58       F
   85.47     140  631.14       F

BRIDGE


RIVER: Flag Creek
REACH: 1                 RS: 8.5

INPUT
Description: I-55 Five-Span Steel Bridge.
Distance from Upstream XS =       1
Deck/Roadway Width        =     143
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
-171.458  649.82  646.33  -64.12  650.89  647.12    -.92  651.39  647.59
    66.5   651.9  648.13  108.57  652.21  648.48

Upstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -171.4  641.91  -164.8   641.6  -137.1  630.38  -128.3  629.72 -111.36  632.81
   -96.3  633.22   -79.1   632.7   -27.2  629.97   -23.2  629.87   -15.5  626.04
   -14.5  625.86     -10  624.13       0  621.75    26.7  623.62    34.5  624.11
      55  625.14      66  630.54    98.8  646.64   105.1  646.97

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -171.4     .05 -111.36    .013   -79.1     .03   -23.2    .063      66    .013

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -23.2      66             .3       .5
Ineffective Flow     num=       3
   Sta L   Sta R    Elev  Permanent
    -180     -97     632       T
     -97     -41  630.58       F
   85.47     140  631.14       F

Downstream  Deck/Roadway Coordinates
    num=       7
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  -176.4  650.39       0 -172.11  650.39       0 -172.11  650.39  646.73
  -70.46  651.45  647.53   -8.07  651.93     648   62.41  652.46  648.39
  101.57  652.73  648.63

Downstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -176.4  644.74  -170.2  644.61 -141.91  630.89    -115  632.74 -101.31  632.91
   -83.8  632.51     -63 629.953   -14.5  623.99       0  623.25    31.3  623.39
    48.6  624.02    61.7  630.73    95.7  646.67   101.2  646.85

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -176.4     .05    -115    .013   -83.8     .03     -63    .063    61.7    .013

Bank Sta: Left   Right    Coeff Contr.   Expan.
           -63    61.7             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  -176.4    -115     632       T
```

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

Number of Piers =  4

Pier Data
Pier Station     Upstream=  -132.1    Downstream=  -136.5
Upstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75     650
Downstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75     650

Pier Data
Pier Station     Upstream=   -64.6    Downstream=   -67.7
Upstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75  647.48
Downstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75  647.53

Pier Data
Pier Station     Upstream=    -1.2    Downstream=    -6.7
Upstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75  647.95
Downstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75  648.01

Pier Data
Pier Station     Upstream=    66.4    Downstream=    59.7
Upstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75  648.49
Downstream     num=       2
    Width   Elev    Width   Elev
    2.75     620    2.75  648.39

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum              Cd   =       2
       Yarnell               KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
```

REACH: 1 RS: 8

INPUT
Description: XS 8, Downstream (South) face of I-55 Bridge
Manning's n-values
adjusted to reflect roadside ditch to left and gravel area to
right of Wolf Road.

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-176.4	644.74	-170.2	644.61	-141.91	630.89	-115	632.74	-101.31	632.91
-83.8	632.51	-63	629.953	-14.5	623.99	0	623.25	31.3	623.39
48.6	624.02	61.7	630.73	95.7	646.67	101.2	646.85		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-176.4	.05	-115	.013	-83.8	.03	-63	.063	61.7	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-63	61.7	10.5	51.5	47.2	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-176.4	-115	632	T

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 7

INPUT
Description: XS 7, 50' Downstream of South face of I-55 Bridge, In line with
71st St

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-182.75	638	-177.6	636	-171.9	634	-125.6	632.66	-91.8	632.71
-85.8	631.57	-32.6	629.95	-20	626.62	-18.6	623.98	0	622.87
19	622.8	30.2	624	50	629.581	60	632.4	113.2	634.04
234.7	634	385.2	636	519.2	638				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-182.75	.013	-32.6	.063	50	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-32.6	50	4	219.8	981	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
117.5	519.2	650.68	F

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 6

INPUT
Description: XS 6, Upstream (West) face of Wolf Rd Bridge Cross Section Skewed
27.5 degrees

Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-222.196	638	-217.85	636	-212.971	634	-132.431	633.18	-66.082	633.31
-48.786	628.479	-42.488	626.72	-26.965	626.68	-20.933	623.98	-12.95	621.94
0	622.65	21.998	624.19	26.167	625.99	31.932	627.74	50.382	633.34
158.598	632	242.509	632	286.416	634	329.525	634	551.011	634
658.872	636	694.529	638						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-222.196	.08	-48.786	.063	31.932	.08

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

```
       -48.786  31.932             24.2    59.2      84             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-222.196 -52.245  633.18       F
  37.343 694.529   634.1       F
Skew Angle = 27.5

BRIDGE


RIVER: Flag Creek
REACH: 1                 RS: 5.5

INPUT
Description: Wolf Rd Two-Span Concrete Bridge-Bridge and deck skewed 27.5
             degrees

Distance from Upstream XS =       2
Deck/Roadway Width        =      39
Weir Coefficient          =     2.6
Bridge Deck/Roadway Skew  =    27.5
Upstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
-240.025     630     620-227.607   632.3     620-147.244  633.18     620
 -52.955  633.86  629.03  42.133   634.1  629.25 119.977  634.37     620
 212.404  635.08     620 307.757  635.33     620 398.144  635.82     620
 499.973   636.1     620 702.654     638     620 725.805   638.5     620

Upstream Bridge Cross Section Data
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-222.196     638 -217.85     636-212.971     634-132.431  633.18 -66.082  633.31
 -48.786 628.479 -42.488  626.72 -26.965  626.68 -20.933  623.98  -12.95  621.94
       0  622.65  21.998  624.19  26.167  625.99  31.932  627.74  50.382  633.34
 158.598     632 242.509     632 286.416     634 329.525     634 551.011     634
 658.872     636 694.529     638

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-222.196     .08 -48.786    .063  31.932     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
       -48.786  31.932             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-222.196 -52.245  633.18       F
  37.343 694.529   634.1       F
Skew Angle = 27.5

Downstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
-240.025     630     620-227.607   632.3     620-147.244  633.18     620
 -66.526  633.94  629.09  27.143  634.16  629.28 119.977  634.37     620
 212.404  635.08     620 307.757  635.33     620 398.144  635.82     620
 499.973   636.1     620 702.654     638     620 725.805   638.5     620

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-235.324     638  -230.8     636-224.857     634 -73.977  633.65 -42.399  627.19
 -35.214   624.1 -24.127  623.04       0  622.59  12.418  623.86  15.966   626.2
  40.359  633.56 246.234     634 368.819     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-235.324     .08 -42.399    .063  15.966     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
       -42.399  15.966             .3       .5
```

```
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-235.324     -66  631.15       F
    43.2 368.819  631.69       F
Skew Angle = 27.5

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

Number of Piers =  1

Pier Data
Pier Station     Upstream=  -9.048    Downstream= -16.853
Upstream     num=       2
    Width   Elev    Width   Elev
    4.75     620    4.75   630.5
Downstream     num=       2
    Width   Elev    Width   Elev
    4.75     620    4.75   630.5

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       2
       Yarnell                KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 5

INPUT
Description: XS 5, Downstream (East) face of Wolf Rd Bridge Section Skewed 27.5
             degrees
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-235.324     638  -230.8     636-224.857     634 -73.977  633.65 -42.399  627.19
 -35.214   624.1 -24.127  623.04       0  622.59  12.418  623.86  15.966   626.2
  40.359  633.56 246.234     634 368.819     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-235.324     .08 -42.399    .063  15.966     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       -42.399  15.966              737   524.8     376             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-235.324     -66  631.15       F
    43.2 368.819  631.69       F
```

Skew Angle = 27.5

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 4

INPUT
Description: XS 4, Upstream (North) face of 72nd St Double Arch Culvert
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-195.8	636.56	-77.3	635.35	-50	627.314	-38.3	623.87	-26.8	622.5
0	622.54	12.1	623.91	20	626.463	43.2	633.96	170.1	632.37
353.5	634	432.5	636						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-195.8	.08	-50	.063	20	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-50	20	44	48.22	49	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-195.8	-44	636.56	F
24.18	432.5	632.43	F

BRIDGE

RIVER: Flag Creek
REACH: 1 RS: 3.5

INPUT
Description: 72nd St Double Arch Culvert
Distance from Upstream XS = 5.5
Deck/Roadway Width = 36.5
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 21

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-197.7	636.57	620	-107.4	636.57	620	-39.5	636.83	623.83
-33	636.87	631.3	-25.7	636.91	633.14	-18.3	636.95	631.4
-11.4	636.95	623.5	-11.4	636.95	618	-9.6	636.84	618
-9.6	636.84	623.46	-3.3	636.73	631.52	4.8	636.62	633.09
12.1	636.51	631.56	17.6	636.4	624.81	32	636.06	620
72	634.89	620	174.9	632.43	620	400.5	634	620
500.8	635.33	620	614.3	636	620	665.4	638	620

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-195.8	636.56	-77.3	635.35	-50	627.314	-38.3	623.87	-26.8	622.5
0	622.54	12.1	623.91	20	626.463	43.2	633.96	170.1	632.37
353.5	634	432.5	636						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-195.8	.08	-50	.063	20	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
-50	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-195.8	-44	636.56	F
24.18	432.5	632.43	F

Downstream Deck/Roadway Coordinates
num= 21

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-197.7	636.57	620	-107.4	636.57	620	-38.4	636.83	624

```
   -32.6  636.87   631.3   -25.6  636.91  632.99   -17.1  636.95  631.43
   -10.4  636.95  623.49   -10.4  636.95     618    -8.8  636.84     618
    -8.8  636.84  623.42    -2.5  636.73  631.01     5.2  636.62  632.91
    12.9  636.51  631.57    19.5   636.4  624.54      32  636.06     620
      72  634.89     620   174.9  632.43     620   400.5     634     620
   500.8  635.33     620   614.3     636     620   665.4     638     620

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -82.3     636   -72.2  634.46   -42.4  625.86   -38.3  623.78   -23.8  622.61
   -11.8  623.51       0  623.06    16.8  623.84   21.05  625.56    45.9  630.54
     232     632  362.77     634  412.67     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   -82.3     .08   -42.4    .063   21.05     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -42.4   21.05             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -82.3   -40.2  634.78       F
    23.2  412.67  632.43       F

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

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       2
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3

INPUT
Description: XS 3, Downstream (South) face of 72nd St Double Arch Culvert
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -82.3     636   -72.2  634.46   -42.4  625.86   -38.3  623.78   -23.8  622.61
   -11.8  623.51       0  623.06    16.8  623.84   21.05  625.56    45.9  630.54
     232     632  362.77     634  412.67     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   -82.3     .08   -42.4    .063   21.05     .08
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-42.4 21.05 535 490.2 444 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
-82.3 -40.2 634.78 F
23.2 412.67 632.43 F

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 2

INPUT
Description: XS 2, 490' Downstream of South face of 72nd St Double Arch Culvert
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-179.4	633.27	-153.4	633.21	-147.1	633.56	-117.9	634.08	-86.3	625.65
-25	624.05	-22.8	623.68	-16	622.74	0	620.85	15.6	622.11
22.8	623.63	27.7	628.82	33.4	630.19	49.3	626.3	90.5	627.15
198.9	628.25	219.4	632.66						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-179.4	.08	-25	.063	22.8	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-25 22.8 445 444.93 425 .1 .3
Ineffective Flow num= 1
Sta L Sta R Elev Permanent
33.4 209 630.19 T

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 1

INPUT
Description: XS 1, 935' Downstream of South face of 72nd St Double Arch Culvert
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-482.6	634	-301	632	-221	630.9	-211.4	630	-202.4	628
-198.6	626	-195.2	624	-38.5	624	-36.2	626	-33.9	628
-22.9	628	-21	626	-19.2	624	-18.2	623.14	0	622.89
15.1	623.21	18.7	625.38	113.9	626.96	138.6	632.99	151.4	634

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-482.6	.08	-21	.063	18.7	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-21 18.7 390 391 391 .1 .3
Ineffective Flow num= 1
Sta L Sta R Elev Permanent
-202.4 -33.9 628 T

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 0.5

INPUT
Description: FIS Crossection H_WSP2 Cross section FC033 converted to NAVD88
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-686	641.42	-586	638.62	-486	635.32	-386	633.02	-286	631.32
-186	628.92	-141	627.42	-86	627.22	-8	626.22	-6	624.72
0	621.72	4	621.92	9	622.12	12	622.72	18	625.92
114	626.22	214	626.82	314	627.22	414	627.12	514	627.52

614	629.82	714	630.62	814	631.52	900	632.72	912.9	633.22

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-686	.08	-8	.063	18	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-8	18	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Flag Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6
1	4240	.1	.035	.1	.013		
1	3755	.1	.035	.1	.025	.025	.1
1	3380	.1	.035	.035			
1	3327	.1	.035	.035			
1	3288	.035	.035	.035			
1	3245	Bridge					
1	3206	.035	.035	.035			
1	3148	.013	.035				
1	3081	.013	.035	.035			
1	2765	.013	.035	.1	.035		
1	2542	.035	.013	.1	.035	.1	.013
1	12.1	.075	.05	.075			
1	12	.075	.05	.075			
1	11	.063	.013	.063	.03		
1	10.5	Bridge					
1	10	.063	.013	.063	.03		
1	9.5	.08	.063	.08			
1	9	.05	.013	.03	.063	.013	
1	8.5	Bridge					
1	8	.05	.013	.03	.063	.013	
1	7	.013	.063	.013			
1	6	.08	.063	.08			
1	5.5	Bridge					
1	5	.08	.063	.08			
1	4	.08	.063	.08			
1	3.5	Bridge					
1	3	.08	.063	.08			
1	2	.08	.063	.08			
1	1	.08	.063	.08			
1	0.5	.08	.063	.08			

SUMMARY OF REACH LENGTHS

River: Flag Creek

Reach	River Sta.	Left	Channel	Right
1	4240	485	485	485
1	3755	375	375	375
1	3380	53	53	53
1	3327	39	39	39
1	3288	82	82	82
1	3245	Bridge		
1	3206	58	58	58
1	3148	67	67	67
1	3081	316	316	316
1	2765	223	223	223
1	2542	367.73	367.73	367.73
1	12.1	34.5	35.17	20

1	12	881	377.27	3.5
1	11	53	38.3	50
1	10.5	Bridge		
1	10	1	1	1
1	9.5	22	34	34
1	9	145	145.4	145
1	8.5	Bridge		
1	8	10.5	51.5	47.2
1	7	4	219.8	981
1	6	24.2	59.2	84
1	5.5	Bridge		
1	5	737	524.8	376
1	4	44	48.22	49
1	3.5	Bridge		
1	3	535	490.2	444
1	2	445	444.93	425
1	1	390	391	391
1	0.5	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Flag Creek

Reach	River Sta.	Contr.	Expan.
1	4240	.1	.3
1	3755	.1	.3
1	3380	.1	.3
1	3327	.3	.5
1	3288	.3	.5
1	3245	Bridge	
1	3206	.3	.5
1	3148	.1	.3
1	3081	.1	.3
1	2765	.1	.3
1	2542	.1	.3
1	12.1	.1	.3
1	12	.3	.5
1	11	.3	.5
1	10.5	Bridge	
1	10	.3	.5
1	9.5	.3	.5
1	9	.3	.5
1	8.5	Bridge	
1	8	.3	.5
1	7	.3	.5
1	6	.3	.5
1	5.5	Bridge	
1	5	.3	.5
1	4	.3	.5
1	3.5	Bridge	
1	3	.3	.5
1	2	.1	.3
1	1	.1	.3
1	0.5	.1	.3

10-Year Design Existing

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q10

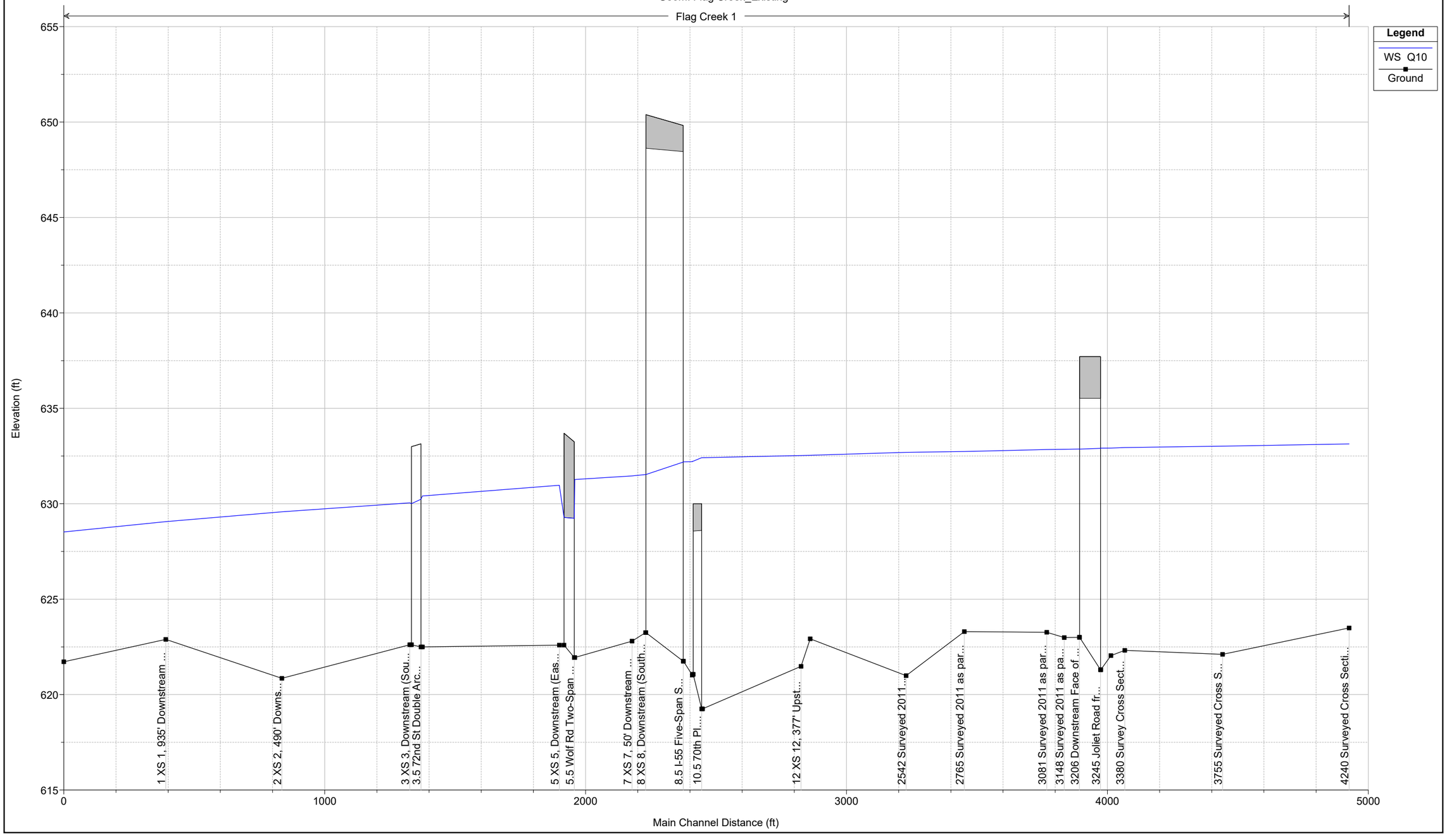
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q10	1260.00	623.49	633.13	626.87	633.20	0.000208	2.13	590.35	87.05	0.14
1	3755	Q10	1260.00	622.11	633.02	626.48	633.10	0.000229	2.27	554.74	82.33	0.15
1	3380	Q10	1260.00	622.32	632.95		633.00	0.000236	1.92	657.14	87.61	0.12
1	3327	Q10	1260.00	622.04	632.91	626.31	632.99	0.000408	2.15	586.14	120.82	0.14
1	3288	Q10	1260.00	621.30	632.91	626.18	632.97	0.000169	1.97	638.37	86.69	0.13
1	3245		Bridge									
1	3206	Q10	1260.00	623.00	632.87	626.94	632.94	0.000224	2.16	582.41	86.50	0.15
1	3148	Q10	1260.00	622.99	632.85	626.37	632.93	0.000196	2.15	585.19	79.88	0.14
1	3081	Q10	1260.00	623.26	632.84	626.32	632.91	0.000196	2.11	597.99	85.38	0.14
1	2765	Q10	1260.00	623.30	632.74	626.74	632.83	0.000283	2.51	510.63	146.45	0.17
1	2542	Q10	1260.00	620.99	632.69	625.98	632.78	0.000216	2.29	552.40	81.37	0.15
1	12.1	Q10	1260.00	622.92	632.54		632.64	0.000656	2.63	484.55	88.85	0.18
1	12	Q10	1260.00	621.48	632.53		632.62	0.000499	2.47	549.76	160.71	0.16
1	11	Q10	1260.00	619.25	632.41	624.48	632.45	0.000293	1.63	806.63	530.70	0.10
1	10.5		Bridge									
1	10	Q10	1260.00	621.06	632.23	624.79	632.26	0.000274	1.54	848.29	138.37	0.10
1	9.5	Q10	1310.00	621.02	632.21	625.08	632.26	0.000415	1.85	739.00	162.87	0.12
1	9	Q10	1310.00	621.75	632.19	625.82	632.24	0.000404	1.81	749.67	165.69	0.11
1	8.5		Bridge									
1	8	Q10	1310.00	623.25	631.53		631.57	0.000438	1.66	793.53	149.90	0.12
1	7	Q10	1310.00	622.80	631.46	626.00	631.54	0.000735	2.20	588.08	138.77	0.15
1	6	Q10	1310.00	621.94	631.27	626.05	631.36	0.000854	2.40	558.88	102.34	0.16
1	5.5		Bridge									
1	5	Q10	1310.00	622.59	630.97	625.96	631.09	0.001043	2.85	506.61	92.62	0.18
1	4	Q10	1310.00	622.50	630.41	625.60	630.53	0.001078	2.84	468.66	92.71	0.19
1	3.5		Bridge									
1	3	Q10	1310.00	622.61	630.05	625.82	630.20	0.001467	3.17	416.73	100.35	0.22
1	2	Q10	1310.00	620.85	629.58		629.65	0.000762	2.46	691.30	301.04	0.16
1	1	Q10	1310.00	622.89	629.06		629.16	0.001771	3.11	711.69	329.67	0.23
1	0.5	Q10	1310.00	621.72	628.52	627.52	628.55	0.001274	2.47	1227.21	731.48	0.19

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q10

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q10	633.20	633.13	0.07	0.11	0.00		1260.00		87.05
1	3755	Q10	633.10	633.02	0.08	0.09	0.01		1260.00	0.00	82.33
1	3380	Q10	633.00	632.95	0.06	0.02	0.00		1260.00		87.61
1	3327	Q10	632.99	632.91	0.07	0.01	0.01		1260.00		120.82
1	3288	Q10	632.97	632.91	0.06	0.00	0.00		1260.00		86.69
1	3245		Bridge								
1	3206	Q10	632.94	632.87	0.07	0.01	0.00		1260.00		86.50
1	3148	Q10	632.93	632.85	0.07	0.01	0.00		1260.00		79.88
1	3081	Q10	632.91	632.84	0.07	0.07	0.00		1260.00		85.38
1	2765	Q10	632.83	632.74	0.10	0.05	0.00		1259.18	0.82	146.45
1	2542	Q10	632.78	632.69	0.08	0.13	0.00		1258.85	1.15	81.37
1	12.1	Q10	632.64	632.54	0.11	0.02	0.00		1258.29	1.71	88.85
1	12	Q10	632.62	632.53	0.09	0.14	0.03	0.32	1235.41	24.27	160.71
1	11	Q10	632.45	632.41	0.04			7.83	1239.03	13.15	530.70
1	10.5		Bridge								
1	10	Q10	632.26	632.23	0.04	0.00	0.00	18.16	1238.66	3.18	138.37
1	9.5	Q10	632.26	632.21	0.05	0.01	0.00	11.42	1298.51	0.07	162.87
1	9	Q10	632.24	632.19	0.05			64.46	1240.29	5.25	165.69
1	8.5		Bridge								
1	8	Q10	631.57	631.53	0.04	0.03	0.01	8.92	1300.25	0.83	149.90
1	7	Q10	631.54	631.46	0.08	0.17	0.00	95.78	1196.14	18.09	138.77
1	6	Q10	631.36	631.27	0.09			7.38	1287.61	15.01	102.34
1	5.5		Bridge								
1	5	Q10	631.09	630.97	0.12	0.56	0.00	31.51	1239.35	39.14	92.62
1	4	Q10	630.53	630.41	0.12	0.01	0.04		1292.25	17.75	92.71
1	3.5		Bridge								
1	3	Q10	630.20	630.05	0.15	0.51	0.04		1293.02	16.98	100.35
1	2	Q10	629.65	629.58	0.07	0.49	0.00	422.70	874.44	12.85	301.04
1	1	Q10	629.16	629.06	0.10	0.58	0.02	157.59	718.46	433.94	329.67
1	0.5	Q10	628.55	628.52	0.03			182.09	346.89	781.02	731.48

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing



Errors Warnings and Notes for Plan : EX

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q10
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q10
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q10 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q10
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q10
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q10 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The
	selected bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 8.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 8 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q10
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q10 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q10

Errors Warnings and Notes for Plan : EX (Continued)

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q10
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q10
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q10 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 2 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.

50-Year Design Existing

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q50

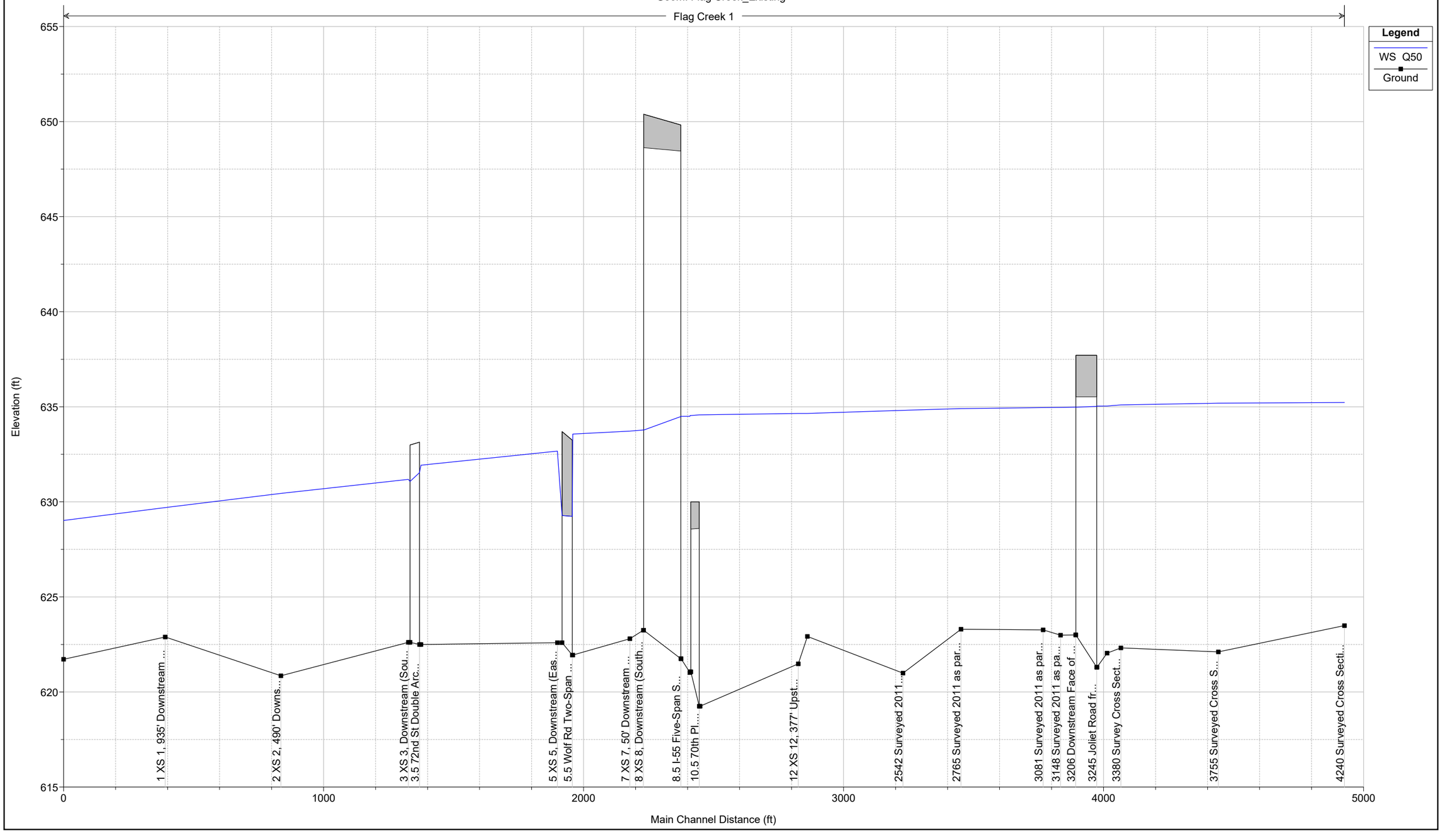
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q50	2000.00	623.49	635.22	627.81	635.32	0.000211	2.53	902.01	270.98	0.15
1	3755	Q50	2000.00	622.11	635.19	627.54	635.23	0.000111	1.87	1494.91	508.54	0.11
1	3380	Q50	2000.00	622.32	635.10		635.17	0.000253	2.17	1027.17	280.00	0.13
1	3327	Q50	2000.00	622.04	635.04	627.33	635.15	0.000523	2.61	766.50	287.33	0.16
1	3288	Q50	2000.00	621.30	635.03	627.09	635.13	0.000194	2.43	822.56	86.69	0.14
1	3245		Bridge									
1	3206	Q50	2000.00	623.00	634.98	627.85	635.09	0.000240	2.61	765.50	86.50	0.15
1	3148	Q50	2000.00	622.99	634.97	627.27	635.07	0.000236	2.63	761.34	90.77	0.16
1	3081	Q50	2000.00	623.26	634.96	627.24	635.06	0.000242	2.53	791.91	100.80	0.16
1	2765	Q50	2000.00	623.30	634.90	627.74	634.98	0.000183	2.40	995.27	278.00	0.14
1	2542	Q50	2000.00	620.99	634.81	626.97	634.93	0.000261	2.76	749.77	101.48	0.16
1	12.1	Q50	2000.00	622.92	634.65		634.79	0.000614	3.03	825.96	312.48	0.18
1	12	Q50	2000.00	621.48	634.65		634.76	0.000462	2.80	948.27	425.12	0.16
1	11	Q50	2000.00	619.25	634.57	625.57	634.61	0.000188	1.53	1506.59	778.56	0.08
1	10.5		Bridge									
1	10	Q50	2000.00	621.06	634.54	625.64	634.57	0.000179	1.47	1445.32	423.64	0.08
1	9.5	Q50	2100.00	621.02	634.50	626.01	634.56	0.000381	2.10	1334.19	429.17	0.12
1	9	Q50	2100.00	621.75	634.50	626.66	634.54	0.000264	1.74	1218.19	221.32	0.10
1	8.5		Bridge									
1	8	Q50	2100.00	623.25	633.78		633.82	0.000331	1.77	1208.50	216.06	0.11
1	7	Q50	2100.00	622.80	633.72	627.00	633.80	0.000334	1.80	1008.72	265.16	0.11
1	6	Q50	2100.00	621.94	633.56	627.28	633.68	0.000791	2.82	823.19	447.04	0.17
1	5.5		Bridge									
1	5	Q50	2100.00	622.59	632.67	626.96	632.85	0.001247	3.58	676.02	106.57	0.21
1	4	Q50	2100.00	622.50	631.93	626.52	632.14	0.001438	3.73	572.35	102.58	0.22
1	3.5		Bridge									
1	3	Q50	2100.00	622.61	631.18	626.73	631.47	0.002222	4.34	488.71	188.65	0.27
1	2	Q50	2100.00	620.85	630.45		630.58	0.001255	3.40	853.55	313.39	0.21
1	1	Q50	2100.00	622.89	629.70		629.84	0.002392	3.88	923.94	335.16	0.27
1	0.5	Q50	2100.00	621.72	629.02	627.80	629.06	0.001550	2.88	1602.20	769.39	0.21

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q50

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q50	635.32	635.22	0.10	0.07	0.02	0.42	1963.49	36.09	270.98
1	3755	Q50	635.23	635.19	0.04	0.06	0.00	3.41	1365.45	631.14	508.54
1	3380	Q50	635.17	635.10	0.07	0.02	0.00	1.33	1858.71	139.96	280.00
1	3327	Q50	635.15	635.04	0.11	0.01	0.01		2000.00		287.33
1	3288	Q50	635.13	635.03	0.09	0.00	0.00		2000.00		86.69
1	3245		Bridge								
1	3206	Q50	635.09	634.98	0.11	0.01	0.00		2000.00		86.50
1	3148	Q50	635.07	634.97	0.11	0.02	0.00		2000.00		90.77
1	3081	Q50	635.06	634.96	0.10	0.07	0.01		2000.00		100.80
1	2765	Q50	634.98	634.90	0.08	0.05	0.00	283.39	1584.28	132.33	278.00
1	2542	Q50	634.93	634.81	0.12	0.14	0.00		1955.82	44.18	101.48
1	12.1	Q50	634.79	634.65	0.14	0.02	0.01	31.36	1904.26	64.38	312.48
1	12	Q50	634.76	634.65	0.11	0.12	0.04	81.73	1789.02	129.25	425.12
1	11	Q50	634.61	634.57	0.03			426.13	1455.28	118.58	778.56
1	10.5		Bridge								
1	10	Q50	634.57	634.54	0.03	0.00	0.01	334.80	1519.54	145.66	423.64
1	9.5	Q50	634.56	634.50	0.06	0.01	0.01	139.66	1903.41	56.92	429.17
1	9	Q50	634.54	634.50	0.05			506.21	1550.39	43.40	221.32
1	8.5		Bridge								
1	8	Q50	633.82	633.78	0.05	0.01	0.01	191.82	1882.66	25.52	216.06
1	7	Q50	633.80	633.72	0.08	0.10	0.01	661.07	1319.26	119.67	265.16
1	6	Q50	633.68	633.56	0.12			28.08	2031.74	40.18	447.04
1	5.5		Bridge								
1	5	Q50	632.85	632.67	0.18	0.70	0.01	92.89	1910.53	96.59	106.57
1	4	Q50	632.14	631.93	0.21	0.02	0.09		2061.25	38.75	102.58
1	3.5		Bridge								
1	3	Q50	631.47	631.18	0.29	0.81	0.08		2069.05	30.95	188.65
1	2	Q50	630.58	630.45	0.13	0.75	0.00	726.07	1349.72	24.22	313.39
1	1	Q50	629.84	629.70	0.14	0.74	0.03	400.46	993.52	706.02	335.16
1	0.5	Q50	629.06	629.02	0.04			325.42	443.28	1331.30	769.39

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing



Errors Warnings and Notes for Plan : EX

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q50
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q50 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 12 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q50
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q50 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the energy is based on critical depth over the weir. The water surface has been projected.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 8.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q50
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.

Errors Warnings and Notes for Plan : EX (Continued)

Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q50 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q50
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q50 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

100-Year Design Existing

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q100

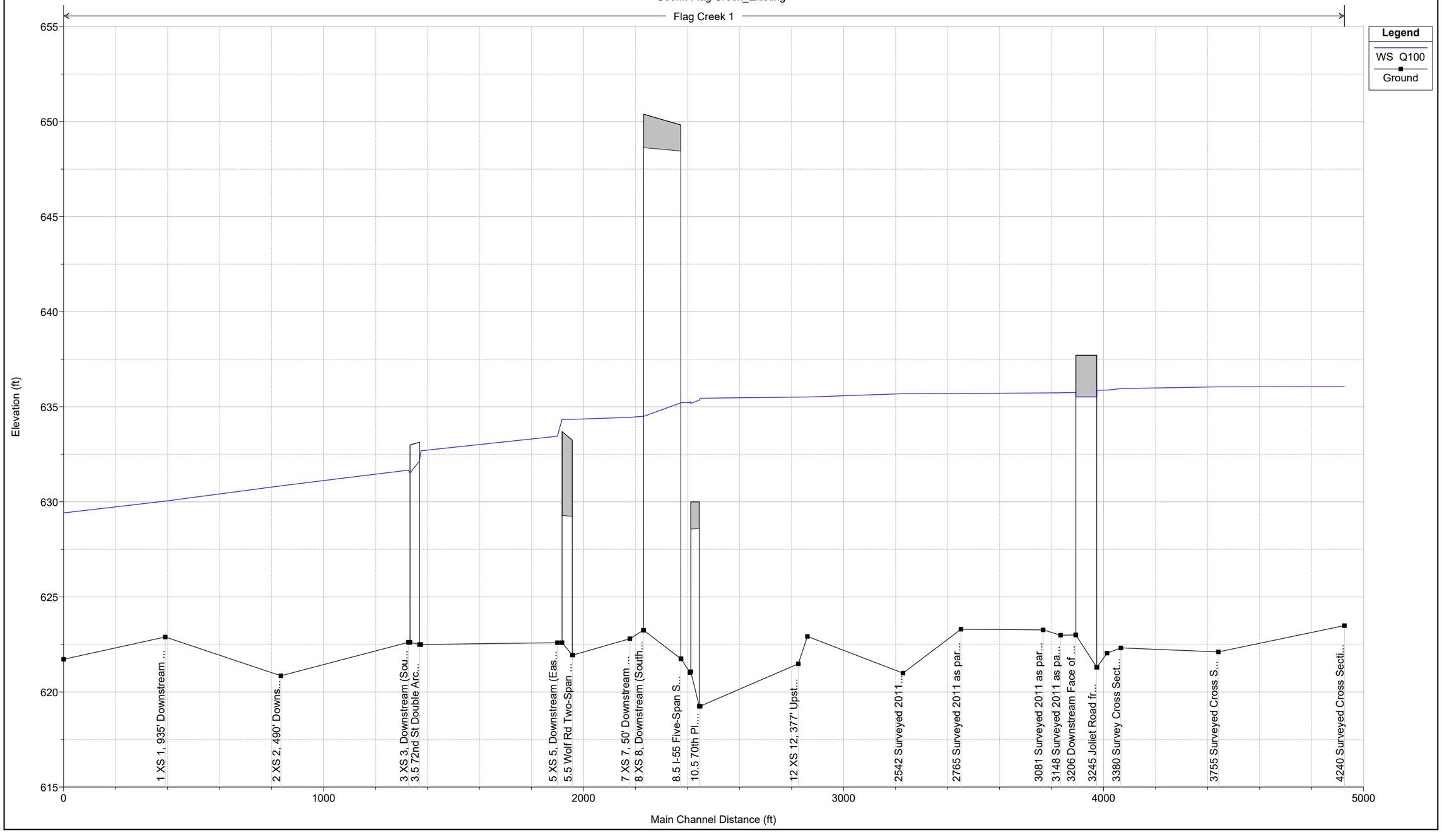
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q100	2400.00	623.49	636.05	628.25	636.17	0.000218	2.73	1044.84	639.77	0.16
1	3755	Q100	2400.00	622.11	636.05	628.03	636.08	0.000084	1.72	1939.68	528.25	0.10
1	3380	Q100	2400.00	622.32	635.96		636.03	0.000239	2.24	1230.47	354.80	0.12
1	3327	Q100	2400.00	622.04	635.88	627.82	636.00	0.000571	2.86	841.94	351.52	0.16
1	3288	Q100	2400.00	621.30	635.87	627.54	635.98	0.000216	2.68	895.03	86.69	0.15
1	3245		Bridge									
1	3206	Q100	2400.00	623.00	635.75	628.25	635.88	0.000268	2.88	831.98	86.50	0.16
1	3148	Q100	2400.00	622.99	635.73	627.70	635.86	0.000266	2.89	831.49	109.12	0.17
1	3081	Q100	2400.00	623.26	635.72	627.69	635.84	0.000277	2.75	872.29	108.38	0.17
1	2765	Q100	2400.00	623.30	635.70	628.22	635.76	0.000145	2.26	1312.50	418.15	0.13
1	2542	Q100	2400.00	620.99	635.69	627.45	635.73	0.000105	1.85	1598.55	315.48	0.11
1	12.1	Q100	2400.00	622.92	635.51		635.65	0.000566	3.10	1109.79	347.32	0.18
1	12	Q100	2400.00	621.48	635.51		635.62	0.000443	2.91	1171.25	459.91	0.16
1	11	Q100	2400.00	619.25	635.45	626.04	635.48	0.000141	1.39	1876.97	884.17	0.07
1	10.5		Bridge									
1	10	Q100	2400.00	621.06	635.27	626.12	635.30	0.000156	1.44	1682.05	503.40	0.08
1	9.5	Q100	2500.00	621.02	635.22	626.41	635.29	0.000380	2.20	1643.13	488.50	0.12
1	9	Q100	2500.00	621.75	635.22	627.04	635.27	0.000246	1.76	1379.71	224.59	0.09
1	8.5		Bridge									
1	8	Q100	2500.00	623.25	634.50		634.55	0.000314	1.82	1365.58	219.09	0.11
1	7	Q100	2500.00	622.80	634.44	627.46	634.53	0.000241	1.61	1213.69	441.28	0.09
1	6	Q100	2500.00	621.94	634.34	627.67	634.44	0.000639	2.68	1576.20	783.16	0.15
1	5.5		Bridge									
1	5	Q100	2500.00	622.59	633.45	627.39	633.66	0.001293	3.85	762.26	113.02	0.22
1	4	Q100	2500.00	622.50	632.69	626.93	632.93	0.001484	4.01	670.47	168.34	0.23
1	3.5		Bridge									
1	3	Q100	2500.00	622.61	631.67	627.12	632.03	0.002573	4.86	519.37	251.96	0.30
1	2	Q100	2500.00	620.85	630.84		631.00	0.001412	3.73	978.60	316.72	0.22
1	1	Q100	2500.00	622.89	630.04		630.18	0.002496	4.10	1037.85	338.30	0.28
1	0.5	Q100	2500.00	621.72	629.42	627.85	629.46	0.001323	2.78	1916.73	803.44	0.20

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q100

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q100	636.17	636.05	0.11	0.06	0.02	1.58	2324.65	73.77	639.77
1	3755	Q100	636.08	636.05	0.03	0.05	0.00	10.28	1377.88	1011.84	528.25
1	3380	Q100	636.03	635.96	0.07	0.02	0.01	7.54	2095.10	297.36	354.80
1	3327	Q100	636.00	635.88	0.13	0.01	0.01	0.40	2399.60		351.52
1	3288	Q100	635.98	635.87	0.11				2400.00		86.69
1	3245		Bridge								
1	3206	Q100	635.88	635.75	0.13	0.02	0.00		2400.00		86.50
1	3148	Q100	635.86	635.73	0.13	0.02	0.00		2400.00		109.12
1	3081	Q100	635.84	635.72	0.12	0.06	0.02		2400.00		108.38
1	2765	Q100	635.76	635.70	0.06	0.03	0.01	583.45	1618.93	197.62	418.15
1	2542	Q100	635.73	635.69	0.04	0.08	0.01	908.24	1443.18	48.58	315.48
1	12.1	Q100	635.65	635.51	0.13	0.02	0.01	140.53	2134.09	125.39	347.32
1	12	Q100	635.62	635.51	0.11	0.10	0.04	196.76	2017.29	185.95	459.91
1	11	Q100	635.48	635.45	0.03	0.00	0.02	703.18	1439.10	257.72	884.17
1	10.5		Bridge								
1	10	Q100	635.30	635.27	0.03	0.00	0.01	552.30	1590.25	257.45	503.40
1	9.5	Q100	635.29	635.22	0.06	0.01	0.01	241.54	2131.93	126.53	488.50
1	9	Q100	635.27	635.22	0.05			752.92	1681.49	65.59	224.59
1	8.5		Bridge								
1	8	Q100	634.55	634.50	0.05	0.01	0.01	355.63	2100.53	43.83	219.09
1	7	Q100	634.53	634.44	0.09	0.09	0.00	987.64	1277.28	235.08	441.28
1	6	Q100	634.44	634.34	0.09			100.15	2097.66	302.19	783.16
1	5.5		Bridge								
1	5	Q100	633.66	633.45	0.21	0.72	0.01	135.17	2231.35	133.48	113.02
1	4	Q100	632.93	632.69	0.24	0.02	0.12		2409.59	90.41	168.34
1	3.5		Bridge								
1	3	Q100	632.03	631.67	0.36	0.93	0.10		2461.59	38.41	251.96
1	2	Q100	631.00	630.84	0.16	0.81	0.00	867.68	1547.99	84.33	316.72
1	1	Q100	630.18	630.04	0.15	0.69	0.03	553.10	1105.05	841.86	338.30
1	0.5	Q100	629.46	629.42	0.04			408.57	456.86	1634.57	803.44

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing



Errors Warnings and Notes for Plan : EX

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q100
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q100 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 12 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q100
Note:	The weir over a bridge is submerged, the energy answer was used.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q100 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 8.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

Errors Warnings and Notes for Plan : EX (Continued)

Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q100
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q100 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The
	selected bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q100
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Notes(60): This is an inside cross section of a perched bridge that has energy, low flow inside of the bridge and weir flow over the embankment. The reported
	hydraulics are based on the flow and area inside of the bridge.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q100 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Notes(60): This is an inside cross section of a perched bridge that has energy, low flow inside of the bridge and weir flow over the embankment. The reported
	hydraulics are based on the flow and area inside of the bridge.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q100
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

500-Year Design Existing

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q500

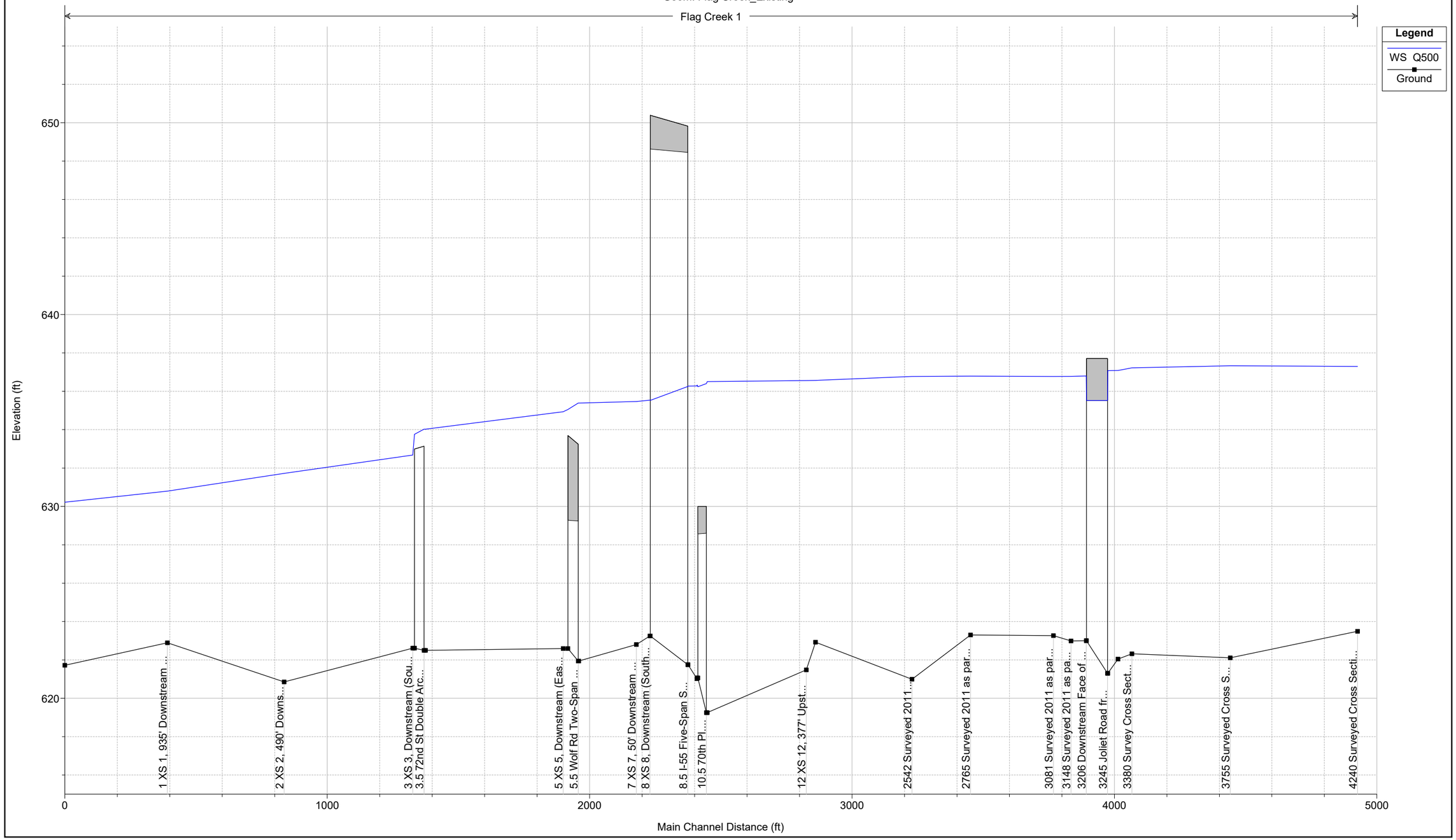
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q500	3350.00	623.49	637.30	629.21	637.46	0.000270	3.30	1262.73	793.37	0.18
1	3755	Q500	3350.00	622.11	637.33	629.08	637.36	0.000070	1.71	2649.55	588.33	0.09
1	3380	Q500	3350.00	622.32	637.22		637.31	0.000261	2.54	1589.87	579.79	0.13
1	3327	Q500	3350.00	622.04	637.08	628.89	637.28	0.000746	3.54	953.08	475.54	0.19
1	3288	Q500	3350.00	621.30	637.08	628.47	637.25	0.000295	3.35	999.50	147.52	0.17
1	3245		Bridge									
1	3206	Q500	3350.00	623.00	636.80	629.20	637.00	0.000380	3.63	922.64	91.15	0.20
1	3148	Q500	3350.00	622.99	636.78	628.64	636.98	0.000360	3.61	927.54	339.52	0.20
1	3081	Q500	3350.00	623.26	636.77	628.67	636.95	0.000376	3.37	1003.14	363.73	0.20
1	2765	Q500	3350.00	623.30	636.79	629.27	636.86	0.000110	2.11	1773.48	423.74	0.11
1	2542	Q500	3350.00	620.99	636.77	628.47	636.83	0.000118	2.11	1943.28	323.24	0.11
1	12.1	Q500	3350.00	622.92	636.57		636.73	0.000647	3.55	1507.59	404.91	0.19
1	12	Q500	3350.00	621.48	636.56		636.71	0.000543	3.43	1452.46	502.90	0.18
1	11	Q500	3350.00	619.25	636.51	627.00	636.54	0.000136	1.45	2322.55	998.98	0.07
1	10.5		Bridge									
1	10	Q500	3350.00	621.06	636.33	626.94	636.37	0.000158	1.54	2031.88	602.88	0.08
1	9.5	Q500	3550.00	621.02	636.28	627.42	636.36	0.000452	2.55	2148.56	529.23	0.13
1	9	Q500	3550.00	621.75	636.27	627.93	636.35	0.000285	2.02	1618.00	229.32	0.10
1	8.5		Bridge									
1	8	Q500	3550.00	623.25	635.54		635.62	0.000371	2.12	1595.26	223.45	0.12
1	7	Q500	3550.00	622.80	635.47	628.49	635.59	0.000201	1.58	1512.41	521.14	0.09
1	6	Q500	3550.00	621.94	635.39	628.56	635.47	0.000598	2.77	2428.25	842.26	0.15
1	5.5		Bridge									
1	5	Q500	3550.00	622.59	634.94	628.48	635.18	0.001390	4.38	1365.61	531.26	0.23
1	4	Q500	3550.00	622.50	634.03	627.91	634.35	0.001748	4.76	1039.16	427.38	0.26
1	3.5		Bridge									
1	3	Q500	3550.00	622.61	632.68	628.10	633.06	0.002690	5.36	959.91	342.17	0.31
1	2	Q500	3550.00	620.85	631.72		631.92	0.001719	4.38	1260.17	324.10	0.25
1	1	Q500	3550.00	622.89	630.80		630.97	0.002735	4.61	1299.29	349.52	0.30
1	0.5	Q500	3550.00	621.72	630.22	628.10	630.26	0.001183	2.85	2593.24	904.16	0.19

HEC-RAS Plan: EX River: Flag Creek Reach: 1 Profile: Q500

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q500	637.46	637.30	0.16	0.06	0.04	5.95	3180.18	163.87	793.37
1	3755	Q500	637.36	637.33	0.03	0.05	0.01	27.59	1547.37	1775.04	588.33
1	3380	Q500	637.31	637.22	0.09	0.02	0.01	35.19	2667.58	647.23	579.79
1	3327	Q500	637.28	637.08	0.19	0.02	0.01	3.82	3346.18		475.54
1	3288	Q500	637.25	637.08	0.17				3350.00		147.52
1	3245		Bridge								
1	3206	Q500	637.00	636.80	0.20	0.02	0.00		3350.00		91.15
1	3148	Q500	636.98	636.78	0.20	0.02	0.01		3350.00		339.52
1	3081	Q500	636.95	636.77	0.18	0.06	0.03	18.19	3331.81		363.73
1	2765	Q500	636.86	636.79	0.07	0.03	0.00	1377.90	1682.41	289.69	423.74
1	2542	Q500	636.83	636.77	0.05	0.09	0.01	1432.05	1832.24	85.71	323.24
1	12.1	Q500	636.73	636.57	0.16	0.02	0.00	384.55	2711.20	254.25	404.91
1	12	Q500	636.71	636.56	0.15	0.11	0.06	437.04	2613.61	299.35	502.90
1	11	Q500	636.54	636.51	0.03	0.00	0.02	1192.98	1635.46	521.57	998.98
1	10.5		Bridge								
1	10	Q500	636.37	636.33	0.05	0.00	0.01	1003.82	1858.50	487.68	602.88
1	9.5	Q500	636.36	636.28	0.08	0.01	0.00	538.62	2715.83	295.55	529.23
1	9	Q500	636.35	636.27	0.08			1314.16	2114.75	121.09	229.32
1	8.5		Bridge								
1	8	Q500	635.62	635.54	0.08	0.01	0.01	734.54	2724.37	91.09	223.45
1	7	Q500	635.59	635.47	0.13	0.10	0.02	1657.02	1382.47	510.52	521.14
1	6	Q500	635.47	635.39	0.08			280.42	2408.30	861.28	842.26
1	5.5		Bridge								
1	5	Q500	635.18	634.94	0.25	0.81	0.02	304.25	2918.26	327.49	531.26
1	4	Q500	634.35	634.03	0.32				3267.35	282.65	427.38
1	3.5		Bridge								
1	3	Q500	633.06	632.68	0.39	1.05	0.09		3049.15	500.85	342.17
1	2	Q500	631.92	631.72	0.20	0.94	0.01	1215.87	2005.37	328.77	324.10
1	1	Q500	630.97	630.80	0.18	0.67	0.04	974.24	1380.76	1195.00	349.52
1	0.5	Q500	630.26	630.22	0.04			643.25	526.98	2379.77	904.16

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing



Errors Warnings and Notes for Plan : EX

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q500
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q500 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 12 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q500
Note:	The weir over a bridge is submerged, the energy answer was used.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q500 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q500
Warning:	The cross-section end points had to be extended vertically for the computed water surface.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 8.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q500

Errors Warnings and Notes for Plan : EX (Continued)

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q500
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q500 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface is based on critical depth over the weir. The energy has been projected.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q500
Warning:	The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of
	error between computed and assumed values.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q500
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q500 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy are based on critical depth over the weir.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q500
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 1 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.

BRIDGE TABLES

HEC-RAS Plan: EX River: Flag Creek Reach: 1

Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)
1	3245	Q10	632.97	635.52	774.90		1260.00	637.72		0.03
1	3245	Q50	635.13	635.52	774.90		2000.00	637.72		0.04
1	3245	Q100	635.98	635.52	774.90	635.87	2400.00	637.72		0.10
1	3245	Q500	637.25	635.52	774.90	637.08	3350.00	637.72		0.25
1	10.5	Q10	632.45	628.60	392.02		1260.00	632.01	62.38	0.19
1	10.5	Q50	634.61	628.60	392.02		2000.00	632.01	1029.49	0.04
1	10.5	Q100	635.48	628.60	392.02		2400.00	632.01		0.18
1	10.5	Q500	636.54	628.60	392.02		3350.00	632.01		0.17
1	8.5	Q10	632.24	648.45	4238.31		1310.00	650.40		0.67
1	8.5	Q50	634.54	648.45	4238.31		2100.00	650.40		0.72
1	8.5	Q100	635.27	648.45	4238.31		2500.00	650.40		0.72
1	8.5	Q500	636.35	648.45	4238.31		3550.00	650.40		0.73
1	5.5	Q10	631.36	629.24	325.83	631.27	1310.00	633.70		0.27
1	5.5	Q50	633.68	629.24	325.83	633.56	2100.00	633.70		0.82
1	5.5	Q100	634.44	629.24	325.83		2500.00	633.70	421.65	0.77
1	5.5	Q500	635.47	629.24	325.83		3550.00	633.70	2008.84	0.29
1	3.5	Q10	630.53	633.14	381.67		1310.00	632.44		0.33
1	3.5	Q50	632.14	633.14	381.67		2100.00	632.44		0.67
1	3.5	Q100	632.93	633.14	381.67		2500.00	632.44	27.10	0.90
1	3.5	Q500	634.35	633.14	381.67	634.83	3550.00	632.44	771.73	1.29

HEC-RAS Plan: EX River: Flag Creek Reach: 1

Reach	River Sta	Profile	E.G. US.	W.S. US.	Br Sel Method	Energy EG	Momen. EG	Yarnell EG	WSPRO EG	Prs O EG	Prs/Wr EG	Energy/Wr EG
			(ft)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1	3245	Q10	632.97	632.91	Energy only	632.97						
1	3245	Q50	635.13	635.03	Energy only	635.13						
1	3245	Q100	635.98	635.87	Press Only	635.96				635.98		
1	3245	Q500	637.25	637.08	Press Only	637.21				637.25		
1	10.5	Q10	632.45	632.41	Press/Weir	632.52				632.48	632.45	
1	10.5	Q50	634.61	634.57	Press/Weir	634.80				635.17	634.61	
1	10.5	Q100	635.48	635.45	Energy only	635.48				636.17	635.32	
1	10.5	Q500	636.54	636.51	Energy only	636.54				638.10	636.40	
1	8.5	Q10	632.24	632.19	Momentum	631.68	632.24	631.60				
1	8.5	Q50	634.54	634.50	Momentum	633.91	634.54	633.84				
1	8.5	Q100	635.27	635.22	Momentum	634.63	635.27	634.57				
1	8.5	Q500	636.35	636.27	Momentum	635.72	636.35	635.64				
1	5.5	Q10	631.36	631.27	Press Only	631.67				631.36		
1	5.5	Q50	633.68	633.56	Press Only	634.40				633.68		
1	5.5	Q100	634.44	634.34	Press/Weir	635.26				634.88	634.44	
1	5.5	Q500	635.47	635.39	Press/Weir	636.35				637.82	635.47	
1	3.5	Q10	630.53	630.41	Energy only	630.53						
1	3.5	Q50	632.14	631.93	Energy only	632.14						
1	3.5	Q100	632.93	632.69	Energy/Weir	632.95						632.93
1	3.5	Q500	634.35	634.03	Press/Weir	635.00				635.04	634.35	

HEC-RAS Plan: EX River: Flag Creek Reach: 1

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	3327	Q10	632.99	632.91	626.31	0.01	0.01	120.82		1260.00		2.15
1	3327	Q50	635.15	635.04	627.33	0.01	0.01	287.33		2000.00		2.61
1	3327	Q100	636.00	635.88	627.82	0.01	0.01	351.52	0.40	2399.60		2.86
1	3327	Q500	637.28	637.08	628.89	0.02	0.01	475.54	3.82	3346.18		3.54
1	3288	Q10	632.97	632.91	626.18	0.00	0.00	86.69		1260.00		1.97
1	3288	Q50	635.13	635.03	627.09	0.00	0.00	86.69		2000.00		2.43
1	3288	Q100	635.98	635.87	627.54			86.69		2400.00		2.68
1	3288	Q500	637.25	637.08	628.47			147.52		3350.00		3.35
1	3245 BR U	Q10	632.97	632.90	626.24	0.02	0.00	83.69		1260.00		2.06
1	3245 BR U	Q50	635.12	635.02	627.20	0.03	0.01	83.69		2000.00		2.53
1	3245 BR U	Q100	635.98	635.52	627.64			83.69		2400.00		2.89
1	3245 BR U	Q500	637.25	635.52	628.62			83.69		3350.00		4.03
1	3245 BR D	Q10	632.94	632.86	627.11	0.00	0.00	83.50		1260.00		2.28
1	3245 BR D	Q50	635.09	634.98	628.03	0.00	0.01	83.50		2000.00		2.74
1	3245 BR D	Q100	635.88	635.52	628.48			83.50		2400.00		3.10
1	3245 BR D	Q500	637.00	635.52	629.43			83.50		3350.00		4.32
1	3206	Q10	632.94	632.87	626.94	0.01	0.00	86.50		1260.00		2.16
1	3206	Q50	635.09	634.98	627.85	0.01	0.00	86.50		2000.00		2.61
1	3206	Q100	635.88	635.75	628.25	0.02	0.00	86.50		2400.00		2.88
1	3206	Q500	637.00	636.80	629.20	0.02	0.00	91.15		3350.00		3.63
1	3148	Q10	632.93	632.85	626.37	0.01	0.00	79.88		1260.00		2.15
1	3148	Q50	635.07	634.97	627.27	0.02	0.00	90.77		2000.00		2.63
1	3148	Q100	635.86	635.73	627.70	0.02	0.00	109.12		2400.00		2.89
1	3148	Q500	636.98	636.78	628.64	0.02	0.01	339.52		3350.00		3.61
1	12	Q10	632.62	632.53		0.14	0.03	160.71	0.32	1235.41	24.27	2.47
1	12	Q50	634.76	634.65		0.12	0.04	425.12	81.73	1789.02	129.25	2.80
1	12	Q100	635.62	635.51		0.10	0.04	459.91	196.76	2017.29	185.95	2.91
1	12	Q500	636.71	636.56		0.11	0.06	502.90	437.04	2613.61	299.35	3.43
1	11	Q10	632.45	632.41	624.48			530.70	7.83	1239.03	13.15	1.63
1	11	Q50	634.61	634.57	625.57			778.56	426.13	1455.28	118.58	1.53
1	11	Q100	635.48	635.45	626.04	0.00	0.02	884.17	703.18	1439.10	257.72	1.39

HEC-RAS Plan: EX River: Flag Creek Reach: 1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	11	Q500	636.54	636.51	627.00	0.00	0.02	998.98	1192.98	1635.46	521.57	1.45
1	10.5 BR U	Q10	632.45	632.41	624.48			402.67	62.80	1197.62		3.06
1	10.5 BR U	Q50	634.61	634.57	625.57			737.45	690.39	852.33	95.23	1.74
1	10.5 BR U	Q100	635.45	635.34	626.04	0.04	0.03	819.17	1461.01	707.67	231.32	1.27
1	10.5 BR U	Q500	636.52	636.40	627.00	0.02	0.03	931.14	2062.19	695.78	592.04	1.07
1	10.5 BR D	Q10	632.26	632.23	624.79			23.22	62.80	1197.62		2.83
1	10.5 BR D	Q50	634.59	634.54	625.64			320.72	690.39	852.33	95.23	1.61
1	10.5 BR D	Q100	635.39	635.18	626.11	0.00	0.09	384.28	1328.55	862.85	208.60	1.47
1	10.5 BR D	Q500	636.46	636.24	626.93	0.00	0.09	490.03	1969.94	865.08	514.98	1.25
1	10	Q10	632.26	632.23	624.79	0.00	0.00	138.37	18.16	1238.66	3.18	1.54
1	10	Q50	634.57	634.54	625.64	0.00	0.01	423.64	334.80	1519.54	145.66	1.47
1	10	Q100	635.30	635.27	626.12	0.00	0.01	503.40	552.30	1590.25	257.45	1.44
1	10	Q500	636.37	636.33	626.94	0.00	0.01	602.88	1003.82	1858.50	487.68	1.54
1	9.5	Q10	632.26	632.21	625.08	0.01	0.00	162.87	11.42	1298.51	0.07	1.85
1	9.5	Q50	634.56	634.50	626.01	0.01	0.01	429.17	139.66	1903.41	56.92	2.10
1	9.5	Q100	635.29	635.22	626.41	0.01	0.01	488.50	241.54	2131.93	126.53	2.20
1	9.5	Q500	636.36	636.28	627.42	0.01	0.00	529.23	538.62	2715.83	295.55	2.55
1	9	Q10	632.24	632.19	625.82			165.69	64.46	1240.29	5.25	1.81
1	9	Q50	634.54	634.50	626.66			221.32	506.21	1550.39	43.40	1.74
1	9	Q100	635.27	635.22	627.04			224.59	752.92	1681.49	65.59	1.76
1	9	Q500	636.35	636.27	627.93			229.32	1314.16	2114.75	121.09	2.02
1	8.5 BR U	Q10	632.24	632.18	625.94			154.40	81.35	1228.00	0.65	1.87
1	8.5 BR U	Q50	634.54	634.49	626.81			210.28	577.65	1501.02	21.33	1.76
1	8.5 BR U	Q100	635.27	635.21	627.19			213.53	851.14	1612.62	36.24	1.77
1	8.5 BR U	Q500	636.34	636.25	628.10			218.23	1472.34	2002.79	74.87	2.00
1	8.5 BR D	Q10	631.58	631.53	625.87			138.87	7.11	1301.95	0.94	1.72
1	8.5 BR D	Q50	633.83	633.78	626.68			205.06	184.04	1885.63	30.33	1.84
1	8.5 BR D	Q100	634.56	634.50	627.03			208.08	355.57	2091.92	52.51	1.89
1	8.5 BR D	Q500	635.62	635.53	627.86			212.40	752.48	2687.73	109.80	2.18
1	8	Q10	631.57	631.53		0.03	0.01	149.90	8.92	1300.25	0.83	1.66
1	8	Q50	633.82	633.78		0.01	0.01	216.06	191.82	1882.66	25.52	1.77

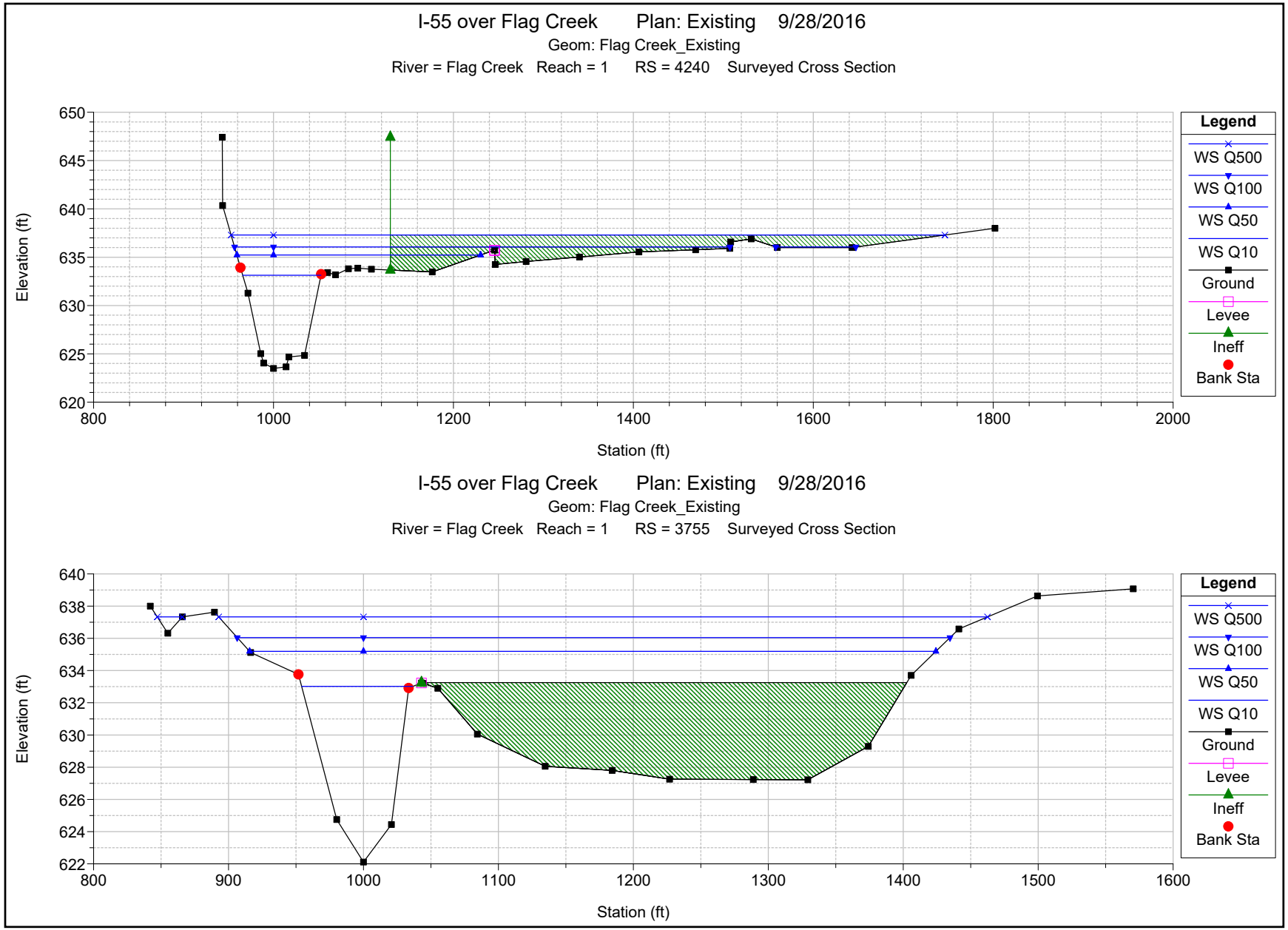
HEC-RAS Plan: EX River: Flag Creek Reach: 1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	8	Q100	634.55	634.50		0.01	0.01	219.09	355.63	2100.53	43.83	1.82
1	8	Q500	635.62	635.54		0.01	0.01	223.45	734.54	2724.37	91.09	2.12
1	7	Q10	631.54	631.46	626.00	0.17	0.00	138.77	95.78	1196.14	18.09	2.20
1	7	Q50	633.80	633.72	627.00	0.10	0.01	265.16	661.07	1319.26	119.67	1.80
1	7	Q100	634.53	634.44	627.46	0.09	0.00	441.28	987.64	1277.28	235.08	1.61
1	7	Q500	635.59	635.47	628.49	0.10	0.02	521.14	1657.02	1382.47	510.52	1.58
1	6	Q10	631.36	631.27	626.05			102.34	7.38	1287.61	15.01	2.40
1	6	Q50	633.68	633.56	627.28			447.04	28.08	2031.74	40.18	2.82
1	6	Q100	634.44	634.34	627.67			783.16	100.15	2097.66	302.19	2.68
1	6	Q500	635.47	635.39	628.56			842.26	280.42	2408.30	861.28	2.77
1	5.5 BR U	Q10	631.36	629.24	626.39				0.29	1306.01	3.69	3.95
1	5.5 BR U	Q50	633.68	629.24	627.59				0.47	2093.61	5.92	6.33
1	5.5 BR U	Q100	634.43	634.34	627.98			325.21	327.16	2147.69	23.97	5.84
1	5.5 BR U	Q500	635.47	635.39	628.87			534.94	1086.06	1987.17	473.70	4.40
1	5.5 BR D	Q10	631.09	629.28	626.17				10.29	1276.31	23.39	4.24
1	5.5 BR D	Q50	632.85	629.28	627.24				16.50	2046.00	37.50	6.80
1	5.5 BR D	Q100	634.43	634.34	627.70			332.71	343.02	2100.57	55.23	6.51
1	5.5 BR D	Q500	635.47	635.05	628.84			437.03	1097.82	1952.23	496.88	5.10
1	5	Q10	631.09	630.97	625.96	0.56	0.00	92.62	31.51	1239.35	39.14	2.85
1	5	Q50	632.85	632.67	626.96	0.70	0.01	106.57	92.89	1910.53	96.59	3.58
1	5	Q100	633.66	633.45	627.39	0.72	0.01	113.02	135.17	2231.35	133.48	3.85
1	5	Q500	635.18	634.94	628.48	0.81	0.02	531.26	304.25	2918.26	327.49	4.38
1	4	Q10	630.53	630.41	625.60	0.01	0.04	92.71		1292.25	17.75	2.84
1	4	Q50	632.14	631.93	626.52	0.02	0.09	102.58		2061.25	38.75	3.73
1	4	Q100	632.93	632.69	626.93	0.02	0.12	168.34		2409.59	90.41	4.01
1	4	Q500	634.35	634.03	627.91			427.38		3267.35	282.65	4.76
1	3.5 BR U	Q10	630.48	630.24	625.67	0.20	0.01	34.13		1310.00		3.98
1	3.5 BR U	Q50	632.04	631.54	626.65	0.38	0.02	28.48		2100.00		5.67
1	3.5 BR U	Q100	632.79	632.15	627.10	0.52	0.02	17.54		2472.90		6.43
1	3.5 BR U	Q500	634.35	634.03	628.19			246.49		2778.27	772.54	7.07
1	3.5 BR D	Q10	630.28	630.00	625.89	0.02	0.06	35.44		1310.00		4.19

HEC-RAS Plan: EX River: Flag Creek Reach: 1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	3.5 BR D	Q50	631.64	631.07	626.88	0.03	0.14	31.60		2100.00		6.03
1	3.5 BR D	Q100	632.24	631.52	627.33	0.03	0.18	27.53		2472.90		6.84
1	3.5 BR D	Q500	634.11	633.76	628.41			227.63		2778.27	772.54	7.28
1	3	Q10	630.20	630.05	625.82	0.51	0.04	100.35		1293.02	16.98	3.17
1	3	Q50	631.47	631.18	626.73	0.81	0.08	188.65		2069.05	30.95	4.34
1	3	Q100	632.03	631.67	627.12	0.93	0.10	251.96		2461.59	38.41	4.86
1	3	Q500	633.06	632.68	628.10	1.05	0.09	342.17		3049.15	500.85	5.36
1	2	Q10	629.65	629.58		0.49	0.00	301.04	422.70	874.44	12.85	2.46
1	2	Q50	630.58	630.45		0.75	0.00	313.39	726.07	1349.72	24.22	3.40
1	2	Q100	631.00	630.84		0.81	0.00	316.72	867.68	1547.99	84.33	3.73
1	2	Q500	631.92	631.72		0.94	0.01	324.10	1215.87	2005.37	328.77	4.38

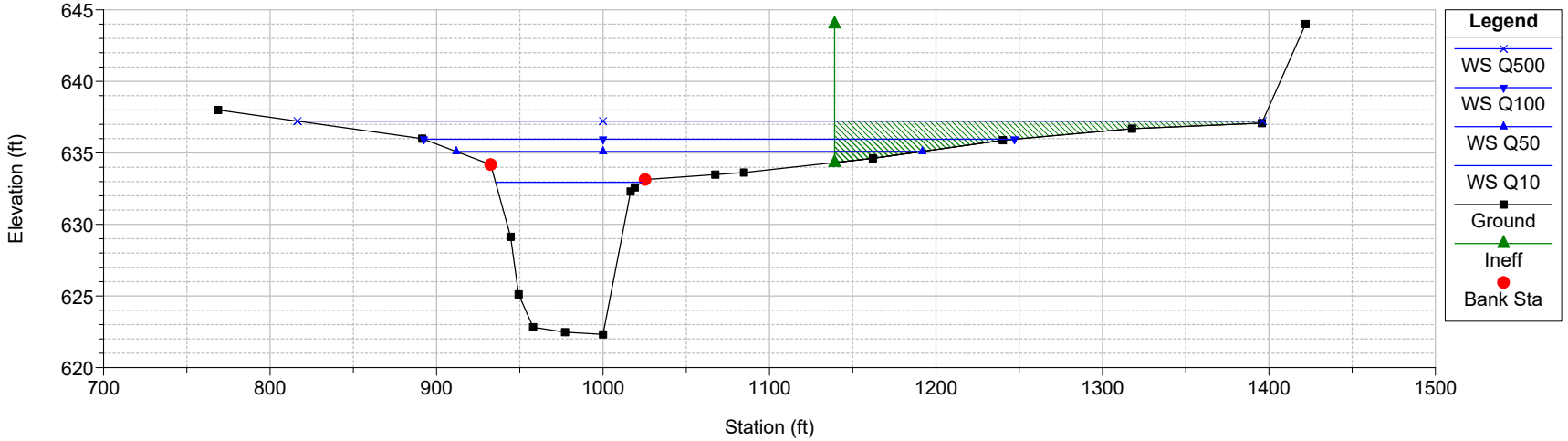
HEC-RAS CROSS PLOTTED SECTIONS


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 4240 Surveyed Cross Section
Elevation (ft)
650
645
640
635
630
625
620
800
1000
1200
1400
1600
1800
2000
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Levee
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3755 Surveyed Cross Section
Elevation (ft)
640
638
636
634
632
630
628
626
624
622
800
900
1000
1100
1200
1300
1400
1500
1600
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Levee
Ineff
Bank Sta

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

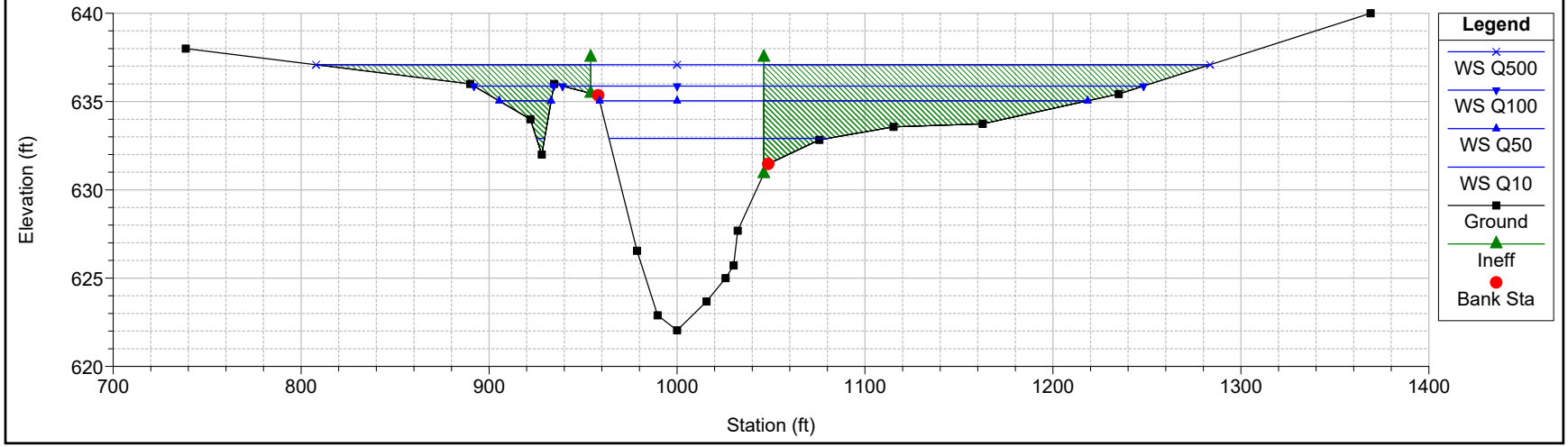
River = Flag Creek Reach = 1 RS = 3380 Survey Cross Section

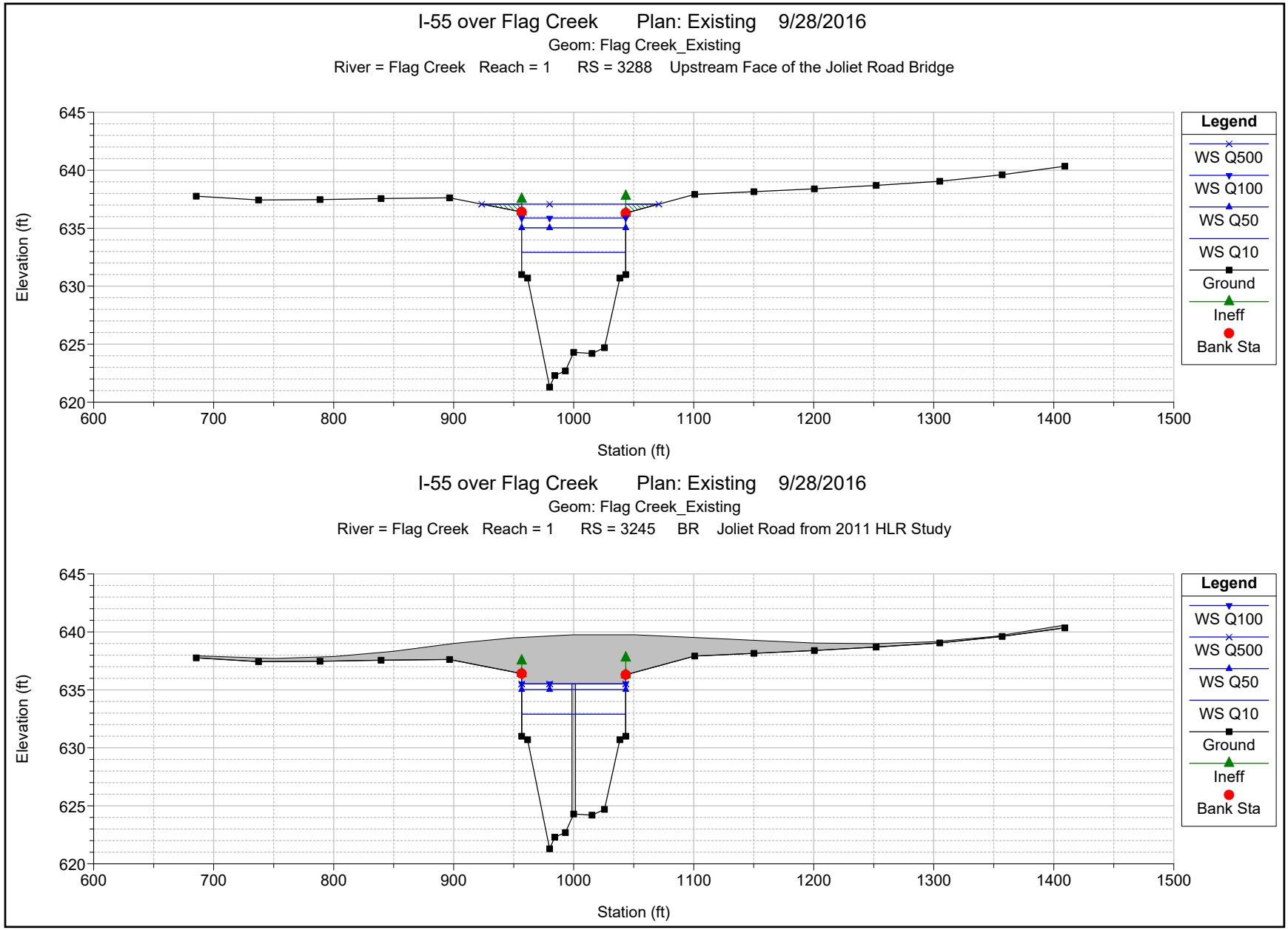


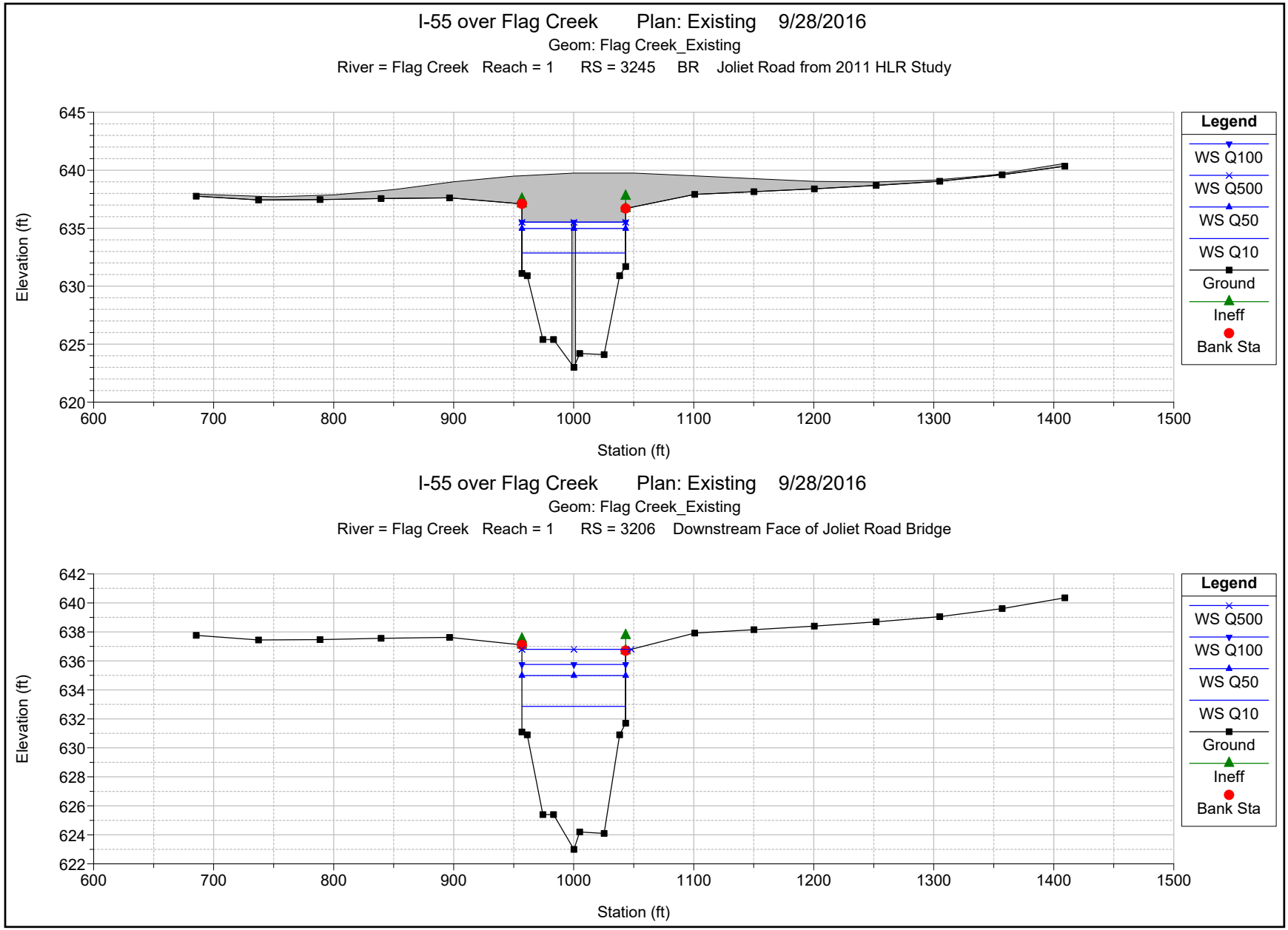
I-55 over Flag Creek Plan: Existing 9/28/2016

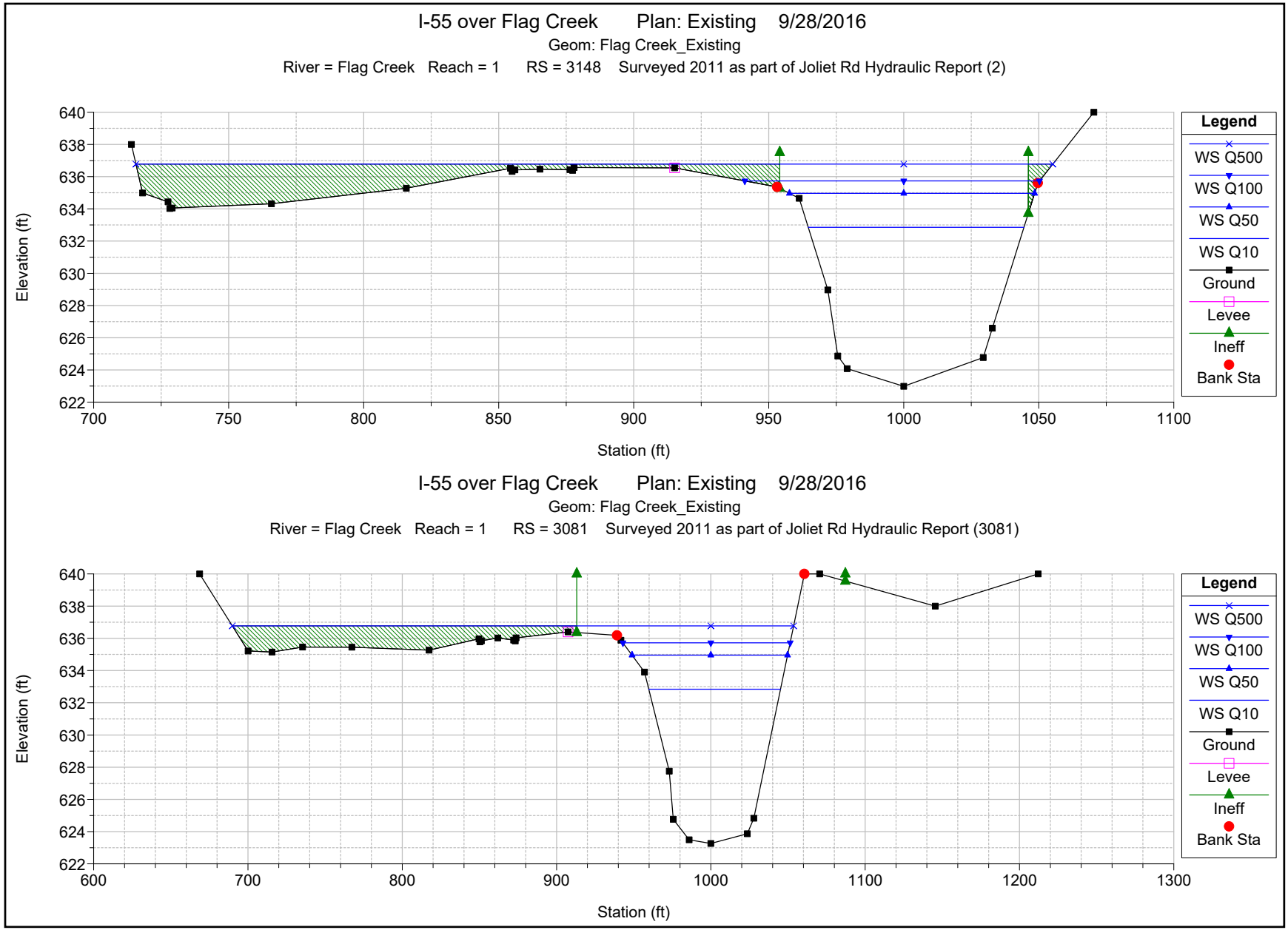
Geom: Flag Creek_Existing

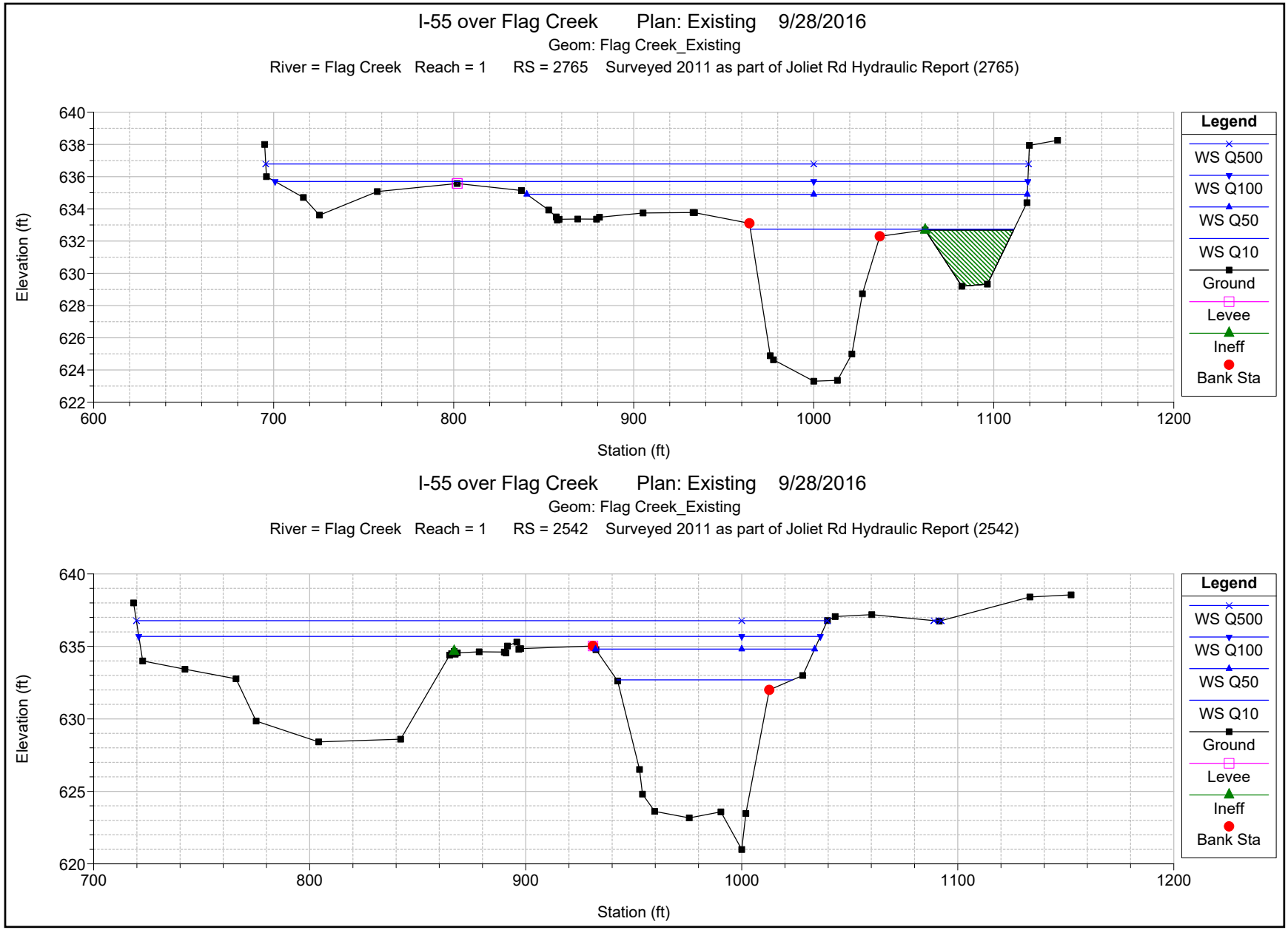
River = Flag Creek Reach = 1 RS = 3327 Surveyed Cross Section

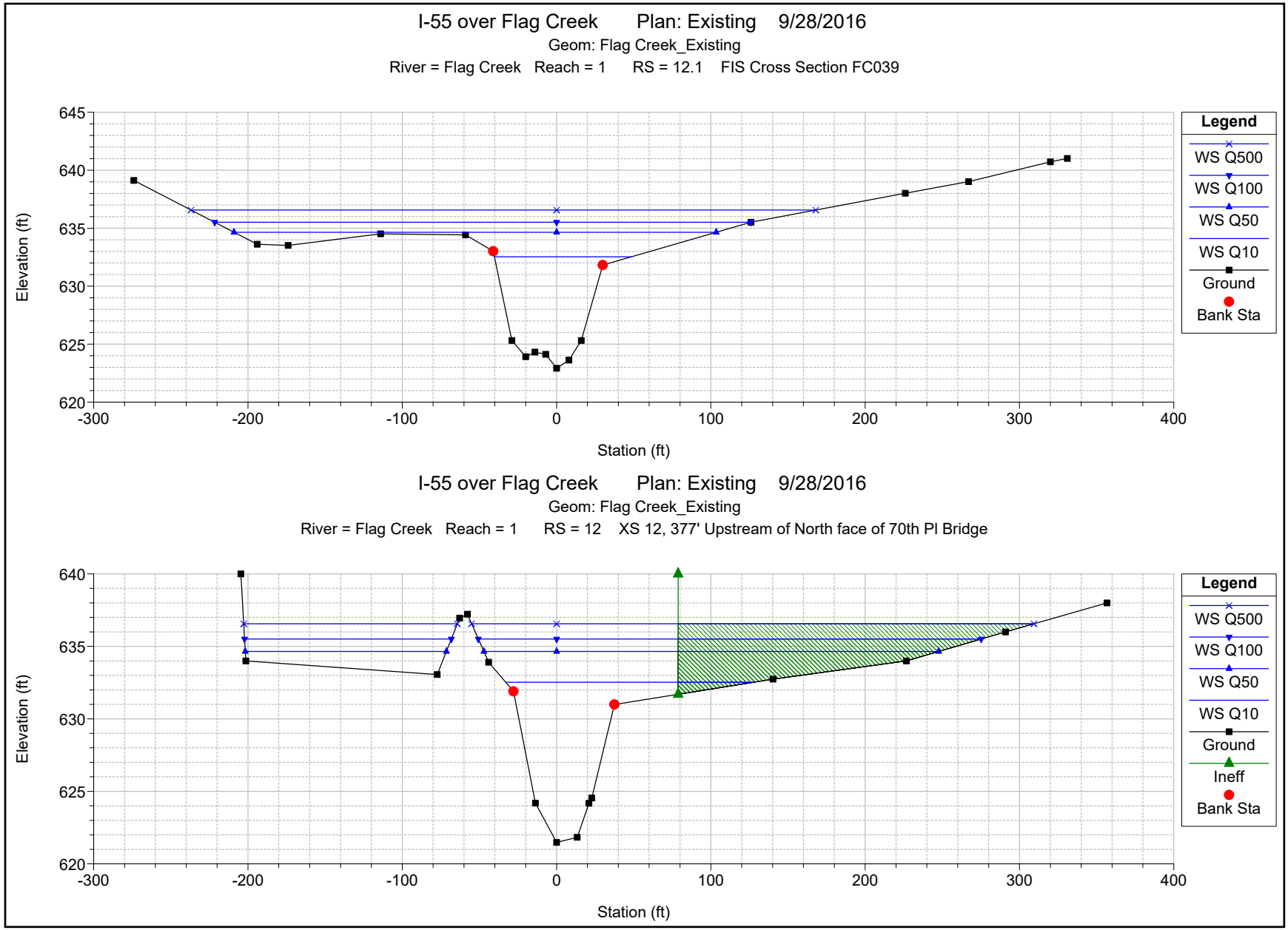



I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3288 Upstream Face of the Joliet Road Bridge
Elevation (ft)
Station (ft)
645
640
635
630
625
620
600
700
800
900
1000
1100
1200
1300
1400
1500
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3245 BR Joliet Road from 2011 HLR Study
Elevation (ft)
Station (ft)
645
640
635
630
625
620
600
700
800
900
1000
1100
1200
1300
1400
1500
Legend
WS Q100
WS Q500
WS Q50
WS Q10
Ground
Ineff
Bank Sta


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3245 BR Joliet Road from 2011 HLR Study
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q500
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3206 Downstream Face of Joliet Road Bridge
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3148 Surveyed 2011 as part of Joliet Rd Hydraulic Report (2)
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Levee
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3081 Surveyed 2011 as part of Joliet Rd Hydraulic Report (3081)
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Levee
Ineff
Bank Sta

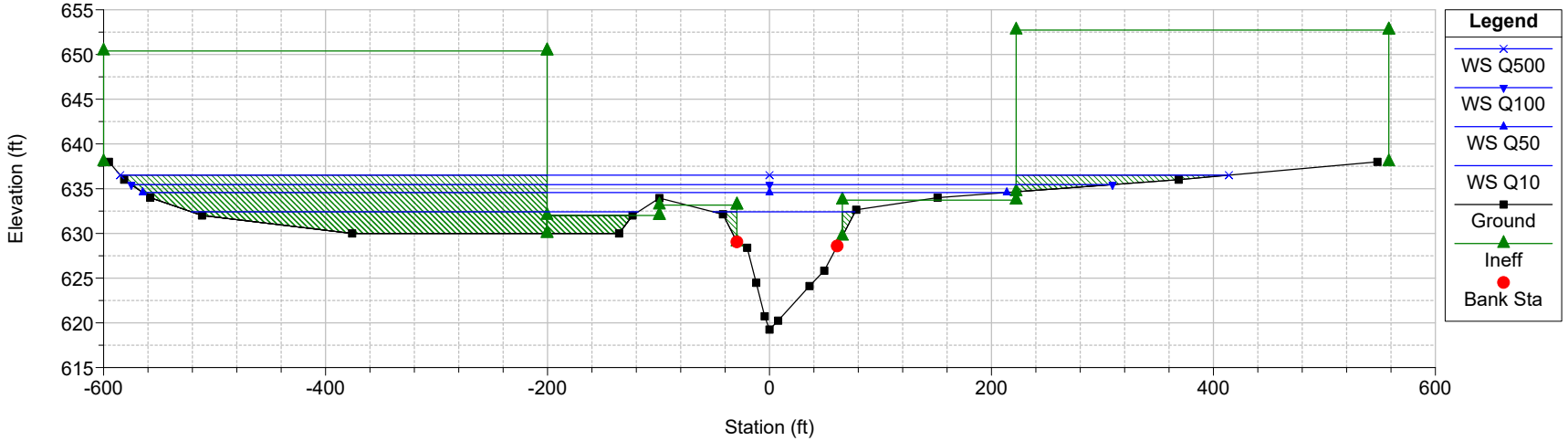

I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 2765 Surveyed 2011 as part of Joliet Rd Hydraulic Report (2765)
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Levee
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 2542 Surveyed 2011 as part of Joliet Rd Hydraulic Report (2542)
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Levee
Ineff
Bank Sta


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 12.1 FIS Cross Section FC039
Elevation (ft)
645
640
635
630
625
620
-300
-200
-100
0
100
200
300
400
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 12 XS 12, 377' Upstream of North face of 70th Pl Bridge
Elevation (ft)
640
635
630
625
620
-300
-200
-100
0
100
200
300
400
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

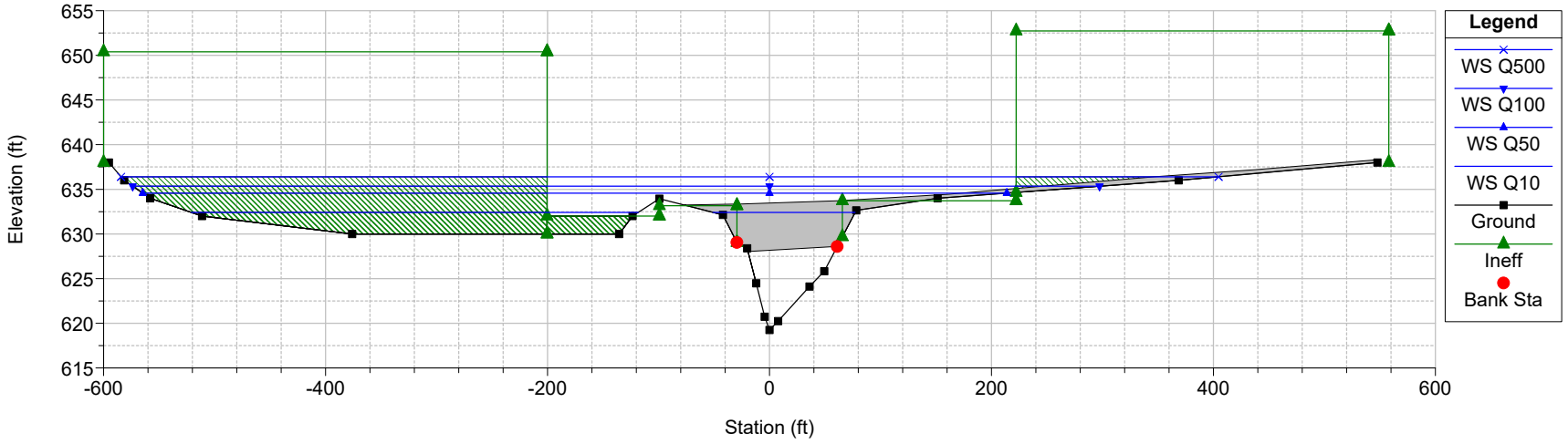
River = Flag Creek Reach = 1 RS = 11 XS 11, Upstream (North) face of 70th Pl Bridge, mod ineff iad

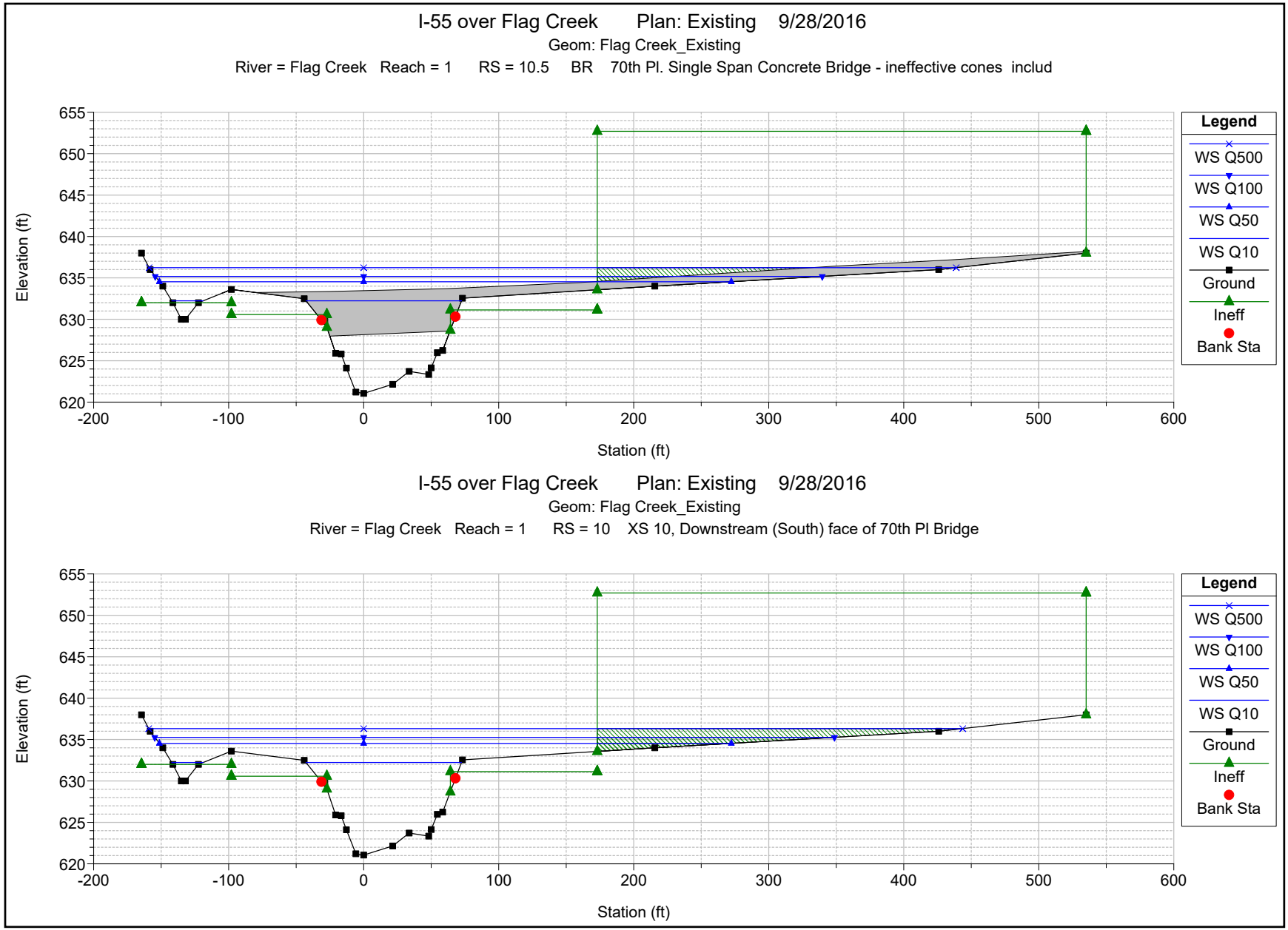


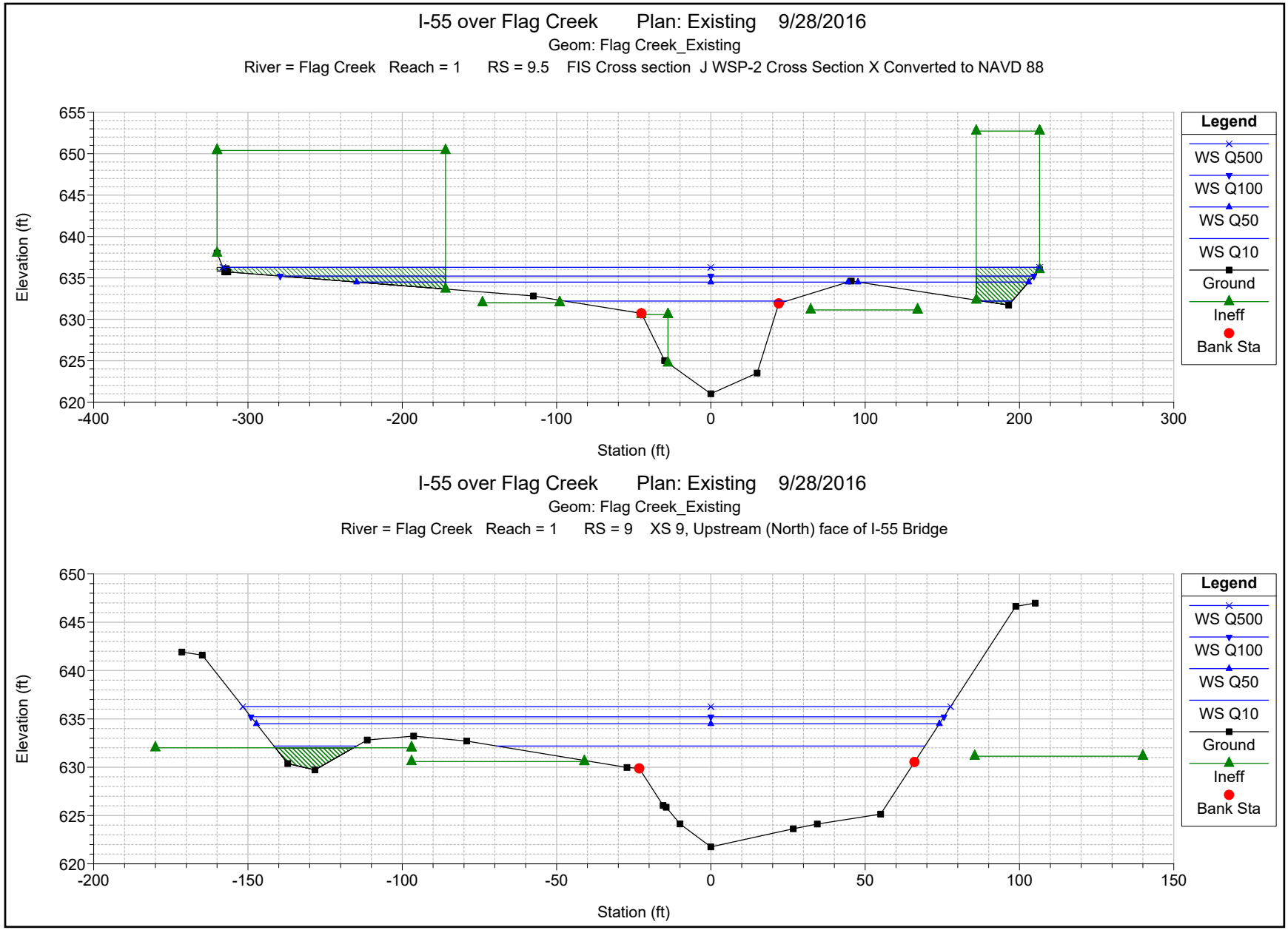
I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

River = Flag Creek Reach = 1 RS = 10.5 BR 70th Pl. Single Span Concrete Bridge - ineffective cones includ



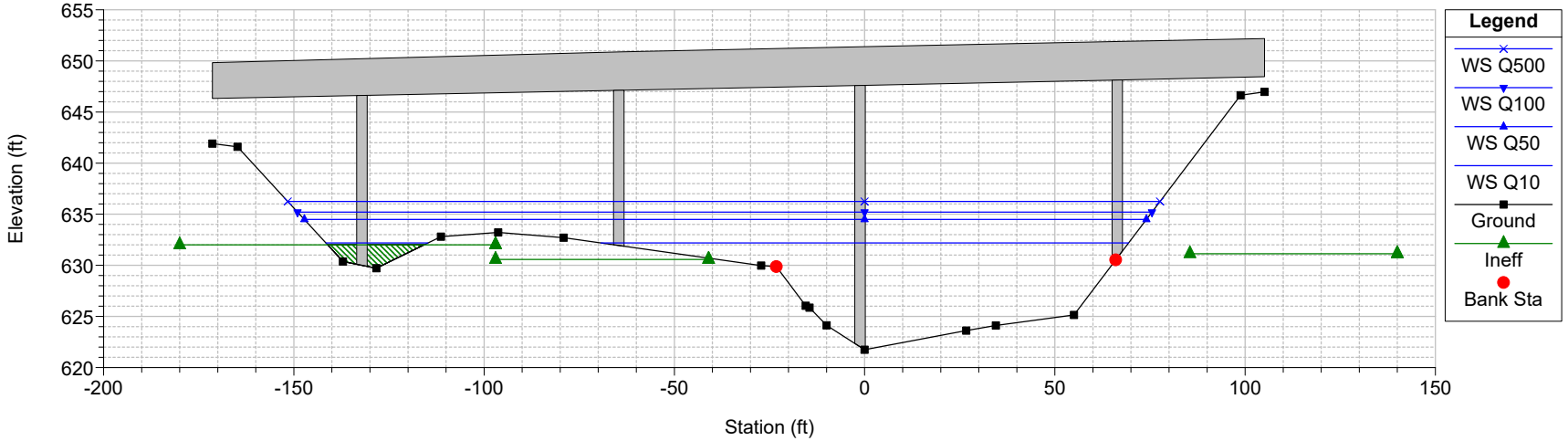

I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 10.5 BR 70th Pl. Single Span Concrete Bridge - ineffective cones includ
Elevation (ft)
655
650
645
640
635
630
625
620
-200
-100
0
100
200
300
400
500
600
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 10 XS 10, Downstream (South) face of 70th Pl Bridge
Elevation (ft)
655
650
645
640
635
630
625
620
-200
-100
0
100
200
300
400
500
600
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 9.5 FIS Cross section J WSP-2 Cross Section X Converted to NAVD 88
Elevation (ft)
655
650
645
640
635
630
625
620
-400
-300
-200
-100
0
100
200
300
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 9 XS 9, Upstream (North) face of I-55 Bridge
Elevation (ft)
650
645
640
635
630
625
620
-200
-150
-100
-50
0
50
100
150
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

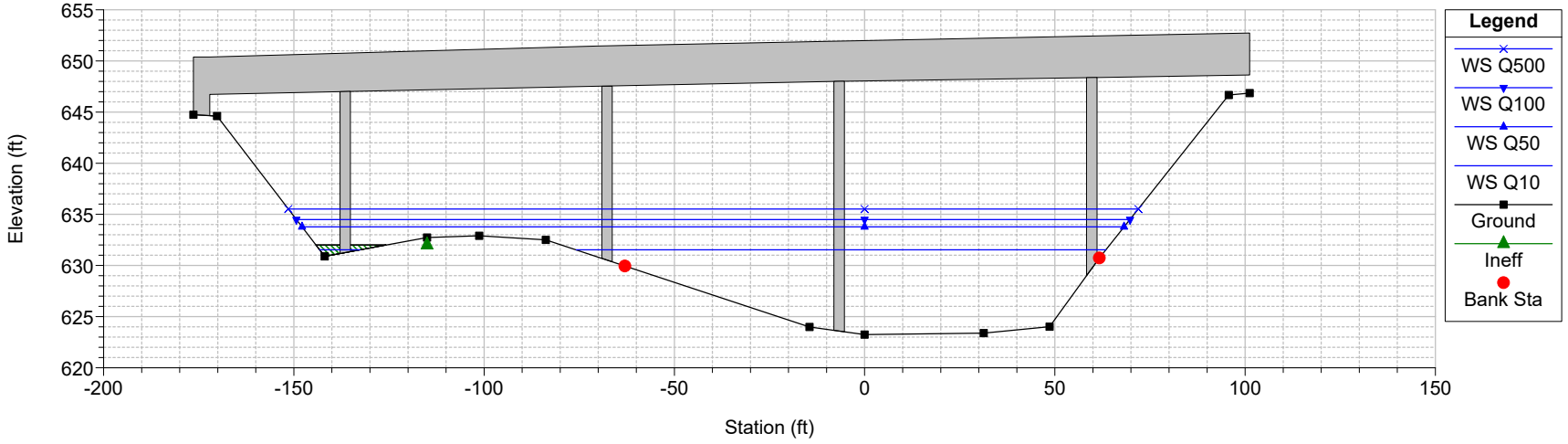
River = Flag Creek Reach = 1 RS = 8.5 BR I-55 Five-Span Steel Bridge.

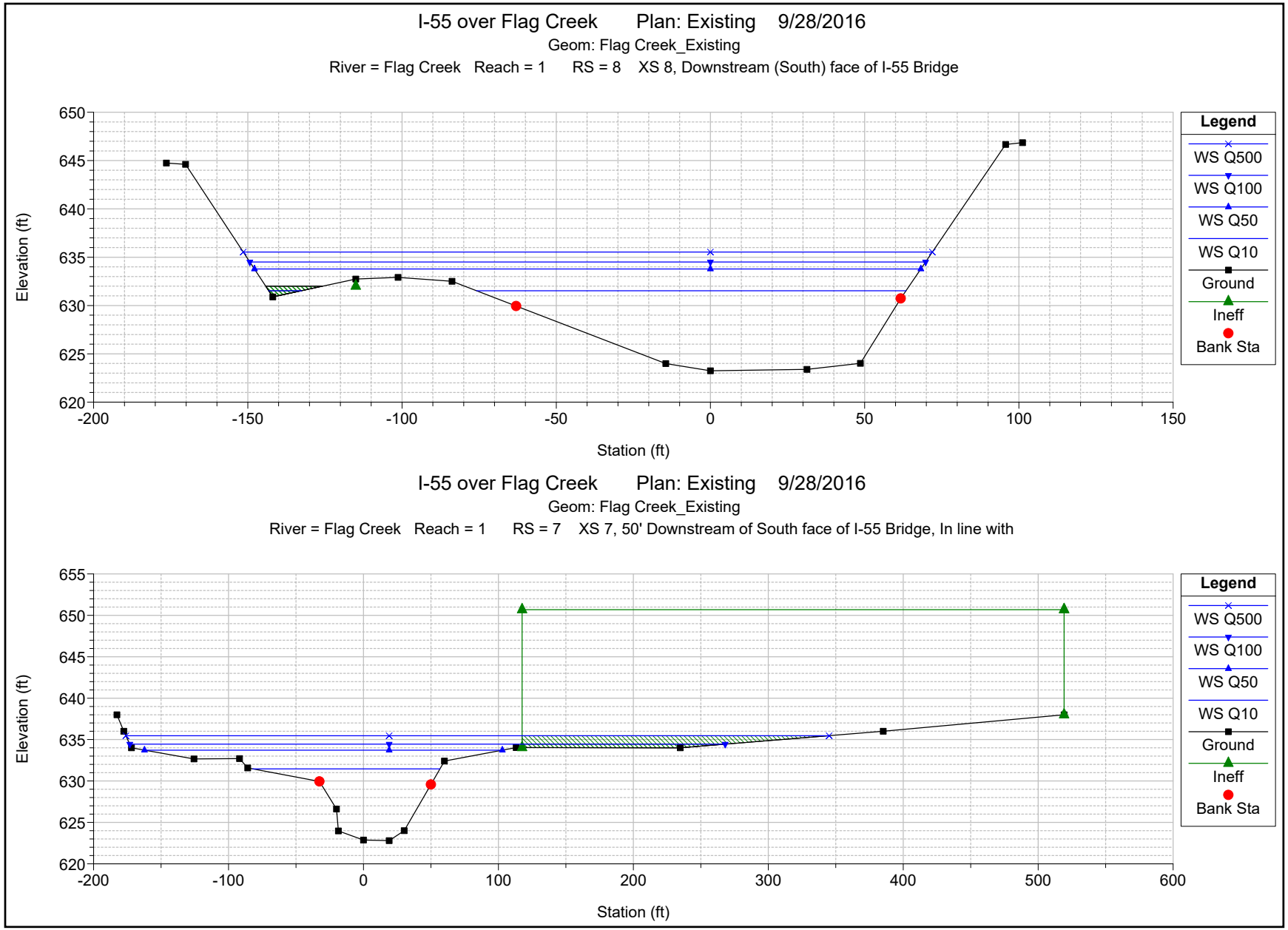


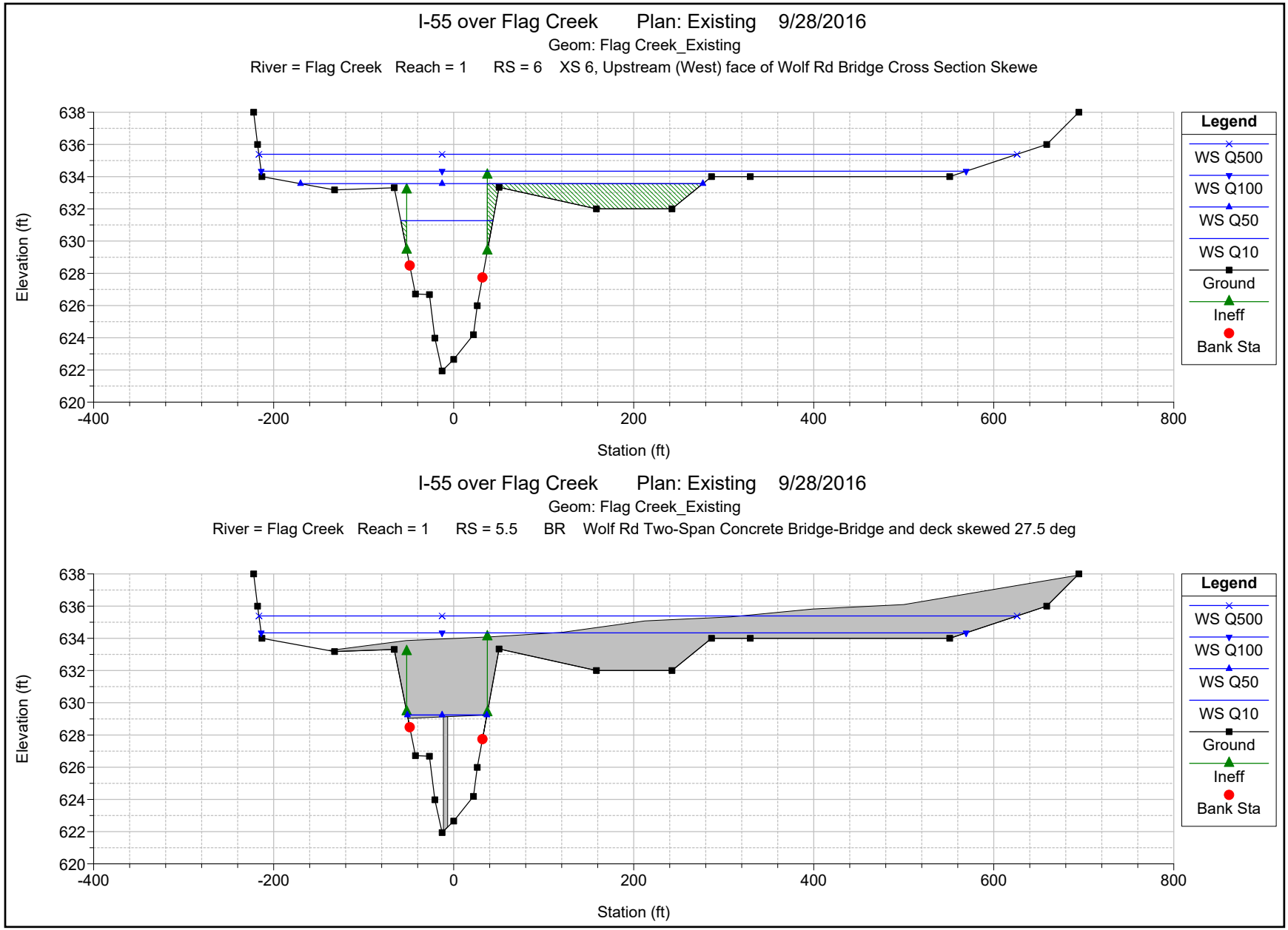
I-55 over Flag Creek Plan: Existing 9/28/2016

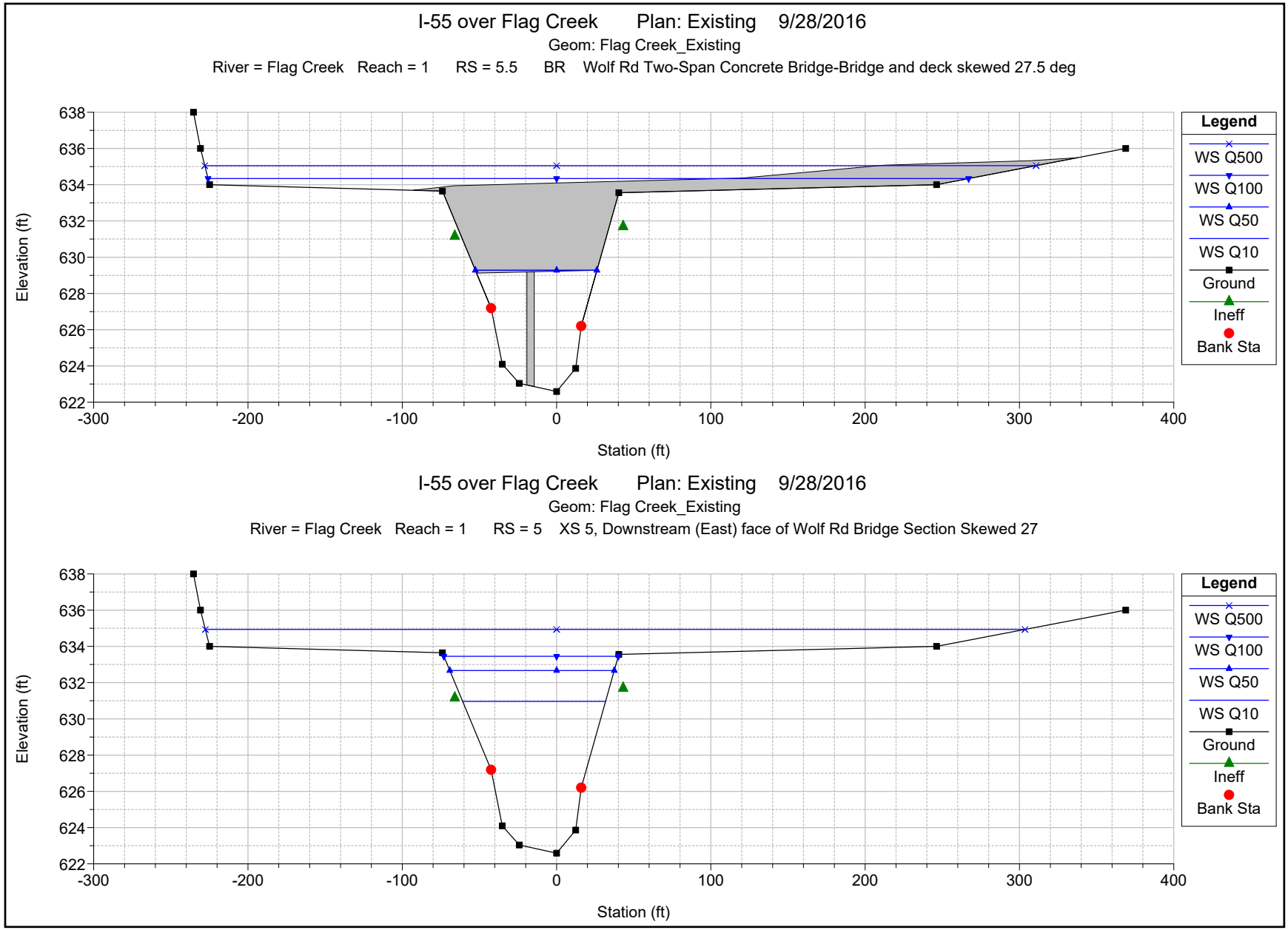
Geom: Flag Creek_Existing

River = Flag Creek Reach = 1 RS = 8.5 BR I-55 Five-Span Steel Bridge.




I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 8 XS 8, Downstream (South) face of I-55 Bridge
Elevation (ft)
650
645
640
635
630
625
620
-200
-150
-100
-50
0
50
100
150
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 7 XS 7, 50' Downstream of South face of I-55 Bridge, In line with
Elevation (ft)
655
650
645
640
635
630
625
620
-200
-100
0
100
200
300
400
500
600
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta

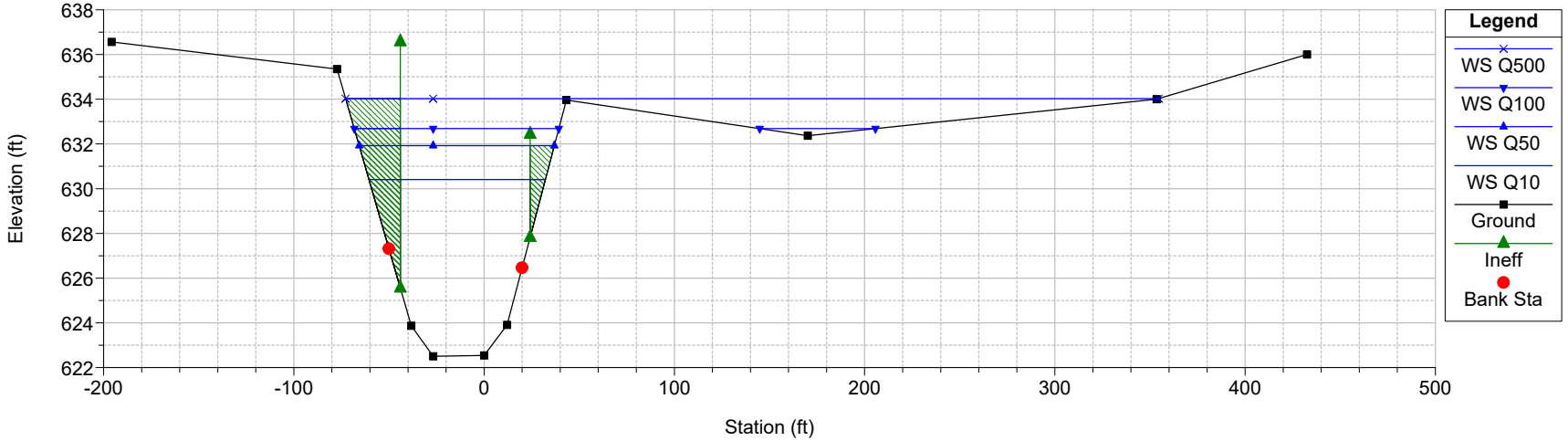

I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 6 XS 6, Upstream (West) face of Wolf Rd Bridge Cross Section Skewe
Elevation (ft)
638
636
634
632
630
628
626
624
622
620
-400
-200
0
200
400
600
800
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 5.5 BR Wolf Rd Two-Span Concrete Bridge-Bridge and deck skewed 27.5 deg
Elevation (ft)
638
636
634
632
630
628
626
624
622
620
-400
-200
0
200
400
600
800
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 5.5 BR Wolf Rd Two-Span Concrete Bridge-Bridge and deck skewed 27.5 deg
Elevation (ft)
638
636
634
632
630
628
626
624
622
-300
-200
-100
0
100
200
300
400
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 5 XS 5, Downstream (East) face of Wolf Rd Bridge Section Skewed 27
Elevation (ft)
638
636
634
632
630
628
626
624
622
-300
-200
-100
0
100
200
300
400
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

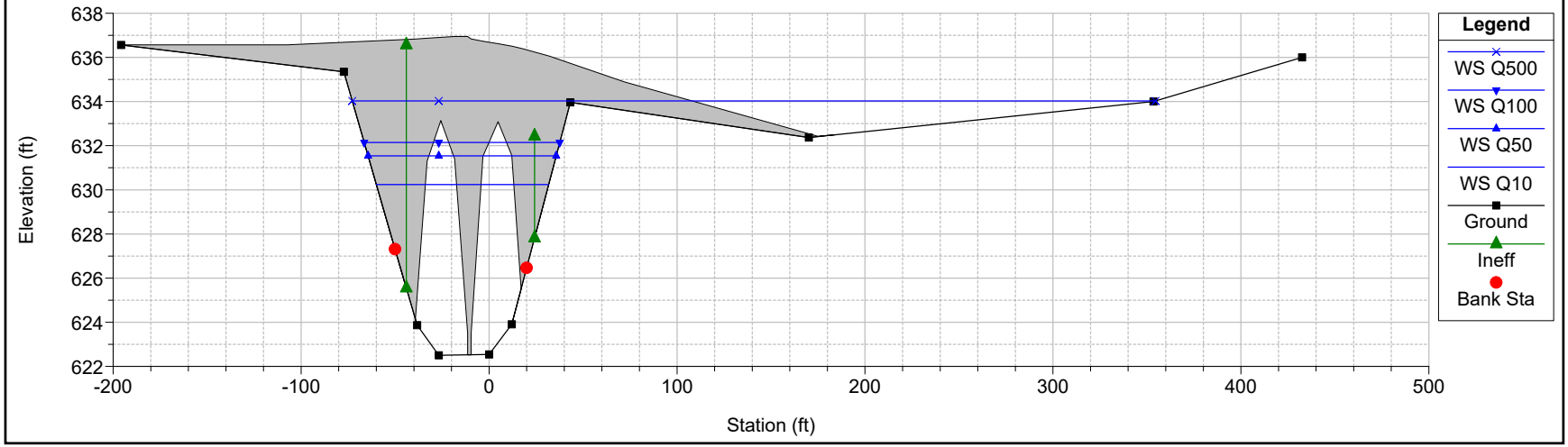
River = Flag Creek Reach = 1 RS = 4 XS 4, Upstream (North) face of 72nd St Double Arch Culvert

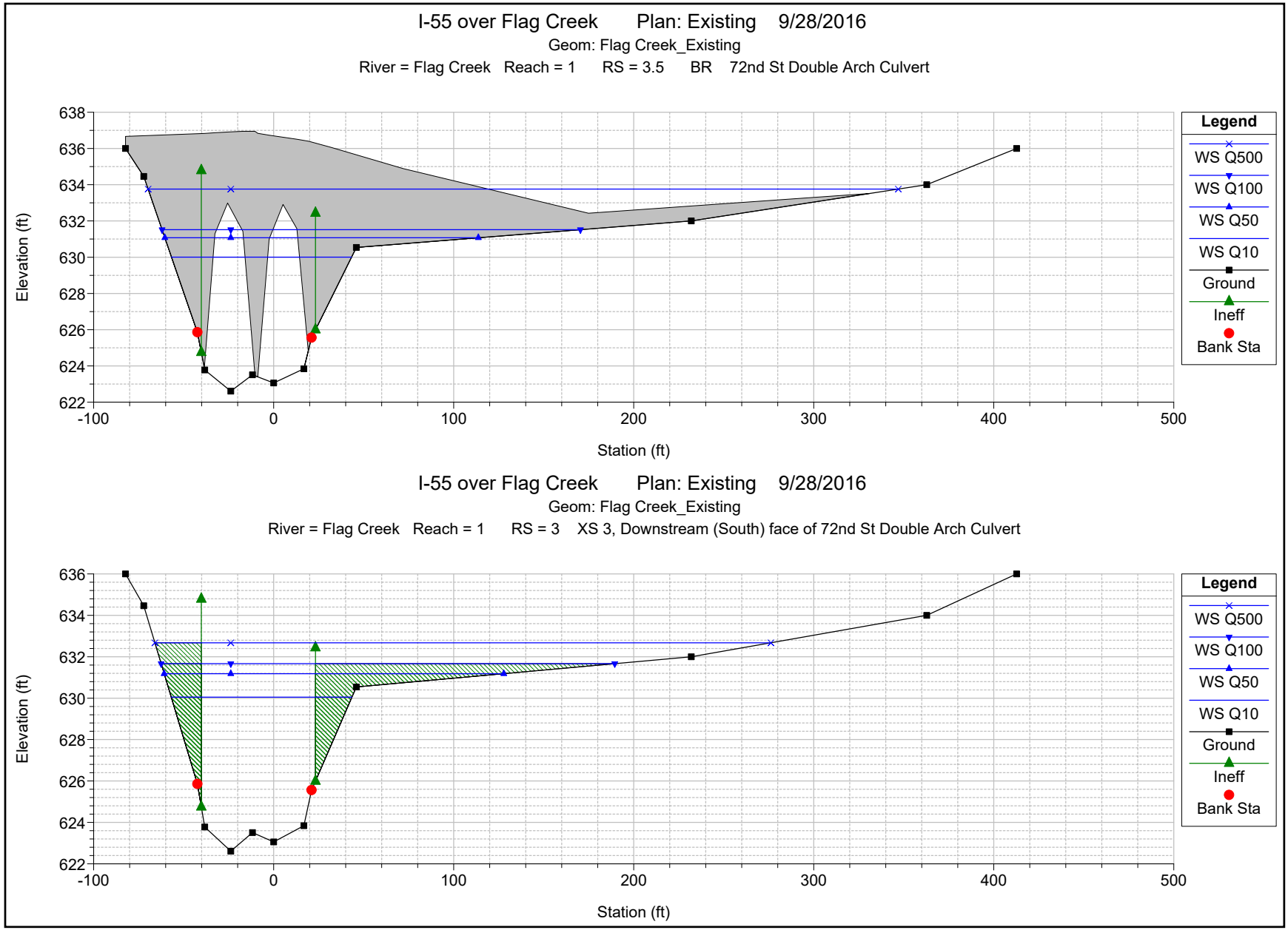


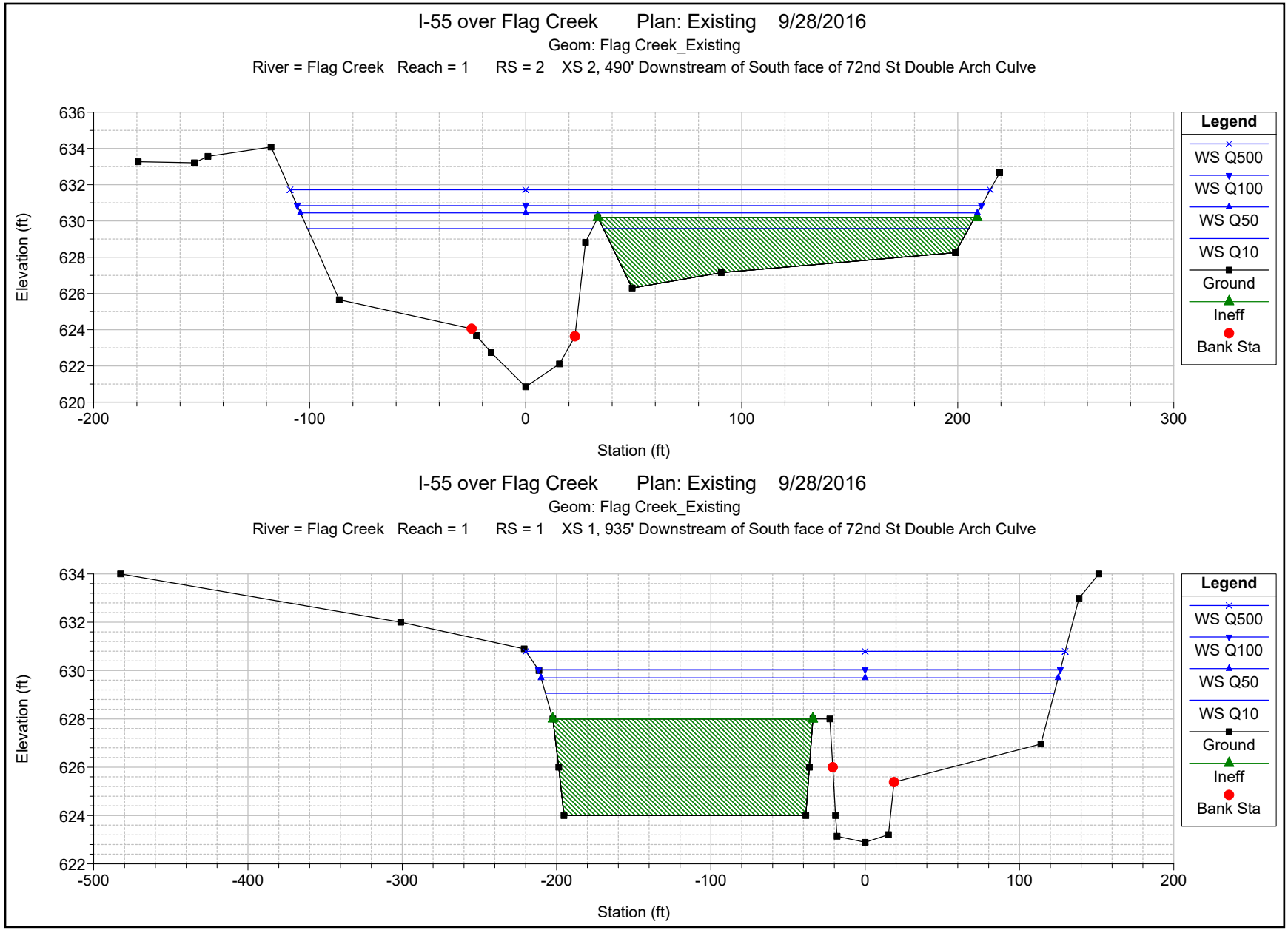
I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

River = Flag Creek Reach = 1 RS = 3.5 BR 72nd St Double Arch Culvert



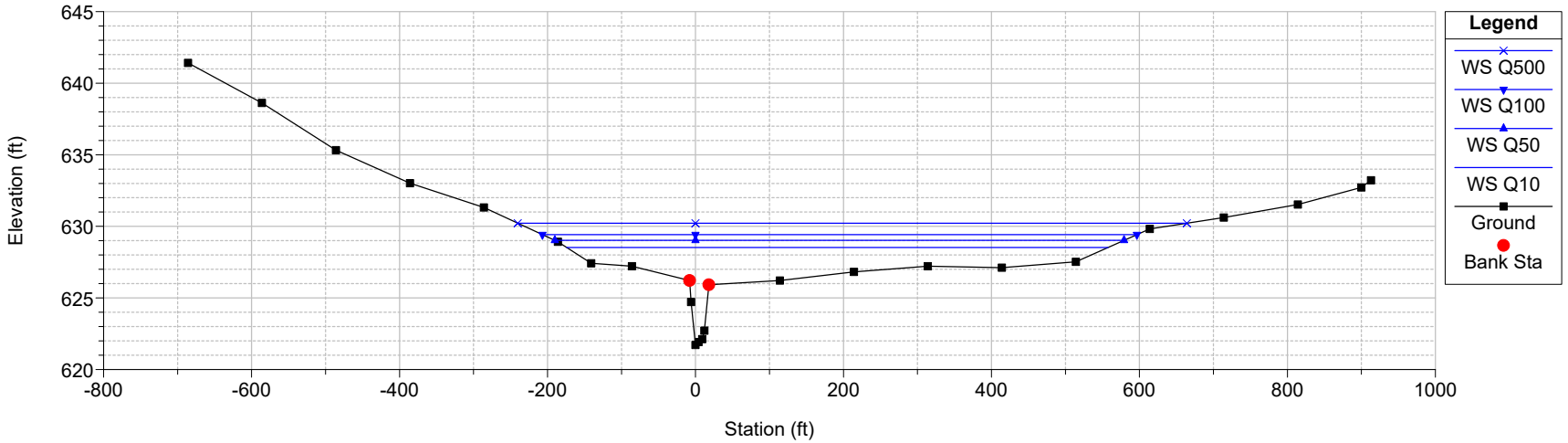

I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3.5 BR 72nd St Double Arch Culvert
Elevation (ft)
638
636
634
632
630
628
626
624
622
-100
0
100
200
300
400
500
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 3 XS 3, Downstream (South) face of 72nd St Double Arch Culvert
Elevation (ft)
636
634
632
630
628
626
624
622
-100
0
100
200
300
400
500
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta


I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 2 XS 2, 490' Downstream of South face of 72nd St Double Arch Culve
Elevation (ft)
636
634
632
630
628
626
624
622
620
-200
-100
0
100
200
300
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta
I-55 over Flag Creek Plan: Existing 9/28/2016
Geom: Flag Creek_Existing
River = Flag Creek Reach = 1 RS = 1 XS 1, 935' Downstream of South face of 72nd St Double Arch Culve
Elevation (ft)
634
632
630
628
626
624
622
-500
-400
-300
-200
-100
0
100
200
Station (ft)
Legend
WS Q500
WS Q100
WS Q50
WS Q10
Ground
Ineff
Bank Sta

I-55 over Flag Creek Plan: Existing 9/28/2016

Geom: Flag Creek_Existing

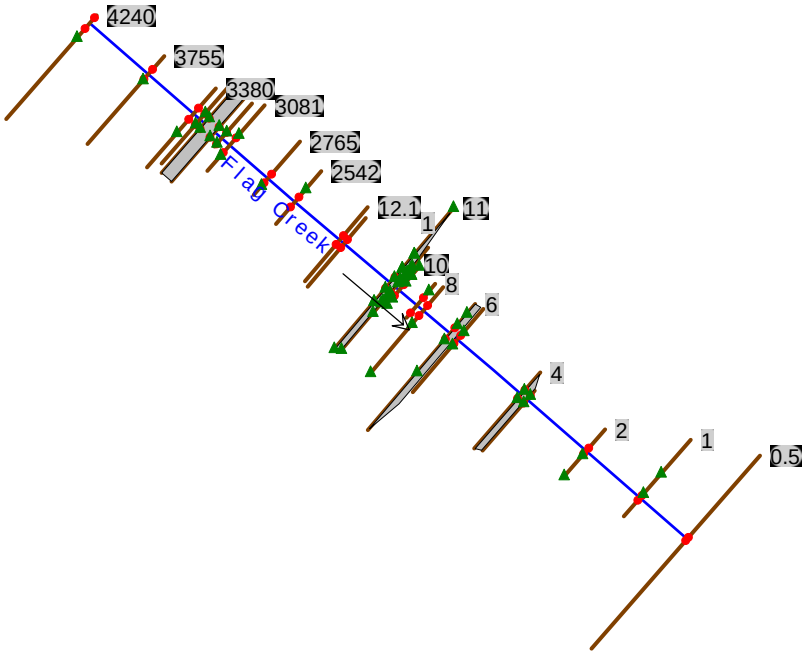
River = Flag Creek Reach = 1 RS = 0.5 FIS Crossection H_WSP2 Cross section FC033 converted to NAVD88



TAB D

SECTION 13.D

NATURAL CONDITIONS



Some schematic data outside default extents (see View/Set Schematic Plot Extents...)
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: I-55 over Flag Creek
Project File : I-55OveFlagCreek.prj
Run Date and Time: 9/28/2016 1:25:13 PM

Project in English units

Project Description:
2016 CBBEL Hydraulic Report for I-55 Over Flag Creek. All Models run in NAVD 88. Conversion from NAVD 88 = NGVD 29 - 0.28'.

PLAN DATA

Plan Title: Natural
Plan File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.p03

Geometry Title: Flag Creek_Natural
Geometry File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.g03

Flow Title : Existing_Flow
Flow File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.f03

Plan Description:
Natural conditions for I-55 over Flag Creek. Cross sections 1-12 based on 2012 CBBEL surveyed cross sections. Cross sections 241-4240 from 2011 HLR Cross sections. Surveyed structures for Wolf Road/72nd Street from 2012 CBBEL Survey. Joliet Road provided from 2011 HLR Report. FIS cross sections whose location could be properly verified were included. Starting water surface elevations and flows provided from WSP-2 regulatory model. All elevations provided in this model are in NAVD 88.

Plan Summary Information:

Number of:	Cross Sections	= 25	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 4	Lateral Structures	=	0

Computational Information

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

Computation Options

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

FLOW DATA

Flow Title: Existing_Flow
Flow File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.f03

Flow Data (cfs)

River	Reach	RS	Q10	Q50	Q100	Q500
Flag Creek	1	4240	1260	2000	2400	3350
Flag Creek	1	9.5	1310	2100	2500	3550

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Flag Creek	1	Q10		Known WS = 628.52
Flag Creek	1	Q50		Known WS = 629.02
Flag Creek	1	Q100		Known WS = 629.42
Flag Creek	1	Q500		Known WS = 630.22

GEOMETRY DATA

Geometry Title: Flag Creek_Natural
Geometry File : N:\Idot\110203.00001\Drain\Model\HEC-RAS\I-55 over Flag Creek iad\I-55OveFlagCreek.g03

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 4240

INPUT
Description: Surveyed Cross Section
Just Downstream of I-294
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
943.02	647.412	943.48	640.344	963.35	633.911	971.53	631.283	985.77	625.018
989.08	624.043	1000	623.49	1013.98	623.654	1017.05	624.678	1034.49	624.84
1053.07	633.246	1060.13	633.409	1069	633.187	1083.3	633.804	1093.69	633.873
1108.87	633.761	1176.51	633.478	1245.68	635.723	1246.42	634.241	1280.74	634.556
1340.09	635.013	1406.16	635.549	1469.2	635.767	1507.24	635.917	1508.17	636.574
1531.03	636.89	1560	636	1643	636	1802	638		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
943.02	.1	963.35	.035	1053.07	.1	1246.42	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
963.35	1053.07	485	485	.1	.3

```
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 1129.87    1802              F
Right Levee     Station= 1245.69      Elevation=  635.72

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3755

INPUT
Description: Surveyed Cross Section
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     842     638  855.03 636.316  865.76 637.331  889.54 637.627  916.42 635.116
  951.87  633.76  980.21 624.746    1000 622.109 1020.69 624.438 1033.51 632.917
 1042.98 633.232 1044.37 633.199 1055.07 632.903 1084.42 630.058 1134.63 628.059
 1184.29 627.801 1226.86 627.254 1288.87 627.235 1329.26 627.215 1374.09 629.294
 1405.91 633.702 1441.25 636.583 1499.51 638.633 1570.41 639.073

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     842      .1  951.87    .035 1033.51      .1 1084.42    .025 1441.25    .025
 1499.51      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        951.87 1033.51              375     375     375             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 1042.98 1570.41  633.25       T
Right Levee     Station= 1042.98      Elevation= 633.232

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3380

INPUT
Description: Survey Cross Section
North ROW of Joliet Road
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   768.8     638   891.4     636  932.57 634.184   944.5 629.132  949.28 625.111
  958.01 622.816  977.15 622.471    1000 622.319 1016.57   632.3 1019.06 632.586
 1025.27  633.14 1067.43 633.486 1084.68 633.627 1162.07 634.615 1240.18 635.884
 1317.76 636.687 1395.69 637.077    1422     644

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   768.8      .1   944.5    .035 1025.27    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        932.57 1025.27               53      53      53             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1139.1    1422              F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3327

INPUT
Description: Surveyed Cross Section
Upstream Face of Joliet Road
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  738.62     638     890     636     922     634     928     632  934.62     636
```

```
  958.05 635.351  978.68 626.551  989.65 622.889    1000 622.043 1015.72 623.677
 1025.86 624.995 1030.13 625.714 1032.24 627.688 1048.55  631.47 1075.72 632.828
 1115.14 633.565  1162.6 633.736 1234.96 635.425 1368.96     640

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  738.62      .1  978.68    .035 1048.55    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        958.05 1048.55               39      39      39             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  738.62  954.07   637.5       F
 1046.13 1368.96   637.5       F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3288

INPUT
Description: Upstream Face of the Joliet Road Bridge
The chanel section was
             adjusted for the 7.3 degree skew.
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
  956.66   636.4  956.66     631  961.61   630.7  979.96   621.3  984.13   622.3
  993.06   622.7    1000   624.3 1015.28   624.2 1025.59   624.7 1038.49   630.7
 1043.35     631 1043.35   636.3 1100.87  637.92 1150.18  638.15 1200.49   638.4
 1252.04  638.69 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035  956.66    .035 1043.35    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        956.66 1043.35               82      82      82             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5  956.66   637.5       F
 1043.35 1409.21  637.75       F
Skew Angle = 7.3

BRIDGE


RIVER: Flag Creek
REACH: 1                  RS: 3245

INPUT
Description: Joliet Road from 2011 HLR Study
Distance from Upstream XS =       1
Deck/Roadway Width        =      80
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      22
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   350.4  642.62           450.4  640.56           550.4  638.97
   650.4  638.06           750.4  637.71           800.4  637.87
   850.4  638.33           900.4  639.01           950.4   639.5
     954  639.51  635.52    1000  639.75  635.52  1046.3  639.75  635.52
  1050.4  639.75          1100.4  639.52          1150.4  639.27
  1200.4  639.04          1250.4  638.99          1300.4  639.15
  1350.4  639.61          1450.4  641.27          1550.4  643.51
  1650.4  646.59

Upstream Bridge Cross Section Data
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
  956.66   636.4  956.66     631  961.61   630.7  979.96   621.3  984.13   622.3
  993.06   622.7    1000   624.3 1015.28   624.2 1025.59   624.7 1038.49   630.7
 1043.35     631 1043.35   636.3 1100.87  637.92 1150.18  638.15 1200.49   638.4
 1252.04  638.69 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035  956.66    .035 1043.35    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        956.66 1043.35             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5  956.66   637.5       F
 1043.35 1409.21  637.75       F
Skew Angle = 7.3

Downstream  Deck/Roadway Coordinates
    num=      22
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   350.4  642.62           450.4  640.56           550.4  638.97
   650.4  638.06           750.4  637.71           800.4  637.87
   850.4  638.33           900.4  639.01           950.4   639.5
     954  639.51  635.52    1000  639.75  635.52  1046.3  639.75  635.52
  1050.4  639.75          1100.4  639.52          1150.4  639.27
  1200.4  639.04          1250.4  638.99          1300.4  639.15
  1350.4  639.61          1450.4  641.27          1550.4  643.51
  1650.4  646.59

Downstream Bridge Cross Section Data
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
   956.8   637.1   956.8   631.1   961.3   630.9   974.3   625.4   983.2   625.4
  1000.2     623    1005   624.2  1025.3   624.1  1038.3   630.9  1043.3   631.7
  1043.3   636.7 1100.87  637.92 1150.18  638.15 1200.49   638.4 1252.04  638.69
 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035   956.8    .035  1043.3    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
         956.8  1043.3             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5   956.8   637.5       F
  1043.3 1409.21  637.75       F

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

Number of Piers =  1

Pier Data
Pier Station     Upstream=    1000    Downstream=    1000
Upstream     num=       2
    Width   Elev    Width   Elev
        3     620        3  635.52
Downstream     num=       2
    Width   Elev    Width   Elev
        3     620        3  635.52

Number of Bridge Coefficient Sets =  1
```

```
Low Flow Methods and Data
       Energy
       Momentum              Cd   =       2
       Yarnell               KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3206

INPUT
Description: Downstream Face of Joliet Road Bridge
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
   956.8   637.1   956.8   631.1   961.3   630.9   974.3   625.4   983.2   625.4
  1000.2     623    1005   624.2  1025.3   624.1  1038.3   630.9  1043.3   631.7
  1043.3   636.7 1100.87  637.92 1150.18  638.15 1200.49   638.4 1252.04  638.69
 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035   956.8    .035  1043.3    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         956.8  1043.3               58      58      58             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5   956.8   637.5       F
  1043.3 1409.21  637.75       F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 3148

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report
             (2)
Downstream Face of Joliet Road
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     714     638   718.1  634.99  727.55 634.439  728.22 634.025  729.09 634.056
  765.83 634.321  815.81  635.28  854.35 636.521  854.94 636.328     856 636.417
  865.25 636.464  876.37 636.435  877.36 636.392  877.96 636.571  915.13 636.548
  953.12  635.36  961.25 634.658   971.9 628.969  975.59 624.863  979.02 624.082
    1000 622.988 1029.42 624.774 1032.82 626.596 1049.64 635.605 1070.41     640

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
     714    .013  953.12    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        953.12 1049.64               67      67      67             .1       .3
Ineffective Flow     num=       2
```

```
   Sta L   Sta R    Elev  Permanent
     714  954.07   637.5       F
 1046.13 1070.41   637.5       F
Left Levee      Station=  915.13      Elevation= 636.548

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 3081

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report (3081)
South
             ROW of Joliet Road
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  668.73     640  700.12 635.213  715.59  635.15  735.43 635.461  767.31 635.449
  817.37  635.27  849.72 635.974  850.32  635.78  851.31 635.845  861.89 636.024
  872.17 635.891  873.24 635.837  873.77 636.034  907.47 636.397   939.2 636.187
  941.74 635.886  956.98 633.907  973.01 627.756  975.66 624.761  985.89 623.489
    1000 623.264 1023.58 623.869 1027.81 624.827  1060.6     640 1070.47     640
 1145.38     638 1212.12     640

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  668.73    .013   939.2    .035  1060.6    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         939.2  1060.6              316     316     316             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  668.73  913.07              F
 1087.13 1212.12              F
Left Levee      Station=  907.47      Elevation= 636.397

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 2765

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report
             (2765)
Approximatley 450' Downstream
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     695     638     696     636  716.52  634.71 725.473  633.61  757.57 635.078
  801.99 635.575  837.63 635.143  852.74 633.931  856.99 633.503  857.56 633.302
  858.55 633.354   868.9 633.369  879.37 633.365  881.01 633.481  905.23 633.742
  932.95 633.777  933.78 633.764  964.28 633.109  975.88 624.879  977.62 624.631
    1000 623.299 1013.14 623.352 1021.19 624.989 1027.01 628.729  1036.7 632.295
 1061.92  632.69 1082.27 629.198 1096.47 629.329  1118.4 634.385  1119.8 637.943
 1135.48  638.26

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     695    .013  964.28    .035  1036.7      .1 1061.92    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        964.28  1036.7              223     223     223             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 1061.92 1135.48  632.69       T
Left Levee      Station=  801.99      Elevation=  635.58

CROSS SECTION


RIVER: Flag Creek
```

REACH: 1 RS: 2542

INPUT
Description: Surveyed 2011 as part of Joliet Rd Hydraulic Report (2542)
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
718.48	638	722.68	634	742.28	633.429	765.89	632.763	775.21	629.851
804.17	628.408	842.1	628.598	864.81	634.4	865.66	634.506	866.87	634.656
867.4	634.463	868.39	634.553	878.45	634.629	890.05	634.609	890.87	634.544
891.56	635.027	895.89	635.295	896.81	634.798	897.62	634.844	931.16	635.029
932.49	634.773	942.56	632.614	952.68	626.51	954.07	624.809	959.68	623.62
975.7	623.167	990.36	623.587	1000	620.992	1001.9	623.468	1012.76	632
1028.26	632.995	1039.67	636.779	1043.28	637.063	1060.18	637.19	1091.44	636.739
1133.41	638.407	1152.48	638.552						

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
718.48	.035	864.81	.013	897.62	.1	931.16	.035	1028.26	.1
1039.67	.013								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
931.16	1012.76	367.73	367.73	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
718.48	866.87	634.656	F

Left Levee Station= 931.16 Elevation= 635.029

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 12.1

INPUT
Description: FIS Cross Section FC039
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-274	639.12	-194	633.62	-174	633.52	-114	634.52	-59	634.42
-41	633.02	-29	625.32	-20	623.92	-14	624.32	-7	624.12
0	622.92	8	623.62	16	625.32	30	631.82	126	635.52
226	638.02	267	639.02	320	640.72	331	641.02		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-274	.075	-41	.05	30	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-41	30	34.5	35.17	20	.1	.3

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 12

INPUT
Description: XS 12, 377' Upstream of North face of 70th Pl Bridge
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-204.6	640	-201.4	634	-77.3	633.06	-62.8	636.95	-57.8	637.22
-44	633.91	-27.9	631.9	-13.7	624.19	0	621.48	13.4	621.83
21	624.17	22.8	624.54	37.5	630.99	140.3	632.74	226.7	634
290.94	636	356.74	638						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-204.6	.075	-27.9	.05	37.5	.075

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-27.9	37.5	881	377.27	3.5	.3	.5

Ineffective Flow num= 1

```
   Sta L   Sta R    Elev  Permanent
    78.8  356.74               F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 11

INPUT
Description: XS 11, Upstream (North) face of 70th Pl Bridge
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -595.2     638  -581.5     636    -558     634  -511.3     632    -376     630
  -135.5     630  -123.4     632   -99.2  633.95     -42  632.13   -29.4  629.04
   -20.1  628.39     -12 624.468    -4.3  620.74       0  619.25     7.7  620.25
      36  624.11    49.3  625.83      61 628.597    78.1  632.64   151.4     634
   368.7     636   547.8     638

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -595.2    .063  -123.4    .013     -42    .063    78.1     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -29.4      61               53    38.3      50             .3       .5
Ineffective Flow     num=       5
   Sta L   Sta R    Elev  Permanent
    -600  -200.4  650.39       F
  -200.4   -99.2     632       T
   -99.2   -29.4  633.17       F
    65.6   222.2  633.71       F
   222.2     558  652.73       F

BRIDGE


RIVER: Flag Creek
REACH: 1                 RS: 10.5

INPUT
Description: 70th Pl. Single Span Concrete Bridge - ineffective cones  include
             ineffective limits from downstream I-55 bridge, and from roadside
             ditch along Wolf Road.  Large leftside upstream ineffective area
             is remnant backwater floodplain at XS 11.
Distance from Upstream XS =     3.5
Deck/Roadway Width        =  32.333
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -105  633.17     620     -25  633.36  627.99      62  633.71  628.61
     160  634.44     620   254.5  635.44     620   347.7  636.41     620
   437.7   637.2     620   534.3  638.18     620   626.3  639.08     620

Upstream Bridge Cross Section Data
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -595.2     638  -581.5     636    -558     634  -511.3     632    -376     630
  -135.5     630  -123.4     632   -99.2  633.95     -42  632.13   -29.4  629.04
   -20.1  628.39     -12 624.468    -4.3  620.74       0  619.25     7.7  620.25
      36  624.11    49.3  625.83      61 628.597    78.1  632.64   151.4     634
   368.7     636   547.8     638

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -595.2    .063  -123.4    .013     -42    .063    78.1     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -29.4      61             .3       .5
Ineffective Flow     num=       5
   Sta L   Sta R    Elev  Permanent
```

```
    -600  -200.4  650.39       F
  -200.4   -99.2     632       T
   -99.2   -29.4  633.17       F
    65.6   222.2  633.71       F
   222.2     558  652.73       F

Downstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -105  633.17     620     -25  633.36  627.98      62  633.71  628.57
     160  634.44     620   254.5  635.44     620   347.7  636.41     620
   437.7   637.2     620   534.3  638.18     620   626.3  639.08     620

Downstream Bridge Cross Section Data
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -164.6     638  -158.2     636  -148.8     634  -141.3     632  -135.1     630
    -132     630  -122.4     632     -98   633.6     -44  632.49   -31.2   629.9
   -28.8  629.75   -20.8   625.9   -16.7  625.82   -12.8  624.11    -5.8  621.22
       0  621.06    21.5  622.16    33.7  623.72    48.2  623.34      50  624.15
    54.6  625.98    58.5  626.25      68 630.321    73.2  632.55   215.6     634
   425.9     636   535.1     638

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -164.6    .063  -122.4    .013     -44    .063      68     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -31.2      68            .3       .5
Ineffective Flow     num=       4
   Sta L   Sta R    Elev  Permanent
   -27.3     -98  630.58       F
   64.17     173  631.14       F
     -98  -164.6     632       T
     173   535.1   652.7       F

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

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       0
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 10

INPUT
```

Description: XS 10, Downstream (South) face of 70th Pl Bridge
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-164.6	638	-158.2	636	-148.8	634	-141.3	632	-135.1	630
-132	630	-122.4	632	-98	633.6	-44	632.49	-31.2	629.9
-28.8	629.75	-20.8	625.9	-16.7	625.82	-12.8	624.11	-5.8	621.22
0	621.06	21.5	622.16	33.7	623.72	48.2	623.34	50	624.15
54.6	625.98	58.5	626.25	68	630.321	73.2	632.55	215.6	634
425.9	636	535.1	638						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-164.6	.063	-122.4	.013	-44	.063	68	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-31.2	68	1	1	.3	.5

Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-27.3	-98	630.58	F
64.17	173	631.14	F
-98	-164.6	632	T
173	535.1	652.7	F

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 9.5

INPUT
Description: FIS Cross section J WSP-2 Cross Section X Converted to NAVD 88
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-320	638	-315	635.72	-314	636.12	-313	635.72	-115	632.82
-45	630.72	-30	625.02	0	621.02	30	623.52	44	631.92
91	634.62	193	631.72	213	636				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-320	.08	-45	.063	44	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-45	44	22	34	.3	.5

Ineffective Flow num= 5

Sta L	Sta R	Elev	Permanent
64.67	134	631.14	F
-45	-27.8	630.58	F
-148	-98	632	T
-320	-172	650.39	F
172	213	652.73	F

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 9

INPUT
Description: XS 9, Upstream (North) face of I-55 Bridge
Manning's n-values
adjusted to reflect roadside ditch to left and gravel area to
right of Wolf Road.
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-171.4	641.91	-164.8	641.6	-137.1	630.38	-128.3	629.72	-111.36	632.81
-96.3	633.22	-79.1	632.7	-27.2	629.97	-23.2	629.87	-15.5	626.04
-14.5	625.86	-10	624.13	0	621.75	26.7	623.62	34.5	624.11
55	625.14	66	630.54	98.8	646.64	105.1	646.97		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

```
  -171.4     .05 -111.36    .013   -79.1     .03   -23.2    .063      66    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -23.2      66              145   145.4     145             .3       .5
Ineffective Flow     num=       3
   Sta L   Sta R    Elev  Permanent
    -180     -97     632       T
     -97     -41  630.58       F
   85.47     140  631.14       F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 8

INPUT
Description: XS 8, Downstream (South) face of I-55 Bridge
Manning's n-values
             adjusted to reflect roadside ditch to left and gravel area to
             right of Wolf Road.
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -176.4  644.74  -170.2  644.61 -141.91  630.89    -115  632.74 -101.31  632.91
   -83.8  632.51     -63 629.953   -14.5  623.99       0  623.25    31.3  623.39
    48.6  624.02    61.7  630.73    95.7  646.67   101.2  646.85

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  -176.4     .05    -115    .013   -83.8     .03     -63    .063    61.7    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           -63    61.7             10.5    51.5    47.2             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  -176.4    -115     632       T

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 7

INPUT
Description: XS 7, 50' Downstream of South face of I-55 Bridge, In line with
             71st St
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 -182.75     638  -177.6     636  -171.9     634  -125.6  632.66   -91.8  632.71
   -85.8  631.57   -32.6  629.95     -20  626.62   -18.6  623.98       0  622.87
      19   622.8    30.2     624      50 629.581      60   632.4   113.2  634.04
   234.7     634   385.2     636   519.2     638

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 -182.75    .013   -32.6    .063      50    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -32.6      50                4   219.8     981             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   117.5   519.2  650.68       F

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 6

INPUT
Description: XS 6, Upstream (West) face of Wolf Rd Bridge Cross Section Skewed
```

```
            27.5 degrees
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-222.196     638 -217.85     636-212.971     634-132.431  633.18 -66.082  633.31
 -48.786 628.479 -42.488  626.72 -26.965  626.68 -20.933  623.98  -12.95  621.94
       0  622.65  21.998  624.19  26.167  625.99  31.932  627.74  50.382  633.34
 158.598     632 242.509     632 286.416     634 329.525     634 551.011     634
 658.872     636 694.529     638

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-222.196     .08 -48.786    .063  31.932     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       -48.786  31.932             24.2    59.2      84             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-222.196 -52.245  633.18       F
  37.343 694.529   634.1       F
Skew Angle = 27.5

BRIDGE


RIVER: Flag Creek
REACH: 1                  RS: 5.5

INPUT
Description: Wolf Rd Two-Span Concrete Bridge-Bridge and deck skewed 27.5
             degrees

Distance from Upstream XS =       2
Deck/Roadway Width        =      39
Weir Coefficient          =     2.6
Bridge Deck/Roadway Skew  =    27.5
Upstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
-240.025     630      620-227.607   632.3     620-147.244  633.18     620
 -52.955  633.86  629.03  42.133   634.1  629.25 119.977  634.37     620
 212.404  635.08     620 307.757  635.33     620 398.144  635.82     620
 499.973   636.1     620 702.654     638     620 725.805   638.5     620

Upstream Bridge Cross Section Data
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-222.196     638 -217.85     636-212.971     634-132.431  633.18 -66.082  633.31
 -48.786 628.479 -42.488  626.72 -26.965  626.68 -20.933  623.98  -12.95  621.94
       0  622.65  21.998  624.19  26.167  625.99  31.932  627.74  50.382  633.34
 158.598     632 242.509     632 286.416     634 329.525     634 551.011     634
 658.872     636 694.529     638

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-222.196     .08 -48.786    .063  31.932     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
       -48.786  31.932             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-222.196 -52.245  633.18       F
  37.343 694.529   634.1       F
Skew Angle = 27.5

Downstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
-240.025     630      620-227.607   632.3     620-147.244  633.18     620
 -66.526  633.94  629.09  27.143  634.16  629.28 119.977  634.37     620
 212.404  635.08     620 307.757  635.33     620 398.144  635.82     620
 499.973   636.1     620 702.654     638     620 725.805   638.5     620
```

```
Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
-235.324     638  -230.8     636-224.857     634 -73.977  633.65 -42.399  627.19
 -35.214   624.1 -24.127  623.04       0  622.59  12.418  623.86  15.966   626.2
  40.359  633.56 246.234     634 368.819     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-235.324     .08 -42.399    .063  15.966     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
       -42.399  15.966             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-235.324     -66  631.15       F
    43.2 368.819  631.69       F
Skew Angle = 27.5

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

Number of Piers =  1

Pier Data
Pier Station     Upstream=  -9.048    Downstream= -16.853
Upstream     num=       2
    Width   Elev    Width   Elev
    4.75     620    4.75   630.5
Downstream     num=       2
    Width   Elev    Width   Elev
    4.75     620    4.75   630.5

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       2
       Yarnell                KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
REACH: 1                 RS: 5

INPUT
Description: XS 5, Downstream (East) face of Wolf Rd Bridge Section Skewed 27.5
             degrees
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
-235.324     638  -230.8     636-224.857     634 -73.977  633.65 -42.399  627.19
 -35.214   624.1 -24.127  623.04       0  622.59  12.418  623.86  15.966   626.2
  40.359  633.56 246.234     634 368.819     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
-235.324     .08 -42.399    .063  15.966     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       -42.399  15.966              737   524.8     376             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-235.324     -66  631.15       F
    43.2 368.819  631.69       F
Skew Angle = 27.5

CROSS SECTION


RIVER: Flag Creek
REACH: 1                  RS: 4

INPUT
Description: XS 4, Upstream (North) face of 72nd St Double Arch Culvert
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -195.8  636.56   -77.3  635.35     -50 627.314   -38.3  623.87   -26.8   622.5
       0  622.54    12.1  623.91      20 626.463    43.2  633.96   170.1  632.37
   353.5     634   432.5     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  -195.8     .08     -50    .063      20     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           -50      20              44   48.22      49             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  -195.8     -44  636.56       F
   24.18   432.5  632.43       F

BRIDGE


RIVER: Flag Creek
REACH: 1                  RS: 3.5

INPUT
Description: 72nd St Double Arch Culvert
Distance from Upstream XS =     5.5
Deck/Roadway Width        =    36.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      21
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  -197.7  636.57     620  -107.4  636.57     620   -39.5  636.83  623.83
     -33  636.87   631.3   -25.7  636.91  633.14   -18.3  636.95   631.4
   -11.4  636.95   623.5   -11.4  636.95     618    -9.6  636.84     618
    -9.6  636.84  623.46    -3.3  636.73  631.52     4.8  636.62  633.09
    12.1  636.51  631.56    17.6   636.4  624.81      32  636.06     620
      72  634.89     620   174.9  632.43     620   400.5     634     620
   500.8  635.33     620   614.3     636     620   665.4     638     620

Upstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -195.8  636.56   -77.3  635.35     -50 627.314   -38.3  623.87   -26.8   622.5
       0  622.54    12.1  623.91      20 626.463    43.2  633.96   170.1  632.37
   353.5     634   432.5     636

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
  -195.8     .08     -50    .063      20     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
           -50      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  -195.8     -44  636.56       F
   24.18   432.5  632.43       F

Downstream  Deck/Roadway Coordinates
    num=      21
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  -197.7  636.57     620  -107.4  636.57     620   -38.4  636.83     624
   -32.6  636.87   631.3   -25.6  636.91  632.99   -17.1  636.95  631.43
   -10.4  636.95  623.49   -10.4  636.95     618    -8.8  636.84     618
    -8.8  636.84  623.42    -2.5  636.73  631.01     5.2  636.62  632.91
    12.9  636.51  631.57    19.5   636.4  624.54      32  636.06     620
      72  634.89     620   174.9  632.43     620   400.5     634     620
   500.8  635.33     620   614.3     636     620   665.4     638     620

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -82.3     636   -72.2  634.46   -42.4  625.86   -38.3  623.78   -23.8  622.61
   -11.8  623.51       0  623.06    16.8  623.84   21.05  625.56    45.9  630.54
     232     632  362.77     634  412.67     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   -82.3     .08   -42.4    .063   21.05     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -42.4   21.05             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -82.3   -40.2  634.78       F
    23.2  412.67  632.43       F

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

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       2
Selected Low Flow Methods = Highest Energy Answer

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

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

CROSS SECTION


RIVER: Flag Creek
```

REACH: 1 RS: 3

INPUT
Description: XS 3, Downstream (South) face of 72nd St Double Arch Culvert
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-82.3	636	-72.2	634.46	-42.4	625.86	-38.3	623.78	-23.8	622.61
-11.8	623.51	0	623.06	16.8	623.84	21.05	625.56	45.9	630.54
232	632	362.77	634	412.67	636				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-82.3	.08	-42.4	.063	21.05	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-42.4	21.05	535	490.2	444	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-82.3	-40.2	634.78	F
23.2	412.67	632.43	F

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 2

INPUT
Description: XS 2, 490' Downstream of South face of 72nd St Double Arch Culvert
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-179.4	633.27	-153.4	633.21	-147.1	633.56	-117.9	634.08	-86.3	625.65
-25	624.05	-22.8	623.68	-16	622.74	0	620.85	15.6	622.11
22.8	623.63	27.7	628.82	33.4	630.19	49.3	626.3	90.5	627.15
198.9	628.25	219.4	632.66						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-179.4	.08	-25	.063	22.8	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-25	22.8	445	444.93	425	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
33.4	209	630.19	T

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 1

INPUT
Description: XS 1, 935' Downstream of South face of 72nd St Double Arch Culvert
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-482.6	634	-301	632	-221	630.9	-211.4	630	-202.4	628
-198.6	626	-195.2	624	-38.5	624	-36.2	626	-33.9	628
-22.9	628	-21	626	-19.2	624	-18.2	623.14	0	622.89
15.1	623.21	18.7	625.38	113.9	626.96	138.6	632.99	151.4	634

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-482.6	.08	-21	.063	18.7	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-21	18.7	390	391	391	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-202.4	-33.9	628	T

CROSS SECTION

RIVER: Flag Creek
REACH: 1 RS: 0.5

INPUT
Description: FIS Crossection H_WSP2 Cross section FC033 converted to NAVD88
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-686	641.42	-586	638.62	-486	635.32	-386	633.02	-286	631.32
-186	628.92	-141	627.42	-86	627.22	-8	626.22	-6	624.72
0	621.72	4	621.92	9	622.12	12	622.72	18	625.92
114	626.22	214	626.82	314	627.22	414	627.12	514	627.52
614	629.82	714	630.62	814	631.52	900	632.72	912.9	633.22

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-686	.08	-8	.063	18	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-8	18	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Flag Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6
1	4240	.1	.035	.1	.013		
1	3755	.1	.035	.1	.025	.025	.1
1	3380	.1	.035	.035			
1	3327	.1	.035	.035			
1	3288	.035	.035	.035			
1	3245	Bridge					
1	3206	.035	.035	.035			
1	3148	.013	.035				
1	3081	.013	.035	.035			
1	2765	.013	.035	.1	.035		
1	2542	.035	.013	.1	.035	.1	.013
1	12.1	.075	.05	.075			
1	12	.075	.05	.075			
1	11	.063	.013	.063	.03		
1	10.5	Bridge					
1	10	.063	.013	.063	.03		
1	9.5	.08	.063	.08			
1	9	.05	.013	.03	.063	.013	
1	8	.05	.013	.03	.063	.013	
1	7	.013	.063	.013			
1	6	.08	.063	.08			
1	5.5	Bridge					
1	5	.08	.063	.08			
1	4	.08	.063	.08			
1	3.5	Bridge					
1	3	.08	.063	.08			
1	2	.08	.063	.08			
1	1	.08	.063	.08			
1	0.5	.08	.063	.08			

SUMMARY OF REACH LENGTHS

River: Flag Creek

Reach	River Sta.	Left	Channel	Right

1	4240		485	485	485
1	3755		375	375	375
1	3380		53	53	53
1	3327		39	39	39
1	3288		82	82	82
1	3245	Bridge			
1	3206		58	58	58
1	3148		67	67	67
1	3081		316	316	316
1	2765		223	223	223
1	2542		367.73	367.73	367.73
1	12.1		34.5	35.17	20
1	12		881	377.27	3.5
1	11		53	38.3	50
1	10.5	Bridge			
1	10		1	1	1
1	9.5		22	34	34
1	9		145	145.4	145
1	8		10.5	51.5	47.2
1	7		4	219.8	981
1	6		24.2	59.2	84
1	5.5	Bridge			
1	5		737	524.8	376
1	4		44	48.22	49
1	3.5	Bridge			
1	3		535	490.2	444
1	2		445	444.93	425
1	1		390	391	391
1	0.5		0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Flag Creek

Reach	River Sta.		Contr.	Expan.
1	4240		.1	.3
1	3755		.1	.3
1	3380		.1	.3
1	3327		.3	.5
1	3288		.3	.5
1	3245	Bridge		
1	3206		.3	.5
1	3148		.1	.3
1	3081		.1	.3
1	2765		.1	.3
1	2542		.1	.3
1	12.1		.1	.3
1	12		.3	.5
1	11		.3	.5
1	10.5	Bridge		
1	10		.3	.5
1	9.5		.3	.5
1	9		.3	.5
1	8		.3	.5
1	7		.3	.5
1	6		.3	.5
1	5.5	Bridge		
1	5		.3	.5
1	4		.3	.5
1	3.5	Bridge		
1	3		.3	.5
1	2		.1	.3
1	1		.1	.3
1	0.5		.1	.3

10-Year Design Natural

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q10

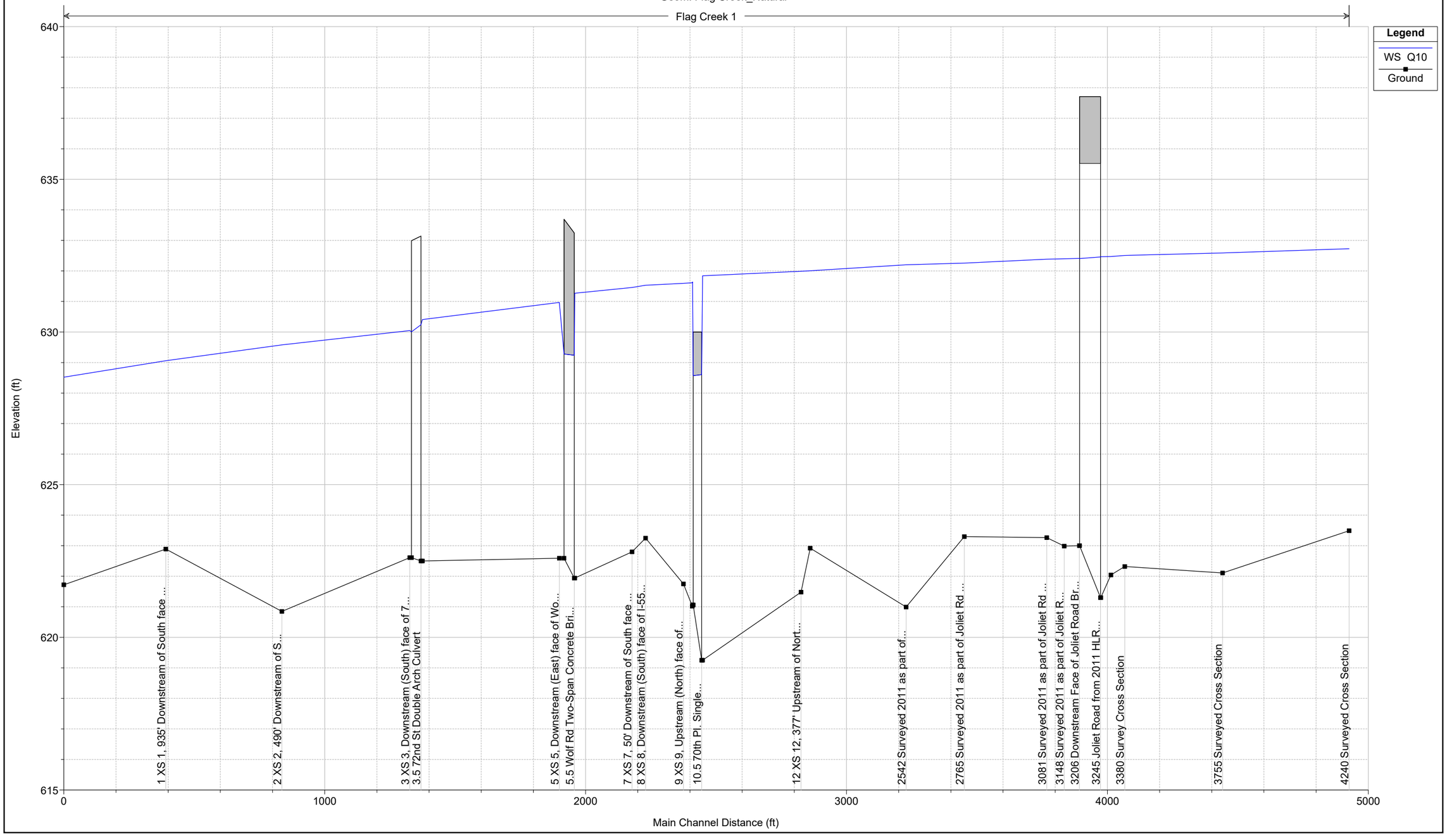
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q10	1260.00	623.49	632.73	626.87	632.81	0.000247	2.27	555.31	84.88	0.16
1	3755	Q10	1260.00	622.11	632.59	626.48	632.68	0.000273	2.42	520.93	77.46	0.16
1	3380	Q10	1260.00	622.32	632.51		632.57	0.000257	2.03	619.99	81.85	0.13
1	3327	Q10	1260.00	622.04	632.47	626.31	632.55	0.000481	2.29	549.81	105.95	0.16
1	3288	Q10	1260.00	621.30	632.47	626.18	632.53	0.000206	2.10	599.79	86.69	0.14
1	3245		Bridge									
1	3206	Q10	1260.00	623.00	632.41	626.94	632.49	0.000279	2.32	543.09	86.50	0.16
1	3148	Q10	1260.00	622.99	632.40	626.37	632.48	0.000235	2.29	549.09	78.17	0.15
1	3081	Q10	1260.00	623.26	632.38	626.32	632.46	0.000237	2.25	559.26	83.19	0.15
1	2765	Q10	1260.00	623.30	632.26	626.74	632.37	0.000353	2.69	467.65	115.82	0.19
1	2542	Q10	1260.00	620.99	632.20	625.98	632.29	0.000263	2.45	514.55	72.65	0.16
1	12.1	Q10	1260.00	622.92	632.01		632.13	0.000846	2.86	441.18	74.22	0.20
1	12	Q10	1260.00	621.48	631.99		632.10	0.000651	2.69	490.89	124.85	0.18
1	11	Q10	1260.00	619.25	631.84	624.48	631.89	0.000377	1.77	719.30	491.61	0.11
1	10.5		Bridge									
1	10	Q10	1260.00	621.06	631.64	624.79	631.68	0.000358	1.68	770.46	126.89	0.11
1	9.5	Q10	1310.00	621.02	631.61	625.08	631.67	0.000541	2.01	661.90	118.20	0.13
1	9	Q10	1310.00	621.75	631.59	625.82	631.66	0.000559	2.01	665.02	148.27	0.13
1	8	Q10	1310.00	623.25	631.53		631.57	0.000438	1.66	793.53	149.90	0.12
1	7	Q10	1310.00	622.80	631.46	626.00	631.54	0.000735	2.20	588.08	138.77	0.15
1	6	Q10	1310.00	621.94	631.27	626.05	631.36	0.000854	2.40	558.88	102.34	0.16
1	5.5		Bridge									
1	5	Q10	1310.00	622.59	630.97	625.96	631.09	0.001043	2.85	506.61	92.62	0.18
1	4	Q10	1310.00	622.50	630.41	625.60	630.53	0.001078	2.84	468.66	92.71	0.19
1	3.5		Bridge									
1	3	Q10	1310.00	622.61	630.05	625.82	630.20	0.001467	3.17	416.73	100.35	0.22
1	2	Q10	1310.00	620.85	629.58		629.65	0.000762	2.46	691.30	301.04	0.16
1	1	Q10	1310.00	622.89	629.06		629.16	0.001771	3.11	711.69	329.67	0.23
1	0.5	Q10	1310.00	621.72	628.52	627.52	628.55	0.001274	2.47	1227.21	731.48	0.19

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q10

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q10	632.81	632.73	0.08	0.13	0.00		1260.00		84.88
1	3755	Q10	632.68	632.59	0.09	0.10	0.01		1260.00		77.46
1	3380	Q10	632.57	632.51	0.06	0.02	0.00		1260.00		81.85
1	3327	Q10	632.55	632.47	0.08	0.01	0.01		1260.00		105.95
1	3288	Q10	632.53	632.47	0.07	0.00	0.00		1260.00		86.69
1	3245		Bridge								
1	3206	Q10	632.49	632.41	0.08	0.01	0.00		1260.00		86.50
1	3148	Q10	632.48	632.40	0.08	0.02	0.00		1260.00		78.17
1	3081	Q10	632.46	632.38	0.08	0.09	0.00		1260.00		83.19
1	2765	Q10	632.37	632.26	0.11	0.07	0.01		1260.00		115.82
1	2542	Q10	632.29	632.20	0.09	0.16	0.00		1259.95	0.05	72.65
1	12.1	Q10	632.13	632.01	0.13	0.03	0.00		1259.95	0.05	74.22
1	12	Q10	632.10	631.99	0.11	0.18	0.03	0.00	1249.86	10.14	124.85
1	11	Q10	631.89	631.84	0.05				1249.18	10.82	491.61
1	10.5		Bridge								
1	10	Q10	631.68	631.64	0.04	0.00	0.01	9.76	1248.89	1.36	126.89
1	9.5	Q10	631.67	631.61	0.06	0.02	0.00	3.34	1306.66		118.20
1	9	Q10	631.66	631.59	0.06	0.07	0.01	34.89	1273.26	1.85	148.27
1	8	Q10	631.57	631.53	0.04	0.03	0.01	8.92	1300.25	0.83	149.90
1	7	Q10	631.54	631.46	0.08	0.17	0.00	95.78	1196.14	18.09	138.77
1	6	Q10	631.36	631.27	0.09			7.38	1287.61	15.01	102.34
1	5.5		Bridge								
1	5	Q10	631.09	630.97	0.12	0.56	0.00	31.51	1239.35	39.14	92.62
1	4	Q10	630.53	630.41	0.12	0.01	0.04		1292.25	17.75	92.71
1	3.5		Bridge								
1	3	Q10	630.20	630.05	0.15	0.51	0.04		1293.02	16.98	100.35
1	2	Q10	629.65	629.58	0.07	0.49	0.00	422.70	874.44	12.85	301.04
1	1	Q10	629.16	629.06	0.10	0.58	0.02	157.59	718.46	433.94	329.67
1	0.5	Q10	628.55	628.52	0.03			182.09	346.89	781.02	731.48

I-55 over Flag Creek Plan: Natural 9/28/2016

Geom: Flag Creek_Natural



Errors Warnings and Notes for Plan : Nat

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q10
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q10
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q10 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q10
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q10
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q10 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 8 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q10
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q10 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q10

Errors Warnings and Notes for Plan : Nat (Continued)

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q10
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q10
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q10 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q10 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q10
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 2 Profile: Q10
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.

50-Year Design Natural

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q50

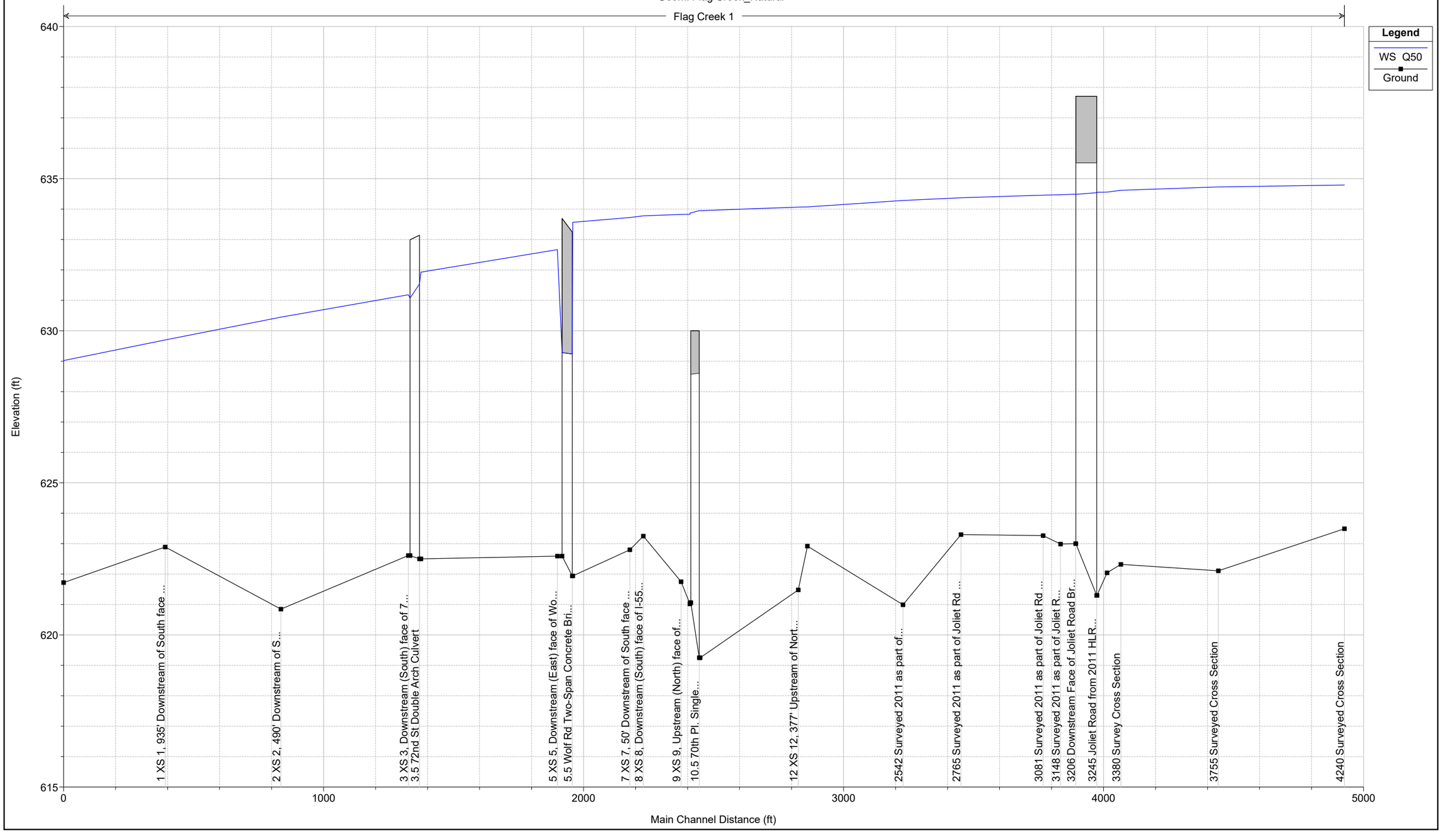
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q50	2000.00	623.49	634.79	627.81	634.90	0.000254	2.68	828.45	256.30	0.16
1	3755	Q50	2000.00	622.11	634.73	627.54	634.79	0.000163	2.18	1263.62	491.95	0.13
1	3380	Q50	2000.00	622.32	634.62		634.70	0.000323	2.37	920.34	239.44	0.14
1	3327	Q50	2000.00	622.04	634.56	627.33	634.67	0.000602	2.76	724.58	256.98	0.17
1	3288	Q50	2000.00	621.30	634.55	627.09	634.65	0.000228	2.56	780.63	86.69	0.15
1	3245		Bridge									
1	3206	Q50	2000.00	623.00	634.49	627.85	634.61	0.000287	2.77	722.86	86.50	0.17
1	3148	Q50	2000.00	622.99	634.47	627.27	634.59	0.000270	2.78	718.75	85.92	0.17
1	3081	Q50	2000.00	623.26	634.46	627.24	634.57	0.000280	2.69	742.91	95.89	0.17
1	2765	Q50	2000.00	623.30	634.37	627.74	634.48	0.000273	2.82	848.94	271.09	0.17
1	2542	Q50	2000.00	620.99	634.28	626.97	634.42	0.000312	2.95	696.78	97.36	0.18
1	12.1	Q50	2000.00	622.92	634.07		634.24	0.000810	3.33	679.73	202.35	0.20
1	12	Q50	2000.00	621.48	634.07		634.20	0.000614	3.10	799.33	401.32	0.18
1	11	Q50	2000.00	619.25	633.95	625.57	633.99	0.000295	1.83	1268.48	705.33	0.10
1	10.5		Bridge									
1	10	Q50	2000.00	621.06	633.87	625.64	633.92	0.000287	1.78	1230.62	351.57	0.10
1	9.5	Q50	2100.00	621.02	633.83	626.01	633.91	0.000516	2.34	1095.53	345.08	0.13
1	9	Q50	2100.00	621.75	633.82	626.66	633.88	0.000399	2.04	1070.27	218.29	0.12
1	8	Q50	2100.00	623.25	633.78		633.82	0.000331	1.77	1208.50	216.06	0.11
1	7	Q50	2100.00	622.80	633.72	627.00	633.80	0.000334	1.80	1008.72	265.16	0.11
1	6	Q50	2100.00	621.94	633.56	627.28	633.68	0.000791	2.82	823.19	447.04	0.17
1	5.5		Bridge									
1	5	Q50	2100.00	622.59	632.67	626.96	632.85	0.001247	3.58	676.02	106.57	0.21
1	4	Q50	2100.00	622.50	631.93	626.52	632.14	0.001438	3.73	572.35	102.58	0.22
1	3.5		Bridge									
1	3	Q50	2100.00	622.61	631.18	626.73	631.47	0.002222	4.34	488.71	188.65	0.27
1	2	Q50	2100.00	620.85	630.45		630.58	0.001255	3.40	853.55	313.39	0.21
1	1	Q50	2100.00	622.89	629.70		629.84	0.002392	3.88	923.94	335.16	0.27
1	0.5	Q50	2100.00	621.72	629.02	627.80	629.06	0.001550	2.88	1602.20	769.39	0.21

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q50

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q50	634.90	634.79	0.11	0.10	0.02	0.16	1976.50	23.34	256.30
1	3755	Q50	634.79	634.73	0.06	0.08	0.00	1.43	1513.88	484.68	491.95
1	3380	Q50	634.70	634.62	0.08	0.02	0.00	0.20	1919.94	79.86	239.44
1	3327	Q50	634.67	634.56	0.12	0.01	0.01		2000.00		256.98
1	3288	Q50	634.65	634.55	0.10	0.00	0.00		2000.00		86.69
1	3245		Bridge								
1	3206	Q50	634.61	634.49	0.12	0.02	0.00		2000.00		86.50
1	3148	Q50	634.59	634.47	0.12	0.02	0.00		2000.00		85.92
1	3081	Q50	634.57	634.46	0.11	0.09	0.00		2000.00		95.89
1	2765	Q50	634.48	634.37	0.11	0.07	0.00	149.22	1749.72	101.06	271.09
1	2542	Q50	634.42	634.28	0.13	0.17	0.00		1969.05	30.95	97.36
1	12.1	Q50	634.24	634.07	0.17	0.02	0.01	8.27	1951.73	40.00	202.35
1	12	Q50	634.20	634.07	0.14	0.16	0.05	31.89	1860.44	107.67	401.32
1	11	Q50	633.99	633.95	0.05			273.57	1646.32	80.10	705.33
1	10.5		Bridge								
1	10	Q50	633.92	633.87	0.05	0.00	0.01	200.55	1726.21	73.24	351.57
1	9.5	Q50	633.91	633.83	0.08	0.01	0.01	93.87	1979.12	27.01	345.08
1	9	Q50	633.88	633.82	0.06	0.05	0.01	370.48	1697.06	32.45	218.29
1	8	Q50	633.82	633.78	0.05	0.01	0.01	191.82	1882.66	25.52	216.06
1	7	Q50	633.80	633.72	0.08	0.10	0.01	661.07	1319.26	119.67	265.16
1	6	Q50	633.68	633.56	0.12			28.08	2031.74	40.18	447.04
1	5.5		Bridge								
1	5	Q50	632.85	632.67	0.18	0.70	0.01	92.89	1910.53	96.59	106.57
1	4	Q50	632.14	631.93	0.21	0.02	0.09		2061.25	38.75	102.58
1	3.5		Bridge								
1	3	Q50	631.47	631.18	0.29	0.81	0.08		2069.05	30.95	188.65
1	2	Q50	630.58	630.45	0.13	0.75	0.00	726.07	1349.72	24.22	313.39
1	1	Q50	629.84	629.70	0.14	0.74	0.03	400.46	993.52	706.02	335.16
1	0.5	Q50	629.06	629.02	0.04			325.42	443.28	1331.30	769.39

I-55 over Flag Creek Plan: Natural 9/28/2016

Geom: Flag Creek_Natural



Errors Warnings and Notes for Plan : Nat

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q50
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q50
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q50 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 12.1 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Location:	River: Flag Creek Reach: 1 RS: 12 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q50
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q50 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The
	selected bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q50
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q50
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

Errors Warnings and Notes for Plan : Nat (Continued)

Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q50 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q50
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q50
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q50 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q50 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q50
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

100-Year Design Natural

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q100

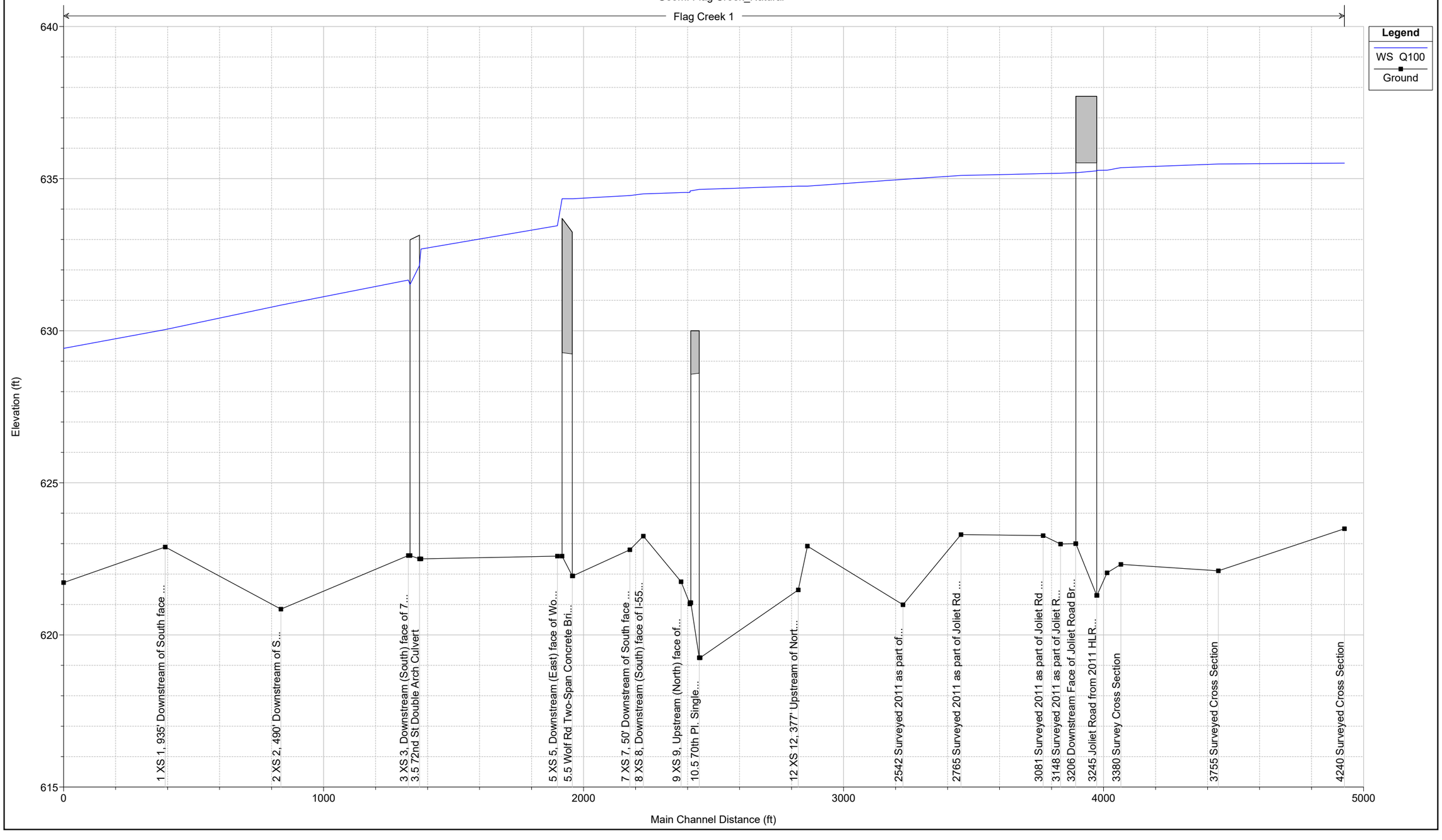
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q100	2400.00	623.49	635.51	628.25	635.64	0.000270	2.92	950.98	280.69	0.17
1	3755	Q100	2400.00	622.11	635.48	628.03	635.53	0.000127	2.04	1643.34	515.20	0.12
1	3380	Q100	2400.00	622.32	635.36		635.45	0.000320	2.49	1087.81	302.19	0.14
1	3327	Q100	2400.00	622.04	635.28	627.82	635.42	0.000704	3.05	787.34	302.28	0.18
1	3288	Q100	2400.00	621.30	635.27	627.54	635.40	0.000259	2.85	843.03	86.69	0.16
1	3245		Bridge									
1	3206	Q100	2400.00	623.00	635.20	628.25	635.34	0.000321	3.06	784.28	86.50	0.18
1	3148	Q100	2400.00	622.99	635.18	627.70	635.33	0.000324	3.08	780.33	93.62	0.18
1	3081	Q100	2400.00	623.26	635.16	627.69	635.30	0.000327	2.95	813.13	102.86	0.18
1	2765	Q100	2400.00	623.30	635.10	628.22	635.20	0.000228	2.72	1050.86	280.56	0.16
1	2542	Q100	2400.00	620.99	634.98	627.45	635.14	0.000357	3.24	766.14	102.79	0.19
1	12.1	Q100	2400.00	622.92	634.75		634.94	0.000840	3.57	857.54	316.55	0.21
1	12	Q100	2400.00	621.48	634.75		634.90	0.000633	3.31	974.06	429.19	0.19
1	11	Q100	2400.00	619.25	634.65	626.04	634.70	0.000257	1.79	1536.50	787.17	0.10
1	10.5		Bridge									
1	10	Q100	2400.00	621.06	634.60	626.12	634.64	0.000246	1.73	1465.08	430.33	0.09
1	9.5	Q100	2500.00	621.02	634.55	626.41	634.63	0.000520	2.46	1325.99	435.13	0.14
1	9	Q100	2500.00	621.75	634.54	627.04	634.61	0.000364	2.05	1228.35	221.53	0.11
1	8	Q100	2500.00	623.25	634.50		634.55	0.000314	1.82	1365.58	219.09	0.11
1	7	Q100	2500.00	622.80	634.44	627.46	634.53	0.000241	1.61	1213.69	441.28	0.09
1	6	Q100	2500.00	621.94	634.34	627.67	634.44	0.000639	2.68	1576.20	783.16	0.15
1	5.5		Bridge									
1	5	Q100	2500.00	622.59	633.45	627.39	633.66	0.001293	3.85	762.26	113.02	0.22
1	4	Q100	2500.00	622.50	632.69	626.93	632.93	0.001484	4.01	670.47	168.34	0.23
1	3.5		Bridge									
1	3	Q100	2500.00	622.61	631.67	627.12	632.03	0.002573	4.86	519.37	251.96	0.30
1	2	Q100	2500.00	620.85	630.84		631.00	0.001412	3.73	978.60	316.72	0.22
1	1	Q100	2500.00	622.89	630.04		630.18	0.002496	4.10	1037.85	338.30	0.28
1	0.5	Q100	2500.00	621.72	629.42	627.85	629.46	0.001323	2.78	1916.73	803.44	0.20

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q100

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q100	635.64	635.51	0.13	0.09	0.02	0.80	2345.43	53.77	280.69
1	3755	Q100	635.53	635.48	0.05	0.07	0.00	6.13	1540.70	853.17	515.20
1	3380	Q100	635.45	635.36	0.09	0.02	0.01	2.93	2188.73	208.34	302.19
1	3327	Q100	635.42	635.28	0.14	0.02	0.01		2400.00		302.28
1	3288	Q100	635.40	635.27	0.13	0.00	0.00		2400.00		86.69
1	3245		Bridge								
1	3206	Q100	635.34	635.20	0.15	0.02	0.00		2400.00		86.50
1	3148	Q100	635.33	635.18	0.15	0.02	0.00		2400.00		93.62
1	3081	Q100	635.30	635.16	0.14	0.09	0.01		2400.00		102.86
1	2765	Q100	635.20	635.10	0.10	0.06	0.01	398.50	1830.81	170.70	280.56
1	2542	Q100	635.14	634.98	0.16	0.19	0.00		2342.08	57.92	102.79
1	12.1	Q100	634.94	634.75	0.19	0.02	0.01	48.06	2269.33	82.62	316.55
1	12	Q100	634.90	634.75	0.15	0.16	0.05	109.34	2131.54	159.12	429.19
1	11	Q100	634.70	634.65	0.04			530.34	1720.50	149.16	787.17
1	10.5		Bridge								
1	10	Q100	634.64	634.60	0.04	0.00	0.01	415.58	1802.08	182.34	430.33
1	9.5	Q100	634.63	634.55	0.09	0.01	0.01	187.73	2242.07	70.20	435.13
1	9	Q100	634.61	634.54	0.07	0.05	0.01	612.94	1834.51	52.55	221.53
1	8	Q100	634.55	634.50	0.05	0.01	0.01	355.63	2100.53	43.83	219.09
1	7	Q100	634.53	634.44	0.09	0.09	0.00	987.64	1277.28	235.08	441.28
1	6	Q100	634.44	634.34	0.09			100.15	2097.66	302.19	783.16
1	5.5		Bridge								
1	5	Q100	633.66	633.45	0.21	0.72	0.01	135.17	2231.35	133.48	113.02
1	4	Q100	632.93	632.69	0.24	0.02	0.12		2409.59	90.41	168.34
1	3.5		Bridge								
1	3	Q100	632.03	631.67	0.36	0.93	0.10		2461.59	38.41	251.96
1	2	Q100	631.00	630.84	0.16	0.81	0.00	867.68	1547.99	84.33	316.72
1	1	Q100	630.18	630.04	0.15	0.69	0.03	553.10	1105.05	841.86	338.30
1	0.5	Q100	629.46	629.42	0.04			408.57	456.86	1634.57	803.44

I-55 over Flag Creek Plan: Natural 9/28/2016

Geom: Flag Creek_Natural



Errors Warnings and Notes for Plan : Nat

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q100
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q100 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 12 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q100
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q100 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The
	selected bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q100
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q100
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.

Errors Warnings and Notes for Plan : Nat (Continued)

Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q100 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The
	selected bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q100
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q100
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q100
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the
	momentum answer has been disregarded.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q100 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Notes(60): This is an inside cross section of a perched bridge that has energy, low flow inside of the bridge and weir flow over the embankment. The reported
	hydraulics are based on the flow and area inside of the bridge.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q100 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	Notes(60): This is an inside cross section of a perched bridge that has energy, low flow inside of the bridge and weir flow over the embankment. The reported
	hydraulics are based on the flow and area inside of the bridge.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q100
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

500-Year Design Natural

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q500

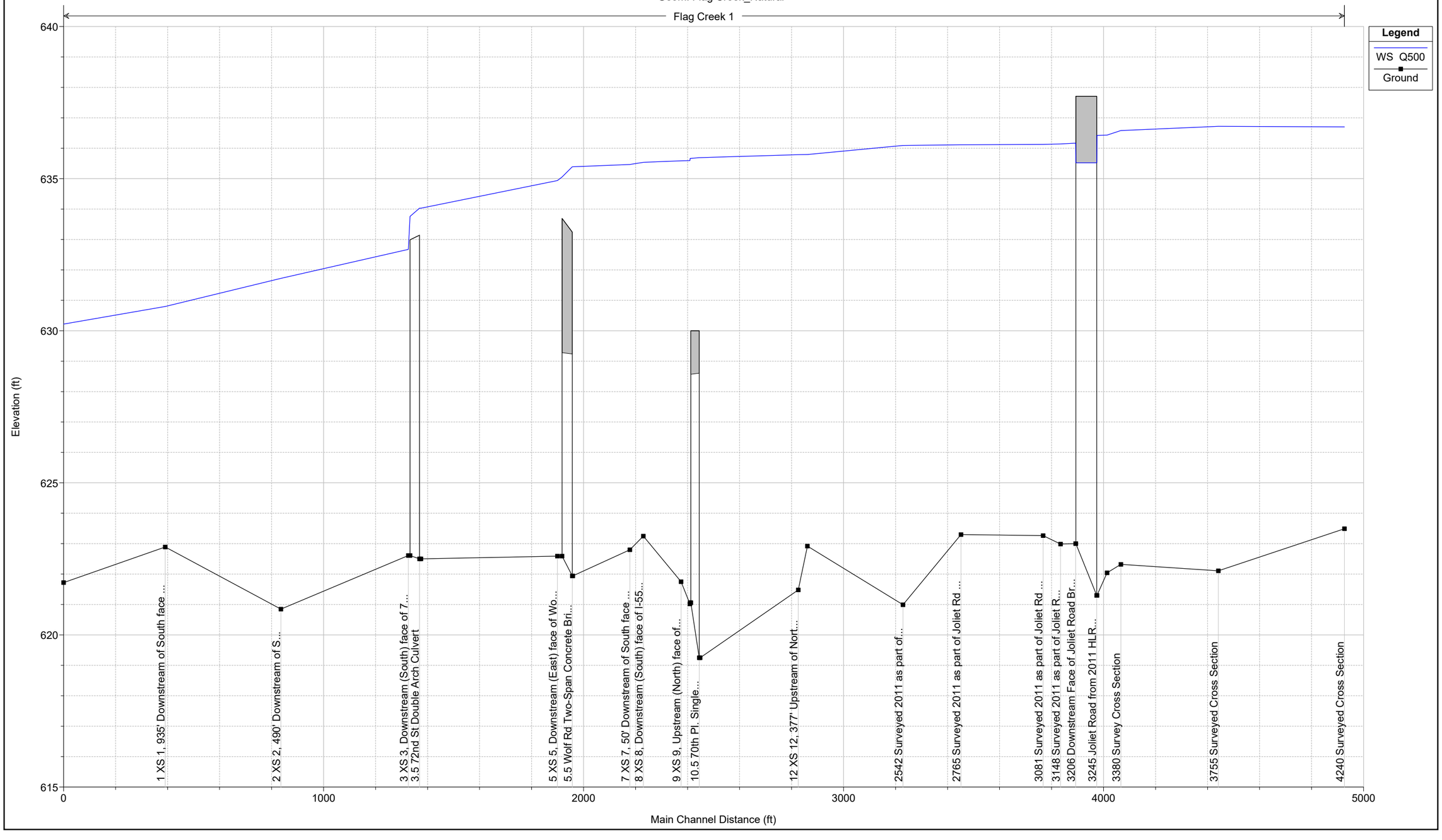
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4240	Q500	3350.00	623.49	636.70	629.21	636.89	0.000333	3.53	1157.70	724.40	0.20
1	3755	Q500	3350.00	622.11	636.72	629.08	636.76	0.000103	2.00	2301.23	553.28	0.11
1	3380	Q500	3350.00	622.32	636.58		636.69	0.000348	2.82	1395.60	451.80	0.15
1	3327	Q500	3350.00	622.04	636.43	628.89	636.65	0.000920	3.77	893.04	407.07	0.21
1	3288	Q500	3350.00	621.30	636.42	628.47	636.62	0.000358	3.55	942.82	92.11	0.19
1	3245		Bridge									
1	3206	Q500	3350.00	623.00	636.17	629.20	636.40	0.000458	3.86	868.03	86.50	0.21
1	3148	Q500	3350.00	622.99	636.14	628.64	636.37	0.000448	3.86	868.90	124.03	0.22
1	3081	Q500	3350.00	623.26	636.13	628.67	636.33	0.000481	3.65	916.62	112.52	0.23
1	2765	Q500	3350.00	623.30	636.11	629.27	636.21	0.000195	2.69	1486.60	423.14	0.15
1	2542	Q500	3350.00	620.99	636.09	628.47	636.16	0.000166	2.39	1725.94	317.12	0.13
1	12.1	Q500	3350.00	622.92	635.79		636.02	0.000956	4.10	1209.58	362.55	0.23
1	12	Q500	3350.00	621.48	635.79		635.98	0.000761	3.87	1244.64	471.15	0.21
1	11	Q500	3350.00	619.25	635.69	627.00	635.76	0.000232	1.81	1978.21	913.02	0.09
1	10.5		Bridge									
1	10	Q500	3350.00	621.06	635.67	626.94	635.72	0.000235	1.81	1813.57	547.36	0.09
1	9.5	Q500	3550.00	621.02	635.59	627.42	635.70	0.000637	2.91	1686.37	515.49	0.15
1	9	Q500	3550.00	621.75	635.59	627.93	635.68	0.000406	2.31	1462.14	226.23	0.12
1	8	Q500	3550.00	623.25	635.54		635.62	0.000371	2.12	1595.26	223.45	0.12
1	7	Q500	3550.00	622.80	635.47	628.49	635.59	0.000201	1.58	1512.41	521.14	0.09
1	6	Q500	3550.00	621.94	635.39	628.56	635.47	0.000598	2.77	2428.25	842.26	0.15
1	5.5		Bridge									
1	5	Q500	3550.00	622.59	634.94	628.48	635.18	0.001390	4.38	1365.61	531.26	0.23
1	4	Q500	3550.00	622.50	634.03	627.91	634.35	0.001748	4.76	1039.16	427.38	0.26
1	3.5		Bridge									
1	3	Q500	3550.00	622.61	632.68	628.10	633.06	0.002690	5.36	959.91	342.17	0.31
1	2	Q500	3550.00	620.85	631.72		631.92	0.001719	4.38	1260.17	324.10	0.25
1	1	Q500	3550.00	622.89	630.80		630.97	0.002735	4.61	1299.29	349.52	0.30
1	0.5	Q500	3550.00	621.72	630.22	628.10	630.26	0.001183	2.85	2593.24	904.16	0.19

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 Profile: Q500

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	4240	Q500	636.89	636.70	0.19	0.08	0.04	3.94	3210.65	135.41	724.40
1	3755	Q500	636.76	636.72	0.04	0.06	0.01	21.18	1708.76	1620.06	553.28
1	3380	Q500	636.69	636.58	0.11	0.03	0.01	18.97	2794.64	536.40	451.80
1	3327	Q500	636.65	636.43	0.22	0.02	0.01	1.87	3348.13		407.07
1	3288	Q500	636.62	636.42	0.20				3350.00		92.11
1	3245		Bridge								
1	3206	Q500	636.40	636.17	0.23	0.03	0.00		3350.00		86.50
1	3148	Q500	636.37	636.14	0.23	0.03	0.01		3350.00		124.03
1	3081	Q500	636.33	636.13	0.21	0.09	0.03		3350.00		112.52
1	2765	Q500	636.21	636.11	0.09	0.04	0.01	1054.15	2011.20	284.65	423.14
1	2542	Q500	636.16	636.09	0.07	0.12	0.02	1332.85	1942.18	74.97	317.12
1	12.1	Q500	636.02	635.79	0.23	0.03	0.01	247.32	2908.46	194.22	362.55
1	12	Q500	635.98	635.79	0.20	0.17	0.07	318.98	2759.73	271.30	471.15
1	11	Q500	635.76	635.69	0.05			1038.41	1910.84	400.76	913.02
1	10.5		Bridge								
1	10	Q500	635.72	635.67	0.06	0.00	0.02	868.24	2068.66	413.10	547.36
1	9.5	Q500	635.70	635.59	0.11	0.02	0.01	406.27	2920.80	222.93	515.49
1	9	Q500	635.68	635.59	0.09	0.06	0.01	1162.61	2284.42	102.98	226.23
1	8	Q500	635.62	635.54	0.08	0.01	0.01	734.54	2724.37	91.09	223.45
1	7	Q500	635.59	635.47	0.13	0.10	0.02	1657.02	1382.47	510.52	521.14
1	6	Q500	635.47	635.39	0.08			280.42	2408.30	861.28	842.26
1	5.5		Bridge								
1	5	Q500	635.18	634.94	0.25	0.81	0.02	304.25	2918.26	327.49	531.26
1	4	Q500	634.35	634.03	0.32				3267.35	282.65	427.38
1	3.5		Bridge								
1	3	Q500	633.06	632.68	0.39	1.05	0.09		3049.15	500.85	342.17
1	2	Q500	631.92	631.72	0.20	0.94	0.01	1215.87	2005.37	328.77	324.10
1	1	Q500	630.97	630.80	0.18	0.67	0.04	974.24	1380.76	1195.00	349.52
1	0.5	Q500	630.26	630.22	0.04			643.25	526.98	2379.77	904.16

I-55 over Flag Creek Plan: Natural 9/28/2016

Geom: Flag Creek_Natural



Errors Warnings and Notes for Plan : Nat

Location:	River: Flag Creek Reach: 1 RS: 4240 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3755 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3380 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Location:	River: Flag Creek Reach: 1 RS: 3327 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Manning's n values were composited to a single value in the main channel.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3288 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q500
Warning:	The Yarnell method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the next valid (user
	selected) method. If the Yarnell method was the only one selected, the program will default to an energy based solution.
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3245 Profile: Q500 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3206 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3148 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 3081 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2765 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 2542 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 12 Profile: Q500
Warning:	Divided flow computed for this cross-section.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Location:	River: Flag Creek Reach: 1 RS: 11 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q500
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10.5 Profile: Q500 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The
	selected bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 10 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 9.5 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 9 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 7 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Location:	River: Flag Creek Reach: 1 RS: 6 Profile: Q500

Errors Warnings and Notes for Plan : Nat (Continued)

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q500
Note:	Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer has been disregarded.
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 5.5 Profile: Q500 Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface is based on critical depth over the weir. The energy has been projected.
Location:	River: Flag Creek Reach: 1 RS: 5 Profile: Q500
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 4 Profile: Q500
Warning:	The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of
	error between computed and assumed values.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q500
Note:	Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note:	The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q500 Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected
	bridge modeling method does not compute answers inside the bridge.
Location:	River: Flag Creek Reach: 1 RS: 3.5 Profile: Q500 Downstream
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note:	For the cross section inside the bridge at the downstream end, the water surface and energy are based on critical depth over the weir.
Location:	River: Flag Creek Reach: 1 RS: 3 Profile: Q500
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Location:	River: Flag Creek Reach: 1 RS: 1 Profile: Q500
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for
	additional cross sections.

Bridge Tables

HEC-RAS Plan: Nat River: Flag Creek Reach: 1

Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)
1	3245	Q10	632.53	635.52	774.90		1260.00	637.72		0.04
1	3245	Q50	634.65	635.52	774.90		2000.00	637.72		0.05
1	3245	Q100	635.40	635.52	774.90		2400.00	637.72		0.05
1	3245	Q500	636.62	635.52	774.90	636.42	3350.00	637.72		0.22
1	10.5	Q10	631.89	628.60	392.02	631.84	1260.00	632.01		0.21
1	10.5	Q50	633.99	628.60	392.02		2000.00	632.01	709.91	0.08
1	10.5	Q100	634.70	628.60	392.02		2400.00	632.01	1252.87	0.05
1	10.5	Q500	635.76	628.60	392.02		3350.00	632.01	1605.07	0.04
1	5.5	Q10	631.36	629.24	325.83	631.27	1310.00	633.70		0.27
1	5.5	Q50	633.68	629.24	325.83	633.56	2100.00	633.70		0.82
1	5.5	Q100	634.44	629.24	325.83		2500.00	633.70	421.65	0.77
1	5.5	Q500	635.47	629.24	325.83		3550.00	633.70	2008.84	0.29
1	3.5	Q10	630.53	633.14	381.67		1310.00	632.44		0.33
1	3.5	Q50	632.14	633.14	381.67		2100.00	632.44		0.67
1	3.5	Q100	632.93	633.14	381.67		2500.00	632.44	27.10	0.90
1	3.5	Q500	634.35	633.14	381.67	634.83	3550.00	632.44	771.73	1.29

HEC-RAS Plan: Nat River: Flag Creek Reach: 1

Reach	River Sta	Profile	E.G. US.	W.S. US.	Br Sel Method	Energy EG	Momen. EG	Yarnell EG	WSPRO EG	Prs O EG	Prs/Wr EG	Energy/Wr EG
			(ft)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1	3245	Q10	632.53	632.47	Energy only	632.53						
1	3245	Q50	634.65	634.55	Energy only	634.65						
1	3245	Q100	635.40	635.27	Energy only	635.40						
1	3245	Q500	636.62	636.42	Press Only	636.58				636.62		
1	10.5	Q10	631.89	631.84	Press Only	631.95				631.89		
1	10.5	Q50	633.99	633.95	Press/Weir	634.30				634.51	633.99	
1	10.5	Q100	634.70	634.65	Press/Weir	634.96				635.51	634.70	
1	10.5	Q500	635.76	635.69	Press/Weir	635.99				637.44	635.76	
1	5.5	Q10	631.36	631.27	Press Only	631.67				631.36		
1	5.5	Q50	633.68	633.56	Press Only	634.40				633.68		
1	5.5	Q100	634.44	634.34	Press/Weir	635.26				634.88	634.44	
1	5.5	Q500	635.47	635.39	Press/Weir	636.35				637.82	635.47	
1	3.5	Q10	630.53	630.41	Energy only	630.53						
1	3.5	Q50	632.14	631.93	Energy only	632.14						
1	3.5	Q100	632.93	632.69	Energy/Weir	632.95						632.93
1	3.5	Q500	634.35	634.03	Press/Weir	635.00				635.04	634.35	

HEC-RAS Plan: Nat River: Flag Creek Reach: 1

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	3327	Q10	632.55	632.47	626.31	0.01	0.01	105.95		1260.00		2.29
1	3327	Q50	634.67	634.56	627.33	0.01	0.01	256.98		2000.00		2.76
1	3327	Q100	635.42	635.28	627.82	0.02	0.01	302.28		2400.00		3.05
1	3327	Q500	636.65	636.43	628.89	0.02	0.01	407.07	1.87	3348.13		3.77
1	3288	Q10	632.53	632.47	626.18	0.00	0.00	86.69		1260.00		2.10
1	3288	Q50	634.65	634.55	627.09	0.00	0.00	86.69		2000.00		2.56
1	3288	Q100	635.40	635.27	627.54	0.00	0.00	86.69		2400.00		2.85
1	3288	Q500	636.62	636.42	628.47			92.11		3350.00		3.55
1	3245 BR U	Q10	632.53	632.46	626.24	0.03	0.01	83.69		1260.00		2.19
1	3245 BR U	Q50	634.65	634.54	627.20	0.03	0.01	83.69		2000.00		2.67
1	3245 BR U	Q100	635.39	635.26	627.64	0.03	0.01	83.69		2400.00		2.97
1	3245 BR U	Q500	636.62	635.52	628.62			83.69		3350.00		4.03
1	3245 BR D	Q10	632.50	632.41	627.11	0.00	0.00	83.50		1260.00		2.45
1	3245 BR D	Q50	634.61	634.48	628.03	0.00	0.01	83.50		2000.00		2.91
1	3245 BR D	Q100	635.35	635.19	628.48	0.00	0.01	83.50		2400.00		3.21
1	3245 BR D	Q500	636.40	635.52	629.43			83.50		3350.00		4.32
1	3206	Q10	632.49	632.41	626.94	0.01	0.00	86.50		1260.00		2.32
1	3206	Q50	634.61	634.49	627.85	0.02	0.00	86.50		2000.00		2.77
1	3206	Q100	635.34	635.20	628.25	0.02	0.00	86.50		2400.00		3.06
1	3206	Q500	636.40	636.17	629.20	0.03	0.00	86.50		3350.00		3.86
1	3148	Q10	632.48	632.40	626.37	0.02	0.00	78.17		1260.00		2.29
1	3148	Q50	634.59	634.47	627.27	0.02	0.00	85.92		2000.00		2.78
1	3148	Q100	635.33	635.18	627.70	0.02	0.00	93.62		2400.00		3.08
1	3148	Q500	636.37	636.14	628.64	0.03	0.01	124.03		3350.00		3.86
1	12	Q10	632.10	631.99		0.18	0.03	124.85	0.00	1249.86	10.14	2.69
1	12	Q50	634.20	634.07		0.16	0.05	401.32	31.89	1860.44	107.67	3.10
1	12	Q100	634.90	634.75		0.16	0.05	429.19	109.34	2131.54	159.12	3.31
1	12	Q500	635.98	635.79		0.17	0.07	471.15	318.98	2759.73	271.30	3.87
1	11	Q10	631.89	631.84	624.48			491.61		1249.18	10.82	1.77
1	11	Q50	633.99	633.95	625.57			705.33	273.57	1646.32	80.10	1.83
1	11	Q100	634.70	634.65	626.04			787.17	530.34	1720.50	149.16	1.79

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	11	Q500	635.76	635.69	627.00			913.02	1038.41	1910.84	400.76	1.81
1	10.5 BR U	Q10	631.89	628.60	624.48					1260.00		3.21
1	10.5 BR U	Q50	633.99	633.95	625.57			650.71	600.01	941.11	5.78	2.17
1	10.5 BR U	Q100	634.69	634.65	626.04			745.05	833.48	1009.13	122.91	2.03
1	10.5 BR U	Q500	635.74	635.69	627.00			856.50	869.63	1071.42	357.88	1.81
1	10.5 BR D	Q10	631.68	628.57	624.79					1260.00		2.98
1	10.5 BR D	Q50	633.99	633.87	625.64			232.36	600.01	941.11	5.78	2.01
1	10.5 BR D	Q100	634.69	634.60	626.11			326.76	833.48	1009.13	122.91	1.88
1	10.5 BR D	Q500	635.72	635.67	626.93			432.80	869.63	1071.42	357.88	1.67
1	10	Q10	631.68	631.64	624.79	0.00	0.01	126.89	9.76	1248.89	1.36	1.68
1	10	Q50	633.92	633.87	625.64	0.00	0.01	351.57	200.55	1726.21	73.24	1.78
1	10	Q100	634.64	634.60	626.12	0.00	0.01	430.33	415.58	1802.08	182.34	1.73
1	10	Q500	635.72	635.67	626.94	0.00	0.02	547.36	868.24	2068.66	413.10	1.81
1	9.5	Q10	631.67	631.61	625.08	0.02	0.00	118.20	3.34	1306.66		2.01
1	9.5	Q50	633.91	633.83	626.01	0.01	0.01	345.08	93.87	1979.12	27.01	2.34
1	9.5	Q100	634.63	634.55	626.41	0.01	0.01	435.13	187.73	2242.07	70.20	2.46
1	9.5	Q500	635.70	635.59	627.42	0.02	0.01	515.49	406.27	2920.80	222.93	2.91
1	7	Q10	631.54	631.46	626.00	0.17	0.00	138.77	95.78	1196.14	18.09	2.20
1	7	Q50	633.80	633.72	627.00	0.10	0.01	265.16	661.07	1319.26	119.67	1.80
1	7	Q100	634.53	634.44	627.46	0.09	0.00	441.28	987.64	1277.28	235.08	1.61
1	7	Q500	635.59	635.47	628.49	0.10	0.02	521.14	1657.02	1382.47	510.52	1.58
1	6	Q10	631.36	631.27	626.05			102.34	7.38	1287.61	15.01	2.40
1	6	Q50	633.68	633.56	627.28			447.04	28.08	2031.74	40.18	2.82
1	6	Q100	634.44	634.34	627.67			783.16	100.15	2097.66	302.19	2.68
1	6	Q500	635.47	635.39	628.56			842.26	280.42	2408.30	861.28	2.77
1	5.5 BR U	Q10	631.36	629.24	626.39				0.29	1306.01	3.69	3.95
1	5.5 BR U	Q50	633.68	629.24	627.59				0.47	2093.61	5.92	6.33
1	5.5 BR U	Q100	634.43	634.34	627.98			325.21	327.16	2147.69	23.97	5.84
1	5.5 BR U	Q500	635.47	635.39	628.87			534.94	1086.06	1987.17	473.70	4.40
1	5.5 BR D	Q10	631.09	629.28	626.17				10.29	1276.31	23.39	4.24

HEC-RAS Plan: Nat River: Flag Creek Reach: 1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	5.5 BR D	Q50	632.85	629.28	627.24				16.50	2046.00	37.50	6.80
1	5.5 BR D	Q100	634.43	634.34	627.70			332.71	343.02	2100.57	55.23	6.51
1	5.5 BR D	Q500	635.47	635.05	628.84			437.03	1097.82	1952.23	496.88	5.10
1	5	Q10	631.09	630.97	625.96	0.56	0.00	92.62	31.51	1239.35	39.14	2.85
1	5	Q50	632.85	632.67	626.96	0.70	0.01	106.57	92.89	1910.53	96.59	3.58
1	5	Q100	633.66	633.45	627.39	0.72	0.01	113.02	135.17	2231.35	133.48	3.85
1	5	Q500	635.18	634.94	628.48	0.81	0.02	531.26	304.25	2918.26	327.49	4.38
1	4	Q10	630.53	630.41	625.60	0.01	0.04	92.71		1292.25	17.75	2.84
1	4	Q50	632.14	631.93	626.52	0.02	0.09	102.58		2061.25	38.75	3.73
1	4	Q100	632.93	632.69	626.93	0.02	0.12	168.34		2409.59	90.41	4.01
1	4	Q500	634.35	634.03	627.91			427.38		3267.35	282.65	4.76
1	3.5 BR U	Q10	630.48	630.24	625.67	0.20	0.01	34.13		1310.00		3.98
1	3.5 BR U	Q50	632.04	631.54	626.65	0.38	0.02	28.48		2100.00		5.67
1	3.5 BR U	Q100	632.79	632.15	627.10	0.52	0.02	17.54		2472.90		6.43
1	3.5 BR U	Q500	634.35	634.03	628.19			246.49		2778.27	772.54	7.07
1	3.5 BR D	Q10	630.28	630.00	625.89	0.02	0.06	35.44		1310.00		4.19
1	3.5 BR D	Q50	631.64	631.07	626.88	0.03	0.14	31.60		2100.00		6.03
1	3.5 BR D	Q100	632.24	631.52	627.33	0.03	0.18	27.53		2472.90		6.84
1	3.5 BR D	Q500	634.11	633.76	628.41			227.63		2778.27	772.54	7.28
1	3	Q10	630.20	630.05	625.82	0.51	0.04	100.35		1293.02	16.98	3.17
1	3	Q50	631.47	631.18	626.73	0.81	0.08	188.65		2069.05	30.95	4.34
1	3	Q100	632.03	631.67	627.12	0.93	0.10	251.96		2461.59	38.41	4.86
1	3	Q500	633.06	632.68	628.10	1.05	0.09	342.17		3049.15	500.85	5.36
1	2	Q10	629.65	629.58		0.49	0.00	301.04	422.70	874.44	12.85	2.46
1	2	Q50	630.58	630.45		0.75	0.00	313.39	726.07	1349.72	24.22	3.40
1	2	Q100	631.00	630.84		0.81	0.00	316.72	867.68	1547.99	84.33	3.73
1	2	Q500	631.92	631.72		0.94	0.01	324.10	1215.87	2005.37	328.77	4.38

TAB E

SECTION 13.E

PROPOSED CONDITIONS

PROPOSED ANALYSIS

There are no proposed modifications to the existing structure. Please refer to the existing conditions analysis in Section 13 C.

TAB 14

SECTION 14

SCOUR ANALYSIS

SCOUR CALCULATIONS

Soil boring data is provided in the historic 1962 plans provided in Section 10. No current borings for the streambed at the structure are available.

1962 borings indicate a mix of soils at the streambed level, including stiff silty clay and sandy loam.

Scour Input from HEC-RAS

Plan: Ex Flag Creek 1 RS: 10 Profile: Q100

E.G. Elev (ft)	635.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.022	0.063	0.030
W.S. Elev (ft)	635.27	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	626.12	Flow Area (sq ft)	336.63	1105.22	240.20
E.G. Slope (ft/ft)	0.000156	Area (sq ft)	336.63	1105.22	387.53
Q Total (cfs)	2400.00	Flow (cfs)	552.30	1590.25	257.45
Top Width (ft)	503.40	Top Width (ft)	123.55	99.20	280.65
Vel Total (ft/s)	1.43	Avg. Vel. (ft/s)	1.64	1.44	1.07
Max Chl Dpth (ft)	14.21	Hydr. Depth (ft)	2.72	11.14	2.29
Conv. Total (cfs)	191990.2	Conv. (cfs)	44181.4	127213.5	20595.3
Length Wtd. (ft)	1.00	Wetted Per. (ft)	124.79	102.52	105.46
Min Ch El (ft)	621.06	Shear (lb/sq ft)	0.03	0.11	0.02
Alpha	1.04	Stream Power (lb/ft s)	535.10	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	19.37	28.28	26.16
C & E Loss (ft)	0.01	Cum SA (acres)	4.85	3.21	15.65

Plan: Ex Flag Creek 1 RS: 10 Profile: Q500

E.G. Elev (ft)	636.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.021	0.063	0.030
W.S. Elev (ft)	636.33	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	626.94	Flow Area (sq ft)	470.09	1210.33	351.46
E.G. Slope (ft/ft)	0.000158	Area (sq ft)	470.09	1210.33	741.26
Q Total (cfs)	3350.00	Flow (cfs)	1003.82	1858.50	487.68
Top Width (ft)	602.88	Top Width (ft)	128.04	99.20	375.64
Vel Total (ft/s)	1.65	Avg. Vel. (ft/s)	2.14	1.54	1.39
Max Chl Dpth (ft)	15.26	Hydr. Depth (ft)	3.67	12.20	3.35
Conv. Total (cfs)	266792.3	Conv. (cfs)	79944.0	148010.1	38838.3
Length Wtd. (ft)	1.00	Wetted Per. (ft)	129.41	102.52	105.46
Min Ch El (ft)	621.06	Shear (lb/sq ft)	0.04	0.12	0.03
Alpha	1.09	Stream Power (lb/ft s)	535.10	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	25.29	31.66	44.74
C & E Loss (ft)	0.01	Cum SA (acres)	6.53	3.19	20.73

Plan: Ex Flag Creek 1 RS: 9 Profile: Q100

E.G. Elev (ft)	635.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.028	0.063	0.013
W.S. Elev (ft)	635.22	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	627.04	Flow Area (sq ft)	401.72	955.68	22.31
E.G. Slope (ft/ft)	0.000246	Area (sq ft)	436.37	955.68	22.31
Q Total (cfs)	2500.00	Flow (cfs)	752.92	1681.49	65.59
Top Width (ft)	224.59	Top Width (ft)	125.85	89.20	9.54
Vel Total (ft/s)	1.81	Avg. Vel. (ft/s)	1.87	1.76	2.94
Max Chl Dpth (ft)	13.47	Hydr. Depth (ft)	3.19	10.71	2.34
Conv. Total (cfs)	159461.8	Conv. (cfs)	48024.9	107253.5	4183.5
Length Wtd. (ft)	1.00	Wetted Per. (ft)	127.18	92.08	10.62

Plan: Ex Flag Creek 1 RS: 9 Profile: Q100 (Continued)

Min Ch El (ft)	621.75	Shear (lb/sq ft)	0.05	0.16	0.03
Alpha	1.03	Stream Power (lb/ft s)	105.10	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	19.14	27.51	26.01
C & E Loss (ft)		Cum SA (acres)	4.75	3.14	15.58

Plan: Ex Flag Creek 1 RS: 9 Profile: Q500

E.G. Elev (ft)	636.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.027	0.063	0.013
W.S. Elev (ft)	636.27	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	627.93	Flow Area (sq ft)	535.21	1049.34	33.45
E.G. Slope (ft/ft)	0.000285	Area (sq ft)	569.86	1049.34	33.45
Q Total (cfs)	3550.00	Flow (cfs)	1314.16	2114.75	121.09
Top Width (ft)	229.32	Top Width (ft)	128.44	89.20	11.67
Vel Total (ft/s)	2.19	Avg. Vel. (ft/s)	2.46	2.02	3.62
Max Chl Dpth (ft)	14.52	Hydr. Depth (ft)	4.17	11.76	2.87
Conv. Total (cfs)	210401.1	Conv. (cfs)	77887.3	125337.0	7176.9
Length Wtd. (ft)	1.00	Wetted Per. (ft)	129.98	92.08	13.00
Min Ch El (ft)	621.75	Shear (lb/sq ft)	0.07	0.20	0.05
Alpha	1.06	Stream Power (lb/ft s)	105.10	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	24.96	30.81	44.52
C & E Loss (ft)		Cum SA (acres)	6.43	3.12	20.66

Plan: Ex Flag Creek 1 RS: 8.5 BR U Profile: Q100

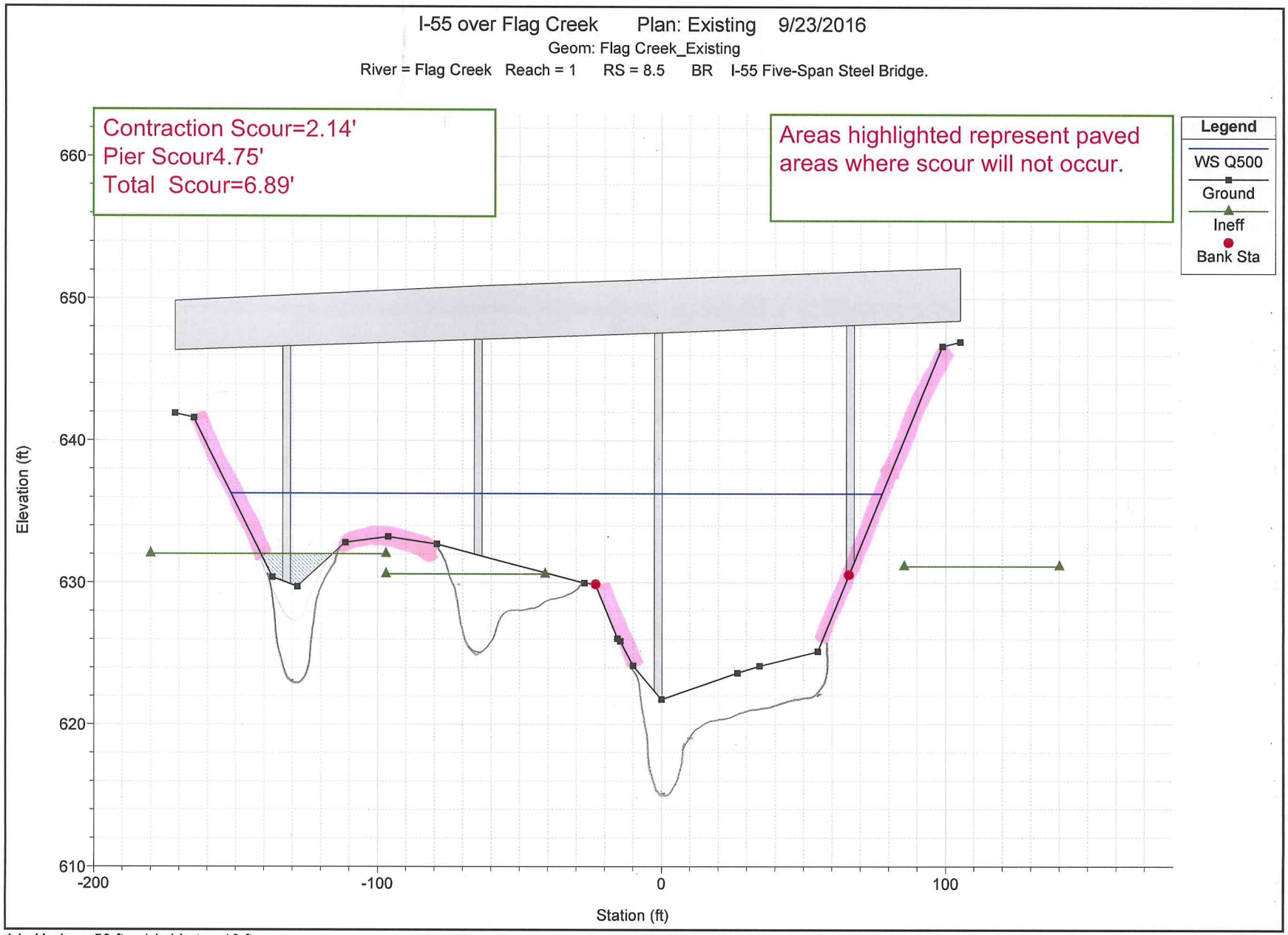
E.G. Elev (ft)	635.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.027	0.063	0.013
W.S. Elev (ft)	635.21	Reach Len. (ft)	143.00	143.00	143.00
Crit W.S. (ft)	627.19	Flow Area (sq ft)	382.47	913.66	14.69
E.G. Slope (ft/ft)	0.000372	Area (sq ft)	411.63	913.66	14.69
Q Total (cfs)	2500.00	Flow (cfs)	851.14	1612.62	36.24
Top Width (ft)	213.53	Top Width (ft)	120.32	85.48	7.74
Vel Total (ft/s)	1.91	Avg. Vel. (ft/s)	2.23	1.77	2.47
Max Chl Dpth (ft)	13.45	Hydr. Depth (ft)	3.18	10.69	1.90
Conv. Total (cfs)	129578.0	Conv. (cfs)	44115.6	83583.9	1878.5
Length Wtd. (ft)	143.00	Wetted Per. (ft)	138.59	119.61	12.42
Min Ch El (ft)	621.76	Shear (lb/sq ft)	0.06	0.18	0.03
Alpha	1.04	Stream Power (lb/ft s)	105.10	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	19.13	27.48	26.01
C & E Loss (ft)		Cum SA (acres)	4.75	3.14	15.58

Plan: Ex Flag Creek 1 RS: 8.5 BR U Profile: Q500

E.G. Elev (ft)	636.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.026	0.063	0.013
W.S. Elev (ft)	636.25	Reach Len. (ft)	143.00	143.00	143.00
Crit W.S. (ft)	628.10	Flow Area (sq ft)	509.20	1002.74	23.86
E.G. Slope (ft/ft)	0.000436	Area (sq ft)	538.36	1002.74	23.86
Q Total (cfs)	3550.00	Flow (cfs)	1472.34	2002.79	74.87
Top Width (ft)	218.23	Top Width (ft)	122.89	85.48	9.86
Vel Total (ft/s)	2.31	Avg. Vel. (ft/s)	2.89	2.00	3.14
Max Chl Dpth (ft)	14.49	Hydr. Depth (ft)	4.14	11.73	2.42
Conv. Total (cfs)	170051.3	Conv. (cfs)	70527.8	95937.3	3586.2
Length Wtd. (ft)	143.00	Wetted Per. (ft)	145.54	122.74	15.82
Min Ch El (ft)	621.76	Shear (lb/sq ft)	0.10	0.22	0.04
Alpha	1.11	Stream Power (lb/ft s)	105.10	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	24.94	30.78	44.52
C & E Loss (ft)		Cum SA (acres)	6.43	3.11	20.66

Scour Results Per HEC-18

1 in Horiz. = 50 ft 1 in Vert. = 10 ft



1 in Horiz. = 50 ft 1 in Vert. = 10 ft

FHWA HEC-18, "Evaluating Scour at Bridges", Fifth Edition, April 2012

Chapter 6.2.1 Critical Velocity for Clear Water vs. Live Bed Contraction Scour

Stream:	Flagg Creek
Route \ County:	I-55\ Cook
S.N. :	16-0003
Storm Event:	100-Year

user input

K_u =	11.17	English units
y =	11.14	Average depth of flow upstream of the bridge, ft
D_{50} =	0.0007	Grain size, feet
V_{100} =	1.44	Mean velocity, channel fps

V_c =	1.48	ft/s

100-Year channel or overbank

If $V_c > V_{100}$, clear water scour exists.

If $V_{100} > V_c$, live bed scour exists.

$$V_c = K_u \, y^{1/6} \, D^{1/3}$$

Eq. 6.1

FHWA HEC-18, "Evaluating Scour at Bridges", Fifth Edition, April 2012

Chapter 6.2.1 Critical Velocity for Clear Water vs. Live Bed Contraction Scour

Stream:	Flagg Creek
Route \ County:	I-55\ Cook
S.N. :	16-0003
Storm Event:	500-Year

user input

K_u =	11.17	English units
y =	12.2	Average depth of flow upstream of the bridge, ft
D_{50} =	0.0007	Grain size, feet
V_{100} =	1.50	Mean velocity, channel or overbank, fps

V_c =	1.50	ft/s

100-Year channel or overbank

If $V_c > V_{100}$, clear water scour exists.

If $V_{100} > V_c$, live bed scour exists.

$$V_c = K_u \, y^{1/6} \, D^{1/3}$$

Eq. 6.1

FHWA HEC-18, "Evaluating Scour at Bridges", Fifth Edition, April 2012

Chapter 6.4 Clear Water Contraction Scour

Stream:	Flagg Creek
Route \ County:	I-55\ Cook
S.N. :	16-0003
Storm Event:	100-Year

user input

K_u =	0.0077	English units
Q	1612.62	Discharge Through Bridge
D_{50}	0.0007	Median Diameter of bed material (ft. min size 0.0007')
D_m	0.0009	$1.25*D_{50}$
W	85.48	Bottom Width of Contracted Section Less Piers Widths , ft.
Y_2	11.52	Average Equilibrium depth in contracted section after scour depth, ft
y_o	10.69	Average Existing Depth (Hydraulic Depth) in Contracted Section, ft.
y_s	0.83	Scour Depth

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2} \right]^{3/7}$$

$y_s = y_2 - y_o$ = (average contraction scour depth)

FHWA HEC-18, "Evaluating Scour at Bridges", Fifth Edition, April 2012

Chapter 6.4 Clear Water Contraction Scour

Stream:	Flagg Creek
Route \ County:	I-55\ Cook
S.N. :	16-0003
Storm Event:	500-Year

user input

K_u =	0.0077	English units
Q	2002.79	Discharge Through Bridge
D_{50}	0.0007	Median Diameter of bed material (ft. min size 0.0007')
D_m	0.0009	$1.25*D_{50}$
W	85.48	Bottom Width of Contracted Section Less Piers Widths , ft.
Y_2	13.87	Average Equilibrium depth in contracted section after scour depth, ft
y_o	11.73	Average Existing Depth (Hydraulic Depth) in Contracted Section, ft.
y_s	2.14	Scour Depth

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2} \right]^{3/7}$$

$y_s = y_2 - y_o$ = (average contraction scour depth)

Pier Scour

Pier # 1-2-3 EMB 9/26/2016

Stream: Flagg Creek

Route \ County: I-55\ Cook

S.N.: 16-0003

			Q_{100}	Q_{500}
Attack angle of flow	(theta)	deg.	0	0
Length of pier	(L)	ft	143	143
Width of pier	(a)	ft	2.75	2.75
Average Velocity	(V)	fps	2.22	2.73
Depth of flow at pier	(y_1)	ft	10.69	11.73
Pier type code		(1 thru 5)	1	1
(maximum = 12)	L/a =		12	12
	K_1 =		1.1	1.1
	K_2 =		1.0	1.0
	K_3 =		1.1	1.1
	Fr =		0.120	0.140
Depth of Pier Scour, y_s =			**4.30** {ft}	**4.75** {ft}

$$\frac{y_s}{a} = 2.0 K_1 K_2 K_3 \left(\frac{y_1}{a}\right)^{0.35} Fr^{0.43}$$

$$Fr = \frac{V}{(g y_1)^{\frac{1}{2}}}$$

assumptions \ directions:

* **The correction factor for pier nose shape is taken from HEC-18 Table 7.1. However, for an attack angle > 5 degrees, K_1 is equal to unity. In that case, use pier type code 2.**
* **K_2 is computed with the formula located below Table 7.2.**
* **K_3 is set at 1.1, which represents the absence of dunes or a dune bed configuration with crest heights under 10 feet. (See Table 7.3 from HEC-18.) Adjust this accordingly for dune heights > 10 feet.**

NOTE: This spreadsheet computes pier scour under the assumption the footing or pile cap is not exposed by some combination of contraction scour, long-term degradation or stream migration. If that is not the case, then scour due to the footing or pile cap may control. See Ch. 6 of HEC-18.

TAB 15

SECTION 15

RIPRAP SIZING

RIPRAP SIZING

There are no proposed changes to the existing concrete slope walls at the abutments, therefore no riprap sizing is required.

Tab 16

SECTION 16

PERMIT SUMMARY FORM (DISTRICT 1) – RELATED EXHIBITS AND CALCULATIONS

Illinois Department of Transportation

Permit Summary for Floodway Construction in Northeast Illinois

Applicant Agency:	IDOT	County:	Cook
Route:	I-55	Stream:	Flag Creek
Section:	I-355 to I-94	SN:	016-0003

General Description: There is an existing 5 Span bridge carrying I-55 over Flag Creek. There is no proposed modifications to the existing bridge.
Existing Facility: The multispan bridge has width of 480' and length of 282.4'
Proposed Improvement: There is no proposed modification to the existing structure nor is there any work proposed below the 100-year floodplain except for repairs that are exempt from permitting under the Part 3708 Rules.

1. Is the proposed work classified as repairs such as deck replacement, pavement resurfacing, or the armoring or filling of a scour hole? ☒ Yes ☐ No

2. Does the proposed work only consist of modifications to the existing structure which will occur above the regulatory 100-year flood profile? ☒ Yes ☐ No

Note: If the answer to question 1 or 2 is yes, no permit is required and questions 3 through 12 may be omitted.

3. Does the proposed work below the regulatory 100-year flood profile consist of widening of the existing structure by 12 feet or less? ☐ Yes ☐ No

Note: If yes, Regional Permit No. 2 applies and questions 4 through 9 may be omitted.

4. Is the proposed improvement, including the approach roadway, more restrictive to normal and flood flows than the existing structure? ☐ Yes ☐ No

5. Is a Channel Modification proposed? ☐ Yes ☐ No

6. Are there any buildings or structures located upstream in the 100-year floodplain within the influence of the structure backwater? ☐ Yes ☐ No

   6a. If no, does the backwater of the proposed improvement exceed the backwater of the existing structure by more than 0.1 foot? ☐ Yes ☐ No

   6b. If yes, does the proposed backwater exceed the natural high water elevation by more than 0.1 foot? ☐ Yes ☐ No

7. Are transitions required for this project? ☐ Yes ☐ No

8. Is the flood profile at the project site impacted by backwater from a downstream receiving stream? ☐ Yes ☐ No

   If yes, list frequency of starting elevation for analysis:

9. Is backwater from a downstream structure affecting the flood profile at the project site? ☐ Yes ☐ No

9a. Was the existing downstream structure used in the analysis for determining flood profile at the project site? years? (Attach documentation) ☐ Yes ☐ No

9b. Is the downstream structure scheduled for improvement in the next 5 ☐ Yes ☐ No

9c. Was the proposed downstream improvement used in the analysis? ☐ Yes ☐ No

10. Is a floodway map change required due to the proposed project? ☐ Yes ☐ No

11. Will fill or material be placed in the floodway due to the proposed work? ☐ Yes ☐ No

11a. If yes, is compensatory storage provided at the project location? (Attach a copy of completed Attachment A) ☐ Yes ☐ No

11b. If the answer to 11a is no, is compensatory storage provided at another location? If yes, give location and attach a copy of completed Attachment A. ☐ Yes ☐ No

11c. Has compensatory storage relief been granted? (Attach Documentation) ☐ Yes ☐ No

12. Coordination based on Memorandum of Agreement has occurred with Agency(ies) (Attach documentation):. ☐ Yes ☐ No

---

All engineering analysis has been performed by me or under my direct supervision.

Signature: Steve A Dailey IL/P.E. #: 062-47420

Date: 03/01/2016 P.E. Expiration Date: 11/30/2017

FOR DEPARTMENTAL USE ONLY

Is a permit required for this project? ☐ Yes ☐ No

If yes, specify type of permit: ☐ Floodway, ☐ Regional 1, ☐ Regional 2

Permit Summary
(Attachment A - Compensatory Storage)

Part of Permit Summary for Floodway Construction in Northeast Illinois:

☐ Phase I (Preliminary) ☐ Phase II (Final)

Applicant Agency:	IDOT	County:	Cook
Route:	I-55	Stream:	Flag Creek
Section:	I-355 to I-94	SN:	016-0003

Provide the following information for Item 11:

a. Flood Water Elevations (Natural): 100-year 634.6 ft. 10-year 631.6 ft.
Normal 624.13 ft.

b. Determine the amount of fill or material being placed in the floodway:

1. Between the 100-year and 10-year flood elevation 0 cu. yds.
2. Between the 10-year and normal water elevation 0 cu. yds.

c. Determine the volume being provided to compensate for above item b:
(i.e. from structures removal, excavation, etc.)

1. Between the 100-year and 10-year flood elevation 0 cu. yds.
2. Between the 10-year and normal water elevation 0 cu. yds.

d. Mark on the exhibits the location and amount of compensatory storage to be excavated. Also show the location of floodway and floodplain boundaries. (Include a set of plans and cross sections)

Attach copy of calculations and Exhibit(s) reflecting the above finding.

All engineering analysis has been performed by me or under my direct supervision.

Signature: Mark A Daily IL/P.E. #: 062-47420

Date: 03/01/2016 P.E. Expiration Date: 11/30/2017

Tab 17

SECTION 17

COMPENSATORY STORAGE

COMPENSATORY STORAGE

There is no fill proposed below the 100-year floodplain elevations within the floodway. Therefore there is no required compensatory storage.

Tab 18

SECTION 18

SURVEY NOTES

Questions concerning the VERTCON process may be mailed to NGS

Latitude: 41 43 59

Longitude: 87 57 00

NGVD 29 height:

Datum shift(NAVD 88 minus NGVD 29): -0.086 meter ≅ 0.28 Feet

Name... LIN ENGINEERING

Address... 576 OAKMONT LANE
WESTMONT IL 60559

Phone... 217-415-2581

Projects
Hyd. Survey... I-55 over Flagg Crk... I-10...

11/12/12 J. Day, T. Willis, J. Holthaus

Hydraulic Survey I-55 over Flagg Creek

BASE @ CW4 N = 1,855,513.182
IH = 5.45 E = 1,103,490.082
Elev. = 632.34

CHK CW2 N = 1,855,531.221
E = 1,104,370.178
Elev. = 643.56
ΔH = 0.06' ΔV = 0.04'

Control Points CW4 & CW2 Prev. set AND BM 3
For Ramp Work From I-55 Control

SET NAILS FOR CONTROL POINTS 5000-5003

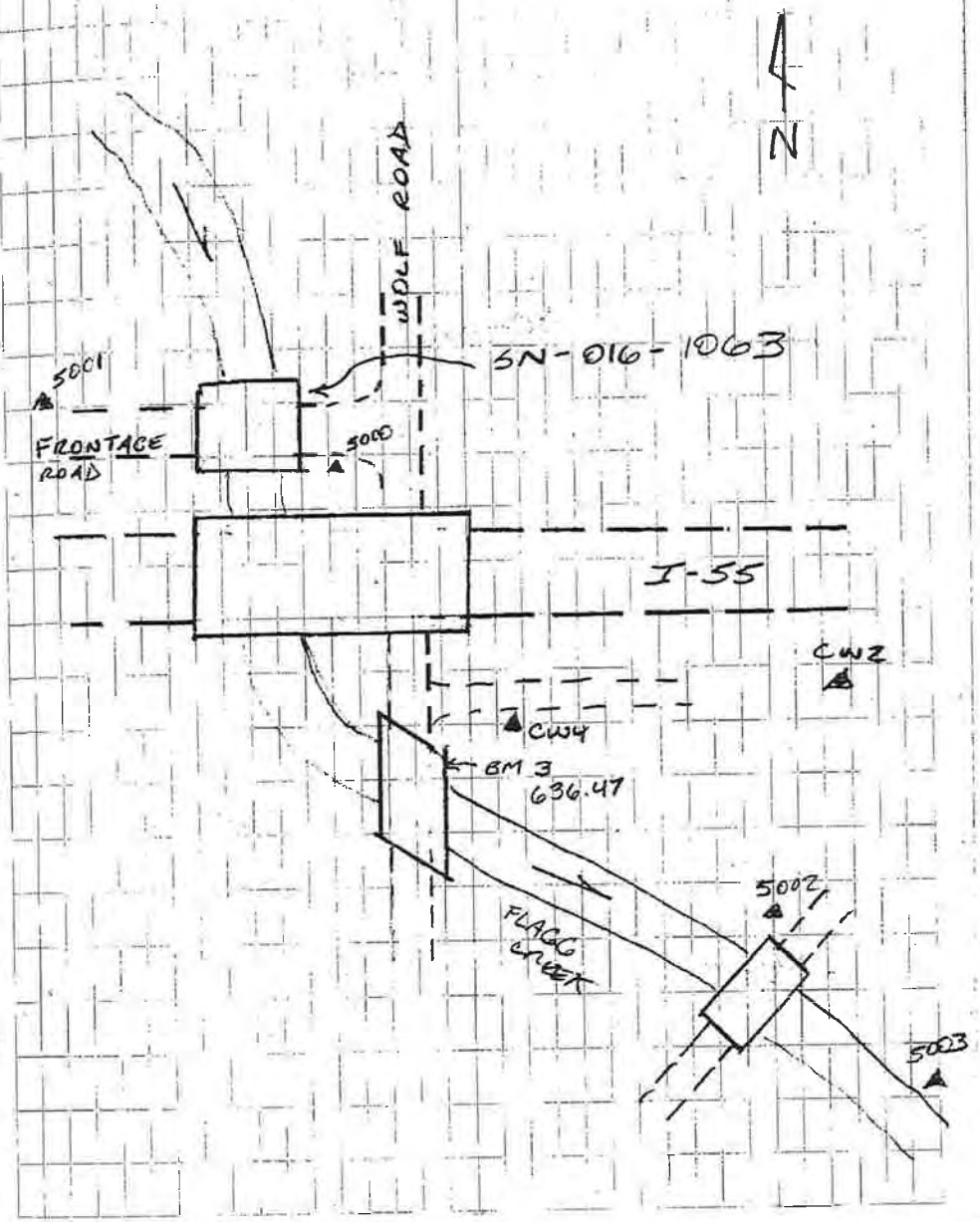
CHECK OUT CW2
ΔH = 0.06' ΔV = 0.09'

CHECK OUT 201233
ΔH = 0.09' ΔV = 0.06'

(1)

300 GPS 40° SUNNY

200 CONTROLLER FILE: 1103_111212JD



13

11/X/12 CONT.

BEGIN SURVEY AT UPSTREAM END
CONT. IN DATASET FILE 1103-1112ZID

T 5001 BS 5000
IH = 5.15' SH = 5.1'

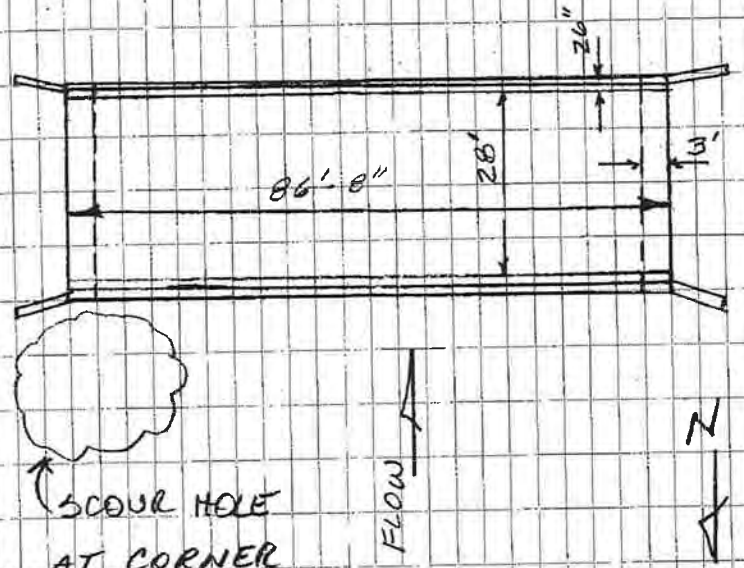
5004 ✓5000 ΔH = 0.02'
ΔV = 0.02'

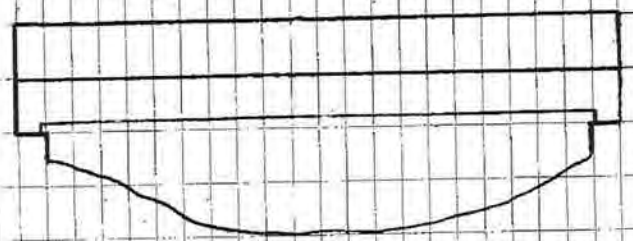
POINT	DESC.
5005 - 5019	FLOODPLAIN SECTION 500' US FLOODPLAIN IS MOWED GRASS CHANNEL BANKS LINED WITH TREES & BRUSH. CHANNEL IS CLEAN & SILTY
5020 - 5022	STREAM PROFILE 300 - 500' UPSTREAM
5023 - 5039	SHOTS @ UPSTRM FACE S.N. 016 - 1063
5040 - 5051	BRIDGE DECK & PROFILE

5052 - ✓5000 ΔH = 0.02'
ΔV = 0.07'

S.N. 016-1063 (2)

NORTH FRONTAGE ROAD BRIDGE - CONC. DECK ON CONC. BEAMS & CONC. ABUTMENTS.





UPSTREAM FACE

11/13/12 CONT

T 5000 BS 5001

IH = 5.13' SH = 5.01

5053 / 5001

ΔH = 0.02' ΔV = 0.02'

5054 FLOWLINE 200' UPSTRM

5055-5076 SHOTS @ DWNSTRM FACE

SN-016-1063

5077-5102 SHOTS @ UPSTRM FACE I-55

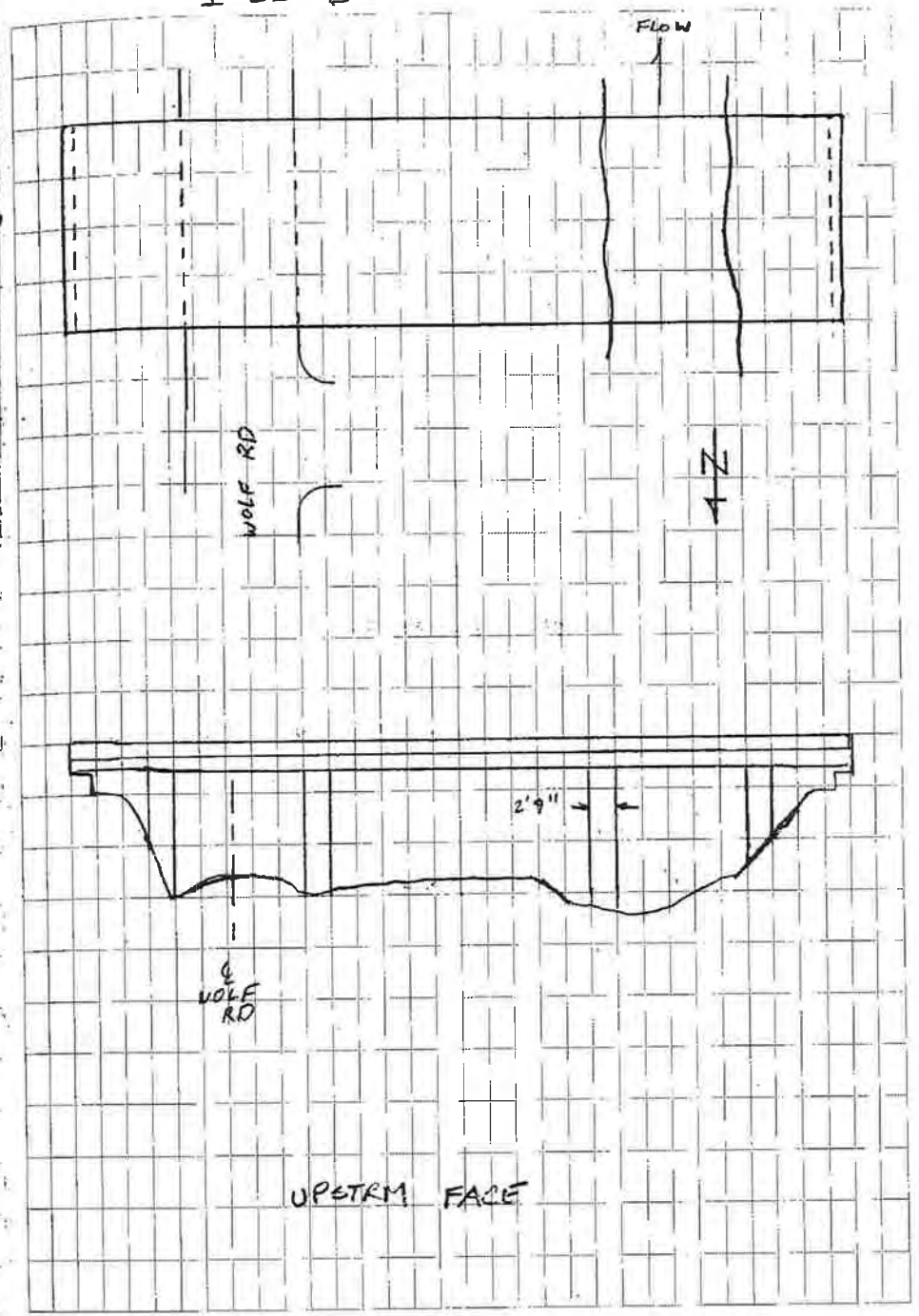
5103 SET NAIL / TOPO STA. MEAS 3x

BACKSIGHT CHK ΔH = 0.02'

5104 @ 5001 ΔV = 0.00

ΔH= ΔV=

I-55 BRIDGE OVER FLAGG CRK (3)



11/13/12 CONT

X 5103 BS 5000

IH = 5.35 SH = 5.1'

5104 ✓ CW4

ΔH = 0.07' ΔV = 0.00'

5105 - 5127 SHOTS @ DWNSTRM FACE I-55 STRUCTURE

5128 - 5140 FLOOD PLAIN SECTION @ ROW DWNSTRM OF I-55
CHANNEL CLEAN & ROCKY
TREES & BRUSH LINE CHANNEL
FLOODPLAIN URBAN/MOWED GRASS

5141 ✓ CW4

ΔH = 0.04 ΔV = 0.01

11/13/12 CONT.

X CW4 BS 5000

IH = 5.43' SH = 5.1'

5142 ✓5000 ΔH = 0.02' ΔV = 0.01'

5143 ✓BM3 (636.47) ΔV = 0.02'

5144 FLOWLINE CHANNEL 200' DOWNSTREAM

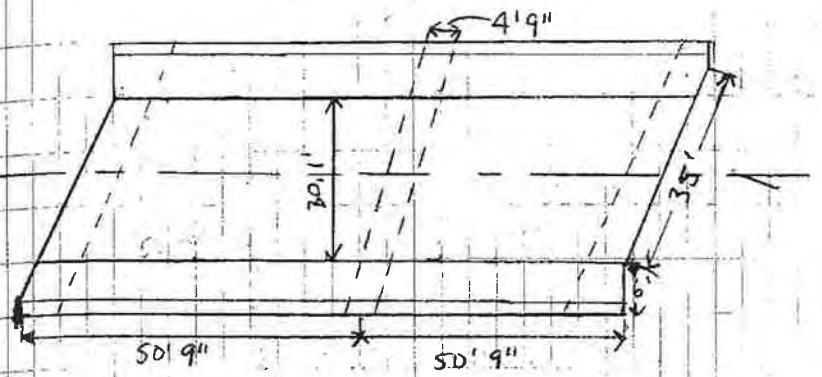
5145 - 5157 SHOTS @ UPSTRM FACE WOLF ROAD BRIDGE

5158 MAG NAIL / TOPO STA. MEAS. 3X

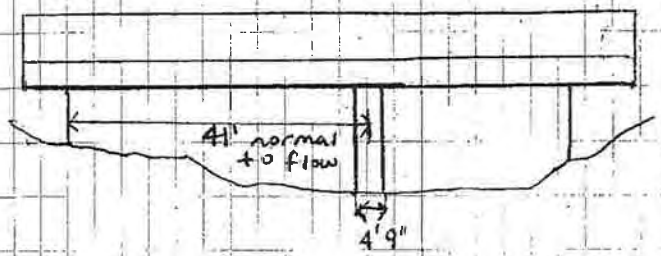
5159 ✓5000

ΔH = 0.03 ΔV = 0.00'

WOLF RD BRIDGE OVER FLAGG CRK (5)



FLOW



UPSTREAM OPENING

T 5158 BS= CW4

IH= 5.47 SH= 5.35

5160 ✓CW4

ΔH= 0.00' ΔV= 0.04'

5161 - 5173 SHOTS @ DWNSTRM FACE WOLF RD. BRDG

5174 - 5178 CHANNEL PROFILE 400' - 800' DWNSTRM

5179 - 5207 BRIDGE DECK & PROFILE WOLF RD BRDG

5208 ✓CW4

ΔH= 0.01' ΔV= 0.04'

11/14/12 30° MOSTLY SUNNY

T 5003 BS 5002
IH = 5.12' SH = 5.10'

5209 ✓5002
ΔH = 0.06' ΔV = 0.07'

5210-5218 SHOTS AT DWNSTRM FACE 72ND ST STR OVER FLAG CR

5219-5222 CHANNEL PROFILE 100'-400' DWNSTRM

5223-5239 FLOOD PLAIN SECTION 500' DS — 72ND ST STR

CHANNEL CLEAN & ROCKY

TREES & BRUSH LINE WEST BANK

FLOOD PLAIN URBAN MOWED GRASS

5240-5243 CHANNEL PROFILE 600'-900' DWNSTRM

(5244) SET NAIL / TOPO STA MEAS 3X

5245-5254 LOCATE DWNSTRM ARCH 72ND OVER FLAGG CRK

5255 ✓5002
ΔH = 0.06 ΔV = 0.05

T 5244 BS 5003
IH = 5.39 SH = 5.10

5256 ✓5003 ΔH = 0.01 ΔV = 0.03

5257-5265 Floodplain section 950' DWNSTRM OF ARCH BRIDGE. FLOODPAIN NORTH IS GOLF COURSE (COULD NOT ACCESS) & SOUTH IS URBAN/MOWED GRASS. DOWNSTRM FROM THIS POINT THE FLOODPLAIN TURNS INTO WOODS WITH NO DISCERNIBLE LIMIT FOR EDGE OF FLOODPLAIN. Believe this section Taken to be more constrictive.

5266 CHANNEL FLOWLINE 1000' DWNSTRM FROM ARCH CULVERT

5267 ✓5003
ΔH = 0.01' ΔV = 0.03'

11/14/12 (CONT)

X 5002 BS 5003

IH= 5.19' S/T= 5.10'

5268 ✓5003

ΔH= 0.07' ΔV= 0.01'

5269 - 5284 UPSTRM OPENING OF ARCH STRUCTURE @ 72ND

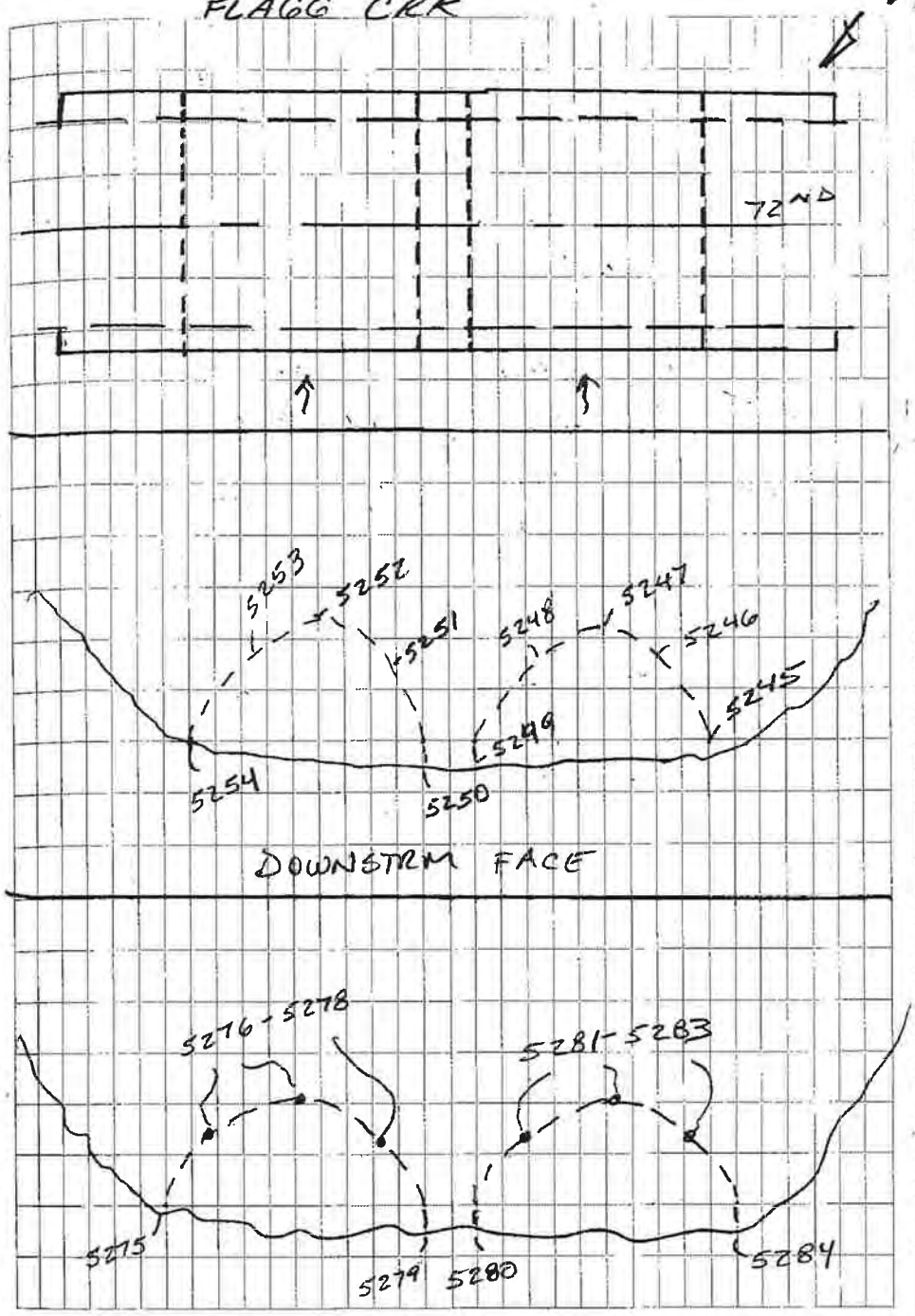
5285 - 5295 Roadway Profile 72ND

5297

5296 ✓5003

ΔH= 0.06' ΔV= 0.02'

DOUBLE ARCH CULVERT 72ND OVER FLAGG CRK (8)



Tab 19

SECTION 19

EWSE DATA

EWSE Data

Date of survey: November, 2012

Existing water surface elevation = 624.13

Streambed elevation = 621.75

Top of bank elevation = 630.54

There is no gaging station data at or near the I-55 crossing over Flag Creek.

April Elevation : 624.13 + 2.25 = 626.38

Maximum WSE: 626.38 – 3.75 = 622.63

One Foot above Streambed = 622.75 > 622.63, *Use 622.75 as September Elevation*

Preliminary EWSE = 0.75 (630.54 – 622.75) + 622.75 = 628.59

April Elevation = 626.38 < 628.59, *Use EWSE = 626.38*

Tab 20

SECTION 20

CORRESPONDENCE NOTES

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DISTRICT ONE - OPERATIONS & COMMUNICATIONS CENTER

5 3/4

*** FLOODING ***

DATE: 6/7/93 DAY: MONDAY PAGE 1 OF 4

DISP. INIT.	INFORMANT/ TIME REC'D	DIRECTION & LOCATION	LANE #'s	EST. DEPTH	PASSABLE (YES/NO)	CONTACTED (WHO/TIME)	TIME CLOSED	VERIFIED (NAME)	TIME / DATE DISP. INIT.
MTK	ROCKY C #999 1145 AM	SW I-55 @ LORAC	ALL	?	YES	STEVENSON & KEN 1147 HRS	1224	KURT STEVENSON	13 44 6/9/93 JAC OPEN
MTK	KANE CO. 1156 HRS	25 @ SHAGBARK	ALL	?	YES	ST. CHAS 1157 HRS. RON		JOHN ST. CHARLES	6/9/93 1246 JAC
JAC	OAK FOREST PD DIANE	4900 W. 159TH ST	ALL	?	NO	710 RC		#61	17:30 6/7
JMA	#4 Woodridge PD 1203	I-53 / 75TH x 83rd St	all	?	YES	Jeff Marcotte 710 RC		83rd by map	Cleared by 6/7
MTK	WILLOW SPRINGS PD #1 1207	171 @ WILL SPRINGS RD	?	?	NO 1223	710 HRS HILLSIDE	1223	#2	17:26 6/7
MTK	CITIZEN 1204	83 @ SW HWY	?	?	?	ALSP		FRANK ALSIP	6/9/93 1219 JAC
JAB	1210 PM RC 913	I-55 SW @ LaGrange Road	LANE 1 & 2	1'	YES	RON Stevenson @		RC681	12:50 6/7
JAB	1213 PM CPD.	I-94 NB & SB @ 87TH ST	ALL	1'	YES	Eddie @ DAN RYAN		ED RYAN	6/9/93 1252 JA
JMA	ISP-4 1238	NB Ryan @ 95TH	1-3	?	YES	RC 653		ED DAN RYAN	6/9/93 1252 JAC
MTK	RC536	NB ~~RYAN~~ @ ARCHER LaGrange	ALL	1 FT.	NO	RC 600	1233	RC 624	6-8-93 1:13 AM RAM

COPIES TO: MR. J. KOS, MR. MCDERMOTT, MR. MARCOTTE, MR. WANG, MR. SABOURIN.

TAKAHASHI 5/92 UPDATED 12/92

CHRISTOPHER B. BURKE ENGINEERING, LTD.
1938 E Lincoln Highway • Suite 212 • New Lenox, Illinois 60451 • Tel.: 815-463-9050 • Fax: 815-463-9065

Stantec Consulting Services, Inc.
135 S. LaSalle Street, Suite 3100
Chicago, IL 60603

Attention: Dustin Book, PE

Subject: Indian Head Park
I-55 Managed Lanes Study

Dear Mr. Book:

Per your request on October 12, 2012, you will find all available Village utility mapping attached. This includes water, sanitary sewer and storm sewer information. Please be advised that Village Ordinances are available on the Village website.

The Village has not experienced unusual flooding associated with I-55 or adjacent properties and has no current or proposed drainage improvements.

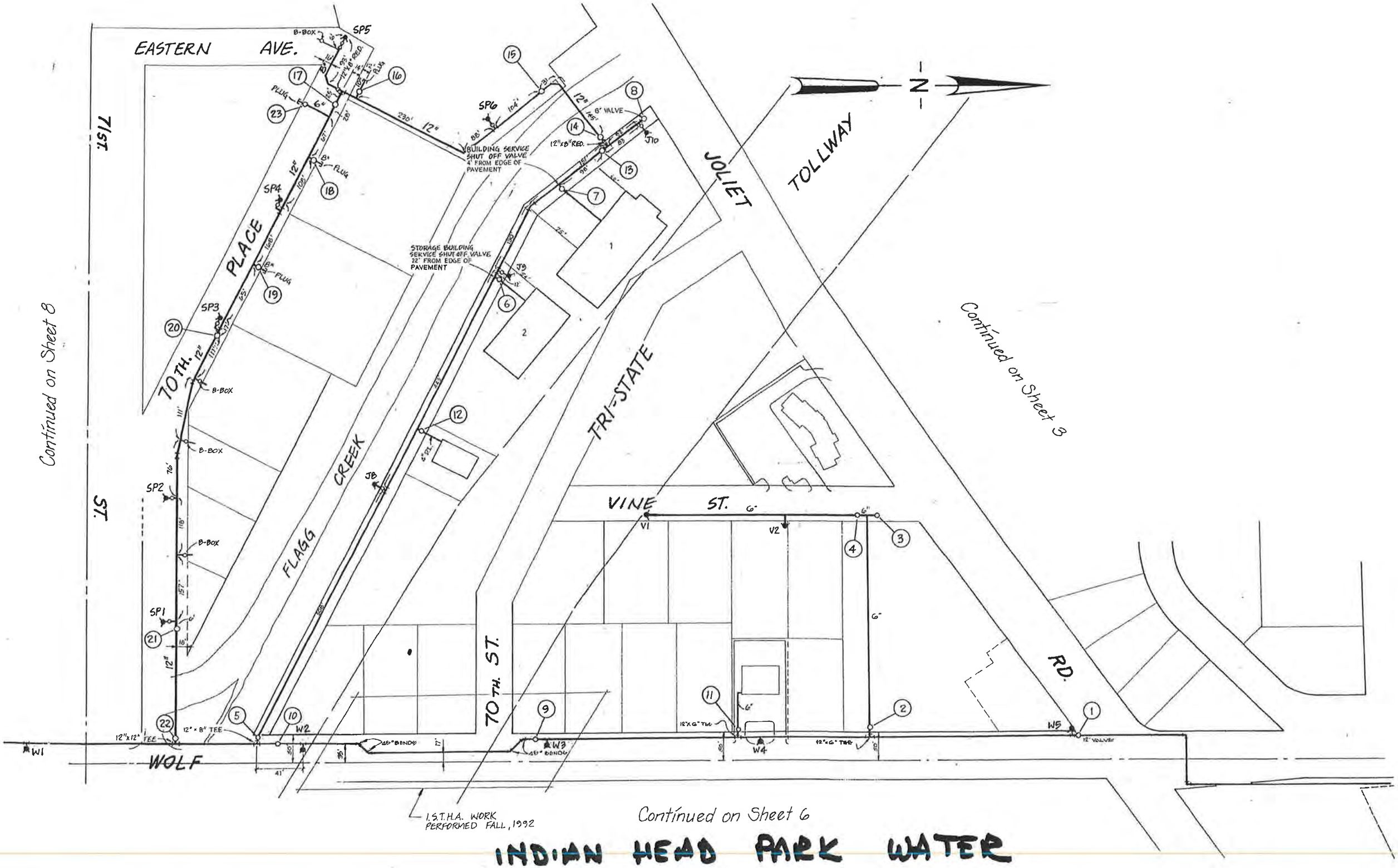
Should you have any further questions feel free to contact me directly or Mr. Ed Santen at the Village.

Sincerely,

Dave Vandervelde, PE
Senior Civil Engineer

cc: Ed Santen, Village of Indian Head Park
Frank Alonzo, Village of Indian Head Park

C:\Documents and Settings\DVANDERVELDE\Local Settings\Temporary Internet Files\Content.Outlook\CIF9AE7I\L1-Stantec Consulting Services 101812.docx



Continued on Sheet 8

Continued on Sheet 3

Continued on Sheet 6

INDIAN HEAD PARK WATER

COUNTRY CLUB

VINE STREET

AREA 10

AREA 11

FLAGG CREEK

EASTERN

70th

PLACE

TOLLWAY

INTERSTATE

AREA 11

AREA 14

ROUTE 55

OUTLET (#12)
36" RCP
END SECTION (#6)
36" PRECAST CONCRETE
FLARED END SECTION
I.E. 628.24

OUTLET (#13)
54" RCP
NO END SECTION
I.E. 626.20

OUTLET (#15)

B1-1 B1 B1-2 B1-2-1 B2 B3-1 B3 B3-2 B4-1 B4 B4-2 B4-3 B57 B57-1 C1 C2 C3 D1 D2 D3

INDIAN HEAD PARK SS
1 of 2

VILLAGE OF INDIAN HEAD PARK

AREA 11

AREA 14

INTERSTATE

ROUTE 55

OUTLET (#15)
15" RCP
NO END SECTION
I.E. 625.91

OUTLET (#14)
24" RCP
END SECTION (#7)
24" PRECAST CONCRETE
FLARED END SECTION
I.E. 625.57

OUTLET (#17)
15" RCP
END SECTION (#9)
15" PRECAST CONCRETE
FLARED END SECTION
I.E. 625.70

OUTLET (#16)
15" RCP
END SECTION (#8)
15" PRECAST CONCRETE
FLARED END SECTION
I.E. 625.59

EDGEWOOD VIEW RD.

72nd STREET

STREET

72nd STREET

ARROWHEAD TRAIL

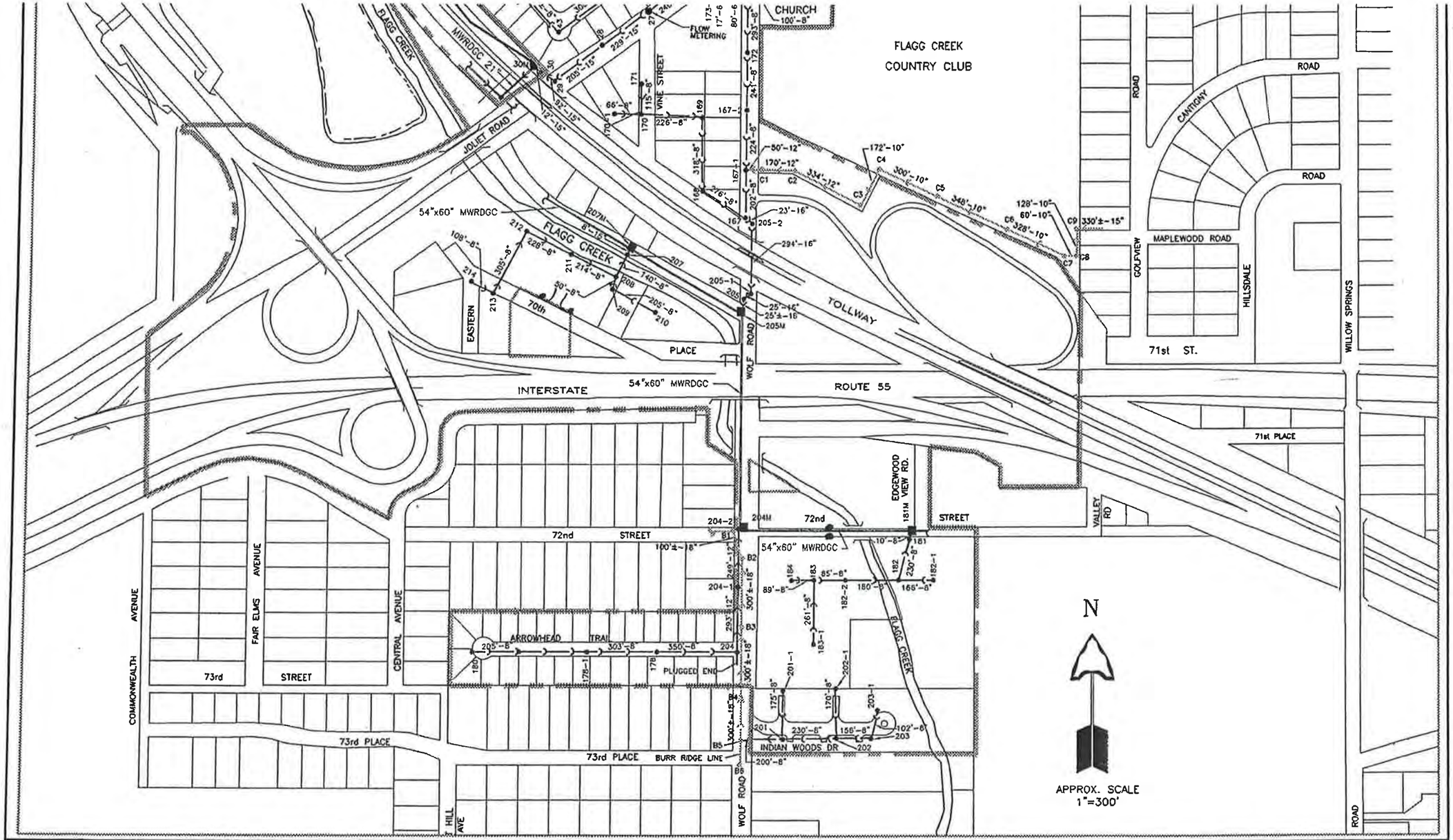
BM #1

OUTLET (#18)
12" RCP
END SECTION (#10)
12" PRECAST CONCRETE
FLARED END SECTION
I.E. 627.69

FLAGG CREEK

I.E. 627.87

INDIAN HEAD PARK SS
2 of 2



SHEET 2 OF 7

DRAWING NO. 335-732-02

STRAND ASSOCIATES, INC. ENGINEERS

2400 GLENWOOD AVENUE,
SUITE 226
JOLIET, ILLINOIS 60435
(815) 744-4200

VILLAGE OF INDIAN HEAD PARK
OVERALL SANITARY SEWER ATLAS

JANUARY 1998

DES BY: JKP CHK BY: SLA
DWN BY: SLN APP BY: ERB
SCALE: APPROX. 1"=300'
PROJECT DATE: JAN. 1998
PRINTED:

LENGTH OF BAR IS 1" ON ORIGINAL DRAWING

NO.	REVISION	BY	DATE
01	ORIGINAL	SLN	FEB. 1997
02	LENGTH & TYPES PER VIDEO	SLN	JAN. 1998

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-3154 312.751.5600

CATHERINE A. O'CONNOR, Ph.D., P.E.
Director of Engineering

312.751.7905 f: 312.751.5681
Catherine.O'Connor@mwrd.org

October 31, 2012

Mr. Dustin Book, P.E.
Transportation Engineer
Stantec Consulting Services Inc.
135 South LaSalle Street, Suite 3100
Chicago, IL 60603-4139

Subject: I-55 Managed Lanes Study/Drainage Documentation

Dear Mr. Book:

Reference is made to your letter dated October 12, 2012, concerning the subject project. The Metropolitan Water Reclamation District of Greater Chicago (MWRD) has reviewed the request and submits the following:

Local storm sewer plans. Please contact each individual municipality for the most current plans.
Combined sewer atlas. Enclosed are Sheets 15-18 of the MWRD Combined Sewer Atlas.
Utility plans. Enclosed are the following documents depicting MWRD facilities:

- Southwest Side Intercepting Sewer 3, Sheets 1 and 2
- Southwest Side Intercepting Sewer 3A, Sheets 1, 7, and 8
- Southwest Side Intercepting Sewer 5, Sheets 1, 4, 5, 6, 7A, and 8
- Southwest Side Intercepting Sewer 9, Sheets 1, 21, and 22
- Southwest Side Intercepting Sewer 12, Sheets 1-6, 6A and 7-9
- Southwest Side Intercepting Sewer 15, Sheets 1, 6, and 7
- Southwest Side Intercepting Sewer 17C, Sheets 1, 16, 17, 17A, and 18
- Stickney-LASMA Solids Pipeline (87-138-2S), Sheets S1, S29, S30, S31, and S37-45
- Western Avenue Sewer, Sheets 1-7
- TARP Contract 73-160-2H, Sheets 3, 4, and 5
- TARP Contract 73-162-2H, Part 2, Sheets S12 and S20
- TARP Contract 75-125-2H, Sheets 9, 10, and 22
- MWRD Sewer Atlas Sheets 15-18
- MWRD TARP Atlas Sheets 15-18

Contour mapping. Contours can be obtained from Cook County.

Current and proposed drainage improvements. Please consult the "Cal-Sag Detailed Watershed Plan" and "Lower Des Plaines Detailed Watershed Plan" available at www.mwrd.org, Departments, Engineering, Stormwater Management. There are no current projects under design in the vicinity of I-55.
Identification of flooding experiences associated with highway or adjacent properties. Please see "Summary of Responses to Form B Questionnaire", Table 2.2.1, in Lower Des Plaines Detailed Watershed Plan.
Local ordinances. Please contact individual municipalities.
Watershed management plans or related studies. Please refer to the Lower Des Plaines Detailed Watershed Plan.

It is requested that during construction extra caution be taken to protect the safety and integrity of our facilities. No access hatches and manhole covers on MWRD structures and manholes within the project area shall be buried or covered. No debris shall enter MWRD structures, sewers, or facilities. MWRD personnel shall have 24 hour-a-day unrestricted access to all MWRD facilities.

Furthermore, MWRD manholes shall be located, protected and/or adjusted to grade, if necessary. Prior authorization is required to make any structural modifications, including manhole frame and lid adjustments. Authorization may be obtained by contacting Ms. Manju Sharma, Director of Maintenance and Operations, at (312) 751-5101. If MWRD facilities are required to be located in the field, please contact Mr. Rafiq Basaria, Senior Civil Engineer, at (708) 588-4080.

Also, we request that your planning team consider green infrastructure, especially in your drainage plan, as you further develop your project concept.

If you need additional information, please contact Mr. Joe Schuessler, Principal Civil Engineer, at (312) 751-3236.

Very truly yours,

Catherine A. O'Connor

Catherine A. O'Connor
Director of Engineering

WSS:KMF:JMS
Enclosure(s)
cc (w/o encl): Ms. Manju P. Sharma, Director of Maintenance and Operations
Mr. John Murray, Supervising Civil Engineer

Book, Dustin

From: Paul May <pmay@burr-ridge.gov>
Sent: Wednesday, October 24, 2012 9:49 AM
To: Book, Dustin
Subject: FW: I-55 Managed lanes project - LDS
Attachments: I-55 drainage, Burr Ridge.png

Categories: I-55 Managed Lanes - Drainage

Dustin, the Village of Burr Ridge does not have any storm sewer that passes underneath I-55 (we do have watermain though). The primary drainage issue that I am aware of is near the intersection of Madison and I-55 where a variety of IDOT storm sewer crossings exist, some of which are blocked, and some of which are submerged. This condition results in flooding on both the north and south sides of I-55 at this location. The area long the north frontage road between Brush Hill Road and Hamilton Street also does not drain properly, and contributes to the aforementioned issue. CBBEL has performed a study for DuPage County in this area previously. Obviously, the Village of Burr Ridge would expect that the project through Burr Ridge would include attenuation of any additional flows, and would comply with the new DuPage County Stormwater ordinance.

Paul D. May, P.E.
Director of Public Works

Village of Burr Ridge DPW
451 Commerce Street
Burr Ridge, IL 60527

Phone: (630) 323-4733 #6000
www.burr-ridge.gov

Stantec Consulting Services Inc.
135 South LaSalle Street Suite 3100
Chicago IL 60603-4139
Tel: (312) 262-2300
Fax: (312) 262-2301

Stantec

October 12, 2012

Attention: <<Full_Name>>
<<Title>>
<<Local Agency>>
<<Address 1>>
<<City>>, <<State>> <<Zip Code>>

Reference: I-55 Managed Lanes Study / Drainage Documentation

Dear <<Salutation>>,

The Illinois Department of Transportation is currently preparing a Preliminary Engineering and Environmental Study (Phase 1) for the improvements for the I-55 Managed Lanes Project. The project study area includes I-55 (Stevenson Expressway) and extends from I-355 on the west to I-90/94 on the east.

This project is proposed to add one managed lane in each direction in the existing median of the expressway. Managed Lanes include High Occupancy Vehicle (HOV), High Occupancy Toll (HOT), Congestion Pricing, as well as other managed lane options. This project has been identified in the Chicago Metropolitan Area for Planning (CMAP) Go To 2040 Plan as a priority project.

As part of the overall project scope, we are preparing a Location Drainage Study of the existing and proposed drainage patterns within the study area. It is the intent of the drainage study to document the hydraulic investigation and provide recommendations as part of the roadway improvement. We are requesting your assistance to provide drainage information within the study area concerning both the existing conditions and any future planned improvements. This information will be to be incorporated into the study to identify existing deficiencies and to develop recommendations for the roadway facility.

In particular, we request the following:

- Local storm sewer plans
- Combined sewer atlas
- Utility plans
- Contour mapping
- Current and proposed drainage improvements
- Identification of flooding experiences associated with the highway or adjacent properties
- Local ordinances
- Watershed management plans or related studies

Stantec

October 12, 2012
Reference: I-55 Managed Lanes Study / Drainage Documentation

Please return any of the available requested information to my attention at the address or email provided below. If you have any questions or need additional information, please contact Dustin Book at 312-262-2233.

Thanks for your time and the information provided.

Regards,

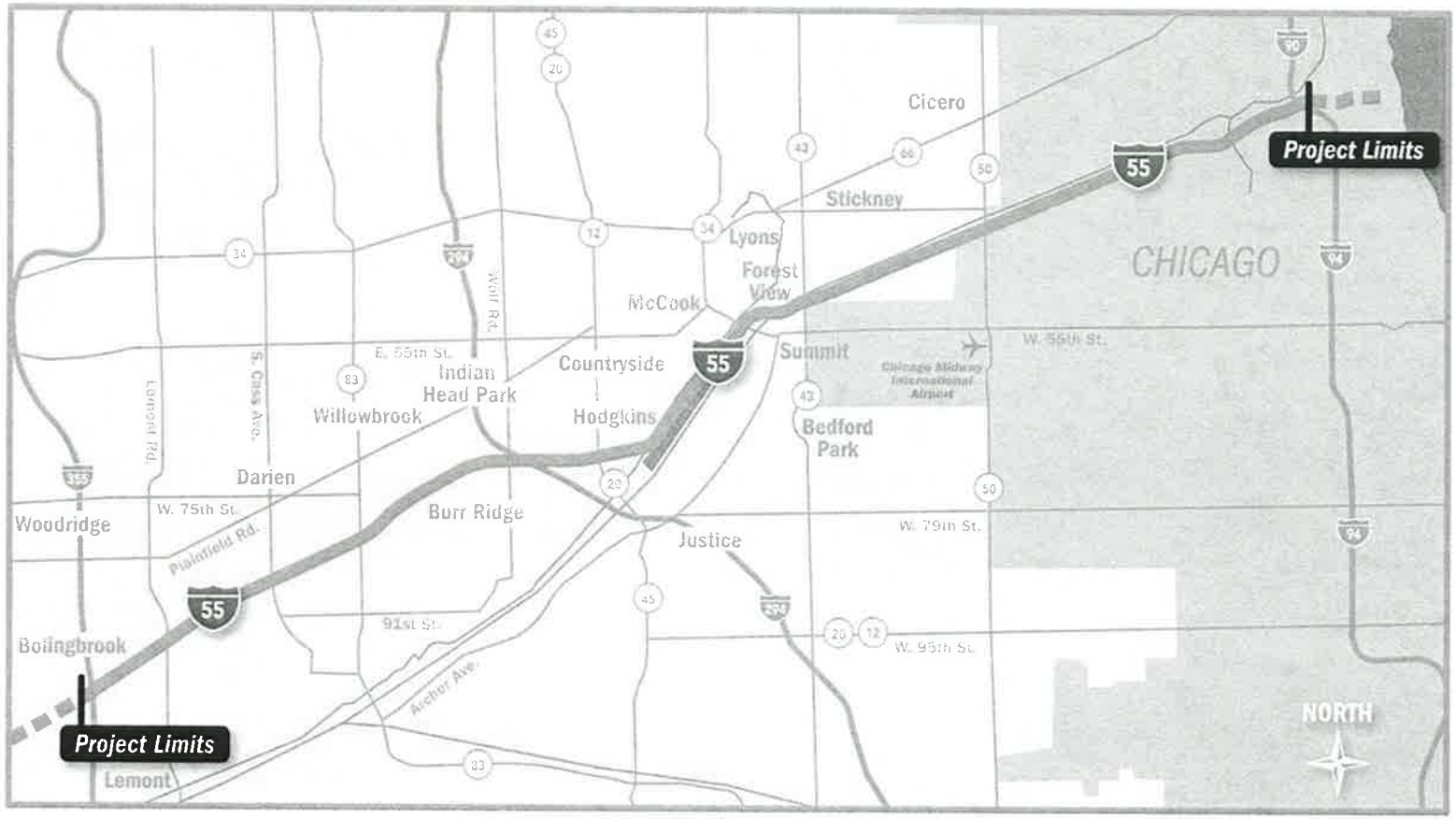
STANTEC CONSULTING SERVICES INC.

Dustin Book, P.E.
Transportation Engineer
135 S. LaSalle Street, Suite 3100
Chicago, IL 60603-4139
Tel: (312) 262-2233
Fax: (312) 262-2301
dustin.dook@stantec.com

Attachment: Location Map

bd \\us1254-f02\workgroup\1786\active\178600037_idot_i-55\civil\drainage\let_20121012_stantec_djb_drainage intro_template.docx

I-55 | MANAGED LANE PROJECT



Interstate 55 (Stevenson Expressway) extending from I-355 to I-90/94
Location Map

Stantec

October 12, 2012
Contact Listing:

Robert Mack
Drainage and Utilities Division Head
Cook County Highway Department
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Chicago, IL 60602-1369

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Director
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Stickney, IL 60402

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Commissioner
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1620 S. Laramie
Cicero, IL 60804

SECTION 20.A

2011 HLR HYDRAULIC REPORT EXCERPTS

Hydraulic Report

Joliet Road Bridge over Flagg Creek
Cook County
Section 430-B-BR-79

Prepared for:

Illinois Department of Transportation

Illinois Department of Transportation
201 West Center Court
Schaumburg, Illinois 60196-1096

Date: February 2011

Prepared by:

Hampton, Lenzini and Renwick, Inc.
Civil Engineers ▫ Structural Engineers ▫ Land Surveyors
380 Shepard Drive
Elgin, Illinois 60123

Contents

Illinois Department of Transportation

HYDRAULIC REPORT OUTLINE (HRO)

In order to facilitate a more efficient and timely approval of Hydraulic Reports, a "Hydraulic Report Outline" shall be prepared and submitted with each hydraulic project. This Outline shall be submitted to the District Hydraulic Engineer along with the Hydraulic Report to aid in review of the report.

If any deviations from the procedural steps below are necessary, they must be documented in the outline. Hydraulic Reports prepared by a Qualified District Hydraulic Engineer or under his supervision, are exempt from the HRO requirement. To facilitate Pump Station Hydraulic Report reviews, the Checklist and Data Sheets from the IDOT Drainage Manual, 13-303 and 13-304, will be used. The Data Sheets must be signed by the consultant's QA/QC person or the District Hydraulic Engineer.

1 SN 016-0393 (Existing); SN ____-____ (Proposed)

Route/Stream: Joliet Road / Flagg Creek

County: Cook

2 Prepared By: ☒ Consultant: Hampton, Lenzini and Renwick
☐ District ____

3 Chapter 2 of the IDOT Drainage ☒ Yes ☐ No
If no, explain ____

Completed checklist (2-701.02) must be attached.

4 Design Considerations:

a. Backwater limitations due to:
IDNR Individual or Floodway Permit ☒ Yes ☐ No
Sensitive Flood Receptor(s) ☒ Yes ☐ No

b. Does proposed average design velocity through the structure exceed natural channel velocities? ☐ Yes ☒ No

c. Is the clearance policy met? ☐ Yes ☒ No

d. Is the freeboard policy met? ☒ Yes ☐ No

5 Project scope (check all that apply):

a. ☐ Complete replacement.

b. ☒ Superstructure replacement.

c. ☐ Superstructure replacement and/or widening; Length of pier extension in the water, upstream ____ft., downstream ____ft.

d. ☒ Bridge ☐ Culvert

e. ☐ New alignment

f. Work planned below Q100 HWE: ☐ Yes ☒ No

6 Hydrology: ☐ USGS ☒ FIS ☐ Other ____
Gage data utilized? ☐ Yes ☒ No

7 WIT: Attached copy of all completed WIT(s) ☒ Yes ☐ No ____

Exhibit A
Hydraulic Report Outline

8. Modeling:
   a. ☒ HEC RAS ☐ WSPRO ☒ Other WSP2
   b. N-values estimated according to Chapter 5 of Drainage Manual? ☒ Yes ☐ No
   c. Source of starting WSE Flood Insurance Study, effective WSP2 model
   d. Non-IDOT encroachments in survey? ☒ Yes ☐ No
      If yes, are they accounted for? ☒ Yes ☐ No
   e. Tail water controls(s)? ☒ Yes ☐ No
      If yes, list: Flood Insurance Study, WSP2 model data
      Properly addressed? ☒ Yes ☐ No
   f. Expansion/Contraction cones addressed per Chapter 7 of Drainage Manual? ☒ Yes ☐ No
      If N/A, explain: _____

9. IDNR-OWR Permit: Drainage Area 13.3 sq. ☐ Rural; ☒ Urbanizing;
   Public Water or within Public Water boundaries ☐ Yes ☒ No
   Indicate Permit Type Required:
   a. Individual ☐
   b. Statewide #2 ☐
   c. Statewide #12 ☐
   d. Floodway ☒
   e. Other: _____
   f. None: ☐

10. Sensitive flood receptors ☒ Yes ☐ No
    Give type, elevations and locations: 8 commercial and 1 residential structures. See Exhibit I, Sensitive Flood Receptors for elevations and locations.
    History of flooding or overtopping problems: Yes ☐ No ☒
    Sources of observed highwater: IDOT

11. Scour/migration problems: ☒ None/minimal ☐ Significant ☐ Severe
    Comments: Existing concrete slope walls countermeasures present
    Ice/Debris concerns: None/minimal ☒ Significant ☐ Severe ☐
    Comments: Incidents of debris
    Countermeasures proposed: Maintain/repair the existing slopewalls

12. Deviations from the general procedures presented above and in Chapters 6 and 7 of the Drainage Manual: none
    (Attach supporting documents if necessary)

Prepared by: _____ Date: _____

Signed:
(QA/QC) _____ Date: _____

NARRATIVE

PROJECT DESCRIPTION

Joliet Road Bridge over Flagg Creek is located between I-55 and I-294 in the corporate limits of Village of Indian Head Park in Cook County (See Exhibit C, Location Map). The bridge is scheduled for the approach, abutments and pier to be elevated approximately 3 feet and replace the superstructure.

DESCRIPTION OF EXISTING STRUCTURE AND FLOODPLAIN

The exiting structure is a single pier, portland cement concrete open abutment bridge. The width of the structure is 92' with one 3' width pier and concrete slope walls located below the structure (See Exhibit M - Construction Plans – 1958, Exhibit O – Bridge Plan and Profile).

The FEMA flood insurance rate maps (FIRM) indicate that the floodplain and floodway are likely conveyed through the existing bridge, however the structure was never modeled as part of the existing hydraulic model. (See Exhibit L – FEMA Flood Insurance Study).

HISTORICAL OBSERVATIONS / RECORDS

USGS records indicate that the all time high water elevation at the structure was 635.7' in October 1954. The flood profile indicated that the structure had approximately 1' of head for this storm event. The structure was replaced in 1959.

IDOT District 1 Pavement Flooding List indicates that there is not a flood of record for this site.

DATUM CORRELATION

The survey for the Joliet Road Bridge and all necessary items including structures and cross sections were taken in NAVD88. The effective FEMA Flagg Creek WSP2 hydraulic model was created with a NGVD29 vertical datum. The WSP2 model was revised with surveyed data that was converted to NGVD29 so that the model remained consistent. The datum correlation from NGVD29 – 0.282 ft = NAVD88. The HEC-RAS model is on the NAVD88 datum. (See Exhibit G – Datum Correlation).

SENSITIVE FLOOD RECEPTOR

There are two structures associated with the Flagg Creek Water Reclamation District upstream of the Joliet Road Bridge over Flagg Creek (See Exhibit J, Project Overview and Cross Section Location). It appears that the buildings/structures could be a possible sensitive flood receptors according to the Flood Insurance Study Maps produced in 2008 with aerial background (See Exhibit L – FEMA Flood Insurance Study).

- Structure #1, Flagg Creek WRD (Sand Filter), located approximately 900' upstream, Low Elevation Opening = 644.16, Base Flood Elevation (HEC-RAS) = 634.94
- Structure #2, Flagg Creek WRD (Building), located approximately 450' upstream, Low Elevation Opening = 639.1, Base Flood Elevation (HEC-RAS) = 634.89

It should be noted that the lowest entry elevation is significantly higher than the 100-year regulatory water surface elevation. A list of the possible sensitive flood receptors and their low entry elevation can be found in the hydraulic report (See Exhibit I - Sensitive Flood Receptors)

Exhibit B1
Narrative

HYDROLOGIC METHODOLOGY

The effective discharges from the FEMA flood insurance studies were used in the hydraulic analysis of the natural, existing/proposed structure for both the HEC-RAS and WSP2 models (See Exhibit L – FEMA Flood Insurance Study).

HYDRAULIC METHODOLOGY

Several models were used to examine the hydraulic properties of the Joliet Road Bridge. The effective hydraulic model used the WSP2 software.

WSP2 Model

The effective WSP2 hydraulic model (See Exhibit R1 – Original WSP2 Model) was obtained from the Illinois Department of Transportation so the existing/proposed bridge could be modeled for the purpose of obtaining an IDNR-OWR floodway permit, if needed. The model was modified so that it could run in the latest version of WSP2 (See Exhibit R2 – Duplicate WSP2 Model), since the FLOW-FREQ command in the original model was not valid in this version of WSP2. The duplicate model is also considered a natural conditions model since the Joliet Road Bridge is not present.

The duplicate model was modified further to include the Joliet Road Bridge, including the roadway deck profile and channel cross section, that had previously not been hydraulically modeled (See Exhibit R4 – Existing Conditions WSP2 Model with Joliet Road Bridge). The Proposed Conditions WSP2 Model modified the existing conditions model with the proposed roadway profile and the bridges increased low beam elevation. The existing and proposed overtopping elevation was determined by survey of the roadway median, approximately 200' east of the bridge, which would perform similar to a weir.

HEC-RAS Model

A HEC-RAS model was created with only surveyed cross sections and was used to confirm the hydraulic data in a modern hydraulic model (See Exhibit R6 – Existing Conditions HEC-RAS Model). This model included the surveyed structure information, cross sections and datum correlation to NAVD88. The existing and proposed overtopping elevation was determined by survey of the roadway median, approximately 200' east of the bridge, which would perform similar to a weir. The upstream and downstream WSEL, based on FEMA flood profiles, were used to create boundary conditions for the HEC-RAS model. Manning's coefficients were input into the model based on onsite visual inspection of the project and aerial photography of the area.

Review of the surveyed cross sections found that manipulation of the model was necessary to improve accuracy. The ineffective flow areas were placed at a 1:1 upstream and a 3:1 downstream horizontal slope from the bridge face. The lagoons from the Flagg Creek Water Reclamation District (Section 3755) and the commercial development stormwater detention facility (Section 2542 and 2765) were made as permanent ineffective flow areas since the depressional areas would not convey water in flooding events. Levees were placed within the model to ensure that the channel would fill before overflow isolated depressional pockets within the floodplain. Contour data was supplemented when necessary if additional points were needed in the cross section data.

The following summarizes the assumptions were made in the HEC-RAS hydraulic modeling:

- The lagoons for the wastewater treatment facility are ineffective flow areas.
- Stormwater detention facilities are ineffective flow areas.
- Upstream ineffective contraction for the Joliet Road Bridge is 1:1
- Downstream ineffective expansion for the Joliet Road Bridge is 3:1
- Effective FEMA flows were used for the 10, 50, 100 and 500-year storm events
- Upstream and Downstream starting WSEL were taken from the Effective FEMA flood profiles.
- A series of levees were used to ensure that the Flagg Creek channel was the first to convey stormwater.
- Contour data was used to supplement overbank survey if needed.

SUMMARY OF NATURAL AND EXISTING HYDRAULIC ANALYSES

The WSP2 model indicated that approximately 0.8 feet of backwater was created by the Joliet Road Bridge over Flagg Creek for the base flood. The HEC-RAS model indicated that the existing bridge creates 0.15 feet of backwater for the base flood (See Exhibit E – Waterway Information Table). The existing conditions bridge created 0.10 ft (HEC-RAS) and 0.58 ft (WSP2) of backwater for the design storm event when compared to natural conditions. The existing structure has -1.32 feet of freeboard and 2.46 feet of clearance.

PROPOSED STRUCTURE ANALYSIS

The proposed Joliet Road Bridge over Flagg Creek low chord will be elevated 2.98 feet (See Exhibit O, Bridge Plan and Profile). The structure layout will remain unmodified but the approach and bridge profiles will be elevated (See Exhibit O, Proposed Bridge Plan and Profile)

This modification reduces the headwater created by the Joliet Road Bridge over Flagg Creek 0.15 feet for the 100-year HEC-RAS evaluation (0.76 feet for the 100-year WSP2 evaluation). The modification creates a greater waterway opening allowing for the passing of larger flood events. The proposed conditions bridge created 0.0ft(HEC-RAS) and 0.04ft(WSP2) of backwater for the design storm event when compared to natural conditions. The proposed structure has 1.66 feet of freeboard and 2.86 feet of clearance.

SCOUR ANALYSIS

Scour analysis indicates that contraction and scour may occur (See Exhibit H, Scour Evaluation). The existing slope wall countermeasure should remain in place. The 1954 Joliet Road Bridge construction plans indicated the center pier footing was placed at elevation 613.68 (613.96 NGVD29). Scour evaluation indicated:

Existing Conditions	Proposed Conditions
• 10-year storm event	• 10-year storm event
▪ Pier scour depth = 0.64 ft	▪ Pier scour depth = 0.64 ft
▪ Contraction scour depth = 3.83 ft	▪ Contraction scour depth = 3.83 ft
▪ Potential scour elevation = 618.53	▪ Potential scour elevation = 618.53
• 50-year storm event	• 50-year storm event
▪ Pier scour depth = 2.02 ft	▪ Pier scour depth = 1.92 ft
▪ Contraction scour depth = 4.38 ft	▪ Contraction scour depth = 4.39 ft
▪ Potential scour elevation = 616.60	▪ Potential scour elevation = 616.69
• 100-year storm event	• 100-year storm event
▪ Pier scour depth = 2.63 ft	▪ Pier scour depth = 2.46 ft
▪ Contraction scour depth = 4.63 ft	▪ Contraction scour depth = 4.66 ft
▪ Potential scour elevation = 615.74	▪ Potential scour elevation = 615.88

• 500-year storm event, ▪ Pier scour depth = 3.93 ft ▪ Contraction scour depth = 5.13 ft ▪ Potential scour elevation = 613.94	• 500-year storm event, ▪ Pier scour depth = 3.52 ft ▪ Contraction scour depth = 5.19 ft ▪ Potential scour elevation = 614.29

The potential scour is calculated from the channel lowpoint (623.0) on the downstream section. Analysis indicates that scour could be a potential issue for storm events above the 500-year.

During the field review and survey of the Joliet Road Bridge, it was noted that the outlet from the Flagg Creek Water Reclamation District's lagoons had created a scour. The outlet is approximately 70' north of the Joliet Road Bridge. The scour continues from the lagoon outlet to the NE corner of the bridge. This scour can be seen in the upstream bridge section (Exhibit O, Bridge Plan and Profile, Upstream Face) but not the downstream section.

COMPENSATORY STORAGE

Compensatory Storage was evaluated for the improvement to the Joliet Road Bridge over Flagg Creek. The proposed roadway cross sections indicated that no fill would be placed within the regulatory floodway. The increase in the bridge low beam elevation created 450 cubic yards of compensatory storage between the 10 and 100-year water surface elevations.

PERMIT REQUIREMENTS

A floodway permit will be necessary since the superstructure replacement is not considered maintenance (See Exhibit F – Permit Summary Form for Floodway Construction). A portion of the existing and proposed bridge superstructure replacement will be located below the 100-year water surface elevation. The floodway permit is satisfied since the backwater created by the structure is less than 0.1 feet and no compensatory storage is required for the project.

CONCLUSION

The proposed revised Joliet Road Bridge will lower the created backwater on Flagg Creek floodway since the waterway opening will be increased. The Joliet Road Bridge:

- Does not meet the clearance criteria (HEC-RAS model).
  - Low beam elevation = 635.52
  - 50-year natural highwater = 633.86
  - Clearance = 1.66 (less than 2 feet)
    - The proposed clearance was increased 2.98 feet compared to existing conditions
- Meets the freeboard criteria (HEC-RAS model).
  - Overtopping elevation = 636.72 (lowest edge of pavement from ramp profile, east of bridge)
  - 50-headwater elevation = 633.86
  - Freeboard = 2.86 feet (less than 3 feet)
    - The existing conditions had 2.46 feet of freeboard with an existing ramp elevation of 636.32 located 50' west of the bridge.

A design exemption will be required since the clearance and freeboard do not meet IDOT criterion.

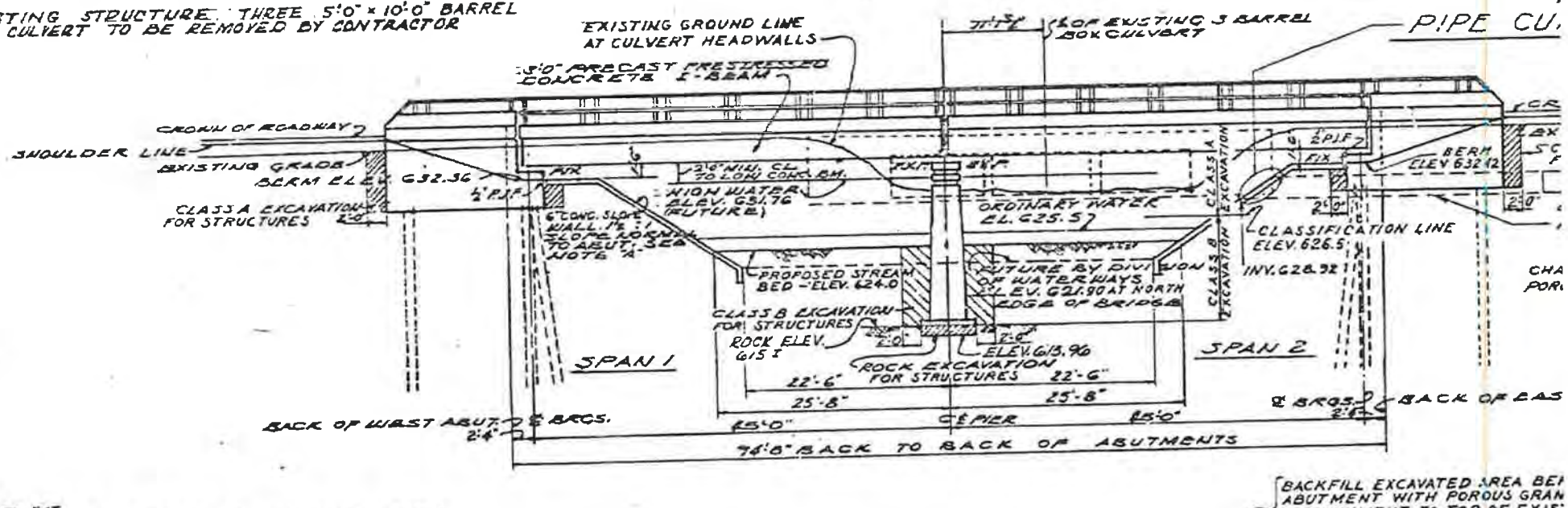
Exhibit J

Project Overview and Cross Section Location
Scale 1"=100'
Contour Interval = 2'
Aerial Photography Date = 2007

BM #78 - ELEVATION 632.66
'D' CUT IN S.E. CORNER AT EAST END OF NORTH HEADWALL OF EXISTING TRIPLE BOX CULVERT AT FLAG CREEK.

NOTE
BRIDGE TO BE CENTERED ON EXISTING ℄ OF U.S. ROUTE 66 AT STATION 46+10

EXISTING STRUCTURE: THREE 5'-0" x 10'-0" BARREL BOX CULVERT TO BE REMOVED BY CONTRACTOR

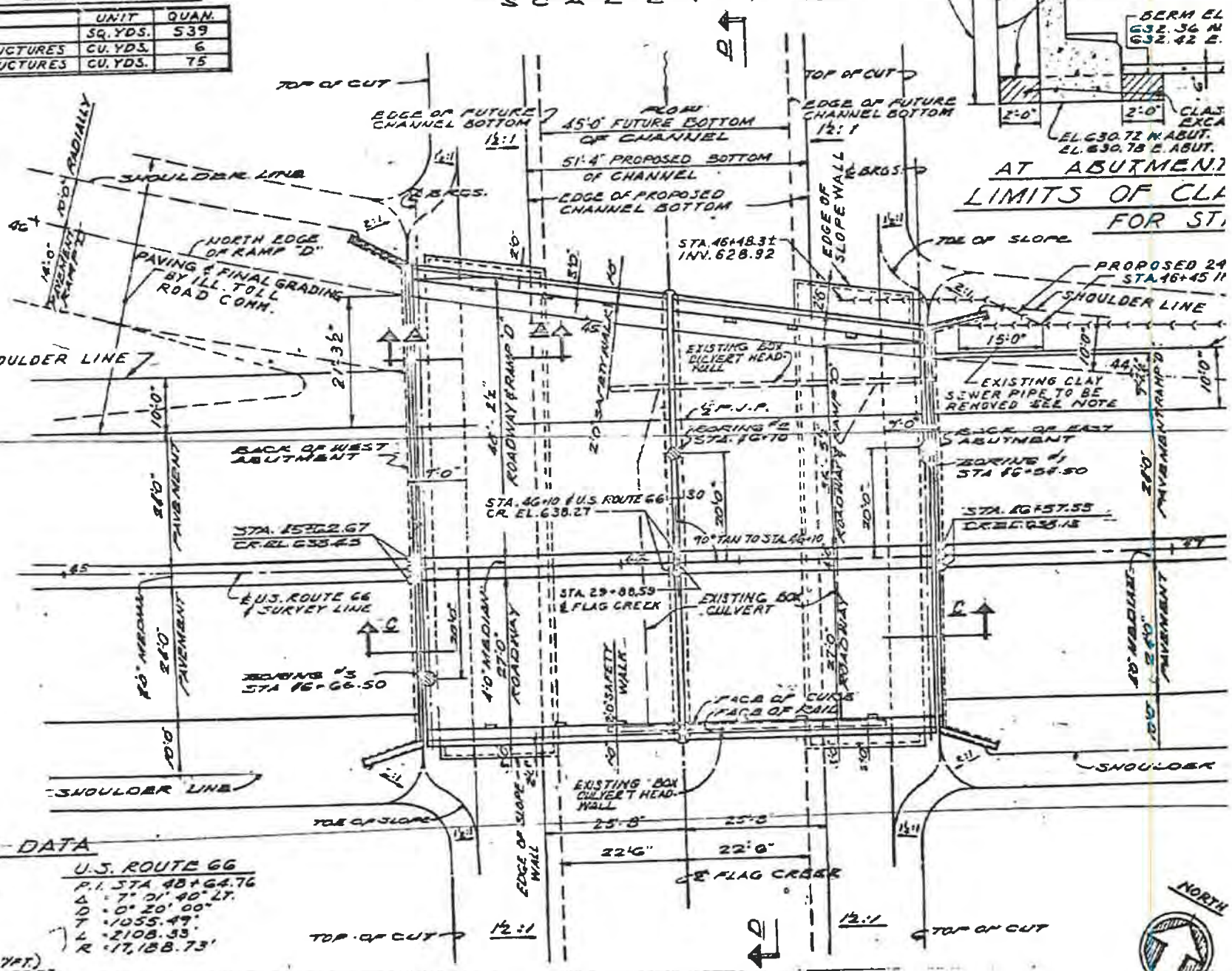


NOTE A
REINFORCE SLOPE WALLS WITH 6"x6"-#11 WELDED WIRE FABRIC WEIGHING APPROX. 60# PER 100 SQ. FT. LAP 6" AT SPLICES.

BILL OF MATERIALS - SLOPE WALL

ITEM	UNIT	QUAN.
SLOPE WALL	SQ. YDS.	539
CLASS A EXCAVATION FOR STRUCTURES	CU. YDS.	6
CLASS B EXCAVATION FOR STRUCTURES	CU. YDS.	75

ELEVATION
SCALE: 1" = 10'-0"



CURVE - DATA

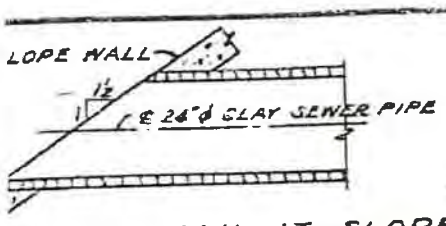
RAMP "D"
P.I. STA. 46+20.36
Δ = 25° 06' 42" RT.
D = 3° 30' 00"
T = 364.59'
L = 717.48'
R = 1637.02'
S.E. = 0.031 FT/FT (0.37% FT.)
S.E. ATTAINED STA. 42+55.77
TO STA. 43+76.72

U.S. ROUTE 66
P.I. STA. 48+64.76
Δ = 7° 01' 40" LT.
D = 0° 20' 00"
T = 1055.49'
L = 2108.33'
R = 17,188.73'

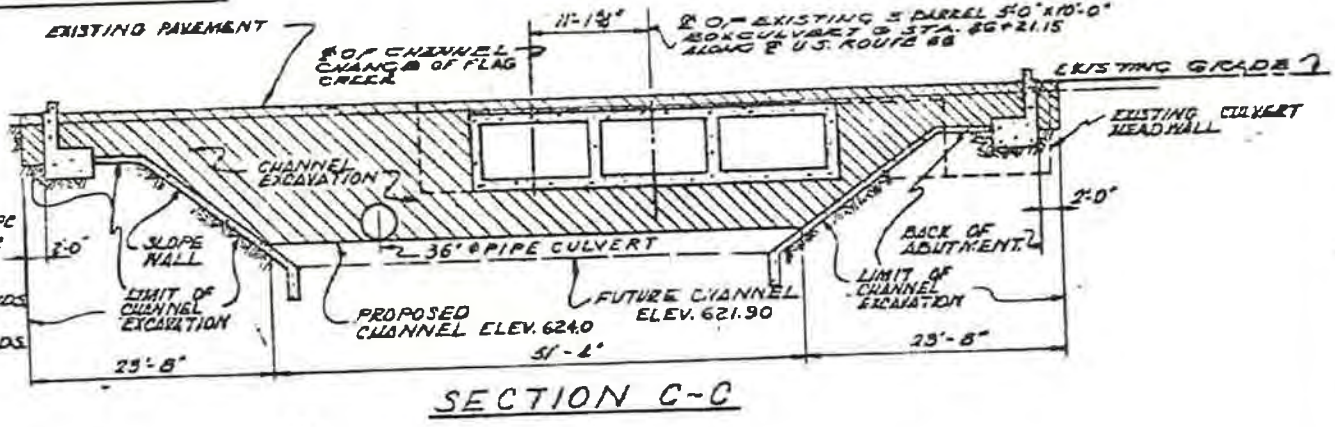
PLAN
SCALE 1" = 15'-0"

Exhibit M
Construction Plans - 1958

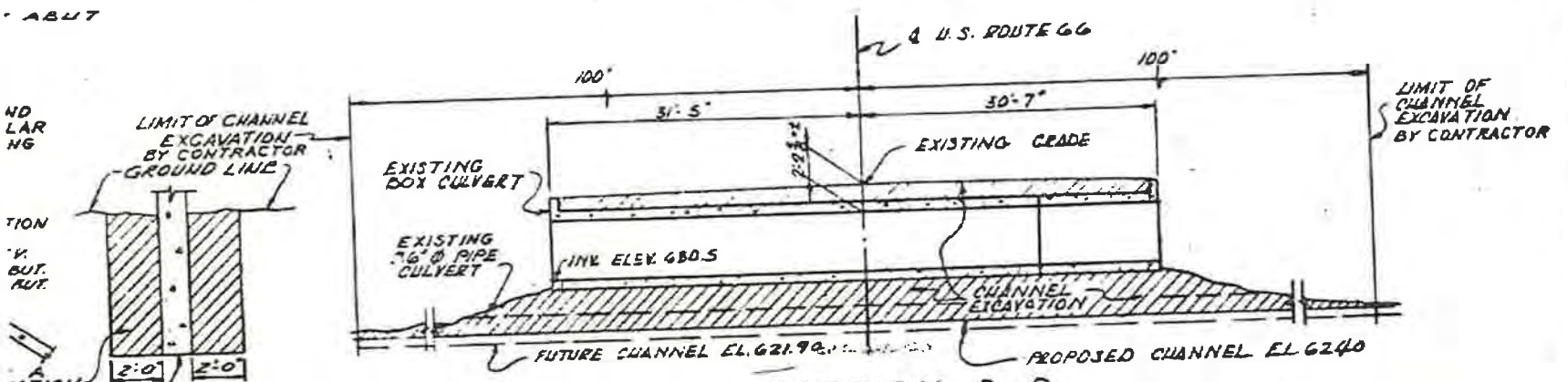
ROUTE NO	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
F.A. 98	20700101-28	COOK	24	2
STA.		TO STA.		
F.A.S. ROAD DIST. NO. 7	ILLINOIS	F.A. PROJECT		



OFF DETAIL AT SLOPE WALL



SECTION C-C



SECTION D-D

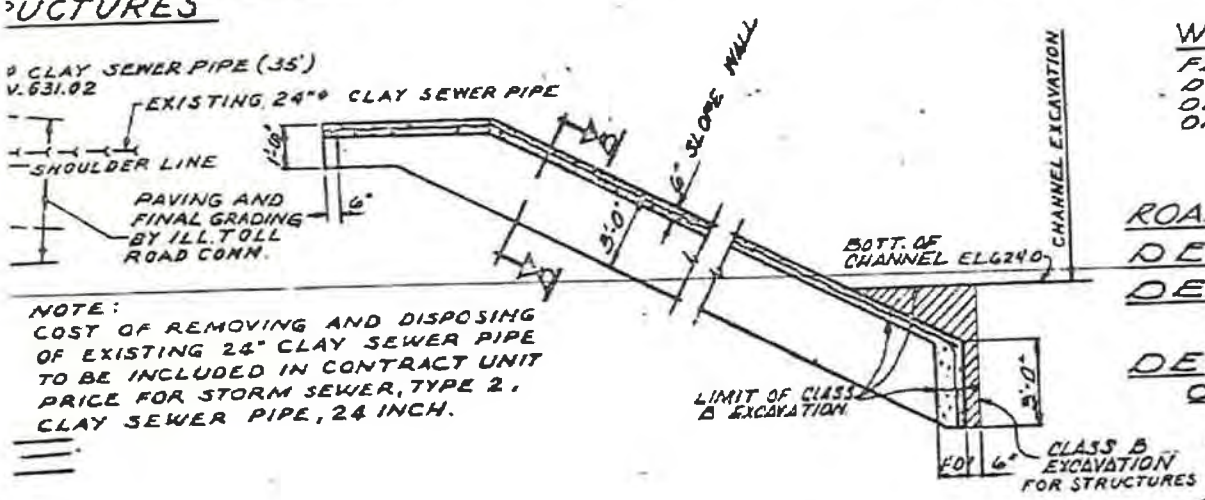
DETAILS OF CHANNEL EXCAVATION & LIMITS

SCALE 3/32"=1'-0"

AT WINGWALLS

SS A EXCAVATION

UCTURES



NOTE:
COST OF REMOVING AND DISPOSING OF EXISTING 24" CLAY SEWER PIPE TO BE INCLUDED IN CONTRACT UNIT PRICE FOR STORM SEWER, TYPE 2, CLAY SEWER PIPE, 24 INCH.

WATERWAY DATA:
FLOOD FREQUENCY--- 50 YEARS
DRAINAGE AREA ---- 13.9 SQ. MILES
OPENING REQUIRED--- 547 SQ. FT.
OPENING PROVIDED--- 561 SQ. FT.

ROAD CLASSIFICATION - A

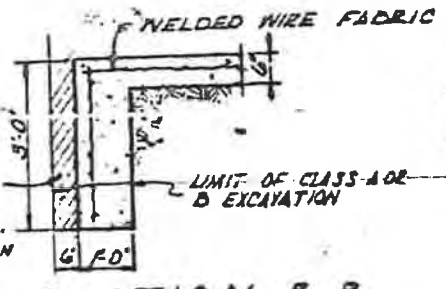
DESIGN SPEED - 70 M.P.H.

DESIGN LOAD
L.L. = H20-S16-44 ALTERNATE
FUTURE D.L. = ½" BIT. WEARING SURFACE

DESIGN STRESSES
CONCRETE (CAST IN PLACE)
f_c = 3500 LBS. PER SQ. IN.
f_c = 1800 LBS PER SQ. IN.
f_c = (WITH EARTH PRESSURE) 1000 LBS/SQ. IN.
V = (PIER FOOTING) 75 LBS. PER SQ. IN.
n = 10
PRESTRESSED CONCRETE
f_b = 5000 LBS PER SQ. IN.
f_{ci} = 4000 LBS PER SQ. IN.
f_c = 2000 LBS. PER SQ. IN.
REINFORCING STEEL
f_s = 20,000 LBS PER SQ. IN.
PRETENSIONING STEEL
f_{su} = 240,000 LBS PER SQ. IN.
f_{si} = 173,600 LBS PER SQ. IN.
FOUNDATION LOADS
ABUTMENTS = 35 TONS (CONCRETE PILES)
WINGWALLS = 10 TONS (TIMBER PILES)
PIER FOOTING = 8,000 LBS. PER SQ. FT.

SECTION A-A

SCALE 4'=1'-0"



SECTION B-B

SCALE 4'=1'-0"

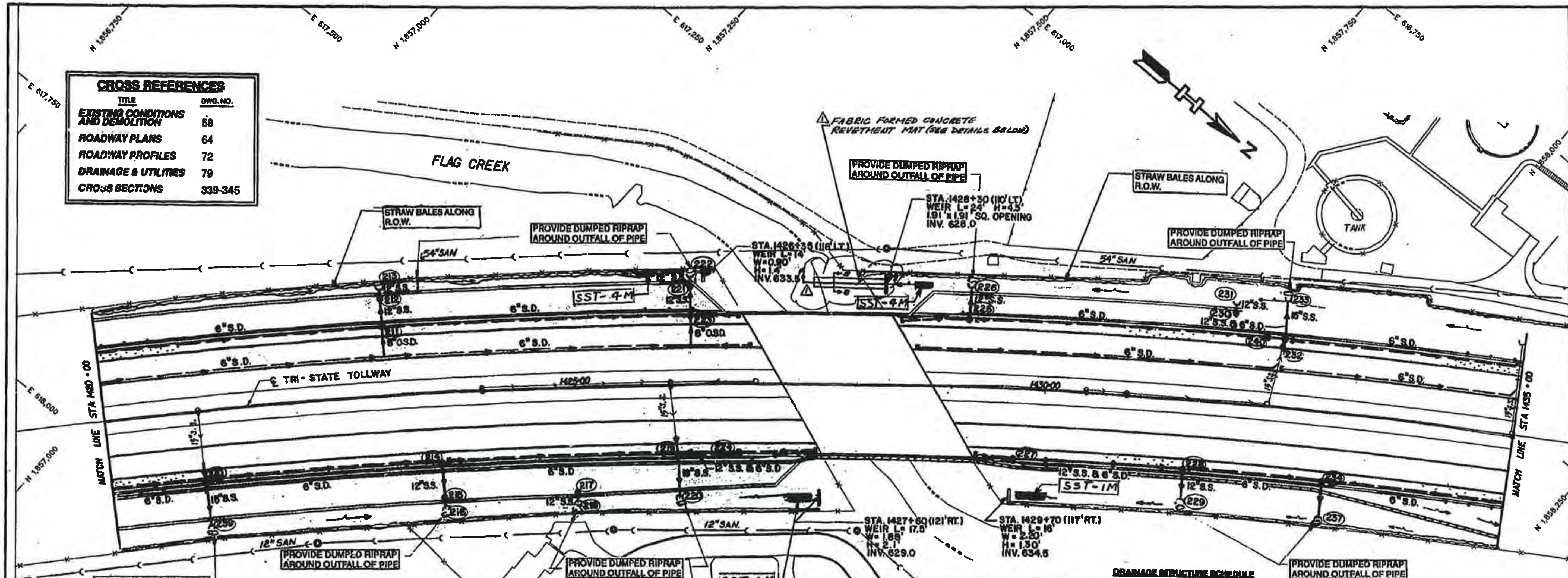
SEPT. 29 19-58

M. Bonine

ENGINEER OF BRIDGES & TRAFFIC STRUCTURES

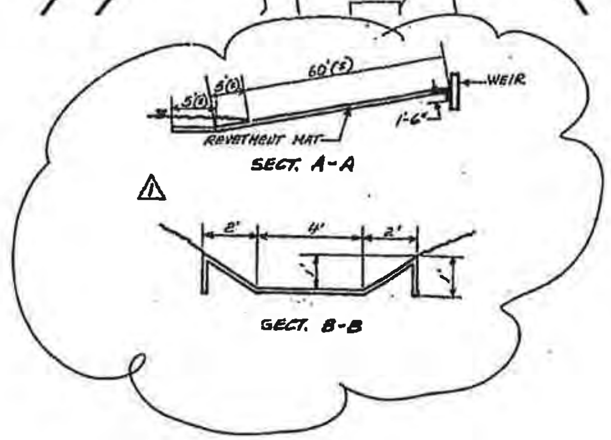
GENERAL PLAN & ELEVATION
U.S ROUTE 66
OVER
FLAG CREEK
F.A. ROUTE 98 SECTION 20700128
COOK COUNTY
STATION 86+10

ALFRED BENESCH & ASSOCIATES CONSULTING ENGINEERS
10 SOUTH WACKER DRIVE -387-2 CHICAGO - ILLINOIS



CROSS REFERENCES

TITLE	DWG. NO.
EXISTING CONDITIONS AND DEMOLITION	58
ROADWAY PLANS	64
ROADWAY PROFILES	72
DRAINAGE & UTILITIES	79
CROSS SECTIONS	339-345



STORM SEWER SCHEDULE

FROM	TO	LENGTH FEET	DIAMETER INCHES	STORM SEWER TYPE	UPSTREAM INVERT	DOWNSTREAM INVERT	SLOPE %
210	239	50	15	RCP	650.40	633.90	1.100 MIN.
211	212	30	12	RCP	651.00	641.80	1.500 MIN.
212	213	10	12	RCP	637.00	636.80	2.000
214	215	40	12	RCP	651.00	637.00	1.500 MIN.
215	216	10	15	RCP	632.75	632.70	0.500
217	218	10	12	RCP	631.00	630.80	2.000
219	220	52	18	RCP	644.70	630.40	0.500 MIN.
221	222	10	12	RCP	634.10	633.90	2.000
223	221	32	12	RCP	647.50	638.00	1.500 MIN.
224	219	64	12	RCP	644.70	644.25	0.703
226	225	32	12	RCP	644.50	630.50	1.500 MIN
227	228	175	12	RCP	641.85	638.60	1.208
228	229	27	12	RCP	638.40	638.00	1.500 MIN
230	231	10	12	RCP	633.10	633.00	1.000
232	233	35	15	BCCSP	640.10	633.70	1.100 MIN
234	237	26	12	RCP	639.20	638.60	0.729
240	232	20	12	RCP	640.30	640.20	0.500
E	232	20	15	RCP	MEET EXIST.	640.15	
SW	210	20	15	RCP	MEET EXIST.	650.40	
SW	219	20	15	RCP	MEET EXIST.	644.70	

DRAINAGE STRUCTURE SCHEDULE

STRUCTURE NUMBER	STRUCTURE TYPE	COVER	RIM EL.	INVERT ELEVATION		STATION - OFFSET
210	CB TYPE G-3	G-3	658.90	650.40 SW	650.40 NE	NB 1421+00 RG
211	CB TYPE G-3	G-3	656.30		651.00 SW	NB 1422+00 LG
212	INLET TYPE D-1	R-4342	647.67	641.80	637.00 SW	NB 1422+00 RW
213	SLOPED HDWL. TYPE I, 12"			636.80		NB 1422+00/114.4L
214	CB TYPE G-3	G-3	654.60		651.00 NE	NB 1422+50 RG
215	INLET TYPE D-1	R-4342	642.60	637.00 SW	632.75 NE	NB 1422+50 RW
216	SLOPED HDWL. TYPE I, 12"			632.70		NB 1422+50/122.4R
217	INLET TYPE D-1	R-4342	641.23	631.00 NE		NB 1423+00 RG
218	SLOPED HDWL. TYPE I, 12"			630.80		NB 1423+00/122.4R
219	CB TYPE G-3	G-3	651.10	644.70 NW	644.70 SAN	NB 1425+10 RG
220	SLOPED HDWL. TYPE I, 18"			630.40		NB 1425+10/123.5R
221	INLET TYPE D-1	R-4342	644.14	638.00 NE	634.10 SW	SB 1425+25 LG
222	SLOPED HDWL. TYPE I, 12"			633.90		SB 1425+25/114.4L
223	CB TYPE G-3	G-3	652.97		647.50 SW	SB 1425+55 LG
224	CB TYPE G-3	G-3	650.40	644.70 SE		NB 1425+75 RG
225	CB TYPE G-3	G-3	649.55	644.50 SW		SB 1429+50 LG
226	SLOPED HDWL. TYPE I, 12"			630.50		SB 1429+50/109.9L
227	CB TYPE G-3	G-3	647.06	641.85 NW		NB 1429+70 RG
228	CB TYPE G-3	G-3	644.95	638.60 NE	638.40 NE	NB 1431+50 RG
229	SLOPED HDWL. TYPE I, 12"			638.00		NB 1431+50/125.68R
230	INLET TYPE D-1	R-4342	640.78	633.10 SW		SB 1431+80/99L
231	SLOPED HDWL. TYPE I, 12"			633.00		SB 1431+80/108.9L
232	CB TYPE G-3	G-3	645.76	640.20 SE 640.15 NE	640.10 SW	SB 1432+50 LG
233	SLOPED HDWL. TYPE III, 15"			633.70		SB 1432+80/118.8L
234	CB TYPE G-3	G-3	643.46		639.20 NE	NB 1433+00 RG
237	SLOPED HDWL. TYPE I, 15"			638.60		NB 1433+00/118R
239	SLOPED HDWL. TYPE I, 15"			633.90		NB 1421+00/122.9R
240	CB TYPE G-3	G-3	645.93	640.20 NW		SB 1432+30 LG

ISSUED FOR CONSTRUCTION

DEC 17 1991

DRAWN . . . B. T.	DATE . . 10-16-91	BOWMAN, BARRETT & ASSOCIATES INC. CONSULTING ENGINEERS 320 NORTH MICHIGAN AVENUE SUITE 2200 CHICAGO, ILLINOIS 60601	THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY EAST-WEST TOLLWAY AND MIDWEST ROAD OAK BROOK, ILLINOIS 60521
CHECKED . . W. G.	SCALE 1" = 50'		

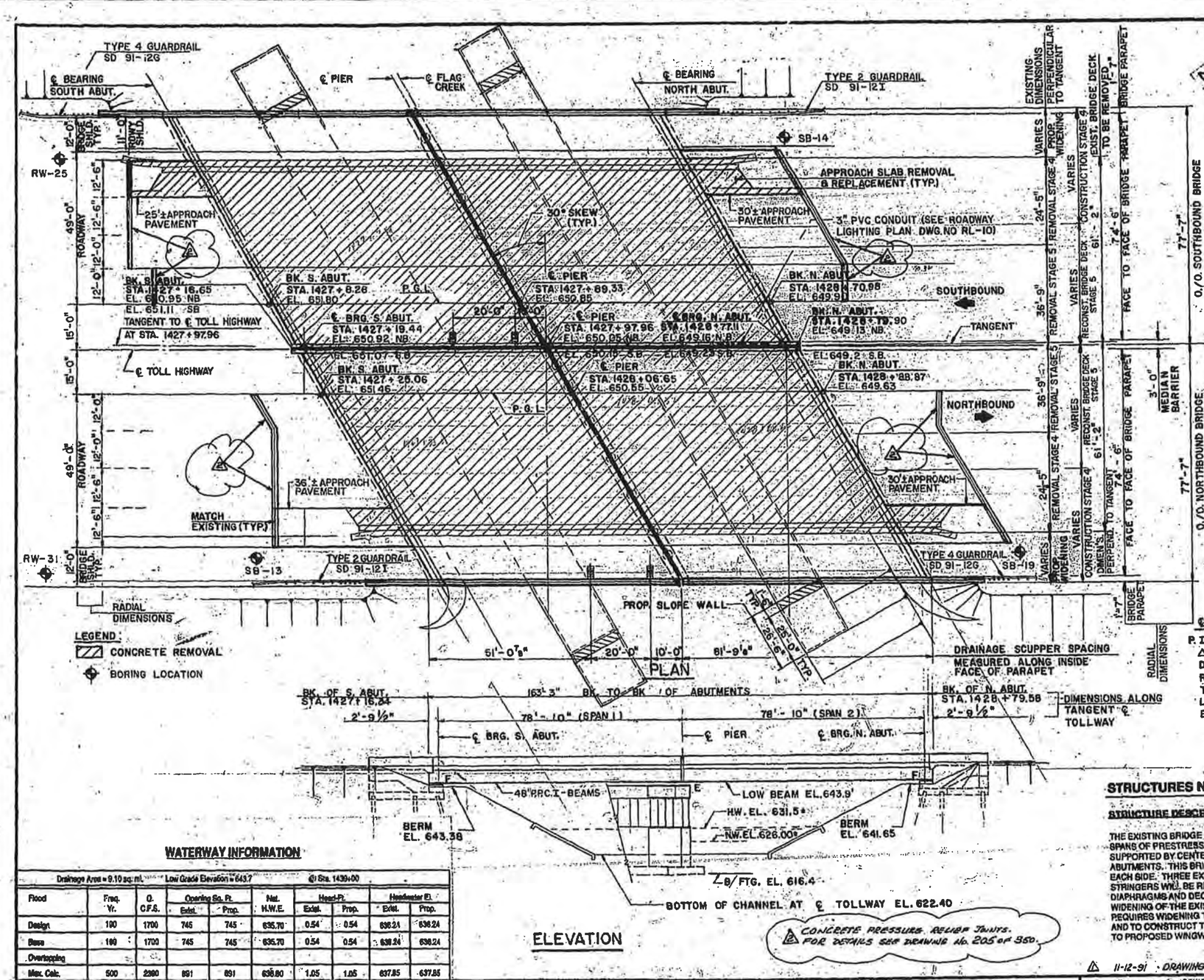
REVISIONS

NO.	DATE	DESCRIPTION
1	1-5-94	RECORD PLAN DRAWING

CONTRACT MIP-90-456 | DRAINAGE & UTILITIES | STATION 1420+00 TO 1435+00 | 79 - 350

Exhibit N
Construction Plans 1294 - 1994

016cut02.dgn



WATERWAY INFORMATION

Drainage Area = 9.10 sq. mi. Low Grade Elevation = 643.7 @ Sta. 1439+00

Flood	Freq. Yr.	Q. C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Net. H.W.E.	Head-Ft. Exist.	Head-Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
Design	100	1700	745	745	635.70	0.54	0.54	636.24	636.24
Base	100	1700	745	745	635.70	0.54	0.54	636.24	636.24
Overtopping									
Max. Calc.	500	2280	891	891	636.80	1.05	1.05	637.85	637.85

⚠ CONCRETE PRESSURE RELIEF JOINTS. FOR DETAILS SEE DRAWING No. 205 of 350.

⚠ 11-12-91 · DRAWING REISSUED

STRUCTURES NOS. 243 & 244

STRUCTURE DESCRIPTION

THE EXISTING BRIDGE CONSISTS OF TWO SKEWED SPANS OF PRESTRESSED PRECAST 48" I-BEAMS, SUPPORTED BY CENTER PIER AND PILE BENT ABUTMENTS. THIS BRIDGE WILL BE WIDENED 16'-5" ON EACH SIDE. THREE EXTERIOR ROWS OF EXISTING STRINGERS WILL BE REMOVED AND REPLACED WITH DIAPHRAGMS AND DECK SLAB ON EACH SIDE. THE WIDENING OF THE EXISTING SUPERSTRUCTURE REQUIRES WIDENING THE EXISTING PIER, ABUTMENTS AND TO CONSTRUCT THE RETAINING WALLS ATTACHED TO PROPOSED WINGWALLS.

MAJOR ITEM OR WORK

REMOVAL AND DISPOSAL OF THE ENTIRE EXISTING DECK AND SOME OF THE EXISTING PRESTRESSED PRECAST CONCRETE GIRDERS AND DIAPHRAGMS. WIDENING AND REHABILITATION OF EXISTING SUBSTRUCTURES INCLUDING SLOPE WALLS. WIDENING AND RECONSTRUCTION OF THE DECK INCLUDING PARAPETS.
MAINTENANCE OF TRAFFIC.

TRAFFIC STAGING

THE BRIDGE WILL BE RECONSTRUCTED IN STAGES. THREE LANES OF TRAFFIC SHALL BE MAINTAINED IN BOTH DIRECTIONS AT ALL TIMES.

ISSUED FOR CONSTRUCTION
DEC 17 1991

S-1 OF S-31

DRAWN ..... I.M.G. .....
CHECKED ..... R.F. .....
DATE ..... 9/16/91 .....
SCALE ..... N.T.S. .....

BOWMAN, BARRETT & ASSOCIATES INC.
CONSULTING ENGINEERS
200 SOUTH MICHIGAN AVENUE SUITE 1000 CHICAGO, ILLINOIS 60604

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
EAST-WEST TOLLWAY AND MIDWEST ROAD
OAK BROOK, ILLINOIS 60521

NO.	DATE	REVISIONS DESCRIPTION
⚠	11-12-91	ADDENDUM NO.1
⚠	1-19-91	RECORD PLAN DRAWING

CONTRAC... IMP-90-...
TRI-STATE TOLLWAY OVER FLAG CREEK
GENERAL PL...

HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: Flagg Creek
Project File : FlaggCreek.prj
Run Date and Time: 5/6/2010 7:35:46 AM

Project in English units

PLAN DATA

Plan Title: Flagg I-294 to I-55 Revised
Plan File : p:\2009\090111\Work Order 1 - Joliet-Flagg Creek\docs\drainage\Calculations\HEC-RAS\FlaggCreek.p02

Geometry Title: Flagg I-294 to I-55 Revised
Geometry File : p:\2009\090111\Work Order 1 - Joliet-Flagg Creek\docs\drainage\Calculations\HEC-RAS\FlaggCreek.g01

Flow Title : Flagg Creek - FEMA
Flow File : p:\2009\090111\Work Order 1 - Joliet-Flagg Creek\docs\drainage\Calculations\HEC-RAS\FlaggCreek.f01

Plan Summary Information:

Number of:	Cross Sections	= 13	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 2	Lateral Structures	=	0

Computational Information

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

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

FLOW DATA

Flow Title: Flagg Creek - FEMA
Flow File : p:\2009\090111\Work Order 1 - Joliet-Flagg Creek\docs\drainage\Calculations\HEC-RAS\FlaggCreek.f01

Flow Data (cfs)

River	Reach	RS	10-year	50-year	100-year	500-year
Flagg Creek	I-294 to I-55	4240	1260	2000	2400	3350

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Flagg Creek	I-294 to I-55	10-year	Known WS = 633.5	
Flagg Creek	I-294 to I-55	50-year	Known WS = 635.2	

Exhibit R6
Existing Conditions
HEC-RAS Model

Flagg Creek	I-294 to I-55	100-year	Known WS = 635.9	Known WS = 633.6
Flagg Creek	I-294 to I-55	500-year	Known WS = 637	Known WS = 634.7

GEOMETRY DATA

Geometry Title: Flagg I-294 to I-55 Revised
Geometry File : p:\2009\090111\Work Order 1 - Joliet-Flagg Creek\docs\drainage\Calculations\HEC-RAS\FlaggCreek.g01

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 4240

INPUT
Description: Surveyed Cross Section
Just Downstream of I-294
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
943.02	647.412	943.48	640.344	963.35	633.911	971.53	631.283	985.77	625.018
989.08	624.043	1000	623.49	1013.98	623.654	1017.05	624.678	1034.49	624.84
1053.07	633.246	1060.13	633.409	1069	633.187	1083.3	633.804	1093.69	633.873
1108.87	633.761	1176.51	633.478	1245.68	635.723	1246.42	634.241	1280.74	634.556
1340.09	635.013	1406.16	635.549	1469.2	635.767	1507.24	635.917	1508.17	636.574
1531.03	636.89								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
943.02	.1	963.35	.035	1053.07	.1	1246.42	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
963.35	1053.07	485	485	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1129.87	1531.03		F

Right Levee Station= 1245.69 Elevation= 635.72

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3755

INPUT
Description: Surveyed Cross Section
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
855.03	636.316	865.76	637.331	889.54	637.627	916.42	635.116	951.87	633.76
980.21	624.746	1000	622.109	1020.69	624.438	1033.51	632.917	1042.98	633.232
1044.37	633.199	1055.07	632.903	1084.42	630.058	1134.63	628.059	1184.29	627.801
1226.86	627.254	1288.87	627.235	1329.26	627.215	1374.09	629.294	1405.91	633.702
1441.25	636.583	1499.51	638.633	1570.41	639.073				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
855.03	.1	951.87	.035	1033.51	.1	1084.42	.025	1441.25	.025
1499.51	.1								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
951.87	1033.51	375	375	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1042.98	1570.41	633.25	T

Right Levee Station= 1042.98 Elevation= 633.232

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3380

INPUT
Description: Survey Cross Section
North ROW of Joliet Road
Station Elevation Data num= 16

Exhibit R6
Existing Conditions
HEC-RAS Model

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
891.4	636	932.57	634.184	944.5	629.132	949.28	625.111	958.01	622.816
977.15	622.471	1000	622.319	1016.57	632.3	1019.06	632.586	1025.27	633.14
1067.43	633.486	1084.68	633.627	1162.07	634.615	1240.18	635.884	1317.76	636.687
1395.69	637.077								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
891.4	.1	944.5	.035	1025.27	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
932.57	1025.27	53	53	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1139.1	1395.69		F

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3327

INPUT
Description: Surveyed Cross Section
Upstream Face of Joliet Road
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
934.62	636	958.05	635.351	978.68	626.551	989.65	622.889	1000	622.043
1015.72	623.677	1025.86	624.995	1030.13	625.714	1032.24	627.688	1048.55	631.47
1075.72	632.828	1115.14	633.565	1162.6	633.736	1234.96	635.425	1368.96	640

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
934.62	.1	978.68	.035	1048.55	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
958.05	1048.55	39	39	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
934.62	954.07	637.5	F
1046.13	1368.96	637.5	F

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3288

INPUT
Description: Upstream Face of the Joliet Road Bridge
The chanel section was
adjusted for the 7.3 degree skew.
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
685.5	637.76	737.35	637.44	788.63	637.47	839.46	637.56	896.59	637.62
956.66	636.4	956.66	631	961.61	630.7	979.96	621.3	984.13	622.3
993.06	622.7	1000	624.3	1015.28	624.2	1025.59	624.7	1038.49	630.7
1043.35	631	1043.35	636.3	1100.87	637.92	1150.18	638.15	1200.49	638.4
1252.04	638.69	1304.98	639.05	1357.01	639.61	1409.21	640.35		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
685.5	.035	956.66	.035	1043.35	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
956.66	1043.35	82	82	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
685.5	956.66	637.5	F
1043.35	1409.21	637.75	F

Skew Angle = 7.3

BRIDGE

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3245

INPUT

```
Description:
Distance from Upstream XS =       1
Deck/Roadway Width        =      80
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      15
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   685.5  637.76          737.35  637.44          788.63  637.47
  839.46  637.56          896.59  637.62          954.07  637.48  632.98
    1000  637.75  632.76 1046.13  637.74  632.54 1100.87  637.92
 1150.18  638.15         1200.49   638.4         1252.04  638.69
 1304.98  639.05         1357.01  639.61         1409.21  640.35

Upstream Bridge Cross Section Data
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
  956.66   636.4  956.66     631  961.61   630.7  979.96   621.3  984.13   622.3
  993.06   622.7    1000   624.3 1015.28   624.2 1025.59   624.7 1038.49   630.7
 1043.35     631 1043.35   636.3 1100.87  637.92 1150.18  638.15 1200.49   638.4
 1252.04  638.69 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035  956.66    .035 1043.35    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        956.66 1043.35           .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5  956.66   637.5       F
 1043.35 1409.21  637.75       F
Skew Angle = 7.3

Downstream  Deck/Roadway Coordinates
    num=      15
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   685.5  637.76          737.35  637.44          788.63  637.47
  839.46  637.56          896.59  637.62          954.07  637.48  632.98
    1000  637.75  632.76 1046.13  637.74  632.54 1100.87  637.92
 1150.18  638.15         1200.49   638.4         1252.04  638.69
 1304.98  639.05         1357.01  639.61         1409.21  640.35

Downstream Bridge Cross Section Data
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   685.5  637.76  737.35  637.44  788.63  637.47  839.46  637.56  896.59  637.62
   956.8   637.1   956.8   631.1   961.3   630.9   974.3   625.4   983.2   625.4
  1000.2     623    1005   624.2  1025.3   624.1  1038.3   630.9  1043.3   631.7
  1043.3   636.7 1100.87  637.92 1150.18  638.15 1200.49   638.4 1252.04  638.69
 1304.98  639.05 1357.01  639.61 1409.21  640.35

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   685.5    .035   956.8    .035  1043.3    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
         956.8  1043.3           .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   685.5   956.8   637.5       F
  1043.3 1409.21  637.75       F

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

Number of Piers =  1

Pier Data
Pier Station     Upstream=    1000    Downstream=    1000
Upstream     num=       2
    Width   Elev    Width   Elev
        3    620        3  632.98
Downstream     num=       2
```


Exhibit R6
Existing Conditions
HEC-RAS Model

Width	Elev	Width	Elev
3	620	3	632.98

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

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

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3206

INPUT
Description: Downstream Face of Joliet Road Bridge
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
685.5	637.76	737.35	637.44	788.63	637.47	839.46	637.56	896.59	637.62
956.8	637.1	956.8	631.1	961.3	630.9	974.3	625.4	983.2	625.4
1000.2	623	1005	624.2	1025.3	624.1	1038.3	630.9	1043.3	631.7
1043.3	636.7	1100.87	637.92	1150.18	638.15	1200.49	638.4	1252.04	638.69
1304.98	639.05	1357.01	639.61	1409.21	640.35				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
685.5	.035	956.8	.035	1043.3	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
956.8	1043.3	58	58	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
685.5	956.8	637.5	F
1043.3	1409.21	637.75	F

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 3148

INPUT
Description: Surveyed Cross Section
Downstream Face of Joliet Road
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
718.1	634.99	727.55	634.439	728.22	634.025	729.09	634.056	765.83	634.321
815.81	635.28	854.35	636.521	854.94	636.328	856	636.417	865.25	636.464
876.37	636.435	877.36	636.392	877.96	636.571	915.13	636.548	953.12	635.36
961.25	634.658	971.9	628.969	975.59	624.863	979.02	624.082	1000	622.988
1029.42	624.774	1032.82	626.596	1049.64	635.605	1070.41	640		

Manning's n Values num= 2

Sta	n Val	Sta	n Val
718.1	.013	953.12	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
953.12	1049.64	67	67	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
718.1	954.07	637.5	F
1046.13	1070.41	637.5	F

Left Levee Station= 915.13 Elevation= 636.548

CROSS SECTION

RIVER: Flagg Creek

Exhibit R6
Existing Conditions
HEC-RAS Model

REACH: I-294 to I-55 RS: 3081

INPUT
Description: Surveyed Cross Section
South ROW of Joliet Road
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
700.12	635.213	715.59	635.15	735.43	635.461	767.31	635.449	817.37	635.27
849.72	635.974	850.32	635.78	851.31	635.845	861.89	636.024	872.17	635.891
873.24	635.837	873.77	636.034	907.47	636.397	939.2	636.187	941.74	635.886
956.98	633.907	973.01	627.756	975.66	624.761	985.89	623.489	1000	623.264
1023.58	623.869	1027.81	624.827	1060.6	640	1070.47	640	1145.38	638
1212.12	640								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
700.12	.013	939.2	.035	1060.6	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
939.2	1060.6	316	316	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
700.12	913.07		F
1087.13	1212.12		F

Left Levee Station= 907.47 Elevation= 636.397

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 2765

INPUT
Description: Surveyed Cross Section
Approximatley 450' Downstream
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
716.52	634.71	725.473	633.61	757.57	635.078	801.99	635.575	837.63	635.143
852.74	633.931	856.99	633.503	857.56	633.302	858.55	633.354	868.9	633.369
879.37	633.365	881.01	633.481	905.23	633.742	932.95	633.777	933.78	633.764
964.28	633.109	975.88	624.879	977.62	624.631	1000	623.299	1013.14	623.352
1021.19	624.989	1027.01	628.729	1036.7	632.295	1061.92	632.69	1082.27	629.198
1096.47	629.329	1118.4	634.385	1119.8	637.943	1135.48	638.26		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
716.52	.013	964.28	.035	1036.7	.1	1061.92	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
964.28	1036.7	223	223	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1061.92	1135.48	632.69	T

Left Levee Station= 801.99 Elevation= 635.58

CROSS SECTION

RIVER: Flagg Creek
REACH: I-294 to I-55 RS: 2542

INPUT
Description: Surveyed Cross Section
Approximatly 670' Downstream
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
718.48	638	722.68	634	742.28	633.429	765.89	632.763	775.21	629.851
804.17	628.408	842.1	628.598	864.81	634.4	865.66	634.506	866.87	634.656
867.4	634.463	868.39	634.553	878.45	634.629	890.05	634.609	890.87	634.544
891.56	635.027	895.89	635.295	896.81	634.798	897.62	634.844	931.16	635.029
932.49	634.773	942.56	632.614	952.68	626.51	954.07	624.809	959.68	623.62
975.7	623.167	990.36	623.587	1000	620.992	1001.9	623.468	1012.76	632
1028.26	632.995	1039.67	636.779	1043.28	637.063	1060.18	637.19	1091.44	636.739
1133.41	638.407	1152.48	638.552						

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
718.48	.035	864.81	.013	897.62	.1	931.16	.035	1028.26	.1
1039.67	.013								

Exhibit R6
Existing Conditions
HEC-RAS Model

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        931.16 1012.76              396     396     396             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  718.48  866.87 634.656       T
Left Levee      Station=  931.16      Elevation= 635.029

CROSS SECTION


RIVER: Flagg Creek
REACH: I-294 to I-55      RS: 2146

INPUT
Description: Surveyed Cross Section
Approximatly 1100'
             Downstream
Approximatly Section K-K from Original WSP2 Model
Station Elevation Data    num=      27
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
  784.86      646  791.46      634  803.26 633.583  809.05   633.64  848.34   633.72
  876.46 633.444  889.29 633.439  891.55 633.433  911.87 633.398   913.9 633.258
  919.04   633.03   953.2   633.66  966.79 631.736   979.4 624.095  994.43 622.149
    1000 621.933 1009.15 621.978 1016.18 624.145  1020.4 626.269 1033.14 630.792
 1104.24 631.928  1161.1  632.77 1212.24 633.797 1238.02 635.952 1249.88 636.399
  1262.7 636.198 1266.91 636.276

Manning's n Values        num=       7
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  784.86    .035  876.46    .013  911.87    .035   953.2      .1  966.79    .035
  1020.4      .1 1033.14    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         953.2 1033.14              384     384     384             .1       .3

CROSS SECTION


RIVER: Flagg Creek
REACH: I-294 to I-55      RS: 1762

INPUT
Description: Copy of Surveyed Cross Section
Approximatly Upstream Face of 70th
             Place Bridge
Adjusted to Stream Survey point
Station Elevation Data    num=       9
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
  776.25      650  844.45      630  860.45      632   962.7  627.03   986.3  619.49
  1007.1  621.09  1046.6  626.69 1085.75      634 1297.25      636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  776.25    .035   962.7    .035  1046.6    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         962.7  1046.6              34      34      34             .1       .3

BRIDGE


RIVER: Flagg Creek
REACH: I-294 to I-55      RS: 1744

INPUT
Description:
Distance from Upstream XS =     2.5
Deck/Roadway Width        =      28
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  776.25      650          844.45      630          860.45      632
  956.15   633.09           962.7   633.15      628    1000   633.32      628
 1043.85   633.55      628  1046.6    633.6      628 1085.75      634
 1297.25      636

Upstream Bridge Cross Section Data
```

```
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  776.25     650  844.45     630  860.45     632   962.7  627.03   986.3  619.49
  1007.1  621.09  1046.6  626.69 1085.75     634 1297.25     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  776.25    .035   962.7    .035  1046.6    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
          962.7  1046.6             .1      .3

Downstream  Deck/Roadway Coordinates
    num=       10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  776.25     650          844.45     630          860.45     632
  956.15  633.09           962.7  633.15     628    1000  633.32     628
 1043.85  633.55     628  1046.6   633.6     628 1085.75     634
 1297.25     636

Downstream Bridge Cross Section Data
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  776.25     650  844.45     630  860.45     632   962.7  627.03   986.3  619.78
  1007.1  621.09  1046.6  626.69 1085.75     634 1297.25     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  776.25    .035   962.7    .035  1046.6    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
          962.7  1046.6             .1      .3

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

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

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

CROSS SECTION


RIVER: Flagg Creek
REACH: I-294 to I-55      RS: 1728

INPUT
Description: Approximatly Downstream Face of 70th Place Bridge
Adjusted to
            Stream Survey point
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  776.25     650  844.45     630  860.45     632   962.7  627.03   986.3  619.78
  1007.1  621.09  1046.6  626.69 1085.75     634 1297.25     636

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  776.25    .035   962.7    .035  1046.6    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          962.7  1046.6              860     880     860             .1      .3
```


Exhibit R6
Existing Conditions
HEC-RAS Model

SUMMARY OF MANNING'S N VALUES

River:Flagg Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
I-294 to I-55	4240	.1	.035	.1	.013			
I-294 to I-55	3755	.1	.035	.1	.025	.025	.1	
I-294 to I-55	3380	.1	.035	.035				
I-294 to I-55	3327	.1	.035	.035				
I-294 to I-55	3288	.035	.035	.035				
I-294 to I-55	3245	Bridge						
I-294 to I-55	3206	.035	.035	.035				
I-294 to I-55	3148	.013	.035					
I-294 to I-55	3081	.013	.035	.035				
I-294 to I-55	2765	.013	.035	.1	.035			
I-294 to I-55	2542	.035	.013	.1	.035	.1	.013	
I-294 to I-55	2146	.035	.013	.035	.1	.035	.1	.035
I-294 to I-55	1762	.035	.035	.035				
I-294 to I-55	1744	Bridge						
I-294 to I-55	1728	.035	.035	.035				

SUMMARY OF REACH LENGTHS

River: Flagg Creek

Reach	River Sta.	Left	Channel	Right
I-294 to I-55	4240	485	485	485
I-294 to I-55	3755	375	375	375
I-294 to I-55	3380	53	53	53
I-294 to I-55	3327	39	39	39
I-294 to I-55	3288	82	82	82
I-294 to I-55	3245	Bridge		
I-294 to I-55	3206	58	58	58
I-294 to I-55	3148	67	67	67
I-294 to I-55	3081	316	316	316
I-294 to I-55	2765	223	223	223
I-294 to I-55	2542	396	396	396
I-294 to I-55	2146	384	384	384
I-294 to I-55	1762	34	34	34
I-294 to I-55	1744	Bridge		
I-294 to I-55	1728	860	880	860

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Flagg Creek

Reach	River Sta.	Contr.	Expan.
I-294 to I-55	4240	.1	.3
I-294 to I-55	3755	.1	.3
I-294 to I-55	3380	.1	.3
I-294 to I-55	3327	.1	.3
I-294 to I-55	3288	.1	.3
I-294 to I-55	3245	Bridge	
I-294 to I-55	3206	.1	.3
I-294 to I-55	3148	.1	.3
I-294 to I-55	3081	.1	.3
I-294 to I-55	2765	.1	.3
I-294 to I-55	2542	.1	.3
I-294 to I-55	2146	.1	.3
I-294 to I-55	1762	.1	.3
I-294 to I-55	1744	Bridge	
I-294 to I-55	1728	.1	.3

Exhibit R6
Existing Conditions
HEC-RAS Model

SECTION 20.B

ISWS NOTES

Flag Creek near 72nd St. / FIS 2000-2007 cross-section I

(Indian Woods Unit 2 and Flagg Creek Townhomes, Village of Indian Head Park)

The effective FIS profile and FIRM mapping from appx FIRM/ FIS 2000 XS H to appx Interstate 55 (I-55), which includes 72nd St and FIS XS I*, is from LOMR 95-05-121P (6/26/1995) and overlapping LOMR 00-05-007P (2/3/2000).

The effective model(s) associated with these revisions are not included with the LOMRs on the FEMA Engineering Study Data Package (ESDP) CD 200105003A archive for the Cook County FIS 2000 countywide revision.

THE EFFECTIVE MODELS IN THIS REACH ARE NOT ON FILE AT ISWS.

Source models:

The documentation provided with LOMR 95-05-121P on the ESDP does not explicitly identify a model run. LOMR case number 95-05-121P was a follow-up to CLOMR 91-05-030R (1/27/1992), and also was processed originally as case number 94-05-259P, which was dropped for administrative reasons and restarted as case 95-05-121P. Any submitted models might be in the case files of any of these three case numbers in the FEMA Project Library.

LOMR 00-05-007P (2/3/2000) cites CLOMR 97-05-850R (8/6/1997) as the basis of the revision. CLOMR 97-05-850R (included here, also from the ESDP) cites a proposed conditions WSP-2 model run dated 5/2/1997. LOMR 00-05-007P does not cite a model run, which implies that as-built conditions were reflected by the proposed model without further revision. The 5/2/1997 proposed conditions model is likely to be the most recent version of a model in this reach.

However, note that it is not clear whether the 5/2/1997 model for LOMR 00-05-007P incorporated any modeling performed for the preceding LOMR 95-05-121P, even though the effective revised area overlapped. The cases were submitted by different study contractors. Therefore, it cannot be predicted whether the 5/2/1997 proposed conditions WSP-2 model alone accounts for the effective FIS modeling in this reach (i.e., near Indian Woods Drive).

*NOTE RE FIS PUBLICATION ERROR:

The first edition of the Cook County countywide FIS (11/6/2000) correctly incorporated the revised Floodway Data Table values at countywide FIS XS I from LOMR 00-05-007P. Subsequent revisions of the Cook County FIS (2002-2007) INCORRECTLY included PREVIOUS (pre- 00-05-007P) floodway data table values at countywide FIS XS I. A scan of the correct FIS 11/6/2000 version of the Flag Creek floodway data table is included here, as file FDT2000_correct_I.pdf.

-ws/ISWS 1/7/2008

The 23 FEB 78 WSP-2 model run of Flag Creek
was the source of the Village of Indian Head Park 1979 FIS (in FC033-FC055).

This version of the model is **superseded** by FIS revisions in the following model reaches:

FC015 - FC027 by LOMR 915023 (and 92-05-003P)
FC033 - Z by LOMRs 95-05-121P and 00-05-007P

FC055 - end of model by 02 AUG 78 WSP-2/FLDWY runs
used for the Western Springs 1980 FIS (with added cross-sections above FC055)

In addition, a 21 FEB 80 WSP-2 trial run was performed during the Western Springs FIS study incorporating updated information within Indian Head Park and Western Springs above FC055 based on field reconnaissance. The 21 FEB 80 version of the WSP-2 represents "post-FIS" conditions compared to the 1978 model versions.

-ws/ISWS 1/8/2008

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Flag Creek								
A	3,000	327	1,174	2.68	599.0	599.0	599.1	0.1
B	3,830	100	1,351	2.10	601.8	601.8	601.8	0.0
C	5,175	420	1,233	2.29	603.7	603.7	603.8	0.1
D	8,330	592	2,313	1.21	608.2	608.2	608.3	0.1
E	8,850	545	2,400	1.17	609.2	609.2	609.3	0.1
F	11,620	203	962	2.88	619.2	619.2	619.3	0.1
G	14,475	221	973	2.80	625.4	625.4	625.5	0.1
H	17,900	579	1,687	1.48	629.7	629.7	629.8	0.1
I	19,000	163	985	2.92	631.8	631.8	631.9	0.1
J	20,370	105	803	3.11	633.5	633.5	633.6	0.1
K	20,780	80	605	3.97	634.3	634.3	634.4	0.1
L	25,280	91	805	2.86	637.6	637.6	637.7	0.1
M	27,640	78	624	3.29	639.5	639.5	639.6	0.1
N	29,540	89	701	1.70	640.2	640.2	640.3	0.1
O	30,870	50	469	2.54	640.7	640.7	640.8	0.1
P	31,970	50	454	2.40	641.1	641.1	641.2	0.1
Q	32,490	82	663	1.52	641.2	641.2	641.3	0.1
R	33,330	35	296	3.41	642.0	642.0	642.1	0.1
S	34,650	142	674	1.20	642.3	642.3	642.4	0.1
T	35,720	68	564	1.31	642.4	642.4	642.5	0.1
U	36,680	373	1,136	0.65	642.5	642.5	642.6	0.1
V	37,630	97	631	1.17	642.5	642.5	642.6	0.1

correctly reflects cross-section?

[1]Feet above mouth

TABLE 12

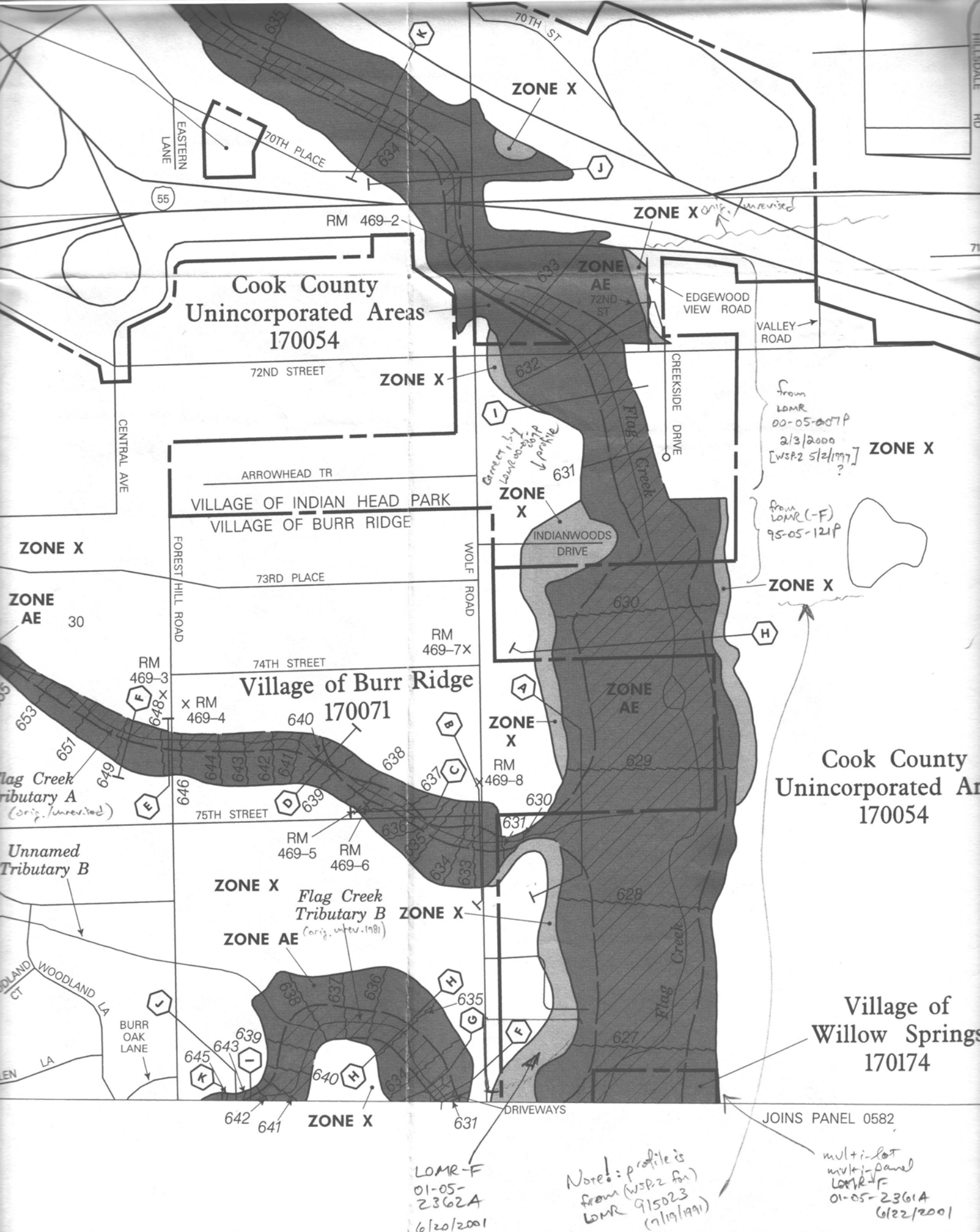
FEDERAL EMERGENCY MANAGEMENT AGENCY

COOK COUNTY, IL AND INCORPORATED AREAS

– FIS 2000 –

FLOODWAY DATA

FLAG CREEK


Cook County
Unincorporated Areas
170054
Village of Burr Ridge
170071
Cook County
Unincorporated Ar
170054
Village of
Willow Springs
170174
ZONE X
ZONE AE
72ND ST
EDGEWOOD VIEW ROAD
VALLEY ROAD
CREEKSIDE DRIVE
INDIANWOODS DRIVE
70TH ST
70TH PLACE
EASTERN LANE
RM 469–2
72ND STREET
ARROWHEAD TR
VILLAGE OF INDIAN HEAD PARK
VILLAGE OF BURR RIDGE
CENTRAL AVE
FOREST HILL ROAD
WOLF ROAD
73RD PLACE
74TH STREET
75TH STREET
RM 469–3
RM 469–4
RM 469–5
RM 469–6
RM 469–7
RM 469–8
Flag Creek
Tributary A
(orig. unrevised)
Unnamed
Tributary B
Flag Creek
Tributary B
(orig. unrev. 1981)
Flag Creek
WOODLAND CT
WOODLAND LA
BURR OAK LANE
DRIVEWAYS
JOINS PANEL 0582
LOMR-F
01-05-
2362A
6/20/2001
Note! : profile is
from (WSP-2 for)
LOMR 915023
(7/19/1991)
multi-lot
multi-panel
LOMR-F
01-05-2361A
6/22/2001
from
LOMR
00-05-007P
2/3/2000
[WSP-2 5/2/1997]
from LOMR(-F)
95-05-121P

SECTION 20.C

STANTEC 2016 EDP

MATCH LINE STATION 620+00

MATCH LINE STATION 635+00

ZONE AE FLOODPLAIN (APPROXIMATE LIMITS)

WOLF RD

FLAG CREEK

I-294 TRI-STATE TOLLWAY

OUTLETS #106 AND #107 ARE CONVEYED VIA SHALLOWED CONCENTRATED FLOW THROUGH DOUBLE CELL 5'x10' BOX CULVERT (WOLF ROAD CULVERT AT ABANDONED FLAG CREEK - S.N. 016-3245) AND ARE TRIBUTARY TO FLAG CREEK.

54" CMP

36"Ø CPP RESTRICTOR PIPE INV=631.18

48" CMP

15" RCP

OUTLET #107 AREA = 0.21 AC

INV=629.50

INV=628.81

70TH PL

OUTLET #106 AREA = 0.23 AC

INV=634.88

EXISTING ROW

OUTLET #25A AREA = 18.86 AC

24" RCP

DA 106-1 AREA = 0.23 AC

DA 107-1 AREA = 0.21 AC

DA 26-4 AREA = 0.70 AC

DA 26-2 AREA = 6.25 AC

℄ I-55

620+00

625+00

630+00

12" RCP

DA 26-3 AREA = 0.50 AC

DA 26-8 AREA = 2.43 AC

DA 26-9 AREA = 3.75 AC

DA 26-7 AREA = 3.96 AC

42" RCP

36" RCP

OUTLET #25B AREA = 29.86 AC

FLAG CREEK BRIDGE (SN 016-0003) HYDRAULIC REPORT 5 SPAN STEEL BRIDGE TOTAL DRAINAGE=13.65 SQ. MI.

RAMP TO I-294

OUTLET #26 AREA = 25.62 AC

OUTLET #26 OVERFLOWS RAMP TO I-294

INV=625.17

UNKNOWN CULVERT IS BURIED AND BLOCKED BY SEDIMENT. CULVERT SHALL BE RESTORED.

OUTLET #26 IS CONVEYED VIA DITCH AND CULVERT FLOW TO DISCHARGE TO FLAG CREEK

CULVERT IS BURIED AND BLOCKED BY SEDIMENT.

DITCH FLOW DISCHARGES TO FLAG CREEK

UPSTREAM INLET NOT LOCATED

ZONE AE FLOODWAY (APPROXIMATE LIMITS)

ZONE AE FLOODPLAIN (APPROXIMATE LIMITS)

EXISTING DRAINAGE PLAN LEGEND

OUTLET NO. — SUB-AREA NO. — D.A. 1-1 AREA = 1.59 AC — DRAINAGE AREA

OUTLET NO. — OUTLET # 1 AREA = 8.49 AC — AREA TRIBUTARY TO OUTLET

EXHIBIT 1-00B.32

I-55 MANAGED LANE PROJECT

USER NAME = dbook	DESIGNED - DJB	REVISED -
	DRAWN - STANTEC	REVISED -
PLOT SCALE = 50.0000 ' / in.	CHECKED - JVO	REVISED -
PLOT DATE = 8/2/2016	DATE - 8/2/2016	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-55 MANAGED LANE STUDY
EXISTING DRAINAGE PLAN

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
55		DUPAGE/COOK	110	32
		CONTRACT NO. P9176210		
	ILLINOIS FED. AID PROJECT			

FILE NAME = N:\706\active\176800037.IDOT.I-55\civil-drainage\location drainage study\DP9176210_EDP030.dgn

Default

Tab 21

SECTION 21

CD

CD POCKET INSERTED HERE