Primera

HYDRAULIC REPORT

ROUTE: Illinois Route 102 (FAP 631) over Ryans Creek (aka Rayns Creek)
COUNTY: Will
STRUCTURE NO.: 099-0170 (Existing), 099-0918 (Proposed)
PROJECT NO.: P-91-187-13
IDOT PTB: 162 Item 005

Prepared for:

Illinois Department of Transportation
Division of Highways - District 1
Bureau of Programming
Hydraulics Studies Unit

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SECTION 1

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1. PROJECT DESCRIPTION

Structure Number:	099-0170 (Existing)
County:	WILL
Route:	FAP 631 (Illinois Route 102)
Waterway:	Ryans Creek
Cross Streets:	1 mile southeast of W. Manteno Road and 0.5 miles northwest of S. Chicago Road.

The Illinois Department of Transportation is proposing the removal and replacement of the existing IL Route 102 single span concrete deck beam bridge across Ryans Creek in Wesley Township, Unincorporated Will County. This project is located approximately 1 mile southeast of W. Manteno Road and 0.5 miles northwest of S. Chicago Road along Illinois Route 102. Associated improvements include resurfacing, new ditches and proposed guardrail as warranted. It is anticipated that the proposed roadway profile will be raised and the waterway opening sized larger than the existing conditions to provide the required clearance and freeboard and reduce the potential for overtopping of the roadway and scour. The purpose of this project is to replace the functionally obsolete and deteriorated structure with a new structure that meets current standards. This report will evaluate the existing bridge and the proposed alternatives and recommendations in accordance with the IDOT Drainage Manual.

2. DESCRIPTION OF EXISTING STRUCTURE AND FLOODPLAIN

Structure Number 099-0170 was constructed in 1929 and the deck rehabilitated in 1971, 1985, and 2009. This structure is a single span concrete bridge with precast concrete deck beams having a span of 21.3’, height of 8.59 feet, and a 44’ width on a 20 degree skew. The span perpendicular to the flow is 20.0’ in width and will be used to model the effective waterway opening.

According to the latest IDOT Structures Information Management System Master Structure Report and structural evaluation, the bridge is in poor condition. Weight restrictions are posted for this bridge. The deck geometry meets the present minimum design criteria and waterway adequacy is better than adequate. The channel and protection is in satisfactory condition with minor deterioration of the scour protection noted. The structure was given a scour critical rating of 7 with riprap countermeasures provided in 1996. The approach roadway alignment also meets present design criteria.

Ryans Creek is located approximately 4200 feet upstream of the confluence with the Kankakee River. The floodplain located downstream of the structure is a heavily forested area within the Kankakee River State Park. Upstream of the culvert the overbank areas consist of a forested area on steep terrain to the northwest and row crops to the southeast. The farmed terrain slopes gently towards Ryans Creek.

A driveway crossing of Ryans Creek previously existed within the state park downstream of IL Route 102. The crossing provided access to what looks like a residence. New maps indicate that the crossing and home have removed. The Preliminary FEMA FIRM, Exhibit 1, removes the call out for the private driveway. The 2012 USGS map, Exhibit 2, also removed the crossing. The 2015 Google Maps, Exhibit 3, shows that the homes have been razed. Therefore, it is assumed that this crossing no longer exists. In addition, the contours indicate the channel at the location of the private driveway to be at approximately elevation 555. The channel elevation at IL route 102 is at elevation 568.5' or 13.5' higher. Any head created by the private driveway will dissipate prior to having any effect on the water surface profiles at the bridge.

Exhibit 1. Preliminary FEMA FIRM

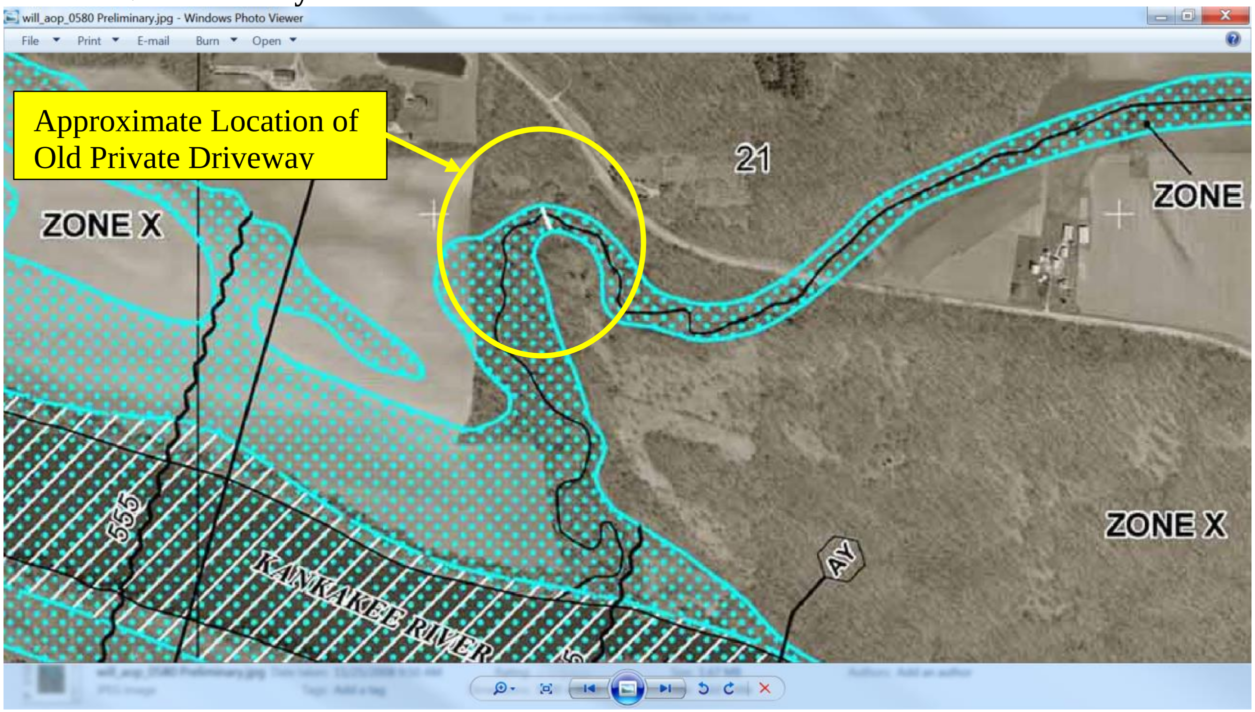


Exhibit 2. 2012 BONFIELD USGS Quadrangle Map

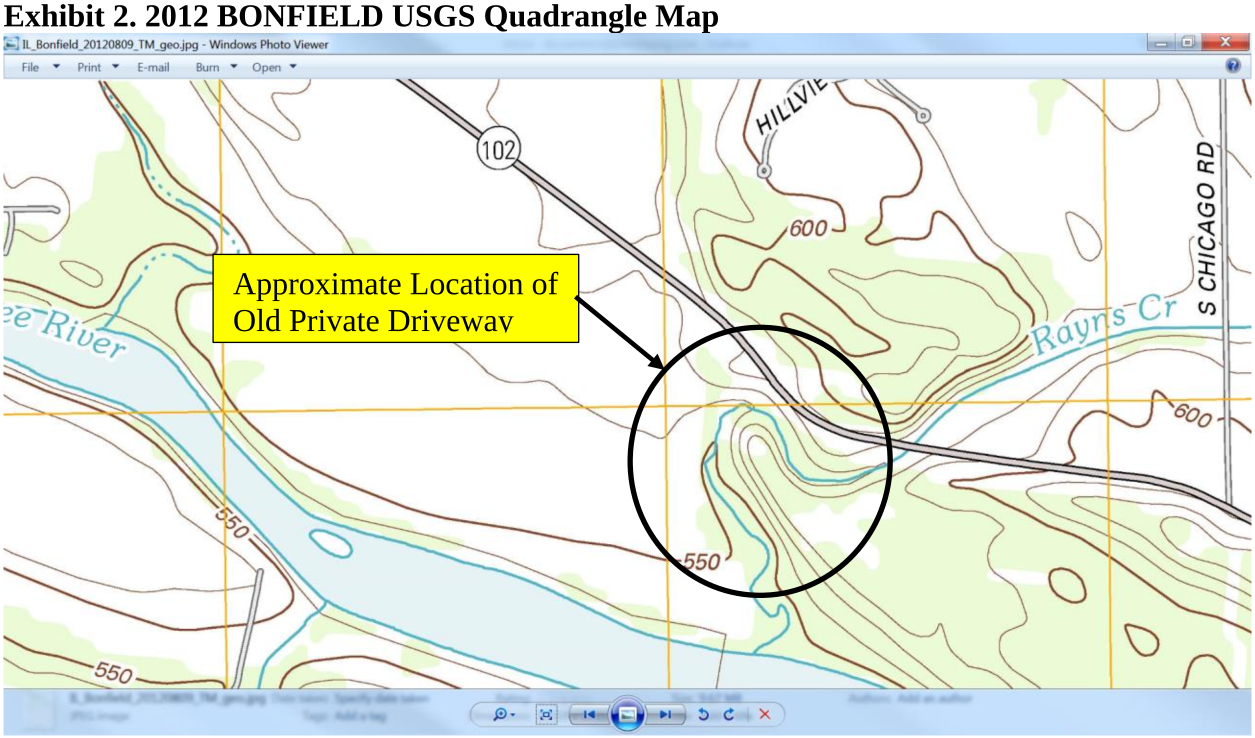


Exhibit 3. 2015 Google Earth Image of area in question.

3. FIELD OBSERVATIONS

A site inspection performed on August 20, 2014 noted that the channel and floodplain upstream and downstream of the structure are in good condition with no erosion of the banks observed. No debris was noted within the waterway opening or under the structure. A small vegetated gravel bar (sediment deposit) was noted within the channel downstream of the structure. Although the weather was dry, continuous base flow through the creek was observed and standing water under the bridge was approximately 3 feet deep. The top of footings were exposed along the northwest abutment or right side facing downstream.

4. HISTORICAL OBSERVATIONS / RECORDS

An email dated May 7, 2012 from the IDOT District 1 Incident Center reported that a flood event occurred along Illinois Route 102 which closed the road between Rivals Road south to Old Chicago Road due to water on the pavement (Exhibit 4). The email indicates the road was temporarily closed due to overflowing water from the tributary of the Kankakee River. Forked Creek is located to the North of this section but would have no effect near Old Chicago Road. Ryans Creek is located at the southern end of this section and it is assumed that the south end of the closure was due to Ryans Creek overtopping the roadway. The all-time H.W.E. over the roadway was determined by assuming a depth of water over the pavement of 0.3' and adding this to the existing overtopping elevation (579.2') for an all-time HWE elevation of 579.5'. This elevation is an assumption since we have reports of the roadway overtopping, but do not have any accurate way of determining the depth of water over the pavement. The extents of the flooding over the roadway were then drawn into an exhibit based on the survey and appeared to be reasonable.

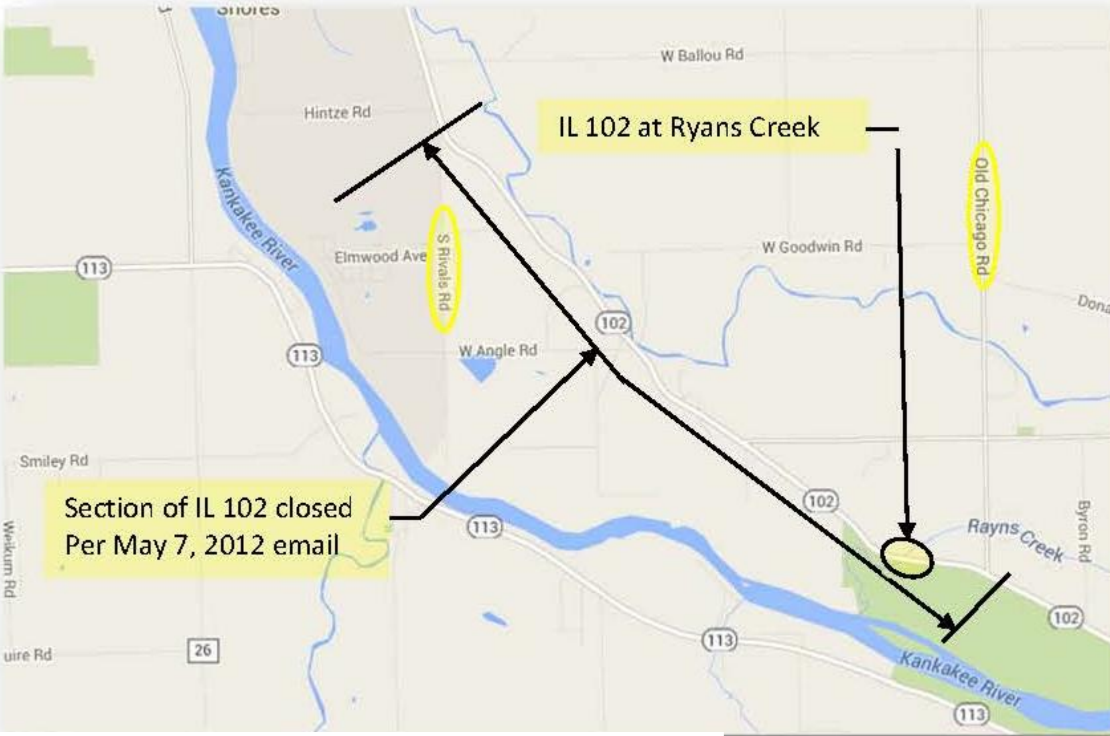


EXHIBIT 4. MAY 7TH Road Closure Aerial Map

A damage inspection report dated 7/31/2012 indicated extensive areas of delamination of the deck beams, but there were no indications of erosion or scour. Emails dated March, 2015 indicate that riprap was placed in the channel to fill a scour hole 2.5' deep beneath the footing as an emergency scour measure in 1996. A memo dated November 1, 1996 indicate an RR7 riprap would be required while the scour hole was filled with an RR5 riprap. Therefore this structure was placed on a scour critical monitoring program including underwater inspections for spread footings.

5. OTHER STUDIES & AFFECTED AGENCIES

The current effective FEMA FIRM map, Map Number 17197C0580 E dated September 6, 1995 indicates Ryans Creek has been designated a Zone A floodplain with no Base Flood Elevations determined. A preliminary map has been prepared which also indicates a Zone A designation. Both maps have been included in Section 5 of this report.

The Kankakee River located 4200 feet downstream of IL Route 102 has been studied and has a designated floodway. The flood profile illustrates a Base Flood Elevation along the Kankakee River of 555 feet at the mouth of Ryans Creek. Kankakee River flood elevations were used as starting water surface elevations for the Ryans Creek backwater analysis. It was found that the structure is located far enough upstream that backwater from the Kankakee River has no effect on water surface elevations along Ryans Creek at the IL Route 102 bridge.

Note there are no Hydrologic Atlas's created for this area of Will County.

6. DATUM CORRELATION

AES Services, Inc. (AES) conducted a topographic and cross section survey of the project site including the roadway approaches to the bridge crossing. In addition, a stream cross-section survey of Ryans Creek, upstream and downstream of the crossing, was completed. The vertical datum used by AES for their survey work was North American Vertical Datum 1988 (NAVD 88). The March 17, 2003 FIS indicates that all flood elevations are referenced to NGVD29. No base flood elevations have been determined along Ryans Creek that would require a datum conversion.

7. SENSITIVE FLOOD RECEPTORS

There are no sensitive flood receptors located within the 100-year backwater of the structure.

8. HYDROLOGIC METHODOLOGY

Ryans Creek at Illinois Route 102 has a drainage area of 6.59 square miles. This area of southern Will County appears to be rural but is a heavily travelled truck route and was considered to be an urbanizing area for hydrologic methodology. A HEC-HMS hydrologic analysis was used to calculate the discharges for the 2-year, 10-year, 50-year, 100-year, 200-year and 500-year storm events. These flows will be used in the HEC-RAS hydraulic model.

The watershed was analyzed using one large subarea due to several factors including land use, flow path, and storage. The land use within the watershed is fairly homogenous throughout consisting of cropland with gently sloping contours. The main flow path runs throughout the length of the watershed area which is characterized as a fairly long and narrow area. Inflows would have fairly consistent lengths to reach the main flow path. Lastly, any storage areas created by upstream road crossings were not considered in the analysis as it is assumed the crossings may be upsized in the future reducing the floodplain storage. Therefore, it was determined that one subarea for this watershed would provide flow rates representative of the actual conditions.

StreamStats was used to calculate the drainage area, stream length (L) and main-channel slope (S) to be used in the Time of Concentration (Tc) and Storage Coefficient (R) equations for the Clark Unit Hydrograph. The value for L was 6.32 miles and the value for S was 12.997 feet per mile. The calculated value for $Tc = 1.54\ L^{0.875}\ S^{-0.181} = 4.859$ hours. The calculated value for $R = 16.4\ L^{0.342}\ S^{-0.790} = 4.062$ hours. The regional value of R/(Tc + R) for the location of the culvert is 0.5. Using the above calculated values for Tc and R, the calculated value for R/(Tc + R) is 0.46.

a. CN VALUE

The drainage area consists primarily of agricultural land and woods in A and B hydrologic soils. Google Earth, NRCS Web Soil Survey, and TR-55 were then used to determine the SCS Curve Number at 59. Calculations can be found in Section 6 of this report.

b. PRECIPITATION GAGES

Time-series precipitation gage data was implemented in HEC-HMS by using the Illinois State Water Survey (ISWS) Isohyetal rainfall depth maps with the Huff Rainfall Distributions. An adjustment factor was applied to each rainfall depth for durations outside the 24-hr event as shown in Table 1: Isohyetal Rainfall Depths with Adjustment Factors. These rainfall depths were input into the HEC-HMS model to calculate the critical duration flows.

Table 1: Isohyetal Rainfall Depths with Adjustment Factors

Storm Event	72-hr Duration (Adj. Factor = 1.16)	48-hr Duration (Adj. Factor =1.08)	24-hr Duration (Adj. Factor = 1.00)	18 hr Duration (Adj. Factor = 0.94)	12 hr Duration (Adj factor = 0.87)
2-yr	3.712	3.46	3.20	3.01	2.78
10-yr	5.8	5.40	5.00	4.70	4.35
50-yr	8.12	7.56	7.00	6.58	6.09
100-yr	9.86	9.18	8.50	7.99	7.40

c. CRITICAL DURATION ANALYSIS

A critical duration analysis was completed to determine the peak flows. The results of the analysis are summarized in Table 2: Critical Duration Analysis. It was found that the 24-hour storm was the critical duration for all storm events except the 2-year storm.

Table 2: Critical Duration Analysis

Storm Duration	2-year (cfs)	10-year (cfs)	50-year (cfs)	100-yr (cfs)	200-year (cfs)	500-yr (cfs)
12-hour	38.4	259.8	652	1015.2		
18-hour	58.9	317.6	759.8	1151.3		
24-hour	97.7	407.6	866	1250.3	1700*	2375*
48-hour	102.7	384.8	772.9	1085.2		
72-hour	103.5	268	606.8	838.9		

***** Extrapolated value

StreamStats rural regression equations were used to verify the drainage area and basin characteristics and to determine if our flows were within the streamstats 90% prediction intervals. It was found that HEC-HMS results were close to the average flows for the 10 and 50-year storms and more conservative than the regression equations for the 100-year and 500-year storms. All events with the exception of the 2-year storm fell within the maximum 90% prediction intervals. Table 3 illustrates the flow comparison between the two models. Since the two-year storm was well below the Stream Stats minimum, the Stream Stats average flow of 242 cfs was used for the 2-year storm event.

Table 3: Comparison of HEC-HMS and Stream Stats Flow Rates

Flow model	2-year (cfs)	10-year (cfs)	50-year (cfs)	100-yr (cfs)	200-yr (cfs)	500-yr (cfs)
HEC-HMS	104	408	866	1250	1700	2375
Stream Stats (Minimum)	128	270	373	408	---	479
Stream Stats (Average)	242	523	774	873	---	1110
Stream Stats (Maximum)	457	1010	1600	1870	---	2570

9. HYDRAULIC ANALYSES

The hydraulic modeling was performed using HEC-RAS 4.1.0 and is based on the field survey performed by AES Services, Inc. in August 2014 and March 2015. The stream survey consisted of a total of eight cross sections; two each at the upstream and downstream face of the bridge and at 500 feet and 1000 feet upstream and downstream. Elevations were taken every 50 to 100 feet along the centerline of the stream. Additional cross-sections were interpolated in HEC-RAS at RS 1144, 1708, 2275, and 2772 to reduce warnings generated in the model. The warnings indicated that the conveyance ratio's were not falling into the allowable range and additional cross-sections may be needed. Therefore, cross-sections were interpolated between two surveyed cross-sections to try and reduce the warnings generated and provide better results.

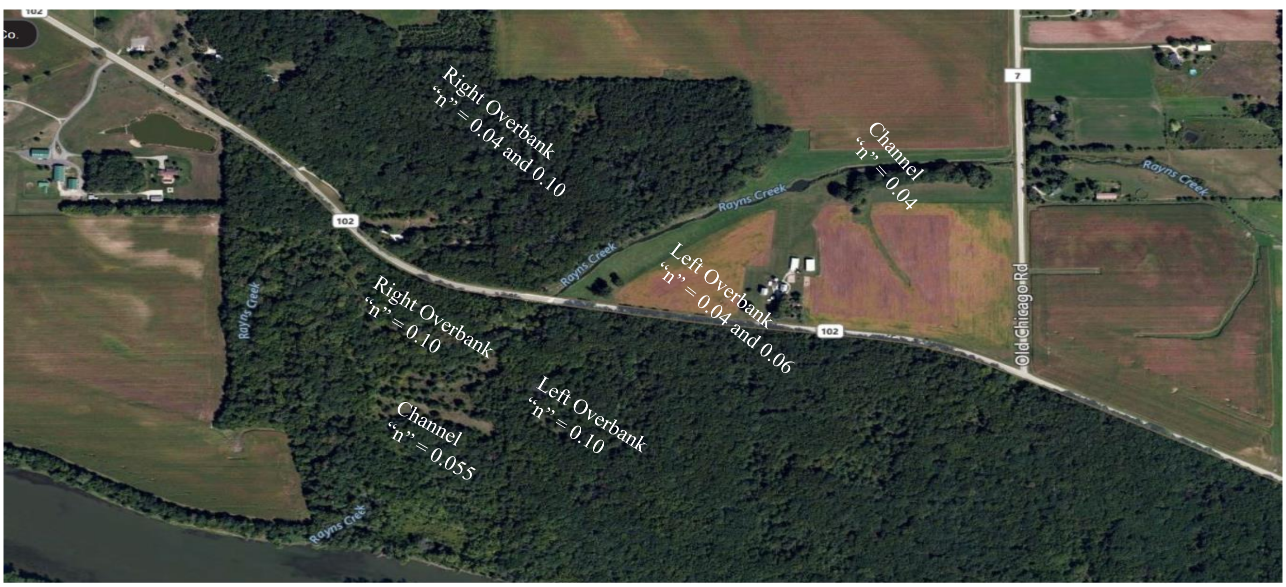
An IDOT roadway survey was provided in August 2014 which picked up roadway profile elevations every 50 feet along the roadway. The surveys were merged and used for modeling purposes.

a. <u>MANNINGS “n” VALUES</u>

The Manning's “n” values were determined using Chapter 5, Section 5-301.01 of the IDOT Drainage Manual. The main channel ‘n’ value on the upstream side of the bridge crossing is a clean, straight dug channel and was determined to have an “n” value of 0.04. The left overbank floodplain “n” value consists of lawn and crops. A Manning's “n” value of 0.04 was calculated for the mowed grassed area, and a value of 0.06 was calculated for the crops. The right over bank consists of a mowed grass area and a stand of timber. An “n” value of 0.04 was used for the mowed grass area and 0.1 for the timber.

The channel downstream of the structure had dense vegetation. A Manning's “n” of 0.55 was calculated for the main channel. The floodplain area downstream of the structure was heavily wooded and the “n” value was determined to be 0.1 in both left and right overbank areas. Exhibit 5 shows the corresponding Manning's “n” values on aerial mapping. The channel cross-section exhibits in Section 9 also display the corresponding “n” values. Manning's “n” calculations are found in Section 13. Hydraulic Analysis.

Exhibit 5: Manning's “n” Value Determination



The contraction and expansion coefficients used for the HEC-RAS cross sections were 0.1 and 0.3, respectively; since the change in the cross sections is small and flow is subcritical. Near the bridge crossing, the coefficients were increased to 0.3 and 0.5 at the upstream and downstream crossing sections.

Ineffective flow areas were used to model the channel areas where flow is stagnant. A contraction ratio on the upstream side of the bridge of 1:1 was used. An expansion ratio of 3:1 was used downstream of the bridge.

b. STARTING WATER SURFACE ELEVATION

Various starting water surface elevations (SWSE's) were used to determine convergence downstream of the bridge. Critical depth and normal depth were used as SWSE's and it was found that the WSE's converged approximately 500 feet downstream of the bridge at river station (RS) 1708 for all storm events.

In addition, an analysis was completed using backwater from the Kankakee River to determine if backwater had any effect on Ryans Creek. The 100-yr water surface elevations (555.7) from the Kankakee River were used as starting water surface elevations. It was determined that the bottom of channel elevations along Ryans Creek were approximately 12 feet above the 100-yr backwater elevation from the Kankakee River and had no effect on flows along Ryans Creek.

Normal depth SWSE were used for existing, natural and proposed conditions modeling.

c. EXISTING BRIDGE GEOMETRY

The existing structure is a single span bridge having a span of 21 feet, height of 8.59 feet and width of 44 feet on a 20 degree skew. To account for the skew, the waterway opening was measured perpendicular to the abutments and an opening of 20 feet was used for modeling purposes. Reinforced concrete wingwalls at 45° angles are located upstream and downstream of the bridge.

The roadway profile was entered using the roadway centerline elevations which were found to be the high point. No superelevated sections. The bridge modeling approach used energy and momentum equations for low flow methods and pressure/weir for high flow methods.

The model was generating warnings indicating the conveyance ratio's were not falling into the allowable range and additional cross-sections may be needed. Therefore, cross-sections were interpolated between two surveyed cross-sections to try and reduce the warnings generated and provide better results.

It was found that the existing structure has a waterway opening of 140 square feet and passes the 100-year storm event without overtopping of the roadway. The roadway overtops during the 200-year storm. The overtopping elevation (low point of road) is at elevation 579.17' at STA 740+68. The existing structure does not meet the 2 foot minimum clearance criteria for the 50-year design storm with a clearance of 1.91 feet from the low beam elevation (577.20'). The minimum freeboard requirement of 3 feet from the existing headwater elevation (576.1') is also not met with a calculated freeboard of 2.87 feet from the low edge of pavement (578.97'). Table 4 summarizes the Existing Conditions WSE's.

Table 4: Summary of Existing Conditions Water Surface Elevations

Existing Conditions RS	10-year	50-year	100-year	200-year	500-year
3022	575.54	576.89	579.09	580.05	580.60
2772	575.19	576.62	579.03	580.00	580.53
2508	574.85	576.42	578.99	579.95	580.47
2275	574.39	576.31	578.96	579.93	580.43
2040	573.96	576.15	578.84	579.94	580.45

2026	573.87	575.82	578.50	579.60	580.08
2000	Bridge				
1977	573.60	575.15	575.88	576.53	577.29
1966	573.56	575.15	575.91	576.60	577.47
1708	572.24	573.42	574.10	574.77	575.62
1485	571.20	572.36	572.97	573.60	574.42
1144	568.09	568.90	569.45	569.90	570.45
939	565.98	566.70	567.11	567.52	568.03

d. Natural Conditions Hydraulic Analysis

The Natural Conditions model was then created from the existing conditions model by removing the IL Route 102 bridge, roadway embankment, and ineffective flow areas from the model. The contraction and expansion ratios were reduced to 0.1 and 0.3. Table 5 summarizes the Natural Conditions WSE's.

Table 5: Summary of Natural Conditions Water Surface Elevations

Natural Conditions	10-year	50-year	100-year	200-year	500-year
3022	575.54	576.65	577.30	577.93	578.66
2772	575.18	576.24	576.88	577.49	578.22
2508	574.83	575.88	576.51	577.11	577.85
2275	574.30	575.58	576.26	576.89	577.63
2040	573.78	575.36	576.11	576.77	577.57
2026	573.77	575.30	576.00	576.62	577.41
1977	573.61	575.15	575.88	576.51	577.29
1966	573.55	575.10	575.84	576.48	577.26
1708	572.24	573.42	574.10	574.77	575.63
1485	571.20	572.36	572.97	573.60	574.42
1144	568.09	568.90	569.45	569.90	570.45
939	565.98	566.70	567.11	567.52	568.03

Table 6 illustrates the change in WSE between the existing and natural WSE's at RS 2026 for various storm events.

Table 6: Comparison of Existing and Natural WSE's at Upstream Face (RS 2026)

RS 2026	Existing Conditions WSE	Natural Conditions WSE	Δ in WSE
10-year	573.87	573.77	+0.10
50-year	575.82	575.30	+0.52
100-year	578.50	576.00	+2.50
200-year	579.60	576.62	+2.98
500-year	580.08	577.41	+2.67

The results of the modeling are further summarized in the Waterway Information Table located in Section 2.

e. PROPOSED STRUCTURE ALTERNATIVES ANALYSIS

A proposed structure alternatives analysis was completed with various structures considered including various size single span bridges, open abutment bridges, double and multi-cell culverts and three sided structures. The following summary discusses the benefits and constraints associated with each alternative. The alternatives were required to meet the following six criteria:

1. No Impacts to the archeological Area east of the bridge
2. No impacts to the State Park on the south side of the ROW
3. Mitigate existing scour concerns
4. Meet 3' of freeboard from edge of shoulder for 50-yr design storm
5. Meet 2' of Clearance from low chord (bridges only)
6. Increase the level of protection to reduce overtopping

Numerous iterations of sizes were completed for each type of alternative analyzed. The five best fit proposed alternatives with their associated pros and cons are outlined below.

Alternative 1: Open Abutment – An open abutment structure was analyzed with a proposed 57 foot span. The perpendicular opening chosen has a 50 foot top width and a 29 foot bottom width. This structure meets clearance and freeboard criteria and addresses the existing scour issue by placing the abutments outside the main channel flow. Water surface elevations will be lowered reducing the potential for roadway overtopping and increasing the level of protection to greater than a 500-year event. A raise in roadway profile is required to fit the larger beams and meet clearance requirements. Retaining walls are proposed to avoid acquiring ROW from the State Park. The raise in profile will extend the project limits to well inside the archeological site. Impacts to the archeological site will trigger additional surveys and coordination with IHPA which may delay the project by several years. The existing structure has a current rating of 3 and replacement without further delay is critical. Therefore, this alternative was not the best practicable alternative.

Alternative 2. Closed Abutment – A proposed 30' foot span was evaluated. This structure met freeboard and clearance requirements with no raise in the roadway profile. The shorter project limits avoided the archeological area and the need to acquire ROW. A HEC-RAS scour analysis indicated scour depths of approximately 16 feet below the channel bed. The structure increased the level of protection of overtopping to between a 200-year and 500-year event. Borings indicate the depth to bedrock is approximately 45 to 50 feet below the channel bed at this location. It was determined that the scour elevations would be below the footings and would not meet the scour rating criteria. Therefore, this alternative was not chosen as the best practicable alternative.

Alternative 3. Double Box Culverts – Twin 12' x 9' double box culverts were evaluated. The culverts were depressed 1 foot into the channel and a weir wall was proposed on one side to allow for a low flow channel. No raise in profile was required and this alternative avoided the archeological site as well as the need to acquire ROW. This structure did not meet freeboard requirements and the waterway opening decreased from existing conditions for the 200 and 500 year storm events. Velocities were increased from existing conditions for storm events greater than a 50-year storm. The level of protection was increased to a 200-year event but this alternative is not recommended based on the decrease in waterway opening and increase in channel velocities.

Alternative 4. Precast Multi-Cell Box Culverts – This alternative proposed a multi-cell culvert consisting of (1) - 12' x 9' center culvert with two (2) outer 10' x 9' precast RC box culverts. The culverts were depressed 1 foot into the channel and a weir wall was proposed on the two outside culverts to allow for a low flow channel through the center culvert. These culverts met the freeboard requirements with no increase in roadway profile. No impacts to the archeological site were required and no need to acquire ROW. Water surface elevations were lowered and an increased waterway opening provided. The level of protection was increased to between a 200-year and 500-year storm event. Scour is not an issue with culverts, riprap protection would be provided at the inlet and outlet. This scenario meets five of the six requirements with the clearance requirement no longer applicable. Drawbacks associated with a multi-cell culvert includes the tendency to collect debris and block during high flows. Another drawback is the maximum width of a precast box culvert is approximately 12 feet which is less than the existing 20 foot clear span opening. The precast culvert will reduce the main waterway opening span even though we are increasing overall waterway opening area. In discussions with the Hydraulics Unit, it was requested that we run an additional multi-cell alternative which uses a wider cast-in-place center structure appx 15'- 18' to reduce blockages.

Alternative 4a. Cast-in-Place Multi-Cell Box Culverts – This alternative proposed a multi-cell culvert consisting of (1) - 18' x 9' center culvert with two (2) outer 10' x 9' cast-in-place RC box culverts. The culverts were depressed 1 foot into the channel and a weir wall was proposed on the two outside culverts to allow for a low flow channel through the center culvert. These culverts meet freeboard requirements with no increase in roadway profile. No impacts to the archeological site are proposed and no need to acquire ROW is required. Water surface elevations were lowered, an increased waterway opening provided, and the level of protection was increased to between a 200-year and 500-year storm event. Scour is not an issue with culverts. Riprap protection is proposed at the inlet and outlet of the culverts. This scenario meets five of the six requirements with the clearance requirement no longer applicable. Drawbacks associated with a cast-in-place multi-cell culvert will have a tendency to collect debris and block during high flows. This scenario has a wider center culvert opening than Alternative 4 which will reduce the potential to block. Another drawback to this alternative is the increased cost of a cast-in-place structure versus precast culverts. This structure meets the requirements listed above and was determined to be the best practicable alternative. Therefore, the cast-in-place culvert is the recommended alternative.

Alternative 5. Three-sided Culvert – A three-sided culvert was analyzed and found to meet freeboard criteria with no increase in the roadway profile. No impacts to the archeological site were proposed. This type of structure would have similar scour issues to the closed abutment structure so was not further evaluated. This alternative was not chosen as the best practicable alternative.

The results of the alternatives analysis concluded that Alternative 4a, the cast-in-place multi-cell culvert, is the best practicable alternative and is the recommended structure. This structure meets five of the six criteria with the clearance requirement no longer applicable. The wider center culvert will reduce the potential for blocking associated with the smaller precast multi-cell culverts. A more in-depth proposed conditions analysis of this structure follows. Section 2 of the report provides the backup documentation for the alternatives analysis and includes a waterway information table, roadway profile, and HEC-RAS Output for each alternative studied.

f. PROPOSED CONDITIONS

The proposed structure consists of (1) - 18' x 9' center culvert with (2) - 10' x 9' cast-in-place RC box culverts with a length along the stream of 43.93 feet. The culverts were depressed 1 foot into the channel and a weir wall was proposed on the two outside culverts to allow for a low flow channel through the center culvert. The proposed waterway opening height from the flowline elevation is 8 feet for the center culvert and 7 feet for the outside culverts. The skew of the structure was increased from 20 degrees to 28 degrees, relative to the road, in order to better match the flow of Ryans Creek. The skew reduced the perpendicular waterway opening to (1) 15.9' x 8' and (2) – 8.8' x 7' RC box culverts. In order to keep the culvert sizes on the skew as whole numbers for construction purposes, the perpendicular waterway opening lengths were kept as decimal places when accounting for the perpendicular waterway opening and HEC-RAS analysis. The overall waterway opening was increased for all storm events.

The roadway profile was modified to provide a smoother vertical curve to the west of the culvert. No change in profile is proposed on the east side in order to avoid the archeological site. The low point of the road occurs along the archeological site boundary line and therefore was not changed. Roadway overtopping will occur at STA 740+68 at elevation 579.17'. The culvert "low chord" is proposed to be lower than the existing bridge low chord. This is required to meet the existing roadway elevation at the structure which includes the 8-foot waterway opening, thickness of the top of culvert (14-inches) and depth of pavement (10.5-inches of HMA and 12-inches of aggregate). A raise in roadway profile would extend the limits of roadway construction east into the archeological area which IDOT requested we avoid impacts. Therefore, we were unable to raise the roadway profile and had to reduce our culvert "low chord" elevation.

The results of the HEC-RAS proposed conditions analysis are summarized in Table 7 below. Water surface elevations were reduced from existing conditions for all storm events. Table 8 compares the existing and proposed water surface elevations for all storm events at RS 2026, the upstream face of the structure. The 100-year WSE was reduced by 1.83'. An overtopping analysis was completed which shows the level of protection from overtopping is increased from the 130 year storm event in existing conditions, to the 360-year storm event in proposed conditions. The overtopping analysis can be found in Section 2. Waterway Opening of this report. Freeboard was increased from 2.87 feet in existing conditions to 3.27 feet in proposed conditions which meets the minimum requirement. Freeboard calculations are detailed in the Freeboard section of this narrative.

Table 7: Summary of Proposed Conditions Water Surface Elevations

Proposed Conditions RS	10-year	50-year	100-year	200-year	500-year
3022	575.54	576.72	577.56	578.61	580.31
2772	575.18	576.36	577.26	578.42	580.21
2508	574.83	576.06	577.03	578.28	580.14
2275	574.31	575.86	576.92	578.21	580.10
2040	573.79	575.62	576.66	577.92	580.11
2026	573.83	575.65	576.67	577.89	579.81
2000	Multi-Cell Culverts				
1977	573.75	575.44	576.34	577.20	578.52
1966	573.56	575.15	575.91	576.60	577.47
1708	572.24	573.42	574.10	574.77	575.62
1485	571.20	572.36	572.97	573.60	574.42
1144	568.09	568.90	569.45	569.90	570.45
939	565.98	566.70	567.11	567.52	568.03

Table 8: Comparison of Existing and Proposed WSE's at Upstream Face (RS 2026)

RS 2026	Existing Conditions WSE	Proposed Conditions WSE	Δ in WSE
10-year	573.87	573.83	-0.04'
50-year	575.82	575.65	-0.17'
100-year	578.50	576.67	-1.83'
200-year	579.60	577.89	-1.71'
500-year	580.08	579.81	-.027'

The proposed structure should strive to have a created head less than 0.3' for the 50-year event and less than 0.5' for the 100-year event. The created head for the proposed structure is 0.4' for the 50-year event and 0.7 feet for the 100-year event. Although the structure does not meet the above considerations, the head is reduced substantially from existing conditions which were 0.8' and 2.7' respectively.

In summary, these culverts increase the waterway opening and decrease water surface elevations. Freeboard requirements are met with no increase in roadway profile. No impacts to the archeological site are proposed. The level of protection for overtopping was increased from the 130-yr storm event to the 360-yr storm event. Scour is not an issue with culverts. Riprap protection is proposed at the inlet and outlet of the culverts and is discussed further in the Riprap Analysis section of this narrative.

The proposed structure does not require ROW acquisition to accommodate the proposed drainage improvements.

10. SCOUR ANALYSIS

The SIMS Master Structure Report indicates a scour critical evaluation was completed in December 1995 and the structure was given a Scour Critical Rating of 7. The evaluation noted that the scour problem was corrected. Emails dated March, 2015 indicate that riprap was placed in the channel to fill a scour hole 2.5' deep beneath the footing as an emergency scour measure. A memo dated November 1, 1996 indicate calculations were completed and an RR7 riprap would be required while the scour hole was filled with an RR5 riprap. Therefore this structure was placed on a scour critical monitoring program including underwater inspections for spread footings.

An underwater inspection was completed in August 2004 and given an appraisal rating of 5. This report indicated major deterioration in underwater units and the east and west footings are entirely exposed. The August 2014 inspection noted scattered riprap in the channel within the bridge and a scour hole of approximately 2.3 feet along the right abutment.

A detailed channel survey was completed under the bridge on March 19, 2015. The findings indicate "In a review of the stream bed our crew didn't find any holes, pockets or scour locations. We did a grid of approximately 10', we did notice that there is an exposed footing." An exhibit titled *Survey Under Bridge* can be found in Section 14. Scour Analysis and illustrates the additional shots taken under the bridge and the location of the exposed footings.

A HEC-18 scour analysis was completed for the existing conditions. A live bed contraction scour depth of 6.7' was computed for the 100-year event. This is assuming no overtopping of the structure. Abutment Scour of 31.6' was computed for a total 100-year scour depth of 40.6'. A total scour depth of 53.2' was calculated for the 130-year pressure flow. Calculations are included in Section 14. Scour Analysis.

A second analysis was completed using the NCHRP Method. Scour depths of 10.4 feet for the 100-year and 16.9 feet for pressure flow using the 130 year storm event were calculated. Table 9 summarizes the results of the two scour calculation methods.

Table 9. Existing Conditions Scour Analysis

Scour Analysis Method	Total Scour Depths (feet)		
	100-year Storm Event	130-year Pressure Flow	200-year Overtopping Event
HEC-18	40.6’	53.2’	40.7’
NCHRP	10.4	16.9’	12.5’

11. <u>RIPRAP DESIGN</u>

Riprap protection sizing will be completed during the Phase II design process in accordance with IDOT standards.

12. <u>COMPENSATORY STORAGE</u>

No compensatory storage required.

13. <u>PERMIT REQUIREMENTS</u>

This structure has a drainage area of 6.59 square miles in southern Will County. The FEMA FIRM designates Ryans Creek as a Zone “A”, “non-designated” floodway in NE IL and falls under the IDNR-OWR Section 3700 regulations for Construction in Floodways of Rivers, Lakes and Streams.

To meet the Part 3700 floodway regulations, in non-regulatory floodplain (urban) areas, the water surface profile increase will not exceed 0.5 feet at the structure, nor 0.1 foot at a point 1000 feet upstream of the structure. The water surface profiles at the proposed structure have been reduced from existing conditions for all storm events up to and including the 100-year storm event.

This project falls under Statewide Permit #12 as there is no demonstrable flood damage associated with this crossing, the waterway opening is larger than the existing structure, no increase in the roadway profile is proposed, and the structure has been designed by standard hydrologic and hydraulic engineering methods. The Bureau of Design should process statewide Permit No. 12 through the Hydraulics Section when the final plans are prepared.

14. FREEBOARD / CLEARANCE

Design Criteria

- Design Storm = 50-year event
- Minimum roadway freeboard 3ft between design headwater elevation and lowest edge of pavement elevation.
- Minimum clearance from low chord elevation is 2 feet to the natural high water elevation

Existing Clearance

Clearance = Low chord – NHWE

Clearance = 577.20 – 575.30 = 1.90' < 2' Does not meet Design Criteria

Existing Freeboard

Freeboard = Low EOP - Design HWE

Low EOP = 578.97'

Design HWE (50-year) = 576.1'

Existing Freeboard = 2.87' < than the minimum required 3'

Proposed Clearance

Not Applicable

Proposed Freeboard

Freeboard = Low EOP - Design HWE

Low EOP = 578.97'

Design HWE (50-year) = 575.70'

Proposed Freeboard = 3.27' > than the minimum required 3'

15. CONCLUSION

The existing structure consists of a single span bridge having a width of 20 feet and height of 8.56 feet with an overall length of 44 feet on a 20 degree skew. The structure was overtopped in May, 2012. The existing conditions modeling indicates the structure passes the 100-year storm event with no overtopping of the roadway but overtops during the 130-year event. The structure has a 100-year waterway opening of 140 sq. ft., provides 2.87 feet of freeboard and 1.90 feet of clearance from the low beam elevation neither of which meets the minimum design criteria. The structure had a scour critical evaluation of 7 in 1995 and provided riprap countermeasures in the channel. In 2004 an underwater inspection determined the footings to be exposed. The existing footings do not sit on pilings.

An alternatives analysis was completed to address the existing site constraints which included avoiding an archeological site, avoiding the need to acquire ROW from adjacent state park, reducing scour potential, meeting freeboard and clearance requirements, and increase the level of protection of overtopping. The recommended alternative is a multi-cell culvert option which consists of (1) - 18' x 9' center culvert with (2) - 10' x 9' cast-in-place RC box culverts. No widening of the crossing is required and the culverts have a length along the stream of 44 feet. The culverts were depressed 1 foot into the channel and a weir wall was proposed on the two outside culverts to allow for a low flow channel through the center culvert. The proposed waterway opening height from the flowline elevation is 8 feet for the center culvert and 7 feet for the outside culverts. The skew of the structure was increased from 20 degrees to 28 degrees, relative to the road, in order to better match the flow of Ryans Creek. The skew reduced the proposed perpendicular waterway opening to (1) 15.9' x 8' and (2) – 8.8' x 7' RC box culverts.

The proposed multi-cell culverts provide a larger waterway opening, no increase in roadway profile, and an increased level of protection of overtopping to a 360-yr storm event. Scour is not an issue for the proposed culverts and riprap is proposed at the inlets and outlets of the structure. The proposed culverts reduce the velocity through the bridge, meet freeboard requirements, and reduce the created head. No impacts to the archeological site are proposed.

SECTION 2

Waterway Information Table

Illinois Department of Transportation

Culvert Waterway Information Table

Route: IL Route 102 (FAP 631)
Waterway: Rayns Creek
Section: (111 N-B) B-R
County: Will

Existing SN: 099-0170
Proposed SN: 099-0918
Prepared by: Dawn Cosentino Date: 02/11/2016
Checked by: Chad Dillavou Date: 02/12/2016

Drainage Area = 6.59 square miles
Existing Overtopping Elev. = 579.17 at Sta. 740+68
Proposed Overtopping Elev. = 579.17 at Sta. 740+68

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	408	96	157	573.8	0.2	0.0	574.0	573.8
Design	50	866	126	207	575.3	0.8	0.4	576.1	575.7
Base	100	1250	140	231	576.0	2.7	0.7	578.7	576.7
Scour Design Check	200	1700	152	250	576.6	3.2	1.3	579.8	577.9
Overtop Existing	130	1375	164	----	576.2	2.9	----	579.1	----
Overtop Proposed	360	2100	----	250	576.2	----	1.9	---	578.1
Max. Calc.	500	2375	164	250	577.4	2.9	2.5	580.3	579.9

Datum:

All-Time H.W.E. & Date: May 7, 2012 579.5' ft
Surveyed Normal Water Level: 570.0 ft

10-Year Velocity through Existing Structure = 4.3 ft/s
10-Year Velocity through Proposed Structure = 2.6 ft/s
2-Yr. Flow Rate = 242 ft^3/s

EXISTING STRUCTURE

Type: Single Span Conc. Precast Channel Beam
Length/Width: 21.3' on skew, 20.0' perpendicular to flow
Spans/Cells: 1 –Length along stream/abutments=43.93’
Low Chord: 577.20
Skew: 20 degrees (relative to road)
Clearance: 1.90'
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.97 at STA 740+68
Freeboard: 2.87'
Culvert Inverts: N/A (u/s) N/A (d/s)

PROPOSED STRUCTURE

Culvert Type: (1)- 15.9' x 8' and (2) 8.8' x 7' Box Culverts
Length Of Span: 40' on skew, 36.5' on perpendicular
Cells: 3
Top Of Crown Elev.: Beam: 576.58
Skew: 28 degrees (relative to road)
Culvert Invert Elev.: 567.58(u/s)567.5(d/s)
Low E.O.P: 578.97 at STA 740.68
Freeboard: 3.27'

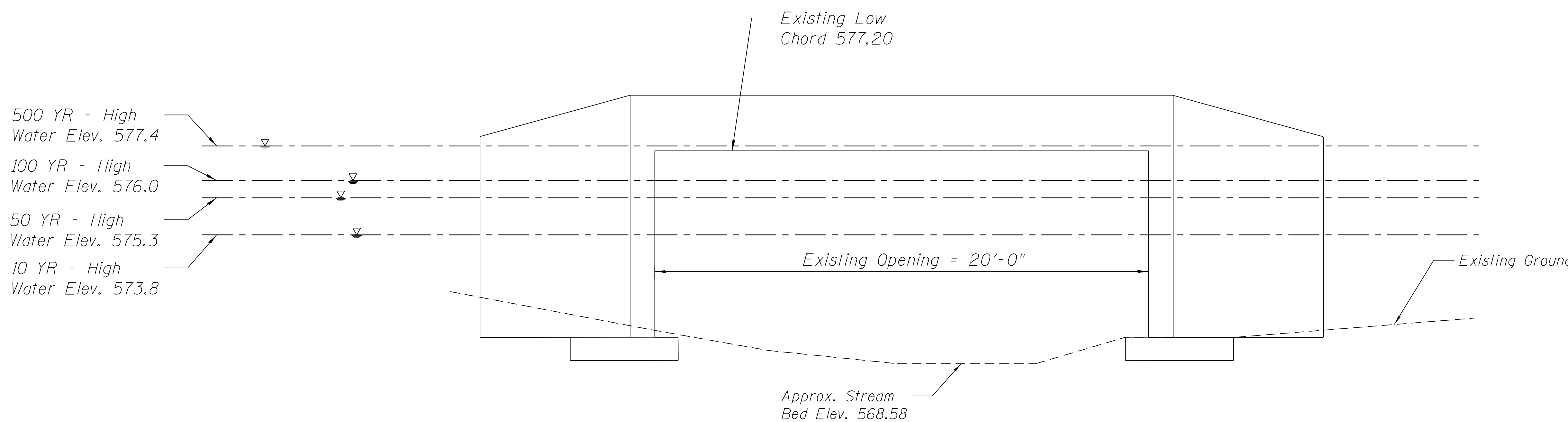
EXISTING EMBEDMENT

Depth: N/A
U/S Streambed Elev.:
D/S Streambed Elev.:

PROPOSED EMBEDMENT

Depth: 1'
U/S Streambed Elev.: 568.58 in center and 569.58 on outer culverts
D/S Streambed Elev.: 568.5 in center and 569.5 on outer culverts

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.



EXISTING STRUCTURE ELEVATION

Dimensions measured perpendicular to flow

FILE NAME =	USER NAME = $USER$	DESIGNED - DCC	REVISED -
$FILES$		DRAWN - CBP	REVISED -
	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -
$MODELNAME$	PLOT DATE = $DATE$	DATE - 5/11/2016	REVISED -

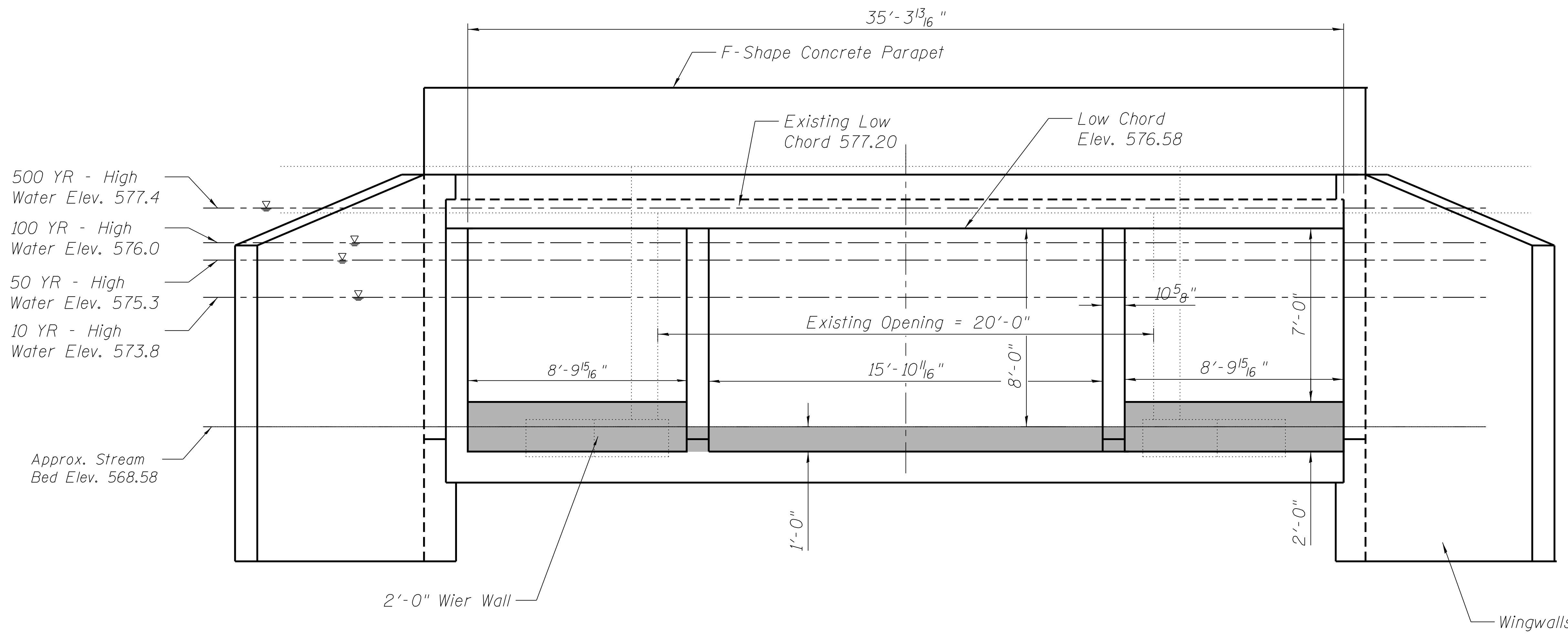
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

IL ROUTE 102 OVER RYANS CREEK
EXISTING SITE STRUCTURE CROSS SECTIONAL INFORMATION

SCALE: 1" = 5' | SHEET 1 OF 1 SHEETS | STA. 740+50.00 TO STA. 742+50.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(111N-B)B-R	WILL	1	1
		CONTRACT NO. 60V28		

ILLINOIS | FED. AID PROJECT



PROPOSED STRUCTURE ELEVATION

Dimensions measured perpendicular to flow

FILE NAME =	USER NAME = $USER$	DESIGNED - DCC	REVISED -	STATE OF ILLINOIS	IL ROUTE 102 OVER RYANS CREEK
$FILES$		DRAWN - CBP	REVISED -	DEPARTMENT OF TRANSPORTATION	PROPOSED SITE STRUCTURE CROSS SECTIONAL INFORMATION
	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -		SCALE: 1" = 5' SHEET 1 OF 1 SHEETS STA. 740+50.00 TO STA. 742+50.00
$MODELNAME$	PLOT DATE = $DATE$	DATE - 5/11/2016	REVISED -		

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(111N-B)B-R	WILL	1	1
		CONTRACT NO. 60V28		
		ILLINOIS FED. AID PROJECT		

WATERWAY OPENING - The effective waterway opening should be calculated at the upstream face of the structure based on the Natural Highwater Elevation for a given frequency. It should represent actual existing conditions, not as-built or cleaned out. It is determined by calculating the flow area under the Natural High Water Elevation (N.H.W.E.) at the surveyed bridge opening section. It is not based on the Existing H.W.E. or the Proposed H.W.E. This value is not the value you can find in the Hydraulic Software output. It is calculated separately from any Hydraulic Software. Pier area below the N.H.W.E. should be subtracted from the total opening area. An adjustment for improperly skewed piers may be required which will increase the pier area and reduce the net opening.

WATERWAY OPENING (sq. ft.) - EXISTING

	A	B	C	D	E	C+(D*E)
Flood Frequency	Natural H.W.E.	Bridge U/S Flowline	Area Under elev 569.93*	Bridge Span W (ft)	NHWE-569.93	Waterway Opening (sq. ft.)
10-year	573.8	568.58	18	20.0	3.86	96
50-year	575.3	568.58	18	20.0	5.36	126
100-year	576.0	568.58	18	20.0	6.06	140
200-year	576.6	568.58	18	20.0	6.68	152
500-year	577.4	568.58	18	20.0	7.27	164

*See attached openign exhibit

WATERWAY OPENING (sq. ft.) - PROPOSED

(1) 18' x 9' and (2) 10' x 9' RC Box Culverts depressed 9" with 1' weir wall on outside culverts on a 28 degree skew
Perpendicular Waterway Opening = (1)-15.9' x 8' and (2)-8.8' x 7' Cast in place culverts

	A	B	C	D=(A-B)*C	E	F	G=(A-E)*F	H	I	J=(A-E)*F	D+G+J
Flood Frequency	Natural H.W.E.	Culvert #1 U/S Flowline	ert Span on I W (ft)	Waterway Opening #1 (Sq. Ft.)	Culvert #2 U/S Flowline	Culvert Span W (ft)	Waterway Opening #2 (Sq. Ft.)	Culvert #3 U/S Flowline	Culvert Span W (ft)	Waterway Opening #2 (Sq. Ft.)	Total Waterway Opening (sq. ft.)
10-year	573.8	568.58	15.9	82.84	569.58	8.8	37.05	569.58	8.8	37.05	157
50-year	575.3	568.58	15.9	106.69	569.58	8.8	50.25	569.58	8.8	50.25	207
100-year	576.0	568.58	15.9	117.82	569.58	8.8	56.41	569.58	8.8	56.41	231
200-year	576.6	568.58	15.9	127.20	569.58	8.8	61.60	569.58	8.8	61.60	250
500-year	577.4	568.58	15.9	127.20	569.58	8.8	61.60	569.58	8.8	61.60	250

HEAD - The largest change in computed water surface elevation, comparing the computed water surface elevations from the existing condition and proposed condition to the natural condition for each upstream cross section, is the Created Head. That Created Head is entered into the HEAD column of the Waterway Information Table for each flow profile. Head should not be negative, so use a value of zero if a negative number is computed. Proposed structures that result in headwater less than the Natural HWE for a given frequency should indicate "0.0" as the head and the headwater elevation will be equal to the NHWE.

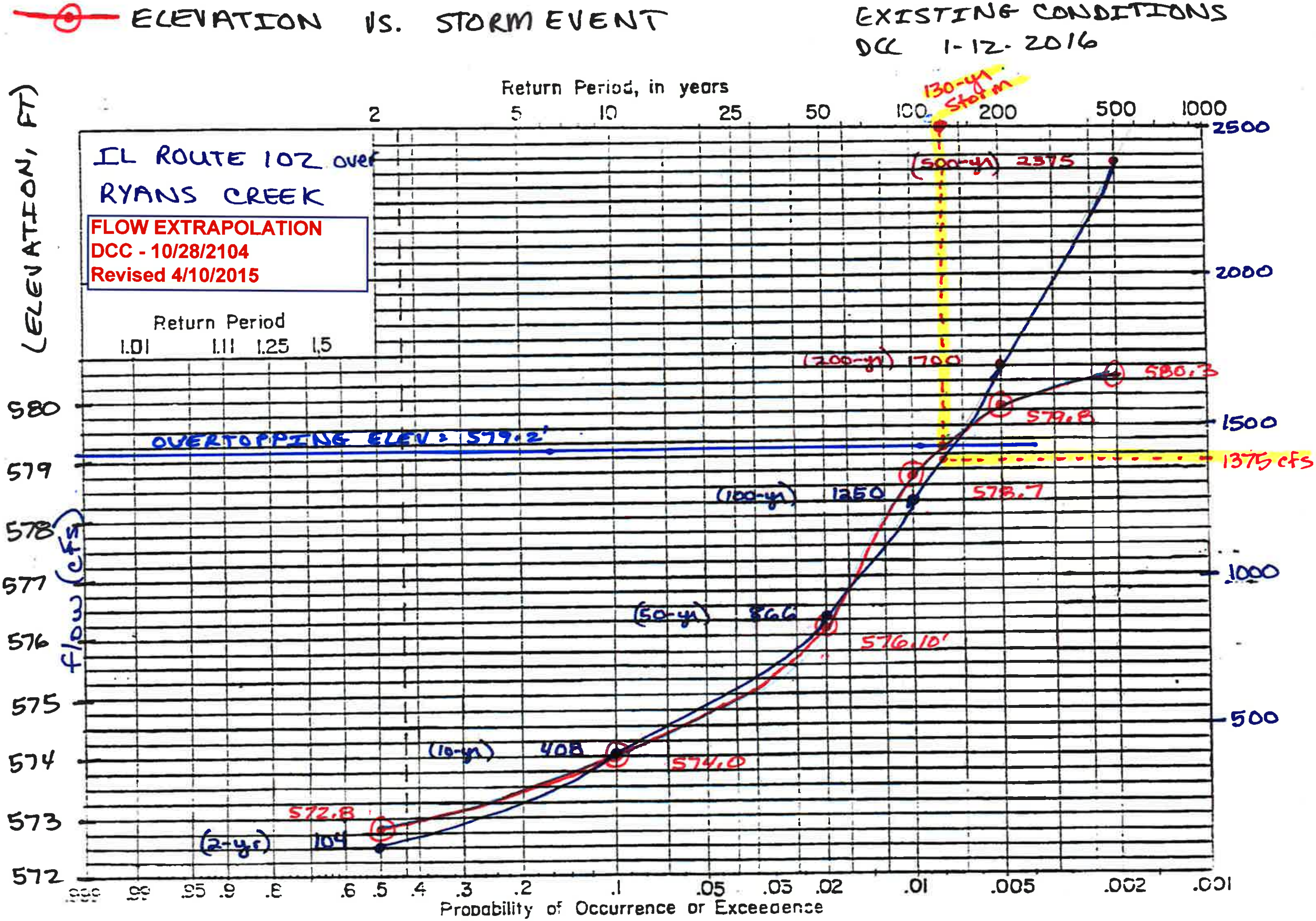
HEAD (ft) - EXISTING

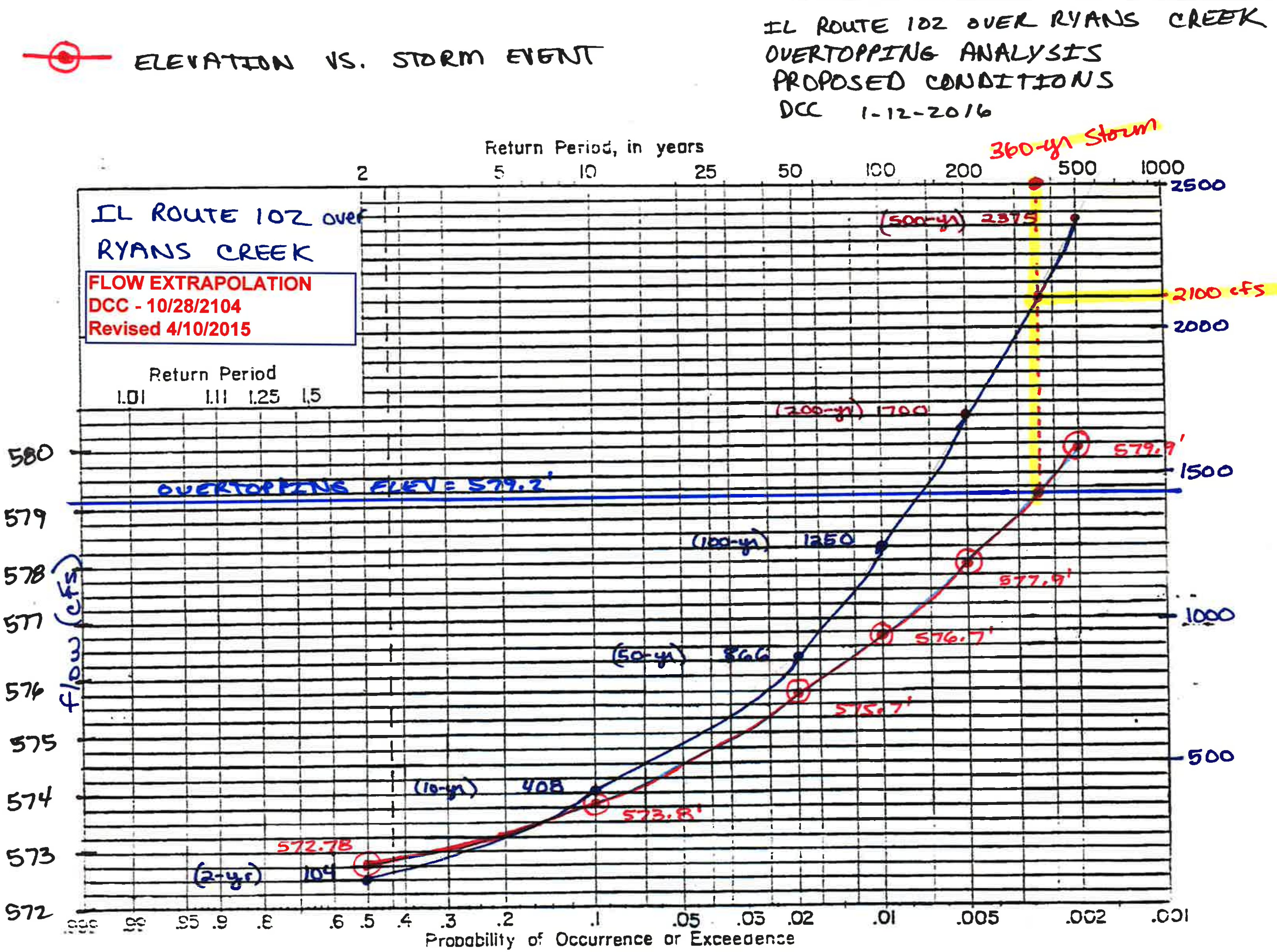
	(A) Existing Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Existing Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Existing Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.56	575.55	0.0		577.01	576.75	0.3		579.15	577.43	1.7		580.08	578.08	2.0		580.64	578.82	1.8	
2772	575.22	575.20	0.0		576.77	576.40	0.4		579.09	577.09	2.0		580.03	577.72	2.3		580.57	578.45	2.1	
2508	574.91	574.88	0.0		576.61	576.13	0.5		579.05	576.80	2.3		579.99	577.43	2.6		580.51	578.16	2.4	
2275	574.41	574.32	0.1		576.44	575.75	0.7		579.01	576.48	2.5		579.96	577.13	2.8		580.47	577.88	2.6	
2040	573.96	573.78	0.2		576.15	575.36	0.8		578.84	576.11	2.7		579.94	576.77	3.2		580.45	577.57	2.9	
2026	573.87	573.77	0.1	574.0	575.82	575.30	0.5	576.1	578.50	576.00	2.5	578.7	579.60	576.62	3.0	579.8	580.08	577.41	2.7	580.3

HEAD (ft) - PROPOSED

	(A) Proposed Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Proposed Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Proposed Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Upstream Channel Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.55	575.55	0.0		576.83	576.75	0.1		577.71	577.43	0.3		578.75	578.08	0.7		580.36	578.82	1.5	
2772	575.20	575.20	0.0		576.53	576.40	0.1		577.45	577.09	0.4		578.57	577.72	0.9		580.26	578.45	1.8	
2508	574.88	574.88	0.0		576.31	576.13	0.2		577.27	576.80	0.5		578.46	577.43	1.0		580.19	578.16	2.0	
2275	574.32	574.32	0.0		576.04	575.75	0.3		577.10	576.48	0.6		578.36	577.13	1.2		580.15	577.88	2.3	
2040	573.79	573.78	0.0		575.62	575.36	0.3		576.66	576.11	0.5		577.92	576.77	1.1		580.11	577.57	2.5	
2026	573.83	573.77	0.0	573.8	575.65	575.30	0.4	575.7	576.67	576.00	0.7	576.7	577.89	576.62	1.3	577.8	579.81	577.41	2.4	580.0

IL ROUTE 102 OVER RYANS CK
OVERTOPPING ANALYSIS
EXISTING CONDITIONS
DCC 1-12-2016





ELEVATION VS. STORM EVENT
IL ROUTE 102 OVER RYANS CREEK
OVERTOPPING ANALYSIS
PROPOSED CONDITIONS
DCC 1-12-2016
Return Period, in years
2
5
10
25
50
100
200
500
1000
360-yr Storm
IL ROUTE 102 over
RYANS CREEK
FLOW EXTRAPOLATION
DCC - 10/28/2104
Revised 4/10/2015
Return Period
1.01
1.11
1.25
1.5
2500
2100 cfs
2000
1500
1000
500
(500-yr) 2375
(200-yr) 1700
(100-yr) 1250
(50-yr) 866
(10-yr) 408
(2-yr) 104
579.9'
577.9'
576.7'
575.7'
573.8'
572.78
OVERTOPPING ELEV = 579.2'
580
579
578
577
576
575
574
573
572
Flow (cfs)
.999
.99
.95
.9
.8
.6
.5
.4
.3
.2
.1
.05
.03
.02
.01
.005
.002
.001
Probability of Occurrence or Exceedence

SECTION 3

Hydraulic Report Data Sheets

Illinois Department of Transportation

Hydraulic Report Data Sheets

Route	FAP 631 (IL Route 102)	P or D #	P-91-187-13
Section	(111 N-B) B-R	PTB #	162 Item 005
County	Will		
Exist SN	099-0170		
Prop SN	099-0918		

General Information

1. Stream name: Ryans Creek

2. Structure location: NW ¼ of the SE ¼ of Section 21, Township 32N, Range 10E of the 3rd P.M.

3. Hydraulic Report Prepared By: ☒ Consultant Primera Engineers, Ltd. ☐ Prime ☒ Sub
   ☐ 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.): 6.59

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 HEC-HMS 3.5

10. Hydraulic Modeling (check all that apply):
    a. Method: ☒ HEC-RAS ☐ WSPRO ☐ Other
    b. Manning's "n" values determined per IDOT Drainage Manual Chap. 5? ☒ Yes ☐ No
    If no, explain: Values from Chapter 5 Drainage Manual and FHWA values used in model
    c. Source of Starting WSE: Normal Depth S = 0.00079
    d. Non- IDOT encroachments in Survey? ☐ Yes ☒ No
    If yes, are they accounted for? ☐ Yes ☐ No
    e. Does a Tailwater Control exist? ☐ 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: 3:1 (X:1)
Contraction 1:1 (X:1)

IDNR – OWR Floodway Permit

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

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.

13. Is there any History of Flooding or Overtopping problems? ☒ Yes ☐ No
Sources & dates of Observed Highwater:
IDOT email dated May 7, 2012 indicates roadway overtopped from South Rivals Road to Old Chicago Road due to "overflowing tributary to Kankakee River." See attached map illustrating the limits of flooding.

14. Is the structure hydraulically connected to or within the floodway of an IDNR-OWR designated Public Body of Water? ☒ No ☐ Yes. OWR 3704 Rules apply.

15. Required IDNR - OWR Permit type:
☐ Individual 3700 ☐ SWP #2 ☒ SWP #12 ☐ Floodway 3708
☐ 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 ☒Culvert ☐ Three-sided Bridge
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): Abutment type:
Preliminary low beam elevation (ft): Skew (degrees):
Width of deck (ft): Number of spans:
Total length from face to face of abutment (ft)

18. If a culvert is proposed, supply:
Type and size: (1) - 15.9' x 8' and (2) - 8.8' x 7' Length (ft): 44'
Upstream invert elevation (ft): 568.58 Entrance type: Wingwalls
Downstream invert elevation (ft): 568.50 Skew (degrees): 28 degrees
Note: Upstream and downstream elevations should reflect the elevations before the standard 3" drop (or other embedment) is applied

19. If a three-sided structure is proposed, supply:
U/S Flow line elevation (ft): Skew (degrees):
Span (ft): Length (ft):
Height (ft): Number of spans:

20. a. Is the IDOT Clearance Policy met? ☐ Yes ☐ No ☒ NA Value (ft):
b. Is the IDOT Freeboard Policy met? ☒ Yes ☐ No ☐ NA Value (ft): 3.27'

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

22. Scour/ Migration Problems: ☐ None/Minimal ☒ Significant ☐ Severe
Comments: Existing Scour critical rating of 7 with riprap countermeasures placed in 1995.

Ice Concerns: ☒ None/Minimal ☐ Significant ☐ Severe
Comments:

Debris Concerns: ☒ None/Minimal ☐ Significant ☐ Severe
Comments:

Proposed or Identified Countermeasures: Riprap inlet and Outlet Protection

Existing Structure Data

	Structure U/S	Subject Structure	Structure D/S
23. Distance from proposed (subject) structure: (ft.)	2588'	N\A	N/A
24. Type of structure:	Four (4) 10' x 6' Box CUlverts	Single Span Bridge	N/A
25. Low beam elevation:	N/A	577.17	N/A
26. Flow line elevation:	N/A	U/S 868.58 D/S 868.61	N/A
27. Maximum known high water elevation:	N/A	579.5'	N/A
28. Date of maximum high water:	N/A	May 7, 2012	N/A
29. Cause (backwater, headwater, etc.):	N/A	Headwater	N/A
30. Does structure carry entire design flood flow?	☐ Yes ☐ No	☒ Yes ☐ No	☐ Yes ☐ No
If not, state area of additional waterway opening: (ft^2)	N/A		N/A
31. Type and size of existing overflow structures:	N/A	N/A	N/A
32. Has adverse scour occurred under or adjacent to the structure?	N/A	Yes at abutments	N/A
33. Classify type of scour and/or aggradation / degradation:	N/A	Abutment /Degradation	N/A

Required Additional Data

34. Deviations from the General Procedures presented in IDOT Drainage Manual 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:
None

36. Site Inspection made by: Dawn Cosentino Date: August 20, 2014
Remarks:

37. Prepared by: Dawn C. Cosentino Date February 16, 2016

Signed (QA/QC): Chad Dillavou Date February 17, 2016

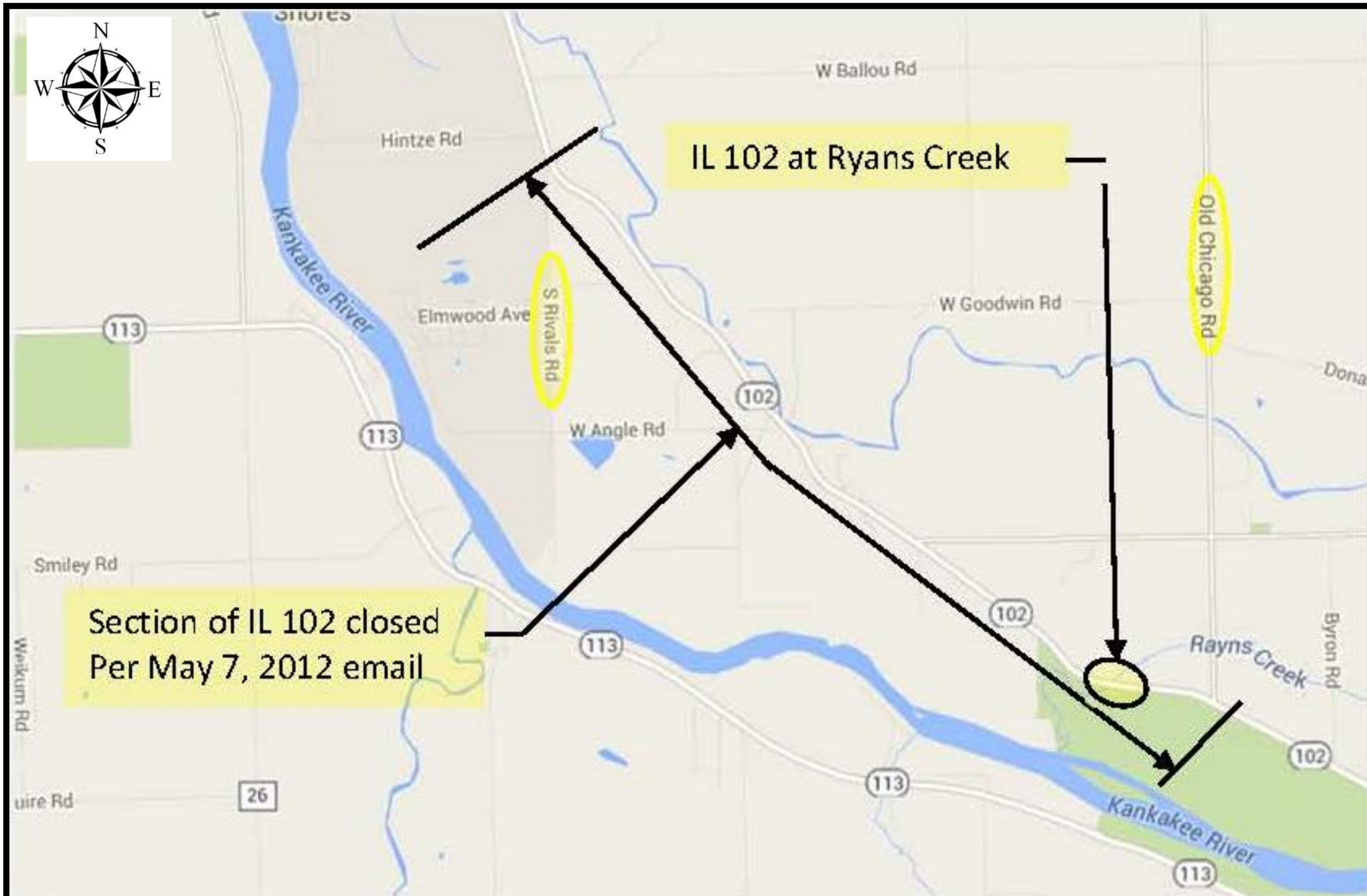
Hydraulic Report Checklist

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, nearby structures over same stream, etc.)
7. ☒ USGS Hydrologic Atlas (historical data available on selected streams- District 1 only)
8. ☒ Photographs - (Minimum: U/S & D/S structure faces, U/S & D/S channel, U/S & D/S roadway across structure)
9. ☒ Hydrology (map, calculations and related exhibits)
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- District 1 only. Include permit summary form and related attachments.)
19. ☒ Survey Notes (if available, CADD plot of survey points. No Electronic Point Files)
20. ☒ EWSE Data - (per Section 2-402.06)
21. ☒ Correspondence Notes
22. ☒ CD with Project Files (Include pdf copy of the Hydraulic Report and working files for the hydrology and hydraulic analyses.)

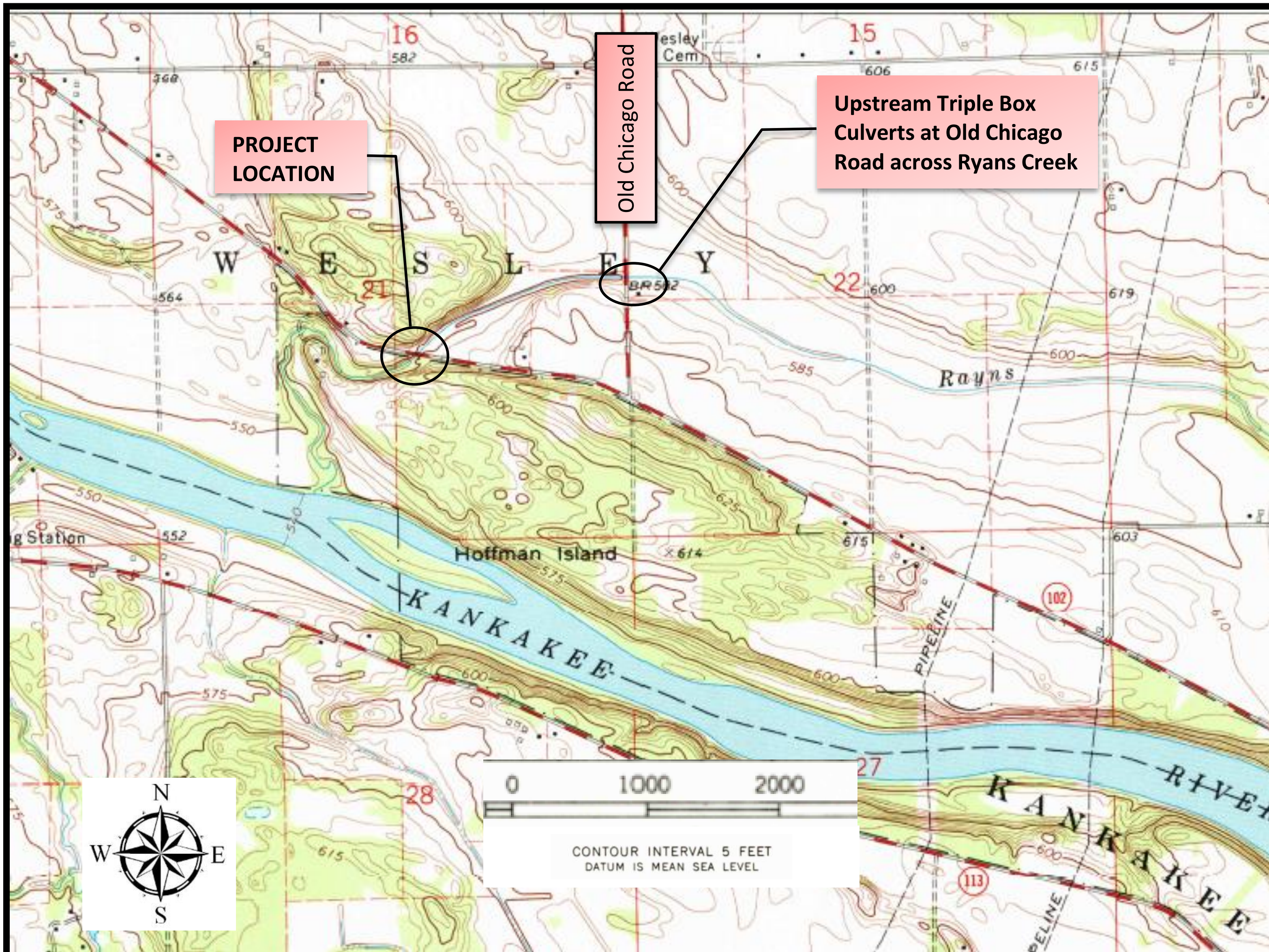


LOCATION MAP OF DOCUMENTED FLOODING

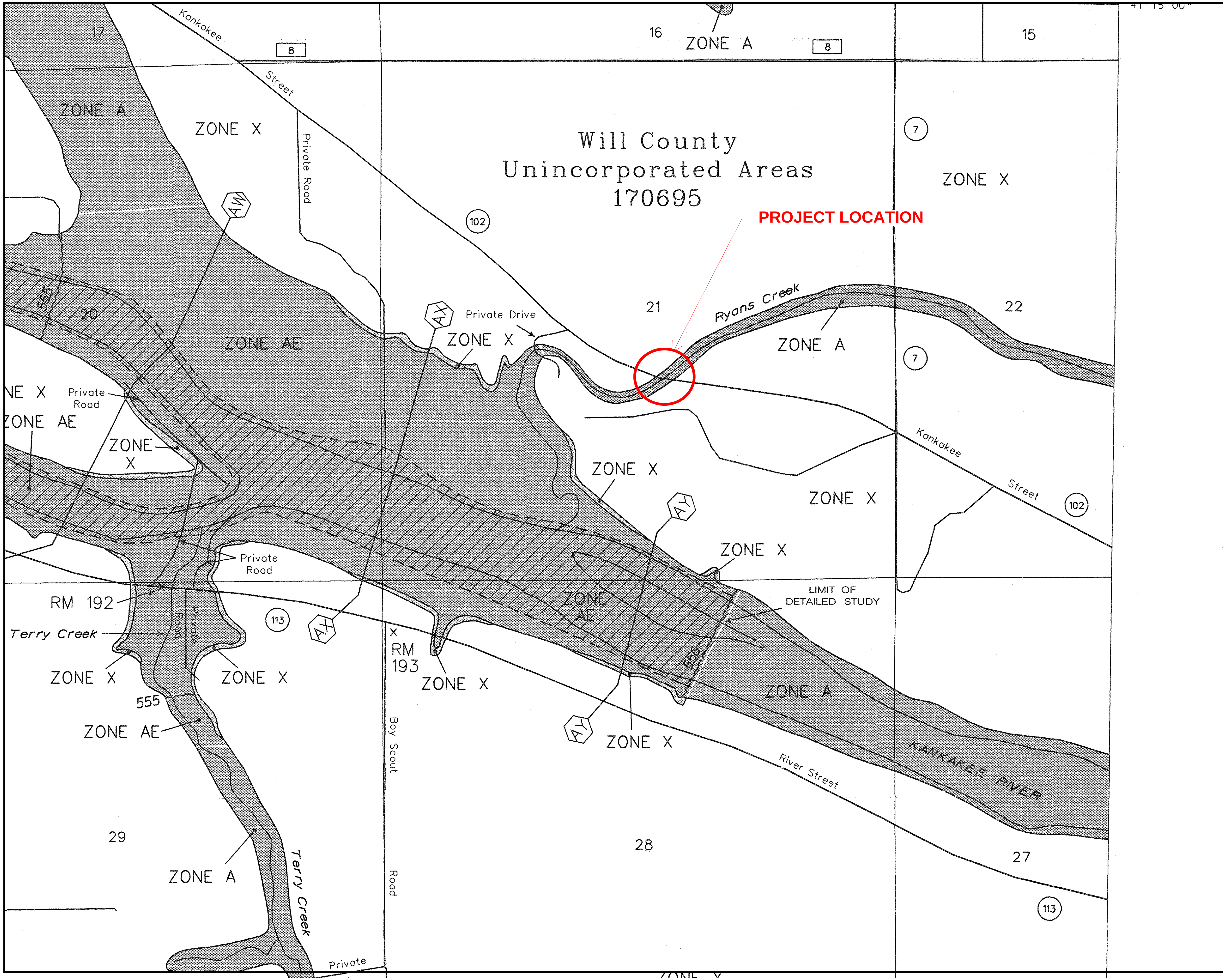
SECTION 4

Location Maps

USGS Bonfield Quadrangle, 1973



LOCATION MAP



APPROXIMATE SCALE
1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

WILL COUNTY, ILLINOIS AND INCORPORATED AREAS

PANEL 580 OF 585

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
UNINCORPORATED AREAS	170695	0580	E

Notice to User: The MAP NUMBER shown below should be used when placing map orders; the COMMUNITY NUMBER shown above should be used on insurance applications for the subject community.

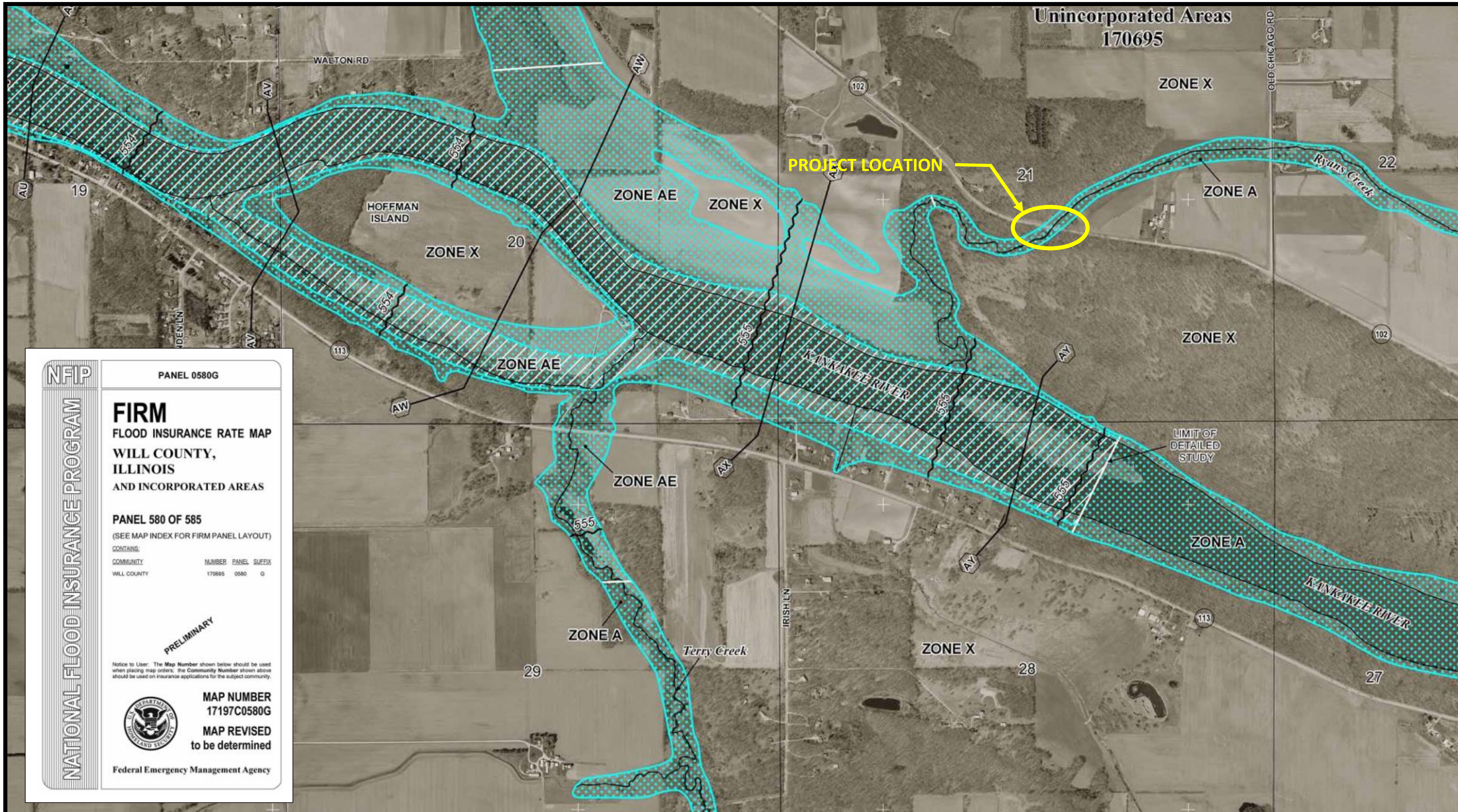
MAP NUMBER
17197C0580 E

EFFECTIVE DATE:
SEPTEMBER 6, 1995

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



PRELIMINARY MAP NO. 17197C0580G

LEGEND

MAY 7, 2012 FLOOD EVENT (Approximated ELEV = 579.5')

FILE NAME =	USER NAME = default	DESIGNED - DCC	REVISED -
$FILES$		DRAWN - JFS	REVISED -
	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -
$MODELNAME$	PLOT DATE = 5/4/2015	DATE - 11/19/2014	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

IL ROUTE 102 OVER RYANS CREEK
EXHIBIT 1 : MAY, 2012 FLOOD EVENT

SCALE: 1" = 50' | SHEET 1 OF 1 SHEETS | STA. 729+00.00 TO STA. 744+00.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631		WILL	1	1

CONTRACT NO.

ILLINOIS | FED. AID PROJECT

P-91-187-13

SECTION 5

Photographs

Upstream face of structure looking downstream (southwest)

Downstream face of structure looking upstream (northeast)

IL Route 102 looking northwest towards Ryans Creek

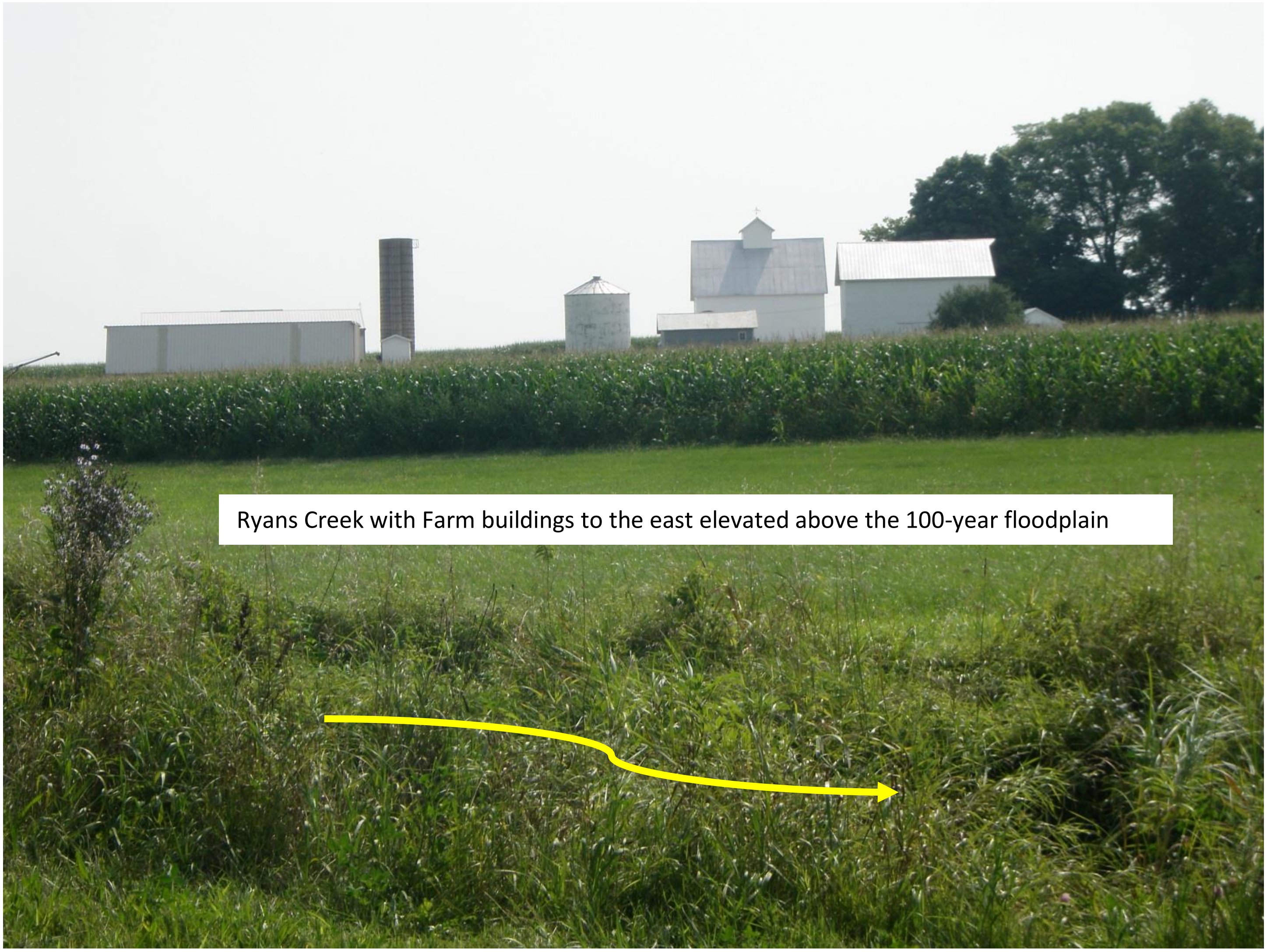
IL Route 102 looking southeast towards structure

Looking upstream through structure

Ryans Creek looking downstream from structure

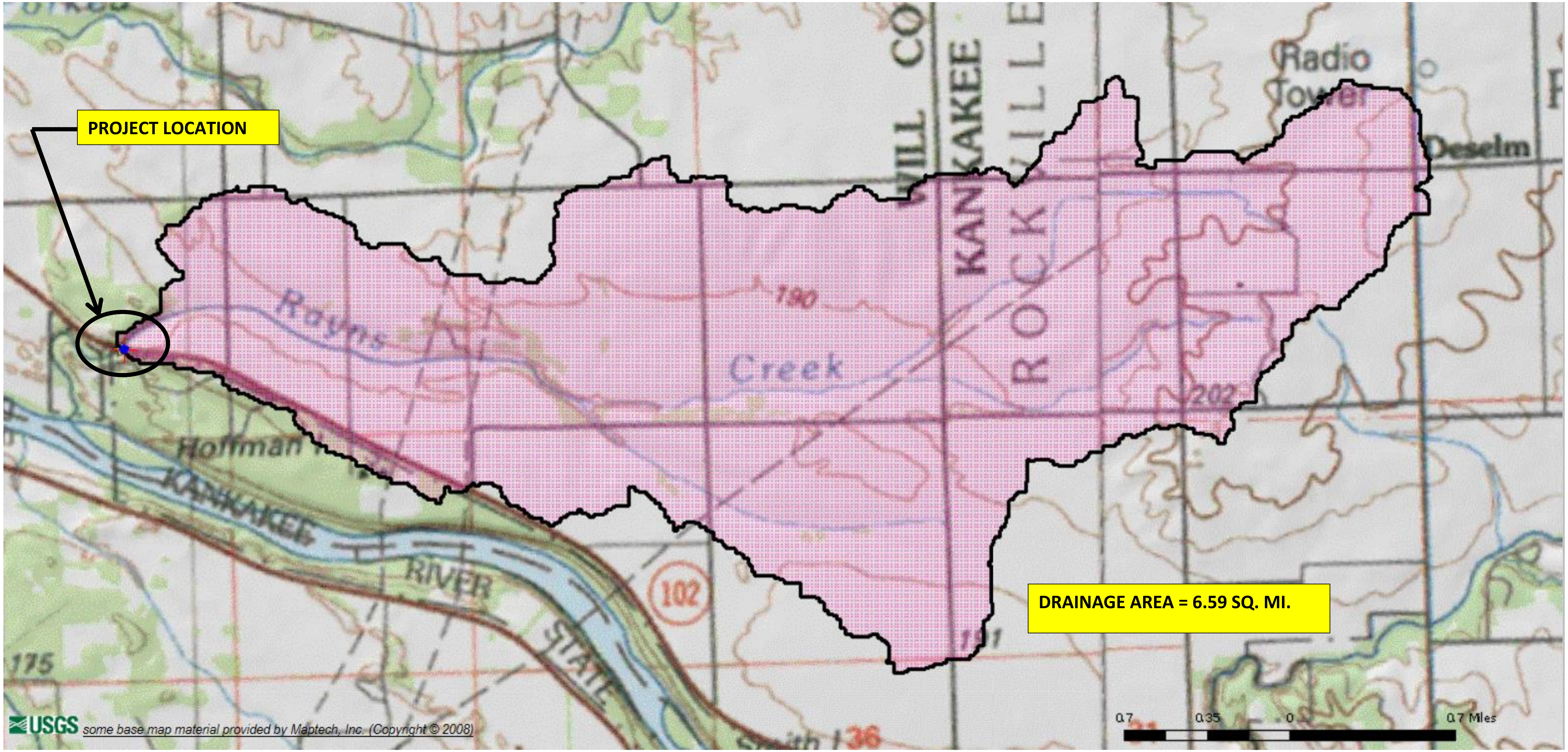
South abutment looking downstream through structure

Ryans Creek Floodplain looking upstream from structure


Ryans Creek with Farm buildings to the east elevated above the 100-year floodplain

SECTION 6

Hydrology



IL 102 (FAP 631) ACROSS RYANS CREEK (also known as RAYNS CREEK)

STREAM STATS DRAINAGE BOUNDARY MAP

USGS Illinois StreamStats

Basin Characteristics Report

Date: Mon Apr 14 2014 08:13:29 Mountain Daylight Time
NAD27 Latitude: 41.2394 (41 14 22)
NAD27 Longitude: -88.0793 (-88 04 46)
NAD83 Latitude: 41.2394 (41 14 22)
NAD83 Longitude: -88.0794 (-88 04 46)

Parameter	Value
Area in square miles	6.59
Unadjusted 10-85 slope in feet per mile	13.815
Adjusted 10-85 slope in feet per mile	12.997
Unadjusted Basin Length ArcHydro Method in miles	5.98
Adjusted Basin Length ArcHydro Method in miles	6.32
Average soil permeability	1.418
Percent of area covered by open water	0.047

USGS Illinois StreamStats

Streamstats Ungaged Site Report

Date: Mon Apr 14 2014 08:14:35 Mountain Daylight Time
Site Location: Illinois
NAD27 Latitude: 41.2394 (41 14 22)
NAD27 Longitude: -88.0793 (-88 04 46)
NAD83 Latitude: 41.2394 (41 14 22)
NAD83 Longitude: -88.0794 (-88 04 46)
Drainage Area: 6.59 mi2

Peak Flow Basin Characteristics

100% Region 2 AMS (6.59 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	6.59	0.03	9554
Stream Slope 10 and 85 Method (feet per mi)	12.997	0.81	317
Percent Open Water AND Herb Wetland (percent)	0.047	0	8

Peak Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	242	40	2.6	128	457
PK5	407	41	3.1	215	772
PK10	523	42	3.8	270	1010
PK25	664	45	4.6	331	1340
PK50	774	47	5.2	373	1600
PK100	873	49	5.6	408	1870
PK500	1110	55	6.2	479	2570

TR 55 Worksheet 2: Runoff Curve Number and Runoff

Project: IL Route 102 across Ryans Creek Designed By: DCC Date: 4/14/1

Location: Unincorporated Will County Checked: Doug Keppy Date: 4/22/1

Check one: ☑ Present ☐ Developed

1. Runoff curve number (CN)

Soil name and hydrologic group (Appendix A)	Cover description (Cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Fig. 2-3	CN [1/] Fig. 2-4	Area ☐ acres ☐ mi^2 ☑ %	Product of CN x area
	Residential 2 acre lots 70%A 30%B	52			5.0	258.5
A	Row Crops SR Good Condition	67			15.0	1,005.0
A	Woods - Fair Condition	36			25.0	900.0
A	Grassed Waterways	49			10.0	490.0
B	Row Crops SR Good Condition	78			30.0	2,340.0
B	Woods - Fair Condition	60			15.0	900.0
				Totals =	100.0	5,893.5

[1/] Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{5,893.5}{100.0} = 59$ Use CN = 59

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .... years			
Rainfall, P (24 hour) .... in.			
Runoff, Q .... in.			

(Use P and CN with Table 2-1, Figure 2-1, or equations 2-3 and 2-4.)

IL 102 over Ryans Creek DCC 04/14/2014

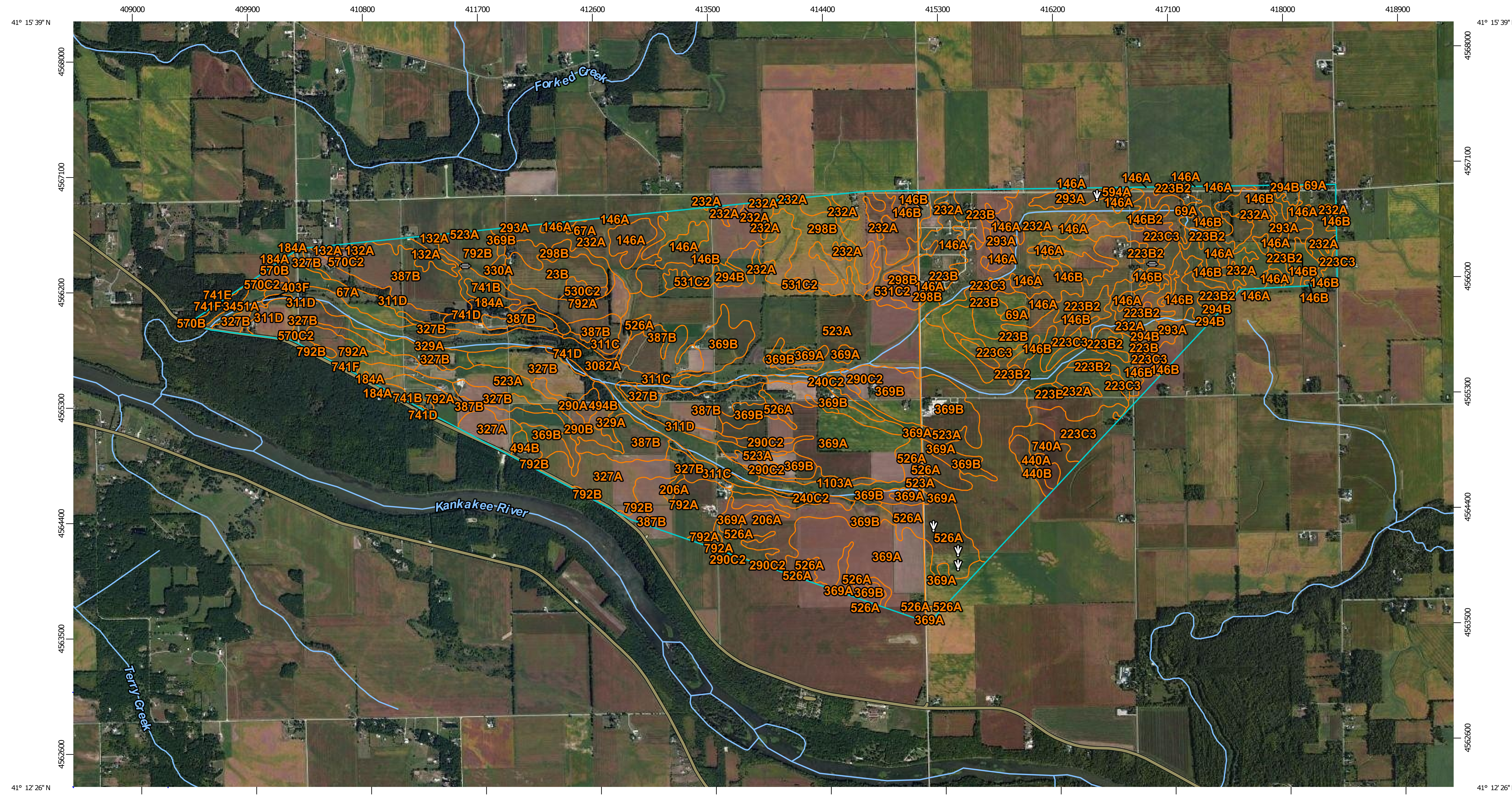
Acres of Soils Groups from Soil Survey

	A	B	C	D	
	45.1	202.5		5.9	
	235.9	30.3			
	204.4	157.2			
	41.5	76.5			
	26.3	5.5	102.7		
	15	2.4			
	235.7	53.3			
	62.2	8.2			
	10.3				
	26.6				
		42.3			
	35.4	135.3			
	16.7				
	48.2				
	17.1				
	5.9				
	90.9		27.6		
	8	20	13.7		
	0.1	6.3			
		91.6			
			32.9	58.2	
			10.6		
	93	149.3			
	24.1				
	2.2				
	246			2.2	
		242.7			
		267.3			
	345.8	19			
	63.7		9.2		
			77.5		
		6	22.5		
		29		35.4	
	157.9			2.4	
		40.9		23.7	
	26.8				
	134.4				
	9.2				
TOTAL	2228.4	1585.6	296.7	127.8	4238.5
	53%	37%	7%	3%	

C & D soils will be absorbed into B

Use 53% A and 47% B Soils breakdown

Soil Map—Kankakee County, Illinois, and Will County, Illinois
(IL 102 over Ryans Creek)



Map Scale: 1:29,100 if printed on B landscape (17" x 11") sheet.

N

Meters: 0, 400, 800, 1600, 2400

Feet: 0, 1000, 2000, 4000, 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Kankakee County, Illinois
Survey Area Data: Version 9, Dec 8, 2013

Soil Survey Area: Will County, Illinois
Survey Area Data: Version 8, Dec 8, 2013

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jun 13, 2011—Mar 28, 2012

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

Map Unit Legend

Kankakee County, Illinois (IL091)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
69A	Milford silty clay loam, 0 to 2 percent slopes	45.1	1.1%
146A	Elliott silt loam, 0 to 2 percent slopes	235.9	5.6%
146B	Elliott silt loam, 2 to 4 percent slopes	202.5	4.8%
146B2	Elliott silty clay loam, 2 to 4 percent slopes, eroded	30.3	0.7%
223B	Varna silt loam, 2 to 4 percent slopes	157.2	3.7%
223B2	Varna silt loam, 2 to 4 percent slopes, eroded	76.5	1.8%
223C3	Varna silty clay loam, 4 to 6 percent slopes, severely eroded	102.7	2.4%
232A	Ashkum silty clay loam, 0 to 2 percent slopes	204.4	4.8%
293A	Andres silt loam, 0 to 2 percent slopes	41.5	1.0%
294B	Symerton silt loam, 2 to 5 percent slopes	5.5	0.1%
298B	Beecher silt loam, 2 to 4 percent slopes	2.4	0.1%
369A	Waupecan silt loam, 0 to 2 percent slopes	26.3	0.6%
369B	Waupecan silt loam, 2 to 4 percent slopes	53.3	1.3%
440A	Jasper loam, 0 to 2 percent slopes	15.0	0.4%
440B	Jasper loam, 2 to 5 percent slopes	8.2	0.2%
523A	Dunham silty clay loam, 0 to 2 percent slopes	235.7	5.6%
526A	Grundelein silt loam, 0 to 2 percent slopes	62.2	1.5%
530D3	Ozaukee silty clay loam, 6 to 12 percent slopes, severely eroded	5.9	0.1%
594A	Reddick clay loam, 0 to 2 percent slopes	10.3	0.2%
740A	Darroch silt loam, 0 to 2 percent slopes	26.6	0.6%
Subtotals for Soil Survey Area		**1,547.4**	**36.5%**
Totals for Area of Interest		**4,238.6**	**100.0%**

Will County, Illinois (IL197)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
23B	Blount silt loam, 2 to 4 percent slopes	42.3	1.0%
67A	Harpster silty clay loam, 0 to 2 percent slopes	35.4	0.8%
132A	Starks silt loam, 0 to 2 percent slopes	16.7	0.4%
146A	Elliott silt loam, 0 to 2 percent slopes	48.2	1.1%
146B	Elliott silt loam, 2 to 4 percent slopes	135.3	3.2%
184A	Roby fine sandy loam, 0 to 2 percent slopes	17.1	0.4%
206A	Thorp silt loam, 0 to 2 percent slopes	5.9	0.1%
232A	Ashkum silty clay loam, 0 to 2 percent slopes	90.9	2.1%
240C2	Plattville silt loam, 4 to 6 percent slopes, eroded	27.6	0.7%
290A	Warsaw silt loam, 0 to 2 percent slopes	8.0	0.2%
290B	Warsaw silt loam, 2 to 4 percent slopes	20.0	0.5%
290C2	Warsaw silt loam, 4 to 6 percent slopes, eroded	13.7	0.3%
293A	Andres silt loam, 0 to 2 percent slopes	0.1	0.0%
294B	Symerton silt loam, 2 to 5 percent slopes	6.3	0.1%
298B	Beecher silt loam, 2 to 4 percent slopes	91.6	2.2%
311C	Ritchey silt loam, 4 to 6 percent slopes	32.9	0.8%
311D	Ritchey silt loam, 6 to 12 percent slopes	58.2	1.4%
315C2	Channahon silt loam, 4 to 6 percent slopes, eroded	10.6	0.2%
327A	Fox silt loam, 0 to 2 percent slopes	93.0	2.2%
327B	Fox silt loam, 2 to 4 percent slopes	149.3	3.5%
329A	Will silty clay loam, 0 to 2 percent slopes	24.1	0.6%
330A	Peotone silty clay loam, 0 to 2 percent slopes	2.2	0.1%
369A	Waupecan silt loam, 0 to 2 percent slopes	246.0	5.8%

Will County, Illinois (IL197)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
369B	Waupecan silt loam, 2 to 4 percent slopes	242.7	5.7%
387B	Ockley loam, 2 to 4 percent slopes	267.3	6.3%
403F	Elizabeth silt loam, 20 to 30 percent slopes	2.2	0.1%
494B	Kankakee fine sandy loam, 2 to 4 percent slopes	19.0	0.4%
523A	Dunham silty clay loam, 0 to 2 percent slopes	345.8	8.2%
526A	Grundelein silt loam, 0 to 2 percent slopes	63.7	1.5%
530C2	Ozaukee silt loam, 4 to 6 percent slopes, eroded	9.2	0.2%
531C2	Markham silt loam, 4 to 6 percent slopes, eroded	77.5	1.8%
570B	Martinsville loam, 2 to 4 percent slopes	6.0	0.1%
570C2	Martinsville loam, 4 to 6 percent slopes, eroded	22.5	0.5%
741B	Oakville fine sand, 1 to 6 percent slopes	29.0	0.7%
741D	Oakville fine sand, 6 to 12 percent slopes	35.4	0.8%
741E	Oakville fine sand, 12 to 20 percent slopes	2.4	0.1%
741F	Oakville fine sand, 20 to 30 percent slopes	23.7	0.6%
792A	Bowes silt loam, 0 to 2 percent slopes	157.9	3.7%
792B	Bowes silt loam, 2 to 4 percent slopes	40.9	1.0%
1103A	Houghton muck, undrained, 0 to 2 percent slopes	26.8	0.6%
3082A	Millington silt loam, 0 to 2 percent slopes, frequently flooded	134.4	3.2%
3451A	Lawson silt loam, 0 to 2 percent slopes, frequently flooded	9.2	0.2%
Subtotals for Soil Survey Area		**2,691.0**	**63.5%**
Totals for Area of Interest		**4,238.6**	**100.0%**

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.
2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

1 Average runoff condition, and I_a=0.2S
2 Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.
3 Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Primera

PAGE ____ OF ____

PROJECT NO: 2013127.05 TITLE: IL 102 over Rayns Ck CALC NO: ______ REV. NO: ______

PREPARED BY: Dawn Cosentino DCC DATE: 9/14/2016

REVIEWED BY: Chad Di Carrow CD DATE: 9/14/2016

APPROVED BY: ______ DATE: ______

Calculations of Time of Concentration (T_c) and Storage Coefficient (R) for CLARK UNIT HYDROGRAPH

* Using Stream Stats

L = 6.32 miles
S = 12.997 feet per mile

$$T_c = (1.54) L^{0.875} * S^{-0.181}$$

$$T_c = (1.54)(6.32)^{0.875} (12.997)^{-0.181}$$

$$\boxed{T_c = 4.859 \text{ hrs.}}$$

$$R = (16.4) L^{0.342} S^{-0.790}$$

$$R = (16.4)(6.32)^{.342} (12.997)^{-0.790}$$

$$\boxed{R = 4.062 \text{ hrs}}$$

From Figure 2 $R/(T_c + R) = 0.5$

calculated Value $R/(T_c + R) = \dfrac{4.062}{(4.859 + 4.062)} = 0.46$

Illinois StreamStats

Basin Characteristics Report

Date: Mon Apr 14 2014 08:13:29 Mountain Daylight Time
NAD27 Latitude: 41.2394 (41 14 22)
NAD27 Longitude: -88.0793 (-88 04 46)
NAD83 Latitude: 41.2394 (41 14 22)
NAD83 Longitude: -88.0794 (-88 04 46)

Parameter	Value
Area in square miles	6.59
Unadjusted 10-85 slope in feet per mile	13.815
Adjusted 10-85 slope in feet per mile	12.997
Unadjusted Basin Length ArcHydro Method in miles	5.98
Adjusted Basin Length ArcHydro Method in miles	6.32
Average soil permeability	1.418
Percent of area covered by open water	0.047

science for a changing world

In cooperation with the Illinois Department of Natural Resources, Office of Water Resources

Equations for Estimating Clark Unit-Hydrograph Parameters for Small Rural Watersheds in Illinois

Water-Resources Investigations Report 00–4184

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Equation Development

For small rural watersheds in Illinois, three methods were used to develop new equations for estimating T_C and R. Similar to the Graf and others (1982b) study, a multiple-linear regression analysis was used to determine mathematical relations among watershed characteristics and (T_C+R), and an attempt was made to determine regional values of $R/(T_C+R)$. The second method involved using multiple-linear regression analysis to determine mathematical relations among watershed characteristics and average values of T_C and R for each watershed. No storm characteristics or seasonal effects were analyzed in the second method. The third method involved using multiple-linear regression analysis to determine mathematical relations among watershed, storm, and seasonal characteristics and values of T_C and R for each storm. Overall, the second method yielded the best equations, as described in the following sections.

Results Based on Methods Similar to the Graf and others (1982b) Study

In the first method, equations for estimating (T_C+R) were developed utilizing multiple-linear regression to relate the logarithm of the average (T_C+R) for each watershed to logarithms of watershed area and main-channel length and slope. The multiple-linear regression of logarithms resulted in an estimation equation

$$h_{pi} = aW_1^{b1}\ W_2^{b2} \ , \tag{8}$$

where

- h_{pi} is hydrograph parameter i [in this case (T_C+ R)],
- W_j are watershed characteristics j,
- bj are exponents corresponding to watershed characteristics j, and
- a is a coefficient.

Watershed characteristics were added one at a time to the regression model (eq. 8), and characteristics were retained in the regression model only if the corresponding exponents were statistically significant (the corresponding 95-percent confidence interval for the parameter did not include zero) and the sign of the exponent was correct from a physical viewpoint. For example, hydrograph-timing parameters should increase with increasing area and main-channel length and decrease with increasing main-channel slope. From the regression, an equation involving the length and slope was determined to yield the highest coefficient of determination (R^2=0.74).

Next, the average [$R/(T_C+R)$] values for each watershed were plotted on a map of the State of Illinois. Contours were drawn to try to determine regional trends in the values, but all such attempts were unsuccessful. Before abandoning the method similar to that used by Graf and others (1982b) because of the inability to find regional trends in average [$R/(T_C+R)$], the logarithm of these values were regressed against watershed characteristics similar to the previous regression, using values of average (T_C+R). All combinations of the regression yielded very poor coefficient of determination (R^2) values (highest equaling 0.38). With no reliable method of determining [$R/(T_C+R)$], this method was abandoned.

Interestingly, the coefficient and exponents for the Graf and others (1982b) equation for (T_C+R) were not within the 95-percent confidence intervals when compared to the equation developed for (T_C+R) for this study, except for a slight overlap in the length exponent. The upper and lower confidence bounds for the length exponent were 0.650 and 0.339, respectively, for the (T_C+R) equation developed in this study.

Results Based on Average Values of T_C and R for Each Watershed

The second method, determined to be the overall best method in this study, utilized multiple-linear regression analysis to relate the logarithms of the average T_C and average R for each watershed to logarithms of watershed area and main-channel length and slope. Equations for the T_C and R estimations (in hours) that yield the highest R^2 values included main-channel length and slope and are

$$T_C = 1.54\ L^{0.875}\ S^{-0.181} \text{ and} \tag{9}$$

$$R = 16.4\ L^{0.342}\ S^{-0.790}, \tag{10}$$

where

- L is the stream length measured along the main channel from the watershed outlet to the watershed divide, in mi, and
- S is the main-channel slope determined from elevations at points that represent 10 and 85 percent of the distance along the channel

IL RTE 102 across Ryans Creek ~~acro~~ Will Co.

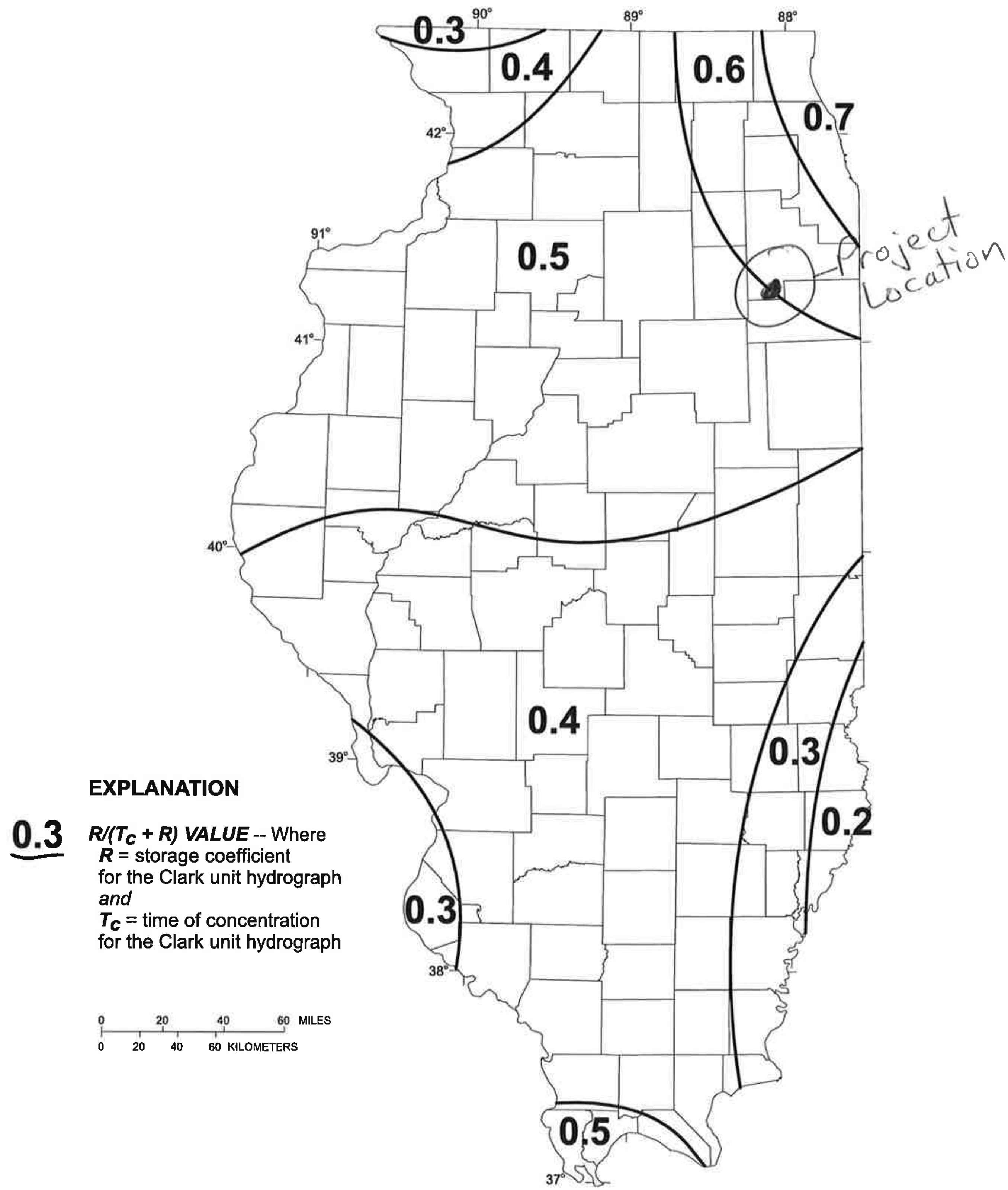


Figure 2. Regional values of $R/(T_C + R)$ determined by Graf and others (1982b) for Illinois.

Table 2. Average Ratios of X-Hour/24-Hour Rainfall for Illinois

Storm period (hours)	*Ratio, x-hr/24-hr*
0.08 (5 min.)	0.12
0.17 (10 min.)	0.21
0.25	0.27
0.50	0.37
1	0.47
2	0.58
3	0.64
6	0.75
12	0.87
18	0.94
24	1.00
48	1.08
72	1.16

Table 3. Ratios of Illinois Rainfall Amounts for Recurrence Intervals of Less than 1 Year to Rainfall Amounts for Recurrence Intervals of 1 Year, for Various Rainstorm Periods

	Ratio, x-month to 12-month rainfall amount for given rainstorm period				
Storm period	*2 months*	*3 months*	*4 months*	*6 months*	*9 months*
≤24 hours	0.55	0.64	0.70	0.81	0.92
48 hours	0.53	0.62	0.69	0.80	0.92
72 hours	0.52	0.61	0.69	0.80	0.92

Table 3 shows the relationship between 1-year and shorter-interval frequency values for various rain periods (Huff and Angel, 1989). Table 3 can be used if one desires recurrence-interval values for 2 to 9 months.

The following examples illustrate how to use figure 13 or 14 in conjunction with tables 2 and 3 to calculate frequency values for any given situation. Assume that a user wishes to calculate the maximum 6-hour rainfall expected to occur, on the average, once in 25 years at Aurora (figure 12). The 24-hour map for a 25-year recurrence (figure 14) shows a value of 6.00 inches at Aurora. Table 2 shows that the 6-hour/24-hour ratio is 0.75. Multiplying 6.00 by 0.75 gives a value of 4.50 inches for the 6-hour, 25-year storm.

IL 102 over RHYNS CREEK
Rainfall Depths 24-hr Storms
DCC 10/28/2014

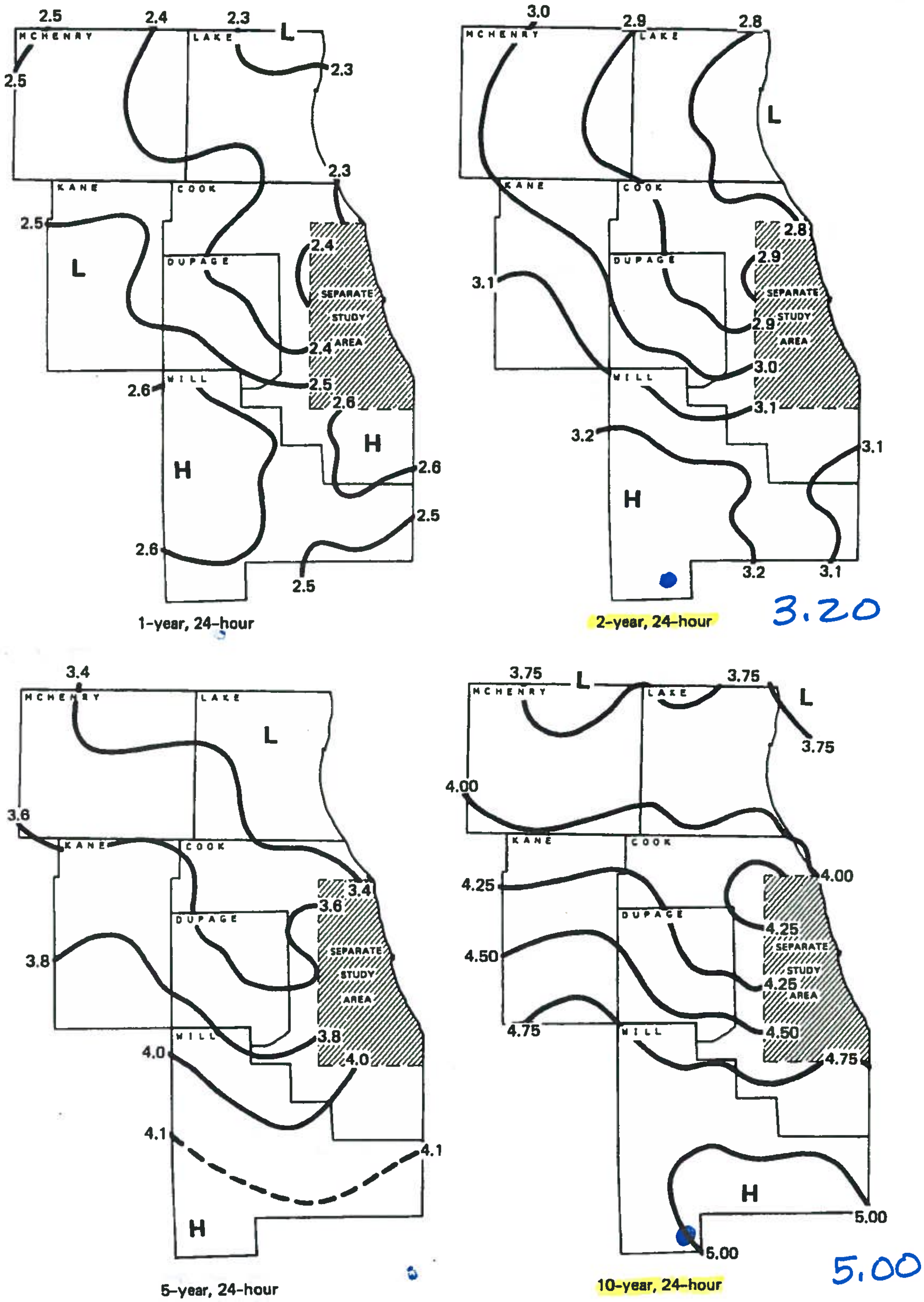
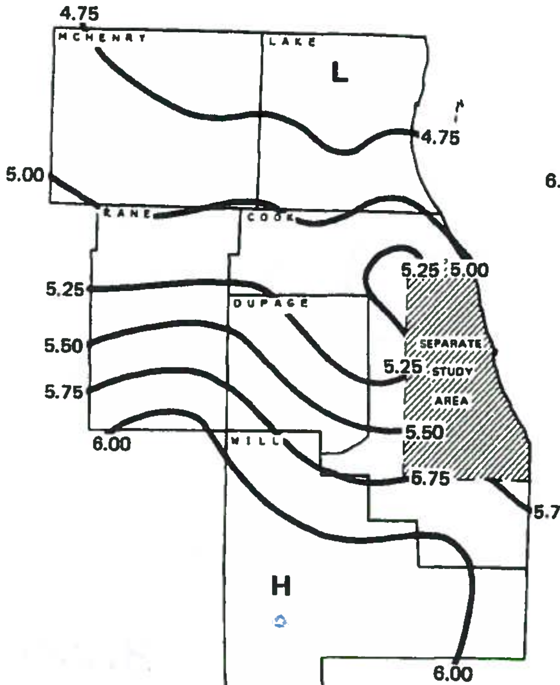
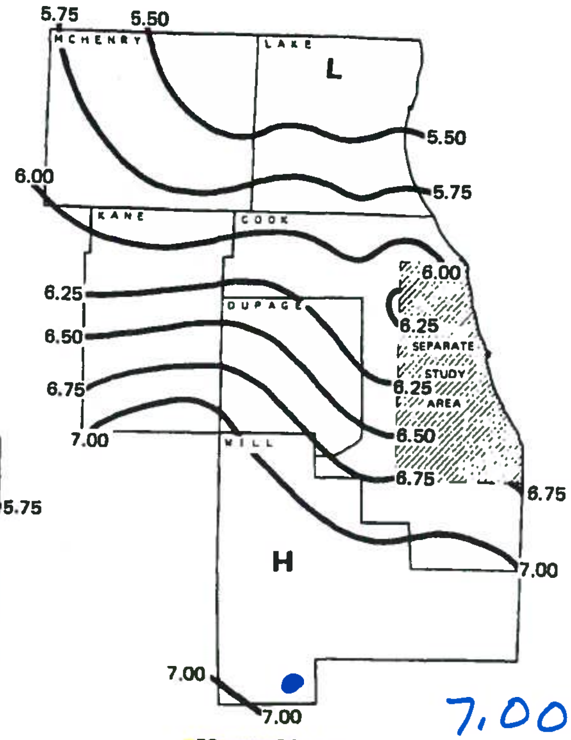


Figure 14. Frequency distribution of 24-hour maximum rainfall (inches), six-county area (adjusted)

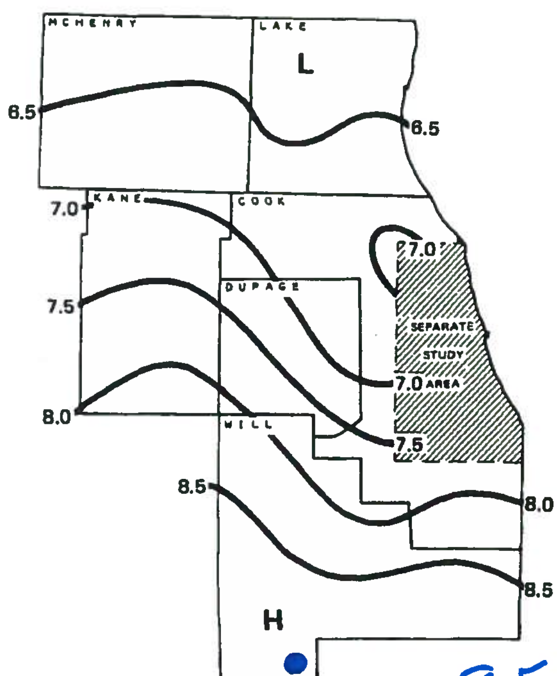


25-year, 24-hour



50-year, 24-hour

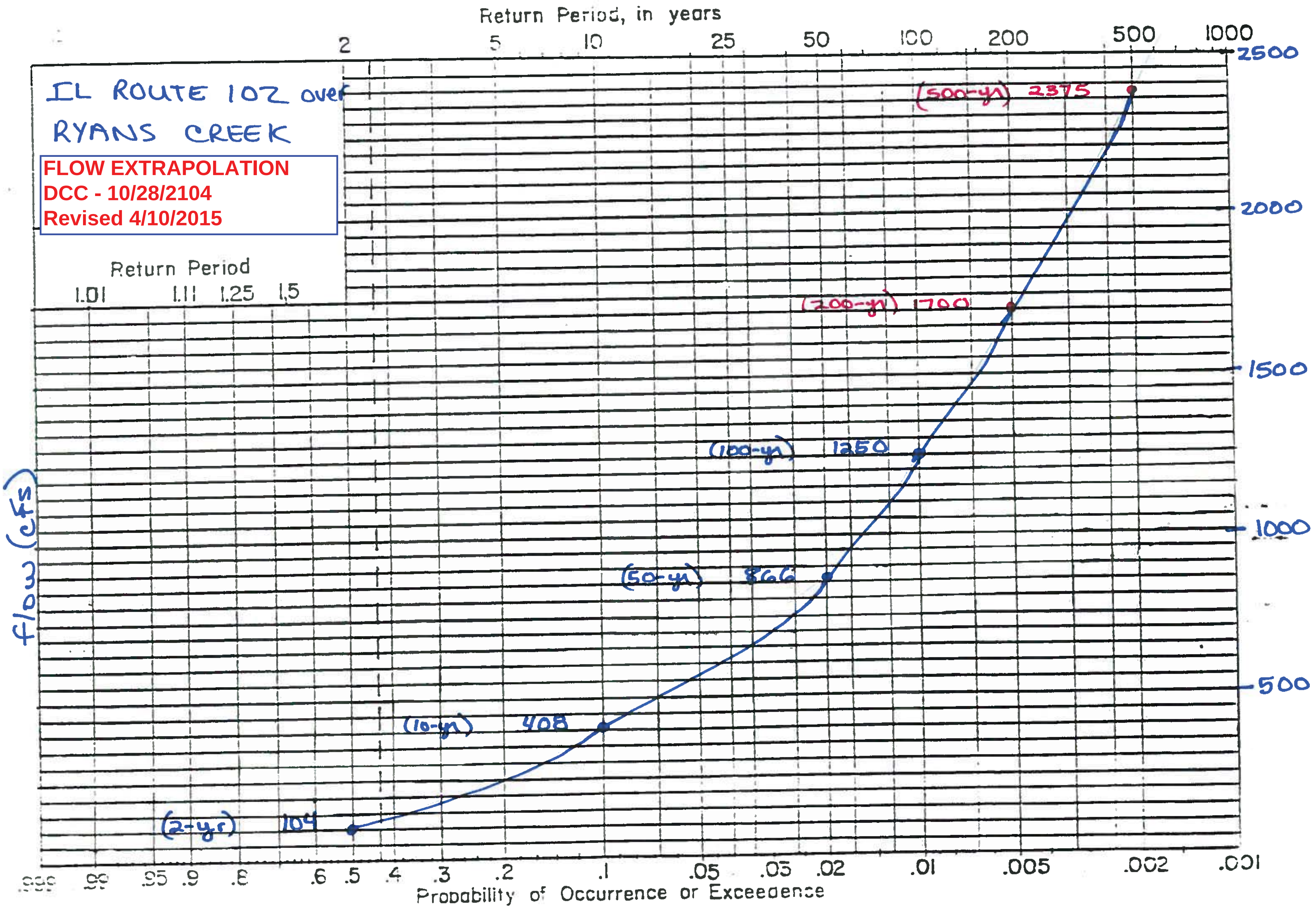
7,00



100-year, 24-hour

8,50

Figure 14. Concluded



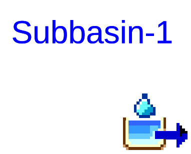
IL ROUTE 102 over
RYANS CREEK
FLOW EXTRAPOLATION
DCC - 10/28/2104
Revised 4/10/2015
Return Period, in years
2 5 10 25 50 100 200 500 1000
Return Period
1.01 1.11 1.25 1.5
(500-yr) 2375
(200-yr) 1700
(100-yr) 1250
(50-yr) 866
(10-yr) 408
(2-yr) 104
2500
2000
1500
1000
500
flow (cfs)
.999 .99 .95 .9 .8 .6 .5 .4 .3 .2 .1 .05 .03 .02 .01 .005 .002 .001
Probability of Occurrence or Exceedence

HEC-HMS

Project : Ryans Creek

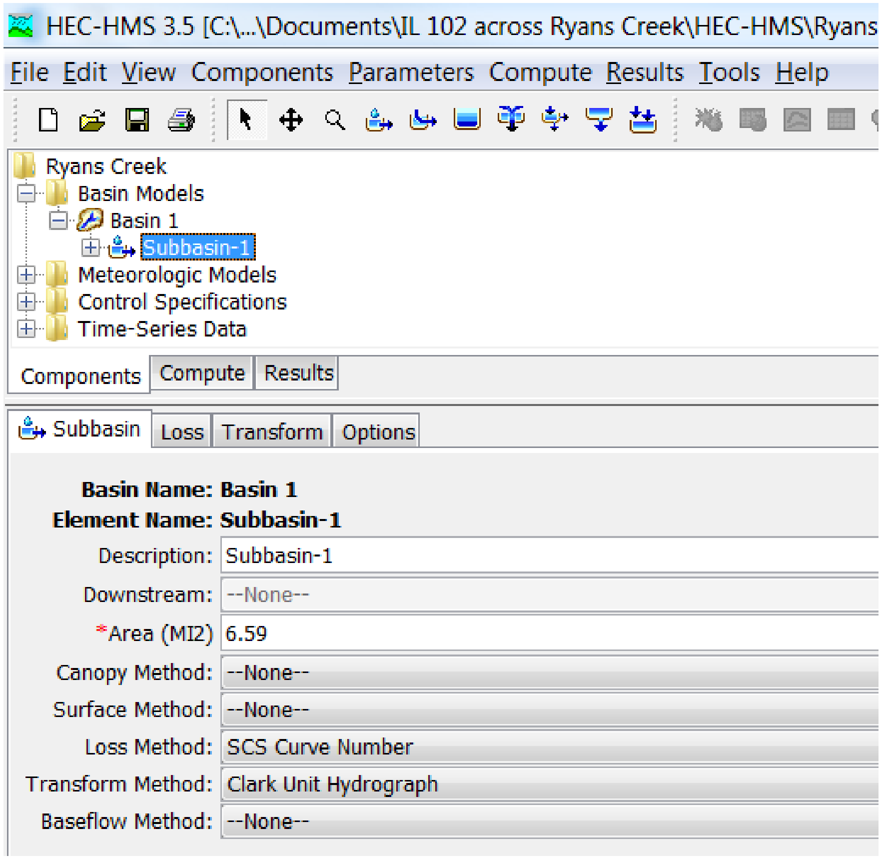
Basin Model : Basin 1

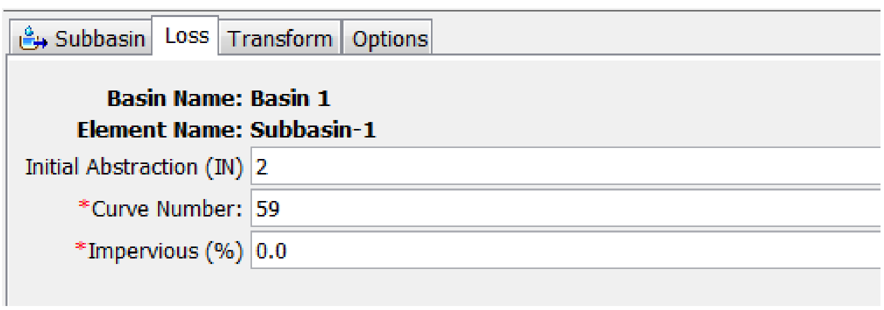
Oct 31 14:20:51 CDT 2014

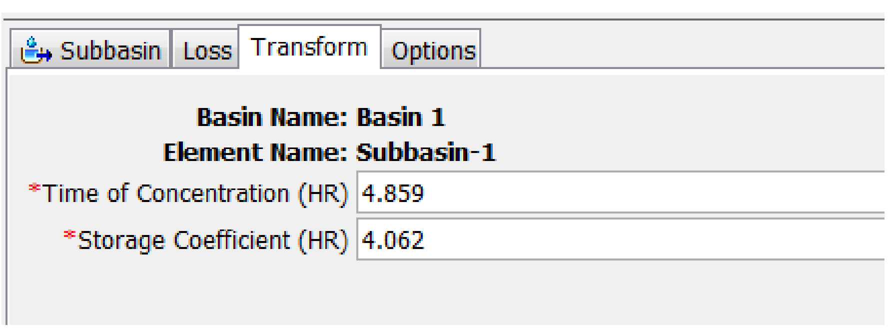


HEC-HMS Input Parameters
IL Route 102 across Ryans Creek

Basin 1 Characteristics

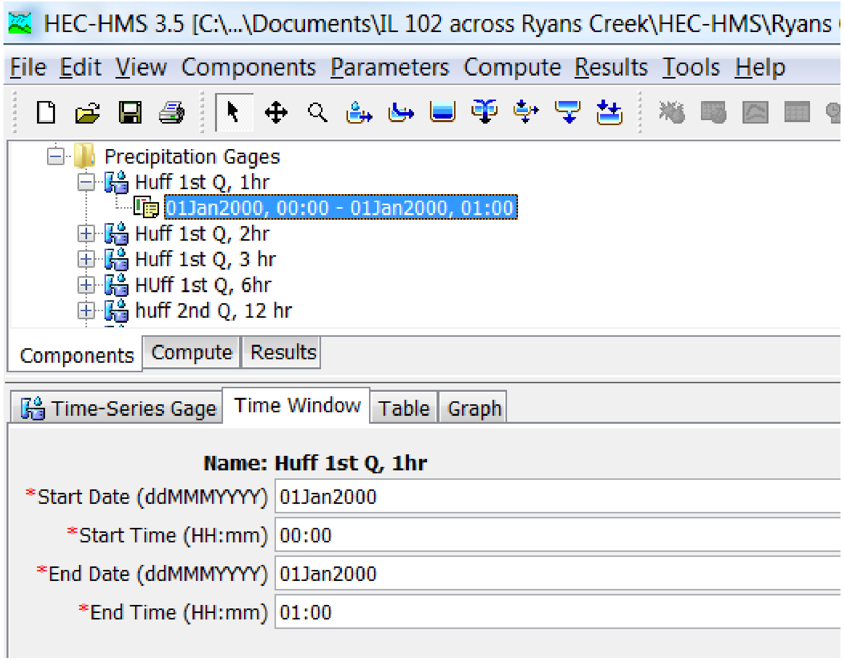






Meteorologic Models

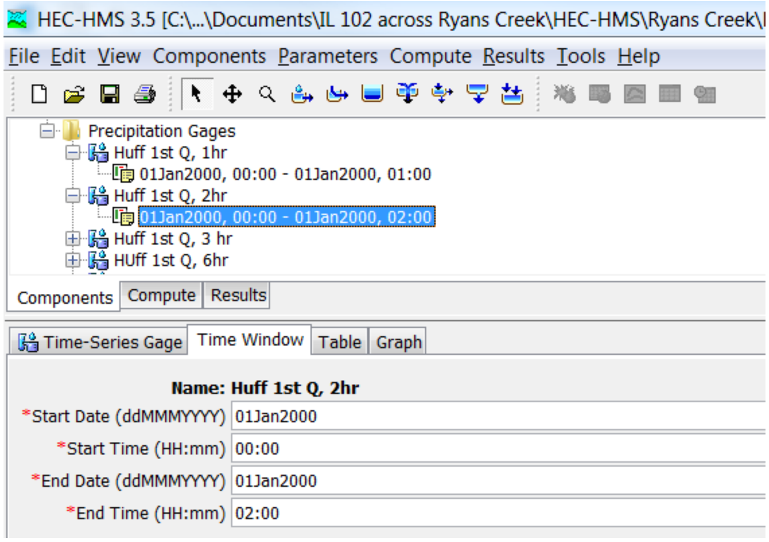
Huff 1st Quartile, 1-hour Rainfall distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 00:03	0.16
01Jan2000, 00:06	0.33
01Jan2000, 00:09	0.43
01Jan2000, 00:12	0.52
01Jan2000, 00:15	0.60
01Jan2000, 00:18	0.66
01Jan2000, 00:21	0.71
01Jan2000, 00:24	0.75
01Jan2000, 00:27	0.79
01Jan2000, 00:30	0.82
01Jan2000, 00:33	0.84
01Jan2000, 00:36	0.86
01Jan2000, 00:39	0.88
01Jan2000, 00:42	0.90
01Jan2000, 00:45	0.92
01Jan2000, 00:48	0.94
01Jan2000, 00:51	0.96
01Jan2000, 00:54	0.97
01Jan2000, 00:57	0.98
01Jan2000, 01:00	1.00

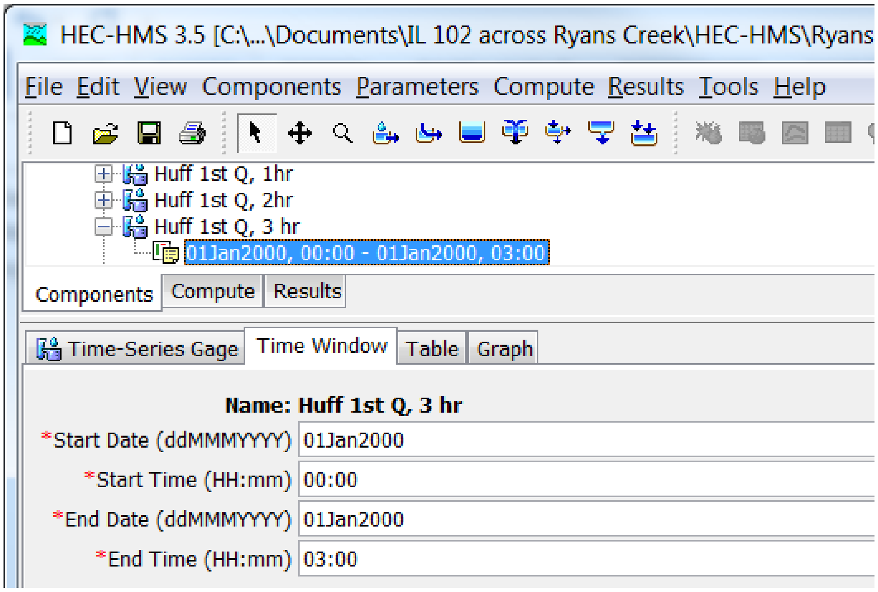
Huff 1st Quartile, 2-hour Rainfall distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.000
01Jan2000, 00:03	0.080
01Jan2000, 00:06	0.160
01Jan2000, 00:09	0.245
01Jan2000, 00:12	0.330
01Jan2000, 00:15	0.380
01Jan2000, 00:18	0.430
01Jan2000, 00:21	0.475
01Jan2000, 00:24	0.520
01Jan2000, 00:27	0.560
01Jan2000, 00:30	0.600
01Jan2000, 00:33	0.630
01Jan2000, 00:36	0.660
01Jan2000, 00:39	0.685
01Jan2000, 00:42	0.710
01Jan2000, 00:45	0.730
01Jan2000, 00:48	0.750
01Jan2000, 00:51	0.770
01Jan2000, 00:54	0.790
01Jan2000, 00:57	0.805
01Jan2000, 01:00	0.820
01Jan2000, 01:03	0.830
01Jan2000, 01:06	0.840
01Jan2000, 01:09	0.850
01Jan2000, 01:12	0.860
01Jan2000, 01:15	0.870
01Jan2000, 01:18	0.880
01Jan2000, 01:21	0.890
01Jan2000, 01:24	0.900
01Jan2000, 01:27	0.910
01Jan2000, 01:30	0.920
01Jan2000, 01:33	0.930
01Jan2000, 01:36	0.940
01Jan2000, 01:39	0.950
01Jan2000, 01:42	0.960
01Jan2000, 01:45	0.965
01Jan2000, 01:48	0.970
01Jan2000, 01:51	0.975
01Jan2000, 01:54	0.980
01Jan2000, 01:57	0.990
01Jan2000, 02:00	1.000

Huff 1st Quartile, 3-hour Rainfall distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 00:06	0.11
01Jan2000, 00:12	0.23
01Jan2000, 00:18	0.33
01Jan2000, 00:24	0.40
01Jan2000, 00:30	0.46
01Jan2000, 00:36	0.52
01Jan2000, 00:42	0.57
01Jan2000, 00:48	0.62
01Jan2000, 00:54	0.66
01Jan2000, 01:00	0.69
01Jan2000, 01:06	0.72
01Jan2000, 01:12	0.75
01Jan2000, 01:18	0.78
01Jan2000, 01:24	0.80
01Jan2000, 01:30	0.82
01Jan2000, 01:36	0.83
01Jan2000, 01:42	0.85
01Jan2000, 01:48	0.86
01Jan2000, 01:54	0.87
01Jan2000, 02:00	0.89
01Jan2000, 02:06	0.90
01Jan2000, 02:12	0.91
01Jan2000, 02:18	0.93
01Jan2000, 02:24	0.94
01Jan2000, 02:30	0.95
01Jan2000, 02:36	0.96
01Jan2000, 02:42	0.97
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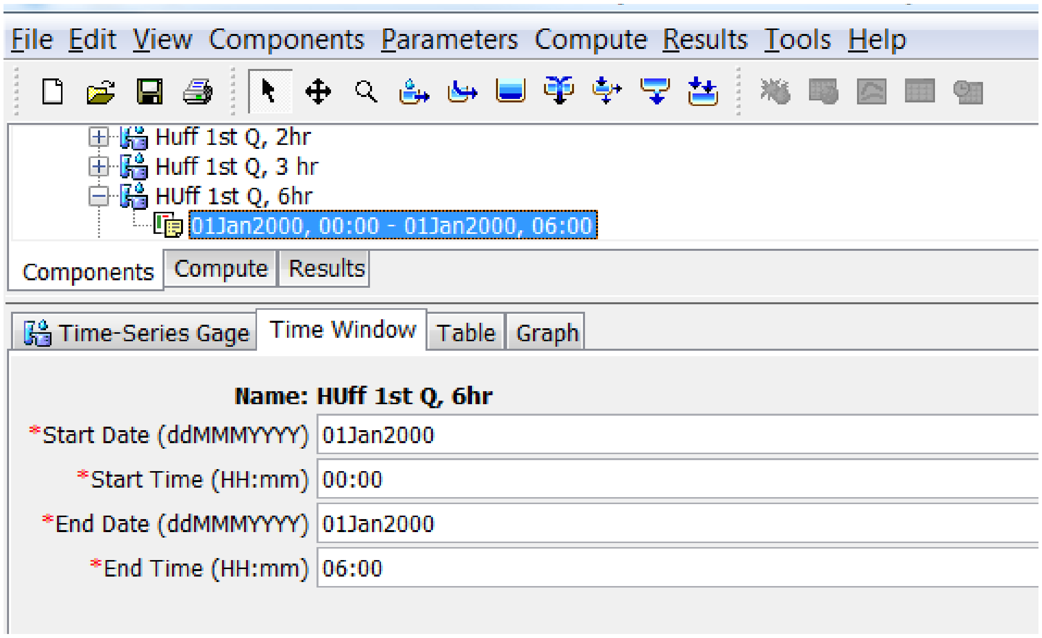
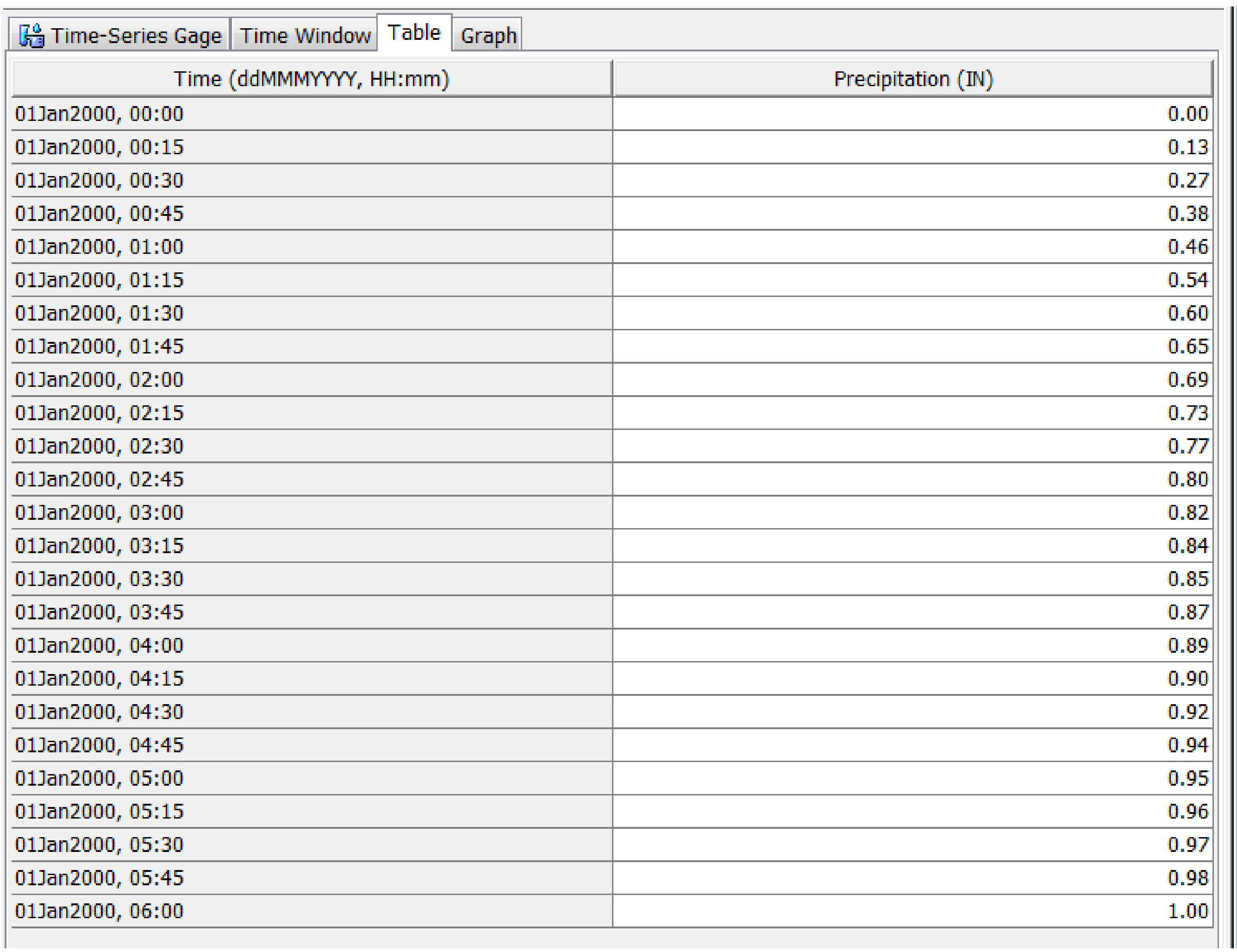
01Jan2000, 02:54	0.99
01Jan2000, 03:00	1.00

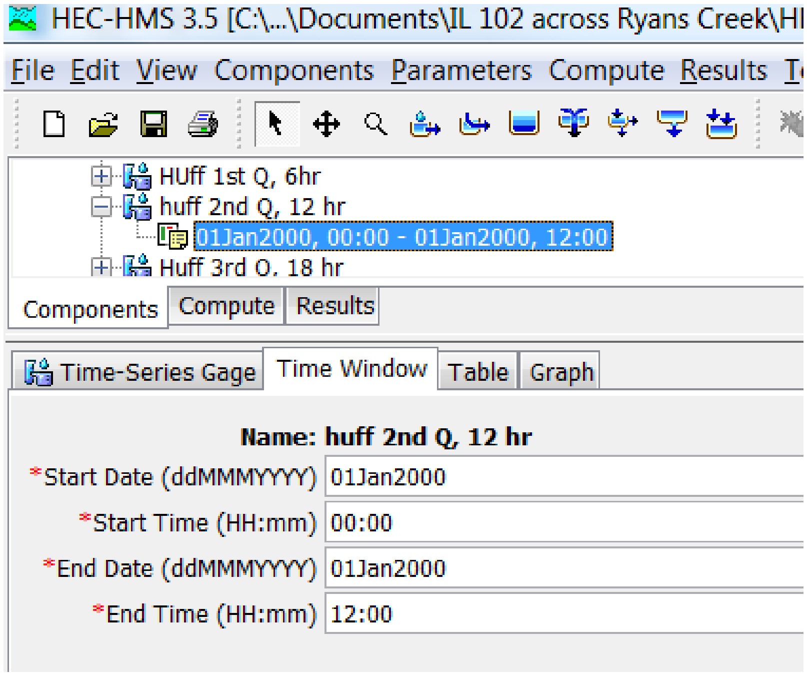
Huff 1st Quartile, 6-hour Rainfall Distribution





Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 00:15	0.13
01Jan2000, 00:30	0.27
01Jan2000, 00:45	0.38
01Jan2000, 01:00	0.46
01Jan2000, 01:15	0.54
01Jan2000, 01:30	0.60
01Jan2000, 01:45	0.65
01Jan2000, 02:00	0.69
01Jan2000, 02:15	0.73
01Jan2000, 02:30	0.77
01Jan2000, 02:45	0.80
01Jan2000, 03:00	0.82
01Jan2000, 03:15	0.84
01Jan2000, 03:30	0.85
01Jan2000, 03:45	0.87
01Jan2000, 04:00	0.89
01Jan2000, 04:15	0.90
01Jan2000, 04:30	0.92
01Jan2000, 04:45	0.94
01Jan2000, 05:00	0.95
01Jan2000, 05:15	0.96
01Jan2000, 05:30	0.97
01Jan2000, 05:45	0.98
01Jan2000, 06:00	1.00

Huff 2nd Quartile, 12-hour Rainfall Distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
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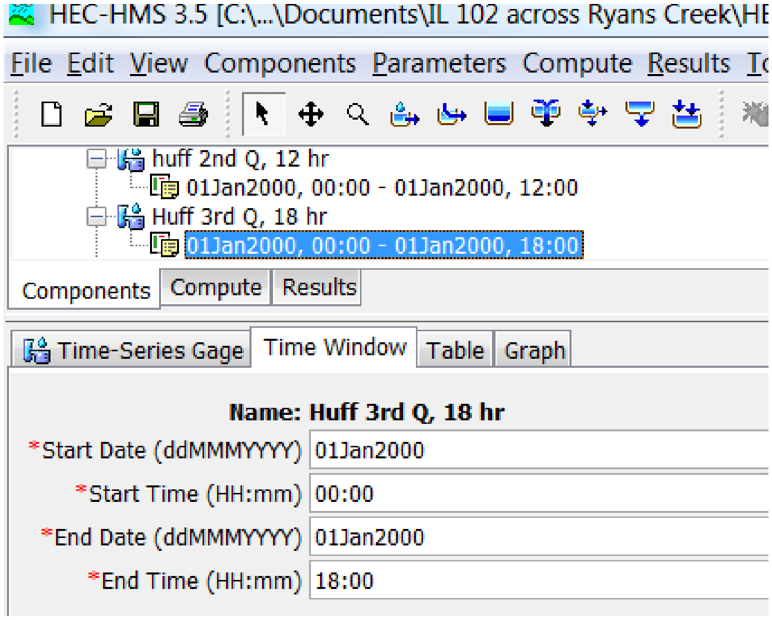
01Jan2000, 00:30	0.03
01Jan2000, 01:00	0.06
01Jan2000, 01:30	0.10
01Jan2000, 02:00	0.13
01Jan2000, 02:30	0.17
01Jan2000, 03:00	0.22
01Jan2000, 03:30	0.28
01Jan2000, 04:00	0.36
01Jan2000, 04:30	0.45
01Jan2000, 05:00	0.58
01Jan2000, 05:30	0.63
01Jan2000, 06:00	0.70
01Jan2000, 06:30	0.75
01Jan2000, 07:00	0.79
01Jan2000, 07:30	0.83
01Jan2000, 08:00	0.86
01Jan2000, 08:30	0.89
01Jan2000, 09:00	0.91
01Jan2000, 09:30	0.93
01Jan2000, 10:00	0.94
01Jan2000, 10:30	0.96
01Jan2000, 11:00	0.97
01Jan2000, 11:30	0.98
01Jan2000, 12:00	1.00

Huff 3rd Quartile, 18-hour Rainfall Distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
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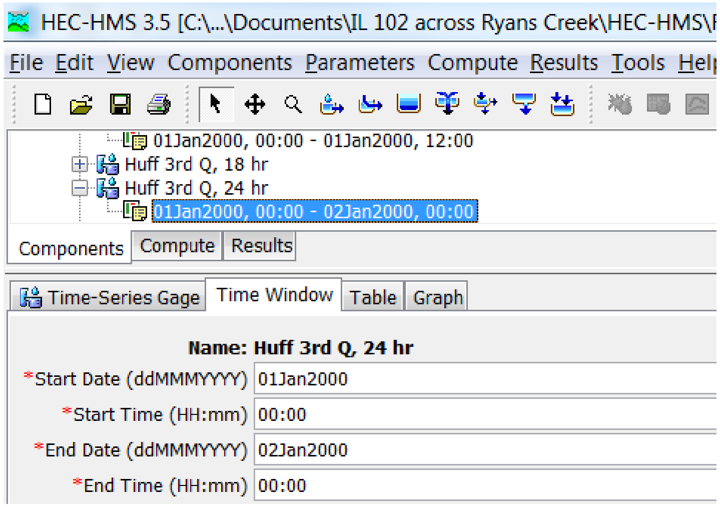
01Jan2000, 00:30	0.02
01Jan2000, 01:00	0.03
01Jan2000, 01:30	0.05
01Jan2000, 02:00	0.07
01Jan2000, 02:30	0.08
01Jan2000, 03:00	0.10
01Jan2000, 03:30	0.12
01Jan2000, 04:00	0.13
01Jan2000, 04:30	0.15
01Jan2000, 05:00	0.17
01Jan2000, 05:30	0.19
01Jan2000, 06:00	0.22
01Jan2000, 06:30	0.24
01Jan2000, 07:00	0.26
01Jan2000, 07:30	0.29
01Jan2000, 08:00	0.31
01Jan2000, 08:30	0.35
01Jan2000, 09:00	0.38
01Jan2000, 09:30	0.42
01Jan2000, 10:00	0.46
01Jan2000, 10:30	0.53
01Jan2000, 11:00	0.60
01Jan2000, 11:30	0.67
01Jan2000, 12:00	0.73
01Jan2000, 12:30	0.78
01Jan2000, 13:00	0.82
01Jan2000, 13:30	0.85
01Jan2000, 14:00	0.87
01Jan2000, 14:30	0.89
01Jan2000, 15:00	0.91
01Jan2000, 15:30	0.93
01Jan2000, 16:00	0.94
01Jan2000, 16:30	0.96
01Jan2000, 17:00	0.97
01Jan2000, 17:30	0.98
01Jan2000, 18:00	1.00

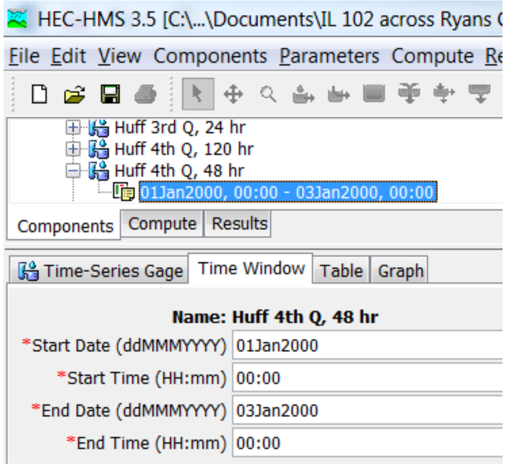
Huff 3rd Quartile, 24 hour Rainfall Distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 00:30	0.01
01Jan2000, 01:00	0.03
01Jan2000, 01:30	0.04
01Jan2000, 02:00	0.05
01Jan2000, 02:30	0.06
01Jan2000, 03:00	0.08
01Jan2000, 03:30	0.09
01Jan2000, 04:00	0.10
01Jan2000, 04:30	0.11
01Jan2000, 05:00	0.12
01Jan2000, 05:30	0.14
01Jan2000, 06:00	0.15
01Jan2000, 06:30	0.17
01Jan2000, 07:00	0.18
01Jan2000, 07:30	0.20
01Jan2000, 08:00	0.22
01Jan2000, 08:30	0.23
01Jan2000, 09:00	0.25
01Jan2000, 09:30	0.27
01Jan2000, 10:00	0.29
01Jan2000, 10:30	0.31
01Jan2000, 11:00	0.33
01Jan2000, 11:30	0.36
01Jan2000, 12:00	0.38
01Jan2000, 12:30	0.41
01Jan2000, 13:00	0.44
01Jan2000, 13:30	0.48
01Jan2000, 14:00	0.53
01Jan2000, 14:30	0.58
01Jan2000, 15:00	0.64
01Jan2000, 15:30	0.69
01Jan2000, 16:00	0.73
01Jan2000, 16:30	0.77
01Jan2000, 17:00	0.80
01Jan2000, 17:30	0.83
01Jan2000, 18:00	0.85
01Jan2000, 18:30	0.87
01Jan2000, 19:00	0.90
01Jan2000, 19:30	0.97
01Jan2000, 20:00	0.91
01Jan2000, 20:30	0.92
01Jan2000, 21:00	0.94
01Jan2000, 21:30	0.95
01Jan2000, 22:00	0.96
01Jan2000, 22:30	0.97
01Jan2000, 23:00	0.97
01Jan2000, 23:30	0.99
02Jan2000, 00:00	1.00

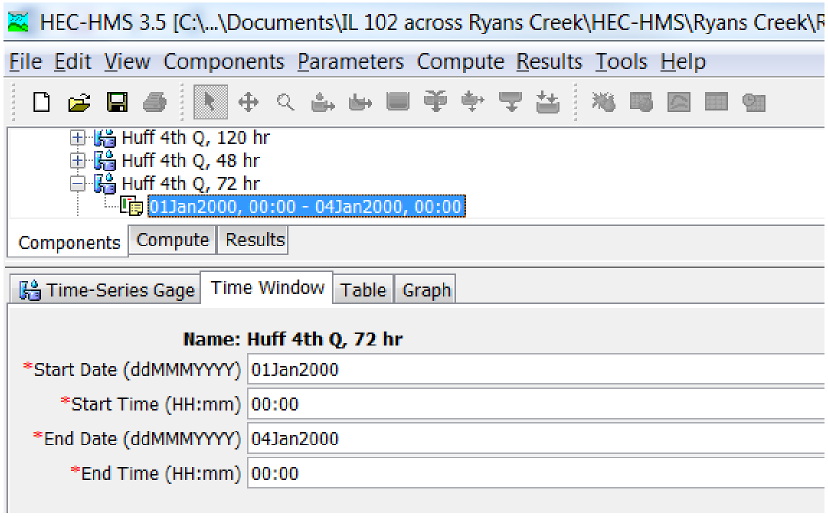
Huff 4th Quartile, 48-hour Rainfall Distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 01:00	0.01
01Jan2000, 02:00	0.02
01Jan2000, 03:00	0.03
01Jan2000, 04:00	0.04
01Jan2000, 05:00	0.05
01Jan2000, 06:00	0.07
01Jan2000, 07:00	0.08
01Jan2000, 08:00	0.09
01Jan2000, 09:00	0.10
01Jan2000, 10:00	0.10
01Jan2000, 11:00	0.12
01Jan2000, 12:00	0.13
01Jan2000, 13:00	0.14
01Jan2000, 14:00	0.16
01Jan2000, 15:00	0.17
01Jan2000, 16:00	0.18
01Jan2000, 17:00	0.19
01Jan2000, 18:00	0.21
01Jan2000, 19:00	0.22
01Jan2000, 20:00	0.23
01Jan2000, 21:00	0.24
01Jan2000, 22:00	0.25
01Jan2000, 23:00	0.27
02Jan2000, 00:00	0.28
02Jan2000, 01:00	0.30
02Jan2000, 02:00	0.31
02Jan2000, 03:00	0.33
02Jan2000, 04:00	0.34
02Jan2000, 05:00	0.35
02Jan2000, 06:00	0.37
02Jan2000, 07:00	0.39
02Jan2000, 08:00	0.40
02Jan2000, 09:00	0.42
02Jan2000, 10:00	0.46
02Jan2000, 11:00	0.49
02Jan2000, 12:00	0.51
02Jan2000, 13:00	0.53
02Jan2000, 14:00	0.53
02Jan2000, 15:00	0.62
02Jan2000, 16:00	0.68
02Jan2000, 17:00	0.73
02Jan2000, 18:00	0.78
02Jan2000, 19:00	0.83
02Jan2000, 20:00	0.88
02Jan2000, 21:00	0.93
02Jan2000, 22:00	0.93
02Jan2000, 23:00	0.97
03Jan2000, 00:00	1.00

Huff 4th Quartile, 72-hour Rainfall Distribution



Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:mm)	Precipitation (IN)
01Jan2000, 00:00	0.00
01Jan2000, 02:00	0.01
01Jan2000, 04:00	0.02
01Jan2000, 06:00	0.04
01Jan2000, 08:00	0.06
01Jan2000, 10:00	0.07
01Jan2000, 12:00	0.09
01Jan2000, 14:00	0.10
01Jan2000, 16:00	0.11
01Jan2000, 18:00	0.13
01Jan2000, 20:00	0.15
01Jan2000, 22:00	0.16
02Jan2000, 00:00	0.18
02Jan2000, 02:00	0.20
02Jan2000, 04:00	0.21
02Jan2000, 06:00	0.23
02Jan2000, 08:00	0.25
02Jan2000, 10:00	0.26
02Jan2000, 12:00	0.28
02Jan2000, 14:00	0.30
02Jan2000, 16:00	0.32
02Jan2000, 18:00	0.34
02Jan2000, 20:00	0.36
02Jan2000, 22:00	0.38
03Jan2000, 00:00	0.41
03Jan2000, 02:00	0.44
03Jan2000, 04:00	0.48
03Jan2000, 06:00	0.51
03Jan2000, 08:00	0.55
03Jan2000, 10:00	0.60
03Jan2000, 12:00	0.68
03Jan2000, 14:00	0.75
03Jan2000, 16:00	0.81
03Jan2000, 18:00	0.87
03Jan2000, 20:00	0.91
03Jan2000, 22:00	0.96
04Jan2000, 00:00	1.00

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 01hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 1.50

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 02hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 1.86

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 03hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 2.05

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 06hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 2.4

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 12hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 2.78

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 18hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 3.008

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 24hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 3.2

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 48hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 3.46

Start States | Save States
Simulation Run | Ratio

Name: 002yr, 72hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 3.712

Start States | Save States
Simulation Run | Ratio

Name: 010yr, 01hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 2.35

Start States | Save States
Simulation Run | Ratio

Name: 010yr, 02hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 2.9

Start States | Save States
Simulation Run | Ratio

Name: 010yr, 03hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 3.2

Start States | Save States
Simulation Run | Ratio

Name: 010yr, 06hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 3.75

Start States | Save States
Simulation Run | Ratio

Name: 010yr, 12hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 4.35

Start States | Save States
Simulation Run | Ratio

Name: 010yr, 18hr
Ratio Method: Precipitation
Apply to Subbasins: Yes
Apply to Sources: No
Ratio: 4.70

Name	Ratio Method	Apply to Subbasins	Apply to Sources	Ratio
010yr, 24hr	Precipitation	Yes	No	5.0
010yr, 48hr	Precipitation	Yes	No	5.4
010yr, 72hr	Precipitation	Yes	No	5.4
050yr, 01hr	Precipitation	Yes	No	3.29
050yr, 02hr	Precipitation	Yes	No	4.06
050yr, 03hr	Precipitation	Yes	No	4.48
050yr, 06hr	Precipitation	Yes	No	5.25
050yr, 12hr	Precipitation	No	No	6.09
050yr, 18hr	Precipitation	Yes	No	6.58
050yr, 24hr	Precipitation	Yes	No	7.00
050yr, 48hr	Precipitation	Yes	No	7.56
050yr, 72hr	Precipitation	Yes	No	8.12
100yr, 01hr	Precipitation	Yes	No	4.0
100yr, 02hr	Precipitation	Yes	No	4.93
100yr, 03hr	Precipitation	Yes	No	5.44

Simulation Run | Ratio | Start States

Name:	100yr, 06hr
Ratio Method:	Precipitation
Apply to Subbasins:	Yes
Apply to Sources:	No
Ratio:	6.38

Simulation Run | Ratio | Start States

Name:	100YR, 12hr
Ratio Method:	Precipitation
Apply to Subbasins:	Yes
Apply to Sources:	No
Ratio:	7.40

Simulation Run | Ratio | Start States

Name:	100yr, 18hr
Ratio Method:	Precipitation
Apply to Subbasins:	Yes
Apply to Sources:	No
Ratio:	7.99

Simulation Run | Ratio | Start States

Name:	100yr, 24hr
Ratio Method:	Precipitation
Apply to Subbasins:	Yes
Apply to Sources:	No
Ratio:	8.5

Simulation Run | Ratio | Start States

Name:	100yr, 48hr
Ratio Method:	Precipitation
Apply to Subbasins:	Yes
Apply to Sources:	No
Ratio:	9.18

Simulation Run | Ratio | Start States

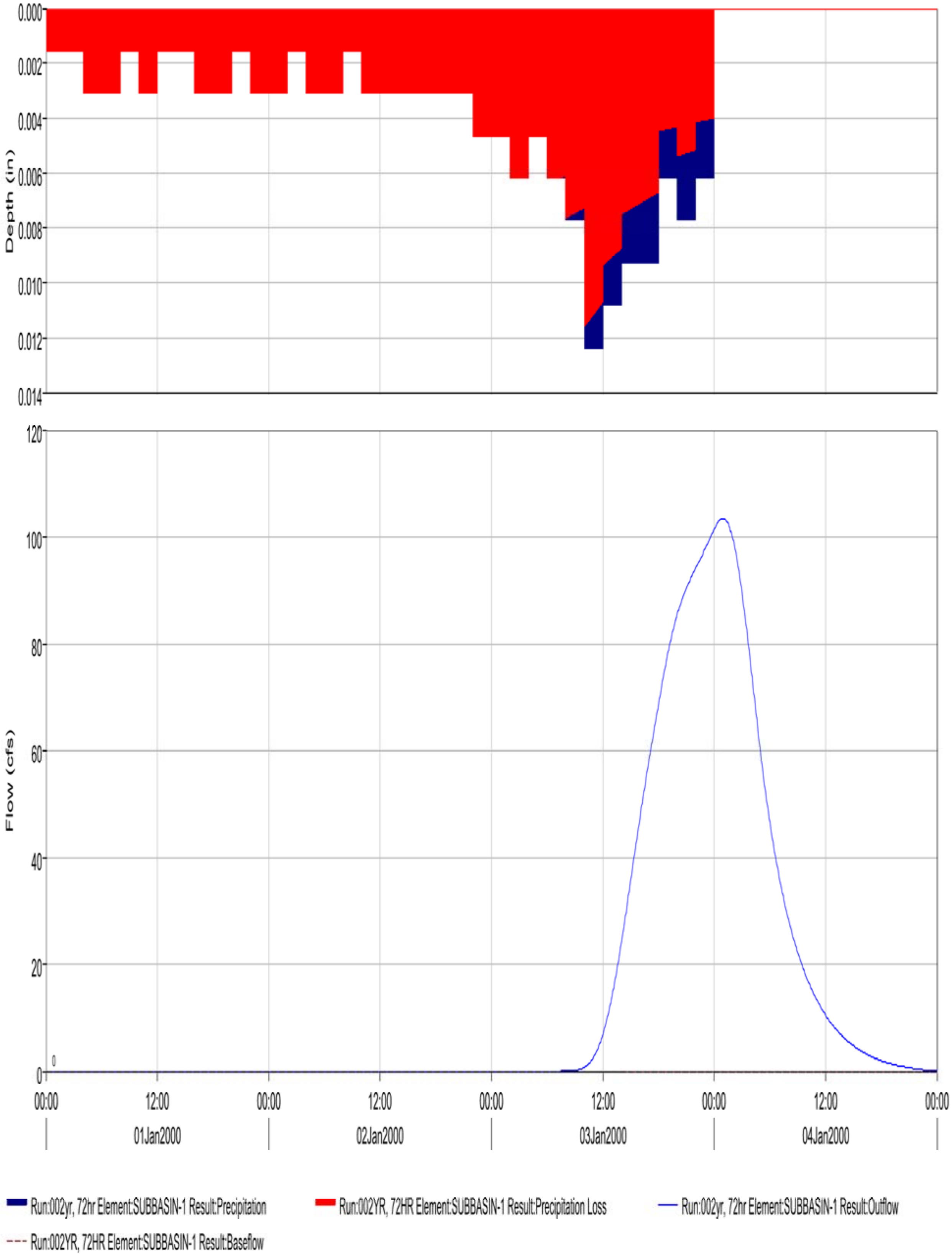
Name:	100yr, 72hr
Ratio Method:	Precipitation
Apply to Subbasins:	Yes
Apply to Sources:	No
Ratio:	9.86

Project: Ryans Creek Simulation Run: 002yr, 72hr

Start of Run:	01Jan2000, 00:00	Basin Model:	Basin 1
End of Run:	05Jan2000, 00:00	Meteorologic Model:	Huff 4th Q 72
Compute Time:	30Oct2014, 16:44:36	Control Specifications:	Control 09 - I

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	103.5	04Jan2000, 00:55	0.34

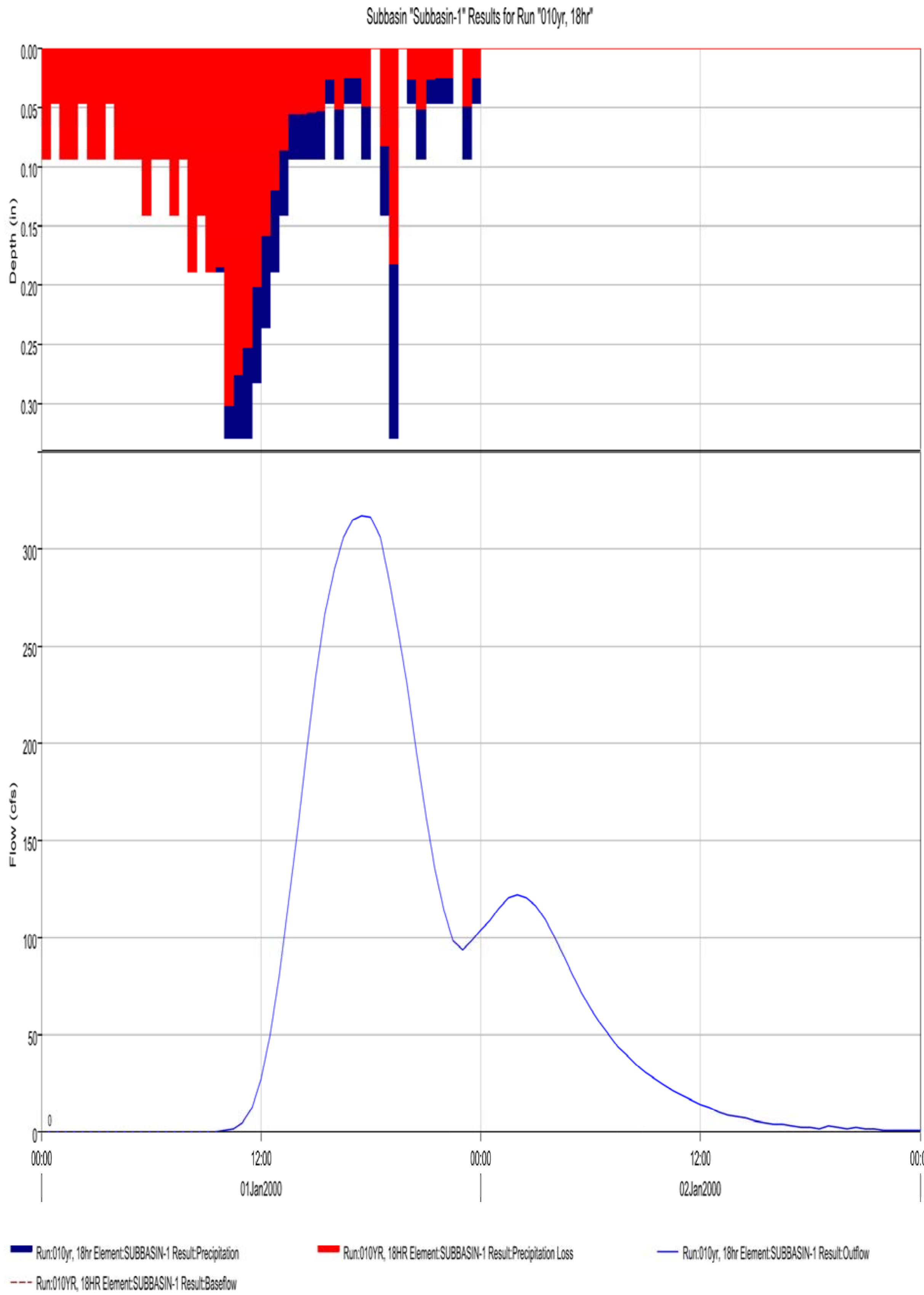
Subbasin "Subbasin-1" Results for Run "002yr, 72hr"



Project: Ryans Creek Simulation Run: 010yr, 18hr

Start of Run:	01Jan2000, 00:00	Basin Model:	Basin 1
End of Run:	03Jan2000, 00:00	Meteorologic Model:	HUFF 3RD Q
Compute Time:	30Oct2014, 16:50:47	Control Specifications:	Control 06 H

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	317.6	01Jan2000, 17:30	0.76



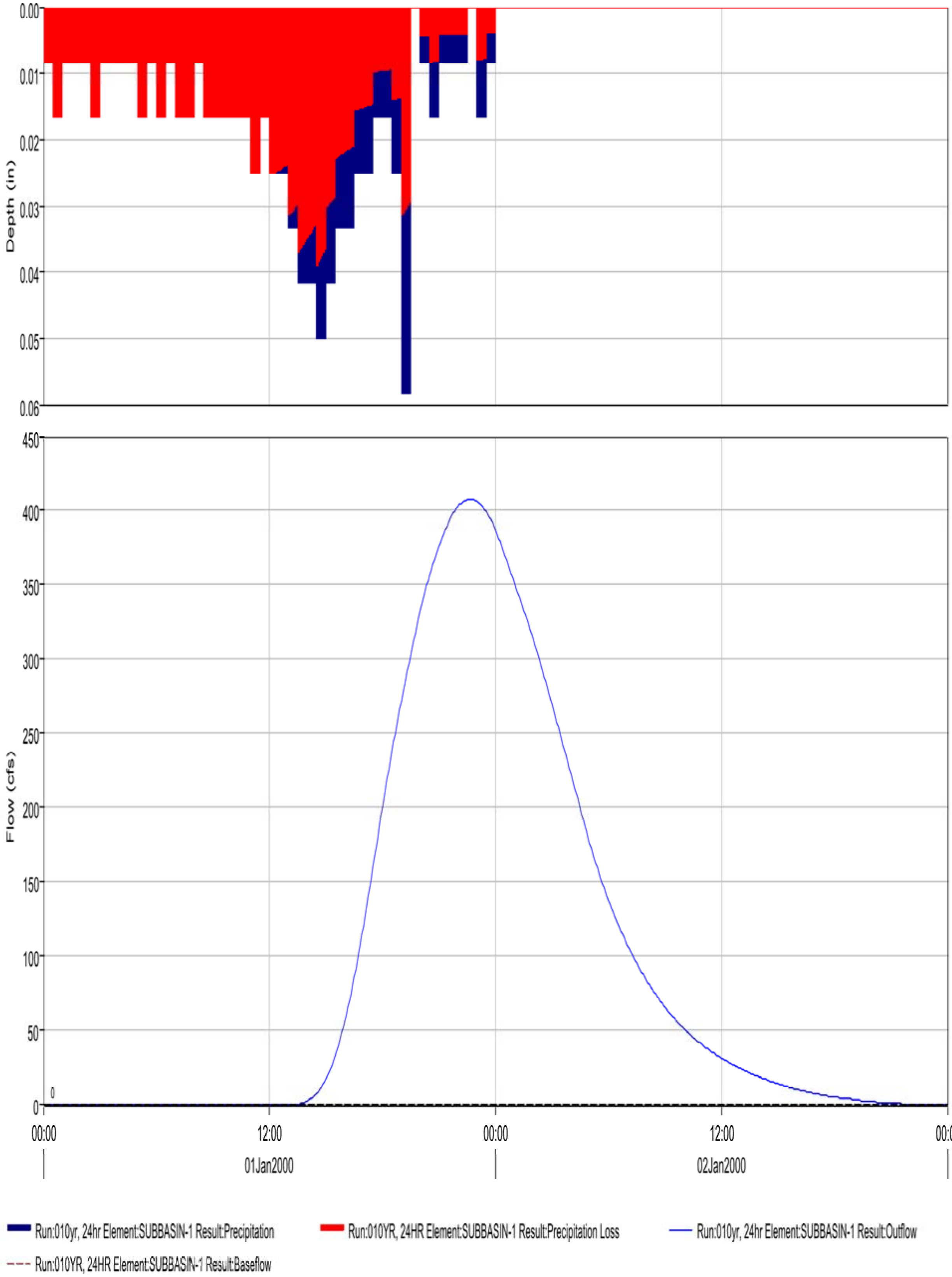
Subbasin "Subbasin-1" Results for Run "010yr, 18hr"
Depth (in)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Flow (cfs)
300
250
200
150
100
50
0
00:00
12:00
00:00
12:00
00:00
01Jan2000
02Jan2000
Run:010yr, 18hr Element:SUBBASIN-1 Result:Precipitation
Run:010YR, 18HR Element:SUBBASIN-1 Result:Precipitation Loss
Run:010yr, 18hr Element:SUBBASIN-1 Result:Outflow
Run:010YR, 18HR Element:SUBBASIN-1 Result:Baseflow

Project: Ryans Creek Simulation Run: 010yr, 24hr

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 03Jan2000, 00:00 Meteorologic Model: Huff 3rd Q 2
Compute Time: 30Oct2014, 16:49:53 Control Specifications: Control 07 -

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	407.6	01Jan2000, 22:40	1.06

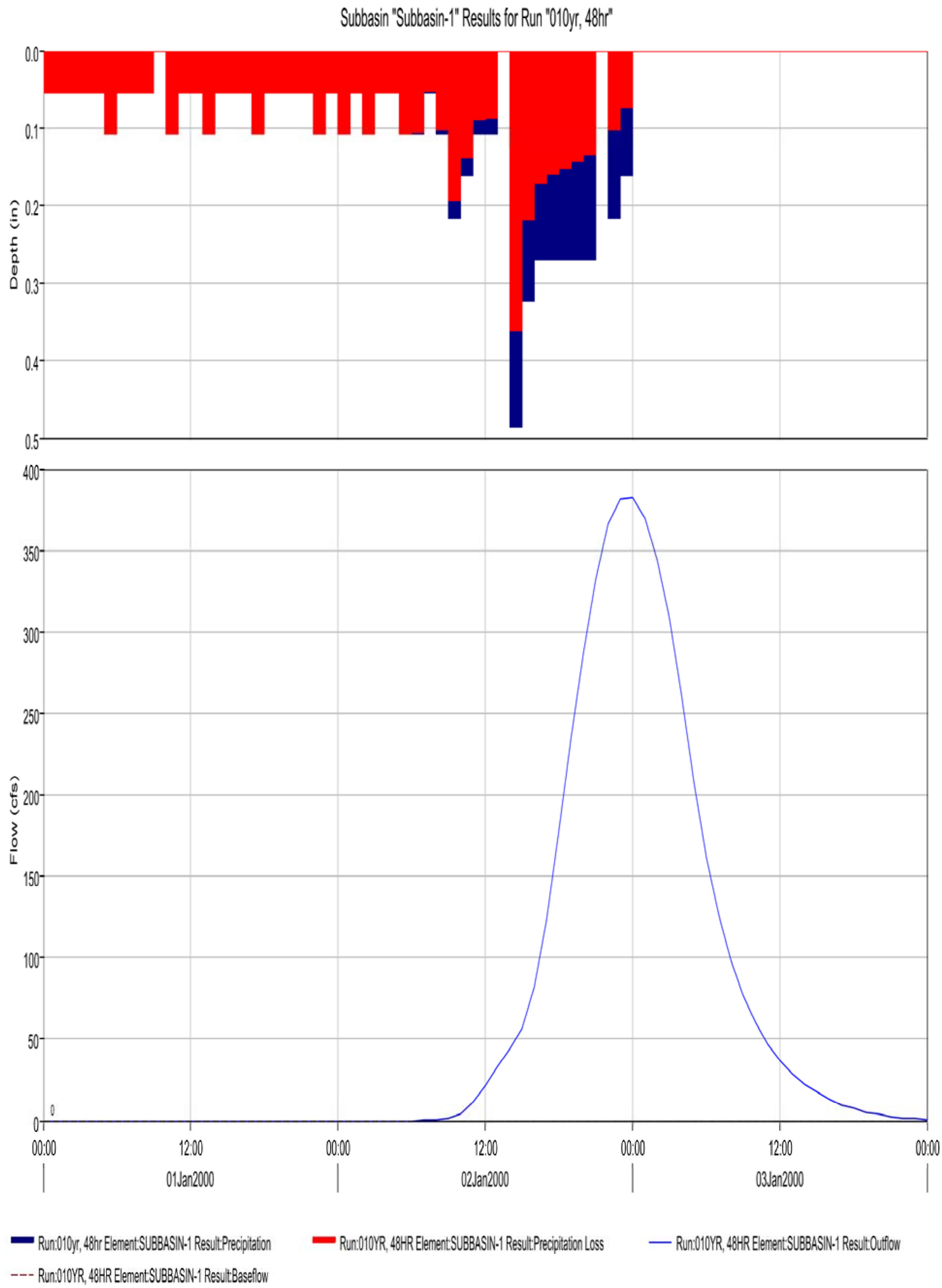
Subbasin "Subbasin-1" Results for Run "010yr, 24hr"



Project: Ryans Creek Simulation Run: 010yr, 48hr

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 04Jan2000, 00:00 Meteorologic Model: HUFF 4TH (
Compute Time: 30Oct2014, 16:51:38 Control Specifications: Control 08 -

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	384.8	02Jan2000, 23:25	1.12



Subbasin "Subbasin-1" Results for Run "010yr, 48hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
Flow (cfs)
400
350
300
250
200
150
100
50
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
01Jan2000
02Jan2000
03Jan2000
Run:010yr, 48hr Element:SUBBASIN-1 Result:Precipitation
Run:010YR, 48HR Element:SUBBASIN-1 Result:Precipitation Loss
Run:010YR, 48HR Element:SUBBASIN-1 Result:Outflow
Run:010YR, 48HR Element:SUBBASIN-1 Result:Baseflow

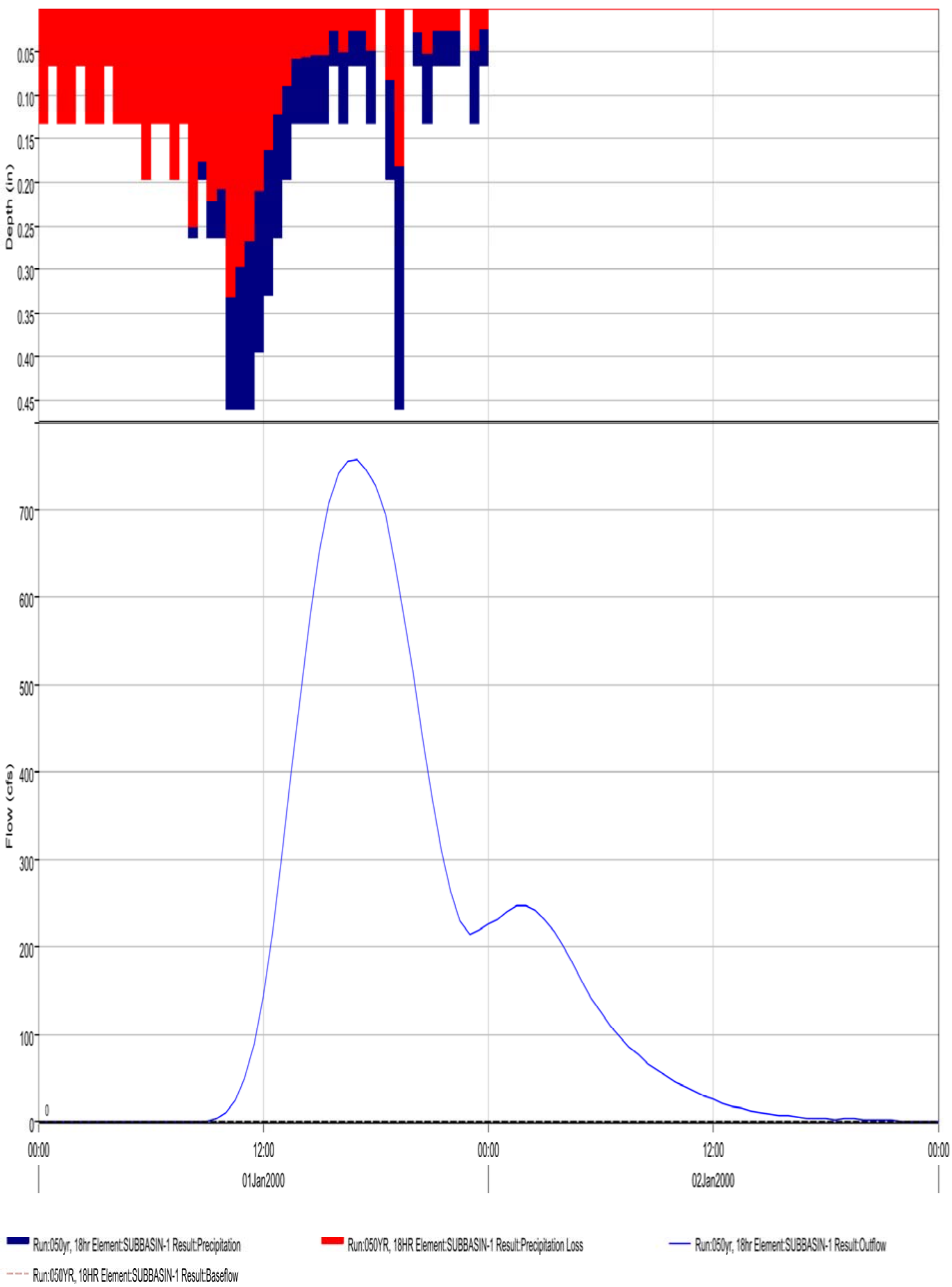
Project: Ryans Creek Simulation Run: 050yr, 18hr

Start of Run: 01Jan2000, 00:00
End of Run: 03Jan2000, 00:00
Compute Time: 30Oct2014, 16:54:46

Basin Model: Basin 1
Meteorologic Model: HUFF 3RD Q
Control Specifications: Control 06 H

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	759.8	01Jan2000, 16:45	1.82

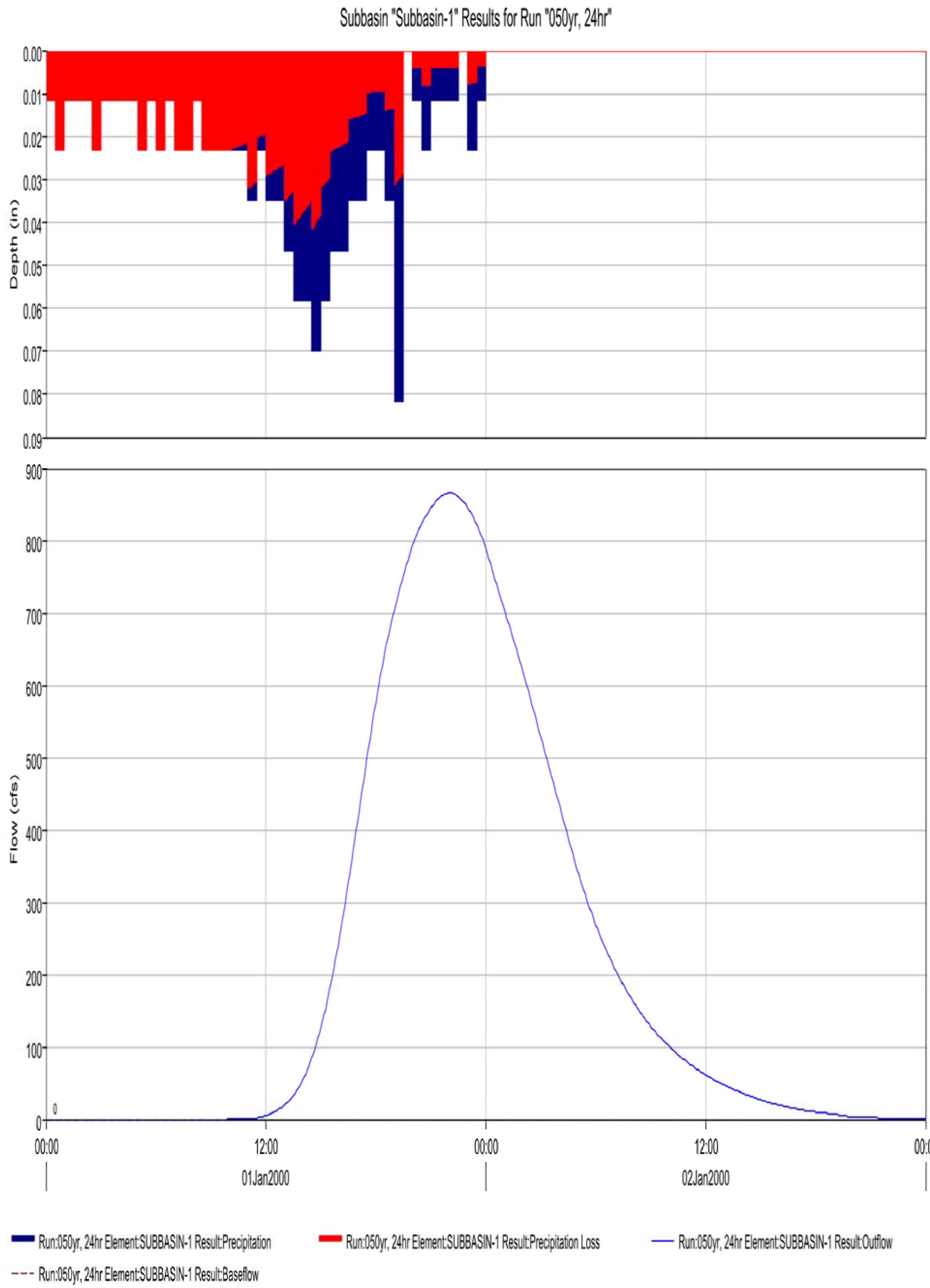
Subbasin "Subbasin-1" Results for Run "050yr, 18hr"



Project: Ryans Creek Simulation Run: 050yr, 24hr

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 03Jan2000, 00:00 Meteorologic Model: Huff 3rd Q 2
Compute Time: 30Oct2014, 16:55:30 Control Specifications: Control 07 -

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	866.0	01Jan2000, 22:00	2.37

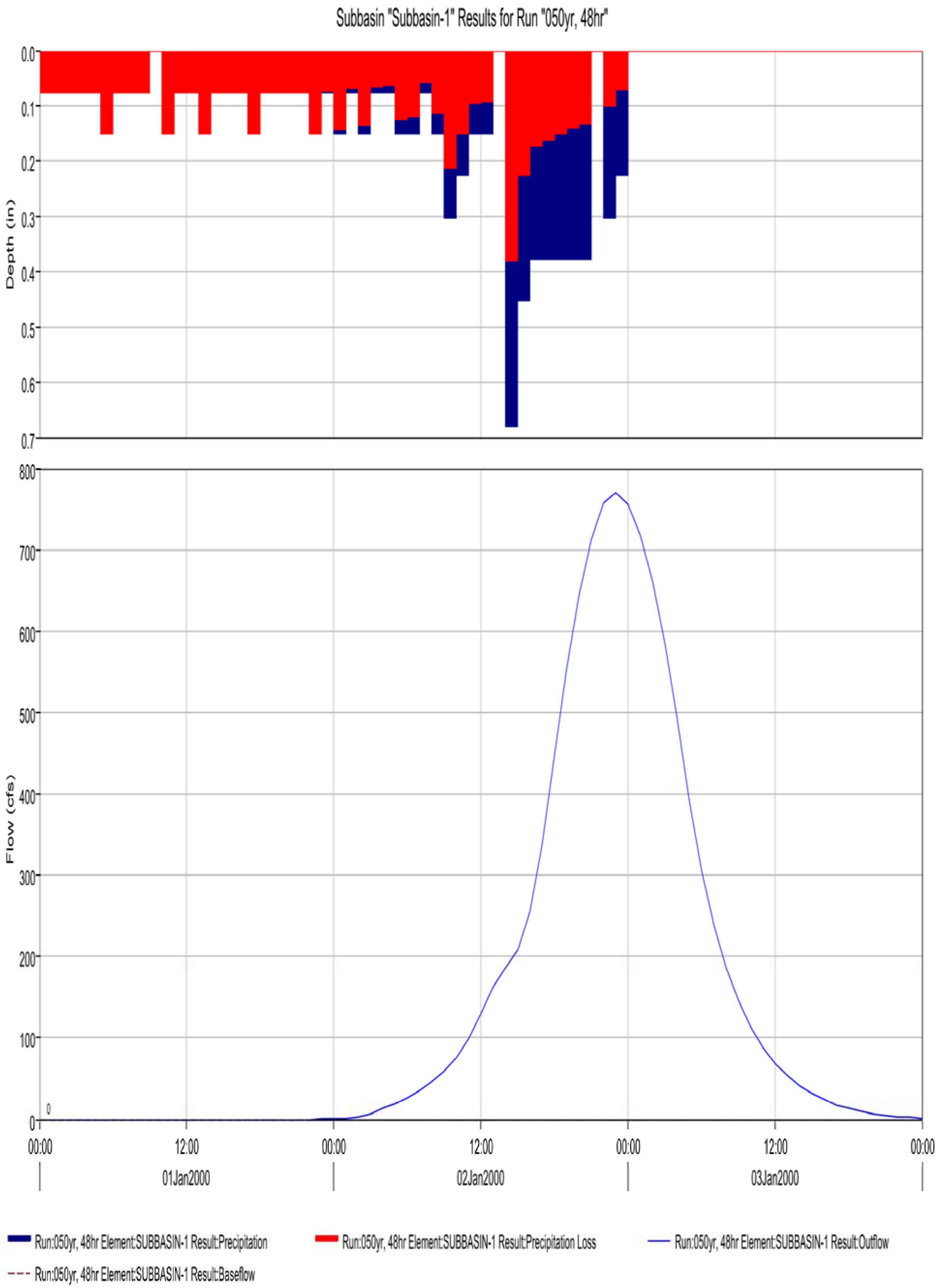


Subbasin "Subbasin-1" Results for Run "050yr, 24hr"
Depth (in)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Flow (cfs)
900
800
700
600
500
400
300
200
100
0
00:00
12:00
00:00
12:00
00:00
01Jan2000
02Jan2000
Run:050yr, 24hr Element:SUBBASIN-1 Result:Precipitation
Run:050yr, 24hr Element:SUBBASIN-1 Result:Precipitation Loss
Run:050yr, 24hr Element:SUBBASIN-1 Result:Outflow
Run:050yr, 24hr Element:SUBBASIN-1 Result:Baseflow

Project: Ryans Creek Simulation Run: 050yr, 48hr

Start of Run:	01Jan2000, 00:00	Basin Model:	Basin 1
End of Run:	04Jan2000, 00:00	Meteorologic Model:	HUFF 4TH (
Compute Time:	30Oct2014, 16:56:32	Control Specifications:	Control 08 -

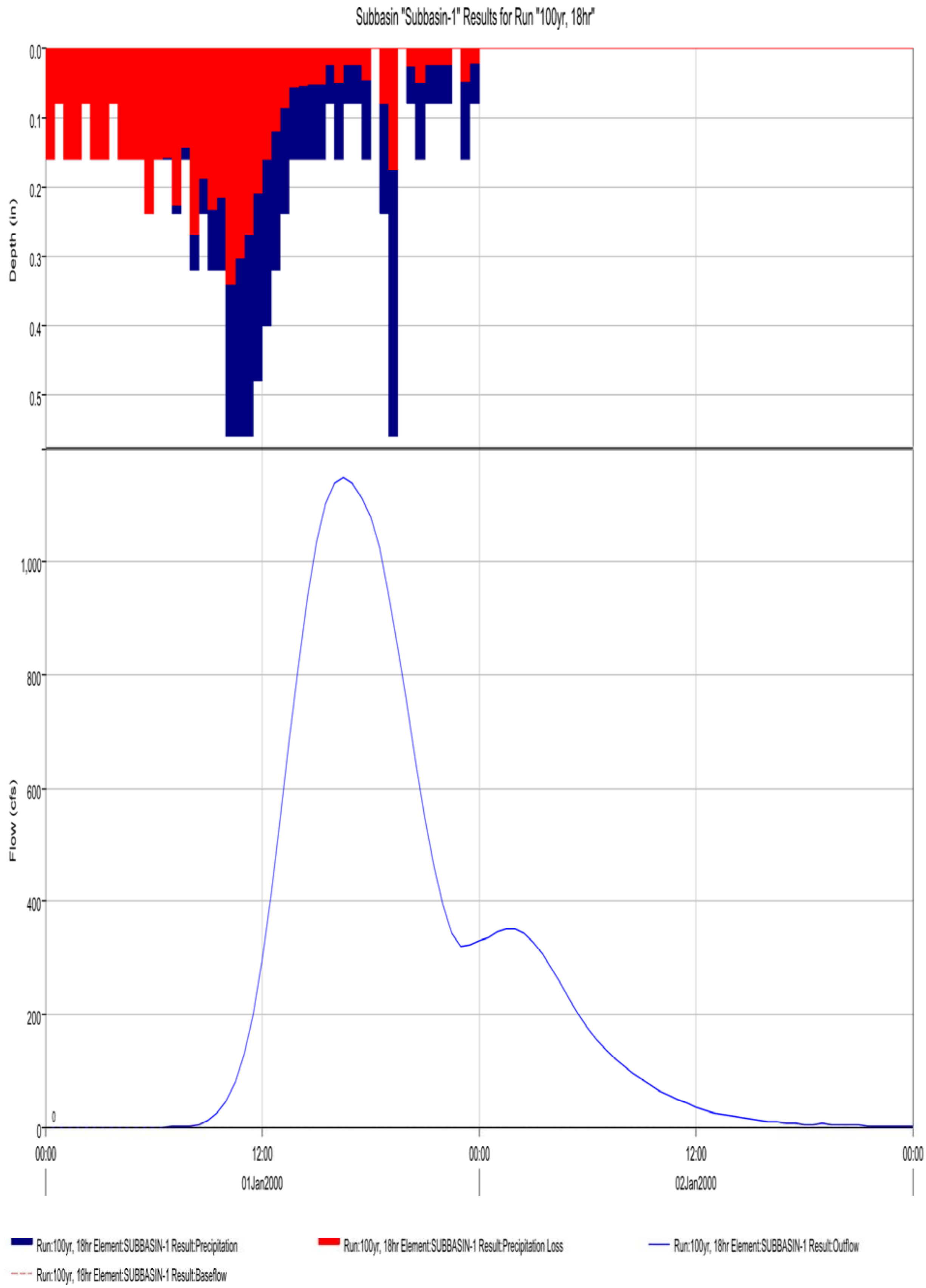
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	772.9	02Jan2000, 22:50	2.47


Subbasin "Subbasin-1" Results for Run "050yr, 48hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Flow (cfs)
800
700
600
500
400
300
200
100
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
01Jan2000
02Jan2000
03Jan2000
Run:050yr, 48hr Element:SUBBASIN-1 Result:Precipitation
Run:050yr, 48hr Element:SUBBASIN-1 Result:Precipitation Loss
Run:050yr, 48hr Element:SUBBASIN-1 Result:Outflow
Run:050yr, 48hr Element:SUBBASIN-1 Result:Baseflow

Project: Ryans Creek Simulation Run: 100yr, 18hr

Start of Run:	01Jan2000, 00:00	Basin Model:	Basin 1
End of Run:	03Jan2000, 00:00	Meteorologic Model:	HUFF 3RD Q
Compute Time:	30Oct2014, 16:57:20	Control Specifications:	Control 06 H

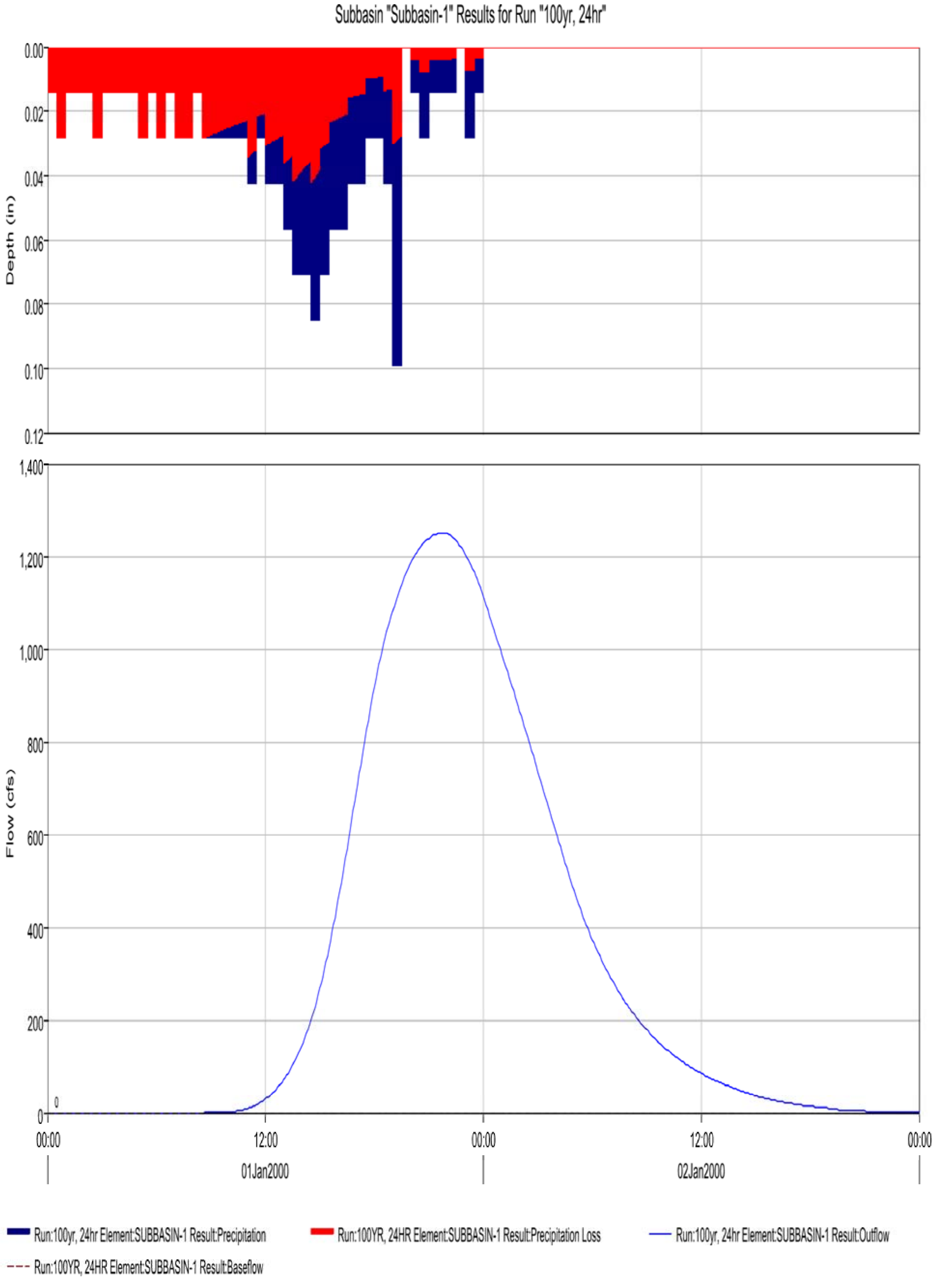
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	1151.3	01Jan2000, 16:25	2.77


Subbasin "Subbasin-1" Results for Run "100yr, 18hr"
Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
Flow (cfs)
1,000
800
600
400
200
0
00:00
12:00
00:00
12:00
00:00
01Jan2000
02Jan2000
Run:100yr, 18hr Element:SUBBASIN-1 Result:Precipitation
Run:100yr, 18hr Element:SUBBASIN-1 Result:Precipitation Loss
Run:100yr, 18hr Element:SUBBASIN-1 Result:Outflow
Run:100yr, 18hr Element:SUBBASIN-1 Result:Baseflow

Project: Ryans Creek Simulation Run: 100yr, 24hr

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 03Jan2000, 00:00 Meteorologic Model: Huff 3rd Q 2
Compute Time: 30Oct2014, 17:02:19 Control Specifications: Control 07 -

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	1250.3	01Jan2000, 21:45	3.52



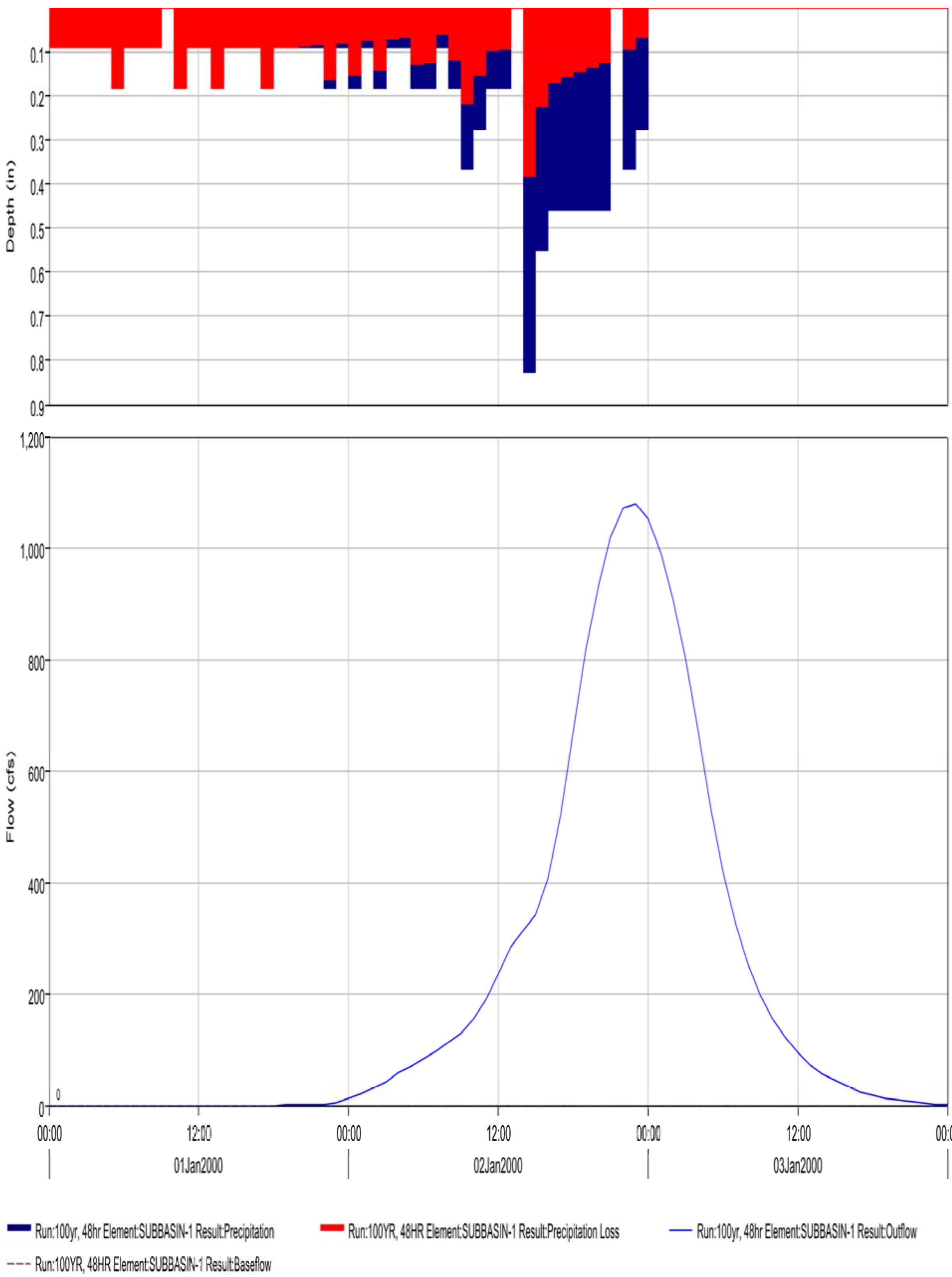
Subbasin "Subbasin-1" Results for Run "100yr, 24hr"
Depth (in)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
0
00:00
12:00
00:00
12:00
00:00
01Jan2000
02Jan2000
Run:100yr, 24hr Element:SUBBASIN-1 Result:Precipitation
Run:100YR, 24HR Element:SUBBASIN-1 Result:Precipitation Loss
Run:100yr, 24hr Element:SUBBASIN-1 Result:Outflow
Run:100YR, 24HR Element:SUBBASIN-1 Result:Baseflow

Project: Ryans Creek Simulation Run: 100yr, 48hr

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 04Jan2000, 00:00 Meteorologic Model: HUFF 4TH (
Compute Time: 30Oct2014, 17:03:47 Control Specifications: Control 08 -

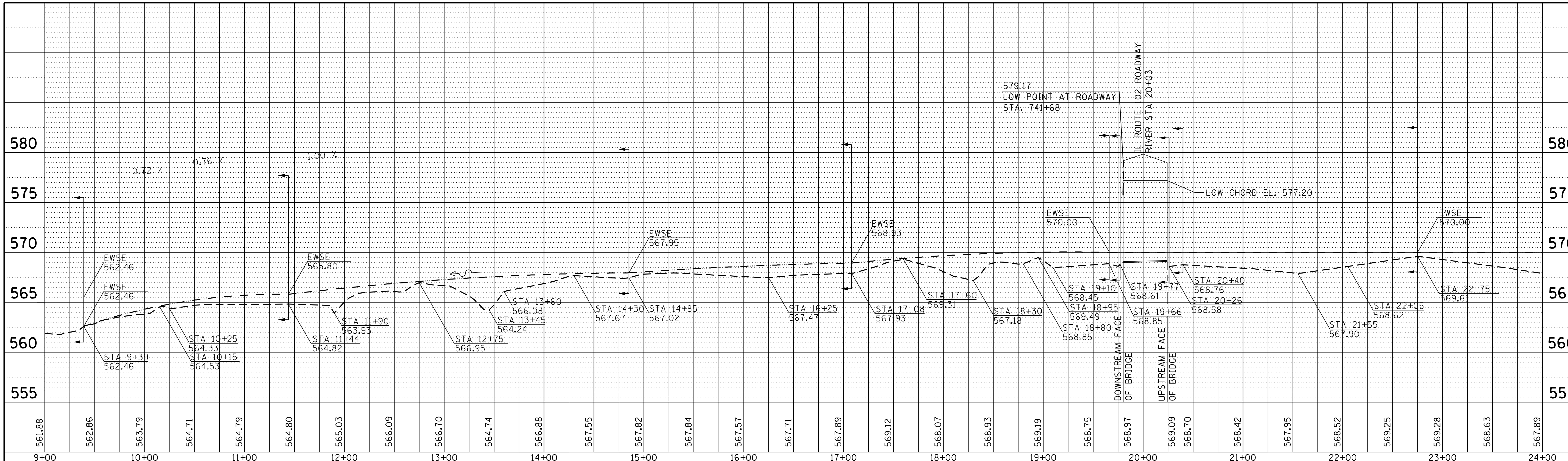
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	6.59	1085.2	02Jan2000, 22:35	3.65

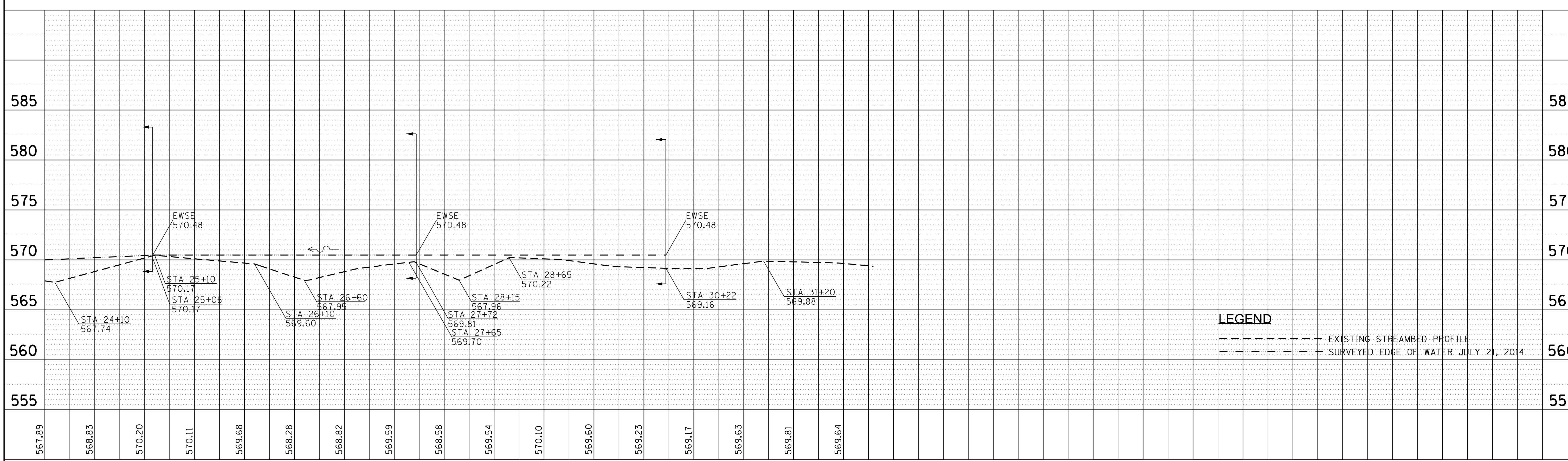
Subbasin "Subbasin-1" Results for Run "100yr, 48hr"



SECTION 7

Streambed Profile





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

PROFILE		
NOTE BOOK	SURVEYED	
NO. ____	PLOTTED	
	GRADES CHECKED	
	B.M. NOTED	
	STRUCTURE NOTAT'NS CHK'D	
	BY	DATE

FILE NAME =	USER NAME = \$USER\$	DESIGNED - CMD	REVISED -
\$FILES\$		DRAWN - VEA	REVISED -
	PLOT SCALE = \$SCALE\$	CHECKED - RJD	REVISED -
\$MODELNAME\$	PLOT DATE = \$DATE\$	DATE - 10/11/2014	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

IL ROUTE 102 OVER RYANS CREEK
STREAMBED PROFILE

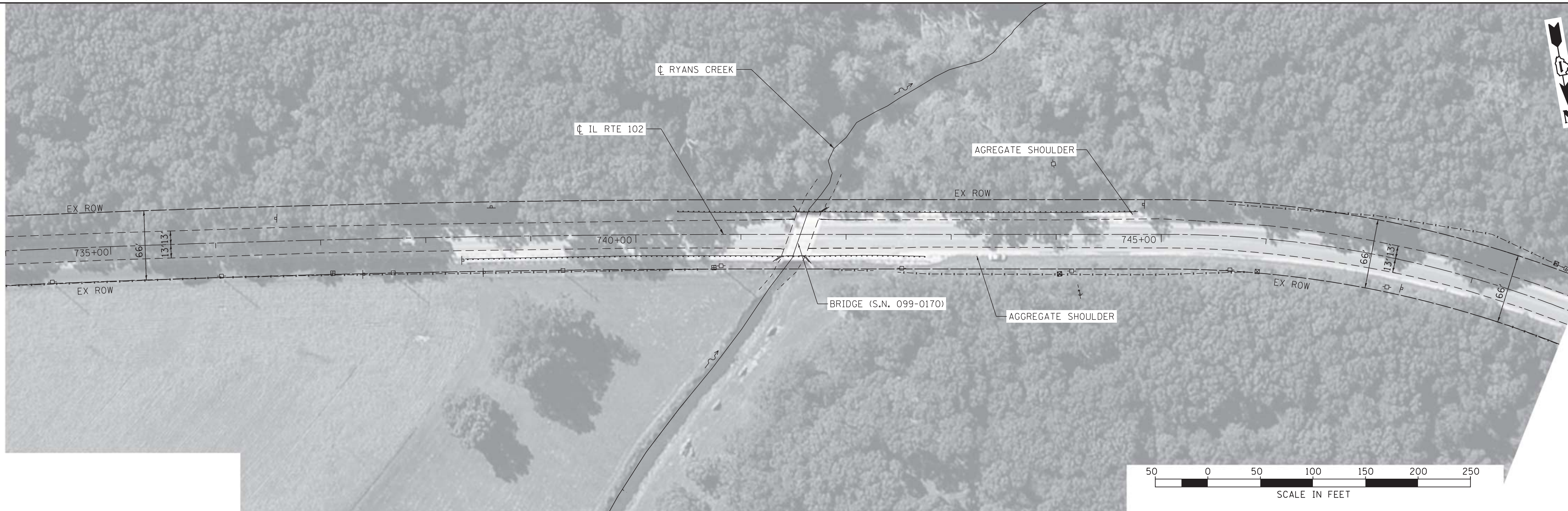
SCALE: 1"=5' (VERT.) 1"=50' (HORIZ.) | SHEET 1 OF 1 SHEETS | STA. TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631		WILL	1	1
		CONTRACT NO. P-91-187-13		
		ILLINOIS FED. AID PROJECT		

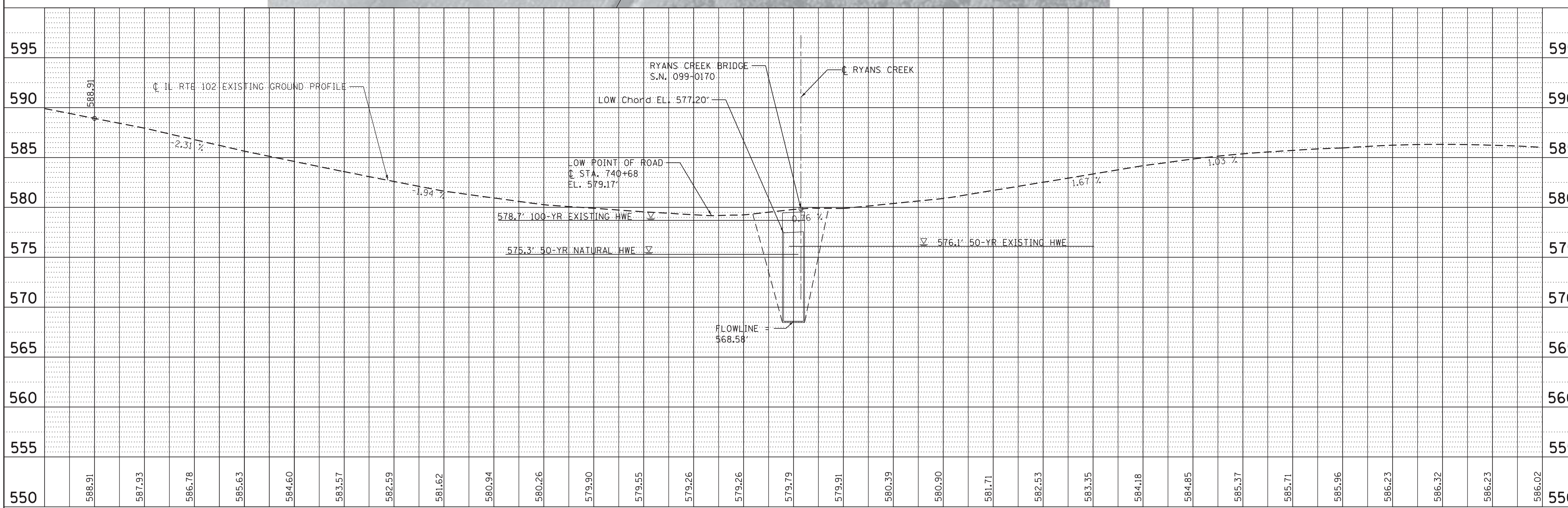
SECTION 8

Roadway Profile

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



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



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		DRAWN - VEA	REVISED -	DEPARTMENT OF TRANSPORTATION	PLAN AND PROFILE	CONTRACT NO. P-91-187-13
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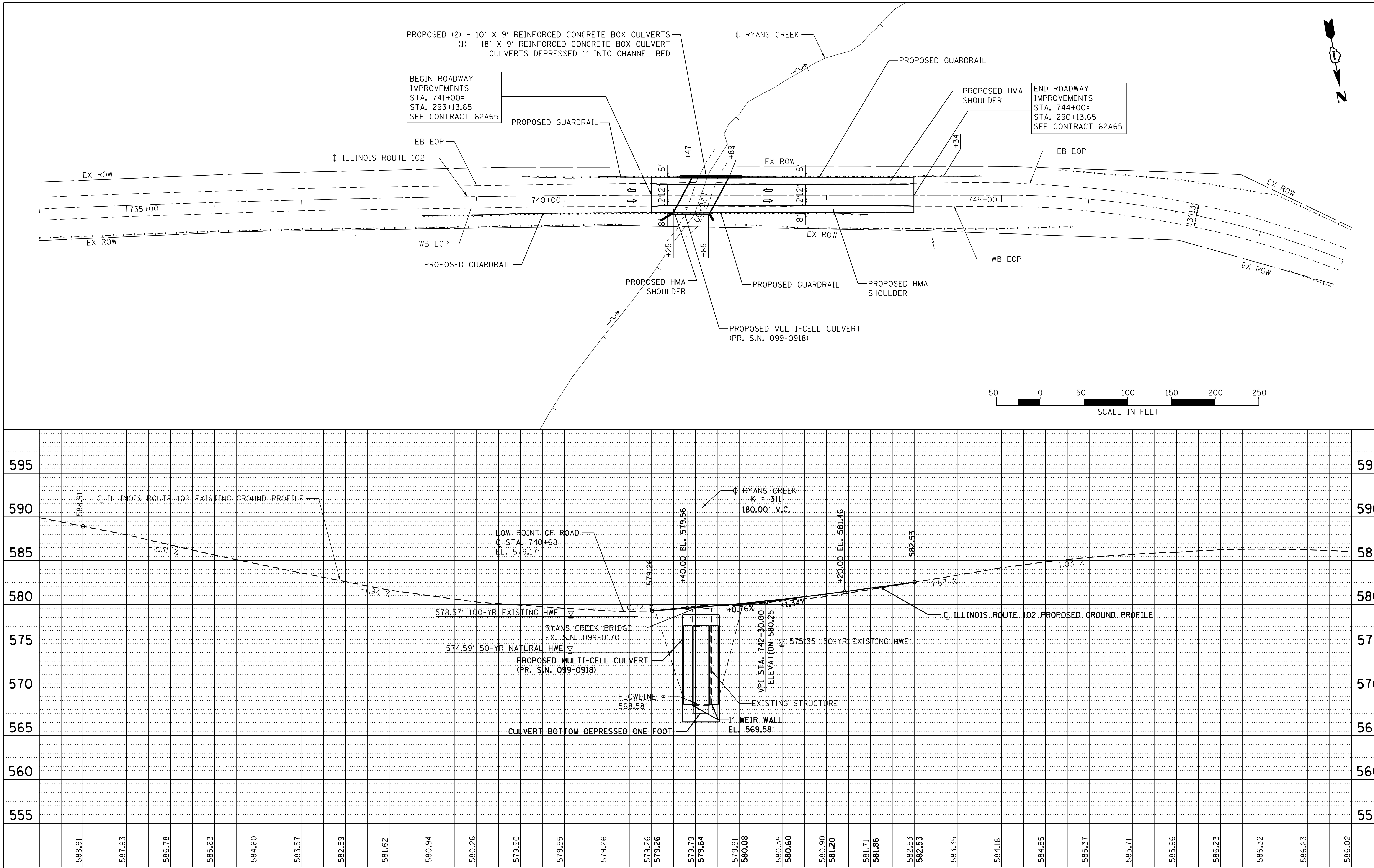
	PLOT DATE = $DATE$	DATE - 11/19/2014	REVISED -		SCALE: 1"=50' SHEET 1 OF 1 SHEETS STA. 734+00 TO STA. 749+00	ILLINOIS FED. AID PROJECT



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		DRAWN - JMR	REVISED - 5/4/2015	
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ILLINOIS ROUTE 102 OVER RYANS CREEK PLAN AND PROFILE

SCALE: 1"=50' | SHEET 1 OF 1 SHEETS | STA. 734+00 TO STA. 749+00

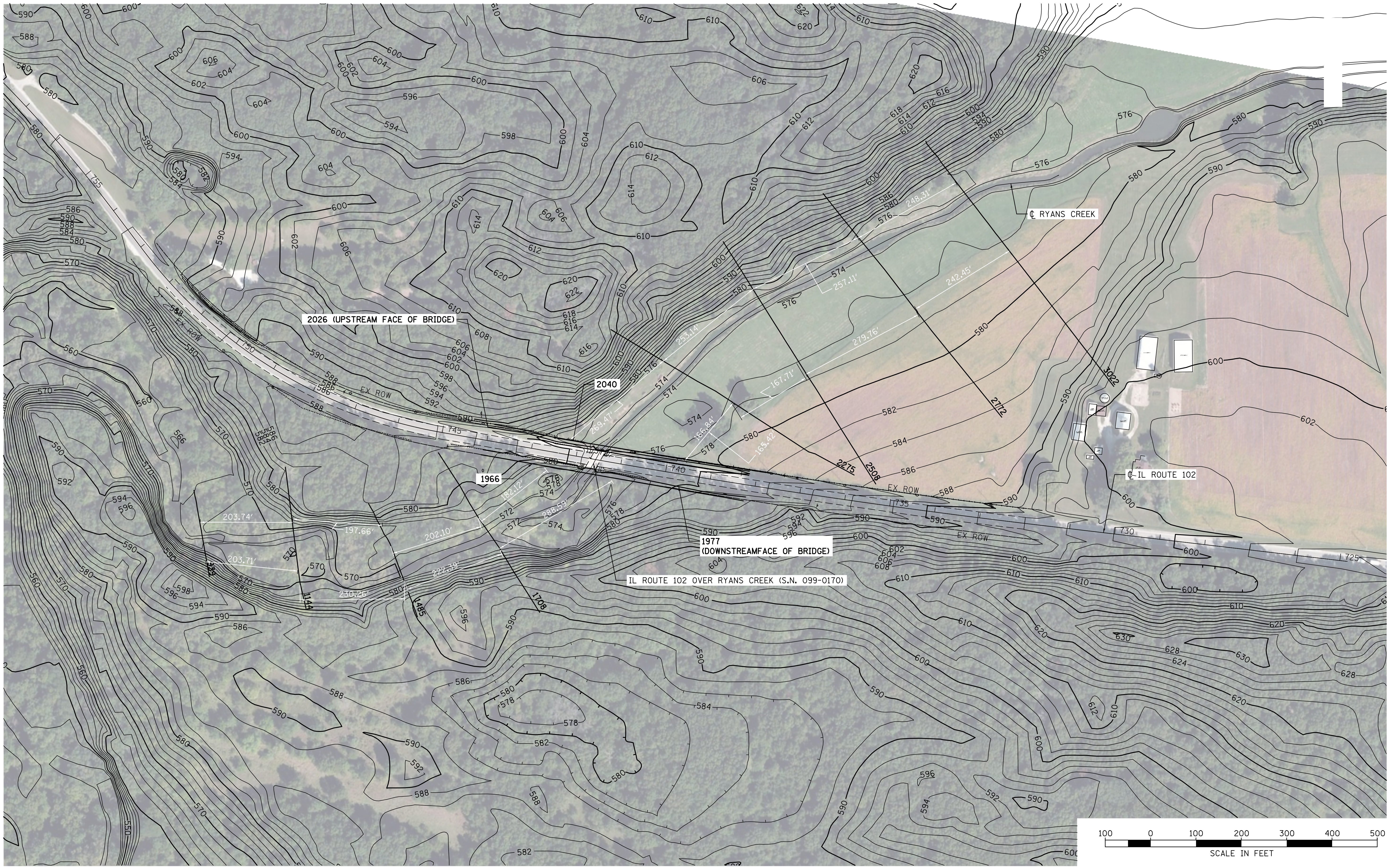
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(111N-B)B-R	WILL	1	1

CONTRACT NO. 60V28

ILLINOIS FED. AID PROJECT

SECTION 9

Cross Section Plots



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		DRAWN - VEA	REVISED -		
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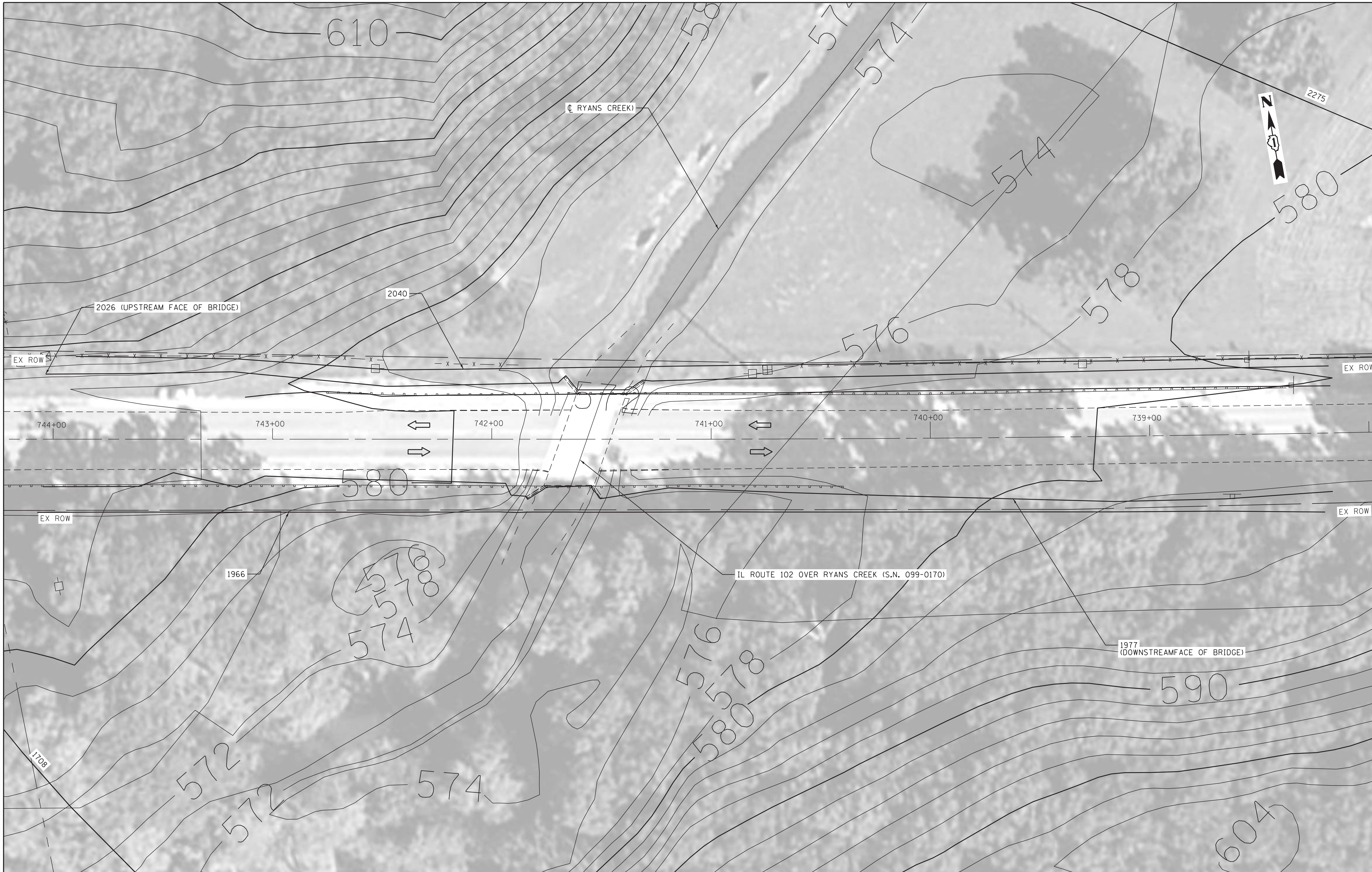
Default	PLOT DATE = 7/22/2015	DATE - 11/19/2014	REVISED -		SCALE: 1" = 100' SHEET 1 OF 1 SHEETS STA. 724+83.33 TO STA. 757+00.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631		WILL	1	1
		CONTRACT NO. P-91-187-13		
		ILLINOIS FED. AID PROJECT		



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		DRAWN -	REVISED -						
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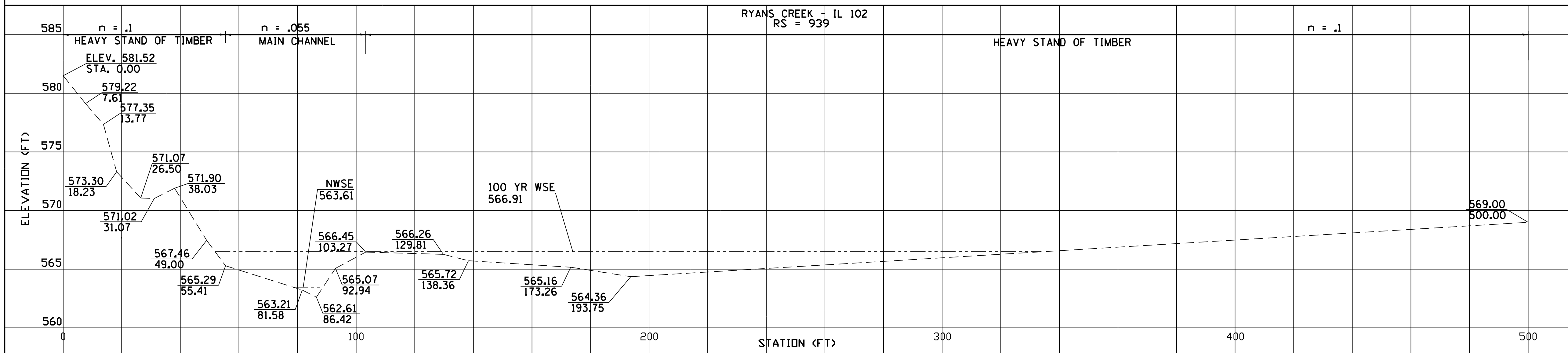
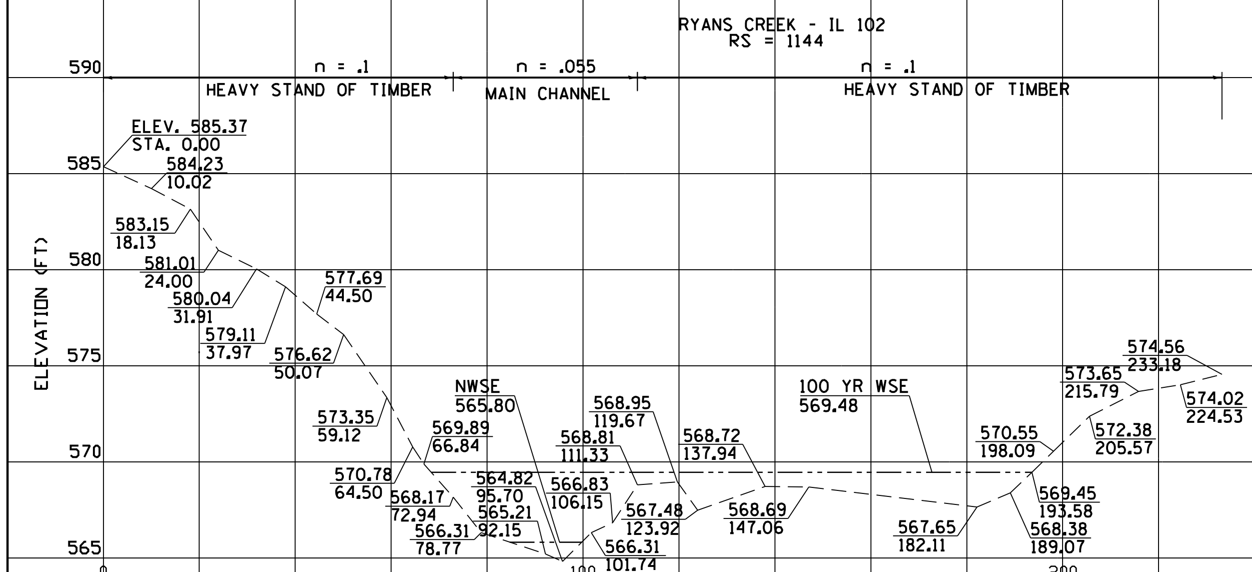
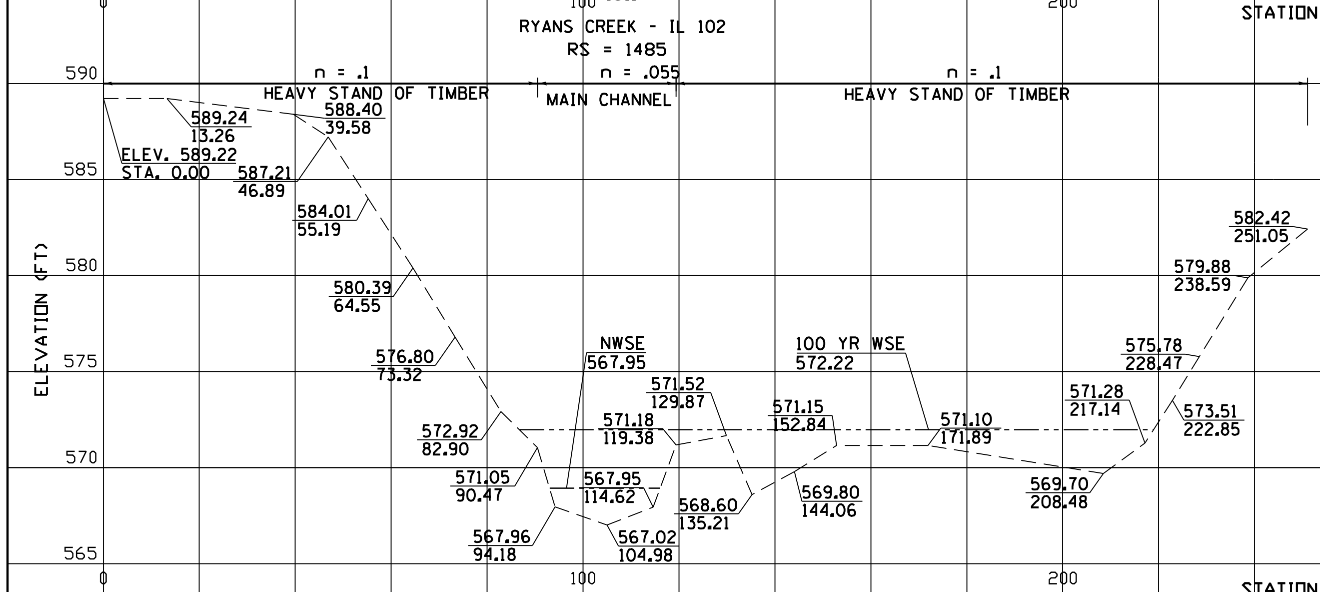


CROSS SECTIONS TAKEN LOOKING DOWNSTREAM





SURVEY COMPLETED BY AES SERVICES, INC. IN AUGUST 2013

ALL ELEVATIONS ARE REFERENCED TO NAVD 88.

FINAL SURVEY	NOTE BOOK	NO.	
SURVEYED	PLOTTED	TEMPLATE	AREAS / AREAS CHECKED
BY			
DATE			

ORIGINAL SURVEY	NOTE BOOK	NO.	
SURVEYED	PLOTTED	TEMPLATE	AREAS / AREAS CHECKED
BY			
DATE			

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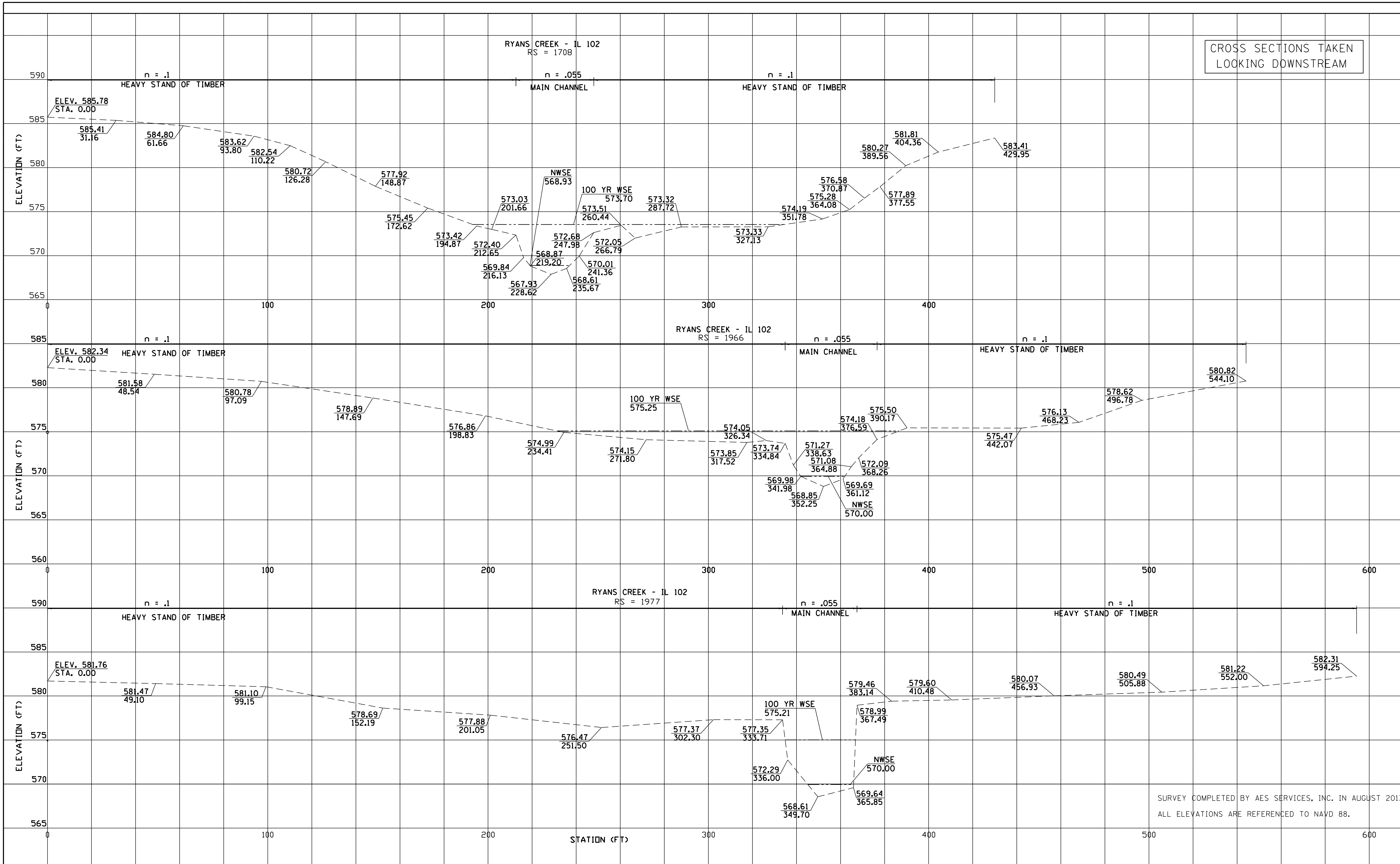
IL ROUTE 102 OVER RYANS CREEK
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

EXISTING CONDITIONS CHANNEL CROSS SECTIONS

SCALE: 1"=20' (HORIZ.) 1"=5' (VERT.) | SHEET NO. 1 OF 5 SHEETS | STA. 9+39 TO STA. 14+85

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	20-Y	WILL	5	1
		CONTRACT NO. 60V28		
FED. ROAD DIST. NO. 1	ILLINOIS	FED. AID PROJECT		



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$MODELNAME$	PLOT DATE = $DATE$	DATE - 4/27/2015	REVISED -

IL ROUTE 102 OVER RYANS CREEK
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

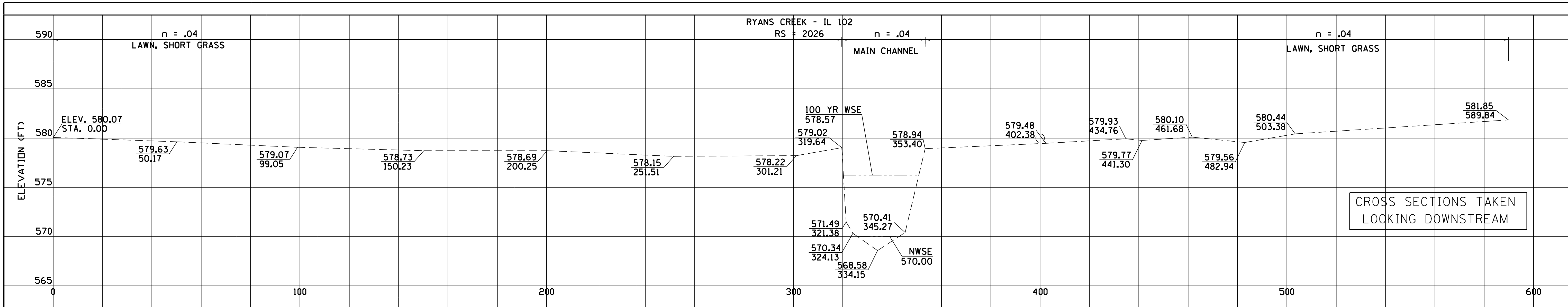
EXISTING CONDITIONS CHANNEL CROSS SECTIONS

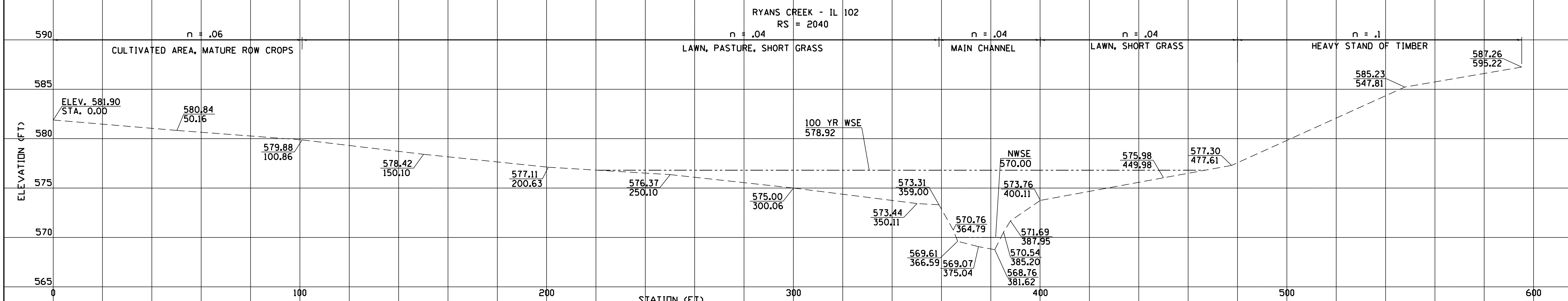
SCALE: 1"=20' (HORIZ.) 1"=5' (VERT.) | SHEET NO. 2 OF 5 SHEETS | STA. 17+08 TO STA. 19+77

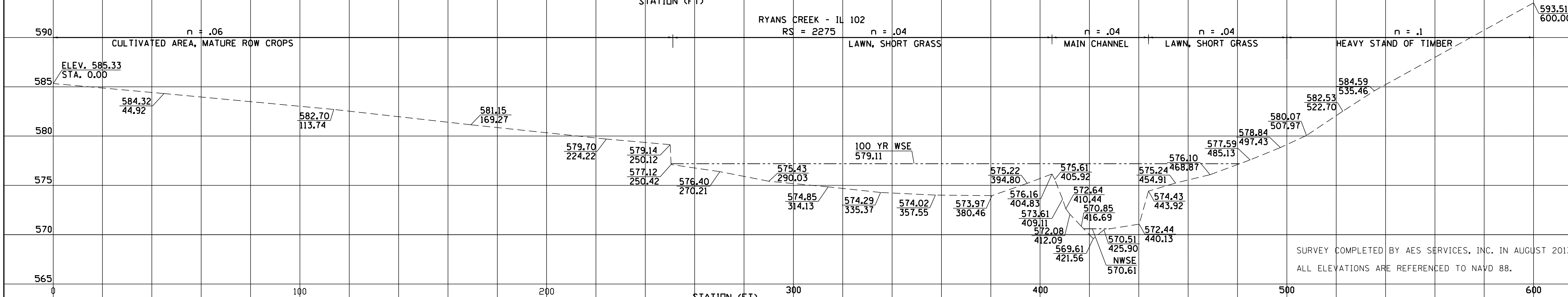
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(111N-B)B-R	WILL	5	2

CONTRACT NO. 60V28

FED. ROAD DIST. NO. 1 | ILLINOIS | FED. AID PROJECT







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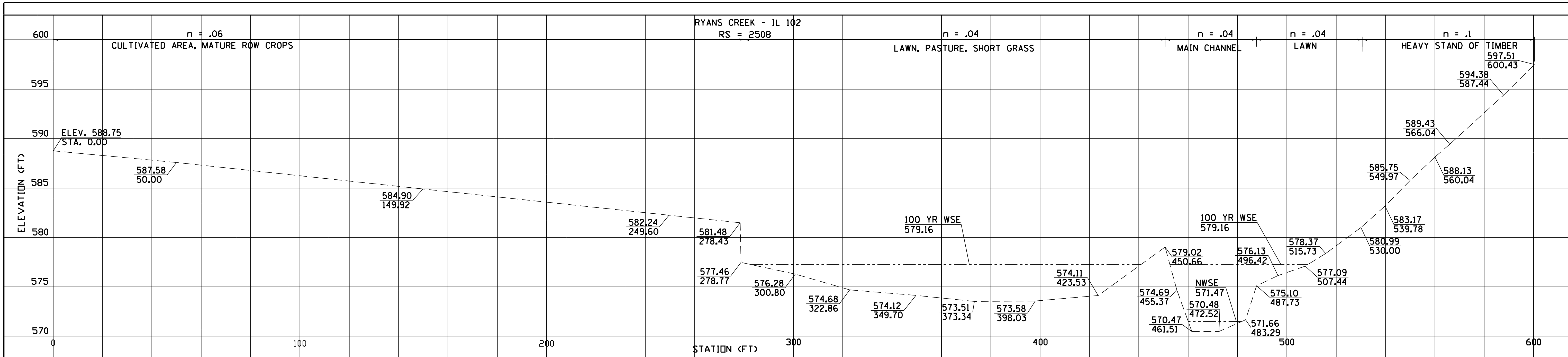
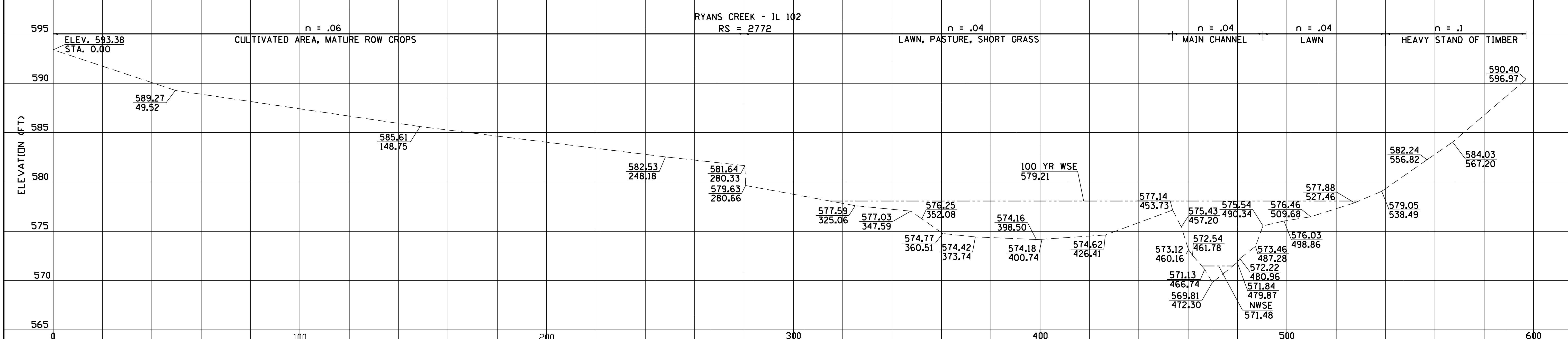
	PLOT SCALE = $SCALE$	DRAWN - JFS	REVISED -	STATE OF ILLINOIS		CONTRACT NO. 60V28
$MODELNAME$	PLOT DATE = $DATE$	CHECKED - RJD	REVISED -	DEPARTMENT OF TRANSPORTATION	SCALE: 1"=20' (HORIZ.) 1"=5' (VERT.) SHEET NO. 3 OF 5 SHEETS STA. 20+26 TO STA. 22+75	FED. ROAD DIST. NO. 1 ILLINOIS FED. AID PROJECT
		DATE - 4/27/2015	REVISED -			



CROSS SECTIONS TAKEN LOOKING DOWNSTREAM



FINAL SURVEY: NOTE BOOK NO. / SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED / BY / DATE

ORIGINAL SURVEY: NOTE BOOK NO. / SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED / BY / DATE

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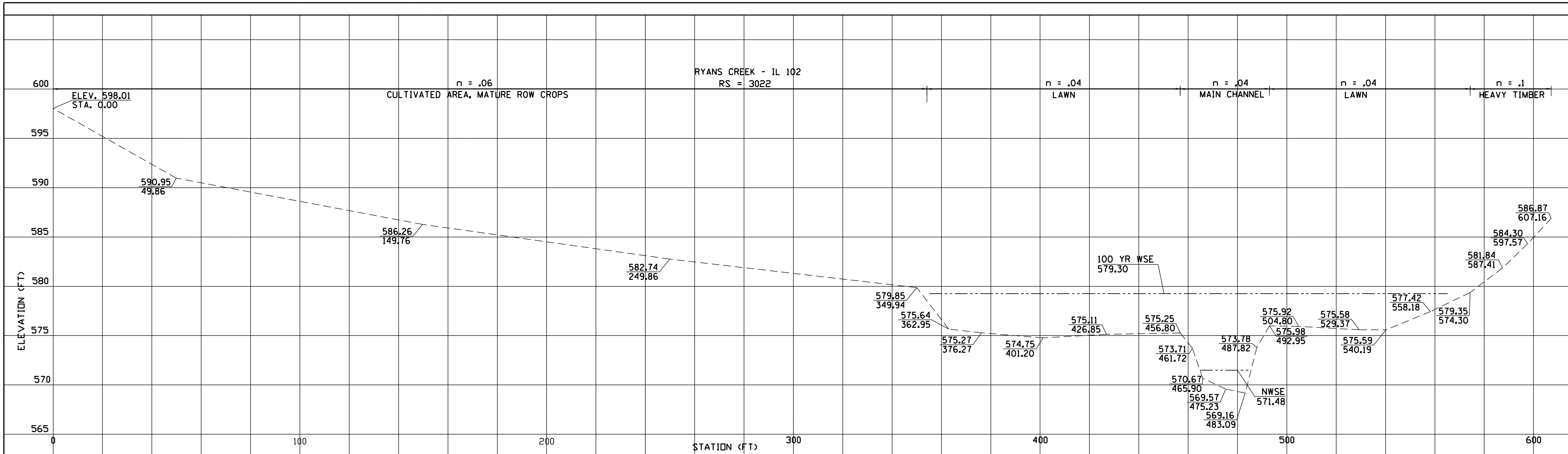
IL ROUTE 102 OVER RYANS CREEK
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

EXISTING CONDITIONS CHANNEL CROSS SECTIONS

SCALE: 1"=20' (HORIZ.) 1"=5' (VERT.) | SHEET NO. 4 OF 5 SHEETS | STA. 25+08 TO STA. 27+72

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(111N-B)B-R	WILL	5	4
		CONTRACT NO. 60V28		

FED. ROAD DIST. NO. 1 | ILLINOIS | FED. AID PROJECT



CROSS SECTIONS TAKEN LOOKING DOWNSTREAM

SURVEY COMPLETED BY AES SERVICES, INC. IN AUGUST 2013

ALL ELEVATIONS ARE REFERENCED TO NAVD 88.

ELEVATION (FT)

FINAL SURVEY | NOTE BOOK | NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE

ORIGINAL SURVEY | NOTE BOOK | NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE

FILE NAME = $FILES$	USER NAME = $USER$	DESIGNED - SF	REVISED -	IL ROUTE 102 OVER RYANS CREEK STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
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		CHECKED - NWS	REVISED -	
$MODELNAME$	PLOT DATE = $DATE$	DATE - 4/27/2015	REVISED -	

EXISTING CONDITIONS CHANNEL CROSS SECTIONS

SCALE: 1"=20' (HORIZ.) 1"=5' (VERT.) | SHEET NO. 5 OF 5 SHEETS | STA. 30+22 TO STA. 30+22

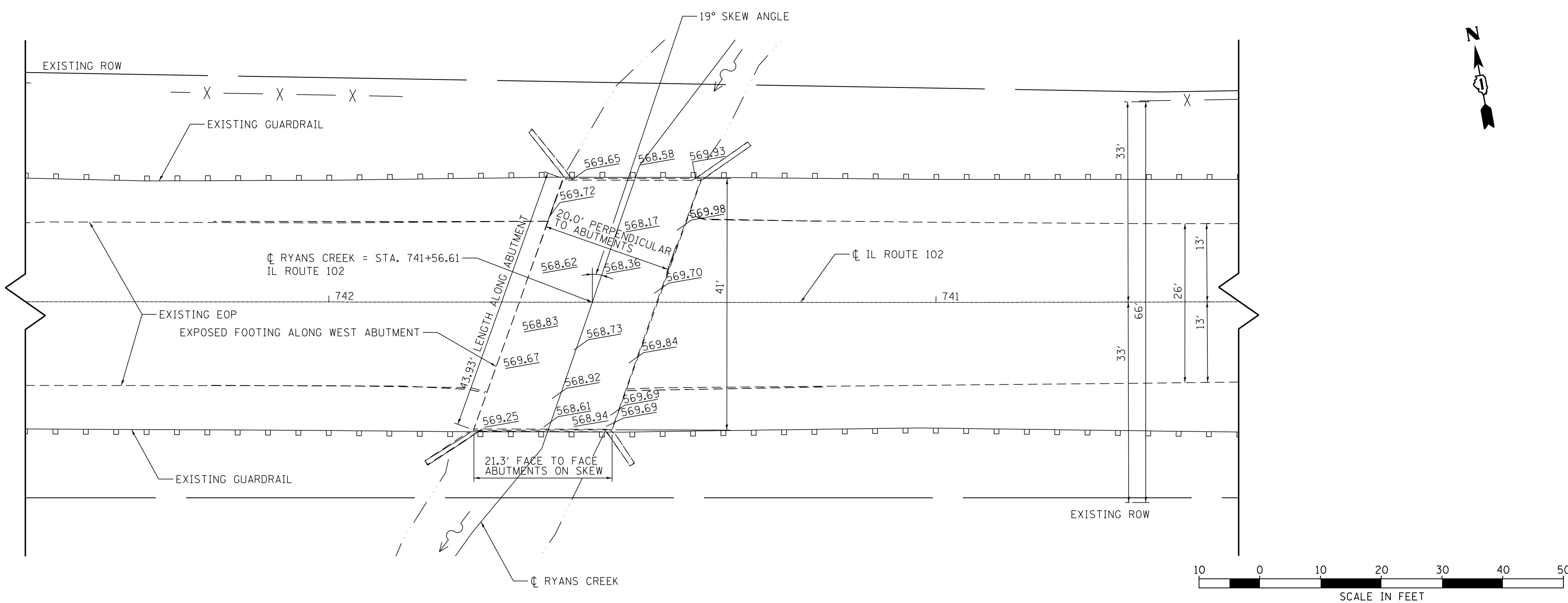
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(111N-B)B-R	WILL	5	5

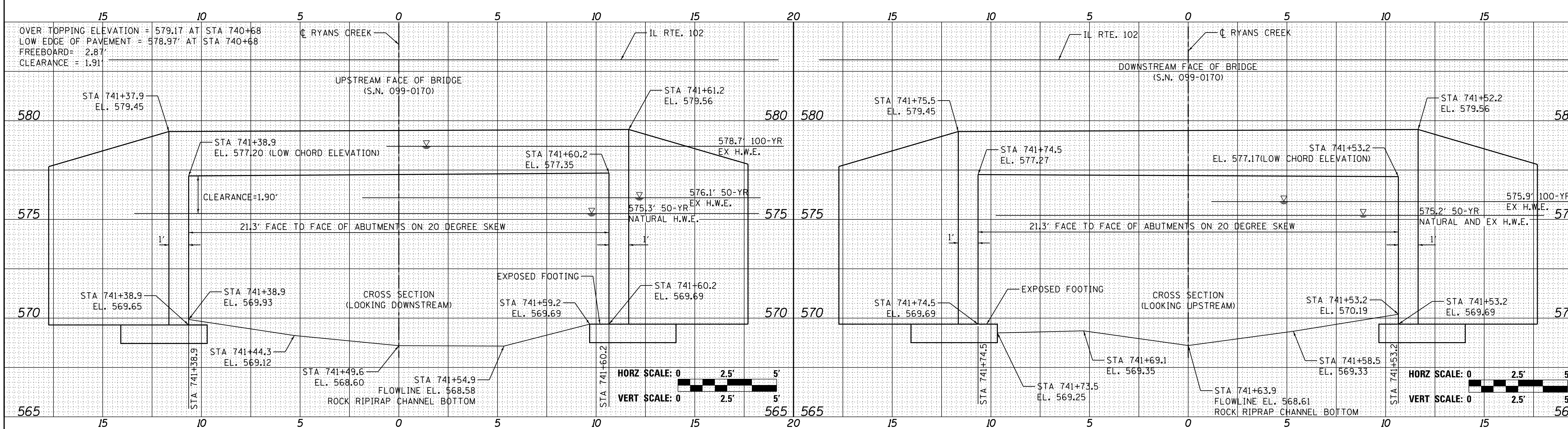
CONTRACT NO. 60V28

FED. ROAD DIST. NO. 1 | ILLINOIS | FED. AID PROJECT

SECTION 10

Bridge Layout/Plan Drawing Plots





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Default	PLOT DATE = 10/20/2016	DATE - 5/12/2016	REVISED -	

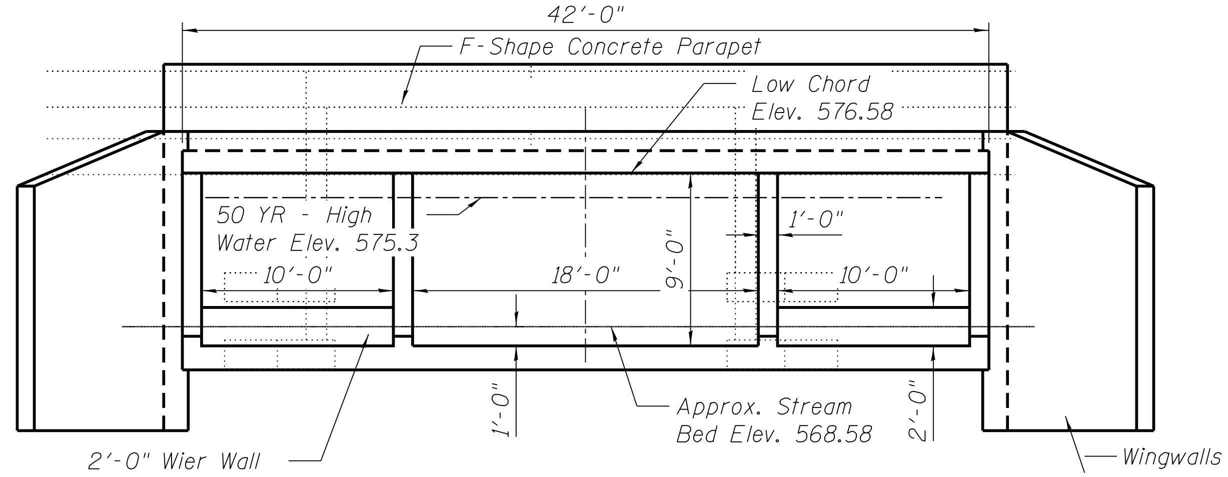
IL ROUTE 102 OVER RYANS CREEK
EXISTING SITE STRUCTURE CROSS SECTIONAL INFORMATION

SCALE: 1" = 10' | SHEET 1 OF 1 SHEETS | STA. 740+50.00 TO STA. 742+50.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631	(11N-B)B-R	WILL	1	1

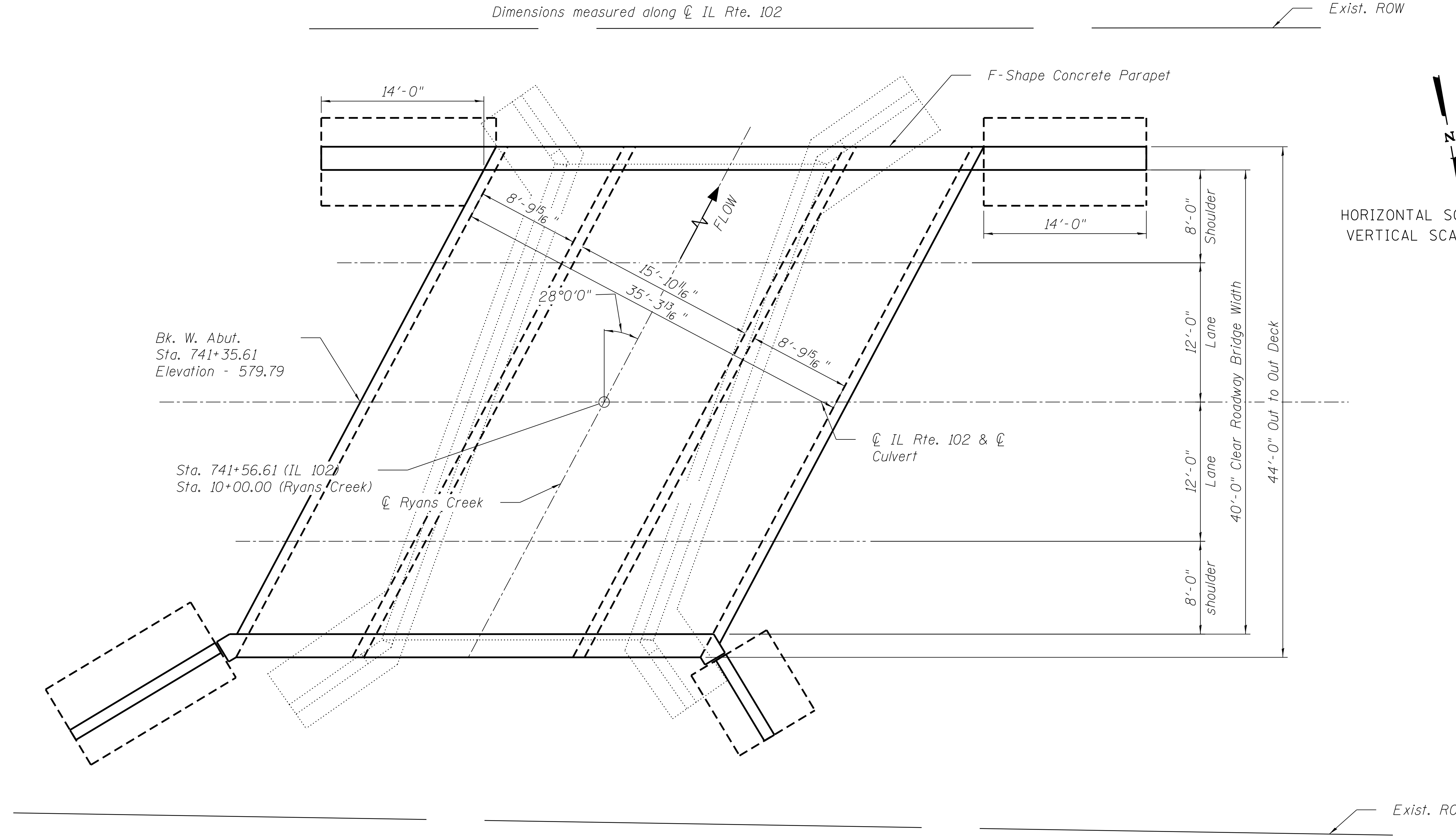
CONTRACT NO. 60V28

ILLINOIS FED. AID PROJECT



PROPOSED STRUCTURE ELEVATION

Dimensions measured along ℄ IL Rte. 102



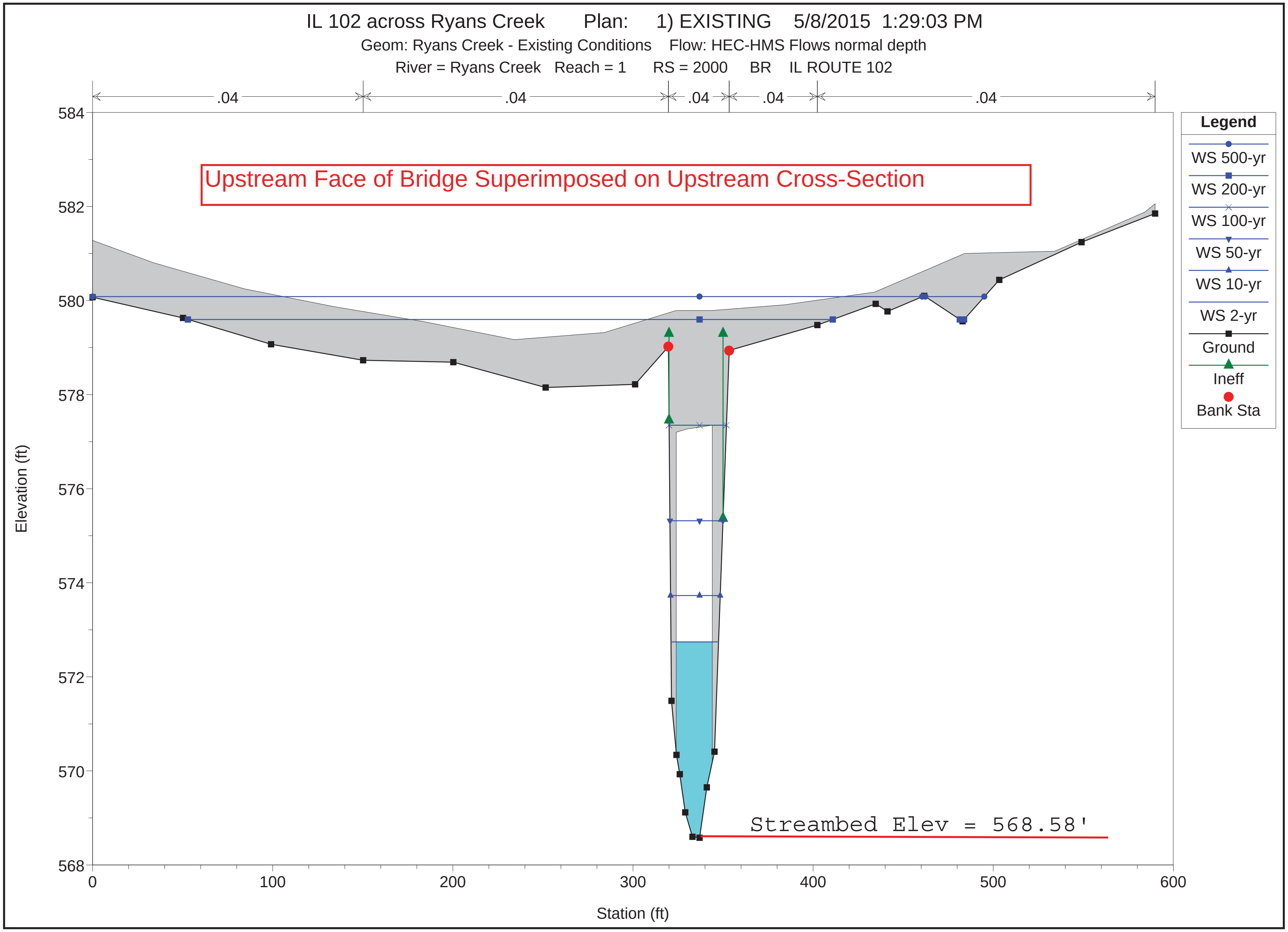
HORIZONTAL SCALE 1'' = 10'
VERTICAL SCALE 1'' = 10'

PROPOSED STRUCTURE PLAN

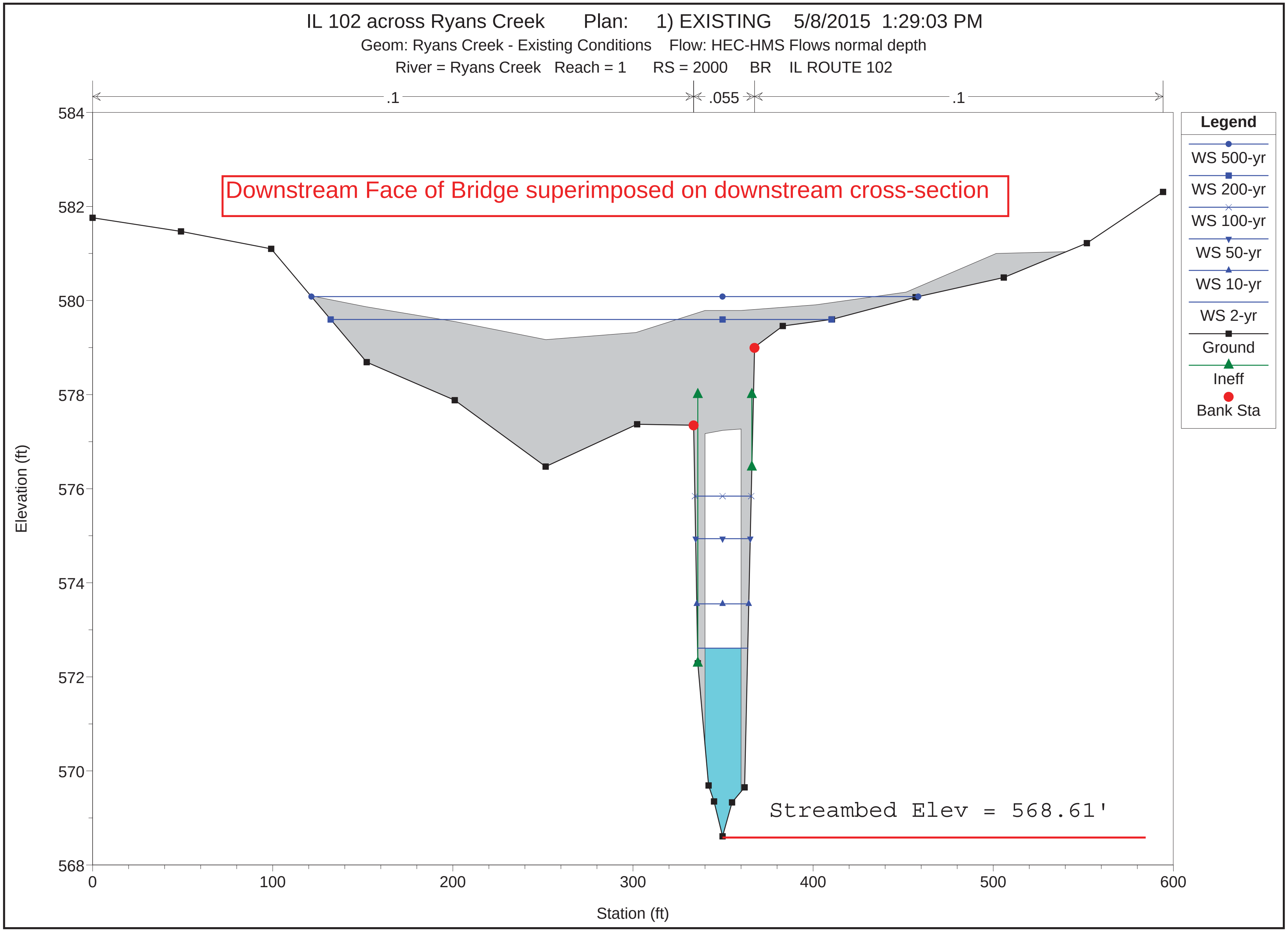
Primera 100 S. WACKER DRIVE SUITE 700 . CHICAGO IL 60606 . P:312-606-0910 F:312-606-0415	**STATE OF ILLINOIS** **DEPARTMENT OF TRANSPORTATION**	IDOT PROJECT NO. P-91-187-13 BRIDGE CONDITION REPORT	IL RTE. 102 OVER RYANS CREEK PROPOSED SKETCH PLAN ALTERNATIVE 3	EXHIBIT: G-3

SECTION 11

Bridge Cross Section Plots – Existing Conditions

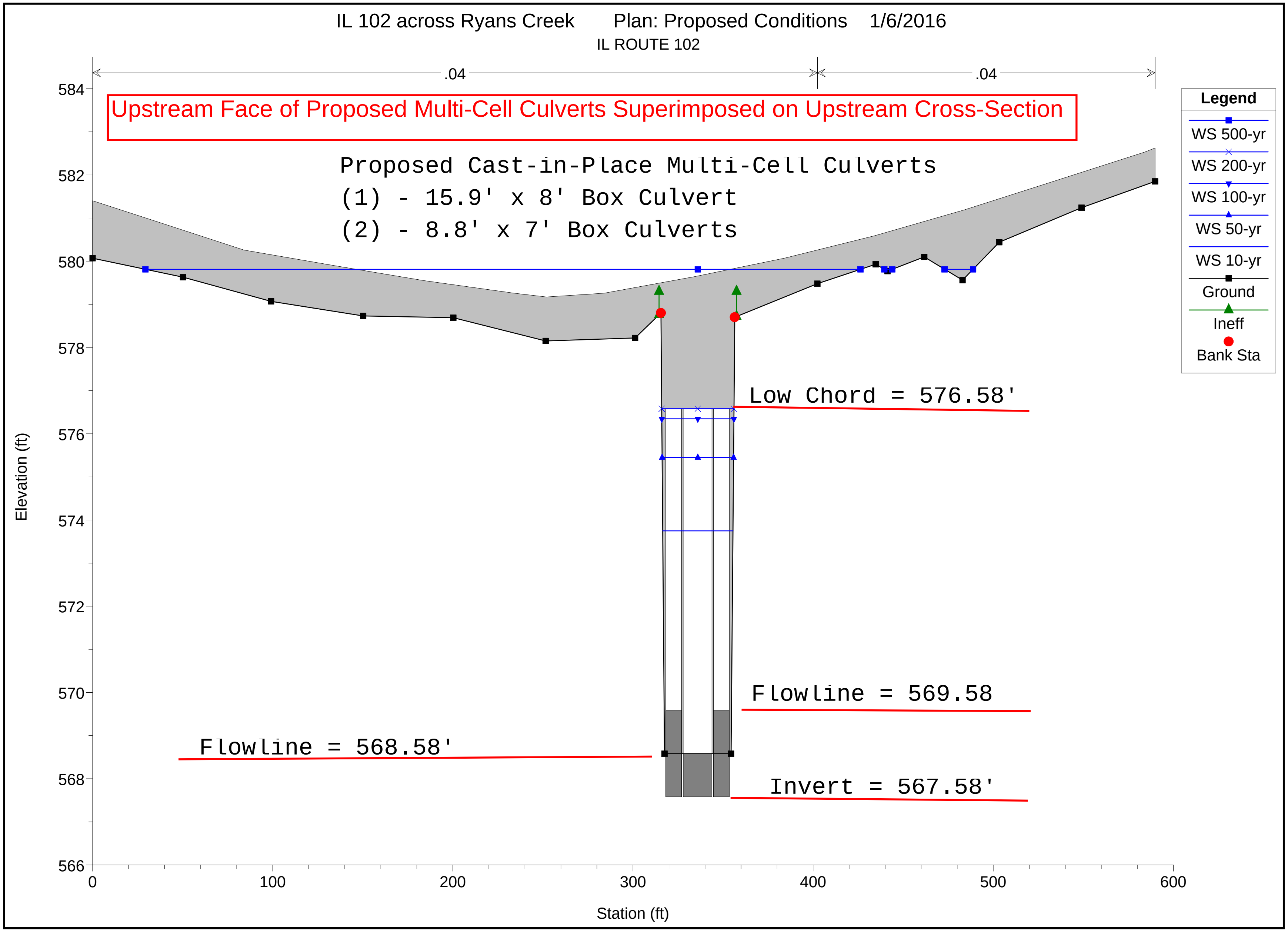


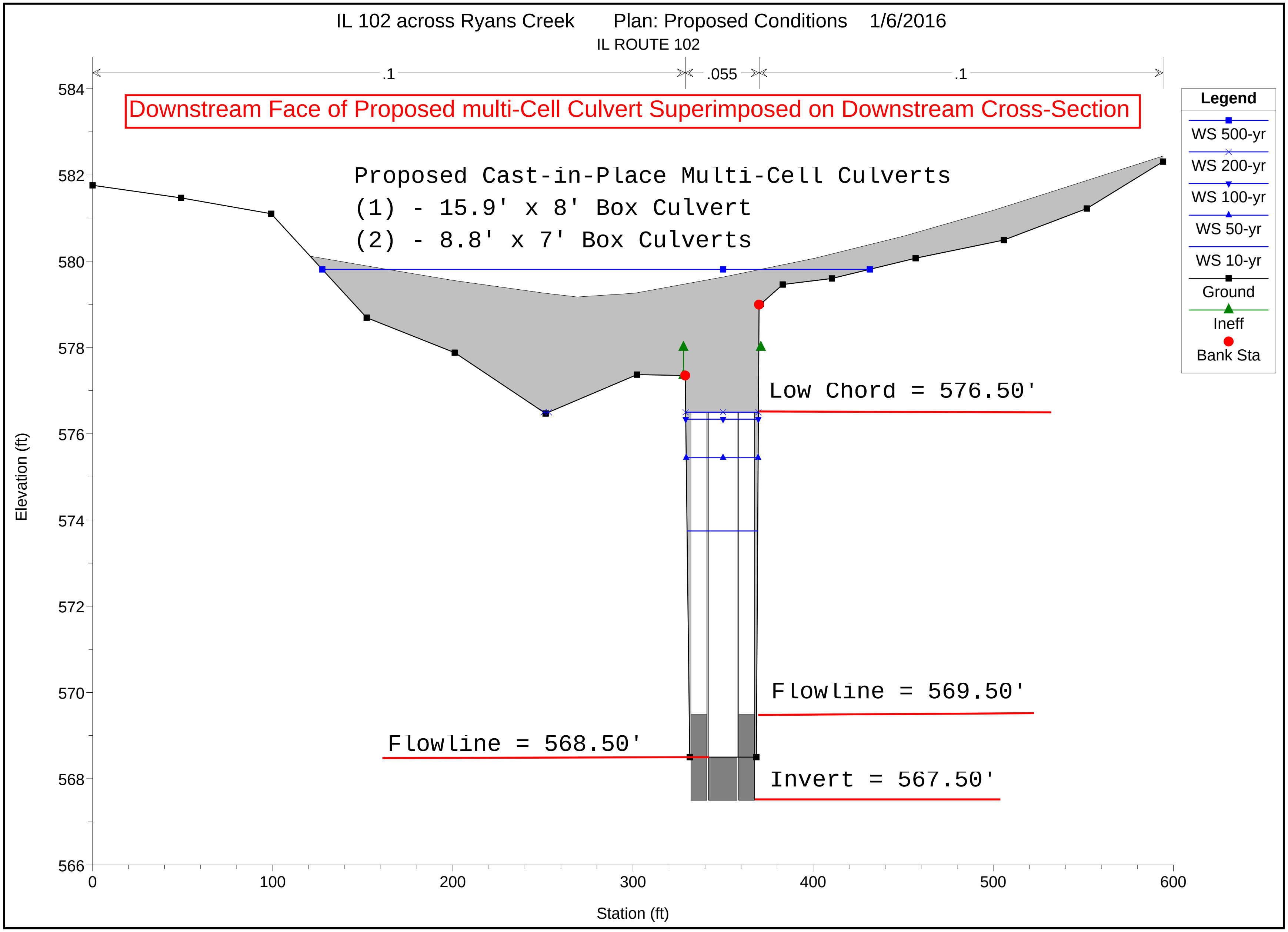
IL 102 across Ryans Creek Plan: 1) EXISTING 5/8/2015 1:29:03 PM
Geom: Ryans Creek - Existing Conditions Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 BR IL ROUTE 102
.04
.04
.04
.04
.04
Upstream Face of Bridge Superimposed on Upstream Cross-Section
Streambed Elev = 568.58'
Elevation (ft)
584
582
580
578
576
574
572
570
568
Station (ft)
0
100
200
300
400
500
600
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta


IL 102 across Ryans Creek Plan: 1) EXISTING 5/8/2015 1:29:03 PM
Geom: Ryans Creek - Existing Conditions Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 BR IL ROUTE 102
.1
.055
.1
Downstream Face of Bridge superimposed on downstream cross-section
Streambed Elev = 568.61'
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600
Station (ft)

SECTION 12

Bridge Cross Section Plots – Proposed Conditions


IL 102 across Ryans Creek Plan: Proposed Conditions 1/6/2016
IL ROUTE 102
.04
.04
Upstream Face of Proposed Multi-Cell Culverts Superimposed on Upstream Cross-Section
Proposed Cast-in-Place Multi-Cell Culverts
(1) - 15.9' x 8' Box Culvert
(2) - 8.8' x 7' Box Culverts
Low Chord = 576.58'
Flowline = 569.58
Flowline = 568.58'
Invert = 567.58'
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
566
0
100
200
300
400
500
600


IL 102 across Ryans Creek Plan: Proposed Conditions 1/6/2016
IL ROUTE 102
.1
.055
.1
Downstream Face of Proposed multi-Cell Culvert Superimposed on Downstream Cross-Section
Proposed Cast-in-Place Multi-Cell Culverts
(1) - 15.9' x 8' Box Culvert
(2) - 8.8' x 7' Box Culverts
Low Chord = 576.50'
Flowline = 569.50'
Flowline = 568.50'
Invert = 567.50'
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
566
0
100
200
300
400
500
600

SECTION 13

Hydraulic Analyses

PROJECT NO: 2013129.05 TITLE: IL 102 over Ryans Ck CALC NO: REV. NO:
PREPARED BY: DCC DATE: 5-12-2016
REVIEWED BY: Chad Dillavou DATE: 5-12-2016
APPROVED BY: DATE: —

Mannings "n" Calculations

Upstream Channel Roughness Coefficient

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

n_b = Gravel - Cobbles = 0.035 (table 5-301.011b)

n_1 = Smooth = 0.000 (Irregularity) (table 5-301.011c)

n_2 = Gradual = 0.000 (variation in channel) "

n_3 = negligible = 0.000 (obstructions) "

n_4 = small = 0.005 (vegetation "

m = 1.0 = minor

$n = (0.035 + .005)1 = \underline{0.04}$

Downstream Channel Roughness Coefficient

n_b = gravel = 0.030 (5-301.011b)
n_1 = smooth = 0.000 (5-301.011c)
n_2 = Gradual = 0.000 "
n_3 = Negligible = 0.000 "
n_4 = moderately dense vegetation = 0.025
m = 1

$n = (0.030 + .025)1$

$\underline{n = .055}$

PROJECT NO: 2013127.05 TITLE: IL 102 over Ryans Ck CALC NO: REV. NO:
PREPARED BY: DCC DATE: 5-12-2016
REVIEWED BY: CD DATE: 5-12-2016
APPROVED BY: DATE: —

Floodplain Roughness Coefficient

Cultivated Areas

n_b = firm soil = 0.025
n_1 = Smooth = 0.000
n_2 = N/A = 0.000
n_3 = Negligible = 0.000
n_4 = Mature Row Crops = 0.035
m_1 = 1.0

$n = (0.025 + .035) * 1$

$n = 0.06$

Turf/Grassed Area

n_b = firm soil = 0.025
n_1 = Smooth = 0.000
n_2 = N/A = 0.000
n_3 = Negligible = 0.000
n_4 = grass = 0.015
m = 1.0

$n = (0.025 + 0.015) * 1$

$n = 0.04$

Woods/Timber

n_b = firm soil = 0.025
n_1 = Smooth = 0.000
n_2 = N/A = 0.000
n_3 = Negligible = 0.000
n_4 = Stand of timber = 0.075
m = 1.0

$n = (.025 + .075) * 1$

$n = 0.10$

Table 5-301.011b
Base n_b Values for Stable Channel and Floodplains

Material	Median Size of Bed Material Base n_b		
	Millimeters	Inches	Range
Concrete	-------	-------	0.012-0.018
Rock cut	-------	-------	---------
Firm soil	-------	-------	0.025-0.032 Floodplain
Coarse sand	1-2	-------	0.026-0.035
Fine gravel	-------	-------	---------
Gravel	2-64	0.08-2.5	0.028-0.035 Channel
Coarse gravel	-------	-------	---------
Cobble	64-256	2.5-10.1	0.030-0.050
Boulder	>256	>10.1	0.040-0.070

The n_b values selected from Table 5-301.011a and Table 5-301.011b are for straight channels of nearly uniform cross-sectional shape. Channel irregularities (n_1), alignment (n_2), obstruction (n_3), vegetation (n_4) and meandering (m) increase the roughness and the value of n must be adjusted accordingly as shown in Table 5-301.011c.

The effects of depth of flow on the selection of n values for channels must be considered. If the depth of flow is shallow in relation to the size of the roughness elements, the n value can be large. The n value generally decreases with increasing depth, except where the channel banks are much rougher than the bed or where dense brush overhangs the low-water channel.

Irregularity (n_1)

Where the ratio of width to depth is small, roughness caused by eroded and scalloped banks, projecting points, and exposed tree roots along the banks must be accounted for by fairly large adjustments. Chow_(1959)[3], and Benson and Dalrymple (1967)[5], showed that severely eroded and scalloped banks can increase n values by as much as 0.02. Larger adjustments may be required for very large, irregular banks having projecting points.

Variation in Channel Cross Section (n_2)

The value of n is not affected significantly by relatively large changes in the shape and size of cross sections if the changes are gradual and uniform. Greater roughness is associated with alternating large and small sections where the changes are abrupt. The degree of the effect of changes in the size of the channel depends primarily on the number of alternations of large and small sections and secondarily on the magnitude of the changes. The effects of sharp ends, constrictions, and side-to-side shifting of the low-water channel may extend downstream for several hundred feet. The n value for a reach below these disturbances may require adjustment, even though none of the roughness-producing factors are apparent in the study reach. A maximum increase in n of 0.003 will result from the usual amount of channel curvature found in designed channels and the reaches of natural channels used to compute discharge.

Table 5-301.011c
Factors that Effect Roughness of Channel

Channel Conditions		n value Adjustment 1/	Example
Degree of Irregularity (n_1)	Smooth	0.000	Compares to the smoothest channel attainable in a given bed material.
	Minor	0.001-0.005	Compares to carefully dredged channels in good condition but having slightly eroded or scoured sideslopes
	Moderate	0.006-0.010	Compares to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded sideslopes.
	Severe	0.011-0.020	Badly sloughed or scalloped banks of natural streams; badly eroded or sloughed sides of canals or drainage channels; unshaped, jagged and irregular surfaces of channels in rock.
Variation in Channel Cross Section (n_2)	Gradual	0.000	Size and shape of channel cross sections change gradually.
	Alternating occasionally	0.001-0.005	Large and small cross sections alternate occasionally, or the main flow shifts from side to side owing to changes in cross-sectional shape.
	Alternating Frequently	0.010-0.015	Large and small cross sections alternate frequently, or the main flow frequently shifts from side to side owing to changes in cross-sectional shape.

2c

Table 5-301.011c (continued)
Factors that Effect Roughness of Channel

Channel Conditions		n value Adjustment 1/	Example
Effect of Obstruction (n_3)	Negligible	0.000-0.004	A few scattered obstructions, which include debris deposits, stumps, exposed roots, logs, piers, or isolated boulders, that occupy less than 5 percent of the cross-sectional area.
	Minor	0.005-0.015	Obstructions occupy less than 15 percent of the cross-sectional area and the spacing between obstructions is such that the sphere of influence around one obstruction does not extend to the sphere of influence around another obstruction. Small adjustments are used for curved smooth-surfaced objects than are used for sharp-edged angular objects.
	Appreciable	0.020-0.030	Obstructions occupy from 15 to 50 percent of the cross-sectional area or the space between obstructions is small enough to cause the effects of several obstructions to be additive, thereby blocking an equivalent part of a cross section.
	Severe	0.040-0.050	Obstructions occupy more than 50 percent of the cross-sectional area or the space between obstructions is small enough to cause turbu-lence across most of the cross-section.

2d

Table 5-301.011c (continued)
Factors that Effect Roughness of Channel

Channel Conditions		n value Adjustment 1/	Example
Amount of Vegetation (n_4)	Small	0.002-0.010	Dense growths of flexible turf grass, such as Bermuda, or weeds growing where the average depth of flow is at least two times the height of the vegetation; supple tree seedlings such as willow, cottonwood, arrowseed, or saltcedar growing where the average depth of flow is at least three times the height of the vegetation.
	Medium	0.010-0.025	Turf grass growing where the average depth of flow is from one to two times the height of the vegetation; moderately dense stemmy grass, weeds, or tree seedlings growing where the average depth of flow is from two to three times the height of the vegetation; brushy, moderately dense vegetation, similar to 1 to 2 year old willow trees in the dormant season growing along the banks and no significant vegetation along the channel bottoms where the hydraulic radius exceeds two feet.
	Large	0.025-0.050	Turf grass growing where the average depth of flow is about equal to the height of vegetation; 8 to 10 year old willow or cottonwood trees inter-grown with some weeds and brush (none of the vegetation in foliage) where the hydraulic radius exceeds 2 ft; bushy willows about 1 year old inter-grown with some weeds along sideslopes (all vegetation in full foliage) and no significant vegetation along channel bottoms where the hydraulic radius is greater than 2 feet.
	Very Large	0.050-0.100	Turf grass growing where the average depth of flow is less than half the height of the vegetation; bushy willow trees about 1 year old inter-grown with weeds along sideslopes (all vegetation in full foliage) or dense cat-tails growing along channel bottom; trees inter-grown with weeds and brush (all vegetation in full foliage).

Table 5-301.011c (continued)
Factors that Effect Roughness of Channel

Channel Conditions		n value Adjustment 1/	Example
Degree of Meandering 1/ (Adjustment values apply to flow confined in the channel and do not apply where downvalley flow crosses meanders.) (m)	Minor	1.00	Ratio of the channel length to valley length is 1.0 to 1.2.
	Appreciable	1.15	Ratio of the channel length to valley length is 1.2 to 1.5.
	Severe	1.30	Ratio of the channel length to valley length is greater than 1.5.

1/ Adjustments for degree of irregularity, variations in cross-section, effect of obstructions, and vegetation are added to the base n value before multiplying by the adjustment for meander.

5-301.012 Floodplain Roughness Coefficient

It is usually necessary to determine roughness values for channels and floodplains separately. The makeup of a floodplain can be quite different from that of a channel. The physical shape of a floodplain is different from that of a channel and the vegetation covering a floodplain is typically different from that found in a channel. The following procedure is used for determining an n value for floodplains.

Modified Channel Method

By altering the procedure that was developed for estimating n values for channels, the following equation can be used to estimate n values for a floodplain.

$$n = (n_b + n_1 + n_2 + n_3 + n_4)m \qquad \text{(Eq. 5-11)}$$

Where:

- n_b = a base value of n for the floodplain's natural bare soil surface, with nothing on the surface
- n_1 = a value to correct for the effect of surface irregularities on the floodplain
- n_2 = a value for variations in shape and size of the floodplain cross-section assumed to equal 0.0
- n_3 = a value for obstructions on the floodplain
- n_4 = a value for vegetation on the floodplain
- m = a correction factor for sinuosity of the floodplain, equal to 1.0

Using Equation 5-11, the roughness value for the floodplain is determined by selecting a base value of n_b for the natural bare soil surface of the floodplain and adding adjustment factors due to surface irregularity, obstructions and vegetation.

2F

Table 5-301.012
Factors that Effect Roughness of Floodplains

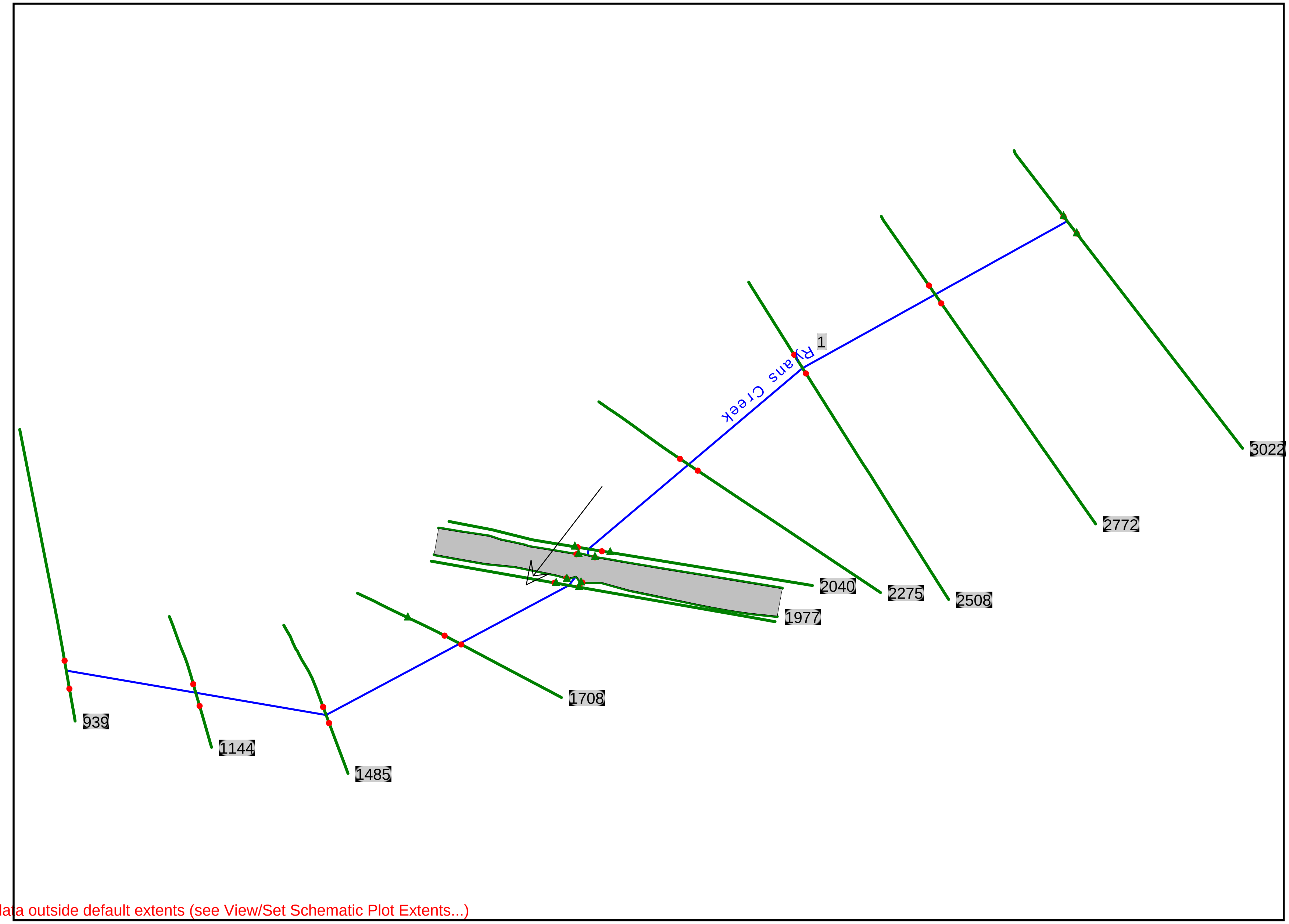
Floodplain Conditions		n value adjustment	Example
Degree of Irregularity (n_1)	Smooth	0.000	Compares to the smoothest, flattest floodplain attainable
	Minor	0.001-0.005	A floodplain with minor irregularity in shape, a few rises and dips or sloughs may be visible on the floodplain.
	Moderate	0.006-0.010	Has more rises and dips. Sloughs and hummocks may occur.
	Severe	0.011-0.020	The floodplain is very irregular in shape. Many rises and dips or sloughs are visible. Irregular ground surfaces in pastureland and furrows perpendicular to the flow are also included.
Variation of Floodplain Cross Section (n_2)		0.000	Not applicable.
Effect of Obstructions (n_3)	Negligible	0.000-0.004	A few scattered obstructions, which include debris deposits, stumps, exposed roots, logs or isolated boulders, occupy less than 5 percent of the cross-sectional area.
	Minor	0.005-0.019	Obstructions occupy less than 15 percent of the cross- sectional area.
	Appreciable	0.020-0.030	Obstructions occupy from 15 to 50 percent of the cross-sectional area.

Table 5-301.012 (continued)
Factors that Effect Roughness of Floodplains

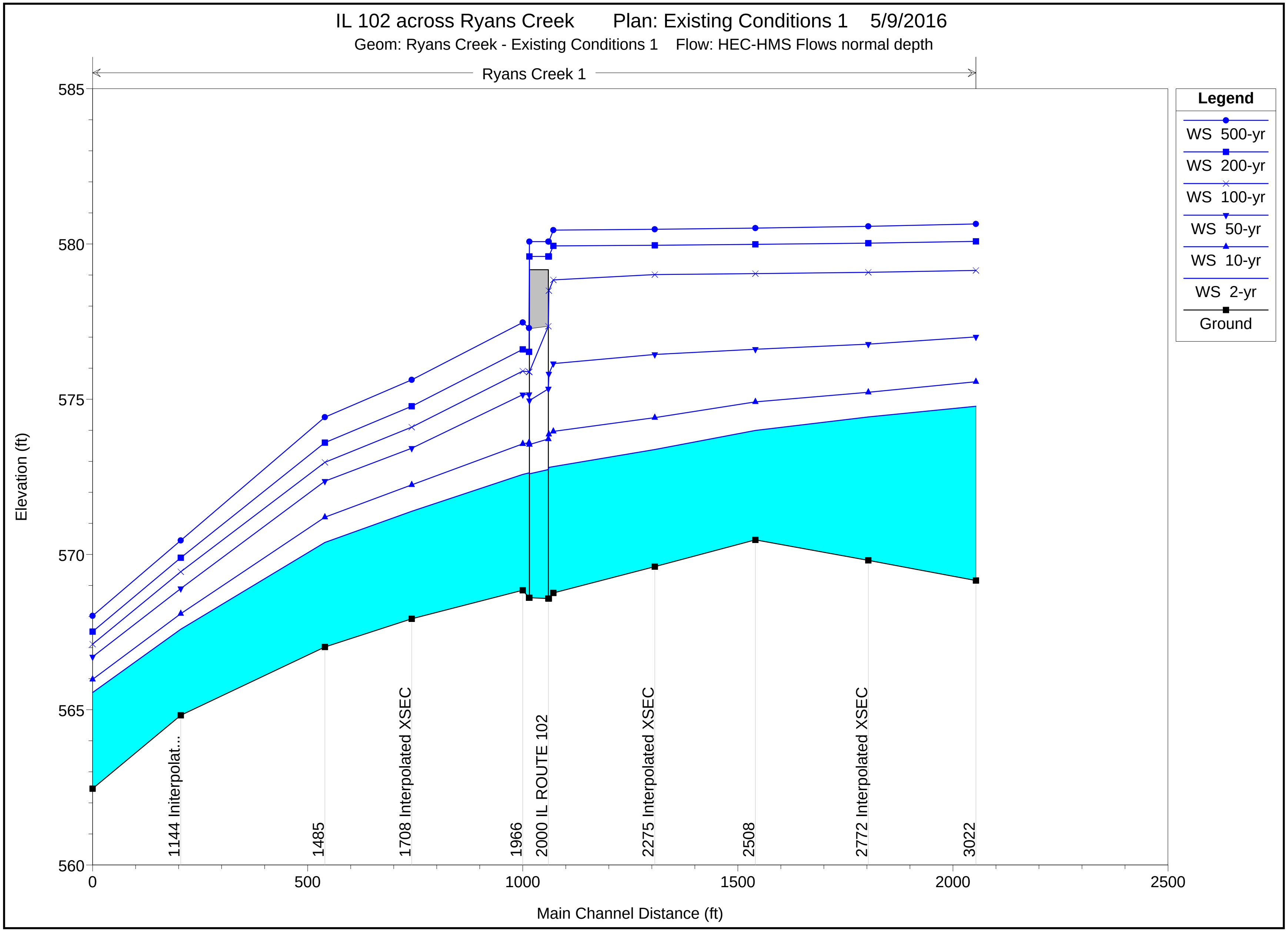
Floodplain Conditions		n value adjustment	Example
Amount of Vegetation (n_4)	Small	0.001-0.010	Dense growth of flexible turf grass, such as Bermuda, or weeds growing where the average depth of flow is at least two times the height of the vegetation; or supple tree seedlings such as willow, cottonwood, arrowweed, or saltcedar growing where the average depth of flow is at least three times the height of the vegetation.
	Medium	0.011-0.025	Turf grass growing where the average depth of flow is from one to two times the height of the vegetation; or moderately dense stemmy grass, weeds or tree seedlings growing where the average depth of flow is from two to three times the height of the vegetation; brushy, moderately dense vegetation, similar to 1 to 2 year old willow trees in the dormant season.
	Large	0.025-0.050	Turf grass growing where the average depth of flow is about equal to the height of vegetation; or 8 to 10 year old willow or cottonwood trees inter-grown with some weeds and brush (none of the vegetation in foliage) where the hydraulic radius exceeds 2 ft.; or mature row crops such as small vegetables; or mature field crops where depth of flow is at least twice the height of the vegetation.
	Very Large	0.050-0.100	Turf grass growing where the average depth of flow is less than half the height of the vegetation; or moderate to dense brush; or heavy stand of timber with few down trees and little undergrowth with depth of flow below branches; or mature field crops where depth of flow is less than height of the vegetation.
	Extreme	0.100-0.200	Dense bushy willow, mesquite, and saltcedar (all vegetation in full foliage); or heavy stand of timber, few down trees, depth of flow reaching branches.
Degree of Meander (m)		1.0	Not applicable.

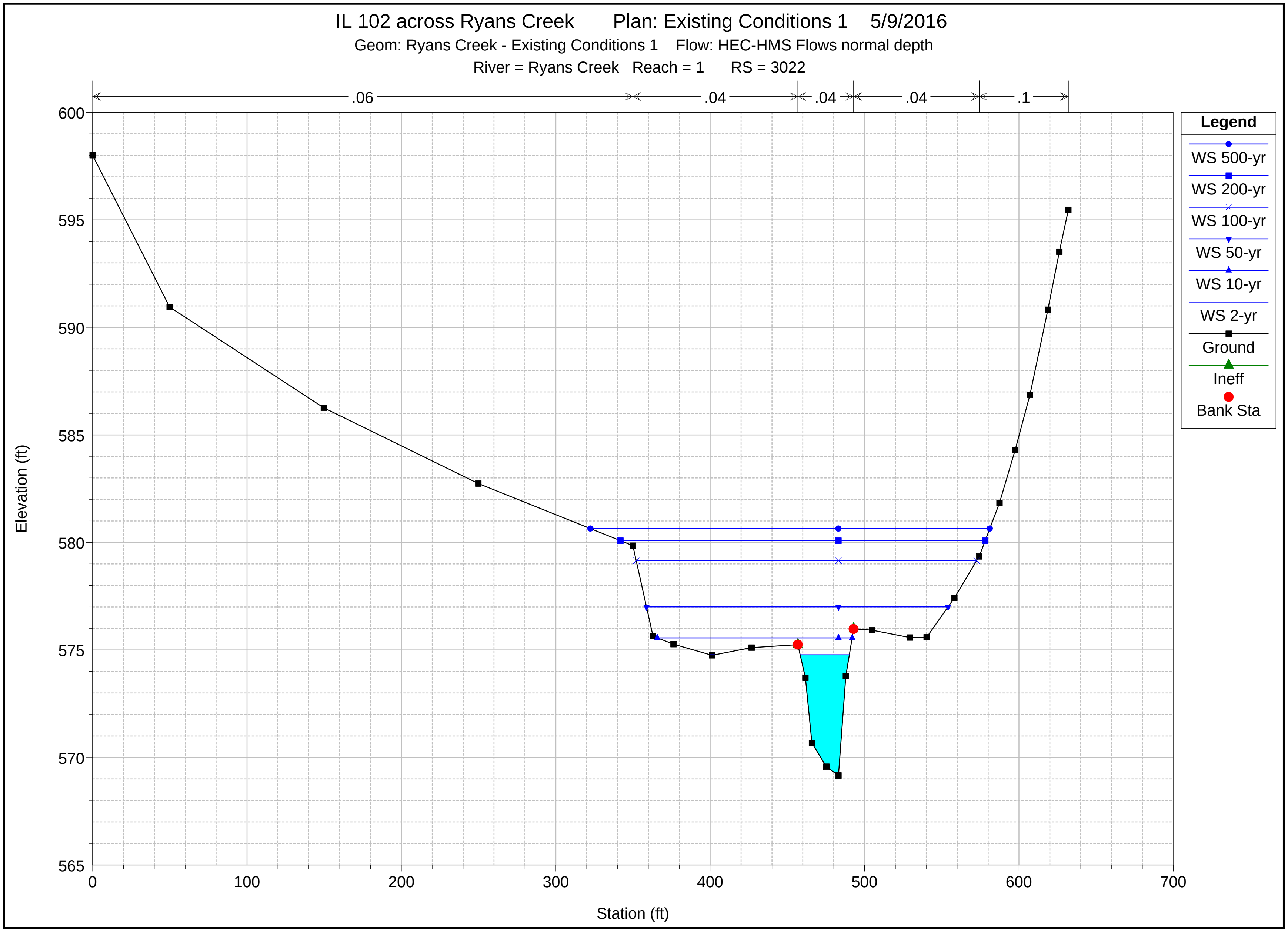
HEC-RAS

EXISTING CONDITIONS MODEL

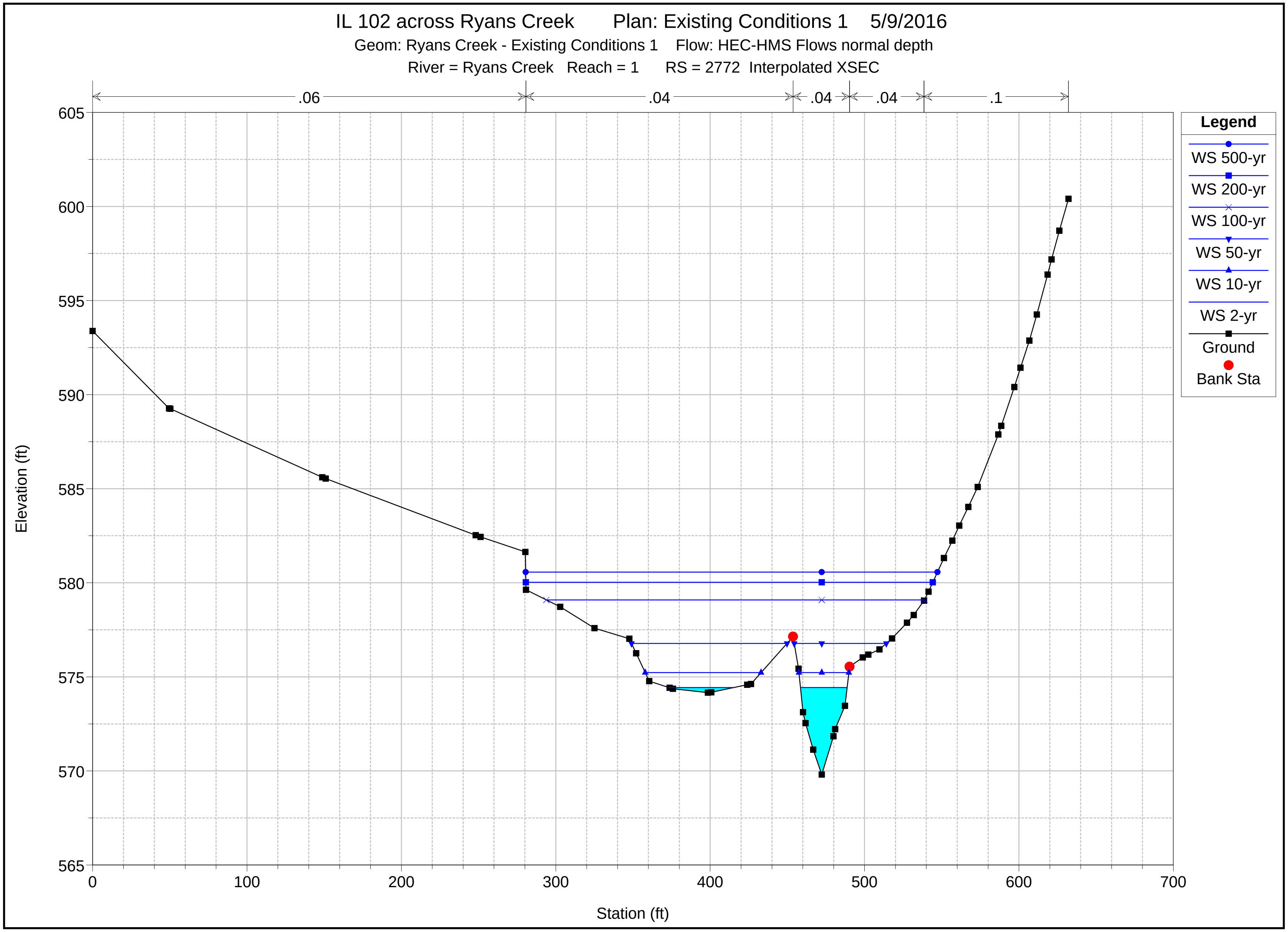


Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

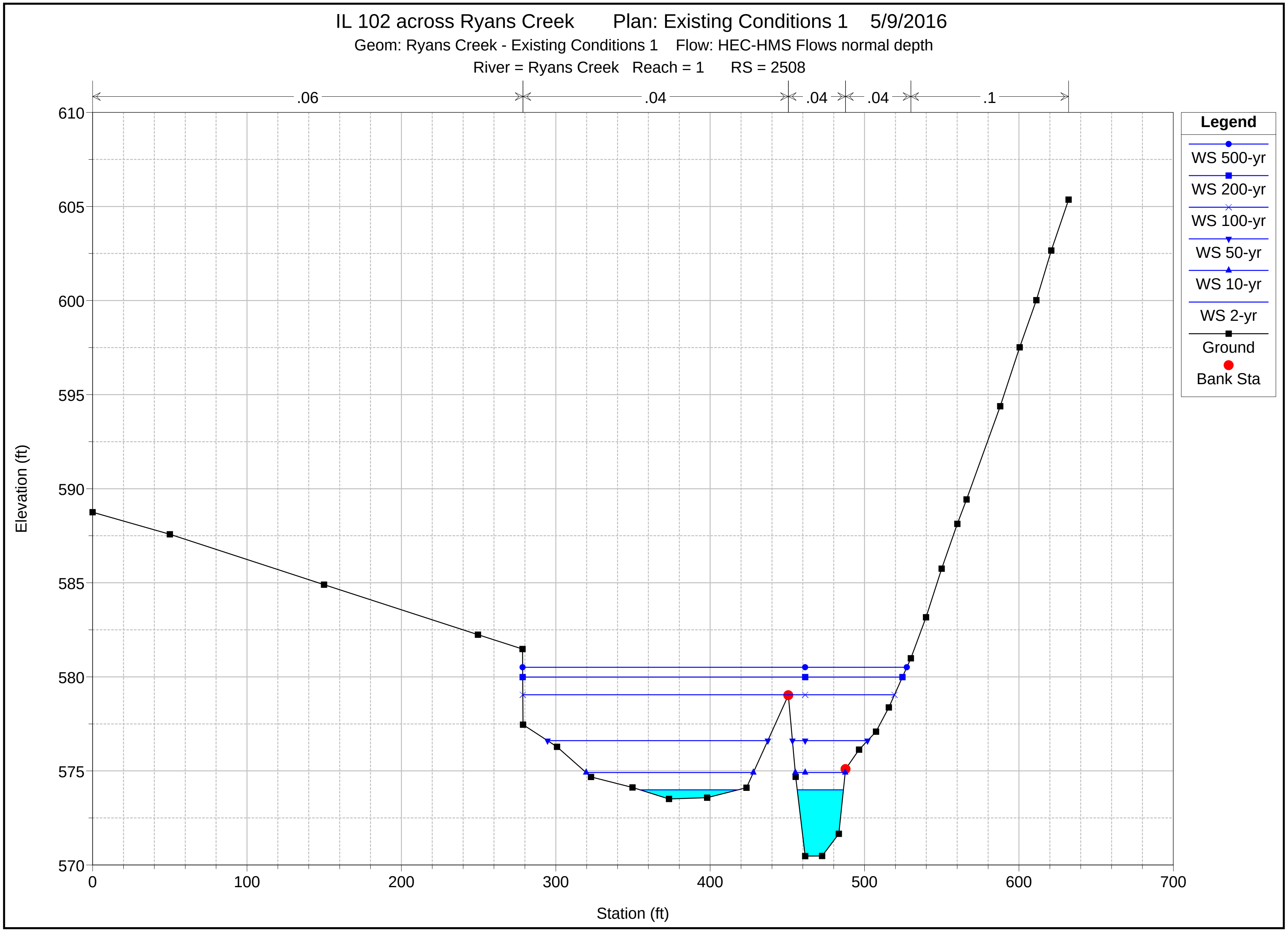

IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
585
580
575
570
565
560
0
500
1000
1500
2000
2500
1144 Interpolat...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

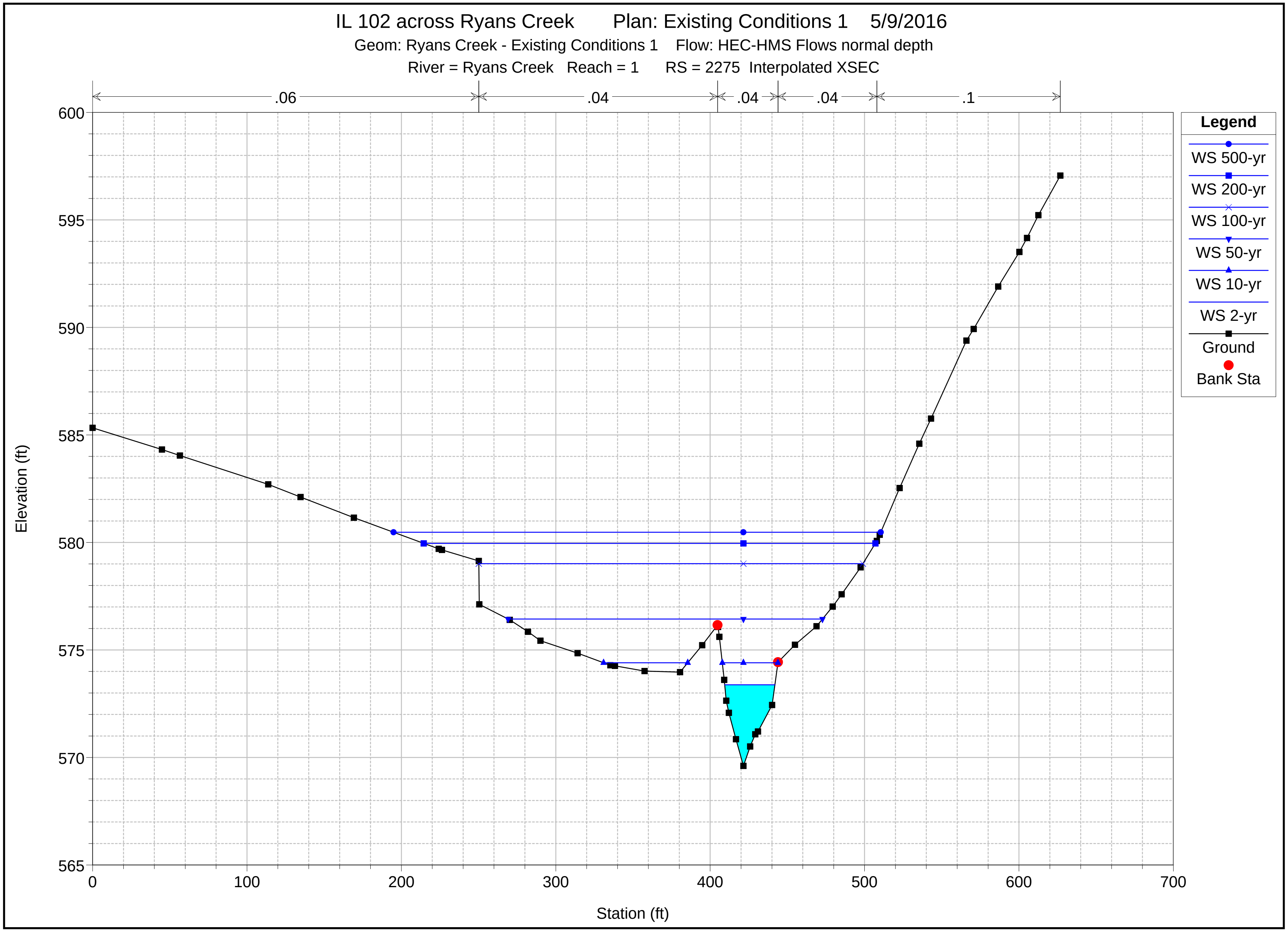


IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 3022
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700

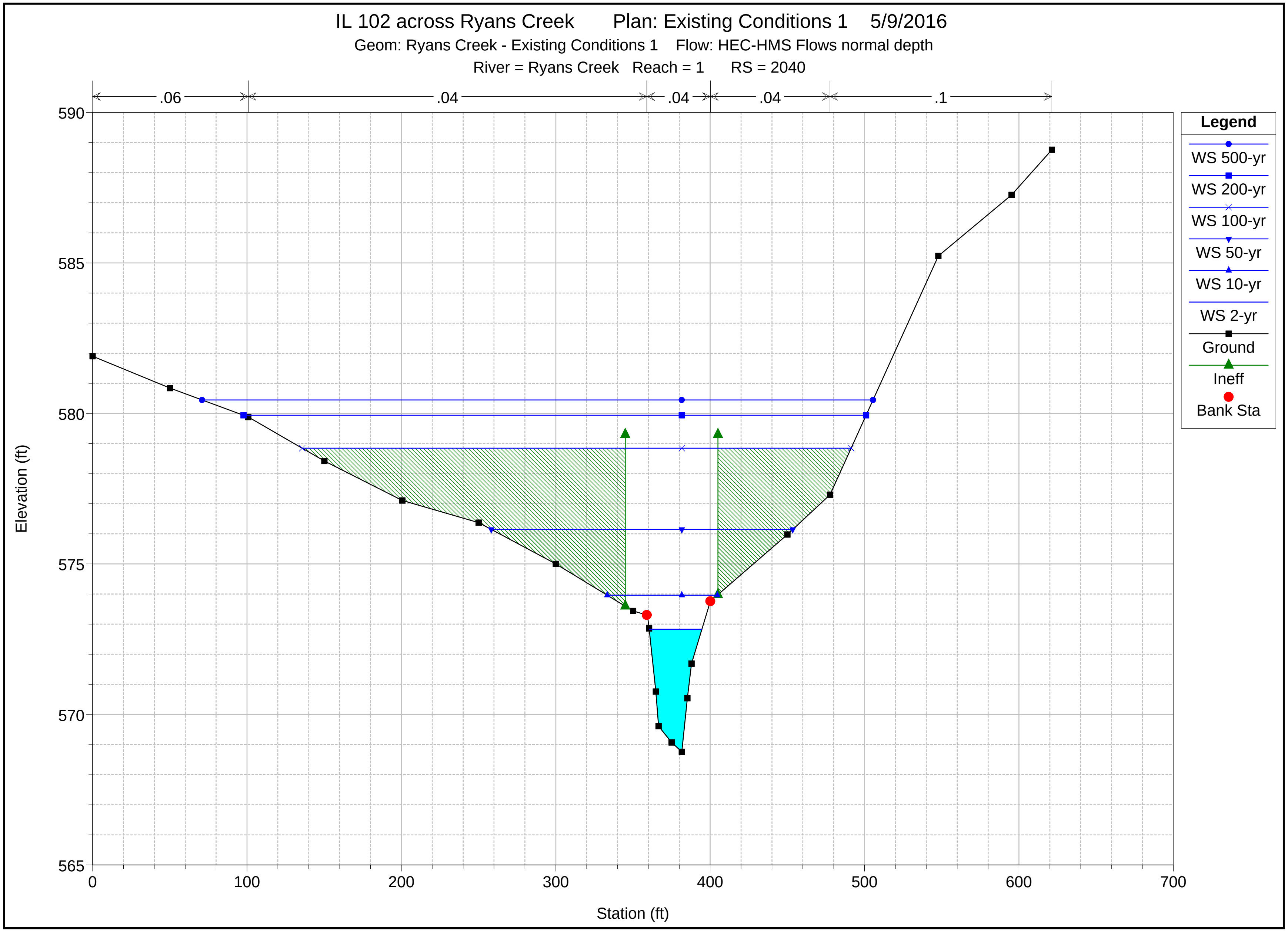


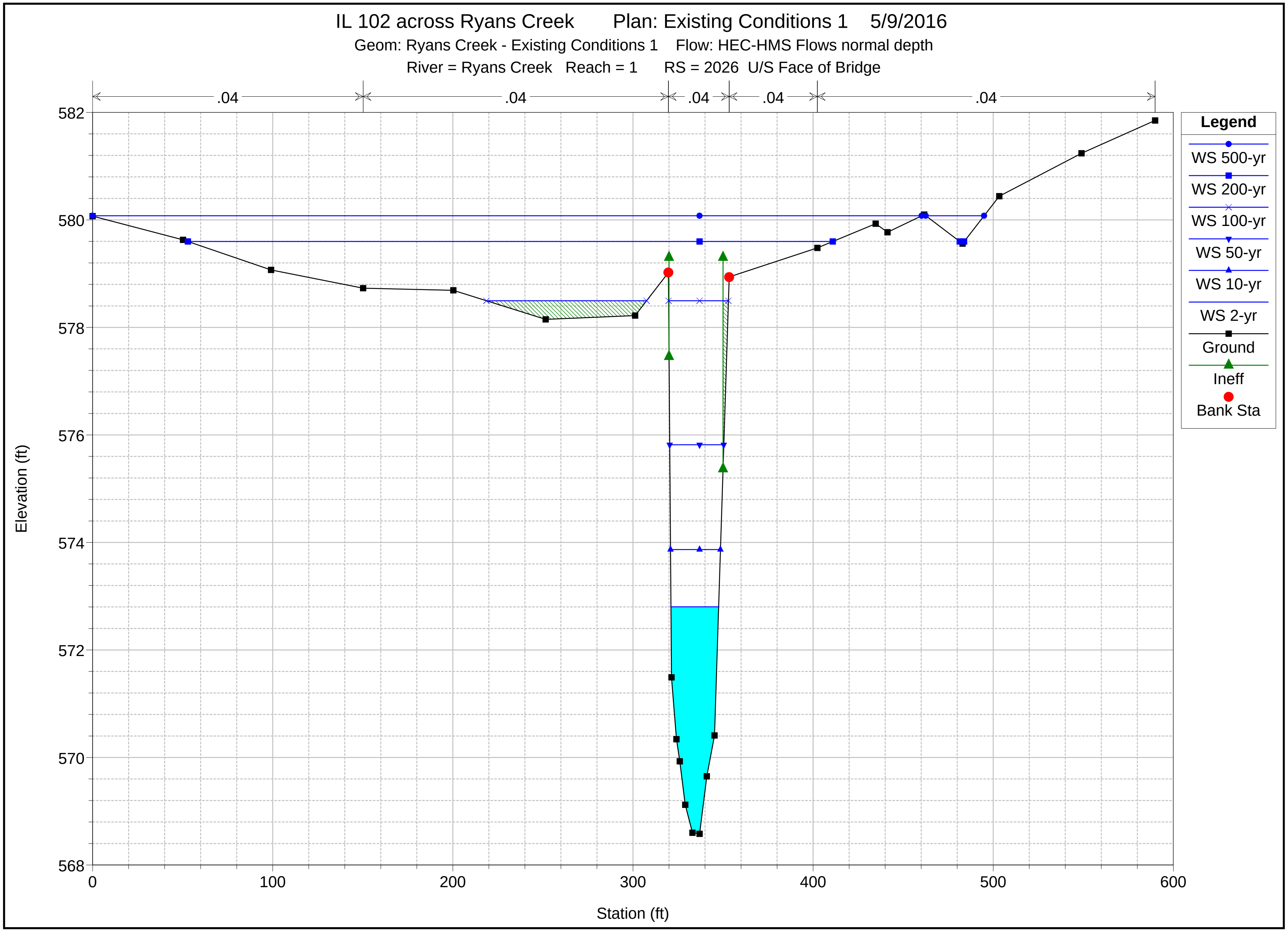
IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2772 Interpolated XSEC
.06
.04
.04
.04
.1
Elevation (ft)
Station (ft)
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
605
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700

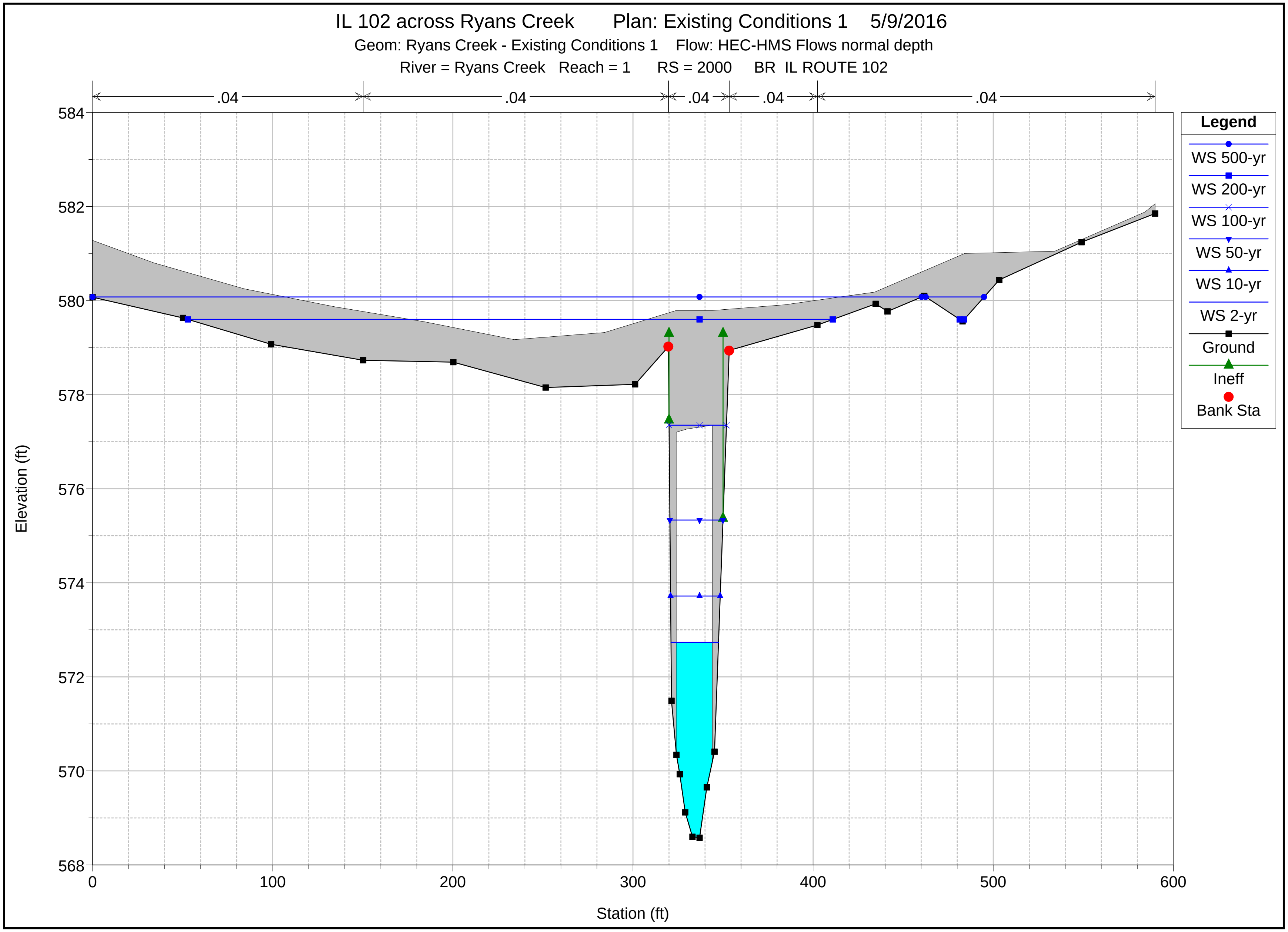

IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2508
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
570
575
580
585
590
595
600
605
610
0
100
200
300
400
500
600
700

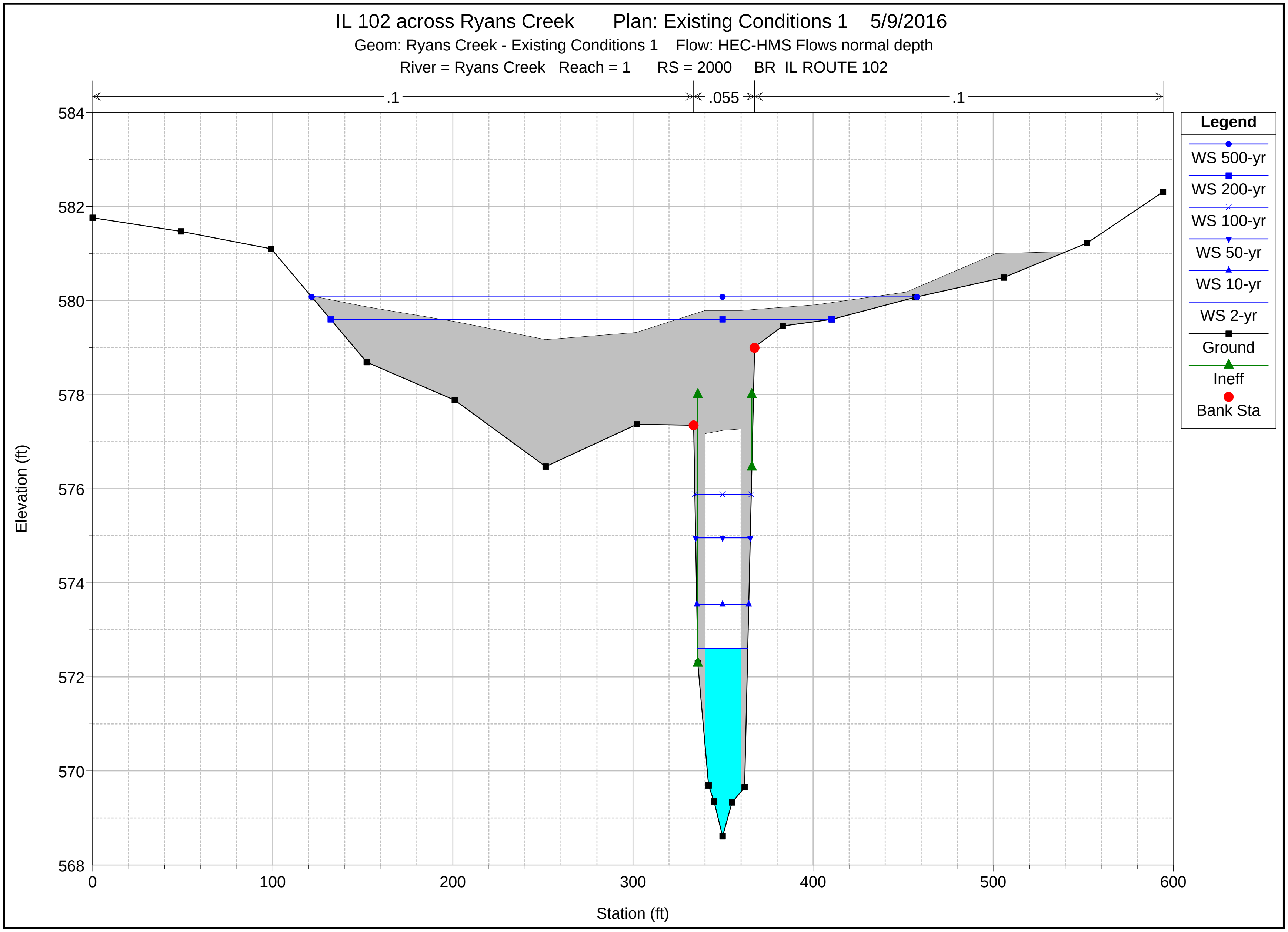


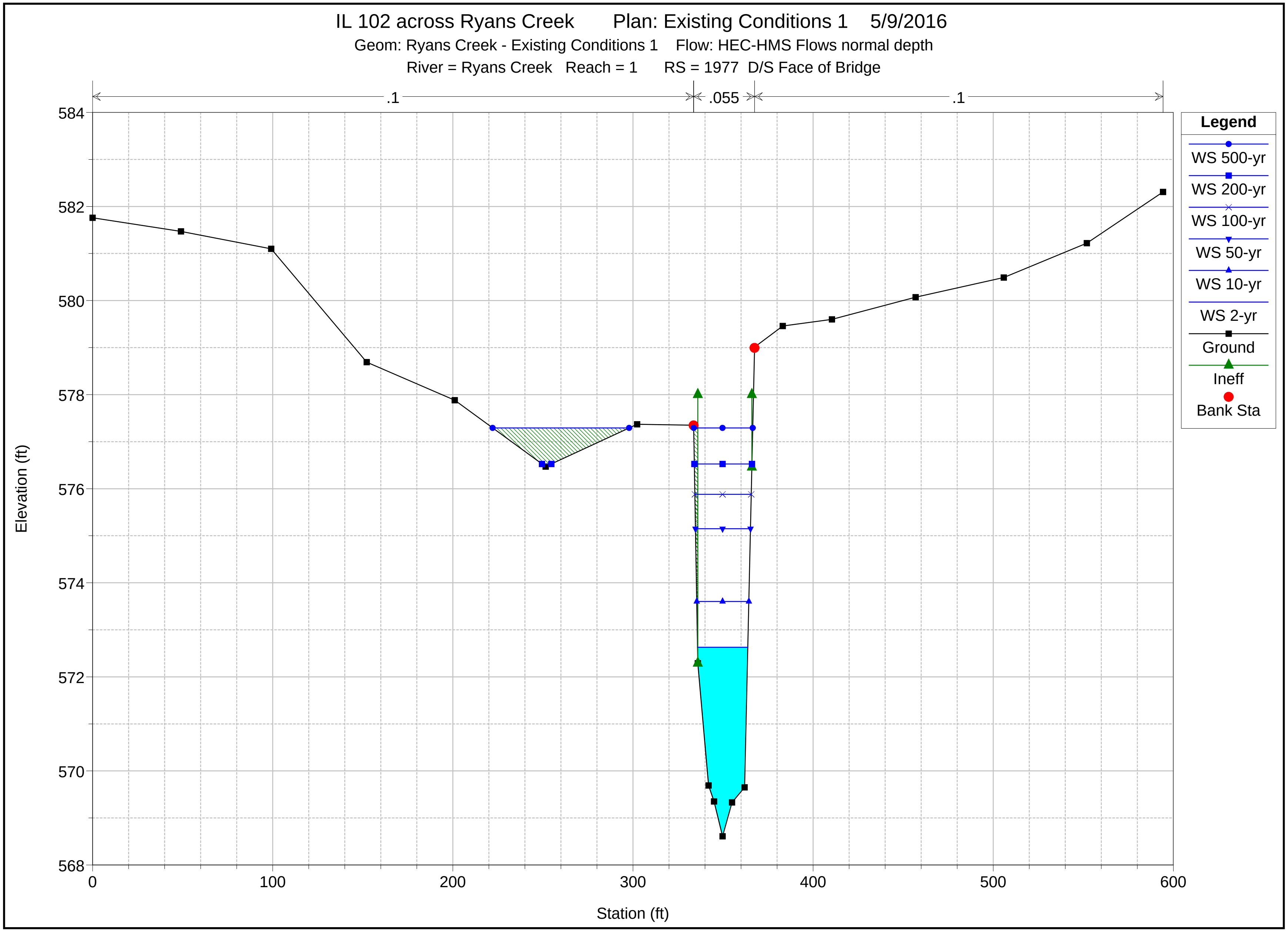
IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2275 Interpolated XSEC
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)

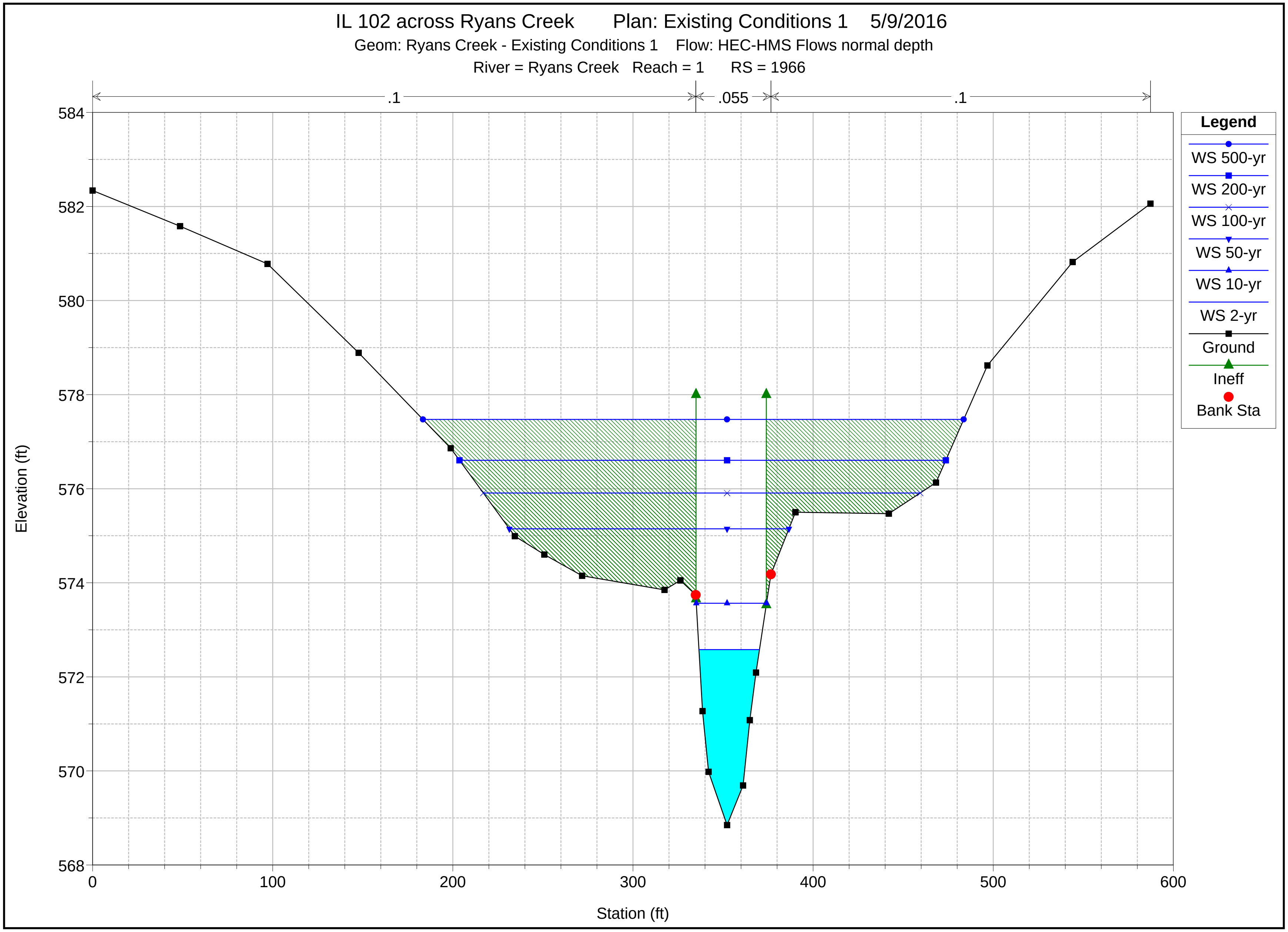

IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2040
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)


IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2026 U/S Face of Bridge
.04
.04
.04
.04
.04
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600
Station (ft)

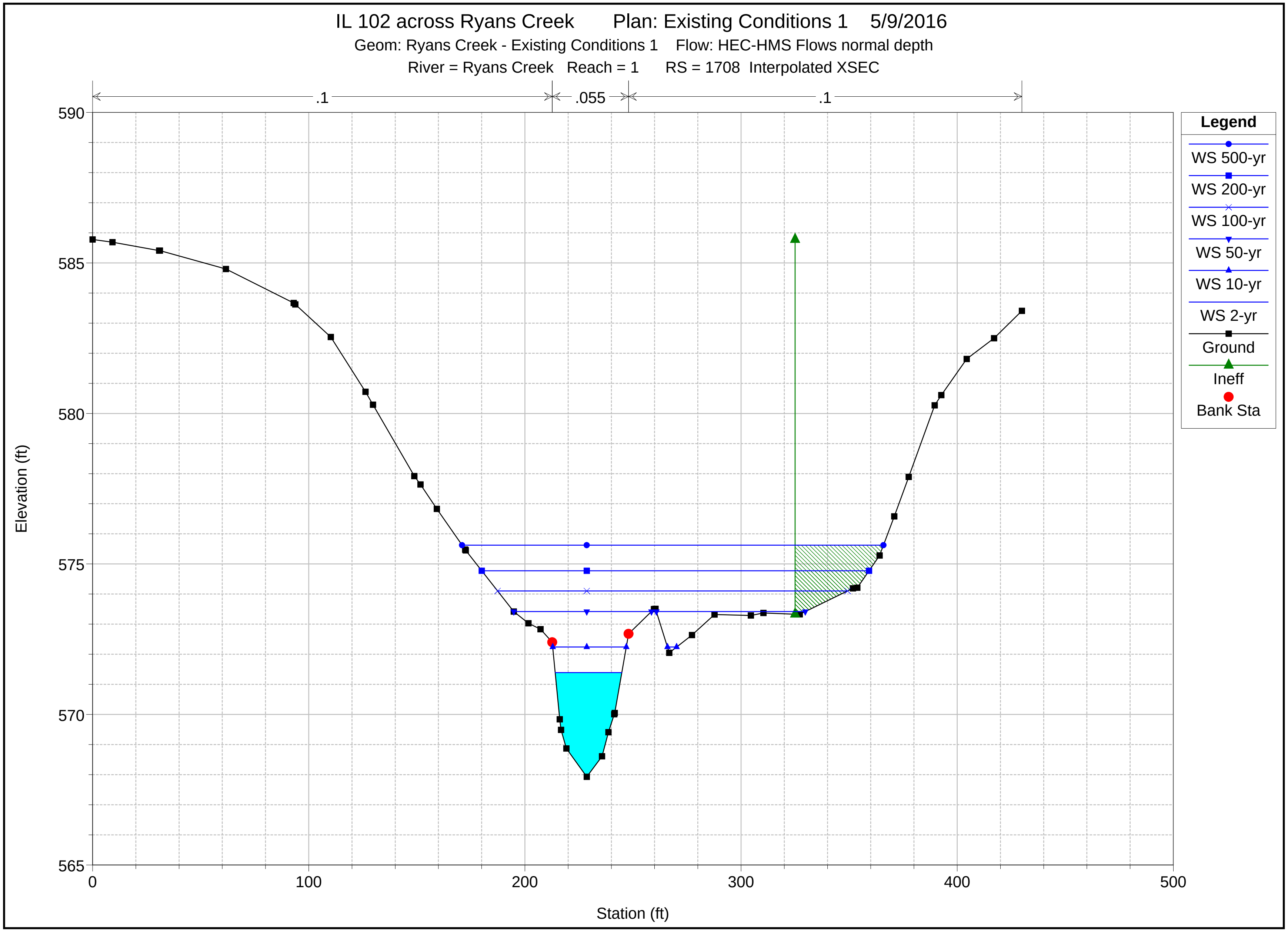

IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 BR IL ROUTE 102
.04
.04
.04
.04
.04
584
582
580
578
576
574
572
570
568
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta


IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 BR IL ROUTE 102
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600


IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1977 D/S Face of Bridge
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1966
.1
.055
.1
584
582
580
578
576
574
572
570
568
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1708 Interpolated XSEC
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
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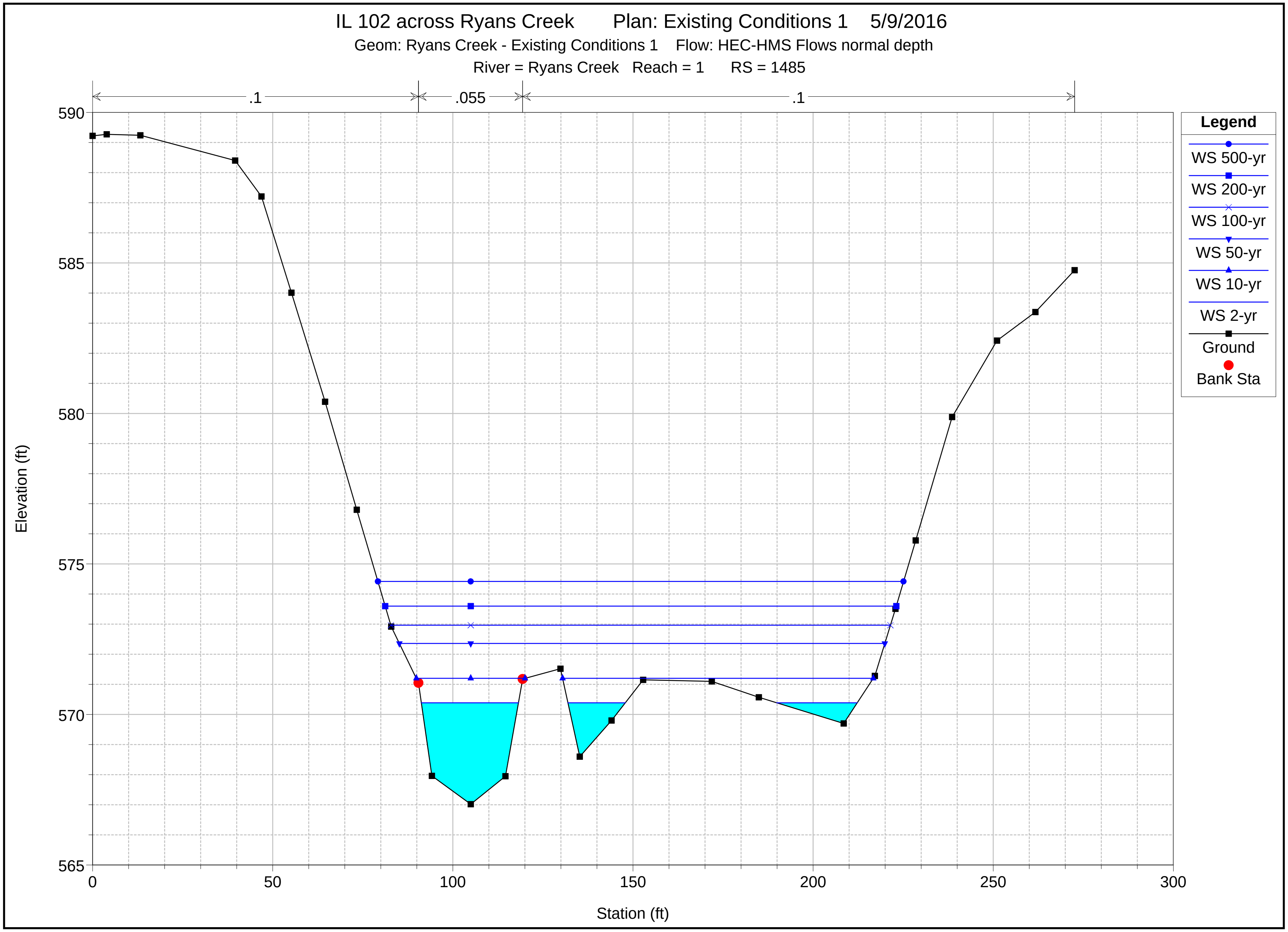
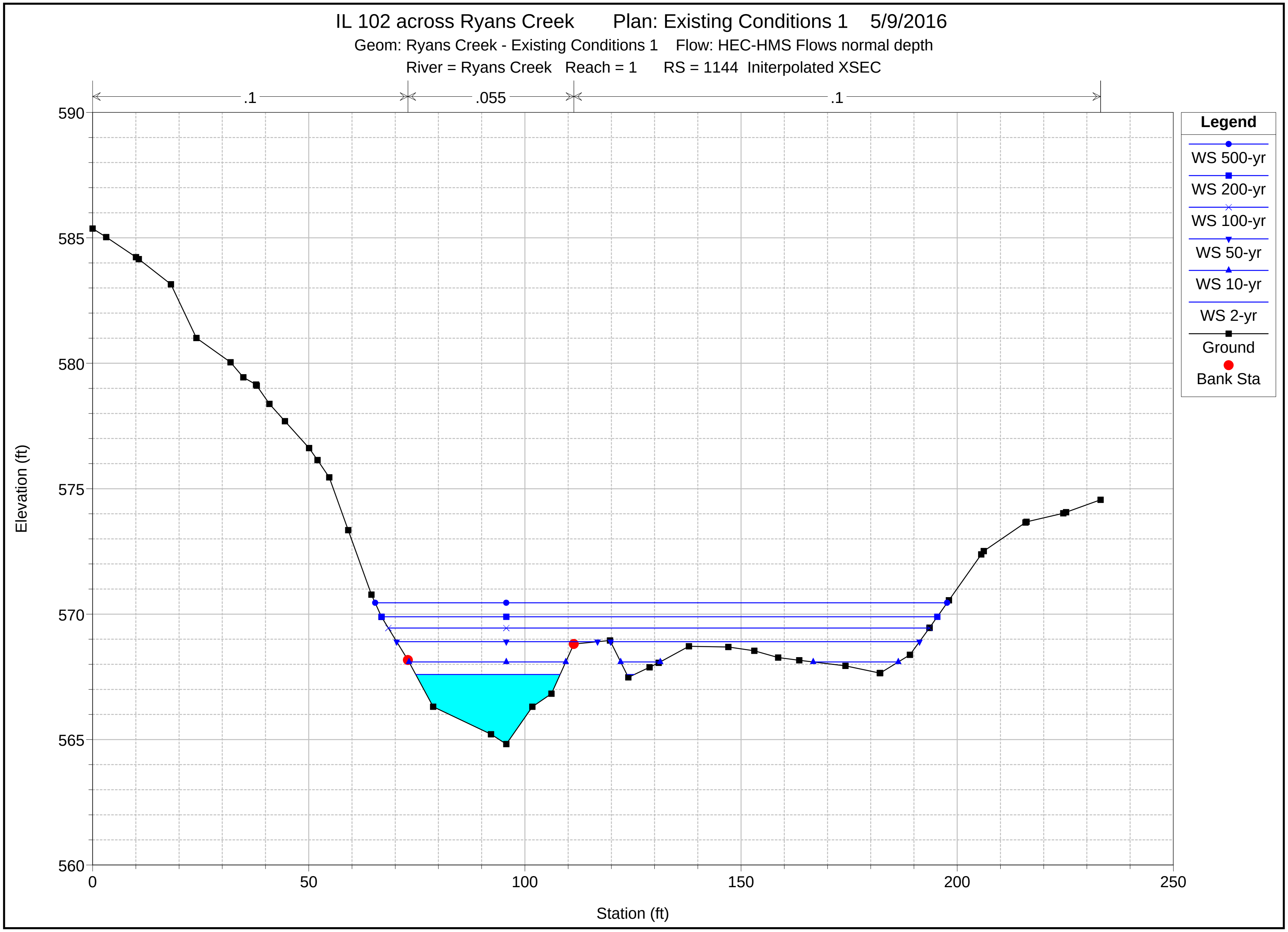
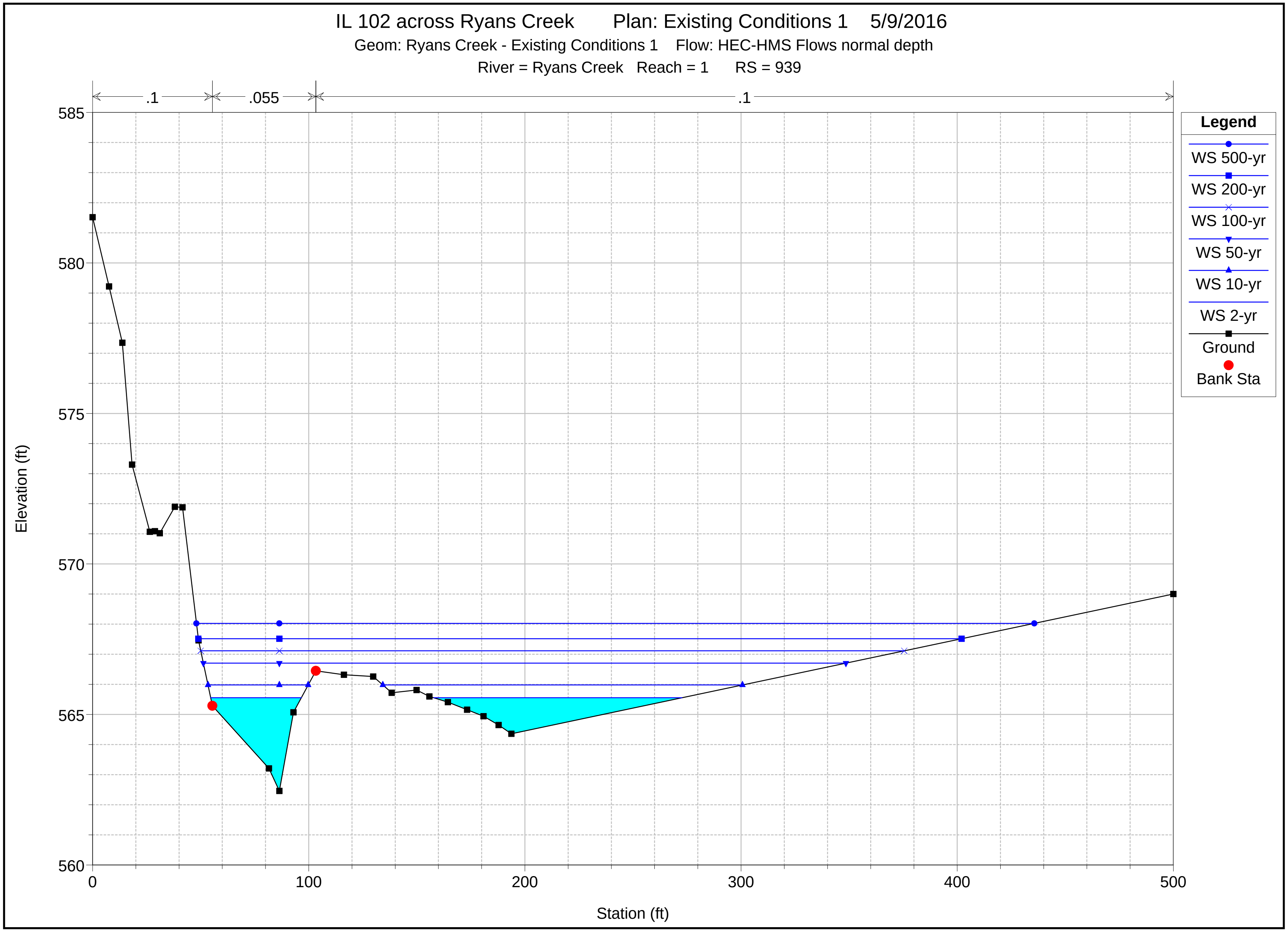
585
580
575
570
565
0
100
200
300
400
500
Station (ft)



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1485
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
590
585
580
575
570
565
0
50
100
150
200
250
300
Station (ft)


IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1144 Initerpolated XSEC
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
590
585
580
575
570
565
560
0
50
100
150
200
250
Station (ft)



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 939
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
585
580
575
570
565
560
0
100
200
300
400
500
Station (ft)

```
                    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
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PROJECT DATA
Project Title: IL 102 across Ryans Creek
Project File : IL102acrossRaynsCK.prj
Run Date and Time: 5/9/2016 2:16:49 PM

Project in English units

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PLAN DATA

Plan Title: Existing Conditions 1
Plan File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.p04

Geometry Title: Ryans Creek - Existing Conditions 1
Geometry File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.g04

Flow Title   : HEC-HMS Flows normal depth
Flow File   : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.f03

```
Plan Summary Information:
Number of:  Cross Sections =   12    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    1    Lateral Structures =    0

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

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

****

```
FLOW DATA

Flow Title: HEC-HMS Flows normal depth
Flow File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.f03

Flow Data (cfs)
*******************************************************************************************************************************
******
* River           Reach           RS      *            2-yr           10-yr           50-yr          100-yr          200-yr
500-yr *
* Ryans Creek     1               3022    *             242             408             866            1250            1700
2375 *
*******************************************************************************************************************************
******

Boundary Conditions
*******************************************************************************************************
* River           Reach           Profile          *           Upstream                 Downstream    *
*******************************************************************************************************
* Ryans Creek     1               2-yr             *                                Normal S = 0.0079 *
* Ryans Creek     1               10-yr            *                                Normal S = 0.0079 *
* Ryans Creek     1               50-yr            *                                Normal S = 0.0079 *
* Ryans Creek     1               100-yr           *                                Normal S = 0.0079 *
* Ryans Creek     1               200-yr           *                                Normal S = 0.0079 *
* Ryans Creek     1               500-yr           *                                Normal S = 0.0079 *
*******************************************************************************************************

********************************************************************************

GEOMETRY DATA

Geometry Title: Ryans Creek - Existing Conditions 1
Geometry File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.g04

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                 RS: 3022

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  598.01  49.856  590.95 149.759  586.26 249.858  582.74 349.944  579.85
 362.947  575.64 376.267  575.27 401.201  574.75 426.854  575.11   456.8  575.25
 456.803  575.25 461.715  573.71   465.9  570.67 475.225  569.57 483.085  569.16
 487.823  573.78  492.95 575.978 492.954  575.98   504.8  575.92 529.371  575.58
 540.193  575.59 558.176  577.42 574.296  579.35  587.41  581.84 597.565   584.3
 607.162  586.87 618.717  590.82 626.175  593.52 632.004  595.47

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
********************************************************************************
       0     .06 349.944     .04   456.8     .04  492.95     .04 574.296      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         456.8  492.95            242.5     250   248.3             .1       .3
Ineffective Flow     num=       2
```

Sta L	Sta R	Elev	Permanent
0	456.8	575.25	F
492.95	632.004	575.98	F

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2772

INPUT
Description: Interpolated XSEC
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	593.38	49.52	589.27	50.35	589.25	148.75	585.61	150.94	585.54
248.18	582.53	251.3	582.44	280.33	581.64	280.66	579.63	302.85	578.72
325.06	577.59	347.59	577.03	352.08	576.25	360.51	574.77	373.74	574.42
375.88	574.37	398.5	574.16	400.74	574.18	423.99	574.58	426.41	574.62
453.73	577.14	457.2	575.43	460.16	573.12	461.78	572.54	466.74	571.13
472.3	569.81	479.87	571.84	480.96	572.22	487.28	573.46	490.34	575.54
498.86	576.03	502.42	576.18	509.68	576.46	517.82	577.04	527.46	577.88
531.83	578.29	538.49	579.05	541.42	579.53	551.42	581.32	556.82	582.24
561.31	583.04	567.2	584.03	573.26	585.09	586.62	587.88	588.59	588.34
596.97	590.4	600.95	591.43	606.76	592.87	611.6	594.26	618.53	596.38
621.09	597.19	626.14	598.71	632.08	600.41				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	280.66	.04	453.73	.04	490.34	.04	538.49	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
453.73	490.34	279.8	262.7	257.1	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2508

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	588.75	50.007	587.58	149.921	584.9	249.602	582.24	278.434	581.48
278.765	577.46	300.802	576.28	322.862	574.68	349.697	574.12	373.339	573.51
398.031	573.58	423.527	574.11	450.66	579.02	455.366	574.69	461.507	570.47
472.517	570.48	483.288	571.66	487.73	575.1	496.415	576.13	507.437	577.09
515.726	578.37	530.002	580.99	539.779	583.17	549.967	585.75	560.04	588.13
566.042	589.43	587.844	594.38	600.434	597.51	611.284	600.02	620.958	602.66
632.149	605.36								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	278.765	.04	450.66	.04	487.73	.04	530.002	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
450.66	487.73	167.7	233.9	253.1	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2275

INPUT
Description: Interpolated XSEC
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	585.33	44.92	584.32	56.56	584.04	113.74	582.7	134.67	582.11
169.27	581.15	224.22	579.7	226.24	579.65	250.12	579.14	250.42	577.12
270.21	576.4	282.03	575.85	290.03	575.43	314.13	574.85	335.37	574.29
338.37	574.26	357.55	574.02	380.46	573.97	394.8	575.22	404.83	576.16
405.12	576.07	405.92	575.61	409.11	573.61	410.44	572.64	412.09	572.08
416.69	570.85	421.56	569.61	425.9	570.51	429.22	571.08	430.95	571.21
440.13	572.44	443.92	574.43	454.91	575.24	468.87	576.1	479.36	577.02
485.13	577.59	497.43	578.84	507.97	580.07	509.81	580.36	522.7	582.53
535.46	584.59	543.05	585.76	565.98	589.39	570.65	589.93	586.59	591.9
600.32	593.51	605.17	594.16	612.57	595.22	626.74	597.06		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	250.12	.04	404.83	.04	443.92	.04	507.97	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
404.83	443.92	165.4	235.8	269.5	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2040

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	581.9	50.161	580.84	100.862	579.88	150.103	578.42	200.63	577.11
250.103	576.37	300.06	575	350.109	573.44	359	573.306	359.389	573.3
360.473	572.86	364.785	570.76	366.588	569.61	375.036	569.07	381.617	568.76
385.202	570.54	387.953	571.69	400.108	573.76	400.11	573.76	449.98	575.98
477.612	577.3	547.81	585.23	595.223	587.26	621.324	588.76		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100.862	.04	359	.04	400.11	.04	477.612	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
359	400.11	7	10.5	7	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	345	579.3	F
405	621.324	579.3	F

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2026

INPUT
Description: U/S Face of Bridge
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	580.07	50.169	579.63	99.049	579.07	150.23	578.73	200.253	578.69
251.513	578.15	301.206	578.22	319.64	579.02	319.64	579.018	321.377	571.49
324.132	570.34	326	569.93	329	569.12	333	568.6	337	568.58
341	569.65	345.274	570.41	353.4	578.935	353.405	578.94	402.381	579.48
434.757	579.93	441.297	579.77	461.679	580.1	482.935	579.56	503.38	580.44
549.01	581.24	589.84	581.85						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	150.23	.04	319.64	.04	353.4	.04	402.381	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
319.64	353.4	47.7	46	44	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	320	579.3	F
350	589.84	579.3	F

BRIDGE

RIVER: Ryans Creek
REACH: 1 RS: 2000

INPUT
Description: IL ROUTE 102
Distance from Upstream XS = 1
Deck/Roadway Width = 44
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 27

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-165.85	584.46		-115.85	583.48		-65.85	582.48	
-15.85	581.5		34.15	580.8		84.15	580.25	
134.15	579.87		184.15	579.55		234.15	579.17	
284.15	579.32		324	579.79	0	324	579.79	577.2
330	579.79	577.27	344	579.79	577.35	344	579.79	0
384.15	579.91		434.15	580.18		484.15	581	
534.15	581.05		584.15	581.88		609.15	582.66	
634.15	583.1		684.15	583.54		734.15	584.26	
784.15	584.89		834.15	585.35		884.15	585.69	

Upstream Bridge Cross Section Data
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	580.07	50.169	579.63	99.049	579.07	150.23	578.73	200.253	578.69
251.513	578.15	301.206	578.22	319.64	579.02	319.64	579.018	321.377	571.49
324.132	570.34	326	569.93	329	569.12	333	568.6	337	568.58

```
     341  569.65 345.274  570.41   353.4 578.935 353.405  578.94 402.381  579.48
 434.757  579.93 441.297  579.77 461.679   580.1 482.935  579.56  503.38  580.44
  549.01  581.24  589.84  581.85

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
********************************************************************************
       0     .04  150.23     .04  319.64     .04   353.4     .04 402.381     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
        319.64   353.4            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     320   579.3       F
     350  589.84   579.3       F

Downstream  Deck/Roadway Coordinates
    num=      27
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
 -148.33  584.46          -98.33  583.48          -48.33  582.48
    1.67   581.5           51.67   580.8          101.67  580.25
  151.67  579.87          201.67  579.55          251.67  579.17
  301.67  579.32             340  579.79       0     340  579.79  577.17
     350  579.79  577.24     360  579.79  577.27     360  579.79       0
  401.67  579.91          451.67  580.18          501.67     581
  551.67  581.05          601.67  581.88          626.67  582.66
  651.67   583.1          701.67  583.54          751.67  584.26
  801.67  584.89          851.67  585.35          901.67  585.69

Downstream Bridge Cross Section Data
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.76  49.102  581.47  99.149   581.1 152.194  578.69 201.052  577.88
 251.501  576.47 302.302  577.37 333.707  577.35  333.71 577.344 335.997  572.29
     342  569.69     345  569.35 349.704  568.61     355  569.33     362  569.65
  367.49 578.993 367.493  579.01 383.139  579.46 410.477   579.6 456.934  580.07
 505.876  580.49 552.003  581.22 594.245  582.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1  333.71    .055  367.49      .1

Bank Sta: Left   Right    Coeff Contr.   Expan.
        333.71  367.49            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     336     578       F
     366 594.245     578       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   =      .6
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: Ryans Creek
REACH: 1                 RS: 1977

INPUT
Description: D/S Face of Bridge
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.76  49.102  581.47  99.149   581.1 152.194  578.69 201.052  577.88
 251.501  576.47 302.302  577.37 333.707  577.35  333.71 577.344 335.997  572.29
     342  569.69     345  569.35 349.704  568.61     355  569.33     362  569.65
  367.49 578.993 367.493  579.01 383.139  579.46 410.477   579.6 456.934  580.07
 505.876  580.49 552.003  581.22 594.245  582.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1  333.71    .055  367.49      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        333.71  367.49               11    14.5      14             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     336     578       F
     366 594.245     578       F

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                 RS: 1966

INPUT
Description:
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  582.34  48.536  581.58  97.087  580.78 147.691  578.89  198.83  576.86
 234.409  574.99 250.806   574.6 271.804  574.15  317.52  573.85  326.34  574.05
```

```
 326.343  574.05  334.84 573.741 334.869  573.74 338.634  571.27 341.982  569.98
 352.252  568.85 361.121  569.69  364.88  571.08 368.264  572.09 376.587  574.18
  376.59  574.18  390.17   575.5 390.174   575.5 442.069  575.47 468.234  576.13
 496.783  578.62 544.104  580.82 587.298  582.06

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1  334.84    .055  376.59      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        334.84  376.59              289     258     182              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     335     578       F
     374 587.298     578       F

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                  RS: 1708

INPUT
Description: Interpolated XSEC
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  585.78    9.22  585.69   30.82  585.41   31.16  585.41   61.66   584.8
   93.04  583.67    93.8  583.62  110.22  582.54  126.28  580.72  129.72  580.29
  148.87  577.92  151.68  577.64  159.29  576.83  172.35  575.48  172.62  575.45
  194.87  573.42  201.66  573.03  207.26  572.83  212.65   572.4  212.68  572.38
  216.13  569.84  216.74  569.49   219.2  568.87  228.62  567.93  235.67  568.61
  238.67  569.41  241.36  570.01  241.57  570.05  247.98  572.68  259.71   573.5
  260.44  573.51  266.79  572.05  277.29  572.64  287.72  573.32  304.53  573.29
  310.34  573.37  325.85  573.33  327.13  573.33  351.78  574.19  353.79  574.21
  364.08  575.28  370.87  576.58  377.55  577.89  389.56  580.27  392.65  580.61
  404.36  581.81  417.03   582.5  429.95  583.41

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1  212.65    .055  247.98      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        212.65  247.98              222     202     202              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     325  429.95               F

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                  RS: 1485

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
```

```
       0  589.22   3.922  589.27  13.258  589.24   39.58   588.4  46.889  587.21
  55.187  584.01  64.531  580.39  73.323   576.8  82.904  572.92  90.468  571.05
   90.47 571.048  94.183  567.96 104.978  567.02 114.613  567.95  119.38 571.179
 119.381  571.18 129.867  571.52 135.214   568.6 144.055   569.8 152.838  571.15
 171.886   571.1 184.941  570.57 208.475   569.7 217.139  571.28 222.854  573.51
 228.474  575.78  238.59  579.88 251.054  582.42 261.718  583.37 272.598  584.76

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1   90.47    .055  119.38      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         90.47  119.38            230.3     335   197.7             .1       .3

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                  RS: 1144

INPUT
Description: Initerpolated XSEC
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  585.37    3.16  585.03   10.02  584.23   10.69  584.15   18.13  583.15
      24  581.01   31.91  580.04   34.88  579.44   37.81  579.15   37.97  579.11
    40.9  578.38    44.5  577.69   50.07  576.62   52.03  576.14   54.74  575.45
   59.12  573.35    64.5  570.78   66.84  569.89   72.94  568.17   78.77  566.31
   92.15  565.21    95.7  564.82  101.74  566.31  106.15  566.83  111.33  568.81
  119.67  568.95  123.92  567.48  128.84  567.88  130.95  568.06  137.94  568.72
  147.06  568.69  153.08  568.54  158.57  568.27  163.47  568.16  174.14  567.94
  182.11  567.65  182.18  567.65  189.07  568.38  193.58  569.45  193.62  569.46
  198.09  570.55  205.57  572.38  206.13  572.51  215.79  573.65  216.04  573.68
  224.53  574.02  225.19  574.06  233.18  574.56

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1   72.94    .055  111.33      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         72.94  111.33            203.7     205   203.7             .1       .3

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                  RS: 939

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.527.609546  579.2213.77442  577.3518.23405   573.326.50088  571.07
28.84959  571.0931.07133  571.0238.03796   571.941.58479  571.8849.00148  567.46
55.41613  565.2981.58443  563.2186.42336  562.4692.93948  565.07103.2744  566.45
116.2802  566.32 129.809  566.26138.3556  565.72149.9176  565.81155.8341   565.6
164.3529  565.41173.2559  565.16180.8474  564.94187.8239  564.65193.7582  564.36
```

500 569

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	55.41613	.055	103.2744	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
55.41613	103.2744	0	0	0	.1	.3

****

SUMMARY OF MANNING'S N VALUES

River:Ryans Creek

Reach	River Sta.	n1	n2	n3	n4	n5
1	3022	.06	.04	.04	.04	.1
1	2772	.06	.04	.04	.04	.1
1	2508	.06	.04	.04	.04	.1
1	2275	.06	.04	.04	.04	.1
1	2040	.06	.04	.04	.04	.1
1	2026	.04	.04	.04	.04	.04
1	2000	Bridge				
1	1977	.1	.055	.1		
1	1966	.1	.055	.1		
1	1708	.1	.055	.1		
1	1485	.1	.055	.1		
1	1144	.1	.055	.1		
1	939	.1	.055	.1		

****

SUMMARY OF REACH LENGTHS

River: Ryans Creek

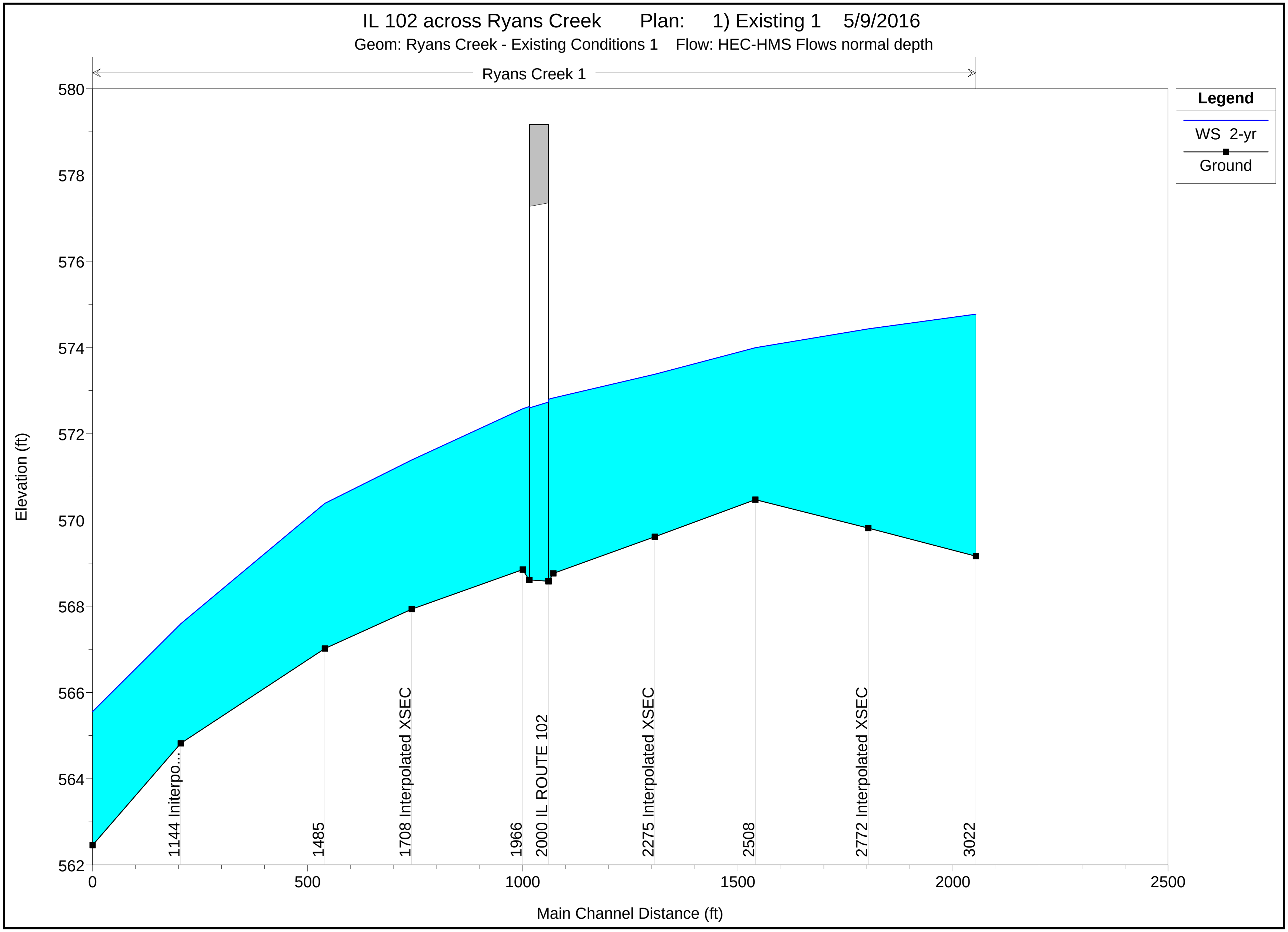
Reach	River Sta.	Left	Channel	Right
1	3022	242.5	250	248.3
1	2772	279.8	262.7	257.1
1	2508	167.7	233.9	253.1
1	2275	165.4	235.8	269.5
1	2040	7	10.5	7
1	2026	47.7	46	44
1	2000	Bridge		
1	1977	11	14.5	14
1	1966	289	258	182
1	1708	222	202	202
1	1485	230.3	335	197.7
1	1144	203.7	205	203.7
1	939	0	0	0

****

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Ryans Creek

Reach	River Sta.	Contr.	Expan.
1	3022	.1	.3
1	2772	.1	.3
1	2508	.1	.3
1	2275	.1	.3
1	2040	.3	.5
1	2026	.3	.5
1	2000	Bridge	
1	1977	.3	.5
1	1966	.3	.5
1	1708	.1	.3
1	1485	.1	.3
1	1144	.1	.3
1	939	.1	.3



IL 102 across Ryans Creek Plan: 1) Existing 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 2-yr

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	3022	2-yr	242.00	569.16	574.77	571.52	574.84	0.000654	2.10	115.29	34.50	0.19
1	2772	2-yr	242.00	569.81	574.43		574.57	0.001957	3.02	85.55	72.29	0.33
1	2508	2-yr	242.00	570.47	573.99		574.11	0.001551	2.76	102.49	93.24	0.29
1	2275	2-yr	242.00	569.61	573.38		573.58	0.003555	3.55	68.17	32.49	0.43
1	2040	2-yr	242.00	568.76	572.83	570.99	572.96	0.001895	2.87	84.35	34.11	0.32
1	2026	2-yr	242.00	568.58	572.80	570.92	572.94	0.001580	2.94	82.17	26.48	0.29
1	2000		Bridge									
1	1977	2-yr	242.00	568.61	572.63	570.88	572.77	0.003369	3.01	80.28	27.91	0.31
1	1966	2-yr	242.00	568.85	572.58	571.03	572.72	0.003833	2.96	81.79	33.57	0.33
1	1708	2-yr	242.00	567.93	571.39		571.57	0.005138	3.34	72.48	30.82	0.38
1	1485	2-yr	242.00	567.02	570.39		570.55	0.004910	3.34	89.32	65.19	0.37
1	1144	2-yr	242.00	564.82	567.59		567.91	0.015086	4.50	53.84	35.09	0.63
1	939	2-yr	242.00	562.46	565.56	565.05	565.67	0.007901	3.05	125.39	156.77	0.45

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 2-yr

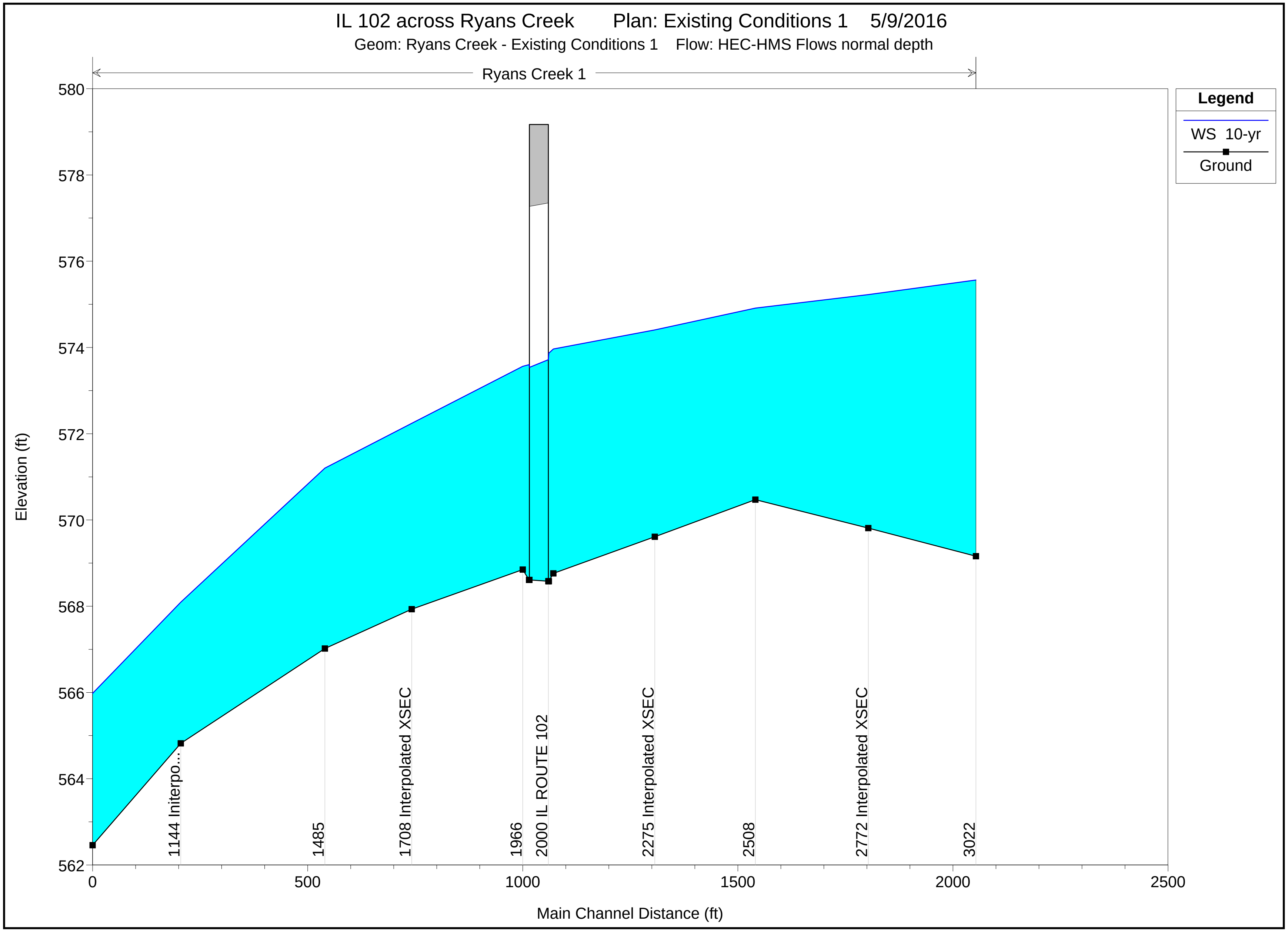
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	2-yr	574.84	574.77	0.07	0.26	0.01		242.00		34.50
1	2772	2-yr	574.57	574.43	0.14	0.46	0.01	2.90	239.10		72.29
1	2508	2-yr	574.11	573.99	0.11	0.52	0.01	13.25	228.75		93.24
1	2275	2-yr	573.58	573.38	0.20	0.60	0.02		242.00		32.49
1	2040	2-yr	572.96	572.83	0.13	0.02	0.00		242.00		34.11
1	2026	2-yr	572.94	572.80	0.13	0.00	0.02		242.00		26.48
1	2000		Bridge								
1	1977	2-yr	572.77	572.63	0.14	0.05	0.00		242.00		27.91
1	1966	2-yr	572.72	572.58	0.14	1.14	0.01		242.00		33.57
1	1708	2-yr	571.57	571.39	0.17	1.01	0.00		242.00		30.82
1	1485	2-yr	570.55	570.39	0.16	2.63	0.02		224.21	17.79	65.19
1	1144	2-yr	567.91	567.59	0.31	2.18	0.06		241.97	0.03	35.09
1	939	2-yr	565.67	565.56	0.11			0.03	182.60	59.37	156.77

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 2-yr

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	2040	2-yr	572.96	572.83	570.99	0.02	0.00	34.11		242.00		2.87
1	2026	2-yr	572.94	572.80	570.92	0.00	0.02	26.48		242.00		2.94
1	2000 BR U	2-yr	572.92	572.73	570.90	0.11	0.01	20.00		242.00		3.47
1	2000 BR D	2-yr	572.81	572.60	570.94	0.00	0.03	20.00		242.00		3.66
1	1977	2-yr	572.77	572.63	570.88	0.05	0.00	27.91		242.00		3.01
1	1966	2-yr	572.72	572.58	571.03	1.14	0.01	33.57		242.00		2.96

Errors Warnings and Notes for Plan : Existing 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2772 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2040 Profile: 2-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 2-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 2-yr
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the
	energy inside of the bridge deck. This is not physically possible. Please review your bridge data and
	results for reasonableness.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 2-yr Upstream
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: Ryans Creek Reach: 1 RS: 2000 Profile: 2-yr Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 2-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1966 Profile: 2-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 939 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 10-yr
Ground
Elevation (ft)
580
578
576
574
572
570
568
566
564
562
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 10-yr

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	3022	10-yr	408.00	569.16	575.56	572.23	575.67	0.000911	2.67	185.06	126.26	0.23
1	2772	10-yr	408.00	569.81	575.22		575.36	0.001708	3.20	162.03	107.46	0.31
1	2508	10-yr	408.00	570.47	574.91		574.99	0.001038	2.59	214.38	140.69	0.25
1	2275	10-yr	408.00	569.61	574.41		574.62	0.002748	3.81	119.53	90.50	0.40
1	2040	10-yr	408.00	568.76	573.96	571.69	574.11	0.001650	3.13	135.94	71.37	0.31
1	2026	10-yr	408.00	568.58	573.87	571.58	574.08	0.001843	3.67	111.02	27.74	0.32
1	2000		Bridge									
1	1977	10-yr	408.00	568.61	573.60	571.53	573.83	0.003792	3.79	107.58	28.92	0.34
1	1966	10-yr	408.00	568.85	573.56	571.65	573.75	0.003987	3.47	117.50	39.00	0.35
1	1708	10-yr	408.00	567.93	572.24		572.50	0.005764	4.08	100.44	38.29	0.42
1	1485	10-yr	408.00	567.02	571.20		571.40	0.004977	3.87	157.73	116.41	0.39
1	1144	10-yr	408.00	564.82	568.09	567.66	568.58	0.018348	5.66	77.96	65.09	0.71
1	939	10-yr	408.00	562.46	565.98	565.43	566.11	0.007910	3.46	204.15	212.75	0.46

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 10-yr

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	3022	10-yr	575.67	575.56	0.10	0.30	0.00	29.29	378.71		126.26
1	2772	10-yr	575.36	575.22	0.13	0.35	0.02	74.73	333.27		107.46
1	2508	10-yr	574.99	574.91	0.08	0.36	0.01	118.98	289.02		140.69
1	2275	10-yr	574.62	574.41	0.22	0.49	0.02	14.10	393.90		90.50
1	2040	10-yr	574.11	573.96	0.15	0.02	0.02	7.50	400.35	0.15	71.37
1	2026	10-yr	574.08	573.87	0.21	0.00	0.03		408.00		27.74
1	2000		Bridge								
1	1977	10-yr	573.83	573.60	0.22	0.06	0.02		408.00		28.92
1	1966	10-yr	573.75	573.56	0.19	1.23	0.02		408.00		39.00
1	1708	10-yr	572.50	572.24	0.26	1.08	0.02		407.90	0.10	38.29
1	1485	10-yr	571.40	571.20	0.20	2.79	0.03	0.01	348.04	59.95	116.41
1	1144	10-yr	568.58	568.09	0.49	2.36	0.11		402.73	5.27	65.09
1	939	10-yr	566.11	565.98	0.13			0.44	270.24	137.32	212.75

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 10-yr

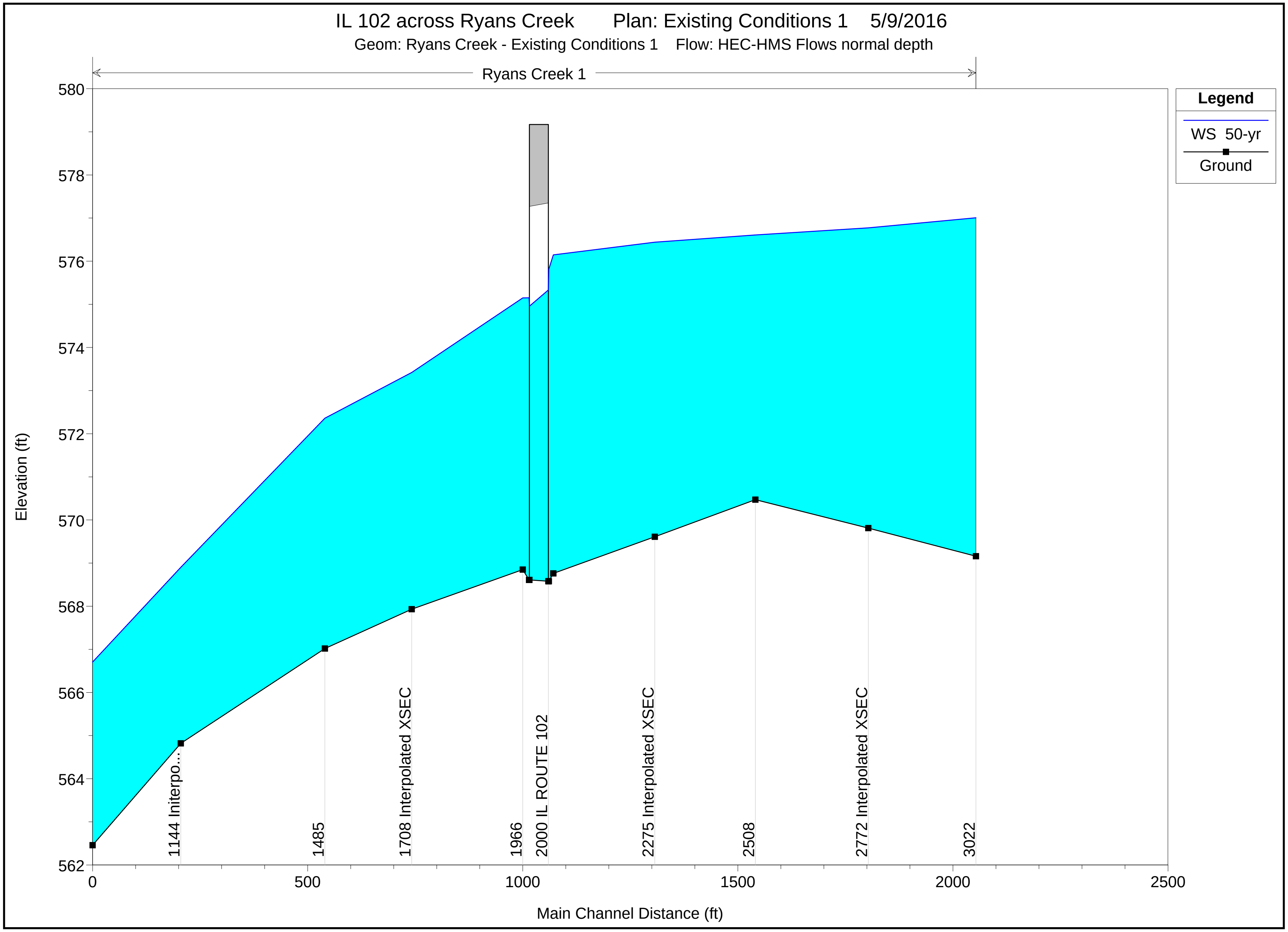
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	2040	10-yr	574.11	573.96	571.69	0.02	0.02	71.37	7.50	400.35	0.15	3.13
1	2026	10-yr	574.08	573.87	571.58	0.00	0.03	27.74		408.00		3.67
1	2000 BR U	10-yr	574.04	573.72	571.59	0.13	0.01	20.00		408.00		4.56
1	2000 BR D	10-yr	573.90	573.54	571.63	0.00	0.07	20.00		408.00		4.80
1	1977	10-yr	573.83	573.60	571.53	0.06	0.02	28.92		408.00		3.79
1	1966	10-yr	573.75	573.56	571.65	1.23	0.02	39.00		408.00		3.47

Errors Warnings and Notes for Plan : Existing 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 10-yr
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: Ryans Creek Reach: 1 RS: 2275 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 10-yr
Warning:	For the final momentum answer at the bridge, the upstream energy was computed lower than the
	energy inside of the bridge deck. This is not physically possible. Please review your bridge data and
	results for reasonableness.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 10-yr Upstream
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: Ryans Creek Reach: 1 RS: 2000 Profile: 10-yr Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1966 Profile: 10-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 10-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 10-yr
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.

Errors Warnings and Notes for Plan : Existing 1 (Continued)

Location:	River: Ryans Creek Reach: 1 RS: 939 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.


IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 50-yr
Ground
Elevation (ft)
580
578
576
574
572
570
568
566
564
562
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 50-yr

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	3022	50-yr	866.00	569.16	577.01	573.71	577.09	0.000664	2.75	443.93	195.39	0.21
1	2772	50-yr	866.00	569.81	576.77		576.88	0.001071	3.11	366.10	160.33	0.26
1	2508	50-yr	866.00	570.47	576.61		576.67	0.000548	2.36	492.67	191.27	0.19
1	2275	50-yr	866.00	569.61	576.44		576.53	0.000812	2.83	431.17	203.69	0.23
1	2040	50-yr	866.00	568.76	576.15	573.13	576.32	0.001000	3.47	267.00	195.29	0.27
1	2026	50-yr	866.00	568.58	575.82	572.93	576.23	0.002488	5.18	167.26	30.05	0.38
1	2000		Bridge									
1	1977	50-yr	866.00	568.61	575.15	572.85	575.65	0.005799	5.69	152.12	30.53	0.44
1	1966	50-yr	866.00	568.85	575.15	572.93	575.51	0.004417	4.83	179.28	155.14	0.40
1	1708	50-yr	866.00	567.93	573.42	571.98	573.95	0.008132	5.94	177.17	132.58	0.52
1	1485	50-yr	866.00	567.02	572.36		572.61	0.004928	4.75	307.67	134.73	0.41
1	1144	50-yr	866.00	564.82	568.90	568.90	569.73	0.022817	7.68	151.55	117.92	0.83
1	939	50-yr	866.00	562.46	566.70	566.05	566.87	0.007907	4.19	390.77	297.29	0.48

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 50-yr

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	3022	50-yr	577.09	577.01	0.08	0.21	0.00	261.02	534.07	70.90	195.39
1	2772	50-yr	576.88	576.77	0.11	0.20	0.02	364.73	488.14	13.13	160.33
1	2508	50-yr	576.67	576.61	0.06	0.13	0.00	462.77	396.43	6.80	191.27
1	2275	50-yr	576.53	576.44	0.09	0.20	0.01	325.91	509.17	30.91	203.69
1	2040	50-yr	576.32	576.15	0.17	0.02	0.07	87.24	756.09	22.66	195.29
1	2026	50-yr	576.23	575.82	0.42	0.00	0.11		866.00		30.05
1	2000		Bridge								
1	1977	50-yr	575.65	575.15	0.50	0.07	0.07		866.00		30.53
1	1966	50-yr	575.51	575.15	0.36	1.51	0.05		866.00		155.14
1	1708	50-yr	573.95	573.42	0.53	1.26	0.08	6.83	840.47	18.70	132.58
1	1485	50-yr	572.61	572.36	0.25	2.81	0.06	2.67	586.88	276.45	134.73
1	1144	50-yr	569.73	568.90	0.83	2.56	0.20	1.06	780.30	84.63	117.92
1	939	50-yr	566.87	566.70	0.16			2.99	468.69	394.31	297.29

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 50-yr

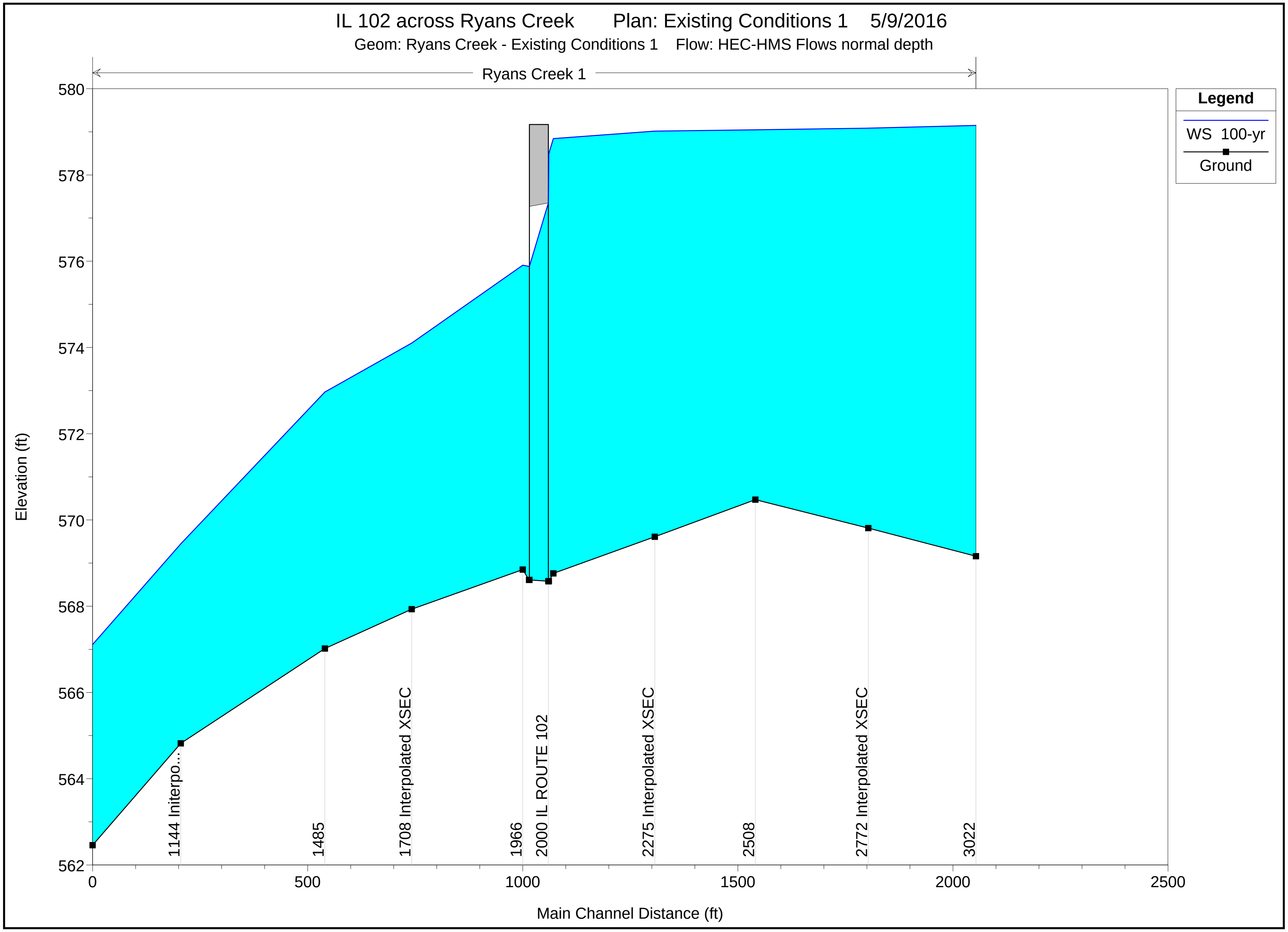
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	2040	50-yr	576.32	576.15	573.13	0.02	0.07	195.29	87.24	756.09	22.66	3.47
1	2026	50-yr	576.23	575.82	572.93	0.00	0.11	30.05		866.00		5.18
1	2000 BR U	50-yr	576.12	575.33	573.13	0.22	0.04	20.00		866.00		7.11
1	2000 BR D	50-yr	575.86	574.96	573.16	0.01	0.20	20.00		866.00		7.64
1	1977	50-yr	575.65	575.15	572.85	0.07	0.07	30.53		866.00		5.69
1	1966	50-yr	575.51	575.15	572.93	1.51	0.05	155.14		866.00		4.83

Errors Warnings and Notes for Plan : Existing 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 50-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 50-yr
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: Ryans Creek Reach: 1 RS: 2000 Profile: 50-yr Upstream
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: Ryans Creek Reach: 1 RS: 2000 Profile: 50-yr Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1966 Profile: 50-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 50-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 50-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.

Errors Warnings and Notes for Plan : Existing 1 (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.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 100-yr
Ground
Elevation (ft)
580
578
576
574
572
570
568
566
564
562
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 100-yr

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	3022	100-yr	1250.00	569.16	579.15	574.79	579.18	0.000201	1.89	889.82	220.50	0.12
1	2772	100-yr	1250.00	569.81	579.09		579.13	0.000271	2.05	843.18	244.78	0.14
1	2508	100-yr	1250.00	570.47	579.05		579.07	0.000144	1.50	1034.86	240.77	0.10
1	2275	100-yr	1250.00	569.61	579.01		579.04	0.000146	1.61	1032.20	248.79	0.11
1	2040	100-yr	1250.00	568.76	578.84	574.08	578.98	0.000452	3.07	428.75	355.47	0.19
1	2026	100-yr	1250.00	568.58	578.50	573.84	578.89	0.001496	5.05	247.35	122.22	0.31
1	2000		Bridge									
1	1977	100-yr	1250.00	568.61	575.88	573.73	576.68	0.008047	7.20	173.60	31.29	0.52
1	1966	100-yr	1250.00	568.85	575.91	573.72	576.46	0.005524	5.98	208.94	242.51	0.46
1	1708	100-yr	1250.00	567.93	574.10		574.73	0.008383	6.70	268.44	161.89	0.55
1	1485	100-yr	1250.00	567.02	572.97		573.28	0.005473	5.48	390.89	138.68	0.44
1	1144	100-yr	1250.00	564.82	569.45	569.45	570.36	0.021237	8.39	218.32	125.14	0.83
1	939	100-yr	1250.00	562.46	567.11	566.38	567.30	0.007901	4.66	517.99	325.46	0.50

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 100-yr

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	3022	100-yr	579.18	579.15	0.04	0.06	0.00	509.05	513.59	227.36	220.50
1	2772	100-yr	579.13	579.09	0.04	0.05	0.00	654.33	495.32	100.35	244.78
1	2508	100-yr	579.07	579.05	0.02	0.03	0.00	814.88	383.95	51.17	240.77
1	2275	100-yr	579.04	579.01	0.03	0.05	0.01	683.71	452.01	114.29	248.79
1	2040	100-yr	578.98	578.84	0.14	0.01	0.08	184.79	1009.24	55.97	355.47
1	2026	100-yr	578.89	578.50	0.40				1250.00		122.22
1	2000		Bridge								
1	1977	100-yr	576.68	575.88	0.81	0.10	0.12		1250.00		31.29
1	1966	100-yr	576.46	575.91	0.56	1.72	0.02		1250.00		242.51
1	1708	100-yr	574.73	574.10	0.62	1.35	0.09	29.56	1109.49	110.95	161.89
1	1485	100-yr	573.28	572.97	0.31	2.86	0.06	7.84	772.21	469.94	138.68
1	1144	100-yr	570.36	569.45	0.91	2.49	0.22	4.51	1027.69	217.80	125.14
1	939	100-yr	567.30	567.11	0.19			5.89	612.80	631.32	325.46

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 100-yr

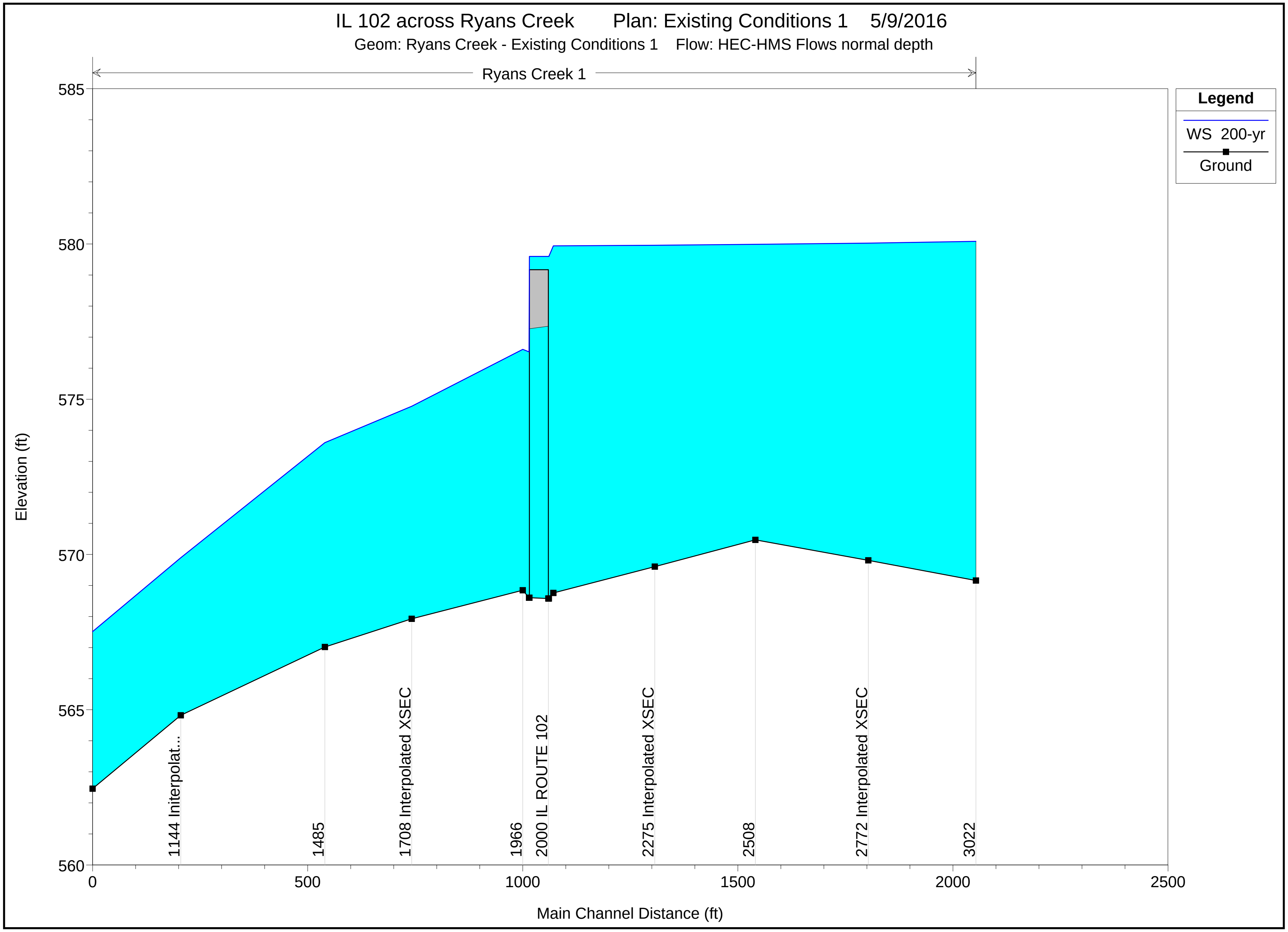
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	2040	100-yr	578.98	578.84	574.08	0.01	0.08	355.47	184.79	1009.24	55.97	3.07
1	2026	100-yr	578.89	578.50	573.84			122.22		1250.00		5.05
1	2000 BR U	100-yr	578.89	577.35	574.18					1250.00		7.77
1	2000 BR D	100-yr	576.71	575.88	574.25			20.00		1250.00		9.48
1	1977	100-yr	576.68	575.88	573.73	0.10	0.12	31.29		1250.00		7.20
1	1966	100-yr	576.46	575.91	573.72	1.72	0.02	242.51		1250.00		5.98

Errors Warnings and Notes for Plan : Existing 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2275 Profile: 100-yr
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: Ryans Creek Reach: 1 RS: 2040 Profile: 100-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 100-yr
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.
Note:	The downstream water surface is below the minimum elevation for pressure flow. The sluice gate
	equations were used for pressure flow.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 100-yr Upstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 100-yr Downstream
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1966 Profile: 100-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 100-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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

Errors Warnings and Notes for Plan : Existing 1 (Continued)

	may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 200-yr
Ground
Elevation (ft)
585
580
575
570
565
560
1144 Interpolat...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 200-yr

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	3022	200-yr	1700.00	569.16	580.08	576.22	580.12	0.000196	2.02	1100.82	236.26	0.12
1	2772	200-yr	1700.00	569.81	580.03		580.07	0.000245	2.13	1084.92	263.60	0.14
1	2508	200-yr	1700.00	570.47	579.99		580.02	0.000143	1.63	1263.92	245.98	0.10
1	2275	200-yr	1700.00	569.61	579.96		579.99	0.000143	1.73	1285.92	292.56	0.11
1	2040	200-yr	1700.00	568.76	579.94	574.69	579.96	0.000105	1.62	1612.35	403.19	0.09
1	2026	200-yr	1700.00	568.58	579.60	574.79	579.88	0.001308	4.71	550.01	360.48	0.28
1	2000		Bridge									
1	1977	200-yr	1700.00	568.61	576.53	574.66	577.73	0.010751	8.81	192.89	37.13	0.61
1	1966	200-yr	1700.00	568.85	576.60	574.45	577.41	0.006802	7.20	236.07	269.97	0.52
1	1708	200-yr	1700.00	567.93	574.77		575.45	0.008296	7.29	362.90	179.13	0.56
1	1485	200-yr	1700.00	567.02	573.60		573.97	0.005777	6.10	479.74	141.86	0.46
1	1144	200-yr	1700.00	564.82	569.90	569.90	570.97	0.022049	9.34	275.51	128.58	0.86
1	939	200-yr	1700.00	562.46	567.52	566.69	567.73	0.007903	5.11	654.56	353.14	0.51

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 200-yr

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	3022	200-yr	580.12	580.08	0.04	0.05	0.00	718.81	617.72	363.47	236.26
1	2772	200-yr	580.07	580.03	0.04	0.05	0.00	934.43	587.96	177.61	263.60
1	2508	200-yr	580.02	579.99	0.03	0.03	0.00	1140.27	472.47	87.26	245.98
1	2275	200-yr	579.99	579.96	0.03	0.03	0.00	968.49	549.92	181.58	292.56
1	2040	200-yr	579.96	579.94	0.02	0.00	0.08	737.05	603.39	359.55	403.19
1	2026	200-yr	579.88	579.60	0.28			323.47	1362.79	13.74	360.48
1	2000		Bridge								
1	1977	200-yr	577.73	576.53	1.21	0.12	0.20		1700.00		37.13
1	1966	200-yr	577.41	576.60	0.81	1.90	0.06		1700.00		269.97
1	1708	200-yr	575.45	574.77	0.68	1.39	0.09	68.37	1378.54	253.09	179.13
1	1485	200-yr	573.97	573.60	0.37	2.93	0.07	17.50	972.39	710.11	141.86
1	1144	200-yr	570.97	569.90	1.07	2.53	0.26	10.30	1305.34	384.35	128.58
1	939	200-yr	567.73	567.52	0.21			10.08	769.77	920.16	353.14

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 200-yr

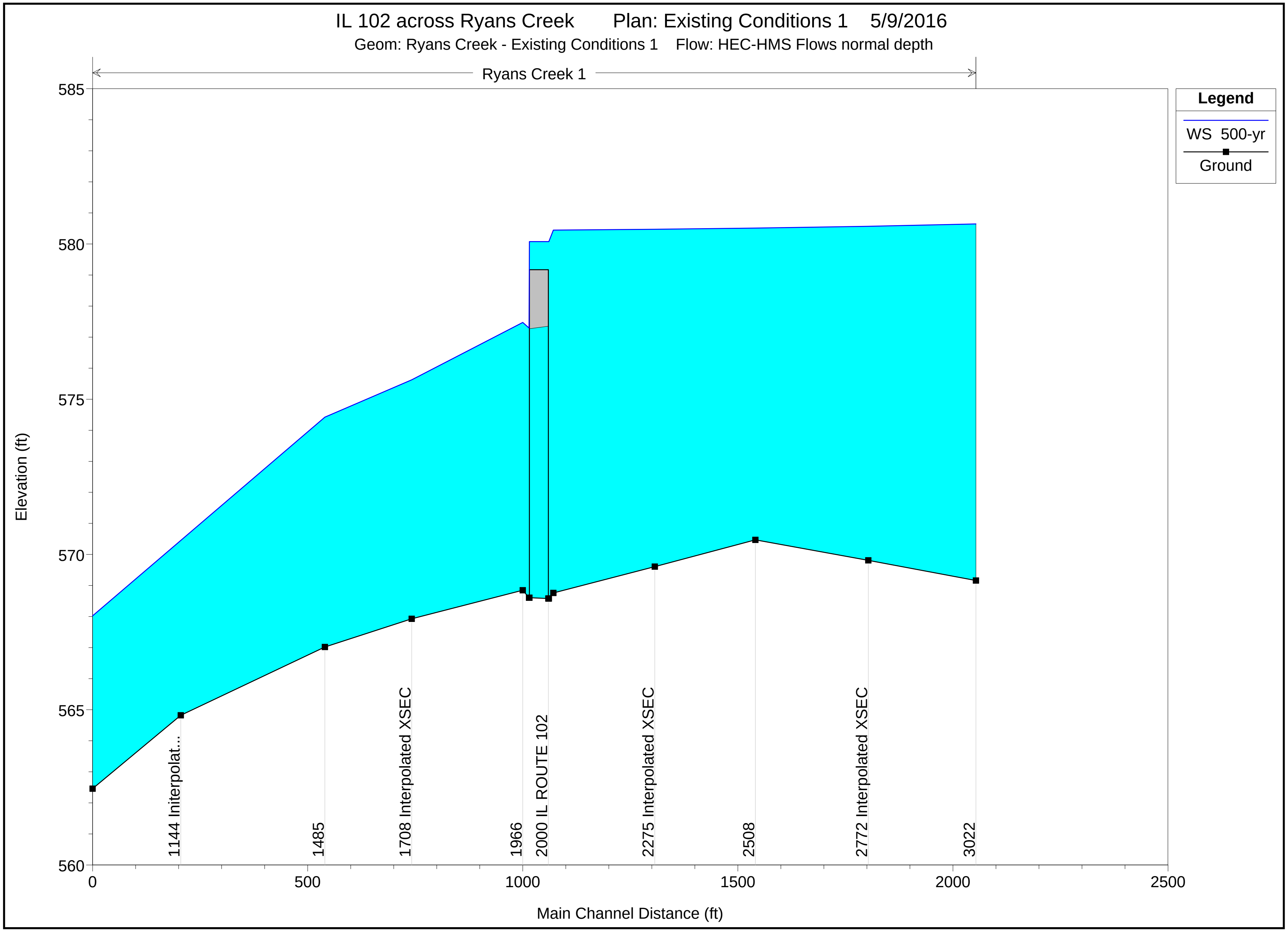
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
1	2040	200-yr	579.96	579.94	574.69	0.00	0.08	403.19	737.05	603.39	359.55	1.62
1	2026	200-yr	579.88	579.60	574.79			360.48	323.47	1362.79	13.74	4.71
1	2000 BR U	200-yr	579.88	579.60	575.32			131.28	143.84	1552.21	0.76	9.47
1	2000 BR D	200-yr	579.85	579.60	575.37			130.38	143.84	1552.21	0.76	9.58
1	1977	200-yr	577.73	576.53	574.66	0.12	0.20	37.13		1700.00		8.81
1	1966	200-yr	577.41	576.60	574.45	1.90	0.06	269.97		1700.00		7.20

Errors Warnings and Notes for Plan : Existing 1

Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 200-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 200-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 200-yr
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: Ryans Creek Reach: 1 RS: 2000 Profile: 200-yr 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: Ryans Creek Reach: 1 RS: 2000 Profile: 200-yr 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: Ryans Creek Reach: 1 RS: 1977 Profile: 200-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 200-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 200-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the

Errors Warnings and Notes for Plan : Existing 1 (Continued)

	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.



IL 102 across Ryans Creek Plan: Existing Conditions 1 5/9/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
585
580
575
570
565
560
0
500
1000
1500
2000
2500
1144 Interpolat...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 500-yr

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	3022	500-yr	2375.00	569.16	580.64	576.69	580.71	0.000271	2.48	1239.65	258.65	0.15
1	2772	500-yr	2375.00	569.81	580.57		580.63	0.000325	2.57	1228.71	266.72	0.16
1	2508	500-yr	2375.00	570.47	580.51		580.56	0.000205	2.04	1393.86	248.88	0.12
1	2275	500-yr	2375.00	569.61	580.47		580.52	0.000203	2.15	1442.46	315.54	0.13
1	2040	500-yr	2375.00	568.76	580.45	575.47	580.48	0.000145	1.96	1825.55	434.58	0.11
1	2026	500-yr	2375.00	568.58	580.08	576.02	580.40	0.001552	5.32	753.90	492.60	0.31
1	2000		Bridge									
1	1977	500-yr	2375.00	568.61	577.29	575.88	579.17	0.014423	11.00	215.86	108.51	0.72
1	1966	500-yr	2375.00	568.85	577.47	575.41	578.67	0.008492	8.80	269.92	300.21	0.59
1	1708	500-yr	2375.00	567.93	575.62		576.36	0.008069	7.93	490.45	194.92	0.56
1	1485	500-yr	2375.00	567.02	574.42		574.86	0.006074	6.86	597.66	145.91	0.48
1	1144	500-yr	2375.00	564.82	570.45	570.45	571.75	0.023372	10.57	347.83	132.31	0.91
1	939	500-yr	2375.00	562.46	568.03	567.03	568.27	0.007912	5.65	843.21	387.61	0.52

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 500-yr

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	3022	500-yr	580.71	580.64	0.06	0.07	0.00	1023.57	808.23	543.20	258.65
1	2772	500-yr	580.63	580.57	0.06	0.07	0.01	1344.08	760.73	270.19	266.72
1	2508	500-yr	580.56	580.51	0.05	0.04	0.00	1609.78	630.72	134.50	248.88
1	2275	500-yr	580.52	580.47	0.05	0.03	0.00	1370.46	726.23	278.31	315.54
1	2040	500-yr	580.48	580.45	0.03	0.00	0.08	1093.93	773.81	507.26	434.58
1	2026	500-yr	580.40	580.08	0.32			678.06	1625.12	71.82	492.60
1	2000		Bridge								
1	1977	500-yr	579.17	577.29	1.88	0.16	0.34		2375.00		108.51
1	1966	500-yr	578.67	577.47	1.20	2.08	0.23		2375.00		300.21
1	1708	500-yr	576.36	575.62	0.74	1.41	0.09	145.12	1739.20	490.68	194.92
1	1485	500-yr	574.86	574.42	0.44	3.02	0.09	36.32	1256.27	1082.41	145.91
1	1144	500-yr	571.75	570.45	1.30	2.59	0.32	22.59	1702.11	650.30	132.31
1	939	500-yr	568.27	568.03	0.25			17.77	988.81	1368.43	387.61

HEC-RAS Plan: Existing 1 River: Ryans Creek Reach: 1 Profile: 500-yr

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	2040	500-yr	580.48	580.45	575.47	0.00	0.08	434.58	1093.93	773.81	507.26	1.96
1	2026	500-yr	580.40	580.08	576.02			492.60	678.06	1625.12	71.82	5.32
1	2000 BR U	500-yr	580.39	580.08	576.85			308.10	474.61	1821.04	69.80	10.05
1	2000 BR D	500-yr	580.39	580.08	576.88			308.11	474.61	1821.04	69.80	10.15
1	1977	500-yr	579.17	577.29	575.88	0.16	0.34	108.51		2375.00		11.00
1	1966	500-yr	578.67	577.47	575.41	2.08	0.23	300.21		2375.00		8.80

Errors Warnings and Notes for Plan : Existing 1

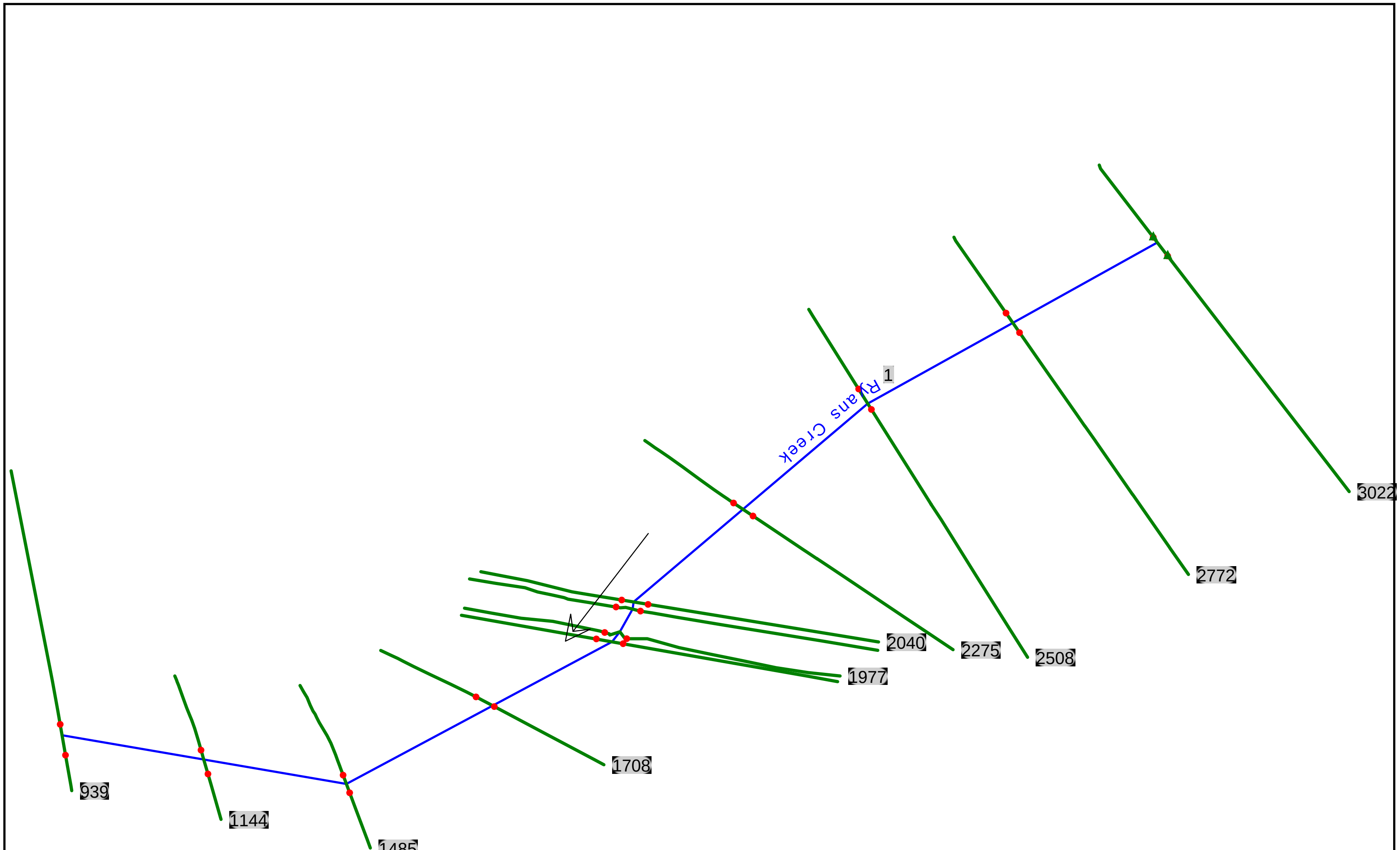
Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 500-yr
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
	greater than 1.4. This may indicate the need for additional cross sections.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 500-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 2000 Profile: 500-yr
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: Ryans Creek Reach: 1 RS: 2000 Profile: 500-yr 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: Ryans Creek Reach: 1 RS: 2000 Profile: 500-yr 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: Ryans Creek Reach: 1 RS: 1977 Profile: 500-yr
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.
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1966 Profile: 500-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 500-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.

Errors Warnings and Notes for Plan : Existing 1 (Continued)

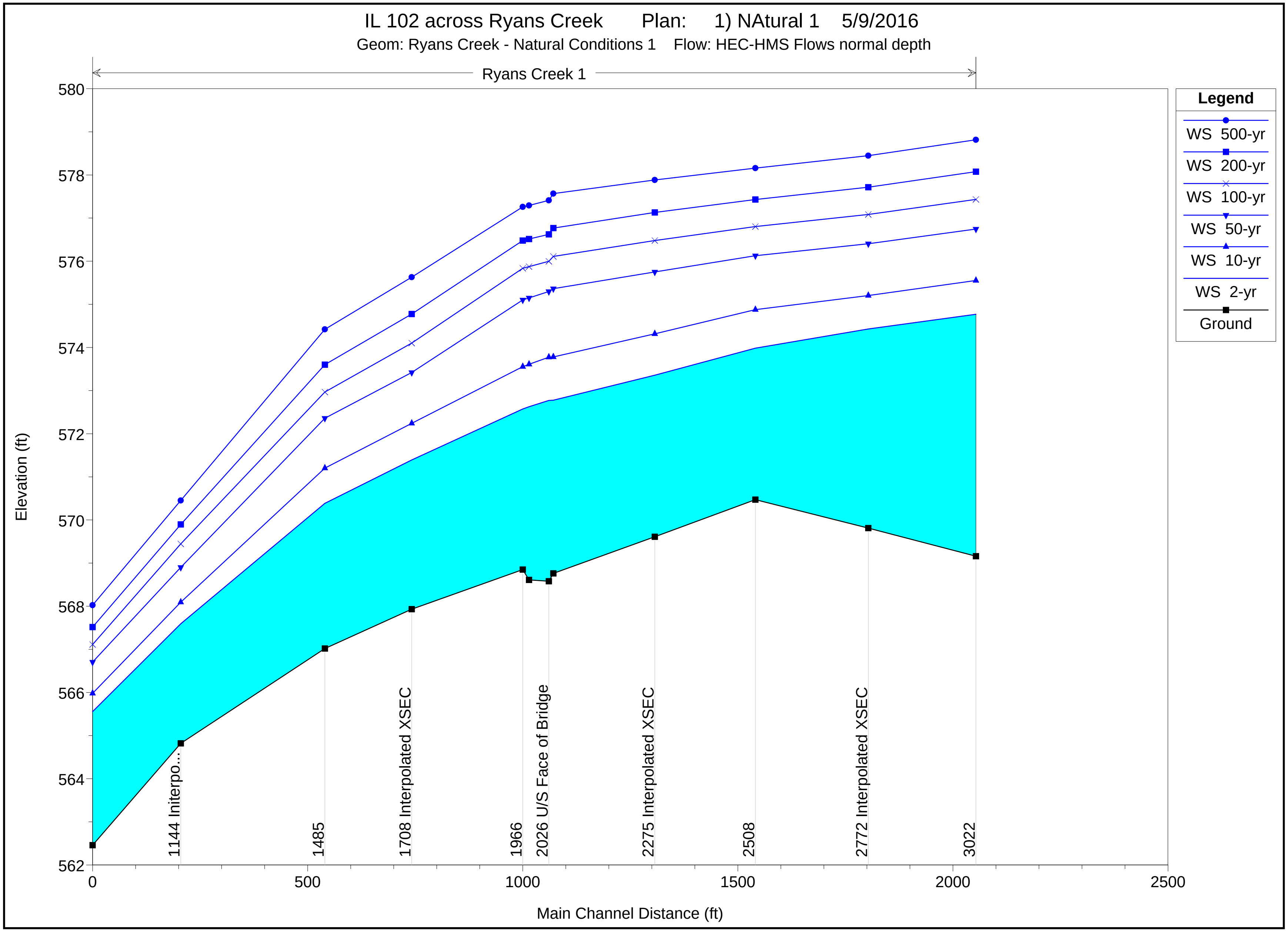
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This
	may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.

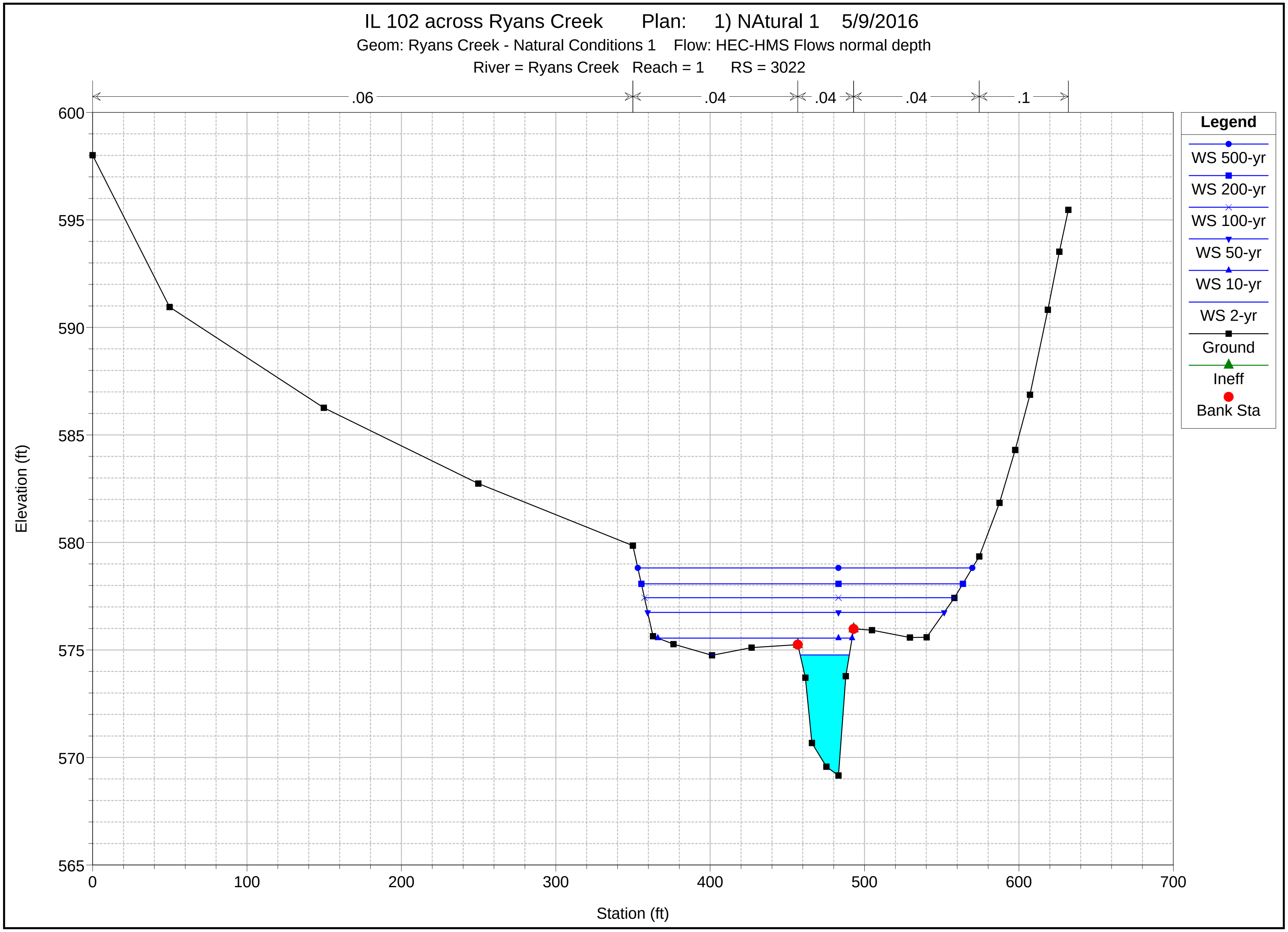
HEC-RAS

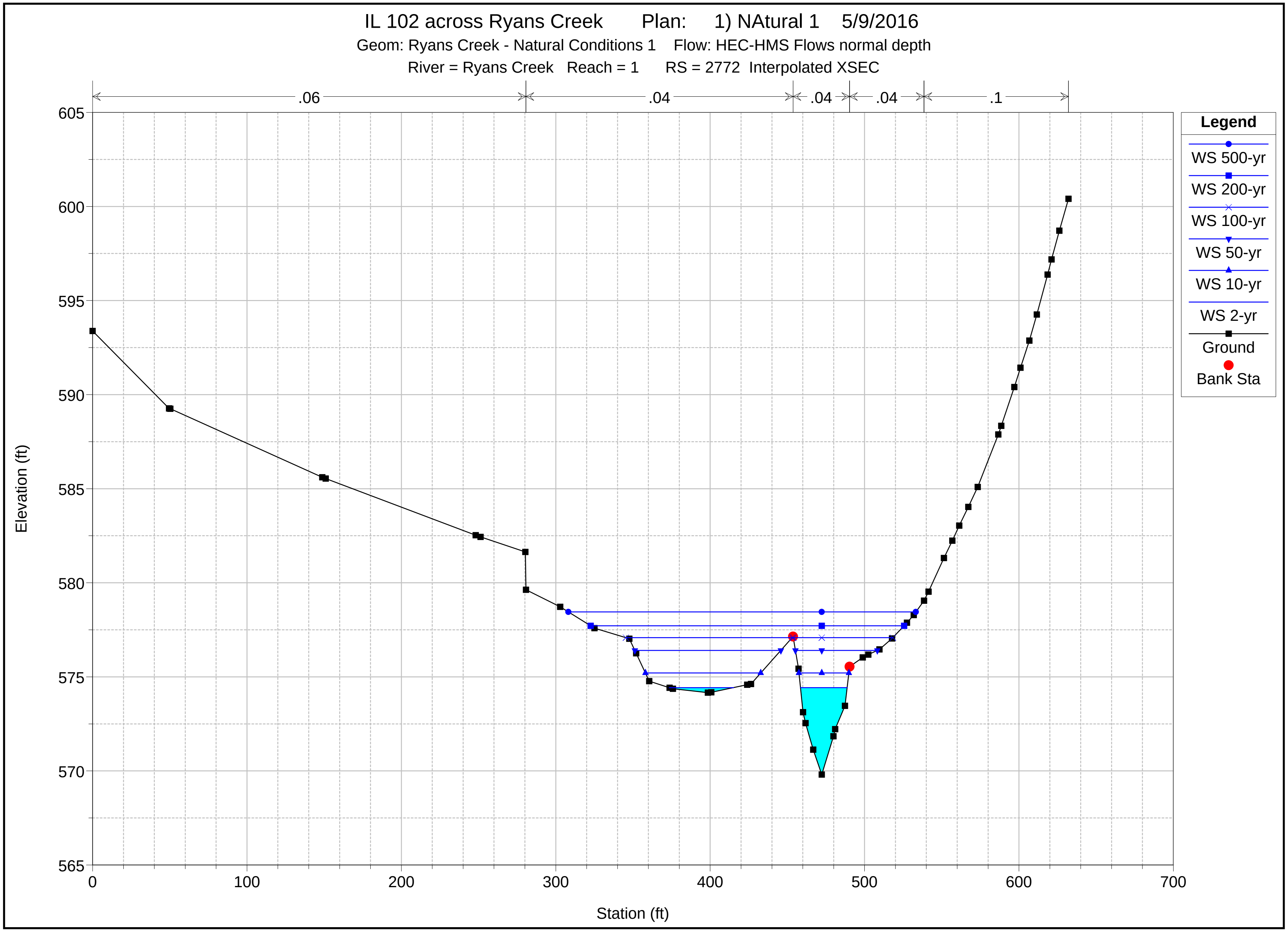
NATURAL CONDITIONS MODEL



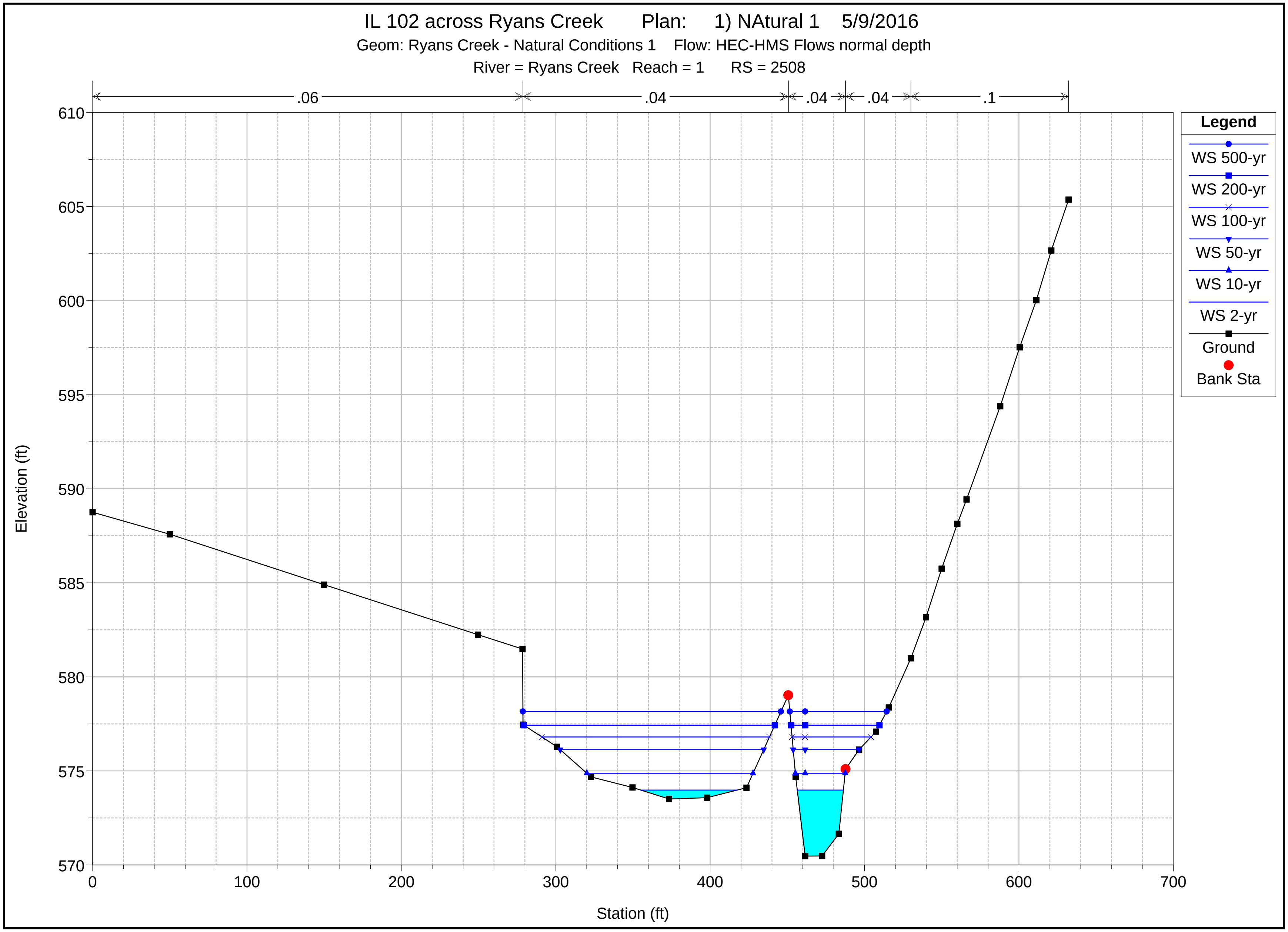
Some schematic data outside default extents (see View/Set Schematic Plot Extents...)


IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
580
578
576
574
572
570
568
566
564
562
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

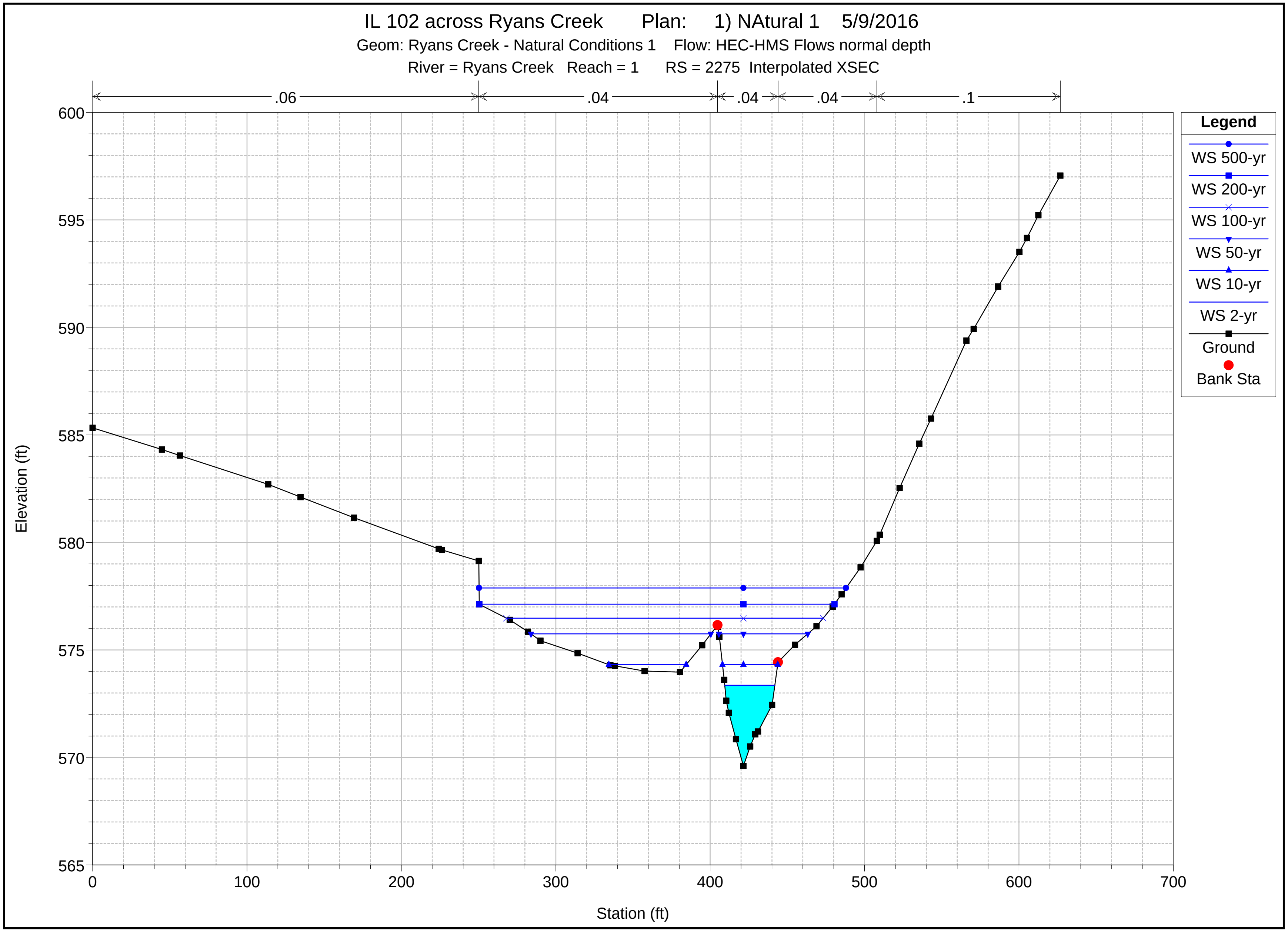

IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 3022
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)



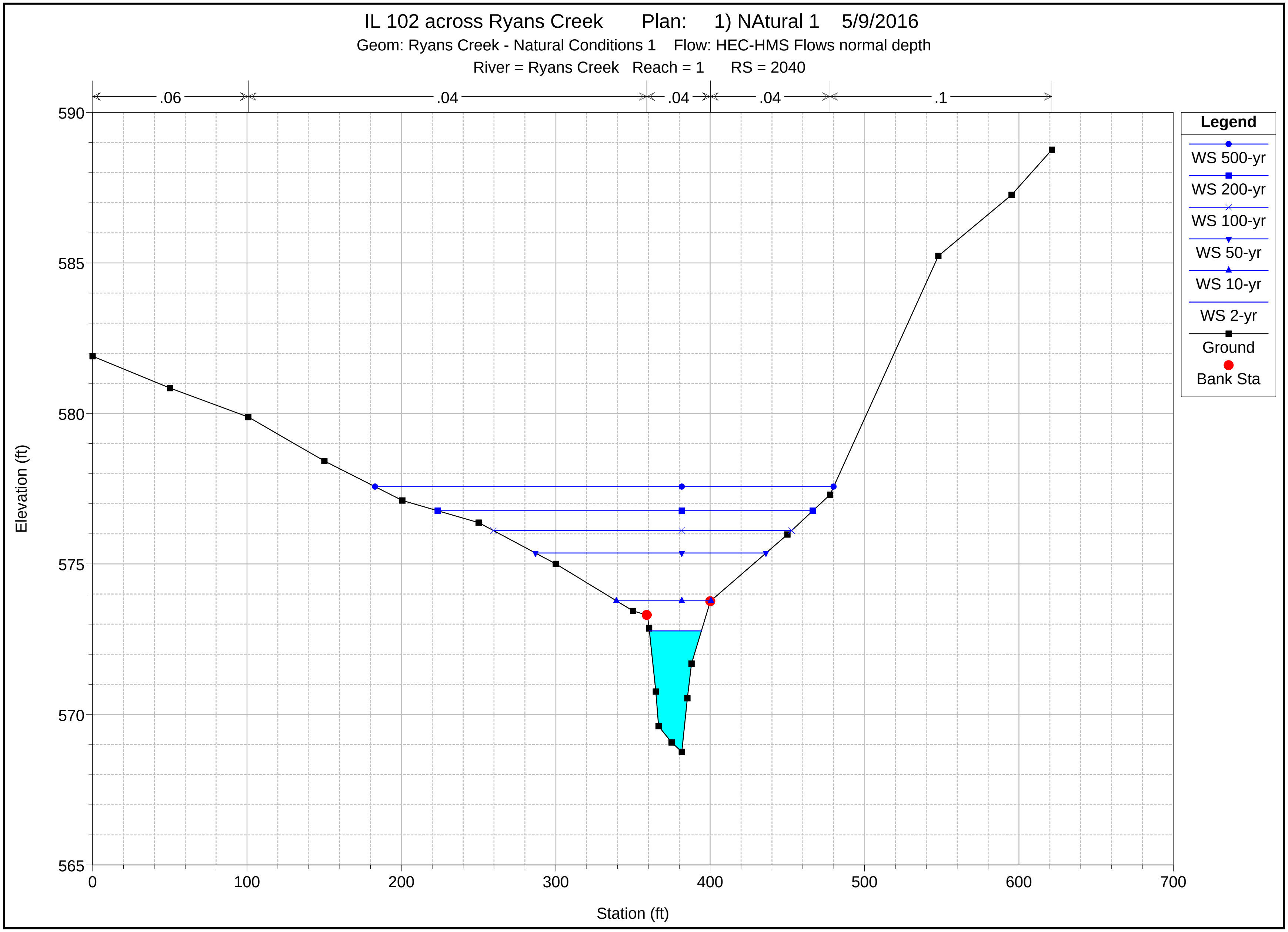
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2772 Interpolated XSEC
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
605
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)



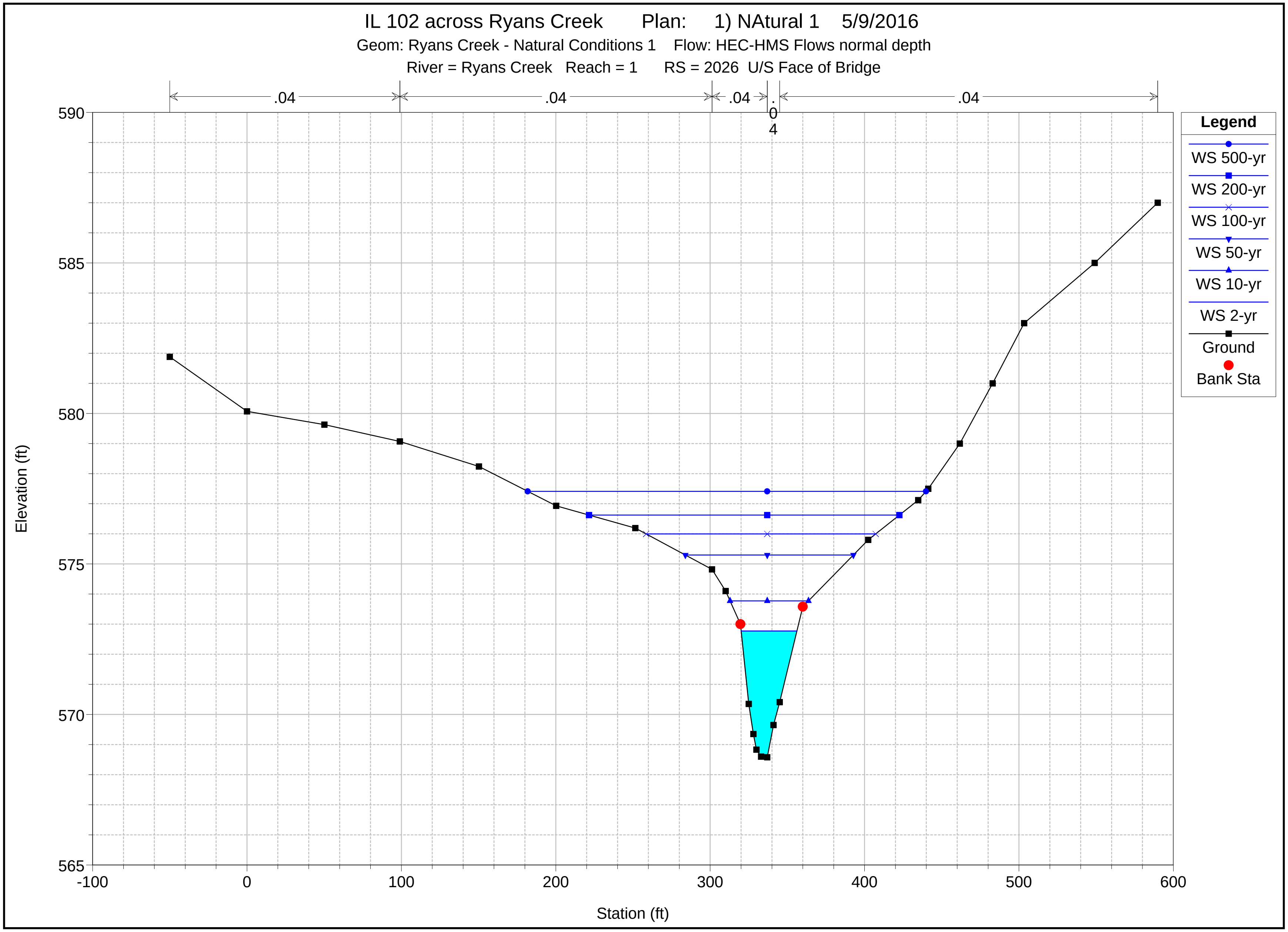
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2508
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
610
605
600
595
590
585
580
575
570
0
100
200
300
400
500
600
700
Station (ft)



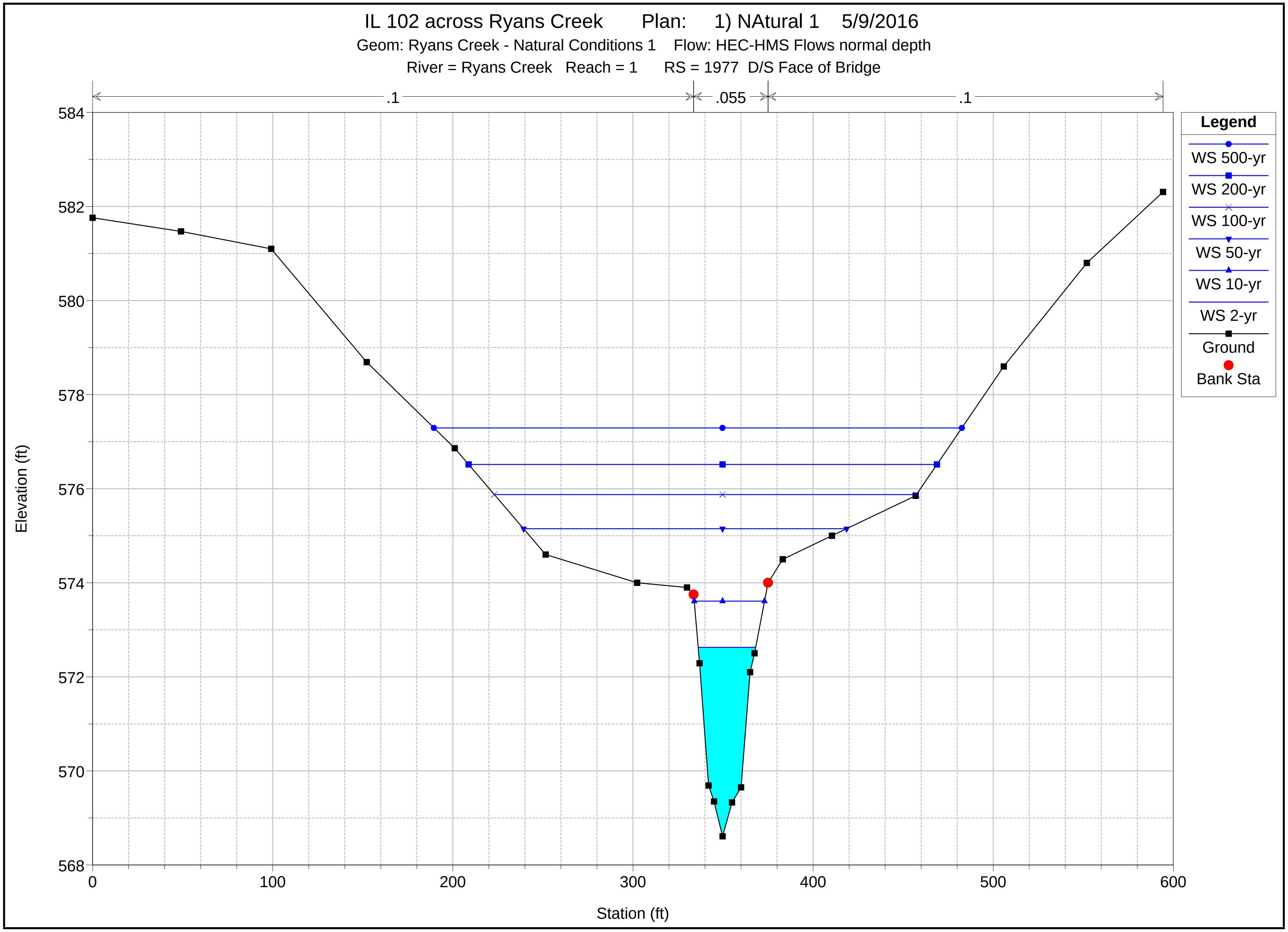
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2275 Interpolated XSEC
.06
.04
.04
.04
.1
Elevation (ft)
600
595
590
585
580
575
570
565
Station (ft)
0
100
200
300
400
500
600
700
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta



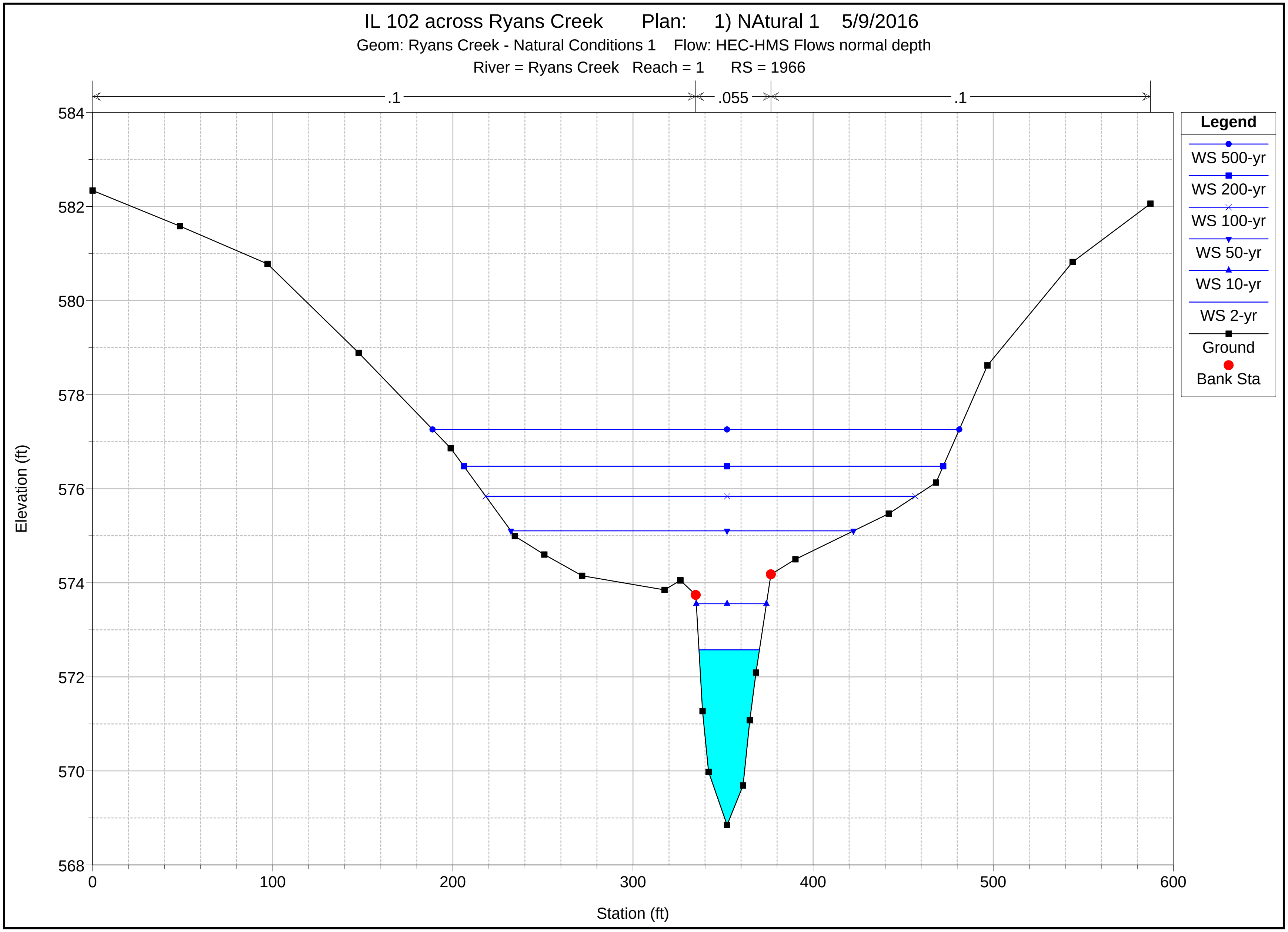
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2040
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)



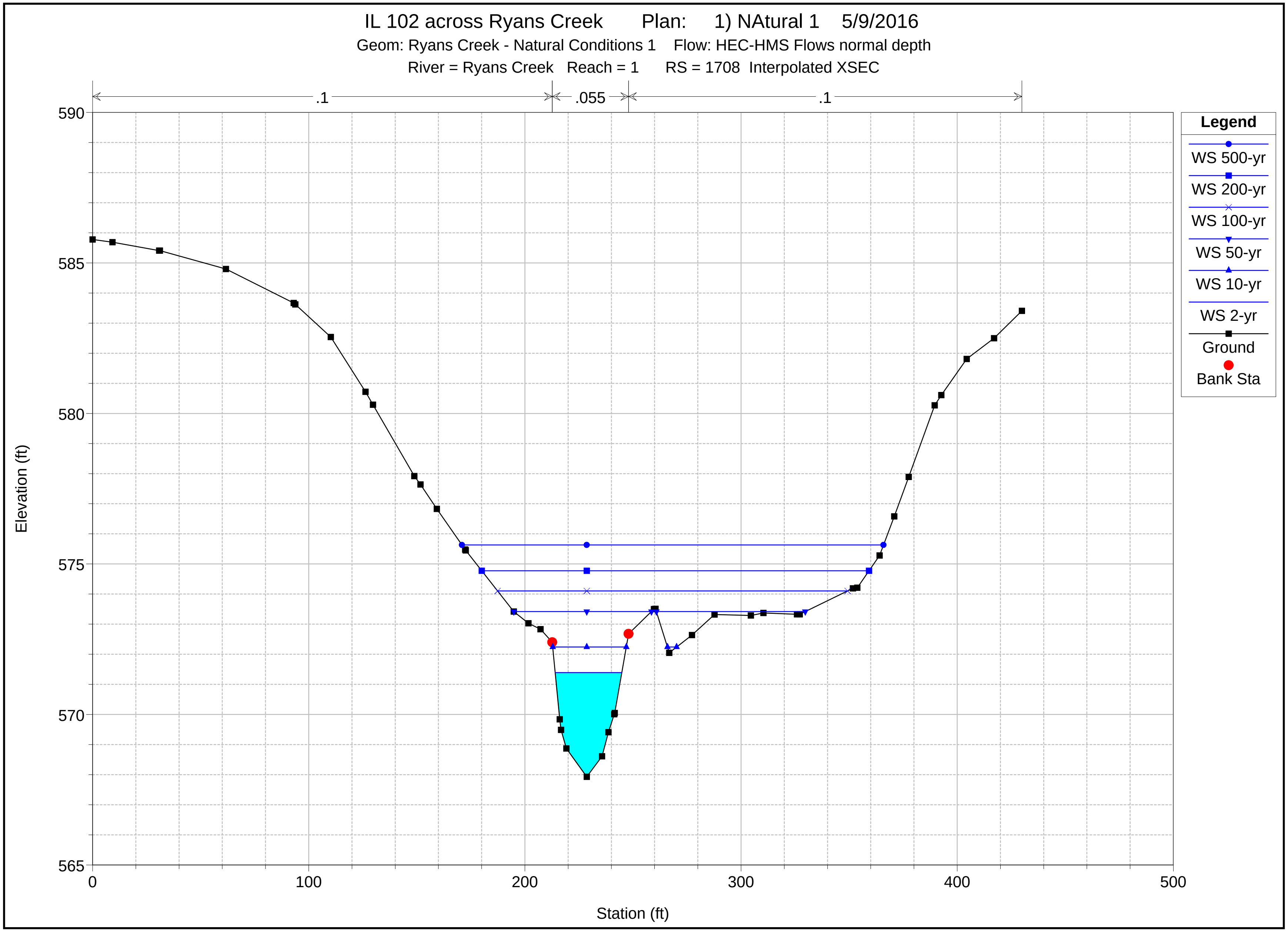
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2026 U/S Face of Bridge
.04
.04
.04
.04
.04
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
585
580
575
570
565
-100
0
100
200
300
400
500
600



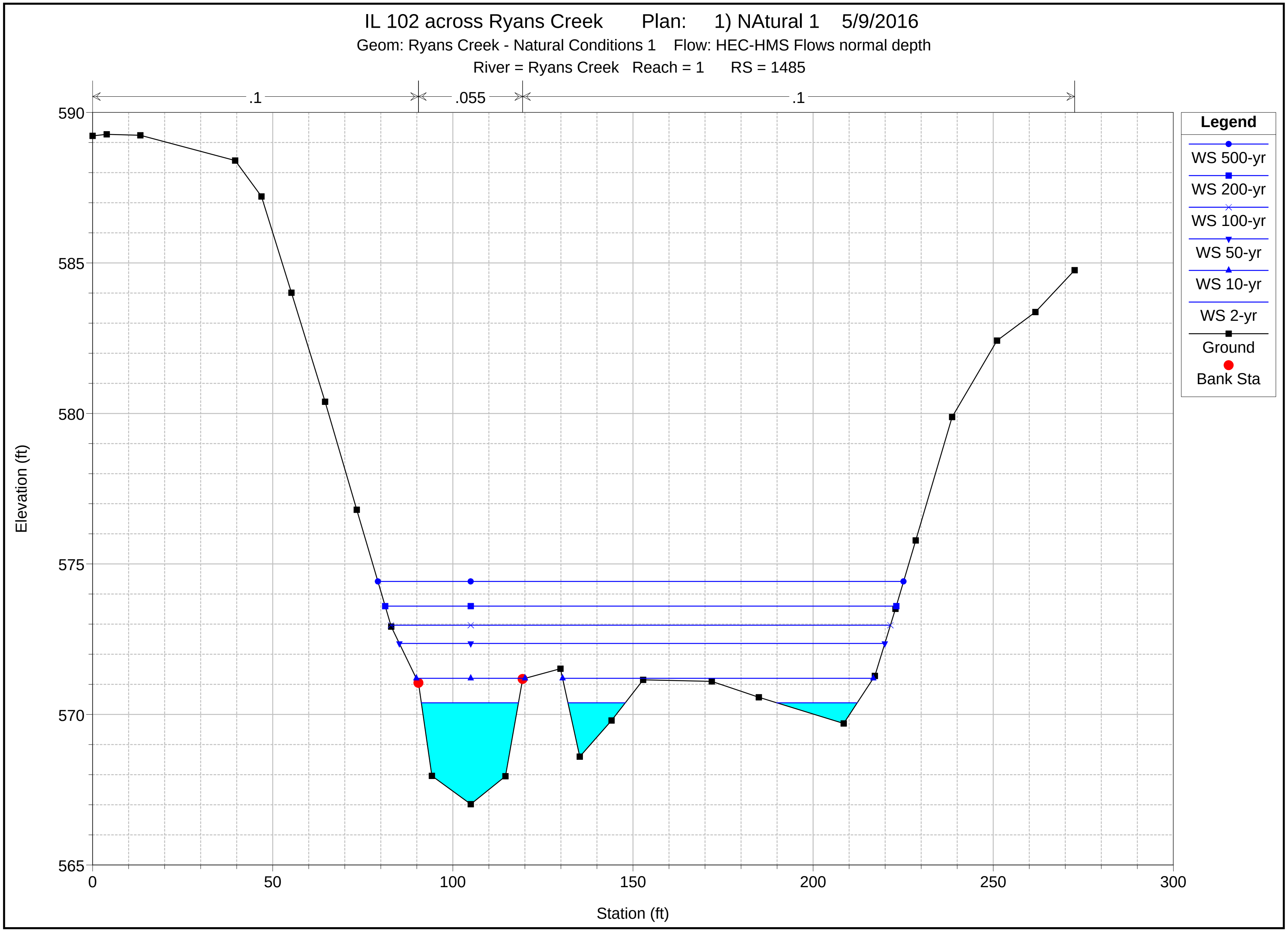
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1977 D/S Face of Bridge
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600

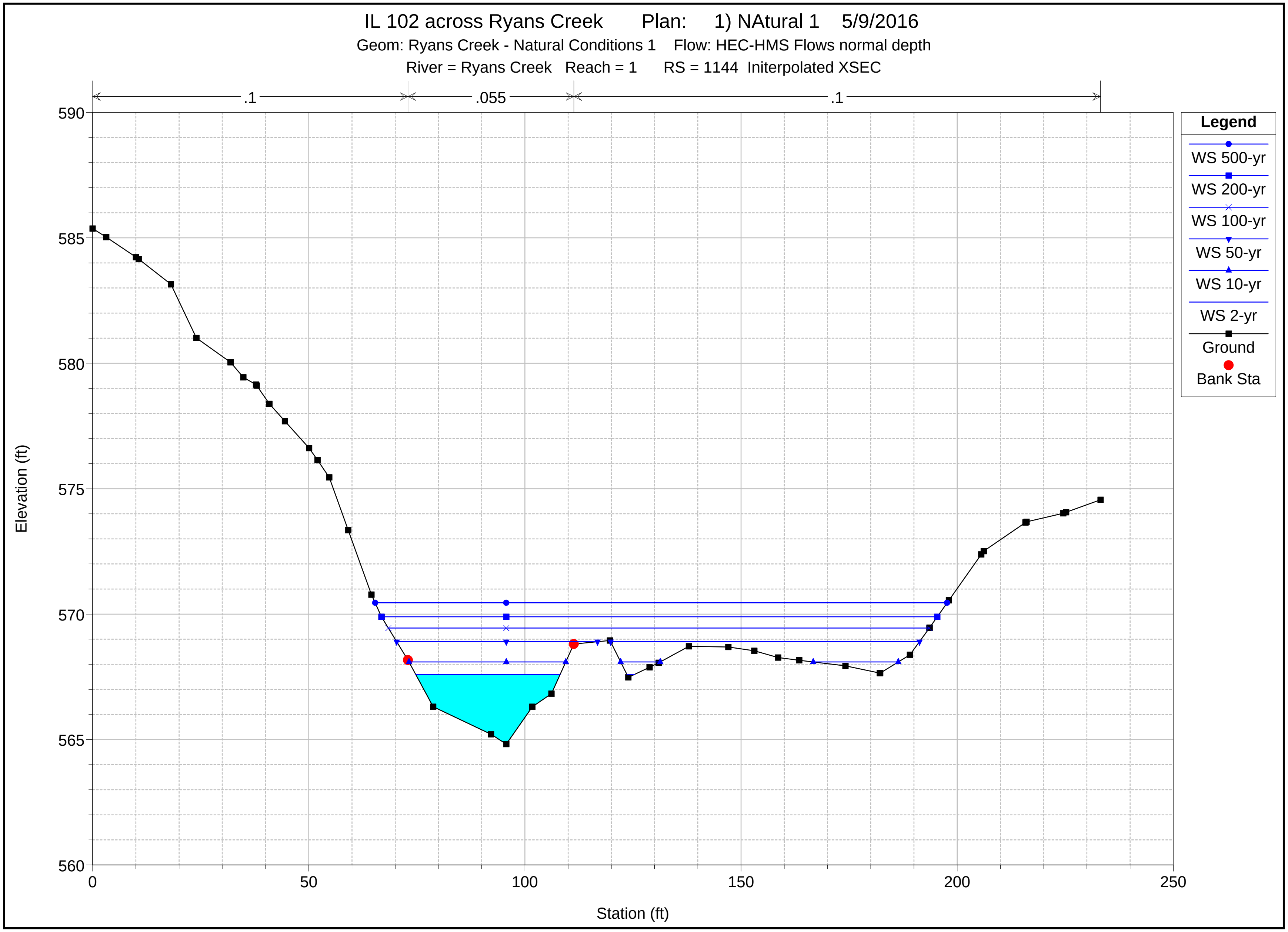


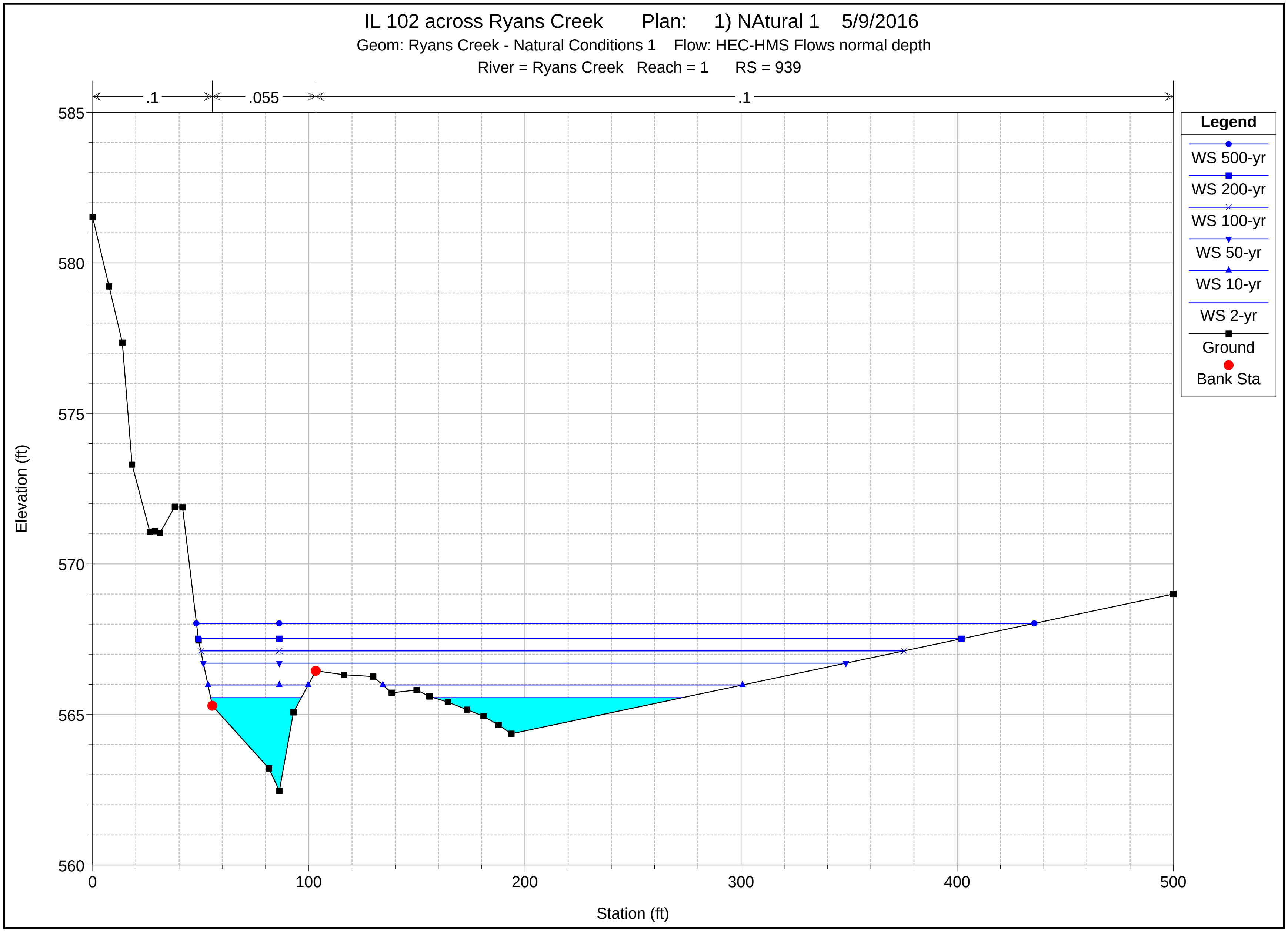
IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1966
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600



IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1708 Interpolated XSEC
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
585
580
575
570
565
0
100
200
300
400
500


IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1485
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
590
585
580
575
570
565
0
50
100
150
200
250
300
Station (ft)


IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1144 Initerpolated XSEC
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
585
580
575
570
565
560
0
50
100
150
200
250



IL 102 across Ryans Creek Plan: 1) NAtural 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 939
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
585
580
575
570
565
560
0
100
200
300
400
500

```
                   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: IL 102 across Ryans Creek
Project File : IL102acrossRaynsCK.prj
Run Date and Time: 5/9/2016 2:13:29 PM

Project in English units

****

PLAN DATA

Plan Title: Natural Conditions 1
Plan File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.p02

Geometry Title: Ryans Creek - Natural Conditions 1
Geometry File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.g03

Flow Title : HEC-HMS Flows normal depth
Flow File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.f03

Plan Summary Information:

Number of:	Cross Sections =	12	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

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

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

```
*********************************************************************************

FLOW DATA

Flow Title: HEC-HMS Flows normal depth
Flow File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.f03

Flow Data (cfs)
*****************************************************************************************************************************************
* River           Reach           RS      *           2-yr           10-yr            50-yr          100-yr          200-yr          500-yr *
* Ryans Creek     1               3022    *            242             408              866            1250            1700            2375 *
*****************************************************************************************************************************************

Boundary Conditions
*********************************************************************************************************
* River           Reach           Profile          *            Upstream                  Downstream    *
*********************************************************************************************************
* Ryans Creek     1               2-yr             *                                Normal S = 0.0079 *
* Ryans Creek     1               10-yr            *                                Normal S = 0.0079 *
* Ryans Creek     1               50-yr            *                                Normal S = 0.0079 *
* Ryans Creek     1               100-yr           *                                Normal S = 0.0079 *
* Ryans Creek     1               200-yr           *                                Normal S = 0.0079 *
* Ryans Creek     1               500-yr           *                                Normal S = 0.0079 *
*********************************************************************************************************

*********************************************************************************

GEOMETRY DATA

Geometry Title: Ryans Creek - Natural Conditions 1
Geometry File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.g03

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                 RS: 3022

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0  598.01  49.856  590.95 149.759  586.26 249.858  582.74 349.944  579.85
 362.947  575.64 376.267  575.27 401.201  574.75 426.854  575.11   456.8  575.25
 456.803  575.25 461.715  573.71   465.9  570.67 475.225  569.57 483.085  569.16
 487.823  573.78  492.95 575.978 492.954  575.98   504.8  575.92 529.371  575.58
 540.193  575.59 558.176  577.42 574.296  579.35  587.41  581.84 597.565   584.3
 607.162  586.87 618.717  590.82 626.175  593.52 632.004  595.47

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************************************************
       0     .06 349.944     .04   456.8     .04  492.95     .04 574.296      .1
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
456.8	492.95	242.5	250	248.3	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	456.8	575.25	F
492.95	632.004	575.98	F

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2772

INPUT
Description: Interpolated XSEC
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	593.38	49.52	589.27	50.35	589.25	148.75	585.61	150.94	585.54
248.18	582.53	251.3	582.44	280.33	581.64	280.66	579.63	302.85	578.72
325.06	577.59	347.59	577.03	352.08	576.25	360.51	574.77	373.74	574.42
375.88	574.37	398.5	574.16	400.74	574.18	423.99	574.58	426.41	574.62
453.73	577.14	457.2	575.43	460.16	573.12	461.78	572.54	466.74	571.13
472.3	569.81	479.87	571.84	480.96	572.22	487.28	573.46	490.34	575.54
498.86	576.03	502.42	576.18	509.68	576.46	517.82	577.04	527.46	577.88
531.83	578.29	538.49	579.05	541.42	579.53	551.42	581.32	556.82	582.24
561.31	583.04	567.2	584.03	573.26	585.09	586.62	587.88	588.59	588.34
596.97	590.4	600.95	591.43	606.76	592.87	611.6	594.26	618.53	596.38
621.09	597.19	626.14	598.71	632.08	600.41				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	280.66	.04	453.73	.04	490.34	.04	538.49	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
453.73	490.34	279.8	262.7	257.1	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2508

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	588.75	50.007	587.58	149.921	584.9	249.602	582.24	278.434	581.48
278.765	577.46	300.802	576.28	322.862	574.68	349.697	574.12	373.339	573.51
398.031	573.58	423.527	574.11	450.66	579.02	455.366	574.69	461.507	570.47
472.517	570.48	483.288	571.66	487.73	575.1	496.415	576.13	507.437	577.09
515.726	578.37	530.002	580.99	539.779	583.17	549.967	585.75	560.04	588.13
566.042	589.43	587.844	594.38	600.434	597.51	611.284	600.02	620.958	602.66

```
 632.149  605.36

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
********************************************************************************
       0     .06 278.765     .04  450.66     .04  487.73     .04 530.002      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        450.66  487.73            167.7   233.9   253.1             .1       .3
```

CROSS SECTION

```
RIVER: Ryans Creek
REACH: 1                  RS: 2275

INPUT
Description: Interpolated XSEC
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  585.33   44.92  584.32   56.56  584.04  113.74   582.7  134.67  582.11
  169.27  581.15  224.22   579.7  226.24  579.65  250.12  579.14  250.42  577.12
  270.21   576.4  282.03  575.85  290.03  575.43  314.13  574.85  335.37  574.29
  338.37  574.26  357.55  574.02  380.46  573.97   394.8  575.22  404.83  576.16
  405.12  576.07  405.92  575.61  409.11  573.61  410.44  572.64  412.09  572.08
  416.69  570.85  421.56  569.61   425.9  570.51  429.22  571.08  430.95  571.21
  440.13  572.44  443.92  574.43  454.91  575.24  468.87   576.1  479.36  577.02
  485.13  577.59  497.43  578.84  507.97  580.07  509.81  580.36   522.7  582.53
  535.46  584.59  543.05  585.76  565.98  589.39  570.65  589.93  586.59   591.9
  600.32  593.51  605.17  594.16  612.57  595.22  626.74  597.06

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
********************************************************************************
       0     .06  250.12     .04  404.83     .04  443.92     .04  507.97      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        404.83  443.92            165.4   235.8   269.5             .1       .3
```

CROSS SECTION

```
RIVER: Ryans Creek
REACH: 1                  RS: 2040

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   581.9  50.161  580.84 100.862  579.88 150.103  578.42  200.63  577.11
 250.103  576.37  300.06     575 350.109  573.44     359 573.306 359.389   573.3
 360.473  572.86 364.785  570.76 366.588  569.61 375.036  569.07 381.617  568.76
 385.202  570.54 387.953  571.69 400.108  573.76  400.11  573.76  449.98  575.98
 477.612   577.3  547.81  585.23 595.223  587.26 621.324  588.76
```

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100.862	.04	359	.04	400.11	.04	477.612	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
359	400.11	7	10.5	7	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2026

INPUT
Description: U/S Face of Bridge
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-50	581.882	0	580.07	50.169	579.63	99.049	579.07	150.23	578.24
200.253	576.93	251.513	576.19	301.206	574.82	310	574.1	319.64	573
325	570.35	328	569.35	330	568.83	333	568.6	337	568.58
341	569.65	345	570.41	360	573.58	402.381	575.8	434.757	577.12
441.297	577.5	461.679	579	482.935	581	503.38	583	549.01	585
589.84	587								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-50	.04	99.049	.04	301.206	.04	337	.04	345	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
319.64	360	47.7	46	44	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 1977

INPUT
Description: D/S Face of Bridge
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	581.76	49.102	581.47	99.149	581.1	152.194	578.69	201.052	576.86
251.501	574.6	302.302	574	330	573.9	333.71	573.75	337	572.29
342	569.69	345	569.35	349.704	568.61	355	569.33	360	569.65
365	572.1	367.493	572.5	375	574	383.139	574.5	410.477	575
456.934	575.85	505.876	578.6	552.003	580.8	594.245	582.31		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	333.71	.055	375	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
333.71	375	11	14.5	14	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 1966

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	582.34	48.536	581.58	97.087	580.78	147.691	578.89	198.83	576.86
234.409	574.99	250.806	574.6	271.804	574.15	317.52	573.85	326.34	574.05
326.343	574.05	334.84	573.741	334.869	573.74	338.634	571.27	341.982	569.98
352.252	568.85	361.121	569.69	364.88	571.08	368.264	572.09	376.587	574.18
376.59	574.18	390.17	574.5	442.069	575.47	468.234	576.13	496.783	578.62
544.104	580.82	587.298	582.06						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	334.84	.055	376.59	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
334.84	376.59	289	258	182	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 1708

INPUT
Description: Interpolated XSEC
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	585.78	9.22	585.69	30.82	585.41	31.16	585.41	61.66	584.8
93.04	583.67	93.8	583.62	110.22	582.54	126.28	580.72	129.72	580.29
148.87	577.92	151.68	577.64	159.29	576.83	172.35	575.48	172.62	575.45
194.87	573.42	201.66	573.03	207.26	572.83	212.65	572.4	212.68	572.38
216.13	569.84	216.74	569.49	219.2	568.87	228.62	567.93	235.67	568.61
238.67	569.41	241.36	570.01	241.57	570.05	247.98	572.68	259.71	573.5
260.44	573.51	266.79	572.05	277.29	572.64	287.72	573.32	304.53	573.29
310.34	573.37	325.85	573.33	327.13	573.33	351.78	574.19	353.79	574.21
364.08	575.28	370.87	576.58	377.55	577.89	389.56	580.27	392.65	580.61
404.36	581.81	417.03	582.5	429.95	583.41				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	212.65	.055	247.98	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
212.65	247.98	222	202	202	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 1485

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	589.22	3.922	589.27	13.258	589.24	39.58	588.4	46.889	587.21
55.187	584.01	64.531	580.39	73.323	576.8	82.904	572.92	90.468	571.05
90.47	571.048	94.183	567.96	104.978	567.02	114.613	567.95	119.38	571.179
119.381	571.18	129.867	571.52	135.214	568.6	144.055	569.8	152.838	571.15
171.886	571.1	184.941	570.57	208.475	569.7	217.139	571.28	222.854	573.51
228.474	575.78	238.59	579.88	251.054	582.42	261.718	583.37	272.598	584.76

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	90.47	.055	119.38	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
90.47	119.38	230.3	335	197.7	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 1144

INPUT
Description: Initerpolated XSEC
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	585.37	3.16	585.03	10.02	584.23	10.69	584.15	18.13	583.15
24	581.01	31.91	580.04	34.88	579.44	37.81	579.15	37.97	579.11
40.9	578.38	44.5	577.69	50.07	576.62	52.03	576.14	54.74	575.45
59.12	573.35	64.5	570.78	66.84	569.89	72.94	568.17	78.77	566.31
92.15	565.21	95.7	564.82	101.74	566.31	106.15	566.83	111.33	568.81
119.67	568.95	123.92	567.48	128.84	567.88	130.95	568.06	137.94	568.72
147.06	568.69	153.08	568.54	158.57	568.27	163.47	568.16	174.14	567.94
182.11	567.65	182.18	567.65	189.07	568.38	193.58	569.45	193.62	569.46
198.09	570.55	205.57	572.38	206.13	572.51	215.79	573.65	216.04	573.68
224.53	574.02	225.19	574.06	233.18	574.56				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	72.94	.055	111.33	.1

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         72.94  111.33             203.7     205   203.7             .1       .3
```

CROSS SECTION

RIVER: Ryans Creek
REACH: 1   RS: 939

INPUT
Description:

```
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.527.609546  579.2213.77442  577.3518.23405   573.326.50088  571.07
28.84959  571.0931.07133  571.0238.03796   571.941.58479  571.8849.00148  567.46
55.41613  565.2981.58443  563.2186.42336  562.4692.93948  565.07103.2744  566.45
116.2802  566.32 129.809  566.26138.3556  565.72149.9176  565.81155.8341   565.6
164.3529  565.41173.2559  565.16180.8474  564.94187.8239  564.65193.7582  564.36
     500     569

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .155.41613    .055103.2744      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      55.41613103.2744                0       0       0             .1       .3

********************************************************************************
```

SUMMARY OF MANNING'S N VALUES

River:Ryans Creek

Reach	River Sta.	n1	n2	n3	n4	n5
1	3022	.06	.04	.04	.04	.1
1	2772	.06	.04	.04	.04	.1
1	2508	.06	.04	.04	.04	.1
1	2275	.06	.04	.04	.04	.1
1	2040	.06	.04	.04	.04	.1
1	2026	.04	.04	.04	.04	.04
1	1977	.1	.055	.1		
1	1966	.1	.055	.1		
1	1708	.1	.055	.1		
1	1485	.1	.055	.1		
1	1144	.1	.055	.1		
1	939	.1	.055	.1		

```
********************************************************************************
```

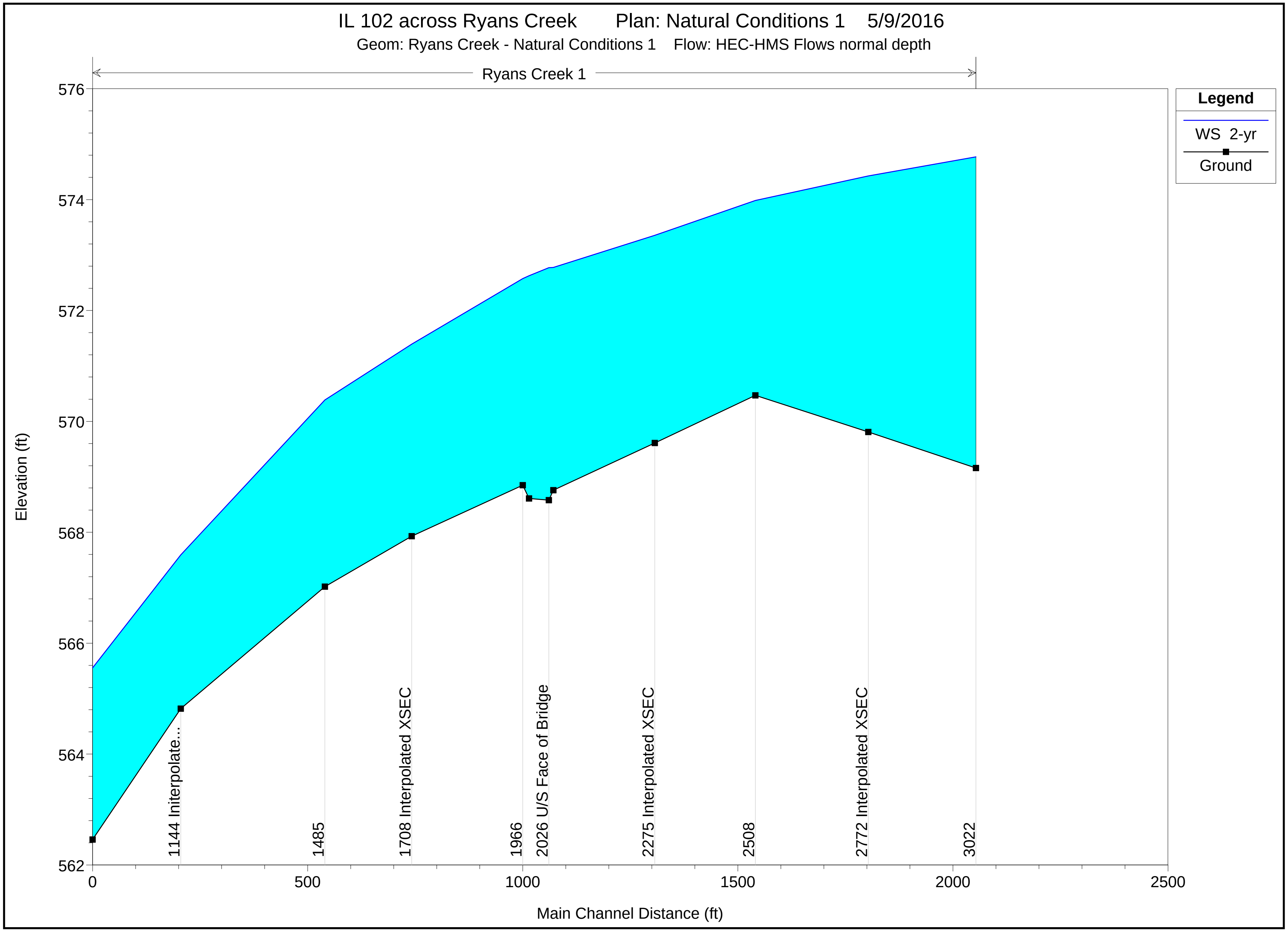
SUMMARY OF REACH LENGTHS

River: Ryans Creek

Reach	River Sta.	Left	Channel	Right
1	3022	242.5	250	248.3
1	2772	279.8	262.7	257.1
1	2508	167.7	233.9	253.1
1	2275	165.4	235.8	269.5
1	2040	7	10.5	7
1	2026	47.7	46	44
1	1977	11	14.5	14
1	1966	289	258	182
1	1708	222	202	202
1	1485	230.3	335	197.7
1	1144	203.7	205	203.7
1	939	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Ryans Creek

Reach	River Sta.	Contr.	Expan.
1	3022	.1	.3
1	2772	.1	.3
1	2508	.1	.3
1	2275	.1	.3
1	2040	.1	.3
1	2026	.1	.3
1	1977	.1	.3
1	1966	.1	.3
1	1708	.1	.3
1	1485	.1	.3
1	1144	.1	.3
1	939	.1	.3


IL 102 across Ryans Creek Plan: Natural Conditions 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 2-yr
Ground
Elevation (ft)
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
Main Channel Distance (ft)
1144 Iinterpolate...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 2-yr

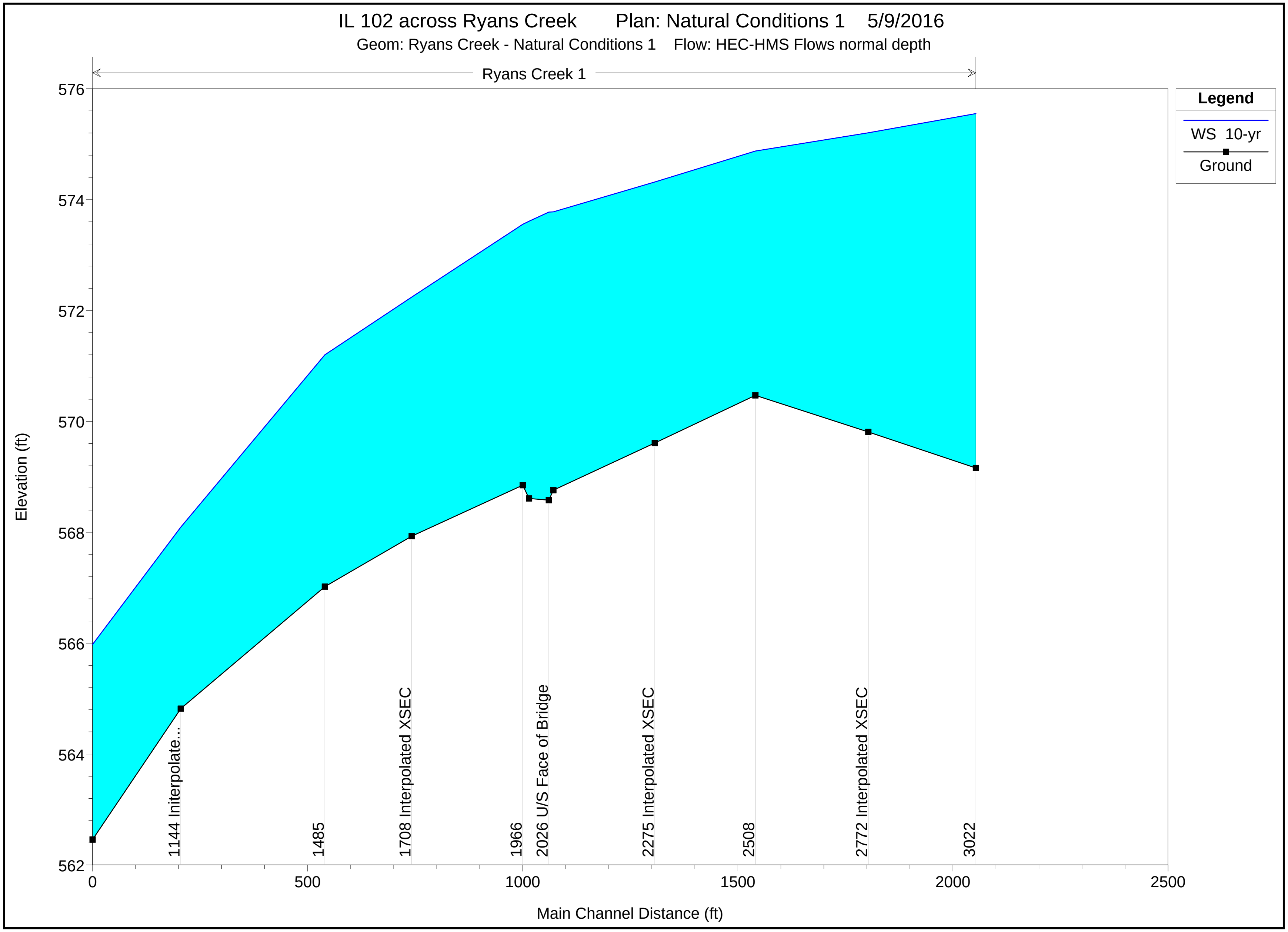
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3022	2-yr	242.00	569.16	574.77	571.52	574.84	0.000656	2.10	115.21	34.17	0.19
1	2772	2-yr	242.00	569.81	574.43		574.57	0.001968	3.02	85.26	71.89	0.33
1	2508	2-yr	242.00	570.47	573.98		574.10	0.001571	2.78	101.67	92.45	0.29
1	2275	2-yr	242.00	569.61	573.36		573.56	0.003680	3.59	67.40	32.42	0.44
1	2040	2-yr	242.00	568.76	572.78		572.91	0.002003	2.93	82.56	33.69	0.33
1	2026	2-yr	242.00	568.58	572.77		572.89	0.001635	2.70	89.78	36.08	0.30
1	1977	2-yr	242.00	568.61	572.63		572.77	0.003996	3.05	79.43	31.88	0.34
1	1966	2-yr	242.00	568.85	572.57		572.71	0.003854	2.96	81.63	33.55	0.33
1	1708	2-yr	242.00	567.93	571.39		571.57	0.005138	3.34	72.48	30.82	0.38
1	1485	2-yr	242.00	567.02	570.39		570.55	0.004910	3.34	89.32	65.19	0.37
1	1144	2-yr	242.00	564.82	567.59		567.91	0.015086	4.50	53.84	35.09	0.63
1	939	2-yr	242.00	562.46	565.56	565.05	565.67	0.007901	3.05	125.39	156.77	0.45

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 2-yr

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	3022	2-yr	574.84	574.77	0.07	0.26	0.01		242.00		34.17
1	2772	2-yr	574.57	574.43	0.14	0.46	0.01	2.80	239.20		71.89
1	2508	2-yr	574.10	573.98	0.11	0.53	0.01	12.82	229.18		92.45
1	2275	2-yr	573.56	573.36	0.20	0.63	0.02		242.00		32.42
1	2040	2-yr	572.91	572.78	0.13	0.02	0.01		242.00		33.69
1	2026	2-yr	572.89	572.77	0.11	0.11	0.00		242.00		36.08
1	1977	2-yr	572.77	572.63	0.14	0.06	0.00		242.00		31.88
1	1966	2-yr	572.71	572.57	0.14	1.14	0.00		242.00		33.55
1	1708	2-yr	571.57	571.39	0.17	1.01	0.00		242.00		30.82
1	1485	2-yr	570.55	570.39	0.16	2.63	0.02		224.21	17.79	65.19
1	1144	2-yr	567.91	567.59	0.31	2.18	0.06		241.97	0.03	35.09
1	939	2-yr	565.67	565.56	0.11			0.03	182.60	59.37	156.77

Errors Warnings and Notes for Plan : NAtural 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2772 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 939 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.



IL 102 across Ryans Creek Plan: Natural Conditions 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 10-yr
Ground
Elevation (ft)
576
574
572
570
568
566
564
562
1144 Iinterpolate...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 10-yr

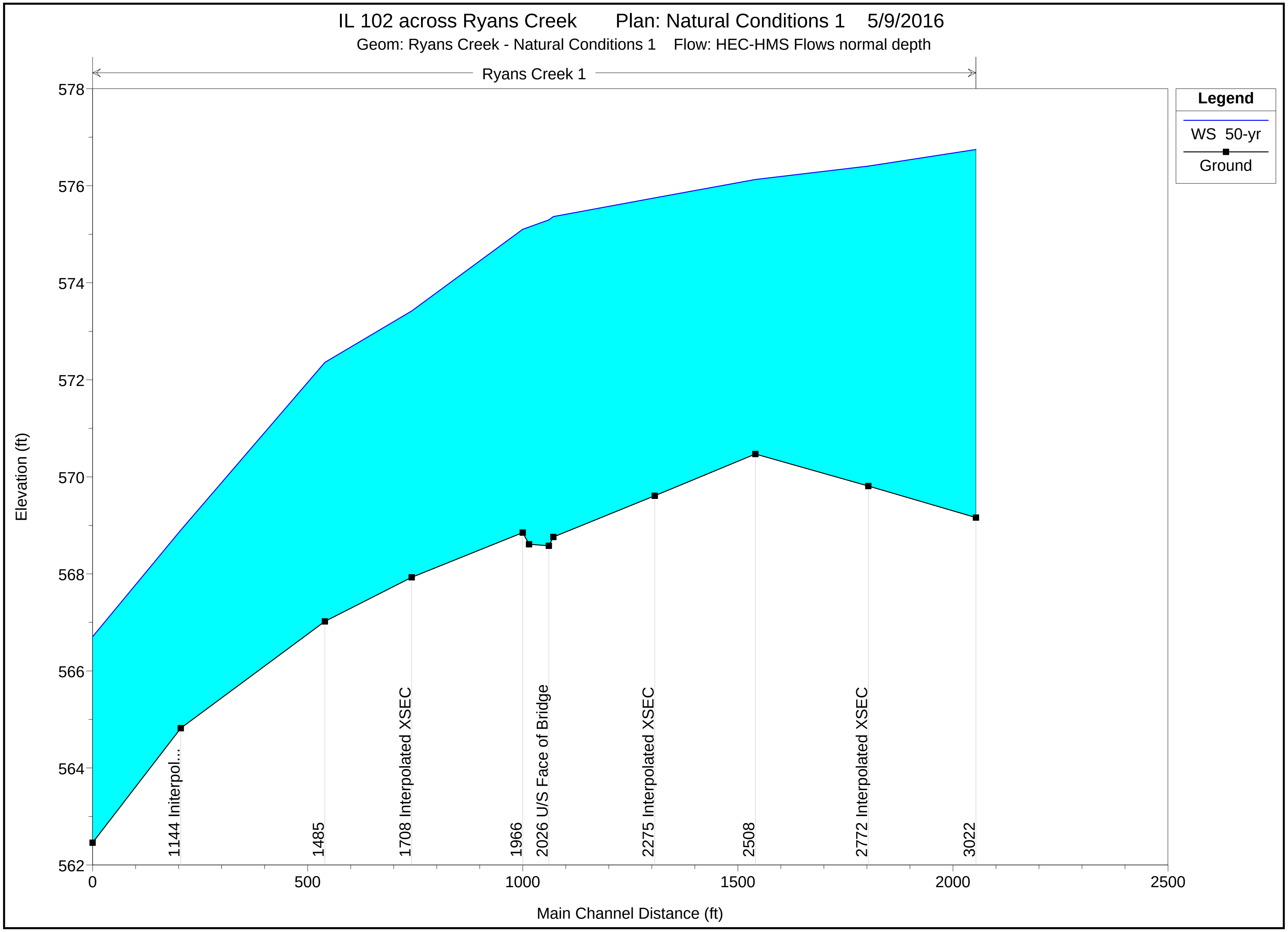
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3022	10-yr	408.00	569.16	575.55	572.23	575.66	0.000923	2.68	183.63	125.83	0.24
1	2772	10-yr	408.00	569.81	575.20		575.34	0.001760	3.24	159.83	107.06	0.32
1	2508	10-yr	408.00	570.47	574.88		574.96	0.001100	2.66	209.16	139.88	0.25
1	2275	10-yr	408.00	569.61	574.32		574.56	0.003087	3.98	111.76	85.84	0.42
1	2040	10-yr	408.00	568.76	573.78		573.95	0.002062	3.36	125.82	61.30	0.35
1	2026	10-yr	408.00	568.58	573.77		573.93	0.001611	3.16	131.57	50.84	0.31
1	1977	10-yr	408.00	568.61	573.61		573.81	0.004418	3.57	114.30	39.02	0.37
1	1966	10-yr	408.00	568.85	573.55		573.74	0.004038	3.48	117.16	38.95	0.35
1	1708	10-yr	408.00	567.93	572.24		572.50	0.005764	4.08	100.44	38.29	0.42
1	1485	10-yr	408.00	567.02	571.20		571.40	0.004977	3.87	157.73	116.41	0.39
1	1144	10-yr	408.00	564.82	568.09	567.66	568.58	0.018348	5.66	77.96	65.09	0.71
1	939	10-yr	408.00	562.46	565.98	565.43	566.11	0.007910	3.46	204.15	212.75	0.46

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 10-yr

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	3022	10-yr	575.66	575.55	0.10	0.31	0.00	28.40	379.60		125.83
1	2772	10-yr	575.34	575.20	0.14	0.37	0.02	72.77	335.23		107.06
1	2508	10-yr	574.96	574.88	0.08	0.39	0.02	115.14	292.86		139.88
1	2275	10-yr	574.56	574.32	0.24	0.59	0.02	9.06	398.94		85.84
1	2040	10-yr	573.95	573.78	0.17	0.02	0.01	3.89	404.10	0.00	61.30
1	2026	10-yr	573.93	573.77	0.15	0.12	0.00	2.07	405.82	0.11	50.84
1	1977	10-yr	573.81	573.61	0.20	0.06	0.00		408.00		39.02
1	1966	10-yr	573.74	573.55	0.19	1.23	0.01		408.00		38.95
1	1708	10-yr	572.50	572.24	0.26	1.08	0.02		407.90	0.10	38.29
1	1485	10-yr	571.40	571.20	0.20	2.79	0.03	0.01	348.04	59.95	116.41
1	1144	10-yr	568.58	568.09	0.49	2.36	0.11		402.73	5.27	65.09
1	939	10-yr	566.11	565.98	0.13			0.44	270.24	137.32	212.75

Errors Warnings and Notes for Plan : NAtural 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 10-yr
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: Ryans Creek Reach: 1 RS: 2275 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 10-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 10-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 10-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 10-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 939 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.


IL 102 across Ryans Creek Plan: Natural Conditions 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 50-yr
Ground
Elevation (ft)
578
576
574
572
570
568
566
564
562
1144 Interpol...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 50-yr

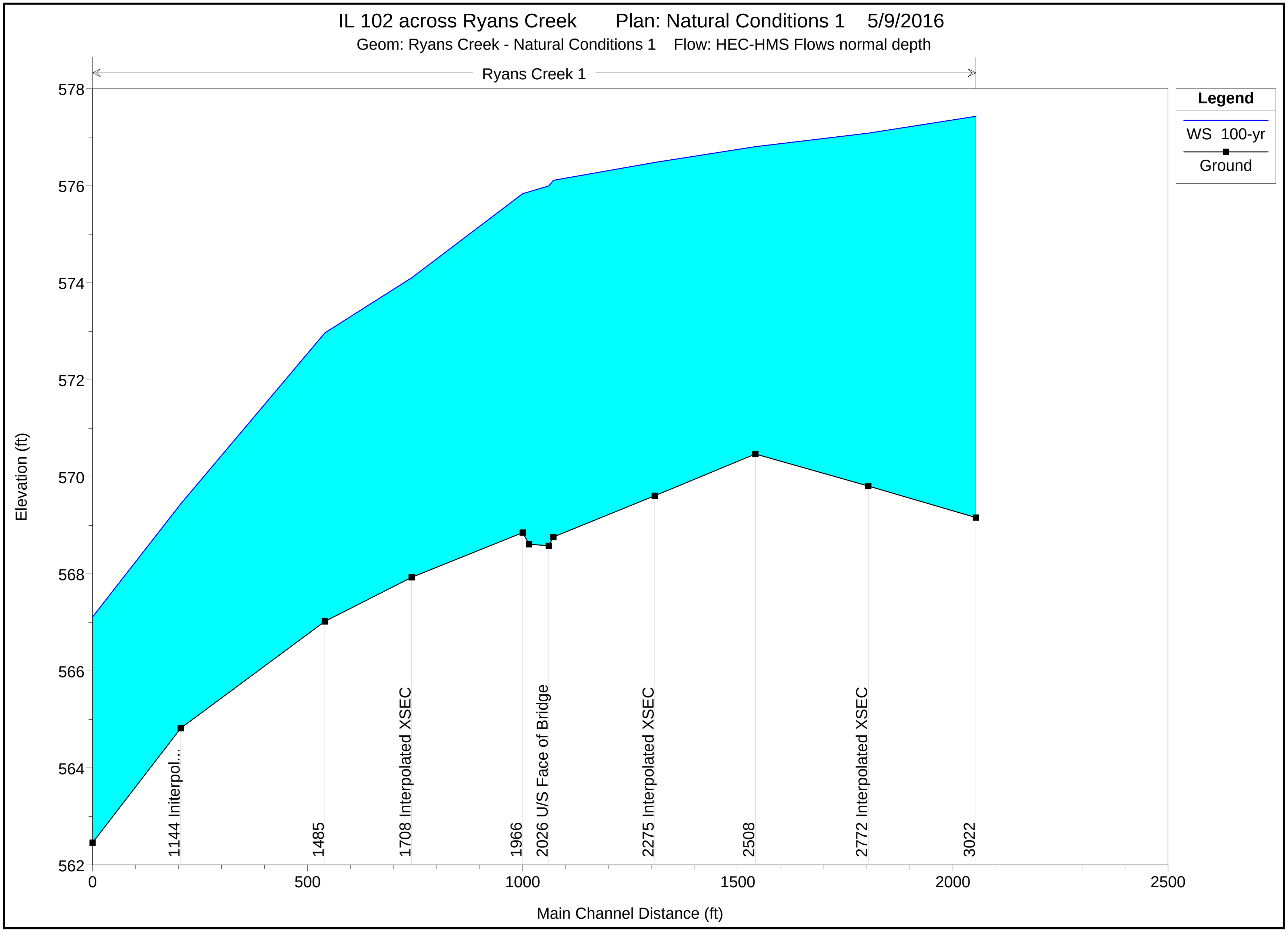
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3022	50-yr	866.00	569.16	576.75	573.71	576.86	0.000902	3.10	393.43	192.02	0.24
1	2772	50-yr	866.00	569.81	576.40		576.56	0.001626	3.66	309.04	147.59	0.32
1	2508	50-yr	866.00	570.47	576.13		576.22	0.000913	2.88	405.15	174.39	0.24
1	2275	50-yr	866.00	569.61	575.75		575.94	0.001935	3.98	299.74	174.04	0.35
1	2040	50-yr	866.00	568.76	575.36		575.56	0.001518	3.84	291.64	149.30	0.32
1	2026	50-yr	866.00	568.58	575.30		575.54	0.001629	4.12	246.44	108.82	0.33
1	1977	50-yr	866.00	568.61	575.15		575.42	0.004032	4.41	280.84	179.35	0.37
1	1966	50-yr	866.00	568.85	575.10		575.36	0.003782	4.30	292.43	190.19	0.36
1	1708	50-yr	866.00	567.93	573.42	571.98	573.95	0.008139	5.95	177.47	132.58	0.52
1	1485	50-yr	866.00	567.02	572.36		572.61	0.004928	4.75	307.67	134.73	0.41
1	1144	50-yr	866.00	564.82	568.90	568.90	569.73	0.022817	7.68	151.55	117.92	0.83
1	939	50-yr	866.00	562.46	566.70	566.05	566.87	0.007907	4.19	390.77	297.29	0.48

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 50-yr

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	3022	50-yr	576.86	576.75	0.11	0.29	0.00	237.78	572.91	55.31	192.02
1	2772	50-yr	576.56	576.40	0.15	0.32	0.02	332.59	527.80	5.60	147.59
1	2508	50-yr	576.22	576.13	0.09	0.27	0.01	426.13	436.67	3.20	174.39
1	2275	50-yr	575.94	575.75	0.19	0.38	0.00	241.20	610.19	14.61	174.04
1	2040	50-yr	575.56	575.36	0.19	0.02	0.00	117.08	712.90	36.02	149.30
1	2026	50-yr	575.54	575.30	0.24	0.11	0.00	45.67	782.31	38.02	108.82
1	1977	50-yr	575.42	575.15	0.27	0.06	0.00	74.14	781.72	10.14	179.35
1	1966	50-yr	575.36	575.10	0.26	1.38	0.03	77.24	778.16	10.60	190.19
1	1708	50-yr	573.95	573.42	0.53	1.26	0.09	6.83	840.86	18.31	132.58
1	1485	50-yr	572.61	572.36	0.25	2.81	0.06	2.67	586.88	276.45	134.73
1	1144	50-yr	569.73	568.90	0.83	2.56	0.20	1.06	780.30	84.63	117.92
1	939	50-yr	566.87	566.70	0.16			2.99	468.69	394.31	297.29

Errors Warnings and Notes for Plan : NAtural 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 50-yr
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: Ryans Creek Reach: 1 RS: 2275 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 50-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 50-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 50-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 50-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.


IL 102 across Ryans Creek Plan: Natural Conditions 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 100-yr
Ground
Elevation (ft)
578
576
574
572
570
568
566
564
562
1144 Interpol...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 100-yr

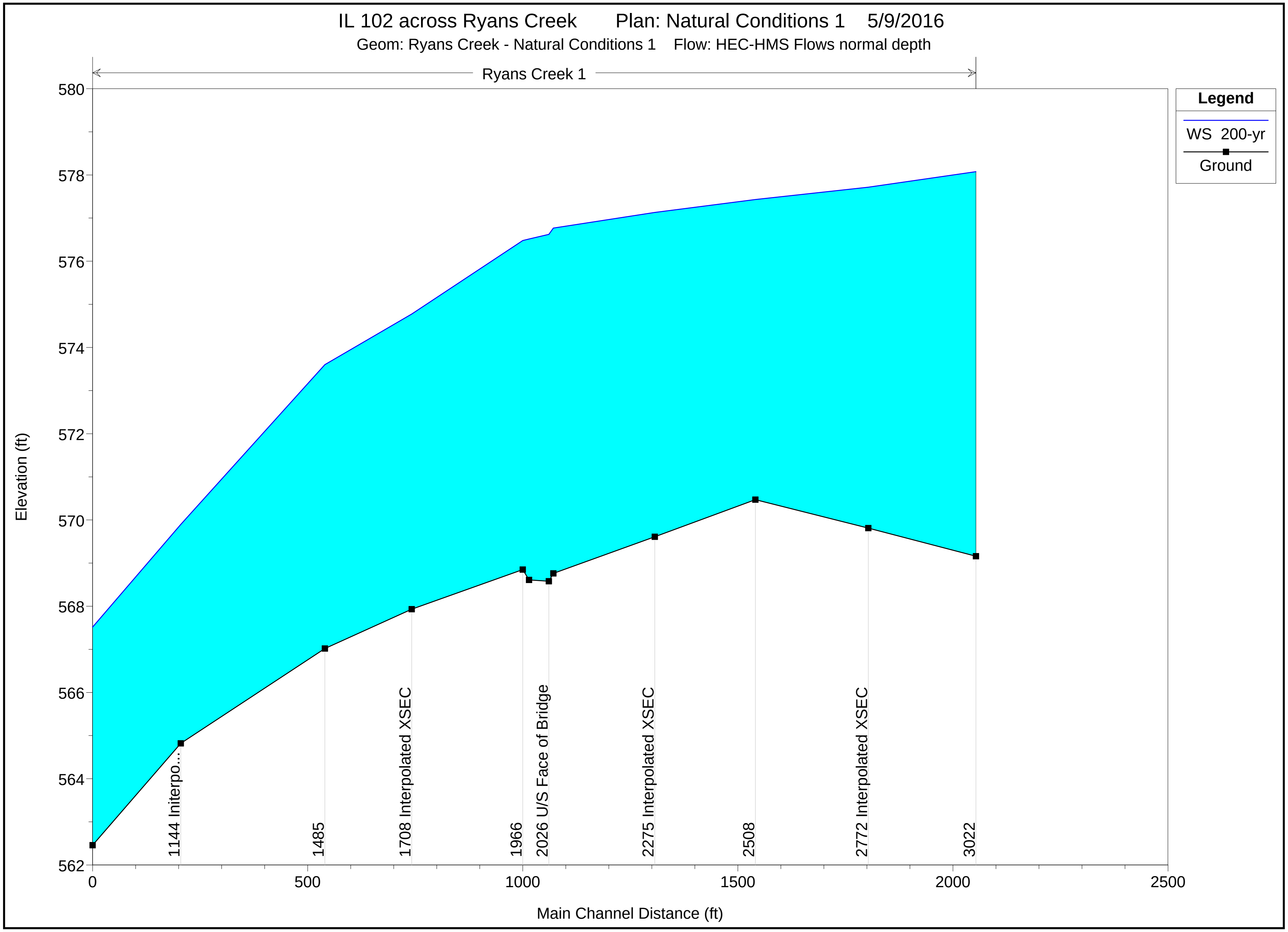
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3022	100-yr	1250.00	569.16	577.43	574.79	577.55	0.000873	3.32	528.19	200.86	0.24
1	2772	100-yr	1250.00	569.81	577.09		577.26	0.001624	3.95	417.50	172.25	0.32
1	2508	100-yr	1250.00	570.47	576.80		576.91	0.000942	3.15	530.91	198.49	0.25
1	2275	100-yr	1250.00	569.61	576.48		576.65	0.001616	4.01	439.07	205.20	0.33
1	2040	100-yr	1250.00	568.76	576.11		576.32	0.001447	4.16	419.89	193.20	0.32
1	2026	100-yr	1250.00	568.58	576.00		576.29	0.001783	4.73	336.51	148.74	0.36
1	1977	100-yr	1250.00	568.61	575.88		576.17	0.003984	4.86	431.45	234.35	0.38
1	1966	100-yr	1250.00	568.85	575.84		576.11	0.003677	4.70	450.62	238.33	0.37
1	1708	100-yr	1250.00	567.93	574.10		574.72	0.008353	6.69	278.68	161.90	0.54
1	1485	100-yr	1250.00	567.02	572.97		573.28	0.005473	5.48	390.89	138.68	0.44
1	1144	100-yr	1250.00	564.82	569.45	569.45	570.36	0.021237	8.39	218.32	125.14	0.83
1	939	100-yr	1250.00	562.46	567.11	566.30	567.30	0.007912	4.66	517.71	325.40	0.50

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 100-yr

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	3022	100-yr	577.55	577.43	0.12	0.29	0.01	419.62	695.39	134.99	200.86
1	2772	100-yr	577.26	577.09	0.17	0.33	0.02	553.98	666.16	29.85	172.25
1	2508	100-yr	576.91	576.80	0.10	0.25	0.01	685.44	552.03	12.53	198.49
1	2275	100-yr	576.65	576.48	0.17	0.33	0.00	475.63	728.39	45.99	205.20
1	2040	100-yr	576.32	576.11	0.21	0.02	0.01	253.00	899.06	97.93	193.20
1	2026	100-yr	576.29	576.00	0.30	0.12	0.00	120.24	1031.75	98.02	148.74
1	1977	100-yr	576.17	575.88	0.30	0.05	0.01	190.03	1008.06	51.92	234.35
1	1966	100-yr	576.11	575.84	0.28	1.36	0.03	200.36	995.72	53.92	238.33
1	1708	100-yr	574.72	574.10	0.62	1.35	0.09	29.52	1107.64	112.84	161.90
1	1485	100-yr	573.28	572.97	0.31	2.86	0.06	7.84	772.21	469.94	138.68
1	1144	100-yr	570.36	569.45	0.91	2.50	0.22	4.51	1027.69	217.80	125.14
1	939	100-yr	567.30	567.11	0.19			5.88	612.91	631.21	325.40

Errors Warnings and Notes for Plan : NAtural 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 100-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 100-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 100-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 100-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.


IL 102 across Ryans Creek Plan: Natural Conditions 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 200-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1144 Initerpo...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 200-yr

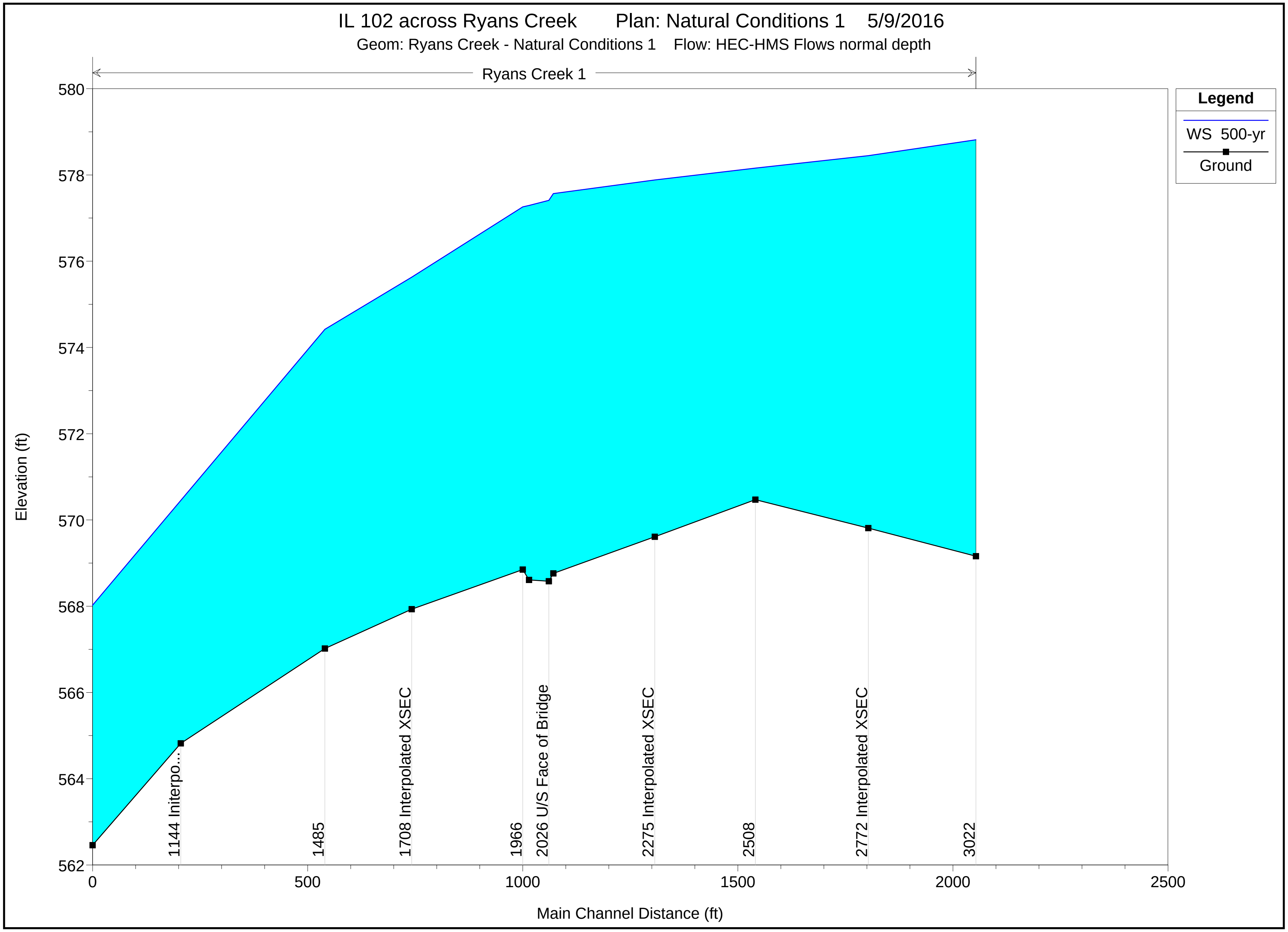
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3022	200-yr	1700.00	569.16	578.08	576.22	578.21	0.000871	3.56	660.06	208.24	0.25
1	2772	200-yr	1700.00	569.81	577.72		577.91	0.001652	4.34	536.87	203.01	0.33
1	2508	200-yr	1700.00	570.47	577.43		577.55	0.000982	3.43	662.03	219.80	0.26
1	2275	200-yr	1700.00	569.61	577.13		577.31	0.001463	4.16	580.49	230.05	0.32
1	2040	200-yr	1700.00	568.76	576.77		576.99	0.001443	4.49	561.48	242.97	0.33
1	2026	200-yr	1700.00	568.58	576.62		576.96	0.001901	5.25	444.56	201.07	0.38
1	1977	200-yr	1700.00	568.61	576.51		576.83	0.003985	5.26	589.38	259.98	0.39
1	1966	200-yr	1700.00	568.85	576.48		576.77	0.003676	5.09	613.77	266.13	0.38
1	1708	200-yr	1700.00	567.93	574.77		575.42	0.008010	7.16	394.01	179.18	0.55
1	1485	200-yr	1700.00	567.02	573.60		573.97	0.005777	6.10	479.74	141.86	0.46
1	1144	200-yr	1700.00	564.82	569.90	569.90	570.97	0.022049	9.34	275.51	128.58	0.86
1	939	200-yr	1700.00	562.46	567.52	566.69	567.73	0.007903	5.11	654.56	353.14	0.51

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 200-yr

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	3022	200-yr	578.21	578.08	0.13	0.29	0.01	631.79	828.23	239.98	208.24
1	2772	200-yr	577.91	577.72	0.19	0.34	0.02	795.73	830.74	73.53	203.01
1	2508	200-yr	577.55	577.43	0.12	0.24	0.01	992.84	675.14	32.02	219.80
1	2275	200-yr	577.31	577.13	0.18	0.31	0.00	745.86	861.98	92.17	230.05
1	2040	200-yr	576.99	576.77	0.22	0.02	0.01	419.29	1091.84	188.87	242.97
1	2026	200-yr	576.96	576.62	0.34	0.12	0.01	235.06	1278.51	186.43	201.07
1	1977	200-yr	576.83	576.51	0.32	0.05	0.01	334.32	1230.85	134.83	259.98
1	1966	200-yr	576.77	576.48	0.30	1.32	0.03	351.34	1214.12	134.55	266.13
1	1708	200-yr	575.42	574.77	0.64	1.37	0.08	67.36	1355.61	277.03	179.18
1	1485	200-yr	573.97	573.60	0.37	2.93	0.07	17.50	972.39	710.11	141.86
1	1144	200-yr	570.97	569.90	1.07	2.53	0.26	10.30	1305.34	384.35	128.58
1	939	200-yr	567.73	567.52	0.21			10.08	769.77	920.16	353.14

Errors Warnings and Notes for Plan : NAtural 1

Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 200-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 200-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 200-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.



IL 102 across Ryans Creek Plan: Natural Conditions 1 5/9/2016
Geom: Ryans Creek - Natural Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2026 U/S Face of Bridge
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 500-yr

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	3022	500-yr	2375.00	569.16	578.82	576.69	578.97	0.000925	3.94	817.25	216.70	0.26
1	2772	500-yr	2375.00	569.81	578.45		578.67	0.001636	4.71	693.54	225.02	0.34
1	2508	500-yr	2375.00	570.47	578.16		578.30	0.001010	3.71	826.14	229.96	0.26
1	2275	500-yr	2375.00	569.61	577.88		578.07	0.001325	4.33	756.82	237.71	0.31
1	2040	500-yr	2375.00	568.76	577.57		577.79	0.001330	4.69	780.44	297.00	0.32
1	2026	500-yr	2375.00	568.58	577.41		577.76	0.001832	5.59	628.44	257.94	0.38
1	1977	500-yr	2375.00	568.61	577.29		577.64	0.004003	5.75	804.38	293.11	0.40
1	1966	500-yr	2375.00	568.85	577.26		577.58	0.003684	5.55	831.45	292.41	0.38
1	1708	500-yr	2375.00	567.93	575.63		576.28	0.007413	7.61	554.75	195.02	0.54
1	1485	500-yr	2375.00	567.02	574.42		574.86	0.006074	6.86	597.66	145.91	0.48
1	1144	500-yr	2375.00	564.82	570.45	570.45	571.75	0.023372	10.57	347.83	132.31	0.91
1	939	500-yr	2375.00	562.46	568.03	567.03	568.27	0.007912	5.65	843.21	387.61	0.52

HEC-RAS Plan: NAtural 1 River: Ryans Creek Reach: 1 Profile: 500-yr

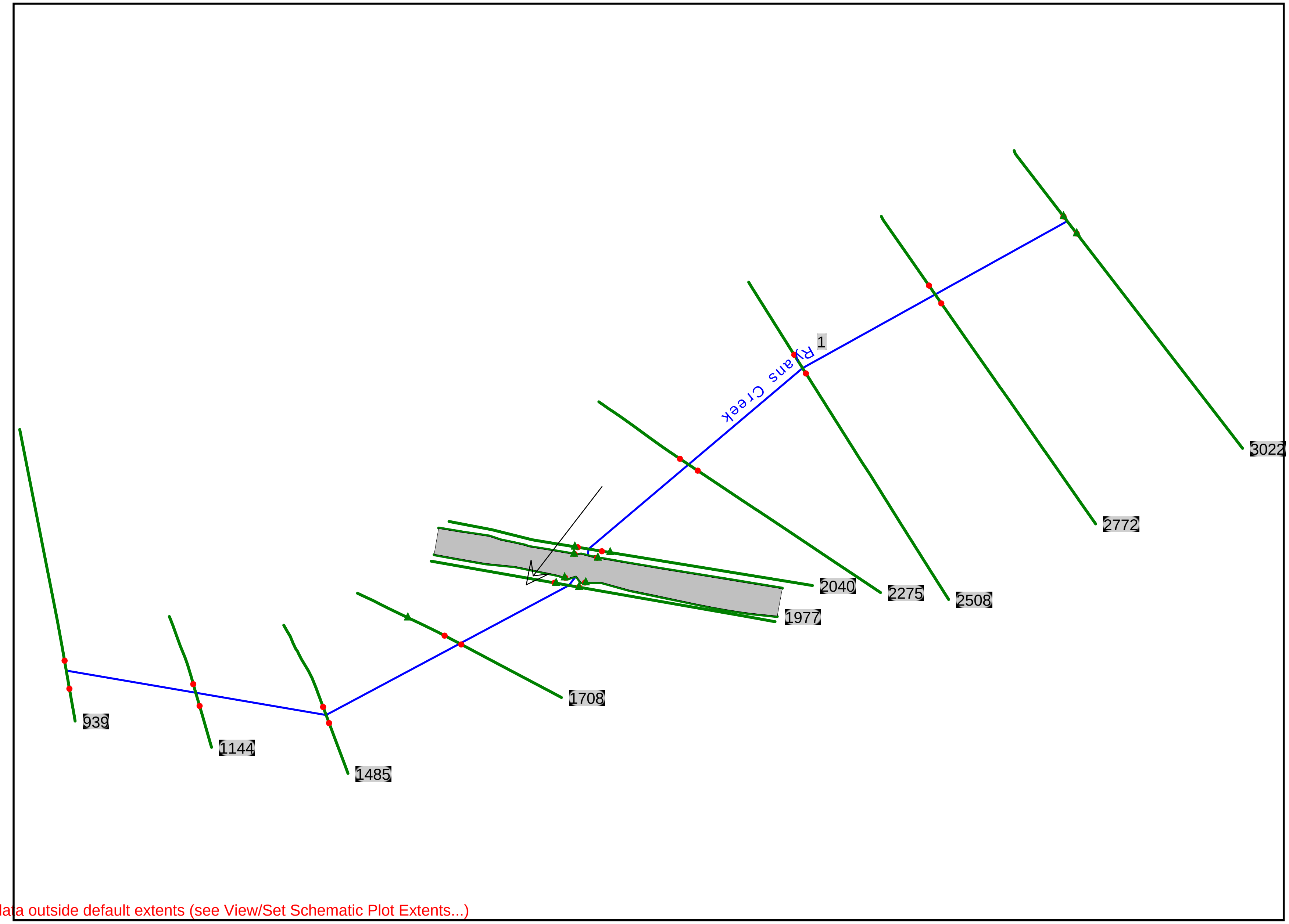
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	500-yr	578.97	578.82	0.16	0.30	0.01	946.34	1023.09	405.57	216.70
1	2772	500-yr	578.67	578.45	0.22	0.34	0.02	1195.61	1028.46	150.93	225.02
1	2508	500-yr	578.30	578.16	0.14	0.23	0.00	1478.73	827.09	69.18	229.96
1	2275	500-yr	578.07	577.88	0.19	0.28	0.00	1183.55	1024.01	167.44	237.71
1	2040	500-yr	577.79	577.57	0.22	0.01	0.01	727.93	1295.22	351.86	297.00
1	2026	500-yr	577.76	577.41	0.35	0.12	0.00	483.83	1540.42	350.75	257.94
1	1977	500-yr	577.64	577.29	0.34	0.05	0.01	562.81	1529.08	283.10	293.11
1	1966	500-yr	577.58	577.26	0.32	1.26	0.03	584.70	1505.12	285.18	292.41
1	1708	500-yr	576.28	575.63	0.65	1.36	0.06	139.80	1669.97	565.23	195.02
1	1485	500-yr	574.86	574.42	0.44	3.02	0.09	36.32	1256.27	1082.41	145.91
1	1144	500-yr	571.75	570.45	1.30	2.59	0.32	22.59	1702.11	650.30	132.31
1	939	500-yr	568.27	568.03	0.25			17.77	988.81	1368.43	387.61

Errors Warnings and Notes for Plan : NAtural 1

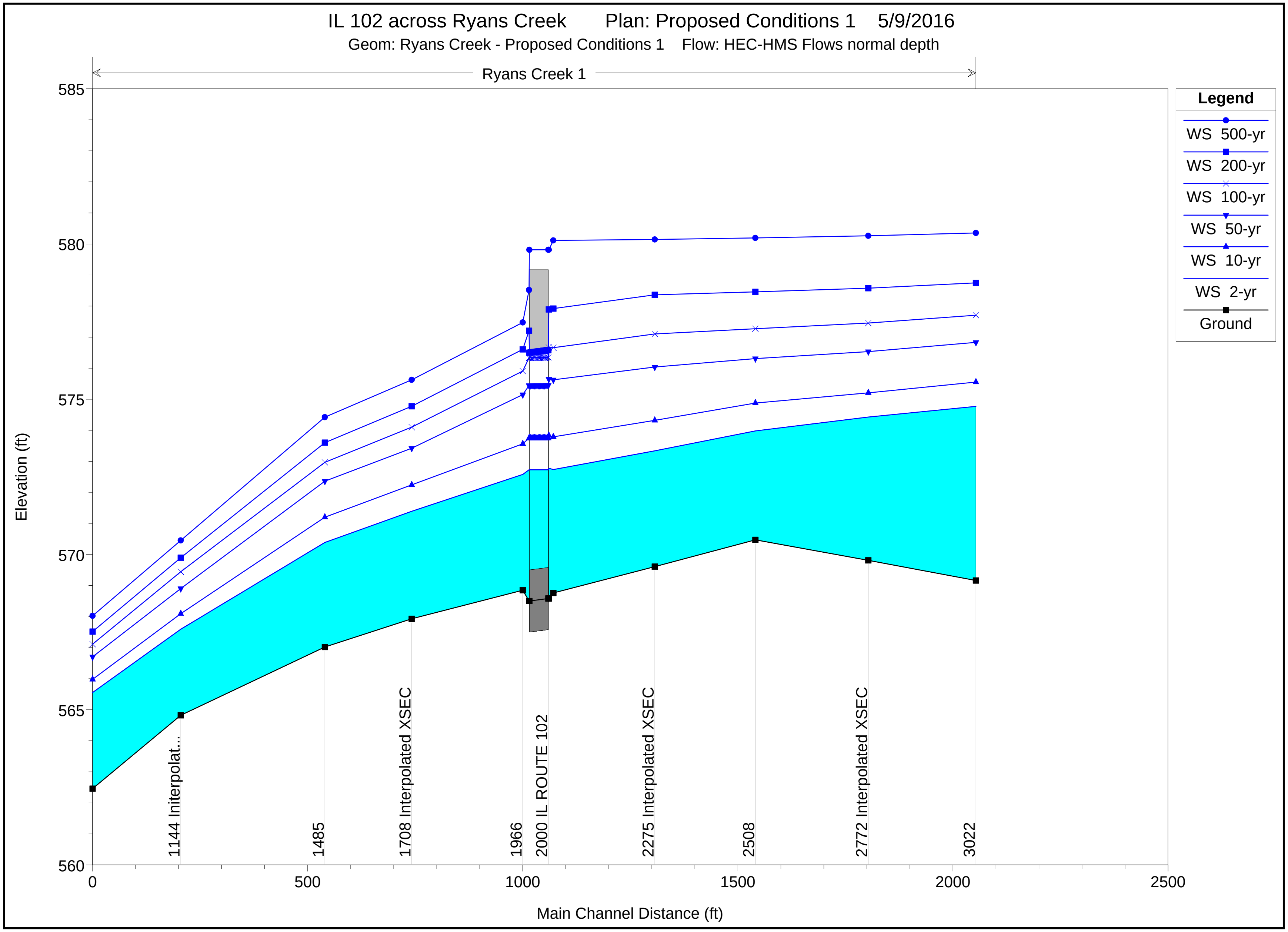
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 500-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 500-yr
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
	greater than 1.4. 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: Ryans Creek Reach: 1 RS: 1966 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 500-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.

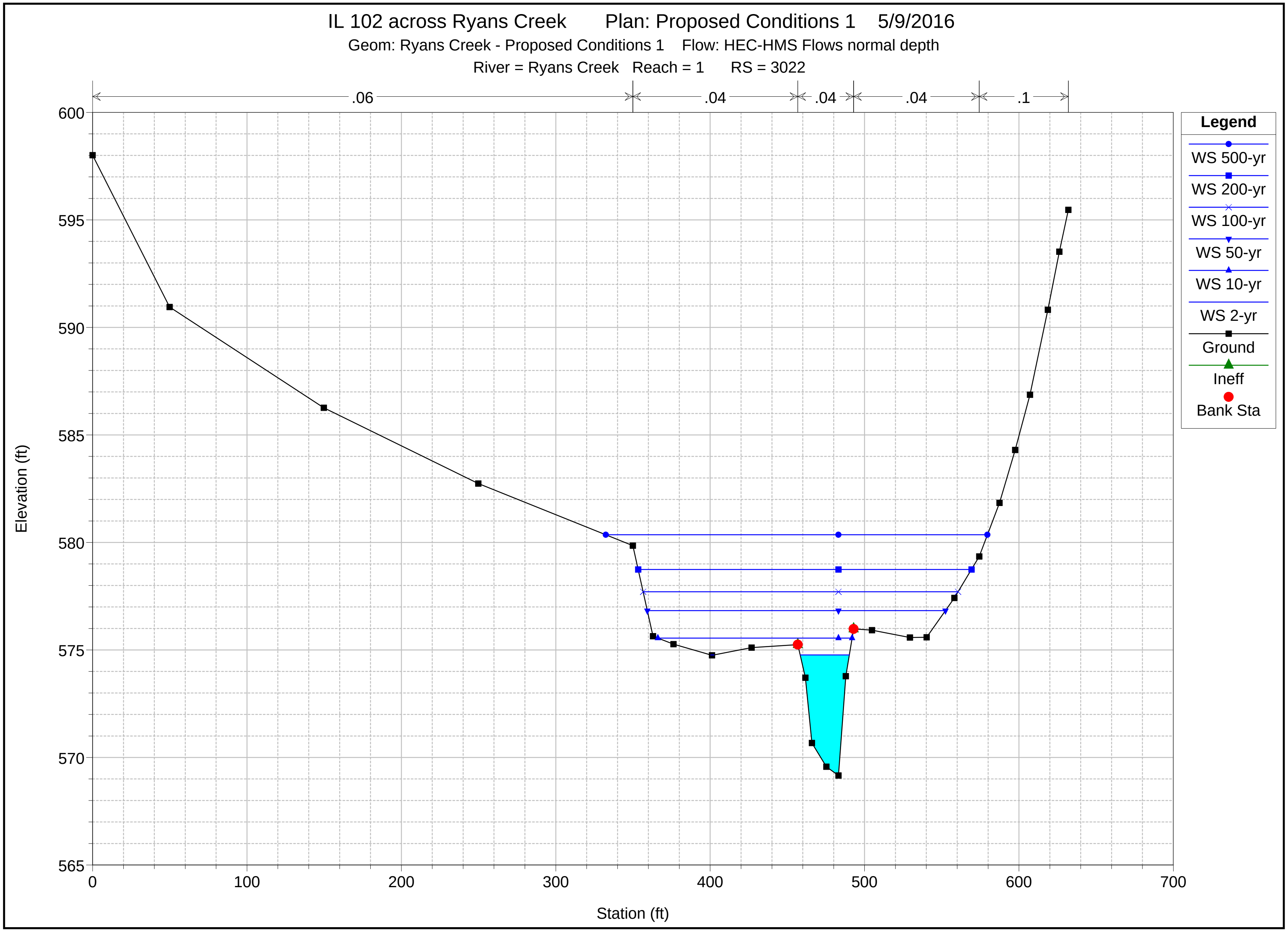
HEC-RAS

PROPOSED CONDITIONS MODEL

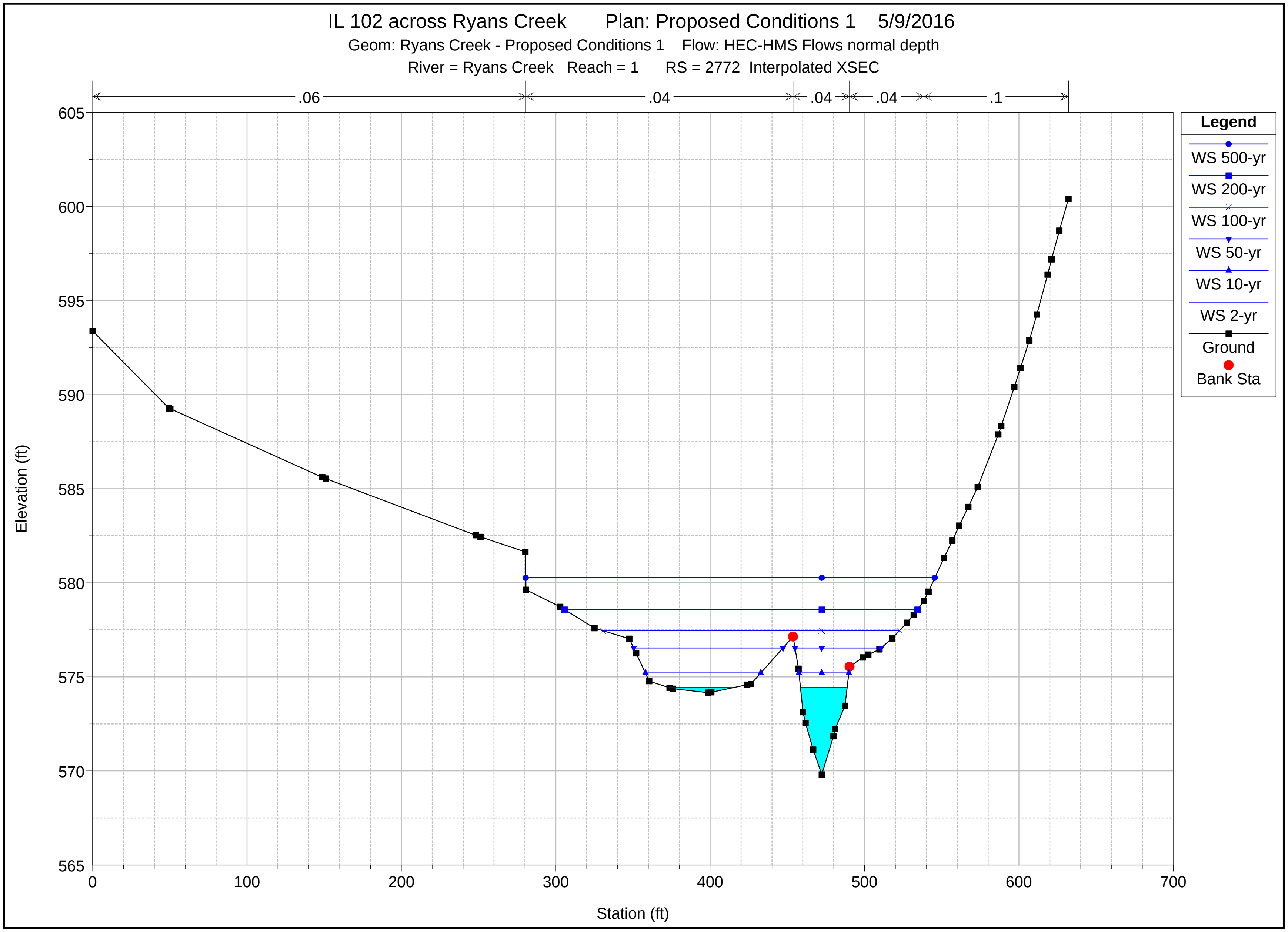


Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

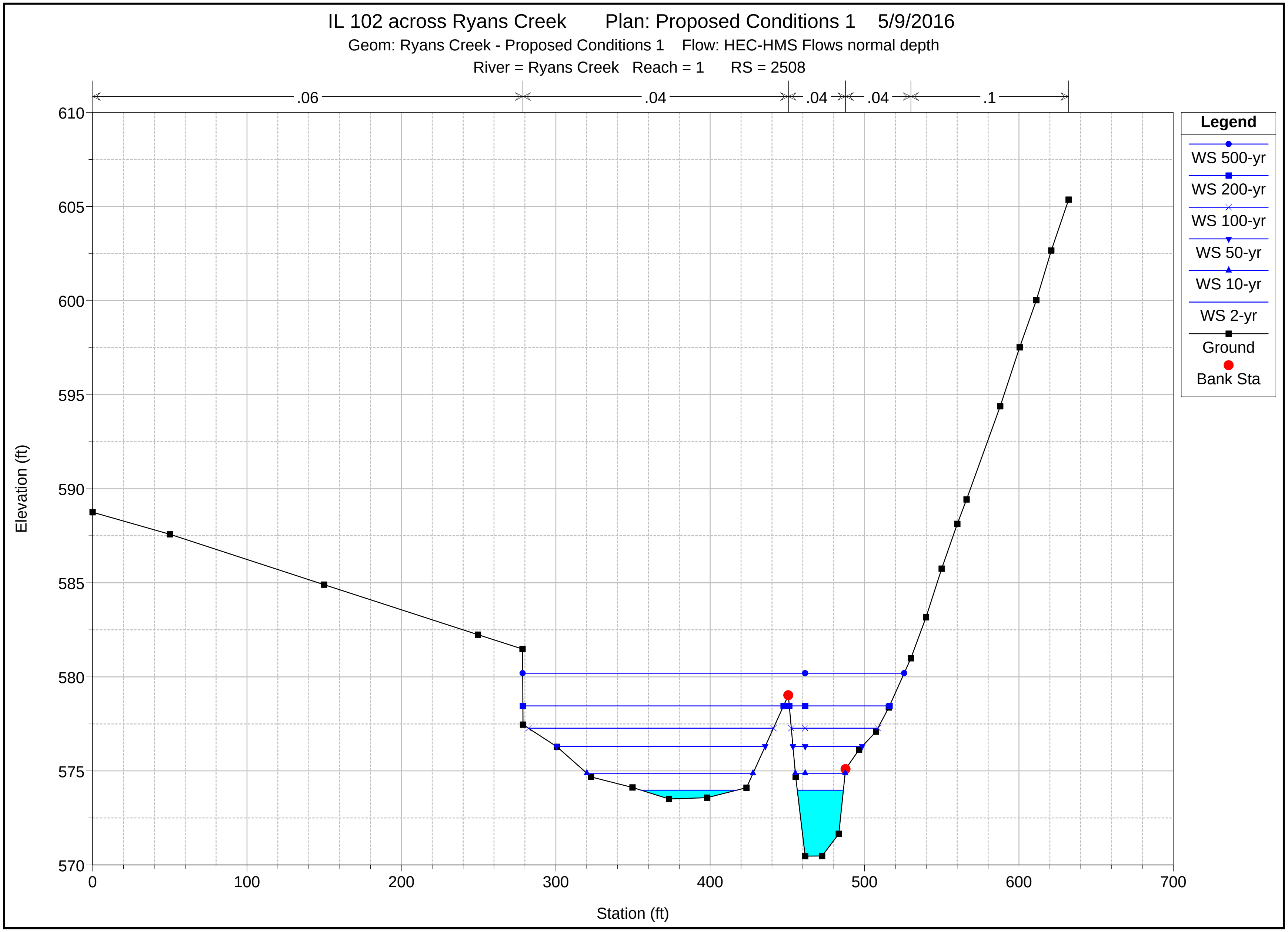

IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
585
580
575
570
565
560
0
500
1000
1500
2000
2500
1144 Interpolat...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

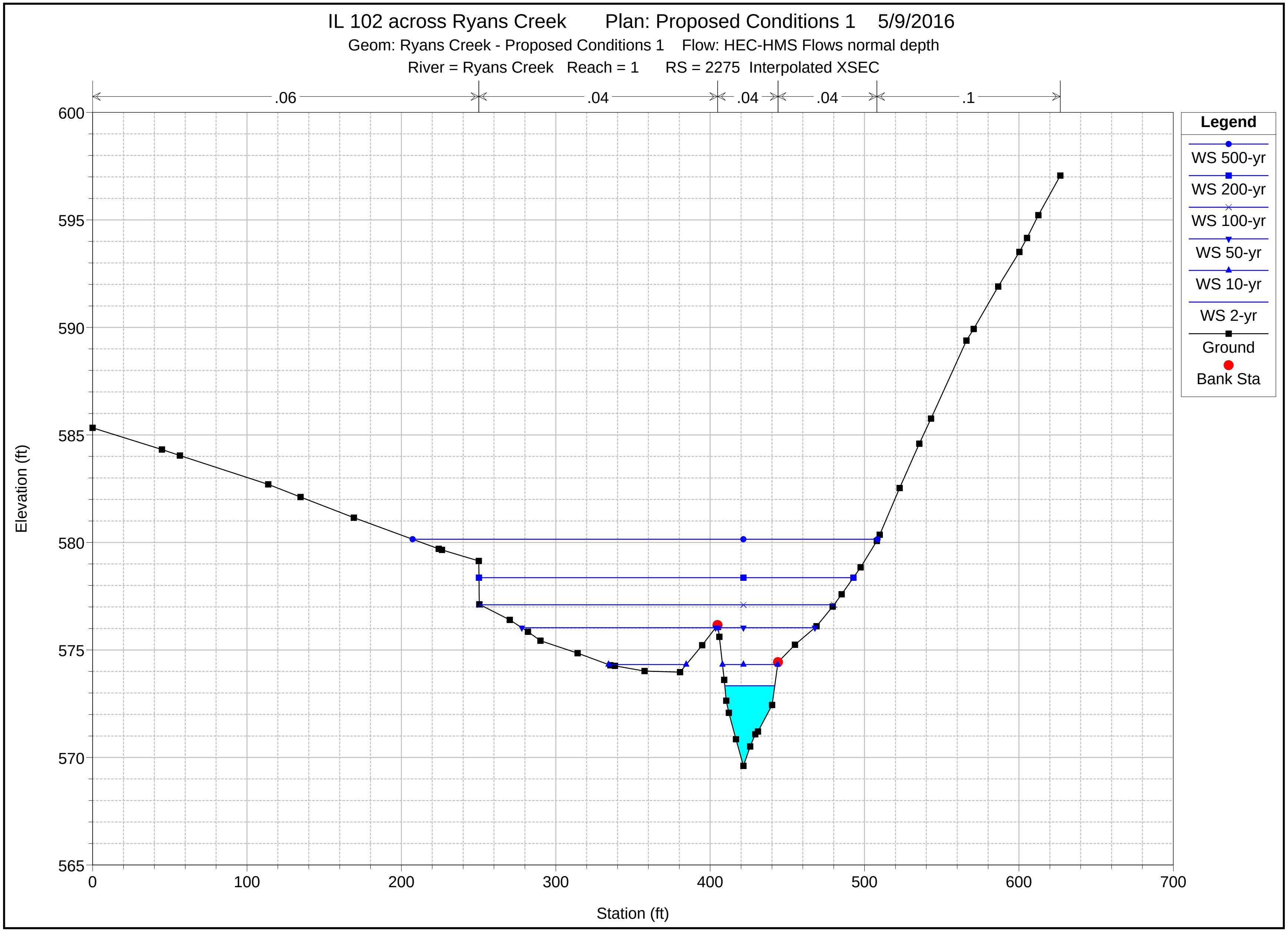


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 3022
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700

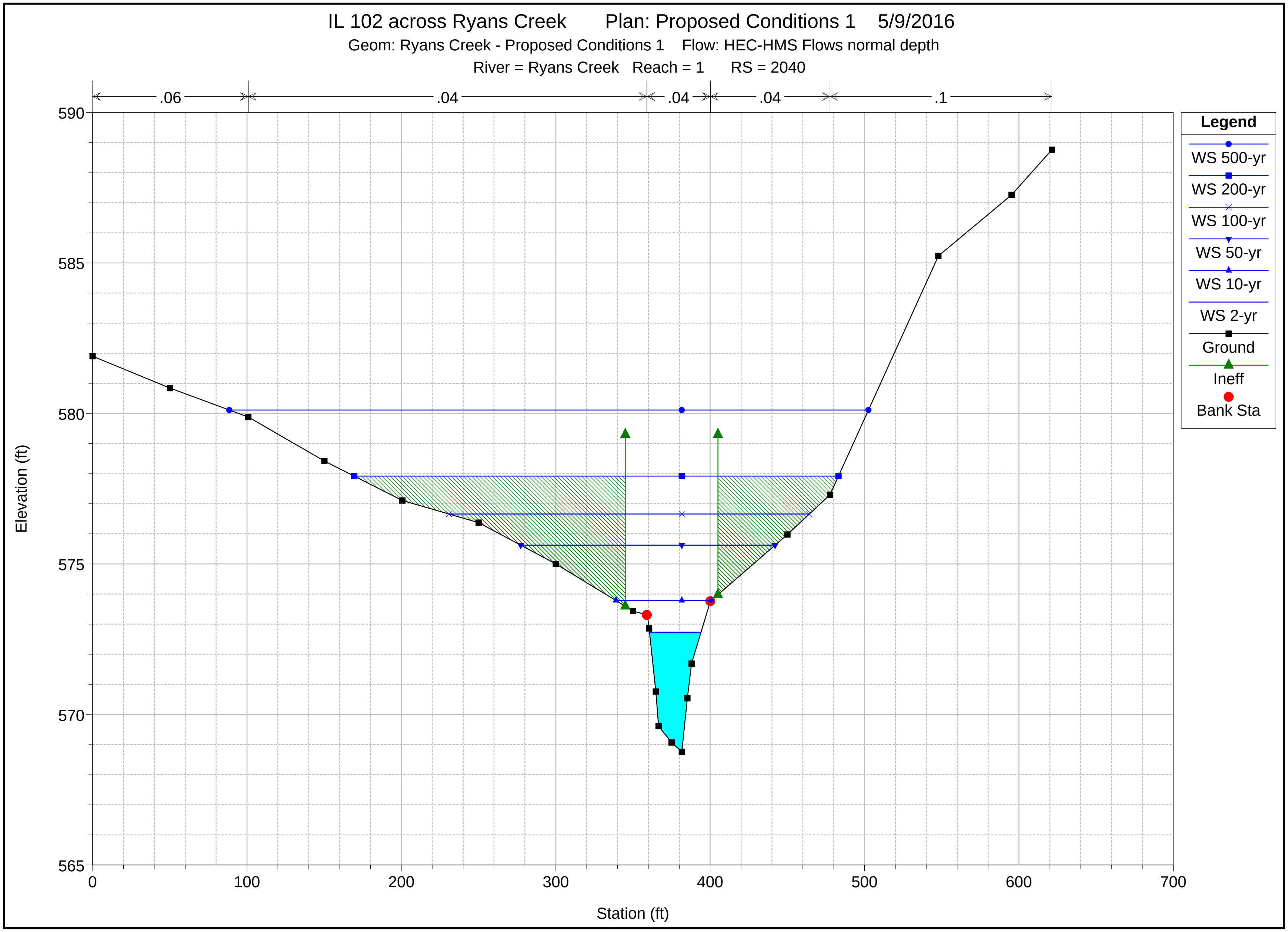


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2772 Interpolated XSEC
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
605
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)

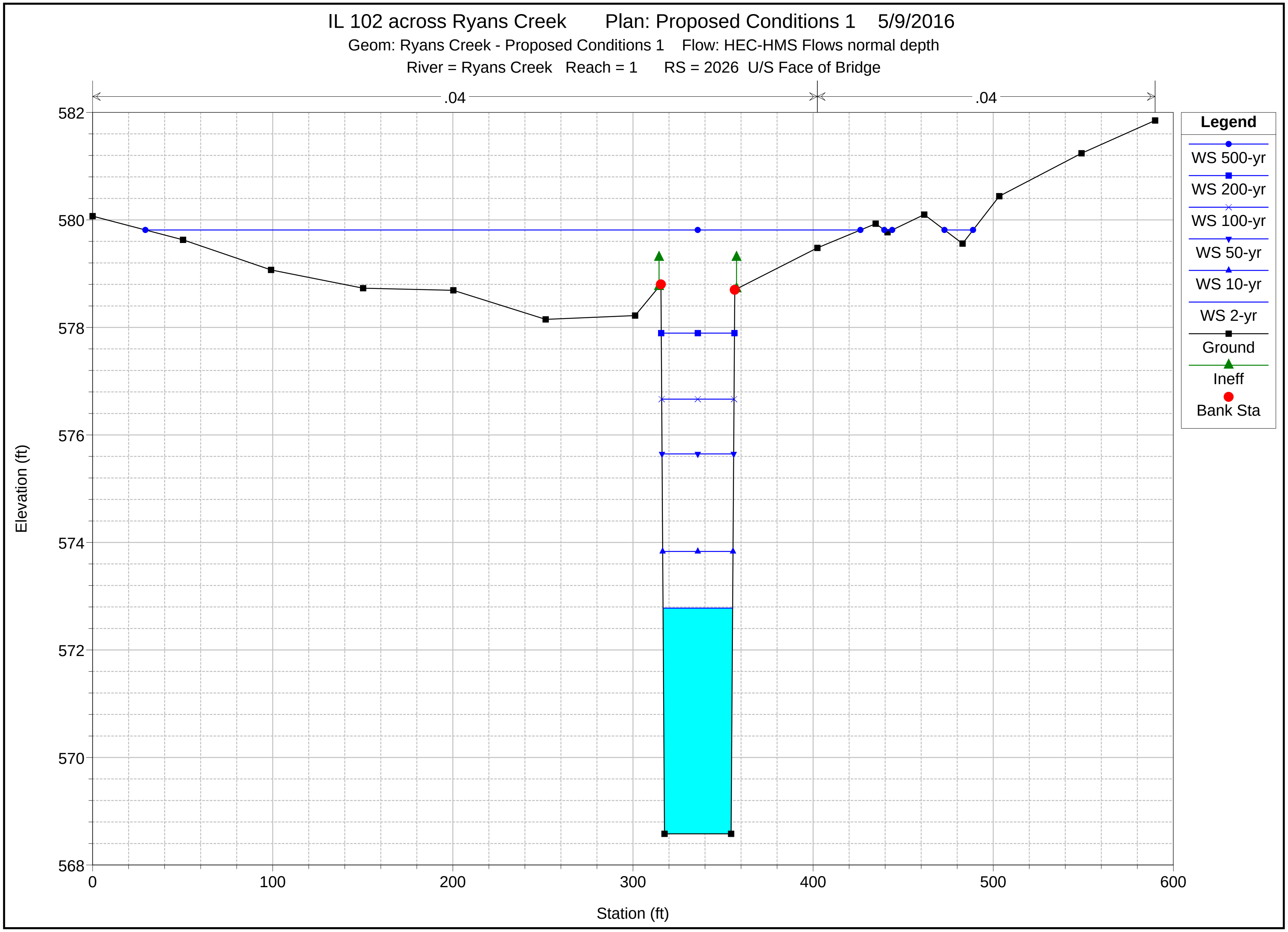

IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2508
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
610
605
600
595
590
585
580
575
570
0
100
200
300
400
500
600
700



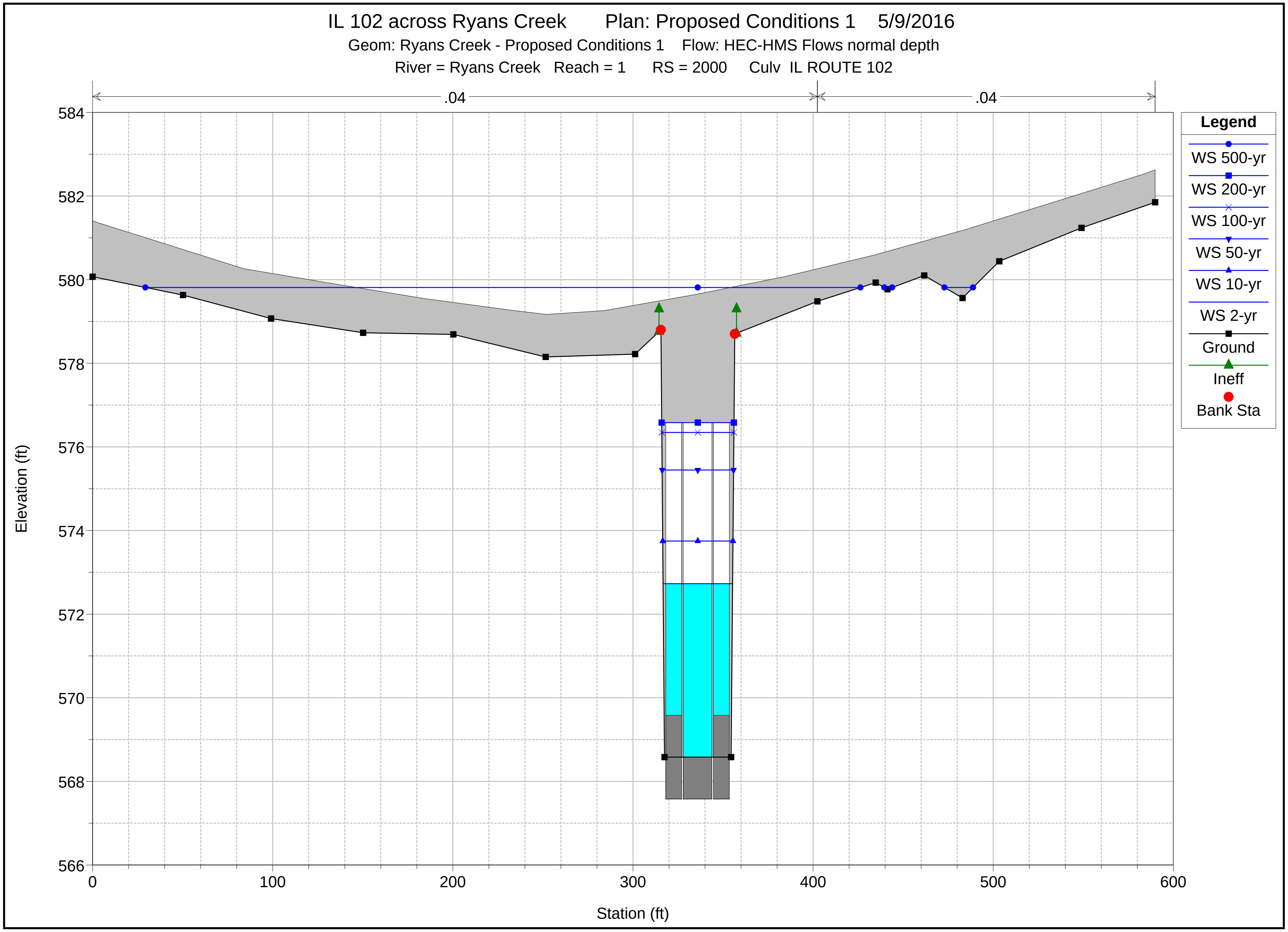
IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2275 Interpolated XSEC
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
600
595
590
585
580
575
570
565
0
100
200
300
400
500
600
700



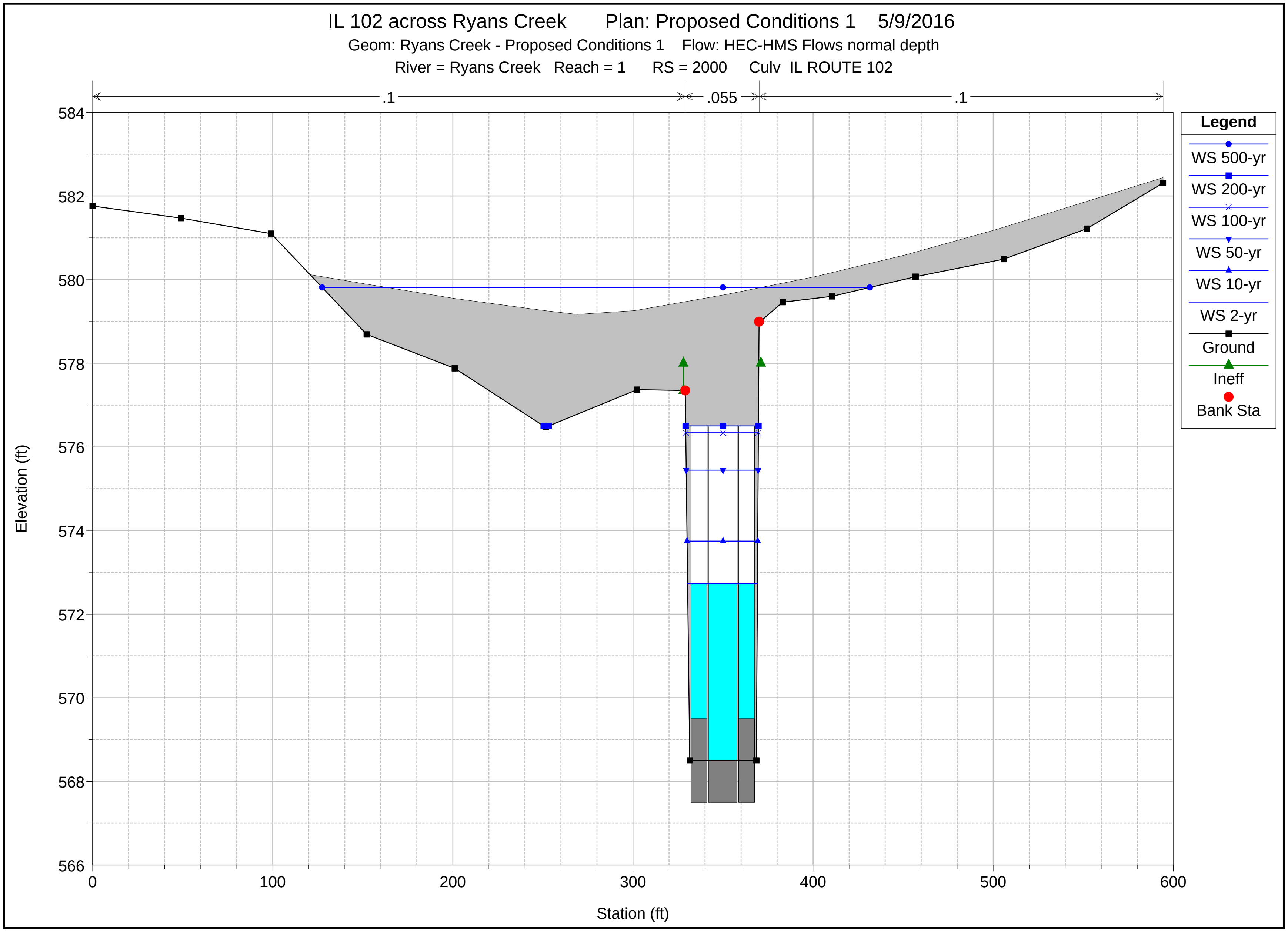
IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2040
.06
.04
.04
.04
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)



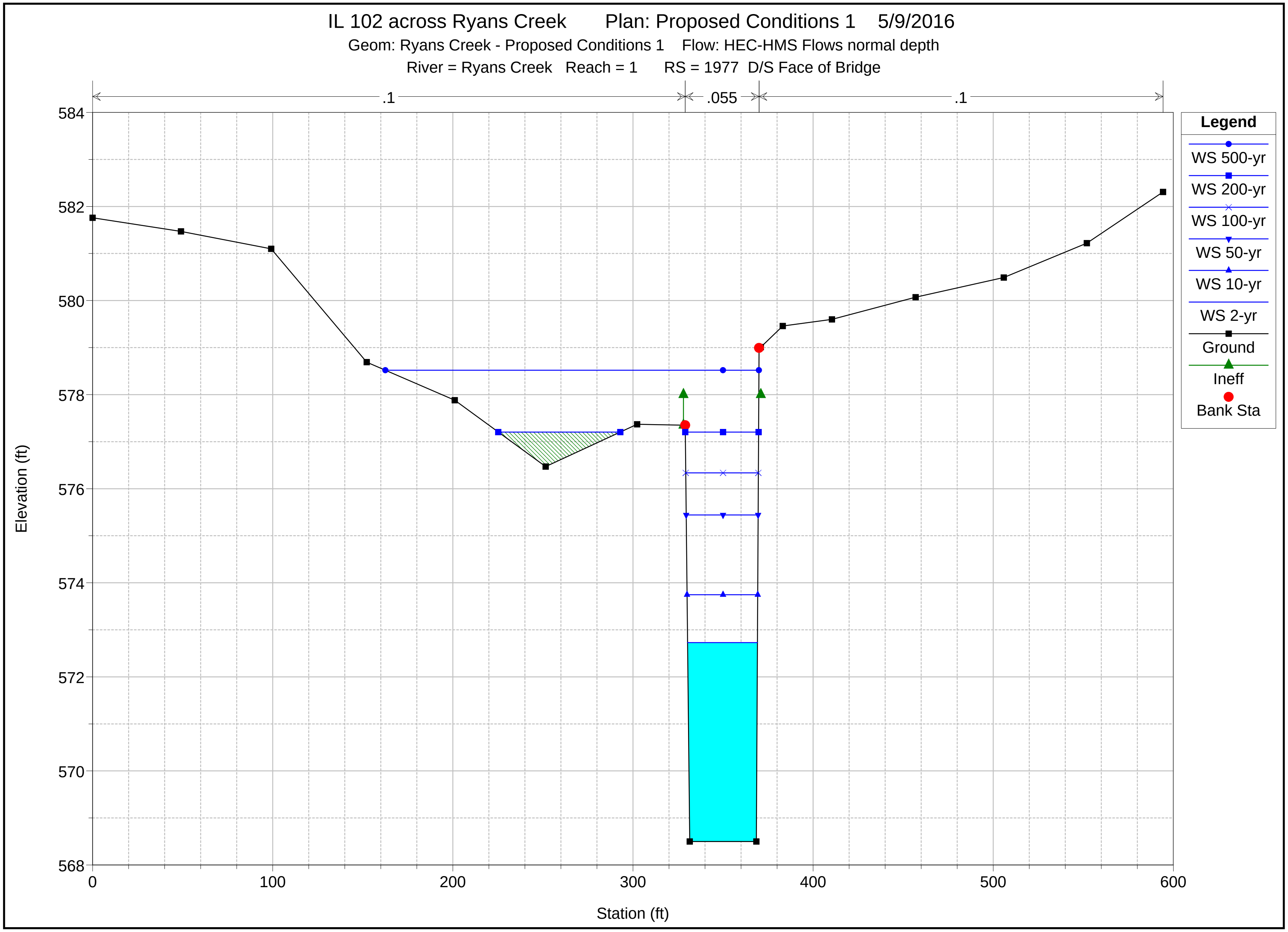
IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2026 U/S Face of Bridge
.04
.04
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600

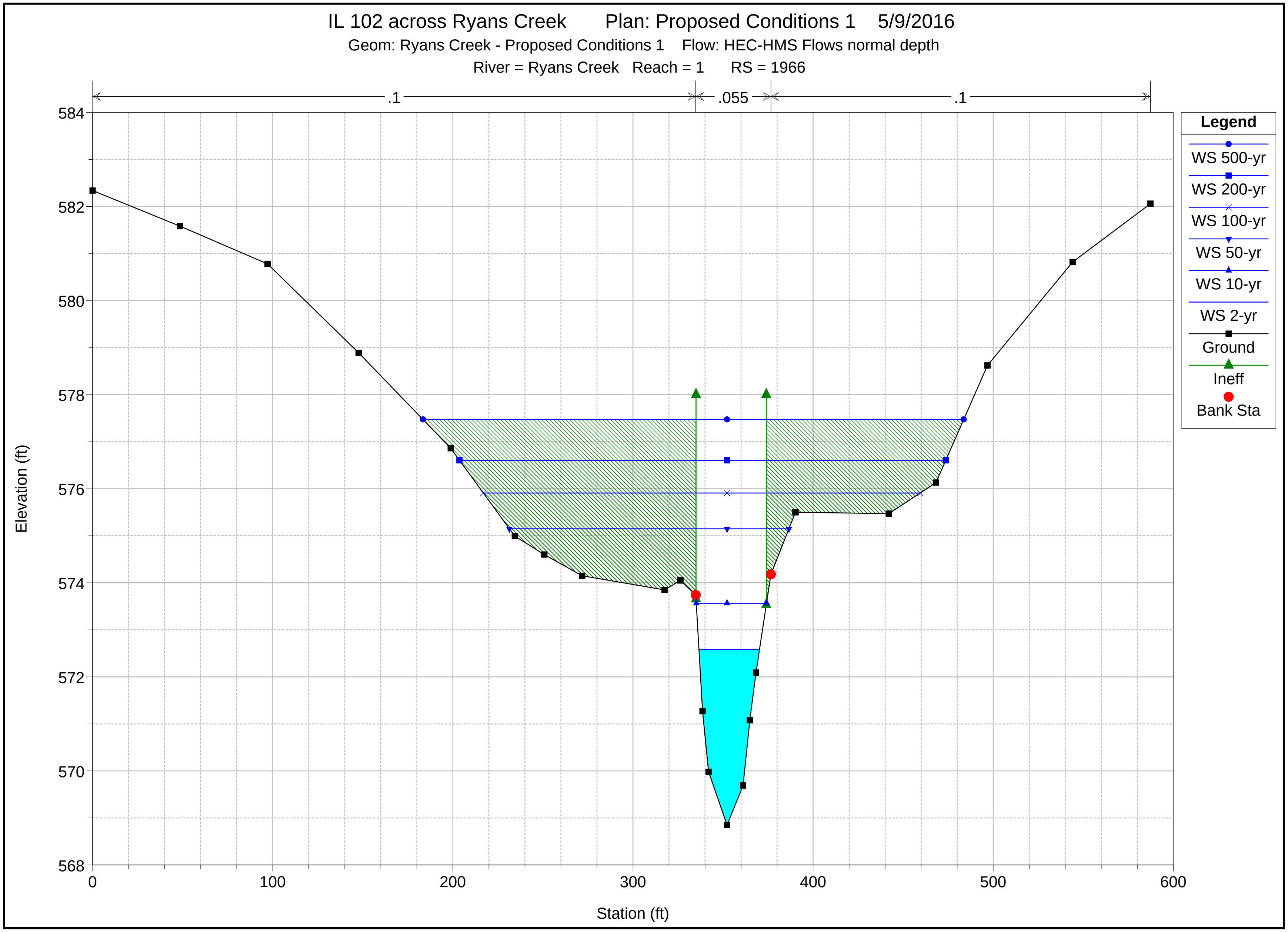


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 Culv IL ROUTE 102
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta

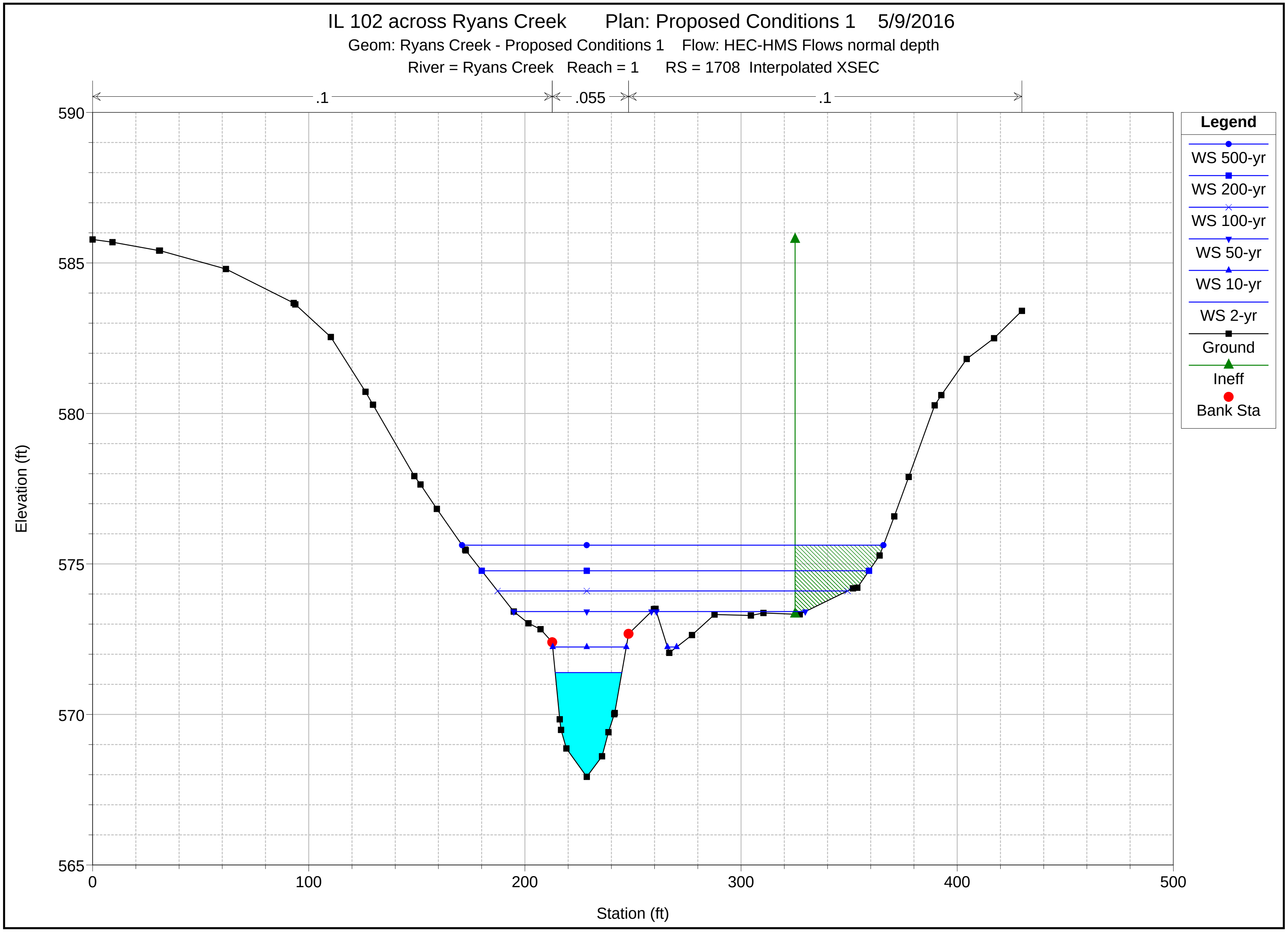


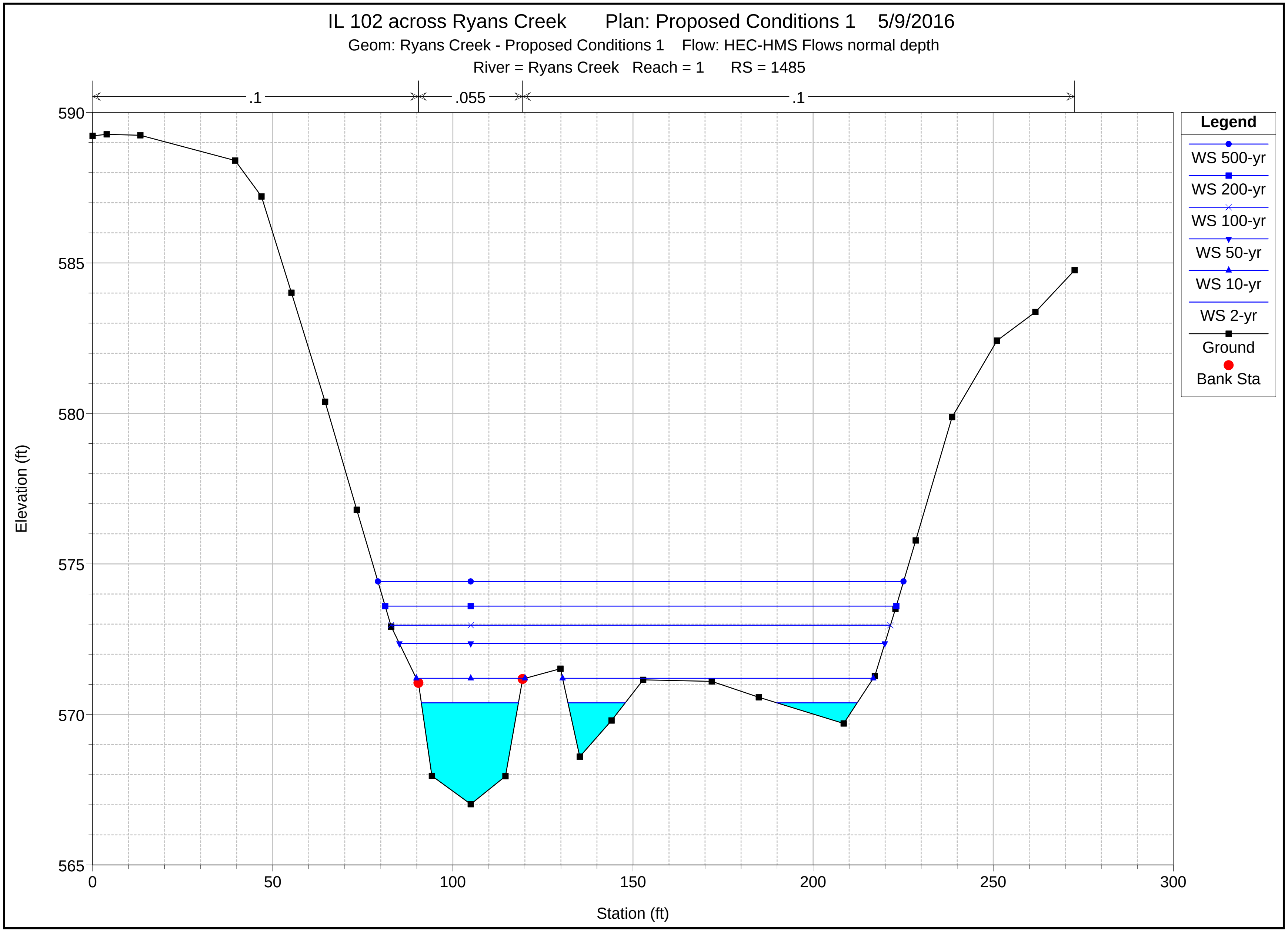
IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 Culv IL ROUTE 102
.1
.055
.1
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
566
0
100
200
300
400
500
600
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1977 D/S Face of Bridge
.1
.055
.1
Elevation (ft)
Station (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta

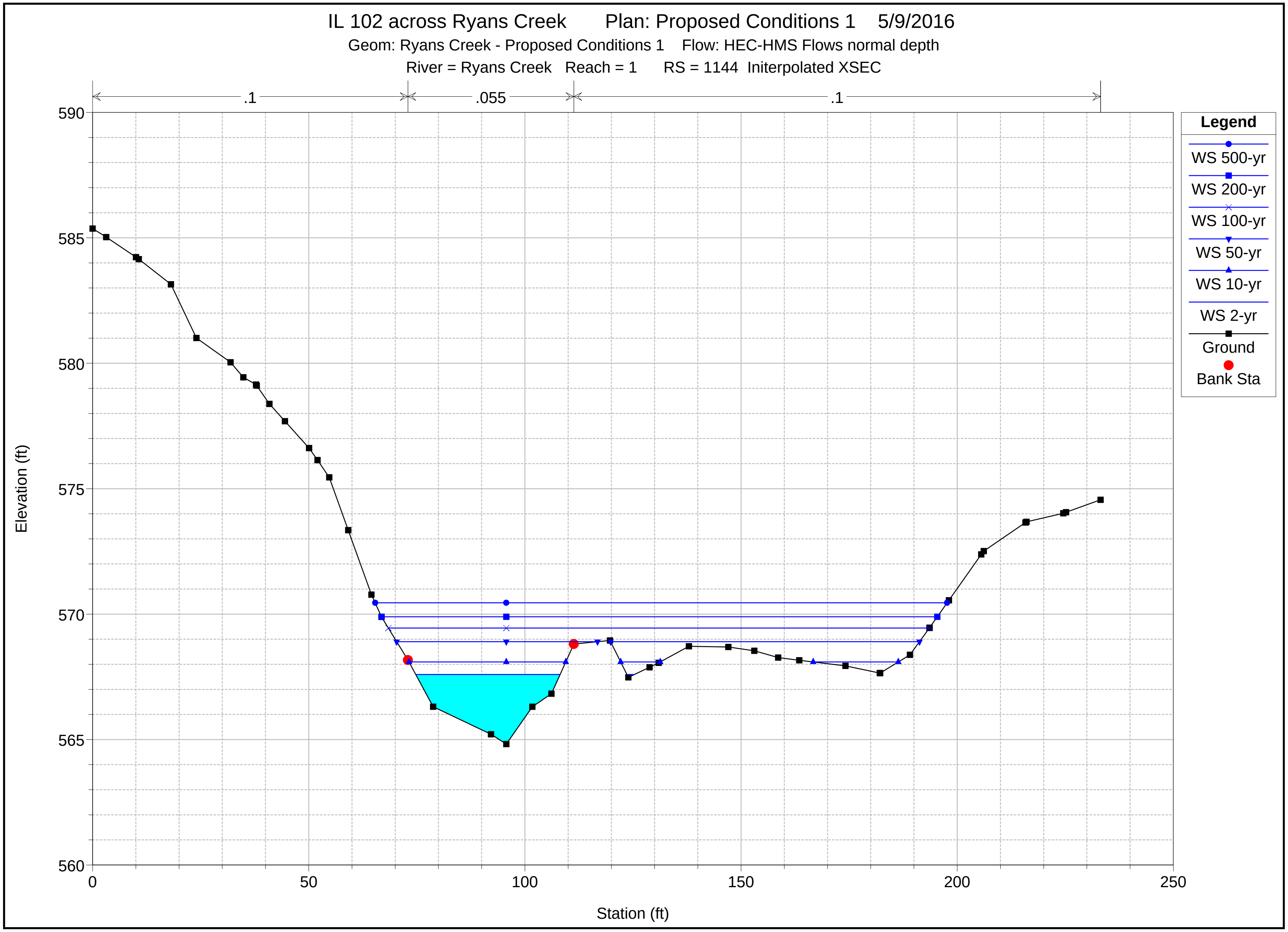


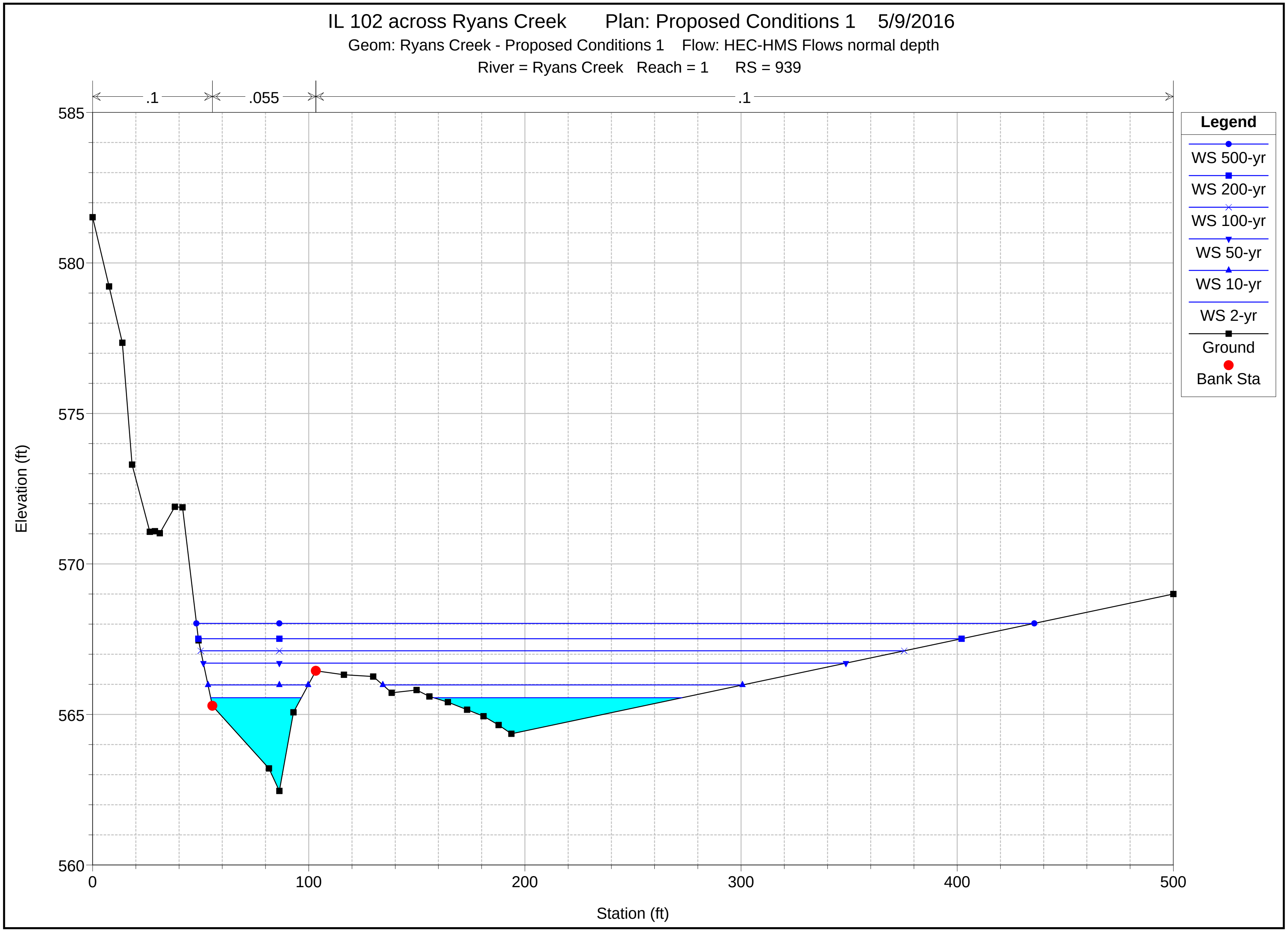
IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1966
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
584
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600
Station (ft)


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1708 Interpolated XSEC
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
590
585
580
575
570
565
0
100
200
300
400
500



IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 1485
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
585
580
575
570
565
0
50
100
150
200
250
300


IL 102 across Ryans Creek   Plan: Proposed Conditions 1   5/9/2016
Geom: Ryans Creek - Proposed Conditions 1   Flow: HEC-HMS Flows normal depth
River = Ryans Creek   Reach = 1   RS = 1144 Initerpolated XSEC
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
585
580
575
570
565
560
0
50
100
150
200
250


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 939
.1
.055
.1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
585
580
575
570
565
560
0
100
200
300
400
500
Station (ft)

```
                    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: IL 102 across Ryans Creek
Project File : IL102acrossRaynsCK.prj
Run Date and Time: 5/9/2016 2:20:17 PM

Project in English units

****

PLAN DATA

Plan Title: Proposed Conditions 1
Plan File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.p05

Geometry Title: Ryans Creek - Proposed Conditions 1
Geometry File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.g05

Flow Title : HEC-HMS Flows normal depth
Flow File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.f03

Plan Summary Information:

Number of:	Cross Sections =	12	Multiple Openings =	0
	Culverts =	1	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

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

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

****

FLOW DATA

Flow Title: HEC-HMS Flows normal depth
Flow File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.f03

Flow Data (cfs)

River	Reach	RS	2-yr	10-yr	50-yr	100-yr	200-yr	500-yr
Ryans Creek	1	3022	242	408	866	1250	1700	2375

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Ryans Creek	1	2-yr		Normal S = 0.0079
Ryans Creek	1	10-yr		Normal S = 0.0079
Ryans Creek	1	50-yr		Normal S = 0.0079
Ryans Creek	1	100-yr		Normal S = 0.0079
Ryans Creek	1	200-yr		Normal S = 0.0079
Ryans Creek	1	500-yr		Normal S = 0.0079

GEOMETRY DATA

Geometry Title: Ryans Creek - Proposed Conditions 1
Geometry File : p:\2013\2013127.05\Calculations\Drainage\Hydraulic Report - Proposed Conditions 3\HEC-RAS\IL102acrossRaynsCK.g05

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 3022

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	598.01	49.856	590.95	149.759	586.26	249.858	582.74	349.944	579.85
362.947	575.64	376.267	575.27	401.201	574.75	426.854	575.11	456.8	575.25
456.803	575.25	461.715	573.71	465.9	570.67	475.225	569.57	483.085	569.16
487.823	573.78	492.95	575.978	492.954	575.98	504.8	575.92	529.371	575.58
540.193	575.59	558.176	577.42	574.296	579.35	587.41	581.84	597.565	584.3
607.162	586.87	618.717	590.82	626.175	593.52	632.004	595.47		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	349.944	.04	456.8	.04	492.95	.04	574.296	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
456.8	492.95	242.5	250	248.3	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	456.8	575.25	F
492.95	632.004	575.98	F

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2772

INPUT
Description: Interpolated XSEC
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	593.38	49.52	589.27	50.35	589.25	148.75	585.61	150.94	585.54
248.18	582.53	251.3	582.44	280.33	581.64	280.66	579.63	302.85	578.72
325.06	577.59	347.59	577.03	352.08	576.25	360.51	574.77	373.74	574.42
375.88	574.37	398.5	574.16	400.74	574.18	423.99	574.58	426.41	574.62
453.73	577.14	457.2	575.43	460.16	573.12	461.78	572.54	466.74	571.13
472.3	569.81	479.87	571.84	480.96	572.22	487.28	573.46	490.34	575.54
498.86	576.03	502.42	576.18	509.68	576.46	517.82	577.04	527.46	577.88
531.83	578.29	538.49	579.05	541.42	579.53	551.42	581.32	556.82	582.24
561.31	583.04	567.2	584.03	573.26	585.09	586.62	587.88	588.59	588.34
596.97	590.4	600.95	591.43	606.76	592.87	611.6	594.26	618.53	596.38
621.09	597.19	626.14	598.71	632.08	600.41				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	280.66	.04	453.73	.04	490.34	.04	538.49	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
453.73	490.34	279.8	262.7	257.1	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2508

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	588.75	50.007	587.58	149.921	584.9	249.602	582.24	278.434	581.48
278.765	577.46	300.802	576.28	322.862	574.68	349.697	574.12	373.339	573.51
398.031	573.58	423.527	574.11	450.66	579.02	455.366	574.69	461.507	570.47
472.517	570.48	483.288	571.66	487.73	575.1	496.415	576.13	507.437	577.09
515.726	578.37	530.002	580.99	539.779	583.17	549.967	585.75	560.04	588.13
566.042	589.43	587.844	594.38	600.434	597.51	611.284	600.02	620.958	602.66
632.149	605.36								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	278.765	.04	450.66	.04	487.73	.04	530.002	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
450.66	487.73	167.7	233.9	253.1	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2275

INPUT
Description: Interpolated XSEC
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	585.33	44.92	584.32	56.56	584.04	113.74	582.7	134.67	582.11
169.27	581.15	224.22	579.7	226.24	579.65	250.12	579.14	250.42	577.12
270.21	576.4	282.03	575.85	290.03	575.43	314.13	574.85	335.37	574.29
338.37	574.26	357.55	574.02	380.46	573.97	394.8	575.22	404.83	576.16
405.12	576.07	405.92	575.61	409.11	573.61	410.44	572.64	412.09	572.08
416.69	570.85	421.56	569.61	425.9	570.51	429.22	571.08	430.95	571.21
440.13	572.44	443.92	574.43	454.91	575.24	468.87	576.1	479.36	577.02
485.13	577.59	497.43	578.84	507.97	580.07	509.81	580.36	522.7	582.53
535.46	584.59	543.05	585.76	565.98	589.39	570.65	589.93	586.59	591.9
600.32	593.51	605.17	594.16	612.57	595.22	626.74	597.06		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	250.12	.04	404.83	.04	443.92	.04	507.97	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
404.83	443.92	165.4	235.8	269.5	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2040

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	581.9	50.161	580.84	100.862	579.88	150.103	578.42	200.63	577.11
250.103	576.37	300.06	575	350.109	573.44	359	573.306	359.389	573.3
360.473	572.86	364.785	570.76	366.588	569.61	375.036	569.07	381.617	568.76
385.202	570.54	387.953	571.69	400.108	573.76	400.11	573.76	449.98	575.98
477.612	577.3	547.81	585.23	595.223	587.26	621.324	588.76		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100.862	.04	359	.04	400.11	.04	477.612	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
359	400.11	7	10.5	7	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	345	579.3	F
405	621.324	579.3	F

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 2026

INPUT
Description: U/S Face of Bridge
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	580.07	50.169	579.63	99.049	579.07	150.23	578.73	200.253	578.69
251.513	578.15	301.206	578.22	315.5	578.8	317.5	568.58	354.5	568.58
356.5	578.7	402.381	579.48	434.757	579.93	441.297	579.77	461.679	580.1
482.935	579.56	503.38	580.44	549.01	581.24	589.84	581.85		

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.04	402.381	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
315.5	356.5	47.7	46	44	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	314.5	579.3	F
357.5	589.84	579.3	F

CULVERT

RIVER: Ryans Creek
REACH: 1 RS: 2000

INPUT
Description: IL ROUTE 102
Distance from Upstream XS = 1
Deck/Roadway Width = 44
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
-166	584.6		-116	583.57		-66	582.59	
-16	581.62		34	580.94		84	580.26	
134	579.9		184	579.55		234	579.26	
252	579.17		284	579.26		334	579.64	
384	580.07		434	580.59		484	581.19	
534	581.86		584	582.53		634	583.35	
684	584.18		734	584.85		784	585.37	
834	585.71							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	580.07	50.169	579.63	99.049	579.07	150.23	578.73	200.253	578.69
251.513	578.15	301.206	578.22	315.5	578.8	317.5	568.58	354.5	568.58
356.5	578.7	402.381	579.48	434.757	579.93	441.297	579.77	461.679	580.1
482.935	579.56	503.38	580.44	549.01	581.24	589.84	581.85		

Manning's n Values num= 2

```
     Sta   n Val     Sta   n Val
********************************
       0     .04 402.381     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
         315.5   356.5             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   314.5   579.3       F
   357.5  589.84   579.3       F

Downstream  Deck/Roadway Coordinates
    num=      22
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    -149   584.6             -99  583.57             -49  582.59
       1  581.62              51  580.94             101  580.26
     151   579.9             201  579.55             251  579.26
     269  579.17             301  579.26             351  579.64
     401  580.07             451  580.59             501  581.19
     551  581.86             601  582.53             651  583.35
     701  584.18             751  584.85             801  585.37
     851  585.71

Downstream Bridge Cross Section Data
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.76  49.101  581.47  99.149   581.1 152.194  578.69 201.052  577.88
 251.501  576.47 302.302  577.37     329  577.35   331.5   568.5   368.5   568.5
     370 578.993     371  579.01 383.139  579.46 410.477   579.6 456.934  580.07
 505.876  580.49 552.003  581.22 594.245  582.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1     329    .055     370      .1

Bank Sta: Left   Right    Coeff Contr.   Expan.
           329     370             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     328     578       F
     371 594.245     578       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 Culverts =  3

Culvert Name     Shape      Rise    Span
Culvert #3           Box       9     8.8
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
```

```
                  1      44     .011     .011        2                   .4                 1
Upstream   Elevation =  567.58
           Centerline Station =  322.6
Downstream Elevation =  567.5
           Centerline Station =  336.6

Culvert Name     Shape      Rise    Span
Culvert #1           Box       9    15.9
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1      44     .011     .011        1                   .4                 1
Upstream   Elevation =  567.58
           Centerline Station =  335.85
Downstream Elevation =  567.5
           Centerline Station =  349.85

Culvert Name     Shape      Rise    Span
Culvert #2           Box       9     8.8
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1      44     .011     .011        2                   .4                 1
Upstream   Elevation =  567.58
           Centerline Station =  349.08
Downstream Elevation =  567.5
           Centerline Station =  363.1

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                 RS: 1977

INPUT
Description: D/S Face of Bridge
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.76  49.101  581.47  99.149   581.1 152.194  578.69 201.052  577.88
 251.501  576.47 302.302  577.37     329  577.35   331.5   568.5   368.5   568.5
     370 578.993     371  579.01 383.139  579.46 410.477   579.6 456.934  580.07
 505.876  580.49 552.003  581.22 594.245  582.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1     329    .055     370      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           329     370               11    14.5      14             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     328     578       F
     371 594.245     578       F

CROSS SECTION
```

```
RIVER: Ryans Creek
REACH: 1                  RS: 1966

INPUT
Description:
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  582.34  48.536  581.58  97.087  580.78 147.691  578.89  198.83  576.86
 234.409  574.99 250.806   574.6 271.804  574.15  317.52  573.85  326.34  574.05
 326.343  574.05  334.84 573.741 334.869  573.74 338.634  571.27 341.982  569.98
 352.252  568.85 361.121  569.69  364.88  571.08 368.264  572.09 376.587  574.18
  376.59  574.18  390.17   575.5 390.174   575.5 442.069  575.47 468.234  576.13
 496.783  578.62 544.104  580.82 587.298  582.06

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1  334.84    .055  376.59      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        334.84  376.59              289     258     182              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     335     578       F
     374 587.298     578       F

CROSS SECTION


RIVER: Ryans Creek
REACH: 1                  RS: 1708

INPUT
Description: Interpolated XSEC
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  585.78    9.22  585.69   30.82  585.41   31.16  585.41   61.66   584.8
   93.04  583.67    93.8  583.62  110.22  582.54  126.28  580.72  129.72  580.29
  148.87  577.92  151.68  577.64  159.29  576.83  172.35  575.48  172.62  575.45
  194.87  573.42  201.66  573.03  207.26  572.83  212.65   572.4  212.68  572.38
  216.13  569.84  216.74  569.49   219.2  568.87  228.62  567.93  235.67  568.61
  238.67  569.41  241.36  570.01  241.57  570.05  247.98  572.68  259.71   573.5
  260.44  573.51  266.79  572.05  277.29  572.64  287.72  573.32  304.53  573.29
  310.34  573.37  325.85  573.33  327.13  573.33  351.78  574.19  353.79  574.21
  364.08  575.28  370.87  576.58  377.55  577.89  389.56  580.27  392.65  580.61
  404.36  581.81  417.03   582.5  429.95  583.41

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0      .1  212.65    .055  247.98      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        212.65  247.98              222     202     202              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     325  429.95               F

CROSS SECTION
```

RIVER: Ryans Creek
REACH: 1 RS: 1485

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	589.22	3.922	589.27	13.258	589.24	39.58	588.4	46.889	587.21
55.187	584.01	64.531	580.39	73.323	576.8	82.904	572.92	90.468	571.05
90.47	571.048	94.183	567.96	104.978	567.02	114.613	567.95	119.38	571.179
119.381	571.18	129.867	571.52	135.214	568.6	144.055	569.8	152.838	571.15
171.886	571.1	184.941	570.57	208.475	569.7	217.139	571.28	222.854	573.51
228.474	575.78	238.59	579.88	251.054	582.42	261.718	583.37	272.598	584.76

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	90.47	.055	119.38	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
90.47	119.38	230.3	335	197.7	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 1144

INPUT
Description: Initerpolated XSEC
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	585.37	3.16	585.03	10.02	584.23	10.69	584.15	18.13	583.15
24	581.01	31.91	580.04	34.88	579.44	37.81	579.15	37.97	579.11
40.9	578.38	44.5	577.69	50.07	576.62	52.03	576.14	54.74	575.45
59.12	573.35	64.5	570.78	66.84	569.89	72.94	568.17	78.77	566.31
92.15	565.21	95.7	564.82	101.74	566.31	106.15	566.83	111.33	568.81
119.67	568.95	123.92	567.48	128.84	567.88	130.95	568.06	137.94	568.72
147.06	568.69	153.08	568.54	158.57	568.27	163.47	568.16	174.14	567.94
182.11	567.65	182.18	567.65	189.07	568.38	193.58	569.45	193.62	569.46
198.09	570.55	205.57	572.38	206.13	572.51	215.79	573.65	216.04	573.68
224.53	574.02	225.19	574.06	233.18	574.56				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	72.94	.055	111.33	.1

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72.94	111.33	203.7	205	203.7	.1	.3

CROSS SECTION

RIVER: Ryans Creek
REACH: 1 RS: 939

```
INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  581.527.609546  579.2213.77442  577.3518.23405   573.326.50088  571.07
28.84959  571.0931.07133  571.0238.03796   571.941.58479  571.8849.00148  567.46
55.41613  565.2981.58443  563.2186.42336  562.4692.93948  565.07103.2744  566.45
116.2802  566.32 129.809  566.26138.3556  565.72149.9176  565.81155.8341   565.6
164.3529  565.41173.2559  565.16180.8474  564.94187.8239  564.65193.7582  564.36
     500     569

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0      .155.41613    .055103.2744      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      55.41613103.2744               0       0       0             .1       .3

********************************************************************************
```

SUMMARY OF MANNING'S N VALUES

River:Ryans Creek

Reach	River Sta.	n1	n2	n3	n4	n5
1	3022	.06	.04	.04	.04	.1
1	2772	.06	.04	.04	.04	.1
1	2508	.06	.04	.04	.04	.1
1	2275	.06	.04	.04	.04	.1
1	2040	.06	.04	.04	.04	.1
1	2026	.04	.04			
1	2000	Culvert				
1	1977	.1	.055	.1		
1	1966	.1	.055	.1		
1	1708	.1	.055	.1		
1	1485	.1	.055	.1		
1	1144	.1	.055	.1		
1	939	.1	.055	.1		

****

SUMMARY OF REACH LENGTHS

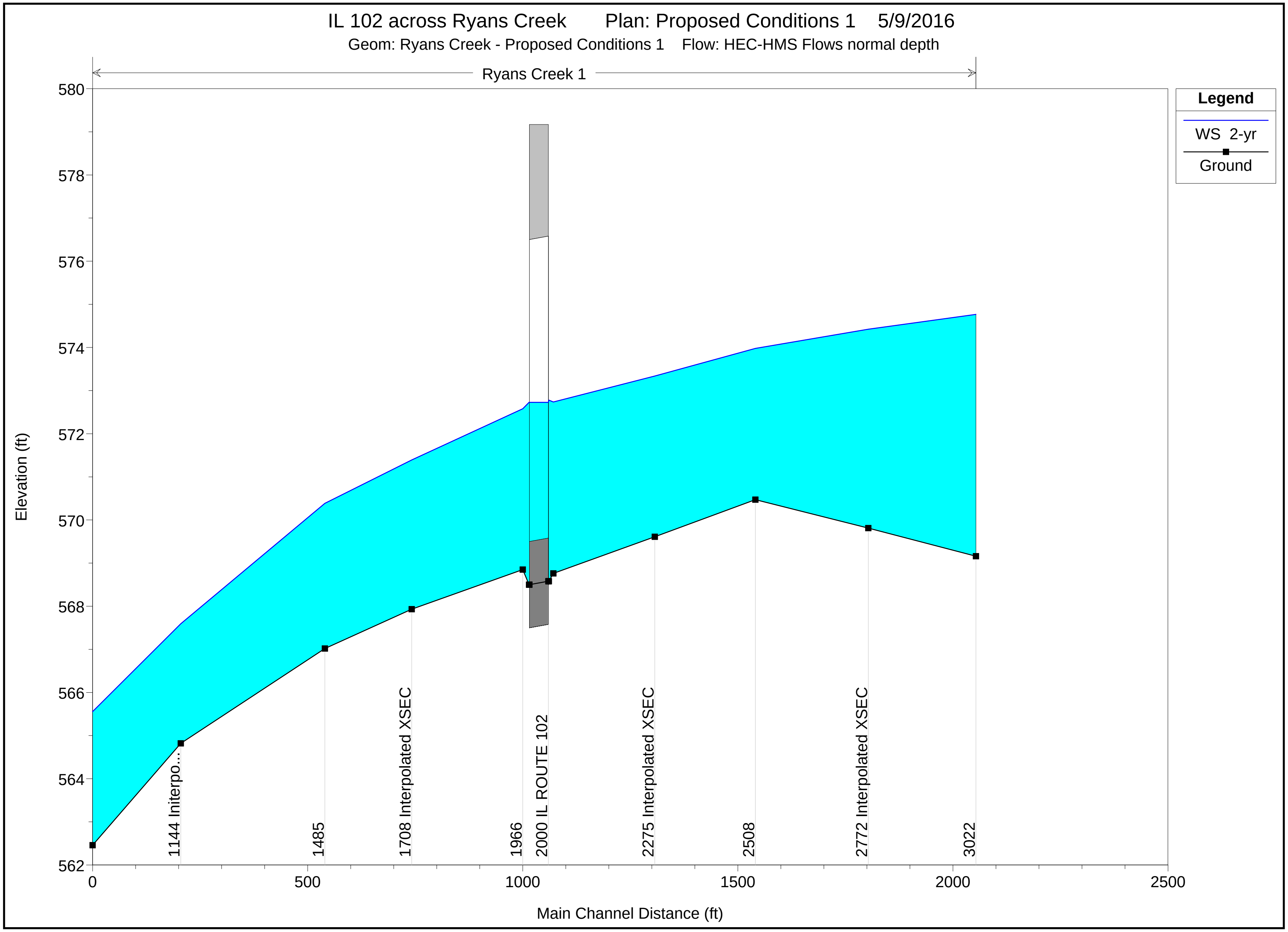
River: Ryans Creek

Reach	River Sta.	Left	Channel	Right
1	3022	242.5	250	248.3
1	2772	279.8	262.7	257.1
1	2508	167.7	233.9	253.1
1	2275	165.4	235.8	269.5
1	2040	7	10.5	7
1	2026	47.7	46	44
1	2000	Culvert		
1	1977	11	14.5	14
1	1966	289	258	182
1	1708	222	202	202

*1	* 1485	*	230.3*	335*	197.7*
*1	* 1144	*	203.7*	205*	203.7*
*1	* 939	*	0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Ryans Creek

Reach	River Sta.	Contr.	Expan.
1	3022	.1	.3
1	2772	.1	.3
1	2508	.1	.3
1	2275	.1	.3
1	2040	.3	.5
1	2026	.3	.5
1	2000	Culvert	
1	1977	.3	.5
1	1966	.3	.5
1	1708	.1	.3
1	1485	.1	.3
1	1144	.1	.3
1	939	.1	.3


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Proposed 1   River: Ryans Creek   Reach: 1   Profile: 2-yr

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	3022	2-yr	242.00	569.16	574.77	571.52	574.84	0.000656	2.10	115.15	33.93	0.19
1	2772	2-yr	242.00	569.81	574.42		574.57	0.001975	3.03	85.05	71.60	0.33
1	2508	2-yr	242.00	570.47	573.98		574.09	0.001586	2.79	101.07	91.87	0.30
1	2275	2-yr	242.00	569.61	573.34		573.54	0.003778	3.62	66.81	32.36	0.44
1	2040	2-yr	242.00	568.76	572.73	570.99	572.87	0.002095	2.98	81.13	33.36	0.34
1	2026	2-yr	242.00	568.58	572.78	569.68	572.81	0.000318	1.52	158.81	38.65	0.13
1	2000		Culvert									
1	1977	2-yr	242.00	568.50	572.73	569.60	572.76	0.000586	1.51	160.22	38.80	0.13
1	1966	2-yr	242.00	568.85	572.58	571.03	572.72	0.003833	2.96	81.79	33.57	0.33
1	1708	2-yr	242.00	567.93	571.39		571.57	0.005138	3.34	72.48	30.82	0.38
1	1485	2-yr	242.00	567.02	570.39		570.55	0.004910	3.34	89.32	65.19	0.37
1	1144	2-yr	242.00	564.82	567.59		567.91	0.015086	4.50	53.84	35.09	0.63
1	939	2-yr	242.00	562.46	565.56	565.05	565.67	0.007901	3.05	125.39	156.77	0.45

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 2-yr

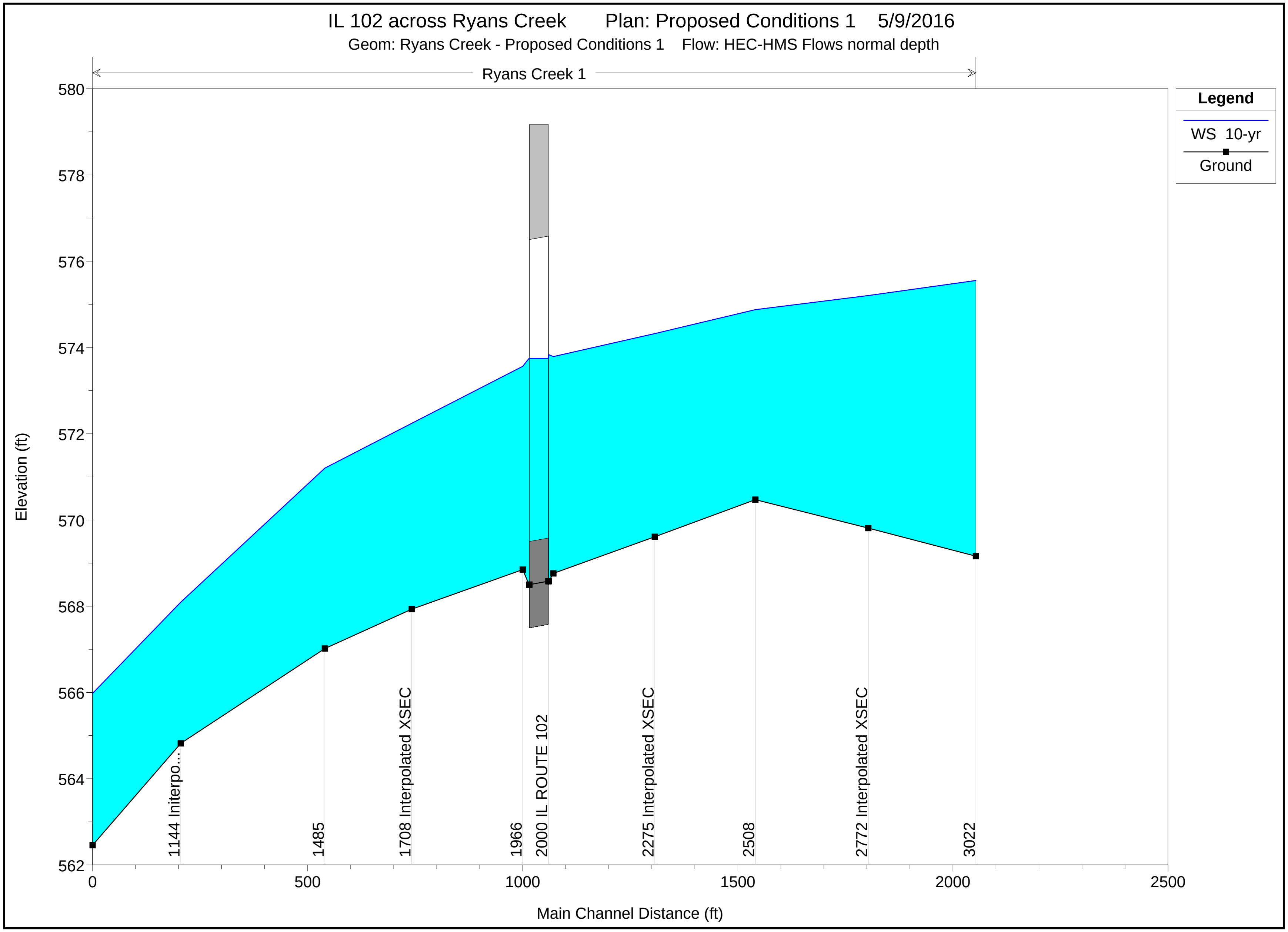
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	2-yr	574.84	574.77	0.07	0.26	0.01		242.00		33.93
1	2772	2-yr	574.57	574.42	0.14	0.46	0.01	2.72	239.28		71.60
1	2508	2-yr	574.09	573.98	0.11	0.54	0.01	12.50	229.50		91.87
1	2275	2-yr	573.54	573.34	0.20	0.65	0.02		242.00		32.36
1	2040	2-yr	572.87	572.73	0.14	0.01	0.05		242.00		33.36
1	2026	2-yr	572.81	572.78	0.04				242.00		38.65
1	2000		Culvert								
1	1977	2-yr	572.76	572.73	0.04	0.02	0.03		242.00		38.80
1	1966	2-yr	572.72	572.58	0.14	1.14	0.01		242.00		33.57
1	1708	2-yr	571.57	571.39	0.17	1.01	0.00		242.00		30.82
1	1485	2-yr	570.55	570.39	0.16	2.63	0.02		224.21	17.79	65.19
1	1144	2-yr	567.91	567.59	0.31	2.18	0.06		241.97	0.03	35.09
1	939	2-yr	565.67	565.56	0.11			0.03	182.60	59.37	156.77

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 2-yr

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
1	2000 Culvert #3	2-yr	572.81	572.78	571.27	572.82	579.31	56.72		0.05	2.05	2.00
1	2000 Culvert #1	2-yr	572.81	572.78	570.55	572.81	579.31	128.57		0.05	1.95	1.91
1	2000 Culvert #2	2-yr	572.81	572.78	571.27	572.82	579.31	56.72		0.05	2.05	2.00

Errors Warnings and Notes for Plan : Proposed 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2772 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2040 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 2-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 2-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 2-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 2-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 939 Profile: 2-yr
Warning:	Divided flow computed for this cross-section.


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 10-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
1144 Initerpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 10-yr

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	3022	10-yr	408.00	569.16	575.55	572.23	575.66	0.000923	2.68	183.67	125.84	0.24
1	2772	10-yr	408.00	569.81	575.20		575.34	0.001759	3.24	159.89	107.08	0.32
1	2508	10-yr	408.00	570.47	574.88		574.96	0.001098	2.65	209.33	139.91	0.25
1	2275	10-yr	408.00	569.61	574.32		574.56	0.003075	3.98	112.02	86.00	0.42
1	2040	10-yr	408.00	568.76	573.79	571.69	573.96	0.002039	3.34	125.75	61.74	0.34
1	2026	10-yr	408.00	568.58	573.83	570.13	573.90	0.000448	2.04	199.75	39.07	0.16
1	2000		Culvert									
1	1977	10-yr	408.00	568.50	573.75	570.05	573.81	0.000845	2.04	199.96	39.23	0.16
1	1966	10-yr	408.00	568.85	573.56	571.65	573.75	0.003987	3.47	117.50	39.00	0.35
1	1708	10-yr	408.00	567.93	572.24		572.50	0.005764	4.08	100.44	38.29	0.42
1	1485	10-yr	408.00	567.02	571.20		571.40	0.004977	3.87	157.73	116.41	0.39
1	1144	10-yr	408.00	564.82	568.09	567.66	568.58	0.018348	5.66	77.96	65.09	0.71
1	939	10-yr	408.00	562.46	565.98	565.43	566.11	0.007910	3.46	204.15	212.75	0.46

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 10-yr

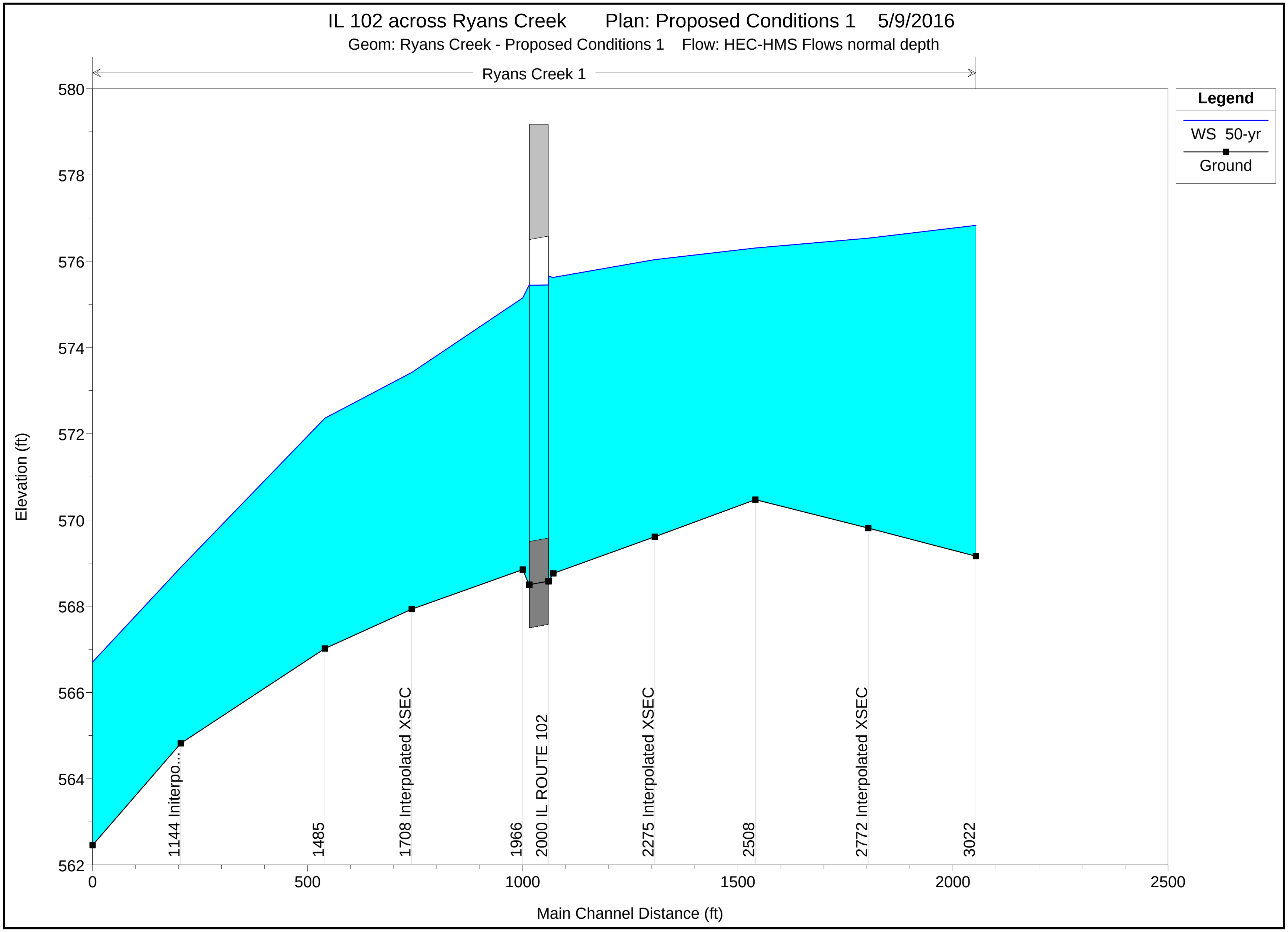
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	10-yr	575.66	575.55	0.10	0.31	0.00	28.42	379.58		125.84
1	2772	10-yr	575.34	575.20	0.14	0.37	0.02	72.83	335.17		107.08
1	2508	10-yr	574.96	574.88	0.08	0.39	0.02	115.27	292.73		139.91
1	2275	10-yr	574.56	574.32	0.24	0.58	0.02	9.21	398.79		86.00
1	2040	10-yr	573.96	573.79	0.17	0.01	0.05	4.29	403.71	0.00	61.74
1	2026	10-yr	573.90	573.83	0.06				408.00		39.07
1	2000		Culvert								
1	1977	10-yr	573.81	573.75	0.06	0.02	0.04		408.00		39.23
1	1966	10-yr	573.75	573.56	0.19	1.23	0.02		408.00		39.00
1	1708	10-yr	572.50	572.24	0.26	1.08	0.02		407.90	0.10	38.29
1	1485	10-yr	571.40	571.20	0.20	2.79	0.03	0.01	348.04	59.95	116.41
1	1144	10-yr	568.58	568.09	0.49	2.36	0.11		402.73	5.27	65.09
1	939	10-yr	566.11	565.98	0.13			0.44	270.24	137.32	212.75

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 10-yr

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
1	2000 Culvert #3	10-yr	573.90	573.83	572.05	573.91	579.31	98.76		0.09	2.69	2.64
1	2000 Culvert #1	10-yr	573.90	573.83	571.33	573.89	579.31	210.48		0.09	2.56	2.52
1	2000 Culvert #2	10-yr	573.90	573.83	572.05	573.91	579.31	98.76		0.09	2.69	2.64

Errors Warnings and Notes for Plan : Proposed 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 10-yr
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: Ryans Creek Reach: 1 RS: 2275 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 10-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 10-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 10-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 10-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 10-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 10-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 939 Profile: 10-yr
Warning:	Divided flow computed for this cross-section.



IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 50-yr
Ground
Elevation (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
Main Channel Distance (ft)
1144 Interpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 50-yr

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	3022	50-yr	866.00	569.16	576.83	573.71	576.93	0.000814	2.98	409.90	193.12	0.23
1	2772	50-yr	866.00	569.81	576.53		576.67	0.001402	3.45	328.39	152.46	0.30
1	2508	50-yr	866.00	570.47	576.31		576.38	0.000750	2.66	436.59	180.17	0.22
1	2275	50-yr	866.00	569.61	576.04		576.17	0.001340	3.44	351.77	188.20	0.29
1	2040	50-yr	866.00	568.76	575.62	573.13	575.85	0.001482	3.94	235.61	164.73	0.32
1	2026	50-yr	866.00	568.58	575.65	571.14	575.81	0.000803	3.19	271.31	39.78	0.22
1	2000		Culvert									
1	1977	50-yr	866.00	568.50	575.44	571.05	575.61	0.001592	3.24	267.13	39.95	0.22
1	1966	50-yr	866.00	568.85	575.15	572.93	575.51	0.004417	4.83	179.28	155.14	0.40
1	1708	50-yr	866.00	567.93	573.42	571.98	573.95	0.008132	5.94	177.17	132.58	0.52
1	1485	50-yr	866.00	567.02	572.36		572.61	0.004928	4.75	307.67	134.73	0.41
1	1144	50-yr	866.00	564.82	568.90	568.90	569.73	0.022817	7.68	151.55	117.92	0.83
1	939	50-yr	866.00	562.46	566.70	566.05	566.87	0.007907	4.19	390.77	297.29	0.48

HEC-RAS Plan: Proposed 1   River: Ryans Creek   Reach: 1   Profile: 50-yr

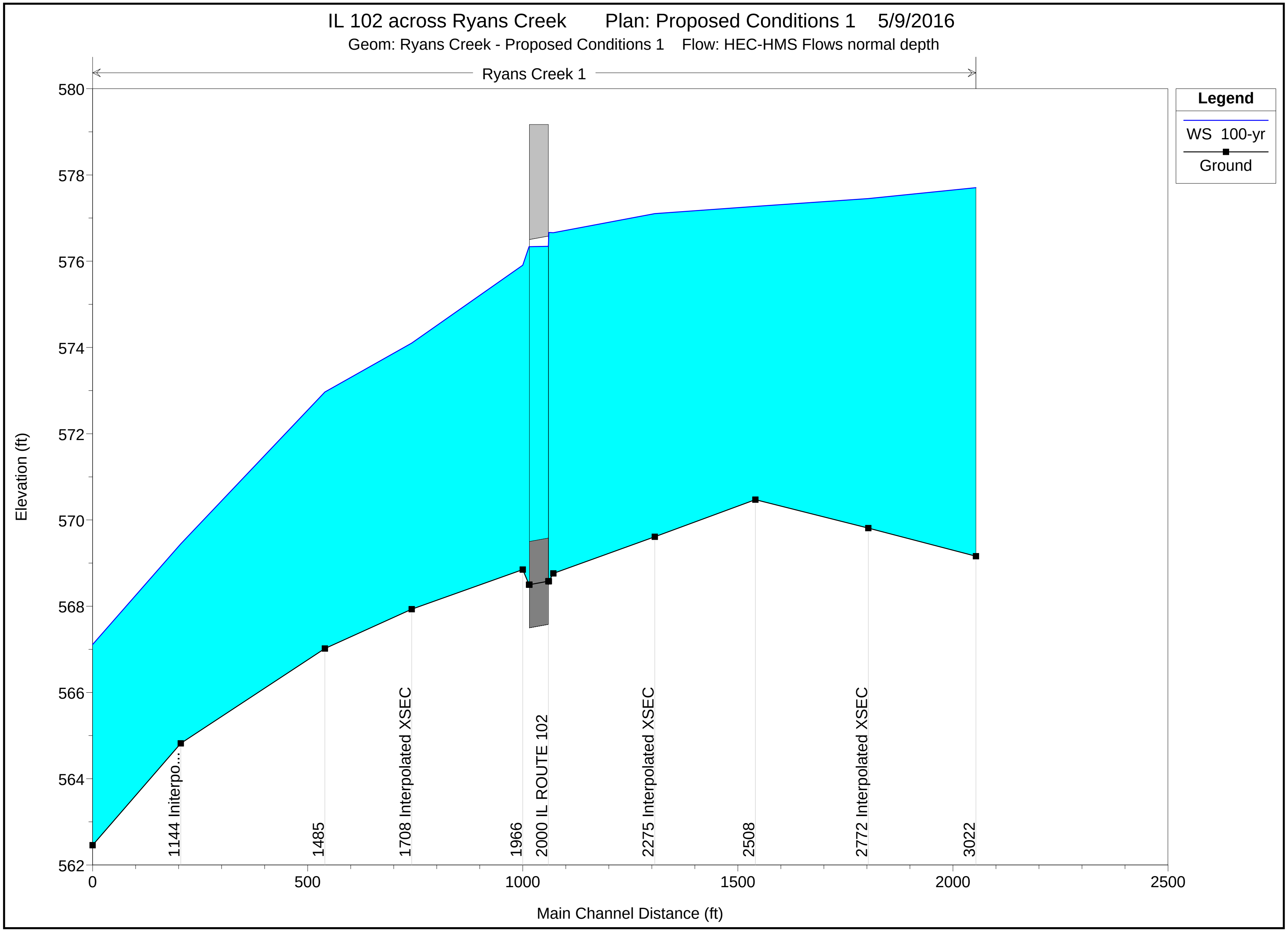
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	50-yr	576.93	576.83	0.10	0.26	0.00	245.90	559.53	60.57	193.12
1	2772	50-yr	576.67	576.53	0.14	0.27	0.02	344.73	513.34	7.92	152.46
1	2508	50-yr	576.38	576.31	0.07	0.20	0.01	441.39	420.27	4.34	180.17
1	2275	50-yr	576.17	576.04	0.13	0.31	0.01	280.23	564.85	20.92	188.20
1	2040	50-yr	575.85	575.62	0.22	0.01	0.03	74.39	773.75	17.86	164.73
1	2026	50-yr	575.81	575.65	0.16				866.00		39.78
1	2000		Culvert								
1	1977	50-yr	575.61	575.44	0.16	0.04	0.06		866.00		39.95
1	1966	50-yr	575.51	575.15	0.36	1.51	0.05		866.00		155.14
1	1708	50-yr	573.95	573.42	0.53	1.26	0.08	6.83	840.47	18.70	132.58
1	1485	50-yr	572.61	572.36	0.25	2.81	0.06	2.67	586.88	276.45	134.73
1	1144	50-yr	569.73	568.90	0.83	2.56	0.20	1.06	780.30	84.63	117.92
1	939	50-yr	566.87	566.70	0.16			2.99	468.69	394.31	297.29

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 50-yr

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
1	2000 Culvert #3	50-yr	575.81	575.65	573.74	575.81	579.31	211.50		0.20	4.10	4.04
1	2000 Culvert #1	50-yr	575.81	575.65	573.16	575.80	579.31	443.01		0.20	4.06	4.01
1	2000 Culvert #2	50-yr	575.81	575.65	573.74	575.81	579.31	211.50		0.20	4.10	4.04

Errors Warnings and Notes for Plan : Proposed 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2772 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2275 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 50-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 50-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 50-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 50-yr
Warning:	Divided flow computed for this cross-section.
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 50-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 50-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 100-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1144 Initerpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
562
564
566
568
570
572
574
576
578
580
0
500
1000
1500
2000
2500

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 100-yr

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	3022	100-yr	1250.00	569.16	577.71	574.79	577.80	0.000665	2.99	583.52	203.99	0.21
1	2772	100-yr	1250.00	569.81	577.45		577.58	0.001152	3.50	484.68	192.00	0.28
1	2508	100-yr	1250.00	570.47	577.27		577.34	0.000610	2.66	627.61	214.77	0.20
1	2275	100-yr	1250.00	569.61	577.10		577.20	0.000814	3.10	574.40	229.31	0.24
1	2040	100-yr	1250.00	568.76	576.66	574.08	576.95	0.001474	4.48	297.71	233.48	0.33
1	2026	100-yr	1250.00	568.58	576.67	571.85	576.92	0.001107	4.01	312.05	40.18	0.25
1	2000		Culvert									
1	1977	100-yr	1250.00	568.50	576.34	571.77	576.60	0.002284	4.13	303.01	40.33	0.27
1	1966	100-yr	1250.00	568.85	575.91	573.72	576.46	0.005524	5.98	208.94	242.51	0.46
1	1708	100-yr	1250.00	567.93	574.10		574.73	0.008383	6.70	268.44	161.89	0.55
1	1485	100-yr	1250.00	567.02	572.97		573.28	0.005473	5.48	390.89	138.68	0.44
1	1144	100-yr	1250.00	564.82	569.45	569.45	570.36	0.021237	8.39	218.32	125.14	0.83
1	939	100-yr	1250.00	562.46	567.11	566.38	567.30	0.007901	4.66	517.99	325.46	0.50

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 100-yr

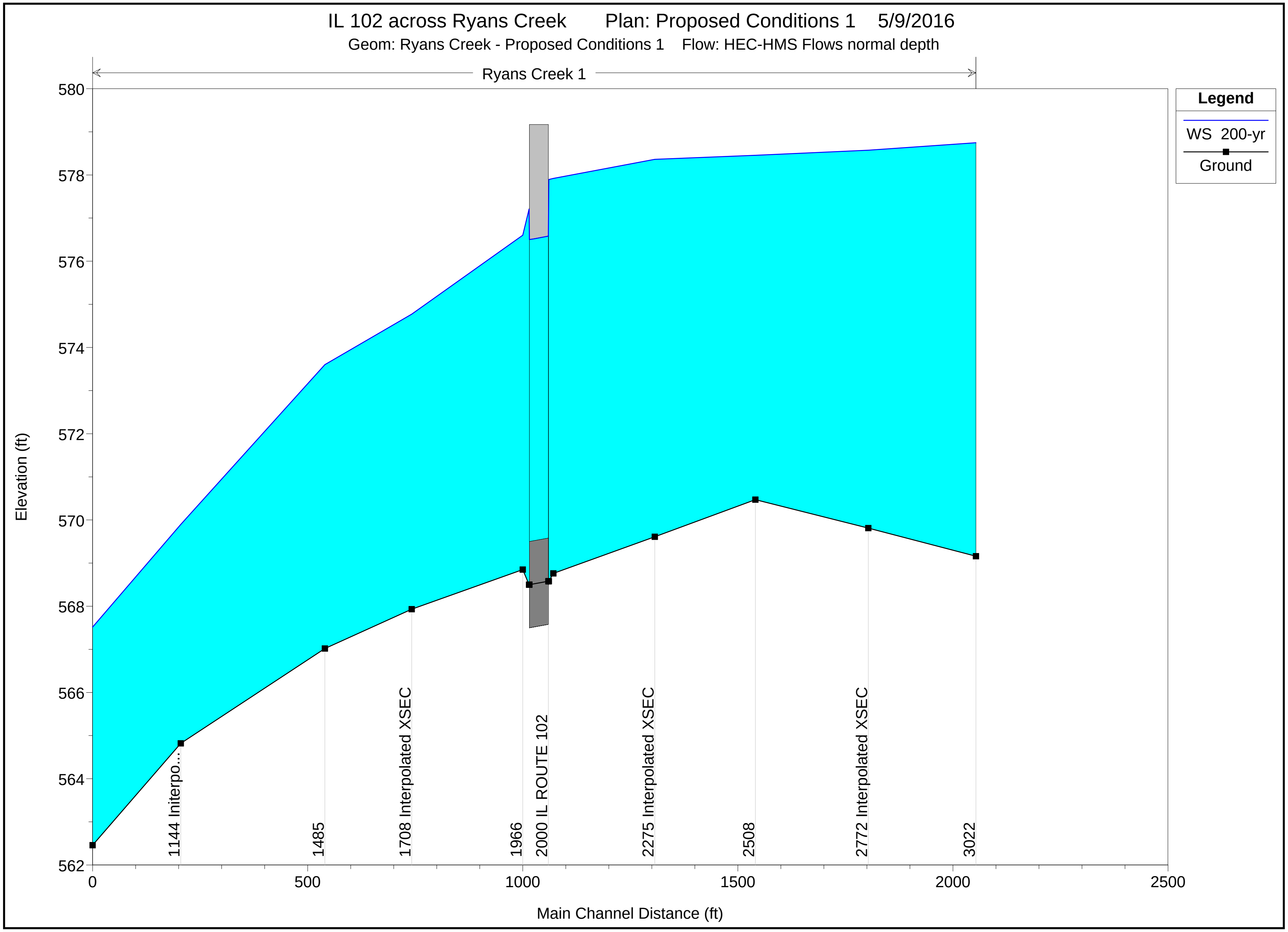
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	100-yr	577.80	577.71	0.09	0.21	0.00	441.02	655.15	153.83	203.99
1	2772	100-yr	577.58	577.45	0.13	0.22	0.02	569.20	636.55	44.25	192.00
1	2508	100-yr	577.34	577.27	0.07	0.14	0.00	720.13	509.38	20.49	214.77
1	2275	100-yr	577.20	577.10	0.10	0.23	0.02	545.62	637.45	66.93	229.31
1	2040	100-yr	576.95	576.66	0.29	0.01	0.02	141.14	1070.30	38.56	233.48
1	2026	100-yr	576.92	576.67	0.25				1250.00		40.18
1	2000		Culvert								
1	1977	100-yr	576.60	576.34	0.26	0.05	0.09		1250.00		40.33
1	1966	100-yr	576.46	575.91	0.56	1.72	0.02		1250.00		242.51
1	1708	100-yr	574.73	574.10	0.62	1.35	0.09	29.56	1109.49	110.95	161.89
1	1485	100-yr	573.28	572.97	0.31	2.86	0.06	7.84	772.21	469.94	138.68
1	1144	100-yr	570.36	569.45	0.91	2.49	0.22	4.51	1027.69	217.80	125.14
1	939	100-yr	567.30	567.11	0.19			5.89	612.80	631.32	325.46

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 100-yr

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
1	2000 Culvert #3	100-yr	576.92	576.67	574.96	576.92	579.31	307.43		0.33	5.16	5.11
1	2000 Culvert #1	100-yr	576.92	576.67	574.45	576.91	579.31	635.15		0.33	5.15	5.10
1	2000 Culvert #2	100-yr	576.92	576.67	574.96	576.92	579.31	307.43		0.33	5.16	5.11

Errors Warnings and Notes for Plan : Proposed 1

Location:	River: Ryans Creek Reach: 1 RS: 3022 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 100-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 100-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 100-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 100-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 100-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 100-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.



IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 200-yr
Ground
Elevation (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
Main Channel Distance (ft)
1144 Initerpo...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 200-yr

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	3022	200-yr	1700.00	569.16	578.75	576.22	578.83	0.000500	2.88	801.98	215.89	0.19
1	2772	200-yr	1700.00	569.81	578.57		578.68	0.000753	3.24	721.98	228.59	0.23
1	2508	200-yr	1700.00	570.47	578.46		578.52	0.000409	2.42	895.03	233.78	0.17
1	2275	200-yr	1700.00	569.61	578.36		578.43	0.000446	2.64	872.02	242.50	0.18
1	2040	200-yr	1700.00	568.76	577.92	574.69	578.25	0.001314	4.82	373.32	313.72	0.32
1	2026	200-yr	1700.00	568.58	577.89	572.59	578.24	0.001331	4.70	361.67	40.66	0.28
1	2000		Culvert									
1	1977	200-yr	1700.00	568.50	577.20	572.51	577.60	0.003061	5.03	338.19	108.45	0.31
1	1966	200-yr	1700.00	568.85	576.60	574.45	577.41	0.006802	7.20	236.07	269.97	0.52
1	1708	200-yr	1700.00	567.93	574.77		575.45	0.008296	7.29	362.90	179.13	0.56
1	1485	200-yr	1700.00	567.02	573.60		573.97	0.005777	6.10	479.74	141.86	0.46
1	1144	200-yr	1700.00	564.82	569.90	569.90	570.97	0.022049	9.34	275.51	128.58	0.86
1	939	200-yr	1700.00	562.46	567.52	566.69	567.73	0.007903	5.11	654.56	353.14	0.51

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 200-yr

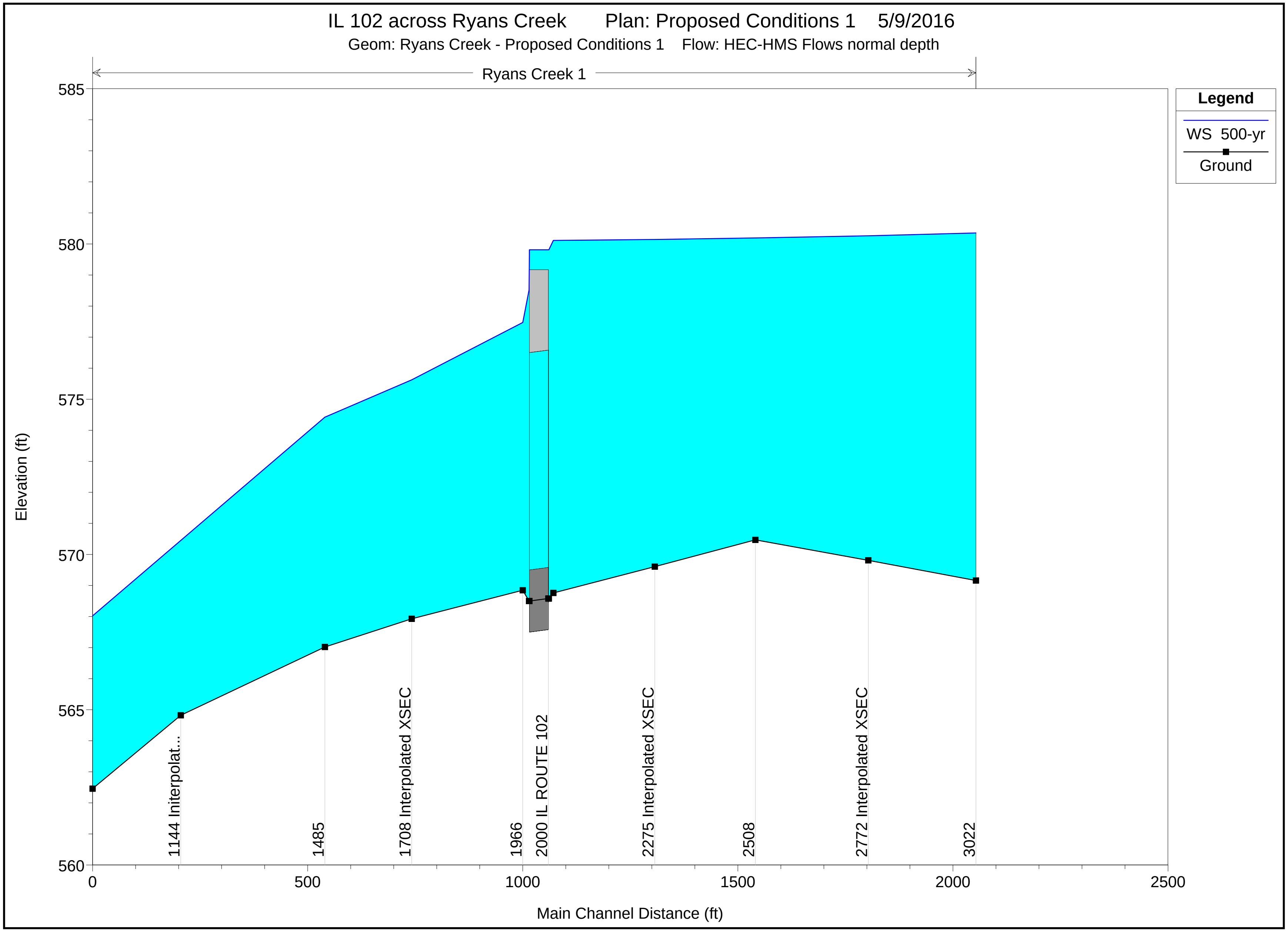
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
1	3022	200-yr	578.83	578.75	0.08	0.15	0.00	673.83	740.15	286.02	215.89
1	2772	200-yr	578.68	578.57	0.10	0.15	0.01	863.93	722.30	113.76	228.59
1	2508	200-yr	578.52	578.46	0.06	0.08	0.00	1078.09	565.54	56.37	233.78
1	2275	200-yr	578.43	578.36	0.07	0.15	0.03	889.50	674.97	135.54	242.50
1	2040	200-yr	578.25	577.92	0.33	0.01	0.00	230.62	1401.64	67.74	313.72
1	2026	200-yr	578.24	577.89	0.34				1700.00		40.66
1	2000		Culvert								
1	1977	200-yr	577.60	577.20	0.39	0.06	0.12		1700.00		108.45
1	1966	200-yr	577.41	576.60	0.81	1.90	0.06		1700.00		269.97
1	1708	200-yr	575.45	574.77	0.68	1.39	0.09	68.37	1378.54	253.09	179.13
1	1485	200-yr	573.97	573.60	0.37	2.93	0.07	17.50	972.39	710.11	141.86
1	1144	200-yr	570.97	569.90	1.07	2.53	0.26	10.30	1305.34	384.35	128.58
1	939	200-yr	567.73	567.52	0.21			10.08	769.77	920.16	353.14

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 200-yr

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
1	2000 Culvert #3	200-yr	578.24	577.89	576.18	578.23	579.31	414.17		0.69	6.72	6.72
1	2000 Culvert #1	200-yr	578.24	577.89	575.88	578.26	579.31	871.66		0.69	6.85	6.85
1	2000 Culvert #2	200-yr	578.24	577.89	576.18	578.23	579.31	414.17		0.69	6.72	6.72

Errors Warnings and Notes for Plan : Proposed 1

Location:	River: Ryans Creek Reach: 1 RS: 2508 Profile: 200-yr
Warning:	Divided flow computed for this cross-section.
Location:	River: Ryans Creek Reach: 1 RS: 2275 Profile: 200-yr
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: Ryans Creek Reach: 1 RS: 2040 Profile: 200-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 2026 Profile: 200-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 200-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 200-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 200-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 200-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.


IL 102 across Ryans Creek Plan: Proposed Conditions 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
Ground
Elevation (ft)
585
580
575
570
565
560
0
500
1000
1500
2000
2500
Main Channel Distance (ft)
1144 Interpolat...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 500-yr

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	3022	500-yr	2375.00	569.16	580.36	576.69	580.43	0.000322	2.65	1166.93	247.17	0.16
1	2772	500-yr	2375.00	569.81	580.26		580.34	0.000401	2.78	1147.63	264.96	0.18
1	2508	500-yr	2375.00	570.47	580.19		580.25	0.000246	2.17	1315.31	247.13	0.14
1	2275	500-yr	2375.00	569.61	580.15		580.20	0.000248	2.32	1341.79	301.14	0.14
1	2040	500-yr	2375.00	568.76	580.11	575.47	580.15	0.000182	2.15	1683.75	413.97	0.12
1	2026	500-yr	2375.00	568.58	579.81	573.58	580.08	0.000983	4.51	776.69	417.15	0.24
1	2000		Culvert									
1	1977	500-yr	2375.00	568.50	578.52	573.49	578.97	0.003240	5.60	584.00	207.38	0.32
1	1966	500-yr	2375.00	568.85	577.47	575.41	578.67	0.008492	8.80	269.92	300.21	0.59
1	1708	500-yr	2375.00	567.93	575.62		576.36	0.008069	7.93	490.45	194.92	0.56
1	1485	500-yr	2375.00	567.02	574.42		574.86	0.006074	6.86	597.66	145.91	0.48
1	1144	500-yr	2375.00	564.82	570.45	570.45	571.75	0.023372	10.57	347.83	132.31	0.91
1	939	500-yr	2375.00	562.46	568.03	567.03	568.27	0.007912	5.65	843.21	387.61	0.52

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 500-yr

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	3022	500-yr	580.43	580.36	0.07	0.09	0.00	1014.02	835.00	525.98	247.17
1	2772	500-yr	580.34	580.26	0.08	0.08	0.01	1323.66	793.04	258.30	264.96
1	2508	500-yr	580.25	580.19	0.05	0.05	0.00	1600.23	647.78	126.99	247.13
1	2275	500-yr	580.20	580.15	0.05	0.04	0.00	1360.63	752.64	261.73	301.14
1	2040	500-yr	580.15	580.11	0.04	0.00	0.07	1053.22	817.56	504.22	413.97
1	2026	500-yr	580.08	579.81	0.27			355.20	1986.70	33.10	417.15
1	2000		Culvert								
1	1977	500-yr	578.97	578.52	0.45	0.07	0.23	178.86	2196.14		207.38
1	1966	500-yr	578.67	577.47	1.20	2.08	0.23		2375.00		300.21
1	1708	500-yr	576.36	575.62	0.74	1.41	0.09	145.12	1739.20	490.68	194.92
1	1485	500-yr	574.86	574.42	0.44	3.02	0.09	36.32	1256.27	1082.41	145.91
1	1144	500-yr	571.75	570.45	1.30	2.59	0.32	22.59	1702.11	650.30	132.31
1	939	500-yr	568.27	568.03	0.25			17.77	988.81	1368.43	387.61

HEC-RAS Plan: Proposed 1 River: Ryans Creek Reach: 1 Profile: 500-yr

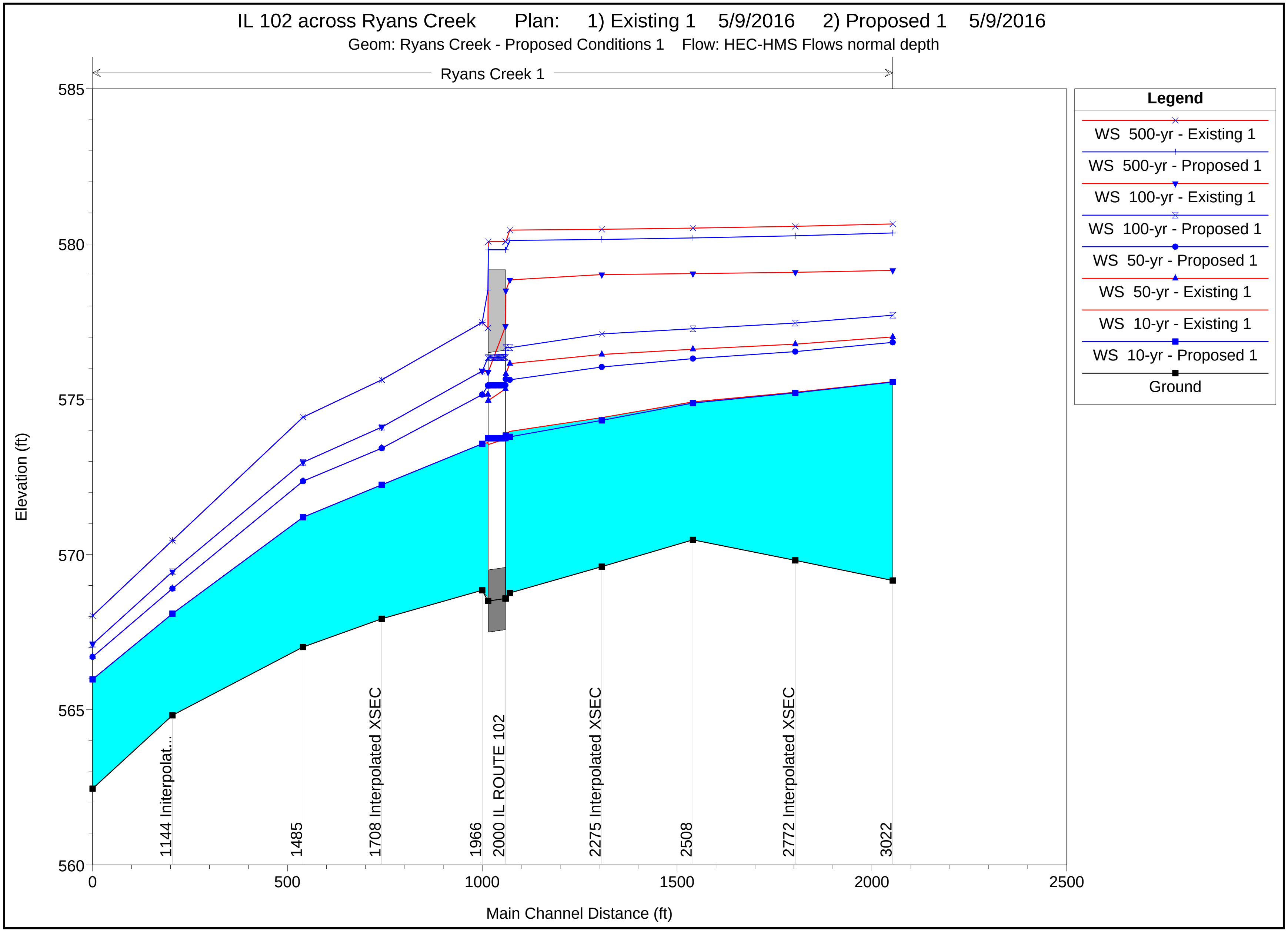
Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
1	2000 Culvert #3	500-yr	580.09	579.81	577.20	580.07	579.31	509.77	285.32	1.29	8.28	8.28
1	2000 Culvert #1	500-yr	580.09	579.81	576.99	580.10	579.31	1070.15	285.32	1.29	8.41	8.41
1	2000 Culvert #2	500-yr	580.09	579.81	577.20	580.07	579.31	509.77	285.32	1.29	8.28	8.28

Errors Warnings and Notes for Plan : Proposed 1

Location:	River: Ryans Creek Reach: 1 RS: 2040 Profile: 500-yr
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: Ryans Creek Reach: 1 RS: 2026 Profile: 500-yr
Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface
	was used.
Location:	River: Ryans Creek Reach: 1 RS: 1977 Profile: 500-yr
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: Ryans Creek Reach: 1 RS: 1966 Profile: 500-yr
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, energy was
	used.
Location:	River: Ryans Creek Reach: 1 RS: 1708 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1485 Profile: 500-yr
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.
Location:	River: Ryans Creek Reach: 1 RS: 1144 Profile: 500-yr
Warning:	The energy equation could not be balanced within the specified number of iterations. The program used
	critical depth for the water surface and continued on with the calculations.
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.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical depth, the
	calculated water surface came back below critical depth. This indicates that there is not a valid
	subcritical answer. The program defaulted to critical depth.

HEC-RAS

EXISTING VS. PROPOSED COMPARISONS



IL 102 across Ryans Creek Plan: 1) Existing 1 5/9/2016 2) Proposed 1 5/9/2016
Geom: Ryans Creek - Proposed Conditions 1 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr - Existing 1
WS 500-yr - Proposed 1
WS 100-yr - Existing 1
WS 100-yr - Proposed 1
WS 50-yr - Proposed 1
WS 50-yr - Existing 1
WS 10-yr - Existing 1
WS 10-yr - Proposed 1
Ground
Elevation (ft)
585
580
575
570
565
560
1144 Interpolat...
1485
1708 Interpolated XSEC
1966
2000 IL ROUTE 102
2275 Interpolated XSEC
2508
2772 Interpolated XSEC
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

HEC-RAS River: Ryans Creek Reach: 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3022	10-yr	Existing 1	408.00	569.16	575.56	572.23	575.67	0.000911	2.67	185.06	126.26	0.23
1	3022	10-yr	Proposed 1	408.00	569.16	575.55	572.23	575.66	0.000923	2.68	183.67	125.84	0.24
1	3022	50-yr	Existing 1	866.00	569.16	577.01	573.71	577.09	0.000664	2.75	443.93	195.39	0.21
1	3022	50-yr	Proposed 1	866.00	569.16	576.83	573.71	576.93	0.000814	2.98	409.90	193.12	0.23
1	3022	100-yr	Existing 1	1250.00	569.16	579.15	574.79	579.18	0.000201	1.89	889.82	220.50	0.12
1	3022	100-yr	Proposed 1	1250.00	569.16	577.71	574.79	577.80	0.000665	2.99	583.52	203.99	0.21
1	3022	500-yr	Existing 1	2375.00	569.16	580.64	576.69	580.71	0.000271	2.48	1239.65	258.65	0.15
1	3022	500-yr	Proposed 1	2375.00	569.16	580.36	576.69	580.43	0.000322	2.65	1166.93	247.17	0.16
1	2772	10-yr	Existing 1	408.00	569.81	575.22		575.36	0.001708	3.20	162.03	107.46	0.31
1	2772	10-yr	Proposed 1	408.00	569.81	575.20		575.34	0.001759	3.24	159.89	107.08	0.32
1	2772	50-yr	Existing 1	866.00	569.81	576.77		576.88	0.001071	3.11	366.10	160.33	0.26
1	2772	50-yr	Proposed 1	866.00	569.81	576.53		576.67	0.001402	3.45	328.39	152.46	0.30
1	2772	100-yr	Existing 1	1250.00	569.81	579.09		579.13	0.000271	2.05	843.18	244.78	0.14
1	2772	100-yr	Proposed 1	1250.00	569.81	577.45		577.58	0.001152	3.50	484.68	192.00	0.28
1	2772	500-yr	Existing 1	2375.00	569.81	580.57		580.63	0.000325	2.57	1228.71	266.72	0.16
1	2772	500-yr	Proposed 1	2375.00	569.81	580.26		580.34	0.000401	2.78	1147.63	264.96	0.18
1	2508	10-yr	Existing 1	408.00	570.47	574.91		574.99	0.001038	2.59	214.38	140.69	0.25
1	2508	10-yr	Proposed 1	408.00	570.47	574.88		574.96	0.001098	2.65	209.33	139.91	0.25
1	2508	50-yr	Existing 1	866.00	570.47	576.61		576.67	0.000548	2.36	492.67	191.27	0.19
1	2508	50-yr	Proposed 1	866.00	570.47	576.31		576.38	0.000750	2.66	436.59	180.17	0.22
1	2508	100-yr	Existing 1	1250.00	570.47	579.05		579.07	0.000144	1.50	1034.86	240.77	0.10
1	2508	100-yr	Proposed 1	1250.00	570.47	577.27		577.34	0.000610	2.66	627.61	214.77	0.20
1	2508	500-yr	Existing 1	2375.00	570.47	580.51		580.56	0.000205	2.04	1393.86	248.88	0.12
1	2508	500-yr	Proposed 1	2375.00	570.47	580.19		580.25	0.000246	2.17	1315.31	247.13	0.14
1	2275	10-yr	Existing 1	408.00	569.61	574.41		574.62	0.002748	3.81	119.53	90.50	0.40
1	2275	10-yr	Proposed 1	408.00	569.61	574.32		574.56	0.003075	3.98	112.02	86.00	0.42
1	2275	50-yr	Existing 1	866.00	569.61	576.44		576.53	0.000812	2.83	431.17	203.69	0.23
1	2275	50-yr	Proposed 1	866.00	569.61	576.04		576.17	0.001340	3.44	351.77	188.20	0.29
1	2275	100-yr	Existing 1	1250.00	569.61	579.01		579.04	0.000146	1.61	1032.20	248.79	0.11
1	2275	100-yr	Proposed 1	1250.00	569.61	577.10		577.20	0.000814	3.10	574.40	229.31	0.24
1	2275	500-yr	Existing 1	2375.00	569.61	580.47		580.52	0.000203	2.15	1442.46	315.54	0.13
1	2275	500-yr	Proposed 1	2375.00	569.61	580.15		580.20	0.000248	2.32	1341.79	301.14	0.14
1	2040	10-yr	Existing 1	408.00	568.76	573.96	571.69	574.11	0.001650	3.13	135.94	71.37	0.31
1	2040	10-yr	Proposed 1	408.00	568.76	573.79	571.69	573.96	0.002039	3.34	125.75	61.74	0.34
1	2040	50-yr	Existing 1	866.00	568.76	576.15	573.13	576.32	0.001000	3.47	267.00	195.29	0.27
1	2040	50-yr	Proposed 1	866.00	568.76	575.62	573.13	575.85	0.001482	3.94	235.61	164.73	0.32
1	2040	100-yr	Existing 1	1250.00	568.76	578.84	574.08	578.98	0.000452	3.07	428.75	355.47	0.19
1	2040	100-yr	Proposed 1	1250.00	568.76	576.66	574.08	576.95	0.001474	4.48	297.71	233.48	0.33
1	2040	500-yr	Existing 1	2375.00	568.76	580.45	575.47	580.48	0.000145	1.96	1825.55	434.58	0.11
1	2040	500-yr	Proposed 1	2375.00	568.76	580.11	575.47	580.15	0.000182	2.15	1683.75	413.97	0.12
1	2026	10-yr	Existing 1	408.00	568.58	573.87	571.58	574.08	0.001843	3.67	111.02	27.74	0.32
1	2026	10-yr	Proposed 1	408.00	568.58	573.83	570.13	573.90	0.000448	2.04	199.75	39.07	0.16
1	2026	50-yr	Existing 1	866.00	568.58	575.82	572.93	576.23	0.002488	5.18	167.26	30.05	0.38
1	2026	50-yr	Proposed 1	866.00	568.58	575.65	571.14	575.81	0.000803	3.19	271.31	39.78	0.22
1	2026	100-yr	Existing 1	1250.00	568.58	578.50	573.84	578.89	0.001496	5.05	247.35	122.22	0.31
1	2026	100-yr	Proposed 1	1250.00	568.58	576.67	571.85	576.92	0.001107	4.01	312.05	40.18	0.25
1	2026	500-yr	Existing 1	2375.00	568.58	580.08	576.02	580.40	0.001552	5.32	753.90	492.60	0.31
1	2026	500-yr	Proposed 1	2375.00	568.58	579.81	573.58	580.08	0.000983	4.51	776.69	417.15	0.24
1	2000			Bridge									
1	1977	10-yr	Existing 1	408.00	568.61	573.60	571.53	573.83	0.003792	3.79	107.58	28.92	0.34
1	1977	10-yr	Proposed 1	408.00	568.50	573.75	570.05	573.81	0.000845	2.04	199.96	39.23	0.16
1	1977	50-yr	Existing 1	866.00	568.61	575.15	572.85	575.65	0.005799	5.69	152.12	30.53	0.44
1	1977	50-yr	Proposed 1	866.00	568.50	575.44	571.05	575.61	0.001592	3.24	267.13	39.95	0.22
1	1977	100-yr	Existing 1	1250.00	568.61	575.88	573.73	576.68	0.008047	7.20	173.60	31.29	0.52
1	1977	100-yr	Proposed 1	1250.00	568.50	576.34	571.77	576.60	0.002284	4.13	303.01	40.33	0.27
1	1977	500-yr	Existing 1	2375.00	568.61	577.29	575.88	579.17	0.014423	11.00	215.86	108.51	0.72
1	1977	500-yr	Proposed 1	2375.00	568.50	578.52	573.49	578.97	0.003240	5.60	584.00	207.38	0.32
1	1966	10-yr	Existing 1	408.00	568.85	573.56	571.65	573.75	0.003987	3.47	117.50	39.00	0.35
1	1966	10-yr	Proposed 1	408.00	568.85	573.56	571.65	573.75	0.003987	3.47	117.50	39.00	0.35
1	1966	50-yr	Existing 1	866.00	568.85	575.15	572.93	575.51	0.004417	4.83	179.28	155.14	0.40
1	1966	50-yr	Proposed 1	866.00	568.85	575.15	572.93	575.51	0.004417	4.83	179.28	155.14	0.40
1	1966	100-yr	Existing 1	1250.00	568.85	575.91	573.72	576.46	0.005524	5.98	208.94	242.51	0.46
1	1966	100-yr	Proposed 1	1250.00	568.85	575.91	573.72	576.46	0.005524	5.98	208.94	242.51	0.46
1	1966	500-yr	Existing 1	2375.00	568.85	577.47	575.41	578.67	0.008492	8.80	269.92	300.21	0.59
1	1966	500-yr	Proposed 1	2375.00	568.85	577.47	575.41	578.67	0.008492	8.80	269.92	300.21	0.59
1	1708	10-yr	Existing 1	408.00	567.93	572.24		572.50	0.005764	4.08	100.44	38.29	0.42
1	1708	10-yr	Proposed 1	408.00	567.93	572.24		572.50	0.005764	4.08	100.44	38.29	0.42
1	1708	50-yr	Existing 1	866.00	567.93	573.42	571.98	573.95	0.008132	5.94	177.17	132.58	0.52
1	1708	50-yr	Proposed 1	866.00	567.93	573.42	571.98	573.95	0.008132	5.94	177.17	132.58	0.52
1	1708	100-yr	Existing 1	1250.00	567.93	574.10		574.73	0.008383	6.70	268.44	161.89	0.55
1	1708	100-yr	Proposed 1	1250.00	567.93	574.10		574.73	0.008383	6.70	268.44	161.89	0.55
1	1708	500-yr	Existing 1	2375.00	567.93	575.62		576.36	0.008069	7.93	490.45	194.92	0.56
1	1708	500-yr	Proposed 1	2375.00	567.93	575.62		576.36	0.008069	7.93	490.45	194.92	0.56
1	1485	10-yr	Existing 1	408.00	567.02	571.20		571.40	0.004977	3.87	157.73	116.41	0.39
1	1485	10-yr	Proposed 1	408.00	567.02	571.20		571.40	0.004977	3.87	157.73	116.41	0.39

HEC-RAS River: Ryans Creek Reach: 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	1485	50-yr	Existing 1	866.00	567.02	572.36		572.61	0.004928	4.75	307.67	134.73	0.41
1	1485	50-yr	Proposed 1	866.00	567.02	572.36		572.61	0.004928	4.75	307.67	134.73	0.41
1	1485	100-yr	Existing 1	1250.00	567.02	572.97		573.28	0.005473	5.48	390.89	138.68	0.44
1	1485	100-yr	Proposed 1	1250.00	567.02	572.97		573.28	0.005473	5.48	390.89	138.68	0.44
1	1485	500-yr	Existing 1	2375.00	567.02	574.42		574.86	0.006074	6.86	597.66	145.91	0.48
1	1485	500-yr	Proposed 1	2375.00	567.02	574.42		574.86	0.006074	6.86	597.66	145.91	0.48
1	1144	10-yr	Existing 1	408.00	564.82	568.09	567.66	568.58	0.018348	5.66	77.96	65.09	0.71
1	1144	10-yr	Proposed 1	408.00	564.82	568.09	567.66	568.58	0.018348	5.66	77.96	65.09	0.71
1	1144	50-yr	Existing 1	866.00	564.82	568.90	568.90	569.73	0.022817	7.68	151.55	117.92	0.83
1	1144	50-yr	Proposed 1	866.00	564.82	568.90	568.90	569.73	0.022817	7.68	151.55	117.92	0.83
1	1144	100-yr	Existing 1	1250.00	564.82	569.45	569.45	570.36	0.021237	8.39	218.32	125.14	0.83
1	1144	100-yr	Proposed 1	1250.00	564.82	569.45	569.45	570.36	0.021237	8.39	218.32	125.14	0.83
1	1144	500-yr	Existing 1	2375.00	564.82	570.45	570.45	571.75	0.023372	10.57	347.83	132.31	0.91
1	1144	500-yr	Proposed 1	2375.00	564.82	570.45	570.45	571.75	0.023372	10.57	347.83	132.31	0.91
1	939	10-yr	Existing 1	408.00	562.46	565.98	565.43	566.11	0.007910	3.46	204.15	212.75	0.46
1	939	10-yr	Proposed 1	408.00	562.46	565.98	565.43	566.11	0.007910	3.46	204.15	212.75	0.46
1	939	50-yr	Existing 1	866.00	562.46	566.70	566.05	566.87	0.007907	4.19	390.77	297.29	0.48
1	939	50-yr	Proposed 1	866.00	562.46	566.70	566.05	566.87	0.007907	4.19	390.77	297.29	0.48
1	939	100-yr	Existing 1	1250.00	562.46	567.11	566.38	567.30	0.007901	4.66	517.99	325.46	0.50
1	939	100-yr	Proposed 1	1250.00	562.46	567.11	566.38	567.30	0.007901	4.66	517.99	325.46	0.50
1	939	500-yr	Existing 1	2375.00	562.46	568.03	567.03	568.27	0.007912	5.65	843.21	387.61	0.52
1	939	500-yr	Proposed 1	2375.00	562.46	568.03	567.03	568.27	0.007912	5.65	843.21	387.61	0.52

SECTION 14

Scour Analysis

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013 — Prepared By: DCC

Date: 28-Apr-15 revised 01-SEP-15, 22-DEC-15

Checked By: CD

SCOUR **100-yr** — Date: 19-Jan-16

Total Scour = Long-term degradration + General Scour + Local Scour

<u>Long term Degradation</u>

Sheet 2 of the 1929 plans indicate the top of footing was constructed at elev 152.3' and the channel bed is at elev 154.6. So the footing was originally 2.3 feet below the channel bed back in 1929. Currently the west top of footing is exposed and the center of the channel is at the bottom of the footing or below. So the channel bottom has 2.3' of degradation (scour) since originally constructed.

Long term Degradation = 2.3'

<u>General Scour</u>

Use Upstream HEC-RAS RS 2040

All flow through the structure - No Overtopping

	From HEC-RAS Output
There are no piers	
Upstream Channel width W1	41.11
Bridge Opening Width W2	20'
Total 100-yr Discharge = 1250 cfs is all contained in channel	1250
Upstream Channel Discharge Q1 =	1009
Upstream Floodplain Discharge Q2 =	1250
Upstream channel flow depth Y1	7.99
Average depth in contracted section Y2	8.5
Existing Depth in contracted section before scour Yo	8.5

D_{50} Taken from Boring Log No. BSB-01 — D_{50} = 1mm= 0.00328'

<u>Determine if live bed or clear-water scour</u> (HEC-18 Section 6.1)

Vc = Ku * y^1/6 * D^1/3

Vc = 11.17 * (7.99^1/6)*(0.0033^1/3)

Vc = 2.35

$$V_{avg} = \frac{1250}{7.99*41.11}$$

V= 3.81 fps > 2.45 fps **Use live-bed scour**

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013 | Prepared By: DCC

Date: 28-Apr-15 revised 01-SEP-15, 22-DEC-15

Checked By: CD

SCOUR **100-yr** Date: 19-Jan-16

Live Bed Contraction Scour

Y2/Y1= (Q2/Q1)^6/7 * (W1/W2)^k1

K1 = 0.64	W1 = 41.11	Yo=8.50
Q1 = Q2	W2 = 20	Y1=7.99

Y2/Y1= [(1250/1009)^6/7]*[(41.11/20)^0.64]

Y2/Y1= 1.91

Y2= 1.91*7.99

Y2= 15.2 ft

Ys = Y2 - Yo Ys=15.2-8.5 **Ys= 6.7**

Local Scour *(HEC-18 - Section 8.6.1)*

Abutment Scour

Vertical Walls with wingwalls

LT	L=227.6	K1=0.82	K2=0.97	Fr=0.3	L'=213.8	Ae=637.5	Y1 = 8.10	ya= 2.80
RT	L1=100.6	K1=0.82	K2=0.97	Fr=0.07	L'=94.5	Ae=337.9	Y1 = 8.31	ya= 3.36

LT	L'/y1 =	213.8/8.1=	27.6 > 25. **Use Hire Equation**
RT	L'/y1 =	94.5/8.3=	11.4 < 25. **Use Froelich Equation**

RT Froelich

Ys/ya=2.27*K1*K2*(L'/ya)^0.43*Fr^0.61+1

Ys/ya= 2.50

Ys= 8.4

LT Hire Eq

Ys/y1 = 4*Fr^0.33*K1/0.55*K2

Ys/y1= 3.9

Ys= 31.59

Left **Total Scour = 2.3 + 6.7 +31.6= 40.6'**

Right **Total Scour = 2.3 + 6.7 +8.4= 17.4'**

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013

Prepared By: DCC

Date: 28-Apr-15 revised 01-SEP-15, 22-DEC-15, 9/15/16, 11/13/2016

Checked By: CD

SCOUR **130-yr** Date: 19-Jan-16 revisions 9/16/2016, 11/14/2016

Total Scour = Long-term degradration + General Scour + Local Scour

Long term Degradation

Sheet 2 of the 1929 plans indicate the top of footing was constructed at elev 152.3' and the channel bed is at elev 154.6. So the footing was originally 2.3 feet below the channel bed back in 1929. Currently the west top of footing is exposed and the center of the channel is at the bottom of the footing or below. So the channel bottom has 2.3' of degradation (scour) since originally constructed.

Long term Degradation = 2.3'

General Scour

Use Upstream HEC-RAS RS 2040

Pressure flow through the structure with no overtopping

There are no piers

Upstream Channel width W1		41.11	From HEC-RAS Output
Bridge Opening Width W2		20'	
Total 130-yr Discharge = 1375 cfs is all contained in channel		1375	
Upstream Channel Discharge Q1 =		531	
Upstream Floodplain Discharge Q2 =		1375	
Upstream channel flow depth Y1		10.26	
Average Depth in contracted section Y2		8.50	
Existing Depth in contracted section before scour Yo		8.50	
D_{50} Taken from Boring Log No. BSB-01	D_{50} =	1mm=	0.00328 ft

Determine if live bed or clear-water scour (HEC-18 Section 6.1)

Vc = Ku * y^1/6 * D^1/3

Vc = 11.17 * (10.26^1/6)*(0.0033^1/3)

Vc = 2.45

$$V_{avg} = \frac{1375}{10.26*41.11}$$

V= 3.26 fps > 2.45 fps **Use live-bed scour**

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

PRESSURE FLOW NO OVERTOPPING **130-yr**

Live Bed No Overtopping

Pressure flow through the structure with no overtopping		
Upstream Channel width W1	41.11	
Bridge Opening Width W2	20'	
Total 130-yr Discharge = 1375 cfs is all contained in channel	1375	
Upstream Channel Discharge Q1 =	531	From HEC-RAS Output
Upstream Floodplain Discharge Q2 =	1375	hue=hu(no overtopping) =
Upstream channel flow depth hu (Y1)	10.26	(578.84-568.58)
Bridge Opening Height hb	8.50	
Deck Thickness (T)	2.55	
Upstream channel velocity (V=Q1/(W1*hu)	1.512478	
K1 = 0.64		

Y2 = Y1(Q2/Q1)^6/7 (w1/w2)^k1

Y2= 23.19

t=0.5(hb-h1/hu^2)^0.2*(1-(hw/h1)^-0.1)-hb where: h1 = 10.26-8.5 = 1.76 hw=0

t= 2.45

Ys = Y2+t-hb

Ys = 23.19+2.45-8.5

Ys= 17.14

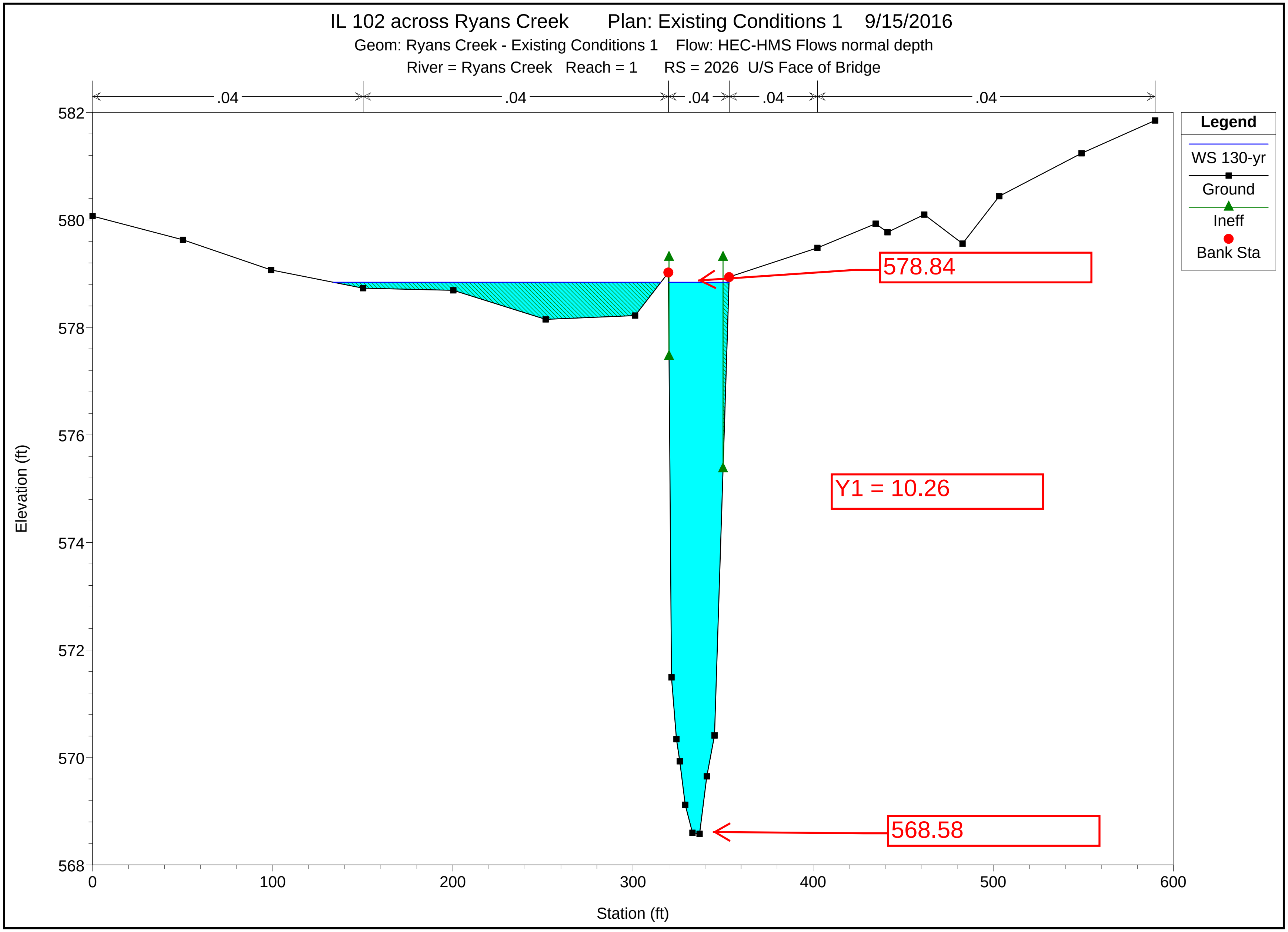
RT	Froelich	**Local Scour**	*(HEC-18 - Section 8.6.1)*						
		Abutment Scour							
		Vertical Walls with wingwalls							
		L=246	K1=0.82	K2=0.97	Fr=0.32	L'=246.0	Ae=764	Y1 = 8.45
LT	Hire Eq							
		L1=105.4	K1=0.82	K2=0.97	Fr=0.09	L'=105.4	Ae=401.2	Y1 =8.66

Left	L'/y1 =	246/8.45=	29.1 > 25. **Use Hire Equation**
Right	L'/y1 =	105.4/8.66=	12.2 < 25. **Use Froelich Equation**

LT	Ys/ya=2.27*K1*K2*(L'/ya)^0.43*Fr^0.61+1		RT	Ys/y1 = 4*Fr^0.33*K1/0.55*K2	
	Ys/ya=	2.733		Ys/y1=	4.0
	Ys=	10.4		Ys=	33.8

Total Scour = 2.3 +17.14 +33.8= 53.2' 53.24

Total Scour = 2.3 +17.14 +10.4=29.8' 29.84



IL 102 across Ryans Creek Plan: Existing Conditions 1 9/15/2016
Geom: Ryans Creek - Existing Conditions 1 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2026 U/S Face of Bridge
.04
.04
.04
.04
.04
Legend
WS 130-yr
Ground
Ineff
Bank Sta
578.84
Y1 = 10.26
568.58
Elevation (ft)
Station (ft)
582
580
578
576
574
572
570
568
0
100
200
300
400
500
600

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013

Prepared By: DCC

Date: 28-Apr-15 revised 01-SEP-15, 22-DEC-15

Checked By: CD

SCOUR **200-yr** Date: 19-Jan-16

Total Scour = Long-term degradration + General Scour + Local Scour

<u>Long term Degradation</u>

Sheet 2 of the 1929 plans indicate the top of footing was constructed at elev 152.3’ and the channel bed is at elev 154.6. So the footing was originally 2.3 feet below the channel bed back in 1929. Currently the west top of footing is exposed and the center of the channel is at the bottom of the footing or below. So the channel bottom has 2.3’ of degradation (scour) since originally constructed.

Long term Degradation = 2.3'

<u>General Scour</u>

Use Upstream HEC-RAS RS 2040

All flow through the structure - No Overtopping

There are no piers

Upstream Channel width W1	41.11	From HEC-RAS Output
Bridge Opening Width W2	20'	
Total 100-yr Discharge = 1700 cfs is all contained in channel	1700	
Upstream Channel Discharge Q1 =	603.4	
Upstream Floodplain Discharge Q2 =	1552	
Upstream channel flow depth Y1	9.09	
Average depth in contracted section Y2	8.6	
Existing Depth in contracted section before scour Yo	8.6	

D_{50} Taken from Boring Log No. BSB-01 D_{50} = 1mm= 0.00328 ft

<u>Determine if live bed or clear-water scour</u> (HEC-18 Section 6.1)

Vc = Ku * y^1/6 * D^1/3

Vc = 11.17 * (9.09^1/6)*(0.0033^1/3)

Vc = 2.40

$$\text{Vavg} = \frac{603}{9.09*41.11}$$

V= 1.61 fps < 2.40 fps **Use clear-water scour Eq's**

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013

Prepared By: DCC
Date: 28-Apr-15 revised 01-SEP-15, 22-DEC-15
Checked By: CD
Date: 19-Jan-16

SCOUR **200-yr**

Clear-water Contraction Scour

Y2= ((Ku*Q^2)/(Dm^2/3*W^2))^3/7

Ys = Y2 - Yo

Ku = 0.0077	W = 41.1		Yo=8.60
Q1 = 603.4	Dm = 1.25*D50=	0.0041	Y1=9.09

Y2= ((0.0077*603.4^2)/(.0041^2/3*20^2))^3/7

Y2= 11.08

Ys = Y2 - Yo   Ys=11.08-8.6   **Ys= 2.5**

Local Scour *(HEC-18 - Section 8.6.1)*

Abutment Scour

Vertical Walls with wingwalls

LT	L=265.6	K1=0.82	K2=0.97	Fr=0.27	L'=249.6	Ae=907	Y1 = 9.2	ya= 3.41
RT	L1=110.3	K1=0.82	K2=0.97	Fr=0.09	L'=103.6	Ae=453.3	Y1 = 9.42	ya= 4.11

LT	L'/y1 =	249.6/9.2=	27.1 > 25. **Use Hire Equation**
RT	L'/y1 =	103.6/9.42=	11.0 < 25. **Use Froelich Equation**

RT Froelich

Ys/ya=2.27*K1*K2*(L'/ya)^0.43*Fr^0.61+1

Ys/ya= 2.665

Ys= 11.0

LT Hire Eq

Ys/y1 = 4*Fr^0.33*K1/0.55*K2

Ys/y1= 3.8

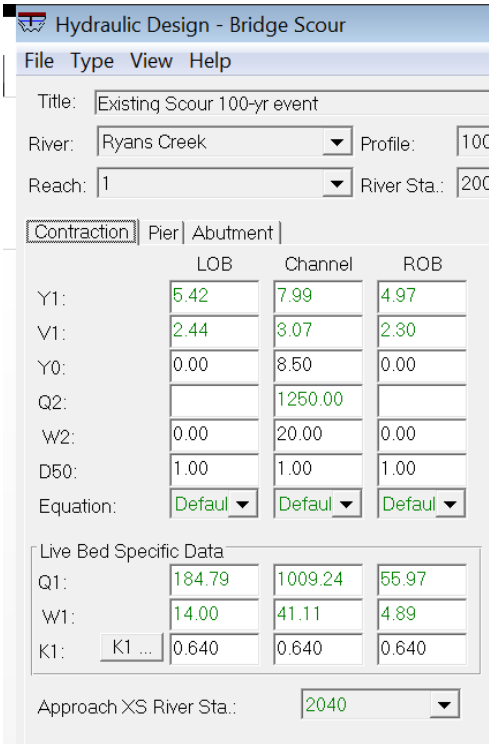
Ys= 35.88

Left **Total Scour = 2.3 + 2.5 +35.9= 40.7'**

Right **Total Scour = 2.3 + 2.5 +11.0= 15.8'**

HEC-18 Analysis inputs from HEC-RAS

100-year Event



Hydraulic Design - Bridge Scour

File Type View Help

Title: Existing Scour 100-yr event

River: Ryans Creek — Profile: 100

Reach: 1 — River Sta.: 200

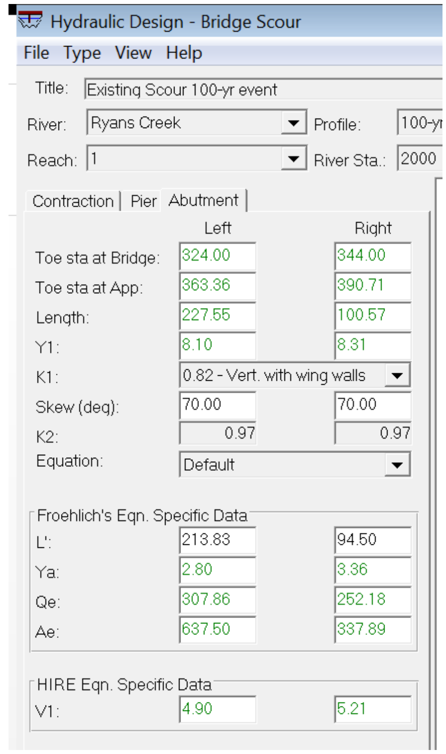
Contraction | Pier | Abutment

	LOB	Channel	ROB
Y1:	5.42	7.99	4.97
V1:	2.44	3.07	2.30
Y0:	0.00	8.50	0.00
Q2:		1250.00	
W2:	0.00	20.00	0.00
D50:	1.00	1.00	1.00
Equation:	Defaul	Defaul	Defaul

Live Bed Specific Data

	LOB	Channel	ROB
Q1:	184.79	1009.24	55.97
W1:	14.00	41.11	4.89
K1: K1 ...	0.640	0.640	0.640

Approach XS River Sta.: 2040



Hydraulic Design - Bridge Scour

File Type View Help

Title: Existing Scour 100-yr event

River: Ryans Creek — Profile: 100-yr

Reach: 1 — River Sta.: 2000

Contraction | Pier | Abutment

	Left	Right
Toe sta at Bridge:	324.00	344.00
Toe sta at App:	363.36	390.71
Length:	227.55	100.57
Y1:	8.10	8.31
K1:	0.82 - Vert. with wing walls	
Skew (deg):	70.00	70.00
K2:	0.97	0.97
Equation:	Default	

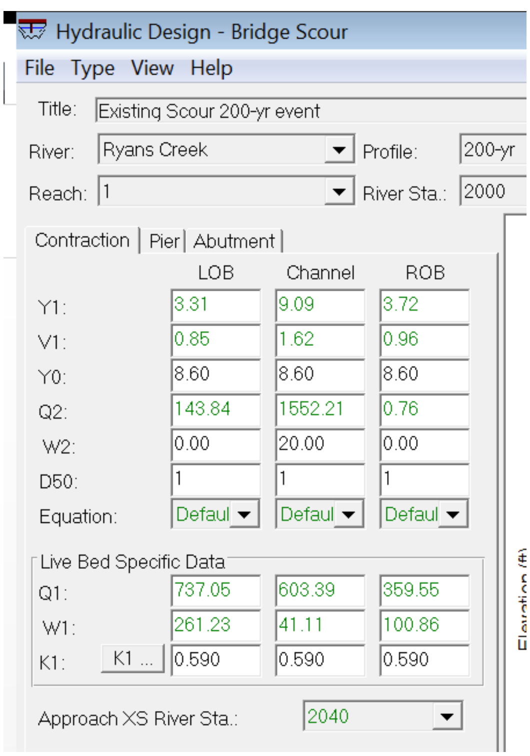
Froehlich's Eqn. Specific Data

	Left	Right
L':	213.83	94.50
Ya:	2.80	3.36
Qe:	307.86	252.18
Ae:	637.50	337.89

HIRE Eqn. Specific Data

	Left	Right
V1:	4.90	5.21

200-year Event



Hydraulic Design - Bridge Scour

File Type View Help

Title: Existing Scour 200-yr event

River: Ryans Creek — Profile: 200-yr

Reach: 1 — River Sta.: 2000

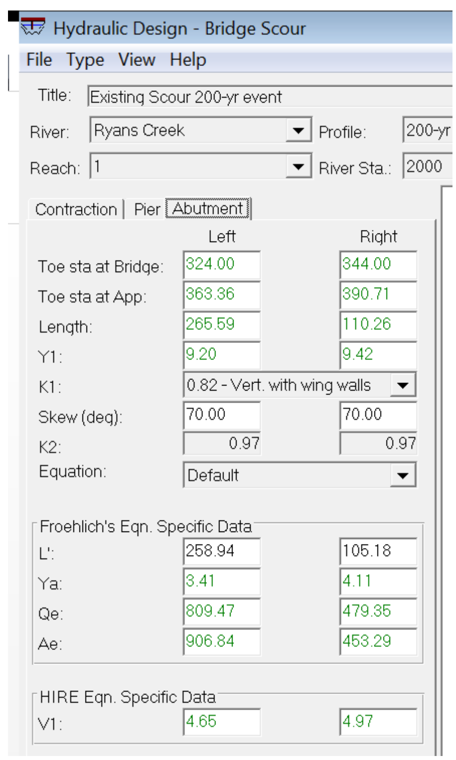
Contraction | Pier | Abutment

	LOB	Channel	ROB
Y1:	3.31	9.09	3.72
V1:	0.85	1.62	0.96
Y0:	8.60	8.60	8.60
Q2:	143.84	1552.21	0.76
W2:	0.00	20.00	0.00
D50:	1	1	1
Equation:	Defaul	Defaul	Defaul

Live Bed Specific Data

	LOB	Channel	ROB
Q1:	737.05	603.39	359.55
W1:	261.23	41.11	100.86
K1: K1 ...	0.590	0.590	0.590

Approach XS River Sta.: 2040



Hydraulic Design - Bridge Scour

File Type View Help

Title: Existing Scour 200-yr event

River: Ryans Creek — Profile: 200-yr

Reach: 1 — River Sta.: 2000

Contraction | Pier | Abutment

	Left	Right
Toe sta at Bridge:	324.00	344.00
Toe sta at App:	363.36	390.71
Length:	265.59	110.26
Y1:	9.20	9.42
K1:	0.82 - Vert. with wing walls	
Skew (deg):	70.00	70.00
K2:	0.97	0.97
Equation:	Default	

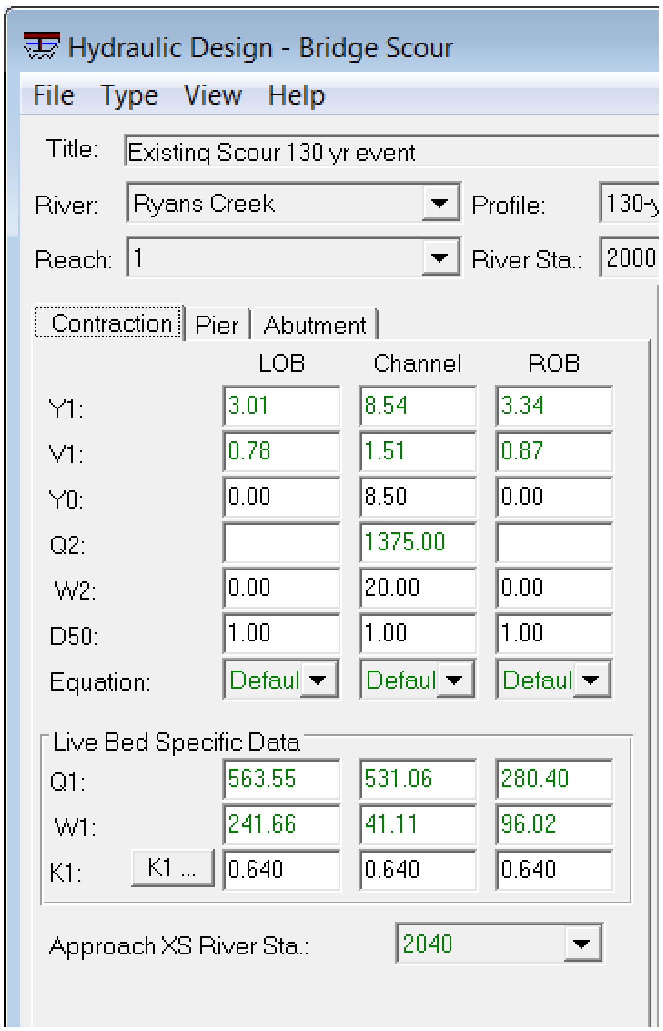
Froehlich's Eqn. Specific Data

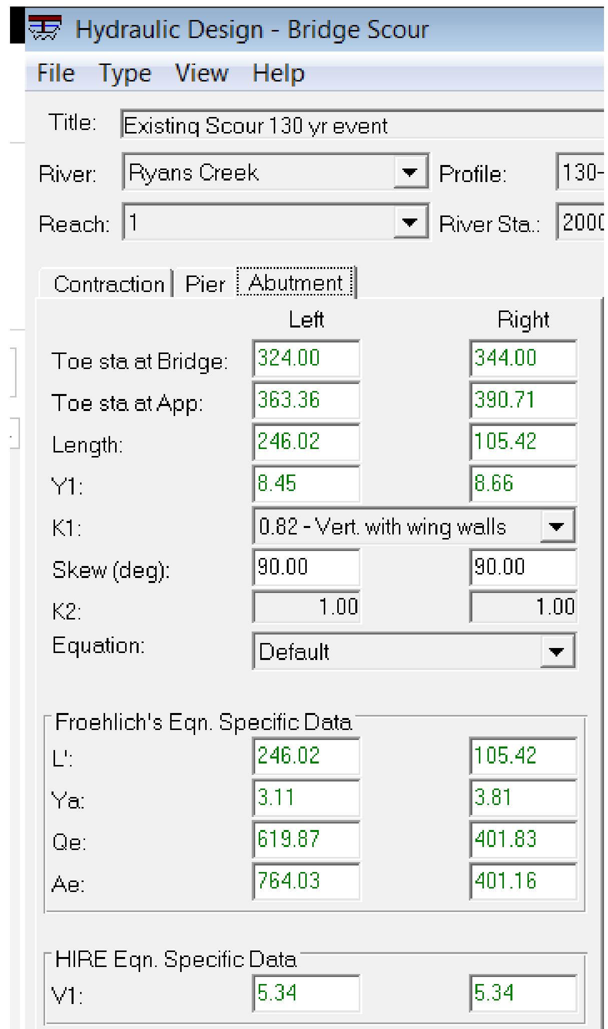
	Left	Right
L':	258.94	105.18
Ya:	3.41	4.11
Qe:	809.47	479.35
Ae:	906.84	453.29

HIRE Eqn. Specific Data

	Left	Right
V1:	4.65	4.97

HEC-18 Analysis inputs from HEC-RAS
130-year Event





Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013 — Prepared By: DCC

Date: 4-Jan-16

Checked By: CD

SCOUR **100-yr** Date: 19-Jan-16

NCHRP Live-Bed Scour

Scour occuring when abutment is close to the channel.

LEFT	L=	231		
	Bf =	241		
	L/Bf =	**96%**	**>75% use Live-Bed scour calculation**	
	yo=	8.5		Flow depth prior to scour
	y1=	7.99		Upstream Flow Depth
	q1=	1250/41	30.49	
	q2f=	1009/20 =	50.45	
	yc=	y1 (q2/q1)^6/7		Flow depth including live-bed contraction scour
	yc=	12.30		
	q2/q1=	1.65		

From Figure 8.10, α = 1.45

ymax= α*yc	17.8	Max Flow depth resulting from Scour
ys=ymax-yo	9.3	Abutment Scour Depth

<u>Ys=9.3</u>

RIGHT	L=	86		
	Bf =	100		
	L/Bf =	**86%**	**>75% use Live-Bed scour calculation**	

Same Calcs as above

yo=	8.5	
y1=	8.31	
q1=	1250/41	30.49
q2f=	1250/20 =	62.5
yc=	y1 (q2/q1)^6/7	
yc=	15.37	
q2/q1=	2	

From Figure 8.10, α = 1.23

ymax= α*yc	18.9
ys=ymax-yo	10.4

<u>Ys=10.4</u>

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013 — Prepared By: DCC
Date: 4-Jan-16
Checked By: CD
SCOUR Pressure flow — Date: 19-Jan-16
130-yr

NCHRP Live-Bed Scour

Scour occuring when abutment is close to the channel.

LEFT	L=	258		
	Bf =	263		
	L/Bf =	**98%**	**>75% use Live-Bed scour calculation**	
	yo=	8.6		Flow depth prior to scour
	y1=	8.6		Estimated Upstream Flow Depth
	q1=	1400/41.1	34.06	
	q2f=	1400/20 =	70	
	yc=	y1 (q2/q1)^6/7		Flow depth including live-bed contraction scour
	yc=	20.73		
	q2/q1=	2		

From Figure 8.10, α = 1.23

ymax= α*yc	25.50	Max Flow depth resulting from Scour
ys=ymax-yo	16.90	Abutment Scour Depth

Ys=16.9'

RIGHT	L=	86	
	Bf =	100	
	L/Bf =	**86%**	**>75% use Live-Bed scour calculation**

Same Calcs as above

Scour Calculations

IL Route 102 over Ryans Creek Existing Structure

FHWA HEC-18 April, 2013 | Prepared By: DCC
Date: 4-Jan-16
Checked By: CD

SCOUR **200-yr** Date: 19-Jan-16

NCHRP Live-Bed Scour

Scour occuring when abutment is close to the channel.

LEFT	L=	265.6		
	Bf =	269		
	L/Bf =	**99%**	**>75% use Live-Bed scour calculation**	
	yo=	8.6		Flow depth prior to scour
	y1=	9.09		Average Upstream Flow Depth
	q1=	1700/41	41.46	
	q2f=	1700/20 =	85	
	yc=	y1 (q2/q1)^6/7		Flow depth including live-bed contraction scour
	yc=	16.82		
	q2/q1=	2.05		

From Figure 8.10, α = 1.23

ymax= α*yc	20.7	Max Flow depth resulting from Scour
ys=ymax-yo	12.1	Abutment Scour Depth

Ys=12.1

RIGHT	L=	86		
	Bf =	100		
	L/Bf =	**86%**	**>75% use Live-Bed scour calculation**	

Same Calcs as above

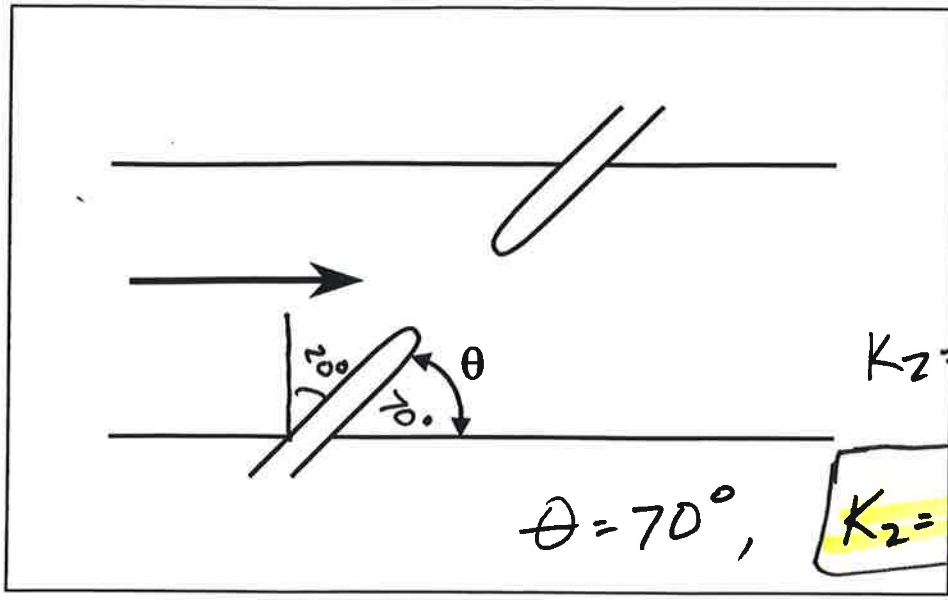
yo=	8.5	
y1=	9.42	
q1=	1700/41	41.46
q2f=	1700/20 =	85
yc=	y1 (q2/q1)^6/7	
yc=	17.06	
q2/q1=	2	

From Figure 8.10, α = 1.23

ymax= α*yc	21.0
ys=ymax-yo	12.5

Ys=12.5

DCC 1-4-2016



$$K_2 = \left(\frac{\theta}{90}\right)^{0.13} = \left(\frac{70}{90}\right)^{.13}$$

$$\theta = 70°, \quad \boxed{K_2 = 0.97}$$

Figure 8.5. Orientation of embankment angle, 2, to the flow.

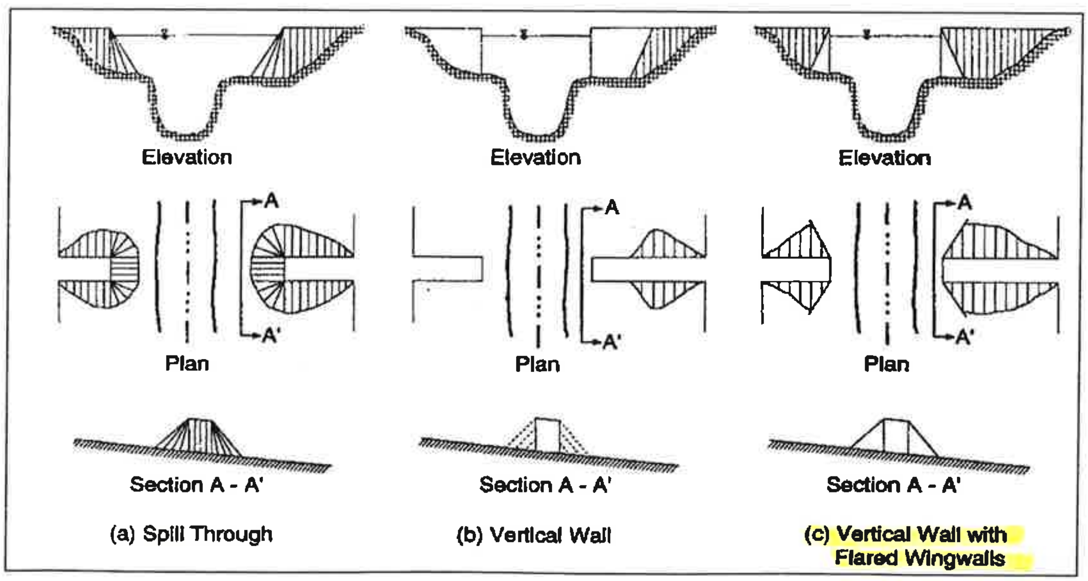


Figure 8.6. Abutment shape.

Table 8.1. Abutment Shape Coefficients.	
Description	K_1
Vertical-wall abutment	1.00
Vertical-wall abutment with wing walls	0.82
Spill-through abutment	0.55

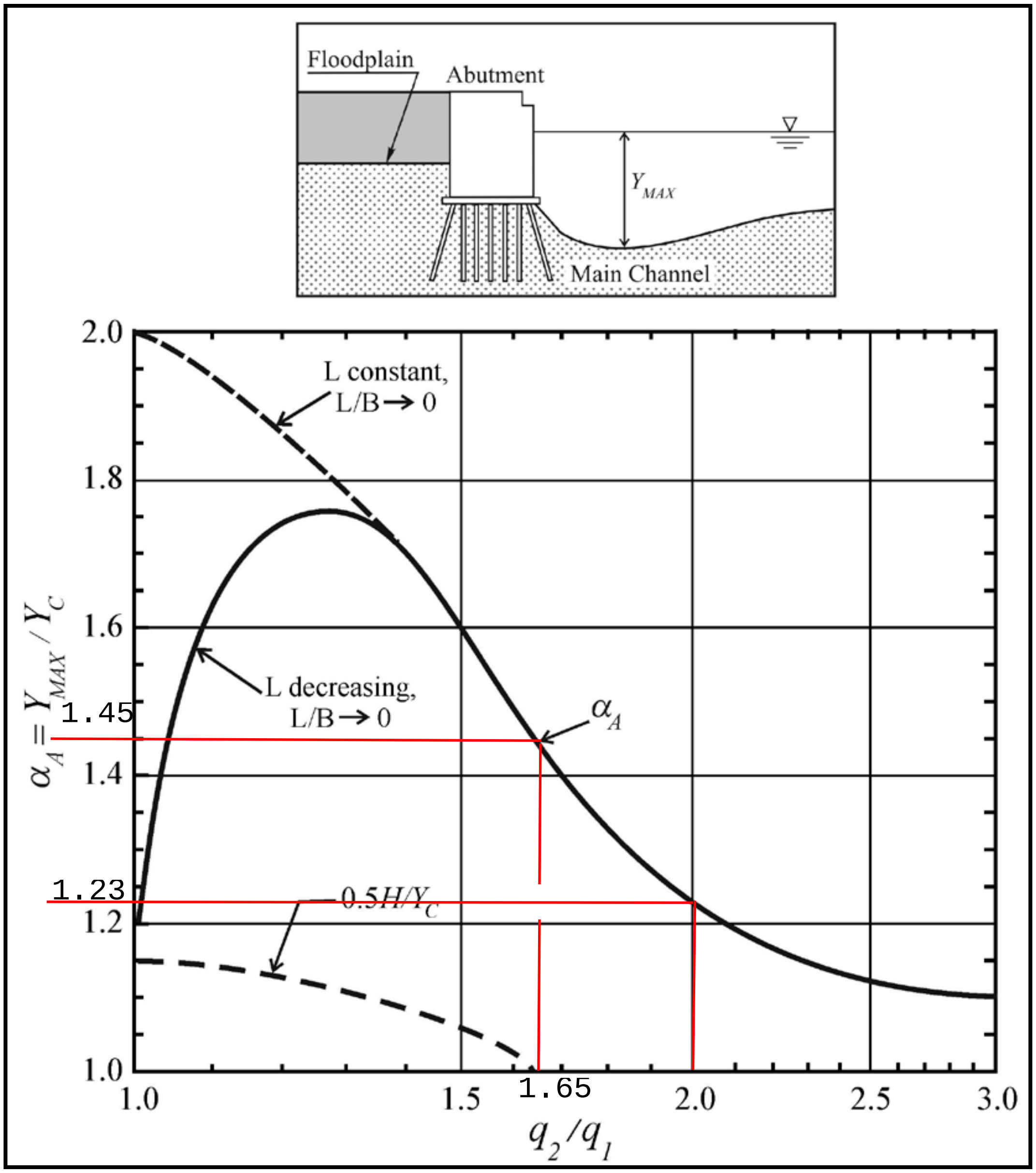
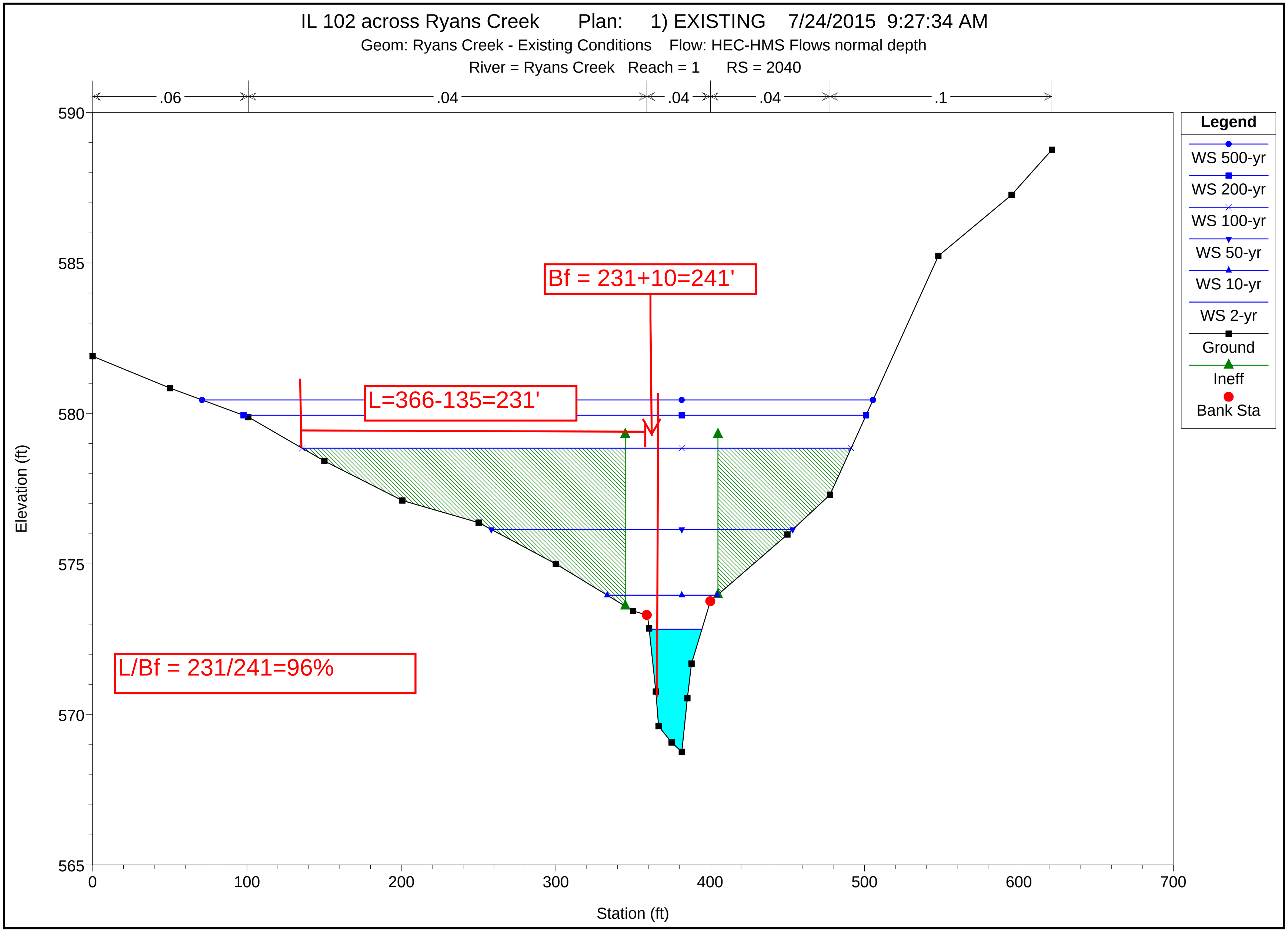
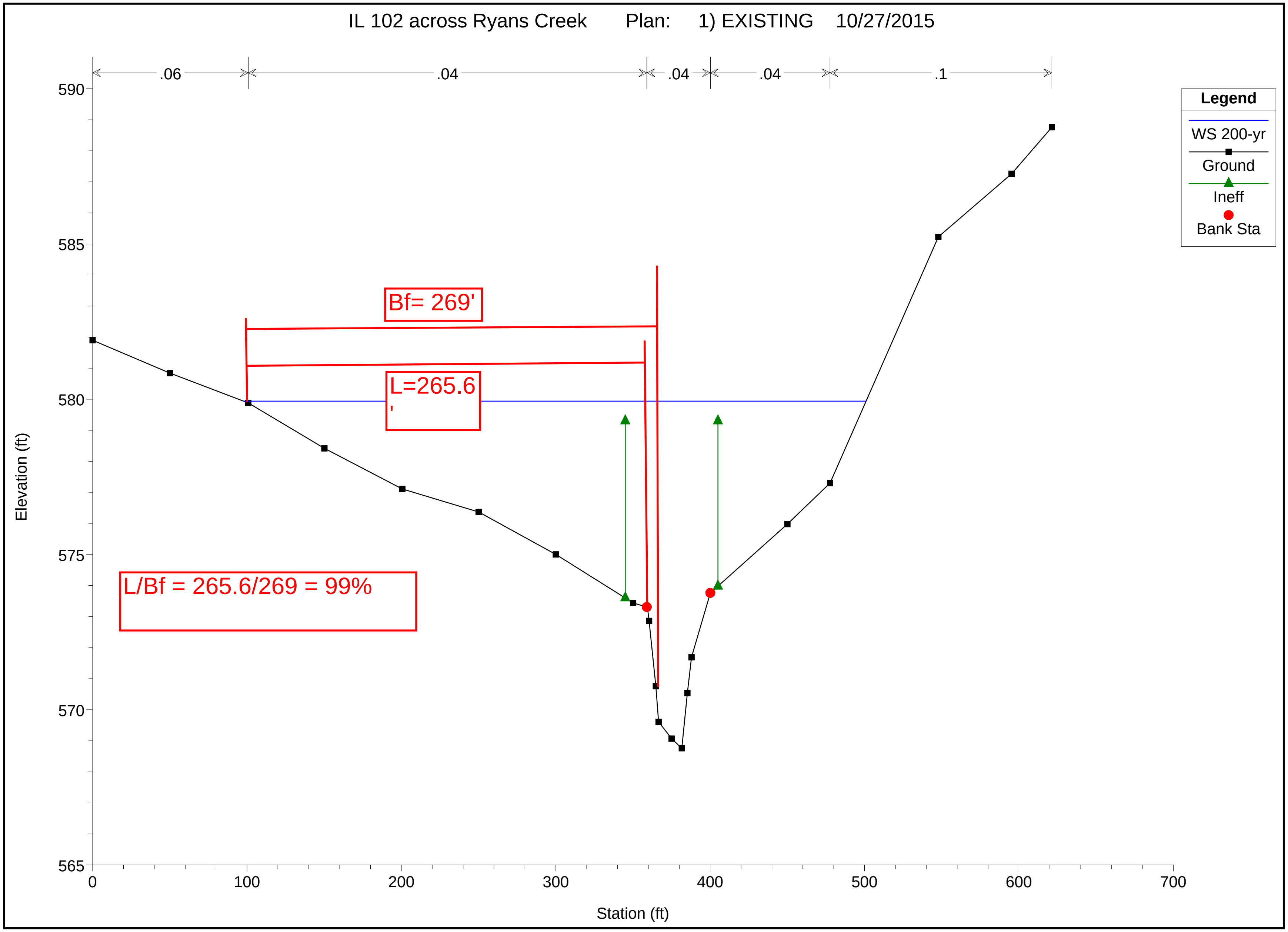


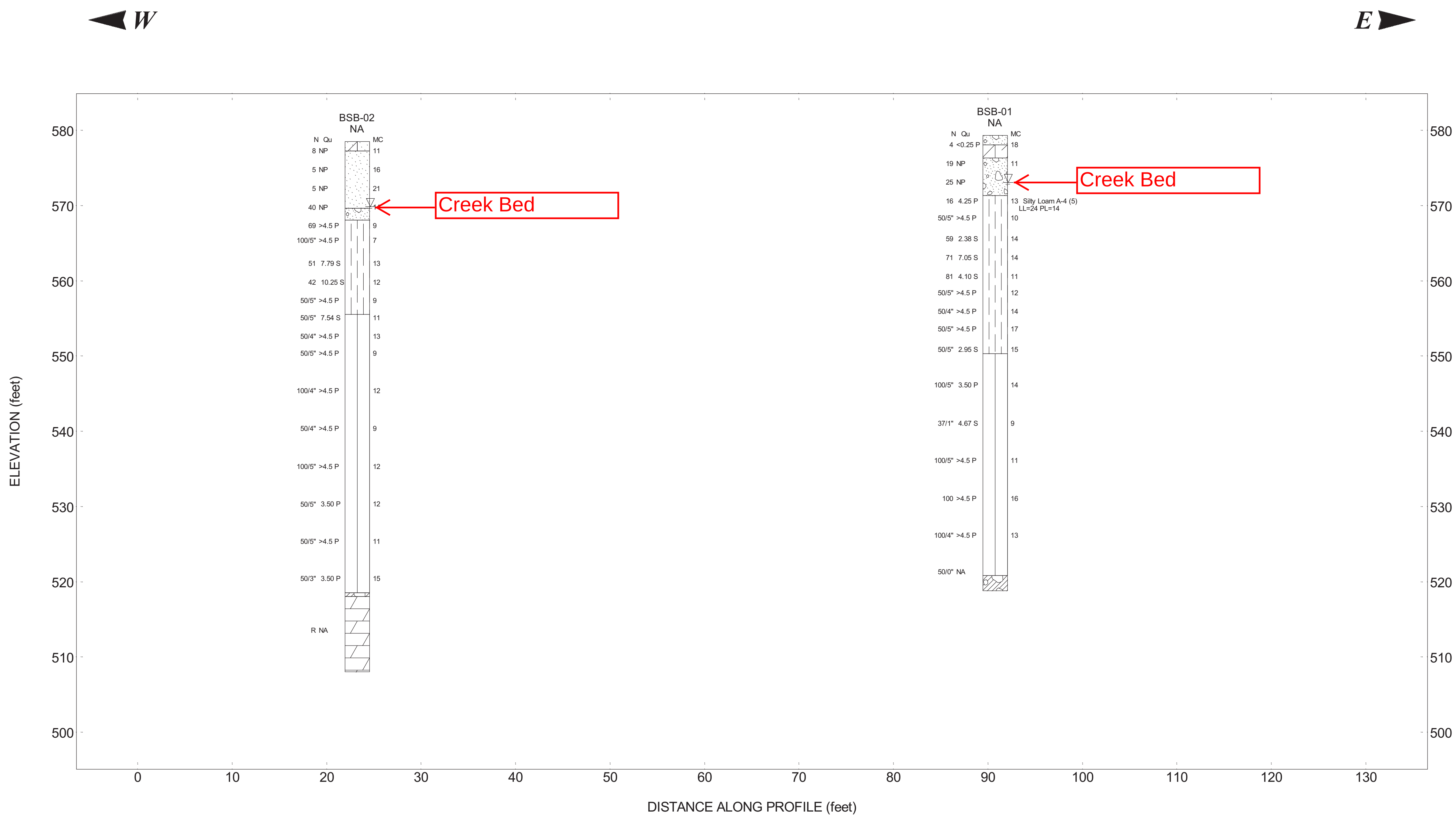
Figure 8.10. Scour amplification factor for wingwall abutments and live-bed conditions (NCHRP 2010b).

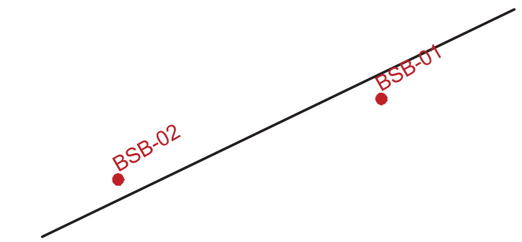
If the projected length of the embankment, L, is less than 75 percent of the width of the floodplain (B_f), scour condition (b) in Figure 8.7 occurs and the contraction scour calculation is performed using a clear-water scour calculation (see Chapter 6). The clear-water contraction scour equation also uses unit discharge (q), which can be estimated either by discharge divided by width or by the product of velocity and depth. Two clear-water contraction scour equations may be applied. The first equation is the standard equation based on grain size:

$$y_c = \left(\frac{q_{2f}}{K_u D_{50}^{1/3}} \right)^{6/7} \tag{8.6}$$


IL 102 across Ryans Creek Plan: 1) EXISTING 7/24/2015 9:27:34 AM
Geom: Ryans Creek - Existing Conditions Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2040
.06
.04
.04
.04
.1
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)
Elevation (ft)
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Bf = 231+10=241'
L=366-135=231'
L/Bf = 231/241=96%

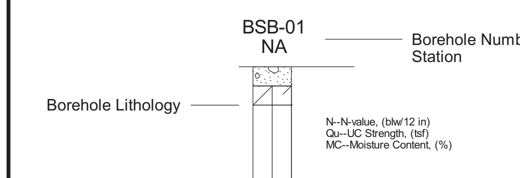

IL 102 across Ryans Creek Plan: 1) EXISTING 10/27/2015
.06
.04
.04
.04
.1
Legend
WS 200-yr
Ground
Ineff
Bank Sta
Bf= 269'
L=265.6'
L/Bf = 265.6/269 = 99%
Elevation (ft)
590
585
580
575
570
565
0
100
200
300
400
500
600
700
Station (ft)





Site Map Scale 1 inch equals 50 feet

Explanation:



▽ Water Level Reading at time of drilling.

▼ Water Level Reading 24-hr after drilling or at end of drilling

Horizontal Scale (feet)

Vertical Exaggeration: 1x

Lithology Graphics

- Gravelly sand, sandy gravel
- IDH Clay Loam
- IDH Silty Clay, Silty Clay Loam
- IDH Silt, Silty Loam
- Weathered bedrock
- IDH Loam
- IDH Sand, Sandy Loam
- Dolomite or Dolomitic Limestone

Wang Engineering
1145 N Main Street
Lombard, IL 60148

Soil Profile

WEI SINCE 1982

IL Route 102 over Ryans Creek
Wesley Township, Will County, IL

JOB NUMBER	PLATE NUMBER
255-24-02	EXHIBIT 4

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG BSB-01

WEI Job No.: 255-24-02

Client: **Stantec**
Project: **IL Route 102 over Ryans Creek**
Location: **Wesley Township, Will County, IL**

Datum: NAVD 88
Elevation: 579.35 ft
North: 1665593.51 ft
East: 1054130.76 ft
Station: NA
Offset: NA

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	15-inch thick GRAVELLY SAND; moist --SHOULDER--					
578.1	Very soft, brown and black CLAY LOAM, sand lenses, trace wood fragments --FILL--		1	4 2 2	<0.25 P	18
576.3	Medium dense, brown GRAVELLY SANDY LOAM to LOAM; moist		2	8 12 7	NP	11
		5	3	17 8	NP	
571.3	Very stiff to hard, greenish-gray SILTY CLAY LOAM to SILTY LOAM		4	4 7 9	4.25 P	13
		10	5	33 50/5"	>4.5 P	10
			6	16 31 28	2.38 S	14
		15	7	25 28 43	7.05 S	14
			8	27 31 50	4.10 S	11
		20	9	43 50/5"	>4.5 P	12
			10	37 50/4"	>4.5 P	14
		25				
			11	50/5"	>4.5 P	17
550.3	Very stiff to hard, greenish-gray SILTY LOAM; horizontally bedded shale --WEATHERED SHALE BEDROCK--		12	42 50/5"	2.95 S	15
		30	13	100/5"	3.50 P	14
		35	14	63 37/1"	4.67 S	9
		40	15	100/5"	>4.5 P	11
		45	16	100	>4.5 P	16
		50				

Water level

GENERAL NOTES

Begin Drilling **03-12-2015** Complete Drilling **03-12-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55**
Driller **R & J** Logger **A. Tomaras** Checked by **C. Marin**
Drilling Method **4.0" OD CFA to 10'; Mud rotary to bedrock; backfilled upon completion**

WATER LEVEL DATA

While Drilling **6.50 ft**
At Completion of Drilling **NA**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG BSB-02

WEI Job No.: 255-24-02

Client: **Stantec**
Project: **IL Route 102 over Ryans Creek**
Location: **Wesley Township, Will County, IL**

Datum: NAVD 88
Elevation: 578.56 ft
North: 1665573.47 ft
East: 1054065.49 ft
Station: NA
Offset: NA

SOIL AND ROCK DESCRIPTION

Elevation (ft)	Description	Depth (ft)
	15-inch thick, brown LOAM, little gravel; moist	
577.3	--SHOULDER--	
	Loose, brown and black SANDY LOAM, trace gravel, clay lenses; moist --FILL--	
569.7	Dense, brown and gray SANDY GRAVEL; wet	
568.1	Hard, greenish-gray SILTY CLAY LOAM to SILTY LOAM	
555.6	Very stiff to hard, greenish-gray SILTY LOAM; horizontally bedded SHALE	25
	--WEATHERED SHALE BEDROCK--	

Water level / Creek Bed

Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
1	5 4 4	NP	11
2	2 2 3	NP	16
3	2 2 3	NP	21
4	22 18	NP	14
5	20 29 40	>4.5 P	9
6	100/5"	>4.5 P	7
7	13 17 34	7.79 S	13
8	12 16 26	10.25 S	12
9	29 43 50/5"	>4.5 P	9
10	22 50/5"	7.54 S	11
11	39 50/4"	>4.5 P	13
12	50/5"	>4.5 P	9
13	100/4"	>4.5 P	12
14	50/4"	>4.5 P	9
15	100/5"	>4.5 P	12
16	50/5"	3.50 P	12

Depth scale (ft): 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

GENERAL NOTES

Begin Drilling **03-13-2015** Complete Drilling **03-13-2015**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55**
Driller **R & J** Logger **A. Tomaras** Checked by **C. Marin**
Drilling Method **4.0" OD CFA to 10'; Mud rotary to bedrock; backfilled upon completion**

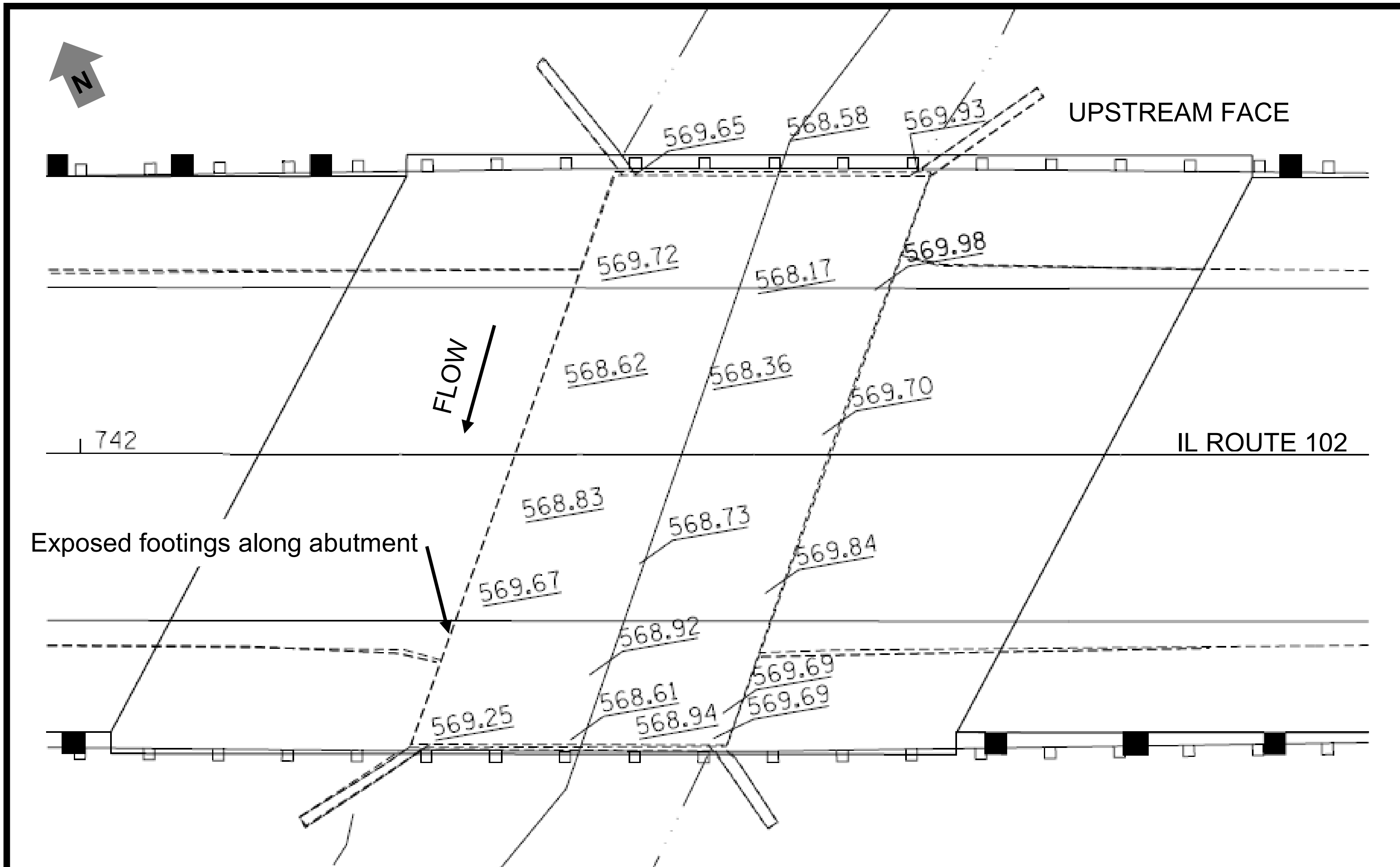
WATER LEVEL DATA

While Drilling **8.90 ft**
At Completion of Drilling **NA**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

Table A.8. Sediment Particles Grade Scale.						
Size				Approximate Sieve Mesh Openings Per Inch		Class
Millimeters	Millimeters	Microns	Inches	Tyler	U.S. Standard	Name
4000-2000			160-80			Very large boulders
2000-1000			80-40			Large boulders
1000-500			40-20			Medium boulders
500-250			20-10			Small boulders
250-130			10-5			Large cobbles
130-64			5-2.5			Small cobbles
64-32			2.5-1.3			Very coarse gravel
32-16			1.3-0.6			Coarse gravel
16-8			0.6-0.3	2.5		Medium gravel
8-4			0.3-0.16	5	5	Fine gravel
4-2			0.16-0.08	9	10	Very fine gravel
2-1	2.00-1.00	2000-1000		16	18	Very coarse sand
1-1/2	1.00-0.50	1000-500		32	35	Coarse sand
1/2-1/4	0.50-0.25	500-250		60	60	Medium sand
1/4-1/8	0.25-0.125	250-125		115	120	Fine sand
1/8-1/16	0.125-0.062	125-62		250	230	Very fine sand
1/16-1/32	0062-0031	62-31				Coarse silt
1/32-1/64	0.031-0.016	31-16				Medium silt
1/64-1/128	0.016-0.008	1[illegible]				Fine silt
1/128-1/256	0.008-0.004	8-4				Very fine silt
1/256-1/512	0.004-0.0020	4-2				Coarse clay
1/512-1/1024	0.0020-0.0010	2-1				Medium clay
1/1024-1/2048	0.0010-0.0005	1-0.5				Fine clay
1/2048-1/4096	0.0005-0.0002	0.5-0.24				Very fine clay

Will use an average particle size of 1 mm



Primera

IL ROUTE 102 OVER RYANS CREEK

SURVEY UNDER BRIDGE
March 19, 2015

+ = C/L DIAPHRAGMS

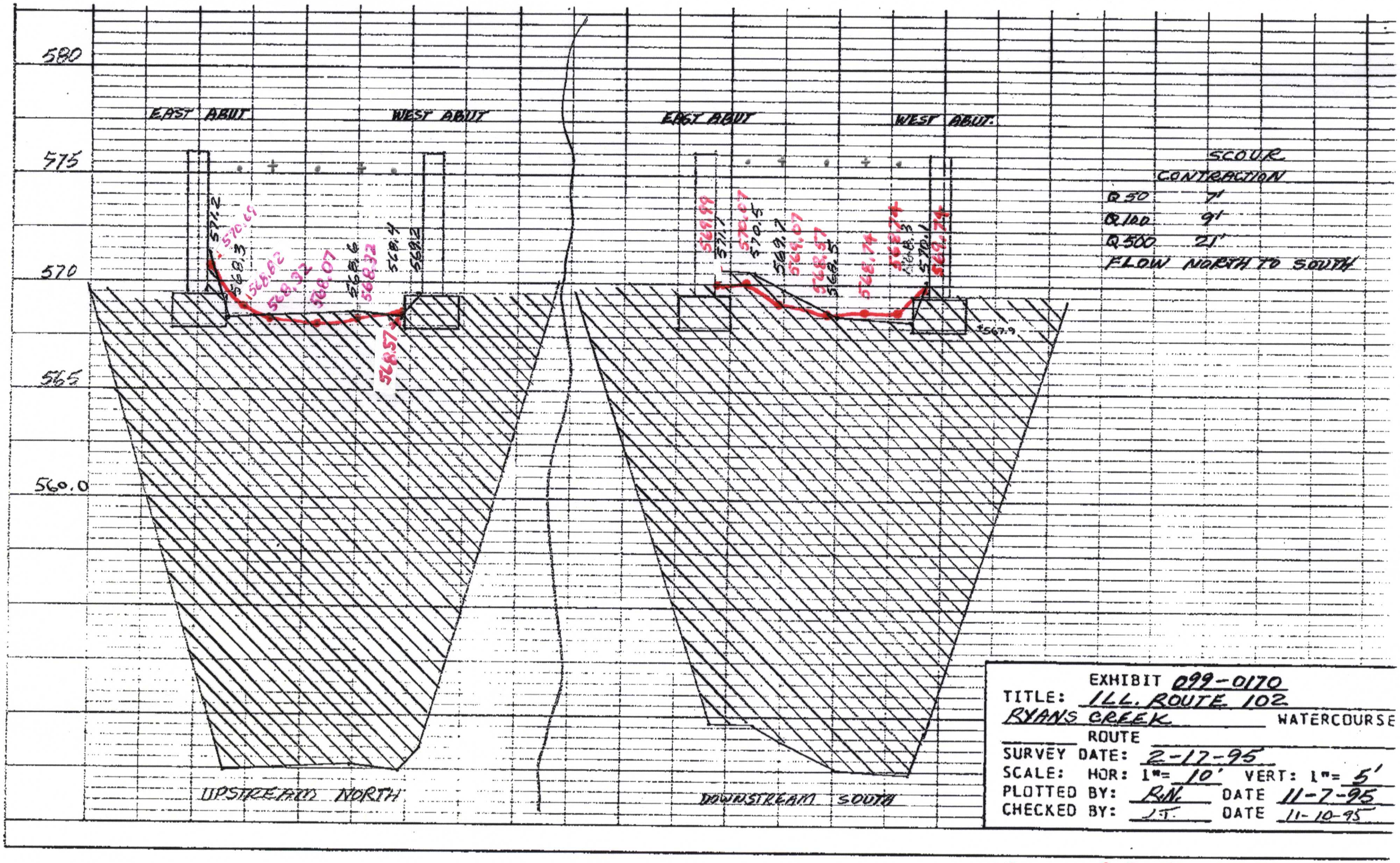


EXHIBIT 099-0170
TITLE: ILL. ROUTE 102
RYANS CREEK WATERCOURSE
ROUTE
SURVEY DATE: 2-17-95
SCALE: HOR: 1" = 10' VERT: 1" = 5'
PLOTTED BY: R.N. DATE 11-7-95
CHECKED BY: J.T. DATE 11-10-95

UPDATED: 9-9-09
BY: M.V., S.M.

Illinois Department of Transportation
Structures Information Management System
Master Structure Report (S-107)

Structure Number: 099-0170 **District:** 1

Inventory Data

Facility Carried:	IL 102	Bridge Name:	
Feature Crossed:	RYANS CREEK	Location:	6 M S OF IL 53
Bridge Remarks:			
Bridge Status:	1 OPEN - NO RESTRICT	StatusDate:	04/1988
Status Remarks:			
Maint County:	099 WILL	Maint Township:	20 WESLEY
Maint Responsibility:	01 I.D.O.T.		
Service On/Under:	1 HIGHWAY / 5 WATERWAY		
Reporting Agency:	1 I.D.O.T. - BUREAU OF MAINTENANCE		
Main Span Matl/Type:	A PRECAST CONCRETE/NOT PRES / 29 CHANNEL BEAM		
Nbr Of Main Spans:	1	Nbr Of Approach Spans:	0

Sufficiency Rating:	48.7	Structure Length:	24.3
HBP Eligible:	Yes	AASHTO Bridge Length:	21.3
Replaced By:		Length of Long Span:	22.3
Replaces:		Bridge Roadway Width:	40.5
Last Update Date:	08/21/2012	Appr Roadway Width:	24.0
Parallel Structure:	None	Deck Width:	41.0
Multi-Level Structure Nbr:		Sidewalk Width Right:	0.0
Skew Direction:	Left	Sidewalk Width Left:	0.0
Skew Angle:	20 D 0 M 0 S	Navigation Control:	0 No
Structure Flared:	No	Navigation Horiz Clear:	0
Historical Significance:	No	Navigation Vert Clear:	0
Border Bridge State:		Culvert Fill Depth:	0.0
Bdr State SN:		Number Culvert Cells:	0
Bdr State % Responsibility:	0	Culvert Opening Area:	0.0
Structural Steel Wt:	0	Culvert Cell Height:	0.00
Substructure Material:		Culvert Cell Width:	0.00

Approaches

Near #1 Matl/Type:	/	
Near #2 Matl/Type:	/	
Far #1 Matl/Type:	/	
Far #2 Matl/Type:	/	

Median Width/Type:	0 Ft. / 0 None	Rated By:	2 IDOT
Rate Method:	1 LOAD FACTOR		
Guardrail Type L/R:	0 None / 0 None	Inventory Rating:	0.770 (27)
Load Rating Date:	08/10/2012		
Toll Facility Indicator:	0 No Toll	Operating Rating:	1.280 (46)
Latitude:	41 D 14 M 22.29 S	Longitude:	88 D 04 M 45.90 S
Design Load:	02 HS20		
Deck Structure Type:	D PCAST REIN CN DK BM	Deck Structure Thickness:	11.0
SD:	Y	FO:	Y
Sidewalks Under Structure:	0 None		

Railroad Crossing Info

Crossing 1 Nbr:	
Crossing 1 Nbr:	
RR Lateral Underclear:	0.0
RR Vertical Underclear:	0 Ft 0 In

Key Route On Data

Key Route Nbr:	FEDERAL-AID PRIMARY 0631	Station:	6.0800
Appurtenances	Main Route 00000	Segment:	
Inventory County:	099 WILL	Linked:	Y
Township/Road Dist	20 WESLEY	Natl. Hwy System:	Not on NHS
Municipality	0000	Inventory Direction:	
Urban Area:	None	Curr AADT Yr/Count:	2013 / 2100
Functional Class:	4 MINOR ARTERIAL	Est Truck Percentage:	20
		Number Of Lanes:	2
		One Or Two Way:	2 Two-Way
		Bypass Length:	0
		Future AADT Yr/Cnt:	2032 / 2883
		Designated Truck Rte:	CLASS II
		Special Systems:	No

** CLEARANCES **	South/East	North/West
Max Rdwy Width:	40.5	
Horizontal:	40.5	0.0
Min Vertical:	99 Ft 11 In	00 Ft 00 In
10 Ft Vertical:	99 Ft 11 In	00 Ft 00 In
Lateral:		

Key Route Under Data

Station:	
Segment:	
Linked:	
Natl. Hwy System:	
Inventory Direction:	
Curr AADT Yr/Count:	/
Est Truck Percentage:	
Number Of Lanes:	
One Or Two Way:	
Bypass Length:	
Future AADT Yr/Cnt:	/
Designated Truck Rte:	
Special Systems:	

	South/East	North/West
	Ft In	Ft In
	Ft In	Ft In
	Ft	Ft

*** Marked Route On Data ***

	Designation	Kind	Number
Route #1:	1 Mainline	3 State Highway	102
Route #2:	1 Mainline		
Route #3:	1 Mainline		

*** Marked Route Under Data ***

Designation	Kind	Number

Illinois Department of Transportation
Structures Information Management System
Master Structure Report (S-107)

Structure Number: 099-0170 **District:** 1

Data Related to Inspection Information

***Inspection Intervals ***

Routine NBIS:	12 MOS	**Underwater:**	0 MOS
Fracture Critical:	0 MOS	**Special:**	Y

*** Maximum Allowable Posting Limits ***

One Truck At A Time:	0	**Combination Type 3S-1:**	Tons
Single Unit Vehicles:	LL Tons	**Combination Type 3S-2:**	Tons

Bridge Posting Level: L Legal Load Only

Inspection/Appraisal Information

Inspection Date:	11/08/2013	
Inspection Temperature:	48 Deg. F	
Deck:	6	SATISFACTORY CONDITION - MINOR DETERIORATION
Superstructure:	3	SERIOUS CONDITION - SIGNIFICANT SECTION LOSS
Substructure:	5	FAIR CONDITION - MINOR SECTION LOSS, CRACKS
Culvert:	N	NOT APPLICABLE
Channel and Protection:	6	SATISFACTORY CONDITION - MINOR DETERIORATION
Structural Evaluation:	3	INTOLERABLE - HIGH PRIORITY FOR CORRECTION
Deck Geometry:	6	EQUAL TO PRESENT MINIMUM CRITERIA
Underclearance-Vert/Lat.:	N	NOT APPLICABLE
Waterway Adequacy:	5	BETTER THAN ADEQUATE TO BE LEFT IN PLACE
Approach Roadway Align:	8	EQUAL TO PRESENT DESIRABLE CRITERIA
Bridge Railing Appraisal:	2	Doesn't Meet Standards
Approach Guardrail:	223	Not Acceptable / Not Acceptable / Acceptable
Pier Navig Protection:	N	N/A

Insp by (Name):	GawendaPE	
Insp by (Name):		
Utilities Attached:	N	N/A
	N	N/A
	N	N/A
Deck Wearing Surf:	R	
Deck Membrane:	A	WATERPROOF MEM SYST
Deck Protection:	J	NONE
Total Deck Thick:	10.0	
Last Paint Date:		

** Actual Posted Limits **

Single Unit Vehicles:	LL Tons
Combination Type 3S-1:	Tons
Combination Type 3S-2:	Tons
One Truck At A Time:	0

Last Paint Type:

Inspection Remarks:
58 - Scattered HL longit cracks & isol HL random/diag cracks NB & SB, moderate tine scaling.59 - Numer HL- wide horiz cracking along bottom of bms(3" +/- up) w/several rust stained areas. Bm 1,2,5,7,8,9 from west has spall w/exposed cor

Underwater Inspection/Appraisal Information

Inspection Date:	08/25/2004
Temperature:	81
Inspection Method:	PV Probe Visual
Inspected By:	M Valentine, CW
Inspected By:	
Appraisal Rating:	5 FAIR - MAJOR DETERIORATION IN UNDERWATER UNITS
Inspection Remarks:	04) E & W footing entirely exposed.

Scour Critical Information

Rating:	7 SCOUR PROBLEM CORRECTED
Analysis Date:	12/13/1995
Evaluation Method:	B Rational Analysis
Analysis By:	E KRAMARZ

Miscellaneous

Fracture Critical Members:	No
Microfilm Data Recorded:	Yes

Construction Information

Year:	1929 Original	Reconstructed
Route:	SBI-113 **Sta:** 742+30	**Sta:**
Section Nbr:	111N-B	
Contract Nbr:		
Fed Aid Pr #:	00000000000000	
Built By:	1 I.D.O.T.	

Waterway Information

Flood Design Frequency:	YRS
Flood Design Q (CFS):	
Flood Design Nat H W E:	
Flood Des Open Prop:	SF
Drainage Area:	Acre
Flood Base Q (CFS):	
Flood Base Nat H W E:	

Proposed Improvement

Cost Estimate Year:	
Length:	
Type of Work:	
Done By:	
Remarks:	

*** Costs in Dollars ***

Bridge Cost:	
Roadway Cost:	
Total Project Cost:	

[illegible] SHEETS

[illegible] SECTION.
[illegible] STA. 685+00 TO STA. 740+00.
STA. 740+00 TO STA. 770+00.
STA. 770+00 TO STA. 800+00.
STA. 800+00 TO STA. 860+00.
STA. 860+00 TO STA. 920+00.
STA. 920+00 TO STA. 980+00.
STA. 980+00 TO STA. 1040+00.
STA. 1040+00 TO STA. 1065+16.
[illegible] INCLUSIVE CROSS SECTIONS.
[illegible] STANDARD CULVERT DESIGN NO. 828-1, 828-4, 1204-1.
[illegible] SPECIAL CULVERT DESIGN STA. (700+00, 709+00).
STA. 772+22, (796+00, 839+00, 905+00, 935+00, 979+00, 1027+35), 874+00, 958+73.
STA. 1000+28.
[illegible] SPECIAL BRIDGE DESIGN STA. 742+30, SHEETS 1, 2, AND 3 OF 3 SHEETS.
STA. 820+90, SHEET 1 OF 3 SHEETS.
STA. 820+90, SHEET 2 AND 3 OF 3 SHEETS.
STANDARD NO. 1178.
NO. 845, 1162, 1203.
NO. 790, 1283 WITH COVER, 791.

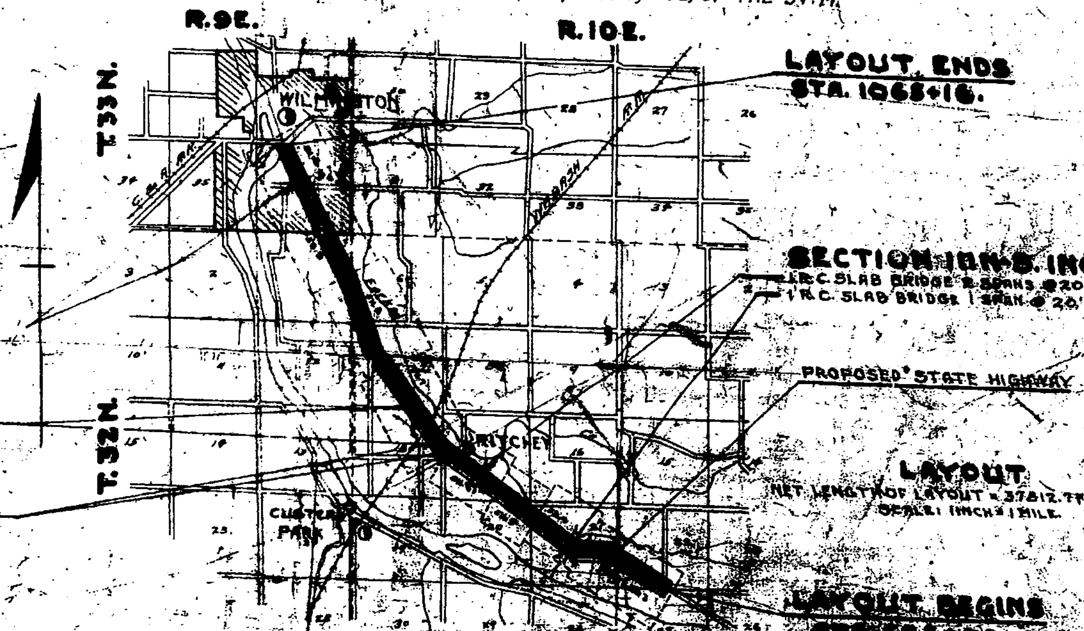
STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF HIGHWAYS
PLANS FOR PROPOSED STATE BOND ISSUE HIGHWAY

099-0170

SCALES { PLAN 1 INCH = 100 FT. / PROFILE, HOR. 1 INCH = 100 FT. / PROFILE, VER. 1 INCH = 10 FT. / CROSS-SECTIONS 1 INCH = 5 FT.

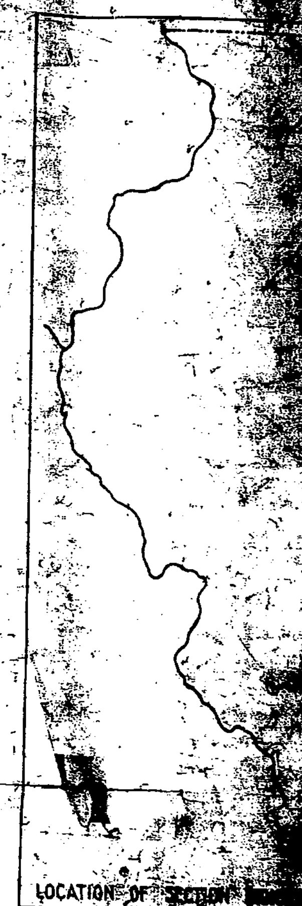
ROUTE 113. SECTION 111N, ~~111N-B~~. WILL COUNTY.

FROM A POINT NEAR THE S.W. CORNER OF THE SE¼ OF SECTION 22, T.32N., R.10E., OF THE 3 P.M.
TO A POINT NEAR THE N.E. CORNER OF THE N.W.¼ OF SECTION 36, T.33N., R.9E., OF THE 3 P.M.



SECTION 111N-B. INCLUDES.
1 R.C. SLAB BRIDGE 3 SPANS @ 20' STA. 820+90.
1 R.C. SLAB BRIDGE 1 SPAN @ 20' STA. 742+30.

LAYOUT
NET LENGTH OF LAYOUT = 37812.7 FT. = 7.161 MI.
SCALE: 1 INCH = 1 MILE.



SUMMARY OF QUANTITIES

SECTION 111N
[illegible] EXCAVATION
[illegible] EXCAVATION
[illegible] EXCAVATION
[illegible] EXCAVATION
[illegible] PULLING
[illegible]
[illegible] VIT. PIPE UNDERDRAIN
[illegible] BASINS.
[illegible] RIGHT OF WAY MARKERS.
[illegible] SHOULDERS.
CLASS A CONCRETE.
REINFORCING STEEL.

SECTION 111N-B.

214.7	CU. YDS.	CLASS A CONCRETE.
25.2	CU. YDS.	CLASS B CONCRETE.
69.0	CU. YDS.	CLASS X CONCRETE (FOOTINGS).
34450	LBS.	REINFORCING STEEL.
240	LIN. FT.	15 TON UNTREATED PILES.
2	EACH.	NAME PLATES.
11.6	CU. YDS.	CLASS X CONCRETE (RAIL).

SUMMARY OF CONCRETE

SECTION 111N

[illegible] CULVERT DESIGN NO. 828-1-3.	68.4 CU. YDS.
NO. 828-4-3.	2.6
NO. 1204-1-3.	9.4
[illegible] DESIGN STA. 700+00.	12.4
STA. 709+00.	12.4
STA. 772+22.	7.9
STA. 796+00.	6.6
STA. 839+00.	6.6
STA. 874+00.	6.6
STA. 905+00.	21.2
STA. 935+00.	6.6
STA. 958+73.	6.6
STA. 979+00.	14.1
STA. 1000+28.	11.4
STA. 1027+35.	6.6
[illegible] DRAIN [illegible] STA. 882+75.	0.94
STA. 1035+80.	3.135
STA. 1049+00.	3.135
STA. 1050+00.	3.135

TOTAL CONCRETE = 208.8 CU. YDS.

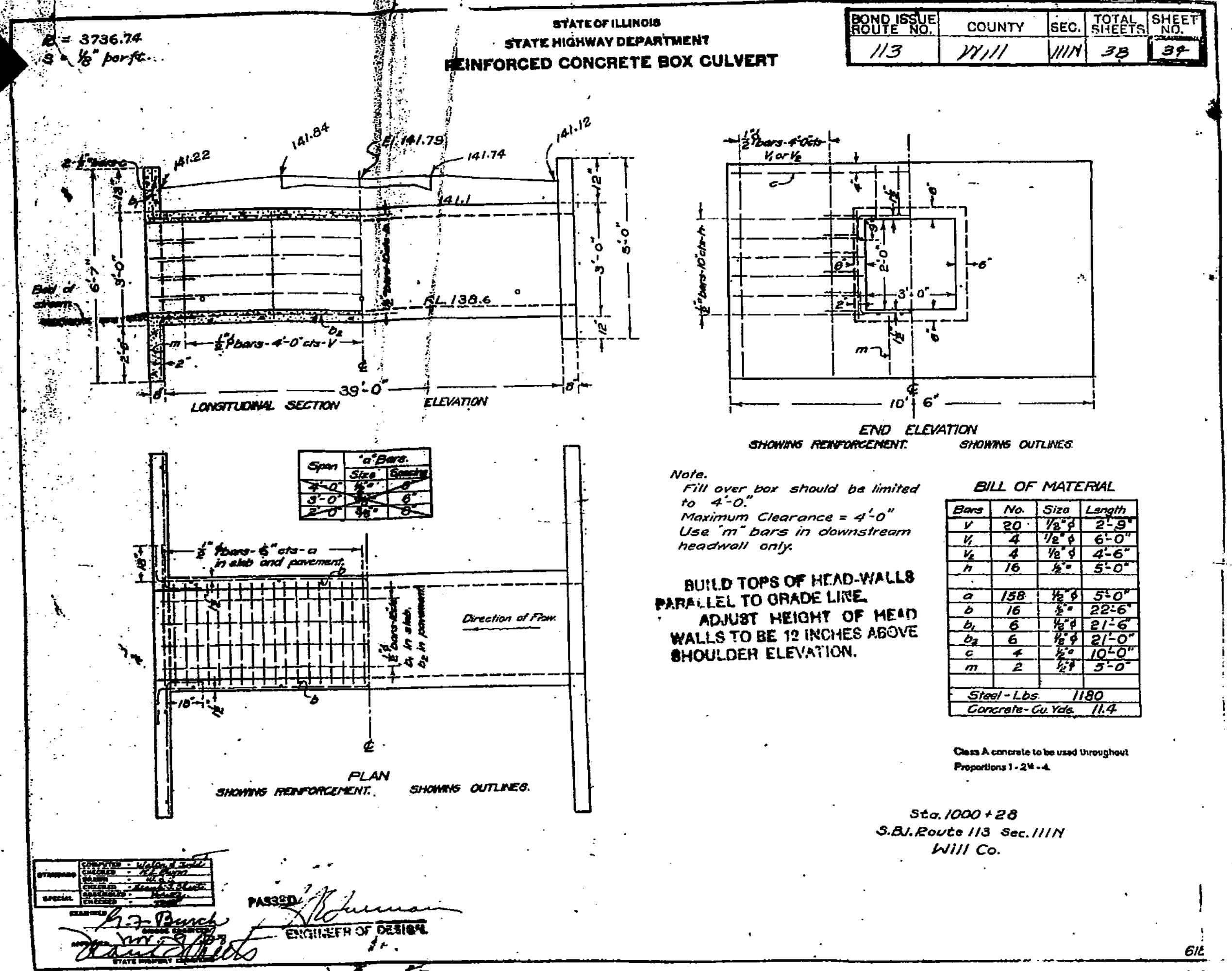
SECTION 111N-B.

	CLASS A CONC.	CLASS B CONC.	(FOOTING) CLASS X CONC.	(RAIL) CLASS X CONC.
STA. 742+30.	129.8 CU. YDS.		32.6 CU. YDS.	4.8 CU. YDS.
STA. 820+90.	84.9	25.2 CU. YDS.	36.4	6.8
[illegible] CONCRETE.	214.7 CU. YDS.	25.2 CU. YDS.	69.0 CU. YDS.	11.6 CU. YDS.

LEVEE
CULVERTS
DROP INLET
TROLLEY POLE
POWER POLE
TELEPHONE OR TELEGRAPH POLES
MARSH
HEDGE
GROUND ELEVATION
GRADE ELEVATION
ELECTRIC [illegible]

SUMMARY

STATION TO STATION		WIDTH OF PAVEMENT	GROSS LENGTH ALONG TRANSIT LINE	CORRECTIONS FOR CURVES		CORRECTIONS FOR RELOCATIONS				[illegible]
		FT.	FEET	STA. OF P.I.	FEET −	STA.	STA.	FEET +	FEET −	FEET
685+00	715+00	9	3000	697+50	0.6					[illegible]
715+00	730+00	9	1500	722+60	6.4					[illegible]
730+00	745+00	9	1500	737+00	0.3					[illegible]
745+00	755+00	[illegible]	1000	749+90	39.2					[illegible]
755+00	780+00	5	2500	757+30	5.5					960.8
780+00	800+00	9	2000	789+00	0.2					2494.5
800+00	817+00	9	1700	813+00	1.6					[illegible]
817+00	830+00	9	1300	823+00	37.6					1699.0
830+00	838+00	9	800	833+40	7.0					1262.4
838+00	[illegible]	9	[illegible]	842+00	1.5					793.0
[illegible]	[illegible]	9	[illegible]	852+00	0.4					1998.5
864+50	[illegible]	9	1550	867+00	0.3					640.6
880+00	895+00	9	1500	885+00	1.2					1549.7
895+00	909+00	9	1400	903+50	17.8					1498.8
903+00	[illegible]	9	[illegible]	912+00	[illegible]					1382.7
[illegible]	972+00	9	1700	964+00	[illegible]					4543.7
972+00	992+00	9	2000	977+50	4.9					[illegible]
992+00	1012+00	9	2000	[illegible]	8.9					1998.1
1012+00	1065+16	9	5316	1020+[illegible]	[illegible]					1994.7
TOTALS			[illegible]		[illegible]					[illegible]



BOND ISSUE ROUTE NO.	COUNTY	SEC.	TOTAL SHEETS	SHEET NO.
113	Will	111N	38	37

Note.
Fill over box should be limited to 4'-0."
Maximum Clearance = 4'-0"
Use "m" bars in downstream headwall only.

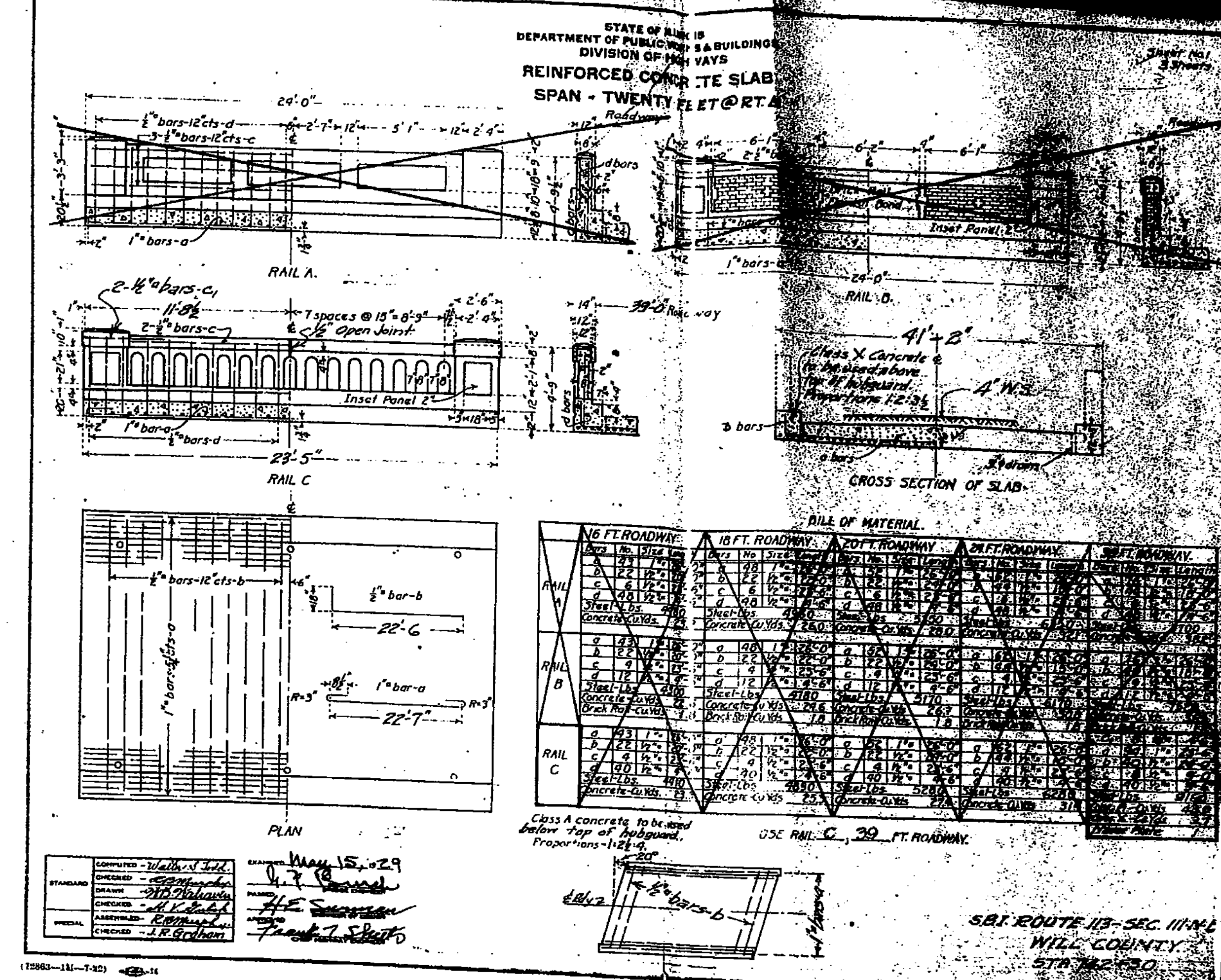
BUILD TOPS OF HEAD-WALLS PARALLEL TO GRADE LINE.
ADJUST HEIGHT OF HEAD WALLS TO BE 12 INCHES ABOVE SHOULDER ELEVATION.

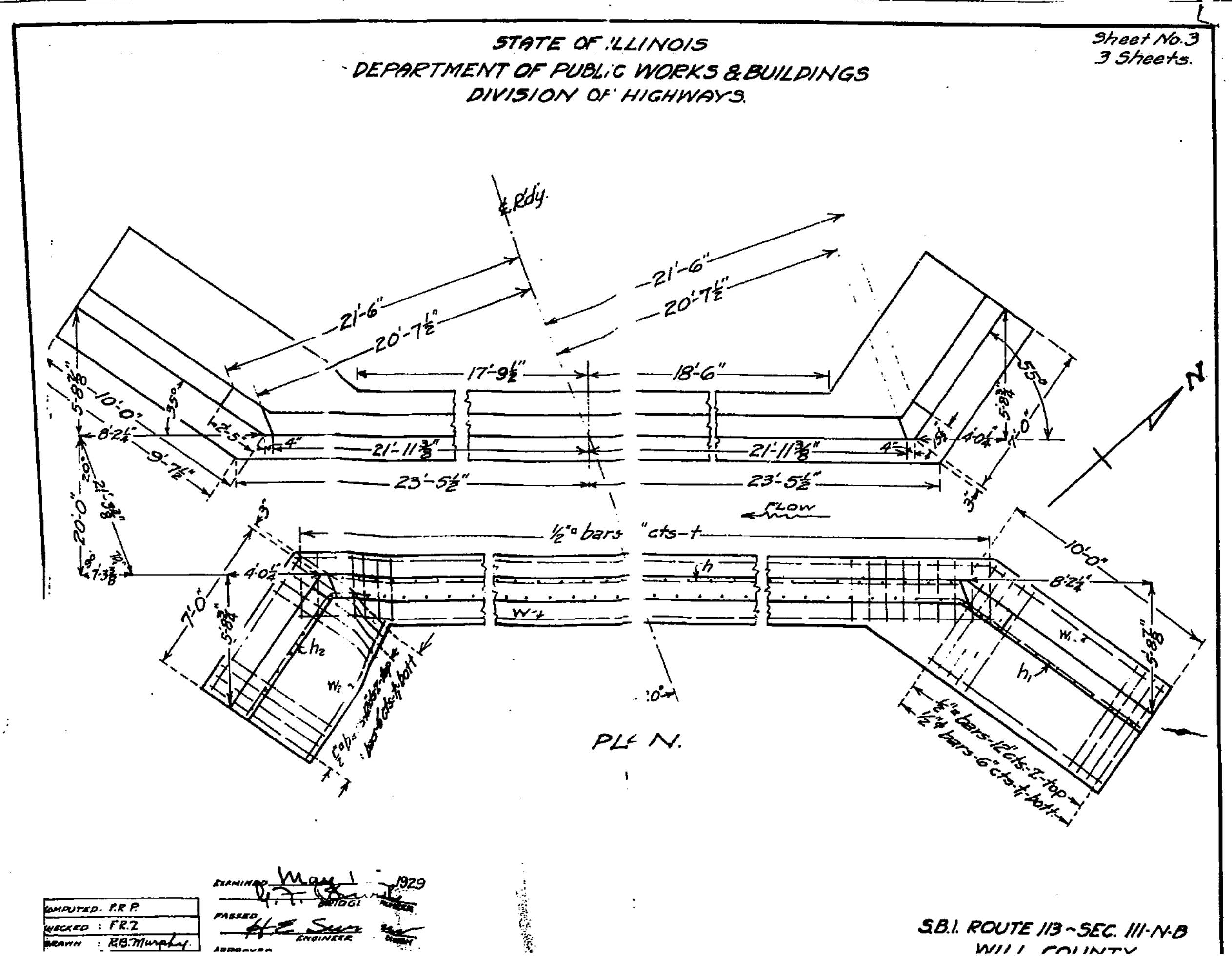
BILL OF MATERIAL

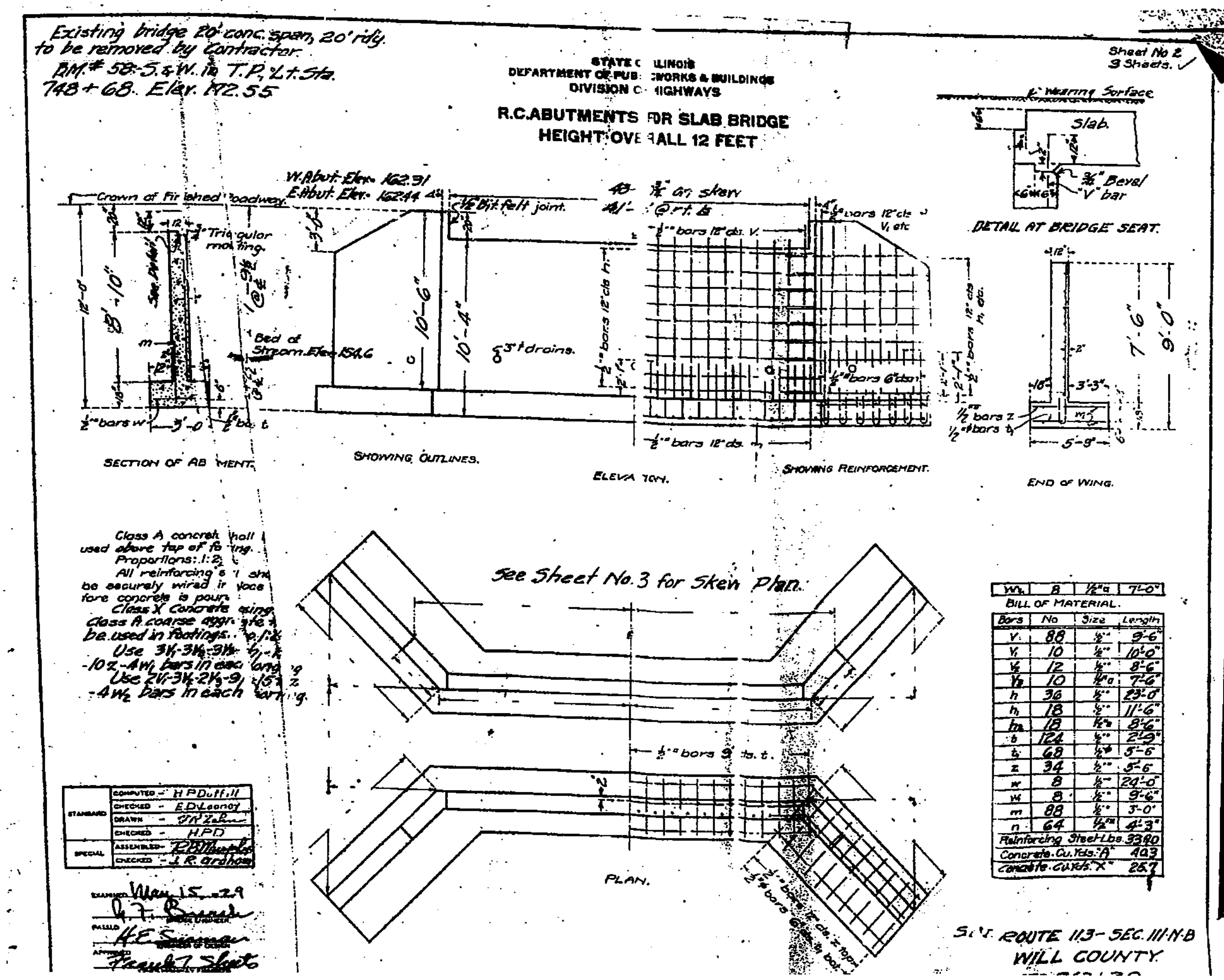
Bars	No.	Size	Length
v	20	1/2"ϕ	2'-9"
v_1	4	1/2"ϕ	6'-0"
v_2	4	1/2"ϕ	4'-6"
h	16	1/2"▪	5'-0"
a	158	1/2"ϕ	5'-0"
b	16	1/2"▪	22'-6"
b_1	6	1/2"ϕ	21'-6"
b_2	6	1/2"ϕ	21'-0"
c	4	1/2"▪	10'-0"
m	2	1/2"ϕ	5'-0"
Steel - Lbs.		1180	
Concrete - Cu. Yds.		11.4	

Class A concrete to be used throughout
Proportions 1 - 2¼ - 4.

Sta. 1000 + 28
S.B.I. Route 113 Sec. 111N
Will Co.







BILL OF MATERIAL.

Bars	No	Size	Length
w_2	8	1/2"▫	7'-0"
v	88	1/2"	9'-6"
v_1	10	1/2"	10'-0"
v_2	12	1/2"	8'-6"
v_3	10	1/2"▫	7'-6"
h	36	1/2"	23'-0"
h_1	18	1/2"	11'-6"
h_2	18	1/2"	8'-6"
t	124	1/2"	2'-9"
t_1	68	1/2"	5'-6
z	34	1/2"	5'-6
w	8	1/2"	24'-0"
w_1	8	1/2"	9'-6"
m	88	1/2"	3'-0"
n	64	1/2"	4'-3"
Reinforcing Steel Lbs.			3340
Concrete. Cu. Yds. "A"			40.3
Concrete. Cu. Yds. "X"			25.7

SECTION 15

Survey Notes

SOKKIA #111

TRANSIT FIELD BOOK

EJM Shram
Surveys
#61230089

No. 8152-00

RTE 102 WILL COUNTY

MONDAY JULY 21, 2014

DALE, ART CHRIS +80 HUMID!

SET CONTROL - GPS

CP 10 IR/CAP SEx BRIDGE CULVERT
EAST OF RTE 102 S S CREEK

CP 11 IR/CAP SOUTH SIDE CREEK
ABOUT 500' E'ly RTE 102

CP 12 IR/CAP SOUTH SIDE CREEK
ABOUT 1000' E'ly RTE 102

CP 13 IR/CAP RTE 102 EAST SIDE
OPP SOUTH END GUARD RAIL.

CP 14 IR/CAP (FOUND) MARKED
CWA 26 ON WEST SIDE
RTE 102 AT N'ly END
GUARD RAIL 300± NORTH
OF CREEK.

BRIDGE PLATE:
STA 742+30 REBUILT 1972
BY STATE OF ILLINOIS SB I RTE 113
SEC. 111 N (W & RS)
LOADING HS 20
PLATE LOCATED ON GUARD RAIL
SEx BRIDGE

CP 15 RM 186 B.M ON NWx BRIDGE
LEASURE LANE RTE 102

CP 16 GPS STATION AE 2545

CP 17 GPS STA AE 2505

CP 18 NGS VERTICAL MF 0322
COAL CITY ROAD DIVISION ST.

CP 19 RM 192 □ in CONC HEADWALL TO
CULVERT

CP 20 NGS HORIZONTAL AE 2546
RTE 20 9000N 7000W

S-6

OVER CP 13 BS CP 140 (14)

HI = 5.36

200 = ℄ RTE 102 AT ℄ BRIDGE 7+00

201 = ℄ " " " ABOUT 300± N of bridge

202	℄ 12+00	217	3+00
203	11+50	216	2+50
204	11+00	217	2+00
205	10+50		
206	10+00		
207	9+50		
208	9+00		
209	8+50		
210	8+00		
211	7+50		
212	6+50		
213	6+00		
214	5+50		
215	5+00		
216	4+50		
217	4+00		
216	3+50		

REOBSERVE CP 13; RECORD AS CP 130 ✓

REOBSERVE CP 14 RECORD AS 141 ✓ 14

FIND BM ON NE TOP OF WALL RTE 102 OVER CREEK

BS	AVE	HI	FS	AVE	ELEV.	Comments / Description / Remarks
					579.305	CLAUSEN & WHITE BM 16 ON BRIDGE WINGWALL
+7.19						
+6.58						
+5.99	6.586	585.891				
			-2.59			
			-1.55			
			-0.55	1.563	584.328	IR/CAP CP 14 C&W CP 26 (584.341 C&W)
					579.305	CLAUSEN WHITE BM ABOVE
+6.00						
5.31						
4.65	5.32	584.625				
			-5.98			
			-5.02			
			-4.06	5.02	579.605	OUR IR/CAP CP 13

OVER CP13 BS CP140(14) CWA26

HI = 5.79 SH = 5.00

ΔH = 0.017

ΔV = +0.036

RERECORD CP 140 AS CP 14

RERECORD CP 10 OUR IR/CAP.

21 BM ON BRIDGE -

22 CP - CUT X ON BRIDGE About ℄

OVER CP 10 BS CP 13

HI = 5.71 SH 5.00

OBSERVE CP 11 IR/CAP

OBSERVE CP 12 IR/CAP.

$\left.\begin{array}{l}\text{CP 10}\\ \text{CP 11}\\ \text{CP 12}\end{array}\right\}$ UP STREAM ALONG Southerly bank CREEK -

PROFILE 1000 - 1001 ALONG ROW LINE
ALIGN ALONG ROW FENCE
1000 - 1011 -

1012 - 1013 ALONG END OF WINGWALL X@S.
1014 - 1015

CAP/IR CP 23 ON W'ly SIDE
RTE 102 FOR ROW Profile

1118 LAST POINT IN FILE "B"
1119 - 1122

SET CP 3, 4, 5 LARGE NAILS WESTERLY
SIDE RTE 102 NORTH OF BRIDGE
SET CP 6

1123 TOP ROW MARKER

24 SET IR/CAP CP 24 for
ROADWAY ROW X SECTION
W'ly SIDE South of bridge

25 SET IR/CAP CP 25 W'ly SIDE
South of CREEK.

26 SET IR/CAP CP 26 Northerly
for ROADWAY topo.

1173 LAST POINT File "B"
ADD TO FILE B IN ORDER
TO FINISH Profile AT
ROADWAY LEVEL

68/111

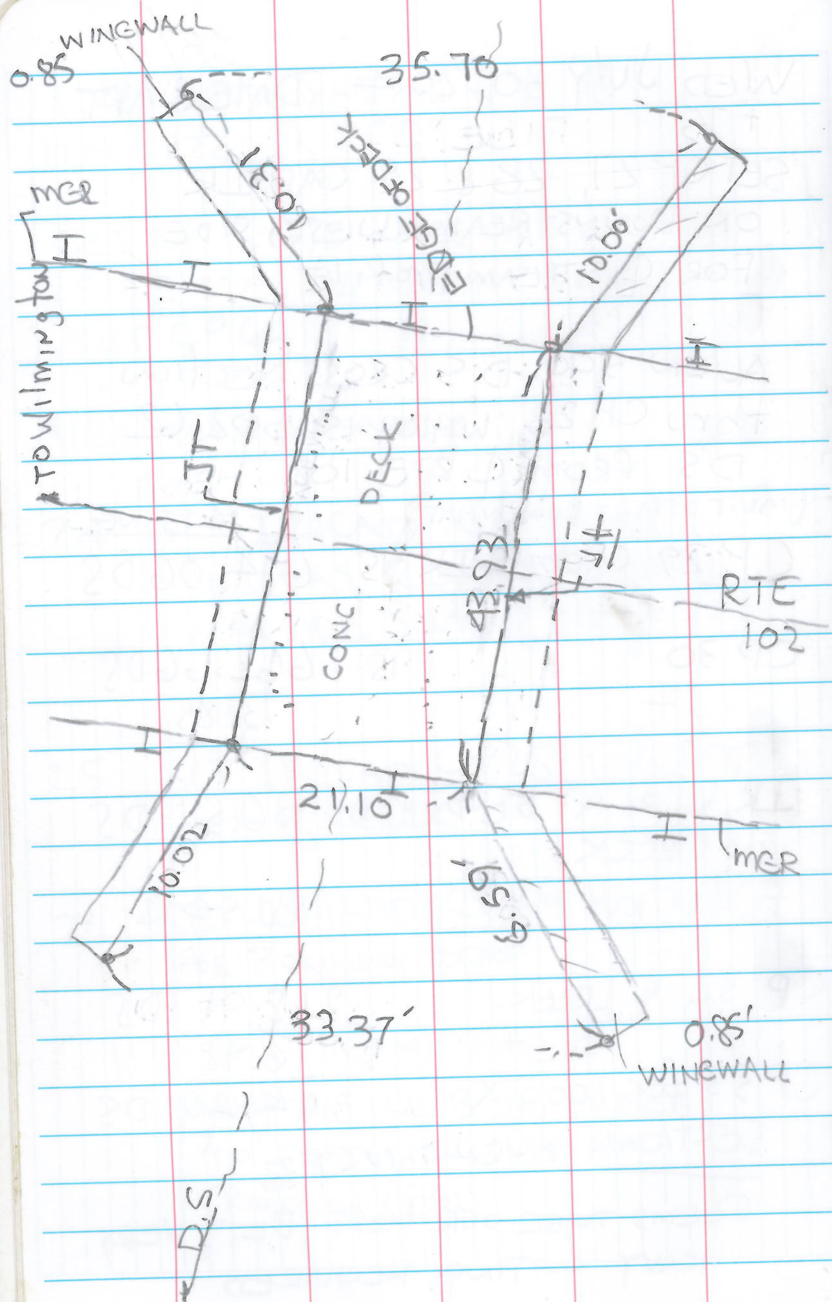
WED July 30, 2014 DALE & ART
+75 FILE "C"
SET CP 27, 28 & 29 CAP IR
ON DOWNSTREAM (WEST) SIDE
FOR ℄ STREAM Profile

ALIGN 500' D.S CROSS Section
thru CP 28, WHICH IS 502.62
DS from ℄ RTE 102 HEAVY CUTTING!
(MUST OFFSET SOMEWHAT)
CP 29 CAPPED IR IS 614.06 DS

CP 30 IS 662.66 DS
+ 73.85

IR CP 31 AT BEND 736.51 DS
IN CREEK
+ 181.50

CP 32 ℄ CREEK. 918.01 DS
+ 76.48
CP 33 for 1000 X 994.49 DS
SECTION ALIGN THRU CP 33
SEEMS TO BE OUR best BET, VERY
HEAVY CUTTING REQUIRED



1259 TOE OF SLOPE } ~~Alignment~~
1260 GRND SHOT

for 1000' X-SECTION D.S
HEAVY CUTTING Both SIDES - !

#   #

500' DS X SECTION - HEAVY CUTTING!
must OFFSET SOMEWHAT IN
PLACES to SEE thru AND MISS
trees that WE could SEE from
STREAM -

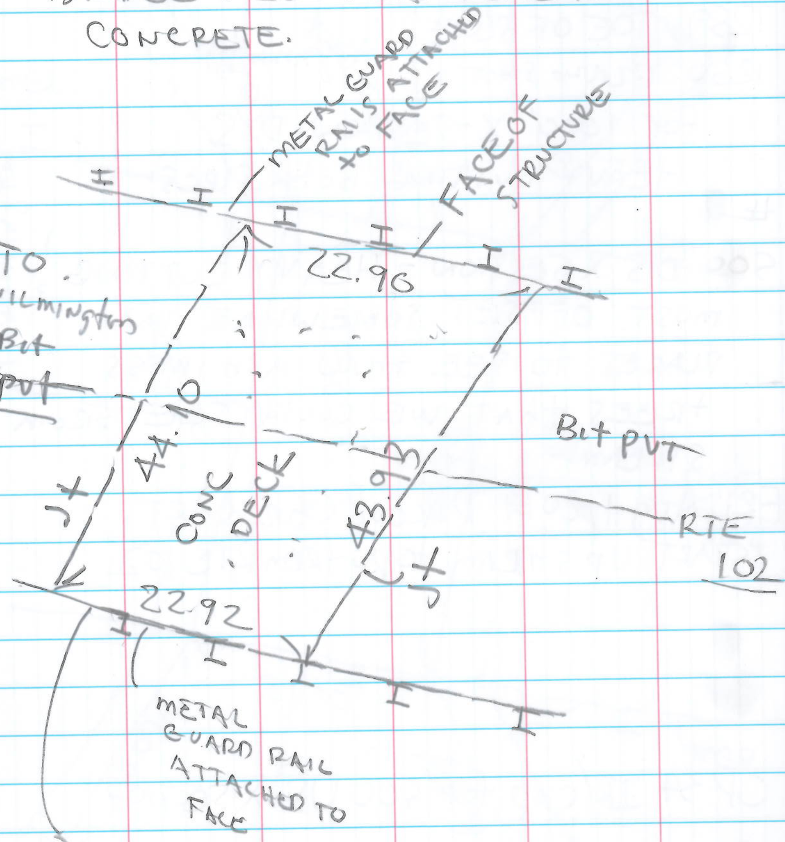
FRI Aug 1, 2014 DALE & Chris & ART
START up stream topo from RTE 102

CP 34 IR/CAP for 500 US X SECTION

ALIGN THRU CP 34 1327 G. Shot ON
NORTH BANK AT TREE LINE

CP 35 IR/CAP for 1000' UP STREAM
X SECTION

BRIDGE DECK MEASUREMENTS
CONCRETE.



FACE OF STRUCTURE

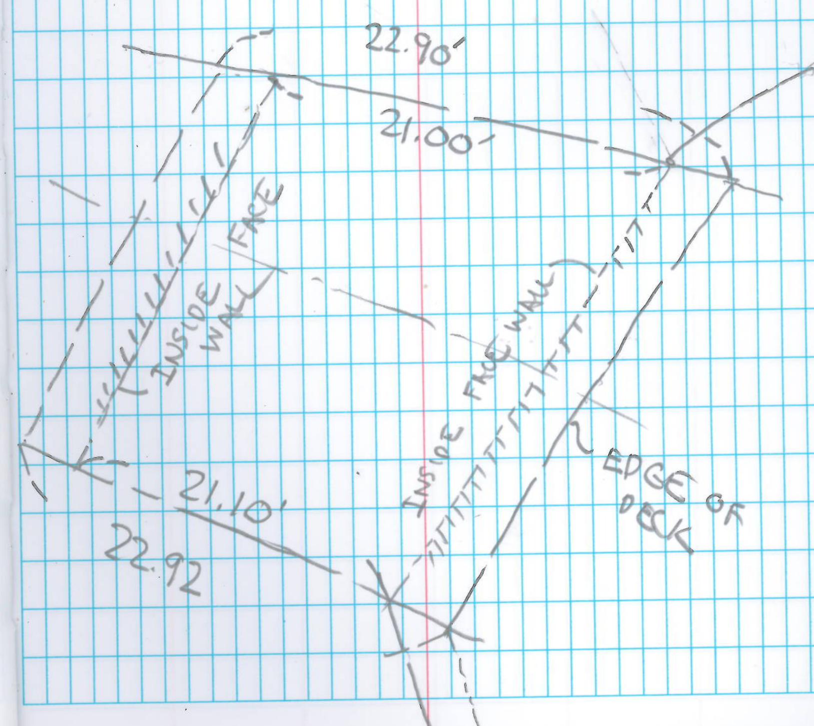
70/111

ALINGMENT FOR 1000 UPSTREAM X-SECTION
35 to GS 1368

OVER CP13 BS CP10

SET CP36 for HOUSE Location

DECK/ WALL MEAS.



PROJECT: EJM RTE102/RAYNS

CLIENT:

DATE: 07/30/14

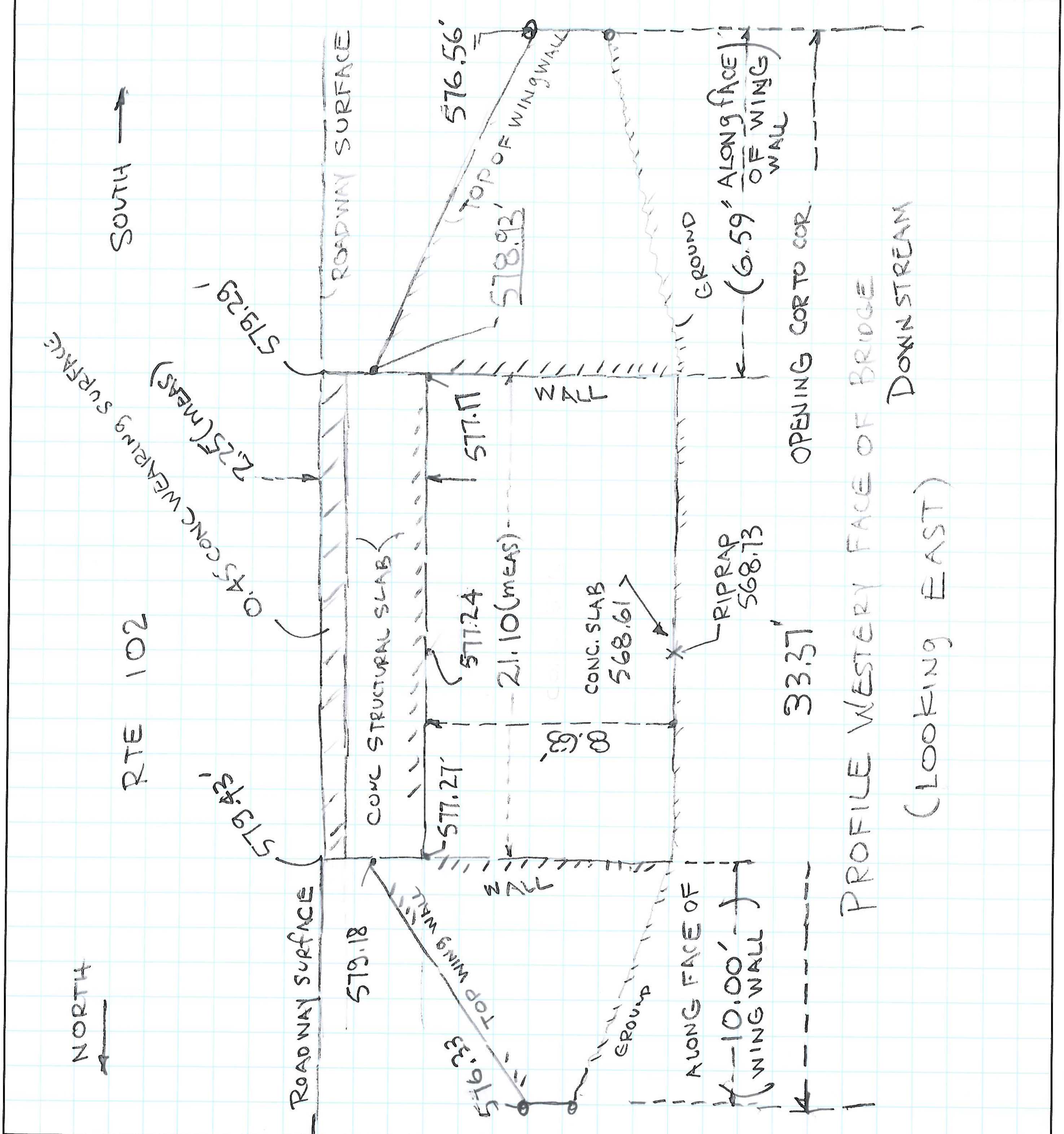
ITEM: RTE 102 BRIDGE

DESIGNED BY:

SHEET NO:

CHECKED BY:

FILE NO:



6201 W. Touhy Avenue, Suite 6 • Chicago, Illinois 60646
p: 773.756.3388 • f: 773.756.3387

PROJECT:

ITEM:

CLIENT:

DESIGNED BY:

CHECKED BY:

DATE:

SHEET NO:

FILE NO:

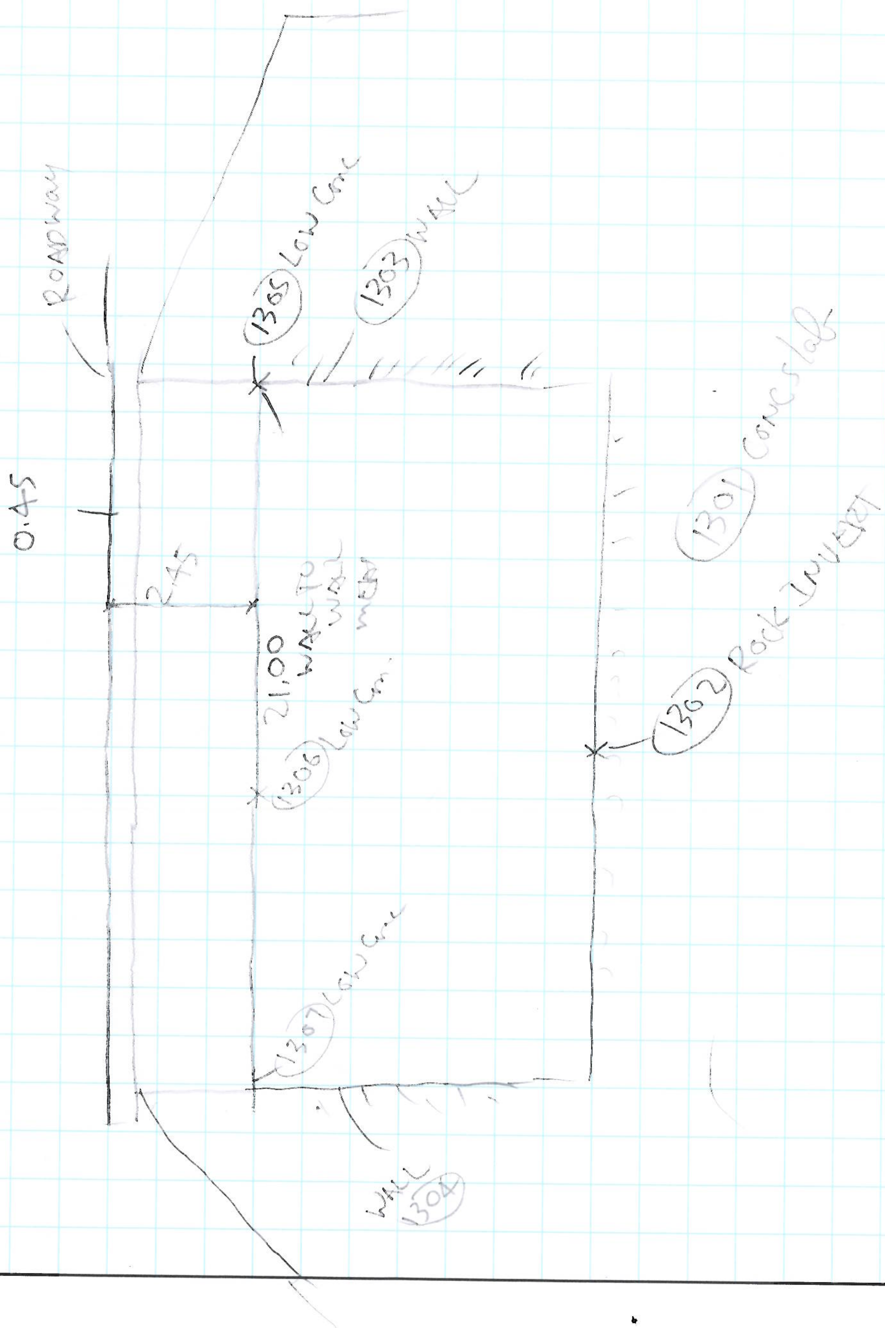
13 166555.24 1054428.12 579.605

1665555.24

579.614

LAST POINT FILE C = 1285

EAST FACE PROFILE (Looking WEST)



PROJECT:

ITEM:

CLIENT:

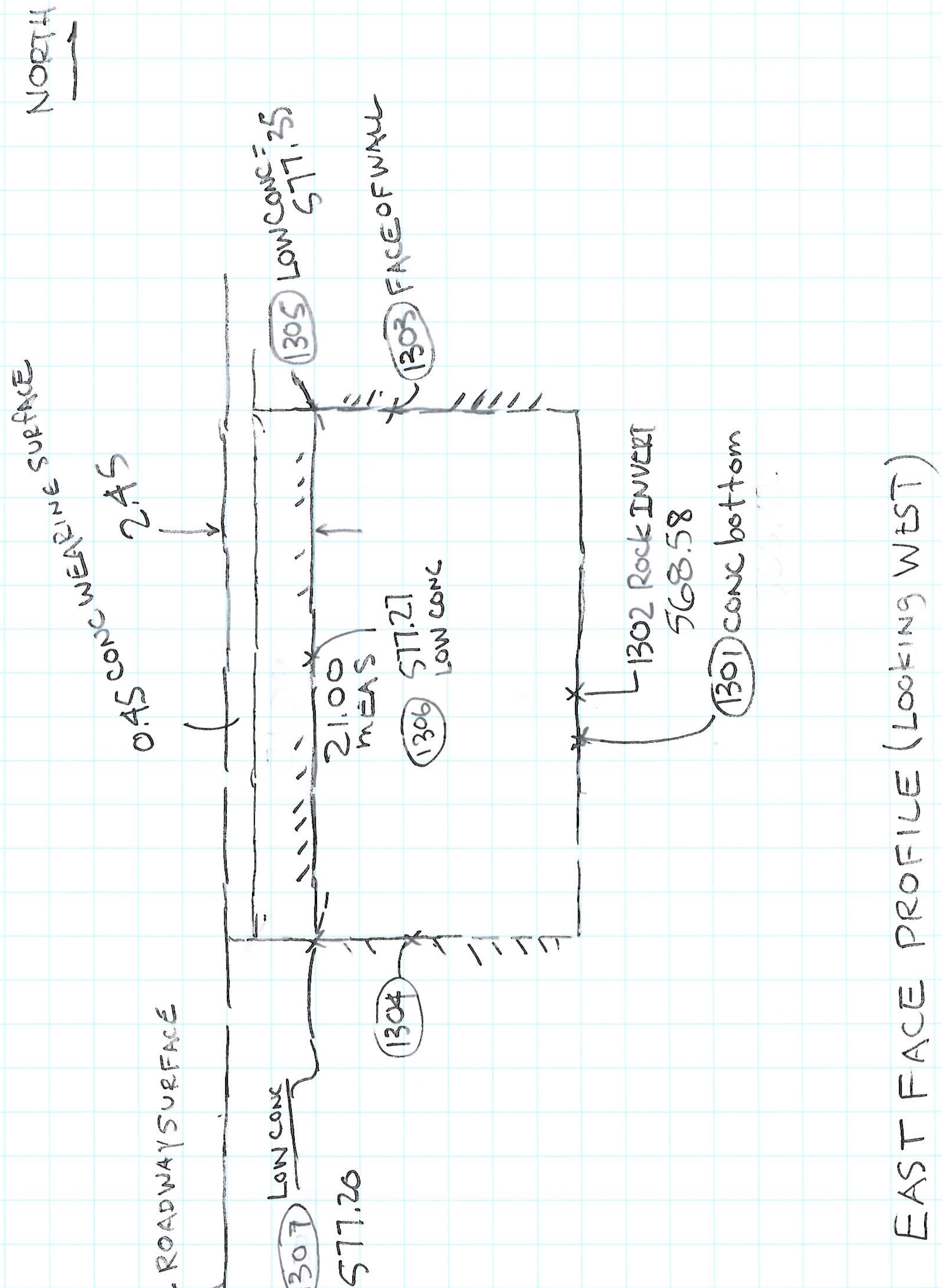
DATE:

DESIGNED BY:

SHEET NO:

CHECKED BY:

FILE NO:



SECTION 16

Estimated Water Surface Elevation (EWSW) Data

IL ROUTE 102 ACROSS RYANS CREEK

Data Survey for EWSE

DCC
11/3/2014

RYANS CREEK

River Sta	Channel Invert	Surveyed Edge of Water	Top of Bank Elevation	
			Left	Right
3022	569.16	570.48	575.25	575.98
2772	569.81	570.48	577.14	575.54
2508	570.17	570.48	579.02	575.10
2275	569.61	570.00	576.16	574.43
2040	568.76	570.00	573.31	573.76
2026	568.58	570.00	579.02	578.93
1977	568.61	570.00	577.34	578.99
1966	568.85	570.00	573.74	574.18
1708	567.93	568.93	572.40	572.68
1485	567.02	567.95	571.05	571.18
1144	564.82	565.80	568.17	568.81
939	562.46	563.46	565.29	566.45

SECTION 17

Correspondence Notes

Will County Division of Transportation

16841 W. Laraway Road
Joliet, Illinois 60433
(815) 727-8476
Fax (815) 727-9806

August 21, 2015

Bruce D. Gould, PE
Director Of Transportation
County Engineer

BUREAU OF PROGRAMMING
RECEIVED
AUG 26 2015
DISTRICT #1

Mr. John Fortmann, P.E.
Deputy Director of Highways
Region One Engineer
Illinois Department of Transportation
201 West Center Court
Schaumburg, IL 60196-1096

Attn: Ms. Esther Winograd

Subject Phase 1 Study
IL Route 102 over Ryans Creek

Dear Ms. Winograd:

The Will County Division of Transportation is in receipt of the request for information concerning the above mention project.

Please be advised that the Will County Division of Transportation has no information regarding said project because the above said location does not involve roadways that are under the jurisdiction of this department.

If there are any questions, please feel free to contact the undersigned or the Director of Transportation / County Engineer, Bruce Gould.

Sincerely,

Bruce D. Gould, P.E.
Director of Transportation
County Engineer

By

Eric K. Wesel, P.E.
Permit Engineer

EKW:ekw

P:\Permits\Correspondence - General\2015\2015-08-21 IDOT (Winograd).docx

Illinois Department of Transportation
Division of Highways / Region 1 / District 1
201 West Center Court / Schaumburg, Illinois 60196-1096

August 17, 2015

Mr. Bruce Gould, P.E.
Director of Transportation and Engineering
Will County Division of Transportation
16841 W. Laraway Road
Joliet, IL. 60433

Dear Mr. Gould:

This is to confirm the telephone conversation on July 13, 2015 between yourself and Esther Winograd of my staff relative to the drainage study to be prepared as part of Phase I Study for the IL 102 over Ryans Creek project (see attached map). We are requesting the appropriate drainage information for incorporation into the drainage study.

In particular, we request the following:

- Storm sewer plans
- Combined sewer atlas
- Utility plans
- Contour mapping
- Proposed and current drainage improvements
- Identification of flooding experience associated with the highway or adjacent properties
- Local ordinances

If you have any questions or need additional information, please contact me or Esther Winograd, Hydraulics Analysis Engineer, at (847) 705-4475.

Very truly yours,

John Fortmann, P.E.
Deputy Director of Highways,
Region One Engineer

Attachment

bcc: John Fortmann
Jose Rios

S:\Gen\WP\HYD\H&H\EW\projects\IL 102 Ryans Ck\reqinfolocal.docx bing Maps

IL 102 over Ryans Creek

On the go? Use **m.bing.com** to find maps, directions, businesses, and more

Winograd, Esther B

From: Wojcik, Rick F
Sent: Tuesday, July 28, 2015 8:20 AM
To: Winograd, Esther B
Subject: FW: Hydraulics Memo
Attachments: 0990170-724103832-0001.pdf; img-727144859-0001.pdf

-----Original Message-----
From: Mastny, Steve C
Sent: Monday, July 27, 2015 2:59 PM
To: Wojcik, Rick F
Cc: Wilson, Sarah M; Valentine, Michael A
Subject: FW: Hydraulics Memo

Hi Rick,

The attached memo requests information regarding flooding or other drainage related problems at IL-102 over Ryan's Cr (099-0170). As you may be aware, we had a fairly significant scour problem at this structure in the late 90's. Specifically, in July, 1996, a rain event caused a contraction scour hole under the structure, which was filled with RR 5 riprap under emergency contract (see attached for more details). The streambed has remained reasonably stable over the past decade plus, although the top of the footings are sometimes exposed.

If you need any other information, please let me know.

Thanks,

Steve

Steve Mastny, P.E.
IDOT - District One
South Area Bridge Inspection Engineer
steve.mastny@illinois.gov
847-956-1494

-----Original Message-----
From: Wilson, Sarah M
Sent: Friday, July 24, 2015 11:11 AM
To: Mastny, Steve C
Subject: Hydraulics Memo

Please prepare a reply and copy me on the response.

Thanks

Illinois Department of Transportation

Memorandum

To:	James Stumpner	Attn:	Dionne Winesberry Sarah Wilson
From:	Pete Harmet		
Subject:	Drainage Study		
Date:	July 27, 2015		

Route:	IL 102
Limits:	Over Ryans Creek
Municipality:	-------
County:	Will
Structure No.:	099-0170

We are in the process of collecting information from the various sources that pertain to flooding or erosion at the subject location (Please refer to the attached location for the study limits).

We have reviewed the Pavement Flooding Prioritization listing:

- ☒ The area is identified to have pavement flooding.
- ☐ The area is not included in the listing.

Please review your records and provide any additional information you may have regarding flooding, drainage complaints and/or erosion and siltation problems for the concerned area.

Because of the major drainage structure (SN 099-0170) located within the project limits, please also have your Bridge Maintenance Section check their records for any flooding occurrences or drainage related problems such as debris and/or icing at the subject structure.

Your early consideration of this request is greatly appreciated.

By: Richard F. Wojcik

Richard F. Wojcik, P.E.
Hydraulics Section Chief

Illinois Department of Transportation

Memorandum

BUREAU OF MAINTENANCE
DEPT. OF TRANS. - DIST. 1
RECEIVED
NOV 08 '96

	NOTE	ACT
BUR. CHIEF		
AREA I		
AREA II		
AREA III		
~~BRIDGES~~		
CONTRACTS		
SUPPORT		
FILE		

To: Roy Fonda Attn: Ed Kramarz

From: Wally Kos

Subject: Scour Rating*

Date: November 1, 1996

* S/N: 099-0170
IL 102/Ryans Creek

We concur with your rating of 7 for the subject structure with the conditions to be coded. Because of the high velocities projected at the subject crossing, the calculated riprap size for scour countermeasure is RR 7 while the scour hole was filled with RR 5. We therefore recommend to enter category 93B5 with coding #4 and #6 (i.e. underwater inspection category for spread footing and scour critical monitoring program).

By: C. [signature]
Chinliang Wang
Hydraulics Section Chief

cc: Bruce Dinkheller/Ed Frank

J. STUMPNER

s:\wp\hydraul\gc61101a.doc

Dawn C. Cosentino

From: Winograd, Esther B <Esther.Winograd@illinois.gov>
Sent: Monday, March 30, 2015 10:09 AM
To: Dawn C. Cosentino
Subject: FW: IL 102 over Ryans Creek, SN 099-0170
Attachments: Scan from D1 District Bridge Office

Hi Dawn

Please include the emails below and attachment in the Hydraulic Report.
It provides scour related information.
Thanks

Esther Winograd
Hydraulic Section
Bureau of programming
IDOT-DOH
201 West Center Court,
Schaumburg, IL 60196-1096
tel; 847/705-4475

From: Mastny, Steve C
Sent: Friday, March 27, 2015 8:45 AM
To: Wilson, Sarah M; Winograd, Esther B
Subject: RE: IL 102 over Ryans Creek, SN 099-0170

Sorry it took so long, but we dug the attached memo out of our files that has some bearing.

Steve

From: Wilson, Sarah M
Sent: Monday, March 02, 2015 12:04 PM
To: Winograd, Esther B
Cc: Mastny, Steve C
Subject: RE: IL 102 over Ryans Creek, SN 099-0170

That's correct – an inspector discovered the scour hole was some 2.5 ft below the bottom of the footing, so we used an emergency process to get the hole filled up asap.

From: Winograd, Esther B
Sent: Monday, March 02, 2015 11:57 AM
To: Wilson, Sarah M
Subject: RE: IL 102 over Ryans Creek, SN 099-0170

Sarah-My recollection is that the riprap was place to fill a scour hole, but without a scour countermeasure design, as an emergency.
Can you confirm? The attachments were not clear on this subject.
Thanks

From: Wilson, Sarah M
Sent: Monday, March 02, 2015 10:47 AM
To: Winograd, Esther B
Cc: Mastny, Steve C
Subject: RE: IL 102 over Ryans Creek, SN 099-0170

Rip rap was placed in 1996 – I don't have any information in my file indicating that the RR5 wasn't adequate. Steve – do you have anything?

Attached is the cross section from 2009, and 2013.

From: Winograd, Esther B
Sent: Thursday, February 26, 2015 10:57 AM
To: Wilson, Sarah M
Subject: IL 102 over Ryans Creek, SN 099-0170

Hi Sarah,

I am working on the hydraulic report for the subject structure and I am looking for some history regarding scour.
This structure had an actual scour problem which was remedied with RR 5 riprap thrown in to fill the hole (probably about 10 years ago +/-?).
Do you have a date for when it was actually done?
Also, after some analysis it was concluded that RR 5 is not adequate for this location.
Was any additional riprap placed? Do you have information on the conditions of the riprap and a current stream x-section under the bridge to show the current conditions of the streambed/riprap?

Your timely input will be much appreciated.
Thanks

Esther Winograd
847/705-4475

099-0169
099-0170

Wilson, Sarah M

From: Mastny, Steve C
Sent: Wednesday, May 09, 2012 6:55 AM
To: Wilson, Sarah M
Subject: Re: ARTERIAL INCIDENT- road closed due to flooding IL 102 from Rivals Road South to Old Chicago/South Chicago Road

Yes, I was able to drive all the way through a bit after lunch, although there was still quite a bit of water on the pavement. Both of our structures on 102 in the area are fine. The Kankakee River is rather high, as are some of the tributaries, but driving 102 and 113 and stopping at our structures, nothing is a huge concern.

From: Wilson, Sarah M
Sent: Wednesday, May 09, 2012 06:41 AM
To: Mastny, Steve C
Subject: FW: ARTERIAL INCIDENT- road closed due to flooding IL 102 from Rivals Road South to Old Chicago/South Chicago Road

Did you get a chance to get down to this area?

From: Fleischmann, Robert M
Sent: Tuesday, May 08, 2012 8:54 PM
To: DOT.D1ELEIncident; DOT.D1.ELE-Executive Notification; DOT.Communications Center; ELE-ComCenter; Hill, Lawrence C; Jucius, Cory; Winesberry, Dionne
Subject: RE: ARTERIAL INCIDENT- road closed due to flooding IL 102 from Rivals Road South to Old Chicago/South Chicago Road

Maint advised that the water has gone down and the road is now open. Water on pavement signs are posted

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From: DOT.D1ELEIncident
Sent: Monday, May 07, 2012 3:18 PM
To: DOT.D1.ELE-Executive Notification; DOT.Communications Center; ELE-ComCenter; Hill, Lawrence C; Jucius, Cory; Winesberry, Dionne
Subject: ARTERIAL INCIDENT- road closed due to flooding IL 102 from Rivals Road South to Old Chicago/South Chicago Road

INCIDENT: road closed due to flooding

LOCATION: IL 102 from Rivals Road South to Old Chicago/South Chicago Road

City/ County: Town of Ritchie,

BLOCKAGE: road closed due to the overflowing water from a tributary of the Kankakee River

RESPONSE: IDOT ISP 5 on scene

En route

HANDLING:

Estimated DURATION:

DETAILS:

Bob Fleischmann

IDOT District One ComCenter Sup. 847 705 4602

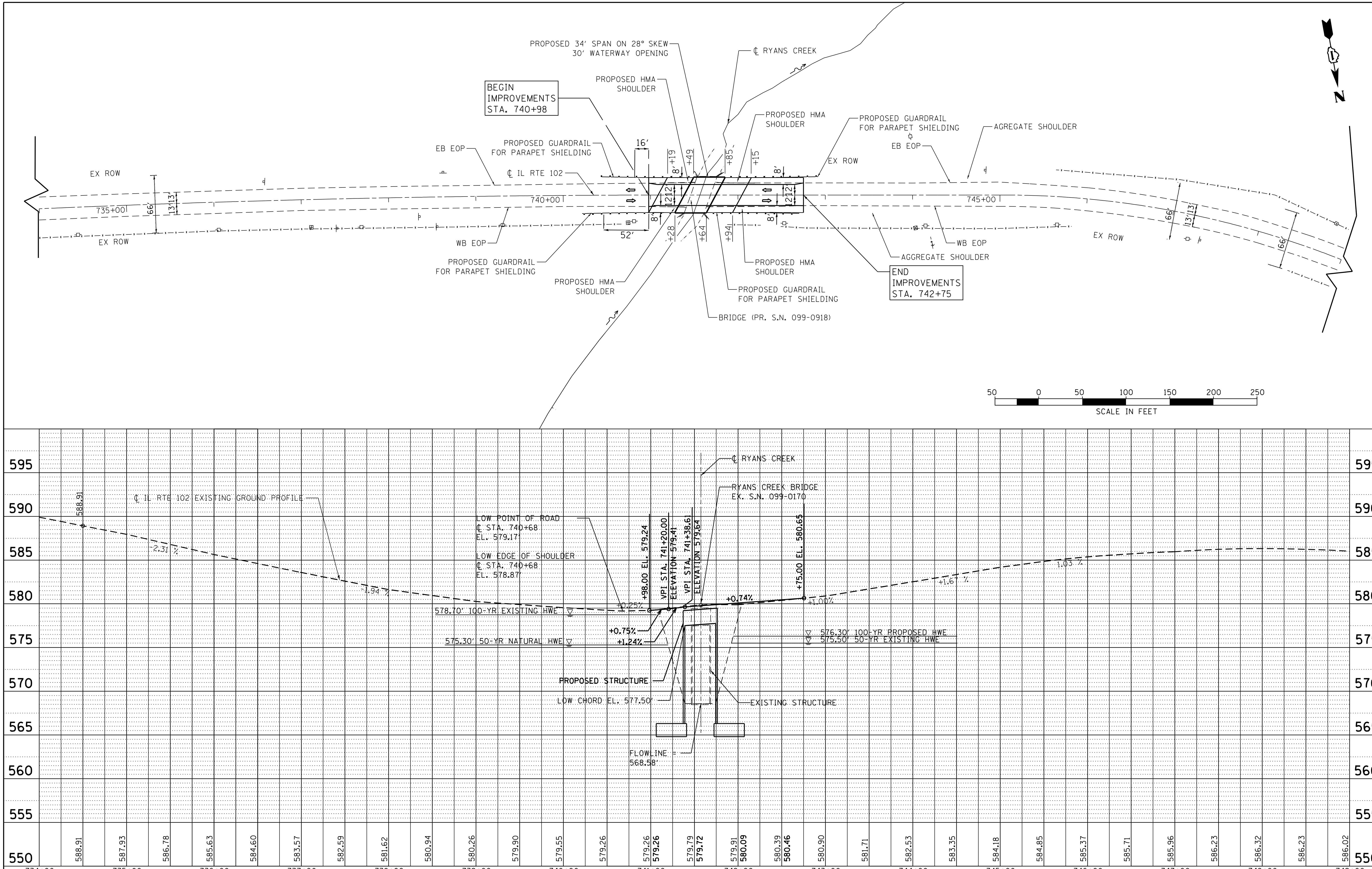
(Send all ComCenter mail to elecc@dot.il.gov)

SECTION 18

Alternatives Analysis

ALTERNATIVES ANALYSIS

Alt 1. Closed Abutment

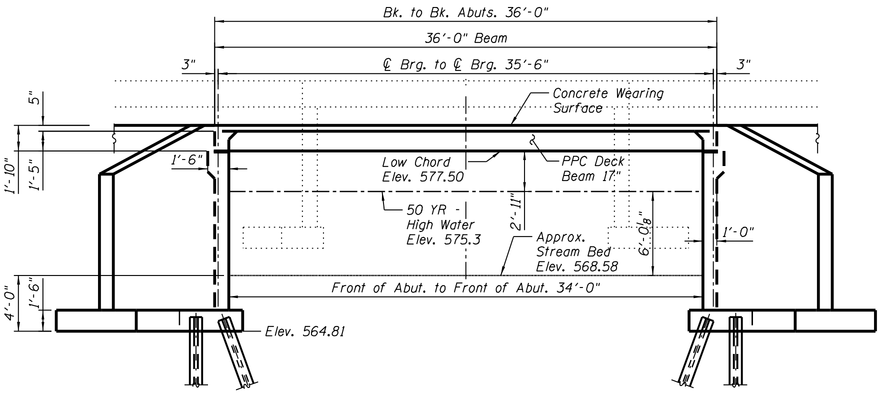


FILE NAME = $FILES$	USER NAME = $USER$	DESIGNED - VEA	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	IL ROUTE 102 OVER RYANS CREEK PLAN AND PROFILE – ALTERNATIVE 1 CLOSED ABUTMENT
		DRAWN - JMR	REVISED -		
$MODELNAME$	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -		
	PLOT DATE = $DATE$	DATE - 5/1/15	REVISED -		SCALE: 1"=50' SHEET 1 OF 1 SHEETS STA. 734+00 TO STA. 749+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631		WILL	1	4
CONTRACT NO. P91-191-13				
ILLINOIS FED. AID PROJECT				

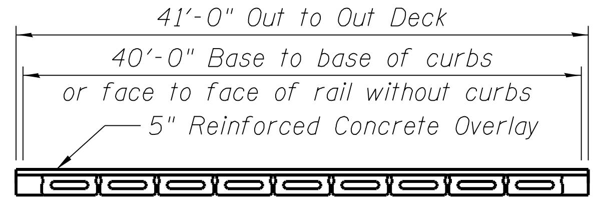
PLAN — SURVEYED / PLOTTED / ALIGNMENT CHECKED / RT. OF WAY CHECKED / CADD FILE NAME — NOTE BOOK NO. — BY — DATE

PROFILE — SURVEYED / PLOTTED / GRADES CHECKED / BM. NOTED / STRUCTURE NOTAT'NS CH'KD — NOTE BOOK NO. — BY — DATE

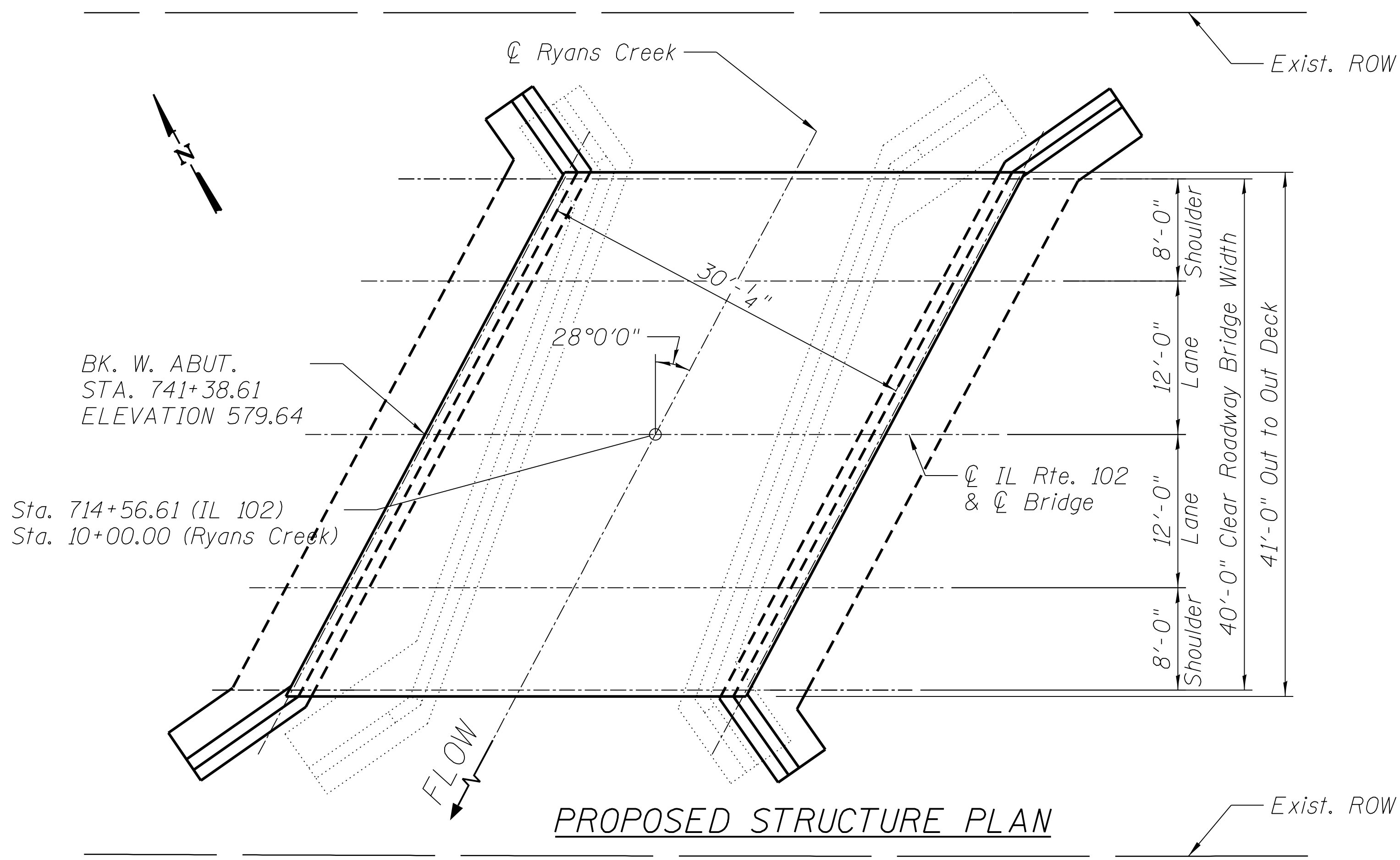


PROPOSED STRUCTURE ELEVATION

Dimensions measured along ℄ IL Rte. 102



PROPOSED CROSS SECTION



PROPOSED STRUCTURE PLAN

Primera 100 S. WACKER DRIVE SUITE 700 . CHICAGO IL 60606 . P:312-606-0910 F:312-606-0415	**STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION**	IDOT PROJECT NO. P-91-187-13 BRIDGE CONDITION REPORT	IL RTE. 102 OVER RYANS CREEK PROPOSED SKETCH PLAN ALTERNATIVE 1	EXHIBIT: G-1

Illinois Department of Transportation

Bridge Waterway Information Table

Route:	Il Route 102 (FAP 631)	Existing SN:	099-0170
Waterway:	Ryans Creek	Proposed SN:	
Section:	111 N-B-I	Prepared by:	Dawn Cosentino — Date: 10/27/2015
County:	Will	Checked by:	Date:

Existing Overtopping Elev. = 579.17 at Sta. 740+68

Drainage Area = 6.59 square miles — Proposed Overtopping Elev. = 579.17 at Sta. 740+68

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-year	10	408	96	134	573.8	0.2	0.0	574.0	573.8
Design	50	866	126	179	575.3	0.8	0.2	576.1	575.5
Base	100	1250	140	200	576.0	2.7	0.5	578.7	576.5
Scour Design Check	200	1700	152	219	576.6	3.2	1.7	579.8	578.3
Overtop Existing	200	1700	152	---	576.6	3.2	----	----	----
Overtop Proposed	----	----	----	236	----	----	2.5	579.8	579.1
Max. Calc.	500	2375	164	236	577.4	2.9	2.5	580.3	579.1

Datum:

All-Time H.W.E. & Date: May, 2012 - Approximately 579.5 ft

Surveyed Normal Water Level: 570.0 ft

10-Year Velocity through Existing Structure = 4.3 ft/s

10-Year Velocity through Proposed Structure = 2.7 ft/s

2-Yr. Flow Rate = 242 ft^3/s

EXISTING STRUCTURE

Type: Single Span Concrete Deck Beam Bridge

Length/Width: 21.3' on skew, 20.0' perpendicular to flow

Spans/Cells: 1 – Length along stream/abutments = 43.93’

Low Chord: 577.20

Skew: 20 degrees (relative to road)

Clearance: 1.90'

Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)

Low E.O.P: 578.97 at STA 740+68

Freeboard: 2.87’

Culvert Inverts: N/A (u/s) N/A (d/s)

PROPOSED STRUCTURE

Type: Single Span PPC Deck Beam 17”

Length Of Span: 34' on skew, 30' perpendicular

Spans: 1 – Length along stream/abutments =

Low Chord: Beam: 577.50’

Skew: 28 degrees (relative to road)

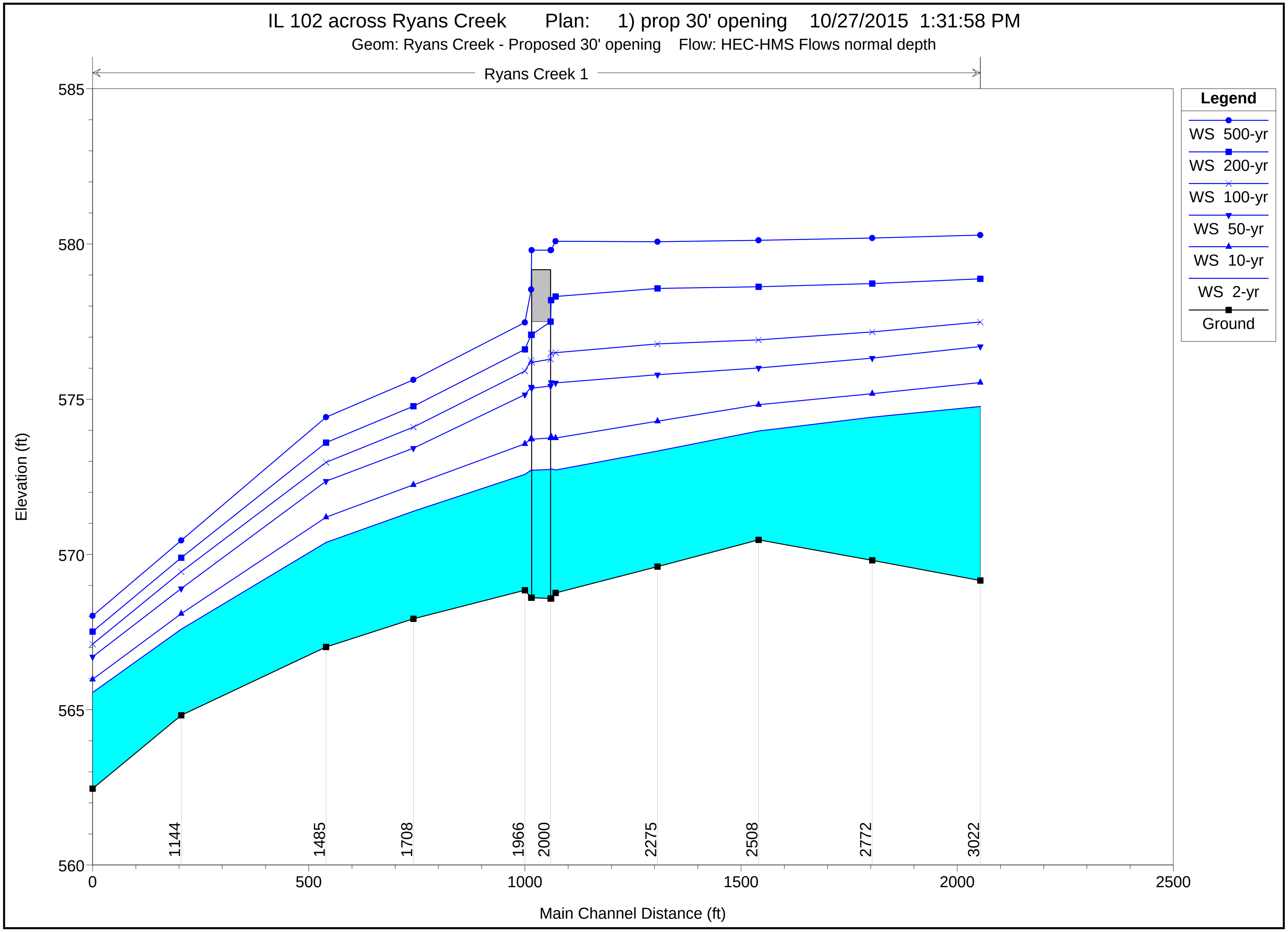
Clearance: 2.2’

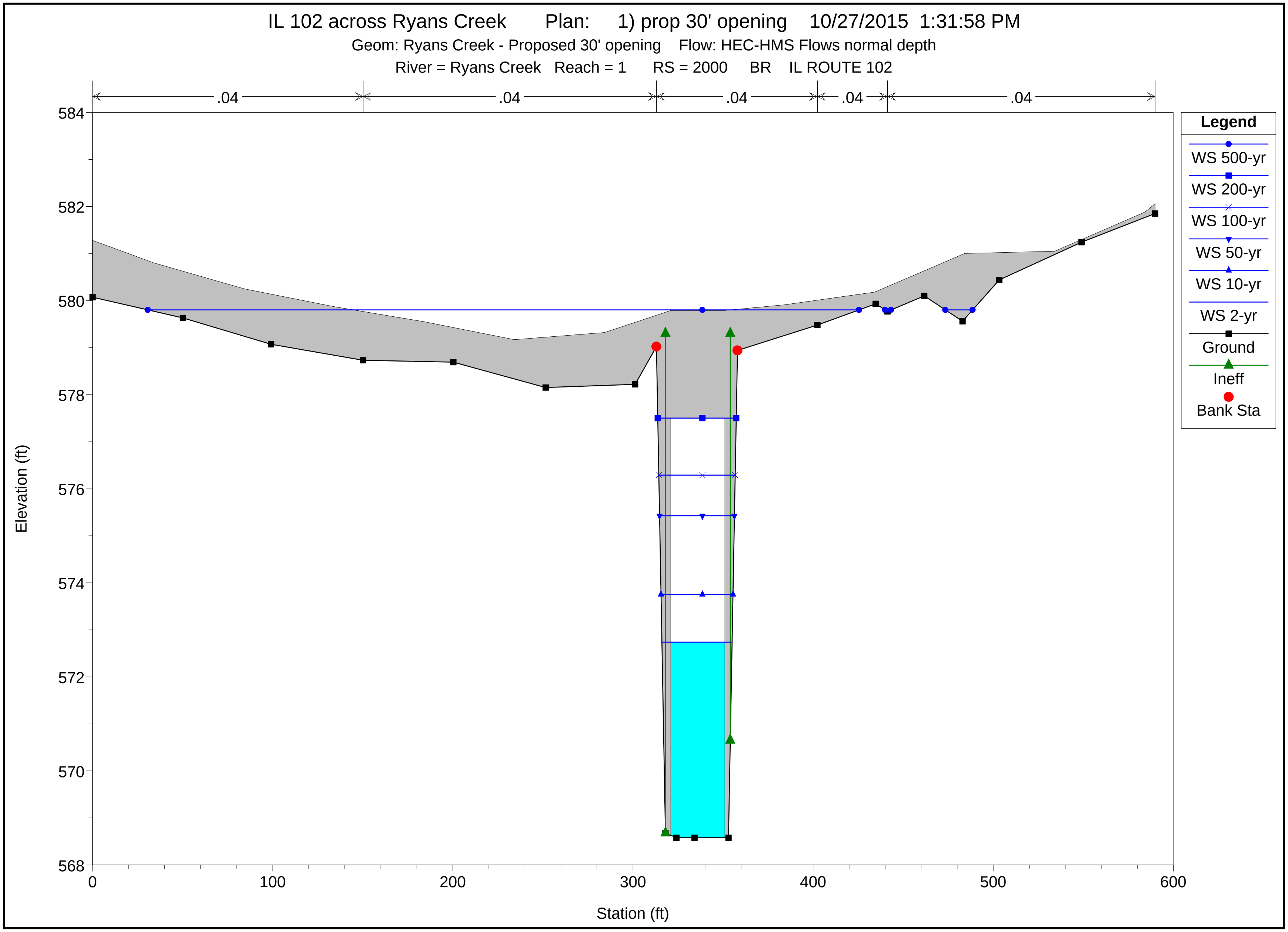
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)

Low E.O.P: 578.97 at STA 740+68

Freeboard: 3.47’

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.


IL 102 across Ryans Creek Plan: 1) prop 30' opening 10/27/2015 1:31:58 PM
Geom: Ryans Creek - Proposed 30' opening Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
585
580
575
570
565
560
1144
1485
1708
1966
2000
2275
2508
2772
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)


IL 102 across Ryans Creek Plan: 1) prop 30' opening 10/27/2015 1:31:58 PM
Geom: Ryans Creek - Proposed 30' opening Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 BR IL ROUTE 102
.04
.04
.04
.04
.04
Elevation (ft)
584
582
580
578
576
574
572
570
568
Station (ft)
0
100
200
300
400
500
600
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta

WATERWAY OPENING - The effective waterway opening should be calculated at the upstream face of the structure based on the Natural Highwater Elevation for a given frequency. It should represent actual existing conditions, not as-built or cleaned out. It is determined by calculating the flow area under the Natural High Water Elevation (N.H.W.E.) at the surveyed bridge opening section. It is not based on the Existing H.W.E. or the Proposed H.W.E. This value is not the value you can find in the Hydraulic Software output. It is calculated separately from any Hydraulic Software. Pier area below the N.H.W.E. should be subtracted from the total opening area. An adjustment for improperly skewed piers may be required which will increase the pier area and reduce the net opening.

WATERWAY OPENING (sq. ft.) - EXISTING

Flood Frequency	A Natural H.W.E.	B Bridge U/S Flowline	C Area Under elev 569.93*	D Bridge Span W (ft)	E NHWE-569.93	C+(D*E) Waterway Opening (sq. ft.)
10-year	573.8	568.58	18	20.0	3.86	96
50-year	575.3	568.58	18	20.0	5.36	126
100-year	576.0	568.58	18	20.0	6.06	140
200-year	576.6	568.58	18	20.0	6.68	152
500-year	577.4	568.58	18	20.0	7.27	164

*See attached opening exhibit

WATERWAY OPENING (sq. ft.) - PROPOSED

Flood Frequency	A Natural H.W.E.	B Bridge U/S Flowline	C Area Under elev 569.93*	D Bridge Span W (ft)	E NHWE-569.93	C+(D*E) Waterway Opening (sq. ft.)
10-year	573.8	568.58	18	30	3.86	134
50-year	575.3	568.58	18	30	5.36	179
100-year	576.0	568.58	18	30	6.06	200
200-year	576.6	568.58	18	30	6.68	219
500-year	577.4	568.58	18	30	7.27	236

HEAD - The largest change in computed water surface elevation, comparing the computed water surface elevations from the existing condition and proposed condition to the natural condition for each upstream cross section, is the Created Head. That Created Head is entered into the HEAD column of the Waterway Information Table for each flow profile. Head should not be negative, so use a value of zero if a negative number is computed. Proposed structures that result in headwater less than the Natural HWE for a given frequency should indicate "0.0" as the head and the headwater elevation will be equal to the NHWE.

HEAD (ft) - EXISTING

	(A) Existing Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Existing Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Existing Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.89	576.65	0.0		579.09	577.30	1.8		580.05	577.93	2.1		580.60	578.66	1.9	
2772	575.19	575.18	0.0		576.62	576.24	0.4		579.03	576.88	2.1		580.00	577.49	2.5		580.53	578.22	2.3	
2508	574.85	574.83	0.0		576.42	575.88	0.0		578.99	576.51	2.5		579.95	577.11	2.8		580.47	577.85	2.6	
2275	574.39	574.30	0.1		576.31	575.58	0.7		578.96	576.26	2.7		579.93	576.89	3.0		580.43	577.63	2.8	
2040	573.96	573.78	0.2		576.15	575.36	0.8		578.84	576.11	2.7		579.94	576.77	3.2		580.45	577.57	2.9	
2026	573.87	573.77	0.1	574.0	575.82	575.30	0.5	576.1	578.50	576.00	2.5	578.7	579.60	576.62	3.0	579.8	580.08	577.41	2.7	580.3

HEAD (ft) - PROPOSED

	(A) Proposed Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Proposed Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Proposed Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Upstream Channel Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.70	576.65	0.1		577.49	577.30	0.2		578.88	577.93	1.0		580.29	578.66	1.6	
2772	575.18	575.18	0.0		576.32	576.24	0.1		577.16	576.88	0.3		578.73	577.49	1.2		580.19	578.22	2.0	
2508	574.82	574.83	0.0		576.01	575.88	0.1		576.91	576.51	0.4		578.62	577.11	1.5		580.12	577.85	2.3	
2275	574.29	574.30	0.0		575.79	575.58	0.2		576.78	576.26	0.5		578.57	576.89	1.7		580.07	577.63	2.4	
2040	573.75	573.78	0.0		575.53	575.36	0.2		576.50	576.11	0.4		578.31	576.77	1.5		580.09	577.57	2.5	
2026	573.79	573.77	0.0	573.7	575.54	575.30	0.2	575.5	576.49	576.00	0.5	576.5	578.19	576.62	1.6	578.2	579.80	577.41	2.4	579.9

Hydraulic Design - Bridge Scour

File Type View Help

Title: Proposed 30 opening, 200-yr event

HD n:\2013\2013127.05\Calculations\Drainage\HEC-RAS\

River: Ryans Creek Profile: 200-yr Defaults Apply

Reach 1 River 2000 BR Compute Report...

Contraction | Pier | Abutment

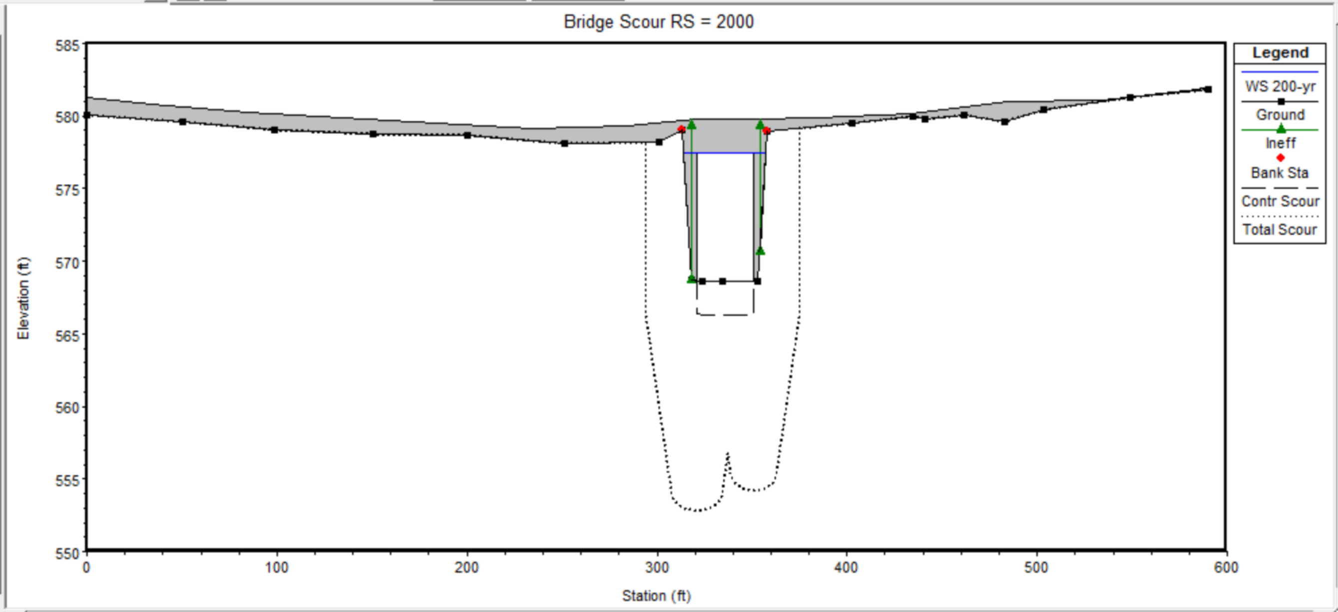
	Left	Right
Toe sta at	321.00	351.00
Toe sta at App:	367.00	393.11
Length:	22.00	11.89
Y1:	9.56	9.61
K1:	0.82 - Vert. with wing wa	
Skew (deg):	90.00	90.00
K2:	1.00	1.00
Equation:	Default	

Froehlich's Eqn. Specific Data

	Left	Right
L':	15.36	7.29
Ya:	5.82	6.22
Qe:	510.15	307.94
Ae:	128.00	73.91

HIRE Eqn. Specific Data

	Left	Right
V1:	4.93	4.93



Froude #:	0.29	0.29
Equation:	Froehlich	Froehlich

Combined Scour Depths

Left abut + contr (ft):	15.82
Right abut + contr (ft):	14.35

183.20, 561.82

Hydraulic Design Data

Contraction Scour

	Left	Channel	Right
Input Data			
Average Depth (ft):	4.88	7.46	4.44
Approach Velocity (ft/s):	3.51	4.53	3.29
Br Average Depth (ft):	0.00	8.60	0.00
BR Opening Flow (cfs):		1700.00	
BR Top WD (ft):	0.00	30.00	0.00
Grain Size D50 (mm):	5.00	5.00	5.00
Approach Flow (cfs):	239.94	1388.56	71.50
Approach Top WD (ft):	14.00	41.11	4.89
K1 Coefficient:	0.590	0.640	0.590
Results			
Scour Depth Ys (ft):		2.25	
Critical Velocity (ft/s):		3.98	
Equation:		Live	

Abutment Scour

	Left	Right
Input Data		
Station at Toe (ft):	321.00	351.00
Toe Sta at appr (ft):	367.00	393.11
Abutment Length (ft):	22.00	11.89
Depth at Toe (ft):	9.56	9.61
K1 Shape Coef:	0.82 - Vert. with wing walls	
Degree of Skew (degrees):	90.00	90.00
K2 Skew Coef:	1.00	1.00
Projected Length L' (ft):	15.36	7.29
Avg Depth Obstructed Ya (ft):	5.82	6.22
Flow Obstructed Qe (cfs):	510.15	307.94
Area Obstructed Ae (sq ft):	128.00	73.91
Results		
Scour Depth Ys (ft):	13.57	12.10
Qe/Ae = Ve:	3.99	4.17
Froude #:	0.29	0.29
Equation:	Froehlich	Froehlich

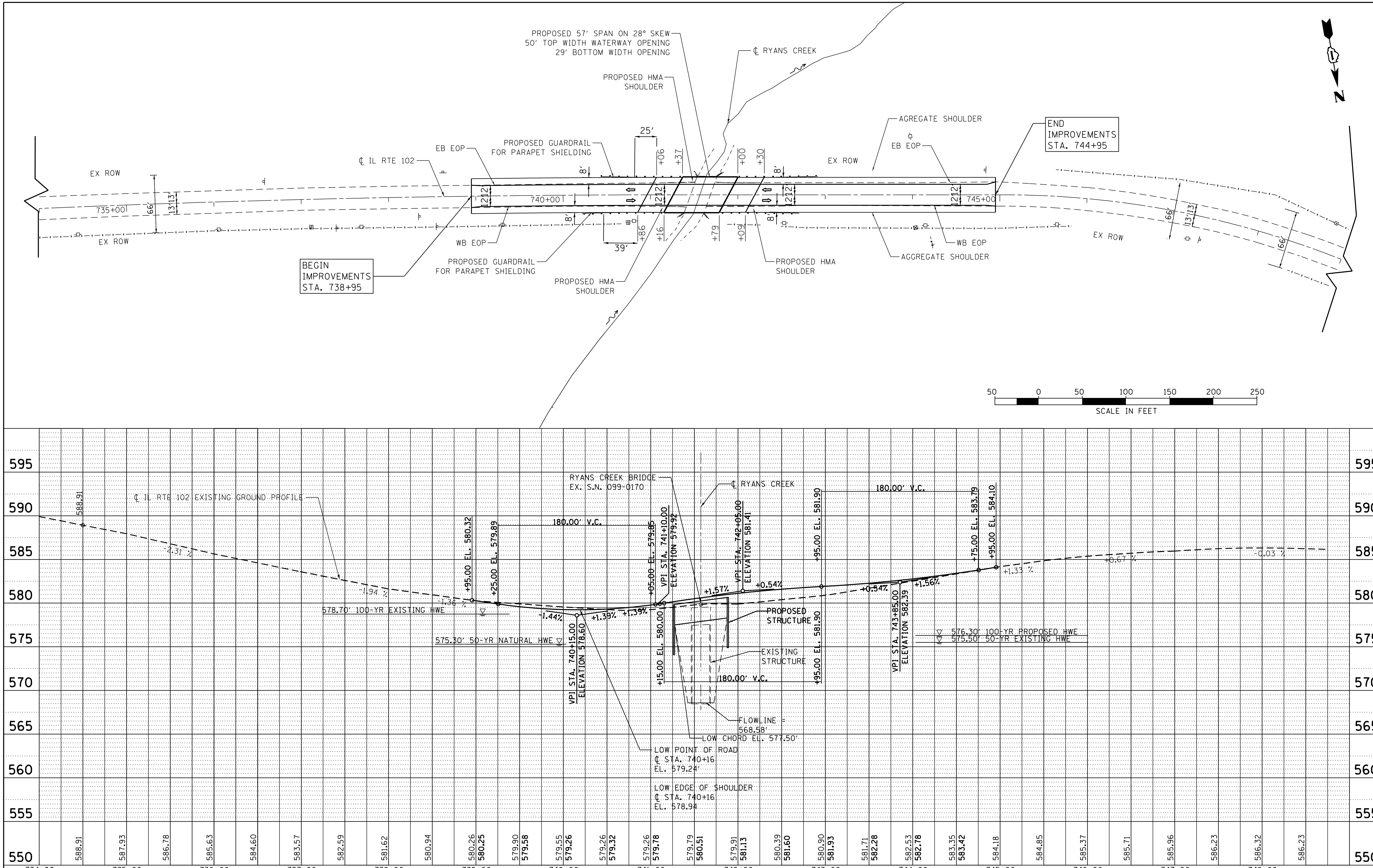
Combined Scour Depths

Left abutment scour + contraction scour (ft):	15.82
Right abutment scour + contraction scour (ft):	14.35

Clipboard | Print ... | File ... | Close

ALTERNATIVES ANALYSIS

Alt.2 Open Abutment



FILE NAME = $FILES$ $MODELNAME$	USER NAME = $USER$	DESIGNED - VEA	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
		DRAWN - JMR	REVISED -	
	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -	
	PLOT DATE = $DATE$	DATE - 5/1/15	REVISED -	

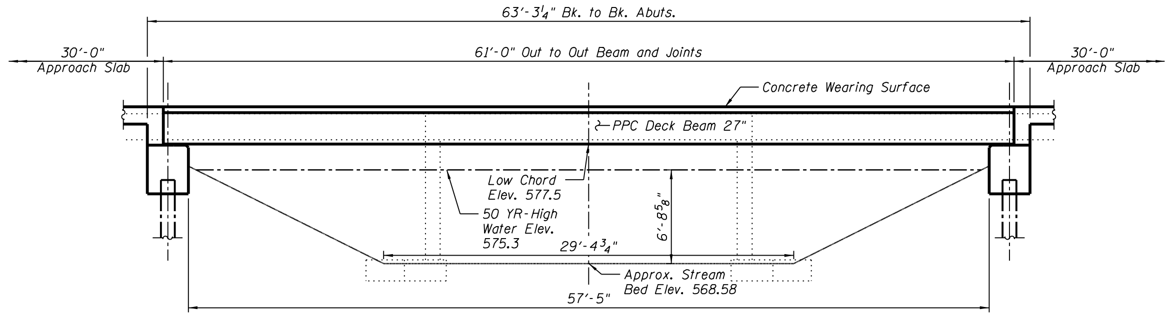
ROUTE 102 OVER RYANS CREEK
PLAN AND PROFILE – ALTERNATIVE 2 OPEN ABUTMENT

SCALE: 1"=50' | SHEET 1 OF 1 SHEETS | STA. 734+00 TO STA. 749+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631		WILL	2	4

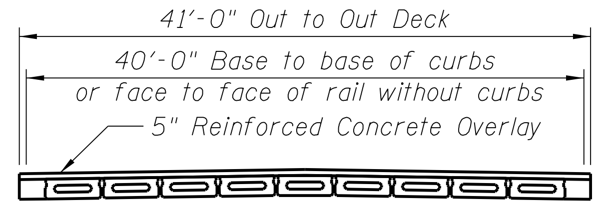
CONTRACT NO. P91-191-13

ILLINOIS FED. AID PROJECT

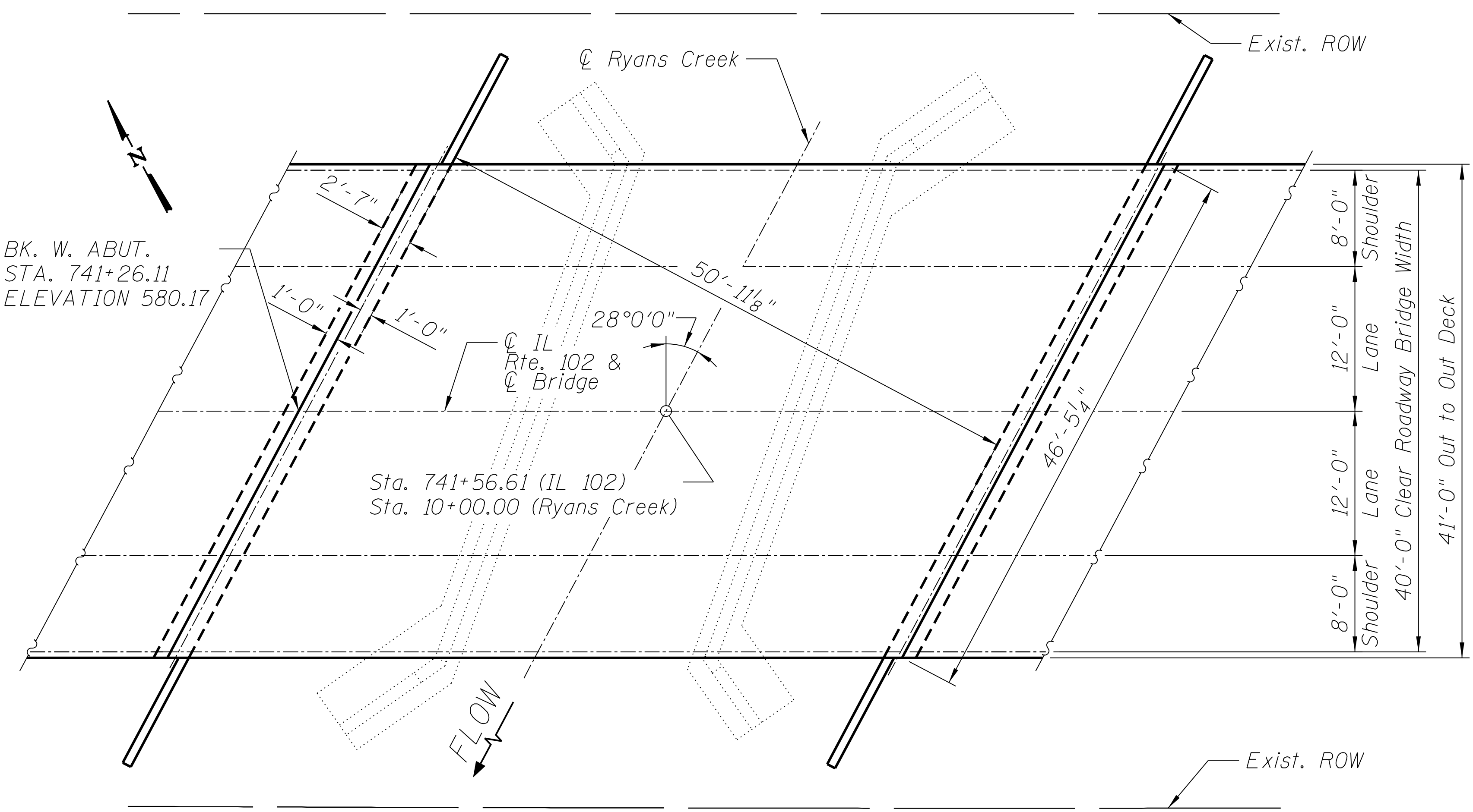


PROPOSED STRUCTURE ELEVATION

Dimensions measured along ℄ IL Rte. 102



PROPOSED STRUCTURE SKETCH



PROPOSED STRUCTURE PLAN

Primera 100 S. WACKER DRIVE SUITE 700 . CHICAGO IL 60606 . P:312-606-0910 F:312-606-0415	**STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION**	IDOT PROJECT NO. P-91-187-13 BRIDGE CONDITION REPORT	IL RTE. 102 OVER RYANS CREEK PROPOSED SKETCH PLAN ALTERNATIVE 2	EXHIBIT: G-2

Illinois Department of Transportation

Bridge Waterway Information Table

Route: Il Route 102 (FAP 631)
Waterway: Ryans Creek
Section: 111 N-B-I
County: Will

Existing SN: 099-0170
Proposed SN:
Prepared by: Dawn Cosentino   Date: 10/27/2015
Checked by: Date:

Existing Overtopping Elev. = 579.17 at Sta. 740+68

Drainage Area = 6.59 square miles

Proposed Overtopping Elev. = 579.24 at Sta. 740+16

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-year	10	408	96	169	573.8	0.2	0.0	574.0	573.8
Design	50	866	126	238	575.3	0.8	0.2	576.1	575.5
Base	100	1250	140	273	576.0	2.7	0.3	578.7	576.3
Scour Design Check	200	1700	152	297	576.6	3.2	0.6	579.8	577.2
Overtop Existing	200	1700	152	---	576.6	3.2	----	----	----
Overtop Proposed	----	----	----	327	577.4	----	2.0	579.8	579.4
Max. Calc.	500	2375	164	327	577.4	2.9	2.0	580.3	579.4

Datum:

All-Time H.W.E. & Date: May, 2012 - Approximately 579.5 ft

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10-Year Velocity through Proposed Structure = 2.5 ft/s

2-Yr. Flow Rate = 242 ft^3/s

EXISTING STRUCTURE

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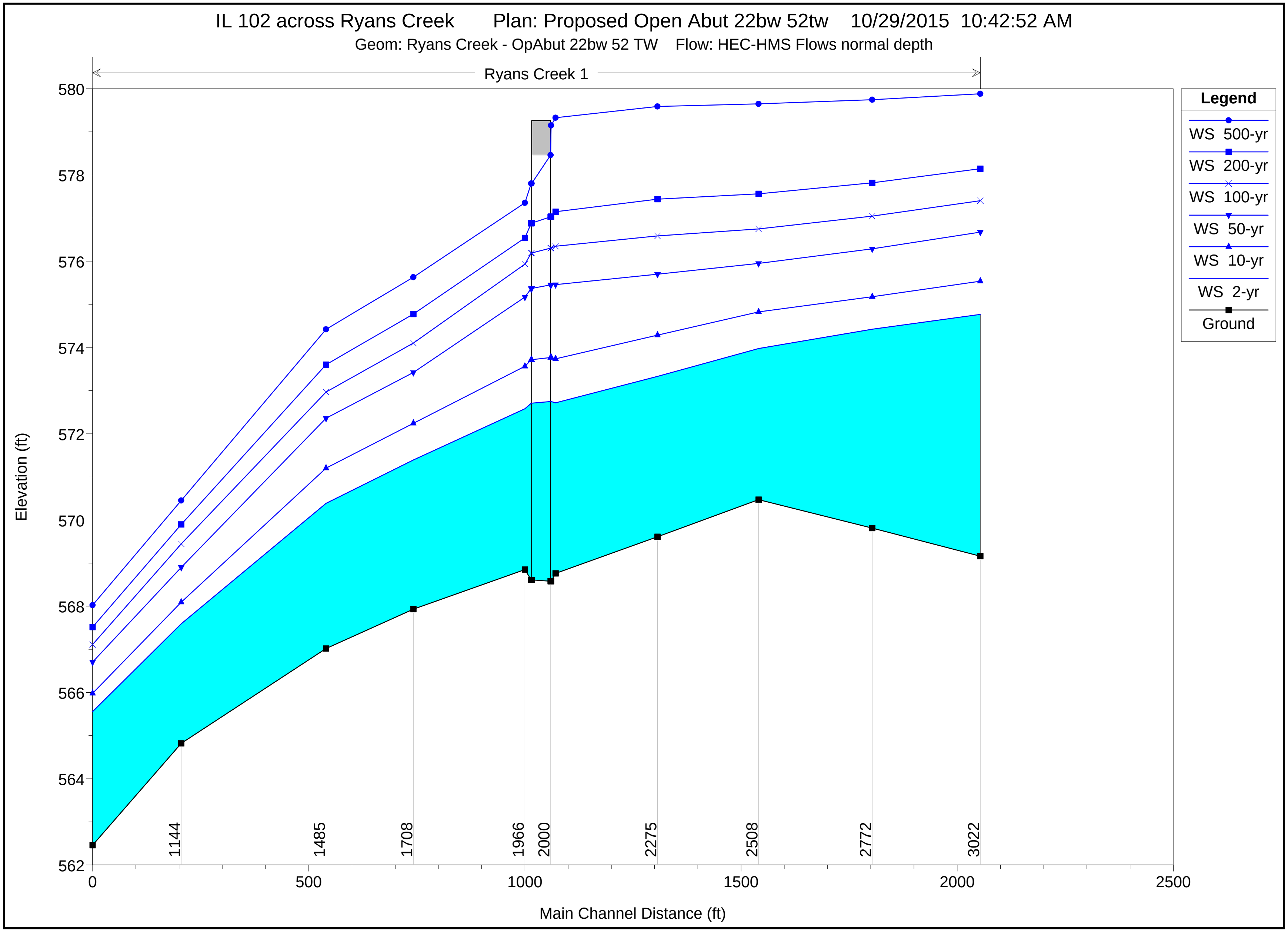
Skew: 20 degrees (relative to road)
Clearance: 1.90'
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.97 at STA 740+68
Freeboard: 2.87’
Culvert Inverts: N/A (u/s) N/A (d/s)

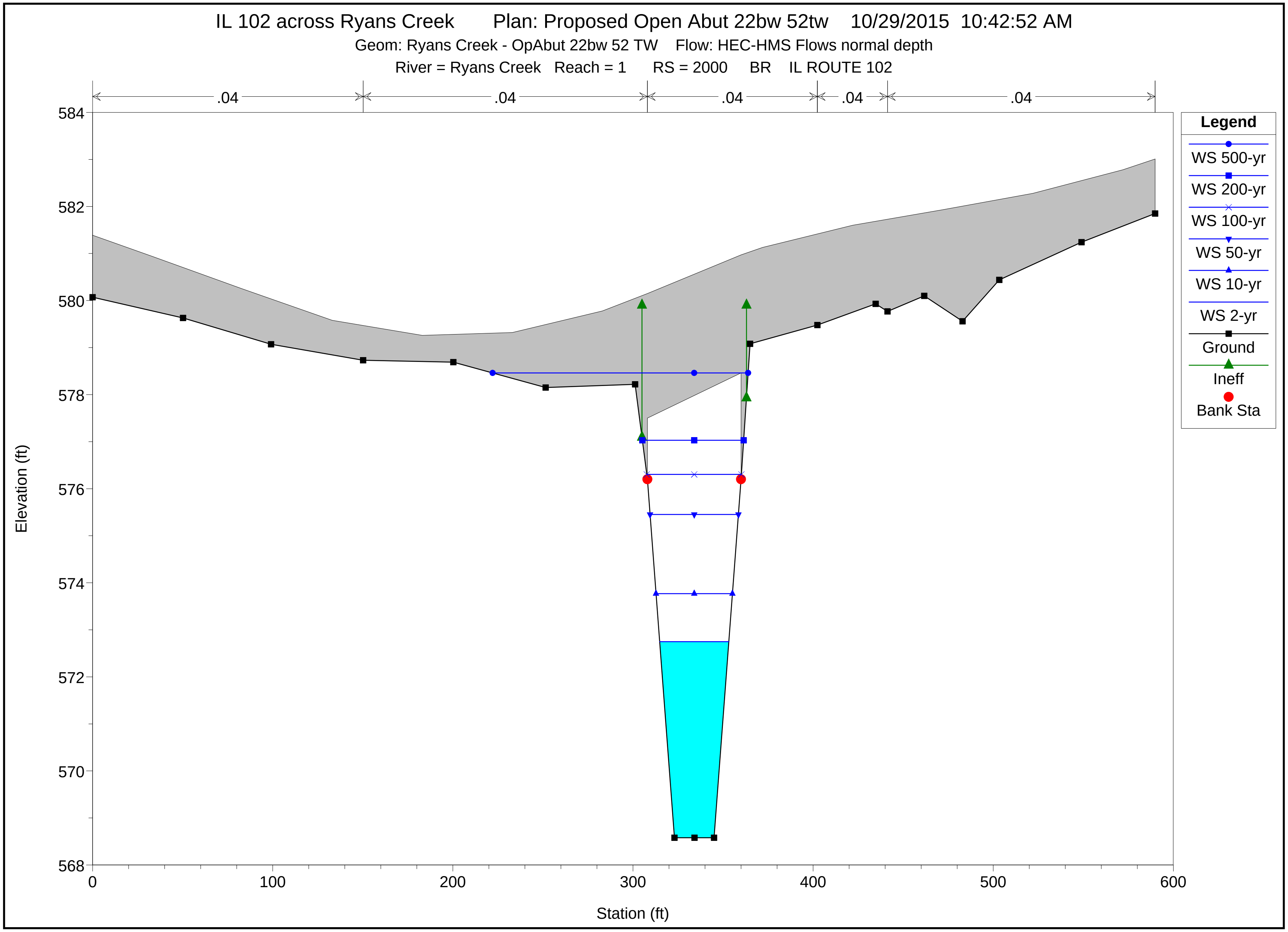
PROPOSED STRUCTURE

Type: Single Span PPC Deck Beam 28”
Length Of Span: 60' on skew, 52' perpendicular
\# Spans: 1 – Length along stream/abutments = 43.93
Low Chord: Beam: 577.50’
Skew: 28 degrees (relative to road)
Clearance: 2.2’
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.94 at STA 740+16
Freeboard: 3.44’

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.



IL 102 across Ryans Creek Plan: Proposed Open Abut 22bw 52tw 10/29/2015 10:42:52 AM
Geom: Ryans Creek - OpAbut 22bw 52 TW Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
580
578
576
574
572
570
568
566
564
562
0
500
1000
1500
2000
2500
1144
1485
1708
1966
2000
2275
2508
2772
3022



IL 102 across Ryans Creek Plan: Proposed Open Abut 22bw 52tw 10/29/2015 10:42:52 AM
Geom: Ryans Creek - OpAbut 22bw 52 TW Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 BR IL ROUTE 102
.04
.04
.04
.04
.04
Elevation (ft)
584
582
580
578
576
574
572
570
568
Station (ft)
0
100
200
300
400
500
600
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta

WATERWAY OPENING - The effective waterway opening should be calculated at the upstream face of the structure based on the Natural Highwater Elevation for a given frequency. It should represent actual existing conditions, not as-built or cleaned out. It is determined by calculating the flow area under the Natural High Water Elevation (N.H.W.E.) at the surveyed bridge opening section. It is not based on the Existing H.W.E. or the Proposed H.W.E. This value is not the value you can find in the Hydraulic Software output. It is calculated separately from any Hydraulic Software. Pier area below the N.H.W.E. should be subtracted from the total opening area. An adjustment for improperly skewed piers may be required which will increase the pier area and reduce the net opening.

WATERWAY OPENING (sq. ft.) - EXISTING

Flood Frequency	A Natural H.W.E.	B Bridge U/S Flowline	C Area Under elev 569.93*	D Bridge Span W (ft)	E NHWE-569.93	C+(D*E) Waterway Opening (sq. ft.)
10-year	573.8	568.58	18	20.0	3.86	96
50-year	575.3	568.58	18	20.0	5.36	126
100-year	576.0	568.58	18	20.0	6.06	140
200-year	576.6	568.58	18	20.0	6.68	152
500-year	577.4	568.58	18	20.0	7.27	164

*See attached openign exhibit

WATERWAY OPENING (sq. ft.) - PROPOSED

Flood Frequency	A Natural H.W.E.	B Bridge U/S Flowline	C (A-B) height	D Bridge Span Wbottom (ft)	E Bridge Span Wtop (ft)	C+(D*E) Waterway Opening (sq. ft.)
10-year	573.8	568.58	5.2	22	43	169
50-year	575.3	568.58	6.7	22	49	238
100-year	576.0	568.58	7.4	22	52	273
200-year	576.6	568.58	8.0	22	52	297
500-year	577.4	568.58	8.8	22	52	327

HEAD - The largest change in computed water surface elevation, comparing the computed water surface elevations from the existing condition and proposed condition to the natural condition for each upstream cross section, is the Created Head. That Created Head is entered into the HEAD column of the Waterway Information Table for each flow profile. Head should not be negative, so use a value of zero if a negative number is computed. Proposed structures that result in headwater less than the Natural HWE for a given frequency should indicate "0.0" as the head and the headwater elevation will be equal to the NHWE.

HEAD (ft) - EXISTING

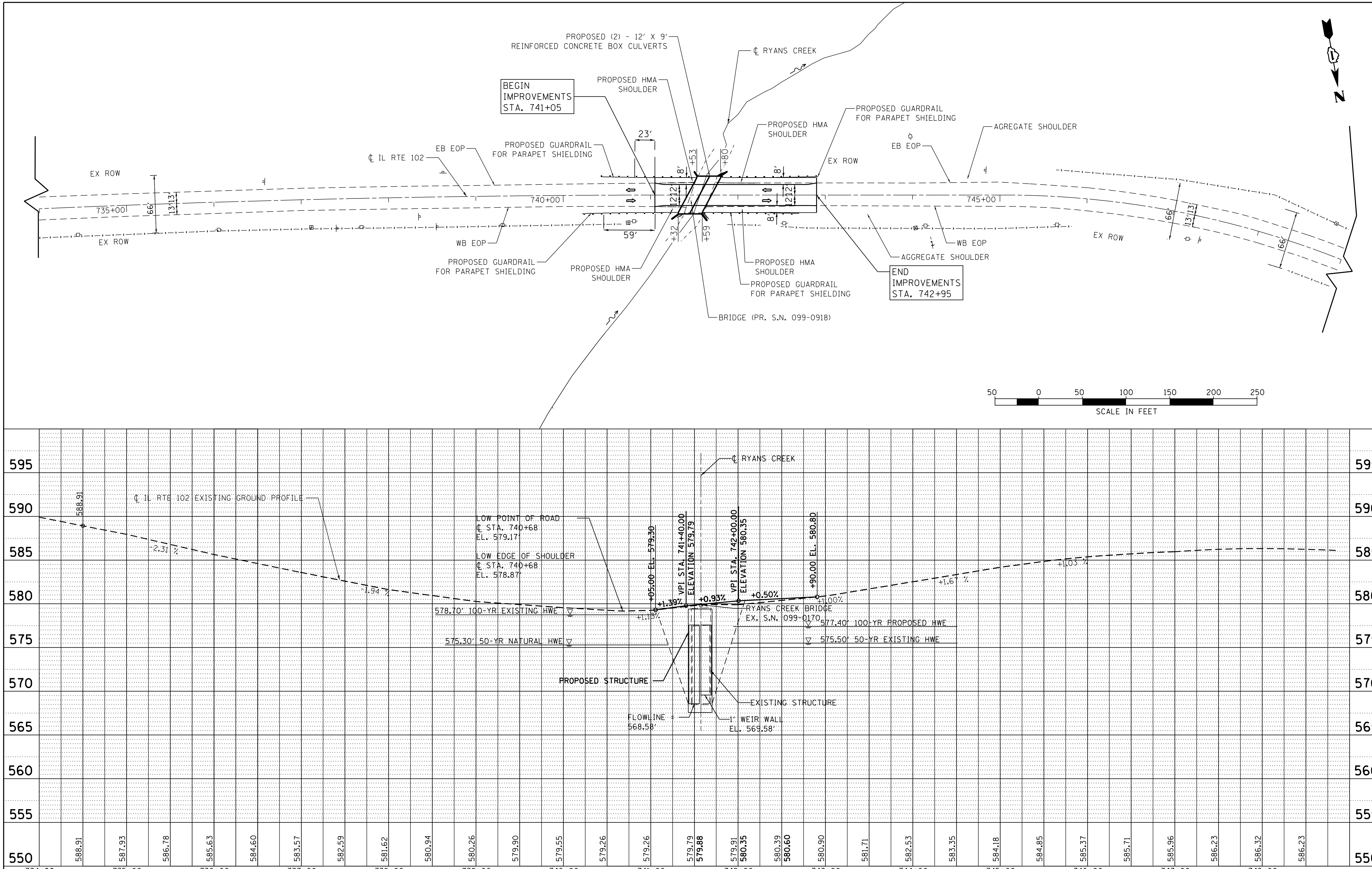
	(A) Existing Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Existing Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Existing Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.89	576.65	0.0		579.09	577.30	1.8		580.05	577.93	2.1		580.60	578.66	1.9	
2772	575.19	575.18	0.0		576.62	576.24	0.4		579.03	576.88	2.1		580.00	577.49	2.5		580.53	578.22	2.3	
2508	574.85	574.83	0.0		576.42	575.88	0.0		578.99	576.51	2.5		579.95	577.11	2.8		580.47	577.85	2.6	
2275	574.39	574.30	0.1		576.31	575.58	0.7		578.96	576.26	2.7		579.93	576.89	3.0		580.43	577.63	2.8	
2040	573.96	573.78	0.2		576.15	575.36	0.8		578.84	576.11	2.7		579.94	576.77	3.2		580.45	577.57	2.9	
2026	573.87	573.77	0.1	574.0	575.82	575.30	0.5	576.1	578.50	576.00	2.5	578.7	579.60	576.62	3.0	579.8	580.08	577.41	2.7	580.3

HEAD (ft) - PROPOSED

	(A) Proposed Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Proposed Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Proposed Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Upstream Channel Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.67	576.65	0.0		577.40	577.30	0.1		578.15	577.93	0.2		579.88	578.66	1.2	
2772	575.18	575.18	0.0		576.29	576.24	0.0		577.04	576.88	0.2		577.82	577.49	0.3		579.75	578.22	1.5	
2508	574.82	574.83	0.0		575.95	575.88	0.1		576.75	576.51	0.2		577.56	577.11	0.4		579.65	577.85	1.8	
2275	574.29	574.30	0.0		575.70	575.58	0.1		576.59	576.26	0.3		577.44	576.89	0.6		579.59	577.63	2.0	
2040	573.74	573.78	0.0		575.46	575.36	0.1		576.35	576.11	0.2		577.15	576.77	0.4		579.33	577.57	1.8	
2026	573.77	573.77	0.0	573.7	575.45	575.30	0.2	575.5	576.31	576.00	0.3	576.3	577.03	576.62	0.4	577.0	579.15	577.41	1.7	579.2

ALTERNATIVES ANALYSIS

Alt 3. Double Box Culvert



FILE NAME = $FILES$	USER NAME = $USER$	DESIGNED - VEA	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	IL ROUTE 102 OVER RYANS CREEK	F.A.P. RTE. 631
		DRAWN - JMR	REVISED -		PLAN AND PROFILE – ALTERNATIVE 3 TWIN BOX CULVERTS	SECTION
$MODELNAME$	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -			COUNTY WILL
	PLOT DATE = $DATE$	DATE - 5/1/15	REVISED -		SCALE: 1"=50' SHEET 1 OF 1 SHEETS STA. 734+00 TO STA. 749+00	TOTAL SHEETS 3 SHEET NO. 4

CONTRACT NO.P91-191-13

ILLINOIS FED. AID PROJECT

Illinois Department of Transportation

Multiple Opening Waterway Information Table

Route: IL Route 102 (FAP 631)
Waterway: Ryans Creek
Section: 111 N-B-I
County: Will

Existing SN: 099-0170
Proposed SN: Pending
Prepared by: Dawn Cosentino Date: **10/21/2015**
Checked by: Date:

Drainage Area = 6.59 sq. mi.
Existing Overtopping Elev. = 579.17 at Sta. 740+68
Proposed Overtopping Elev. = 579.17 at Sta. 740+68

Flood Event		Discharge (cfs)		Waterway Opening (sq.ft.)		Natural H.W.E. ft.	Head – ft.		Headwater Elevation – ft.	
		Existing	Proposed	Existing	Proposed		Existing	Proposed	Existing	Proposed
10	Main Channel	408	254	96	62.5	573.8	0.2	0.1	574.0	573.9
	Relief Structure		154		37.9					
	TOTAL	408	408	96	100					
50	Main Channel	866	529	126	80.5	575.3	0.8	0.7	576.1	576.0
	Relief Structure		337		51.4					
	TOTAL	866	866	126	132					
100	Main Channel	1250	762	140	88.9	576.0	2.7	1.4	578.7	577.4
	Relief Structure		488		57.7					
	TOTAL	1250	1250	140	147					
200	Main Channel	1700	1031	152	96.	576.6	3.2	2.4	579.8	579.0
	Relief Structure		669		63.					
	TOTAL	1700	1700	152	159					
Overtopping	Main Channel	1700	1123	152	96	576.6	3.2	2.8	579.8	579.4
	Relief Structure		731		63					
	TOTAL	1700	1854	152	159					
500	Main Channel	2375	1123	164	96	577.4	2.9	2.8	580.3	580.2
	Relief Structure		731		63					
	TOTAL	2375	1854	164	159					

Datum:
All-Time H.W.E. & Date: ft
Surveyed Normal Water Level: ft

10-Year Velocity through Existing Structure = 4 ft/s
10-Year Velocity through Proposed Structure = 4 ft/s
2-Yr. Flow Rate = 242 ft^3/s

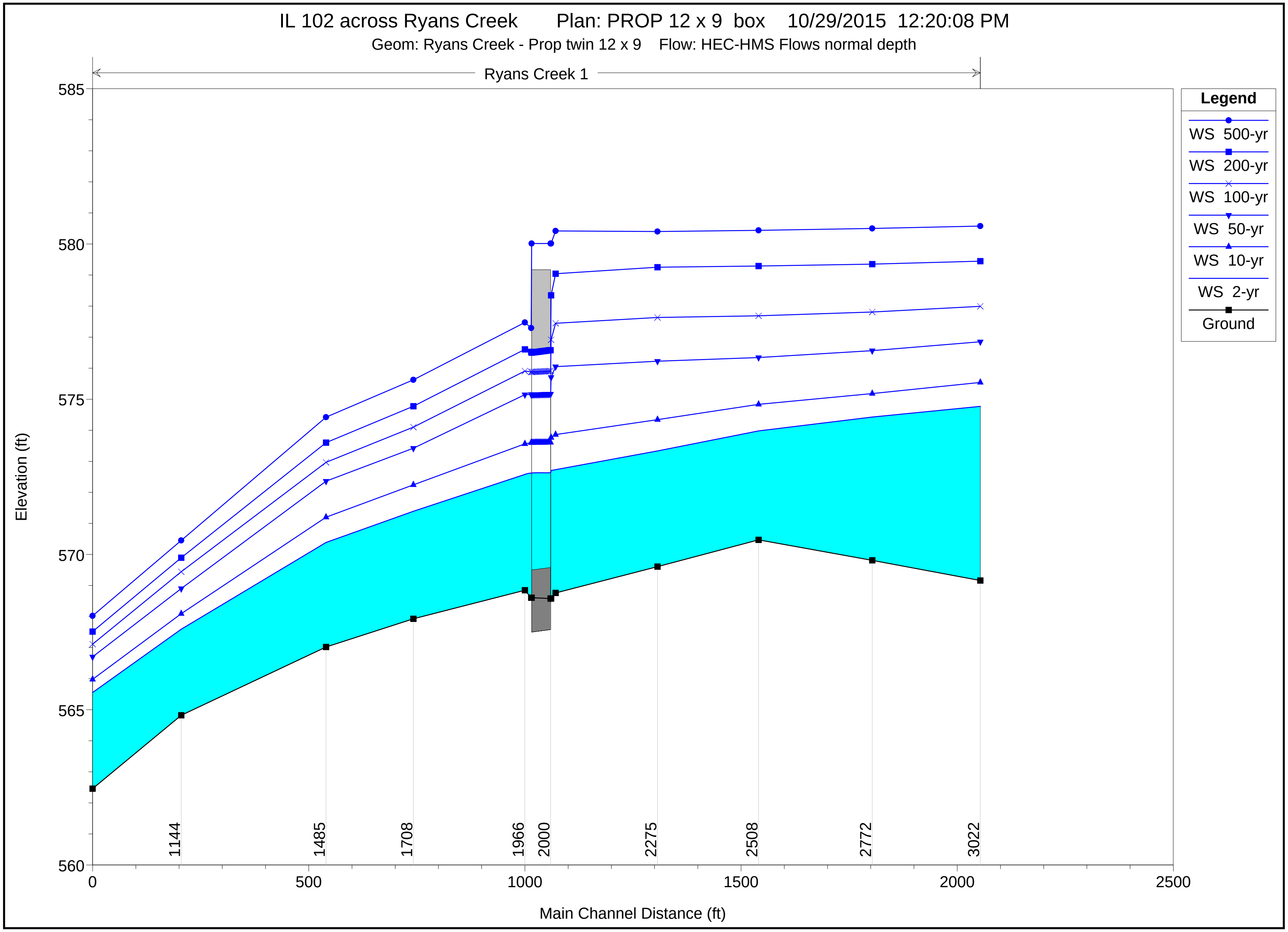
EXISTING STRUCTURE

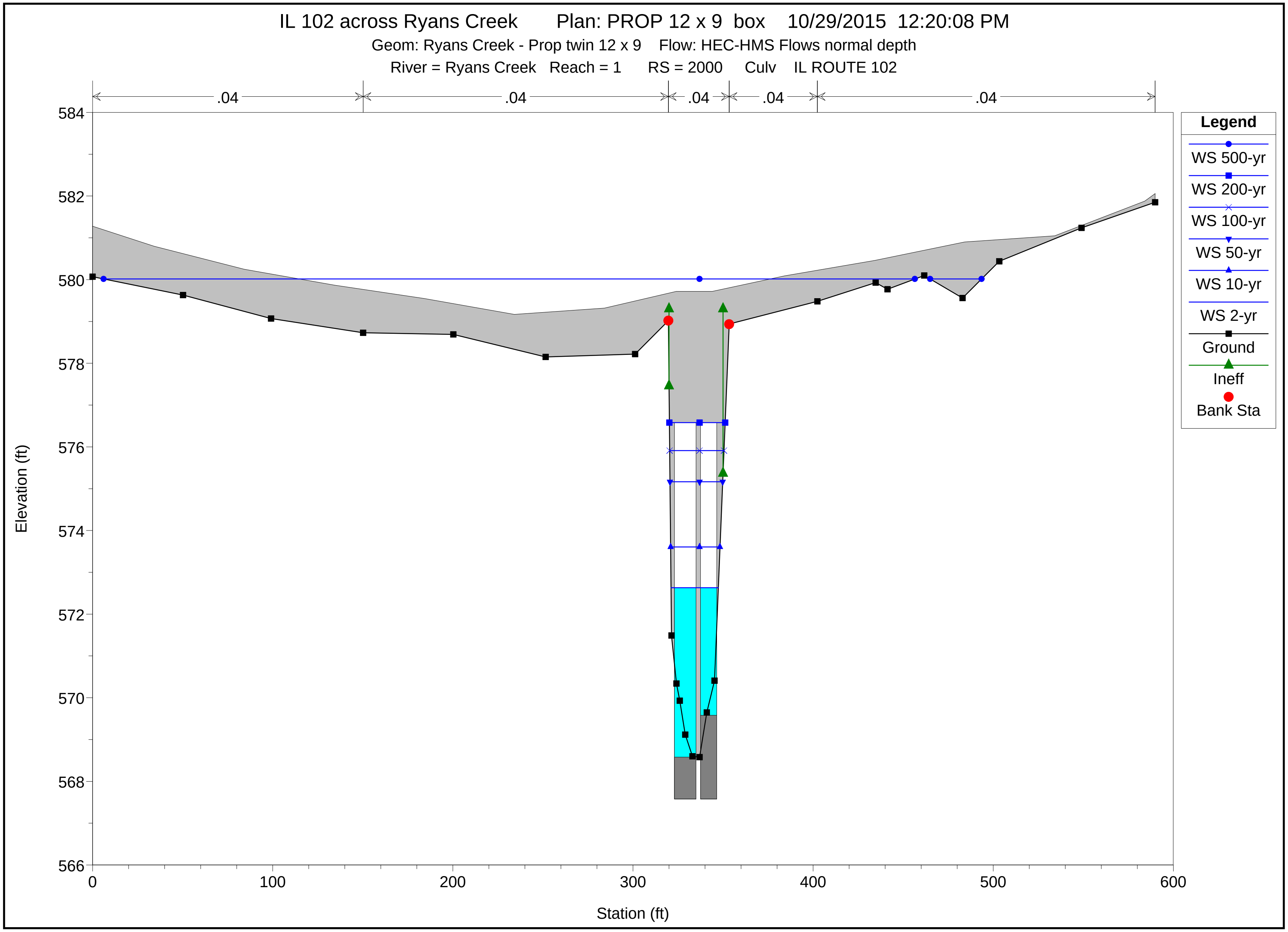
Main Channel Type: Single Span Concrete Deck Beam Bridge
Length/Width: 21.3' on skew, 20.0' perpendicular to flow
\# Spans/Cells: 1 – Length along stream/abutments = 43.93’
Low Chord: 577.20
Skew: 20 degrees (relative to road)
Clearance: 1.90'
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.97 at STA 740+68
Freeboard: 2.87’
Culvert Inverts: N/A (u/s) N/A (d/s)
Exist Relief Structure Type: N/A
Dimensions And Flowline: N/A

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.

PROPOSED STRUCTURE(S)

Main Channel Type: Twin (2)- 12' x 9' RC Box Culverts
Length/Width: 24' on skew, 21' on perpendicular
\# Spans/Cells: 2
Low Chord: Beam: 577.58
Skew: 28 degrees (relative to road)
Clearance: N/A
Flow Line: 568.58(u/s) 568.5(d/s)
Invert If Culvert: 567.58(u/s) 567.5(d/s): EMBEDMENT DEPTH 1ft
Low E.O.P: 578.97 at STA 740+68
Freeboard: 2.97'
Relief Structure Type:
\# Spans/Cells:
Invert And Flowline: 567.58 invert 569.58 flowline


IL 102 across Ryans Creek Plan: PROP 12 x 9 box 10/29/2015 12:20:08 PM
Geom: Ryans Creek - Prop twin 12 x 9 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
585
580
575
570
565
560
1144
1485
1708
1966
2000
2275
2508
2772
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)


IL 102 across Ryans Creek Plan: PROP 12 x 9 box 10/29/2015 12:20:08 PM
Geom: Ryans Creek - Prop twin 12 x 9 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 Culv IL ROUTE 102
.04
.04
.04
.04
.04
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
584
582
580
578
576
574
572
570
568
566
0
100
200
300
400
500
600
Station (ft)

WATERWAY OPENING - The effective waterway opening should be calculated at the upstream face of the structure based on the Natural Highwater Elevation for a given frequency. It should represent actual existing conditions, not as-built or cleaned out. It is determined by calculating the flow area under the Natural High Water Elevation (N.H.W.E.) at the surveyed bridge opening section. It is not based on the Existing H.W.E. or the Proposed H.W.E. This value is not the value you can find in the Hydraulic Software output. It is calculated separately from any Hydraulic Software. Pier area below the N.H.W.E. should be subtracted from the total opening area. An adjustment for improperly skewed piers may be required which will increase the pier area and reduce the net opening.

WATERWAY OPENING (sq. ft.) - EXISTING

	A	B	C	D	E	C+(D*E)
Flood Frequency	Natural H.W.E.	Bridge U/S Flowline	Area Under elev 569.93*	Bridge Span W (ft)	NHWE-569.93	Waterway Opening (sq. ft.)
10-year	573.8	568.58	18	20.0	3.86	96
50-year	575.3	568.58	18	20.0	5.36	126
100-year	576.0	568.58	18	20.0	6.06	140
200-year	576.6	568.58	18	20.0	6.68	152
500-year	577.4	568.58	18	20.0	7.27	164

*See attached openign exhibit

WATERWAY OPENING (sq. ft.) - PROPOSED Twin (2) 12' x 10' RC Box Culverts depressed 1 foot. Culvert 2 buried 2'. On a 28 degree skew

	A	B	C	D=(A-B)*C	E	F	G=(A-E)*F	D+G
Flood Frequency	Natural H.W.E.	Culvert #1 U/S Flowline	Culvert Span W (ft)	Waterway Opening #1 (Sq. Ft.)	Culvert #2 U/S Flowline	Culvert Span W (ft)	Waterway Opening #2 (Sq. Ft.)	Total Waterway Opening (sq. ft.)
10-year	573.8	568.58	12.0	62.52	569.58	9	37.89	100
50-year	575.3	568.58	12.0	80.52	569.58	9	51.39	132
100-year	576.0	568.58	12.0	88.92	569.58	9	57.69	147
200-year	576.6	568.58	12.0	96.00	569.58	9	63.00	159
500-year	577.4	568.58	12.0	96.00	569.58	9	63.00	159

HEAD - The largest change in computed water surface elevation, comparing the computed water surface elevations from the existing condition and proposed condition to the natural condition for each upstream cross section, is the Created Head. That Created Head is entered into the HEAD column of the Waterway Information Table for each flow profile. Head should not be negative, so use a value of zero if a negative number is computed. Proposed structures that result in headwater less than the Natural HWE for a given frequency should indicate "0.0" as the head and the headwater elevation will be equal to the NHWE.

HEAD (ft) - EXISTING

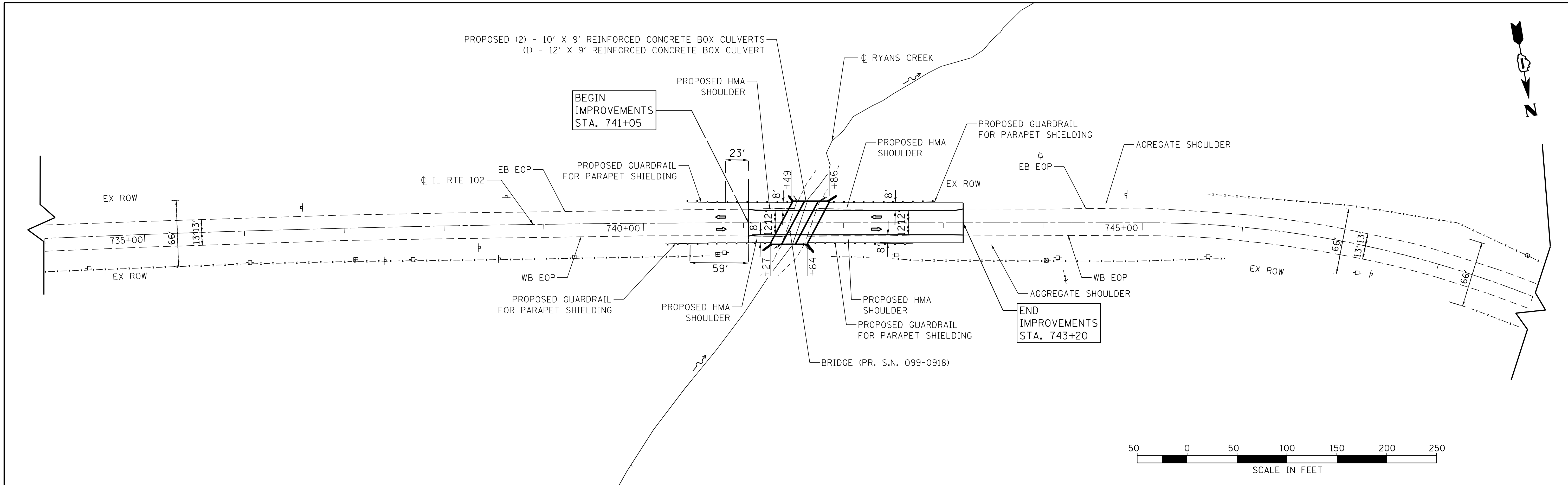
	(A) Existing Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Existing Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Existing Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.89	576.65	0.0		579.09	577.30	1.8		580.05	577.93	2.1		580.60	578.66	1.9	
2772	575.19	575.18	0.0		576.62	576.24	0.4		579.03	576.88	2.1		580.00	577.49	2.5		580.53	578.22	2.3	
2508	574.85	574.83	0.0		576.42	575.88	0.0		578.99	576.51	2.5		579.95	577.11	2.8		580.47	577.85	2.6	
2275	574.39	574.30	0.1		576.31	575.58	0.7		578.96	576.26	2.7		579.93	576.89	3.0		580.43	577.63	2.8	
2040	573.96	573.78	0.2		576.15	575.36	0.8		578.84	576.11	2.7		579.94	576.77	3.2		580.45	577.57	2.9	
2026	573.87	573.77	0.1	574.0	575.82	575.30	0.5	576.1	578.50	576.00	2.5	578.7	579.60	576.62	3.0	579.8	580.08	577.41	2.7	580.3

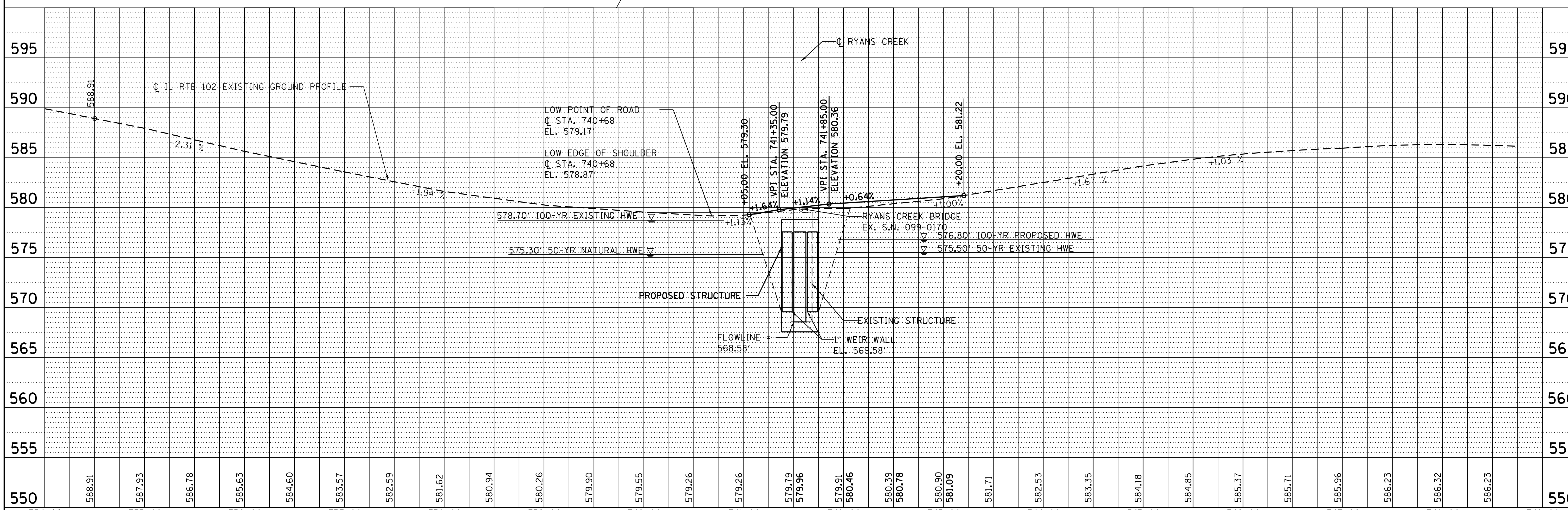
HEAD (ft) - PROPOSED

	(A) Proposed Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Proposed Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Proposed Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Upstream Channel Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.85	576.65	0.2		577.99	577.30	0.7		579.45	577.93	1.5		580.58	578.66	1.9	
2772	575.18	575.18	0.0		576.56	576.24	0.3		577.81	576.88	0.9		579.35	577.49	1.9		580.50	578.22	2.3	
2508	574.84	574.83	0.0		576.34	575.88	0.5		577.69	576.51	1.2		579.29	577.11	2.2		580.44	577.85	2.6	
2275	574.34	574.30	0.0		576.22	575.58	0.6		577.63	576.26	1.4		579.25	576.89	2.4		580.40	577.63	2.8	
2040	573.86	573.78	0.1		576.05	575.36	0.7		577.44	576.11	1.3		579.04	576.77	2.3		580.42	577.57	2.8	
2026	573.77	573.77	0.0	573.9	575.70	575.30	0.4	575.7	576.92	576.00	0.9	576.9	578.35	576.62	1.7	578.9	580.02	577.41	2.6	580.3

ALTERNATIVES ANALYSIS

Alt 4. Precast Multi-Cell Culverts





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		DRAWN - JMR	REVISED -
$MODELNAME$	PLOT SCALE = $SCALE$	CHECKED - CMD	REVISED -
	PLOT DATE = $DATE$	DATE - 5/1/15	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

IL ROUTE 102 OVER RYANS CREEK
PLAN AND PROFILE – ALTERNATIVE 4 TRIPLE BOX CULVERT

SCALE: 1"=50' | SHEET 1 OF 1 SHEETS | STA. 734+00 TO STA. 749+00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
631		WILL	4	4

CONTRACT NO. P91-191-13

ILLINOIS FED. AID PROJECT

Illinois Department of Transportation

Multiple Opening Waterway Information Table

Route: IL Route 102 (FAP 631)
Waterway: Ryans Creek
Section: 111 N-B-I
County: Will

Existing SN: 099-0170
Proposed SN: Pending
Prepared by: Dawn Cosentino Date: **10/21/2015**
Checked by: Date:

Drainage Area = 6.59 sq. mi.
Existing Overtopping Elev. = 579.17 at Sta. 740+68
Proposed Overtopping Elev. = 579.17 at Sta. 740+68

Flood Event		Discharge (cfs)		Waterway Opening (sq.ft.)		Natural H.W.E. ft.	Head – ft.		Headwater Elevation – ft.	
		Existing	Proposed	Existing	Proposed		Existing	Proposed	Existing	Proposed
10	Main Channel	408	208	96	63	573.8	0.2	0.0	574.0	573.8
	Relief Structure		200		80					
	TOTAL	408	408	96	143					
50	Main Channel	866	388	126	80.5	575.3	0.8	0.3	576.1	575.6
	Relief Structure		478		108.5					
	TOTAL	866	866	126	189					
100	Main Channel	1250	577	140	88.9	576.0	2.7	0.8	578.7	576.8
	Relief Structure		673		122					
	TOTAL	1250	1250	140	211					
200	Main Channel	1700	773	152	96.	576.6	3.2	1.5	579.8	578.1
	Relief Structure		927		133					
	TOTAL	1700	1700	152	229					
Overtopping	Main Channel	1700	1007	152	96	576.6	3.2	2.7	579.8	579.3
	Relief Structure		1224		133					
	TOTAL	1700	1854	152	229					
500	Main Channel	2375	1007	164	96	577.4	2.9	2.7	580.3	580.1
	Relief Structure		1224		133					
	TOTAL	2375	2231	164	229					

Datum:
All-Time H.W.E. & Date: ft
Surveyed Normal Water Level: ft

10-Year Velocity through Existing Structure = 4 ft/s
10-Year Velocity through Proposed Structure = 3.4 ft/s
2-Yr. Flow Rate = 242 ft^3/s

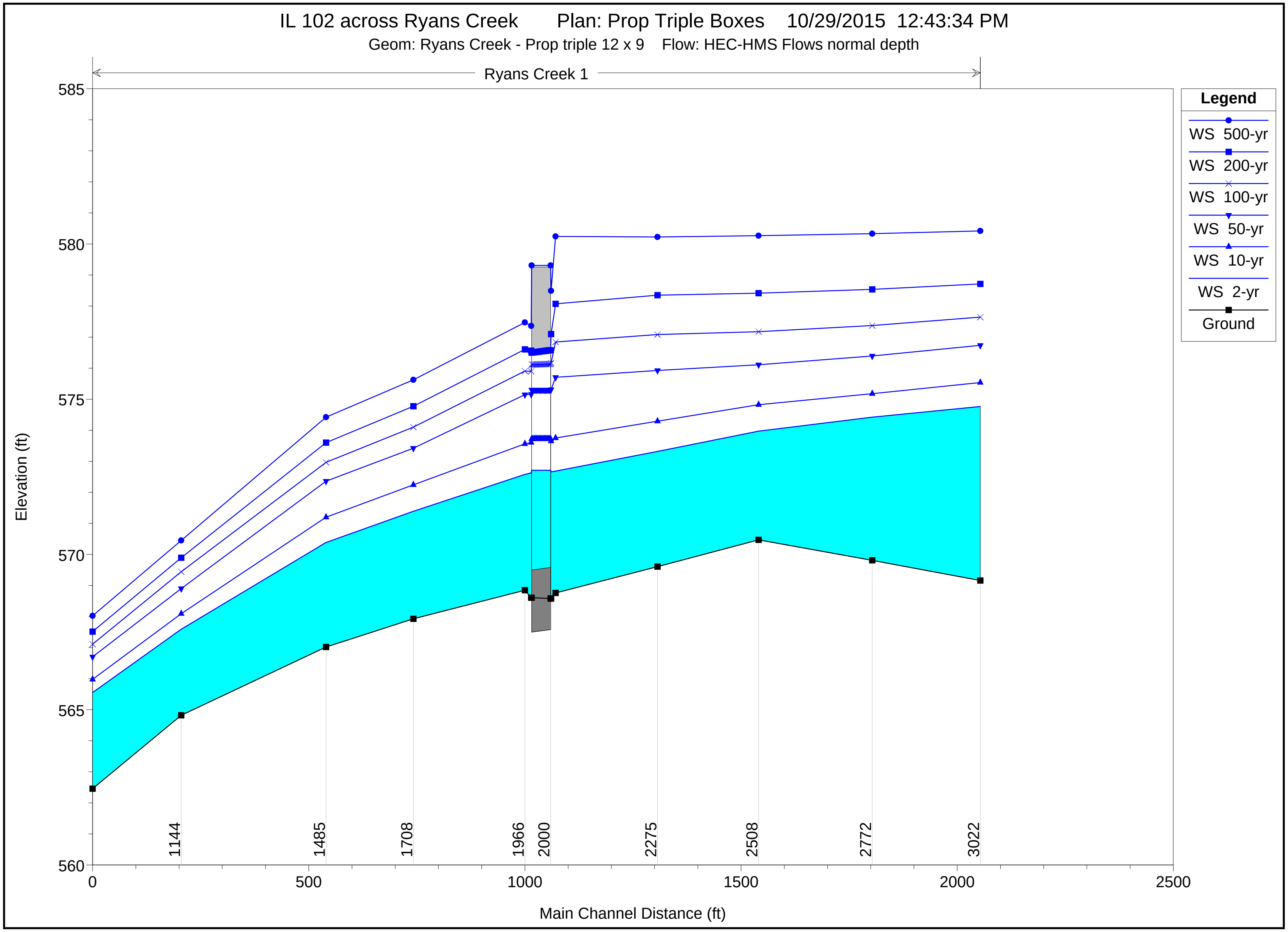
EXISTING STRUCTURE

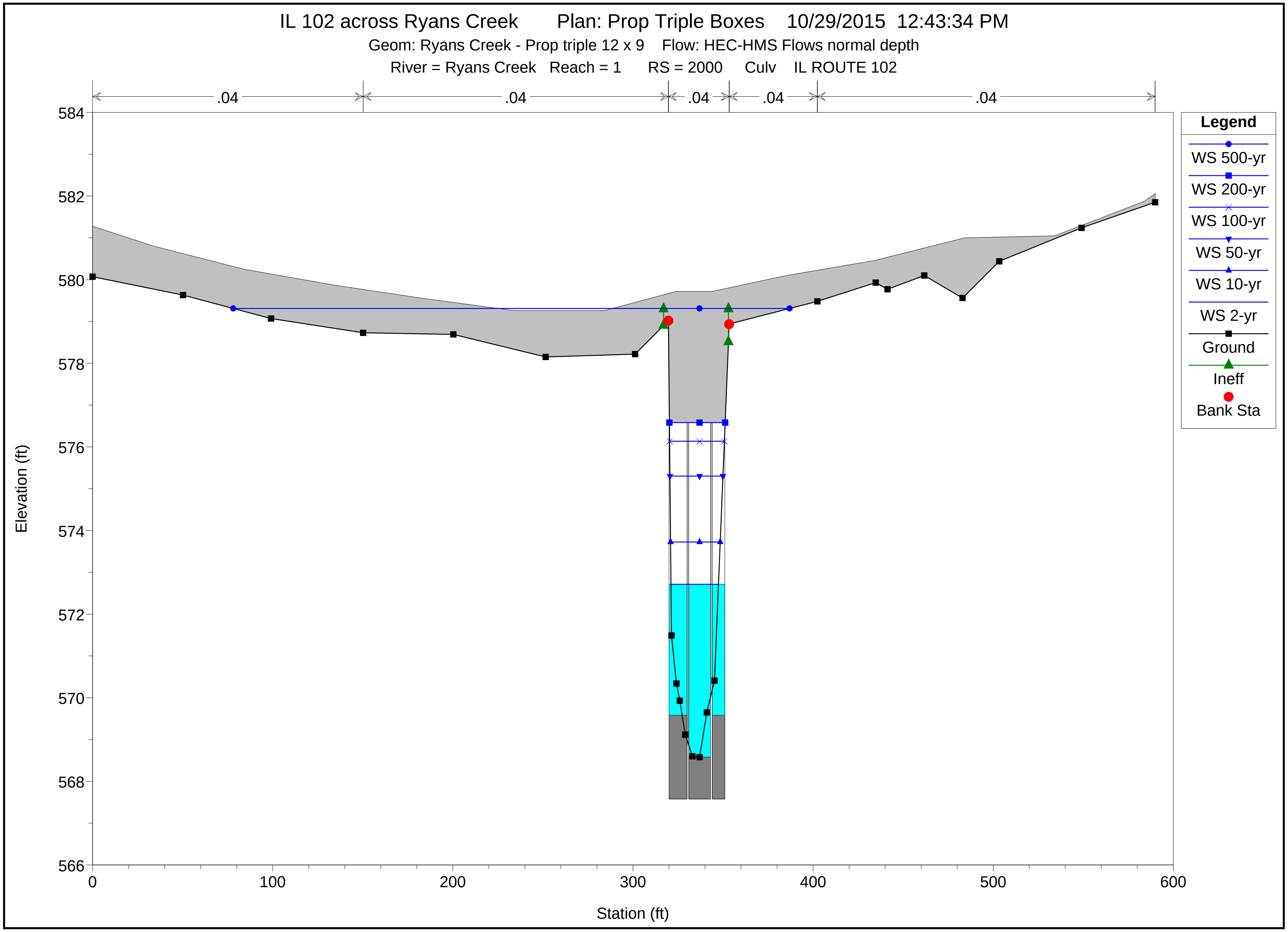
Main Channel Type: Single Span Concrete Deck Beam Bridge
Length/Width: 21.3' on skew, 20.0' perpendicular to flow
Spans/Cells: 1 – Length along stream/abutments = 43.93’
Low Chord: 577.20
Skew: 20 degrees (relative to road)
Clearance: 1.90'
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.97 at STA 740+68
Freeboard: 2.87’
Culvert Inverts: N/A (u/s) N/A (d/s)
Exist Relief Structure Type: N/A
Dimensions And Flowline: N/A

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.

PROPOSED STRUCTURE(S)

Main Channel Type: (1)- 12' x 9'
Length/Width: 36' on skew, 33' on perpendicular
Spans/Cells: 1
Low Chord: Beam: 577.58
Skew: 28 degrees (relative to road)
Clearance: N/A
Flow Line: 568.58(u/s) 568.5(d/s)
Invert If Culvert: 567.58(u/s) 567.5(d/s): EMBEDMENT DEPTH 1ft
Low E.O.P: 578.87 at STA 740+68
Freeboard: 2.97'
Relief Structure Type: (2) 10' x 9' RC Box Culverts
Spans/Cells: 2
Invert And Flowline: 567.58 invert 569.58 flowline


IL 102 across Ryans Creek Plan: Prop Triple Boxes 10/29/2015 12:43:34 PM
Geom: Ryans Creek - Prop triple 12 x 9 Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
585
580
575
570
565
560
0
500
1000
1500
2000
2500
1144
1485
1708
1966
2000
2275
2508
2772
3022


IL 102 across Ryans Creek Plan: Prop Triple Boxes 10/29/2015 12:43:34 PM
Geom: Ryans Creek - Prop triple 12 x 9 Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 Culv IL ROUTE 102
.04
.04
.04
.04
.04
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
584
582
580
578
576
574
572
570
568
566
0
100
200
300
400
500
600
Station (ft)

WATERWAY OPENING - The effective waterway opening should be calculated at the upstream face of the structure based on the Natural Highwater Elevation for a given frequency. It should represent actual existing conditions, not as-built or cleaned out. It is determined by calculating the flow area under the Natural High Water Elevation (N.H.W.E.) at the surveyed bridge opening section. It is not based on the Existing H.W.E. or the Proposed H.W.E. This value is not the value you can find in the Hydraulic Software output. It is calculated separately from any Hydraulic Software. Pier area below the N.H.W.E. should be subtracted from the total opening area. An adjustment for improperly skewed piers may be required which will increase the pier area and reduce the net opening.

WATERWAY OPENING (sq. ft.) - EXISTING

	A	B	C	D	E	C+(D*E)
Flood Frequency	Natural H.W.E.	Bridge U/S Flowline	Area Under elev 569.93*	Bridge Span W (ft)	NHWE-569.93	Waterway Opening (sq. ft.)
10-year	573.8	568.58	18	20.0	3.86	96
50-year	575.3	568.58	18	20.0	5.36	126
100-year	576.0	568.58	18	20.0	6.06	140
200-year	576.6	568.58	18	20.0	6.68	152
500-year	577.4	568.58	18	20.0	7.27	164

*See attached openign exhibit

WATERWAY OPENING (sq. ft.) - PROPOSED

Twin (2) 12' x 10' RC Box Culverts depressed 1 foot. Culvert 2 buried 2'. On a 28 degree skew

	A	B	C	D=(A-B)*C	E	F	G=(A-E)*F	H	I	J=(A-E)*F	D+G+J
Flood Frequency	Natural H.W.E.	Culvert #1 U/S Flowline	Culvert Span W (ft)	Waterway Opening #1 (Sq. Ft.)	Culvert #2 U/S Flowline	Culvert Span W (ft)	Waterway Opening #2 (Sq. Ft.)	Culvert #3 U/S Flowline	Culvert Spa W (ft)	Waterway Opening #2 (Sq. Ft.)	Waterway Opening (sq. ft.)
10-year	573.8	568.58	12.0	62.52	569.58	9	37.89	569.58	10	42.10	143
50-year	575.3	568.58	12.0	80.52	569.58	9	51.39	569.58	10	57.10	189
100-year	576.0	568.58	12.0	88.92	569.58	9	57.69	569.58	10	64.10	211
200-year	576.6	568.58	12.0	96.00	569.58	9	63.00	569.58	10	70.00	229
500-year	577.4	568.58	12.0	96.00	569.58	9	63.00	569.58	10	70.00	229

HEAD - The largest change in computed water surface elevation, comparing the computed water surface elevations from the existing condition and proposed condition to the natural condition for each upstream cross section, is the Created Head. That Created Head is entered into the HEAD column of the Waterway Information Table for each flow profile. Head should not be negative, so use a value of zero if a negative number is computed. Proposed structures that result in headwater less than the Natural HWE for a given frequency should indicate "0.0" as the head and the headwater elevation will be equal to the NHWE.

HEAD (ft) - EXISTING

	(A) Existing Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Existing Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Existing Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.89	576.65	0.0		579.09	577.30	1.8		580.05	577.93	2.1		580.60	578.66	1.9	
2772	575.19	575.18	0.0		576.62	576.24	0.4		579.03	576.88	2.1		580.00	577.49	2.5		580.53	578.22	2.3	
2508	574.85	574.83	0.0		576.42	575.88	0.0		578.99	576.51	2.5		579.95	577.11	2.8		580.47	577.85	2.6	
2275	574.39	574.30	0.1		576.31	575.58	0.7		578.96	576.26	2.7		579.93	576.89	3.0		580.43	577.63	2.8	
2040	573.96	573.78	0.2		576.15	575.36	0.8		578.84	576.11	2.7		579.94	576.77	3.2		580.45	577.57	2.9	
2026	573.87	573.77	0.1	574.0	575.82	575.30	0.5	576.1	578.50	576.00	2.5	578.7	579.60	576.62	3.0	579.8	580.08	577.41	2.7	580.3

HEAD (ft) - PROPOSED

	(A) Proposed Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Proposed Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Proposed Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Upstream Channel Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.74	576.65	0.1		577.64	577.30	0.3		578.71	577.93	0.8		580.42	578.66	1.8	
2772	575.18	575.18	0.0		576.39	576.24	0.1		577.37	576.88	0.5		578.54	577.49	1.0		580.33	578.22	2.1	
2508	574.82	574.83	0.0		576.11	575.88	0.2		577.18	576.51	0.7		578.41	577.11	1.3		580.27	577.85	2.4	
2275	574.29	574.30	0.0		575.93	575.58	0.3		577.08	576.26	0.8		578.35	576.89	1.5		580.23	577.63	2.6	
2040	573.75	573.78	0.0		575.70	575.36	0.3		576.84	576.11	0.7		578.07	576.77	1.3		580.24	577.57	2.7	
2026	573.65	573.77	0.0	573.7	575.31	575.30	0.0	575.3	576.17	576.00	0.2	576.2	577.10	576.62	0.5	577.9	578.49	577.41	1.1	580.1

ALTERNATIVES ANALYSIS

Alt 5. Three-Sided Culvert

Illinois Department of Transportation

3-Sided Bridge Waterway Information Table

Route: IL Route 102 (FAP 631)
Waterway: Ryans Creek
Section: 111 N-B-I
County: Will

Existing SN: 099-0170
Proposed SN:
Prepared by: Dawn Cosentino Date: 10/27/2015
Checked by: Date:

Existing Overtopping Elev. = 579.17 at Sta. 740+68

Drainage Area = square miles Proposed Overtopping Elev. = 579.17 at Sta. 740+68

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	408	96	104	573.8	0.2	0.0	574.0	573.8
Design	50	866	126	151	575.3	0.8	0.3	576.1	575.6
Base	100	1250	140	165	576.0	2.7	0.8	578.7	576.8
Scour Design Check	200	1700	152	184	576.6	3.2	1.4	579.8	578.0
Overtop Existing	200	1700	152	----	576.6	3.2	---	579.8	----
Overtop Proposed	500	2375	-----	216	577.4	-----	2.6	----	580.0
Max. Calc.	500	2375	164	216	577.4	2.9	2.6	580.3	580.0

Datum:

All-Time H.W.E. & Date: May, 2012 Appx 579.5 ft
Surveyed Normal Water Level: 570.0 ft

10-Year Velocity through Existing Structure = 4 ft/s
10-Year Velocity through Proposed Structure = 4 ft/s
2-Yr. Flow Rate = 242 ft^3/s

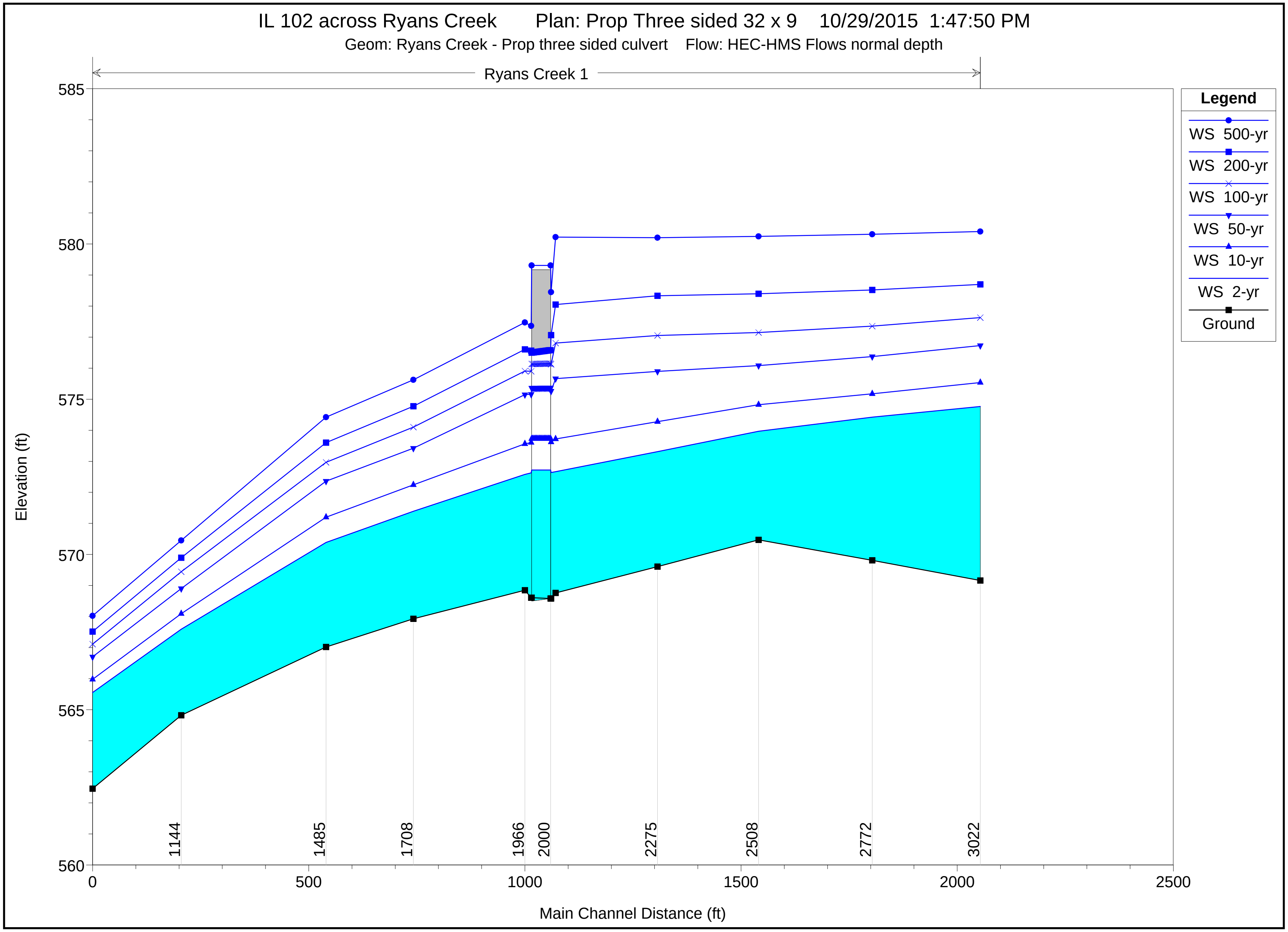
EXISTING STRUCTURE

Type: Single Span Concrete
Length/Width: 21.3 on skew, 20 perpendicular
Spans/Cells: 1 - Length along abutments = 43.93
Low Beam: 577.2
Skew: 20 (relative to road)
Clearance: 1.9
Bridge Flow Line: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.97
Freeboard: 2.87
Culvert Inverts: N/A (u/s) (d/s)

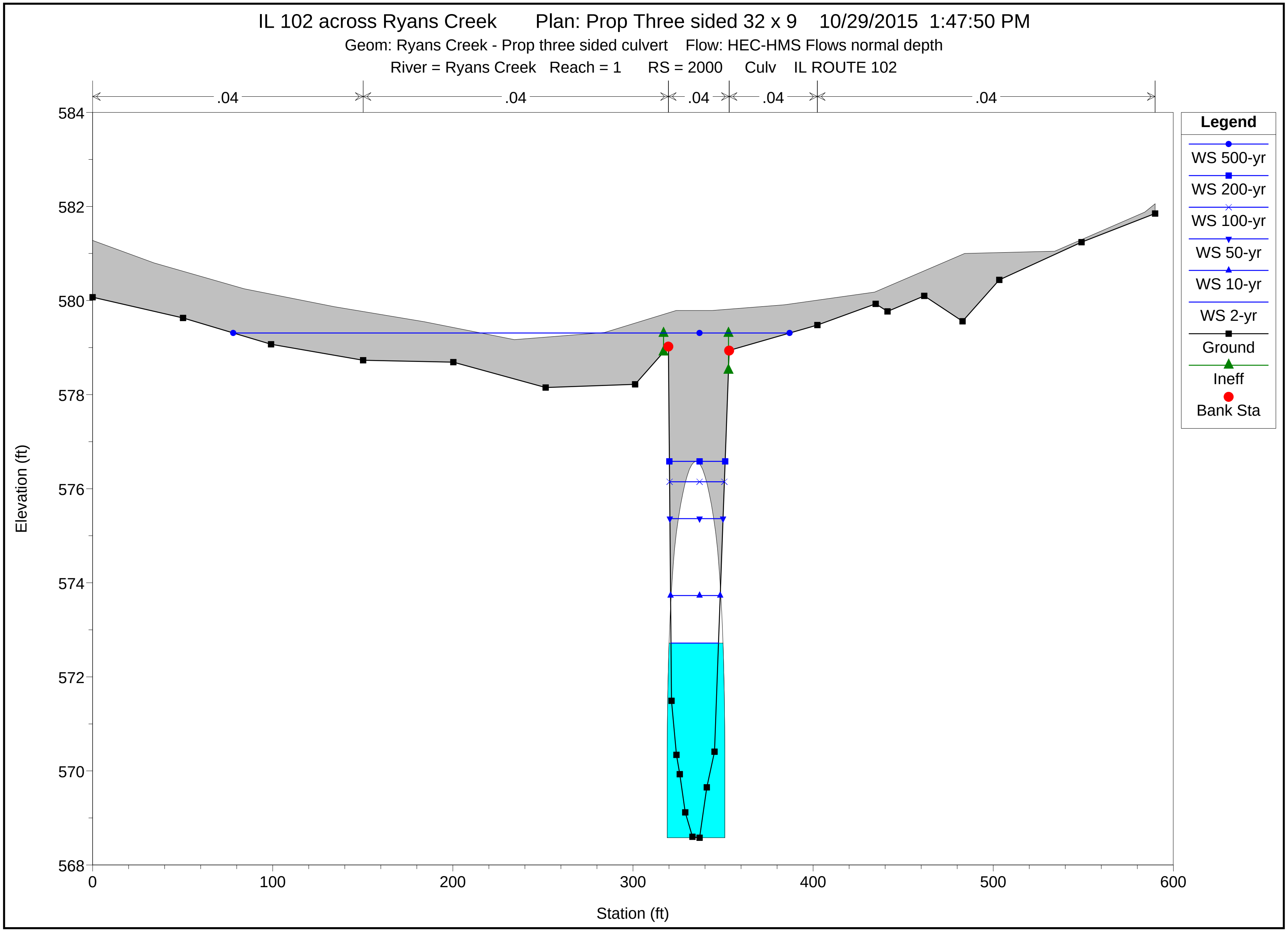
PROPOSED STRUCTURE

3-Sided Culvert Type: Flat Top (Flat Top or Arch)
Length Of Span: length = 43.9, width 36 on skew, 34 perpendicular
Cells: 1
Top Of Crown Elev: Beam: 576.58
Skew: 28 (relative to road)
Flow Line Elev: 568.58 (u/s) 568.61 (d/s)
Low E.O.P: 578.87
Freeboard:

NOTE: Proposed Structure Details Are Preliminary; Subject To Refinement In TSL Stage.



IL 102 across Ryans Creek Plan: Prop Three sided 32 x 9 10/29/2015 1:47:50 PM
Geom: Ryans Creek - Prop three sided culvert Flow: HEC-HMS Flows normal depth
Ryans Creek 1
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Elevation (ft)
585
580
575
570
565
560
1144
1485
1708
1966
2000
2275
2508
2772
3022
0
500
1000
1500
2000
2500
Main Channel Distance (ft)


IL 102 across Ryans Creek Plan: Prop Three sided 32 x 9 10/29/2015 1:47:50 PM
Geom: Ryans Creek - Prop three sided culvert Flow: HEC-HMS Flows normal depth
River = Ryans Creek Reach = 1 RS = 2000 Culv IL ROUTE 102
.04
.04
.04
.04
.04
Legend
WS 500-yr
WS 200-yr
WS 100-yr
WS 50-yr
WS 10-yr
WS 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
584
582
580
578
576
574
572
570
568
Station (ft)
0
100
200
300
400
500
600

HEAD - The largest change in computed water surface elevation, comparing the computed water surface elevations from the existing condition and proposed condition to the natural condition for each upstream cross section, is the Created Head. That Created Head is entered into the HEAD column of the Waterway Information Table for each flow profile. Head should not be negative, so use a value of zero if a negative number is computed. Proposed structures that result in headwater less than the Natural HWE for a given frequency should indicate "0.0" as the head and the headwater elevation will be equal to the NHWE.

HEAD (ft) - EXISTING

	(A) Existing Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Existing Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Existing Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Existing Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.89	576.65	0.0		579.09	577.30	1.8		580.05	577.93	2.1		580.60	578.66	1.9	
2772	575.19	575.18	0.0		576.62	576.24	0.4		579.03	576.88	2.1		580.00	577.49	2.5		580.53	578.22	2.3	
2508	574.85	574.83	0.0		576.42	575.88	0.0		578.99	576.51	2.5		579.95	577.11	2.8		580.47	577.85	2.6	
2275	574.39	574.30	0.1		576.31	575.58	0.7		578.96	576.26	2.7		579.93	576.89	3.0		580.43	577.63	2.8	
2040	573.96	573.78	0.2		576.15	575.36	0.8		578.84	576.11	2.7		579.94	576.77	3.2		580.45	577.57	2.9	
2026	573.87	573.77	0.1	574.0	575.82	575.30	0.5	576.1	578.50	576.00	2.5	578.7	579.60	576.62	3.0	579.8	580.08	577.41	2.7	580.3

HEAD (ft) - PROPOSED

	(A) Proposed Condition	(B) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(C) Proposed Condition	(D) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(E) Proposed Condition	(F) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)	(G) Proposed Condition	(H) Natural Condition	(C) Head (ft) (A - B)	Head Elevs (NHWE +Largest Created Head)
Upstream Channel Cross Section Station	**10-year Flood Frequency**				**50-year Flood Frequency**				**100-year Flood Frequency**				**200-year Flood Frequency**				**500-year Flood Frequency**			
3022	575.54	575.54	0.0		576.73	576.65	0.1		577.63	577.30	0.3		578.70	577.93	0.8		580.40	578.66	1.7	
2772	575.18	575.18	0.0		576.37	576.24	0.1		577.35	576.88	0.5		578.52	577.49	1.0		580.31	578.22	2.1	
2508	574.82	574.83	0.0		576.08	575.88	0.2		577.15	576.51	0.6		578.39	577.11	1.3		580.24	577.85	2.4	
2275	574.28	574.30	0.0		575.89	575.58	0.3		577.05	576.26	0.8		578.33	576.89	1.4		580.20	577.63	2.6	
2040	573.72	573.78	0.0		575.66	575.36	0.3		576.81	576.11	0.7		578.05	576.77	1.3		580.22	577.57	2.6	
2026	573.62	573.77	0.0	573.8	575.26	575.30	0.0	575.3	576.13	576.00	0.1	576.1	577.06	576.62	0.4	577.9	578.45	577.41	1.0	580.1

SECTION 19

CD