SOLTESZ

WELLS RUN STUDY
RIVERDALE PARK STATION

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3/16/15

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 12270, EXPIRATION DATE: January 13, 2017.

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I. INTRODUCTION

This report will examine the effects for impacts to both flow and elevation to the floodplain if no SWM is provided for the Riverdale Park Station southwest discharge point (DA300) and only providing SWM for the southeast (DA200 location). The intent is to document the impacts to the 100-year flow rates and WSEL for the 2 options versus a base condition. The Base condition is predeveloped onsite with the remaining watershed developed. Option1 is based on providing 100-year SWM for the southwest corner discharge point and in the southeast corner. Option 2 will only account for a 100-year SWM in the southeast corner and no 100-year SWM provided in the southwest corner.

This analysis uses the County HEC-2 data that is converted to the latest COE hydraulic program (HECRAS) for water surface elevation differences. In reviewing the County floodplain study issues were found in both the hydrology analysis and the HEC-2 analysis. These issues have an effect on the outfall design of Pond 200 as the WSEL is lower with the proposed revisions. They will be further explained below.

II. SITE INFORMATION

The 37.35 +/- acre Riverdale Park Station property is located almost entirely with the limits of the Town of Riverdale Park, Maryland. About 1.25 acres in the northeast corner is located in the City of College Park. The site is east of Baltimore Avenue (U.S. Route 1) and west of the CSX railroad, between the WMATA property to the north and Tuckerman Street to the south. The tract is bisected by the abandoned Rhode Island Avenue trolley line, which has been converted in the north by the City of College Park to a hiker/biker trail. The Town of Riverdale Park, to the south, is currently in the process of converting the right-of-way to a hiker/biker trail.

The Riverdale Park Station property is identified in the land records of Prince George's County at Liber 27394 Folio 033. The property is in the Developed Tier and is part of the Baltimore Avenue corridor of the 2002 General Plan. It is part of the Approved Master Plan and Sectional Map Amendment for Planning Area 68, dated May 1994 (1994 P.A. 68 Master Plan).

III. PROPOSED SITE

The proposed site is mixed use and will be divided into three sub basins, each with a separate storm drain system. The site will incorporate the ESD design criteria of the 2010 Maryland Stormwater Management Manual, Chapter 5. The overall disturbance for the proposed work is 37.3 acres with approximately 20.12 acres of impervious area.

Drainage area 100 is located on the north and northeast side of the property and drains to SWM-100. The facility discharges towards the CSX and into an existing storm drain system east of CSX. The storm drain system does not drain into Wells Run.

Drainage area 200 is located on the south and southeast side of the property and drains to Wells Run just upstream of the CSX crossing.

Drainage 300 is located on the west side of the property and discharges to the southwest into the proposed storm drain along Route 1(Baltimore Ave) that will outfall into the Wells Run Channel downstream of the Route 1 culvert.

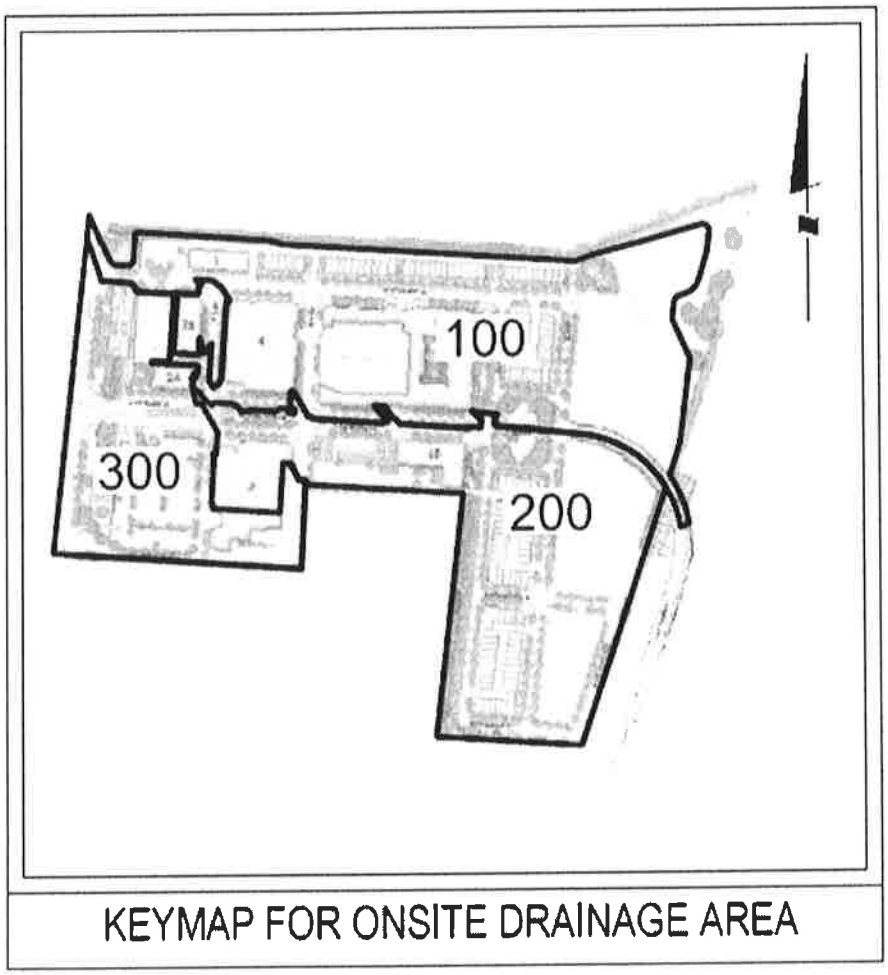

FIGURE 1

IV. ISSUES WITH 1993 H&H MODELS

The 1993 H&H models are revised in this report to more accurately reflect existing conditions. There are a number of issues that affect both the hydrology and hydraulics.

The specific items for the TR-20 that remain the same between the 1993 and current versions of TR-20 are noted below:

- The stream reach routing table values were used for both models.

The specific issues for the TR-20 that were revised are noted below:

- Used 5.3 inches for the 10 year storm in the latest model not 5.2 inches from the 1993 model.

- Five (5) major subareas were created instead of 3. In the case of the 1993 study, the study used the drainage area relationship using a TR-20 PEAKS command to determine the flow at the mouth as the last subarea was too small to include in the model. This value of 2,053 cfs for the 100 year storm was used in the lower reach of the HEC-2 analysis. Equivalent numbers for the 2- and 10- year storms were also determined. These flow values, obtained from the 1993 study, are considered to reflect a conservative condition.

- New RCN values were determined based on the latest land use and latest NRCS soil survey.

- The Stage-storage-discharge table values at the CSX crossing were revised using M-NCPPC topography.

- Revised Tc values were determined.

- Used the most current WIN Tr-20 modeling program.

The specific issues for the HEC-2 that were reused in the HECRAS are noted below:

- The Manning's "n" values are the same.

- Unless noted below, the bridge opening sizes remained the same.

- The expansion and contraction coefficients are the same.

- Used the most current version of the HECRAS modeling program.

The specific revisions to the HEC-2 model are noted below:

- Inclusion of the 2 box culvert openings at 46th Ave. and Tuckerman downstream of Route 1 (actual existing condition) instead of 1 opening in the HEC-2 model. Both crossings have twin 9'x5' openings in the HECRAS instead of one (1) 9'x5' opening.

- Inclusion of two (2) box culvert openings each at 9'x5' and twin 54" RCP openings at 44th Ave. (actual existing conditions) instead of one (1) 9'x5' opening in the HEC-2 model.

V. WATERSHED STUDY - HYDROLOGY ANALYSIS

A total of five (5) major Points of Investigation (POI) were used to establish the adjusted 100-year peak flow rates for Wells Run. Two additional areas (DA300 series and DA200) were also added to define impacts related to SWM provided or not provided onsite. This was done to better define flow rates from Route 1 to CSX RR. The revised analysis is based on the current Soils Survey for Prince George's County and ultimate land use. The individual land use/soil type was determined by Hydro GIS. The T_C was determined using M-NCPPC 2-foot topography. This information was input into NRCS TR-55 for composite RCN and T_C. The T_C was then adjusted

per County floodplain criteria using the P_{100} year rainfall amount for the sheet flow portion of the Tc determination instead of P_2 from the NRCS computer program

The 1993 TR-20 cross section data for a stream reach and the structure rating table for the CSX structure were used in the new TR-20 model.

The five (5) POI's are described as follows: DA1000 and DA2000 are the equivalent of the 1993 County study section 18, which is the confluence of 2 tributaries about 2,170 feet upstream of US Route1. The RCN for the 1993 study was 85. The RCN for the 2 POI's is the equivalent of an 88. DA3000 and DA4000 include the drainage area to US Route 1 and the drainage area downstream of Route 1 to the CSX crossing. The 1993 study RCN is 83 and the composite of DA3000, DA 300 series, DA200, and DA4000 is 85.12. The last POI is the area downstream of the Trolley line to the confluence with the Northeast Branch of the Anacostia River. In the case of the 1993 study, the study used the drainage area relationship between the mouth (1.247 square miles) and CSX crossing of 1.203 square miles adjusting the peak flow using a TR-20 PEAKS command to determine the flow at the mouth. This value was used in the 1993 study HEC-2 from cross section 801 to 815.5.

A summary of the TR-20 input values from the 1993 study and the current TR-55 (Option 1) for the 5 main POI's and the breakouts for DA200 and DA300 series for drainage area, ultimate condition RCN, and Tc from Appendix A are provided in Tables 1 and 2 respectively.

TABLE 1
1993 Study

	DA (Sq. Mi.)	RCN	TC
DA 18	0.736	85	.308
DA 19	0.467	83	.284
DA 22A	0.044	N/A	N/A
Total	1.247	84.22	

TABLE 2
Recalculated Information (Option 1 and 2)

	DA (Sq. Mi.)	RCN	TC
1000	0.4681	90	0.43
2000	0.2519	83	0.25
3000	0.1871	84	0.34
DA300	0.0087	90	0.1
DA325	0.0021	78	0.1
DA350	0.0010	91	0.1
DA350SD	0.0027	90	0.177
DA360	0.0007	98	0.1
4000	0.2516	86	0.40
DA200	0.0157	90	0.1
5000	0.0830	84	0.32
Total	**1.2726**	**86.53**	

The net effect of the changes increases the flows particularly west of the CSX crossing. Because the CSX crossing is acting as a de facto SWM facility, substantial flow reductions are

achieved based on the incoming flows. However, there is a limit below which they cannot be effectively reduced. For example, although the incoming flows to the CSX crossing are 30-36% larger than the 1993 study, the outgoing flows at CSX are only 6-12% larger. Several locations are summarized in table 3.

The reasons for the increased flows are several and they are listed below.

- The new TR-20 uses a new peaking formula which increases the peak flow by 5-7%. It does not change the volume of runoff.
- The new TR-20 uses a new reach routing routine that reduces the peak flows slightly more than the previous version of the TR-20; however the time to peak is only slightly modified. The previous version delayed the peak by more than 30 minutes, whereas the new version will only delay the peak by 3-4 minutes at the CSX crossing
- The RCN is on average two (2) higher than the previous TR-20 which increased the peak flow rates by 3-4% and total volume of runoff, which affected the release rate from the CSX crossing.

TABLE 3

	1993 Study 10-yr Q (cfs)	Base 10-yr Q (cfs)	1993 Study 100-yr Q (cfs)	BASE 100-yr Q (cfs)
200' D/S CSX	1,241	1,241*	2,053	2,053*
D/S Trolley Line	951	1,019	1,263	1,351
200' U/S Trolley Line	1,213	1,667	2,008	2,649
D/S US Route 1	1,213	1,512	2,008	2,374

* The 1993 values were used for this report.

VI. WELLS RUN HYDRAULIC ANALYSIS

The HEC-2 data was input into the HECRAS program starting at cross section 813 (1,600 feet upstream of the confluence at the Northeast Branch of the Anacostia River) to just upstream of 44th Ave. The primary revisions include adding the additional opening for three (3) of the road crossings and ensuring there are ineffective flow areas in vicinity of the Trolley line (822) and CSX (819) crossings. The only other revision is the use of the updated flow rates based on the revised TR-20.

The starting WSEL and flow rate is based on the 1993 HEC-2 WSEL at cross section 813 for all analysis.

VII. DISCHARGE POINT

To determine the effect of providing SWM for the SW (DA300) and SE (DA200) discharge locations, the larger TR-55 subareas (DA3000 and DA4000) were required to be adjusted for development onsite. They are discussed in more detail below.

DA300 Adjustments

The onsite areas of the Riverdale Park Station that drain to US Route 1 were included with DA3000. The onsite area east of the centerline of US Route 1 was subtracted from DA3000 and split into three smaller areas for predeveloped condition. This will be used for the Base condition as this analysis is based on no development on the Riverdale Park Station property to establish a value for comparison. They three areas are; DA300 which is the onsite area and is considered wooded, DA350SD which includes the area east of the centerline of US Route 1 along the property frontage and north of the site along Route 1 and is considered ultimate conditions and lastly DA360 which is the area of US Route 1 south of the site that drains to the low point of Route 1. Both DA300 and DA350SD are routed based on surface flow along Route 1 starting at the southwest corner of the site whereas DA360 discharges directly into Wells Run so no routing is required. See Appendix A for the TR-55 for subareas DA3000, DA300, DA360, and DA350SD. The time of concentration for DA360 is 0.1 hours which is the lowest value that can be used in the TR-20 model. The summary of the information is in Table 4.

TABLE 4

Predeveloped Areas for SW Location	**Acres**	**Sq. Mi.**
Onsite (DA300)	8.31	0.0130
Offsite/Rt. 1 Frontage (DA350SD)	1.73	0.0027
Offsite Route 1 Frontage Downstream (DA360)	0.43	0.0007
Total Area	**10.47**	**0.0164**

The developed condition, which will be used for options 1 and 2, is based on the RCN, Tc, and drainage area from the predeveloped condition for DA350SD and DA360, as they remain the same in the developed condition. DA 300 is broken into 3 parts. The first is DA300 which drains to the location of a potential SWM facility. The design data for the SWM facility may be found in appendix DA 325 and 350 are other developed areas within the original site area that are either Route 1 widening or green space area in front of the parking lot. The net effect is a reduction in drainage area to Wells Run at US Route 1 from the developed Riverdale Park Station site. This is documented in Table 5. Appendix A has the TR-55 computations.

TABLE 5

Developed Areas for SW Location	**Acres**	**Sq. Mi.**
Area to possible SWM facility (DA300)	5.56	0.0087
Green park in front of site (DA325)	1.35	0.0021
US Route 1 new imp. within original property (DA350)	0.66	0.0010
Offsite/Route1 Frontage (DA350SD)	1.73	0.0027
Offsite Route 1 Frontage Downstream (DA360)	0.43	0.0007
Total Area	**9.73**	**0.0152**

To summarize the differences in the flow rate versus time, the peak flow rate from the TR-20 was plotted for each option at a 0.1 hour time increment around the peak time and a hydrograph was created. Although the peak time varies between each option, the important flow point is when the main stem of Wells Run is peaking. According to the TR-20 output, the main stem peaks at hour 12.1. By reviewing the hydrographs in Figure 1 below, and comparing the peak flow at that time at hour 12.1, Option 2 (no SWM in the SW corner) has a flow 6 cfs lower than either predeveloped condition onsite or if SWM is provided at the southwest corner of Riverdale Park Station. The hydrographs are based on the summing of flows at each 0.1 time increment from the TR-20 for DA300, DA325, and DA350, as appropriate for the 3 different analyses considered.

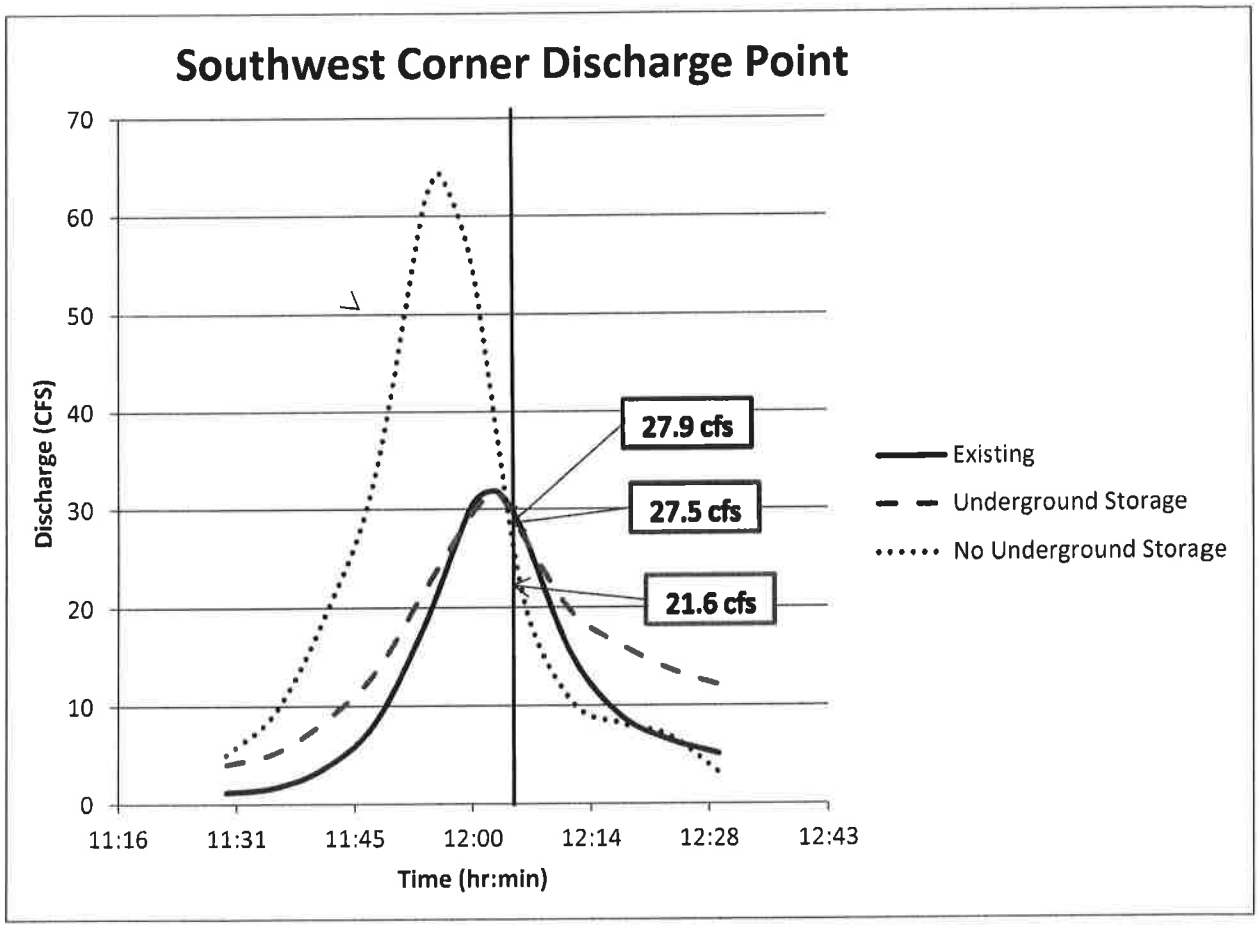

Figure 2

DA 200 Adjustments

The information for the adjustment to the TR-20 model for the southeast discharge point is from the "SWM / TEMPORARY SEDIMENT CONTROL BASIN-200 COMPUTATION REPORT". The design information from that report is provided in appendix C of this study. The data is used for the base condition and both options. This results in predeveloped conditions with 10.0 acres for the BASE condition and 12.6 acres for the

developed condition for options 1 and 2. This difference is based on diversions and minor adjustments to the drainage divides.

The subarea, DA4000, was adjusted for the removal of the 10 acres for DA200. See Appendix A for the RCN for DA4000 and DA200.

VIII. ONSITE SWM

The design of the Riverdale Park Station development has incorporated a number of ESD devices to provide SWM and water quality. They include permeable paving, micro bioretention facilities, and green roofs. These facilities provide treatment of the 1-year storm and count towards peak flow reduction up to the 10-year storm event. They also provide peak flow reduction for the 100-year storm, but this reduction has been neglected for this study.

The previously approved SWM facility for DA 300 and SWM for DA200 is incorporated into option 1. The onsite SWM facility consists of 750 feet of 96" CMP (SWM300). The flows resulting from the SWM facility (DA300) plus uncontrolled areas DA325 and DA350 are less than the 100-year predeveloped peak flows from the site. Appendix B includes the SWM facility design information plus a TR-20 for routing through the underground SWM to document that the ultimate development release rate from the site is at predeveloped conditions. The information for DA 200 SWM facility may be found in Appendix C.

IX. 100 YEAR FLOODPLAIN

To evaluate the flow rates for the base and 2 options, the TR-20 models in Appendices D, E, and F include the information described above Both options use the same areas, curve numbers and times of concentration. SWM 300 is the area that can be controlled by a SWM facility. DA 325 and 350 are other areas onsite that are not routed into a SWM facility.

The 1993 floodplain study, predeveloped conditions onsite (Base), and the 2 options have been summarized in the tables below. Peak flow rates and WSEL are summarized in Table 6 for the 10-year storm and in Table 7 for the 100-year storm. They are on pages 8 and 9 of this report.

The HECRAS input, cross sections, output and profile are in Appendices G and H. The 1993 study TR-20 and HEC-2 are in Appendix I as reference. Flow and WSEL for all cross sections are on page 10 of this report.

Even with an increase in flows upstream of CSX, the results of the study show a drop in water surface elevation (WSEL) for the entire length of the study as compared to the 1993 study starting at the CSX crossing and ending 335 feet upstream of US Route 1.

X. SUMMARY

The enclosed study was performed to analyze cumulative flows and net change in water surface elevations in Wells Run, as a result of the Riverdale Park Station (Cafritz) project. The study first incorporated updates and corrections to the out of date 1993 study. The older study is no longer an accurate bench mark; it does not properly model culverts built at 44th Avenue, 46th Avenue, nor Tuckerman Lane. The new Base study refines and corrects hydrology values and utilizes up

to date modeling software (WinTR20). The new Base study incorporates these revised flows and existing culverts in the stream hydraulic model. These changes resulted in higher flows in Base conditions, but lower elevations, due to the more accurate modeling of hydraulics.

The impact of the development project on the flows and elevations in Wells Run was studied and benchmarked against the Base model. These results are summarized in Tables 6 and 7. The omission of a SWM facility in the southwest corner of Riverdale Park Station is recommended, due to the fact the 10-year flows change from 1,512 to 1,513 cfs and 100-year flows change from 2,374 to 2,369 cfs at the location immediately downstream of US Route 1. Providing no SWM facility in the southwest corner of the site is virtually the same; as contrasted with providing a SWM facility in this location, which slows down the peak and results in combined 100-year flows that are higher in Wells Run at downstream side of Route 1.

It should be noted that the study reflects minor negligible variations in flows and elevations. Some flows in post development conditions are 0.07% higher (negligible) in the area between the Trolley Line and CSX tracks. Some elevations in post developed conditions are 0.01 to 0.03 feet higher, despite lower flows in the reach downstream of US Route 1 to the CSX tracks. Removal of the SWM facility on the SW corner of Riverdale Park Station is recommended, and the development project to provide a fee in lieu of this type of SWM control. This fee in lieu can be collected by the county to contribute to a more effective watershed wide solution to these existing flooding conditions.

Table 6

		1993 Study		BASE CONDITION: Predeveloped for Riverdale Park Station		OPTION 1: With SWM on Riverdale Park Station in SW and SE Corner		OPTION 2: With SWM on Riverdale Park Station only in SE corner		Extent of Change for Option 2 as compared to Base Condition
Stream Cross Section Number	Location	10-year flow	10-year water surface elevation in stream	10-year flow	10-year water surface elevation in stream	10-year flow	10-year water surface elevation in stream	10-year flow	10-year water surface elevation in stream	
834.2	90 feet Upstream of 44th Avenue	1,213	58.51	1,491	58.16	1,491	58.16	1,491	58.16	No Change
834	Upstream side of 44th Avenue	1,213	58.28	1,491	58.01	1,491	58.01	1,491	58.01	No Change
833.2	Downstream side of 44th Avenue	1,213	57.96	1,491	57.85	1,491	57.85	1,491	57.85	No Change
832		1,213	58.02	1,491	57.79	1,491	57.79	1,491	57.79	No Change
831.5		1,213	58.02	1,491	57.76	1,491	57.76	1,491	57.76	No Change
831		1,213	57.97	1,491	57.75	1,491	57.75	1,491	57.75	No Change
830.5	Upstream side of US Route 1	1,213	57.92	1,491	57.73	1,491	57.73	1,491	57.73	No Change
830	Upstream side of US Route 1	1,213	56.84	1,491	57.73	1,491	57.73	1,491	57.73	No Change
828	Downstream side of US Route 1	1,213	56.32	1,512	55.35	1,513	55.35	1,513	55.35	Negligible
827.7		1,213	56.43	1,512	54.38	1,513	54.38	1,513	54.4	Negligible
827		1,213	56.42	1,512	55.02	1,513	55.02	1,513	55.03	No Change
826.5		1,213	56.43	1,512	54.37	1,513	54.37	1,513	54.39	Negligible
826.1	Upstream side of Tuckerman Street	1,213	55.45	1,667	54.34	1,667	54.34	1,670	54.36	Negligible
825.8	Downstream side of Tuckerman Street	1,213	55.31	1,667	54.41	1,667	54.41	1,670	54.43	Negligible
825.5		1,213	55.13	1,667	53.95	1,667	53.95	1,670	53.98	Negligible
825	Upstream side of 46th Ave	1,213	54.07	1,667	53.91	1,667	53.9	1,670	53.93	Negligible
824	Downstream side of 46th Ave.	1,213	52.16	1,667	53.76	1,667	53.77	1,670	53.8	Negligible
823.5		1,213	48.98	1,667	53.76	1,667	53.77	1,670	53.8	Negligible
823		1,213	49.96	1,667	53.75	1,667	53.75	1,670	53.79	Negligible
822	Upstream side of old trolley Line	951	49.74	1,667	53.63	1,667	53.63	1,670	53.66	Negligible
821	Downstream side of old trolley line	951	48.45	1,667	48.84	1,667	48.85	1,670	48.86	Negligible
820		951	48.44	1,667	48.43	1,667	48.45	1,670	48.46	Negligible
819	Upstream side of CSX	951	48.37	1,019	48.81	1,023	48.82	1,025	48.83	Negligible
817	Downstream side of CSX	951	45.87	1,019	46.78	1,023	46.78	1,025	46.78	No Change
816.5		1,241	44.55	1,241	45.97	1,241	45.97	1,241	45.97	No Change
816.3		1,241	44.65	1,241	46.03	1,241	46.03	1,241	46.03	No Change
816	Upstream side of Ravenswood Road	1,241	44.55	1,241	45.81	1,241	45.81	1,241	45.81	No Change
814	Downstream side of Ravenswood Road	1,241	43.79	1,241	43.98	1,241	43.98	1,241	43.98	No Change
813.5		1,241	43.93	1,241	43.97	1,241	43.97	1,241	43.97	No Change
813	140 feet Upstream of 48th Ave.	1,241	43.57	1,241	43.57	1,241	43.57	1,241	43.57	Starting Point - All equal

Table 7

		1993 Study		BASE CONDITION: Predeveloped for Riverdale Park Station		OPTION 1: With SWM on Riverdale Park Station in SW and SE Corner		OPTION 2: With SWM on Riverdale Park Station only in SE corner		Extent of Change for Option 2 as compared to Base Condition
Stream Cross Section Number	Location	100-year flow	100-year water surface elevation in stream	100-year flow	100-year water surface elevation in stream	100-year flow	100-year water surface elevation in stream	100-year flow	100-year water surface elevation in stream	
834.2	90 feet Upstream of 44th Avenue	2,008	60.31	2,335	59.65	2,335	59.66	2,335	59.65	No Change
834	Upstream side of 44th Avenue	2,008	60.18	2,335	59.46	2,335	59.47	2,335	59.46	No Change
833.2	Downstream side of 44th Avenue	2,008	60.11	2,335	59.46	2,335	59.47	2,335	59.47	No Change
832		2,008	60.12	2,335	59.46	2,335	49.46	2,335	59.47	No Change
831.5		2,008	60.11	2,335	59.32	2,335	59.33	2,335	59.32	No Change
831		2,008	60.08	2,335	59.31	2,335	59.31	2,335	59.32	No Change
830.5	Upstream side of US Route 1	2,008	60.04	2,335	59.3	2,335	59.3	2,335	59.31	No Change
830	Upstream side of US Route 1	2,008	59.81	2,335	59.25	2,335	59.26	2,335	59.25	No Change
828	Downstream side of US Route 1	2,008	59.41	2,374	56.99	2,374	57	2,369	57	Negligible
827.7		2,008	59.43	2,374	55.72	2,374	55.68	2,369	55.66	Negligible
827		2,008	59.42	2,374	56.69	2,374	56.67	2,369	56.65	Negligible
826.5		2,008	59.45	2,374	56.13	2,374	56.1	2,369	56.07	Negligible
826.1	Upstream side of Tuckerman Street	2,008	58.17	2,662	56.11	2,631	56.08	2,630	56.06	Negligible
825.8	Downstream side of Tuckerman Street	2,008	58.16	2,662	56.25	2,631	56.21	2,630	56.2	Negligible
825.5		2,008	57.89	2,662	55.92	2,631	55.88	2,630	55.87	Negligible
825	Upstream side of 46th Ave	2,008	57.01	2,662	55.89	2,631	55.85	2,630	55.84	Negligible
824	Downstream side of 46th Ave.	2,008	56.53	2,662	55.76	2,631	55.73	2,630	55.72	Negligible
823.5		2,008	56.59	2,662	55.79	2,631	55.76	2,630	55.74	Negligible
823		2,008	56.63	2,662	55.79	2,631	55.76	2,630	55.74	Negligible
822	Upstream side of old trolley Line	1,263	56.53	2,662	55.72	2,631	55.69	2,630	55.67	Negligible
821	Downstream side of old trolley line	1,263	54.38	2,662	52.11	2,631	52.12	2,630	52.13	Negligible
820		1,263	54.4	2,662	52.08	2,631	52.1	2,630	52.11	Negligible
819	Upstream side of CSX	1,263	54.16	1,351	52.42	1,352	52.42	1,354	52.43	Negligible
817	Downstream side of CSX	1,263	49.31	1,351	48.55	1,352	48.55	1,354	48.55	No Change
816.5		2,053	49.09	2,053	47.86	2,053	47.86	2,053	47.86	No Change
816.3		2,053	49.15	2,053	47.91	2,053	47.91	2,053	47.91	No Change
816	Upstream side of Ravenswood Road	2,053	49.21	2,053	47.69	2,053	47.69	2,053	47.69	No Change
814	Downstream side of Ravenswood Road	2,053	45.65	2,053	45.79	2,053	45.79	2,053	45.79	No Change
813.5		2,053	45.76	2,053	45.8	2,053	45.8	2,053	45.8	No Change
813	140 feet Upstream of 48th Ave.	2,053	44.83	2,053	44.83	2,053	44.83	2,053	44.83	Starting Point - All equal

APPENDIX A
(TR-55 and CSX Stage-Storage-Discharge)

MEW

Cafritz
Wells Run
Prince George's County, Maryland

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
DA1000	Commercial & business		C	49.87	94
	Commercial & business		D	93.7	95
	Residential districts (1/8 acre)		B	1.78	85
	Residential districts (1/8 acre)		C	30.02	90
	Residential districts (1/8 acre)		D	4.23	92
	Residential districts (1/4 acre)		B	4	75
	Residential districts (1/4 acre)		C	61.8	83
	Residential districts (1/4 acre)		D	14.01	87
	Institutional 50% IMP		B	1.78	80
			C	30.03	86
		or	D	4.23	89
	Woods	(good)	C	.71	70
	Woods	(good)	D	3.44	77
	Total Area / Weighted Curve Number			299.6	90
				=====	==
DA3000	Residential districts (1/4 acre)		C	90.21	83
	Residential districts (1/4 acre)		D	8.43	87
	Institutional 50%		C	8.1	86
			D	5.91	89
	Woods	(good)	C	3.67	70
	Woods	(good)	D	3.45	77
	Total Area / Weighted Curve Number			119.77	83
				======	==
Da4000	Open space; grass cover > 75%	(good)	C	.67	74
	Commercial & business		C	12.51	94
	Commercial & business		D	10.4	95
	Industrial		C	6.22	91
	Industrial		D	3.34	93
	Residential districts (1/8 acre)		C	.22	90
	Residential districts (1/4 acre)		C	109.22	83
	Institutional 50%		C	9.23	86
			D	9.23	89
	Total Area / Weighted Curve Number			161.04	86
				======	==
DA2000	Commercial & business		C	.44	94
	Residential districts (1/4 acre)		B	10.01	75
	Residential districts (1/4 acre)		C	121.87	83
	Residential districts (1/4 acre)		D	18.9	87
	Residential districts (1/2 acre)		C	7.12	80
	Residential districts (1/2 acre)		D	1.11	85
			C	1.11	86
	Institional 50%		D	.67	89
	Total Area / Weighted Curve Number			161.23	83
				======	==
DA5000	Open space; grass cover > 75%	(good)	C	1.55	74
	Industrial		D	1.33	93
	Residential districts (1/8 acre)		C	3.45	90

A-1

Cafritz
Wells Run
Prince George's County, Maryland

Sub-Area Land Use and Curve Number Details (continued)

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
	Residential districts (1/4 acre)	C	38.71	83
	Residential districts (1/4 acre)	D	2.33	87
	Institutional 50%	C	4.9	86
		D	.89	89
	Total Area / Weighted Curve Number		53.16	84

A-2

MEW

Cafritz
Wells Run
Prince George's County, Maryland

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
DA1000							
SHEET	100	0.0230	0.240				0.225
SHALLOW	550	0.0540	0.025				0.032
CHANNEL	1970					6.000	0.091
CHANNEL	3350					6.000	0.155
					Time of Concentration		.503
DA3000							
SHEET	100	0.0270	0.240				0.211
SHALLOW	150	0.0400	0.025				0.010
CHANNEL	1875					6.000	0.087
CHANNEL	1515					4.000	0.105
					Time of Concentration		.413
Da4000							
SHEET	100	0.0140	0.240				0.275
SHALLOW	235	0.0430	0.050				0.020
SHALLOW	400	0.0800	0.025				0.019
CHANNEL	3900					6.000	0.181
					Time of Concentration		.495
DA2000							
SHEET	74	0.0580	0.240				0.122
SHALLOW	150	0.0290	0.025				0.012
CHANNEL	1900					6.000	0.088
CHANNEL	1500					6.000	0.069
					Time of Concentration		.291
DA5000							
SHEET	90	0.0160	0.240				0.239
SHALLOW	250	0.0100	0.025				0.034
CHANNEL	1950					6.000	0.090
CHANNEL	1110					8.000	0.039
					Time of Concentration		.402

A-3

Basin ID	Total TC (hrs)	Length of Sheet flow (ft)	Slope (ft/ft)	2 Yr Sheet Flow (hrs)	100 Yr. Sheet Flow (hrs)	100 Yr TC (hrs)
DA1000	0.503	100	0.023	0.225	0.148	0.43
DA2000	0.291	74	0.058	0.122	0.080	0.25
DA3000	0.413	100	0.027	0.211	0.139	0.34
DA4000	0.495	100	0.014	0.275	0.180	0.40
DA5000	0.402	90	0.016	0.239	0.157	0.32

DA 300
PREDEVELOPED

IUZ

2411010
Cafritz- 300 - 350 Predeveloped Conditions
Prince George's County, Maryland

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Ex DA-300	Woods	(good)	B	5.26	55
	Woods	(good)	C	3.05	70
	Total Area / Weighted Curve Number			8.31	61
				====	==
DA350SD	Open space; grass cover > 75%	(good)	B	.03	61
	Open space; grass cover > 75%	(good)	C	.09	74
	Paved; curbs and storm sewers		C	.91	98
	Residential districts (1/4 acre)		C	.7	83
	Total Area / Weighted Curve Number			1.73	90
				====	==
DA 360	Paved parking lots, roofs, driveways		C	.43	98
	Total Area / Weighted Curve Number			.43	98
				===	==

A-5

IUZ

2411010
Cafritz- 300 - 350 Predeveloped Conditions
Prince George's County, Maryland

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Ex DA-300							
SHEET	80	0.0620	0.400				0.188
SHALLOW	180	0.1300	0.050				0.009
SHALLOW	500	0.0600	0.025				0.028
					Time of Concentration		.225
DA350SD							
SHEET	50	0.0400	0.240				0.102
SHALLOW	530	0.0270	0.025				0.044
SHALLOW	890	0.0600	0.025				0.050
					Time of Concentration		.196
DA 360							
User-provided							0.100
					Time of Concentration		0.100

A-6

DA 300
DEVELOPED

MEW

2411010
Cafritz-Ult. Conditions w/US Route 1
Prince George's County, Maryland

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
DA-300	Open space; grass cover > 75%	(good)	B	.69	61
	Open space; grass cover > 75%	(good)	C	.78	74
	Paved parking lots, roofs, driveways		B	3.31	98
	Paved parking lots, roofs, driveways		C	.78	98
	Total Area / Weighted Curve Number			5.56	90
DA-325	Open space; grass cover > 75%	(good)	B	.41	61
	Open space; grass cover > 75%	(good)	C	.51	74
	Paved parking lots, roofs, driveways		B	.23	98
	Paved parking lots, roofs, driveways		C	.2	98
	Total Area / Weighted Curve Number			1.35	78
350SD	Open space; grass cover > 75%	(good)	B	.03	61
	Open space; grass cover > 75%	(good)	C	.09	74
	Paved parking lots, roofs, driveways		C	.91	98
	Residential districts (1/4 acre)		C	.7	83
	Total Area / Weighted Curve Number			1.73	90
DA350	Open space; grass cover > 75%	(good)	B	.03	61
	Open space; grass cover > 75%	(good)	C	.15	74
	Paved parking lots, roofs, driveways		B	.19	98
	Paved parking lots, roofs, driveways		C	.29	98
	Total Area / Weighted Curve Number			.66	91
DA360	Paved parking lots, roofs, driveways		C	.43	98
	Total Area / Weighted Curve Number			.43	98

A-7

2411010
Cafritz-Ult. Conditions w/US Route 1
Prince George's County, Maryland

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
DA-300							
SHEET	85	0.0230	0.011				0.017
SHALLOW	130	0.0230	0.025				0.012
CHANNEL	650					6.000	0.030
					Time of Concentration		0.1
DA-325							
SHEET	50	0.0500	0.240				0.093
SHALLOW	530	0.0270	0.025				0.044
CHANNEL	890					6.000	0.041
					Time of Concentration		.178
350SD							
SHEET	50	0.0400	0.240				0.102
SHALLOW	530	0.0270	0.025				0.044
CHANNEL	890					6.000	0.041
					Time of Concentration		.187
DA350							
SHEET	92	0.0600	0.240				0.141
SHALLOW	10	0.0600	0.050				0.001
SHALLOW	630	0.0600	0.025				0.035
					Time of Concentration		.177
DA360							
User-provided							0.100
					Time of Concentration		0.100

A-8

2411010
Cafritz- 200 Existing Conditions
Prince George's County, Maryland

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Ex DA-200	Woods (good)	C	10.03	70
	Total Area / Weighted Curve Number		10.03	70
			=====	==
pro 200	Newly graded area (pervious only)	B	1.55	86
	Newly graded area (pervious only)	C	11	91
	Newly graded area (pervious only)	D	.05	94
	Total Area / Weighted Curve Number		12.6	90
			====	==

A-9

IUZ

2411010
Cafritz- 200 Existing Conditions
Prince George's County, Maryland

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Ex DA-200							
SHEET	80	0.0300	0.400				0.251
SHALLOW	760	0.0180	0.050				0.098
					Time of Concentration		0.349
pro 200							
SHEET	100	0.0100	0.011				0.026
SHALLOW	75	0.0160	0.025				0.008
CHANNEL	1190					6.000	0.055
					Time of Concentration		0.1

A-12

Stage Stoage at CSX and Trolley Line Based on M-NCPPC GIS Topo

Trolley Line Stage Storage

Stage	Area sf	Volume cf	Cum Vol cf	Cum Vol Acft
40.4	0	0	0	0.00
42	5,760	4,608	4,608	0.11
44	12,960	18,720	23,328	0.54
46	20,262	33,222	56,550	1.30
47.2	139,477	95,843	152,393	3.50
49.2	310,323	449,800	602,193	13.82
51.2	506,120	816,443	1,418,636	32.57
53.2	691,120	1,197,240	2,615,876	60.05
55.2	893,909	1,585,029	4,200,905	96.44
57.2	1,579,128	2,473,037	6,673,942	153.21

CSX Stage Storage

Stage	Area sf	Volume cf	Cum Vol cf	Cum Vol Acft
39.4	0	0	0	0.00
42	3,075	3,998	3,998	0.09
44	3,100	6,175	10,173	0.23
46	6,000	9,100	19,273	0.44
47.2	74,370	48,222	67,495	1.55
49.2	144,031	218,401	285,896	6.56
51.2	222,581	366,612	652,508	14.98
53.2	276,709	499,290	1,151,798	26.44
55.2	390,675	667,384	1,819,182	41.76
57.2	568,743	959,418	2,778,600	63.79

CSX and Trolley Line Stage Storage

Stage	Area sf	Volume cf	Cum Vol cf	Cum Vol Acft
39.4	0	0	0	0.00
42	8,835	11,486	11,486	0.26
44	16,060	24,895	36,381	0.84
46	26,262	42,322	78,703	1.81
47.2	213,847	144,065	222,768	5.11
49.2	454,354	668,201	890,969	20.45
51.2	728,701	1,183,055	2,074,024	47.61
53.2	967,829	1,696,530	3,770,554	86.56
55.2	1,284,584	2,252,413	6,022,967	138.27
57.2	2,147,871	3,432,455	9,455,422	217.07

Values for 48 to 58 adjusted for conversion from 1988 NGVD to 1929 NAVD

HEC-RAS Plan: RatingCurve2 River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	821	PF 6	1200.00	40.30	51.57	44.62	51.79	0.000196	3.91	451.36	326.89	0.21
Wells Run	821	PF 7	1340.00	40.30	52.31	44.94	52.54	0.000186	3.98	531.37	421.09	0.21
Wells Run	821	PF 8	1400.00	40.30	52.65	45.08	52.88	0.000179	3.99	570.47	450.80	0.20
Wells Run	820	PF 1	200.00	39.80	48.77	41.21	48.78	0.000023	0.96	239.47	89.79	0.07
Wells Run	820	PF 2	400.00	39.80	48.99	42.03	49.04	0.000081	1.85	259.59	92.89	0.13
Wells Run	820	PF 3	550.00	39.80	49.26	42.55	49.35	0.000132	2.43	284.97	141.64	0.16
Wells Run	820	PF 4	800.00	39.80	49.92	43.33	50.07	0.000198	3.16	351.70	265.56	0.20
Wells Run	820	PF 5	1000.00	39.80	50.65	43.90	50.83	0.000216	3.51	432.92	309.68	0.21
Wells Run	820	PF 6	1200.00	39.80	51.56	44.42	51.75	0.000204	3.66	544.86	348.06	0.21
Wells Run	820	PF 7	1340.00	39.80	52.31	44.77	52.49	0.000185	3.67	644.51	357.92	0.20
Wells Run	820	PF 8	1400.00	39.80	52.65	44.92	52.83	0.000175	3.65	692.88	360.30	0.20
Wells Run	819	PF 1	200.00	39.40	48.77	40.80	48.78	0.000012	0.84	412.50	298.10	0.05
Wells Run	819	PF 2	400.00	39.40	48.99	41.61	49.03	0.000042	1.61	481.20	317.52	0.10
Wells Run	819	PF 3	550.00	39.40	49.27	42.12	49.33	0.000069	2.09	571.82	349.17	0.12
Wells Run	819	PF 4	800.00	39.40	49.94	42.88	50.03	0.000099	2.64	832.28	427.63	0.15
Wells Run	819	PF 5	1000.00	39.40	50.68	43.42	50.78	0.000100	2.78	1168.32	470.15	0.15
Wells Run	819	PF 6	1200.00	39.40	51.61	43.93	51.69	0.000086	2.73	1625.48	517.81	0.14
Wells Run	819	PF 7	1340.00	39.40	52.36	44.26	52.43	0.000074	2.65	2031.66	583.91	0.13
Wells Run	819	PF 8	1400.00	39.40	52.70	44.40	52.77	0.000069	2.60	2240.54	628.46	0.13
Wells Run	818.9		Culvert									
Wells Run	817	PF 1	200.00	38.20	48.70		48.70	0.000002	0.42	1335.17	461.69	0.02
Wells Run	817	PF 2	400.00	38.20	48.69		48.70	0.000008	0.84	1331.35	460.91	0.05
Wells Run	817	PF 3	550.00	38.20	48.68		48.69	0.000015	1.15	1326.46	459.93	0.07
Wells Run	817	PF 4	800.00	38.20	48.65		48.68	0.000031	1.69	1314.30	457.46	0.10
Wells Run	817	PF 5	1000.00	38.20	48.62		48.67	0.000049	2.12	1300.77	454.70	0.12
Wells Run	817	PF 6	1200.00	38.20	48.58		48.66	0.000073	2.57	1283.58	451.17	0.15
Wells Run	817	PF 7	1340.00	38.20	48.55		48.65	0.000092	2.89	1269.17	448.19	0.17
Wells Run	817	PF 8	1400.00	38.20	48.54		48.65	0.000102	3.03	1262.35	446.77	0.18
Wells Run	816.5	PF 1	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	PF 2	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	PF 3	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	PF 4	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	PF 5	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	PF 6	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42

HEC-RAS Plan: RatingCurve2 River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	816.5	PF 7	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	PF 8	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.3	PF 1	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 2	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 3	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 4	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 5	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 6	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 7	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	PF 8	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816	PF 1	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 2	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 3	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 4	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 5	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 6	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 7	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	PF 8	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	815.9		Bridge									
Wells Run	814	PF 1	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	PF 2	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	PF 3	2053.00	35.40	45.79		46.57	0.000753	7.72	662.33	232.66	0.47
Wells Run	814	PF 4	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	PF 5	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	PF 6	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	PF 7	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	PF 8	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	813.5	PF 1	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	PF 2	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	PF 3	2053.00	35.00	45.80		46.35	0.000553	6.79	694.12	205.74	0.40
Wells Run	813.5	PF 4	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	PF 5	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	PF 6	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	PF 7	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40

HEC-RAS Plan: RatingCurve2 River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	813.5	PF 8	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813	PF 1	2053.00	34.10	44.83	42.58	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 2	2053.00	34.10	44.83	42.58	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 3	2053.00	34.10	44.83	42.55	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 4	2053.00	34.10	44.83	42.57	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 5	2053.00	34.10	44.83	42.58	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 6	2053.00	34.10	44.83	42.57	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 7	2053.00	34.10	44.83	42.55	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	PF 8	2053.00	34.10	44.83	42.56	46.03	0.001294	9.01	530.23	303.33	0.57

APPENDIX B
(Structure 300 Design Data and TR-20)

CONTECH ENGINEERED SOLUTIONS

Round Pipe Stage

Contech Engineered Solutions, LLC Engineer: **MEW**

Date **7/25/2014**

Site Information

Project Name
Project State
Project Location

Enter Pipe I.D.= **96** in.
Enter Desired Increment = **6** in.

Total Volume/LF
50.27

Total CMP Length= **740** ft.
System Invert= **66.00** ft.

Inc Num	*Avg.Water Level (in.)*	*Inc Area (sq. ft.)*	*Hyd Rad (ft.)*	*Top Width (ft.)*	*Volume (cf)*	*WS Elevation (ft.)*	
1	6	1.31	0.32	3.87	968	66.88	0.022
2	12	3.63	0.63	5.29	2684	67.38	0.062
3	18	6.52	0.91	6.24	4828	67.88	0.111
4	24	9.83	1.17	6.93	7272	68.38	0.167
5	30	13.42	1.41	7.42	9931	68.88	0.228
6	36	17.22	1.63	7.75	12740	69.38	0.292
7	42	21.14	1.83	7.94	15646	69.88	0.359
8	48	25.13	2.00	8.00	18598	70.38	0.427
9	54	29.12	2.15	7.94	21551	70.88	0.495
10	60	33.05	2.27	7.75	24456	71.38	0.561
11	66	36.85	2.36	7.42	27266	71.88	0.626
12	72	40.44	2.41	6.93	29925	72.38	0.687
13	78	43.74	2.43	6.24	32368	72.88	0.743
14	84	46.64	2.41	5.29	34513	73.38	0.792
15	90	48.96	2.32	3.87	36229	73.88	0.832
16	96	50.27	2.00	0.00	37196	74.38	0.854
17	102	0.00	0.00	0.00	0	75.00	0.000
18	108	0.00	0.00	0.00	0	75.00	0.000
19	114	0.00	0.00	0.00	0	75.50	0.000
20	120	0.00	0.00	0.00	0	76.00	0.000
21	126	0.00	0.00	0.00	0	76.50	0.000
22	132	0.00	0.00	0.00	0	77.00	0.000
23	138	0.00	0.00	0.00	0	77.50	0.000
24	144	0.00	0.00	0.00	0	78.00	0.000
25	150	0.00	0.00	0.00	0	78.50	0.000
26	156	0.00	0.00	0.00	0	79.00	0.000
27	162	0.00	0.00	0.00	0	79.50	0.000
28	168	0.00	0.00	0.00	0	80.00	0.000
29	174	0.00	0.00	0.00	0	80.50	0.000
30	180	0.00	0.00	0.00	0	81.00	0.000
31	186	0.00	0.00	0.00	0	81.50	0.000
32	192	0.00	0.00	0.00	0	82.00	0.000
33	198	0.00	0.00	0.00	0	82.50	0.000
34	204	0.00	0.00	0.00	0	83.00	0.000

B-1

These results are submitted to you as a guideline only, without liability on the part of CONTECH Construction Products Inc. for accuracy or suitability to any particular application, and are subject to your verification.

Riverdale Park
STAGE-DISCHARGE COMPUTATIONS & RESULTS

SOLTESZ

DATE: 7/24/2014
BY: MEW
CK:

SWM Pond 300

Elev. in pond	12.50-in h(ft)	66.0 Qo(cfs)	5.00-in C	Weir at 70.30 1.00 ft. H1(ft)	H2(ft)	H2/H1	Q1(cfs)	Q/Q1	Q2(cfs)	0-in Weir at 56.0 Breadth of weir crest = 1.00 ft. C	H1(ft)	H2(ft)	H2/H1	Q1(cfs)	Q/Q1	Q2(cfs)	30-in Outfall at Str Elev at Outfall	Total Q (cfs)
67.00	0.48	2.84	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	11.0	10.4	0.95	0.0	0.40	0.0	66.41	2.8
68.00	1.30	4.68	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	12.0	10.7	0.89	0.0	0.49	0.0	66.70	4.7
69.00	2.10	5.95	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	13.0	10.9	0.84	0.0	0.56	0.0	66.90	5.9
70.00	2.97	7.07	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	14.0	11.0	0.79	0.0	0.61	0.0	67.03	7.1
70.30	3.15	7.28	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	14.3	11.2	0.78	0.0	0.63	0.0	67.15	7.3
71.00	3.71	7.90	2.75	0.7	0.0	0.00	0.7	1.00	0.7	3.32	15.0	11.3	0.75	0.0	0.65	0.0	67.29	8.6
72.00	4.58	8.78	3.28	1.7	0.0	0.00	3.0	1.00	3.0	3.32	16.0	11.4	0.71	0.0	0.70	0.0	67.42	11.8
73.00	5.29	9.44	3.31	2.7	0.0	0.00	6.1	1.00	6.1	3.32	17.0	11.7	0.69	0.0	0.71	0.0	67.71	15.6
73.50	5.57	9.68	3.32	3.2	0.0	0.00	7.9	1.00	7.9	3.32	17.5	11.9	0.68	0.0	0.72	0.0	67.93	17.6
74.00	5.90	9.97	3.32	3.7	0.0	0.00	9.8	1.00	9.8	3.32	18.0	12.1	0.67	0.0	0.74	0.0	68.10	19.8
74.40	6.10	10.13	3.32	4.1	0.0	0.00	11.5	1.00	11.5	3.32	18.4	12.3	0.67	0.0	0.74	0.0	68.30	21.6
74.50	6.10	10.13	3.32	4.2	0.0	0.00	11.9	1.00	11.9	3.32	18.5	12.4	0.67	0.0	0.74	0.0	68.40	22.0

Qo= 0.6 X Orifice Area X sqrt(h*2g)
Q1=CLH^1.5 Q2=Q/Q X Q1
"C" from Appendix 4-14g figure 4 DER Manual
h = pond elev - (center of orifice or pond elevation, whichever ifs higher)
Q/Q1 is from Braten-King "Handbook of Hydraulics"

B-2

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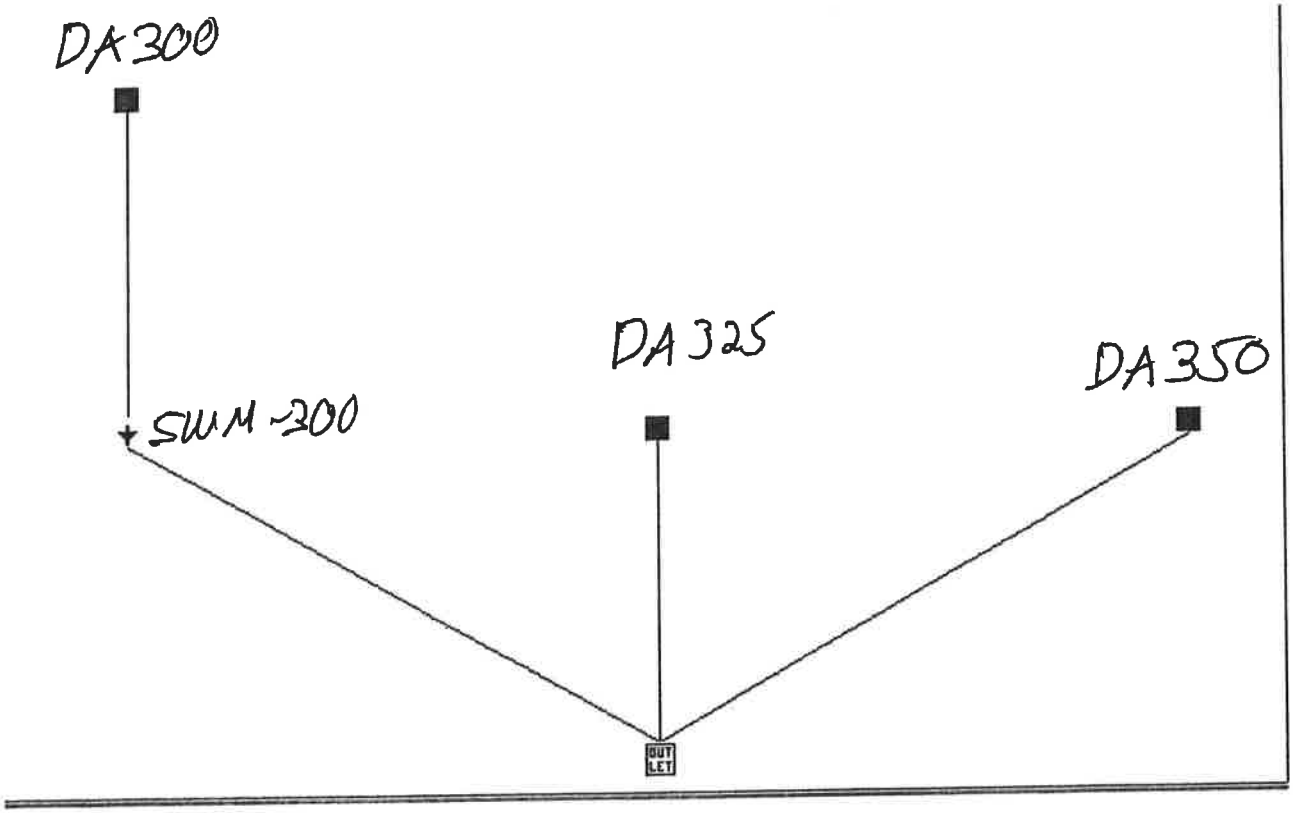

TR-20 Schematic

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WinTR-20: Version 1.0                    0          0          0.1        0
Cafritz
SWM Design -300 100 Year

SUB-AREA:
          DA300     SWM-300              .00868     90.        0.1        Y
          da350     Outlet               .0010      91.        .177
          da325     Outlet               .00211     78.        .1

STREAM REACH:
          SWM-300   Outlet               SWM-300


STORM ANALYSIS:
          100 year                       7.4        Type II    2          3.3


STRUCTURE RATING:
          SWM-300   66.
                    66.00     0.         0.
                    67.00     2.8        .032
                    68.       4.7        .125
                    69.00     6.2        .244
                    70.       7.1        .376
                    70.3      7.3        .415
                    71.       8.7        .511
                    72.       11.8       .641
                    73.       15.6       .755
                    73.5      17.6       .802
                    74.       19.8       .837
                    74.4      21.6       .854
                    74.5      22.        .86



GLOBAL OUTPUT:
          1         0.5       0.1        YNNNN      YNNNNN
```

Cafritz
SWM Design -300 100 Year

Name of printed page file:
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STORM 100 year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA300	0.009		6.205		11.93	49.67	5721.90
SWM-300	0.009	Upstream	6.205		11.93	49.67	5721.90
SWM-300	0.009	Downstream	6.199	74.41	12.07	21.62	2490.92
da350	0.001		5.187		11.98	5.13	5133.96
da325	0.002		4.737		11.93	9.96	4722.40
OUTLET	0.012		5.852		12.05	31.60	2680.44

APPENDIX C
(Structure 200 Design Data and TR-20)

SOLTESZ

Riverdale Park
STAGE-STORAGE COMPUTATIONS

DATE: 11/2/2014
BY: MEW
CK:

Pond 200

Stage	Area	Elev. Diff. (ft)	Incremental Vol. (cf)	Volume Total (cf)	Volume Total (ac-ft)	Blocked Storage (ac-ft)	Dry storage (ac-ft)
45.70	7611			0	0	0.00	0.00
		0.30	2354				
46.00	8085			2354	0.05	0.00	0.00
		2.10	20459				
48.10	11400			22814	0.52	0.00	0.00
		1.70	22442				
49.80	15002			45255	1.04	0.00	0.52
		0.20	3349				
50.00	18484			48604	1.12	0.08	0.59
		1.00	19554				
51.00	20623			68157	1.56	0.53	1.04
		1.00	21693				
52.00	22763			89850	2.06	1.02	1.54
		1.00	23886				
53.00	25009			113736	2.61	1.57	2.09
		1.00	26132				
54.00	27255			139868	3.21	2.17	2.69
		0.50	13813				
54.50	27996			153681	3.53	2.49	3.00
		0.20	5681				
54.70	28818			159363	3.66	2.62	3.13
		0.20	5809				
54.90	29269			165171	3.79	2.75	3.27
		1.10	33603				
56.00	31827			198774	4.56	3.52	4.04

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Riverdale Park
STAGE-DISCHARGE COMPUTATIONS & RESULTS

SOLTESZ

DATE: 1/15/2015
BY: MEW
CK:

Basin 200 (36" Outfall)

Elev.	5.00 in.		48.1	18-in	Weir at 49.8						0-in	Weir at 0.0						36-in Outfall	
				Breadth of weir crest =			1.00 ft.							1.00 ft.				Elev at	Total
in pond		h(ft)	Qo(cfs)	C	H1(ft)	H2(ft)	H2/H1	Q1(cfs)	Q/Q1	Q2(cfs)	C	H1(ft)	H2(ft)	H2/H1	Q1(cfs)	Q/Q1	Q2(cfs)	RR	Q (cfs)
49.80		0.59	0.50	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	49.8	49.2	0.99	0.0	0.30	0.0	49.21	0.50
50.00		0.78	0.58	2.69	0.2	0.0	0.00	0.4	1.00	0.4	3.32	50.0	49.2	0.98	0.0	0.30	0.0	49.22	0.94
50.50		1.25	0.73	2.75	0.7	0.0	0.00	2.4	1.00	2.4	3.32	50.5	49.3	0.98	0.0	0.30	0.0	49.25	3.15
51.00		0.68	0.54	3.08	1.2	0.5	0.43	6.1	0.88	5.3	3.32	51.0	50.3	0.99	0.0	0.30	0.0	50.32	5.89
52.00		1.20	0.72	3.30	2.2	1.0	0.45	16.2	0.87	14.1	3.32	52.0	50.8	0.98	0.0	0.30	0.0	50.80	14.8
52.40		1.23	0.73	3.31	2.6	1.4	0.53	20.8	0.83	17.2	3.32	52.4	51.2	0.98	0.0	0.30	0.0	51.17	17.9
52.80		1.22	0.73	3.32	3.0	1.8	0.59	25.9	0.79	20.3	3.32	52.8	51.6	0.98	0.0	0.30	0.0	51.58	21.0
54.40		0.51	0.47	3.32	4.6	4.1	0.89	49.1	0.46	22.6	3.32	54.4	53.9	0.99	0.0	0.30	0.0	53.89	23.1
54.70		0.53	0.48	3.32	4.9	4.4	0.89	54.0	0.46	24.8	3.32	54.7	54.2	0.99	0.0	0.30	0.0	54.17	25.3
55.00		0.50	0.46	3.32	5.2	4.7	0.90	59.1	0.45	26.6	3.32	55.0	54.5	0.99	0.0	0.30	0.0	54.50	27.0

Qo= 0.6 X Orifice Area X sqrt(h*2g)
Q1=CLH^1.5 Q2=Q/Q X Q1
"C" from Appendix 4-14g figure 4 DER Manual
h = pond elev - (center of orifice or pond elevation, whichever ifs higher)
Q/Q1 is from Brater-King "Handbook of Hydraulics"

C-2

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WinTR-20: Version 1.0                    0          0          0.1        0
Cafritz
SWM Design

SUB-AREA:
          DA200     SWM200               0.0197     90.        0.1        Y

STREAM REACH:
          SWM200    Outlet               swm200


STORM ANALYSIS:
          10-Yr                          5.3        Type II    2          3.3
          100 Year                       7.4        Type II    2          3.3


STRUCTURE RATING:
          swm200    48.1
                    48.1      0.        0.
                    49.8      .5        .52
                    50.       .94       .59
                    51.       5.92      1.04
                    52.       14.8      1.54
                    52.4      17.9      1.76
                    52.8      21.0      1.98
                    54.4      23.1      2.94
                    54.7      25.3      3.13
                    55.       27.       3.34



GLOBAL OUTPUT:
          1         0.5       0.1       YNNNN     YNNNNN
```

C-3

Cafritz
SWM Design

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STORM 10-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA200	0.020		4.163		11.93	77.34	3925.78
SWM200	0.020	Upstream	4.163		11.93	77.34	3925.78
SWM200	0.020	Downstream	4.053	52.93	12.11	21.16	1074.33
OUTLET	0.020		4.053		12.11	21.16	1074.33

STORM 100 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA200	0.020		6.213		11.93	112.72	5721.90
SWM200	0.020	Upstream	6.213		11.93	112.72	5721.90
SWM200	0.020	Downstream	6.105	54.50	12.14	23.85	1210.61
OUTLET	0.020		6105		12.14	23.85	1210.61

C-14

Cafritz
SWM Design

Area or Reach Identifier	Drainage Area (sq mi)	Alternate	Peak Flow by Storm 10Yr (cfs)	100 Year (cfs)	(cfs)	(cfs)	(cfs)
DA200	0.02		77.3	112.7			
SWM200	0.02		77.3	1127			
DOWNSTREAM			21.2	23.8			
OUTLET	0.02		21.2	23.8			

C-5

Riverdale Park
STAGE-DISCHARGE COMPUTATIONS & RESULTS

SOLTESZ

DATE: 1/19/2015
BY: MEW
CK:

Basin 200 (36" Outfall) Block Conditions

	0.00 in.		48.1	18-in	Weir at 49.8						0-in	Weir at 0.0						36-in Outfall	
Elev.				Breadth of weir crest =			1.00 ft.							1.00 ft.				Elev at	Total
in pond		h(ft)	Qo(cfs)	C	H1(ft)	H2(ft)	H2/H1	Q1(cfs)	Q/Q1	Q2(cfs)	C	H1(ft)	H2(ft)	H2/H1	Q1(cfs)	Q/Q1	Q2(cfs)	RR	Q (cfs)
49.80		0.59	0.00	2.69	0.0	0.0	0.00	0.0	1.00	0.0	3.32	49.8	49.2	0.99	0.0	0.30	0.0	49.21	0.00
50.00		0.78	0.00	2.69	0.2	0.0	0.00	0.4	1.00	0.4	3.32	50.0	49.2	0.98	0.0	0.30	0.0	49.22	0.36
50.50		1.25	0.00	2.75	0.7	0.0	0.00	2.4	1.00	2.4	3.32	50.5	49.3	0.98	0.0	0.30	0.0	49.25	2.42
51.00		0.68	0.00	3.08	1.2	0.5	0.43	6.1	0.89	5.4	3.32	51.0	50.3	0.99	0.0	0.30	0.0	50.32	5.37
52.00		1.20	0.00	3.30	2.2	1.0	0.45	16.2	0.87	14.1	3.32	52.0	50.8	0.98	0.0	0.30	0.0	50.80	14.1
52.50		1.33	0.00	3.31	2.7	1.4	0.51	22.0	0.82	18.1	3.32	52.5	51.2	0.97	0.0	0.35	0.0	51.17	18.1
52.80		1.20	0.00	3.32	3.0	1.8	0.60	25.9	0.78	20.2	3.32	52.8	51.6	0.98	0.0	0.30	0.0	51.60	20.2
54.20		0.51	0.00	3.32	4.4	3.9	0.88	46.0	0.48	22.1	3.32	54.2	53.7	0.99	0.0	0.30	0.0	53.69	22.1
54.75		0.75	0.00	3.32	5.0	4.2	0.85	54.8	0.43	23.6	3.32	54.8	54.0	0.99	0.0	0.30	0.0	54.00	23.6
54.90		0.50	0.00	3.32	5.1	4.6	0.90	57.4	0.45	25.8	3.32	54.9	54.4	0.99	0.0	0.30	0.0	54.40	25.8
		0.00	0.00	2.69	0.0	0.0	0.00	0.0	1.00	0.0	2.69	0.0	0.0	0.00	0.0	1.00	0.0		0.0

Qo= 0.6 X Orifice Area X sqrt(h*2g)
Q1=CLH^1.5 Q2=Q/Q X Q1
"C" from Appendix 4-14g figure 4 DER Manual
h = pond elev - (center of orifice or pond elevation, whichever ifs higher)
Q/Q1 is from Brater-King "Handbook of Hydraulics"

C-6

STAGE-DIS36 blocked_011915
P:\24110100\HYD\Final\SWM\Structure 200\June 2014\October 2014\Cafritz_200.xls

4300 Forbes Boulevard, Suite B, Lanham, MD 20706 p. (301) 794-7555 f. (301) 794-7656

```
WinTR-20: Version 1.0                    0          0          0.1        0
Cafritz
SWM Design 36" outfall Blocked Condition

SUB-AREA:
          DA200      SWM-200              0.0197     90.        0.1        Y

STREAM REACH:
          SWM-200    Outlet               SWM-200


STORM ANALYSIS:
          10-Yr                           5.3        Type II    2          3.3
          100 Year                        7.4        Type II    2          3.3


STRUCTURE RATING:
          SWM-200    49.80
                     49.80      0.         0.
                     50.00      0.36       0.08
                     51.00      5.37       0.53
                     52.00      14.1       1.02
                     52.5       18.1       1.29
                     52.8       20.2       1.46
                     54.2       22.1       2.29
                     54.75      23.6       2.66
                     54.9       25.8       2.75



GLOBAL OUTPUT:
          1          0.5        0.1        YNNNN      YNNNNN
```

Cafritz
SWM Design 36" outfall Blocked Condition

Name of printed page file:
P:\24110100\HYD\Final\SWM\Structure 200\June 2014\200_post36-block.out

STORM 10-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA200	0.020		4.163		11.93	77.34	3925.78
SWM-200	0.020	Upstream	4.163		11.93	77.34	3925.78
SWM-200	0.020	Downstream	4.136	53.20	12.11	20.74	1052.74
OUTLET	0.020		4.136		12.11	20.74	1052.74

STORM 100 Year

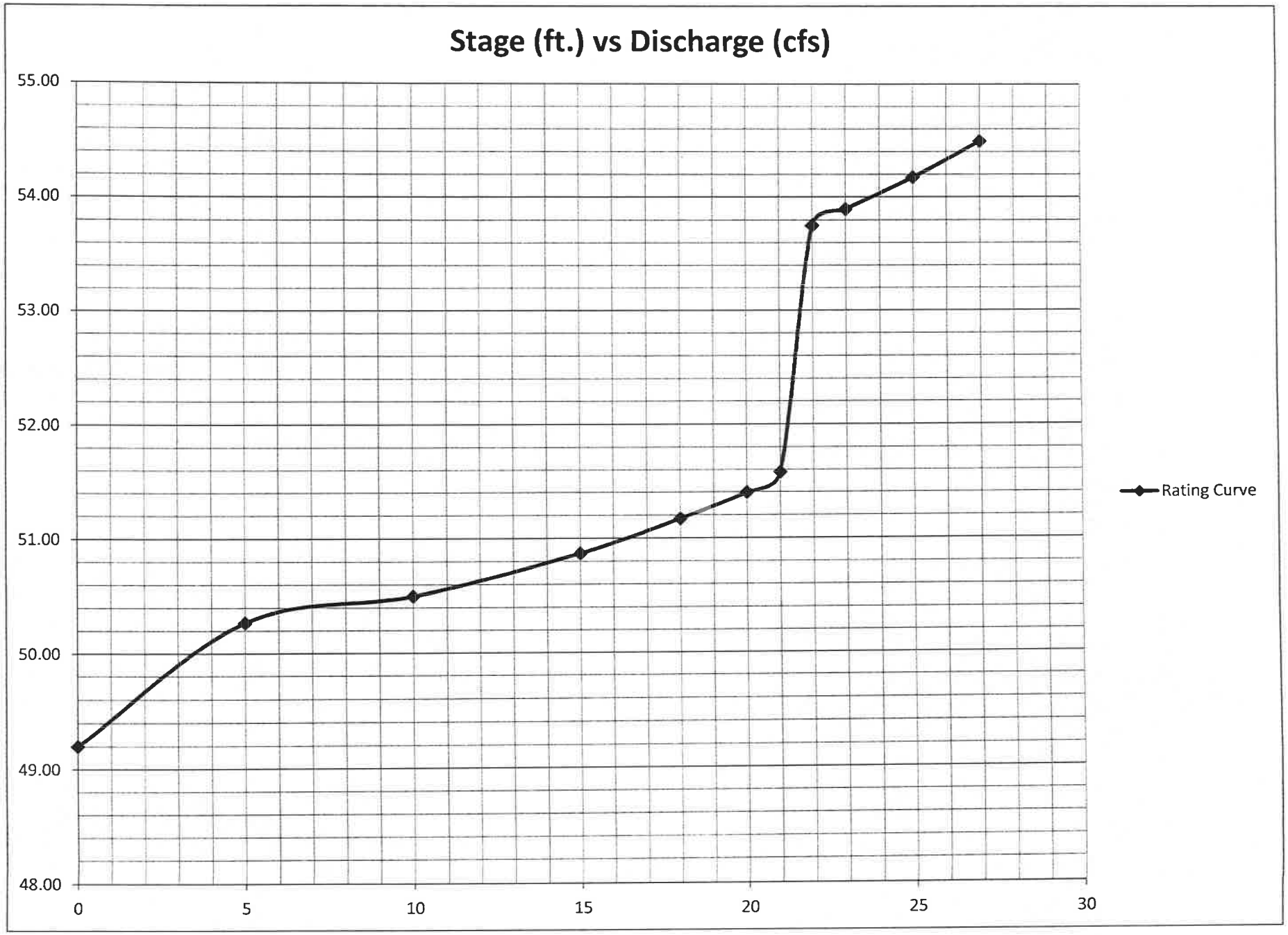
Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA200	0.020		6.213		11.93	112.72	5721.90
SWM-200	0.020	Upstream	6.213		11.93	112.72	5721.90
SWM-200	0.020	Downstream	6.188	54.63	12.14	23.28	1181.77
OUTLET	0.020		6188		12.14	23.28	1181.77

C-8

Rating Curve Determination

Flow (cfs)	Elevation
0	49.20
5	50.27
10	50.50
15	50.87
18	51.17
20	51.40
21	51.58
22	53.75
23	53.89
25	54.17
27	54.49

Note: Data points acquired from the Culvert master analysis.
Please see supporting documentation for additional information.


Stage (ft.) vs Discharge (cfs)
55.00
54.00
53.00
52.00
51.00
50.00
49.00
48.00
0
5
10
15
20
25
30
Rating Curve

C-10

The outfall from basin 200 consists of three pipe sizes. They include a 36" round pipe, a 38"x 24" elliptical pipe, and a 42" x 27" elliptical pipe. The HGL computations indicate a 34" pipe and a 36" pipe. The computations can only accept a pipe size which is round not elliptical. Therefore an equivalent size was required for the two elliptical pipes. The equivalent round pipe size of a 38" x 24" elliptical pipe is 34" inches and a 42" x 27" elliptical pipe is slightly less than 37inches so a 36" round pipe was used. The areas are summarized below.

38" x24"	6.3 sf
42"x27"	7.4 sf
34" Round	6.31 sf
36" Round	7.07 sf
37" Round	7.46 sf

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 10-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	12.71	5.37	5.00	34"	0.013	0.50%	0.01%	0.79	177.00	0.67	0.15	ASSUM, TOP LxSf = 0.01 Normal Depth Elev =Inv. EL.+Dn = Head Loss = 0.00	50.20 50.21 44.10 50.21	50.20 50.21
mh504	MH502	0.00	12.03	5.49	5.00	36"	0.013	0.50%	0.01%	0.71	179.00	0.66	0.15	LxSf = 0.01 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.00	50.23 45.10 50.23	50.21 50.23
mh506	MH504	0.00	10.99	5.67	5.00	36"	0.013	0.50%	0.01%	0.71	270.00	0.66	0.15	LxSf = 0.02 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.00	50.24 46.55 50.24	50.23 50.24
mh508	MH506	0.00	10.22	5.83	5.00	36"	0.013	0.50%	0.01%	0.71	200.00	0.66	0.80	LxSf = 0.01 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.01	50.25 47.70 50.26	50.24 50.25
ew200	MH508	0.00	10.00	5.87	5.00	36"	0.013	0.50%	0.01%	0.71	58.00	0.66	N/A	LxSf = 0.00 Normal Depth Elev.=Inv. EL.+Dn =	50.26 48.14	50.26 50.26
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-12

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 10-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	12.22	5.45	10.00	34"	0.013	0.50%	0.03%	1.59	177.00	0.96	0.15	ASSUM, TOP LxSf = 0.05 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.01	50.20 50.25 44.39 50.26	50.20 50.25
mh504	MH502	0.00	11.66	5.55	10.00	36"	0.013	0.50%	0.02%	1.41	179.00	0.94	0.15	LxSf = 0.04 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.00	50.30 45.38 50.30	50.26 50.30
mh506	MH504	0.00	10.81	5.71	10.00	36"	0.013	0.50%	0.02%	1.41	270.00	0.94	0.15	LxSf = 0.06 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.00	50.37 46.83 50.37	50.30 50.37
mh508	MH506	0.00	10.18	5.83	10.00	36"	0.013	0.50%	0.02%	1.41	200.00	0.94	0.80	LxSf = 0.04 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.42 47.98 50.44	50.37 50.42
ew200	MH508	0.00	10.00	5.87	10.00	36"	0.013	0.50%	0.02%	1.41	58.00	0.94	N/A	LxSf = 0.01 Normal Depth Elev.=Inv. EL.+Dn =	50.45 48.42	50.44 50.45
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

P-19

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 10-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.99	5.49	15.00	34"	0.013	0.50%	0.07%	2.38	177.00	1.20	0.15	ASSUM. TOP LxSf = 0.12 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.01	50.20 50.32 44.63 50.33	50.20 50.32
mh504	MH502	0.00	11.49	5.58	15.00	36"	0.013	0.50%	0.05%	2.12	179.00	1.16	0.15	LxSf = 0.09 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.01	50.43 45.60 50.44	50.33 50.43
mh506	MH504	0.00	10.73	5.72	15.00	36"	0.013	0.50%	0.05%	2.12	270.00	1.16	0.15	LxSf = 0.14 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.01	50.57 47.05 50.58	50.44 50.57
mh508	MH506	0.00	10.16	5.84	15.00	36"	0.013	0.50%	0.05%	2.12	200.00	1.16	0.80	LxSf = 0.10 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.06	50.68 48.20 50.74	50.58 50.68
ew200	MH508	0.00	10.00	5.87	15.00	36"	0.013	0.50%	0.05%	2.12	58.00	1.16	N/A	LxSf = 0.03 Normal Depth Elev.=Inv. EL.+Dn =	50.77 48.64	50.74 50.77
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-14

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 10-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.89	5.51	18.00	34"	0.013	0.50%	0.10%	2.86	177.00	1.33	0.15	ASSUM. TOP LxSf = 0.17 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.20 50.37 44.76 50.39	50.20 50.37
mh504	MH502	0.00	11.41	5.60	18.00	36"	0.013	0.50%	0.07%	2.55	179.00	1.28	0.15	LxSf = 0.13 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.52 45.72 50.54	50.39 50.52
mh506	MH504	0.00	10.69	5.73	18.00	36"	0.013	0.50%	0.07%	2.55	270.00	1.29	0.15	LxSf = 0.20 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.74 47.18 50.75	50.54 50.74
mh508	MH506	0.00	10.16	5.84	18.00	36"	0.013	0.50%	0.07%	2.55	200.00	1.29	0.80	LxSf = 0.15 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.08	50.90 48.33 50.98	50.75 50.90
ew200	MH508	0.00	10.00	5.87	18.00	36"	0.013	0.50%	0.07%	2.55	58.00	1.29	N/A	LxSf = 0.04 Normal Depth Elev.=Inv. EL.+Dn =	51.02 48.77	50.98 51.02
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-15

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 10-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.84	5.52	20.00	34"	0.013	0.50%	0.12%	3.17	177.00	1.41	0.15	ASSUM, TOP LxSf = 0.22 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.20 50.42 44.84 50.44	50.20 50.42
mh504	MH502	0.00	11.38	5.60	20.00	36"	0.013	0.50%	0.09%	2.83	179.00	1.36	0.15	LxSf = 0.16 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.60 45.80 50.62	50.44 50.60
mh506	MH504	0.00	10.67	5.74	20.00	36"	0.013	0.50%	0.09%	2.83	270.00	1.36	0.15	LxSf = 0.24 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.86 47.25 50.88	50.62 50.86
mh508	MH506	0.00	10.15	5.84	20.00	36"	0.013	0.50%	0.09%	2.83	200.00	1.36	0.80	LxSf = 0.18 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.10	51.06 48.40 51.16	50.88 51.06
ew200	MH508	0.00	10.00	5.87	20.00	36"	0.013	0.50%	0.09%	2.83	58.00	1.36	N/A	LxSf = 0.05 Normal Depth Elev.=Inv. EL.+Dn =	51.21 48.84	51.16 51.21
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-16

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 10-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (In)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.82	5.52	21.00	34"	0.013	0.50%	0.13%	3.33	177.00	1.45	0.15	ASSUM. TOP LxSf = 0.24 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	50.20 50.44 44.88 50.46	50.20 50.44
mh504	MH502	0.00	11.36	5.61	21.00	36"	0.013	0.50%	0.10%	2.97	179.00	1.40	0.15	LxSf = 0.18 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.64 45.84 50.66	50.46 50.64
mh506	MH504	0.00	10.66	5.74	21.00	36"	0.013	0.50%	0.10%	2.97	270.00	1.40	0.15	LxSf = 0.27 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	50.93 47.29 50.95	50.66 50.93
mh508	MH506	0.00	10.15	5.84	21.00	36"	0.013	0.50%	0.10%	2.97	200.00	1.40	0.80	LxSf = 0.20 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.11	51.15 48.44 51.26	50.95 51.15
ew200	MH508	0.00	10.00	5.87	21.00	36"	0.013	0.50%	0.10%	2.97	58.00	1.40	N/A	LxSf = 0.06 Normal Depth Elev.=Inv. EL.+Dn =	51.32 48.88	51.26 51.32
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-17

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

DESIGNED / CHECKED BY : MEW
RAINFALL FACTOR: 100-YR STORM
CONTRACT: Riverdale Park Pond 200
Title:
SHEET ____ OF ____
DATE : 1/19/2015

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	I(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.80	7.46	22.00	34"	0.013	0.50%	0.15%	3.49	177.00	1.49	0.15	ASSUM, TOP LxSf = 0.26 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	52.30 52.56 44.92 52.59	52.30 52.56
mh504	MH502	0.00	11.34	7.79	22.00	36"	0.013	0.50%	0.11%	3.11	179.00	1.44	0.15	LxSf = 0.19 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	52.78 45.88 52.81	52.59 52.78
mh506	MH504	0.00	10.66	8.12	22.00	36"	0.013	0.50%	0.11%	3.11	270.00	1.44	0.15	LxSf = 0.29 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	53.10 47.33 53.12	52.81 53.10
mh508	MH506	0.00	10.15	8.24	22.00	36"	0.013	0.50%	0.11%	3.11	200.00	1.44	0.80	LxSf = 0.22 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.12	53.34 48.48 53.46	53.12 53.34
ew200	MH508	0.00	10.00	8.28	22.00	36"	0.013	0.50%	0.11%	3.11	58.00	1.44	N/A	LxSf = 0.06 Normal Depth Elev.=Inv. EL.+Dn =	53.52 48.92	53.46 53.52
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-18

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

DESIGNED / CHECKED BY : MEW
RAINFALL FACTOR: 10-YR STORM
CONTRACT: Riverdale Park Pond 200
Title:
SHEET ____ OF ____
DATE : 1/19/2015

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) In/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.78	5.53	23.00	34"	0.013	0.50%	0.16%	3.65	177.00	1.53	0.15	ASSUM. TOP LxSf = 0.29 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	52.30 52.59 44.96 52.62	52.30 52.59
mh504	MH502	0.00	11.33	5.61	23.00	36"	0.013	0.50%	0.12%	3.25	179.00	1.48	0.15	LxSf = 0.21 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	52.83 45.92 52.85	52.62 52.83
mh506	MH504	0.00	10.65	5.74	23.00	36"	0.013	0.50%	0.12%	3.25	270.00	1.48	0.15	LxSf = 0.32 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.02	53.18 47.37 53.20	52.85 53.18
mh508	MH506	0.00	10.15	5.84	23.00	36"	0.013	0.50%	0.12%	3.25	200.00	1.48	0.80	LxSf = 0.24 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.13	53.44 48.52 53.57	53.20 53.44
ew200	MH508	0.00	10.00	5.87	23.00	36"	0.013	0.50%	0.12%	3.25	58.00	1.48	N/A	LxSf = 0.07 Normal Depth Elev.=Inv. EL.+Dn =	53.64 48.96	53.57 53.64
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-19

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 100-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	i(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.74	7.50	25.00	34"	0.013	0.50%	0.19%	3.97	177.00	1.61	0.15	ASSUM, TOP LxSf = 0.34 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.04	52.30 52.64 45.04 52.67	52.30 52.64
mh504	MH502	0.00	11.30	7.82	25.00	36"	0.013	0.50%	0.14%	3.54	179.00	1.55	0.15	LxSf = 0.25 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	52.93 45.99 52.95	52.67 52.93
mh506	MH504	0.00	10.64	8.13	25.00	36"	0.013	0.50%	0.14%	3.54	270.00	1.55	0.15	LxSf = 0.38 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	53.33 47.44 53.36	52.95 53.33
mh508	MH506	0.00	10.14	8.25	25.00	36"	0.013	0.50%	0.14%	3.54	200.00	1.55	0.80	LxSf = 0.28 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.16	53.64 48.59 53.80	53.36 53.64
ew200	MH508	0.00	10.00	8.28	25.00	36"	0.013	0.50%	0.14%	3.54	58.00	1.55	N/A	LxSf = 0.08 Normal Depth Elev.=Inv. EL.+Dn =	53.88 49.03	53.80 53.88
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-20

MARYLAND STATE HIGHWAY ADMINISTRATION
HYDRAULIC GRADIENT COMPUTATION FOR STORM DRAIN DESIGN

SHEET _____ OF _____

DESIGNED / CHECKED BY : MEW CONTRACT: Riverdale Park Pond 200 DATE : 1/19/2015

RAINFALL FACTOR: 100-YR STORM Title:

Structure		Year Runoff				Pipe								Hydraulic Gradient		
From	To	∑CA	Tc	I(Rainfall Intensity) in/hr	Q (cfs)	Size (in)	n (Manning Coef.)	So (Slope) %	Sf (Slope) %	Vf (Velocity) ft/sec	L (Length)	Dn (Normal Depth-ft)	Kb	Description of Loss	Elevation	HGL
mh502	EW500	0.00	11.71	7.52	27.00	34"	0.013	0.50%	0.22%	4.28	177.00	1.69	0.15	ASSUM. TOP LxSf = 0.39 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.04	52.30 52.69 45.12 52.74	52.30 52.69
mh504	MH502	0.00	11.28	7.84	27.00	36"	0.013	0.50%	0.16%	3.82	179.00	1.62	0.15	LxSf = 0.29 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	53.03 46.06 53.06	52.74 53.03
mh506	MH504	0.00	10.62	8.13	27.00	36"	0.013	0.50%	0.16%	3.82	270.00	1.63	0.15	LxSf = 0.44 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.03	53.51 47.52 53.54	53.06 53.51
mh508	MH506	0.00	10.14	8.25	27.00	36"	0.013	0.50%	0.16%	3.82	200.00	1.63	0.80	LxSf = 0.33 Normal Depth Elev.=Inv. EL.+Dn = Head Loss = 0.18	53.87 48.67 54.05	53.54 53.87
ew200	MH508	0.00	10.00	8.28	27.00	36"	0.013	0.50%	0.16%	3.82	58.00	1.63	N/A	LxSf = 0.10 Normal Depth Elev.=Inv. EL.+Dn =	54.14 49.11	54.05 54.14
														New Branch HGL Starts @ LxSf = Normal Depth Elev.=Inv. EL.+Dn = Head Loss =		#VALUE!

C-21

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	5.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	5.00 cfs	Check Discharge	5.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	50.26 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	5.00 cfs	50.27 ft	0.71 ft/s
Weir	Not Considered	N/A	N/A	N/A

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Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev:	50.27 ft	Discharge	5.00 cfs
Inlet Control HW Elev.	50.26 ft	Tailwater Elevation	50.26 ft
Outlet Control HW Elev.	50.27 ft	Control Type	Outlet Control
Headwater Depth/Height	0.93		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	CompositePressureProfileS1	Depth, Downstream	3.07 ft
Slope Type	N/A	Normal Depth	0.66 ft
Flow Regime	Subcritical	Critical Depth	0.70 ft
Velocity Downstream	0.71 ft/s	Critical Slope	0.003937 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	50.27 ft	Upstream Velocity Head	0.01 ft
Ke	0.50	Entrance Loss	0.00 ft

Inlet Control Properties			
Inlet Control HW Elev.	50.26 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-23

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	10.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	10.00 cfs	Check Discharge	10.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	50.44 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	10.00 cfs	50.50 ft	1.41 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-24

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Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev	50.50 ft	Discharge	10.00 cfs
Inlet Control HW Elev.	50.44 ft	Tailwater Elevation	50.44 ft
Outlet Control HW Elev.	50.50 ft	Control Type	Outlet Control
Headwater Depth/Height	1.01		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	CompositePressureProfileS1	Depth, Downstream	3.25 ft
Slope Type	N/A	Normal Depth	0.94 ft
Flow Regime	Subcritical	Critical Depth	1.00 ft
Velocity Downstream	1.41 ft/s	Critical Slope	0.003905 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	50.50 ft	Upstream Velocity Head	0.03 ft
Ke	0.50	Entrance Loss	0.02 ft

Inlet Control Properties			
Inlet Control HW Elev.	50.44 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-25

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	15.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	15.00 cfs	Check Discharge	15.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	50.74 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	15.00 cfs	50.87 ft	2.12 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-26

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Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev:	50.87 ft	Discharge	15.00 cfs
Inlet Control HW Elev.	50.74 ft	Tailwater Elevation	50.74 ft
Outlet Control HW Elev.	50.87 ft	Control Type	Outlet Control
Headwater Depth/Height	1.13		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	3.55 ft
Slope Type	N/A	Normal Depth	1.16 ft
Flow Regime	N/A	Critical Depth	1.24 ft
Velocity Downstream	2.12 ft/s	Critical Slope	0.004011 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	50.87 ft	Upstream Velocity Head	0.07 ft
Ke	0.50	Entrance Loss	0.03 ft

Inlet Control Properties			
Inlet Control HW Elev.	50.74 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-27

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Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	18.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	18.00 cfs	Check Discharge	18.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	50.98 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	18.00 cfs	51.17 ft	2.55 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-28

Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev	51.17 ft	Discharge	18.00 cfs
Inlet Control HW Elev.	50.98 ft	Tailwater Elevation	50.98 ft
Outlet Control HW Elev.	51.17 ft	Control Type	Outlet Control
Headwater Depth/Height	1.23		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	3.79 ft
Slope Type	N/A	Normal Depth	1.29 ft
Flow Regime	N/A	Critical Depth	1.36 ft
Velocity Downstream	2.55 ft/s	Critical Slope	0.004111 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	51.17 ft	Upstream Velocity Head	0.10 ft
Ke	0.50	Entrance Loss	0.05 ft

Inlet Control Properties			
Inlet Control HW Elev.	50.98 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-29

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	20.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	20.00 cfs	Check Discharge	20.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	51.16 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	20.00 cfs	51.40 ft	2.83 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-30

Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev:	51.40 ft	Discharge	20.00 cfs
Inlet Control HW Elev.	51.16 ft	Tailwater Elevation	51.16 ft
Outlet Control HW Elev.	51.40 ft	Control Type	Outlet Control
Headwater Depth/Height	1.31		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	3.97 ft
Slope Type	N/A	Normal Depth	1.36 ft
Flow Regime	N/A	Critical Depth	1.44 ft
Velocity Downstream	2.83 ft/s	Critical Slope	0.004184 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	51.40 ft	Upstream Velocity Head	0.12 ft
Ke	0.50	Entrance Loss	0.06 ft

Inlet Control Properties			
Inlet Control HW Elev.	51.16 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	21.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	21.00 cfs	Check Discharge	21.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	51.32 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	21.00 cfs	51.58 ft	2.97 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-31

Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev	51.58 ft	Discharge	21.00 cfs
Inlet Control HW Elev.	51.32 ft	Tailwater Elevation	51.32 ft
Outlet Control HW Elev.	51.58 ft	Control Type	Outlet Control
Headwater Depth/Height	1.37		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	4.13 ft
Slope Type	N/A	Normal Depth	1.40 ft
Flow Regime	N/A	Critical Depth	1.47 ft
Velocity Downstream	2.97 ft/s	Critical Slope	0.004227 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	51.58 ft	Upstream Velocity Head	0.14 ft
Ke	0.50	Entrance Loss	0.07 ft

Inlet Control Properties			
Inlet Control HW Elev.	51.32 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-32

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	22.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	22.00 cfs	Check Discharge	22.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	53.46 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	22.00 cfs	53.75 ft	3.11 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-33

Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev	53.75 ft	Discharge	22.00 cfs
Inlet Control HW Elev.	53.46 ft	Tailwater Elevation	53.46 ft
Outlet Control HW Elev.	53.75 ft	Control Type	Outlet Control
Headwater Depth/Height	2.09		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	6.27 ft
Slope Type	N/A	Normal Depth	1.44 ft
Flow Regime	N/A	Critical Depth	1.51 ft
Velocity Downstream	3.11 ft/s	Critical Slope	0.004268 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	53.75 ft	Upstream Velocity Head	0.15 ft
Ke	0.50	Entrance Loss	0.08 ft

Inlet Control Properties			
Inlet Control HW Elev.	53.46 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-34

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	23.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	23.00 cfs	Check Discharge	23.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	53.57 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	23.00 cfs	53.89 ft	3.25 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-35

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Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev	53.89 ft	Discharge	23.00 cfs
Inlet Control HW Elev.	53.57 ft	Tailwater Elevation	53.57 ft
Outlet Control HW Elev.	53.89 ft	Control Type	Outlet Control
Headwater Depth/Height	2.14		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	6.38 ft
Slope Type	N/A	Normal Depth	1.48 ft
Flow Regime	N/A	Critical Depth	1.54 ft
Velocity Downstream	3.25 ft/s	Critical Slope	0.004313 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	53.89 ft	Upstream Velocity Head	0.16 ft
Ke	0.50	Entrance Loss	0.08 ft

Inlet Control Properties			
Inlet Control HW Elev.	53.57 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-36

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	25.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	25.00 cfs	Check Discharge	25.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	53.80 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	25.00 cfs	54.17 ft	3.54 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-37

Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev	54.17 ft	Discharge	25.00 cfs
Inlet Control HW Elev.	53.80 ft	Tailwater Elevation	53.80 ft
Outlet Control HW Elev.	54.17 ft	Control Type	Outlet Control
Headwater Depth/Height	2.23		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	6.61 ft
Slope Type	N/A	Normal Depth	1.55 ft
Flow Regime	N/A	Critical Depth	1.61 ft
Velocity Downstream	3.54 ft/s	Critical Slope	0.004410 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	54.17 ft	Upstream Velocity Head	0.19 ft
Ke	0.50	Entrance Loss	0.10 ft

Inlet Control Properties			
Inlet Control HW Elev.	53.80 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-38

Culvert Designer/Analyzer Report
SWM-200 Outfall

Analysis Component			
Storm Event	Design	Discharge	27.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	27.00 cfs	Check Discharge	27.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	54.05 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	27.00 cfs	54.49 ft	3.82 ft/s
Weir	Not Considered	N/A	N/A	N/A

C-39

Culvert Designer/Analyzer Report
SWM-200 Outfall

Component:Culvert-1

Culvert Summary			
Computed Headwater Elev:	54.49 ft	Discharge	27.00 cfs
Inlet Control HW Elev.	54.05 ft	Tailwater Elevation	54.05 ft
Outlet Control HW Elev.	54.49 ft	Control Type	Outlet Control
Headwater Depth/Height	2.34		

Grades			
Upstream Invert	47.48 ft	Downstream Invert	47.19 ft
Length	58.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	6.86 ft
Slope Type	N/A	Normal Depth	1.63 ft
Flow Regime	N/A	Critical Depth	1.68 ft
Velocity Downstream	3.82 ft/s	Critical Slope	0.004514 ft/ft

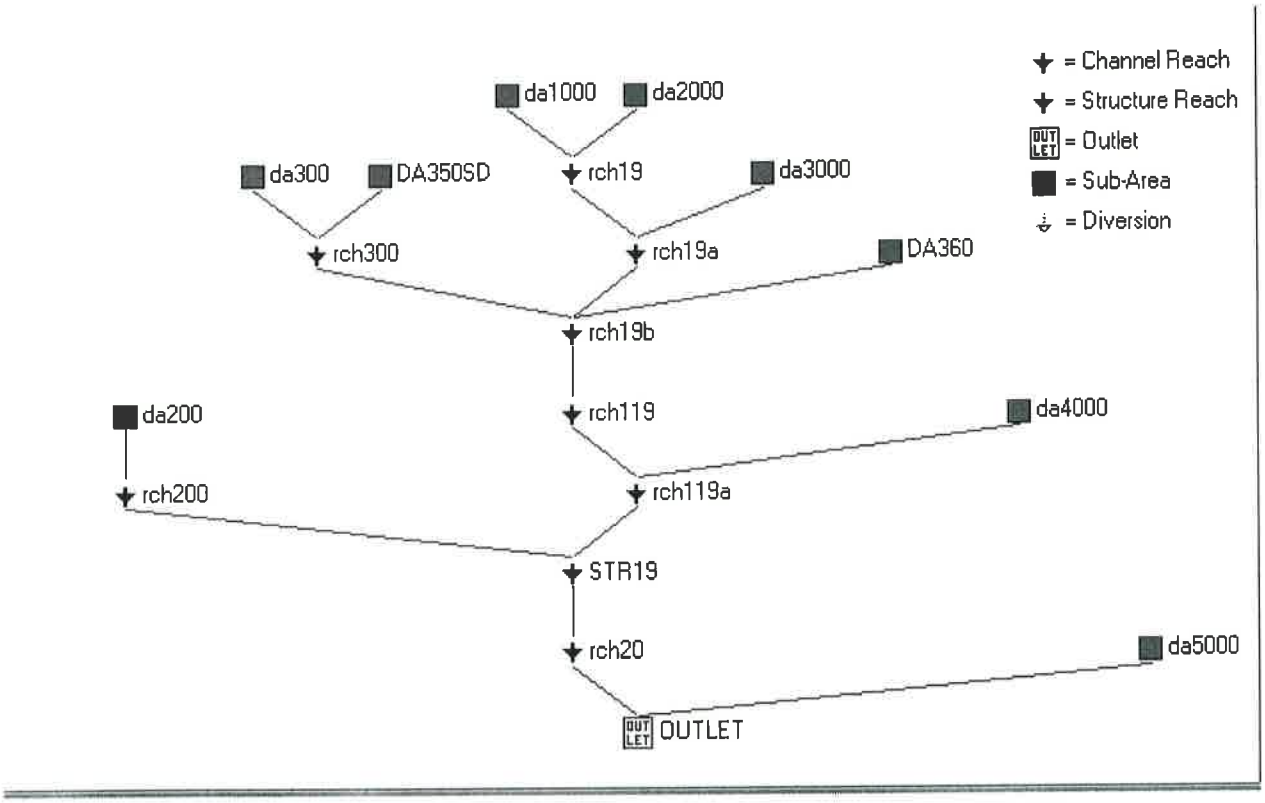
Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	54.49 ft	Upstream Velocity Head	0.23 ft
Ke	0.50	Entrance Loss	0.11 ft

Inlet Control Properties			
Inlet Control HW Elev.	54.05 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

C-40

APPENDIX D
(Predeveloped Onsite (BASE) – TR-20)


= Channel Reach
= Structure Reach
= Outlet
= Sub-Area
= Diversion
da1000
da2000
da300
DA350SD
rch19
da3000
rch300
rch19a
DA360
rch19b
da200
rch119
da4000
rch200
rch119a
STR19
rch20
da5000
OUTLET

BASE

```
WinTR-20: Version 1.0                    0          0          0.1        0
Riverdale
Wells Run - Base - Predeveloped Onsite Only

SUB-AREA:
          da1000    rch19                0.4681     90.        0.43
          da2000    rch19                0.2519     83.        0.25
          da3000    rch19A               0.1871     83.        0.34
          da4000    rch119a              0.2516     86.        0.40
          da5000    outlet               0.0830     84.        .32
          da300     rch300               .013       61.        .225
          DA360     rch19b               .0007      98.        .1
          DA350SD   rch300               .0027      90.        .187
          da200     rch200               0.0157     70.        .349

STREAM REACH:
          rch19     rch19A    rch19                2169.
          STR19     rch20               csx
          rch119    rch119a   rch19                1.
          rch20     outlet    rch814               2275.
          rch300    rch19b    rch300               450.
          rch200    STR19     rch200               650.
          rch19a    rch19b    rch19                1.
          rch119a   STR19     rch19                1.
          rch19b    rch119    rch19                1529.


STORM ANALYSIS:
          2-Year                           3.3        Type II    2          3.3
          10-Year                          5.3        Type II    2          3.3
          100 Year                         7.4        Type II    2          3.3

STREAM CROSS SECTION:
          rch19     56.5                   49.3
                    49.3      0.           0.         0.         .00125
                    54.1      100.         65.        15.
                    56.9      593.         427.       100.
                    57.       626.         444.       110.
                    58.       1198.        710.       150.
                    60.       1936.        1404.      200.
                    63.       3600.        2470.      300.
          827       46.2                   51.2
                    46.2      0.           0.         0.         .005
                    53.56     751.         370.       199.
                    55.04     1541.        684.       222.
                    56.67     2408.        1063.      244.
          rch814    41.8                   35.4
                    35.4      0.           0.         0.         .0027
                    37.96     200.         40.        21.
                    39.33     400.         72.        26.
                    40.36     600.         100.       29.
                    41.21     800.         127.       32.
                    41.95     1000.        161.       70.
                    42.69     1200.        227.       109.
```

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                43.22     1400.     293.      136.
                43.87     1600.     393.      166.
                44.       1700.     420.      180.
        RCH300  55.5                54.
                54.       0.        0.        0.        .01
                55.       40.       8.        5.
                55.5      80.       10.       8.
        rch200  50.                 48.
                48.       0.        0.        0.        .005
                49.       30.       5.        3.
                50.       110.      20.       10.

STRUCTURE RATING:
        CSX     39.4
                39.4      0.        0.
                48.77     200.      17.17
                48.99     400.      18.84
                49.27     550.      21.40
                49.94     800.      30.50
                50.68     1000.     40.55
                51.61     1200.     55.59
                52.36     1360.     70.20
                52.70     1400.     76.82


GLOBAL OUTPUT:
        1       0.5       0.1       YNNNN     YNNNNN
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Riverdale
Wells Run - Base - Predeveloped Onsite Only

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STORM 2-Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		2.261		12.14	649.42	1387.34
da2000	0.252		1.692		12.05	339.12	1346.24
rch19	0.720	Upstream	2.062	57.56	12.10	945.86	1313.69
rch19	0.720	Downstream	2.057	56.49	12.19	520.54	722.97
da3000	0.187		1.691		12.09	220.74	1179.82
rch19a	0.907	Upstream	1.982	57.17	12.14	721.93	795.87
rch19a	0.907	Downstream	1.982	57.17	12.14	721.73	795.64
DA360	0.700E-03		1.728		11.92	1.87	2677.35
da300	0.013		0.484		12.07	3.94	303.22
DA350SD	0.003		1.907		12.00	5.18	1919.05
rch300	0.016	Upstream	0.729	54.22	12.05	8.65	551.20
rch300	0.016	Downstream	0.728	54.22	12.06	8.65	550.68
rch19b	0.924	Upstream	1.960	57.18	12.14	728.43	788.78
rch19b	0.924	Downstream	1.949	56.32	12.27	490.89	531.55
rch119	0.924	Upstream	1.949	56.32	12.27	490.89	531.55
rch119	0.924	Downstream	1.949	56.32	12.27	490.78	531.43
da4000	0.252		1.922		12.14	310.05	1232.33
rch119a	1.175	Upstream	1.944	57.26	12.16	776.91	661.14
rch119a	1.175	Downstream	1.944	57.26	12.16	776.70	660.96
da200	0.016		0.885		12.13	8.77	558.34
rch200	0.016	Upstream	0.885	48.29	12.13	8.77	558.34
rch200	0.016	Downstream	0.885	48.29	12.15	8.67	552.11
STR19	1.191	Upstream	1.930		12.16	785.32	659.49
STR19	1.191	Downstream	1.929	49.31	12.51	563.39	473.12
rch20	1.191	Upstream	1.929	40.17	12.51	563.39	473.12
rch20	1.191	Downstream	1.929	40.16	12.61	560.64	470.81
da5000	0.083		1.766		12.08	105.20	1267.44
OUTLET	1.274		1.918		12.57	579.50	454.94

STORM 10-Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		4.166		12.14	1166.59	2492.18
da2000	0.252		3.447		12.04	683.33	2712.71
rch19	0.720	Upstream	3.914	59.56	12.08	1772.72	2462.11
rch19	0.720	Downstream	3.908	57.74	12.12	1050.90	1459.59
da3000	0.187		3.447		12.10	446.83	2388.21
rch19a	0.907	Upstream	3.813	58.79	12.12	1490.92	1643.61
rch19a	0.907	Downstream	3.813	58.79	12.12	1490.56	1643.22
DA360	0.700E-03		3.282		11.93	3.03	4332.26
da300	0.013		1.551		12.05	15.87	1220.67
DA350SD	0.003		4.029		11.99	9.27	3433.86
rch300	0.016	Upstream	1.977	54.62	12.03	24.60	1567.12

D-4

Riverdale
Wells Run - Base - Predeveloped Onsite Only

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
rch300	0.016	Downstream	1.976	54.61	12.04	24.58	1565.70
rch19b	0.924	Upstream	3.781	58.85	12.10	1512.06	1637.31
rch19b	0.924	Downstream	3.773	57.74	12.15	1051.43	1138.53
rch119	0.924	Upstream	3.773	57.74	12.15	1051.43	1138.53
rch119	0.924	Downstream	3.773	57.74	12.15	1051.19	1138.27
da4000	0.252		3.748		12.13	598.67	2379.45
rch119a	1.175	Upstream	3.768	59.21	12.13	1643.19	1398.34
rch119a	1.175	Downstream	3.768	59.21	12.13	1642.80	1398.01
da200	0.016		2.258		12.11	24.21	1542.36
rch200	0.016	Upstream	2.258	48.81	12.11	24.21	1542.36
rch200	0.016	Downstream	2.256	48.80	12.13	23.93	1524.20
STR19	1.191	Upstream	3.748		12.13	1666.72	1399.67
STR19	1.191	Downstream	3.748	50.77	12.48	1019.35	856.02
rch20	1.191	Upstream	3.748	42.02	12.48	1019.35	856.02
rch20	1.191	Downstream	3.747	42.01	12.58	1017.25	854.26
da5000	0.083		3.546		12.08	209.22	2520.71
OUTLET	1.274		3.734		12.51	1056.36	829.30

STORM 100 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		6.216		12.13	1709.04	3651.01
da2000	0.252		5.406		12.04	1052.82	4179.52
rch19	0.720	Upstream	5.932	61.26	12.09	2637.24	3662.84
rch19	0.720	Downstream	5.927	59.22	12.10	1647.70	2288.47
da3000	0.187		5.406		12.09	691.71	3697.01
rch19a	0.907	Upstream	5.819	60.72	12.10	2334.53	2573.62
rch19a	0.907	Downstream	5.819	60.72	12.10	2334.02	2573.06
DA360	0.700E-03		5.231		11.92	4.25	6064.77
da300	0.013		2.991		12.04	31.77	2443.67
DA350SD	0.003		6.121		11.99	13.52	5005.58
rch300	0.016	Upstream	3.529	55.06	12.03	44.73	2848.90
rch300	0.016	Downstream	3.528	55.06	12.04	44.70	2847.02
rch19b	0.924	Upstream	5.780	60.79	12.10	2374.18	2570.85
rch19b	0.924	Downstream	5.766	59.38	12.12	1706.16	1847.49
rch119	0.924	Upstream	5.766	59.38	12.12	1706.16	1847.49
rch119	0.924	Downstream	5.766	59.38	12.12	1705.77	1847.07
da4000	0.252		5.751		12.12	902.10	3585.46
rch119a	1.175	Upstream	5.763	61.21	12.12	2607.36	2218.84
rch119a	1.175	Downstream	5.763	61.21	12.12	2606.82	2218.38
da200	0.016		3.949		12.11	42.80	2726.18
rch200	0.016	Upstream	3.949	49.16	12.11	42.80	2726.18
rch200	0.016	Downstream	3.947	49.15	12.13	42.37	2698.50
STR19	1.191	Upstream	5.739		12.12	2648.99	2224.55
STR19	1.191	Downstream	5.738	52.32	12.51	1351.04	1134.56
rch20	1.191	Upstream	5.738	43.09	12.51	1351.04	1134.56
rch20	1.191	Downstream	5.738	43.08	12.65	1345.40	1129.83
da5000	0.083		5.520		12.07	320.04	3855.93

D-5

Riverdale
Wells Run - Base - Predeveloped Onsite Only

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
OUTLET	1.274		5.724		12.59	1393.96	1094.33

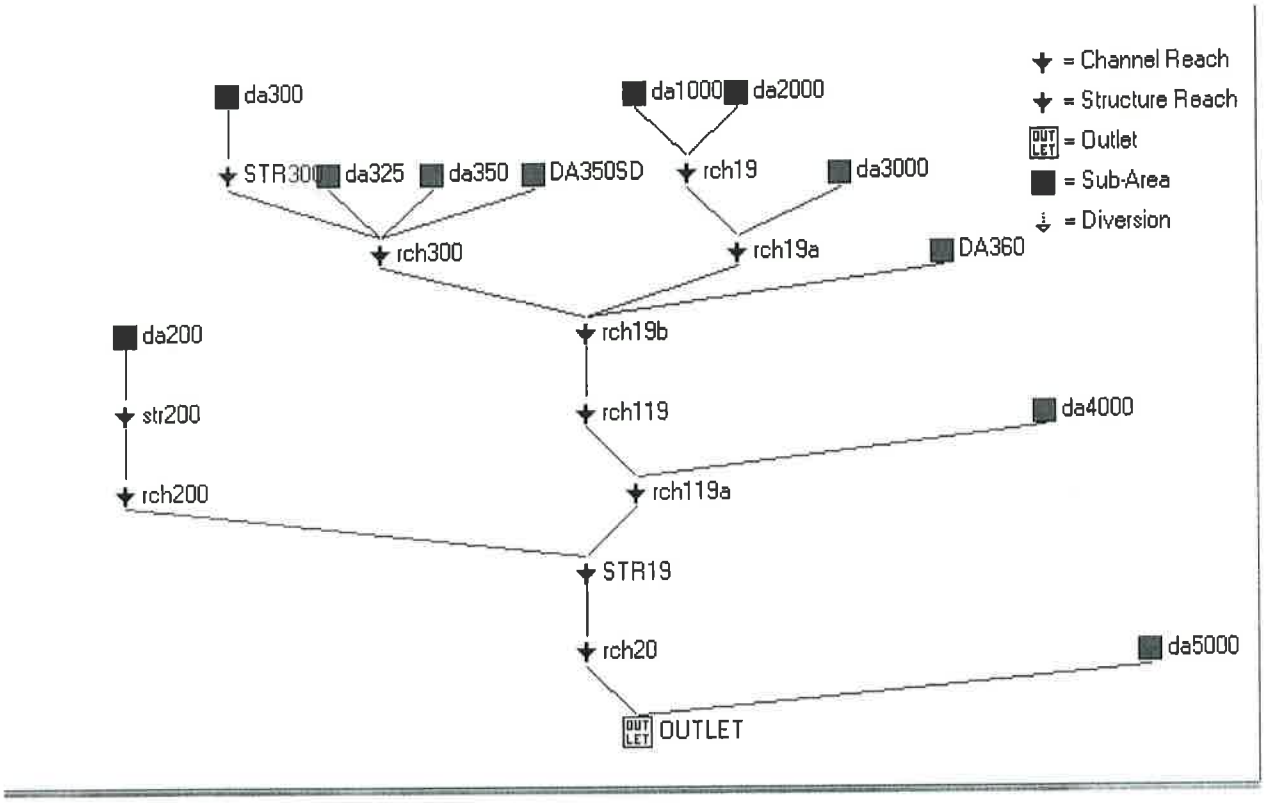
D-6

Riverdale
Wells Run - Base - Predeveloped Onsite Only

Area or Reach Identifier	Drainage Area (sq mi)	Alternate	Peak Flow by Storm 2-Year (cfs)	10-Year (cfs)	100 Year (cfs)	(cfs)	(cfs)
da1000	0.47		649.4	1166.6	1709.0		
da2000	0.25		339.1	683.3	1052.8		
da3000	0.19		220.7	446.8	691.7		
da4000	0.25		310.1	598.7	902.1		
da5000	0.08		105.2	209.2	320.0		
da300	0.01		3.9	15.9	31.8		
DA360	0.700E-03		1.9	3.0	4.2		
DA350SD	0.270E-02		5.2	9.3	13.5		
da200	0.02		8.8	24.2	42.8		
rch19	0.72		945.9	1772.7	2637.2		
DOWNSTREAM			520.5	1050.9	1647.7		
STR19	1.19		785.3	1666.7	2649.0		
DOWNSTREAM			563.4	1019.3	1351.0		
rch119	0.92		490.9	1051.4	1706.2		
DOWNSTREAM			490.8	1051.2	1705.8		
rch20	1.19		563.4	1019.3	1351.0		
DOWNSTREAM			560.6	1017.2	1345.4		
rch300	0.02		8.7	24.6	44.7		
DOWNSTREAM			8.6	24.6	44.7		
rch200	0.02		8.8	24.2	42.8		
DOWNSTREAM			8.7	23.9	42.4		
rch19a	0.91		721.9	1490.9	2334.5		
DOWNSTREAM			721.7	1490.6	2334.0		
rch119a	1.18		776.9	1643.2	2607.4		
DOWNSTREAM			776.7	1642.8	2606.8		
rch19b	0.92		728.4	1512.1	2374.2		
DOWNSTREAM			490.9	1051.4	1706.2		
OUTLET	1.27		579.5	1056.4	1394.0		

D-7

APPENDIX E
(Onsite SWM for SW and SE (Option 1) – TR-20)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= Structure Reach
= Outlet
= Sub-Area
= Diversion
da300
da1000
da2000
STR300
da325
da350
DA350SD
rch19
da3000
rch300
rch19a
DA360
da200
rch19b
str200
rch119
da4000
rch200
rch119a
STR19
rch20
da5000
OUTLET

OPTION 1

```
WinTR-20: Version 1.0                    0          0          0.1        0
Riverdale
Wells Run - Option 1 - SWM for SW and SE

SUB-AREA:
          da1000    rch19                0.4681     90.        0.43
          da2000    rch19                0.2519     83.        0.25
          da3000    rch19A               0.1871     83.        0.34
          da4000    rch119a              0.2516     86.        0.40
          da5000    outlet               0.0830     84.        .32
          da300     STR300               .0087      90.        .10
          da325     rch300               .0021      78.        .1
          da350     rch300               .001       91.        .177
          DA360     rch19B               .0007      98.        .1
          DA350SD   rch300               .0027      90.        .187
          da200     str200               0.0197     90.        .1

STREAM REACH:
          rch19     rch19a    rch19                2169.
          STR19     rch20               csx
          rch119    rch119a   rch19                1.
          rch20     outlet    rch814               2275.
          rch300    rch19b    rch300               450.
          STR300    rch300              SWM300
          str200    rch200              swm200
          rch200    STR19     rch200               650.
          rch19a    rch19b    rch19                1.
          rch119a   STR19     rch19                1.
          rch19b    rch119    rch19                1529.


STORM ANALYSIS:
          2-Year                        3.3        Type II    2          3.3
          10-Year                       5.3        Type II    2          3.3
          100 Year                      7.4        Type II    2          3.3

STREAM CROSS SECTION:
          rch19     56.5                49.3
                    49.3      0.        0.         0.         .00125
                    54.1      100.      65.        15.
                    56.9      593.      427.       100.
                    57.       626.      444.       110.
                    58.       1198.     710.       150.
                    60.       1936.     1404.      200.
                    63.       3600.     2470.      300.
          rch814    41.8                35.4
                    35.4      0.        0.         0.         .0027
                    37.96     200.      40.        21.
                    39.33     400.      72.        26.
                    40.36     600.      100.       29.
                    41.21     800.      127.       32.
                    41.95     1000.     161.       70.
                    42.69     1200.     227.       109.
                    43.22     1400.     293.       136.
```

E-2

	43.87	1600.	393.	166.	
	44.	1700.	420.	180.	
RCH300	55.5		54.		
	54.	0.	0.	0.	.01
	55.	40.	8.	5.	
	55.5	80.	10.	8.	
rch200	50.		48.		
	48.	0.	0.	0.	.005
	49.	30.	5.	3.	
	50.	110.	20.	10.	

STRUCTURE RATING:

SWM300	66.		
	66.	0.	0.
	67.	2.8	.032
	68.	4.7	.125
	69.	6.2	.244
	70.	7.1	.376
	71.	8.7	.511
	72.	11.8	.641
	73.	15.6	.755
	73.5	17.6	.802
	74.	19.8	.837
	74.5	22.	.86
swm200	48.1		
	48.1	0.	0.
	49.8	.5	.52
	50.	.94	.59
	51.	5.92	1.04
	52.	14.8	1.54
	52.4	17.9	1.76
	52.8	21.0	1.98
	54.4	23.1	2.94
	54.7	25.3	3.13
	55.	27.	3.34
CSX	39.4		
	39.4	0.	0.
	48.77	200.	17.17
	48.99	400.	18.84
	49.27	550.	21.40
	49.94	800.	30.50
	50.68	1000.	40.55
	51.61	1200.	55.59
	52.36	1360.	70.20
	52.70	1400.	76.82

GLOBAL OUTPUT:

1	0.5	0.1	YNNNN	YNNNNN

Riverdale
Wells Run - Option 1 - SWM for SW and SE

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STORM 2-Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		2.261		12.14	649.42	1387.34
da2000	0.252		1.692		12.05	339.12	1346.24
rch19	0.720	Upstream	2.062	57.56	12.10	945.86	1313.69
rch19	0.720	Downstream	2.057	56.49	12.19	520.54	722.97
da3000	0.187		1.691		12.09	220.74	1179.82
rch19a	0.907	Upstream	1.982	57.17	12.14	721.93	795.87
rch19a	0.907	Downstream	1.982	57.17	12.14	721.73	795.64
DA360	0.700E-03		1.728		11.92	1.87	2677.35
da300	0.009		2.238		11.93	19.09	2194.37
STR300	0.009	Upstream	2.238		11.93	19.09	2194.37
STR300	0.009	Downstream	2.233	69.32	12.09	6.49	746.21
da325	0.002		0.940		11.94	2.76	1315.29
da350	0.001		1.494		11.98	2.01	2008.55
DA350SD	0.003		1.907		12.00	5.18	1919.05
rch300	0.015	Upstream	1.934	54.40	12.01	15.87	1094.52
rch300	0.015	Downstream	1.934	54.40	12.02	15.86	1093.69
rch19b	0.922	Upstream	1.981	57.19	12.14	733.29	795.07
rch19b	0.922	Downstream	1.970	56.35	12.27	496.30	538.11
rch119	0.922	Upstream	1.970	56.35	12.27	496.30	538.11
rch119	0.922	Downstream	1.970	56.35	12.27	496.18	537.98
da4000	0.252		1.922		12.14	310.05	1232.33
rch119a	1.174	Upstream	1.960	57.27	12.16	781.99	666.15
rch119a	1.174	Downstream	1.960	57.27	12.16	781.78	665.97
da200	0.020		2.256		11.93	43.23	2194.37
str200	0.020	Upstream	2.256		11.93	43.23	2194.37
str200	0.020	Downstream	2.147	51.28	12.15	8.44	428.58
rch200	0.020	Upstream	2.147	48.28	12.15	8.44	428.58
rch200	0.020	Downstream	2.131	48.28	12.19	8.42	427.41
STR19	1.194	Upstream	1.963		12.16	790.18	662.01
STR19	1.194	Downstream	1.963	49.32	12.51	568.58	476.35
rch20	1.194	Upstream	1.963	40.20	12.51	568.58	476.35
rch20	1.194	Downstream	1.962	40.18	12.61	566.01	474.21
da5000	0.083		1.766		12.08	105.20	1267.44
OUTLET	1.277		1.949		12.58	584.63	457.96

STORM 10-Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		4.166		12.14	1166.59	2492.18
da2000	0.252		3.447		12.04	683.33	2712.71
rch19	0.720	Upstream	3.914	59.56	12.08	1772.72	2462.11
rch19	0.720	Downstream	3.908	57.74	12.12	1050.90	1459.59
da3000	0.187		3.447		12.10	446.83	2388.21

E-4

Riverdale
Wells Run - Option 1 - SWM for SW and SE

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
rch19a	0.907	Upstream	3.813	58.79	12.12	1490.92	1643.61
rch19a	0.907	Downstream	3.813	58.79	12.12	1490.56	1643.22
DA360	0.700E-03		3.282		11.93	3.03	4332.26
da300	0.009		4.151		11.93	34.15	3925.78
STR300	0.009	Upstream	4.151		11.93	34.15	3925.78
STR300	0.009	Downstream	4.145	71.60	12.10	10.56	1213.82
da325	0.002		2.585		11.93	6.15	2927.89
da350	0.001		3.168		11.98	3.54	3543.13
DA350SD	0.003		4.029		11.99	9.27	3433.86
rch300	0.015	Upstream	3.830	54.67	12.02	26.82	1849.70
rch300	0.015	Downstream	3.830	54.67	12.03	26.80	1848.23
rch19b	0.922	Upstream	3.813	58.85	12.10	1512.66	1640.10
rch19b	0.922	Downstream	3.804	57.75	12.15	1054.02	1142.82
rch119	0.922	Upstream	3.804	57.75	12.15	1054.02	1142.82
rch119	0.922	Downstream	3.804	57.75	12.15	1053.78	1142.56
da4000	0.252		3.748		12.13	598.67	2379.45
rch119a	1.174	Upstream	3.792	59.21	12.13	1645.49	1401.73
rch119a	1.174	Downstream	3.792	59.21	12.13	1645.10	1401.40
da200	0.020		4.163		11.93	77.34	3925.78
str200	0.020	Upstream	4.163		11.93	77.34	3925.78
str200	0.020	Downstream	4.053	52.93	12.11	21.16	1074.33
rch200	0.020	Upstream	4.053	48.71	12.11	21.16	1074.33
rch200	0.020	Downstream	4.026	48.70	12.15	21.15	1073.53
STR19	1.194	Upstream	3.796		12.13	1666.23	1395.97
STR19	1.194	Downstream	3.796	50.79	12.50	1023.44	857.44
rch20	1.194	Upstream	3.796	42.04	12.50	1023.44	857.44
rch20	1.194	Downstream	3.796	42.03	12.59	1021.40	855.73
da5000	0.083		3.546		12.08	209.22	2520.71
OUTLET	1.277		3.779		12.52	1059.64	830.05

STORM 100 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		6.216		12.13	1709.04	3651.01
da2000	0.252		5.406		12.04	1052.82	4179.52
rch19	0.720	Upstream	5.932	61.26	12.09	2637.24	3662.84
rch19	0.720	Downstream	5.927	59.22	12.10	1647.70	2288.47
da3000	0.187		5.406		12.09	691.71	3697.01
rch19a	0.907	Upstream	5.819	60.72	12.10	2334.53	2573.62
rch19a	0.907	Downstream	5.819	60.72	12.10	2334.02	2573.06
DA360	0.700E-03		5.231		11.92	4.25	6064.77
da300	0.009		6.205		11.93	49.78	5721.90
STR300	0.009	Upstream	6.205		11.93	49.78	5721.90
STR300	0.009	Downstream	6.199	74.41	12.07	21.61	2483.53
da325	0.002		4.736		11.93	9.92	4722.40
da350	0.001		5.187		11.98	5.13	5133.96
DA350SD	0.003		6.121		11.99	13.52	5005.58
rch300	0.015	Upstream	5.903	55.05	12.03	44.35	3058.32

E-5

Riverdale
Wells Run - Option 1 - SWM for SW and SE

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
rch300	0.015	Downstream	5.903	55.05	12.04	44.30	3055.46
rch19b	0.922	Upstream	5.820	60.79	12.10	2373.81	2573.79
rch19b	0.922	Downstream	5.809	59.38	12.12	1706.95	1850.75
rch119	0.922	Upstream	5.809	59.38	12.12	1706.95	1850.75
rch119	0.922	Downstream	5.809	59.38	12.12	1706.56	1850.33
da4000	0.252		5.751		12.12	902.10	3585.46
rch119a	1.174	Upstream	5.797	61.21	12.12	2608.15	2221.78
rch119a	1.174	Downstream	5.797	61.21	12.12	2607.60	2221.31
da200	0.020		6.213		11.93	112.72	5721.90
str200	0.020	Upstream	6.213		11.93	112.72	5721.90
str200	0.020	Downstream	6.105	54.50	12.14	23.85	1210.61
rch200	0.020	Upstream	6.105	48.79	12.14	23.85	1210.61
rch200	0.020	Downstream	6.076	48.79	12.17	23.80	1208.10
STR19	1.194	Upstream	5.801		12.12	2631.12	2204.36
STR19	1.194	Downstream	5.801	52.32	12.52	1351.55	1132.33
rch20	1.194	Upstream	5.801	43.09	12.52	1351.55	1132.33
rch20	1.194	Downstream	5.801	43.08	12.66	1346.18	1127.83
da5000	0.083		5.520		12.07	320.04	3855.93
OUTLET	1.277		5.783		12.59	1393.82	1091.82

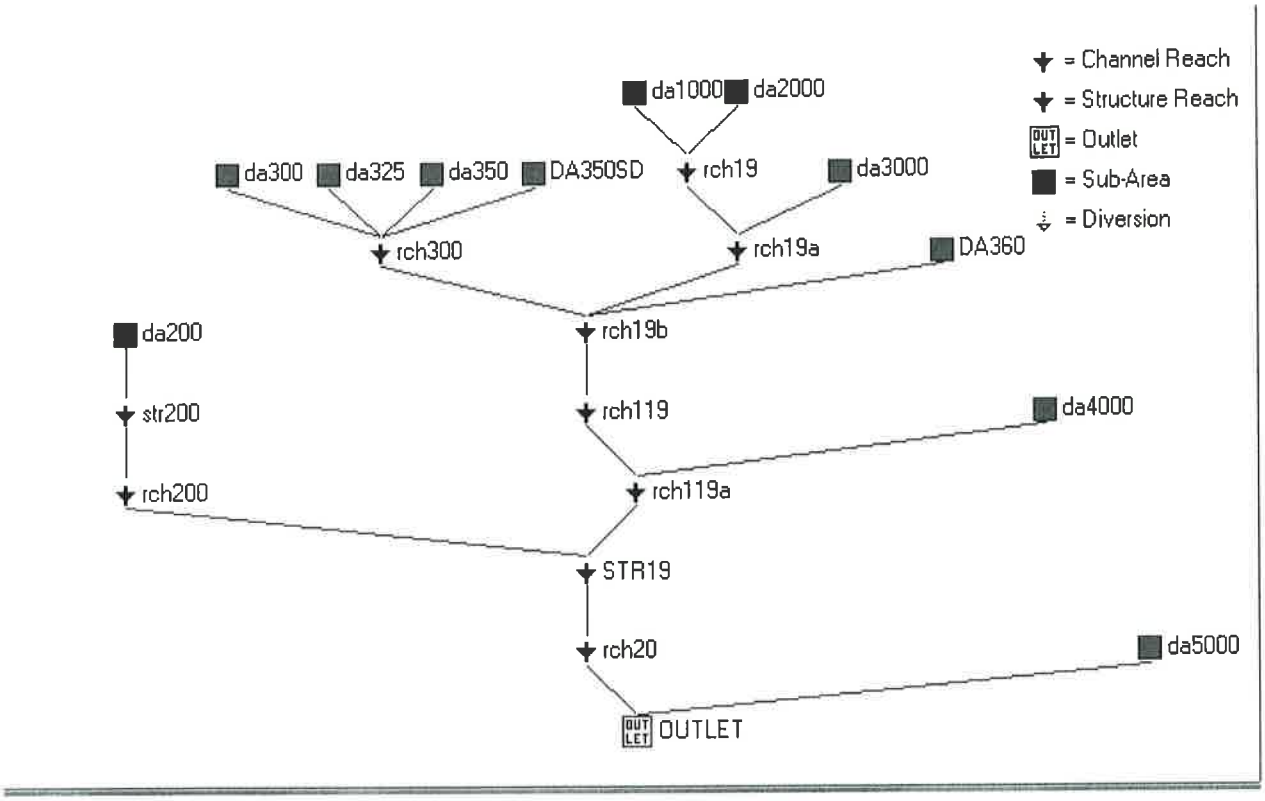
E-4

Riverdale
Wells Run - Option 1 - SWM for SW and SE

Area or Reach Identifier	Drainage Area (sq mi)	Alternate	Peak Flow by Storm 2-Year (cfs)	10-Year (cfs)	100 Year (cfs)	(cfs)	(cfs)
da1000	0.47		649.4	1166.6	1709.0		
da2000	0.25		339.1	683.3	1052.8		
da3000	0.19		220.7	446.8	691.7		
da4000	0.25		310.1	598.7	902.1		
da5000	0.08		105.2	209.2	320.0		
da300	0.870E-02		19.1	34.2	49.8		
da325	0.210E-02		2.8	6.1	9.9		
da350	0.100E-02		2.0	3.5	5.1		
DA360	0.700E-03		1.9	3.0	4.2		
DA350SD	0.270E-02		5.2	9.3	13.5		
da200	0.02		43.2	77.3	112.7		
rch19	0.72		945.9	1772.7	2637.2		
DOWNSTREAM			520.5	1050.9	1647.7		
STR19	1.19		790.2	1666.2	2631.1		
DOWNSTREAM			568.6	1023.4	1351.5		
rch119	0.92		496.3	1054.0	1706.9		
DOWNSTREAM			496.2	1053.8	1706.6		
rch20	1.19		568.6	1023.4	1351.5		
DOWNSTREAM			566.0	1021.4	1346.2		
rch300	0.01		15.9	26.8	44.3		
DOWNSTREAM			15.9	26.8	44.3		
STR300	0.870E-02		19.1	34.2	49.8		
DOWNSTREAM			6.5	10.6	21.6		
str200	0.02		43.2	77.3	112.7		
DOWNSTREAM			8.4	21.2	23.8		
rch200	0.02		8.4	21.2	23.8		
DOWNSTREAM			8.4	21.1	23.8		
rch19a	0.91		721.9	1490.9	2334.5		
DOWNSTREAM			721.7	1490.6	2334.0		
rch119a	1.17		782.0	1645.5	2608.1		
DOWNSTREAM			781.8	1645.1	2607.6		
rch19b	0.92		733.3	1512.7	2373.8		
DOWNSTREAM			496.3	1054.0	1706.9		
OUTLET	1.28		584.6	1059.6	1393.8		

E-7

APPENDIX F
(Onsite SWM for SE Only (Option 2) – TR-20)


= Channel Reach
= Structure Reach
= Outlet
= Sub-Area
= Diversion
da1000
da2000
da300
da325
da350
DA350SD
rch19
da3000
rch300
rch19a
DA360
da200
rch19b
str200
rch119
da4000
rch200
rch119a
STR19
rch20
da5000
OUTLET

OPTION 2

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WinTR-20: Version 1.0                    0          0          0.1        0
Riverdale
Wells Run - Option 2 - No SWM for SW and SWM for SE

SUB-AREA:
          da1000    rch19                0.4681     90.        0.43
          da2000    rch19                0.2519     83.        0.25
          da3000    rch19a               0.1871     83.        0.34
          da4000    rch119a              0.2516     86.        0.40
          da5000    outlet               0.0830     84.        .32
          da300     rch300               .0087      90.        .10
          da325     rch300               .0021      78.        .1
          da350     rch300               .001       91.        .177
          DA360     rch19b               .0007      98.        .1
          DA350SD   rch300               .0027      90.        .187
          da200     str200               0.0197     90.        .10

STREAM REACH:
          rch19     rch19a    rch19                2169.
          STR19     rch20               csx
          rch119    rch119a   rch19                1.
          rch20     outlet    rch814               2275.
          rch300    rch19b    rch300               450.
          str200    rch200              swm200
          rch200    STR19     rch200               650.
          rch119a   STR19     rch19                1.
          rch19a    rch19b    rch19                1.
          rch19b    rch119    rch19                1529.


STORM ANALYSIS:
          2-Year                         3.3        Type II    2          3.3
          10-Year                        5.3        Type II    2          3.3
          100 Year                       7.4        Type II    2          3.3

STREAM CROSS SECTION:
          rch19     56.5                 49.3
                    49.3      0.         0.         0.         .00125
                    54.1      100.       65.        15.
                    56.9      593.       427.       100.
                    57.       626.       444.       110.
                    58.       1198.      710.       150.
                    60.       1936.      1404.      200.
                    63.       3600.      2470.      300.
          rch814    41.8                 35.4
                    35.4      0.         0.         0.         .0027
                    37.96     200.       40.        21.
                    39.33     400.       72.        26.
                    40.36     600.       100.       29.
                    41.21     800.       127.       32.
                    41.95     1000.      161.       70.
                    42.69     1200.      227.       109.
                    43.22     1400.      293.       136.
                    43.87     1600.      393.       166.
```

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                44.       1700.     420.      180.
        RCH300  55.5                54.
                54.       0.        0.        0.        .01
                55.       40.       8.        5.
                55.5      80.       10.       8.
        rch200  50.                 48.
                48.       0.        0.        0.        .005
                49.       30.       5.        3.
                50.       110.      20.       10.

STRUCTURE RATING:
        swm200  48.1
                48.1      0.        0.
                49.8      .5        .52
                50.       .94       .59
                51.       5.92      1.04
                52.       14.8      1.54
                52.4      17.9      1.76
                52.8      21.0      1.98
                54.4      23.1      2.94
                54.7      25.3      3.13
                55.       27.       3.34
        CSX     39.4
                39.4      0.        0.
                48.77     200.      17.17
                48.99     400.      18.84
                49.27     550.      21.40
                49.94     800.      30.50
                50.68     1000.     40.55
                51.61     1200.     55.59
                52.36     1360.     70.20
                52.70     1400.     76.82


GLOBAL OUTPUT:
        1       0.5       0.1       YNNNN     YNNNNN
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F-3

Riverdale
Wells Run - Option 2 - No SWM for SW and SWM for SE

Name of printed page file:
P:\24110100\HYD\Final\SWM\Wells Run Floodplain Model\County\CSX4AT.out

STORM 2-Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		2.261		12.14	649.42	1387.34
da2000	0.252		1.692		12.05	339.12	1346.24
rch19	0.720	Upstream	2.062	57.56	12.10	945.86	1313.69
rch19	0.720	Downstream	2.057	56.49	12.19	520.54	722.97
da3000	0.187		1.691		12.09	220.74	1179.82
rch19a	0.907	Upstream	1.982	57.17	12.14	721.93	795.87
rch19a	0.907	Downstream	1.982	57.17	12.14	721.73	795.64
DA360	0.700E-03		1.728		11.92	1.87	2677.35
da300	0.009		2.238		11.93	19.09	2194.37
da325	0.002		0.940		11.94	2.76	1315.29
da350	0.001		1.494		11.98	2.01	2008.55
DA350SD	0.003		1.907		12.00	5.18	1919.05
rch300	0.015	Upstream	1.937	54.71	11.94	28.26	1948.91
rch300	0.015	Downstream	1.937	54.71	11.95	28.21	1945.73
rch19b	0.922	Upstream	1.981	57.18	12.13	731.61	793.25
rch19b	0.922	Downstream	1.970	56.35	12.27	496.41	538.24
rch119	0.922	Upstream	1.970	56.35	12.27	496.41	538.24
rch119	0.922	Downstream	1.970	56.35	12.27	496.30	538.12
da4000	0.252		1.922		12.14	310.05	1232.33
rch119a	1.174	Upstream	1.960	57.28	12.16	783.39	667.34
rch119a	1.174	Downstream	1.960	57.27	12.16	783.18	667.16
da200	0.020		2.256		11.93	43.23	2194.37
str200	0.020	Upstream	2.256		11.93	43.23	2194.37
str200	0.020	Downstream	2.147	51.28	12.15	8.44	428.58
rch200	0.020	Upstream	2.147	48.28	12.15	8.44	428.58
rch200	0.020	Downstream	2.131	48.28	12.19	8.42	427.41
STR19	1.194	Upstream	1.963		12.16	791.57	663.18
STR19	1.194	Downstream	1.963	49.32	12.51	569.17	476.85
rch20	1.194	Upstream	1.963	40.20	12.51	569.17	476.85
rch20	1.194	Downstream	1.962	40.19	12.61	566.58	474.68
da5000	0.083		1.766		12.08	105.20	1267.44
OUTLET	1.277		1.949		12.57	585.38	458.54

STORM 10-Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		4.166		12.14	1166.59	2492.18
da2000	0.252		3.447		12.04	683.33	2712.71
rch19	0.720	Upstream	3.914	59.56	12.08	1772.72	2462.11
rch19	0.720	Downstream	3.908	57.74	12.12	1050.90	1459.59
da3000	0.187		3.447		12.10	446.83	2388.21
rch19a	0.907	Upstream	3.813	58.79	12.12	1490.92	1643.61
rch19a	0.907	Downstream	3.813	58.79	12.12	1490.56	1643.22

F-4

Riverdale
Wells Run - Option 2 - No SWM for SW and SWM for SE

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA360	0.700E-03		3.282		11.93	3.03	4332.26
da300	0.009		4.151		11.93	34.15	3925.78
da325	0.002		2.585		11.93	6.15	2927.89
da350	0.001		3.168		11.98	3.54	3543.13
DA350SD	0.003		4.029		11.99	9.27	3433.86
rch300	0.015	Upstream	3.834	55.15	11.93	51.81	3572.78
rch300	0.015	Downstream	3.833	55.15	11.95	51.75	3569.24
rch19b	0.922	Upstream	3.813	58.85	12.10	1513.31	1640.80
rch19b	0.922	Downstream	3.804	57.75	12.15	1056.71	1145.73
rch119	0.922	Upstream	3.804	57.75	12.15	1056.71	1145.73
rch119	0.922	Downstream	3.804	57.75	12.15	1056.47	1145.47
da4000	0.252		3.748		12.13	598.67	2379.45
rch119a	1.174	Upstream	3.792	59.22	12.13	1649.09	1404.80
rch119a	1.174	Downstream	3.792	59.22	12.13	1648.70	1404.47
da200	0.020		4.163		11.93	77.34	3925.78
str200	0.020	Upstream	4.163		11.93	77.34	3925.78
str200	0.020	Downstream	4.053	52.93	12.11	21.16	1074.33
rch200	0.020	Upstream	4.053	48.71	12.11	21.16	1074.33
rch200	0.020	Downstream	4.026	48.70	12.15	21.15	1073.53
STR19	1.194	Upstream	3.796		12.13	1669.84	1398.99
STR19	1.194	Downstream	3.796	50.80	12.49	1025.25	858.96
rch20	1.194	Upstream	3.796	42.04	12.49	1025.25	858.96
rch20	1.194	Downstream	3.796	42.04	12.59	1023.20	857.24
da5000	0.083		3.546		12.08	209.22	2520.71
OUTLET	1.277		3.779		12.52	1061.69	831.66

STORM 100 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
da1000	0.468		6.216		12.13	1709.04	3651.01
da2000	0.252		5.406		12.04	1052.82	4179.52
rch19	0.720	Upstream	5.932	61.26	12.09	2637.24	3662.84
rch19	0.720	Downstream	5.927	59.22	12.10	1647.70	2288.47
da3000	0.187		5.406		12.09	691.71	3697.01
rch19a	0.907	Upstream	5.819	60.72	12.10	2334.53	2573.62
rch19a	0.907	Downstream	5.819	60.72	12.10	2334.02	2573.06
DA360	0.700E-03		5.231		11.92	4.25	6064.77
da300	0.009		6.205		11.93	49.78	5721.90
da325	0.002		4.736		11.93	9.92	4722.40
da350	0.001		5.187		11.98	5.13	5133.96
DA350SD	0.003		6.121		11.99	13.52	5005.58
rch300	0.015	Upstream	5.906	55.46	11.94	76.52	5277.08
rch300	0.015	Downstream	5.905	55.46	11.94	76.47	5273.54
rch19b	0.922	Upstream	5.820	60.78	12.10	2368.54	2568.08
rch19b	0.922	Downstream	5.809	59.38	12.11	1706.08	1849.81
rch119	0.922	Upstream	5.809	59.38	12.11	1706.08	1849.81
rch119	0.922	Downstream	5.809	59.38	12.11	1705.69	1849.39
da4000	0.252		5.751		12.12	902.10	3585.46

F-5

Riverdale
Wells Run - Option 2 - No SWM for SW and SWM for SE

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
rch119a	1.174	Upstream	5.797	61.21	12.12	2607.26	2221.02
rch119a	1.174	Downstream	5.797	61.21	12.12	2606.72	2220.57
da200	0.020		6.213		11.93	112.72	5721.90
str200	0.020	Upstream	6.213		11.93	112.72	5721.90
str200	0.020	Downstream	6.105	54.50	12.14	23.85	1210.61
rch200	0.020	Upstream	6.105	48.79	12.14	23.85	1210.61
rch200	0.020	Downstream	6.076	48.79	12.17	23.80	1208.10
STR19	1.194	Upstream	5.801		12.12	2630.25	2203.62
STR19	1.194	Downstream	5.801	52.33	12.52	1353.55	1134.01
rch20	1.194	Upstream	5.801	43.10	12.52	1353.55	1134.01
rch20	1.194	Downstream	5.801	43.08	12.66	1348.12	1129.45
da5000	0.083		5.520		12.07	320.04	3855.93
OUTLET	1.277		5.783		12.59	1396.04	1093.56

F-6

Riverdale

Wells Run - Option 2 - No SWM for SW and SWM for SE

Area or Reach Identifier	Drainage Area (sq mi)	Alternate	Peak Flow by Storm 2-Year (cfs)	10-Year (cfs)	100 Year (cfs)	(cfs)	(cfs)
da1000	0.47		649.4	1166.6	1709.0		
da2000	0.25		339.1	683.3	1052.8		
da3000	0.19		220.7	446.8	691.7		
da4000	0.25		310.1	598.7	902.1		
da5000	0.08		105.2	209.2	320.0		
da300	0.870E-02		19.1	34.2	49.8		
da325	0.210E-02		2.8	6.1	9.9		
da350	0.100E-02		2.0	3.5	5.1		
DA360	0.700E-03		1.9	3.0	4.2		
DA350SD	0.270E-02		5.2	9.3	13.5		
da200	0.02		43.2	77.3	112.7		
rch19	0.72		945.9	1772.7	2637.2		
DOWNSTREAM			520.5	1050.9	1647.7		
STR19	1.19		791.6	1669.8	2630.2		
DOWNSTREAM			569.2	1025.3	1353.6		
rch119	0.92		496.4	1056.7	1706.1		
DOWNSTREAM			496.3	1056.5	1705.7		
rch20	1.19		569.2	1025.3	1353.6		
DOWNSTREAM			566.6	1023.2	1348.1		
rch300	0.01		28.3	51.8	76.5		
DOWNSTREAM			28.2	51.8	76.5		
str200	0.02		43.2	77.3	112.7		
DOWNSTREAM			8.4	21.2	23.8		
rch200	0.02		8.4	21.2	23.8		
DOWNSTREAM			8.4	21.1	23.8		
rch119a	1.17		783.4	1649.1	2607.3		
DOWNSTREAM			783.2	1648.7	2606.7		
rch19a	0.91		721.9	1490.9	2334.5		
DOWNSTREAM			721.7	1490.6	2334.0		
rch19b	0.92		731.6	1513.3	2368.5		
DOWNSTREAM			496.4	1056.7	1706.1		
OUTLET	1.28		585.4	1061.7	1396.0		

F-7

APPENDIX G
(HECRAS Model Input and Cross Sections)

HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

****

PROJECT DATA
Project Title: WellsRun
Project File : WellsRun.prj
Run Date and Time: 2/23/2015 1:50:46 PM

Project in English units

Project Description:
Wells Run - Anacostia River Watershed

****

PLAN DATA

Plan Title: 100-year
Plan File : p:\24110100\HYD\Final\SWM\Wells Run Floodplain Model\WellsRun.p28

Geometry Title: WellsRun_1-15-15_final
Geometry File : p:\24110100\HYD\Final\SWM\Wells Run Floodplain Model\WellsRun.g10

Flow Title : WellsRun_1-13-14-pre/noswm
Flow File : p:\24110100\HYD\Final\SWM\Wells Run Floodplain Model\WellsRun.f23

Plan Summary Information:
Number of: Cross Sections = 30 Multiple Openings = 0
Culverts = 6 Inline Structures = 0
Bridges = 1 Lateral Structures = 0

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

Computation Options

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

****

FLOW DATA

Flow Title: WellsRun_1-13-14-pre/noswm
Flow File : p:\24110100\HYD\Final\SWM\Wells Run Floodplain Model\WellsRun.f23

Flow Data (cfs)

River	Reach	RS	Base	Opt 1	Opt 2
Wells Run	Wells Run	834.2	2347	2347	2347
Wells Run	Wells Run	831.5	2347	2347	2347
Wells Run	Wells Run	828	2386	2386	2381
Wells Run	Wells Run	826.1	2658	2640	2639
Wells Run	Wells Run	822	1341	1341	1342
Wells Run	Wells Run	816.5	2053	2053	2053

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Wells Run	Wells Run	Base	Normal S = 0.005	Known WS = 44.83
Wells Run	Wells Run	Opt 1	Normal S = 0.005	Known WS = 44.83
Wells Run	Wells Run	Opt 2	Normal S = 0.005	Known WS = 44.83

****

GEOMETRY DATA

Geometry Title: WellsRun_1-15-15_final
Geometry File : p:\24110100\HYD\Final\SWM\Wells Run Floodplain Model\WellsRun.g10

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 834.2

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
219	62	263	60	300	58	430	56	506	54
515	52	523	50	527	48.8	537	48.8	543	50
550	56	650	58	673	60	738	62		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
219	.08	506	.04	550	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
506	550	90	90	90	.1	.3

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 834

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
210	64.3	235	62.8	260	62.7	275	62.8	305	62.3
350	60.3	405	59.3	450	58.3	518	57.3	595.8	56.3
600	56	601.7	54.3	603.7	52.3	605.7	50.3	606.5	49.5
613	48.7	618.1	48.7	626.9	48.7	632	48.7	638.5	49.5
639.3	50.3	641.3	52.3	643.3	54.3	645	56	653.1	56.3
680	57.3	730	58.3	770	60.3	815	62.3	900	63.3
950	64.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
210	.08	600	.04	645	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
600	645	37	37	37	.1	.3

CULVERT

RIVER: Wells Run
REACH: Wells Run RS: 833.3

INPUT
Description: Twin 9x5 Box with Twin 54" RCP
Distance from Upstream XS = 1
Deck/Roadway Width = 35
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 31

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
210	64.3	64.3	235	62.8	62.8	260	62.7	62.7
275	62.8	62.8	305	62.3	62.3	350	60.3	60.3
405	59.3	59.3	450	58.3	58.3	518	57.3	57.3
595.8	56.3	56.3	600	56	56	601.7	56	54.3
603.7	56	52.3	605.7	56	50.3	606.5	56	49.5
613	56	48.7	618.1	56	48.7	626.9	56.4	48.7
632	56.4	48.7	638.5	56.5	49.5	639.3	56.5	50.3

641.3	56.5	52.3	643.3	56	54.3	645	56.1	56
653.1	56.5	56.3	680	57.3	57.3	730	58.3	58.3
770	60.3	60.3	815	62.3	62.3	900	63.3	63.3
950	64.3	64.3						

Upstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
210	64.3	235	62.8	260	62.7	275	62.8	305	62.3
350	60.3	405	59.3	450	58.3	518	57.3	595.8	56.3
600	56	601.7	54.3	603.7	52.3	605.7	50.3	606.5	49.5
613	48.7	618.1	48.7	626.9	48.7	632	48.7	638.5	49.5
639.3	50.3	641.3	52.3	643.3	54.3	645	56	653.1	56.3
680	57.3	730	58.3	770	60.3	815	62.3	900	63.3
950	64.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
210	.08	600	.04	645	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
600	645	.1	.3

Downstream Deck/Roadway Coordinates
num= 31

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
210	64	64	235	62.5	62.5	260	62.4	62.4
275	62.5	62.5	305	62	62	350	60	60
405	59	59	450	58	58	518	57	57
595.8	56	56	600	56	55.7	601.7	56	54
603.7	56	52	605.7	56	50	606.5	56	49.2
613	56	48.4	618.1	56	48.4	626.9	56.4	48.4
632	56.4	48.4	638.5	56.5	49.2	639.3	56.5	50
641.3	56.5	52	643.3	56	54	645	56.1	55.7
653.1	56.5	56	680	57	57	730	58	58
770	60	60	815	62	62	900	63	63
950	64	64						

Downstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
210	64	235	62.5	260	62.4	275	62.5	305	62
350	60	405	59	450	58	518	57	595.8	56
600	55.7	601.7	54	603.7	52	605.7	50	606.5	49.2
613	48.4	618.1	48.4	626.9	48.4	632	48.4	638.5	49.2
639.3	50	641.3	52	643.3	54	645	55.7	653.1	56
680	57	730	58	770	60	815	62	900	63
950	64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

210 .08 600 .04 645 .08

Bank Sta: Left Right Coeff Contr. Expan.
600 645 .1 .3

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
Downstream Embankment side slope = 1 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 = 2

Culvert Name Shape Rise Span
Culvert #2 Circular 4.5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	1	35	.013	.013	0	.2	1

Number of Barrels = 2
Upstream Elevation = 49.4
Centerline Stations

Sta.	Sta.
609.5	636.5

Downstream Elevation = 49.25
Centerline Stations

Sta.	Sta.
609.5	636.5

Culvert Name Shape Rise Span
Culvert #1 Box 5 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	35	.013	.013	0	.4	1

Number of Barrels = 2
Upstream Elevation = 48.7
Centerline Stations

Sta.	Sta.
618	628

Downstream Elevation = 48.55
Centerline Stations

Sta.	Sta.
618	628

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 833.2

INPUT

Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
210	64	235	62.5	260	62.4	275	62.5	305	62
350	60	405	59	450	58	518	57	595.8	56
600	55.7	601.7	54	603.7	52	605.7	50	606.5	49.2
613	48.4	618.1	48.4	626.9	48.4	632	48.4	638.5	49.2
639.3	50	641.3	52	643.3	54	645	55.7	653.1	56
680	57	730	58	770	60	815	62	900	63
950	64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
210	.08	600	.04	645	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
600	645	1	1	1	.1	.3

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 832.0

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
240	62	255	62	310	61	345	60	430	58
500	57	555	56.3	565	56.2	575	56.3	580	56
585	54	586	52	588	50	601	48.4	610	48.4
615	50	618	52	620	54	621	56	627	56.6
635	56.5	645	56.6	670	57	710	58	750	60
810	61	865	62						

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
240	.18	500	.07	565	.03	610	.04	627	.03
670	.07	710	.18						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
580	621	40	40	40	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 831.5

INPUT
Description:
Station Elevation Data num= 45

G

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68.2	10	66.2	30	65.4	40	65.2	50	65.4
85	64.2	150	62.2	175	60.2	200	58.2	280	57.2
308	57.2	309	80.2	325	80.2	339	80.2	340	56.7
370	56.2	391	55.4	405	55.3	415	55.4	418	54.2
425	52.2	428	50.2	431	48.3	441	48.3	445	50.2
450	52.2	455	54.2	465	55.6	475	55.5	481	55.6
488	56.2	520	57.2	542	58	543	80.2	555	80.2
569	80.2	570	58.4	600	59.2	640	60.1	690	62.2
791	63.9	805	63.8	815	63.9	840	64.1	970	68.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.18	340	.07	391	.03	415	.015	465	.03
488	.07	543	.18						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
415	465	110	110	110	.1	.3

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 831

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68.1	10	66.1	30	65.3	40	65.1	50	65.3
85	64.1	150	62.1	175	60.1	200	58.1	280	57.1
308	57.1	309	80.1	325	80.1	339	80.1	340	56.6
370	56.1	391	55.3	405	55.2	415	55.3	418	54.1
425	52.1	428	50.1	431	48.2	441	48.2	445	50.1
450	52.1	455	54.1	465	55.5	475	55.4	481	55.5
488	56.1	520	57.1	542	57.9	543	80.1	555	80.1
569	80.1	570	58.3	600	59.1	640	60	690	62.1
791	63.8	805	63.7	815	63.8	840	64	970	68.1

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.18	340	.07	391	.03	415	.015	465	.03
488	.07	543	.18						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
415	465	115	115	115	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 830.5

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68	10	66	30	65.2	40	65	50	65.2
85	64	150	62	175	60	200	58	280	57
308	57	309	80	325	80	339	80	340	56.5
370	56	391	55.2	405	55.1	415	55.2	418	54
425	52	428	50	431	48.1	441	48.1	445	50
450	52	455	54	465	55.4	475	55.3	481	55.4
488	56	520	57	542	57.8	543	80	555	80
569	80	570	58.2	600	59	640	59.9	690	62
791	63.7	805	63.6	815	63.7	840	63.9	970	68

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.18	340	.07	391	.03	415	.015	465	.03
488	.07	543	.18						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
415	465	75	110	140	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 830

INPUT
Description:
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	20	68	50	66	55	65.3	65	65.3
75	65.2	130	64	180	62	255	61	300	60
355	59	400	58	470	56	490	54	500	54.1
505	54	520	48	521	47.8	539	47.8	540	48
545	50	560	56.2	570	56.1	575	56.2	640	58
700	59	740	60	790	61	820	62	840	62.3
851	62.2	860	62.3	870	64	920	65	950	66
1005	68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	505	.02	545	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
505	545	70	70	70	.3	.5

CULVERT

RIVER: Wells Run
REACH: Wells Run RS: 829

INPUT
Description: 18x9 Culvert under Baltimore Ave
Distance from Upstream XS = 4
Deck/Roadway Width = 65
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 36

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	70		20	68		50	66	
55	65.3		65	65.3		75	65.2	
130	64		180	62		255	61	
300	60.6		355	59.8		400	59.3	
470	58.7		490	58.6		500	58.5	
505	58.4		520	58.2		521	58.2	
539	58.1		540	58.2		545	58.2	
560	58.5		570	58.7		575	58.8	
640	59.2		700	59.9		740	60.5	
790	61		820	62		840	62.3	
851	62.2		860	62.3		870	64	
920	65		950	66		1005	68	

Upstream Bridge Cross Section Data
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	20	68	50	66	55	65.3	65	65.3
75	65.2	130	64	180	62	255	61	300	60
355	59	400	58	470	56	490	54	500	54.1
505	54	520	48	521	47.8	539	47.8	540	48
545	50	560	56.2	570	56.1	575	56.2	640	58
700	59	740	60	790	61	820	62	840	62.3
851	62.2	860	62.3	870	64	920	65	950	66
1005	68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	505	.02	545	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
505	545	.3	.5

Downstream Deck/Roadway Coordinates
num= 36

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	70		20	68		50	66	
55	65.3		65	65.3		75	65.2	
130	64		180	62		255	61	
300	60.6		355	59.8		400	59.3	
470	58.7		490	58.6		500	58.5	
505	58.4		520	58.2		521	58.2	

539	58.1	540	58.2	545	58.2
560	58.5	570	58.7	575	58.8
640	59.2	700	59.9	740	60.5
790	61	820	62	840	62.3
851	62.2	860	62.3	870	64
920	65	950	66	1005	68

Downstream Bridge Cross Section Data
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	50	68	90	66	130	64	140	62.5
160	62	170	61.9	220	60.3	230	60.5	240	60.3
300	60	335	59.8	345	59.8	355	59.7	435	58.3
445	58.2	455	58.3	480	58	530	56	540	54
547	46.4	565	46.4	567	54	570	54	580	54
585	56	680	58	735	59.1	745	59	760	59.1
790	60	835	62	880	64	915	65	940	66
995	68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	540	.02	567	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
540	567	.3	.5

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

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Baltimore Av	Box	9	18

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
	4	65	.015	.015	0	.4	.3

Upstream Elevation = 47.8
Centerline Station = 530
Downstream Elevation = 46.4
Centerline Station = 556

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 828

INPUT
Description:
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	50	68	90	66	130	64	140	62.5
160	62	170	61.9	220	60.3	230	60.5	240	60.3
300	60	335	59.8	345	59.8	355	59.7	435	58.3
445	58.2	455	58.3	480	58	530	56	540	54
547	46.4	565	46.4	567	54	570	54	580	54
585	56	680	58	735	59.1	745	59	760	59.1
790	60	835	62	880	64	915	65	940	66
995	68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	540	.02	567	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
540	567	80	80	80	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 827.7

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
49	80	50	57	65	56	80	52	80	46.2
98	46.2	98	52	130	54	170	53.5	171	80
200	80	222	80	223	55	270	56	295	58
360	60								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
49	.05	80	.02	98	.11

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
80	98	260	250	250	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 827

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
*********************************************************************************
   179   59.5   180    80   310    80   311   58.4   360    58
   370    56   375    54   381    52   381   46.2   399   46.2
   399    51   480   52.3  481    80   490    80   500    80
   519    80   520   52.4  550   52.2  570    53   605    53
   624    54   643    56   665    58   712    60   770    62
   800    64

Manning's n Values      num=     3
   Sta  n Val   Sta  n Val   Sta  n Val
************************************************
   179   .05   381   .02   399  .011

Bank Sta: Left  Right   Lengths: Left Channel  Right    Coeff Contr.  Expan.
        381    399          100    80    60          .1      .3

CROSS SECTION


RIVER: Wells Run
REACH: Wells Run        RS: 826.5

INPUT
Description:
Station Elevation Data    num=     20
   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev
*********************************************************************************
  1000    60   1030    58   1040    56   1056    54   1092    52
  1105   50.8  1105.1  45.8  1122.9  45.8  1123   50.8  1169    52
  1185   52.5  1186    80   1240    80   1241   52.5  1280   52.2
  1312   52.2  1350    54   1372    56   1384    58   1439    60

Manning's n Values      num=     3
   Sta  n Val   Sta  n Val   Sta  n Val
************************************************
  1000   .08   1105   .02   1123   .1

Bank Sta: Left  Right   Lengths: Left Channel  Right    Coeff Contr.  Expan.
       1105   1123          130    110    80          .6      .8

CROSS SECTION


RIVER: Wells Run
REACH: Wells Run        RS: 826.1

INPUT
Description:
Station Elevation Data    num=     17
   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev
*********************************************************************************
     0    60     8    58    50    56   110    54   115    52
   283    51   283.1  45.4  287   45.3  287.1  45.3  295.9  45.3
   296   45.3  301    45.4  301.1  51   390    52   450    54
   495    56   560    60
```

G

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	283	.02	301.1	.1

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

283	301.1	72	82	102	.6	.8

CULVERT

RIVER: Wells Run
REACH: Wells Run RS: 826

INPUT
Description: Twin 9x5 culvert under Tuckerman Ave
Distance from Upstream XS = 1
Deck/Roadway Width = 80
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 17

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	60		8	58		50	56	
110	54		115	52		283	51.6	
283.1	51.6		287	51.6		287.1	51.6	
295.9	51.6		296	51.6		301	51.6	
301.1	51.6		390	52		450	54	
495	56		560	60				

Upstream Bridge Cross Section Data
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	60	8	58	50	56	110	54	115	52
283	51	283.1	45.4	287	45.3	287.1	45.3	295.9	45.3
296	45.3	301	45.4	301.1	51	390	52	450	54
495	56	560	60						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	283	.02	301.1	.1

Bank Sta: Left Right Coeff Contr. Expan.

283	301.1	.6	.8

Downstream Deck/Roadway Coordinates
num= 14

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1000	80		1001	56		1050	54	
1102	52		1220	51.7		1242	51.6	
1243	51.6		1250	51.6		1251	51.6	
1320	52.1		1368	54		1430	56	
1460	58		1490	60				

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	80	1001	56	1050	54	1102	52	1220	51.7
1242	50.3	1243	45.3	1250	45.3	1251	50.3	1320	52
1368	54	1430	56	1460	58	1490	60		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.055	1242	.02	1251	.065

Bank Sta: Left	Right	Coeff Contr.	Expan.
1242	1251	.6	.8

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 = 1

Culvert Name	Shape	Rise	Span
Tuckerman Av	Box	5	9

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 3 - Wingwall flared 0 deg. (sides extended straight)
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	1	80	.015	.015	0	.2	.3

Number of Barrels = 2
Upstream Elevation = 45.3
Centerline Stations

Sta.	Sta.
287.3	296.8

Downstream Elevation = 45.3
Centerline Stations

Sta.	Sta.
1241.75	1251.25

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 825.8

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	80	1001	56	1050	54	1102	52	1220	51.7

1242	50.3	1243	45.3	1250	45.3	1251	50.3	1320	52
1368	54	1430	56	1460	58	1490	60		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.055	1242	.02	1251	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1242	1251	90	90	90	.6	.8

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 825.5

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	80	1040	80	1041	56	1080	54	1165	52
1180	51.5	1181	80	1215	80	1216	51.2	1258.5	50.6
1260	44.6	1275	44.6	1276.5	50.6	1342	51.8	1354	52
1404	54	1438	55	1439	80	1470	80	1471	57
1495	58	1560	60						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.055	1258.5	.02	1276.5	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1258.5	1276.5	95	95	95	.6	.8

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 825

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	60	12	58	32	56	60	54	158	53
213	52	290	51	336.9	50.2	337	43.9	356	43.9
356.1	50.2	385	51	478	52	536	56	571	58
621	60								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.18	290	.07	336.9	.02	356	.07	385	.18

G

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
290	385	153	153	153	.6	.8

CULVERT

RIVER: Wells Run
REACH: Wells Run RS: 824.2

INPUT
Description: Twin 9x5 Culvert Under 46th Ave
Distance from Upstream XS = 1
Deck/Roadway Width = 151
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 14

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	60		12	58		32	56	
60	54		158	53		213	52	
290	51		336.9	50.2		356.1	50.2	
385	51		478	52		536	56	
571	58		621	60				

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	60	12	58	32	56	60	54	158	53
213	52	290	51	336.9	50.2	337	43.9	356	43.9
356.1	50.2	385	51	478	52	536	56	571	58
621	60								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.18	290	.07	336.9	.02	356	.07	385	.18

Bank Sta: Left	Right	Coeff Contr.	Expan.
290	385	.6	.8

Downstream Deck/Roadway Coordinates
num= 15

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1000	60		1070	56		1076	54	
1190	52		1350	52		1380	51	
1416	50.2		1430	50.2		1431	50.2	
1450	50.2		1451	50.2		1540	50.2	
1600	52		1639	54		1700	56	

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

1000	60	1070	56	1076	54	1190	52	1350	52
1380	51	1416	50	1430	49.4	1431	43.9	1450	43.9
1451	49.4	1540	50	1600	52	1639	54	1700	56

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1000	.18	1380	.08	1430	.02	1451	.07	1540	.18

Bank Sta: Left Right Coeff Contr. Expan.
1430 1451 .6 .8

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 = 1

Culvert Name Shape Rise Span
Culvert #1 Box 5 9
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 3 - Wingwall flared 0 deg. (sides extended straight)
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	1	151	.015	.015	0	.2	.3

Number of Barrels = 2
Upstream Elevation = 43.9
Centerline Stations
Sta. Sta.
341.75 351.25
Downstream Elevation = 43.9
Centerline Stations
Sta. Sta.
1436.25 1445.75

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 824

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	60	1070	56	1076	54	1190	52	1350	52
1380	51	1416	50	1430	49.4	1431	43.9	1450	43.9
1451	49.4	1540	50	1600	52	1639	54	1700	56

Manning's n Values num= 5

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

****

1000	.18	1380	.08	1430	.02	1451	.07	1540	.18

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1430	1451	95	95	95	.6	.8

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 823.5

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	60	1018	58	1070	56	1079	54	1159	52.5
1160	80	1192	80	1193	52	1235	50	1330	50
1472	50	1526	49.1	1535	43.2	1545	43.2	1554	49.2
1690	50	1763	52	1853	54	1910	56		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1000	.18	1235	.08	1330	.03	1526	.02	1554	.08
1690	.18								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1526	1554	110	170	200	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
1000	1472	54	F
1690	1910	54	F

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 823

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	60	40	58	82	56	91	54	160	52
220	50	281	49.9	375	49.7	500	49	581	48
610	47.9	619	41.9	633	41.9	642	47.9	665	48.4
685	48.8	695	49	710	49.2	730	50	735	55
736	80	780	80	781	55	810	56	925	60
1210	62								

Manning's n Values num= 6

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

****

```
    0    .18    220    .08    375    .03    610    .02    642    .03
  735    .18

Bank Sta: Left   Right    Lengths: Left Channel   Right    Coeff Contr.   Expan.
        610    642            140    175    195          .3      .5
Ineffective Flow     num=      2
  Sta L   Sta R    Elev  Permanent
    0    581      54      F
  685   1210      54      F

CROSS SECTION


RIVER: Wells Run
REACH: Wells Run         RS: 822

INPUT
Description:
Station Elevation Data    num=      28
   Sta    Elev    Sta    Elev    Sta    Elev    Sta    Elev    Sta    Elev
**********************************************************************************
    0     60     80     58    105     56    144     54    205     52
  305     50    435     49    508   48.5    590     48    710     47
  720     41    721   40.8    744   40.8    750     49    756     50
  765     52    777     54    794     55    815     56    845   56.7
  910     58    916     60    975     62   1060   62.3   1095   62.3
 1225   62.3   1256     62   1290     60

Manning's n Values       num=      3
   Sta   n Val    Sta   n Val    Sta   n Val
**************************************************
    0    .11    710    .02    750   .055

Bank Sta: Left   Right    Lengths: Left Channel   Right    Coeff Contr.   Expan.
        710    750             65     65     65          .6      .8
Ineffective Flow     num=      1
  Sta L   Sta R    Elev  Permanent
    0    710      54      F

CULVERT


RIVER: Wells Run
REACH: Wells Run         RS: 821.5

INPUT
Description:
Distance from Upstream XS =      27
Deck/Roadway Width       =      20
Weir Coefficient         =     2.6
Upstream  Deck/Roadway Coordinates
   num=      2
   Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************
    0     55            900     55
```

Upstream Bridge Cross Section Data
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	60	80	58	105	56	144	54	205	52
305	50	435	49	508	48.5	590	48	710	47
720	41	721	40.8	744	40.8	750	49	756	50
765	52	777	54	794	55	815	56	845	56.7
910	58	916	60	975	62	1060	62.3	1095	62.3
1225	62.3	1256	62	1290	60				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	710	.02	750	.055

Bank Sta: Left Right Coeff Contr. Expan.
710 750 .6 .8

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	710	54	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1740	55		1889	55	

Downstream Bridge Cross Section Data
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	60	1042	56	1200	54	1353	52	1638	50
1639	80	1748	80	1749	49	1779	48.3	1781	40.3
1804	40.3	1806	48.3	1830	50	1858	52	1878	54
1889	54.5	1890	80						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.11	1779	.02	1806	.055

Bank Sta: Left Right Coeff Contr. Expan.
1779 1806 .6 .8

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
1000	1748	54	F
1890	1890	54	F

Upstream Embankment side slope = 2 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 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

G

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	5.5	11

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
	0	65	.015	.015	0	.5	1

Number of Barrels = 2
Upstream Elevation = 40.8
Centerline Stations

Sta.	Sta.
726	738

Downstream Elevation = 40.3
Centerline Stations

Sta.	Sta.
1787	1799

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 821

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	60	1042	56	1200	54	1353	52	1638	50
1639	80	1748	80	1749	49	1779	48.3	1781	40.3
1804	40.3	1806	48.3	1830	50	1858	52	1878	54
1889	54.5	1890	80						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.11	1779	.02	1806	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1779	1806	80	75	70	.6	.8

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
1000	1748	54	F
1890	1890	54	F

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 820

INPUT
Description:

G

Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	58	1012	56	1030	55.5	1031	80	1158	80
1159	53.7	1242	53.5	1243	80	1404	80	1405	51.5
1450	50	1624	49	1625	80	1732	80	1733	48.5
1780	47.8	1781	39.8	1802	39.8	1803	47.8	1812	48
1840	50	1868	52	1874	52.5	1875	80	1945	80
1946	58								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.11	1780	.02	1812	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1780	1812	65	65	65	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
1000	1732	54	F
1875	1946	54	F

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 819

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	57.1	20	56	148	54	300	52.7	380	52
463	50	568	49	643	48	668	48	718	48.2
761	48	793	47.9	813	48.5	818	48	823	39.4
844	39.4	845	47	874	48	898	50	918	52
948	54	983	56	1098	57	1213	58	1328	59

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	818	.02	845	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
818	845	172	172	172	.6	.8

CULVERT

RIVER: Wells Run
REACH: Wells Run RS: 818.9

INPUT
Description: Twin 10'x5' box culvert under railroad
Distance from Upstream XS = 1

Deck/Roadway Width = 170
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 29

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	57.5		20	57.5		148	57.5	
300	57.5		380	57.5		463	57.5	
568	57.5		643	57.4		668	57.4	
718	57.4		761	57.1		793	56.9	
813	56.7		818	56.6		823	56.5	
823.1	56.5		833	56.5		833.1	56.5	
834	56.6		844	56.6		844.1	56.6	
845	56.6		874	56.8		898	56.9	
918	57.2		948	57.3		983	57.3	
1098	57.5		1213	58				

Upstream Bridge Cross Section Data
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	57.1	20	56	148	54	300	52.7	380	52
463	50	568	49	643	48	668	48	718	48.2
761	48	793	47.9	813	48.5	818	48	823	39.4
844	39.4	845	47	874	48	898	50	918	52
948	54	983	56	1098	57	1213	58	1328	59

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	818	.02	845	.055

Bank Sta: Left	Right	Coeff Contr.	Expan.
818	845	.6	.8

Downstream Deck/Roadway Coordinates
num= 29

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	57.5		20	57.5		148	57.5	
300	57.5		380	57.5		463	57.5	
568	57.5		643	57.4		668	57.4	
718	57.4		761	57.1		793	56.9	
813	56.7		818	56.6		823	56.5	
823.1	56.5		833	56.5		833.1	56.5	
834	86.6		844	56.6		844.1	56.6	
845	56.6		874	56.8		898	56.9	
918	57.2		948	57.3		983	57.3	
1098	57.5		1213	58				

Downstream Bridge Cross Section Data
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	52	18	51.3	29	51.2	42	51	90	50
200	49	293	48	315	47.3	330	47	342	46.8

G

370	46.5	410	45.8	430	45.7	455	45.6	500	44.2
504	38.2	513	38.2	525	38.2	530	39.9	540	44
585	45	621	46	690	48.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	500	.02	540	.055

Bank Sta: Left Right Coeff Contr. Expan.
500 540 .6 .8

Upstream Embankment side slope = 2 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 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 = 1

Culvert Name	Shape	Rise	Span
RailRoad	Box	5	10

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	170	.015	.015	0	.5	.3

Number of Barrels = 2
Upstream Elevation = 39.4
Centerline Stations

Sta.	Sta.
828	839

Downstream Elevation = 38.2
Centerline Stations

Sta.	Sta.
509	520

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 817

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	52	18	51.3	29	51.2	42	51	90	50
200	49	293	48	315	47.3	330	47	342	46.8
370	46.5	410	45.8	430	45.7	455	45.6	500	44.2
504	38.2	513	38.2	525	38.2	530	39.9	540	44
585	45	621	46	690	48.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	500	.02	540	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
500	540	120	100	80	.6	.8

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 816.5

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	50	130	48	320	46	417	43.7	426	37.7
434	37.7	443	43.7	454	44	532	45.7	533	70
879	70	880	48.1						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	417	.02	443	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
417	443	95	80	60	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 816.3

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	46	1050	44	1177	43.2	1186	37.2	1194	37.2
1203	43.2	1212	44	1282	46	1329	47.5	1330	70
1360	70	1361	48.5	1412	50				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.11	1177	.02	1203	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1177	1203	130	110	70	.5	.8

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 816

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
47.119	46	179.693	44.9	231.604	44	259.557	42.6	259.636	42.6
268.342	36.6	272.335	36.6	272.415	36.6	273.053	36.6	273.133	36.6
277.127	36.6	285.832	42.6	285.911	42.6	295.495	44	353.796	46
423.277	48	479.181	50						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
47.119	.11	259.557	.02	285.911	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
259.557	285.911	52	52	52	.6	.8

Skew Angle = 37

BRIDGE

RIVER: Wells Run
REACH: Wells Run RS: 815.9

INPUT
Description:
Distance from Upstream XS = 1
Deck/Roadway Width = 50
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew = 37
Bridge Pier Skew = 37
Upstream Deck/Roadway Coordinates
num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
179.693	44.9	44	231.604	44.9	42.6	259.557	44.9	42.6
259.636	44.9	43.6	268.342	44.9	43.6	272.335	44.9	43.6
272.415	44.9	36.6	273.053	44.9	36.6	273.133	44.9	43.6
277.127	44.9	43.6	285.832	44.9	43.6	285.911	44.9	42.6
295.495	45	44	353.796	46.2	46	423.277	48	48
479.181	50	50						

Upstream Bridge Cross Section Data
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
47.119	46	179.693	44.9	231.604	44	259.557	42.6	259.636	42.6
268.342	36.6	272.335	36.6	272.415	36.6	273.053	36.6	273.133	36.6
277.127	36.6	285.832	42.6	285.911	42.6	295.495	44	353.796	46
423.277	48	479.181	50						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
47.119	.11	259.557	.02	285.911	.055

Bank Sta: Left Right Coeff Contr. Expan.
259.557 285.911 .6 .8
Skew Angle = 37

Downstream Deck/Roadway Coordinates
num= 17

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
171.707	44.8	43.8	207.645	44.9	42.8	259.557	44.9	41.4
259.636	44.9	42.4	268.342	44.9	42.4	272.335	44.9	42.4
272.415	44.9	35.4	273.053	44.9	35.4	273.133	44.9	42.4
277.127	45	42.4	285.832	45	42.4	285.911	45	41.4
295.495	45	42	305.079	45	44	375.359	46	46
439.25	48	48	499.147	50	50			

Downstream Bridge Cross Section Data
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
131.775	46	171.707	43.8	207.645	42.8	259.557	41.4	259.636	41.1
268.342	35.4	272.335	35.4	272.415	35.4	273.053	35.4	273.133	35.4
277.127	35.4	285.832	41.4	285.911	41.4	295.495	42	305.079	44
375.359	46	439.25	48	499.147	50				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
131.775	.11	259.557	.02	285.911	.055

Bank Sta: Left Right Coeff Contr. Expan.
259.557 285.911 .6 .8
Skew Angle = 37

Upstream Embankment side slope = 2 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

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

High Flow Method
Energy Only

Additional Bridge Parameters

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

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 814

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
131.775	46	171.707	43.8	207.645	42.8	259.557	41.4	259.636	41.1
268.342	35.4	272.335	35.4	272.415	35.4	273.053	35.4	273.133	35.4
277.127	35.4	285.832	41.4	285.911	41.4	295.495	42	305.079	44
375.359	46	439.25	48	499.147	50				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
131.775	.11	259.557	.02	285.911	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
259.557	285.911	40	55	80	.6	.8

Skew Angle = 37

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 813.5

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	48	120	43	134	42	137	41	146	35
154	35	163	41	212	42	244	44	260	46
295	48	323	50	340	52				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.11	137	.02	163	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
137	163	130	150	170	.3	.5

CROSS SECTION

RIVER: Wells Run
REACH: Wells Run RS: 813

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	47	60	47.2	125	47.8	180	48	230	48
280	48	291	49	311	44.3	330	44.2	355	44.3
380	44	395	43.8	410	43.8	430	43.8	470	43.8
518	43.7	582	42	592	34.1	600	34.1	609	42
610	44	625	50	632	52	636	54	640	56
642	58	650	60						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.18	582	.02	610	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
582	610	120	140	160	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Wells Run

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Wells Run	834.2	.08	.04	.08				
Wells Run	834	.08	.04	.08				
Wells Run	833.3	Culvert						
Wells Run	833.2	.08	.04	.08				
Wells Run	832.0	.18	.07	.03	.04	.03	.07	.18
Wells Run	831.5	.18	.07	.03	.015	.03	.07	.18
Wells Run	831	.18	.07	.03	.015	.03	.07	.18
Wells Run	830.5	.18	.07	.03	.015	.03	.07	.18
Wells Run	830	.06	.02	.06				
Wells Run	829	Culvert						
Wells Run	828	.06	.02	.06				
Wells Run	827.7	.05	.02	.11				
Wells Run	827	.05	.02	.011				
Wells Run	826.5	.08	.02	.1				
Wells Run	826.1	.08	.02	.1				
Wells Run	826	Culvert						
Wells Run	825.8	.055	.02	.065				
Wells Run	825.5	.055	.02	.065				
Wells Run	825	.18	.07	.02	.07	.18		
Wells Run	824.2	Culvert						
Wells Run	824	.18	.08	.02	.07	.18		
Wells Run	823.5	.18	.08	.03	.02	.08	.18	
Wells Run	823	.18	.08	.03	.02	.03	.18	
Wells Run	822	.11	.02	.055				

*Wells Run	*	821.5	*Culvert *	*	*	*	*	*	*	
*Wells Run	*	821	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	820	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	819	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	818.9	*Culvert *	*	*	*	*	*	*	
*Wells Run	*	817	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	816.5	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	816.3	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	816	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	815.9	*Bridge *	*	*	*	*	*	*	
*Wells Run	*	814	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	813.5	*	.11*	.02*	.055*	*	*	*	*
*Wells Run	*	813	*	.18*	.02*	.08*	*	*	*	*

****

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SUMMARY OF REACH LENGTHS

River: Wells Run

Reach	River Sta.	Left	Channel	Right
*Wells Run	* 834.2	* 90*	90*	90*
*Wells Run	* 834	* 37*	37*	37*
*Wells Run	* 833.3	*Culvert *	*	*
*Wells Run	* 833.2	* 1*	1*	1*
*Wells Run	* 832.0	* 40*	40*	40*
*Wells Run	* 831.5	* 110*	110*	110*
*Wells Run	* 831	* 115*	115*	115*
*Wells Run	* 830.5	* 75*	110*	140*
*Wells Run	* 830	* 70*	70*	70*
*Wells Run	* 829	*Culvert *	*	*
*Wells Run	* 828	* 80*	80*	80*
*Wells Run	* 827.7	* 260*	250*	250*
*Wells Run	* 827	* 100*	80*	60*
*Wells Run	* 826.5	* 130*	110*	80*
*Wells Run	* 826.1	* 72*	82*	102*
*Wells Run	* 826	*Culvert *	*	*
*Wells Run	* 825.8	* 90*	90*	90*
*Wells Run	* 825.5	* 95*	95*	95*
*Wells Run	* 825	* 153*	153*	153*
*Wells Run	* 824.2	*Culvert *	*	*
*Wells Run	* 824	* 95*	95*	95*
*Wells Run	* 823.5	* 110*	170*	200*
*Wells Run	* 823	* 140*	175*	195*
*Wells Run	* 822	* 65*	65*	65*
*Wells Run	* 821.5	*Culvert *	*	*
*Wells Run	* 821	* 80*	75*	70*
*Wells Run	* 820	* 65*	65*	65*
*Wells Run	* 819	* 172*	172*	172*
*Wells Run	* 818.9	*Culvert *	*	*
*Wells Run	* 817	* 120*	100*	80*
*Wells Run	* 816.5	* 95*	80*	60*
*Wells Run	* 816.3	* 130*	110*	70*
*Wells Run	* 816	* 52*	52*	52*

```
*Wells Run     *  815.9     *Bridge  *       *       *
*Wells Run     *  814       *    40*     55*     80*
*Wells Run     *  813.5     *   130*    150*    170*
*Wells Run     *  813       *   120*    140*    160*
*************************************************************
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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Wells Run

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*******************************************************
*    Reach     *  River Sta.  * Contr.  * Expan.  *
*******************************************************
*Wells Run     *  834.2  *     .1*     .3*
*Wells Run     *  834    *     .1*     .3*
*Wells Run     *  833.3  *Culvert  *       *
*Wells Run     *  833.2  *     .1*     .3*
*Wells Run     *  832.0  *     .3*     .5*
*Wells Run     *  831.5  *     .1*     .3*
*Wells Run     *  831    *     .3*     .5*
*Wells Run     *  830.5  *     .3*     .5*
*Wells Run     *  830    *     .3*     .5*
*Wells Run     *  829    *Culvert  *       *
*Wells Run     *  828    *     .3*     .5*
*Wells Run     *  827.7  *     .3*     .5*
*Wells Run     *  827    *     .1*     .3*
*Wells Run     *  826.5  *     .6*     .8*
*Wells Run     *  826.1  *     .6*     .8*
*Wells Run     *  826    *Culvert  *       *
*Wells Run     *  825.8  *     .6*     .8*
*Wells Run     *  825.5  *     .6*     .8*
*Wells Run     *  825    *     .6*     .8*
*Wells Run     *  824.2  *Culvert  *       *
*Wells Run     *  824    *     .6*     .8*
*Wells Run     *  823.5  *     .3*     .5*
*Wells Run     *  823    *     .3*     .5*
*Wells Run     *  822    *     .6*     .8*
*Wells Run     *  821.5  *Culvert  *       *
*Wells Run     *  821    *     .6*     .8*
*Wells Run     *  820    *     .3*     .5*
*Wells Run     *  819    *     .6*     .8*
*Wells Run     *  818.9  *Culvert  *       *
*Wells Run     *  817    *     .6*     .8*
*Wells Run     *  816.5  *     .3*     .5*
*Wells Run     *  816.3  *     .5*     .8*
*Wells Run     *  816    *     .6*     .8*
*Wells Run     *  815.9  *Bridge  *       *
*Wells Run     *  814    *     .6*     .8*
*Wells Run     *  813.5  *     .3*     .5*
*Wells Run     *  813    *     .1*     .3*
*******************************************************
```

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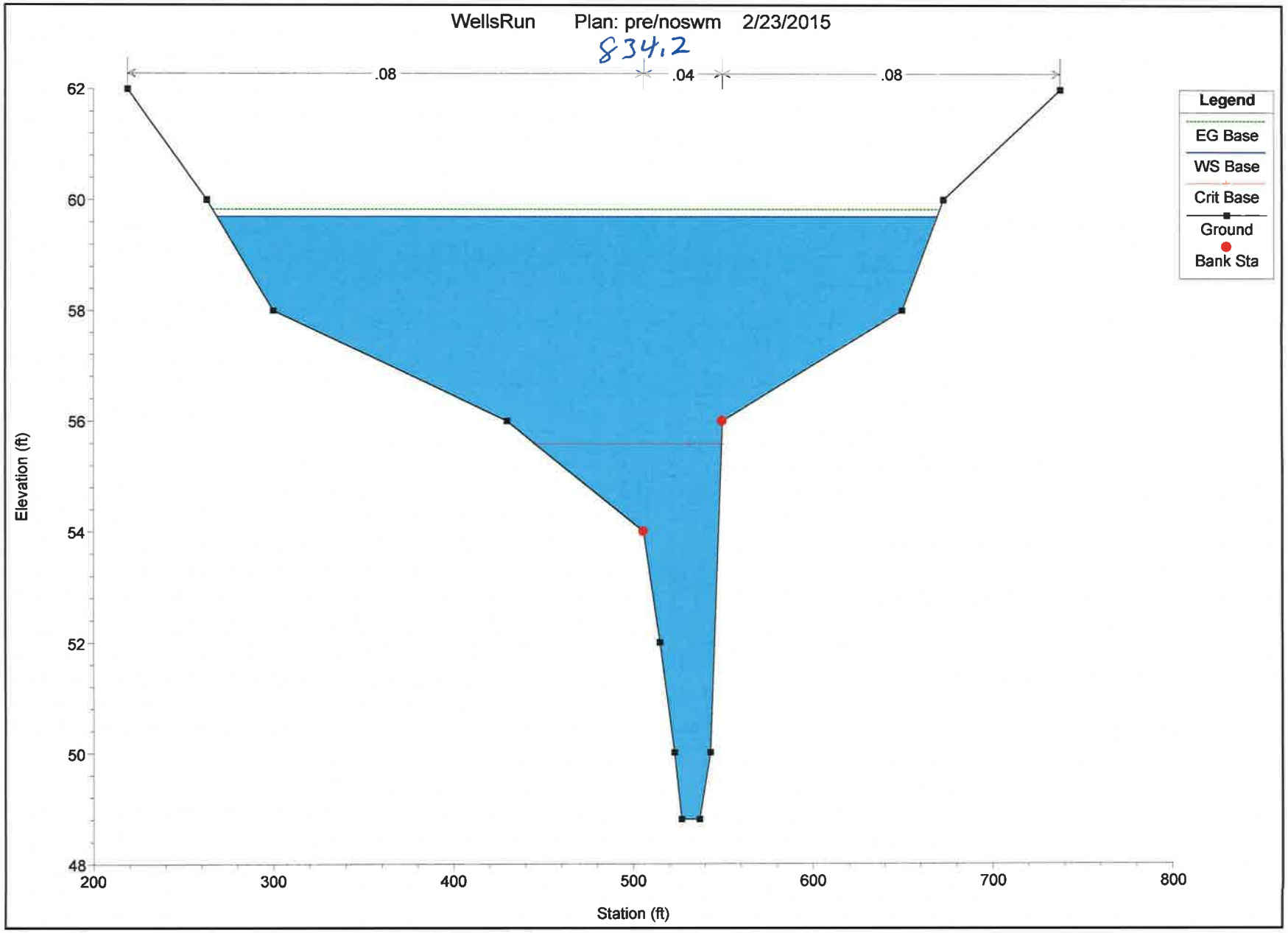
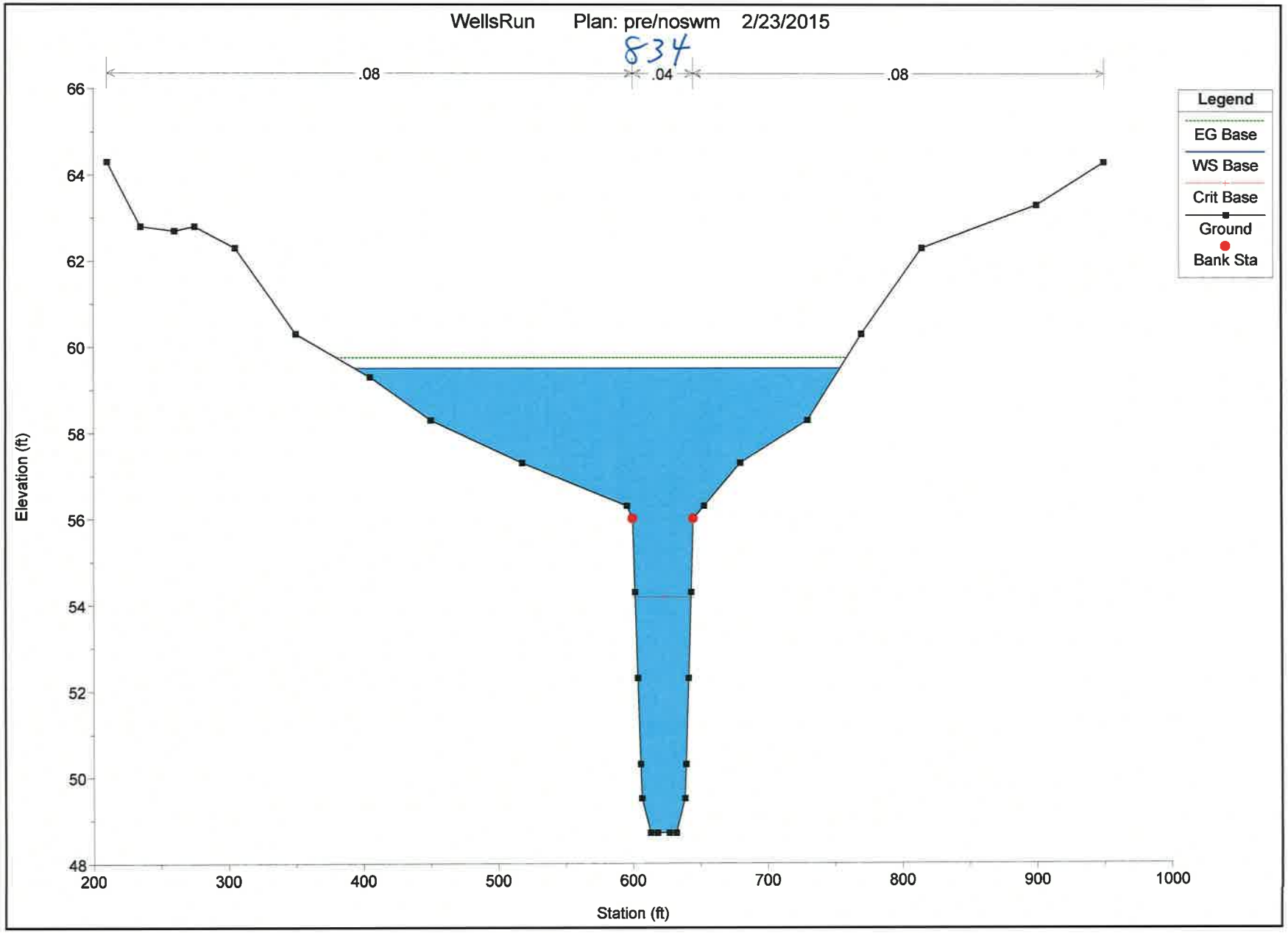
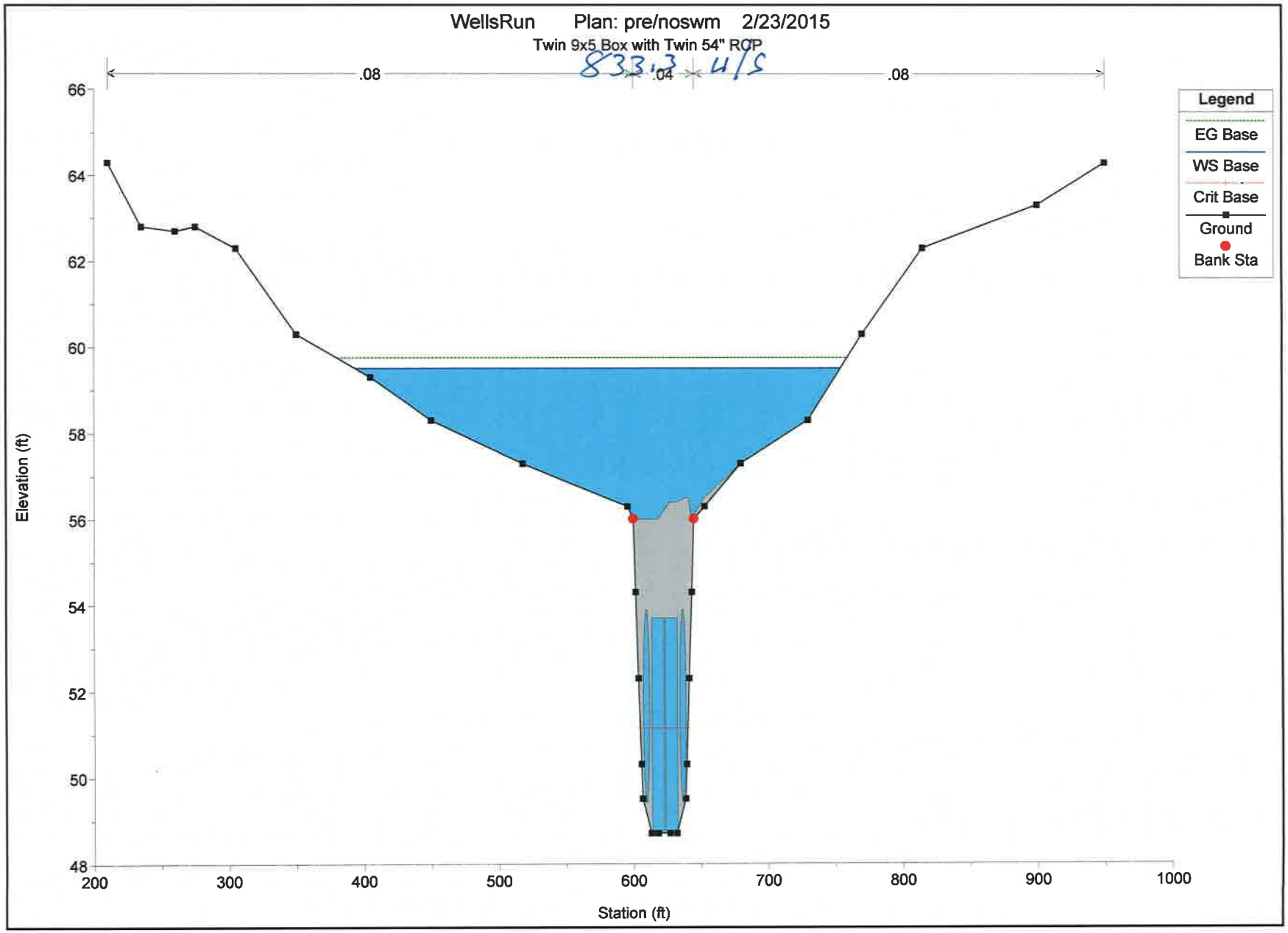
ERRORS WARNINGS AND NOTES


WellsRun Plan: pre/noswm 2/23/2015
834.2
.08
.04
.08
Legend
EG Base
WS Base
Crit Base
Ground
Bank Sta
Elevation (ft)
62
60
58
56
54
52
50
48
200
300
400
500
600
700
800
Station (ft)

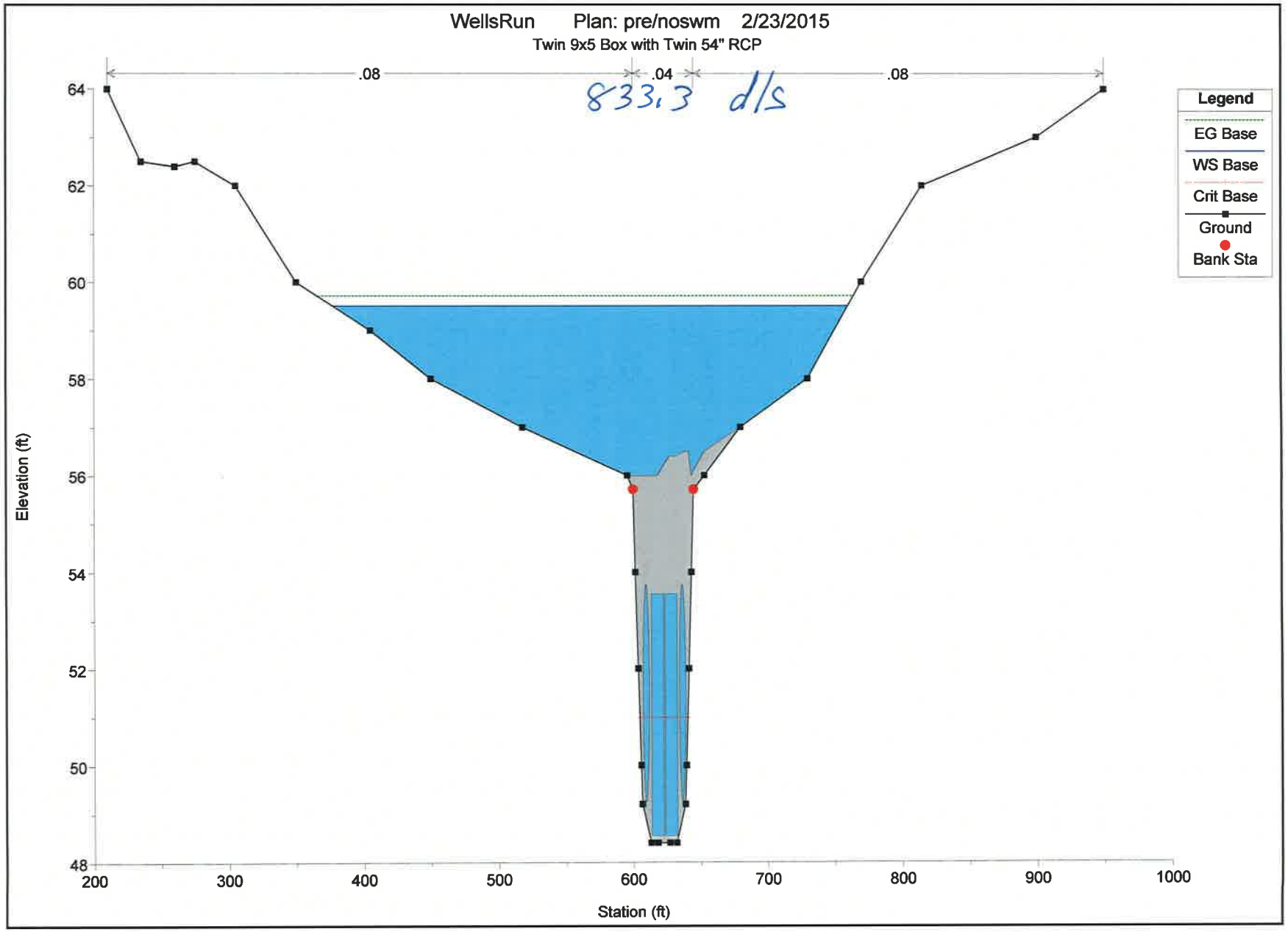
G-32


WellsRun Plan: pre/noswm 2/23/2015
834
.08
.04
.08
Legend
EG Base
WS Base
Crit Base
Ground
Bank Sta
Elevation (ft)
66
64
62
60
58
56
54
52
50
48
200
300
400
500
600
700
800
900
1000
Station (ft)

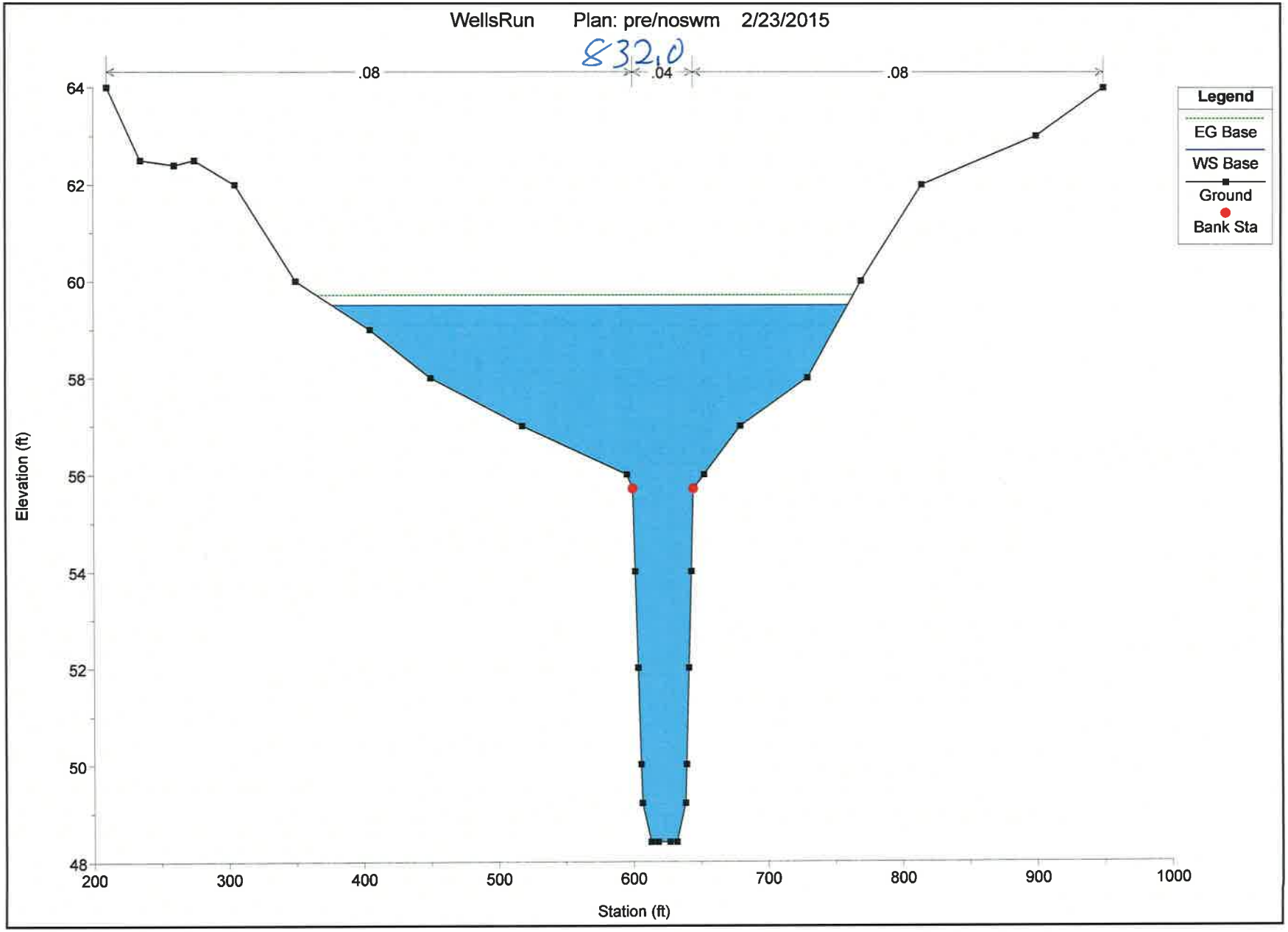
5-33


WellsRun Plan: pre/noswm 2/23/2015
Twin 9x5 Box with Twin 54" RCP
833.3 U/S
.08
.04
.08
Legend
EG Base
WS Base
Crit Base
Ground
Bank Sta
Elevation (ft)
66
64
62
60
58
56
54
52
50
48
200
300
400
500
600
700
800
900
1000
Station (ft)

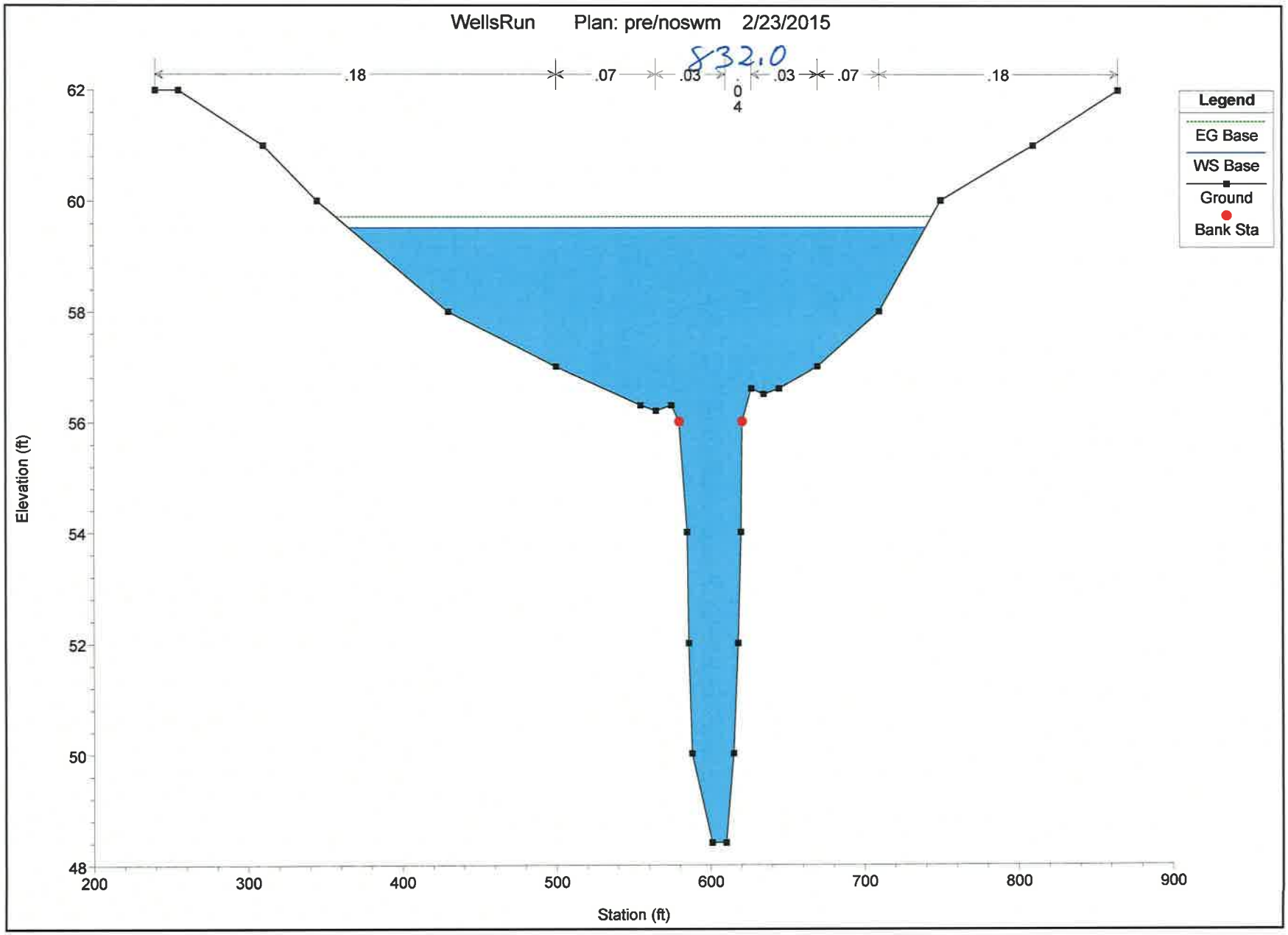
G-34


WellsRun Plan: pre/noswm 2/23/2015
Twin 9x5 Box with Twin 54" RCP
.08
.04
.08
833.3 d/s
Legend
EG Base
WS Base
Crit Base
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
54
52
50
48
200
300
400
500
600
700
800
900
1000
Station (ft)

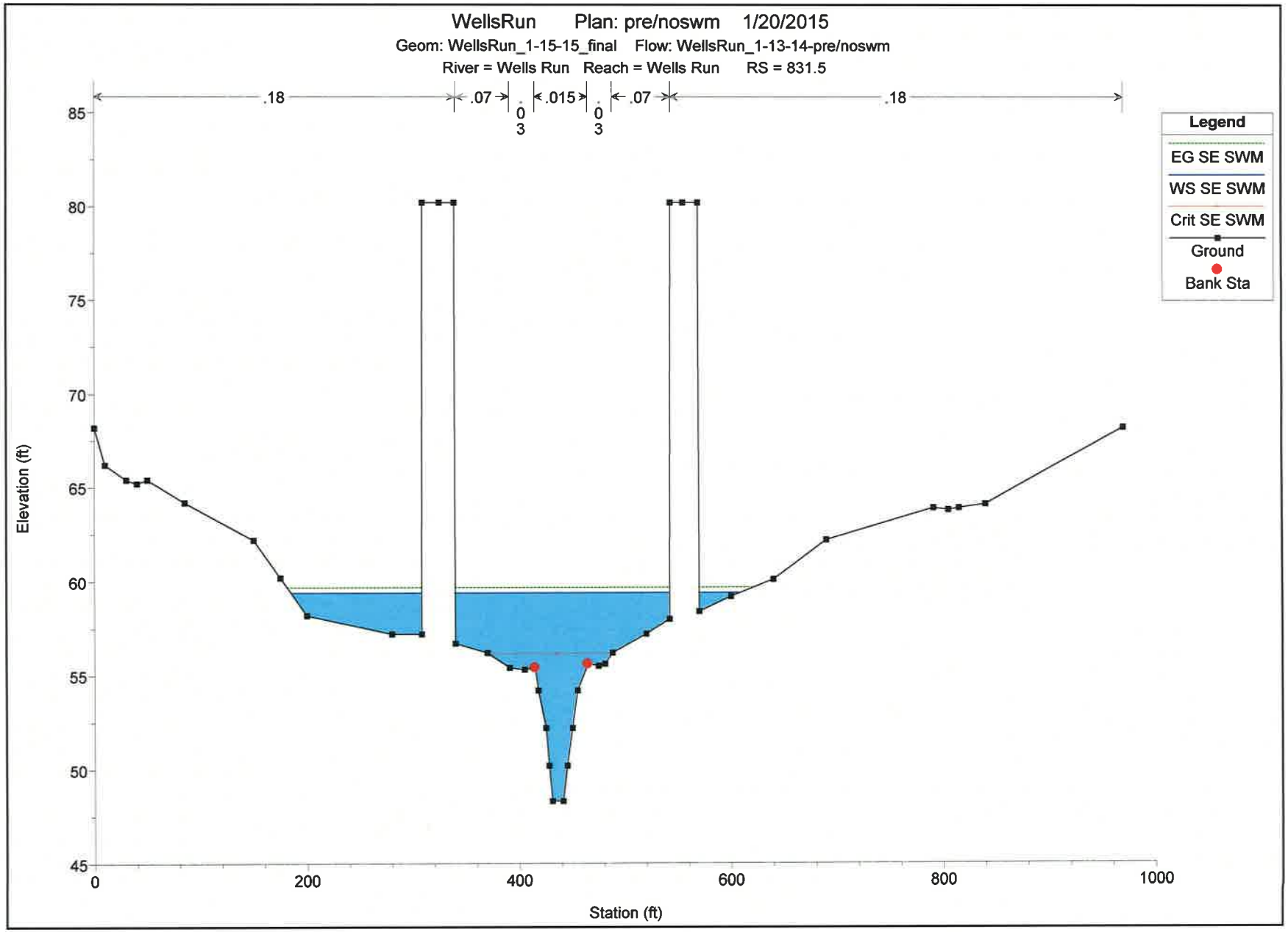
G-35


WellsRun Plan: pre/noswm 2/23/2015
832.0
.08
.04
.08
Legend
EG Base
WS Base
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
54
52
50
48
200
300
400
500
600
700
800
900
1000
Station (ft)

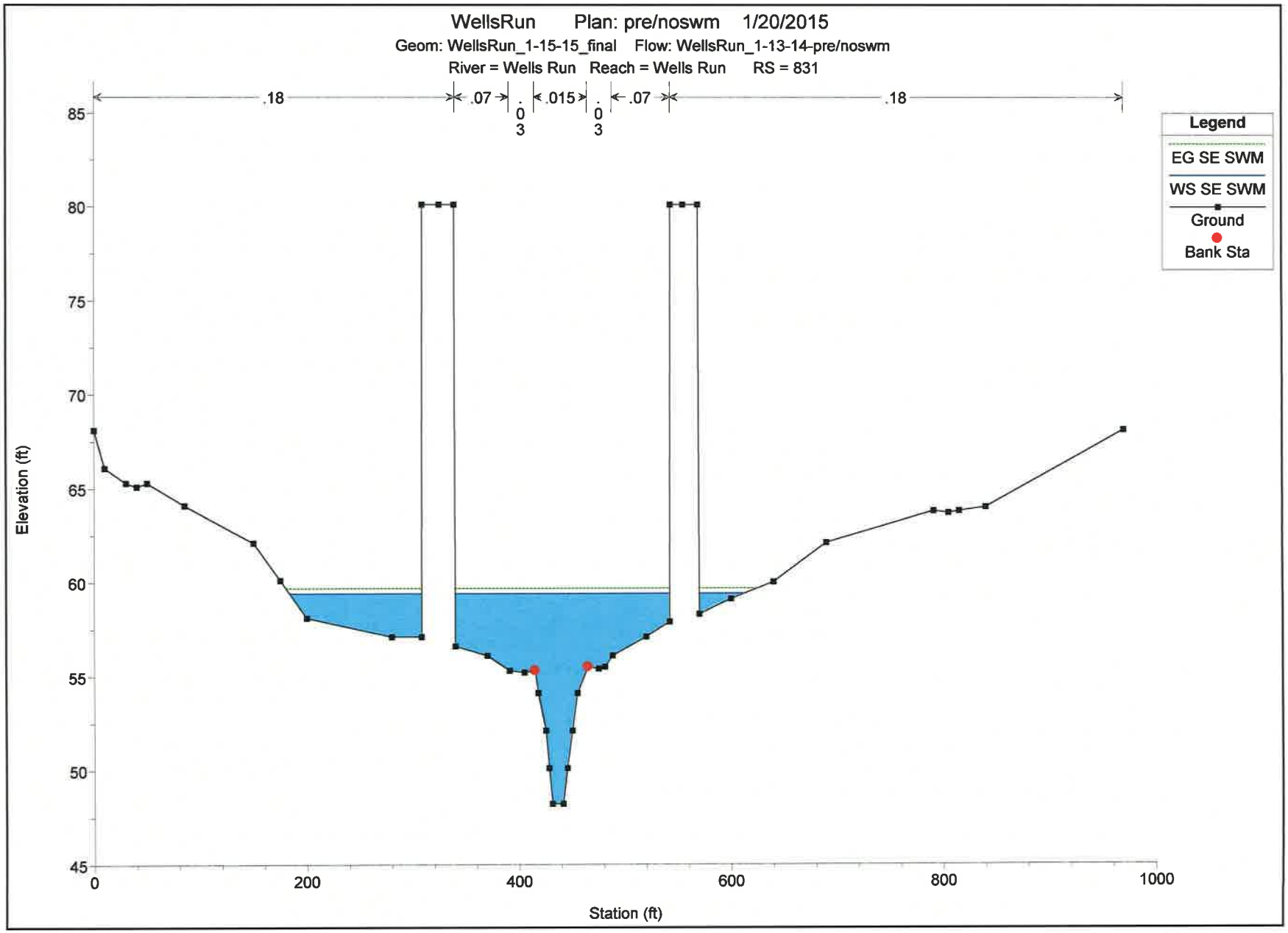
G-36


WellsRun Plan: pre/noswm 2/23/2015
832.0
.18
.07
.03
0
4
.03
.07
.18
Legend
EG Base
WS Base
Ground
Bank Sta
Elevation (ft)
62
60
58
56
54
52
50
48
200
300
400
500
600
700
800
900
Station (ft)

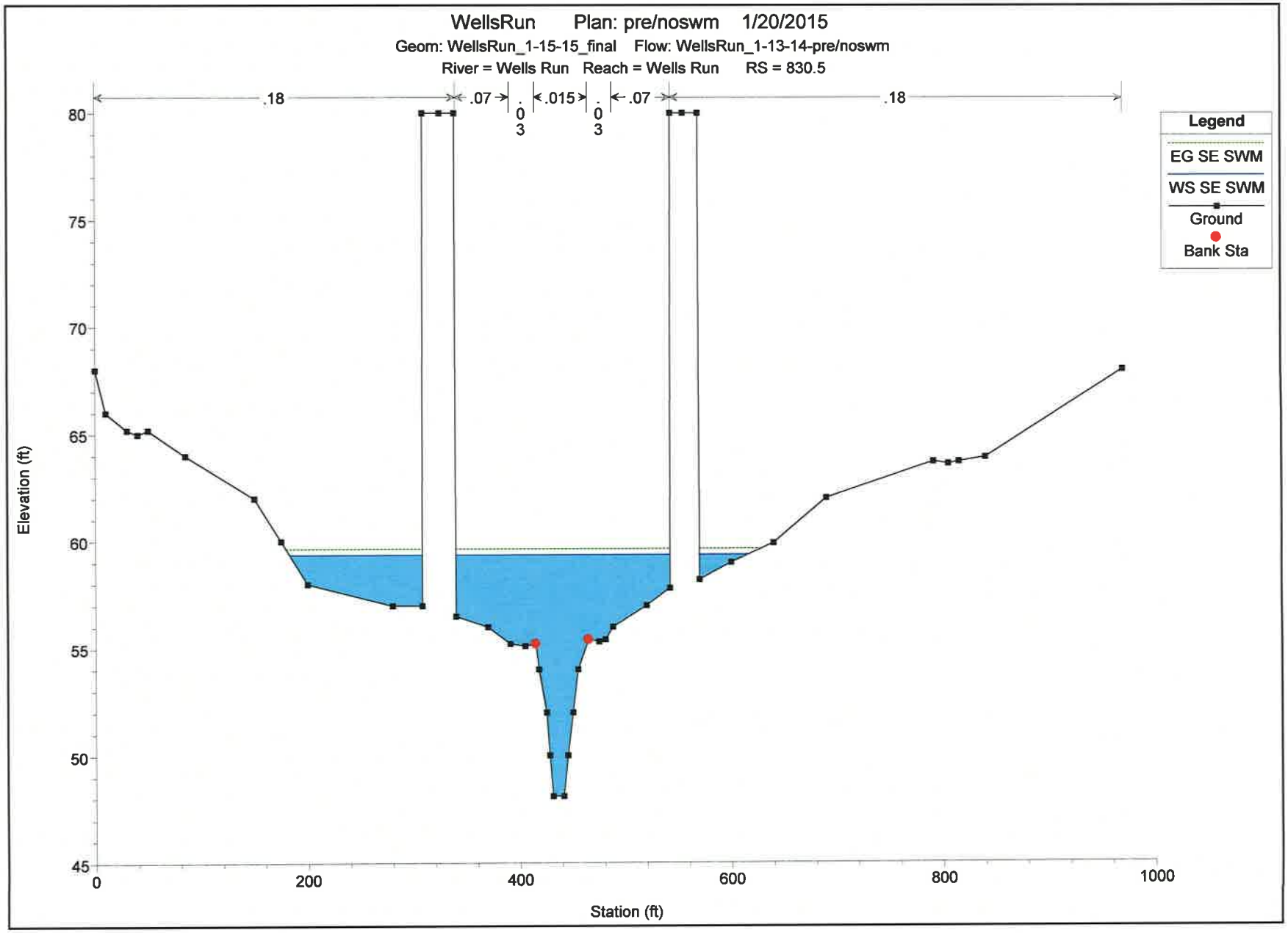
G37


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 831.5
.18
.07
.03
.015
.03
.07
.18
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
50
45
0
200
400
600
800
1000
Station (ft)

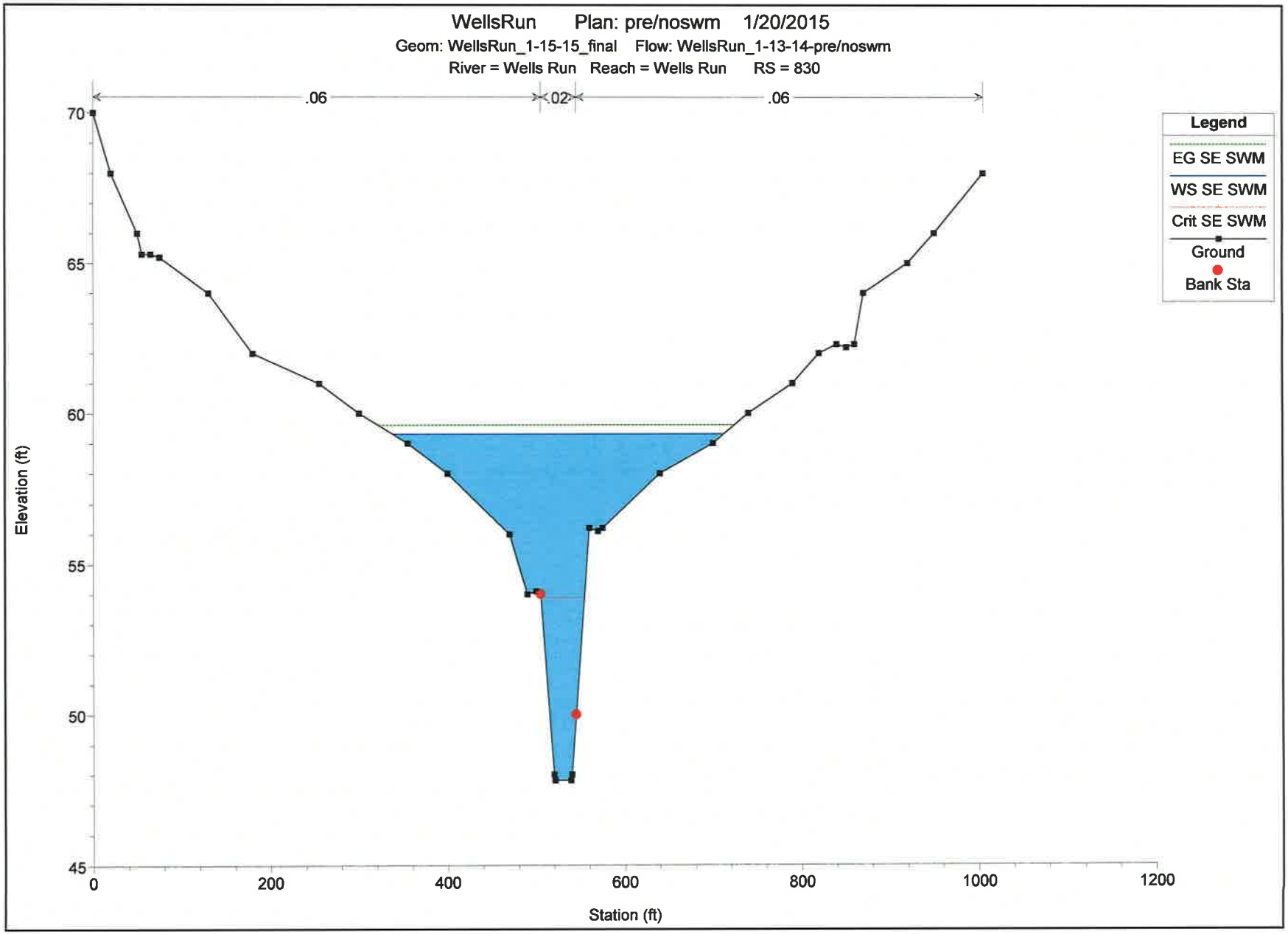
G-38


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 831
.18
.07
.03
.015
.03
.07
.18
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
50
45
0
200
400
600
800
1000
Station (ft)

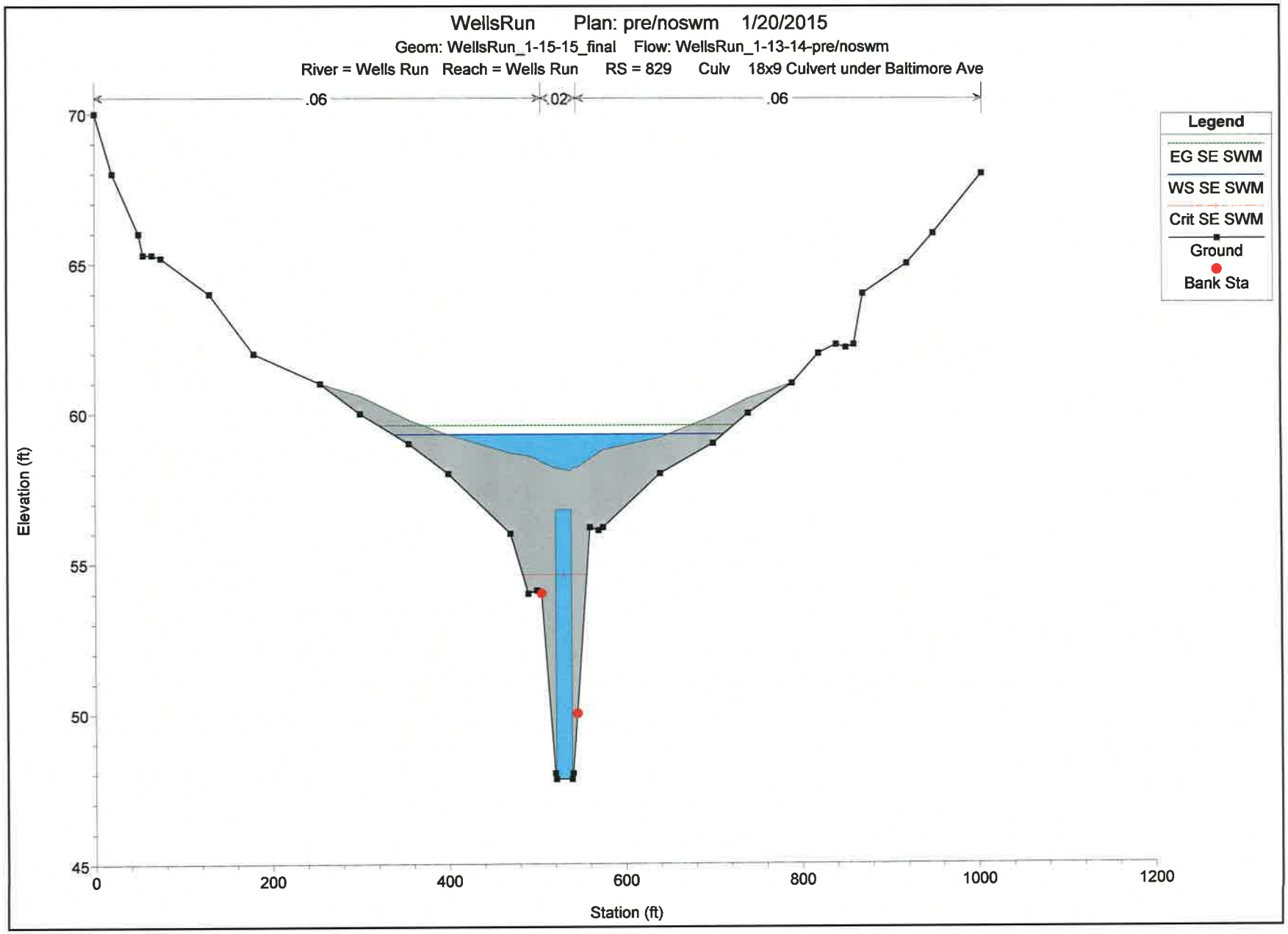
G-29


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 830.5
.18
.07
.03
.015
.03
.07
.18
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
0
200
400
600
800
1000
Station (ft)

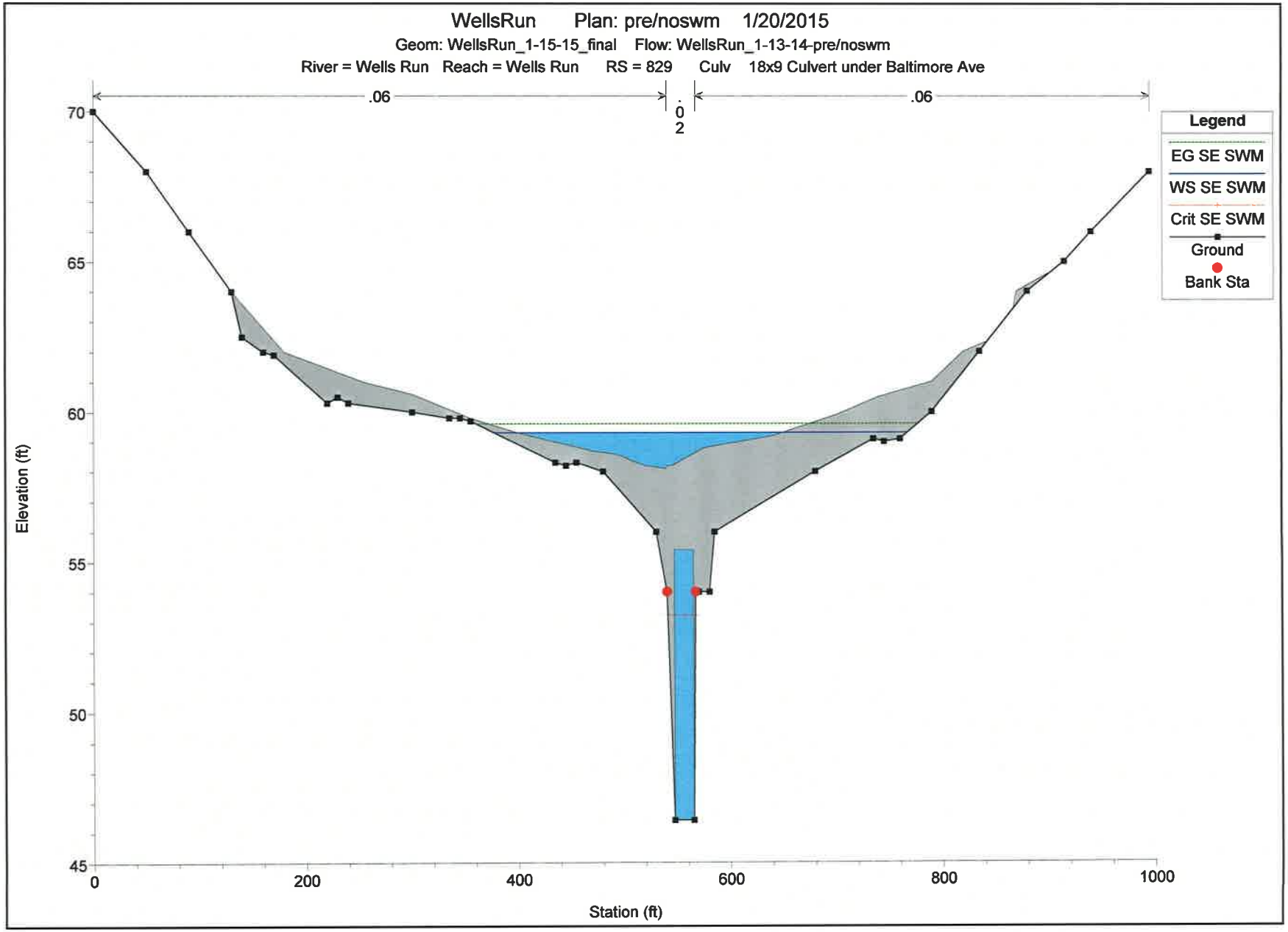
G-40


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 830
.06
.02
.06
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
70
65
60
55
50
45
0
200
400
600
800
1000
1200
Station (ft)

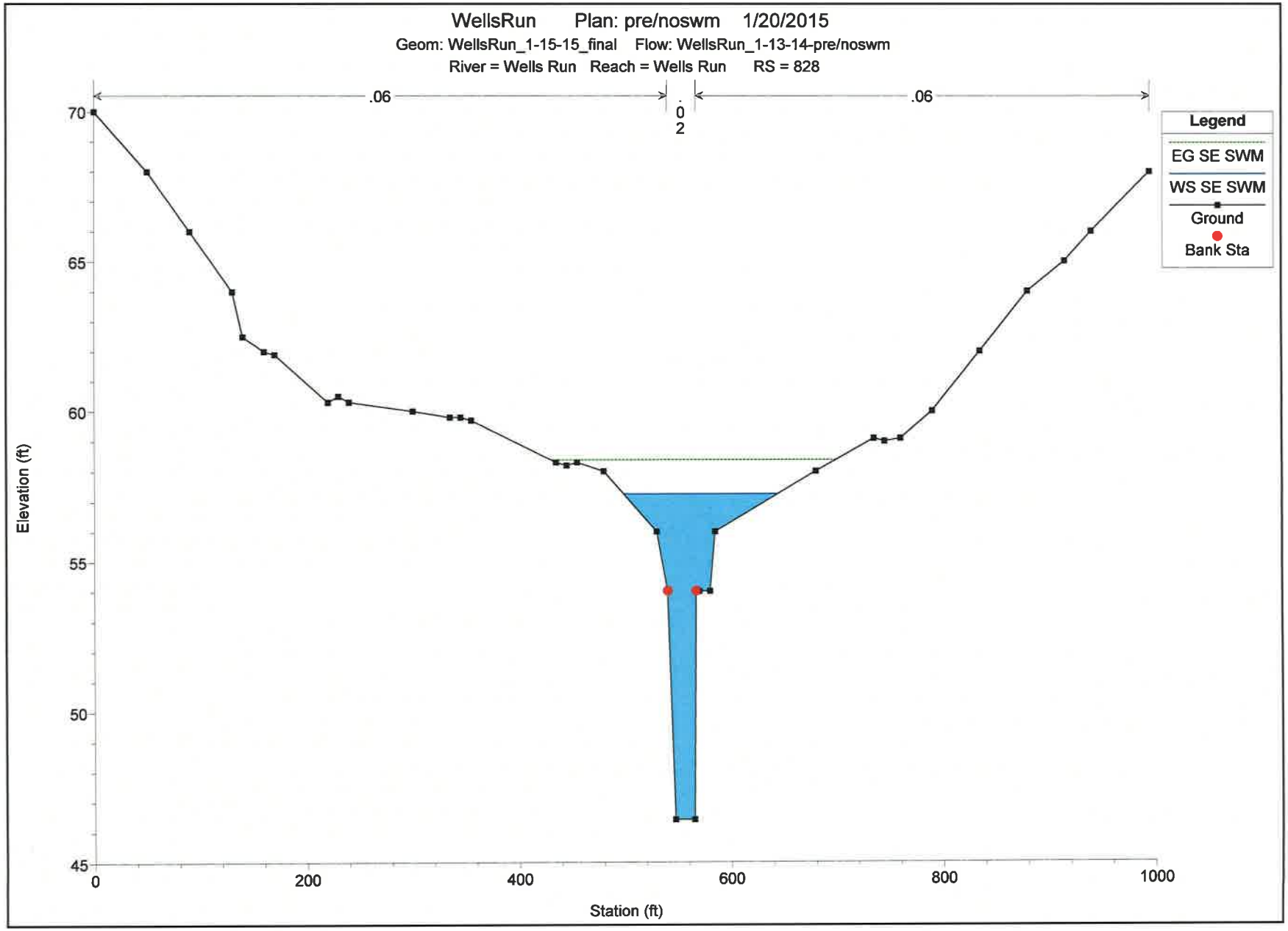
G-41


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 829 Culv 18x9 Culvert under Baltimore Ave
.06
.02
.06
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
70
65
60
55
50
45
0
200
400
600
800
1000
1200
Station (ft)

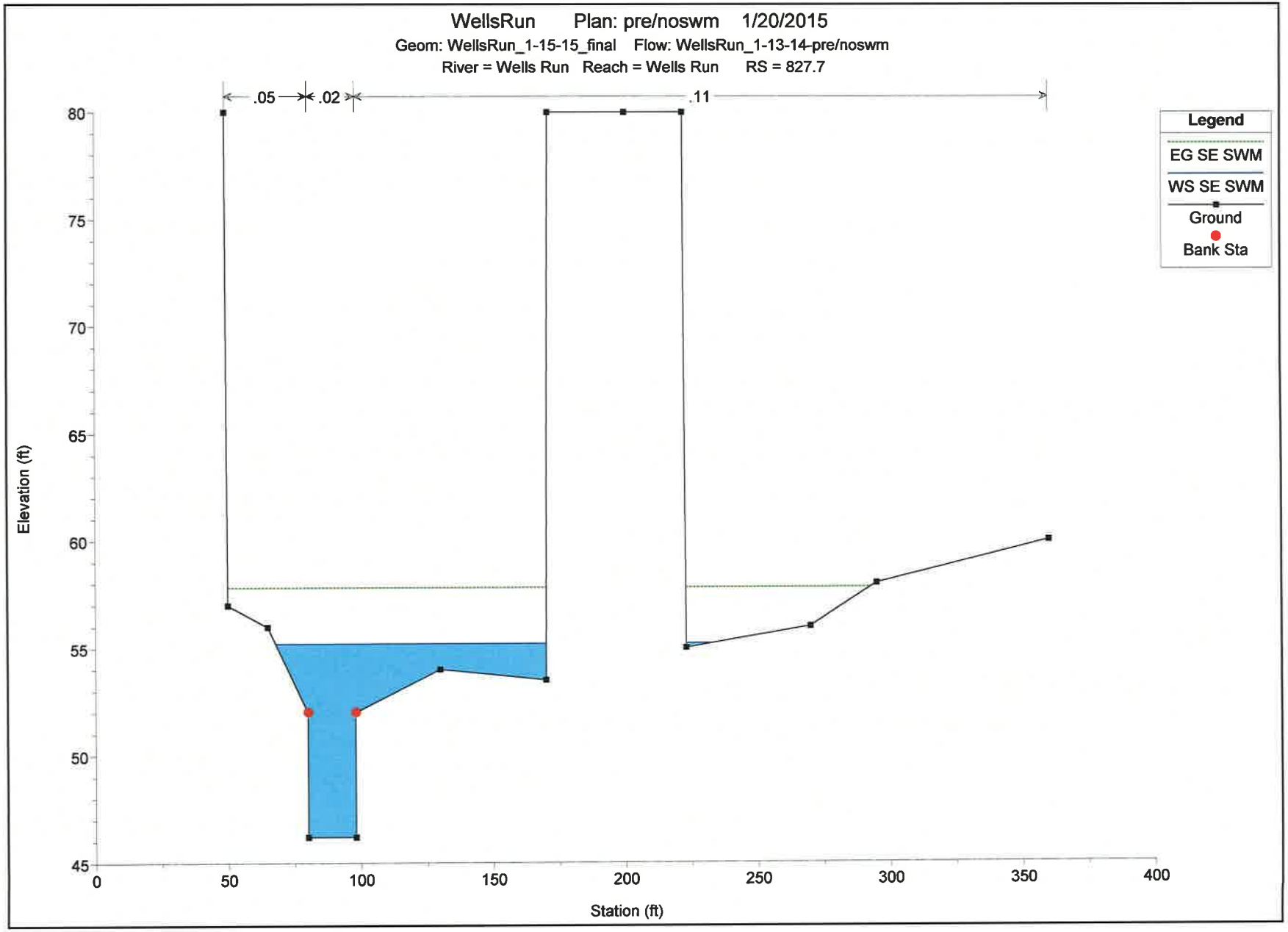
G-42


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 829 Culv 18x9 Culvert under Baltimore Ave
.06
.02
.06
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
70
65
60
55
50
45
0
200
400
600
800
1000
Station (ft)

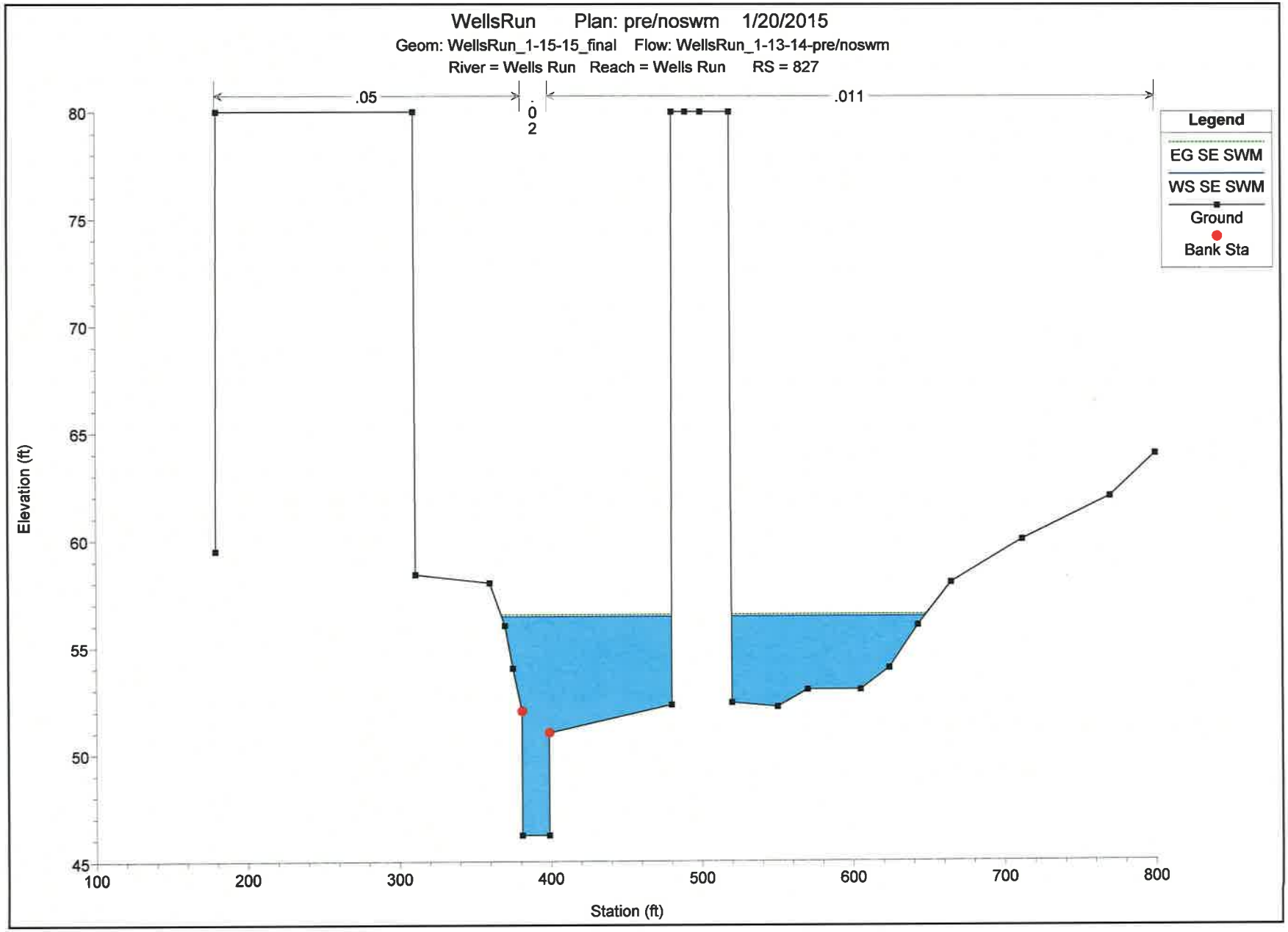
G-43


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 828
.06
.02
.06
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
70
65
60
55
50
45
0
200
400
600
800
1000
Station (ft)

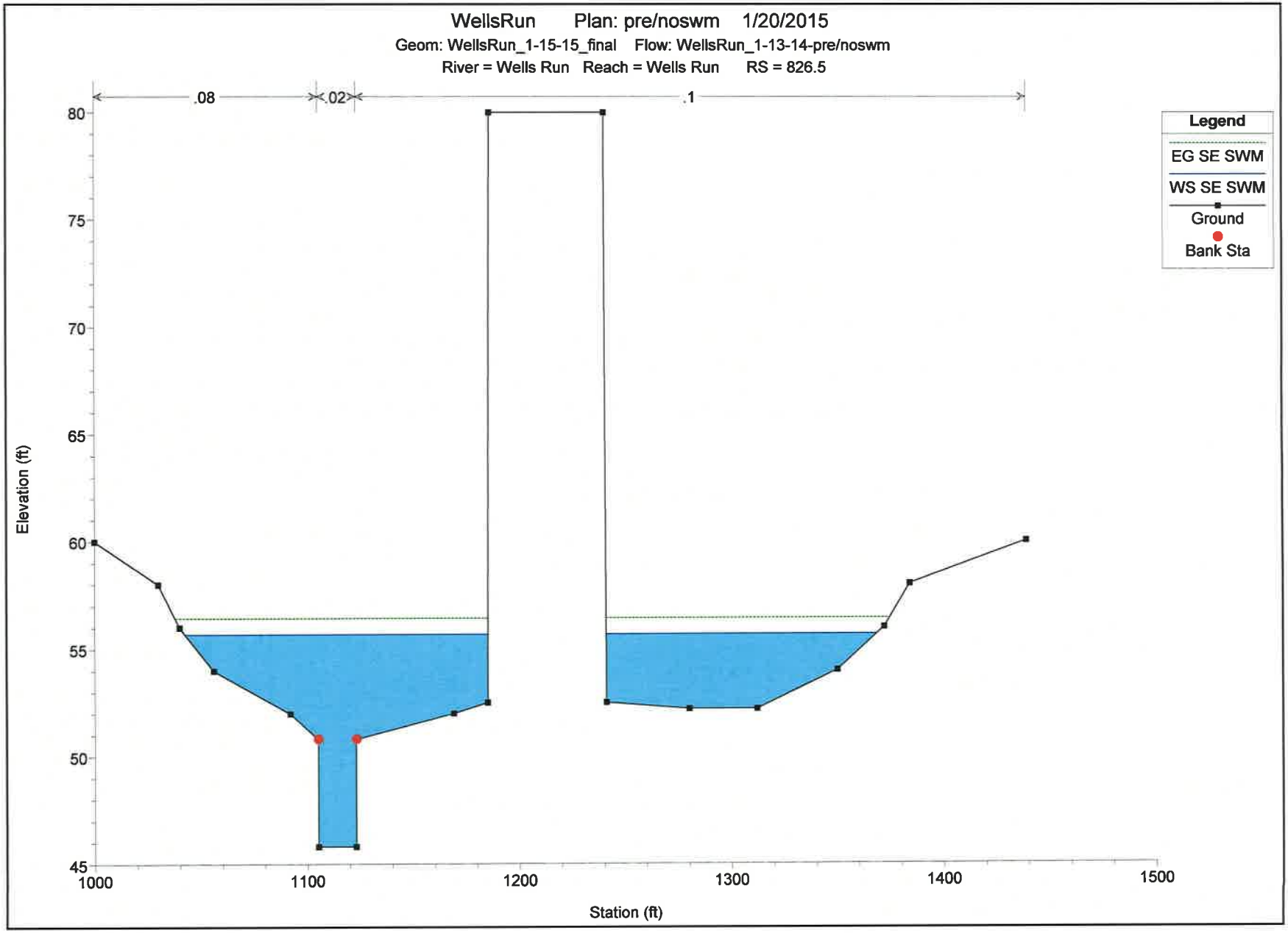
G-44


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 827.7
.05
.02
.11
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
0
50
100
150
200
250
300
350
400
Station (ft)

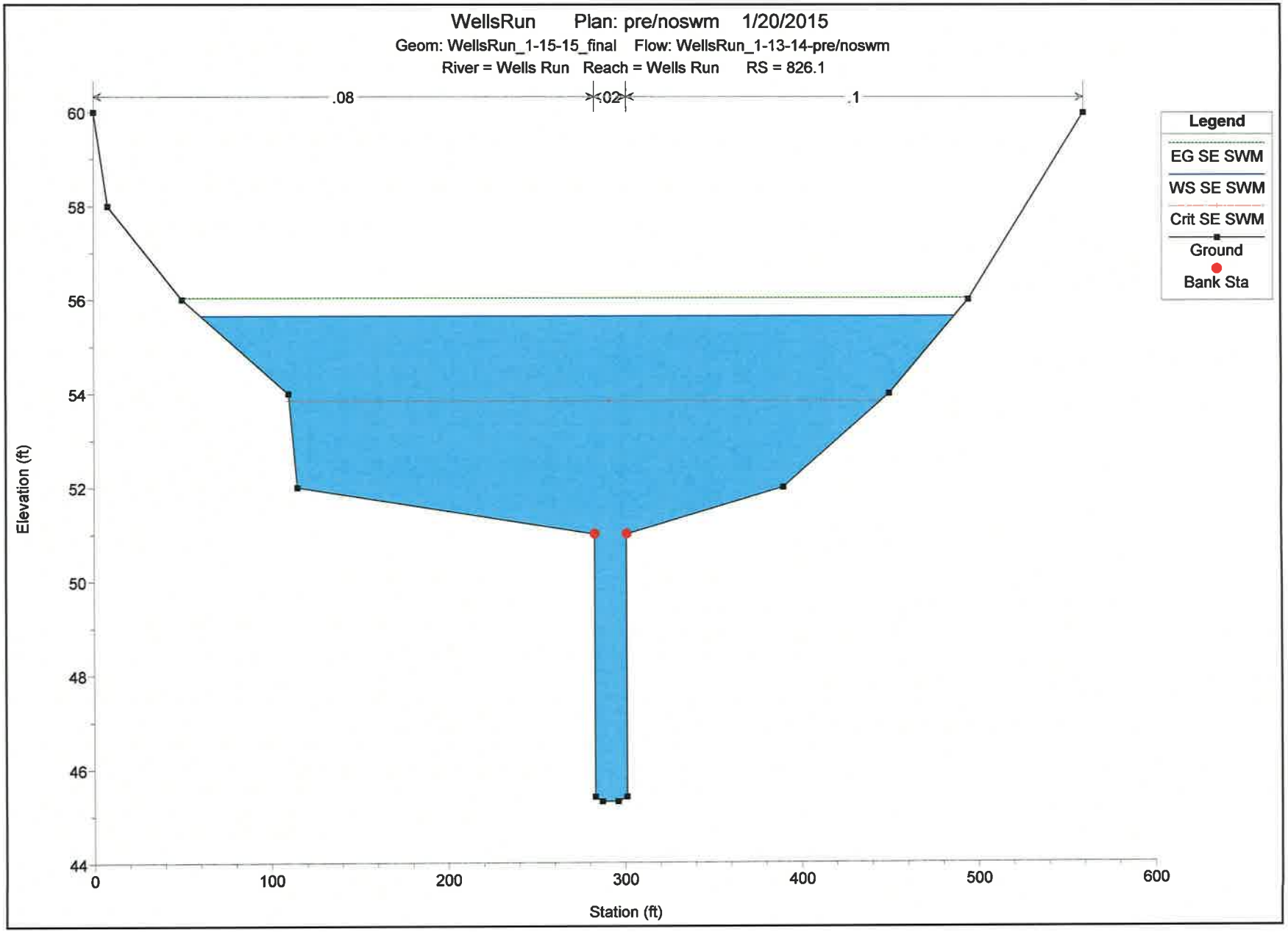
G-45


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 827
.05
.02
.011
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
80
75
70
65
60
55
50
45
100
200
300
400
500
600
700
800

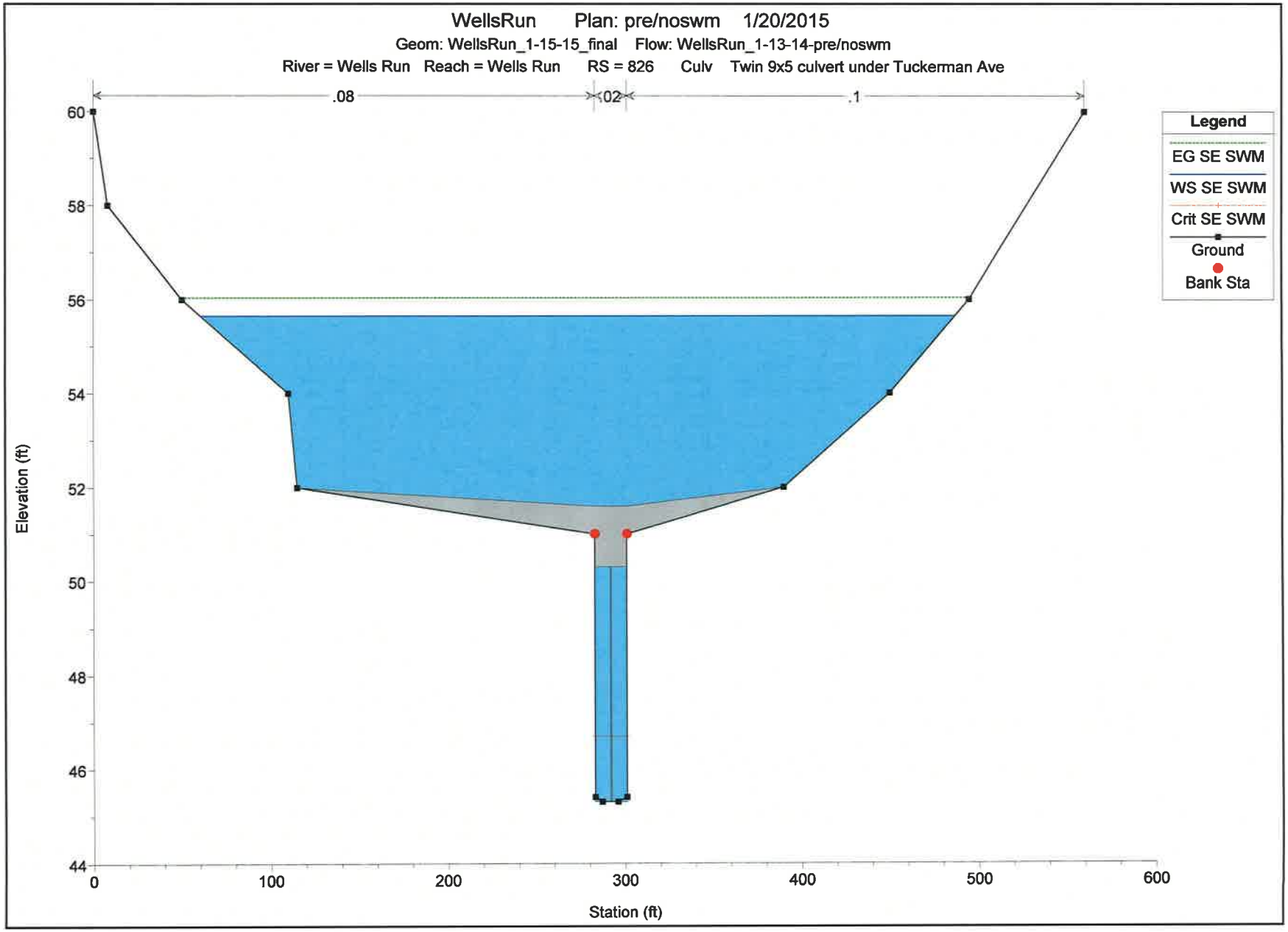
G-46


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 826.5
.08
.02
.1
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
1000
1100
1200
1300
1400
1500
Station (ft)

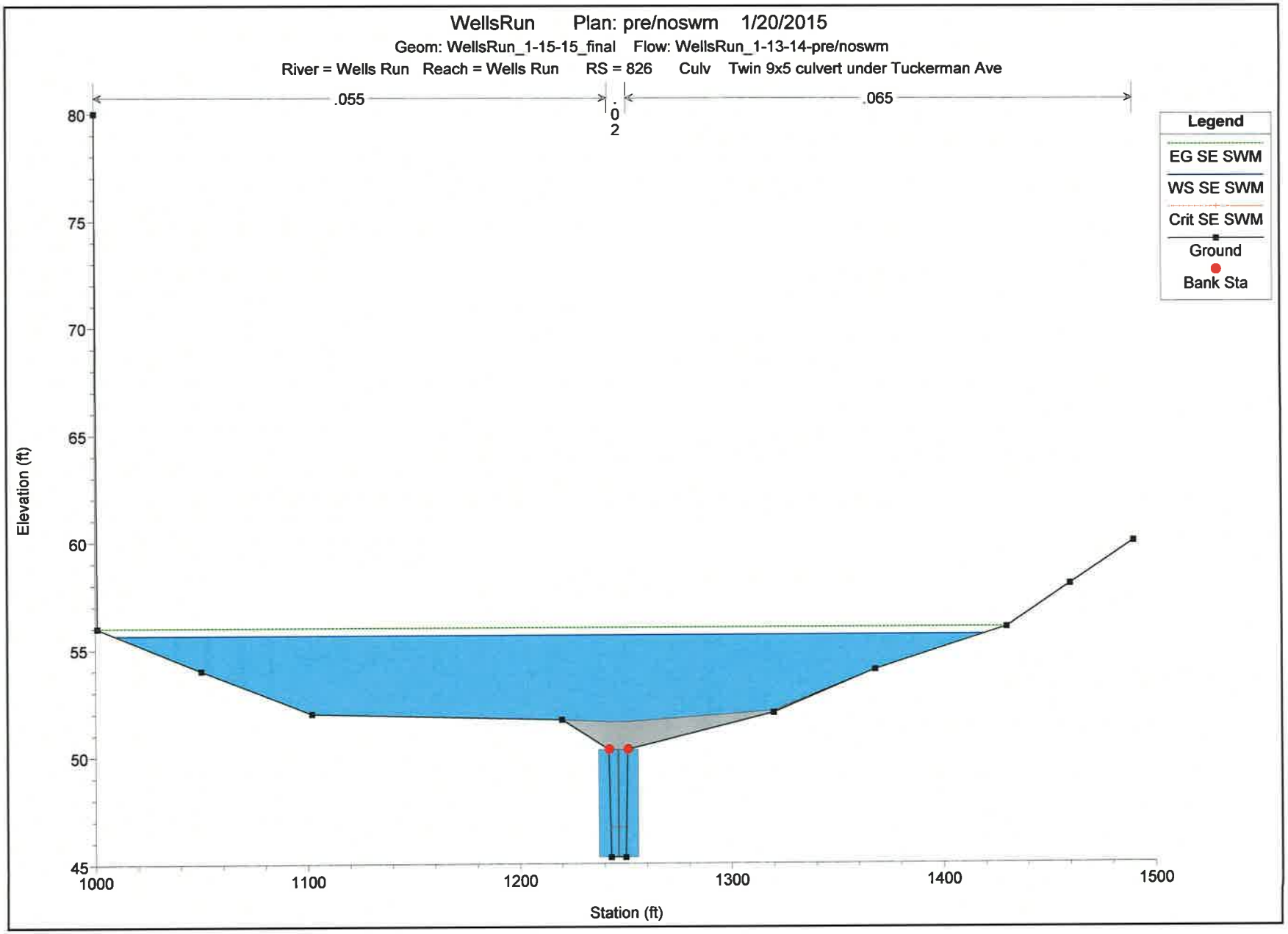
G-47


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 826.1
.08
.02
.1
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
46
44
0
100
200
300
400
500
600
Station (ft)

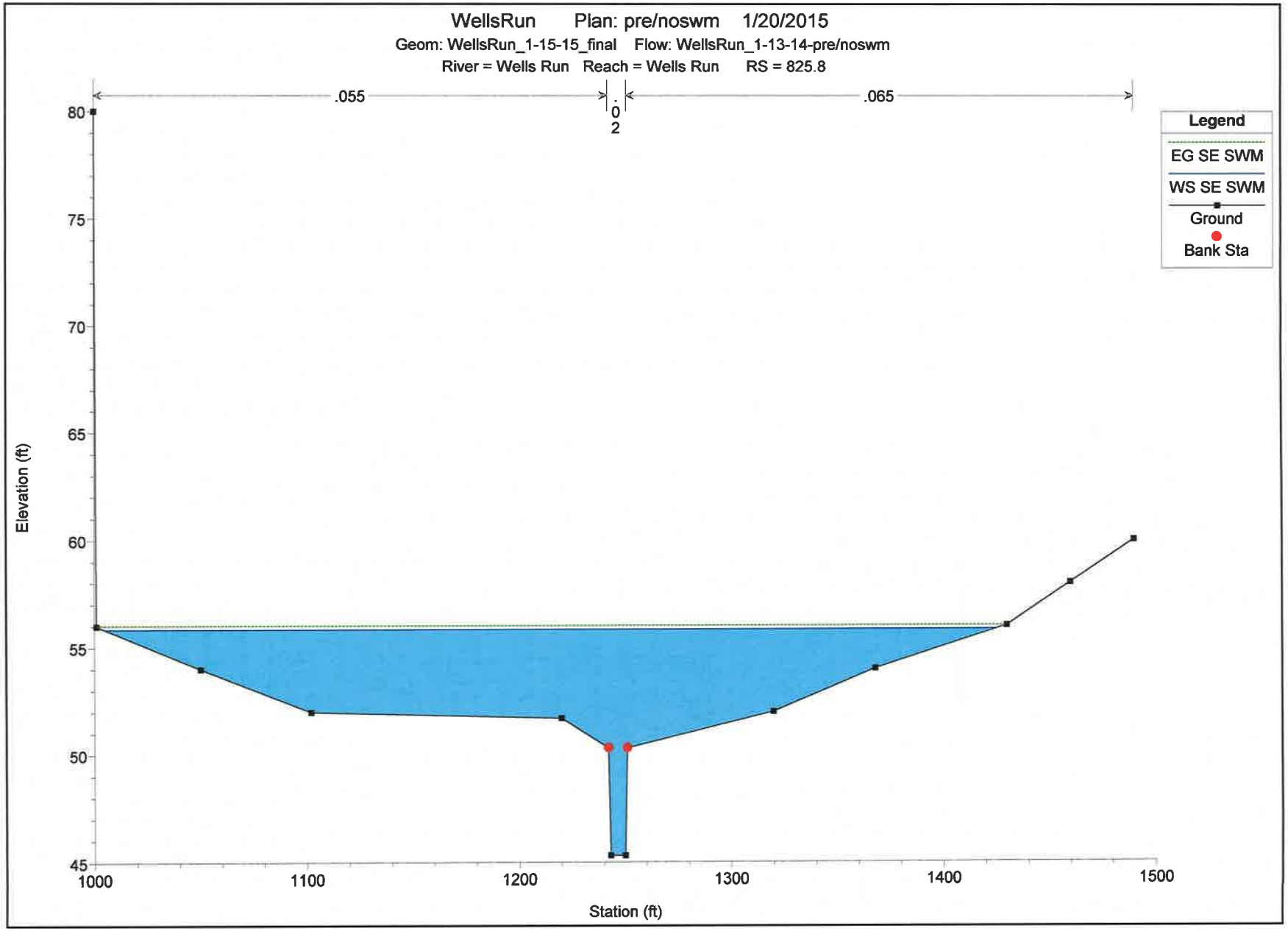
G-48


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 826 Culv Twin 9x5 culvert under Tuckerman Ave
.08
.02
.1
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
46
44
0
100
200
300
400
500
600
Station (ft)

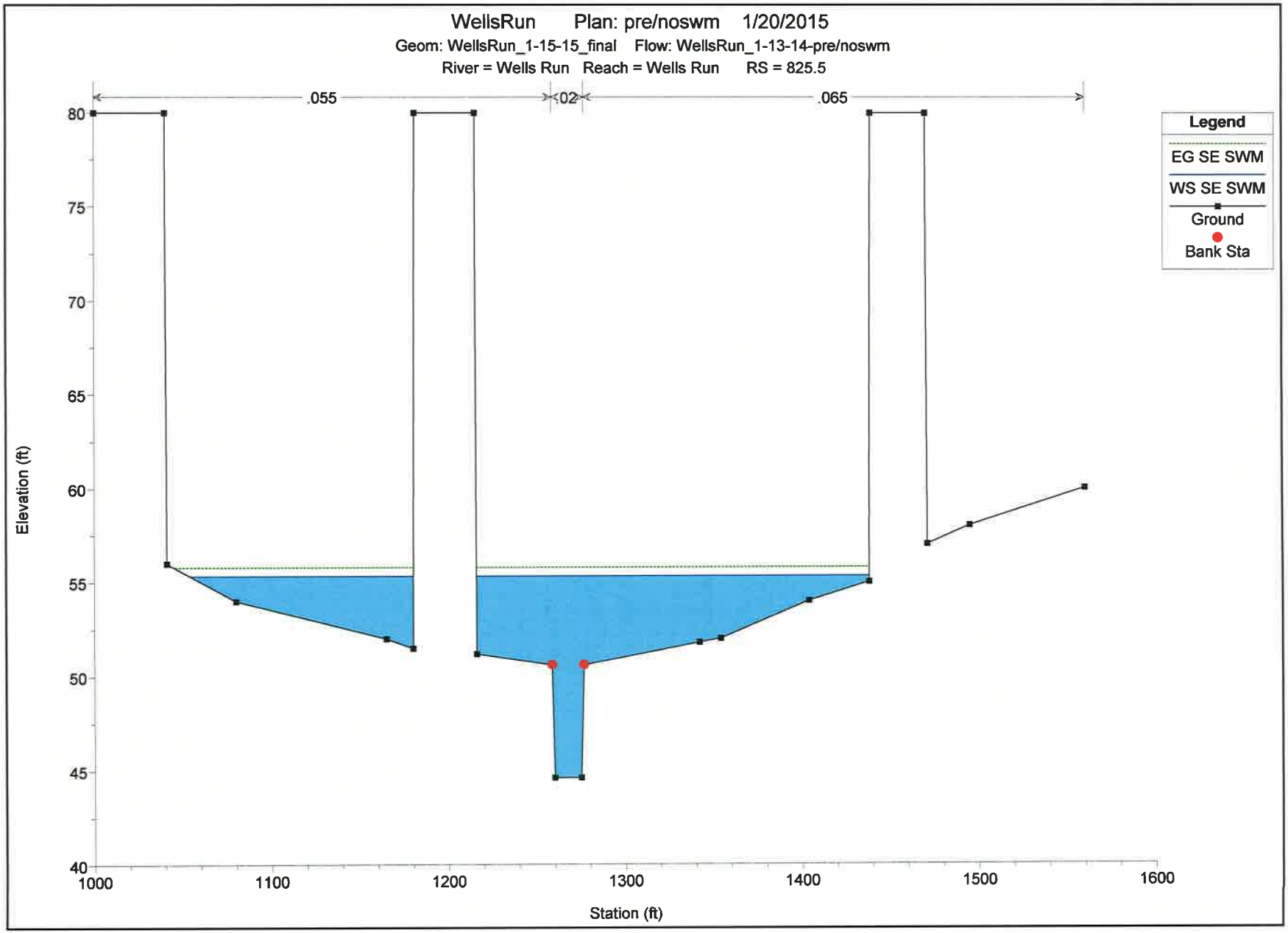
G-49


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 826 Culv Twin 9x5 culvert under Tuckerman Ave
.055
.02
.065
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
1000
1100
1200
1300
1400
1500
Station (ft)

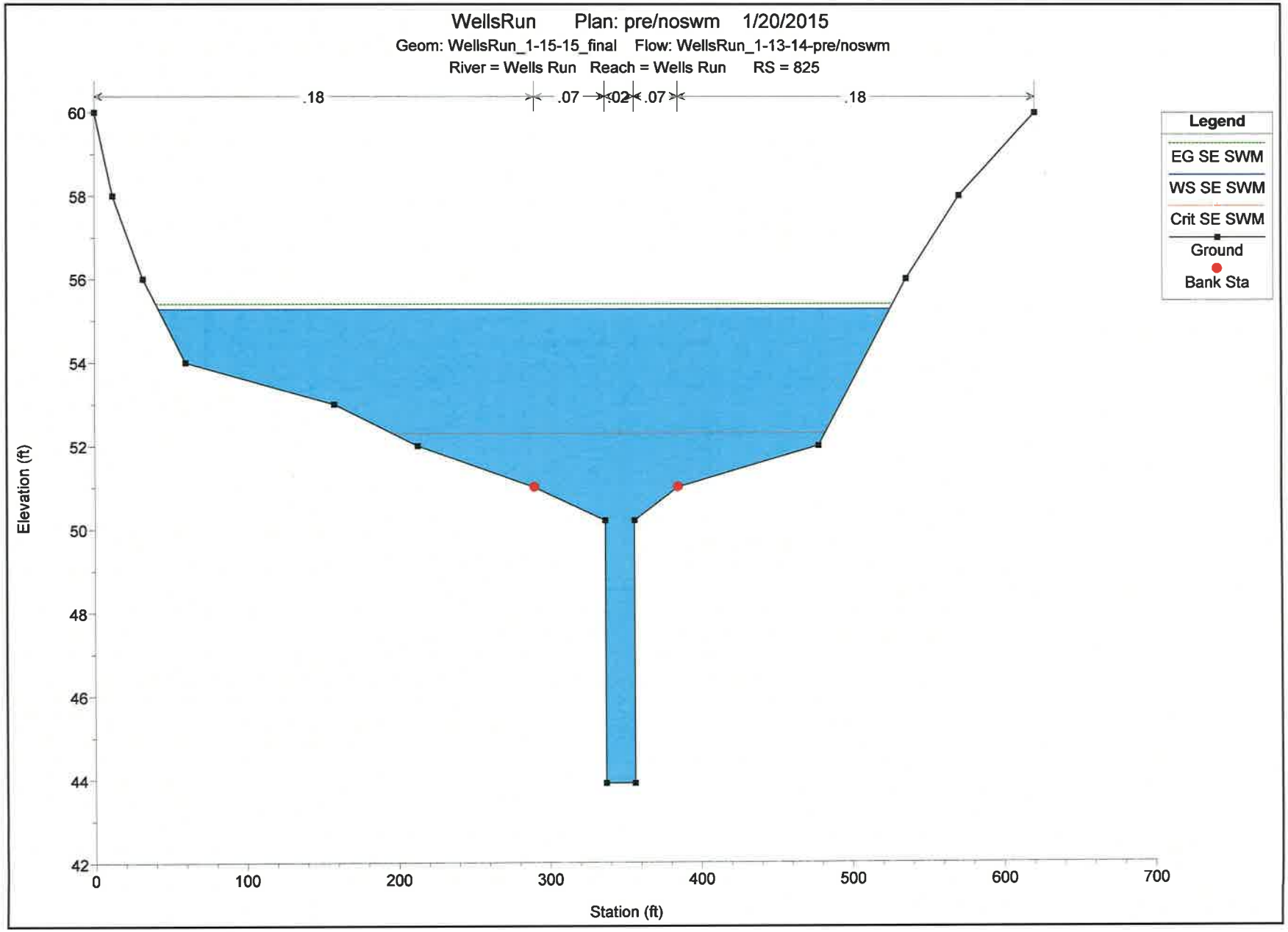
G-50


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 825.8
.055
.02
.065
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
1000
1100
1200
1300
1400
1500
Station (ft)

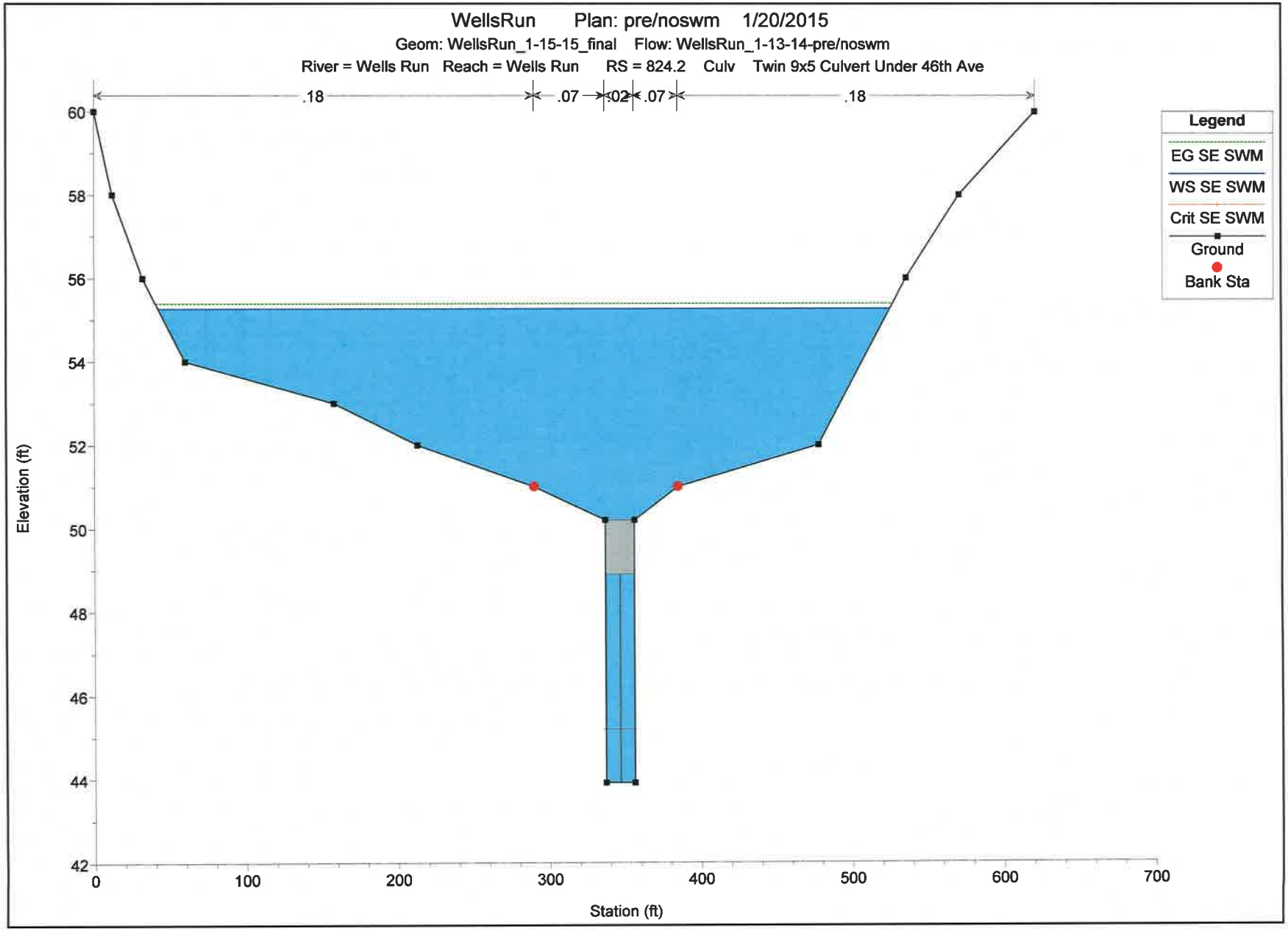
G-51


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 825.5
.055
.02
.065
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
40
1000
1100
1200
1300
1400
1500
1600
Station (ft)

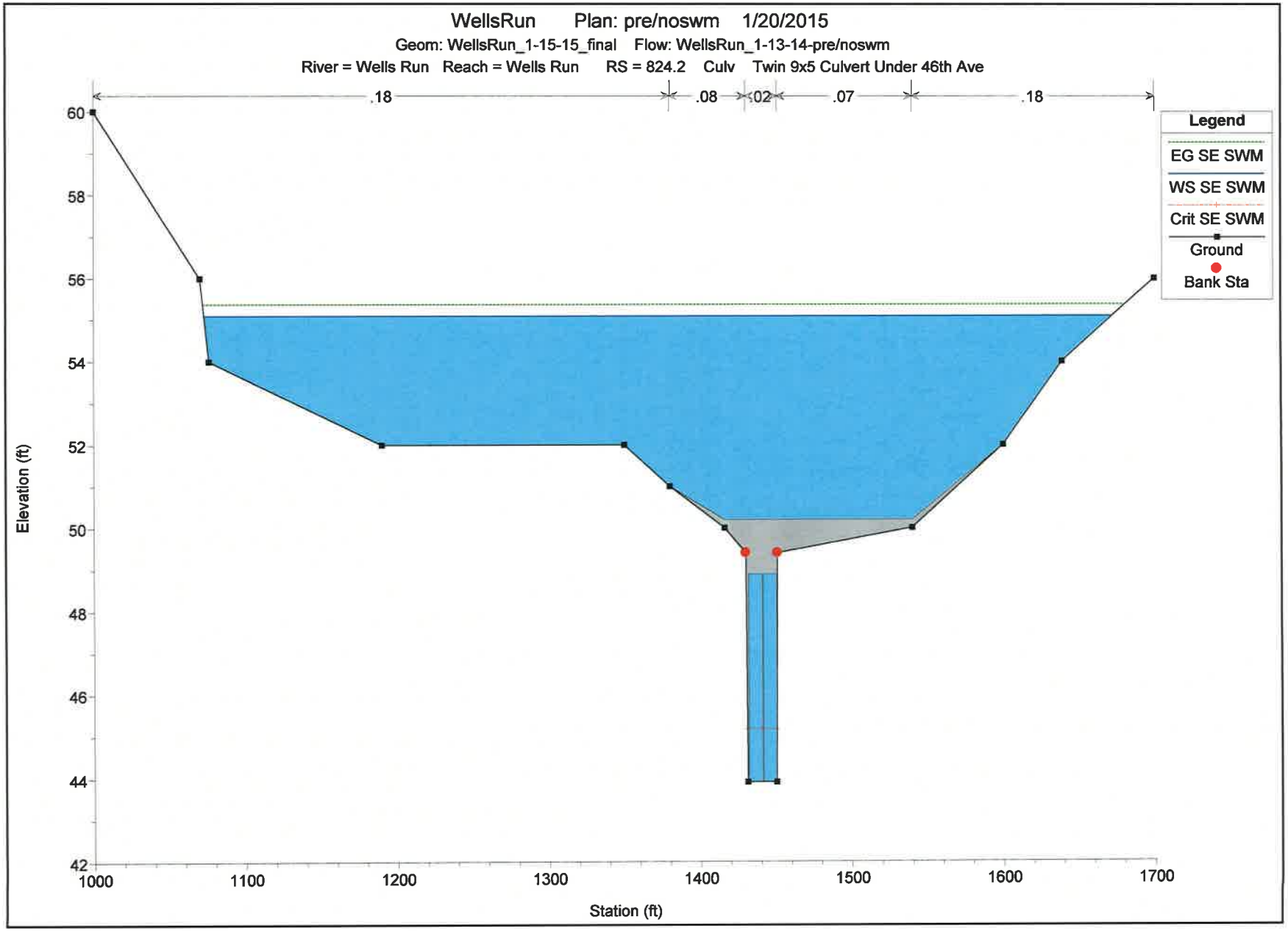
G-52


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 825
.18
.07
.02
.07
.18
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
46
44
42
0
100
200
300
400
500
600
700
Station (ft)

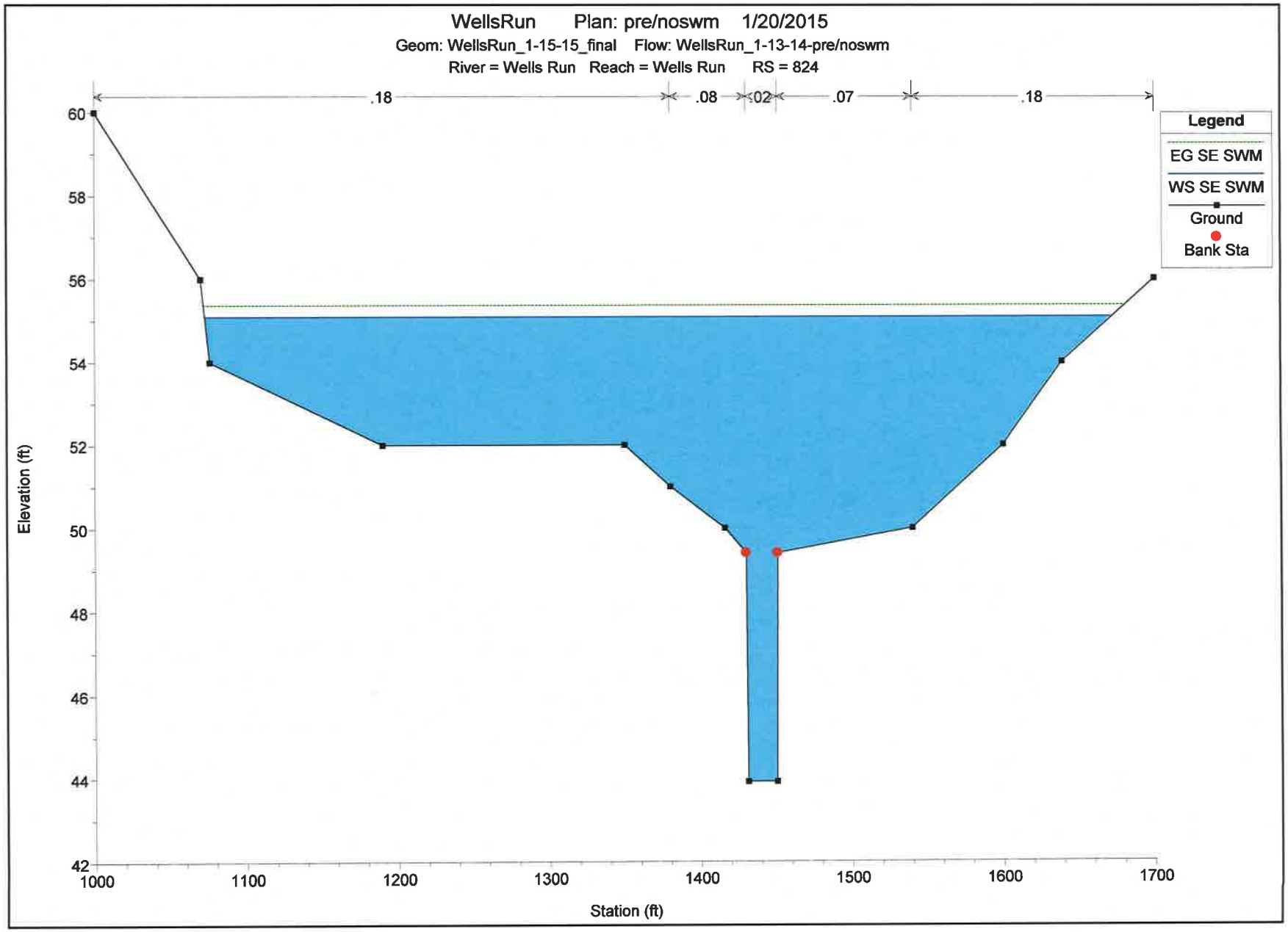
G-53


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 824.2 Culv Twin 9x5 Culvert Under 46th Ave
.18
.07
.02
.07
.18
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
46
44
42
0
100
200
300
400
500
600
700
Station (ft)

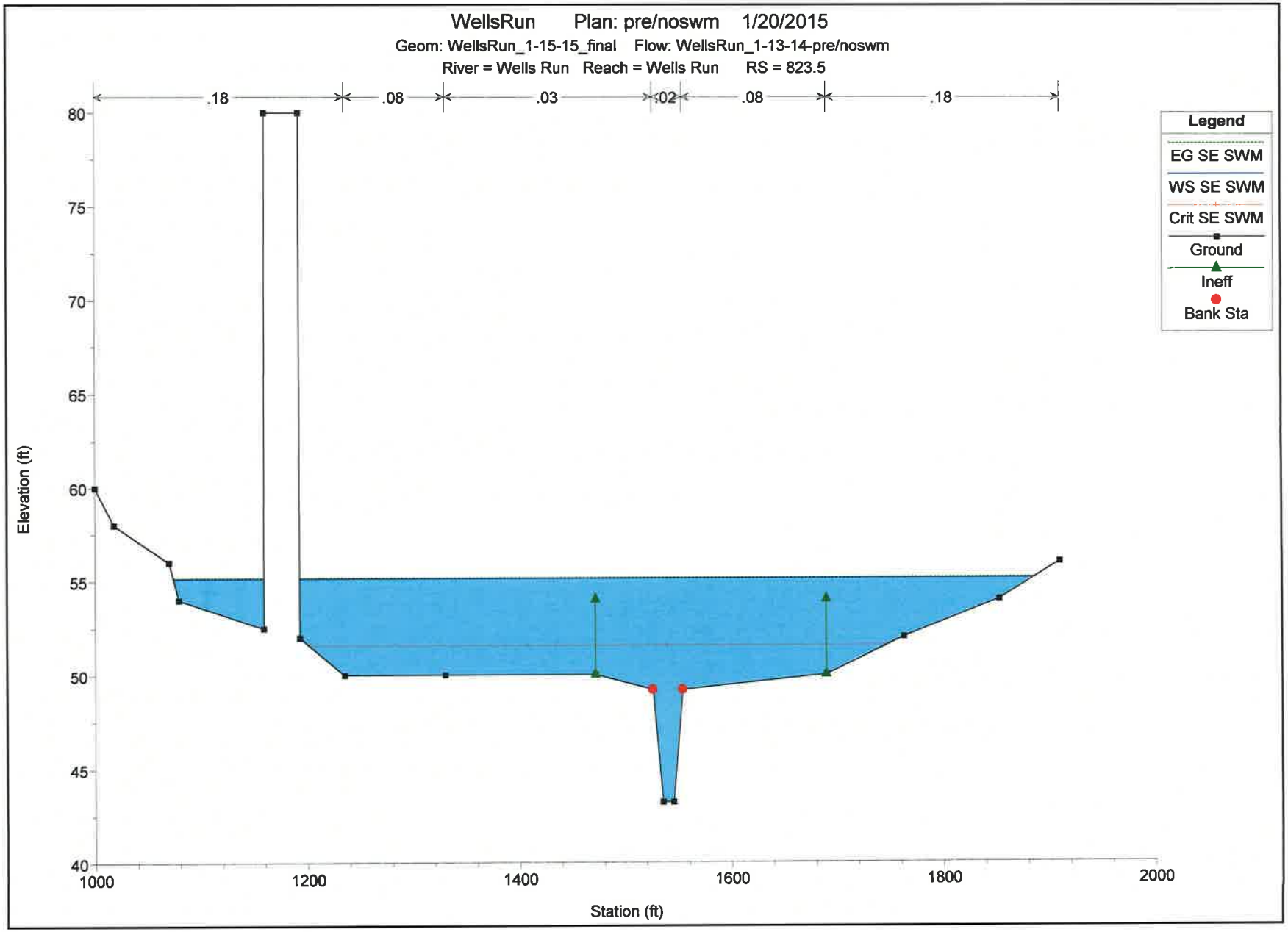
G-54


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 824.2 Culv Twin 9x5 Culvert Under 46th Ave
.18
.08
.02
.07
.18
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
46
44
42
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)

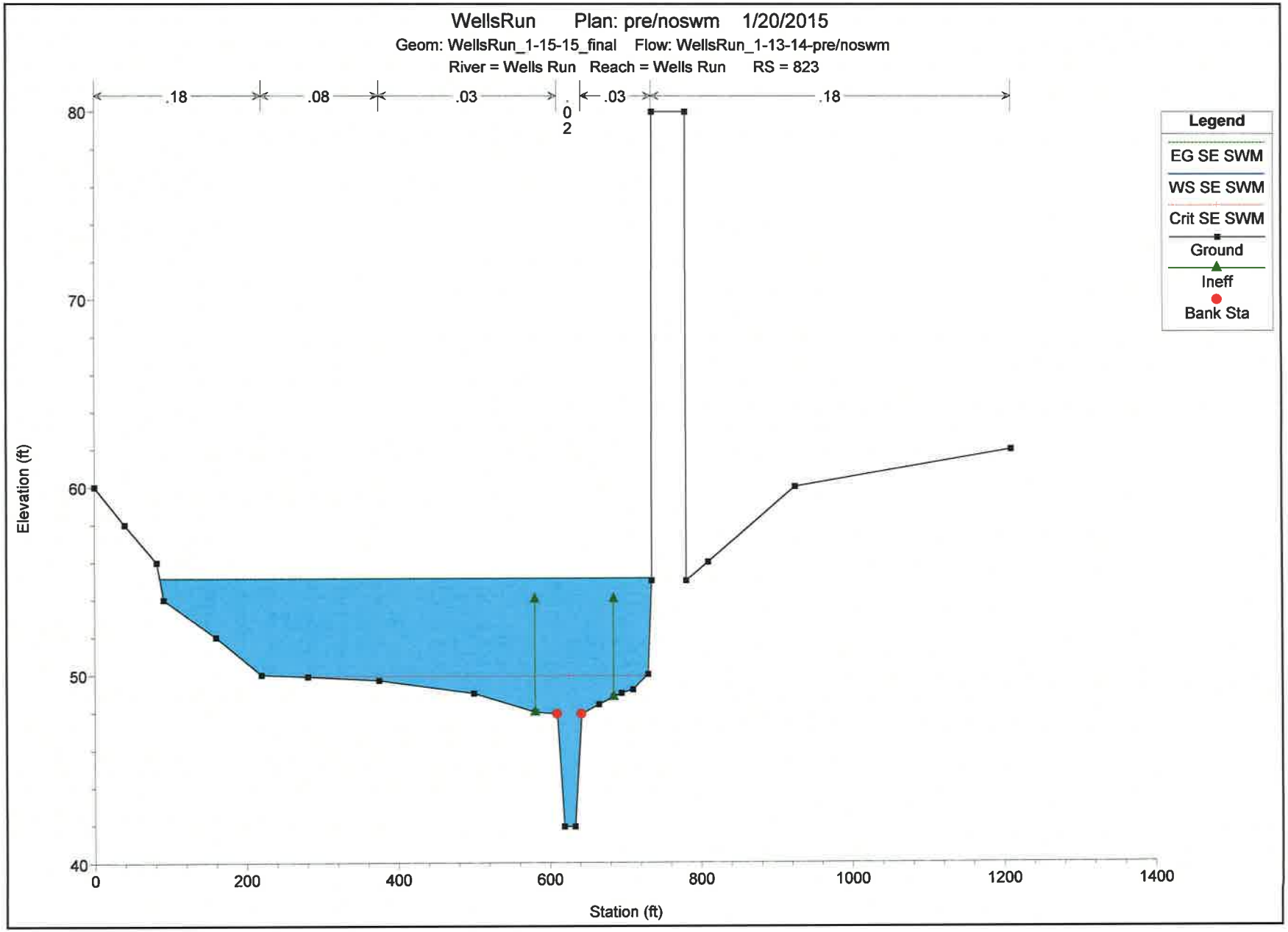
G-55


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 824
.18
.08
.02
.07
.18
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
46
44
42
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)

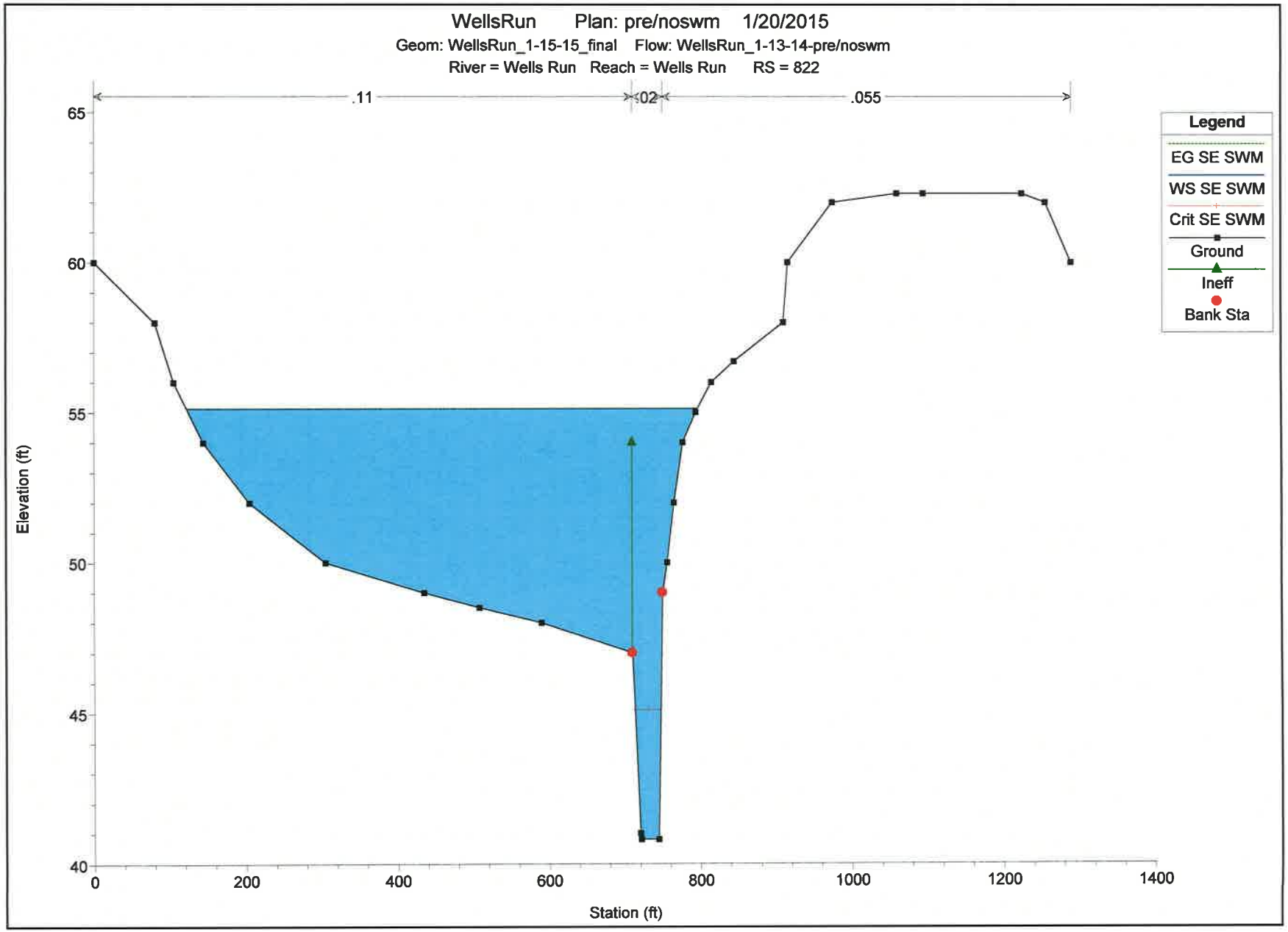
G-56


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 823.5
.18
.08
.03
.02
.08
.18
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
80
75
70
65
60
55
50
45
40
1000
1200
1400
1600
1800
2000
Station (ft)

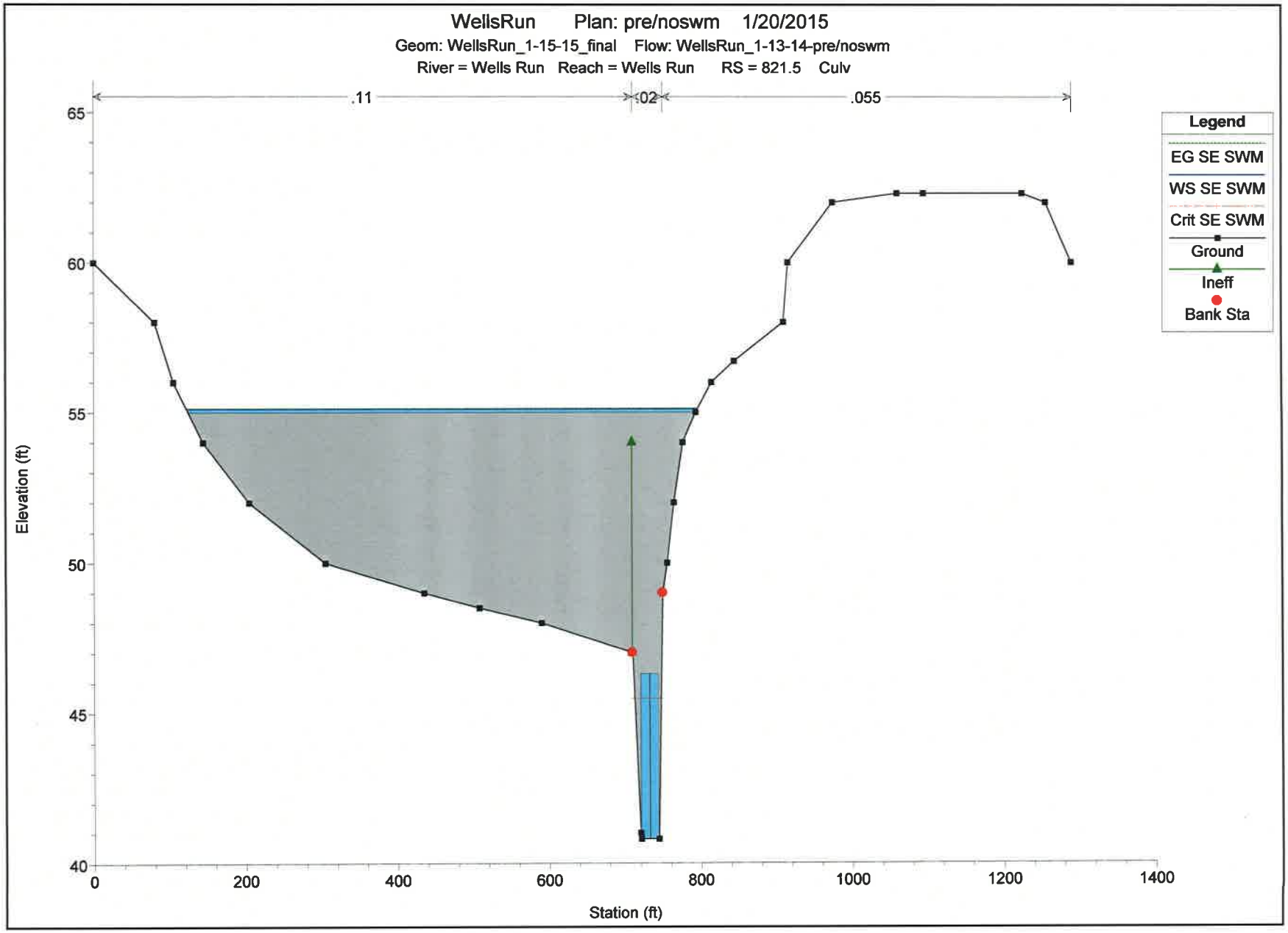
G-57


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 823
.18
.08
.03
.02
.03
.18
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
80
70
60
50
40
0
200
400
600
800
1000
1200
1400
Station (ft)

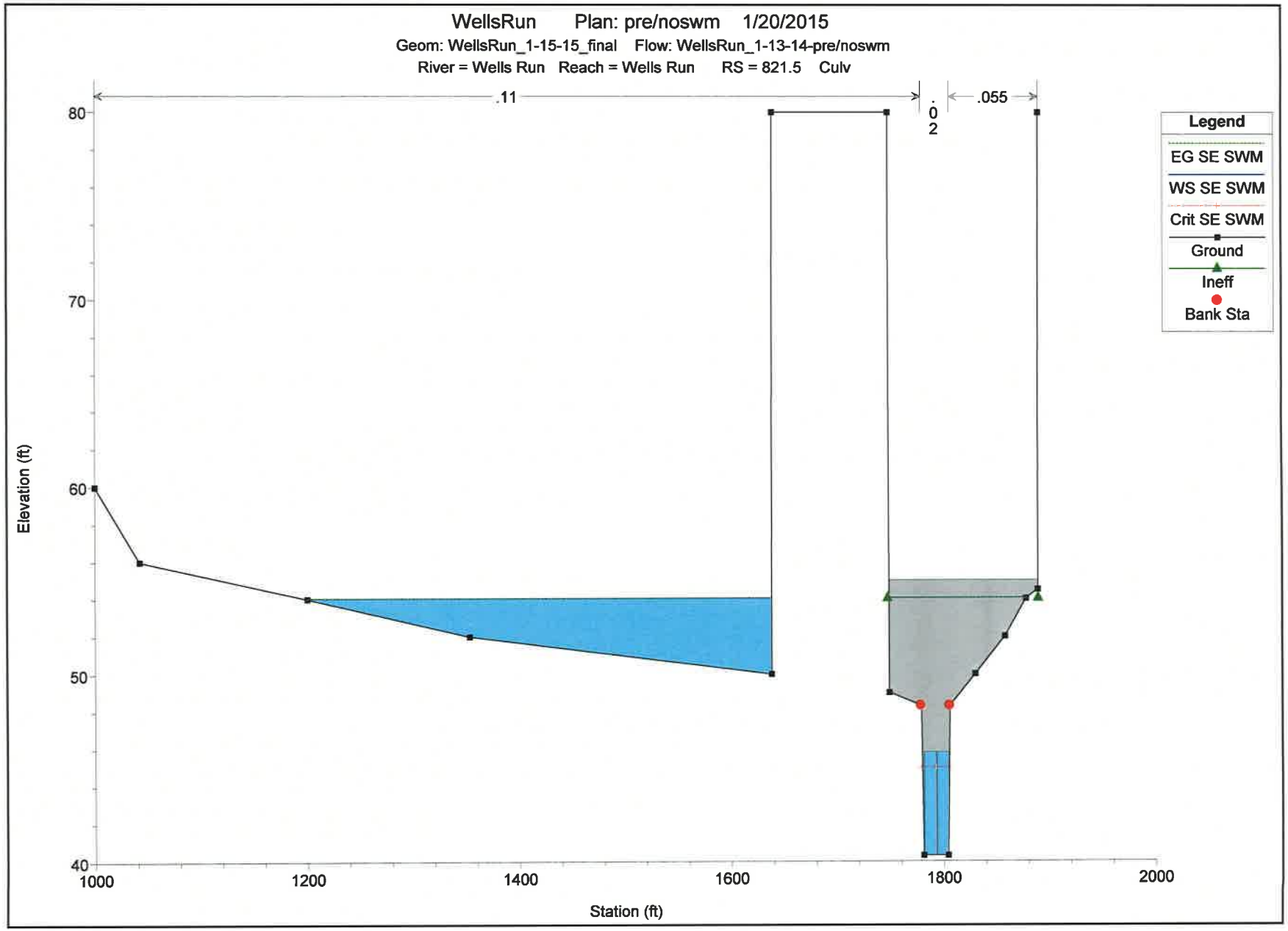
G-58.


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 822
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
65
60
55
50
45
40
0
200
400
600
800
1000
1200
1400

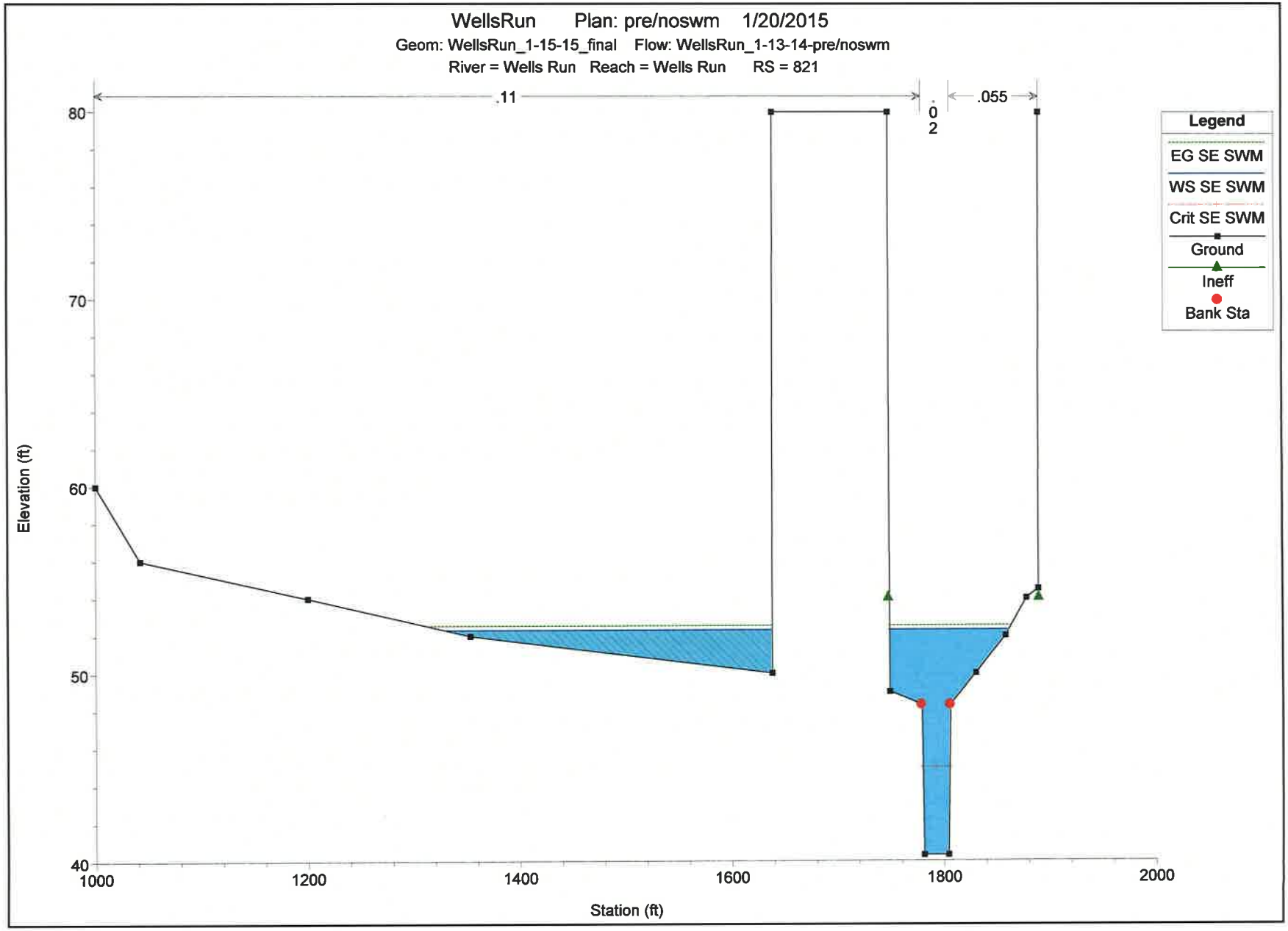
G-59


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 821.5 Culv
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
65
60
55
50
45
40
0
200
400
600
800
1000
1200
1400
Station (ft)

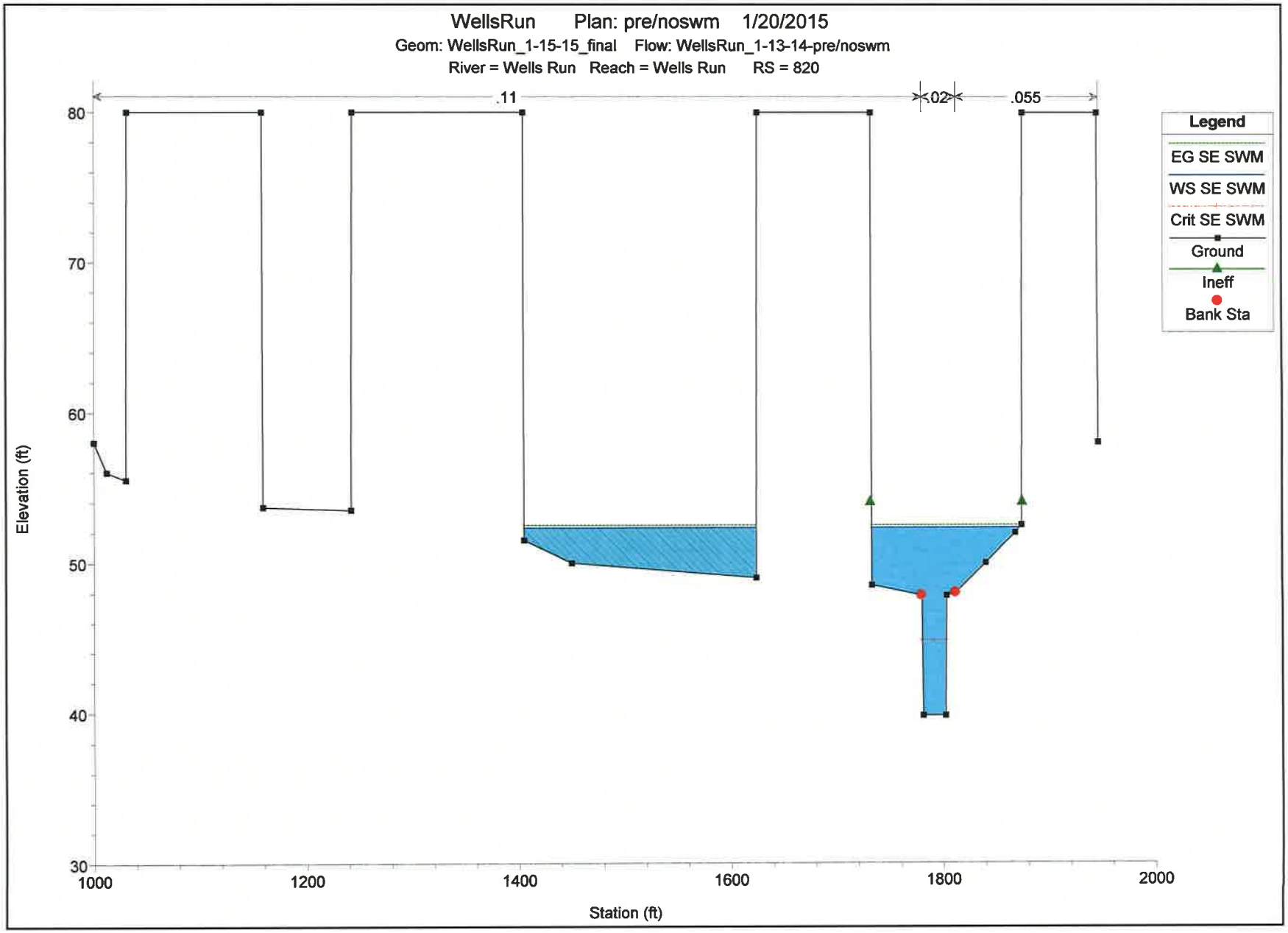
G-60


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 821.5 Culv
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
80
70
60
50
40
1000
1200
1400
1600
1800
2000
Station (ft)

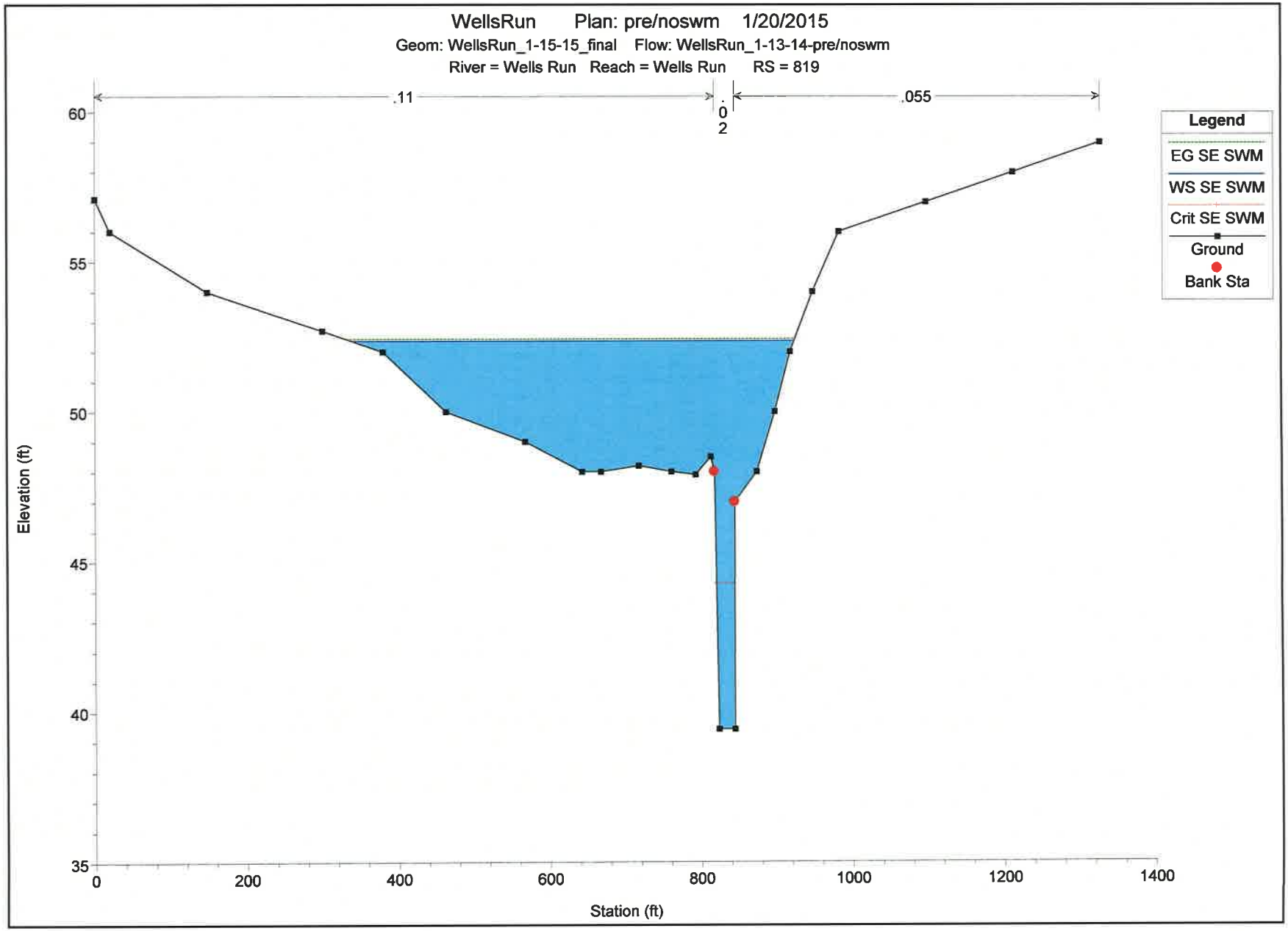
G-61


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 821
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
80
70
60
50
40
1000
1200
1400
1600
1800
2000
Station (ft)

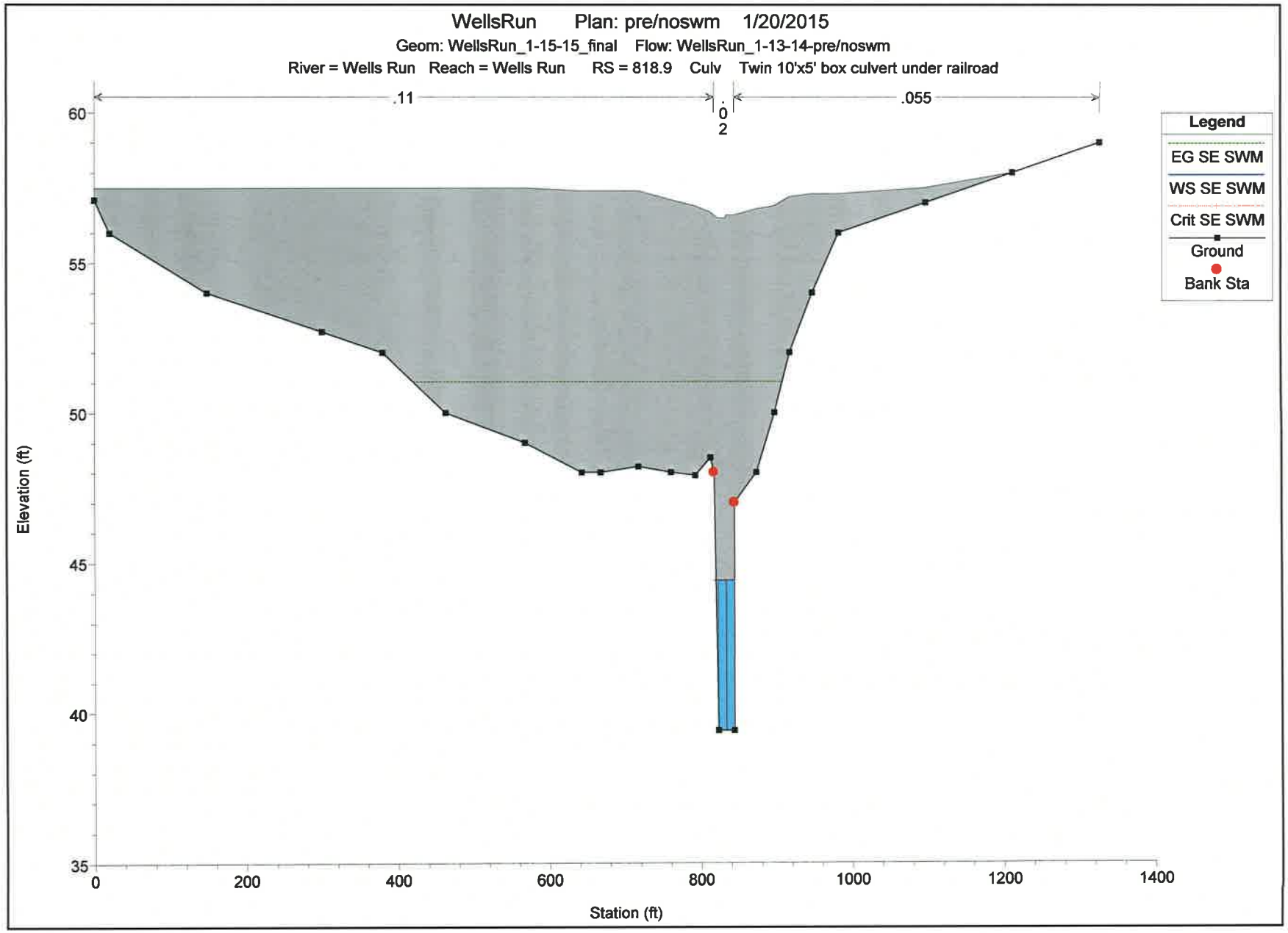
G-62


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 820
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Ineff
Bank Sta
Elevation (ft)
80
70
60
50
40
30
1000
1200
1400
1600
1800
2000
Station (ft)

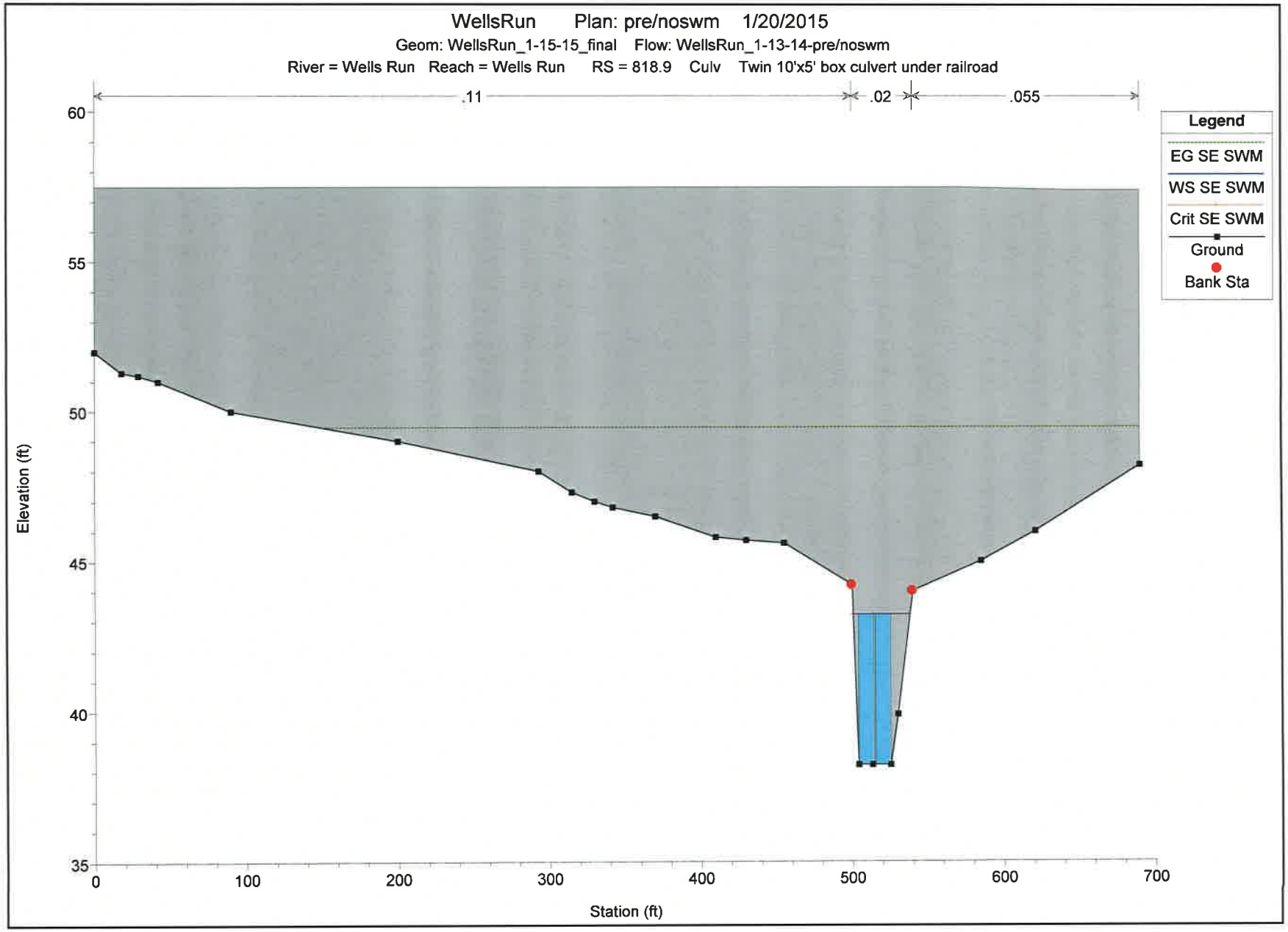
G-103


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 819
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
55
50
45
40
35
0
200
400
600
800
1000
1200
1400

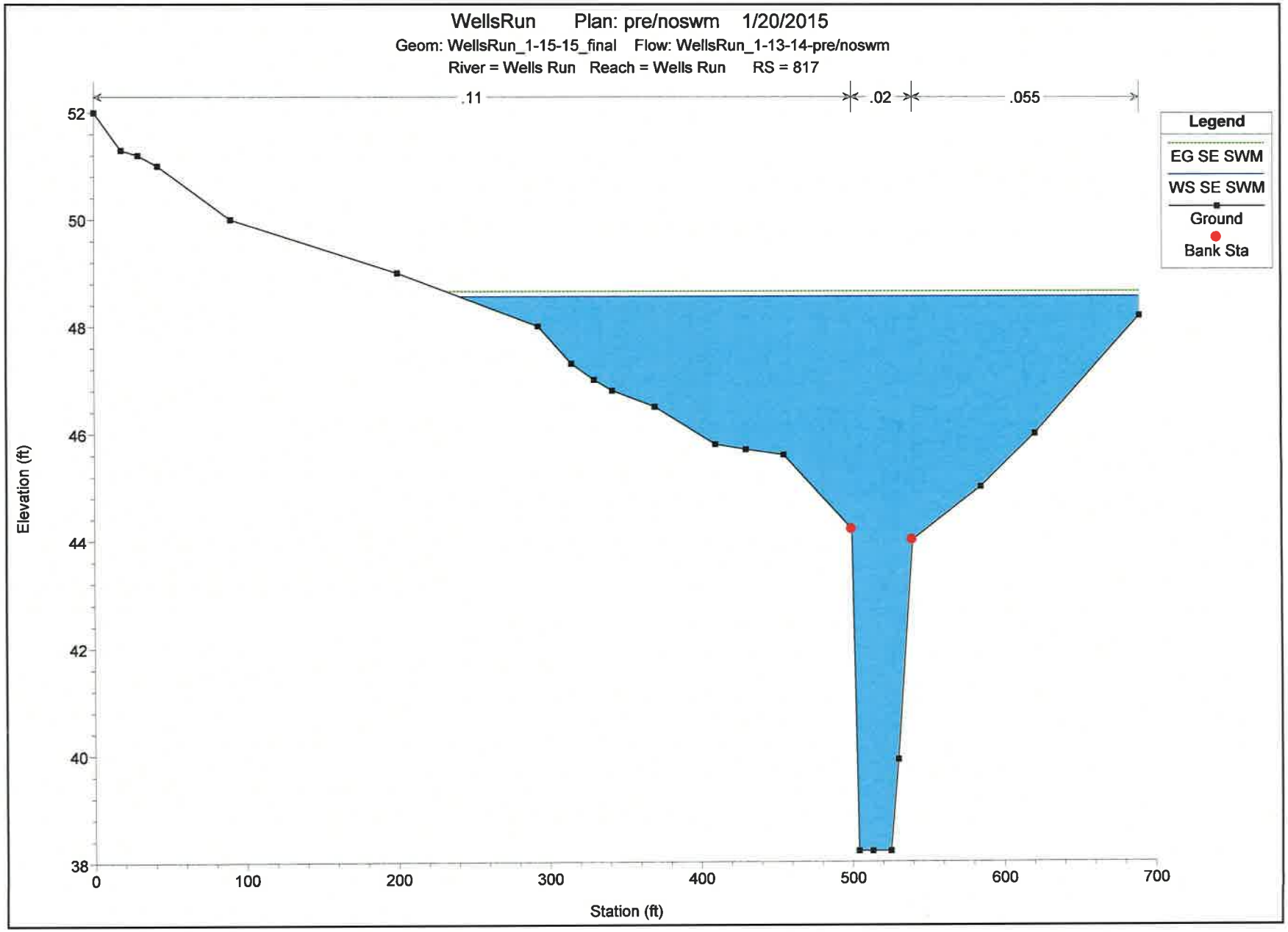
G-64


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 818.9 Culv Twin 10'x5' box culvert under railroad
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
55
50
45
40
35
0
200
400
600
800
1000
1200
1400

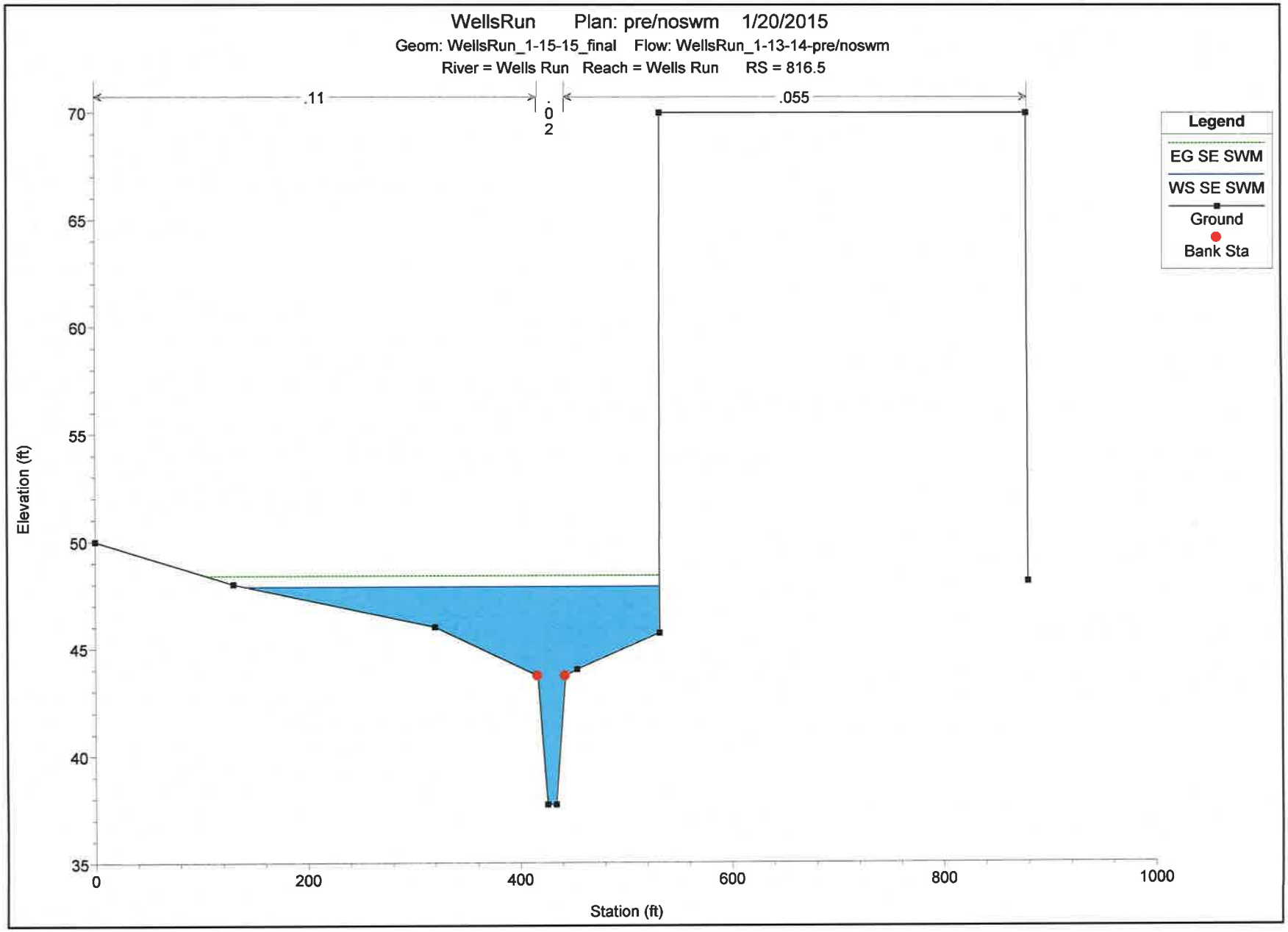
G-65


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 818.9 Culv Twin 10'x5' box culvert under railroad
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
60
55
50
45
40
35
0
100
200
300
400
500
600
700
Station (ft)

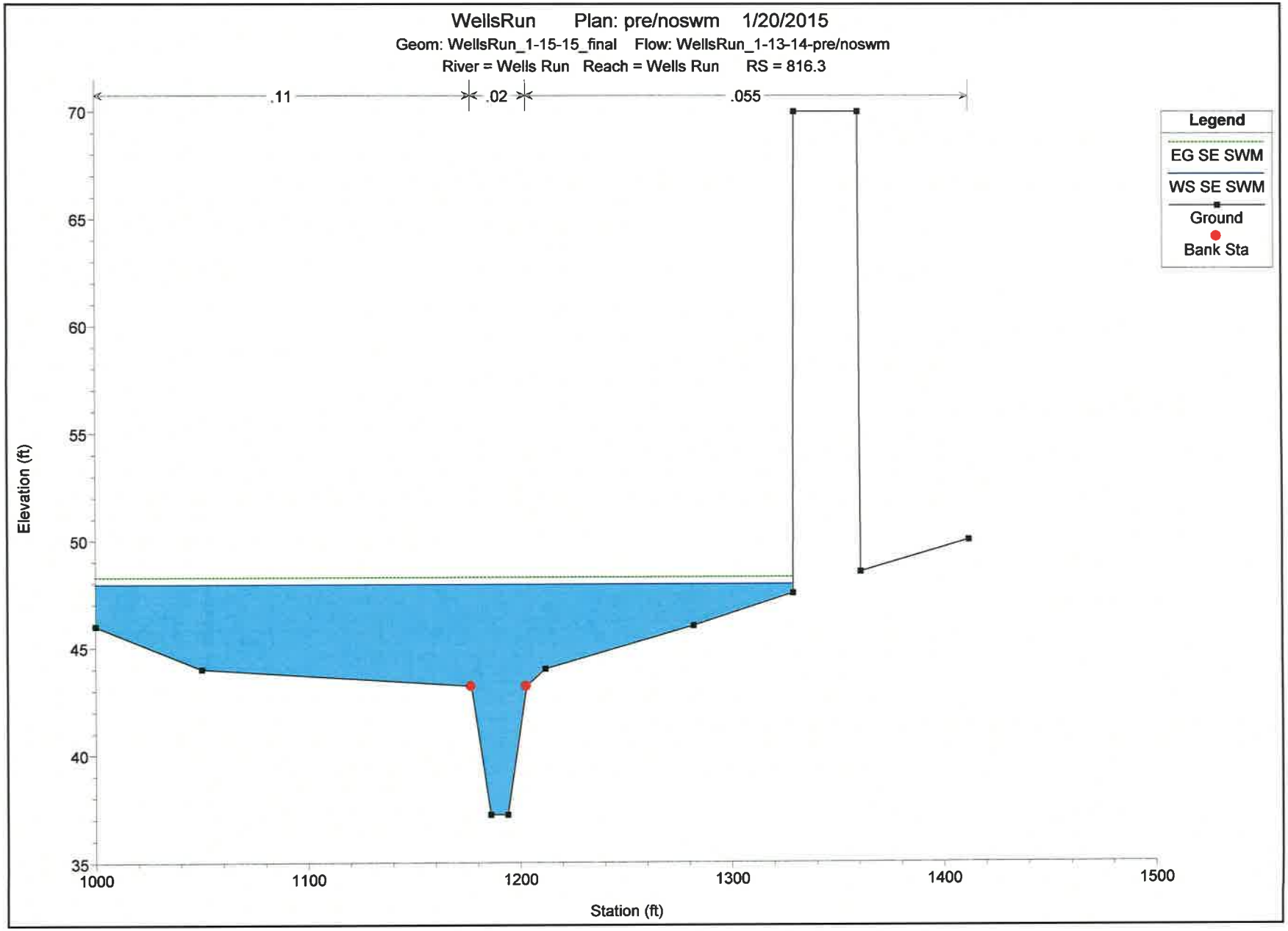
G-66


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 817
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
52
50
48
46
44
42
40
38
0
100
200
300
400
500
600
700
Station (ft)

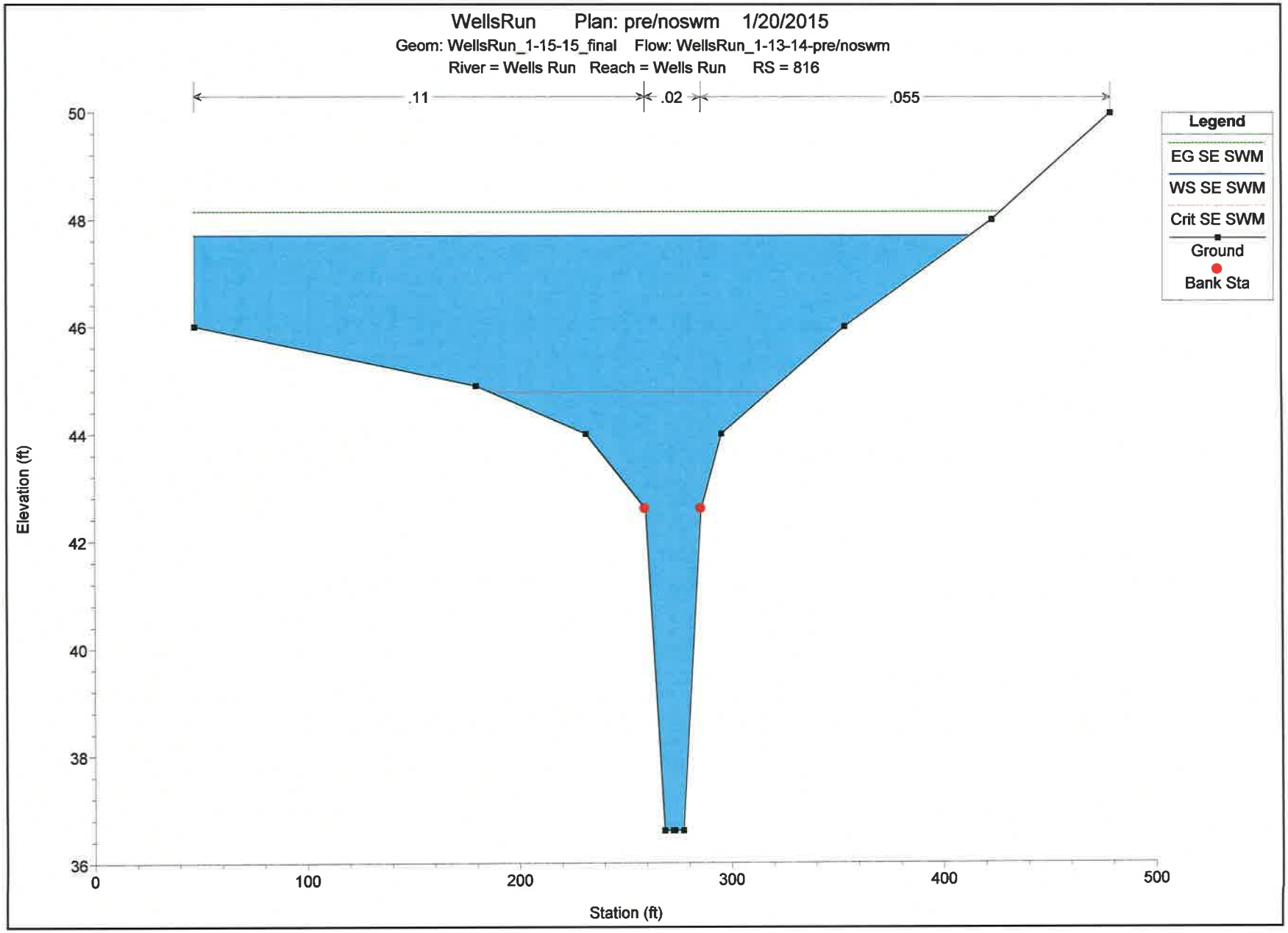
G-167


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 816.5
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
70
65
60
55
50
45
40
35
0
200
400
600
800
1000
Station (ft)

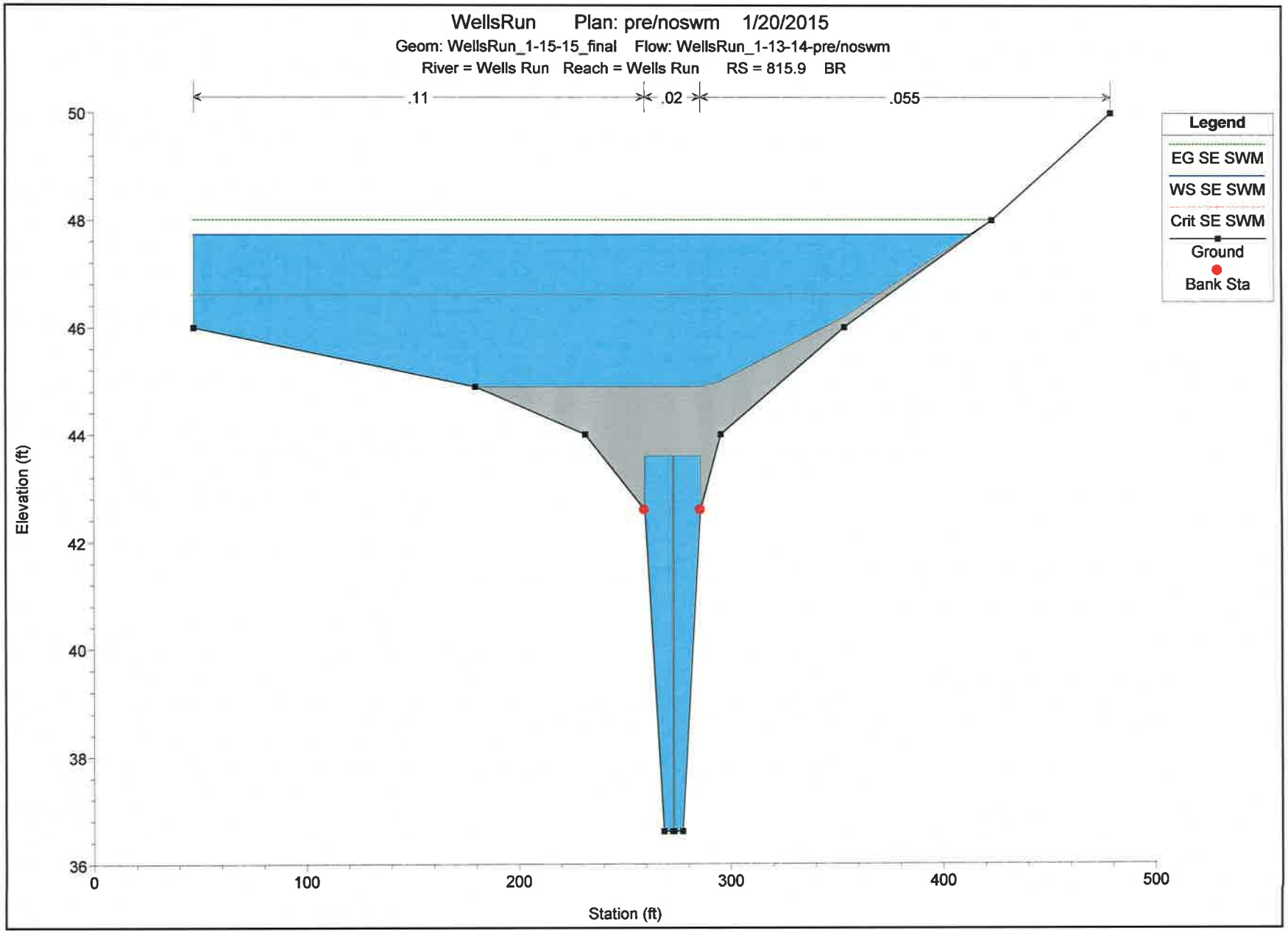
G-68


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 816.3
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
70
65
60
55
50
45
40
35
1000
1100
1200
1300
1400
1500
Station (ft)

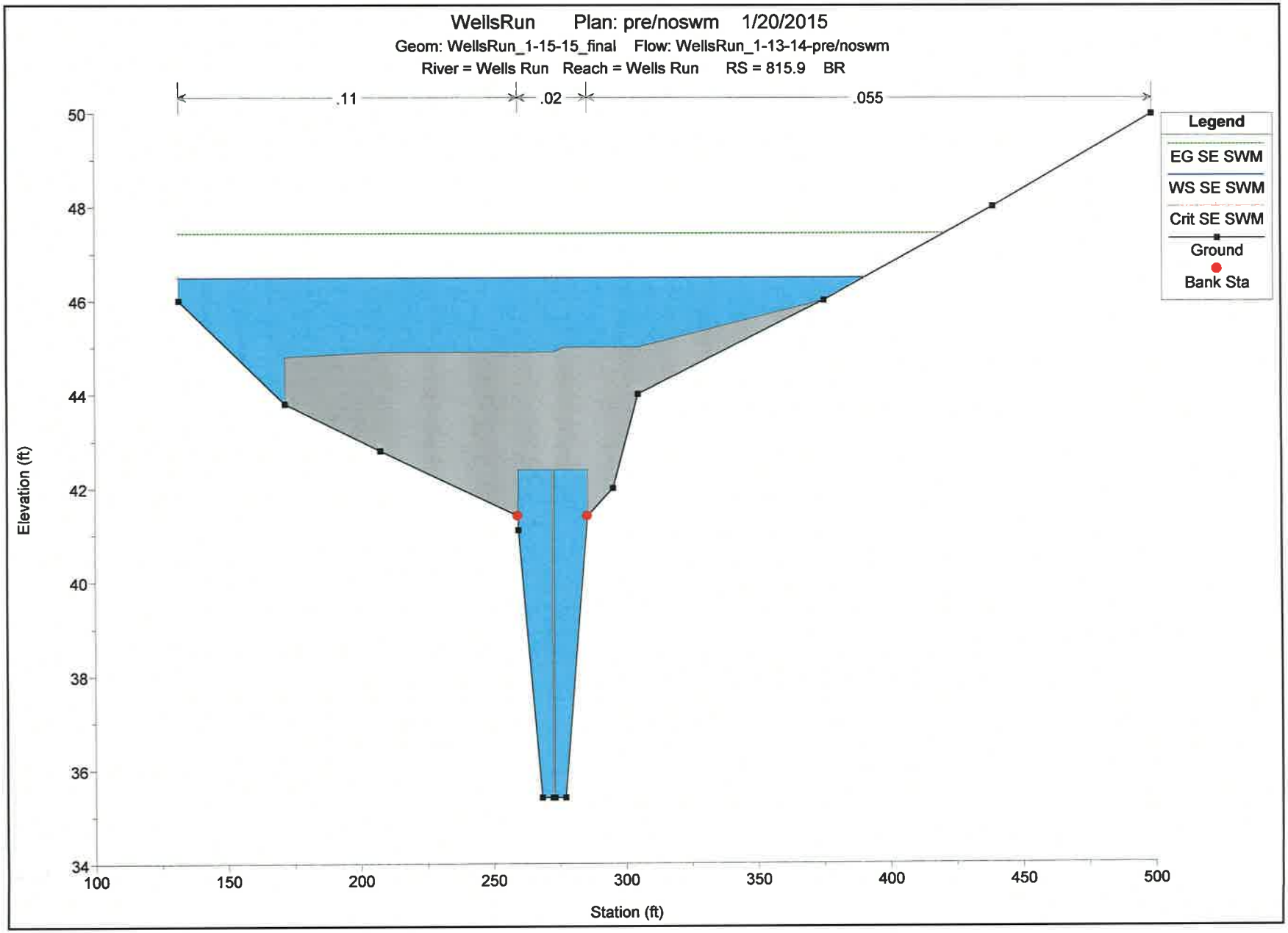
G-69


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 816
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
50
48
46
44
42
40
38
36
0
100
200
300
400
500

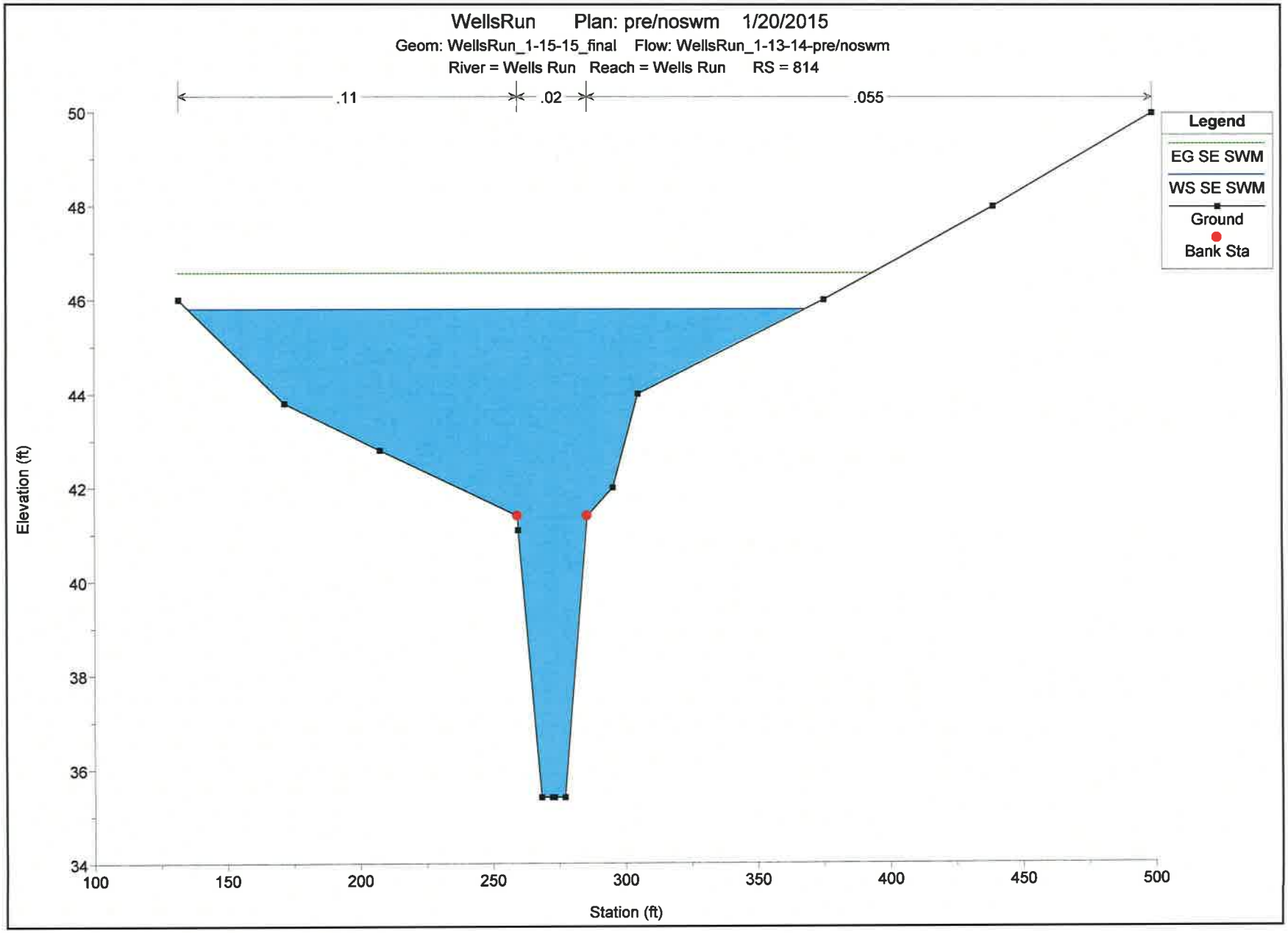
G-10


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 815.9 BR
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
50
48
46
44
42
40
38
36
0
100
200
300
400
500
Station (ft)

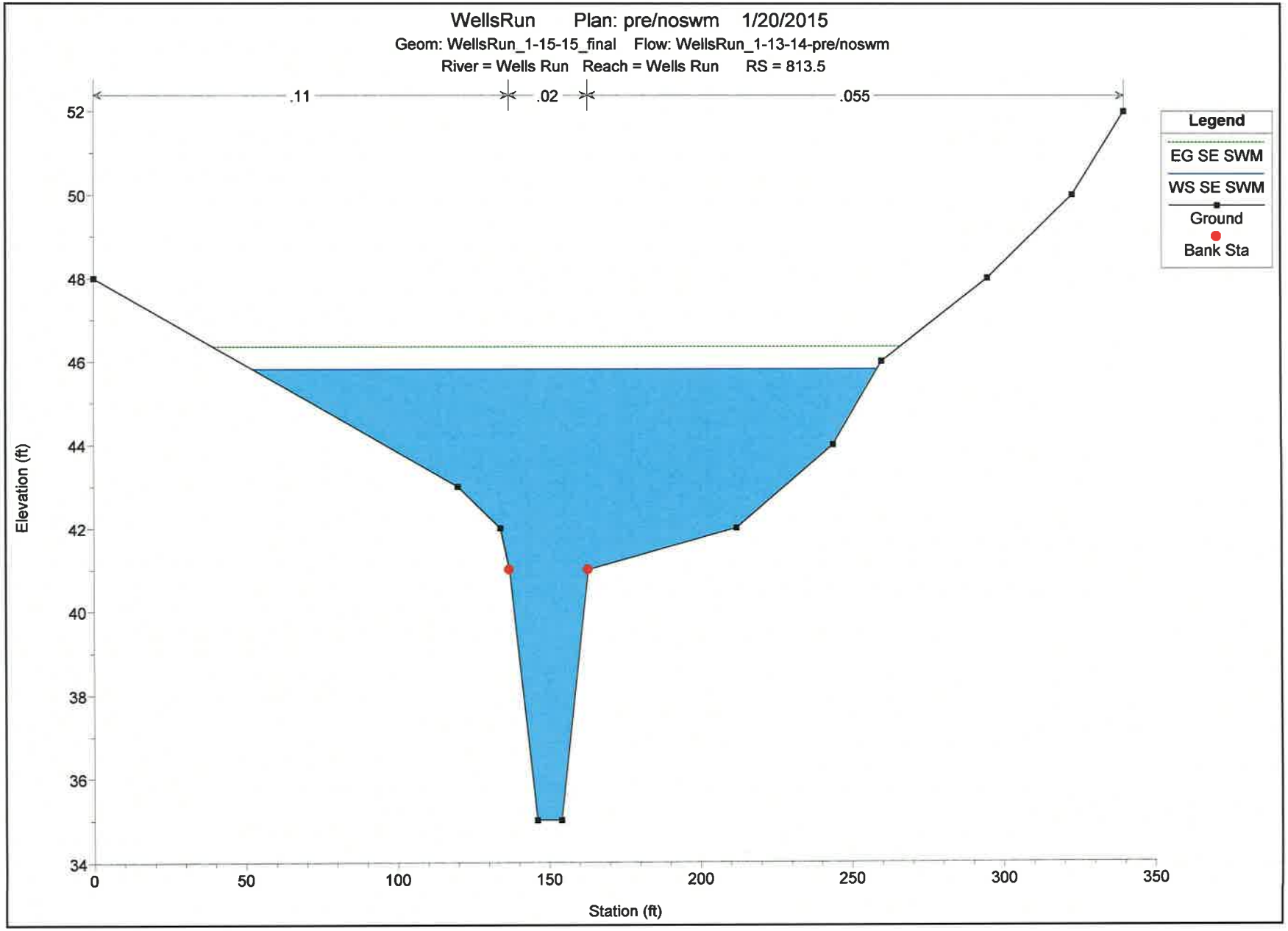
G-11


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 815.9 BR
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
50
48
46
44
42
40
38
36
34
100
150
200
250
300
350
400
450
500

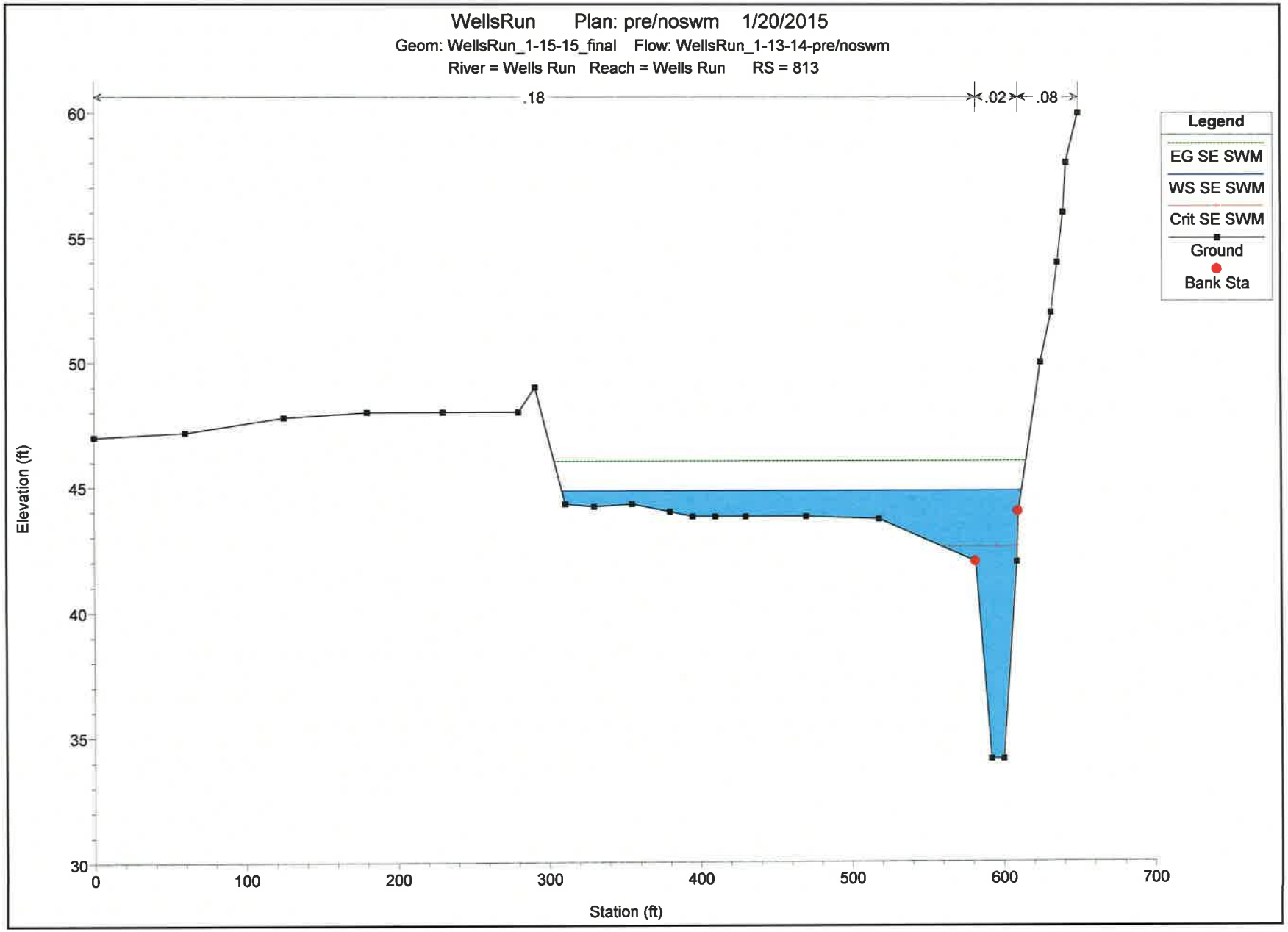
Q-72


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 814
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
50
48
46
44
42
40
38
36
34
100
150
200
250
300
350
400
450
500

G-13


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 813.5
.11
.02
.055
Legend
EG SE SWM
WS SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
52
50
48
46
44
42
40
38
36
34
0
50
100
150
200
250
300
350

G-14


WellsRun Plan: pre/noswm 1/20/2015
Geom: WellsRun_1-15-15_final Flow: WellsRun_1-13-14-pre/noswm
River = Wells Run Reach = Wells Run RS = 813
.18
.02
.08
Legend
EG SE SWM
WS SE SWM
Crit SE SWM
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
55
50
45
40
35
30
0
100
200
300
400
500
600
700

G-75

APPENDIX H
(HECRAS Model Output

HEC-RAS Plan: WR_2yr River: Wells Run Reach: Wells Run

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)	
Wells Run	834.2	Base	722.00	48.80	55.32	52.39	55.52	0.001342	3.59	229.83	93.53	0.30
Wells Run	834.2	Opt 1	722.00	48.80	55.33	52.39	55.52	0.001335	3.58	230.44	93.78	0.30
Wells Run	834.2	Opt 2	722.00	48.80	55.33	52.39	55.53	0.001334	3.58	230.58	93.84	0.30
Wells Run	834	Base	722.00	48.70	55.27	51.35	55.41	0.000794	3.03	238.31	43.54	0.23
Wells Run	834	Opt 1	722.00	48.70	55.28	51.35	55.42	0.000792	3.03	238.60	43.55	0.23
Wells Run	834	Opt 2	722.00	48.70	55.28	51.35	55.42	0.000791	3.03	238.66	43.56	0.23
Wells Run	833.3		Culvert									
Wells Run	833.2	Base	722.00	48.40	54.62		54.78	0.000960	3.23	223.29	42.84	0.25
Wells Run	833.2	Opt 1	722.00	48.40	54.63		54.79	0.000957	3.23	223.56	42.86	0.25
Wells Run	833.2	Opt 2	722.00	48.40	54.63		54.79	0.000956	3.23	223.62	42.86	0.25
Wells Run	832.0	Base	722.00	48.40	54.50		54.77	0.001269	4.18	172.70	36.50	0.34
Wells Run	832.0	Opt 1	722.00	48.40	54.51		54.78	0.001264	4.17	172.94	36.52	0.34
Wells Run	832.0	Opt 2	722.00	48.40	54.51		54.78	0.001263	4.17	173.00	36.53	0.34
Wells Run	831.5	Base	722.00	48.30	54.19		54.67	0.000657	5.59	129.18	36.92	0.53
Wells Run	831.5	Opt 1	722.00	48.30	54.20		54.68	0.000653	5.57	129.52	36.98	0.52
Wells Run	831.5	Opt 2	722.00	48.30	54.20		54.68	0.000652	5.57	129.60	36.99	0.52
Wells Run	831	Base	722.00	48.20	54.12		54.60	0.000642	5.53	130.49	37.22	0.52
Wells Run	831	Opt 1	722.00	48.20	54.13		54.61	0.000638	5.52	130.85	37.31	0.52
Wells Run	831	Opt 2	722.00	48.20	54.13		54.61	0.000637	5.51	130.93	37.33	0.52
Wells Run	830.5	Base	722.00	48.10	54.05		54.52	0.000630	5.48	131.65	37.52	0.52
Wells Run	830.5	Opt 1	722.00	48.10	54.06		54.53	0.000626	5.47	132.03	37.62	0.51
Wells Run	830.5	Opt 2	722.00	48.10	54.07		54.53	0.000625	5.46	132.12	37.64	0.51
Wells Run	830	Base	722.00	47.80	54.15	50.85	54.34	0.000282	3.55	222.00	66.49	0.28
Wells Run	830	Opt 1	722.00	47.80	54.16	50.85	54.35	0.000280	3.54	222.64	66.61	0.28
Wells Run	830	Opt 2	722.00	47.80	54.16	50.85	54.35	0.000279	3.54	222.78	66.64	0.28
Wells Run	829		Culvert									
Wells Run	828	Base	728.00	46.40	53.56		53.88	0.000506	4.57	159.17	26.48	0.33
Wells Run	828	Opt 1	732.00	46.40	53.57		53.89	0.000509	4.59	159.43	26.49	0.33
Wells Run	828	Opt 2	732.00	46.40	53.57		53.90	0.000508	4.59	159.51	26.49	0.33

U/S 44th

D/S 44th

U/S Routel

D/S Routel

HEC-RAS Plan: WR_2yr River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	827.7	Base	728.00	46.20	53.29		53.78	0.000828	5.66	143.91	43.41	0.37
Wells Run	827.7	Opt 1	732.00	46.20	53.29		53.79	0.000834	5.69	144.24	43.56	0.38
Wells Run	827.7	Opt 2	732.00	46.20	53.30		53.80	0.000833	5.68	144.38	43.62	0.38
Wells Run	827	Base	728.00	46.20	53.43		53.50	0.000137	2.39	344.39	196.50	0.16
Wells Run	827	Opt 1	732.00	46.20	53.44		53.51	0.000137	2.39	346.28	196.71	0.16
Wells Run	827	Opt 2	732.00	46.20	53.44		53.51	0.000136	2.38	346.95	196.79	0.16
Wells Run	826.5	Base	728.00	45.80	53.11		53.46	0.000565	4.97	324.91	203.35	0.32
Wells Run	826.5	Opt 1	732.00	45.80	53.12		53.46	0.000568	4.98	326.36	203.63	0.33
Wells Run	826.5	Opt 2	732.00	45.80	53.12		53.47	0.000566	4.98	327.22	203.79	0.32
Wells Run	826.1	Base	785.00	45.30	53.09	49.21	53.30	0.000402	4.24	566.94	310.34	0.27
Wells Run	826.1	Opt 1	790.00	45.30	53.09	49.23	53.31	0.000405	4.26	569.11	310.57	0.27
Wells Run	826.1	Opt 2	792.00	45.30	53.10	49.24	53.31	0.000405	4.26	570.34	310.70	0.27
Wells Run	826		Culvert									
Wells Run	825.8	Base	785.00	45.30	52.66	52.66	53.29	0.002140	8.01	308.17	250.95	0.54
Wells Run	825.8	Opt 1	790.00	45.30	52.67	52.67	53.30	0.002148	8.03	309.79	251.27	0.54
Wells Run	825.8	Opt 2	792.00	45.30	52.67	52.67	53.30	0.002151	8.04	310.40	251.39	0.54
Wells Run	825.5	Base	785.00	44.60	50.46	48.89	51.49	0.002202	8.13	96.51	17.93	0.62
Wells Run	825.5	Opt 1	790.00	44.60	50.50	48.91	51.52	0.002192	8.13	97.12	17.95	0.62
Wells Run	825.5	Opt 2	792.00	44.60	50.50	48.92	51.53	0.002192	8.14	97.28	17.95	0.62
Wells Run	825	Base	785.00	43.90	50.23	47.64	50.89	0.004982	6.48	121.05	22.48	0.49
Wells Run	825	Opt 1	790.00	43.90	50.25	47.65	50.91	0.005765	6.51	121.43	24.01	0.51
Wells Run	825	Opt 2	792.00	43.90	50.26	47.66	50.91	0.005990	6.52	121.53	24.42	0.51
Wells Run	824.2		Culvert									
Wells Run	824	Base	785.00	43.90	49.27		50.10	0.001770	7.32	107.22	20.95	0.57
Wells Run	824	Opt 1	790.00	43.90	49.28		50.12	0.001779	7.35	107.50	20.96	0.57
Wells Run	824	Opt 2	792.00	43.90	49.29		50.13	0.001784	7.36	107.59	20.96	0.57
Wells Run	823.5	Base	785.00	43.20	47.75	47.75	49.37	0.004575	10.22	76.83	23.77	1.00
Wells Run	823.5	Opt 1	790.00	43.20	47.77	47.77	49.39	0.004568	10.23	77.23	23.82	1.00

U/S Tuckerman

D/S Tuckerman

U/S 46th

D/S 46th

N

HEC-RAS Plan: WR_2yr River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	823.5	Opt 2	792.00	43.20	47.78	47.78	49.40	0.004562	10.23	77.41	23.84	1.00
Wells Run	823	Base	785.00	41.90	45.01	45.87	47.85	0.010908	13.53	58.03	23.33	1.51
Wells Run	823	Opt 1	790.00	41.90	45.02	45.89	47.87	0.010896	13.55	58.31	23.36	1.51
Wells Run	823	Opt 2	792.00	41.90	45.03	45.89	47.88	0.010893	13.56	58.42	23.38	1.51
Wells Run	822	Base	785.00	40.80	46.31	43.87	46.65	0.000623	4.71	166.65	36.88	0.39
Wells Run	822	Opt 1	790.00	40.80	46.33	43.88	46.68	0.000621	4.72	167.54	36.93	0.39
Wells Run	822	Opt 2	792.00	40.80	46.34	43.89	46.69	0.000620	4.72	167.92	36.96	0.39
Wells Run	821.5		Culvert									
Wells Run	821	Base	785.00	40.30	44.89	43.57	45.67	0.001770	7.09	110.78	25.29	0.60
Wells Run	821	Opt 1	790.00	40.30	44.90	43.58	45.69	0.001775	7.11	111.15	25.30	0.60
Wells Run	821	Opt 2	792.00	40.30	44.90	43.59	45.69	0.001781	7.12	111.21	25.30	0.60
Wells Run	820	Base	785.00	39.80	44.50	43.29	45.43	0.002179	7.73	101.49	22.18	0.64
Wells Run	820	Opt 1	790.00	39.80	44.51	43.30	45.45	0.002197	7.77	101.65	22.18	0.64
Wells Run	820	Opt 2	792.00	39.80	44.51	43.31	45.45	0.002212	7.80	101.59	22.18	0.64
Wells Run	819	Base	563.00	39.40	44.72	42.16	45.05	0.000665	4.62	121.80	24.79	0.37
Wells Run	819	Opt 1	569.00	39.40	44.73	42.18	45.07	0.000677	4.66	121.99	24.80	0.37
Wells Run	819	Opt 2	569.00	39.40	44.73	42.18	45.07	0.000677	4.66	121.99	24.80	0.37
Wells Run	818.9		Culvert									
Wells Run	817	Base	563.00	38.20	44.26		44.39	0.000234	2.99	190.00	53.30	0.24
Wells Run	817	Opt 1	569.00	38.20	44.25		44.39	0.000240	3.02	189.76	52.96	0.25
Wells Run	817	Opt 2	569.00	38.20	44.25		44.39	0.000240	3.02	189.76	52.96	0.25
Wells Run	816.5	Base	641.00	37.70	42.94		43.87	0.002389	7.71	83.17	23.73	0.73
Wells Run	816.5	Opt 1	641.00	37.70	42.94		43.87	0.002389	7.71	83.18	23.73	0.73
Wells Run	816.5	Opt 2	641.00	37.70	42.94		43.87	0.002389	7.71	83.18	23.73	0.73
Wells Run	816.3	Base	641.00	37.20	42.88		43.60	0.001726	6.83	93.81	25.04	0.62
Wells Run	816.3	Opt 1	641.00	37.20	42.88		43.60	0.001726	6.83	93.81	25.04	0.62
Wells Run	816.3	Opt 2	641.00	37.20	42.88		43.60	0.001726	6.83	93.81	25.04	0.62
Wells Run	816	Base	641.00	36.60	42.77	40.91	43.30	0.001115	5.86	109.70	30.81	0.51

U/S Trolley

D/S Trolley

U/S CSX

D/S CSX

N

HEC-RAS Plan: WR_2yr River: Wells Run Reach: Wells Run (Continued)

U/S Ravens wood

D/S Ravens wood

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)	
Wells Run	816	Opt 1	641.00	36.60	42.77	40.91	43.30	0.001115	5.86	109.70	30.82	0.51
Wells Run	816	Opt 2	641.00	36.60	42.77	40.91	43.30	0.001115	5.86	109.70	30.82	0.51
Wells Run	815.9		Bridge									
Wells Run	814	Base	641.00	35.40	42.57		42.90	0.000508	4.60	171.94	82.23	0.36
Wells Run	814	Opt 1	641.00	35.40	42.57		42.90	0.000508	4.60	171.96	82.24	0.36
Wells Run	814	Opt 2	641.00	35.40	42.57		42.90	0.000508	4.60	171.96	82.24	0.36
Wells Run	813.5	Base	641.00	35.00	42.56		42.83	0.000411	4.29	202.29	94.77	0.32
Wells Run	813.5	Opt 1	641.00	35.00	42.56		42.83	0.000411	4.29	202.31	94.78	0.32
Wells Run	813.5	Opt 2	641.00	35.00	42.56		42.83	0.000411	4.29	202.31	94.78	0.32
Wells Run	813	Base	641.00	34.10	42.49	38.71	42.77	0.000429	4.23	156.06	45.69	0.32
Wells Run	813	Opt 1	641.00	34.10	42.49	38.71	42.77	0.000429	4.23	156.06	45.69	0.32
Wells Run	813	Opt 2	641.00	34.10	42.49	38.71	42.77	0.000429	4.23	156.06	45.69	0.32

HEC-RAS Plan: WR_10yr River: Wells Run Reach: Wells Run

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)	
Wells Run	834.2	Base	1491.00	48.80	58.16	54.04	58.31	0.000701	3.54	828.08	354.77	0.23
Wells Run	834.2	Opt 1	1491.00	48.80	58.16	54.04	58.31	0.000701	3.54	828.09	354.78	0.23
Wells Run	834.2	Opt 2	1491.00	48.80	58.16	54.04	58.31	0.000701	3.54	828.09	354.78	0.23
Wells Run	834	Base	1491.00	48.70	58.01	52.83	58.24	0.000793	3.88	541.57	246.34	0.24
Wells Run	834	Opt 1	1491.00	48.70	58.01	52.83	58.24	0.000793	3.88	541.58	246.34	0.24
Wells Run	834	Opt 2	1491.00	48.70	58.01	52.83	58.24	0.000793	3.88	541.58	246.34	0.24
Wells Run	833.3		Culvert									
Wells Run	833.2	Base	1491.00	48.40	57.85		58.05	0.000736	3.78	574.91	261.82	0.23
Wells Run	833.2	Opt 1	1491.00	48.40	57.85		58.05	0.000736	3.78	574.91	261.82	0.23
Wells Run	833.2	Opt 2	1491.00	48.40	57.85		58.05	0.000736	3.78	574.91	261.82	0.23
Wells Run	832.0	Base	1491.00	48.40	57.79		58.05	0.000752	4.30	497.17	257.30	0.28
Wells Run	832.0	Opt 1	1491.00	48.40	57.79		58.05	0.000752	4.30	497.17	257.30	0.28
Wells Run	832.0	Opt 2	1491.00	48.40	57.79		58.05	0.000752	4.30	497.17	257.30	0.28
Wells Run	831.5	Base	1491.00	48.30	57.76		58.03	0.000197	4.41	552.40	268.42	0.32
Wells Run	831.5	Opt 1	1491.00	48.30	57.76		58.03	0.000197	4.41	552.40	268.42	0.32
Wells Run	831.5	Opt 2	1491.00	48.30	57.76		58.03	0.000197	4.41	552.40	268.42	0.32
Wells Run	831	Base	1491.00	48.20	57.75		58.00	0.000186	4.32	576.32	277.84	0.31
Wells Run	831	Opt 1	1491.00	48.20	57.75		58.00	0.000186	4.32	576.32	277.85	0.31
Wells Run	831	Opt 2	1491.00	48.20	57.75		58.00	0.000186	4.32	576.32	277.85	0.31
Wells Run	830.5	Base	1491.00	48.10	57.73		57.98	0.000175	4.24	600.30	286.98	0.30
Wells Run	830.5	Opt 1	1491.00	48.10	57.73		57.98	0.000175	4.24	600.30	286.98	0.30
Wells Run	830.5	Opt 2	1491.00	48.10	57.73		57.98	0.000175	4.24	600.30	286.98	0.30
Wells Run	830	Base	1491.00	47.80	57.73	52.48	57.95	0.000171	3.96	639.86	220.56	0.24
Wells Run	830	Opt 1	1491.00	47.80	57.73	52.48	57.95	0.000171	3.96	639.86	220.56	0.24
Wells Run	830	Opt 2	1491.00	47.80	57.73	52.48	57.95	0.000171	3.96	639.86	220.56	0.24
Wells Run	829		Culvert									
Wells Run	828	Base	1512.00	46.40	55.35		56.15	0.000914	7.19	231.93	50.14	0.46
Wells Run	828	Opt 1	1513.00	46.40	55.35		56.15	0.000914	7.20	232.00	50.15	0.46
Wells Run	828	Opt 2	1513.00	46.40	55.36		56.15	0.000912	7.19	232.28	50.19	0.46

U/S 44th

D/S 44th

U/S Routel

D/S Routel

Fig 4

HEC-RAS Plan: WR_10yr River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	827.7	Base	1512.00	46.20	54.38		55.84	0.002079	9.87	227.62	98.97	0.61
Wells Run	827.7	Opt 1	1513.00	46.20	54.38		55.84	0.002083	9.88	227.45	98.97	0.61
Wells Run	827.7	Opt 2	1513.00	46.20	54.40		55.85	0.002064	9.85	229.24	99.03	0.61
Wells Run	827	Base	1512.00	46.20	55.02		55.10	0.000080	2.08	679.12	221.39	0.12
Wells Run	827	Opt 1	1513.00	46.20	55.02		55.10	0.000080	2.09	679.03	221.38	0.12
Wells Run	827	Opt 2	1513.00	46.20	55.03		55.11	0.000079	2.07	682.11	221.55	0.12
Wells Run	826.5	Base	1512.00	45.80	54.37		55.02	0.001030	7.46	609.63	245.13	0.45
Wells Run	826.5	Opt 1	1513.00	45.80	54.37		55.02	0.001033	7.46	609.06	245.08	0.45
Wells Run	826.5	Opt 2	1513.00	45.80	54.39		55.04	0.001016	7.42	615.12	245.55	0.45
Wells Run	826.1	Base	1667.00	45.30	54.34	52.89	54.69	0.000690	6.14	981.75	357.76	0.36
Wells Run	826.1	Opt 1	1666.00	45.30	54.34	52.89	54.69	0.000690	6.14	981.00	357.65	0.36
Wells Run	826.1	Opt 2	1670.00	45.30	54.36	52.89	54.71	0.000681	6.12	989.88	358.96	0.36
Wells Run	826		Culvert									
Wells Run	825.8	Base	1667.00	45.30	54.41		54.68	0.001195	6.98	825.93	340.96	0.42
Wells Run	825.8	Opt 1	1666.00	45.30	54.41		54.68	0.001198	6.98	824.77	340.77	0.42
Wells Run	825.8	Opt 2	1670.00	45.30	54.43		54.70	0.001176	6.93	832.78	342.07	0.42
Wells Run	825.5	Base	1667.00	44.60	53.95		54.45	0.000828	6.92	656.31	285.07	0.41
Wells Run	825.5	Opt 1	1666.00	44.60	53.95		54.45	0.000829	6.92	655.18	284.80	0.41
Wells Run	825.5	Opt 2	1670.00	44.60	53.98		54.47	0.000814	6.87	664.19	286.93	0.41
Wells Run	825	Base	1667.00	43.90	53.91	51.40	54.03	0.002349	3.06	994.87	436.39	0.25
Wells Run	825	Opt 1	1666.00	43.90	53.90	51.40	54.02	0.002355	3.07	993.09	435.93	0.25
Wells Run	825	Opt 2	1670.00	43.90	53.93	51.41	54.05	0.002299	3.04	1007.34	439.60	0.25
Wells Run	824.2		Culvert									
Wells Run	824	Base	1667.00	43.90	53.76		54.00	0.000363	5.02	1372.29	544.88	0.29
Wells Run	824	Opt 1	1666.00	43.90	53.77		54.01	0.000361	5.01	1374.69	545.22	0.28
Wells Run	824	Opt 2	1670.00	43.90	53.80		54.03	0.000356	4.99	1391.91	547.63	0.28
Wells Run	823.5	Base	1667.00	43.20	53.76	50.65	53.90	0.000174	3.81	1035.41	716.59	0.23
Wells Run	823.5	Opt 1	1666.00	43.20	53.77	50.65	53.90	0.000173	3.80	1036.37	717.02	0.23

U/S Tuckerman

D/S Tuckerman

U/S 46th

D/S 46th

A-6

HEC-RAS Plan: WR_10yr River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	823.5	Opt 2	1670.00	43.20	53.80	50.66	53.93	0.000171	3.79	1043.22	720.11	0.23
Wells Run	823	Base	1667.00	41.90	53.75	48.48	53.87	0.000099	3.23	725.23	634.14	0.18
Wells Run	823	Opt 1	1666.00	41.90	53.75	48.47	53.87	0.000098	3.22	725.69	634.29	0.18
Wells Run	823	Opt 2	1670.00	41.90	53.79	48.49	53.90	0.000098	3.21	728.94	635.40	0.18
Wells Run	822	Base	1667.00	40.80	53.63	45.71	53.82	0.000109	3.59	512.63	619.33	0.19
Wells Run	822	Opt 1	1666.00	40.80	53.63	45.71	53.83	0.000109	3.59	512.93	619.50	0.19
Wells Run	822	Opt 2	1670.00	40.80	53.66	45.71	53.86	0.000108	3.59	514.94	620.63	0.19
Wells Run	821.5		Culvert									
Wells Run	821	Base	1667.00	40.30	48.84	45.65	49.78	0.001140	7.76	223.09	57.97	0.48
Wells Run	821	Opt 1	1666.00	40.30	48.85	45.66	49.78	0.001134	7.74	223.68	58.55	0.48
Wells Run	821	Opt 2	1670.00	40.30	48.86	45.66	49.79	0.001136	7.75	224.08	58.93	0.48
Wells Run	820	Base	1667.00	39.80	48.43	45.54	49.55	0.001919	8.52	209.86	80.30	0.61
Wells Run	820	Opt 1	1666.00	39.80	48.45	45.54	49.56	0.001894	8.48	211.54	81.98	0.60
Wells Run	820	Opt 2	1670.00	39.80	48.46	45.54	49.57	0.001896	8.49	212.11	82.54	0.60
Wells Run	819	Base	1019.00	39.40	48.81	43.47	49.07	0.000305	4.25	422.88	301.12	0.26
Wells Run	819	Opt 1	1023.00	39.40	48.82	43.48	49.09	0.000305	4.25	427.79	302.53	0.26
Wells Run	819	Opt 2	1025.00	39.40	48.83	43.48	49.10	0.000305	4.25	430.27	303.24	0.26
Wells Run	818.9		Culvert									
Wells Run	817	Base	1019.00	38.20	46.78		46.92	0.000151	3.19	610.09	301.64	0.21
Wells Run	817	Opt 1	1023.00	38.20	46.78		46.92	0.000152	3.20	609.52	301.41	0.21
Wells Run	817	Opt 2	1025.00	38.20	46.78		46.92	0.000153	3.21	609.24	301.29	0.21
Wells Run	816.5	Base	1241.00	37.70	45.97		46.60	0.000873	6.78	380.01	210.68	0.48
Wells Run	816.5	Opt 1	1241.00	37.70	45.97		46.60	0.000873	6.78	380.01	210.68	0.48
Wells Run	816.5	Opt 2	1241.00	37.70	45.97		46.60	0.000873	6.78	380.01	210.68	0.48
Wells Run	816.3	Base	1241.00	37.20	46.03		46.43	0.000542	5.66	629.12	282.88	0.38
Wells Run	816.3	Opt 1	1241.00	37.20	46.03		46.43	0.000542	5.66	629.12	282.88	0.38
Wells Run	816.3	Opt 2	1241.00	37.20	46.03		46.43	0.000542	5.66	629.12	282.88	0.38
Wells Run	816	Base	1241.00	36.60	45.81	42.69	46.31	0.000554	5.96	451.51	277.97	0.39

U/S Trolley

D/S Trolley

U/S CSX

D/S CSX

Fin

HEC-RAS Plan: WR_10yr River: Wells Run Reach: Wells Run (Continued)

U/S Ravenswood

D/S Ravenswood

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)	
Wells Run	816	Opt 1	1241.00	36.60	45.81	42.69	46.31	0.000554	5.96	451.51	277.97	0.39
Wells Run	816	Opt 2	1241.00	36.60	45.81	42.69	46.31	0.000554	5.96	451.51	277.97	0.39
Wells Run	815.9		Bridge									
Wells Run	814	Base	1241.00	35.40	43.98		44.61	0.000764	6.61	328.28	136.62	0.45
Wells Run	814	Opt 1	1241.00	35.40	43.98		44.61	0.000764	6.61	328.28	136.62	0.45
Wells Run	814	Opt 2	1241.00	35.40	43.98		44.61	0.000764	6.61	328.28	136.62	0.45
Wells Run	813.5	Base	1241.00	35.00	43.97		44.46	0.000590	6.00	371.28	146.99	0.40
Wells Run	813.5	Opt 1	1241.00	35.00	43.97		44.46	0.000590	6.00	371.28	146.99	0.40
Wells Run	813.5	Opt 2	1241.00	35.00	43.97		44.46	0.000590	6.00	371.28	146.99	0.40
Wells Run	813	Base	1241.00	34.10	43.57	40.66	44.28	0.000914	6.79	227.65	86.89	0.47
Wells Run	813	Opt 1	1241.00	34.10	43.57	40.67	44.28	0.000914	6.79	227.65	86.89	0.47
Wells Run	813	Opt 2	1241.00	34.10	43.57	40.67	44.28	0.000914	6.79	227.65	86.89	0.47

HEC-RAS Plan: 100 yr River: Wells Run Reach: Wells Run

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)	
Wells Run	834.2	Base	2335.00	48.80	59.65	55.57	59.79	0.000589	3.68	1392.16	399.64	0.22
Wells Run	834.2	Opt 1	2335.00	48.80	59.66	55.57	59.79	0.000587	3.67	1394.96	399.85	0.22
Wells Run	834.2	Opt 2	2335.00	48.80	59.65	55.57	59.79	0.000589	3.68	1392.24	399.64	0.22
Wells Run	834	Base	2335.00	48.70	59.46	54.16	59.71	0.000829	4.44	986.59	357.27	0.25
Wells Run	834	Opt 1	2335.00	48.70	59.47	54.16	59.72	0.000826	4.43	989.39	357.86	0.25
Wells Run	834	Opt 2	2335.00	48.70	59.46	54.16	59.71	0.000829	4.44	986.67	357.29	0.25
Wells Run	833.3		Culvert									
Wells Run	833.2	Base	2335.00	48.40	59.46		59.67	0.000701	4.16	1094.52	379.25	0.23
Wells Run	833.2	Opt 1	2335.00	48.40	59.46		59.68	0.000698	4.16	1097.47	379.83	0.23
Wells Run	833.2	Opt 2	2335.00	48.40	59.46		59.67	0.000701	4.16	1094.53	379.25	0.23
Wells Run	832.0	Base	2335.00	48.40	59.46		59.67	0.000567	4.28	1029.28	371.46	0.25
Wells Run	832.0	Opt 1	2335.00	48.40	59.47		59.67	0.000564	4.27	1032.19	371.95	0.25
Wells Run	832.0	Opt 2	2335.00	48.40	59.46		59.67	0.000567	4.28	1029.29	371.46	0.25
Wells Run	831.5	Base	2335.00	48.30	59.32		59.62	0.000180	4.92	1052.59	359.87	0.32
Wells Run	831.5	Opt 1	2335.00	48.30	59.33		59.63	0.000179	4.91	1055.48	360.33	0.32
Wells Run	831.5	Opt 2	2335.00	48.30	59.32		59.62	0.000180	4.92	1052.59	359.87	0.32
Wells Run	831	Base	2335.00	48.20	59.31		59.60	0.000171	4.84	1084.82	364.95	0.31
Wells Run	831	Opt 1	2335.00	48.20	59.32		59.61	0.000171	4.83	1087.77	365.41	0.31
Wells Run	831	Opt 2	2335.00	48.20	59.31		59.60	0.000171	4.84	1084.82	364.95	0.31
Wells Run	830.5	Base	2335.00	48.10	59.30		59.58	0.000163	4.76	1116.49	369.88	0.30
Wells Run	830.5	Opt 1	2335.00	48.10	59.31		59.58	0.000163	4.75	1119.51	370.34	0.30
Wells Run	830.5	Opt 2	2335.00	48.10	59.30		59.58	0.000163	4.76	1116.49	369.88	0.30
Wells Run	830	Base	2335.00	47.80	59.25	53.85	59.55	0.000203	4.82	1084.06	368.63	0.27
Wells Run	830	Opt 1	2335.00	47.80	59.26	53.85	59.56	0.000202	4.81	1087.12	369.42	0.27
Wells Run	830	Opt 2	2335.00	47.80	59.25	53.85	59.55	0.000203	4.82	1084.06	368.63	0.27
Wells Run	829		Culvert									
Wells Run	828	Base	2374.00	46.40	56.99		58.22	0.001123	9.07	356.23	126.92	0.52
Wells Run	828	Opt 1	2374.00	46.40	57.00		58.23	0.001121	9.07	356.82	127.25	0.52
Wells Run	828	Opt 2	2369.00	46.40	57.00		58.22	0.001116	9.05	356.82	127.25	0.52

U/S 44th

D/S 44th

U S Route 1

D/S Route 1 + 1 6

HEC-RAS Plan: 100 yr River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	827.7	Base	2374.00	46.20	55.72		57.83	0.002656	12.34	374.97	137.73	0.71
Wells Run	827.7	Opt 1	2374.00	46.20	55.68		57.82	0.002704	12.42	369.92	135.86	0.71
Wells Run	827.7	Opt 2	2369.00	46.20	55.66		57.81	0.002721	12.44	366.95	134.74	0.71
Wells Run	827	Base	2374.00	46.20	56.69		56.77	0.000049	1.84	1067.84	244.38	0.10
Wells Run	827	Opt 1	2374.00	46.20	56.67		56.75	0.000050	1.85	1062.41	244.02	0.10
Wells Run	827	Opt 2	2369.00	46.20	56.65		56.74	0.000051	1.86	1058.15	243.74	0.10
Wells Run	826.5	Base	2374.00	45.80	56.13		56.71	0.000882	7.82	1070.58	277.67	0.43
Wells Run	826.5	Opt 1	2374.00	45.80	56.10		56.69	0.000898	7.87	1061.46	277.31	0.43
Wells Run	826.5	Opt 2	2369.00	45.80	56.07		56.67	0.000906	7.89	1055.30	277.06	0.43
Wells Run	826.1	Base	2662.00	45.30	56.11	53.80	56.41	0.000583	6.37	1697.84	449.09	0.34
Wells Run	826.1	Opt 1	2631.00	45.30	56.08	53.83	56.38	0.000580	6.34	1683.97	447.94	0.34
Wells Run	826.1	Opt 2	2630.00	45.30	56.06	53.82	56.36	0.000588	6.37	1673.71	447.09	0.34
Wells Run	826		Culvert									
Wells Run	825.8	Base	2662.00	45.30	56.25		56.38	0.000639	5.81	1544.56	432.77	0.32
Wells Run	825.8	Opt 1	2631.00	45.30	56.21		56.35	0.000642	5.81	1528.67	432.21	0.32
Wells Run	825.8	Opt 2	2630.00	45.30	56.20		56.34	0.000649	5.84	1522.88	432.01	0.32
Wells Run	825.5	Base	2662.00	44.60	55.92		56.23	0.000537	6.37	1307.22	359.80	0.34
Wells Run	825.5	Opt 1	2631.00	44.60	55.88		56.19	0.000537	6.36	1294.43	359.10	0.34
Wells Run	825.5	Opt 2	2630.00	44.60	55.87		56.18	0.000542	6.38	1288.36	358.77	0.34
Wells Run	825	Base	2662.00	43.90	55.89	52.31	55.98	0.001298	2.89	1931.12	500.80	0.20
Wells Run	825	Opt 1	2631.00	43.90	55.85	52.29	55.94	0.001297	2.88	1913.40	499.79	0.20
Wells Run	825	Opt 2	2630.00	43.90	55.84	52.29	55.93	0.001311	2.89	1904.82	499.30	0.20
Wells Run	824.2		Culvert									
Wells Run	824	Base	2662.00	43.90	55.76		55.96	0.000300	5.18	2548.63	622.09	0.27
Wells Run	824	Opt 1	2631.00	43.90	55.73		55.93	0.000298	5.15	2528.84	621.02	0.27
Wells Run	824	Opt 2	2630.00	43.90	55.72		55.92	0.000300	5.16	2519.26	620.50	0.27
Wells Run	823.5	Base	2662.00	43.20	55.79	51.57	55.82	0.000046	2.26	3908.37	799.32	0.12
Wells Run	823.5	Opt 1	2631.00	43.20	55.76	51.54	55.78	0.000046	2.25	3882.78	798.26	0.12

U/S Tuckerman

D/S Tuckerman

U/S 46th

D/S 46th

F-10

HEC-RAS Plan: 100 yr River: Wells Run Reach: Wells Run (Continued)

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)	
Wells Run	823.5	Opt 2	2630.00	43.20	55.74	51.54	55.77	0.000046	2.25	3870.60	797.76	0.12
Wells Run	823	Base	2662.00	41.90	55.79	49.94	55.81	0.000019	1.60	4059.11	675.09	0.08
Wells Run	823	Opt 1	2631.00	41.90	55.76	49.91	55.77	0.000019	1.59	4037.49	674.01	0.08
Wells Run	823	Opt 2	2630.00	41.90	55.74	49.91	55.76	0.000019	1.59	4027.22	673.50	0.08
Wells Run	822	Base	2662.00	40.80	55.72	47.30	55.78	0.000051	2.74	4261.36	698.63	0.13
Wells Run	822	Opt 1	2631.00	40.80	55.69	47.25	55.75	0.000050	2.72	4239.66	697.37	0.13
Wells Run	822	Opt 2	2630.00	40.80	55.67	47.26	55.74	0.000050	2.72	4228.81	696.74	0.13
Wells Run	821.5		Culvert									
Wells Run	821	Base	2662.00	40.30	52.11	47.57	53.05	0.000790	8.12	508.48	403.27	0.43
Wells Run	821	Opt 1	2631.00	40.30	52.12	47.51	53.04	0.000768	8.01	510.17	404.60	0.42
Wells Run	821	Opt 2	2630.00	40.30	52.13	47.51	53.05	0.000763	7.99	511.58	405.71	0.42
Wells Run	820	Base	2662.00	39.80	52.08	47.61	52.86	0.000804	7.53	613.31	355.18	0.43
Wells Run	820	Opt 1	2631.00	39.80	52.10	47.55	52.85	0.000780	7.43	615.54	355.38	0.42
Wells Run	820	Opt 2	2630.00	39.80	52.11	47.55	52.86	0.000775	7.41	617.32	355.53	0.42
Wells Run	819	Base	1351.00	39.40	52.42	44.29	52.49	0.000073	2.64	2068.13	591.93	0.13
Wells Run	819	Opt 1	1352.00	39.40	52.42	44.29	52.49	0.000073	2.64	2071.48	592.66	0.13
Wells Run	819	Opt 2	1354.00	39.40	52.43	44.29	52.50	0.000073	2.64	2078.21	594.13	0.13
Wells Run	818.9		Culvert									
Wells Run	817	Base	1351.00	38.20	48.55		48.65	0.000094	2.91	1267.95	447.94	0.17
Wells Run	817	Opt 1	1352.00	38.20	48.55		48.65	0.000094	2.92	1267.84	447.92	0.17
Wells Run	817	Opt 2	1354.00	38.20	48.55		48.65	0.000095	2.92	1267.61	447.87	0.17
Wells Run	816.5	Base	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	Opt 1	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.5	Opt 2	2053.00	37.70	47.86		48.38	0.000623	6.85	946.42	389.03	0.42
Wells Run	816.3	Base	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	Opt 1	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816.3	Opt 2	2053.00	37.20	47.91		48.25	0.000407	5.79	1215.81	329.02	0.35
Wells Run	816	Base	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37

u/s Trolley

D/s Trolley

u/s CSX

D/s CSX

#11

HEC-RAS Plan: 100 yr River: Wells Run Reach: Wells Run (Continued)

U/S Ravens wood

D/S Ravens Wood

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)	
Wells Run	816	Opt 1	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	816	Opt 2	2053.00	36.60	47.69	44.77	48.14	0.000449	6.27	1076.39	365.48	0.37
Wells Run	815.9		Bridge									
Wells Run	814	Base	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	Opt 1	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	814	Opt 2	2053.00	35.40	45.79		46.57	0.000753	7.72	662.23	232.64	0.47
Wells Run	813.5	Base	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	Opt 1	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813.5	Opt 2	2053.00	35.00	45.80		46.35	0.000553	6.79	694.04	205.72	0.40
Wells Run	813	Base	2053.00	34.10	44.83	42.58	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	Opt 1	2053.00	34.10	44.83	42.58	46.03	0.001294	9.01	530.23	303.33	0.57
Wells Run	813	Opt 2	2053.00	34.10	44.83	42.58	46.03	0.001294	9.01	530.23	303.33	0.57

APPENDIX I
(1993 Study TR-20 and HEC-2)

TR-20

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****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY******************

 .8 TR-20                                          SUMMARY   NOPLOTS
TITLE      ANACOSTIA WATERSHED STUDY                 FILENAME: NE_ULT.T20
TITLE       ANACOSTIA & NORTHEAST BRANCH WATERSHED    ULTIMATE LAND USE
 3 STRUCT       4                                                        BR. 9 @
 8                              93.5          0.          0.            I-495
 8                              98.0        395.          0.7           HEC-2
 8                              99.2        566.          1.9           SECTION
 8                             100.5        769.          3.2             926
 8                             104.3       1382.         10.6
 8                             107.9       1834.         25.5
 8                             112.5       2610.         56.9
 9 ENDTBL
 3 STRUCT       6                                                        BR. 9 @
 8                              71.7          0.          0.            B-W PKWY
 8                              75.7        435.          2.            HEC-2
 8                              78.6        736.          7.            SECTION
 8                              79.3        842.          9.            916.1
 8                              84.7       1408.         62.
 8                              89.0       1749.        154.
 9 ENDTBL
 3 STRUCT      10                                                        BRIER @
 8                              85.5          0.          0.            1-495
 8                              89.0        150.          1.0           HEC-2
 8                              90.0        300.          2.1           SECTION
 8                              91.2        596.         13.0             636
 8                              91.4        625.         14.0
 -                              94.9       1260.         25.2
                                99.0       1710.         70.7
                               103.0       2020.        133.5
 9 ENDTBL
 3 STRUCT      15
 8                              45.1          0.          0.            BRIER
 8                              52.0        500.          4.2           DITCH @
 8                              53.0        800.          6.5           B-W PKWY
 8                              55.5       1606.         22.            HEC-2
 8                              56.6       1888.         35.            SECTION
 8                              60.8       2915.         93.              615
 8                              65.9       3867.        203.
 8                              67.0       4060.        232.
 9 ENDTBL
 3 STRUCT      19                                                        NE. TR.3
 8                              39.4          0.          0.            @ R.R.
 8                              43.9        588.          0.4           HEC-2
 8                              44.1        621.          0.6           SECTION
 8                              48.6        936.          4.              819
 8                              54.2       1430.         56.
```

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*******************80-80 LIST OF INPUT DATA (CONTINUED)**********************

8                          57.7       2650.       138.
9 ENDTBL
3 STRUCT      27                                                AN. TR.2
8                           9.8          0.          0.        @ KENIL-
8                          17.2        627.        2.0         WORTH
8                          17.5        655.        2.1         HEC-2
8                          19.6        935.        6.7        SECTION
8                          23.6       1308.        31.          415
8                          28.9       1770.        99.
9 ENDTBL
2 XSECTN       1           1.00                                 NE. BR.
8                          31.7          0.          0.        HEC-2
8                          38.6       5520.        906.       SECTION
8                          40.2       6732.       1501.         200
8                          41.3       8434.       2419.
8                          45.0      16434.       8729.
8                          48.8      24731.      16137.
8                          49.5      26385.      17664.
9 ENDTBL
2 XSECTN       3           1.00                                 NE. TR.5
8                          84.2          0.          0.        HEC-2
8                          88.0        200.         36.       SECTION
8                          89.1        400.         70.         509
8                          90.7        850.        136.
8                          91.3       1355.        187.
8                          91.8       1745.        253.
9 ENDTBL
2 XSECTN       5           1.00                                 BR. 9
8                          85.9          0.          0.        HEC-2
8                          91.1        638.        161.       SECTION
8                          92.1        877.        239.       920.3
8                          94.4       1621.        506.
8                          96.3       2470.        840.
9 ENDTBL
2 XSECTN       8           1.00                                 BR. 9
8                          58.0          0.          0.        HEC-2
8                          62.1        698.        120.       SECTION
8                          62.4        788.        135.       907.2
8                          63.7       1548.        309.
8                          65.0       2644.        593.
8                          65.4       3000.        700.
9 ENDTBL
2 XSECTN      11           1.00                                 BRIER
8                          73.5          0.          0.        HEC-2
8                          77.0        200.         45.       SECTION
8                          79.3        575.        146.        629.1
```

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*******************80-80 LIST OF INPUT DATA (CONTINUED)*********************

8                           80.3       643.       191.
8                           83.1      1463.       447.
8                           84.4      2238.       619.
9 ENDTBL
2 XSECTN    14              1.00                            BRIER
8                           56.4         0.          0.     HEC2
8                           61.6      1407.       164.     SECTION
8                           62.3      1641.       190.      620.1
8                           66.8      3652.       583.
8                           72.0      6783.      1455.
9 ENDTBL
2 XSECTN    16              1.00                            BRIER
8                           38.9         0.          0.     DITCH
8                           41.0       470.         40.     HEC-2
8                           44.1      1602.       271.     SECTION
8                           44.6      1849.       305.      612.4
8                           47.1      3359.       629.
8                           48.5      4766.       966.
9 ENDTBL
2 XSECTN    17              1.00                            NE. BR.
8                           16.8         0.          0.     HEC-2
8                           24.0      3000.       300.     SECTION
8                           28.3      7220.      1161.      123.12
8                           29.5      8922.      1442.
8                           32.8     16801.      4419.
8                           35.1     25265.      6626.
8                           36.0     28300.      7400.
  ENDTBL
2 XSECTN    19              1.00                            NE. TR.3
8                           49.3         0.          0.     HEC-2
8                           54.1       100.         65.     SECTION
8                           56.9       593.        427.       835
8                           57.0       626.        444.
8                           58.0      1198.        710.
8                           60.0      1936.       1404.
8                           63.0      3600.       2470.
9 ENDTBL
2 XSECTN   119              1.00                            NE. TR.3
8                           27.8         0.          0.     HEC-2
8                           32.0       160.         48.     SECTION
8                           33.2       606.         92.      806.5
8                           33.8      1226.        110.
8                           35.8      1980.        197.
9 ENDTBL
2 XSECTN    21              1.00                            CAPT.
8                           41.5         0.          0.     JOHN'S
```

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*******************80-80 LIST OF INPUT DATA (CONTINUED)**********************

6                            45.0       400.       52.          BRANCH
8                            46.4       908.       86.          HEC-2
8                            46.6       981.       91.         SECTION
8                            48.9      1967.      166.          860.1
8                            50.6      2917.      261.
8                            55.8      3340.      603.
8                            57.2      4365.      701.
9 ENDTBL
2 XSECTN     22              1.00                                NE. BR.
8                             9.0         0.         0.         HEC-2
8                            16.0      2000.      400.         SECTION
8                            20.7      7285.     1107.           110
8                            21.5      8987.     1367.
8                            24.3     16909.     2239.
8                            27.5     25414.     3284.
8                            28.0     27000.     3450.
9 ENDTBL
2 XSECTN     24              1.00                                NE. BR.
8                             5.9         0.         0.         HEC-2
8                            12.0      3000.      440.         SECTION
8                            15.5      7311.     1249.            80
8                            16.5      9014.     1626.
8                            21.1     16948.     3317.
8                            25.8     25470.     5194.
8                            26.5     26750.     5480.
9 ENDTBL
  XSECTN     26              1.00                               ANNCSTIA
                              0.0         0.         0.         HEC-2
8                             5.0      5000.      800.         SECTION
8                             8.6     11030.     1786.           9080
8                             9.4     13035.     2121.
8                            14.3     26376.     4603.
8                            19.2     42902.     7332.
9 ENDTBL
2 XSECTN    128              1.00                                AN. TR.2
8                             0.0         0.         0.         HEC-2
8                             3.0       480.       75.         SECTION
8                             5.9       627.      310.          400.1
8                             6.7       655.      379.
8                            12.4       935.     1579.
8                            17.6      1308.     3010.
8                            20.1      1770.     6897.
9 ENDTBL
2 XSECTN     28              1.00                               ANNCSTIA
8                             0.0         0.         0.         HEC-2
8                             2.5      6000.     1250.         SECTION
```

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*******************80-80 LIST OF INPUT DATA (CONTINUED)**********************

8                                  4.0       11059.       1726.          4560
8                                  4.7       13064.       1884.
8                                 10.9       26173.       4682.
8                                 16.2       42693.       8560.
9 ENDTBL
2 XSECTN    30                    1.00                                  AN. TR.1
8                                  0.0          0.          0.
8                                  3.1        200.        610.          HEC-2
8                                  4.7        734.        709.         SECTION
8                                  5.7       1071.        896.          102.1
8                                 11.4       2034.       2171.
8                                 16.6       3165.       3504.
9 ENDTBL
6 REACH  3   1   4   1          3200.                                   INDIAN
6 RUNOFF 1   1       2          0.260         86.       0.399          NE. BR.
6 ADDHYD 4   1   1 2 6                                                  NE. BR.
6 RUNOFF 1   2       1          0.525         80.       0.466         NE. TR.5
6 REACH  3   3   1   2          5900. ✓                                 NE. TR.5
6 RUNOFF 1   3       3          0.543         85.       0.354         NE. TR.5
6 ADDHYD 4   3   2 3 1                                                 NE. TR.5
6 ADDHYD 4 103   1 6 5                                                  NE. BR.
6 RUNOFF 1   4       1          0.772         88.       0.531          BR. 9
6 RESVOR 2     4 1   2           93.5                                   BR. 9
6 REACH  3   5   2   1          2400.                                   BR. 9
6 RUNOFF 1   5       2          0.601         78.       0.440          BR. 9
6 ADDHYD 4   5   1 2 3                                                  BR. 9
  RUNOFF 1   6       2          0.413         70.       0.458          BR. 9
  ADDHYD 4   6   3 2 1                                                  BR. 9
6 RESVOR 2     6 1   3           71.7                                   BR. 9
6 RUNOFF 1   7       2          0.672         70.       0.592          BR. 9A
6 ADDHYD 4 107   3 2 1                                                  BR. 9A
6 REACH  3   8   1   3          8800.                                   BR. 9
6 RUNOFF 1   8       2          0.861         69.       0.608          BR. 9
6 ADDHYD 4   8   3 2 1                                                  BR. 9
6 RUNOFF 1   9       2          0.457         69.       0.578          BR. 9C
6 ADDHYD 4 109   1 2 3                                                  BR. 9
6 ADDHYD 4 101   3 5 6                                                  NE. BR.
6 RUNOFF 1  10       1          0.690         82.       0.452          BRIER
6 RESVOR 2    10 1   2           85.5                                   BRIER
6 REACH  3  11   2   1          5000.                                   BRIER
6 RUNOFF 1  11       2          0.499         80.       0.438          BRIER
6 ADDHYD 4  11   1 2 3                                                  BRIER
6 RUNOFF 1  12       2          0.892         84.       0.458          BRIER 2
6 ADDHYD 4 112   3 2 1                                                  BRIER
6 RUNOFF 1  13       2          0.421         83.       0.286          BRIER 1
6 ADDHYD 4 113   1 2 3                                                  BRIER
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*******************80-80 LIST OF INPUT DATA (CONTINUED)**********************

6 REACH  3  14   3   1        3700.                                  BRIER
6 RUNOFF 1  14       2        0.601        80.       0.311         BRIER
6 ADDHYD 4  14   1 2 3                                               BRIER
6 RUNOFF 1  15       2        0.610        81.       0.369         BRIER 3
6 ADDHYD 4 115   3 2 1                                               BRIER
6 RESVOR 2     15 1   2         45.1                                 BRIER
6 REACH  3  16   2   1        4500.                                  BRIER
6 RUNOFF 1  16       2        0.399        79.       0.375         BRIER
6 ADDHYD 4  16   1 2 3                                               BRIER
6 ADDHYD 4 116   6 3 2                                               NE. BR.
6 REACH  3  17   2   1        4800.                                  NE. BR.
6 RUNOFF 1  17       2        0.597        85.       0.379         NE. BR.
6 ADDHYD 4  17   1 2 5                                               NE. BR.
6 RUNOFF 1  18       1        0.736        85.       0.308         NE. TR.3
6 REACH  3  19   1   2        3700.                                  NE. TR.3
6 RUNOFF 1  19       3        0.467        83.       0.284         NE. TR.3
6 ADDHYD 4  19   2 3 1                                               NE. TR.3
6 RESVOR 2     19 1   2         39.4                                 NE. TR.3
6 REACH  3 119   2   3        3000.                                  NE. TR.3
6 ADDHYD 4 119   5 3 6                                               NE. BR.
6 RUNOFF 1  20       1        0.749        81.       0.467         NE. TR.2
6 REACH  3  21   1   3        5700.                                  NE. TR.2
6 RUNOFF 1  21       2        0.699        80.       0.470         NE. TR.2
6 ADDHYD 4  21   3 2 1                                               NE. TR.2
6 ADDHYD 4 121   6 1 2                                               NE. BR.
6 REACH  3  22   2   1        2900.                                  NE. BR.
  RUNOFF 1  22       2        0.362        87.       0.354         NE. BR.
  ADDHYD 4  22   1 2 3                                               NE. BR.
  RUNOFF 1  23       2        0.614        82.       0.443         NE. TR.1
6 ADDHYD 4 123   3 2 1                                               NE. BR.
6 REACH  3  24   1   2        5400.                                  NE. BR.
6 RUNOFF 1  24       3        0.754        87.       0.518         NE. BR.
6 ADDHYD 4  24   2 3 1                                               NE. BR.
6 RUNOFF 1  25       2        0.661        86.       0.426         NE. TR.6
6 ADDHYD 4  26   1 2 3                                               NE. BR.
6 ADDHYD 4  26   3 7 1                                               NW. BR.
6 REACH  3  26   1   3        4000.                                  ANNCSTIA
6 RUNOFF 1  26       2        0.715        88.       0.411         ANNCSTIA
6 ADDHYD 4  26   3 2 1                                               ANNCSTIA
6 RUNOFF 1  27       2        0.775        84.       0.391         AN. TR.2
6 RESVOR 2     27 2   3          9.8                                 AN. TR.2
6 REACH  3 128   3   2        1200.                                  AN. TR.2
6 ADDHYD 4  28   1 2 3                                               ANNCSTIA
6 REACH  3  28   3   2        5500.                                  ANNCSTIA
6 RUNOFF 1  28       1        0.476        81.       0.571         ANNCSTIA
6 ADDHYD 4  28   1 2 5                                               ANNCSTIA
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```
*******************80-80 LIST OF INPUT DATA (CONTINUED)**********************

6 RUNOFF 1  29       1        0.917        85.       0.363          AN. TR.1
6 REACH  3  30   1   3        5000.✓                                  AN. TR.1
6 RUNOFF 1  30       2        0.572        84.       0.428          AN. TR.1
6 ADDHYD 4  30   3 2 1                                               AN. TR.1
6 ADDHYD 4  99   1 5 2                                               ANNCSTIA
  ENDATA
7 READHD 8     4                                                      INDIAN
7 READHD 9         .0000      .0750     61.4710      .0000            CREEK  &
8                    .00        .00         .00        .00        .00 PAINT
8                    .00        .00         .00        .00        .00 BRANCH
8                    .00        .00         .00        .00        .00  2-YR
8                    .00        .00         .00        .00        .00ULTIMATE
8                    .00        .00         .00        .00        .00 HYDRO-
8                    .00        .00         .00        .00        .00 GRAPH
8                    .01        .02         .04        .06        .09       7
8                    .13        .19         .26        .35        .47       8
8                    .60        .76         .95       1.16       1.40       9
8                   1.67       1.97        2.29       2.65       3.03      10
8                   3.44       3.88        4.34       4.82       5.32      11
8                   5.85       6.39        6.95       7.51       8.09      12
8                   8.68       9.27        9.87      10.47      11.07      13
8                  11.68      12.30       12.91      13.54      14.17      14
8                  14.81      15.45       16.10      16.76      17.42      15
8                  18.09      18.76       19.43      20.10      20.76      16
8                  21.42      22.08       22.73      23.37      24.01      17
8                  24.65      25.29       25.96      26.65      27.37      18
                   28.12      28.89       29.70      30.52      31.37      19
                   32.23      33.11       34.01      34.91      35.83      20
8                  36.76      37.69       38.65      39.62      40.61      21
8                  41.62      42.68       43.80      45.00      46.29      22
8                  47.70      49.23       50.91      52.75      54.73      23
8                  56.84      59.06       61.38      63.81      66.31      24
8                  68.92      71.63       74.53      77.66      81.03      25
8                  84.59      88.28       92.11      96.14     100.50      26
8                 105.19     110.16      115.36     120.73     126.33      27
8                 132.28     138.73      145.72     153.34     161.80      28
8                 171.17     181.46      192.98     205.86     220.01      29
8                 235.54     252.65      271.24     291.36     313.39      30
8                 337.28     363.25      392.09     424.60     466.81      31
8                 537.59     661.37      840.24    1115.21    1536.02      32
8                2117.85    2755.30     3265.67    3561.10    3702.55      33
8                3760.93    3791.23     3822.72    3854.22    3890.31      34
8                3928.91    3972.45     4020.57    4074.92    4139.21      35
8                4217.20    4311.97     4425.19    4557.16    4706.64      36
8                4872.55    5052.93     5244.77    5444.79    5646.55      37
8                5846.47    6042.22     6232.61    6416.35    6592.24      38
```

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 0 STORM 10													
XSECTION 8	RUNOFF	.86	2	2	.08	.0	5.20	24.00	2.01	---	12.27	826.22	959.6
XSECTION 8	ADDHYD	3.32	2	2	.08	.0	5.20	24.00	2.55	63.99	12.46	1794.34	540.6
XSECTION 9	RUNOFF	.46	2	2	.08	.0	5.20	24.00	2.01	---	12.25	450.39	985.5
XSECTION 109	ADDHYD	3.78	2	2	.08	.0	5.20	24.00	2.49	---	12.38	2179.05	577.1
XSECTION 101	ADDHYD	66.57	2	2	.08	.0	5.20	24.00	2.58	---	16.28	15955.58	239.7
XSECTION 10	RUNOFF	.69	2	2	.08	.0	5.20	24.00	3.15	---	12.16	1259.61	1825.5
STRUCTURE 10	RESVOR	.69	2	2	.08	.0	5.20	24.00	3.15	92.88	12.35	893.03	1294.3
XSECTION 11	REACH	.69	2	2	.08	.0	5.20	24.00	3.11	80.07	12.84	627.12	908.9
XSECTION 11	RUNOFF	.50	2	2	.08	.0	5.20	24.00	2.96	---	12.16	877.72	1758.9
XSECTION 11	ADDHYD	1.19	2	2	.08	.0	5.20	24.00	3.05	81.72	12.18	1057.69	889.6
' -CTION 12	RUNOFF	.89	2	2	.08	.0	5.20	24.00	3.35	---	12.16	1710.46	1917.6
.CTION 112	ADDHYD	2.08	2	2	.08	.0	5.20	24.00	3.18	---	12.17	2766.76	1329.5
SECTION 13	RUNOFF	.42	2	2	.08	.0	5.20	24.00	3.26	---	12.07	987.89	2346.5
XSECTION 113	ADDHYD	2.50	2	2	.08	.0	5.20	24.00	3.19	---	12.13	3619.99	1446.8
XSECTION 14	REACH	2.50	2	2	.08	.0	5.20	24.00	3.18	65.49	12.30	3065.71	1225.3
XSECTION 14	RUNOFF	.60	2	2	.08	.0	5.20	24.00	2.97	---	12.08	1252.71	2084.4
XSECTION 14	ADDHYD	3.10	2	2	.08	.0	5.20	24.00	3.14	67.07	12.23	3813.49	1229.0
XSECTION 15	RUNOFF	.61	2	2	.08	.0	5.20	24.00	3.06	---	12.12	1208.65	1981.4
XSECTION 115	ADDHYD	3.71	2	2	.08	.0	5.20	24.00	3.13	---	12.18	4913.34	1323.3
STRUCTURE 15	RESVOR	3.71	2	2	.08	.0	5.20	24.00	3.12	60.99	12.54	2950.19	794.6
XSECTION 16	REACH	3.71	2	2	.08	.0	5.20	24.00	3.11	46.16	12.84	2791.28	751.8
XSECTION 16	RUNOFF	.40	2	2	.08	.0	5.20	24.00	2.88	---	12.12	743.83	1864.2
XSECTION 16	ADDHYD	4.11	2	2	.08	.0	5.20	24.00	3.08	46.36	12.81	2909.84	707.6
XSECTION 116	ADDHYD	70.69	2	2	.08	.0	5.20	24.00	2.61	---	16.26	16268.68	230.2
XSECTION 17	REACH	70.69	2	2	.08	.0	5.20	24.00	2.58	32.51	16.65	16099.27	227.8
XSECTION 17	RUNOFF	.60	2	2	.08	.0	5.20	24.00	3.45	---	12.11	1286.71	2155.3
XSECTION 17	ADDHYD	71.28	2	2	.08	.0	5.20	24.00	2.58	32.52	16.64	16142.04	226.4
XSECTION 18	RUNOFF	.74	2	2	.08	.0	5.20	24.00	3.45	---	12.08	1775.04	2411.7
XSECTION 19	REACH	.74	2	2	.08	.0	5.20	24.00	3.39	57.22	12.74	753.70	1024.0
XSECTION 19	RUNOFF	.47	2	2	.08	.0	5.20	24.00	3.26	---	12.07	1107.67	2371.9
XSECTION 19	ADDHYD	1.20	2	2	.08	.0	5.20	24.00	3.34	58.04	12.07	1213.47	1008.7
STRUCTURE 19	RESVOR	1.20	2	2	.08	.0	5.20	24.00	3.34	48.77	12.19	951.15	790.6
XSECTION 119	REACH	1.20	2	2	.08	.0	5.20	24.00	3.33	33.53	12.28	950.18	789.8
XSECTION 119	ADDHYD	72.49	2	2	.08	.0	5.20	24.00	2.60	73.63	16.64	16240.52	224.0
"-ECTION 20	RUNOFF	.75	2	2	.08	.0	5.20	24.00	3.06	---	12.17	1304.08	1741.1
.SECTION 21	REACH	.75	2	2	.08	.0	5.20	24.00	3.05	47.15	12.29	1218.57	1626.9

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SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 0 STORM 99													
XSECTION 116	ADDHYD	70.69	2	2	.08	.0	7.40	24.00	4.27	---	16.40	24899.93	352.3
XSECTION 17	REACH	70.69	2	2	.08	.0	7.40	24.00	4.20	34.94	16.79	24658.35	348.8
XSECTION 17	RUNOFF	.60	2	2	.08	.0	7.40	24.00	5.48	---	12.11	2012.14	3370.4
XSECTION 17	ADDHYD	71.28	2	2	.08	.0	7.40	24.00	4.21	34.95	16.78	24717.63	346.7
XSECTION 18	RUNOFF	.74	2	2	.08	.0	7.40	24.00	5.49	---	12.08	2758.51	3748.0
XSECTION 19	REACH	.74	2	2	.08	.0	7.40	24.00	5.41	58.43	12.63	1357.14	1843.9
XSECTION 19	RUNOFF	.47	2	2	.08	.0	7.40	24.00	5.26	---	12.07	1750.30	3748.0
XSECTION 19	ADDHYD	1.20	2	2	.08	.0	7.40	24.00	5.35	60.13	12.08	2008.31	1669.4
STRUCTURE 19	RESVOR	1.20	2	2	.08	.0	7.40	24.00	5.36	52.30	12.93	1262.72	1049.6
XSECTION 119	REACH	1.20	2	2	.08	.0	7.40	24.00	5.34	33.90	13.01	1262.72	1049.6
XSECTION 119	ADDHYD	72.49	2	2	.08	.0	7.40	24.00	4.23	96.46	16.77	24849.91	342.8
XSECTION 20	RUNOFF	.75	2	2	.08	.0	7.40	24.00	5.02	---	12.16	2113.25	2821.4
XSECTION 21	REACH	.75	2	2	.08	.0	7.40	24.00	5.01	48.89	12.29	1963.61	2621.6
XSECTION 21	RUNOFF	.70	2	2	.08	.0	7.40	24.00	4.91	---	12.17	1924.98	2753.9
XSECTION 21	ADDHYD	1.45	2	2	.08	.0	7.40	24.00	4.96	56.35	12.23	3743.15	2585.0
XSECTION 121	ADDHYD	73.93	2	2	.08	.0	7.40	24.00	4.24	---	16.76	24997.25	338.1
XSECTION 22	REACH	73.93	2	2	.08	.0	7.40	24.00	4.22	27.34	16.89	24983.80	337.9
XSECTION 22	RUNOFF	.36	2	2	.08	.0	7.40	24.00	5.71	---	12.10	1305.39	3606.1
XSECTION 22	ADDHYD	74.30	2	2	.08	.0	7.40	24.00	4.22	27.35	16.88	25018.45	336.7
XSECTION 23	RUNOFF	.61	2	2	.08	.0	7.40	24.00	5.13	---	12.15	1817.48	2960.1
XSECTION 123	ADDHYD	74.91	2	2	.08	.0	7.40	24.00	4.23	---	16.88	25076.95	334.8
XSECTION 24	REACH	74.91	2	2	.08	.0	7.40	24.00	4.16	25.49	17.23	24903.50	332.4
XSECTION 24	RUNOFF	.75	2	2	.08	.0	7.40	24.00	5.71	---	12.19	2228.21	2955.2
XSECTION 24	ADDHYD	75.66	2	2	.08	.0	7.40	24.00	4.17	25.53	17.23	24974.10	330.1
XSECTION 25	RUNOFF	.66	2	2	.08	.0	7.40	24.00	5.59	---	12.14	2143.34	3242.6
XSECTION 26	ADDHYD	76.33	2	2	.08	.0	7.40	24.00	4.18	13.81	17.23	25035.07	328.0
XSECTION 26	ADDHYD	129.11	2	2	.08	.0	7.40	24.00	4.21	18.96	18.01	42090.89	326.0
XSECTION 26	REACH	129.11	2	2	.08	.0	7.40	24.00	4.18	18.92	18.25	41967.65	325.0
XSECTION 26	RUNOFF	.71	2	2	.08	.0	7.40	24.00	5.82	---	12.13	2424.70	3391.2
XSECTION 26	ADDHYD	129.83	2	2	.08	.0	7.40	24.00	4.19	18.94	18.25	42022.56	323.7
XSECTION 27	RUNOFF	.77	2	2	.08	.0	7.40	24.00	5.36	---	12.12	2539.33	3276.6
STRUCTURE 27	RESVOR	.77	2	2	.08	.0	7.40	24.00	5.37	24.11	12.37	1352.53	1745.2
XSECTION 128	REACH	.77	2	2	.08	.0	7.40	24.00	5.30	13.66	13.01	1025.37	1323.1
XSECTION 28	ADDHYD	130.60	2	2	.08	.0	7.40	24.00	4.19	16.01	18.25	42093.44	322.3
XSECTION 28	REACH	130.60	2	2	.08	.0	7.40	24.00	4.12	15.94	18.57	41878.95	320.7
SECTION 28	RUNOFF	.48	2	2	.08	.0	7.40	24.00	5.01	---	12.23	1182.94	2485.2

CAFRITZ
0244-05-00
6-13-2008

ANACOSTIA WATERSHED STUDY

HEC-2 RUN

Northeast Branch Tributary 3

March 1993

Prepared by: Greenhorne & O'Mara, Inc.
9001 Edmonston Road
Greenbelt, MD 20770

Prepared for: Prince George's County Government
Department of Environmental Resources
Watershed Protection Branch
Flood Management Section
9400 Peppercorn Place
Landover, MD 20785

I-10

THIS RUN EXECUTED 26MAY93 15:36:58

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************


T1      ANACOSTIA WATERSHED STUDY                    FILENAME:   NE_T3.DAT
T2      PRINCE GEORGE'S COUNTY, MD                   EXISTING LAND USE
T3      NORTHEAST TRIBUTARY 3                        2-YEAR FLOOD

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

              2.0                                                                   24.08

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    1.0                 -1.0


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

  150.0

NC                                      0.3       0.5
        DISCHARGES FROM ADDHYD 119 IN TR-20 RUN ( D.A. = 72.49 MI^2 )
QT        8      6623     14766     23153                8286     16241     24850
NH        8      0.18      1195      0.08      1510      0.035      1659      0.04      2033      0.02
NH     2045      0.04      3310      0.02      3338      0.04      3491
                 ************************************************************
                 ** CROSS SECTIONS ORIENTED LEFT TO RIGHT LOOKING DOWNSTREAM **
                 ************************************************************

                 STARTING WATER SURFACE ELEVATIONS ARE FROM HEC2 RUN FOR THE
                 NORTHEAST BRANCH.

X1      122        52      1510      1659        95        95        95
X3       10                                     2300                  35.8      32.0
GR     32.0      1000      30.0      1110      28.0      1195      26.0      1330      24.0      1510
GR     24.0    1510.1      14.2      1538      14.2      1559      14.2    1559.1      14.2    1560.9
GR     14.2      1561      14.2      1609      14.2    1609.1      14.2    1610.9      14.2      1611
GR     16.0      1625      24.0    1658.9      24.0      1659      26.0      1665      26.0      1890
GR     24.0      2028      21.4      2033      20.9    2033.1      20.4    2033.6      20.1    2034.5
GR     20.1      2035      20.1    2035.5      20.4    2036.4      20.9    2036.9      21.4      2037
GR     21.4      2041      20.9    2041.1      20.4    2041.6      20.1    2042.5      20.1      2043
GR     20.1    2043.5      20.4    2044.4      20.9    2044.9      21.4      2045      24.0      2050
GR     28.0      2080      33.0      2140      32.0      3300      30.4      3310      22.4    3310.1
GR     22.4    3337.9      30.4      3338      32.0      3350      32.0      3410      32.0      3470
GR     32.5      3490      60.0      3491
        DISCHARGES FROM INTERMEDIATE PEAK 22A IN TR-20 RUN ( D.A. = 1.25 MI^2 )
```

QT	8	589	1189	2012		641	1241	2053		
NC	0.04	0.04	0.04	0.3	0.5					
X1	802.6	15	1025	1053	350	190	240			
X3				930						
GR	30.0	750	31.0	780	30.2	850	31.0	930	31.8	980
GR	31.8	1015	29.7	1025	23.7	1026	23.7	1052	29.7	1053
GR	30.0	1060	31.5	1085	32.0	1110	33.9	1125	60.0	1126
X1	803	28	680.0	697.0	150	150	150		-0.2	
X3	10.0			564		834		30.0	30.0	
GR	38.3	350.0	38.3	361.0	38.2	375.0	38.4	425.0	38.0	490.0
GR	36.0	560.0	34.0	580.0	33.8	605.0	33.7	630.0	33.8	645.0
GR	33.7	655.0	32.0	670.0	30.6	679.0	24.6	680.0	24.6	697.0
GR	30.6	698	32.0	705.0	32.3	710.0	32.4	730.0	32.3	745.0
GR	34.0	810.0	34.5	833	60.0	834	60.0	860	35.0	861
GR	35.8	905	35.8	930	36.0	948				
X1	804.2	0	0	0	1	1	1		-0.2	
X3	10.0			564		834		30.0	30.0	
BT	-28	350	38.3	38.1	361	38.3	38.1	375	38.2	38.0
BT		425	38.4	38.2	490	38.0	37.8	560	36.0	35.8
BT		580	34.0	33.8	605	33.8	33.6	630	33.7	33.5
BT		645	33.8	33.6	655	33.7	33.5	670	32.3	31.8
BT		679	32.3	30.4	680	32.3	29.4	697	32.3	29.4
BT		698	32.3	30.4	705	32.3	31.8	710	32.3	32.1
BT		730	32.4	32.2	745	32.3	32.1	810	34.0	33.8
P"		833	34.5	34.3	834	60.0	59.8	860	60.0	59.8
		861	35.0	34.8	905	35.8	35.6	930	35.8	35.6
B1		948	36.0	35.8						
		TAYLOR ROAD			(17'X 5' BOX CULVERT)					
X1	804.3	28	680.0	697.0	95	95	95			
X3	10.0			564		834		30.0	30.0	
BT	-28	350	38.3	38.3	361	38.3	38.3	375	38.2	38.2
BT		425	38.4	38.4	490	38.0	38.0	560	36.0	36.0
BT		580	34.0	34.0	605	33.8	33.8	630	33.7	33.7
BT		645	33.8	33.8	655	33.7	33.7	670	32.3	32.0
BT		679	32.3	30.6	680	32.3	29.6	697	32.3	29.6
BT		698	32.3	30.6	705	32.3	32.0	710	32.3	32.3
BT		730	32.4	32.4	745	32.3	32.3	810	34.0	34.0
BT		833	34.5	34.5	834	60.0	60.0	860	60.0	60.0
BT		861	35.0	35.0	905	35.8	35.8	930	35.8	35.8
BT		948	36.0	36.0						
GR	38.3	350.0	38.3	361.0	38.2	375.0	38.4	425.0	38.0	490.0
GR	36.0	560.0	34.0	580.0	33.8	605.0	33.7	630.0	33.8	645.0
GR	33.7	655.0	32.0	670.0	30.6	679.0	24.6	680.0	24.6	697.0
GR	30.6	698	32.0	705.0	32.3	710.0	32.4	730.0	32.3	745.0
GR	34.0	810.0	34.5	833	60.0	834	60.0	860	35.0	861
GR	35.8	905	35.8	930	36.0	948				

```
X1    804.3      0      0      0      1      1      1
X3     10.0                   564            834            30.0   30.0

NH       5   0.18   1180   0.03   1236   0.02   1262   0.03   1306   0.18
NH    1411
X1     806     19   1236   1262    215    215    215
X3                          1159           1320
GR    41.0   1000   40.0   1070   39.0   1129   60.0   1130   60.0   1159
GR    38.0   1160   36.0   1180   34.9   1191   34.8   1219   34.0   1230
GR    32.4   1236   26.4   1245   26.4   1253   32.4   1262   33.1   1306
GR    34.0   1328   36.0   1383   37.0   1410   60.0   1411

NH       4   0.18    142   0.03    188   0.02    220   0.03    415
X1   806.5     17    188    220  135.0  130.0  135.0
X3                           110            240
GR    42.0      0   41.0     60   40.5     80   60.0     81   60.0    108
GR    40.3    109   40.0  110.0   38.0  122.0   36.0    142   34.8  188.0
GR    27.8  200.0   27.8  208.0   34.8    220   36.0    230   36.0    260
GR    38.0    380   40.0    415

NC                           0.6    0.8
NH       5   0.18   1171   0.03   1219  0.025   1239   0.03   1292   0.18
NH    1485
X1     807     25   1219   1239     95     95     95
X3      10                  1140           1331            34.0   42.5
GR    70.0   1000   42.0   1001   40.0   1050   39.0   1104   70.0   1105
GR    70.0   1140   38.5   1141   38.0   1171   37.8   1210   35.4   1219
      28.4   1224   28.4   1234   35.4   1239   37.8   1257   38.0   1292
GR    38.8   1330   70.0   1331   70.0   1360   39.0   1361   40.0   1382
GR    40.5   1410   70.0   1411   70.0   1440   41.2   1441   42.0   1485

SB           1.80    3.0             20            120           31.1   28.4
NC   0.045   0.05  0.025
           49TH STREET          ( 20'X 6' BOX CULVERT )
X1     808     13   1201   1221    110    210    140
X2                    1    37.1   38.3
X3      10                                         38.3   43.0
BT     -13    980   42.0   42.0   1010   41.0   41.0   1030   40.0   40.0
BT           1090   39.0   39.0   1145   38.3   38.3   1165   40.0   38.2
BT           1200   42.0   37.1   1201   42.0   37.1   1221   43.0   37.1
BT           1222   43.0   37.1   1242   44.0   44.0   1265   46.0   46.0
BT           1330   48.0   48.0
GR    42.0    980   41.0   1010   40.0   1030   39.0   1090   38.3   1145
GR    38.2   1165   37.1   1200   31.1   1201   31.1   1221   42.0   1222
GR    44.0   1242   46.0   1265   48.0   1330

NC   0.095  0.045  0.025
X1     809     20   1313   1339    180     90    140
X3                          1219
GR    47.3   1000   47.0   1038   70.0   1039   70.0   1090   46.5   1091
GR    46.0   1105   45.2   1112   45.2   1139   44.5   1171   70.0   1172
GR    70.0   1219   42.0   1220   40.0   1248   38.3   1313   32.3   1322
GR    32.3   1326   32.3   1330   38.3   1339   48.0   1362   48.9   1370
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NC                                0.1       0.3
X1    809.5       0       0       0        90        90        90                0.4
X3                                1219

NC                                0.6       0.8
X1      810      20   225.0     235.0       120       120       120
X3     10.0                       120                                   40.1      40.1
GR     46.0     0.0    44.2      25.0      44.1      35.0      44.2      50.0      44.0      90.0
GR     43.0   150.0    42.0     211.0      40.0       217      33.3       225      33.3       230
GR     33.3     235    40.0     245.0      54.0     259.0      56.0     261.0      58.0     265.0
GR     59.8   275.0    59.8     285.0      59.0     305.0      59.9     321.0      59.0     339.0

SB            1.60     3.0                  10                  50                  33.4      33.3
NC    0.085    0.04   0.025
            48TH STREET                 ( 10'X 5' BOX CULVERT )
X1      812    15.0   205.0     215.0        40        40        40
X2                        1      38.4      41.8
X3      10.                       90                                   41.8      41.8
BT       12      60    70.0      70.0        70      70.0      70.0        80      70.0      70.0
BT       89    70.0    70.0        90      43.3      43.1     120.0      43.0      42.5       195
BT     42.0    39.4     205      41.9      33.4       206      41.9      38.4       214      41.8
BT     38.4     215    41.8      33.4       230      58.0      58.0
GR     70.0      60    70.0        70      70.0        80      70.0        89      43.1        90
GR     42.5   120.0    39.4       195      33.4       205      33.4       206      33.4       214
GR     33.4     215    58.0     230.0      60.0     235.0      60.4     250.0      60.3     260.0

NC     0.18    0.08    0.02
         813    27.0     582     610.0       120       160       140
X3                                510                 710
GR     47.0     0.0    47.2      60.0      47.8     125.0      48.0     180.0      48.0     230.0
GR     48.0   280.0    46.0     291.0      44.3     311.0      44.2     330.0      44.3     355.0
GR     44.0   380.0    43.8     395.0      43.8     410.0      43.8     430.0      43.8     470.0
GR     43.7   518.0    42.0       582      34.1       592      34.1       600      42.0       609
GR     44.0     610    50.0     625.0      52.0     632.0      54.0     636.0      56.0     640.0
GR     58.0   642.0    60.0     650.0

NC     0.11   0.055    0.02       0.1       0.3
X1    813.5    13.0     137       163     130.0       170     150.0
X3                                105
GR     48.0     0.0    43.0     120.0      42.0     134.0      41.0       137      35.0       146
GR     35.0     154    41.0       163      42.0     212.0      44.0     244.0      46.0     260.0
GR     48.0   295.0    50.0     323.0      52.0     340.0

NC                                0.3       0.5
X1      814      17     325       358        40        80        55       0.8
X3       10                       245                 435                44.0      44.0
        X3 ENCROACHMENT STATIONS HAVE BEEN MANUALLY SKEWED.
GR     43.8     215    42.8       260      41.4       325      41.4     325.1      35.4       336
GR     35.4     341    35.4     341.1      35.4     341.9      35.4       342      35.4       347
GR     41.4   357.9    41.4       358      42.0       370      44.0       382      46.0       470
GR     48.0     550    50.0       625
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                RAVENSWOOD AVENUE        ( 2 - SPAN BRIDGE SKEWED 37 DEGREES )
X1    814.1        0        0        0        1        1        1
X2                                                                          0.8
X3       10                          245                435                44.0      44.0
        X3 ENCROACHMENT STATIONS HAVE BEEN MANUALLY SKEWED.
BT      -17      215     44.8     43.8      260     44.9     42.8      325     44.9     41.4
BT            325.1     44.9     42.4      336     44.9     42.4      341     44.9     42.4
BT            341.1     44.9     35.4    341.9     44.9     35.4      342     44.9     42.4
BT              347     45.0     42.4    357.9     45.0     42.4      358     45.0     41.4
BT              370     45.0     42.0      382     45.0     44.0      470     46.0     46.0
BT              550     48.0     48.0      625     50.0     50.0

X1    815.9       16      325      358       50       50       50      0.8
X2                                                                          0.8
X3       10                          240                440                44.0      44.0
        X3 ENCROACHMENT STATIONS HAVE BEEN MANUALLY SKEWED.
BT      -16      225     44.9     44.9      290     44.9     44.0      325     44.9     42.6
BT            325.1     44.9     43.6      336     44.9     43.6      341     44.9     43.6
BT            341.1     44.9     36.6    341.9     44.9     36.6      342     44.9     43.6
BT              347     44.9     43.6    357.9     44.9     43.6      358     44.9     42.6
BT              370     45.0     44.0      443     46.2     46.0      530     48.0     48.0
BT              600     50.0     50.0
GR     44.9     225     44.0      290     42.6      325     42.6    325.1     36.6      336
GR     36.6     341     36.6    341.1     36.6    341.9     36.6      342     36.6      347
GR     42.6   357.9     42.6      358     44.0      370     46.0      443     48.0      530
GR     50.0     600

       816                                 1        1        1
X3      10                          240                440                44.9      44.9
        X3 ENCROACHMENT STATIONS HAVE BEEN MANUALLY SKEWED.

X1    816.3      13     1177     1203      130       70      110
X3                           1145                1250
GR     46.0    1000     44.0     1050     43.2     1177     37.2     1186     37.2     1194
GR     43.2    1203     44.0     1212     46.0     1282     47.5     1329     70.0     1330
GR     70.0    1360     48.5     1361     50.0     1412

NC                           0.1      0.3
X1    816.5      12    417.0    443.0       95       60       80
X3                           375                 470
GR     50.0     0.0     48.0    130.0     46.0    320.0     43.7    417.0     37.7      426
GR     37.7     434     43.7    443.0     44.0    454.0     45.7      532     70.0      533
GR     70.0     879     48.1      880
        DISCHARGES FROM RESVOR 19 IN TR-20 RUN ( D.A. = 1.20 MI^2 )

QT        8     574      946     1224                611      951     1263
NC                           0.3      0.5
X1    817.0    23.0    504.0    525.0    120.0     80.0    100.0
X3      10.                                                 55.0      55.0
GR     52.0     0.0     51.3     18.0     51.2     29.0     51.0     42.0     50.0      90.0
GR     49.0   200.0     48.0    293.0     47.3    315.0     47.0    330.0     46.8     342.0
GR     46.5   370.0     45.8    410.0     45.7    430.0     45.6    455.0     44.2     500.0
GR     38.2   504.0     38.2    513.0     38.2    525.0     39.9    530.0     44.0     540.0
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      45.0      585.0      46.0      621.0      48.2      690.0
SC    2.015      0.5       3.0                   5        10        170       8.2       39.4      38.2
                RAILROAD                    ( 2 - 10'X 5' BOX CULVERTS )
X1    819       25.0      823.0     844.0     170.0     170.0     170.0
X2                          2       44.4      56.5                                   56.5      57.2
X3    10.
X4    2         39.4      833       39.4      834
BT    30.       0.0       57.5      57.1      20.0      57.5      56.0      148.0     57.5      54.0
BT    300.0     57.5      52.7      380.0     57.5      52.0      463.0     57.5      50.0      568.0
BT    57.5      49.0      643.0     57.4      48.0      668.0     57.4      48.0      718.0     57.4
BT    48.2      761.0     57.1      48.0      793.0     56.9      47.9      813.0     56.7      48.5
BT    818.0     56.6      48.0      823.0     56.5      39.4      823.1     56.5      44.4      833.0
BT    56.5      44.4      833.1     56.5      39.4      834.0     56.6      39.4      834.0     56.6
BT    44.4      844.0     56.6      44.4      844.1     56.6      39.4      845.0     56.6      47.0
BT    874.0     56.8      48.0      898.0     56.9      50.0      918.0     57.2      52.0      948.0
BT    57.3      54.0      983.0     57.3      56.0      1098.0    57.5      57.0      1213.0    58.0
BT    58.0
GR    57.1      0.0       56.0      20.0      54.0      148.0     52.7      300.0     52.0      380.0
GR    50.0      463.0     49.0      568.0     48.0      643.0     48.0      668.0     48.2      718.0
GR    48.0      761.0     47.9      793.0     48.5      813.0     48.0      818.0     39.4      823.0
GR    39.4      844.0     47.0      845.0     48.0      874.0     50.0      898.0     52.0      918.0
GR    54.0      948.0     56.0      983.0     57.0      1098.0    58.0      1213.0    59.0      1328.0

X1    820       26        1780      1812      65        65        65
X3                                  1732                1875
GR    58.0      1000      56.0      1012      55.5      1030      80.0      1031      80.0      1158
GR    53.7      1159      53.5      1242      80.0      1243      80.0      1404      51.5      1405
      50.0      1450      49.0      1624      80.0      1625      80.0      1732      48.5      1733
GR    47.8      1780      39.8      1781      39.8      1802      47.8      1803      48.0      1812
GR    50.0      1840      52.0      1868      52.5      1874      80.0      1875      80.0      1945
GR    58.0      1946

X1    821       17        1781      1804      80        70        75
X3    10                                  1748                                   54.0      54.0
GR    60.0      1000      56.0      1042      54.0      1200      52.0      1353      50.0      1638
GR    80.0      1639      80.0      1748      49.0      1749      48.3      1781      40.3      1782
GR    40.3      1803      48.3      1804      50.0      1830      52.0      1858      54.0      1878
GR    54.5      1889      80.0      1890

SC    2.015      0.5       2.6                   5.5       11        65       8.2       40.8      40.3
                ABANDONED RAILROAD          ( 2 - 11'X 5.5' BOX CULVERTS )
X1    822       28.0      721.0     744.0      65        65        65
X2                          2       46.3      56.0
X3    10.                           650                 760                    56.0      56.0
X4    2.        40.8      732.0     40.8      733.0
BT    29.0      0.0       61.0      60.0      80.0      59.5      58.0      105.0     59.0      56.0
BT    144.0     58.5      54.0      205.0     58.0      52.0      305.0     57.5      50.0      435.0
BT    56.8      49.0      508.0     56.6      48.5      590.0     56.4      48.0      710.0     56.1
BT    47.0      720.0     56.1      41.0      721.0     56.1      40.8      721.0     56.1      46.3
BT    732.0     56.0      46.3      732.0     56.0      40.8      733.0     56.0      40.8      733.0
BT    56.0      46.3      744.0     56.1      46.3      744.0     56.1      40.8      750.0     56.2
BT    49.0      756.0     56.2      50.0      765.0     56.3      52.0      777.0     56.4      54.0
BT    794.0     56.5      55.0      815.0     56.6      56.0      845.0     56.7      56.7      910.0
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        58.0      58.0     916.0      60.0      60.0     975.0      62.0      62.0
GR      60.0       0.0      58.0      80.0      56.0     105.0      54.0     144.0      52.0     205.0
GR      50.0     305.0      49.0     435.0      48.5     508.0      48.0     590.0      47.0     710.0
GR      41.0     720.0      40.8     721.0      40.8     744.0      49.0     750.0      50.0     756.0
GR      52.0     765.0      54.0     777.0      55.0     794.0      56.0     815.0      56.7     845.0
GR      58.0     910.0      60.0     916.0      62.0     975.0      62.3    1060.0      62.3    1095.0
GR      62.3    1225.0      62.0    1256.0      60.0    1290.0
        DISCHARGES FROM ADDHYD 19 IN TR-20 RUN ( D.A. = 1.20 MI^2 )

QT       8        577      1163      1969                627      1213      2008
NH       6       0.18       220      0.08       375      0.03       610      0.02       642      0.03
NH     735       0.18      1210
X1     823         26       610       642       140       195       175
X3                                   400                 860
GR      60.0       0.0      58.0      40.0      56.0      82.0      54.0      91.0      52.0     160.0
GR      50.0     220.0      49.9     281.0      49.7     375.0      49.0     500.0      48.0     581.0
GR      47.9       610      41.9       619      41.9       633      47.9       642      48.4       665
GR      48.8     685.0      49.0     695.0      49.2     710.0      50.0     730.0      55.0       735
GR      80.0       736      80.0       780      55.0       781      56.0       810      60.0       925
GR      62.0    1210.0

NC                                     0.1       0.3
NH       6       0.18      1235      0.08      1330      0.03      1526      0.02      1554      0.08
NH    1690       0.18      1910
X1   823.5         19      1526      1554       110       200       170
X3                                  1440                1630
GR      60.0      1000      58.0      1018      56.0      1070      54.0      1079      52.5      1159
GR      80.0      1160      80.0      1192      52.0      1193      50.0      1235      50.0      1330
        50.0      1472      49.2      1526      43.2      1535      43.2      1545      49.2      1554
GR      50.0      1690      52.0      1763      54.0      1853      56.0      1910

NC                                     0.6       0.8
NH       5       0.18      1380      0.08      1436      0.02      1445      0.07      1540      0.18
NH    1700
X1     824         15      1436      1445        95        95        95
X3      10                          1380                1520                48.0      48.0
GR      60.0      1000      56.0      1070      54.0      1076      52.0      1190      52.0      1350
GR      51.0      1380      50.0      1416      49.4      1435      43.9      1436      43.9      1445
GR      49.4      1446      50.0      1540      52.0      1600      54.0      1639      56.0      1700

NH       5       0.18      1380      0.08      1436      0.02      1445      0.07      1540      0.18
NH    1700
X1   824.1         0         0         0         1         1         1
X3      10                          1380                1520                48.0      48.0
BT      -8      1380      51.0      51.0      1416      50.2      50.0      1435      50.2      49.4
BT              1436      50.2      48.9      1445      50.2      48.9      1446      50.2      49.4
BT              1540      50.2      50.0      1600      52.0      52.0

NH       5       0.18       290      0.07       342      0.02       351      0.07       385      0.18
NH     621
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46TH AVENUE (9'X 5' BOX CULVERT)

X1	824.2	16	342	351	155	155.0	155.0			
X3	10.			290		385		50.0	50.0	
BT	-4	341.9	50.2	50.2	342	50.2	48.9	351	50.2	48.9
BT		351.1	50.2	50.2						
GR	60.0	0.0	58.0	12.0	56.0	32.0	54.0	60.0	53.0	158
GR	52.0	213	51.0	290	50.2	341.9	43.9	342	43.9	351
GR	50.2	351.1	51.0	385	52.0	478	56.0	536	58.0	571
GR	60.0	621								
NH	5	0.18	290	0.07	342	0.02	351	0.07	385	0.18
NH	621									
X1	825	0	0	0	1	1	1			
X3	10			290		385		50.2	50.2	
NC	0.055	0.065	0.02							
X1	825.5	22	1260	1275	95	95	95			
X3				1215		1340				
GR	80.0	1000	80.0	1040	56.0	1041	54.0	1080	52.0	1165
GR	51.5	1180	80.0	1181	80.0	1215	51.2	1216	50.6	1259.9
GR	44.6	1260	44.6	1275	50.6	1275.1	51.8	1342	52.0	1354
GR	54.0	1404	55.0	1438	80.0	1439	80.0	1470	57.0	1471
GR	58.0	1495	60.0	1560						
X1	825.8	14	1242	1251	90	90	90			
X3	10			1190		1320		51.5	51.5	
GR	80.0	1000	56.0	1001	54.0	1050	52.0	1102	51.7	1220
GR	50.3	1242	45.3	1243	45.3	1250	50.3	1251	52.0	1320
	54.0	1368	56.0	1430	58.0	1460	60.0	1490		
X1	825.9	14	1242	1251	1	1	1			
X3	10			1190		1320		51.6	51.6	
BT	-14	1000	80.0	80.0	1001	56.0	56.0	1050	54.0	54.0
BT		1102	52.0	52.0	1220	51.7	51.7	1242	51.6	50.3
BT		1243	51.6	50.3	1250	51.6	50.3	1251	51.6	50.3
BT		1320	52.1	52.0	1368	54.0	54.0	1430	56.0	56.0
BT		1460	58.0	58.0	1490	60.0	60.0			
GR	80.0	1000	56.0	1001	54.0	1050	52.0	1102	51.7	1220
GR	50.3	1242	45.3	1243	45.3	1250	50.3	1251	52.0	1320
GR	54.0	1368	56.0	1430	58.0	1460	60.0	1490		
NC	0.08	0.1	0.02							

TUCKERMAN STREET (9'X 5' BOX CULVERT)

X1	826.0	17	287.0	296.0	70	100	80			
X3	10.0			260		350		51.6	51.6	
BT	17.0	0.0	60.0	60.0	8.0	58.0	58.0	50.0	56.0	56.0
BT	110.0	54.0	54.0	115.0	52.0	52.0	283.0	51.6	51.0	283.1
BT	51.6	45.3	287.0	51.6	45.3	287.1	51.6	50.3	295.9	51.6
BT	50.3	296.0	51.6	45.3	301.0	51.6	45.4	301.1	51.6	51.0
BT	390.0	52.0	52.0	450.0	54.0	54.0	495.0	56.0	56.0	560.0
BT	60.0	60.0								
GR	60.0	0.0	58.0	8.0	56.0	50.0	54.0	110.0	52.0	115.0
GR	51.0	283.0	45.4	283.1	45.3	287.0	45.3	287.1	45.3	295.9
GR	45.3	296	45.4	301	51.0	301.1	52.0	390.0	54.0	450.0

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I      56.0      495      60.0      560

X1    826.1        0         0        0        1        1        1
X3       10                           260              350              51.6     51.6

X1    826.5       20      1105     1123      130       80      110
X3                                                    1180
GR     60.0     1000      58.0     1030     56.0     1040     54.0     1056     52.0     1092
GR     50.8     1105      45.8   1105.1     45.8   1122.9     50.8     1123     52.0     1169
GR     52.5     1185      80.0     1186     80.0     1240     52.5     1241     52.2     1280
GR     52.2     1312      54.0     1350     56.0     1372     58.0     1394     60.0     1439

NC     0.05     0.11      0.02      0.1      0.3
X1      827     26.0       381      399      100       60       80
X3                                                     481
GR     59.5      179      80.0      180     80.0      310     58.4      311     58.0    360.0
GR     56.0    370.0      54.0    375.0     52.0      381     46.2      381     46.2      399
GR     51.0      399      52.3      480     80.0      481     80.0      490     80.0      500
GR     80.0      519      52.4      520     52.2    550.0     53.0    570.0     53.0    605.0
GR     54.0    624.0      56.0    643.0     58.0    665.0     60.0    712.0     62.0    770.0
GR     64.0    800.0

X1    827.7       16      80.0     98.0    260.0    250.0    250.0
X3                                                     170
GR     80.0       49      57.0       50     56.0       65     52.0     80.0     46.2     80.0
GR     46.2     98.0      52.0     98.0     54.0    130.0     53.5      170     80.0      171
GR     80.0      200      80.0      222     55.0      223     56.0    270.0     58.0    295.0
GP     60.0    360.0
.
NC     0.06     0.06      0.02      0.3      0.5
X1      828     36.0     547.0    565.0     80.0     80.0     80.0
X3      10.                           460                670              57.5     57.5
GR     70.0      0.0      68.0     50.0     66.0     90.0     64.0    130.0     62.5    140.0
GR     62.0    160.0      61.9    170.0     60.3    220.0     60.5    230.0     60.3    240.0
GR     60.0    300.0      59.8    335.0     59.8    345.0     59.7    355.0     58.3    435.0
GR     58.2    445.0      58.3    455.0     58.0    480.0     56.0    530.0     54.0    540.0
GR     46.4    547.0      46.4    565.0     54.0    567.0     54.0    570.0     54.0    580.0
GR     56.0    585.0      58.0    680.0     59.1    735.0     59.0    745.0     59.1    760.0
GR     60.0    790.0      62.0    835.0     64.0    880.0     65.0    915.0     66.0    940.0
GR     68.0    995.0

SC    1.015      0.5       3.0      0.0        9       18       65      8.2     47.8     46.4
             U.S. ROUTE 1                ( 18'X 9' BOX CULVERT )
X1      830     36.0     522.0    540.0     65.0     65.0     65.0
X2                          2     56.8     58.1
X3      10.                           390                680              58.1     58.1
BT      22.    255.0      61.0     61.0    300.0     60.6     60.0    355.0     59.8     59.0
BT    400.0     59.3      58.0    470.0     58.7     56.0    490.0     58.6     54.0    500.0
BT     58.5     54.1     505.0     58.4     54.0    520.0     58.2     48.0    522.0     58.2
BT     47.8    522.0      58.2     56.8    535.0     58.1     56.8    540.0     58.2     56.8
BT    540.0     58.2      48.0    545.0     58.2     50.0    560.0     58.5     56.2    570.0
BT     58.7     56.1     575.0     58.8     56.2    640.0     59.2     58.0    700.0     59.9
BT     59.0    740.0      60.5     60.0    790.0     61.0     61.0
GR     70.0      0.0      68.0     20.0     66.0     50.0     65.3     55.0     65.3     65.0
```

I	65.2	75.0	64.0	130.0	62.0	180.0	61.0	255.0	60.0	300.0
GR	59.0	355.0	58.0	400.0	56.0	470.0	54.0	490.0	54.1	500.0
GR	54.0	505.0	48.0	520.0	47.8	522.0	47.8	535.0	48.0	540.0
GR	50.0	545.0	56.2	560.0	56.1	570.0	56.2	575.0	58.0	640.0
GR	59.0	700.0	60.0	740.0	61.0	790.0	62.0	820.0	62.3	840.0
GR	62.2	851.0	62.3	860.0	64.0	870.0	65.0	920.0	66.0	950.0
GR	68.0	1005.0								
NH	7	0.18	340	0.07	391	0.03	415	0.04	465	0.03
NH	488	0.07	543	0.18	970					
X1	830.5	45	415.0	465.0	75	140	110		-0.1	
X3				340		543				
GR	68.0	0.0	66.0	10.0	65.2	30.0	65.0	40.0	65.2	50.0
GR	64.0	85.0	62.0	150.0	60.0	175.0	58.0	200.0	57.0	280.0
GR	57.0	308	80.0	309	80.0	325	80.0	339	56.5	340
GR	56.0	370.0	55.2	391.0	55.1	405.0	55.2	415.0	54.0	418.0
GR	52.0	425.0	50.0	428.0	48.1	431.0	48.1	441.0	50.0	445.0
GR	52.0	450.0	54.0	455.0	55.4	465.0	55.3	475.0	55.4	481.0
GR	56.0	488.0	57.0	520.0	57.8	542	80.0	543	80.0	555
GR	80.0	569	58.2	570	59.0	600.0	59.9	640.0	62.0	690.0
GR	63.7	791.0	63.6	805.0	63.7	815.0	63.9	840.0	68.0	970.0
NH	7	0.18	340	0.07	391	0.03	415	0.04	465	0.03
NH	488	0.07	543	0.18	970					
X1	831	0	0	0	115	115	115		0.1	
X3				340		543				
NH	7	0.18	340	0.07	391	0.03	415	0.04	465	0.03
I	488	0.07	543	0.18	970					
X1	831.5	0	0	0	110	110	110		0.2	
X3				340		543				
NC				0.3	0.5					
NH	7	0.18	500	0.07	565	0.03	610	0.04	627	0.03
NH	670	0.07	710	0.18	1211					
X1	832.0	39.0	601.0	610.0	40.0	40.0	40.0			
X3	10.0			470		725		53.3	53.3	
GR	70.0	0.0	68.0	50.0	66.0	120.0	64.0	180.0	62.0	230.0
GR	62.0	240.0	62.0	255.0	61.0	310.0	60.0	345.0	58.0	430.0
GR	57.0	500.0	56.3	555.0	56.2	565.0	56.3	575.0	56.0	580.0
GR	54.0	585.0	52.0	586.0	50.0	588.0	48.4	601.0	48.4	610.0
GR	50.0	615.0	52.0	618.0	54.0	620.0	56.0	621.0	56.6	627.0
GR	56.5	635.0	56.6	645.0	57.0	670.0	58.0	710.0	60.0	750.0
GR	61.0	810.0	62.0	865.0	64.0	910.0	65.2	965.0	65.4	975.0
GR	65.2	985.0	66.0	1035.0	67.0	1175.0	68.0	1211.0		
X1	833.2	35	618.0	627.0	1	1	1			
X3	10.			487		742		53.3	53.3	
BT	29.0	130.0	66.0	66.0	210.0	64.0	64.0	235.0	62.5	62.5
BT	260.0	62.4	62.4	275.0	62.5	62.5	305.0	62.0	62.0	350.0
BT	60.0	60.0	405.0	59.0	59.0	450.0	58.0	58.0	518.0	57.0
BT	57.0	605.0	56.0	56.0	606.0	56.0	54.0	608.0	56.1	52.0
BT	611.0	56.2	50.0	618.0	56.0	48.4	618.1	56.4	53.6	626.9
BT	56.4	53.6	627.0	56.4	48.4	635.0	56.5	50.0	638.0	56.5

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I      52.0     640.0     56.5     54.0     642.0     56.0     56.0     680.0     57.0     57.0
B1    730.0      58.0     58.0    770.0      60.0     60.0    815.0      62.0     62.0    900.0
BT     63.0      63.0    950.0     64.0      64.0    988.0     65.5      65.5
GR     70.0       0.0     68.0     70.0      66.0    130.0     64.0     210.0     62.5    235.0
GR     62.4     260.0     62.5    275.0      62.0    305.0     60.0     350.0     59.0    405.0
GR     58.0     450.0     57.0    518.0      56.0    605.0     54.0     606.0     52.0    608.0
GR     50.0     611.0     48.4    618.0      48.4    618.1     48.4     626.9     48.4    627.0
GR     48.4       627     50.0      635      54.0    640.0     56.0     642.0     57.0    680.0
GR     58.0       730     60.0      770      62.0    815.0     63.0     900.0     64.0    950.0
GR     65.5       988     65.4      998      65.5   1005.0     66.0    1055.0     68.0   1115.0

NC     0.08      0.08     0.04
                44TH STREET                    ( 9'X 5.2' BOX CULVERT )
C1    833.3         0        0        0        35       35       35
C2                                                          1
C3     10.                            450                780                55.0     55.0

C1     834          0        0        0         1        1        1
C3     10.                            450                780                55.0     55.0

C1    834.2      20.0    506.0    550.0        90       90       90
C3                                 270
iR     68.0       0.0     66.0     72.0      64.0    120.0     62.0     219.0     60.0    263.0
iR     58.0     300.0     56.0    430.0      54.0    506.0     52.0     515.0     50.0    523.0
iR     48.6     527.0     48.6    537.0      50.0    543.0     56.0     550.0     58.0    650.0
iR     60.0     672.0     62.0    738.0      64.0    782.0     66.0     917.0     68.0    950.0

IC                                 0.1       0.3
       835      30.0    360.0    391.0     355.0    370.0    365.0
                                 260                520
iR     70.0       0.0     69.2     10.0      69.1     20.0     69.2      30.0     68.0     75.0
iR     64.0     135.0     58.0    198.0      56.0    250.0     55.0     310.0     54.0    360.0
iR     52.0     361.0     50.0    365.0      49.3    368.0     49.3     375.0     50.0    378.0
iR     52.0     382.0     54.0    388.0      56.0    391.0     57.0     460.0     58.0    510.0
iR     60.0     560.0     62.0    585.0      63.0    650.0     63.8     690.0     68.0    765.0
iR     69.0     795.0     68.9    808.0      69.0    820.0     70.0     850.0     72.0    960.0

C      0.06      0.04     0.04
1     835.1      21.0    250.0    294.0     310.0    330.0    320.0
3                                                    415
R     70.0       0.0     68.0     10.0      66.0     35.0     64.0      82.0     62.0    220.0
R     60.0     244.0     58.0    250.0      56.0    254.0     54.0     259.0     52.0    262.0
R     50.0     266.0     50.0    277.0      52.0    284.0     58.0     294.0     60.0    330.0
R     62.0     436.0     64.0    464.0      66.0    480.0     68.0     508.0     70.0    575.0
R     72.0     580.0

C                                 0.3       0.5
1      836      32.0    420.0    451.0     150.0    175.0    165.0
3      10.                       120                745                61.0     61.0
R     72.0       0.0     70.0     40.0      69.4     45.0     69.6      55.0     69.4     65.0
R     68.0     120.0     66.0    180.0      65.0    241.0     64.0     325.0     56.0    405.0
R     54.0     410.0     52.0    420.0      51.7    421.0     51.7     430.0     51.7    445.0
R     51.7     450.0     52.0    451.0      54.0    460.0     56.0     465.0     58.0    468.0
R     60.0     469.0     62.0    470.0      63.0    565.0     64.0     650.0     66.0    680.0
```

26MAY93 15:36:58

THIS RUN EXECUTED 26MAY93 15:46:12

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HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

NORTHEAST TRIBUTARY 3

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	122.000	.00	.00	.00	14.20	6623.00	24.08	.00	24.62	13.33	5.89	1124.23	1814.32
	122.000	.00	.00	.00	14.20	14766.00	29.99	.00	30.83	9.63	7.37	2004.82	4757.99
	122.000	.00	.00	.00	14.20	23153.00	33.55	.00	33.83	3.36	5.09	6236.38	12635.65
	122.000	.00	.00	.00	14.20	8286.00	25.24	.00	25.87	12.95	6.39	1297.07	2302.66
	122.000	.00	.00	.00	14.20	16241.00	30.49	.00	31.44	10.32	7.81	2079.32	5056.31
	122.000	.00	.00	.00	14.20	24850.00	33.86	.00	34.15	3.52	5.27	6481.28	13241.45
*	802.600	240.00	.00	.00	23.70	589.00	26.20	26.20	27.44	210.69	8.92	66.06	40.58
	802.600	240.00	.00	.00	23.70	1189.00	30.53	.00	31.15	35.61	6.35	193.89	199.24
*	802.600	240.00	.00	.00	23.70	2012.00	33.72	.00	33.93	10.26	4.43	649.42	628.07
*	802.600	240.00	.00	.00	23.70	641.00	26.35	26.35	27.65	208.59	9.16	69.97	44.38
*	802.600	240.00	.00	.00	23.70	1241.00	31.37	.00	31.84	24.01	5.65	246.08	253.28
*	802.600	240.00	.00	.00	23.70	2053.00	34.11	.00	34.28	8.02	4.02	725.92	725.00
*	803.000	150.00	.00	.00	24.40	589.00	28.25	.00	29.51	96.86	8.99	65.53	59.85
*	803.000	150.00	.00	.00	24.40	1189.00	30.66	.00	32.53	76.62	11.04	113.27	135.83
*	803.000	150.00	.00	.00	24.40	2012.00	33.72	33.72	34.78	32.84	9.43	353.15	351.11
*	803.000	150.00	.00	.00	24.40	641.00	28.41	.00	29.78	100.39	9.40	68.20	63.97
*	803.000	150.00	.00	.00	24.40	1241.00	31.33	.00	32.95	58.51	10.33	130.52	162.24
*	803.000	150.00	.00	.00	24.40	2053.00	33.97	33.76	34.82	27.23	8.74	411.82	393.43
	804.200	1.00	32.30	29.40	24.20	589.00	28.68	.00	29.61	58.88	7.74	76.08	76.76
*	804.200	1.00	32.30	29.40	24.20	1189.00	30.27	29.40	32.95	354.78	13.23	93.81	63.12
*	804.200	1.00	32.30	29.40	24.20	2012.00	34.17	34.17	35.02	206.38	9.45	390.87	140.05
	804.200	1.00	32.30	29.40	24.20	641.00	28.91	.00	29.90	59.00	8.01	79.99	83.45
*	804.200	1.00	32.30	29.40	24.20	1241.00	30.70	29.40	33.60	385.76	13.80	94.70	63.18
*	804.200	1.00	32.30	29.40	24.20	2053.00	34.20	34.20	35.05	206.24	9.47	398.74	142.96
	804.300	95.00	32.30	29.60	24.60	589.00	29.31	.00	30.15	49.46	7.35	80.16	83.75
*	804.300	95.00	32.30	29.60	24.60	1189.00	34.32	.00	34.49	36.68	3.97	378.34	196.33
*	804.300	95.00	32.30	29.60	24.60	2012.00	35.53	.00	35.66	18.89	3.16	693.22	462.95
*	804.300	95.00	32.30	29.60	24.60	641.00	29.83	.00	30.72	121.44	7.54	85.00	58.17
*	804.300	95.00	32.30	29.60	24.60	1241.00	34.82	.00	34.92	18.54	2.95	503.81	288.22
*	804.300	95.00	32.30	29.60	24.60	2053.00	35.55	.00	35.69	19.05	3.18	700.45	470.38

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
804.300	1.00	.00	.00	24.60	589.00	29.32	.00	30.16	49.30	7.34	80.24	83.89
804.300	1.00	.00	.00	24.60	1189.00	34.28	.00	34.54	8.27	4.85	437.47	413.37
804.300	1.00	.00	.00	24.60	2012.00	35.48	.00	35.70	7.84	5.11	751.19	718.40
804.300	1.00	.00	.00	24.60	641.00	30.05	.00	30.77	35.47	6.85	97.57	107.62
804.300	1.00	.00	.00	24.60	1241.00	34.79	.00	34.95	5.58	4.13	567.19	525.19
804.300	1.00	.00	.00	24.60	2053.00	35.51	.00	35.73	7.98	5.16	758.25	726.54
806.000	215.00	.00	.00	26.40	589.00	30.61	30.61	32.09	48.32	9.77	60.30	84.73
806.000	215.00	.00	.00	26.40	1189.00	34.28	.00	34.92	9.71	6.86	238.52	381.66
806.000	215.00	.00	.00	26.40	2012.00	35.34	.00	36.27	12.46	8.69	358.82	570.09
806.000	215.00	.00	.00	26.40	641.00	30.80	30.80	32.35	47.96	9.96	64.34	92.56
806.000	215.00	.00	.00	26.40	1241.00	34.75	.00	35.27	7.41	6.31	283.32	455.79
806.000	215.00	.00	.00	26.40	2053.00	35.36	.00	36.31	12.77	8.81	361.58	574.46
806.500	135.00	.00	.00	27.80	589.00	31.91	31.91	33.32	47.28	9.52	61.86	85.66
806.500	135.00	.00	.00	27.80	1189.00	34.01	.00	35.64	34.97	10.23	116.21	201.05
806.500	135.00	.00	.00	27.80	2012.00	36.00	36.00	37.81	25.54	10.95	211.68	398.15
806.500	135.00	.00	.00	27.80	641.00	32.10	32.10	33.56	46.79	9.70	66.08	93.71
806.500	135.00	.00	.00	27.80	1241.00	34.48	.00	35.89	28.17	9.55	130.01	233.82
806.500	135.00	.00	.00	27.80	2053.00	36.20	36.20	37.87	22.89	10.62	231.41	429.07
807.000	95.00	.00	.00	28.40	589.00	32.66	32.66	34.40	84.24	10.61	55.51	64.17
807.000	95.00	.00	.00	28.40	1189.00	34.84	34.84	37.32	80.74	12.64	94.06	132.32
807.000	95.00	.00	.00	28.40	2012.00	37.09	37.09	40.26	66.46	14.36	144.14	246.80
807.000	95.00	.00	.00	28.40	641.00	32.88	32.88	34.70	83.82	10.85	59.10	70.01
807.000	95.00	.00	.00	28.40	1241.00	35.00	35.00	37.54	80.66	12.78	97.11	138.18
807.000	95.00	.00	.00	28.40	2053.00	37.17	37.17	40.39	66.47	14.47	146.25	251.81
808.000	140.00	38.30	37.10	31.10	589.00	34.09	34.09	35.60	63.73	9.85	59.80	73.78
808.000	140.00	38.30	37.10	31.10	1189.00	37.38	.00	38.90	64.22	9.91	120.00	148.37
808.000	140.00	38.30	37.10	31.10	2012.00	39.39	39.39	41.00	19.67	10.80	299.63	453.69
808.000	140.00	38.30	37.10	31.10	641.00	34.36	.00	35.85	56.49	9.83	65.23	85.28
808.000	140.00	38.30	37.10	31.10	1241.00	37.45	.00	39.11	69.96	10.34	120.00	148.37
808.000	140.00	38.30	37.10	31.10	2053.00	39.73	39.47	41.08	16.31	10.10	355.65	508.28
809.000	140.00	.00	.00	32.30	589.00	36.52	36.52	37.99	74.86	9.74	60.49	68.08
809.000	140.00	.00	.00	32.30	1189.00	38.40	38.40	40.41	68.02	11.37	104.81	144.17
809.000	140.00	.00	.00	32.30	2012.00	40.52	40.52	42.56	41.73	11.81	256.84	311.45
809.000	140.00	.00	.00	32.30	641.00	36.71	36.71	38.25	74.51	9.94	64.47	74.26
809.000	140.00	.00	.00	32.30	1241.00	38.53	38.53	40.58	66.68	11.49	109.02	151.97
809.000	140.00	.00	.00	32.30	2053.00	40.63	40.63	42.64	40.39	11.76	268.43	323.03
809.500	90.00	.00	.00	32.70	589.00	37.57	.00	38.54	42.62	7.92	74.41	90.22
809.500	90.00	.00	.00	32.70	1189.00	39.47	38.77	40.93	40.47	9.71	133.65	186.90
809.500	90.00	.00	.00	32.70	2012.00	40.94	40.94	42.96	41.25	11.76	258.65	313.25
809.500	90.00	.00	.00	32.70	641.00	37.78	.00	38.80	42.67	8.10	79.16	98.13
809.500	90.00	.00	.00	32.70	1241.00	39.62	38.91	41.09	39.29	9.77	143.04	197.99
809.500	90.00	.00	.00	32.70	2053.00	41.00	41.00	43.04	41.31	11.85	264.80	319.40

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	810.000	120.00	.00	.00	33.30	589.00	38.05	38.05	40.44	54.46	12.40	47.51	79.81
*	810.000	120.00	.00	.00	33.30	1189.00	40.29	40.29	42.78	40.84	13.89	135.57	186.04
*	810.000	120.00	.00	.00	33.30	2012.00	43.13	43.13	45.75	30.05	14.96	271.81	367.05
*	810.000	120.00	.00	.00	33.30	641.00	38.31	38.31	40.85	54.13	12.80	50.07	87.12
*	810.000	120.00	.00	.00	33.30	1241.00	40.41	40.41	42.99	41.62	14.18	139.12	192.36
*	810.000	120.00	.00	.00	33.30	2053.00	43.35	43.35	45.86	28.32	14.73	296.11	385.80
*	812.000	40.00	41.80	38.40	33.40	589.00	40.40	.00	41.50	14.95	8.41	70.02	152.33
*	812.000	40.00	41.80	38.40	33.40	1189.00	42.95	.00	43.87	11.34	9.01	344.49	353.09
*	812.000	40.00	41.80	38.40	33.40	2012.00	44.53	.00	45.75	14.22	11.18	551.59	533.48
*	812.000	40.00	41.80	38.40	33.40	641.00	41.13	.00	42.20	12.71	8.29	77.33	179.77
*	812.000	40.00	41.80	38.40	33.40	1241.00	42.96	.00	43.96	12.29	9.39	345.67	354.01
*	812.000	40.00	41.80	38.40	33.40	2053.00	44.66	.00	45.86	13.96	11.16	567.74	549.55
*	813.000	140.00	.00	.00	34.10	589.00	41.78	.00	42.09	5.40	4.45	132.47	253.53
	813.000	140.00	.00	.00	34.10	1189.00	43.49	.00	44.16	8.71	6.59	221.23	402.95
	813.000	140.00	.00	.00	34.10	2012.00	44.71	.00	45.98	13.64	9.16	341.32	544.71
*	813.000	140.00	.00	.00	34.10	641.00	42.49	.00	42.77	4.29	4.23	156.07	309.58
	813.000	140.00	.00	.00	34.10	1241.00	43.57	.00	44.28	9.14	6.79	227.74	410.59
	813.000	140.00	.00	.00	34.10	2053.00	44.83	.00	46.10	13.44	9.19	353.11	559.90
	813.500	150.00	.00	.00	35.00	589.00	41.85	.00	42.19	5.92	4.69	142.73	242.15
	813.500	150.00	.00	.00	35.00	1189.00	43.82	.00	44.29	5.82	5.87	349.43	492.95
*	813.500	150.00	.00	.00	35.00	2012.00	45.64	.00	46.18	5.66	6.78	611.49	845.68
	813.500	150.00	.00	.00	35.00	641.00	42.56	.00	42.83	4.08	4.28	202.53	317.48
	813.500	150.00	.00	.00	35.00	1241.00	43.93	.00	44.41	5.90	5.97	364.44	510.80
	813.500	150.00	.00	.00	35.00	2053.00	45.76	.00	46.30	5.51	6.76	630.76	874.42
	814.000	55.00	.00	.00	35.40	589.00	41.86	.00	42.25	7.48	5.03	117.19	215.36
	814.000	55.00	.00	.00	35.40	1189.00	43.70	.00	44.50	9.58	7.17	165.84	384.15
	814.000	55.00	.00	.00	35.40	2012.00	45.53	.00	46.37	8.47	7.99	510.11	691.25
	814.000	55.00	.00	.00	35.40	641.00	42.55	.00	42.90	5.47	4.73	135.45	274.14
	814.000	55.00	.00	.00	35.40	1241.00	43.79	.00	44.64	9.93	7.37	168.31	393.73
	814.000	55.00	.00	.00	35.40	2053.00	45.65	.00	46.49	8.25	7.97	530.36	714.88
	814.100	1.00	44.80	42.40	35.40	589.00	41.84	.00	42.27	13.95	5.24	112.38	157.71
*	814.100	1.00	44.80	42.40	35.40	1189.00	43.41	.00	44.79	74.20	9.41	126.40	138.04
*	814.100	1.00	44.80	42.40	35.40	2012.00	43.98	42.40	47.92	212.46	15.92	126.40	138.04
*	814.100	1.00	44.80	42.40	35.40	641.00	42.52	.00	42.92	21.56	5.07	126.40	138.04
*	814.100	1.00	44.80	42.40	35.40	1241.00	43.47	.00	44.97	80.83	9.82	126.40	138.04
*	814.100	1.00	44.80	42.40	35.40	2053.00	44.02	42.40	48.12	221.20	16.24	126.40	138.04
*	815.900	50.00	44.90	44.00	36.60	589.00	41.74	.00	42.58	34.55	7.36	80.02	100.20
	815.900	50.00	44.90	44.00	36.60	1189.00	43.78	.00	45.16	74.20	9.41	126.40	138.04
*	815.900	50.00	44.90	44.00	36.60	2012.00	49.00	46.51	49.19	11.60	4.55	829.50	590.65
	815.900	50.00	44.90	44.00	36.60	641.00	42.51	.00	43.17	23.67	6.50	98.54	131.76
	815.900	50.00	44.90	44.00	36.60	1241.00	43.87	.00	45.37	80.83	9.82	126.40	138.04
*	815.900	50.00	44.90	44.00	36.60	2053.00	49.26	.00	49.44	10.15	4.34	883.65	644.40

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	816.000	1.00	.00	.00	36.60	589.00	41.94	.00	42.63	16.91	6.64	88.68	143.22
*	816.000	1.00	.00	.00	36.60	1189.00	44.31	.00	45.28	13.37	7.92	150.07	325.23
*	816.000	1.00	.00	.00	36.60	2012.00	48.95	.00	49.25	2.57	5.18	983.31	1254.53
	816.000	1.00	.00	.00	36.60	641.00	42.62	.00	43.19	12.49	6.06	105.72	181.39
*	816.000	1.00	.00	.00	36.60	1241.00	44.55	.00	45.53	12.68	7.93	156.42	348.47
*	816.000	1.00	.00	.00	36.60	2053.00	49.21	.00	49.49	2.37	5.06	1035.59	1332.21
	816.300	110.00	.00	.00	37.20	589.00	42.02	.00	43.02	28.15	8.01	73.55	111.02
	816.300	110.00	.00	.00	37.20	1189.00	44.39	43.34	45.54	18.64	8.73	177.50	275.37
	816.300	110.00	.00	.00	37.20	2012.00	48.89	.00	49.37	4.14	6.27	641.80	988.89
	816.300	110.00	.00	.00	37.20	641.00	42.67	.00	43.48	20.04	7.22	88.75	143.19
	816.300	110.00	.00	.00	37.20	1241.00	44.65	43.51	45.75	16.87	8.58	199.53	302.14
	816.300	110.00	.00	.00	37.20	2053.00	49.15	.00	49.61	3.88	6.17	668.97	1042.78
	816.500	80.00	.00	.00	37.70	589.00	42.06	.00	43.40	42.21	9.30	63.36	90.65
	816.500	80.00	.00	.00	37.70	1189.00	44.29	43.80	45.85	29.34	10.07	131.42	219.52
	816.500	80.00	.00	.00	37.70	2012.00	48.83	.00	49.45	5.52	6.95	559.58	856.35
	816.500	80.00	.00	.00	37.70	641.00	42.68	.00	43.75	29.32	8.31	77.12	118.39
	816.500	80.00	.00	.00	37.70	1241.00	44.55	43.96	46.03	26.04	9.85	153.00	243.17
	816.500	80.00	.00	.00	37.70	2053.00	49.09	.00	49.69	5.16	6.85	584.23	904.06
*	817.000	100.00	.00	.00	38.20	574.00	43.36	.00	43.79	5.72	5.30	108.22	239.92
*	817.000	100.00	.00	.00	38.20	946.00	45.69	.00	46.26	4.47	6.01	157.34	447.65
	817.000	100.00	.00	.00	38.20	1224.00	49.09	.00	49.54	2.15	5.35	228.77	835.36
*	817.000	100.00	.00	.00	38.20	611.00	43.60	.00	44.05	5.55	5.39	113.40	259.34
*	817.000	100.00	.00	.00	38.20	951.00	45.87	.00	46.41	4.18	5.91	161.01	465.20
	817.000	100.00	.00	.00	38.20	1263.00	49.31	.00	49.76	2.14	5.41	233.28	863.02
	819.000	170.00	56.50	44.40	39.40	574.00	43.83	.00	44.42	9.48	6.17	93.03	186.45
	819.000	170.00	56.50	44.40	39.40	946.00	48.15	.00	48.56	2.66	5.15	183.81	580.08
*	819.000	170.00	56.50	44.40	39.40	1224.00	53.64	.00	53.90	.88	4.09	298.96	1304.86
	819.000	170.00	56.50	44.40	39.40	611.00	44.23	.00	44.80	8.02	6.02	101.54	215.74
	819.000	170.00	56.50	44.40	39.40	951.00	48.37	.00	48.77	2.47	5.05	188.44	604.63
*	819.000	170.00	56.50	44.40	39.40	1263.00	54.16	.00	54.42	.83	4.07	310.06	1386.63
	820.000	65.00	.00	.00	39.80	574.00	43.88	.00	44.54	17.90	6.54	87.74	135.68
*	820.000	65.00	.00	.00	39.80	946.00	48.20	.00	48.60	7.04	5.03	193.72	356.66
	820.000	65.00	.00	.00	39.80	1224.00	53.86	.00	53.95	.81	2.68	863.93	1356.97
	820.000	65.00	.00	.00	39.80	611.00	44.28	.00	44.90	15.27	6.33	96.57	156.33
*	820.000	65.00	.00	.00	39.80	951.00	48.44	.00	48.80	6.22	4.85	210.39	381.30
	820.000	65.00	.00	.00	39.80	1263.00	54.40	.00	54.48	.71	2.59	939.51	1495.76
	821.000	75.00	.00	.00	40.30	574.00	43.95	.00	44.78	25.15	7.33	78.27	114.45
	821.000	75.00	.00	.00	40.30	946.00	48.22	.00	48.68	6.74	5.42	174.41	364.42
*	821.000	75.00	.00	.00	40.30	1224.00	53.79	.00	54.04	1.81	4.05	302.23	908.83
	821.000	75.00	.00	.00	40.30	611.00	44.33	.00	45.10	20.96	7.04	86.76	133.44
	821.000	75.00	.00	.00	40.30	951.00	48.45	.00	48.88	6.23	5.30	179.38	380.96
	821.000	75.00	.00	.00	40.30	1263.00	54.38	.00	54.51	1.06	3.19	759.62	1227.19

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	822.000	65.00	56.00	46.30	40.80	574.00	45.00	.00	45.55	9.43	5.94	96.63	186.93
*	822.000	65.00	56.00	46.30	40.80	946.00	49.48	.00	49.83	2.28	4.74	199.60	626.33
*	822.000	65.00	56.00	46.30	40.80	1224.00	56.27	.00	56.35	.33	2.64	1166.99	2138.49
*	822.000	65.00	56.00	46.30	40.80	611.00	45.19	.00	45.76	9.20	6.05	101.04	201.39
*	822.000	65.00	56.00	46.30	40.80	951.00	49.74	.00	50.07	2.09	4.63	205.54	657.70
*	822.000	65.00	56.00	46.30	40.80	1263.00	56.53	.00	56.62	.33	2.67	1195.92	2207.65
*	823.000	175.00	.00	.00	41.90	577.00	45.20	45.20	46.52	47.75	9.24	62.47	83.50
	823.000	175.00	.00	.00	41.90	1163.00	49.65	.00	49.91	4.01	4.61	447.34	580.50
*	823.000	175.00	.00	.00	41.90	1969.00	56.36	.00	56.38	.11	1.28	2707.90	5816.88
*	823.000	175.00	.00	.00	41.90	627.00	45.36	45.36	46.74	47.24	9.43	66.48	91.22
	823.000	175.00	.00	.00	41.90	1213.00	49.96	.00	50.15	3.05	4.16	549.69	694.37
*	823.000	175.00	.00	.00	41.90	2008.00	56.63	.00	56.64	.11	1.26	2808.33	6122.09
*	823.500	170.00	.00	.00	43.20	577.00	47.04	47.04	48.45	47.40	9.52	60.59	83.81
*	823.500	170.00	.00	.00	43.20	1163.00	48.79	48.79	50.78	45.08	11.30	102.89	173.21
*	823.500	170.00	.00	.00	43.20	1969.00	56.33	.00	56.40	.70	2.87	1403.78	2354.16
*	823.500	170.00	.00	.00	43.20	627.00	47.23	47.23	48.69	46.94	9.71	64.58	91.51
*	823.500	170.00	.00	.00	43.20	1213.00	48.98	48.98	50.94	42.98	11.23	108.00	185.01
*	823.500	170.00	.00	.00	43.20	2008.00	56.59	.00	56.66	.65	2.82	1454.47	2481.33
*	824.000	95.00	.00	.00	43.90	577.00	48.92	48.92	51.41	33.92	12.69	49.80	99.07
*	824.000	95.00	.00	.00	43.90	1163.00	52.12	52.12	53.37	12.74	10.80	372.58	325.85
*	824.000	95.00	.00	.00	43.90	1969.00	56.26	.00	56.71	3.96	7.91	953.16	989.53
*	824.000	95.00	.00	.00	43.90	627.00	49.11	49.11	51.84	35.56	13.31	51.77	105.14
*	824.000	95.00	.00	.00	43.90	1213.00	52.16	52.16	53.48	13.41	11.12	378.92	331.21
	824.000	95.00	.00	.00	43.90	2008.00	56.53	.00	56.96	3.71	7.76	990.96	1043.18
*	824.100	1.00	50.20	48.90	43.90	577.00	48.93	48.90	51.42	86.27	12.71	49.59	62.12
	824.100	1.00	50.20	48.90	43.90	1163.00	53.82	52.12	54.01	12.94	5.40	542.52	323.34
	824.100	1.00	50.20	48.90	43.90	1969.00	56.78	.00	56.91	6.98	4.83	956.96	745.28
*	824.100	1.00	50.20	48.90	43.90	627.00	49.07	48.90	52.01	101.84	13.81	49.80	62.13
*	824.100	1.00	50.20	48.90	43.90	1213.00	53.98	52.15	54.16	12.56	5.39	564.67	342.24
	824.100	1.00	50.20	48.90	43.90	2008.00	57.02	.00	57.14	6.54	4.74	990.76	785.47
*	824.200	155.00	50.20	48.90	43.90	577.00	52.96	.00	53.17	11.38	4.72	272.38	171.02
	824.200	155.00	50.20	48.90	43.90	1163.00	54.03	.00	54.41	20.58	6.92	374.23	256.37
	824.200	155.00	50.20	48.90	43.90	1969.00	56.89	.00	57.18	12.73	6.56	646.53	551.84
*	824.200	155.00	50.20	48.90	43.90	627.00	53.83	.00	53.96	6.86	3.93	355.40	239.42
	824.200	155.00	50.20	48.90	43.90	1213.00	54.18	.00	54.56	20.18	6.93	388.97	269.99
	824.200	155.00	50.20	48.90	43.90	2008.00	57.12	.00	57.40	12.00	6.46	668.83	579.72
*	825.000	1.00	.00	.00	43.90	577.00	52.92	.00	53.30	2.99	5.57	281.83	333.79
*	825.000	1.00	.00	.00	43.90	1163.00	53.92	.00	54.84	6.97	9.12	376.57	440.51
*	825.000	1.00	.00	.00	43.90	1969.00	56.77	.00	57.65	5.75	9.79	647.38	820.80
*	825.000	1.00	.00	.00	43.90	627.00	53.80	.00	54.09	2.16	5.03	365.22	426.91
*	825.000	1.00	.00	.00	43.90	1213.00	54.07	.00	55.00	7.02	9.24	390.72	457.75
*	825.000	1.00	.00	.00	43.90	2008.00	57.01	.00	57.85	5.49	9.68	670.00	856.93

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	825.500	95.00	.00	.00	44.60	577.00	53.29	.00	53.45	1.28	3.55	374.21	510.34
*	825.500	95.00	.00	.00	44.60	1163.00	54.97	.00	55.25	2.13	5.15	581.10	797.41
*	825.500	95.00	.00	.00	44.60	1969.00	57.69	.00	58.01	2.00	5.84	919.94	1392.29
*	825.500	95.00	.00	.00	44.60	627.00	54.07	.00	54.19	.98	3.28	469.88	634.94
*	825.500	95.00	.00	.00	44.60	1213.00	55.13	.00	55.42	2.14	5.22	601.24	828.73
*	825.500	95.00	.00	.00	44.60	2008.00	57.89	.00	58.20	1.94	5.81	944.68	1440.98
*	825.800	90.00	.00	.00	45.30	577.00	53.31	.00	53.52	6.83	4.81	314.61	220.79
*	825.800	90.00	.00	.00	45.30	1163.00	55.13	.00	55.33	6.63	5.48	550.68	451.76
*	825.800	90.00	.00	.00	45.30	1969.00	57.97	.00	58.13	4.34	5.30	919.80	945.30
*	825.800	90.00	.00	.00	45.30	627.00	54.09	.00	54.21	4.12	3.99	414.42	309.07
*	825.800	90.00	.00	.00	45.30	1213.00	55.31	.00	55.51	6.44	5.47	573.64	478.11
*	825.800	90.00	.00	.00	45.30	2008.00	58.16	.00	58.32	4.16	5.25	945.31	984.47
*	825.900	1.00	51.60	50.30	45.30	577.00	53.31	.00	53.52	25.06	5.03	239.47	115.27
	825.900	1.00	51.60	50.30	45.30	1163.00	55.25	.00	55.38	13.46	4.43	492.02	317.05
	825.900	1.00	51.60	50.30	45.30	1969.00	58.06	.00	58.17	7.00	3.90	857.81	744.15
*	825.900	1.00	51.60	50.30	45.30	627.00	54.14	.00	54.23	10.85	3.60	347.22	190.32
	825.900	1.00	51.60	50.30	45.30	1213.00	55.42	.00	55.55	12.77	4.37	514.80	339.39
	825.900	1.00	51.60	50.30	45.30	2008.00	58.26	.00	58.36	6.66	3.84	882.94	778.36
	826.000	80.00	51.60	50.30	45.30	577.00	53.51	.00	53.89	33.46	6.07	210.56	99.75
*	826.000	80.00	51.60	50.30	45.30	1163.00	55.36	.00	55.76	32.18	6.98	377.30	205.02
*	826.000	80.00	51.60	50.30	45.30	1969.00	58.12	.00	58.45	22.41	6.99	624.48	415.92
	826.000	80.00	51.60	50.30	45.30	627.00	54.23	.00	54.47	21.16	5.15	275.10	136.31
*	826.000	80.00	51.60	50.30	45.30	1213.00	55.53	.00	55.92	31.46	6.99	392.51	216.27
*	126.000	80.00	51.60	50.30	45.30	2008.00	58.31	.00	58.63	21.54	6.93	641.69	432.62
*	826.100	1.00	.00	.00	45.30	577.00	53.51	.00	53.91	3.78	5.88	313.44	296.75
*	826.100	1.00	.00	.00	45.30	1163.00	55.29	.00	56.08	6.37	8.69	472.80	460.89
*	826.100	1.00	.00	.00	45.30	1969.00	57.98	.00	58.99	6.55	10.34	715.50	769.33
*	826.100	1.00	.00	.00	45.30	627.00	54.21	.00	54.56	3.09	5.61	375.84	356.90
*	826.100	1.00	.00	.00	45.30	1213.00	55.45	.00	56.26	6.45	8.84	487.56	477.76
*	826.100	1.00	.00	.00	45.30	2008.00	58.17	.00	59.17	6.41	10.33	732.60	793.37
	826.500	110.00	.00	.00	45.80	577.00	53.94	.00	54.10	2.28	3.39	349.66	381.96
*	826.500	110.00	.00	.00	45.80	1163.00	56.24	.00	56.46	2.84	4.47	654.15	690.21
*	826.500	110.00	.00	.00	45.80	1969.00	59.27	.00	59.50	2.43	4.90	1112.39	1262.87
	826.500	110.00	.00	.00	45.80	627.00	54.58	.00	54.72	1.88	3.24	430.41	456.81
*	826.500	110.00	.00	.00	45.80	1213.00	56.43	.00	56.66	2.83	4.51	681.64	721.39
*	826.500	110.00	.00	.00	45.80	2008.00	59.45	.00	59.67	2.37	4.89	1143.25	1303.25
	827.000	80.00	.00	.00	46.20	577.00	53.95	.00	54.12	2.82	3.59	332.38	343.76
	827.000	80.00	.00	.00	46.20	1163.00	56.23	.00	56.51	3.69	4.87	576.91	605.63
	827.000	80.00	.00	.00	46.20	1969.00	59.23	.00	59.54	3.26	5.46	981.47	1090.93
	827.000	80.00	.00	.00	46.20	627.00	54.58	.00	54.74	2.35	3.45	399.68	409.31
	827.000	80.00	.00	.00	46.20	1213.00	56.42	.00	56.70	3.69	4.94	598.36	631.40
	827.000	80.00	.00	.00	46.20	2008.00	59.42	.00	59.72	3.17	5.43	1012.37	1128.58

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	827.700	250.00	.00	.00	46.20	577.00	53.98	.00	54.22	3.70	4.03	187.80	299.91
	827.700	250.00	.00	.00	46.20	1163.00	56.24	.00	56.65	5.01	5.56	417.80	519.34
	827.700	250.00	.00	.00	46.20	1969.00	59.25	.00	59.67	4.19	6.05	774.86	961.45
	827.700	250.00	.00	.00	46.20	627.00	54.60	.00	54.83	3.19	3.93	249.20	351.22
	827.700	250.00	.00	.00	46.20	1213.00	56.43	.00	56.85	5.00	5.62	438.91	542.40
	827.700	250.00	.00	.00	46.20	2008.00	59.43	.00	59.84	4.09	6.03	796.49	992.65
	828.000	80.00	.00	.00	46.40	577.00	53.99	.00	54.26	2.16	4.22	136.71	392.49
	828.000	80.00	.00	.00	46.40	1163.00	56.14	.00	56.82	3.83	6.63	175.30	594.02
	828.000	80.00	.00	.00	46.40	1969.00	59.23	.00	59.74	2.56	6.52	775.66	1229.58
	828.000	80.00	.00	.00	46.40	627.00	54.59	.00	54.88	1.98	4.25	147.51	445.52
	828.000	80.00	.00	.00	46.40	1213.00	56.32	.00	57.03	3.93	6.80	178.50	612.21
	828.000	80.00	.00	.00	46.40	2008.00	59.41	.00	59.90	2.46	6.45	814.68	1280.34
*	830.000	65.00	58.10	56.80	47.80	577.00	53.82	.00	54.26	4.77	5.35	107.81	264.15
	830.000	65.00	58.10	56.80	47.80	1163.00	56.57	.00	57.42	5.49	7.39	157.36	496.13
	830.000	65.00	58.10	56.80	47.80	1969.00	59.75	.00	59.98	1.72	5.08	1195.44	1501.58
	830.000	65.00	58.10	56.80	47.80	627.00	54.45	.00	54.88	4.04	5.26	119.14	312.04
	830.000	65.00	58.10	56.80	47.80	1213.00	56.84	.00	57.71	5.40	7.48	162.22	521.95
	830.000	65.00	58.10	56.80	47.80	2008.00	59.81	.00	60.04	1.73	5.12	1213.77	1524.87
*	830.500	110.00	.00	.00	48.00	577.00	54.15	.00	54.42	25.21	4.14	139.39	114.93
	830.500	110.00	.00	.00	48.00	1163.00	57.61	.00	57.70	5.30	2.76	553.31	505.04
	830.500	110.00	.00	.00	48.00	1969.00	59.98	.00	60.05	3.00	2.58	1031.47	1136.57
*	830.500	110.00	.00	.00	48.00	627.00	54.80	.00	55.02	19.62	3.75	167.23	141.54
	830.500	110.00	.00	.00	48.00	1213.00	57.92	.00	58.00	4.50	2.62	614.91	571.91
	130.500	110.00	.00	.00	48.00	2008.00	60.04	.00	60.11	3.01	2.60	1044.62	1157.28
	831.000	115.00	.00	.00	48.10	577.00	54.46	.00	54.70	22.12	3.91	147.74	122.69
	831.000	115.00	.00	.00	48.10	1163.00	57.67	.00	57.77	5.47	2.79	545.94	497.28
	831.000	115.00	.00	.00	48.10	1969.00	60.01	.00	60.08	3.13	2.62	1016.69	1113.48
	831.000	115.00	.00	.00	48.10	627.00	55.04	.00	55.24	18.02	3.62	173.39	147.69
	831.000	115.00	.00	.00	48.10	1213.00	57.97	.00	58.05	4.65	2.66	606.33	562.31
	831.000	115.00	.00	.00	48.10	2008.00	60.08	.00	60.15	3.14	2.63	1029.86	1134.05
	831.500	110.00	.00	.00	48.30	577.00	54.71	.00	54.94	21.37	3.85	149.99	124.82
	831.500	110.00	.00	.00	48.30	1163.00	57.73	.00	57.84	6.17	2.92	518.00	468.20
	831.500	110.00	.00	.00	48.30	1969.00	60.04	.00	60.12	3.43	2.70	984.48	1063.91
	831.500	110.00	.00	.00	48.30	627.00	55.24	.00	55.44	17.94	3.61	173.71	148.01
	831.500	110.00	.00	.00	48.30	1213.00	58.02	.00	58.11	5.28	2.78	574.98	528.04
	831.500	110.00	.00	.00	48.30	2008.00	60.11	.00	60.19	3.43	2.72	997.67	1084.09
*	832.000	40.00	.00	.00	48.40	577.00	54.83	.00	54.99	4.77	3.74	184.74	264.29
	832.000	40.00	.00	.00	48.40	1163.00	57.74	.00	57.87	3.65	4.20	481.26	608.46
	832.000	40.00	.00	.00	48.40	1969.00	60.05	.00	60.14	2.47	4.00	1060.07	1252.37
*	832.000	40.00	.00	.00	48.40	627.00	55.32	.00	55.48	4.24	3.70	203.49	304.52
	832.000	40.00	.00	.00	48.40	1213.00	58.02	.00	58.14	3.28	4.06	548.39	669.33
	832.000	40.00	.00	.00	48.40	2008.00	60.12	.00	60.20	2.48	4.03	1076.71	1274.96

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	833.200	1.00	56.00	53.60	48.40	577.00	53.70	53.47	56.12	581.85	12.47	46.28	23.92
*	833.200	1.00	56.00	53.60	48.40	1163.00	57.62	.00	57.98	105.89	5.07	258.15	113.02
*	833.200	1.00	56.00	53.60	48.40	1969.00	60.04	.00	60.15	9.42	1.87	863.62	641.66
*	833.200	1.00	56.00	53.60	48.40	627.00	53.98	53.60	56.83	687.05	13.55	46.28	23.92
*	833.200	1.00	56.00	53.60	48.40	1213.00	57.96	.00	58.20	55.95	3.82	336.50	162.17
*	833.200	1.00	56.00	53.60	48.40	2008.00	60.11	.00	60.22	9.23	1.87	880.31	660.97
	833.300	35.00	56.00	53.60	48.40	577.00	55.74	53.38	58.15	581.85	12.47	46.28	23.92
	833.300	35.00	56.00	53.60	48.40	1163.00	58.21	.00	58.39	99.17	5.20	412.74	116.79
*	833.300	35.00	56.00	53.60	48.40	1969.00	60.15	.00	60.21	22.12	2.90	1003.00	418.68
*	833.300	35.00	56.00	53.60	48.40	627.00	57.97	.00	58.05	44.22	3.40	348.36	94.29
	833.300	35.00	56.00	53.60	48.40	1213.00	58.30	.00	58.47	92.64	5.07	437.15	126.02
*	833.300	35.00	56.00	53.60	48.40	2008.00	60.21	.00	60.28	21.59	2.87	1024.19	432.15
*	834.000	1.00	.00	.00	48.40	577.00	58.84	.00	58.87	1.56	2.21	776.48	462.30
*	834.000	1.00	.00	.00	48.40	1163.00	58.20	.00	58.41	10.32	5.46	590.61	362.07
*	834.000	1.00	.00	.00	48.40	1969.00	60.11	.00	60.25	7.43	5.22	1170.92	722.24
*	834.000	1.00	.00	.00	48.40	627.00	57.99	.00	58.06	3.53	3.15	530.82	333.76
*	834.000	1.00	.00	.00	48.40	1213.00	58.28	.00	58.49	10.56	5.56	613.03	373.23
*	834.000	1.00	.00	.00	48.40	2008.00	60.18	.00	60.32	7.41	5.23	1192.10	737.83
*	834.200	90.00	.00	.00	48.60	577.00	58.87	.00	58.88	.57	1.08	1092.43	766.17
*	834.200	90.00	.00	.00	48.60	1163.00	58.43	.00	58.50	3.20	2.46	927.73	650.01
*	834.200	90.00	.00	.00	48.60	1969.00	60.25	.00	60.31	2.68	2.60	1632.18	1203.24
*	834.200	90.00	.00	.00	48.60	627.00	58.06	.00	58.09	1.23	1.48	797.25	564.63
*	834.200	90.00	.00	.00	48.60	1213.00	58.51	.00	58.58	3.27	2.51	957.76	670.52
	834.200	90.00	.00	.00	48.60	2008.00	60.31	.00	60.38	2.68	2.61	1658.10	1226.25
	835.000	365.00	.00	.00	49.30	577.00	58.89	.00	58.91	1.00	1.35	876.15	577.83
	835.000	365.00	.00	.00	49.30	1163.00	58.56	.00	58.65	5.20	3.00	787.41	510.25
	835.000	365.00	.00	.00	49.30	1969.00	60.36	.00	60.44	4.63	3.27	1254.26	915.31
	835.000	365.00	.00	.00	49.30	627.00	58.11	.00	58.15	2.13	1.84	672.55	429.62
	835.000	365.00	.00	.00	49.30	1213.00	58.65	.00	58.74	5.30	3.05	809.61	526.71
	835.000	365.00	.00	.00	49.30	2008.00	60.42	.00	60.51	4.64	3.29	1270.96	931.93
*	835.100	320.00	.00	.00	50.00	577.00	58.91	.00	58.98	3.28	2.13	278.32	318.59
*	835.100	320.00	.00	.00	50.00	1163.00	58.67	.00	58.98	15.41	4.49	263.12	296.22
*	835.100	320.00	.00	.00	50.00	1969.00	60.35	.00	60.81	17.25	5.62	392.91	474.06
*	835.100	320.00	.00	.00	50.00	627.00	58.17	.00	58.28	6.06	2.65	236.72	254.73
*	835.100	320.00	.00	.00	50.00	1213.00	58.75	.00	59.08	15.98	4.61	267.95	303.42
*	835.100	320.00	.00	.00	50.00	2008.00	60.41	.00	60.88	17.33	5.66	399.73	482.31
	836.000	165.00	.00	.00	51.70	577.00	58.95	.00	59.05	3.44	2.57	224.30	311.15
	836.000	165.00	.00	.00	51.70	1163.00	58.86	.00	59.29	14.55	5.25	221.59	304.92
	836.000	165.00	.00	.00	51.70	1969.00	60.49	.00	61.30	21.02	7.23	272.16	429.49
	836.000	165.00	.00	.00	51.70	627.00	58.25	.00	58.40	5.71	3.10	202.50	262.40
	836.000	165.00	.00	.00	51.70	1213.00	58.95	.00	59.40	15.20	5.41	224.31	311.17
	836.000	165.00	.00	.00	51.70	2008.00	60.55	.00	61.38	21.39	7.33	273.93	434.17