ELLIOT ROAD BASINS AND OUTFALL CHANNEL PRELIMINARY FLOODPLAIN ANALYSIS

Contract FCD 2000C036

Assignment No. 6

West of Ellsworth Road

June 2002

WP #011315.05

DRAFT

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Addendum - Read First

Addendum to
Elliot Road Detention Basins and Outfall Channel
Preliminary Floodplain Analysis

Draft
Contract FCD 2000C036
Assignment No. 6
West of Ellsworth Road

WP #011315.05

At the request of FCDMC, Wood/Patel has preliminarily re-evaluated the drainage pattern at the Elliot Road Channel Outfall area for the 2-year storm event assuming that the berm that existed prior to the channel construction is considered to have been structurally stable. Please note that our work effort is based on limited topographic data (2' contour map) and approximate floodplain type hydraulic analysis.

If the berm that existed prior to the channel construction is considered to have been structurally stable when a 2-year storm occurs, the surface runoff splits will differ from the result documented in our report dated in June 2002 which estimated higher flow to south branch. A cross section at the berm location was cut and approximate hydraulic computations show that 53 cfs of the total runoff flowed to south branch and 172 cfs flowed to north branch for the 2-year storm (total 225 cfs). Based on the rating curves of the split washes at the berm and the split structure (all the hydraulic computations are attached), the following modifications to the split structure are proposed:

A 3.0 ft high dike should be constructed within the south branch channel with a 3.5 ft bottom width and 2:1 (H:V) side slope notch in the middle of the dike (see modified design plan). The existing sugar dike within the north branch should be removed.

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Worksheet For the Total Flow
Worksheet for Irregular Channel

Project Description	
Worksheet	Total
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.007000	ft/ft
Discharge	225.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.035	
Water Surface Elevation	98.40	ft
Elevation Range	96.00 to 100.00	
Flow Area	118.7	ft²
Wetted Perimeter	304.42	ft
Top Width	303.44	ft
Actual Depth	2.40	ft
Critical Elevation	98.23	ft
Critical Slope	0.026823	ft/ft
Velocity	1.90	ft/s
Velocity Head	0.06	ft
Specific Energy	98.45	ft
Froude Number	0.53	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
1+00	5+50	0.035

Natural Channel Points

Station (ft)	Elevation (ft)
1+00	98.50
1+70	98.00
1+74	96.00
1+76	96.00
1+80	98.00
2+00	100.00
3+25	98.00
4+25	98.00
4+45	97.50
4+55	97.50

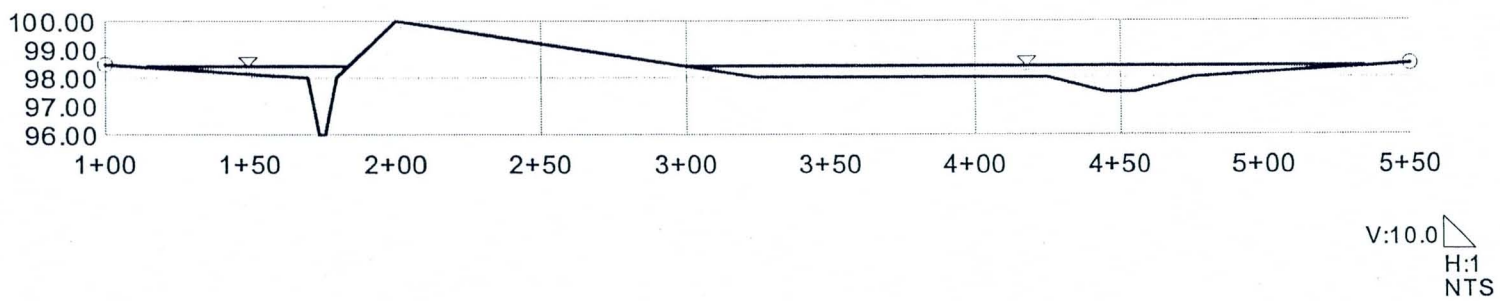
Worksheet For the Total Flow
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
4+75	98.00
5+50	98.50

Cross Section For the Total Flow
Cross Section for Irregular Channel

Project Description	
Worksheet	Total
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.035	
Slope	0.007000	ft/ft
Water Surface Elevation	98.40	ft
Elevation Range	96.00 to 100.00	
Discharge	225.00	cfs



Worksheet For Flow to South
Worksheet for Irregular Channel

Project Description	
Worksheet	South
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Slope	0.007000 ft/ft
Water Surface Elevation	98.40 ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.035
Elevation Range	96.00 to 100.00
Discharge	53.50 cfs
Flow Area	28.0 ft²
Wetted Perimeter	70.97 ft
Top Width	70.00 ft
Actual Depth	2.40 ft
Critical Elevation	97.70 ft
Critical Slope	0.019758 ft/ft
Velocity	1.91 ft/s
Velocity Head	0.06 ft
Specific Energy	98.46 ft
Froude Number	0.53
Flow Type	Subcritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
1+00	2+00	0.035

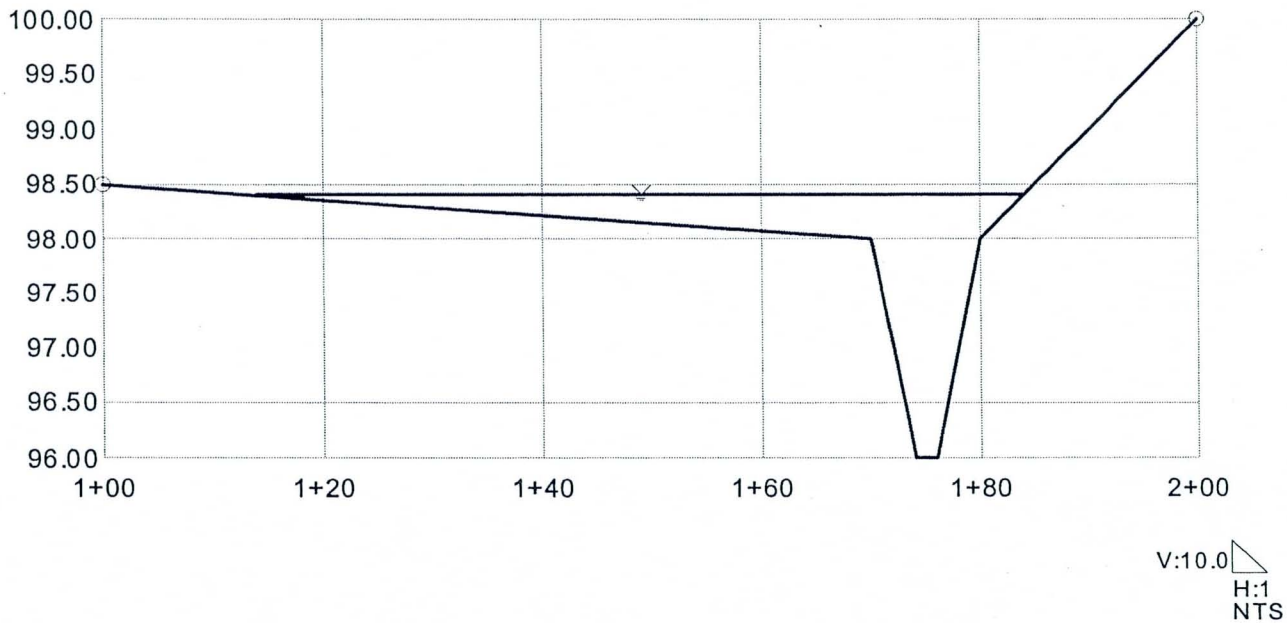
Natural Channel Points

Station (ft)	Elevation (ft)
1+00	98.50
1+70	98.00
1+74	96.00
1+76	96.00
1+80	98.00
2+00	100.00

Cross Section For Flow to South
Cross Section for Irregular Channel

Project Description	
Worksheet	South
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.035	
Slope	0.007000	ft/ft
Water Surface Elevation	98.40	ft
Elevation Range	96.00 to 100.00	
Discharge	53.50	cfs



Worksheet For Flow to North
Worksheet for Irregular Channel

Project Description	
Worksheet	North
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.007000	ft/ft
Water Surface Elevation	98.40	ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.035	
Elevation Range	97.50 to 100.00	
Discharge	174.87	cfs
Flow Area	92.0	ft²
Wetted Perimeter	235.02	ft
Top Width	235.00	ft
Actual Depth	0.90	ft
Critical Elevation	98.24	ft
Critical Slope	0.027096	ft/ft
Velocity	1.90	ft/s
Velocity Head	0.06	ft
Specific Energy	98.46	ft
Froude Number	0.54	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
2+00	5+50	0.035

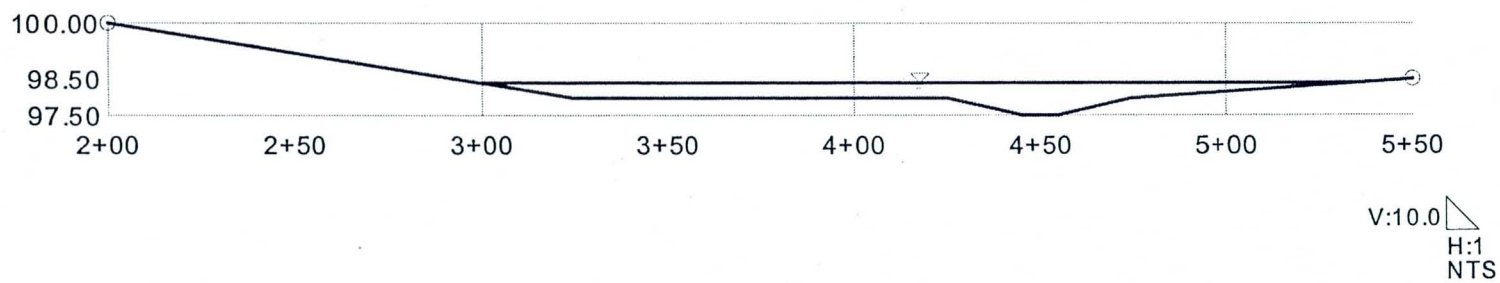
Natural Channel Points

Station (ft)	Elevation (ft)
2+00	100.00
3+25	98.00
4+25	98.00
4+45	97.50
4+55	97.50
4+75	98.00
5+50	98.50

Cross Section For Flow to North
Cross Section for Irregular Channel

Project Description	
Worksheet	North
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.035	
Slope	0.007000	ft/ft
Water Surface Elevation	98.40	ft
Elevation Range	97.50 to 100.00	
Discharge	174.87	cfs



South Branch - Q=53 cfs (2-Year Storm)
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 225
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Bottom Width

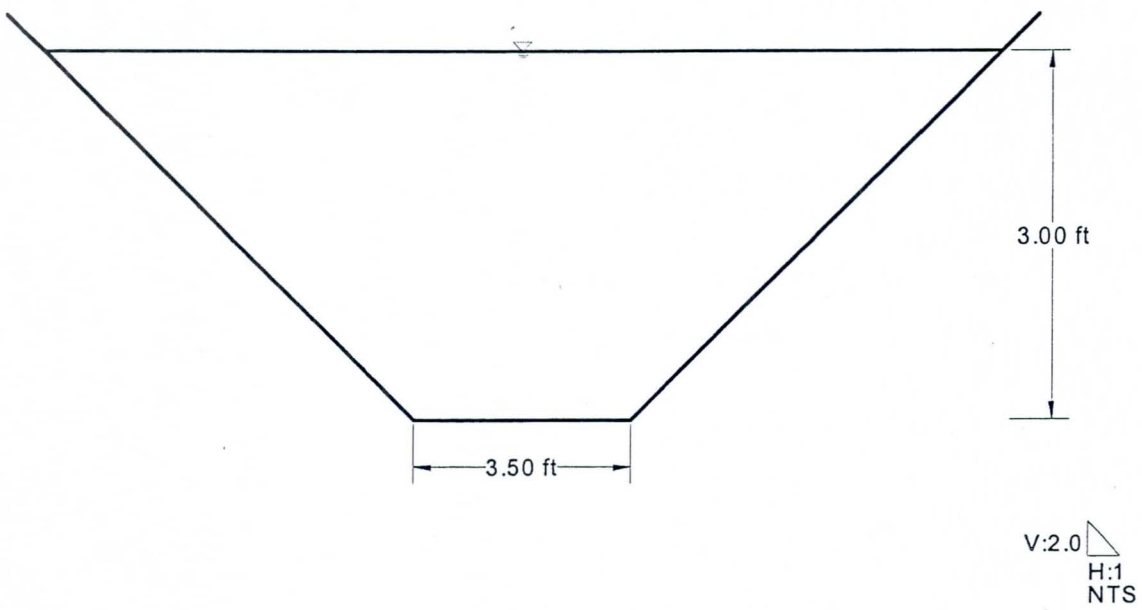
Input Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Depth	3.00	ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	53.00	cfs

Results		
Bottom Width	3.50	ft
Flow Area	28.5	ft²
Wetted Perimeter	16.92	ft
Top Width	15.50	ft
Critical Depth	1.46	ft
Critical Slope	0.016399	ft/ft
Velocity	1.86	ft/s
Velocity Head	0.05	ft
Specific Energy	3.05	ft
Froude Number	0.24	
Flow Type	Subcritical	

South Branch - Q = 53 cfs (2-Year Storm)
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 225
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Bottom Width

Section Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Depth	3.00	ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.50	ft
Discharge	53.00	cfs



Rating Table For Diversion Channel
Rating Table for Irregular Channel

Project Description	
Worksheet	Diversion - Q = 513
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Slope	0.000700 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Water Surface Elevation (ft)	0.00	3.00	0.20

Water Surface Elevation (ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	N/A	N/A	N/A	N/A	N/A
0.20	1.57	0.41	3.8	19.76	19.70
0.40	5.03	0.64	7.9	21.03	20.90
0.60	10.00	0.82	12.2	22.29	22.10
0.80	16.34	0.98	16.7	23.56	23.30
1.00	24.00	1.12	21.5	24.82	24.50
1.20	32.94	1.24	26.5	26.09	25.70
1.40	43.15	1.36	31.8	27.35	26.90
1.60	54.63	1.47	37.3	28.62	28.10
1.80	67.38	1.57	43.0	29.88	29.30
2.00	81.42	1.66	49.0	31.15	30.50
2.20	96.77	1.75	55.2	32.41	31.70
2.40	113.43	1.84	61.7	33.68	32.90
2.60	131.43	1.92	68.4	34.94	34.10
2.80	150.79	2.00	75.3	36.21	35.30
3.00	171.53	2.08	82.5	37.47	36.50

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Exhibit A — Vicinity Map

Exhibit B — Preliminary Floodplain Delineations

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1.0 INTRODUCTION

Wood, Patel & Associates, Inc. (Wood/Patel), as part of the main contract – Elliot Road Basins and Outfall Channel Design, prepared a Draft Preliminary Floodplain Delineation of the 100-year flows for the area southwest of the Elliot and Ellsworth Roads intersection in early 2000. Due to the fact that the acquisition of the basin property is not settled, the Flood Control District of Maricopa County (District) has requested that the Draft Preliminary Floodplain Delineation be revised for the area southwest of the intersection of Elliot and Ellsworth Roads. The revision is based on the fact that the major storm drain trunk line has been constructed along the Elliot and Ellsworth Roads, including the 104th Street inlet/channel. However, the basins' construction will be excluded for the purpose of this analysis. See Exhibit A for the project site and its vicinity.

Since the basins cannot be constructed for the Elliot Road Basins and Outfall Channel system in the near future, the project has the potential for diverting flows from their historical flow paths, concentrating them at the Ellsworth Road outfall, and exceeding historical flows at this point. The purpose of this study is to find design alternatives to mitigate this potential problem by performing hydrologic and hydraulic analyses. Floodplain limits will be delineated for both existing and interim conditions for storms with return periods of 100-year, 10-year and 2-year to show the impact of the storm drain system on the downstream areas of the outfall channel.

In the Elliot Road Basins and Outfall Channel project, outfall channel alignment is identified as the south branch of the historical drainage path and the splitter channel is identified as the north branch of the historical drainage path for the distributary outfall channel system.

2.0 HYDROLOGY

The original HEC-1 hydrologic models for the existing condition are SEMP100S.DAT and SEMP100N.DAT for the portions of the watershed south and north of the Superstition Freeway, respectively. These models were developed for the East Mesa ADMP and approved by FCDMC in 1999.

These existing condition models were later updated to incorporate improvements made within the watershed for the Santa Rita Ranch Development. These include 100-year, 2-hour onsite detention and a collector channel along the south side of Guadalupe Road that intercepts offsite flows from the north (sub-basins 66b and 67c) and outfalls to the west along the SRP corridor ½ mile north of Elliot Road. The updated existing condition models are now defined as existing condition hydrologic models and are used to generate the peak flows at the southeast corner of Ellsworth Road and Elliot Road.

The interim condition is defined as the existing condition plus major storm drain trunk line along the Elliot and Ellsworth Roads. The interim condition models can be derived from the existing condition models by modifying the open channel routing operations because the major storm drain trunk line will carry partial flows. Since all regional retention basins are excluded in the interim condition model, both interim and existing conditions models are basically the same except routing operations along the Elliot and Ellsworth Roads. The differences between channel routing and pipe routing have minor impact on the modeling results at the southeast corner of Ellsworth Road and Elliot Road, therefore, the updated existing condition models are used for both conditions.

Three different runoff events (2-year, 10-year and 100-year) were evaluated to determine peak flows for the project. The model names for the south region are: EX02S.DAT, EX10S.DAT, and EX100S.DAT. The model names for the north region are: EX02N.DAT, EX10N.DAT, and EX100N.DAT.

There are two locations that impact this site where flows from the north side of the CAP canal are hard coded into the HEC-1 model. These flows are based on peak outflow from the CAP overchutes for the existing condition 100-year model. Sub-basin 58 is the contributing area for flows at these locations. In order to determine flows from the CAP overchutes for different storm

events, the runoff from this area was calculated based on the ratios of precipitation values to the 100-year storm.

Note that the 2-year and 10-year hydrologic models are built by applying pertinent rainfall values to the 100-year model. It is the intent of this scope of work not to recreate the 2-year and the 10-year HEC-1 models using DDMS process. The applied 2-year and 10-year storm rainfall values are 1.35 in and 2.30 in, respectively. The HEC-1 modeling results show that, for both existing and interim conditions, the total peak flows at southeast corner of Ellsworth Road and Elliot Road (C66D) including both flows on the surface and in the storm drain pipe are 2,035 cfs, 1,043 cfs, and 225 cfs, respectively, for the 100-year storm, 10-year storm, and 2-year storm.

Table 1

Summary of Flows at Ellsworth Road and Elliot Road

Return Period	Existing Condition (cfs)	Interim Condition (cfs)
2-year	225	225
10-year	1,043	1,043
100-year	2,035	2,035

3.0 HYDRAULICS

The U.S. Army Corps of Engineer's HEC-RAS model, version 3.0, was used to generate the water surface profiles for the outfall channel areas. The starting water surface elevations were determined using slope-area method or known ponding water surface elevations.

Topographic mapping for the study areas was the 2-foot contour map provided by the FCDMC.

Local deep depression areas were simulated by placing blocked obstructions within the cross sections to define ineffective flow regions in backwater or ponded areas with the cross section where appropriate. This prevents the HEC-RAS model from putting flow conveyance in areas of low ground near the ends of sections that are outside of the main wash flow path.

The study areas consists of three reaches: the east side along Ellsworth Road alignment south of Elliot Road (approximately 2,000 feet), the north branch of the distributary outfall channel (approximately 3,600 feet), and the south branch of the distributary outfall channel (approximately 3,200 feet).

The total inflows at southeast corner of Elliot Road and Ellsworth Road are 2,035 cfs, 1,043 cfs, and 225 cfs, respectively, for the 100-year storm, 10-year storm, and 2-year storm. The modeling purpose of the first reach (east side along Ellsworth Road alignment) is to determine the flow splits between north branch and south branch of the washes west of Ellsworth Road. Ellsworth Road was modeled as a broad-crested weir to account for split flows at depressions along the road. The peak flow values for each of the cross-sections of the HEC-RAS model were determined by trial-and-error method, i.e., first, a series of initial peak flows for all cross-sections were assumed, and the HEC-RAS model was executed, then the computed surface water elevations were used to calculate split flows, and a new flow series were again assigned to cross-sections of the HEC-RAS model. These steps were repeated until the sum of computed split flow and the flow remained at the downstream cross section of the HEC-RAS model was close to flow at the upstream cross section. The final results of the split flow computations are shown in Table 2. The split flow computations and HEC-RAS modeling results are shown in Appendix A. Table 2 shows that the flow distribution does not change for the 2-year storm for interim condition. However, the flow increases by 513 cfs and 750 cfs to the south branch for the 10-year and 100-year storms, respectively.

Table 2

Summary of Split Flows Computation

Return Period	100-Year (Existing)	10-Year (Existing)	2-Year (Existing)
Total Flow (cfs)	2,035	1,043	225
North Branch (cfs)	1,415	513	0
South Branch (cfs)	620	530	225
Return Period	**100-Year (Interim)**	**10-Year (Interim)**	**2-Year (Interim)**
Total Flow (cfs)	2,035	1,043	225
North Branch (cfs)	665	0	0
South Branch	1,370	1,043	225

For the interim conditions, although the design capacity for the pipes is 1,100 cfs, preliminary estimation according to the design plans (Appendix D) shows that the storm drain will intercept 750 cfs for both 100-year and 10-year storms, and 215 cfs for the 2-year storm. The remaining flow on the surface is 1,285 cfs for the 100-year storm, 293 cfs for the 10-year storm, and 10 cfs for the 2-year storm. This is because the Ellsworth Road and Elliot Road improvements are not complete yet and, consequently, some of the surface flow cannot get into the storm drain.

For the interim condition 100-year storm, 750 cfs in the pipe plus 620 cfs out of 1285 cfs from the surface flow (total 1,370 cfs) will flow to south branch. The flow in the south branch will split at the north diversion channel so that 620 cfs continues to the southwest and 750 cfs flows to the northwest. The total interim flows at the downstream end of the diversion channels will be 620 cfs to the south and 1,415 cfs to the north. Therefore, existing condition flow distribution is maintained for the interim condition.

For the interim condition 10-year storm, 750 cfs will be discharged into the pipe and flow to the south branch. The remaining 293 cfs will flow on the surface to the south branch too. In order to maintain the existing condition, 513 cfs should be diverted into the north branch.

For the 2-year storm, all the flow will go to south branch for both existing and interim conditions. Therefore, no diversion is needed.

The modeling results for the existing conditions of both north branch and south branch are included in Appendix B, and those for the interim conditions in Appendix C. The preliminary flood delineations are shown on Exhibit B.

4.0 CONCLUSIONS

Because all detention basins proposed as part of the Elliot Basins and Outfall Channel Project are excluded in the interim condition HEC-1 hydrologic model, both interim and existing conditions models are basically the same except a few channel routing operations that have minor impact on the modeling results. Therefore, the updated HEC-1 model for the existing condition is used for both conditions.

The HEC-1 modeling results show that, for both existing and interim conditions, the total peak flows at southeast corner of Ellsworth Road and Elliot Road (C66D) are 2,035 cfs, 1,043 cfs, and 225 cfs, respectively, for the 100-year storm, 10-year storm, and 2-year storm. The total flow intercepted by the major storm drain trunk line at southeast corner of Ellsworth Road and Elliot Road is 750 cfs for both the 100-year storm and the 10-year storm, and 10 cfs for the 2-year storm.

Hydraulic modeling results show that the flow distribution crossing Ellsworth Road into north and south branches does not change for the 2-year storm for interim condition. However, for the 100-year storm, flow to the south branch is increased by 750 cfs (750 cfs less to the north branch) and, for the 10-year storm, flow to the south branch is increased by 513 cfs (513 cfs less to the north branch).

Therefore, a flow split structure is recommended in the south branch at the north diversion channel so that existing flow distribution can be recreated. The rating curve for the recommended flow split structure is as follows:

Rating Curve for the Proposed Flow Split Structure

Total Inflow to South Branch	DI	0.0	225	1,043	1,370
Diversion to North Branch	DQ	0.0	0.0	513	750
Flow to Downstream of South Branch	q	0.0	225	530	620

The floodplain delineations resulting from the modified flows by the split structure are depicted on Exhibit B. The hydraulic design computations of the split structure are shown in Appendix E.

The hydraulic computations show that a 2.9-foot high sugar dike is needed in the diversion channel to make sure that the 2-year storm flow of 225 cfs will continue to the south branch. In excess of the 2-year storm events, the sugar dike will be overtopped and a portion of the flows will be allowed into the north diversion channel. In order to divert 750 cfs flow of the 100-year

storm, the diversion channel has to be modified. At a height of 4.2 feet above the bottom, an 8-foot wide shelf (overbank) is required on both sides, as shown in Appendix E.

APPENDIX A

SPLIT FLOW COMPUTATION TABLES, HEC-RAS MODELING RESULTS FOR WASH AT EAST ELLSWORTH ROAD

Table 1a

Split Flow Computation along Ellsworth Road (100-Year Flow)
Existing Condition

Station	Distance	Bank Elev.	WSEL	Head H	Coef. C	Length L	Weir Qi	Weir Q	Remaining Q	Q in Hec-Ras
	(ft)	(ft)	(ft)	(ft)		(ft)	(cfs/ft)	(cfs)	(cfs)	(cfs)
1100	1545.000	1406.00	1406.00	0.00	2.90	0	0.0		2035	2035
1000	1239.000	1405.00	1405.50	0.50	2.90	306	1.0	157	1878	1880
900	1026.000	1405.00	1405.30	0.30	2.90	213	0.5	160	1718	1720
800	857.000	1404.00	1405.10	1.10	2.90	169	3.3	323	1395	1400
700	693.000	1404.00	1405.00	1.00	2.90	164	2.9	512	883	900
600	554.000	1404.00	1404.10	0.10	2.90	139	0.1	208	675	700
500	469.000	1402.00	1402.60	0.60	2.90	85	1.3	61	614	620
400	332.000	1401.00	1401.60	0.60	2.90	137	1.3	185	429	430
300	210.000	1401.00	1401.60	0.60	2.90	122	1.3	164	265	270
200	115.000	1401.00	1401.60	0.60	2.90	95	1.3	128	137	140
100	0.000	1400.00	1400.40	0.40	2.90	115	0.7	120	17	20

Table 1b

Split Flow Computation along Ellsworth Road (10-Year Flow)
Existing Condition

Station	Distance	Bank Elev.	WSEL	Head H	Coef. C	Length L	Weir Qi	Weir Q	Remaining Q	Q in Hec-Ras
	(ft)	(ft)	(ft)	(ft)		(ft)	(cfs/ft)	(cfs)	(cfs)	(cfs)
1100	1545.000	1406.00	1405.30	0.00	2.90	0	0.0		1043	1043
1000	1239.000	1405.00	1405.00	0.00	2.90	0	0.0	0	1043	1043
900	1026.000	1405.00	1404.90	0.00	2.90	0	0.0	0	1043	1043
800	857.000	1404.00	1404.70	0.70	2.90	148	1.7	126	917	920
700	693.000	1404.00	1404.60	0.60	2.90	164	1.3	250	668	670
600	554.000	1404.00	1404.00	0.00	2.90	139	0.0	94	574	580
500	469.000	1402.00	1402.50	0.50	2.90	85	1.0	44	530	530
400	332.000	1401.00	1401.60	0.60	2.90	137	1.3	163	368	370
300	210.000	1401.00	1401.55	0.55	2.90	122	1.2	154	213	220
200	115.000	1401.00	1401.50	0.50	2.90	95	1.0	105	109	110
100	0.000	1400.00	1400.40	0.40	2.90	115	0.7	101	7	10

Table 1c

Split Flow Computation along Ellsworth Road (2-Year Flow)
Existing Condition

Station	Distance	Bank Elev.	WSEL	Head H	Coef. C	Length L	Weir Qi	Weir Q	Remaining Q	Q in Hec-Ras
	(ft)	(ft)	(ft)	(ft)		(ft)	(cfs/ft)	(cfs)	(cfs)	(cfs)
1100	1545.000	1406.00	1403.80	0.00	2.90	0	0.0		225	225
1000	1239.000	1405.00	1403.70	0.00	2.90	0	0.0	0	225	225
900	1026.000	1405.00	1403.65	0.00	2.90	0	0.0	0	225	225
800	857.000	1404.00	1403.60	0.00	2.90	0	0.0	0	225	225
700	693.000	1404.00	1403.55	0.00	2.90	0	0.0	0	225	225
600	554.000	1404.00	1403.10	0.00	2.90	0	0.0	0	225	225
500	469.000	1402.00	1402.00	0.00	2.90	0	0.0	0	225	225
400	332.000	1401.00	1401.35	0.35	2.90	137	0.6	41	184	185
300	210.000	1401.00	1401.35	0.35	2.90	122	0.6	73	111	110
200	115.000	1401.00	1401.30	0.30	2.90	95	0.5	51	59	60
100	0.000	1400.00	1400.30	0.30	2.90	115	0.5	55	5	5

Table 2a

Split Flow Computation along Ellsworth Road (100-Year Flow)
Interim Condition

Station	Distance	Bank Elev.	WSEL	Head H	Coef. C	Length L	Weir Qi	Weir Q	Remaining	Q in Hec-R
	(ft)	(ft)	(ft)	(ft)		(ft)	(cfs/ft)	(cfs)	(cfs)	(cfs)
1100	1545.000	1406.00	1405.30	0.00	2.90	0	0.0		1285	1285
1000	1239.000	1405.00	1405.20	0.20	2.90	68	0.3	9	1276	1280
900	1026.000	1405.00	1405.00	0.00	2.90	213	0.0	28	1249	1250
800	857.000	1404.00	1404.80	0.80	2.90	169	2.1	175	1073	1080
700	693.000	1404.00	1404.70	0.70	2.90	164	1.7	309	764	770
600	554.000	1404.00	1404.00	0.00	2.90	139	0.0	118	646	650
500	469.000	1402.00	1402.40	0.40	2.90	85	0.7	31	615	620
400	332.000	1401.00	1401.80	0.80	2.90	137	2.1	192	422	420
300	210.000	1401.00	1401.65	0.65	2.90	122	1.5	219	203	210
200	115.000	1401.00	1401.40	0.40	2.90	95	0.7	107	96	100
100	0.000	1400.00	1400.40	0.40	2.90	115	0.7	84	11	10

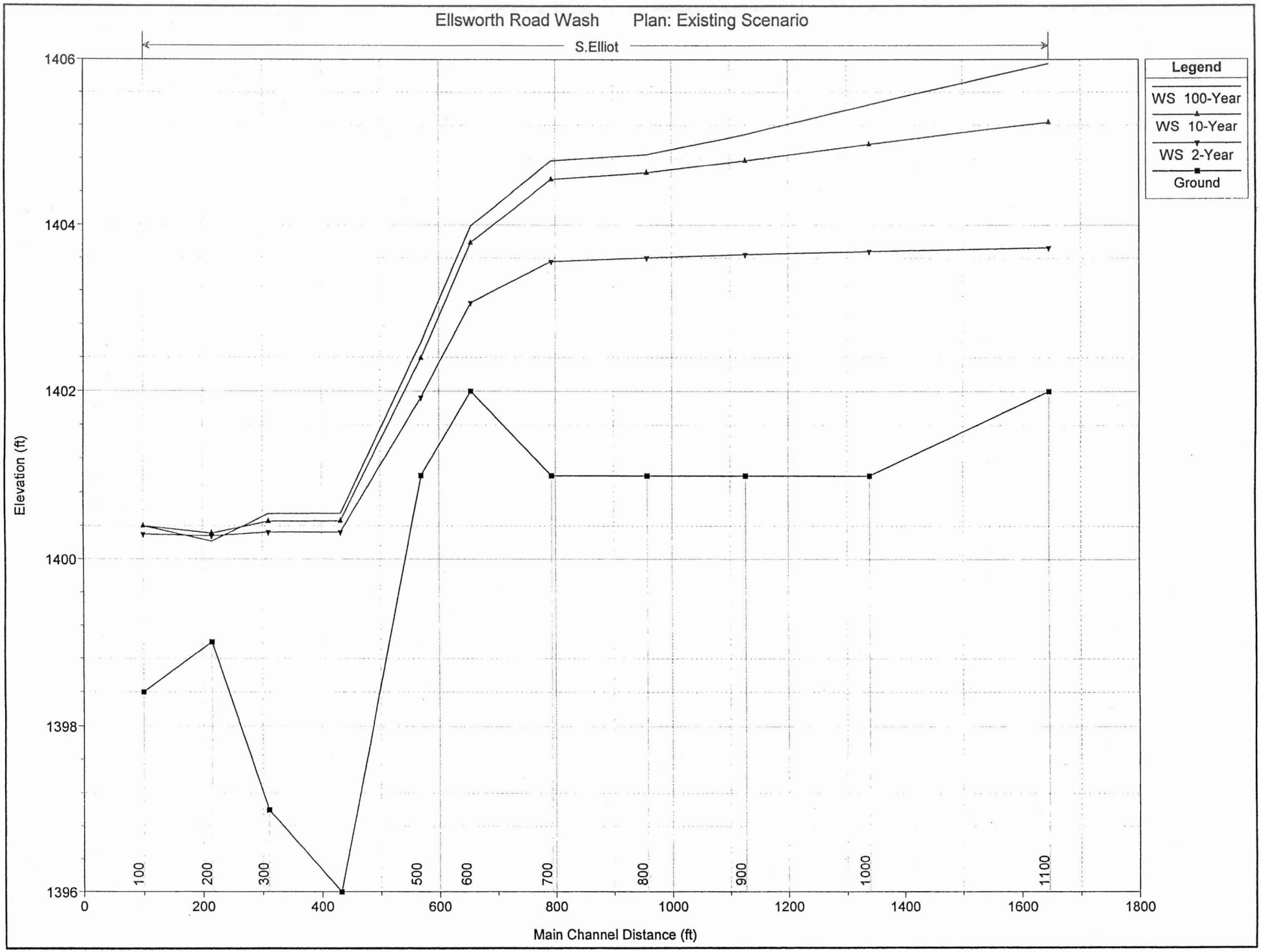
Table 2b

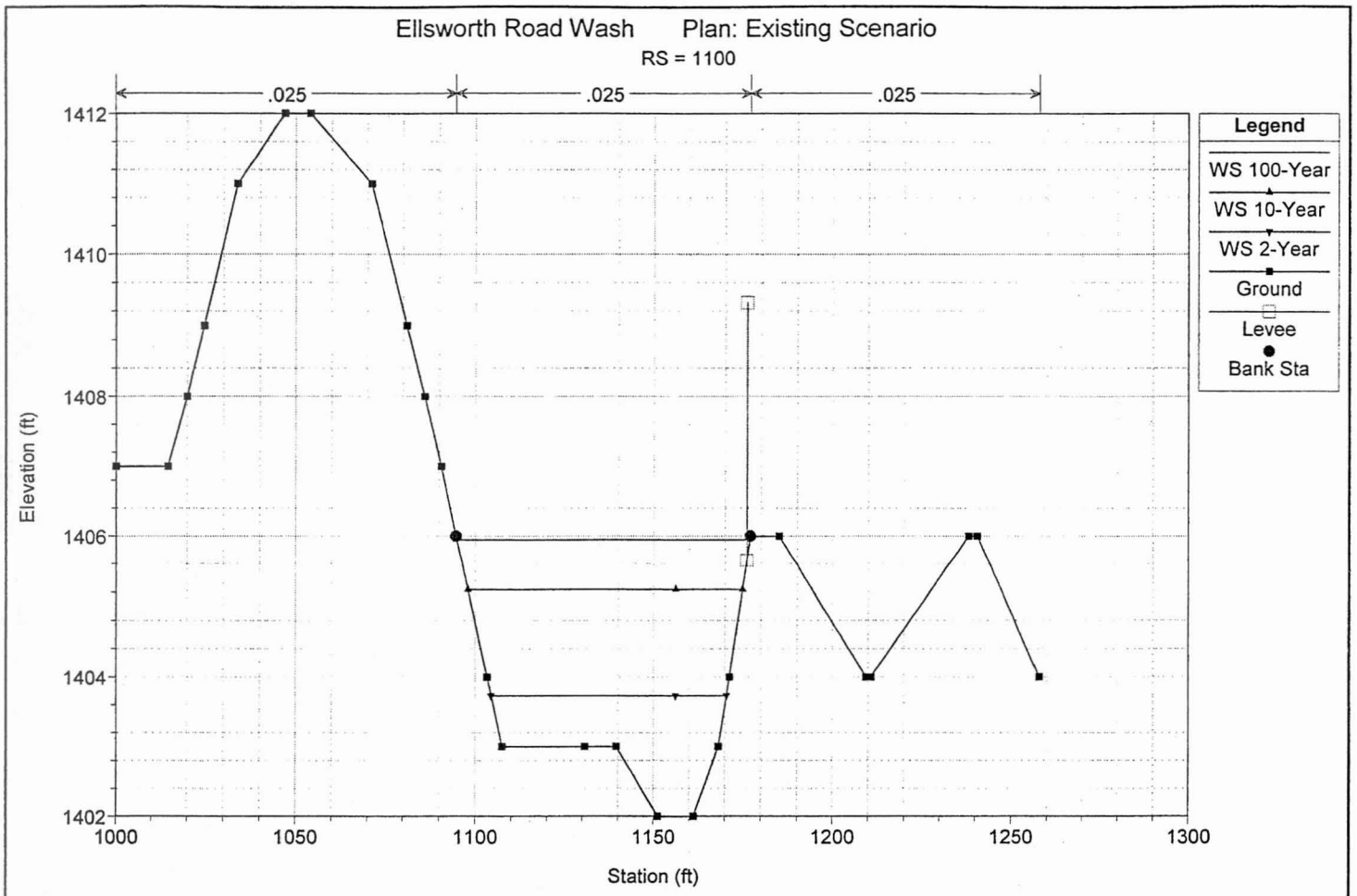
Split Flow Computation along Ellsworth Road (10-Year Flow)
Interim Condition

Station	Distance	Bank Elev.	WSEL	Head H	Coef. C	Length L	Weir Qi	Weir Q	Remaining	Q in Hec-R
	(ft)	(ft)	(ft)	(ft)		(ft)	(cfs/ft)	(cfs)	(cfs)	(cfs)
1100	1545.000	1406.00	1404.00	0.00	2.90	0	0.0		293	293
1000	1239.000	1405.00	1404.00	0.00	2.90	0	0.0	0	293	293
900	1026.000	1405.00	1404.00	0.00	2.90	0	0.0	0	293	293
800	857.000	1404.00	1404.00	0.00	2.90	0	0.0	0	293	293
700	693.000	1404.00	1404.00	0.00	2.90	0	0.0	0	293	293
600	554.000	1404.00	1404.00	0.00	2.90	0	0.0	0	293	293
500	469.000	1402.00	1402.00	0.00	2.90	0	0.0	0	293	293
400	332.000	1401.00	1401.50	0.50	2.90	137	1.0	70	223	220
300	210.000	1401.00	1401.45	0.45	2.90	122	0.9	116	107	100
200	115.000	1401.00	1401.10	0.10	2.90	95	0.1	46	61	60
100	0.000	1400.00	1400.40	0.40	2.90	115	0.7	47	13	5

HEC-RAS Plan: Existing River: E-Ellsworth Rd Reach: S.Elliot

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
S.Elliot	1100	2035.00	1402.00	1405.95	1405.80	1407.17	0.005664	8.87	229.55	81.09	0.93
S.Elliot	1100	1043.00	1402.00	1405.24	1404.72	1405.80	0.003516	6.02	173.25	76.86	0.71
S.Elliot	1100	225.00	1402.00	1403.73	1403.43	1403.91	0.003376	3.43	65.63	66.04	0.61
S.Elliot	1000	1880.00	1401.00	1405.45	1404.24	1406.04	0.001847	6.19	311.09	92.56	0.56
S.Elliot	1000	1043.00	1401.00	1404.97	1403.28	1405.22	0.000901	3.96	267.66	89.87	0.38
S.Elliot	1000	225.00	1401.00	1403.68	1401.86	1403.71	0.000199	1.40	161.17	74.47	0.17
S.Elliot	900	1720.00	1401.00	1405.09	1403.94	1405.63	0.001860	5.92	296.06	95.39	0.55
S.Elliot	900	1043.00	1401.00	1404.78	1403.16	1405.02	0.000936	3.95	267.04	91.60	0.39
S.Elliot	900	225.00	1401.00	1403.65	1401.81	1403.67	0.000172	1.31	171.38	77.90	0.16
S.Elliot	800	1400.00	1401.00	1404.85	1403.65	1405.30	0.001687	5.39	262.17	84.54	0.52
S.Elliot	800	920.00	1401.00	1404.63	1403.04	1404.86	0.000915	3.79	244.04	83.22	0.38
S.Elliot	800	225.00	1401.00	1403.61	1401.83	1403.64	0.000195	1.39	162.35	74.63	0.17
S.Elliot	700	900.00	1401.00	1404.78	1403.17	1405.02	0.000945	3.95	229.63	75.86	0.39
S.Elliot	700	670.00	1401.00	1404.55	1402.80	1404.71	0.000668	3.16	212.78	74.60	0.32
S.Elliot	700	225.00	1401.00	1403.56	1401.90	1403.60	0.000263	1.58	142.15	66.99	0.19
S.Elliot	600	700.00	1402.00	1403.99	1403.99	1404.72	0.007970	6.84	102.33	69.62	0.99
S.Elliot	600	580.00	1402.00	1403.79	1403.79	1404.45	0.008293	6.54	88.67	66.49	1.00
S.Elliot	600	225.00	1402.00	1403.06	1403.06	1403.46	0.009817	5.08	44.28	55.10	1.00
S.Elliot	500	620.00	1401.00	1402.50	1402.83	1403.74	0.015983	8.99	70.24	58.15	1.38
S.Elliot	500	530.00	1401.00	1402.39	1402.67	1403.47	0.015429	8.37	64.31	57.33	1.34
S.Elliot	500	225.00	1401.00	1401.93	1402.02	1402.46	0.013877	5.84	38.53	50.43	1.18
S.Elliot	400	430.00	1396.00	1400.52	1397.98	1400.61	0.000364	2.41	178.34	56.25	0.24
S.Elliot	400	370.00	1396.00	1400.46	1397.81	1400.53	0.000284	2.12	174.88	55.79	0.21
S.Elliot	400	185.00	1396.00	1400.33	1397.19	1400.35	0.000080	1.10	167.69	54.80	0.11
S.Elliot	300	270.00	1397.00	1400.51	1398.53	1400.56	0.000246	1.95	171.50	110.57	0.20
S.Elliot	300	220.00	1397.00	1400.45	1398.35	1400.49	0.000177	1.64	165.34	107.86	0.17
S.Elliot	300	110.00	1397.00	1400.33	1397.87	1400.34	0.000054	0.88	152.02	101.76	0.09
S.Elliot	200	140.00	1399.00	1400.25	1399.99	1400.50	0.004319	4.01	34.92	33.31	0.69
S.Elliot	200	110.00	1399.00	1400.32	1399.85	1400.45	0.002227	2.96	37.11	33.87	0.50
S.Elliot	200	60.00	1399.00	1400.28	1399.58	1400.33	0.000725	1.67	36.00	33.58	0.28
S.Elliot	100	20.00	1398.40	1400.40	1398.78	1400.40	0.000004	0.18	127.79	87.57	0.02
S.Elliot	100	10.00	1398.40	1400.40	1398.67	1400.40	0.000001	0.09	127.79	87.57	0.01
S.Elliot	100	5.00	1398.40	1400.30	1398.59	1400.30	0.000000	0.05	119.05	87.18	0.01


Ellsworth Road Wash Plan: Existing Scenario
S.Elliot
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Elevation (ft)
1406
1404
1402
1400
1398
1396
0
200
400
600
800
1000
1200
1400
1600
1800
Main Channel Distance (ft)
100
200
300
500
600
700
800
900
1000
1100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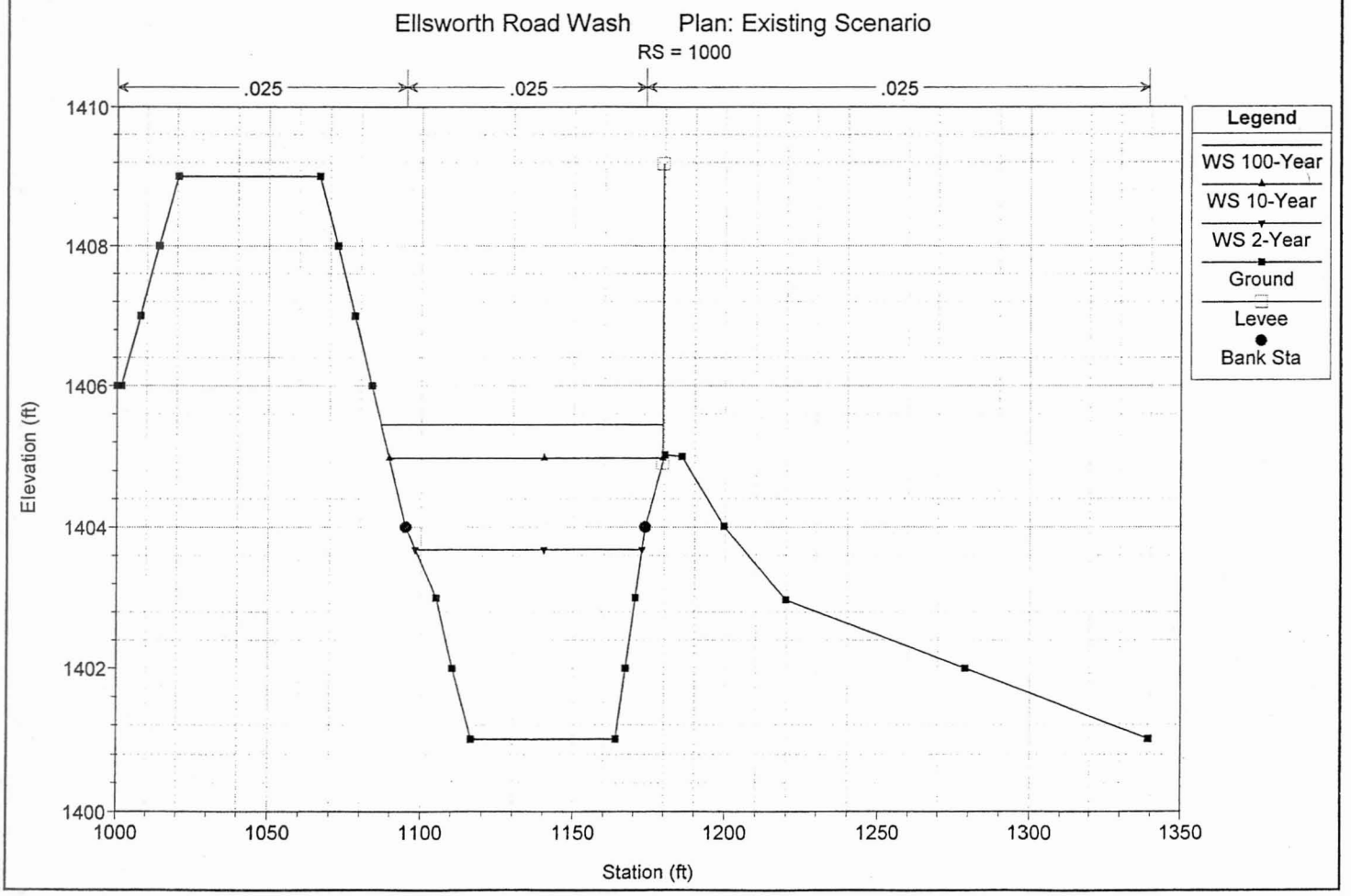
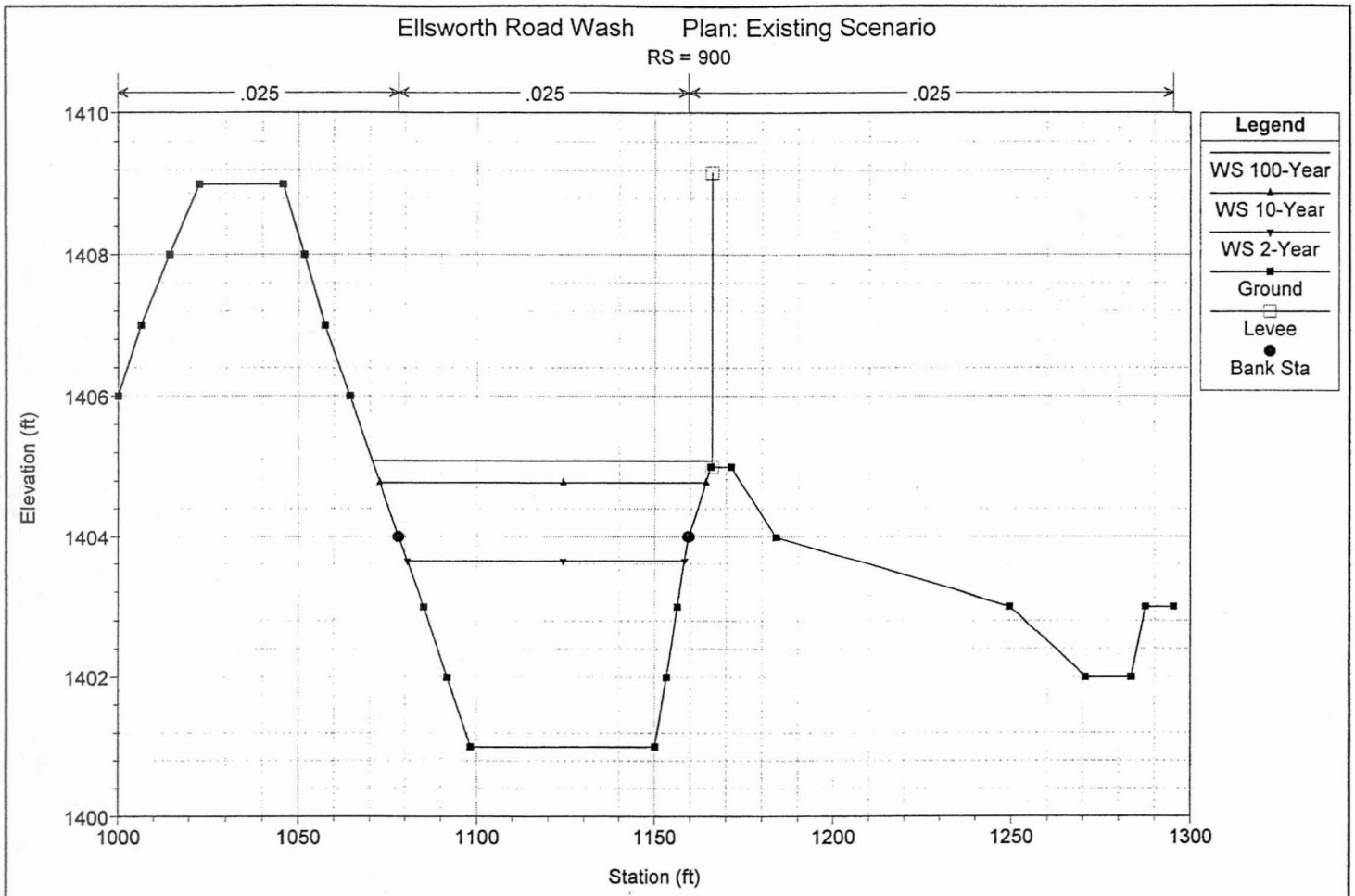
RS = 1100
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1412
1410
1408
1406
1404
1402
1000
1050
1100
1150
1200
1250
1300


Ellsworth Road Wash Plan: Existing Scenario
RS = 1000
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
1300
1350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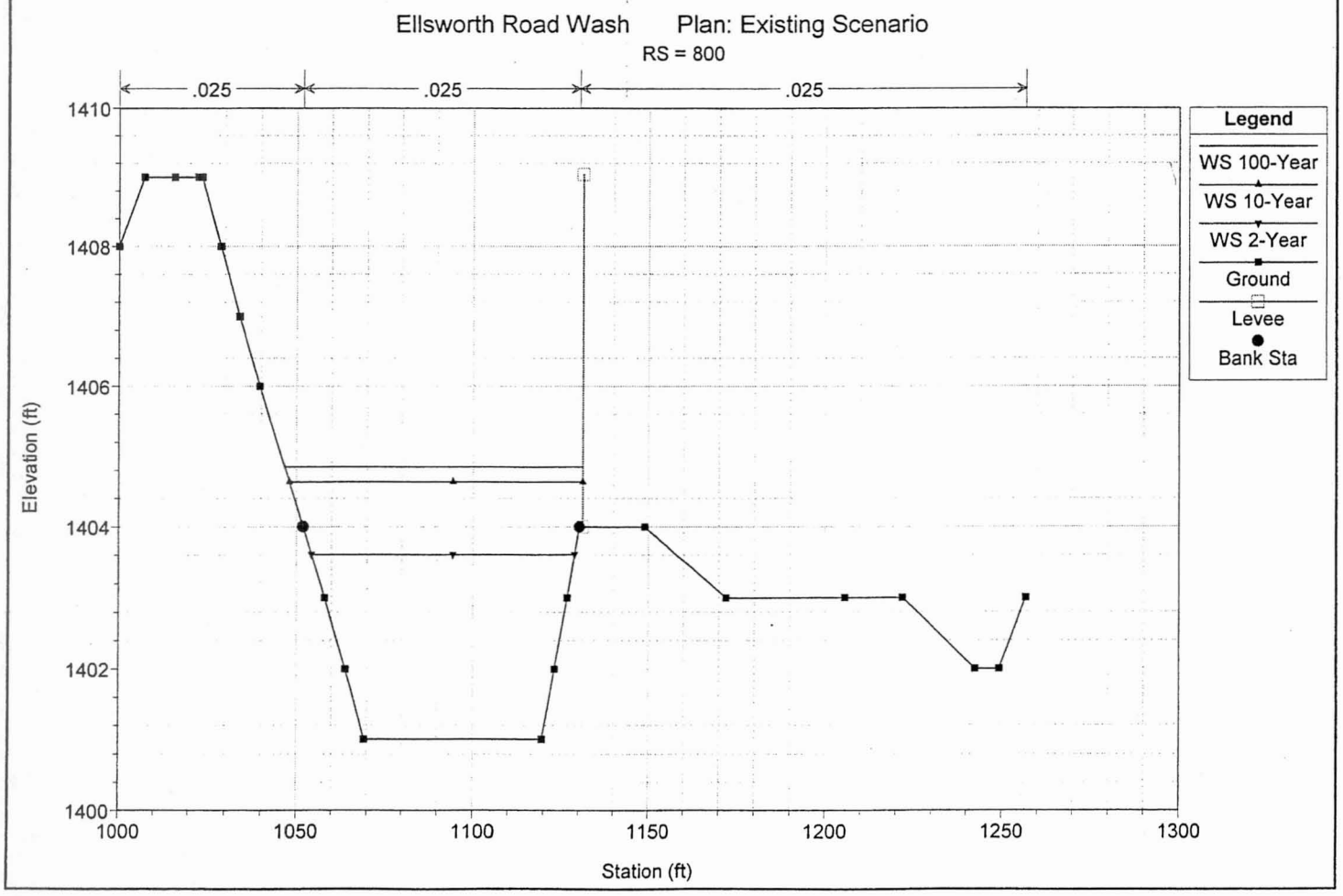
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
1300


Ellsworth Road Wash Plan: Existing Scenario
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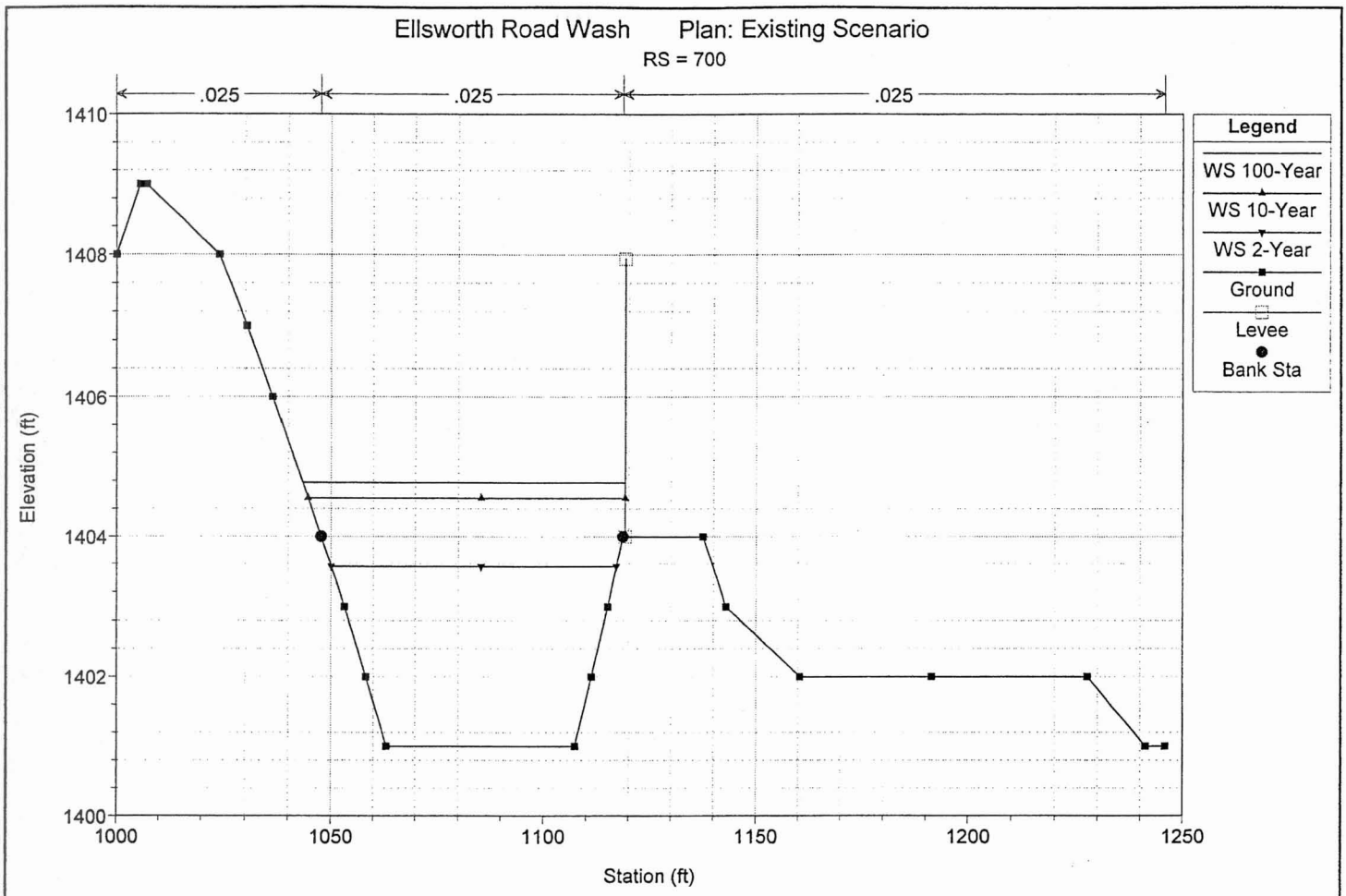
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
1300


Ellsworth Road Wash Plan: Existing Scenario
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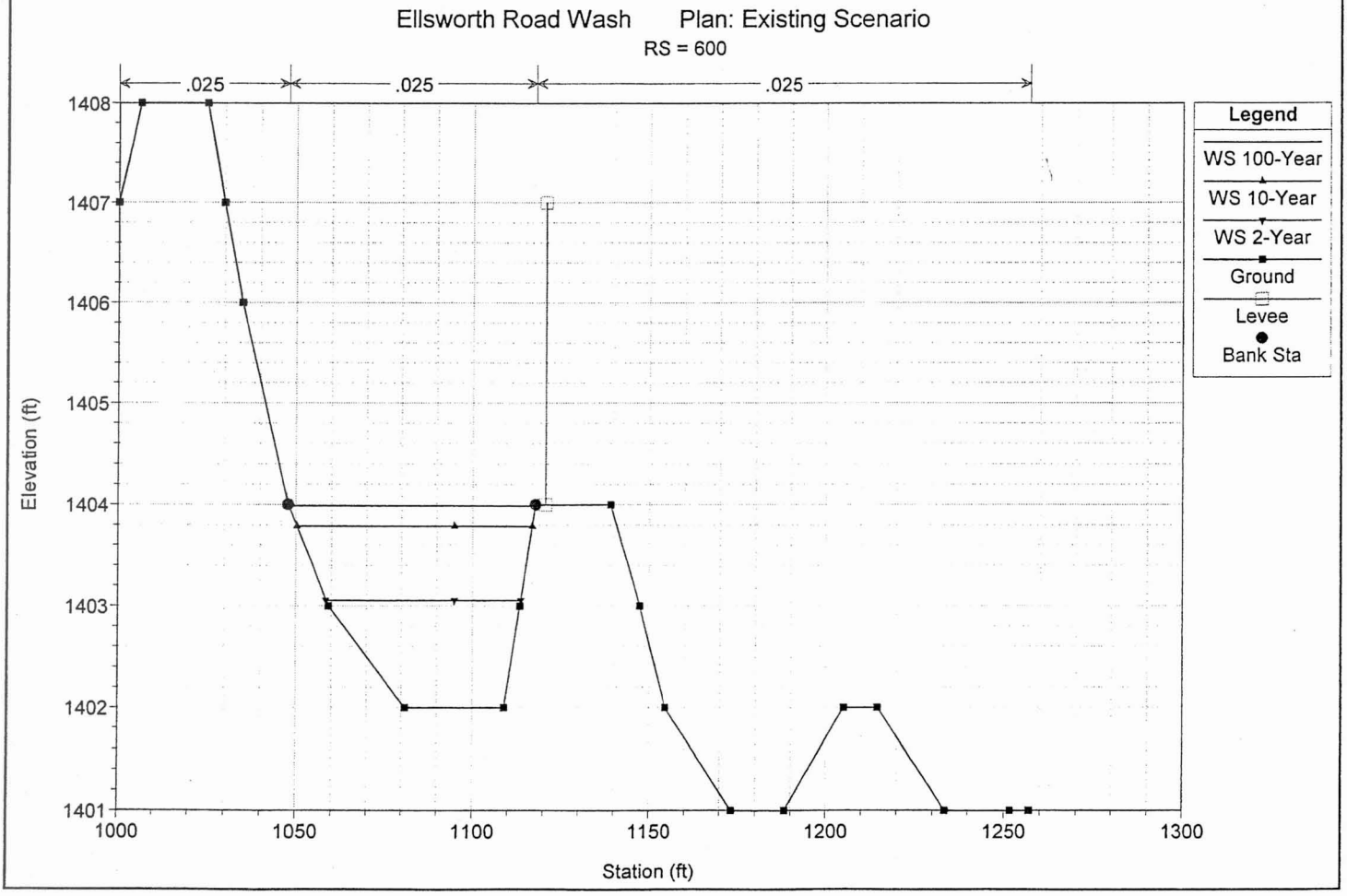
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
Station (ft)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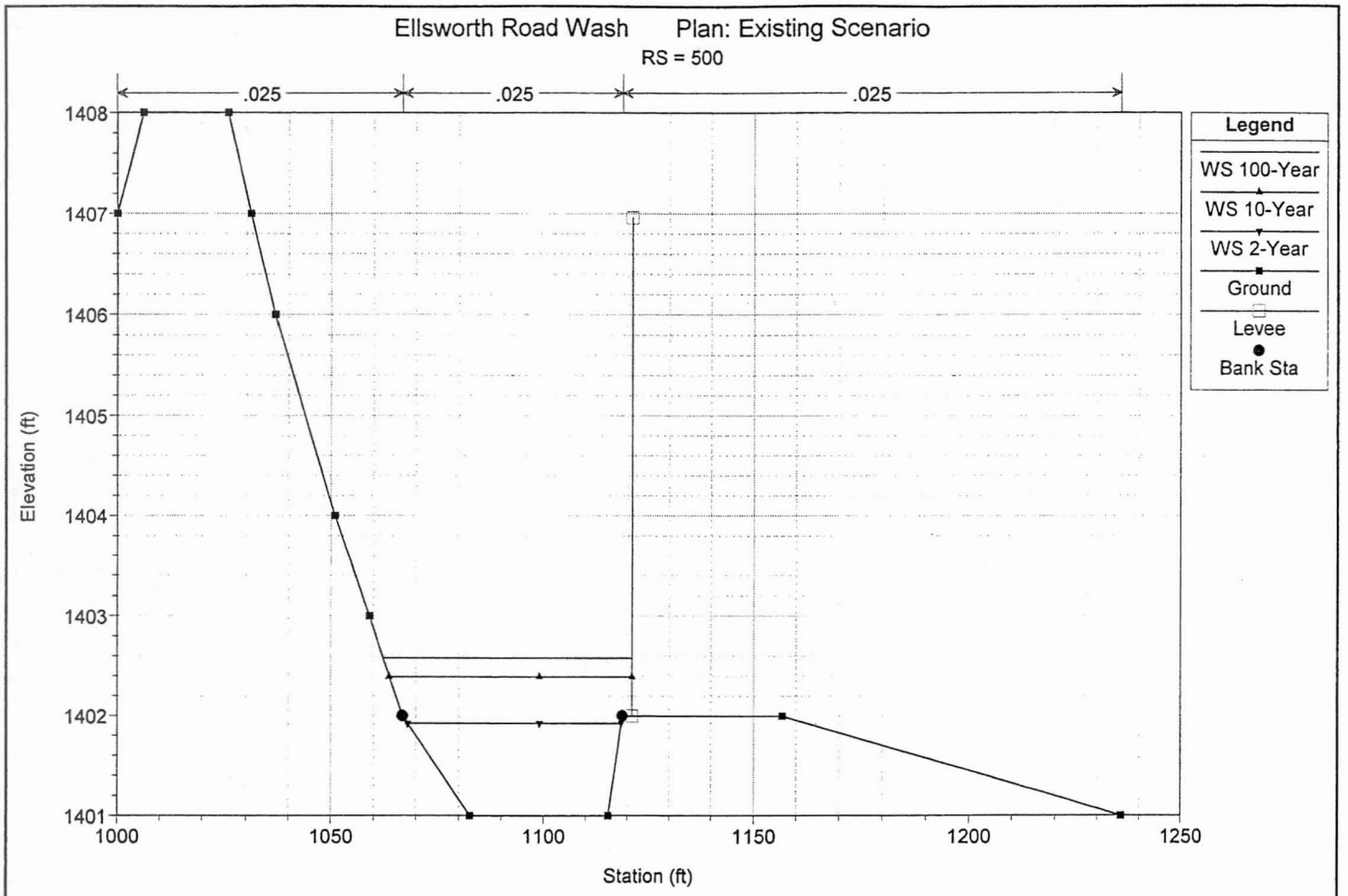
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1407
1406
1405
1404
1403
1402
1401
1000
1050
1100
1150
1200
1250
1300
Station (ft)


Ellsworth Road Wash Plan: Existing Scenario
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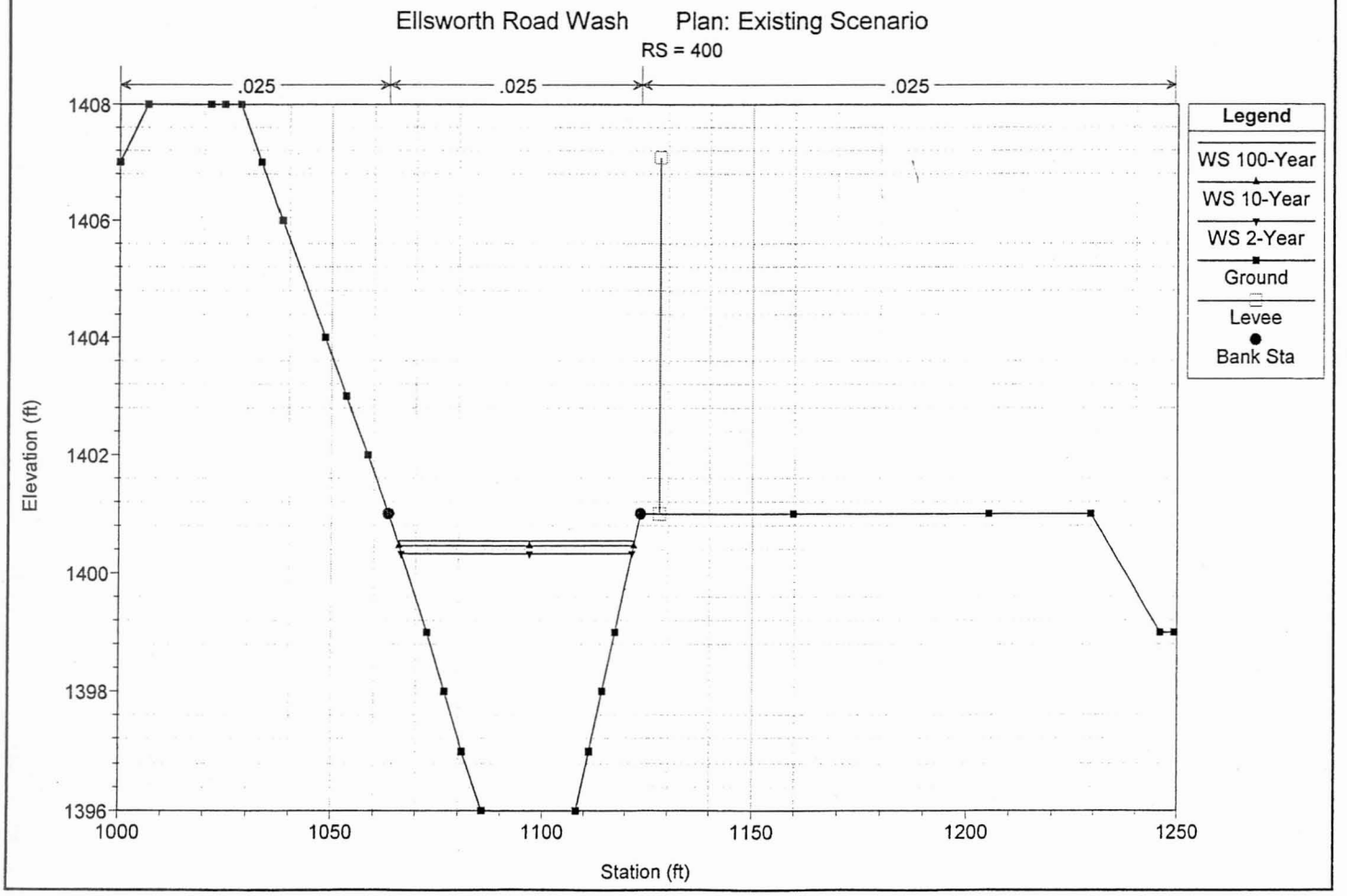
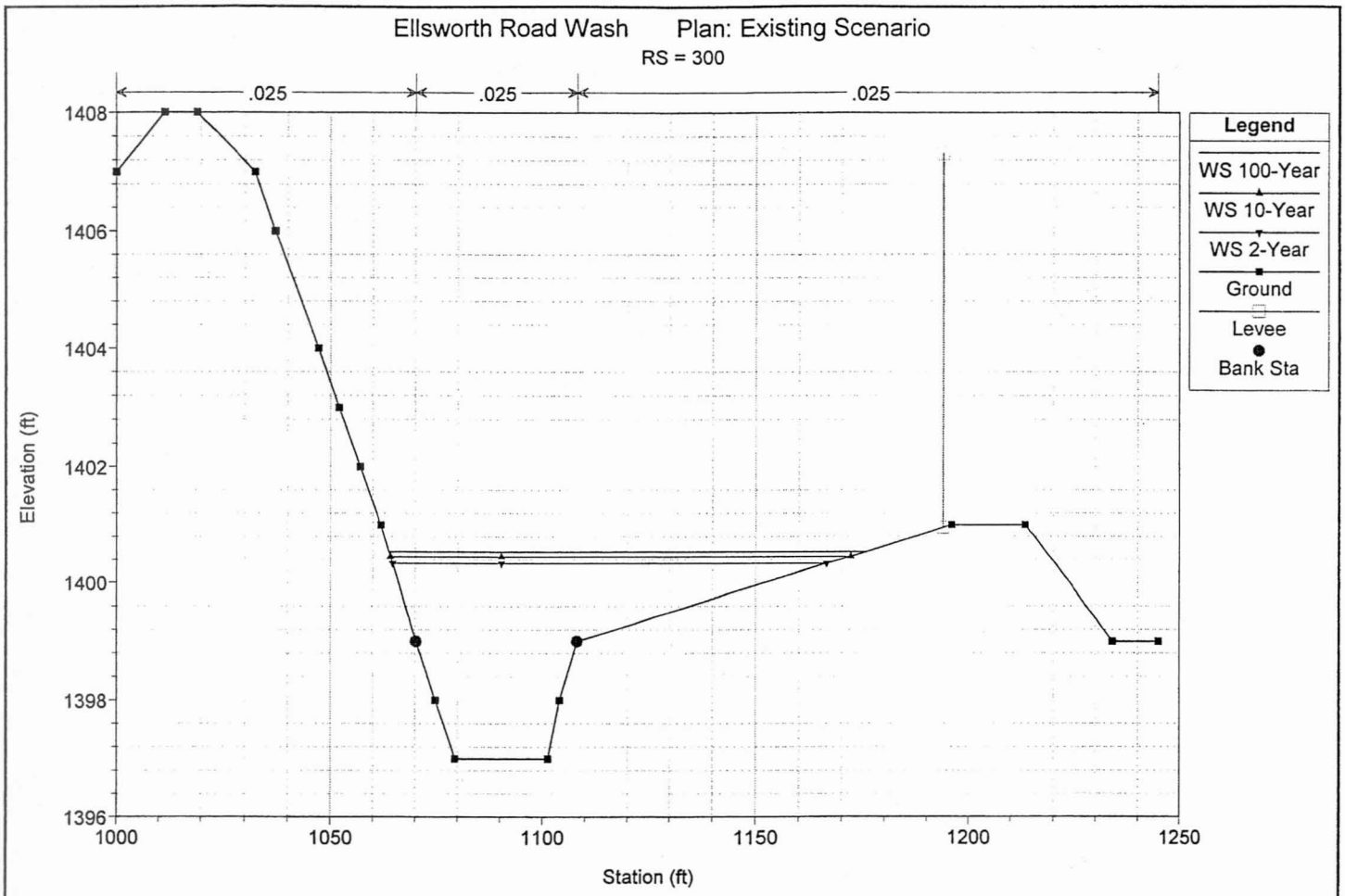
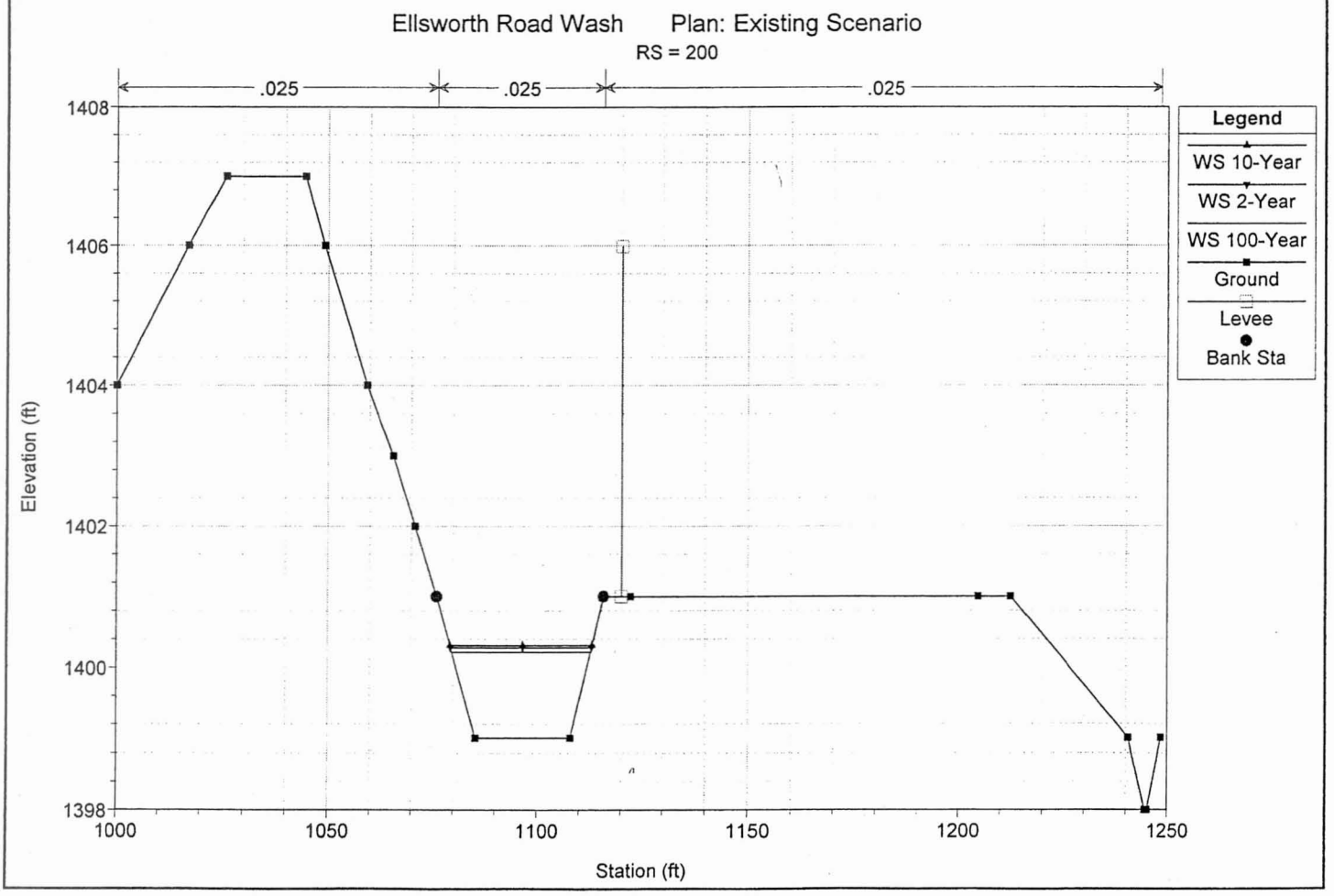
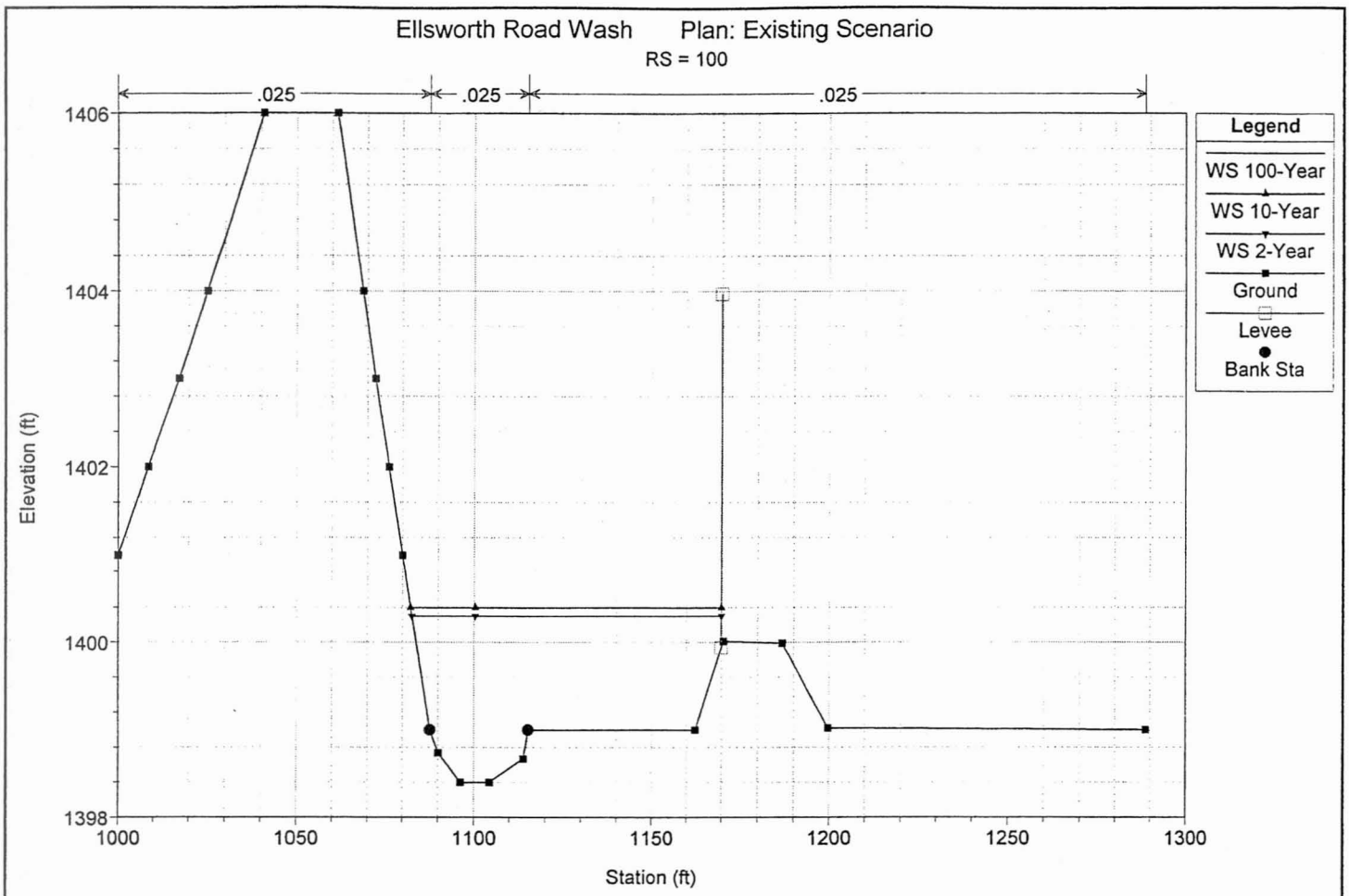
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1407
1406
1405
1404
1403
1402
1401
1000
1050
1100
1150
1200
1250
Station (ft)


Ellsworth Road Wash Plan: Existing Scenario
RS = 400
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1406
1404
1402
1400
1398
1396
1000
1050
1100
1150
1200
1250
Station (ft)

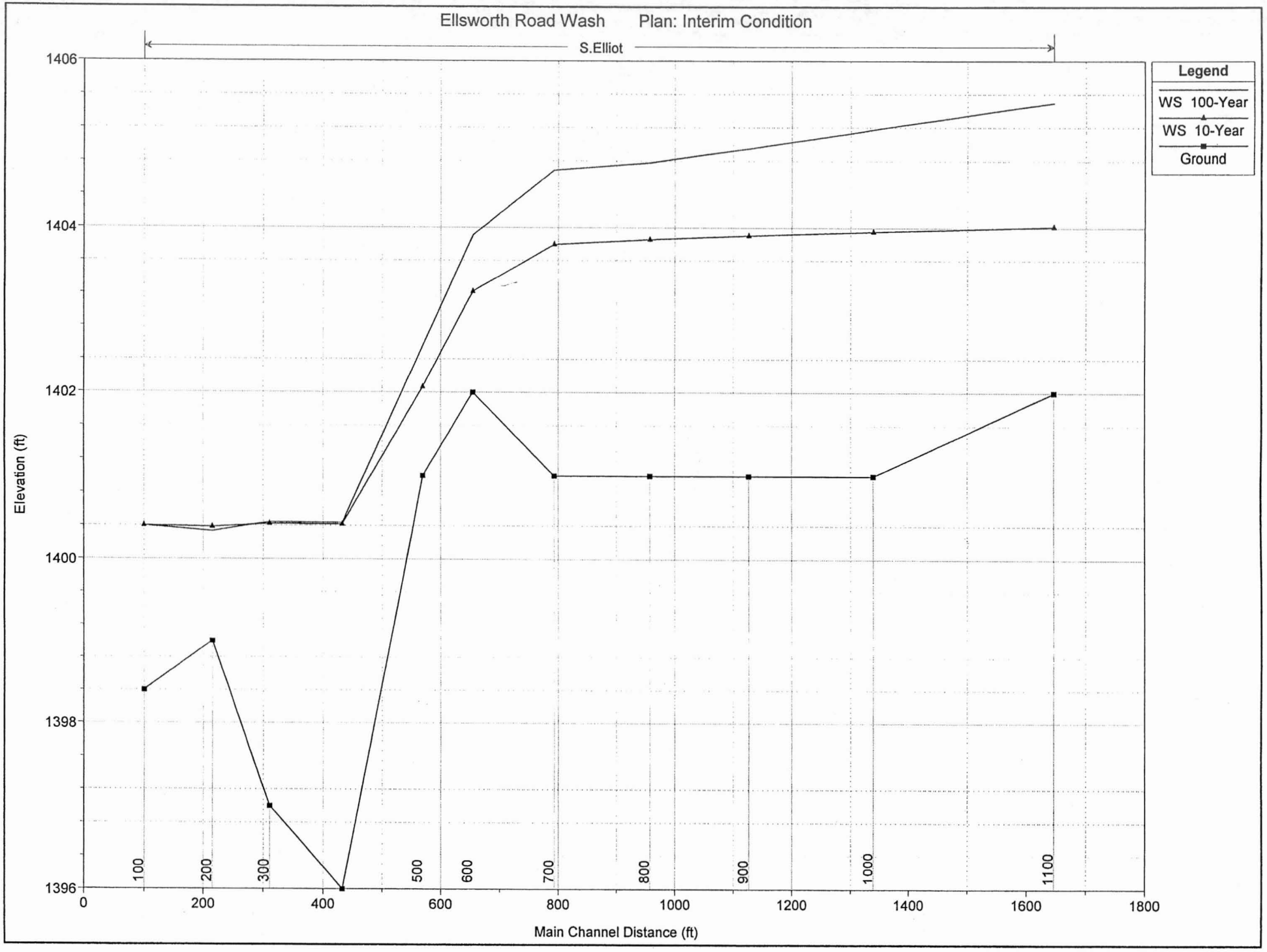

Ellsworth Road Wash Plan: Existing Scenario
RS = 300
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1406
1404
1402
1400
1398
1396
1000
1050
1100
1150
1200
1250
Station (ft)

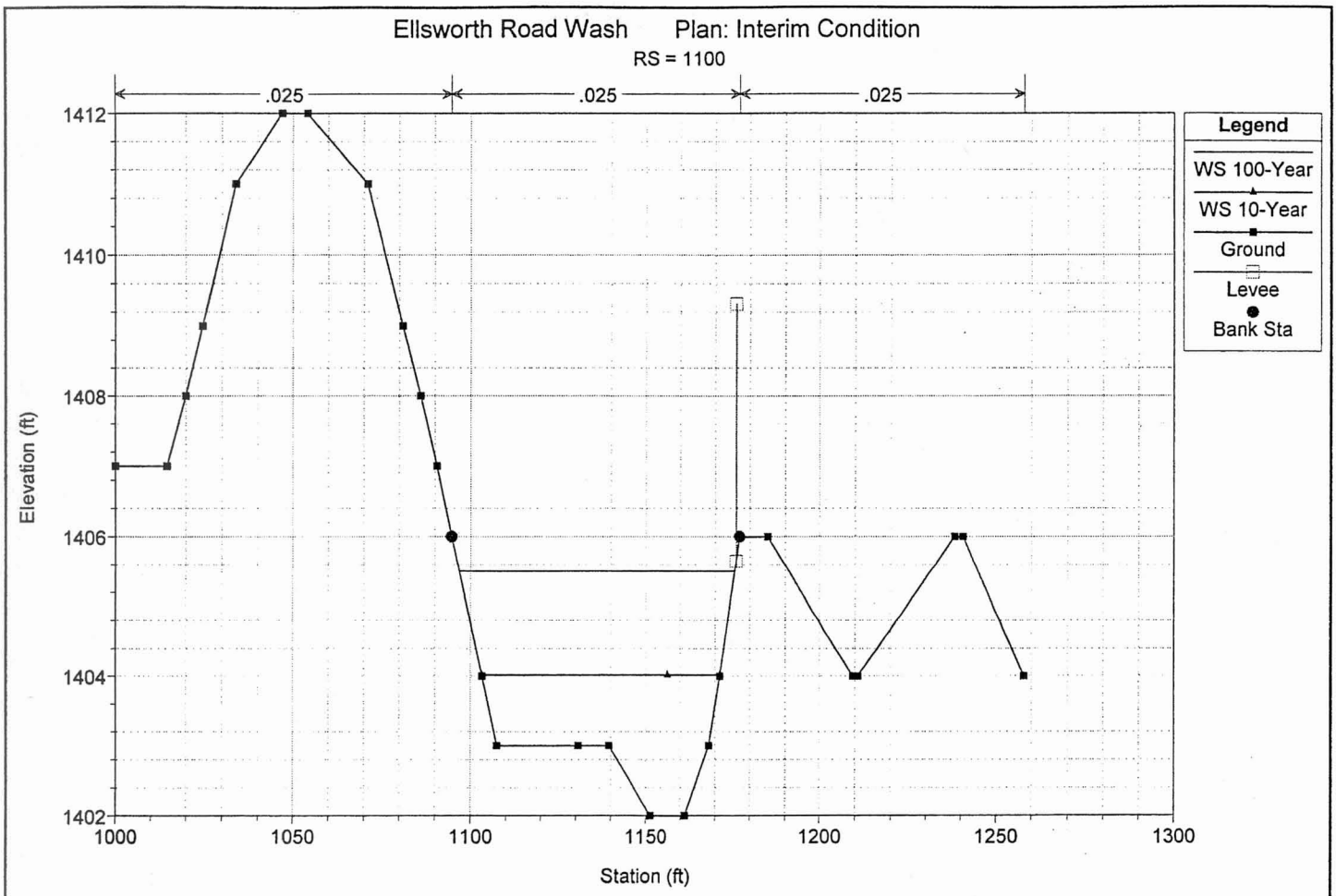

Ellsworth Road Wash Plan: Existing Scenario
RS = 200
.025
.025
.025
Legend
WS 10-Year
WS 2-Year
WS 100-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1406
1404
1402
1400
1398
1000
1050
1100
1150
1200
1250
Station (ft)

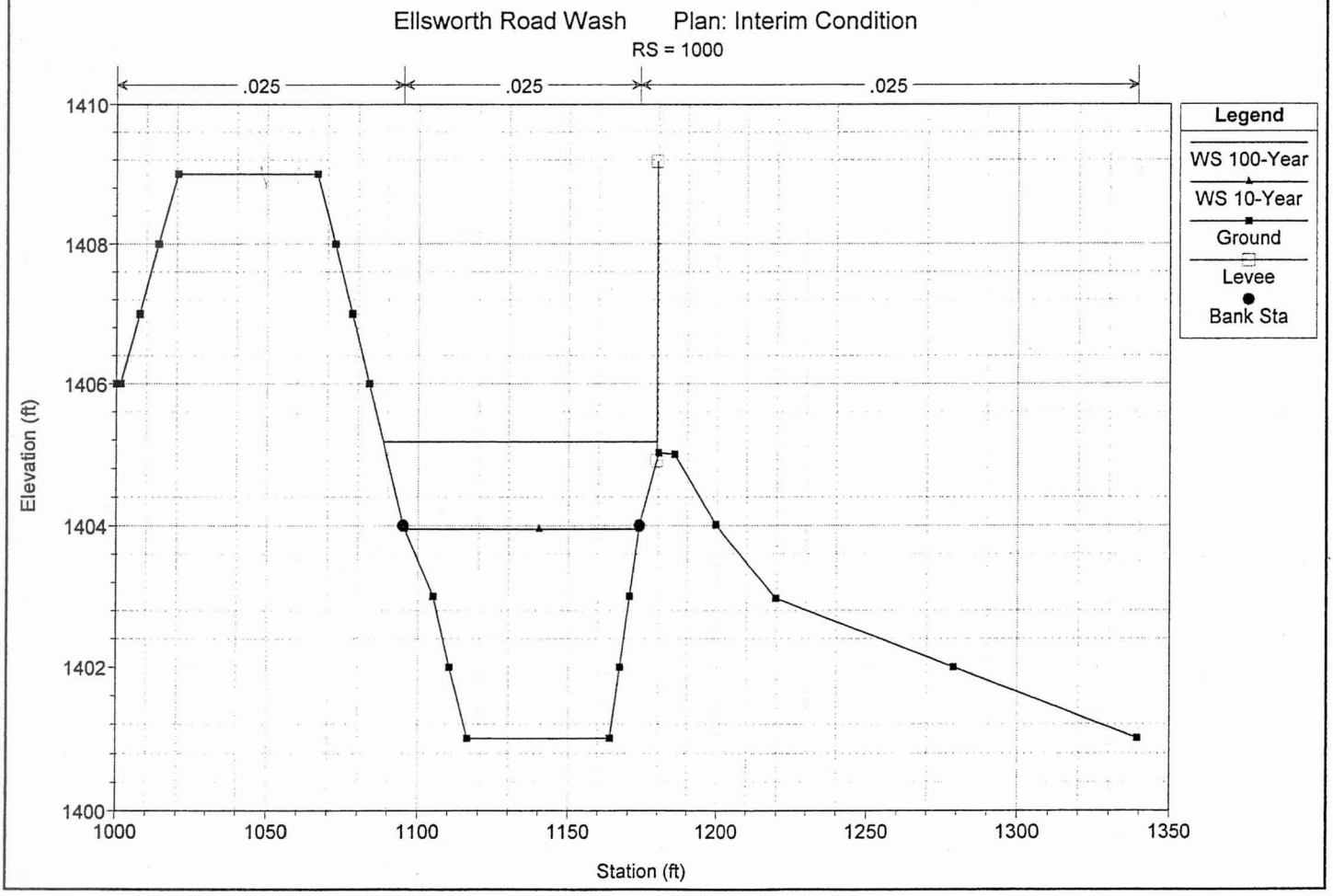

Ellsworth Road Wash Plan: Existing Scenario
RS = 100
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
1406
1404
1402
1400
1398
1000
1050
1100
1150
1200
1250
1300
Station (ft)

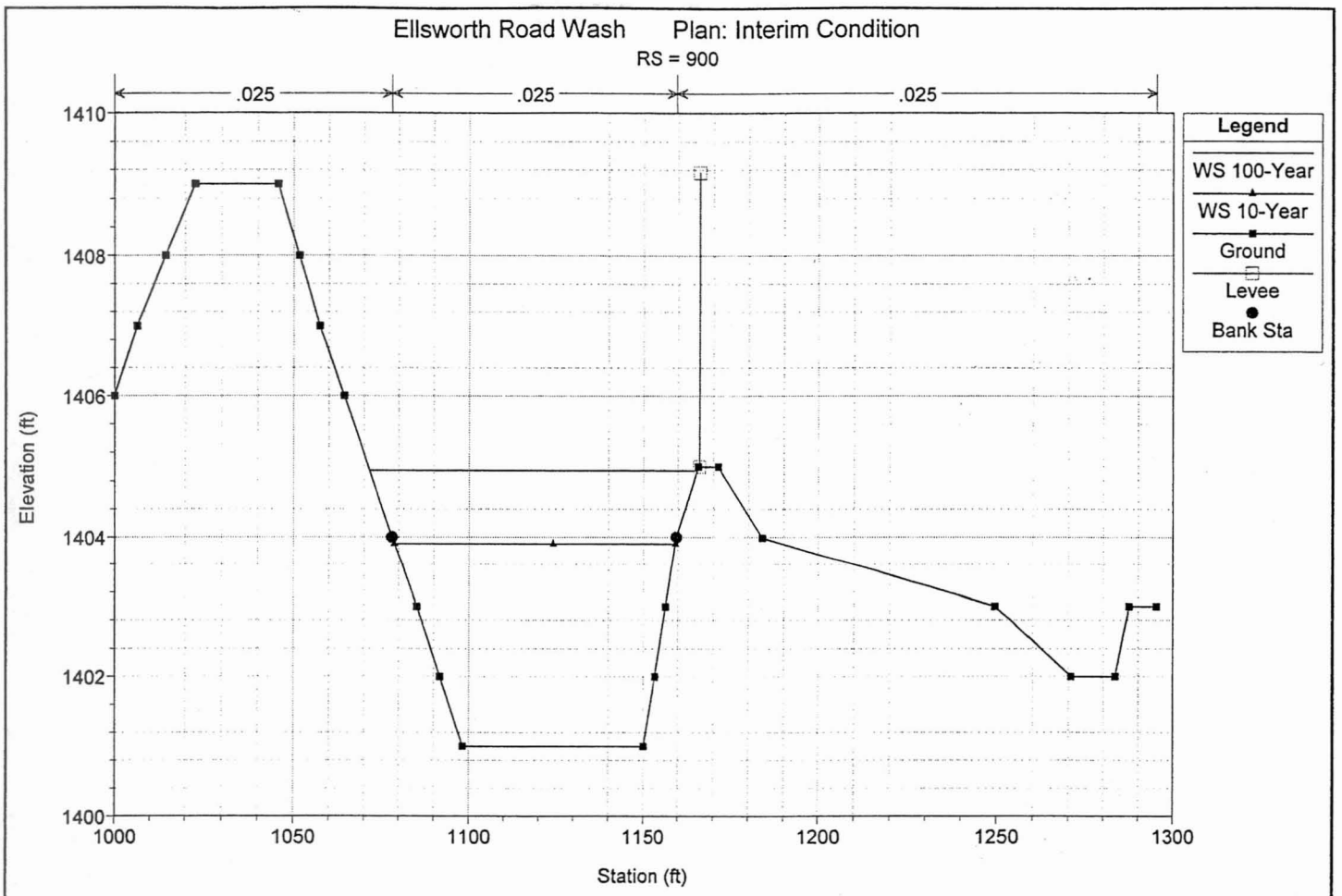
HEC-RAS Plan: Interim River: E-Ellsworth Rd Reach: S.Elliot

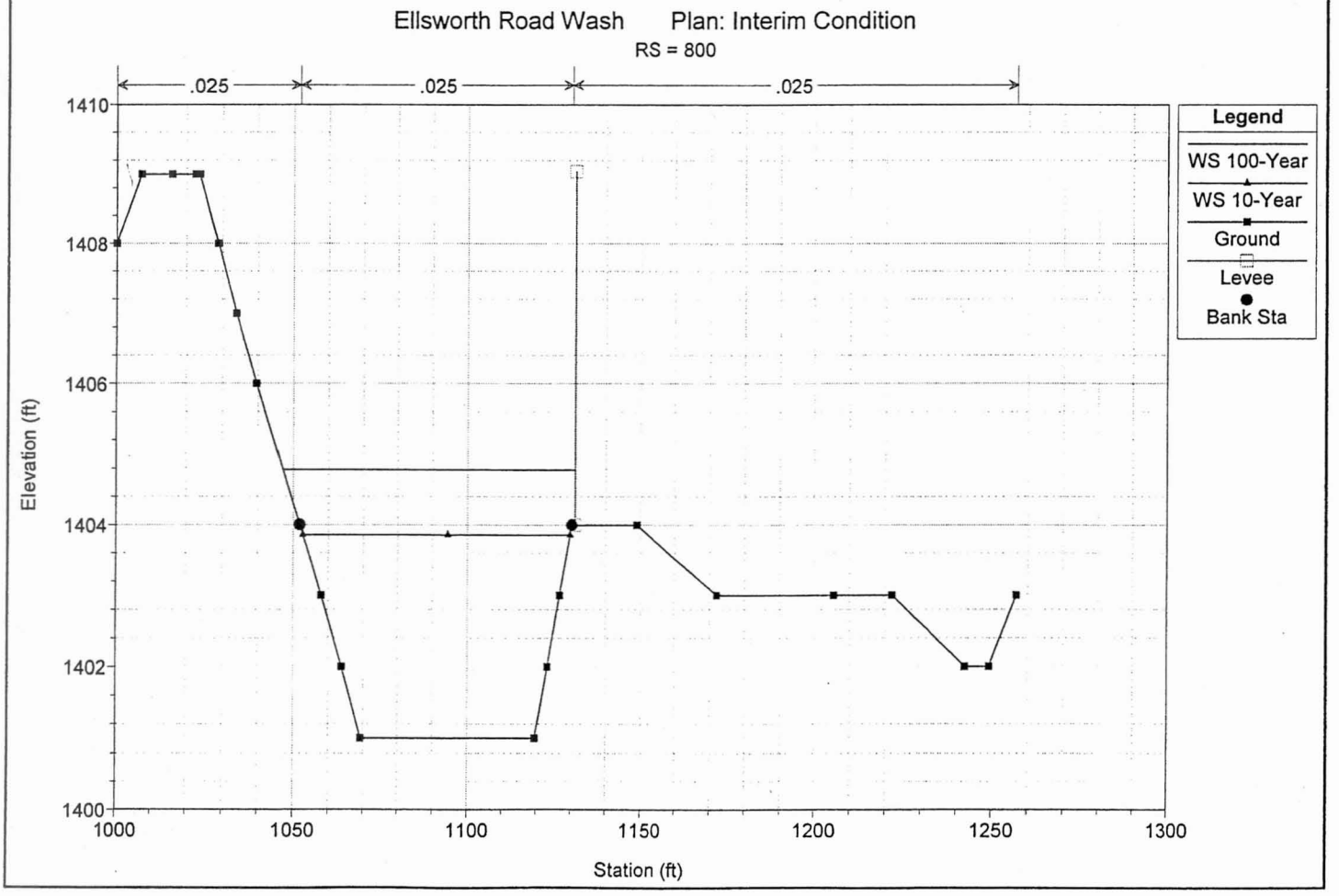
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
S.Elliot	1100	1285.00	1402.00	1405.50	1405.01	1406.18	0.003812	6.64	193.56	78.73	0.75
S.Elliot	1100	293.00	1402.00	1404.02	1403.57	1404.20	0.002531	3.45	84.92	68.12	0.54
S.Elliot	1000	1280.00	1401.00	1405.18	1403.59	1405.50	0.001105	4.56	286.18	91.03	0.43
S.Elliot	1000	293.00	1401.00	1403.95	1402.02	1403.99	0.000241	1.61	181.85	78.05	0.19
S.Elliot	900	1250.00	1401.00	1404.95	1403.41	1405.26	0.001131	4.49	282.62	93.78	0.43
S.Elliot	900	293.00	1401.00	1403.91	1401.97	1403.94	0.000209	1.53	192.10	80.55	0.17
S.Elliot	800	1080.00	1401.00	1404.78	1403.26	1405.06	0.001078	4.24	256.37	84.12	0.42
S.Elliot	800	293.00	1401.00	1403.86	1401.98	1403.90	0.000238	1.61	181.44	77.08	0.19
S.Elliot	700	770.00	1401.00	1404.69	1402.97	1404.88	0.000755	3.47	223.44	75.40	0.35
S.Elliot	700	293.00	1401.00	1403.80	1402.06	1403.85	0.000325	1.85	158.40	69.16	0.22
S.Elliot	600	650.00	1402.00	1403.91	1403.91	1404.61	0.008083	6.72	96.76	68.36	1.00
S.Elliot	600	293.00	1402.00	1403.22	1403.22	1403.69	0.009431	5.48	53.47	57.64	1.00
S.Elliot	500	620.00	1401.00	1402.56	1402.83	1403.68	0.013569	8.55	74.00	58.66	1.28
S.Elliot	500	293.00	1401.00	1402.07	1402.19	1402.70	0.013772	6.40	45.91	54.72	1.20
S.Elliot	400	420.00	1396.00	1400.44	1397.95	1400.53	0.000374	2.42	173.55	55.61	0.24
S.Elliot	400	220.00	1396.00	1400.42	1397.32	1400.44	0.000104	1.27	172.55	55.47	0.13
S.Elliot	300	210.00	1397.00	1400.44	1398.31	1400.48	0.000164	1.57	164.08	107.30	0.16
S.Elliot	300	100.00	1397.00	1400.42	1397.82	1400.43	0.000038	0.76	161.82	106.29	0.08
S.Elliot	200	100.00	1399.00	1400.33	1399.80	1400.44	0.001751	2.65	37.74	34.02	0.44
S.Elliot	200	60.00	1399.00	1400.38	1399.58	1400.42	0.000553	1.52	39.45	34.45	0.25
S.Elliot	100	10.00	1398.40	1400.40	1398.67	1400.40	0.000001	0.09	127.79	87.57	0.01
S.Elliot	100	5.00	1398.40	1400.40	1398.59	1400.40	0.000000	0.04	127.79	87.57	0.01

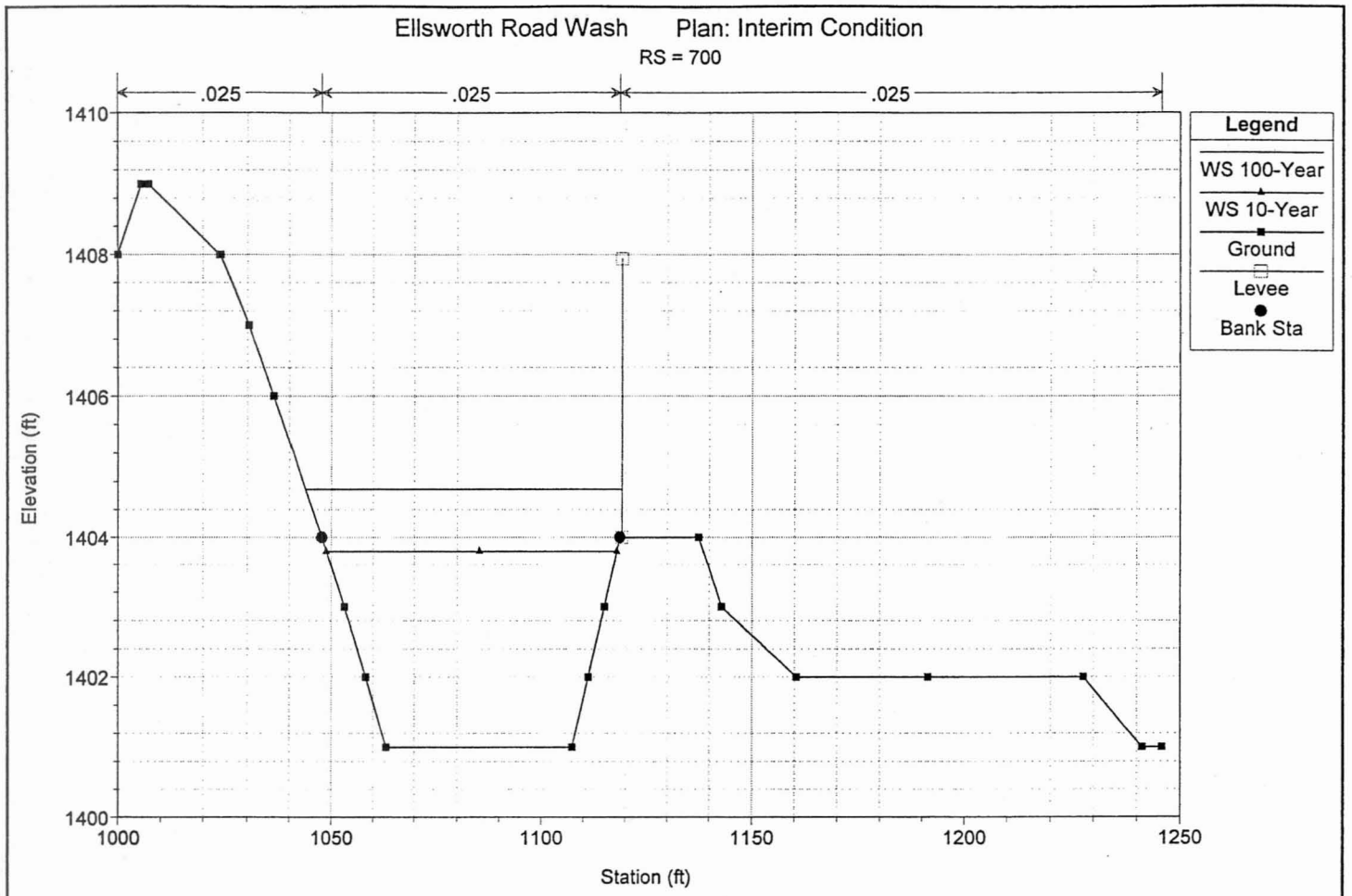

Ellsworth Road Wash Plan: Interim Condition
S.Elliot
Legend
WS 100-Year
WS 10-Year
Ground
Elevation (ft)
1406
1404
1402
1400
1398
1396
0
200
400
600
800
1000
1200
1400
1600
1800
Main Channel Distance (ft)
100
200
300
500
600
700
800
900
1000
1100

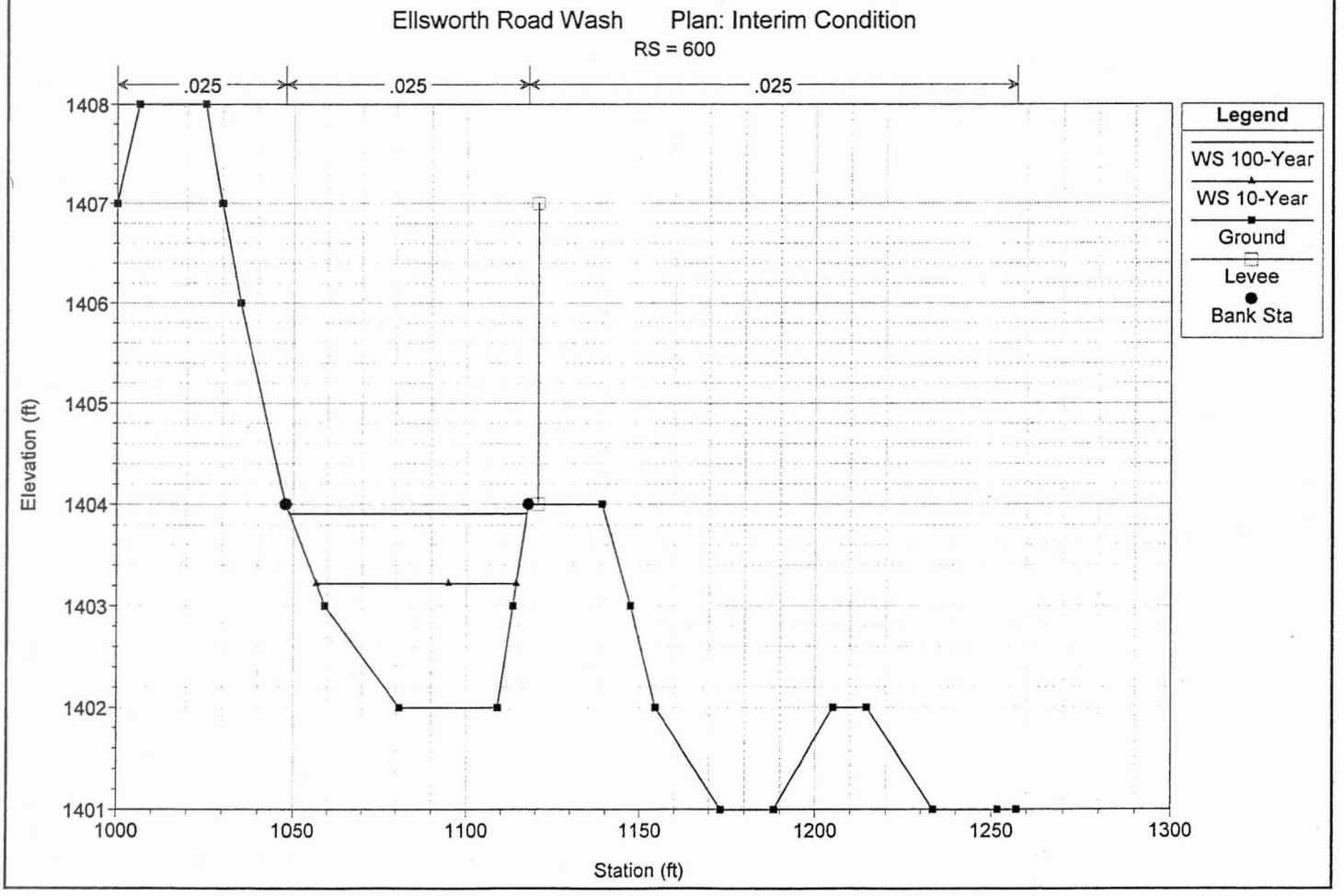

Ellsworth Road Wash Plan: Interim Condition
RS = 1100
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1412
1410
1408
1406
1404
1402
1000
1050
1100
1150
1200
1250
1300
Station (ft)

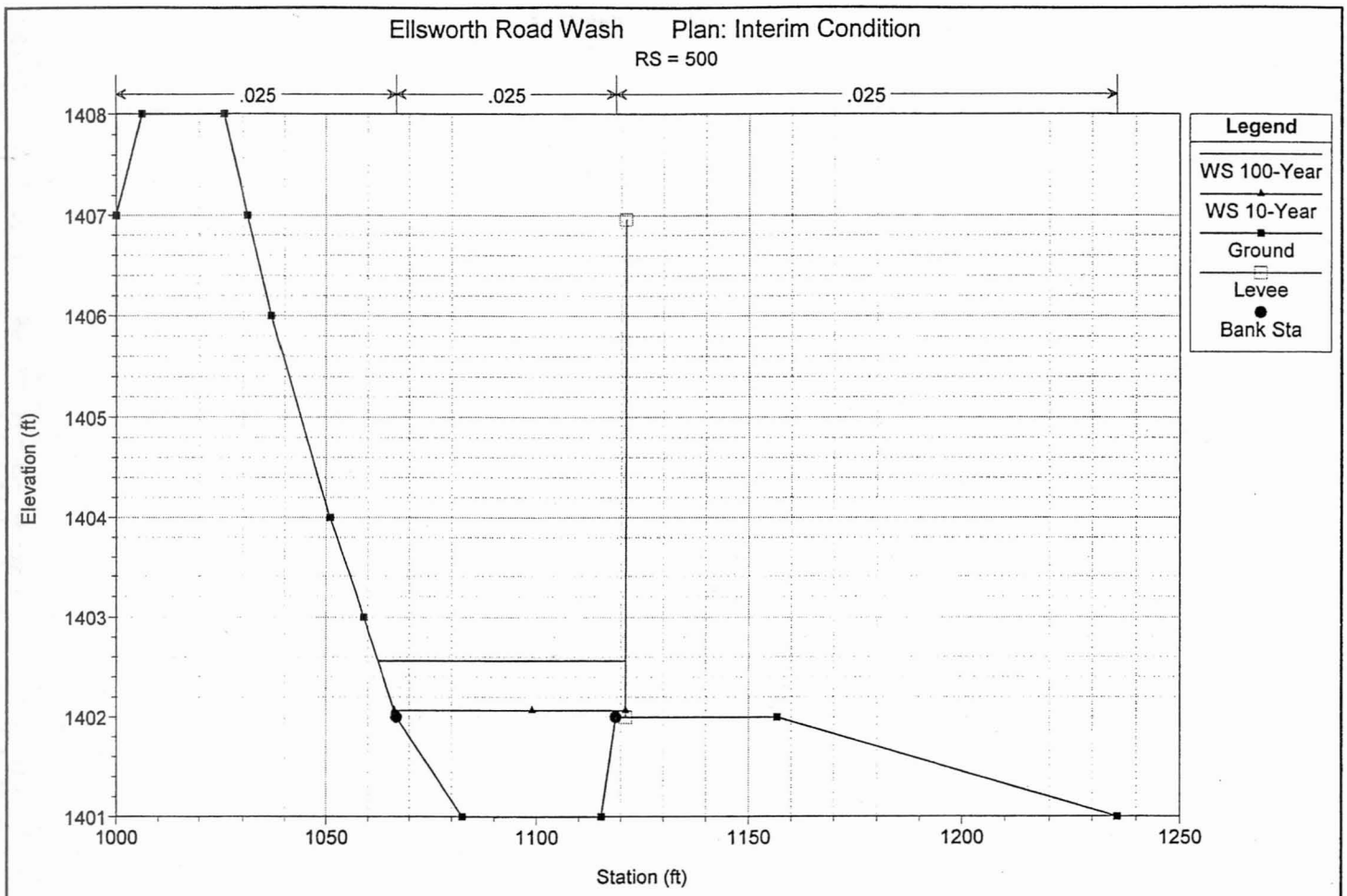

Ellsworth Road Wash Plan: Interim Condition
RS = 1000
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
1300
1350
Station (ft)

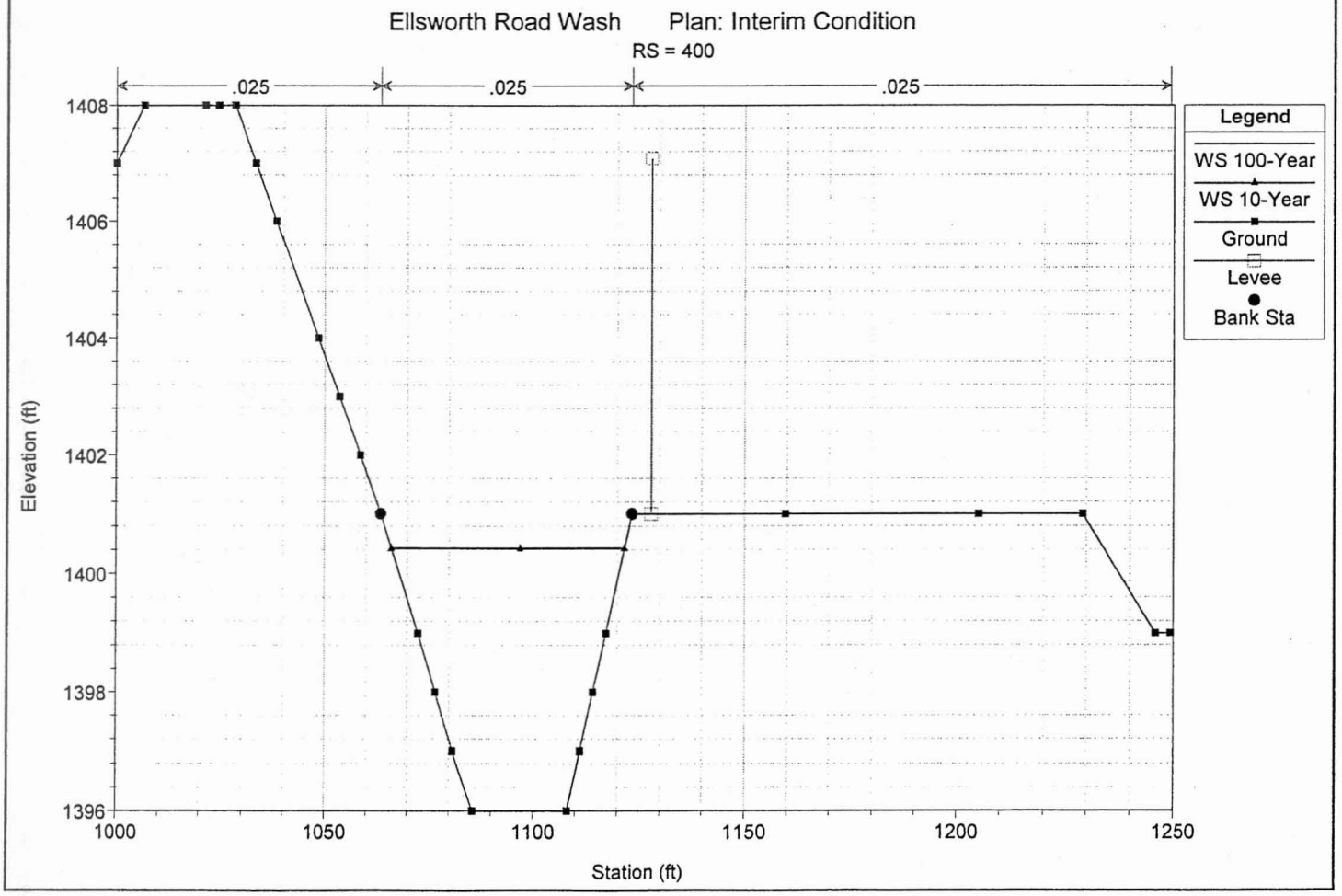

Ellsworth Road Wash Plan: Interim Condition
RS = 900
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
1300

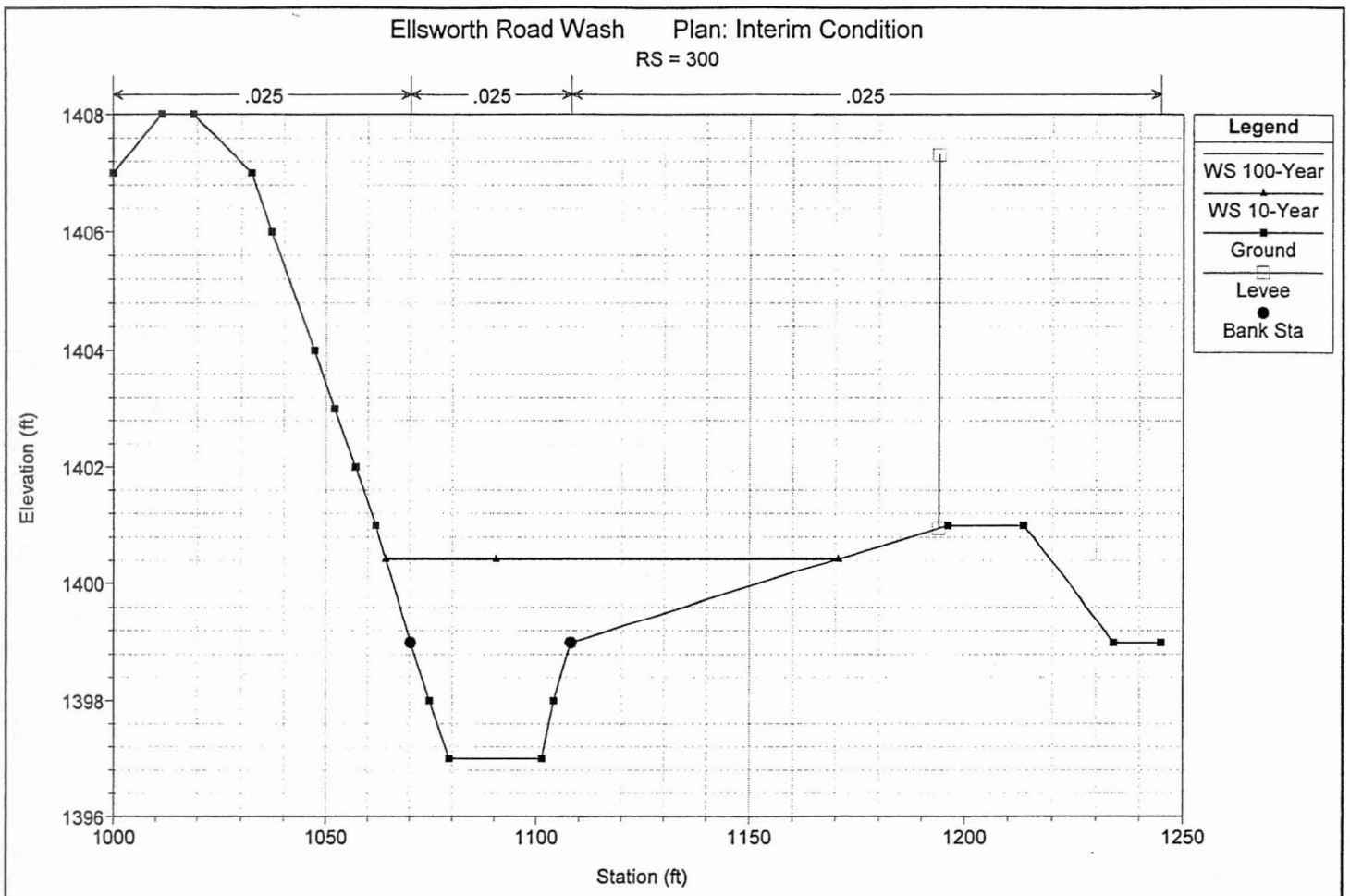

Ellsworth Road Wash Plan: Interim Condition
RS = 800
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
1300

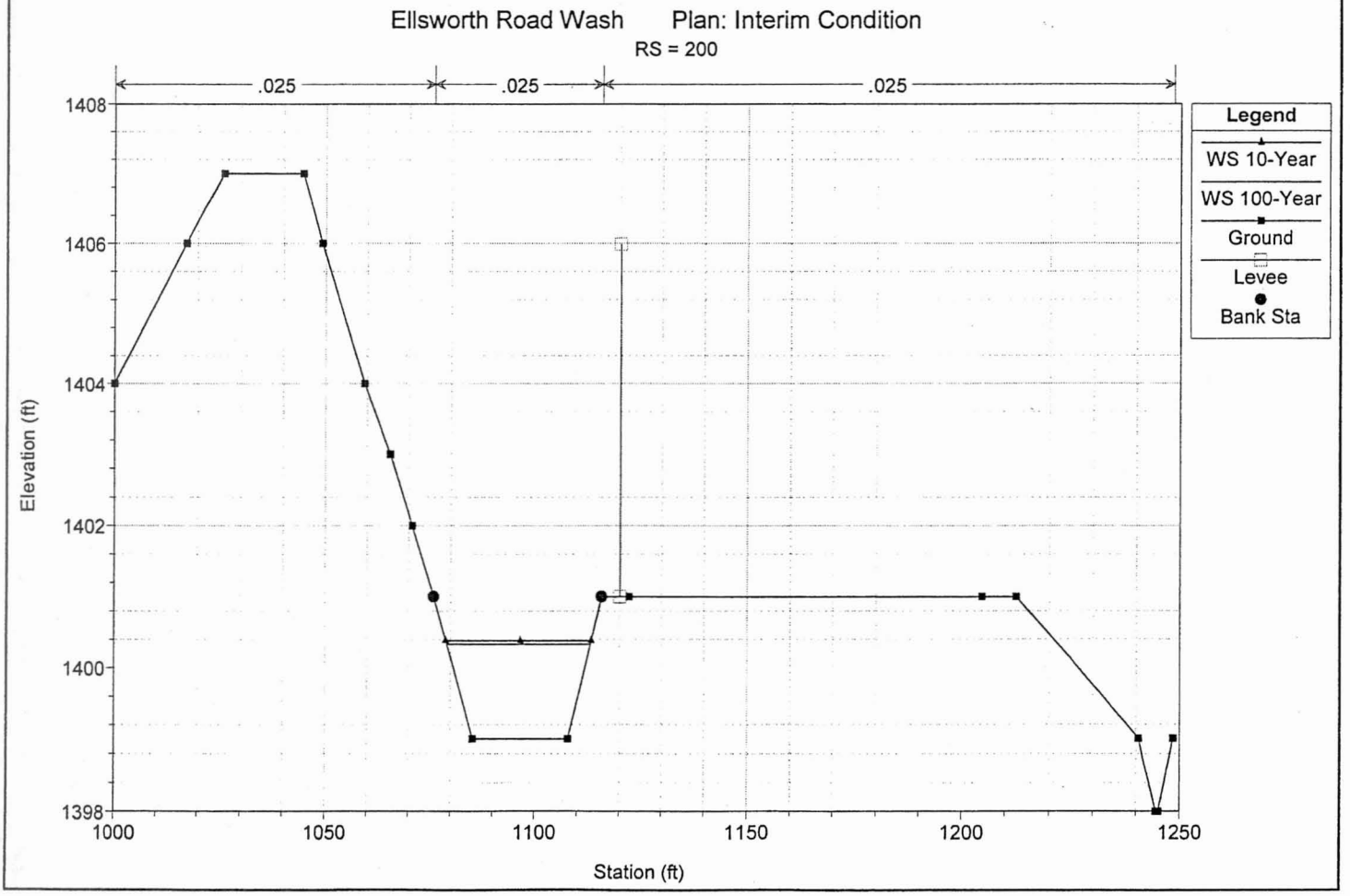

Ellsworth Road Wash Plan: Interim Condition
RS = 700
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1410
1408
1406
1404
1402
1400
1000
1050
1100
1150
1200
1250
Station (ft)

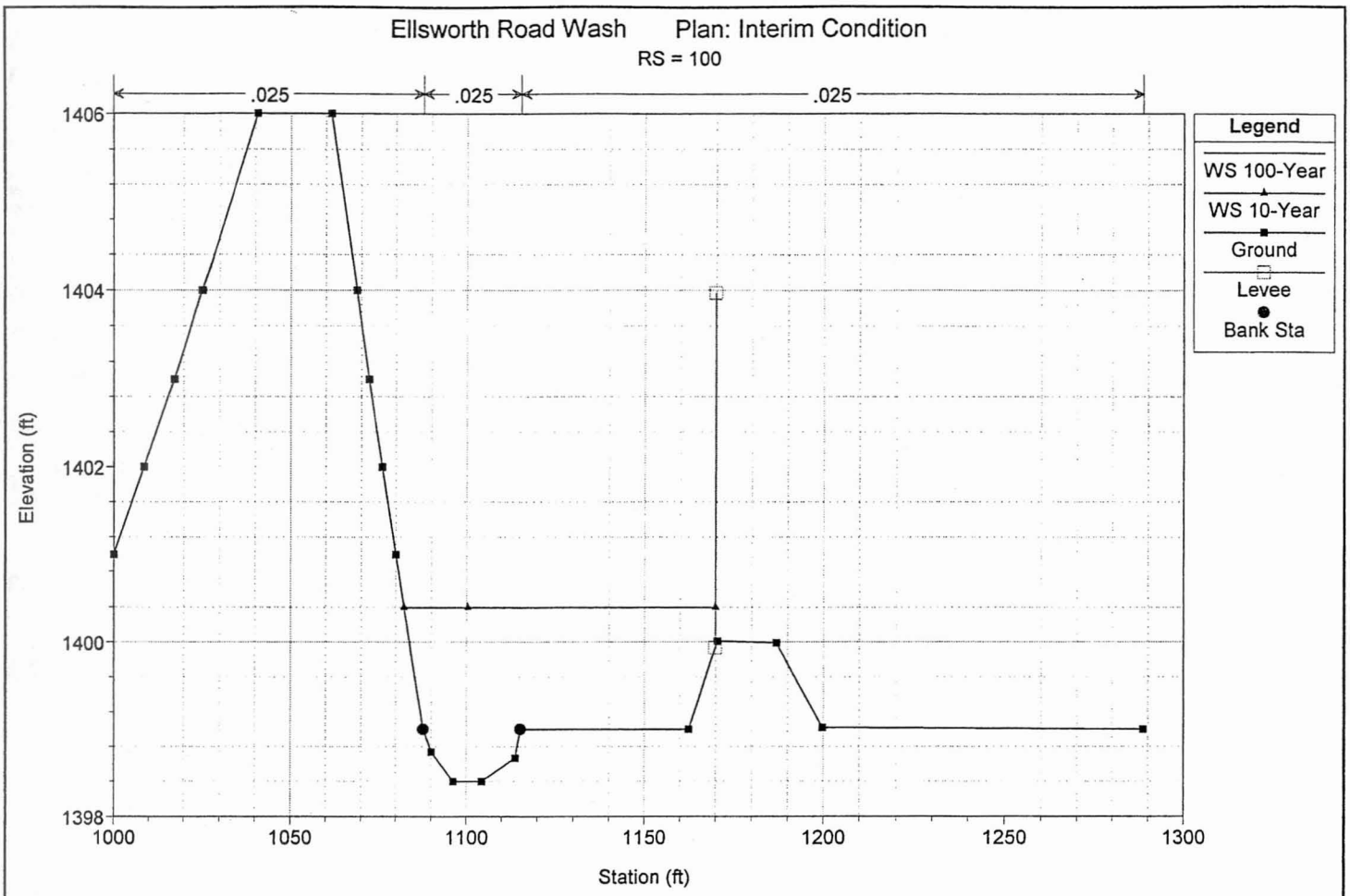

Ellsworth Road Wash Plan: Interim Condition
RS = 600
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1407
1406
1405
1404
1403
1402
1401
1000
1050
1100
1150
1200
1250
1300
Station (ft)


Ellsworth Road Wash Plan: Interim Condition
RS = 500
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1407
1406
1405
1404
1403
1402
1401
1000
1050
1100
1150
1200
1250
Station (ft)


Ellsworth Road Wash Plan: Interim Condition
RS = 400
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1406
1404
1402
1400
1398
1396
1000
1050
1100
1150
1200
1250
Station (ft)


Ellsworth Road Wash Plan: Interim Condition
RS = 300
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1406
1404
1402
1400
1398
1396
1000
1050
1100
1150
1200
1250
Station (ft)


Ellsworth Road Wash Plan: Interim Condition
RS = 200
.025
.025
.025
Legend
WS 10-Year
WS 100-Year
Ground
Levee
Bank Sta
Elevation (ft)
1408
1406
1404
1402
1400
1398
1000
1050
1100
1150
1200
1250
Station (ft)


Ellsworth Road Wash Plan: Interim Condition
RS = 100
.025
.025
.025
Legend
WS 100-Year
WS 10-Year
Ground
Levee
Bank Sta
Elevation (ft)
1406
1404
1402
1400
1398
1000
1050
1100
1150
1200
1250
1300
Station (ft)

APPENDIX B

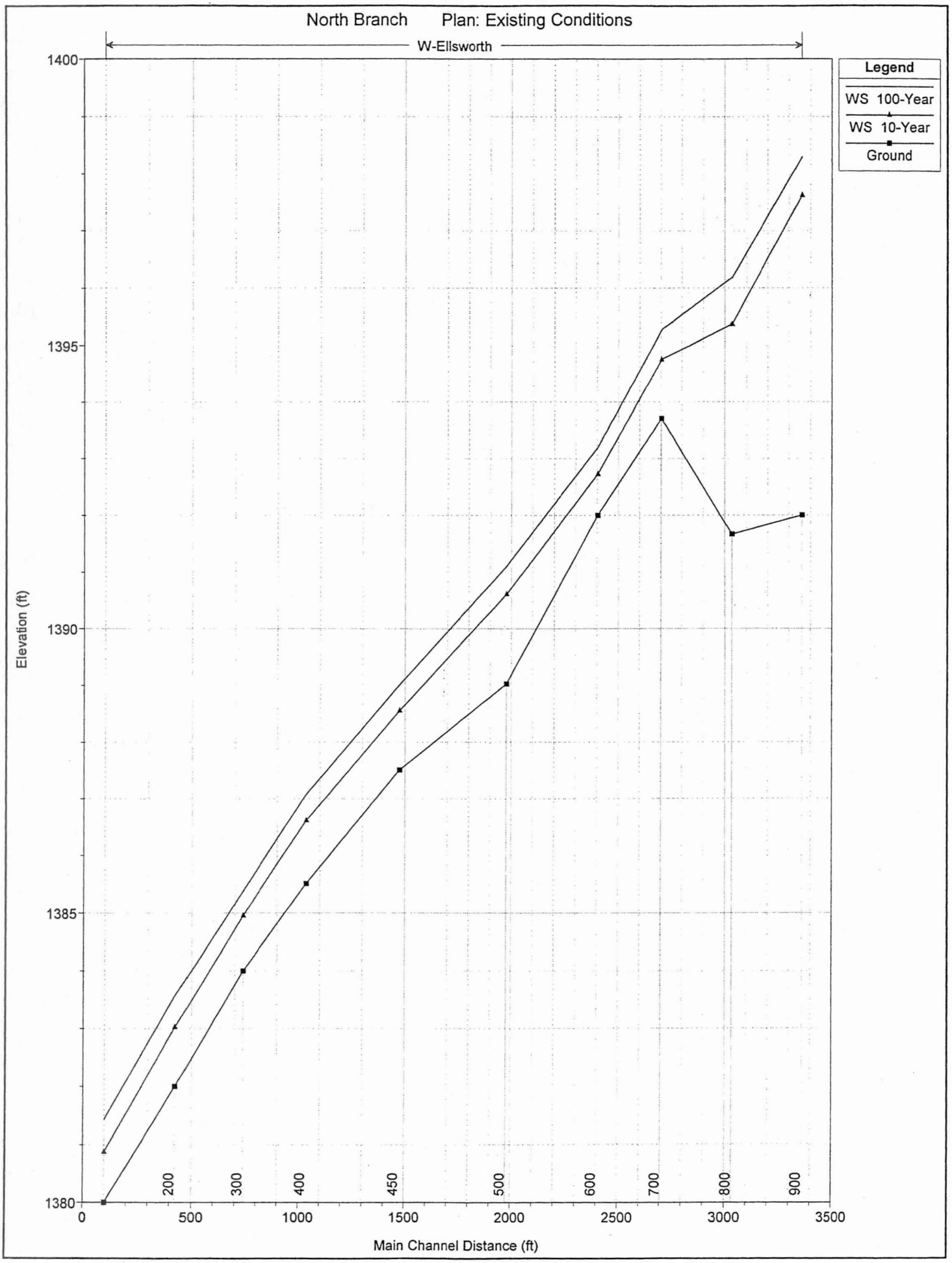
HEC-RAS MODELING RESULTS FOR EXISTING CONDITIONS

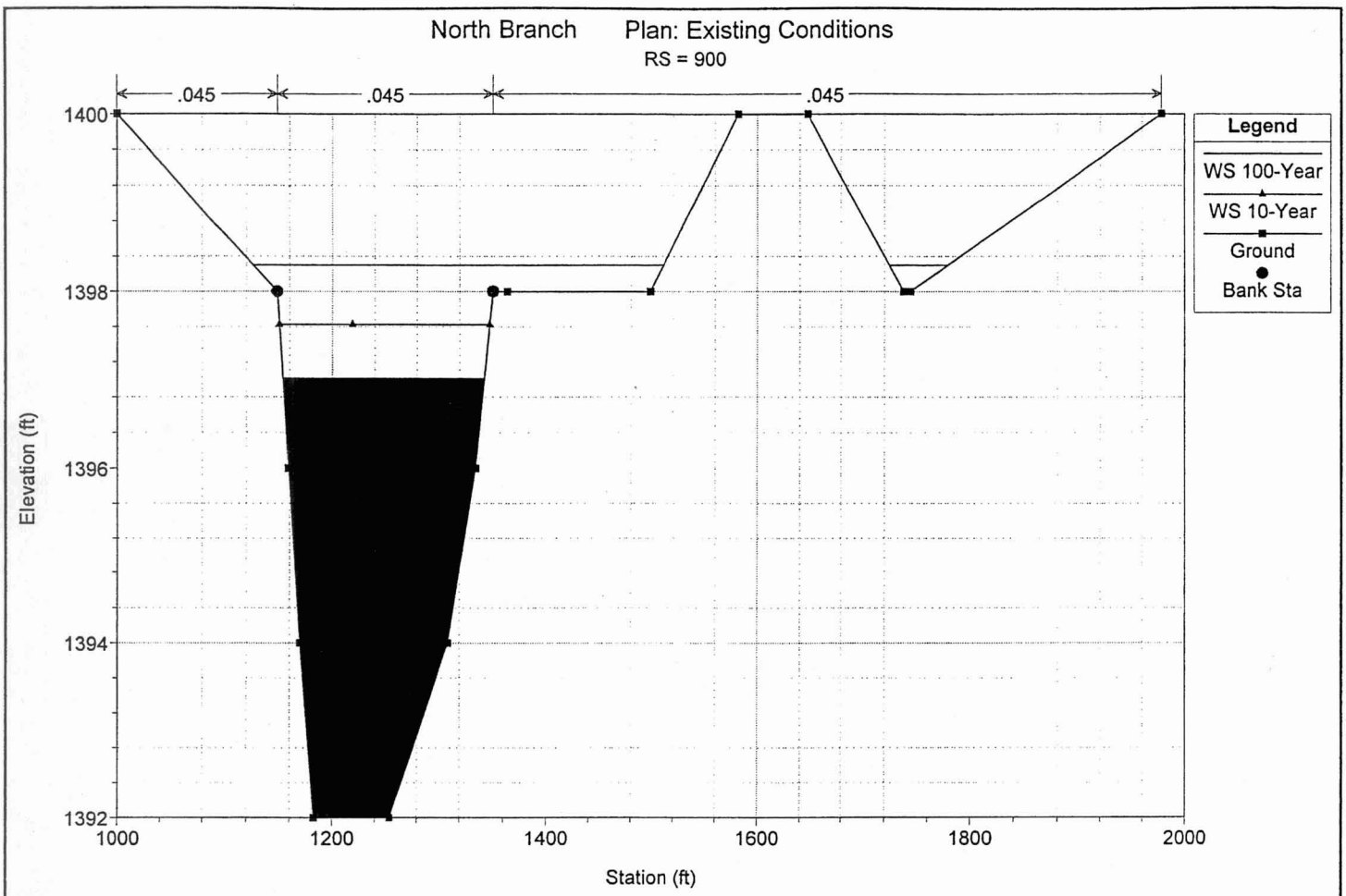
NORTH BRANCH

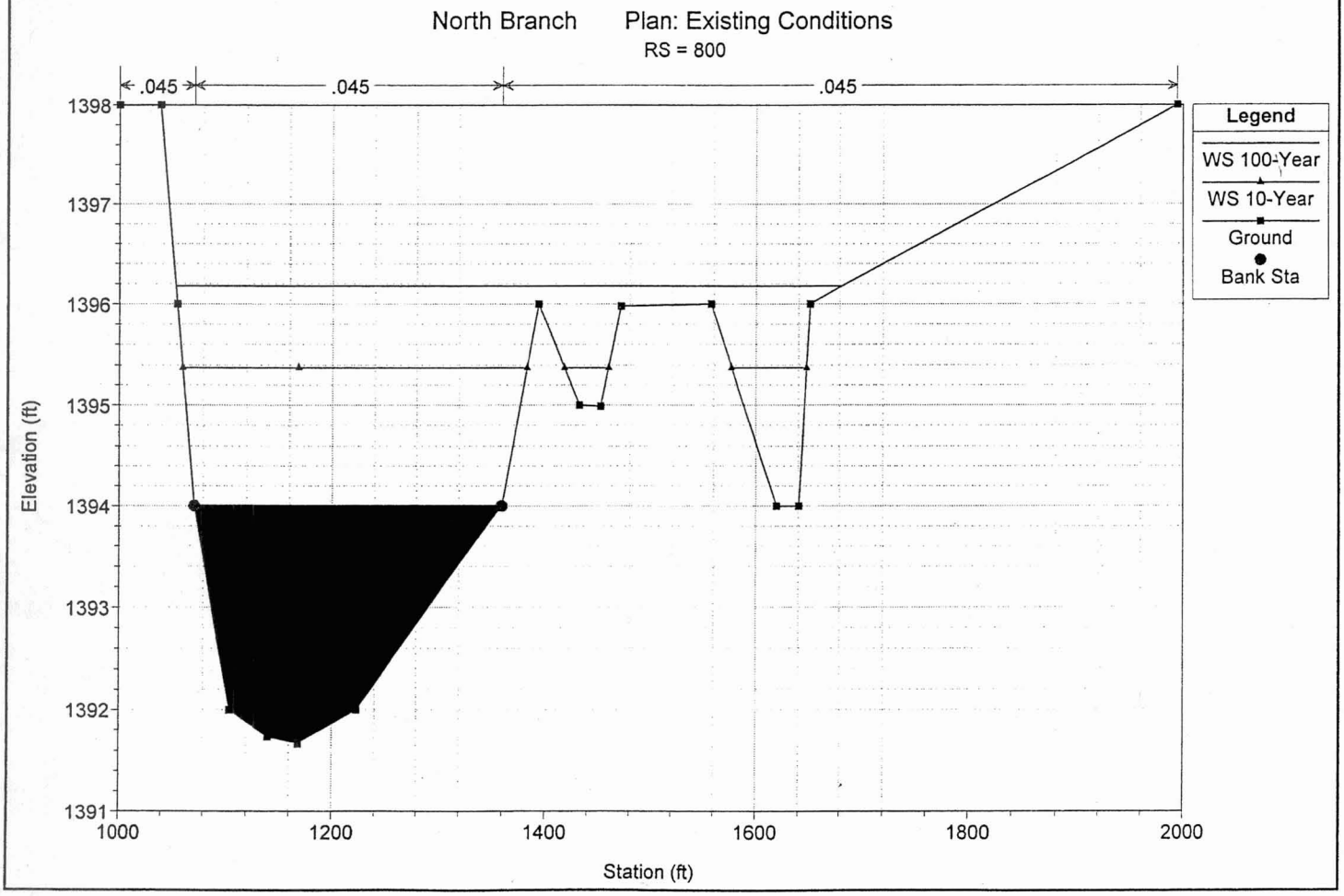
SOUTH BRANCH

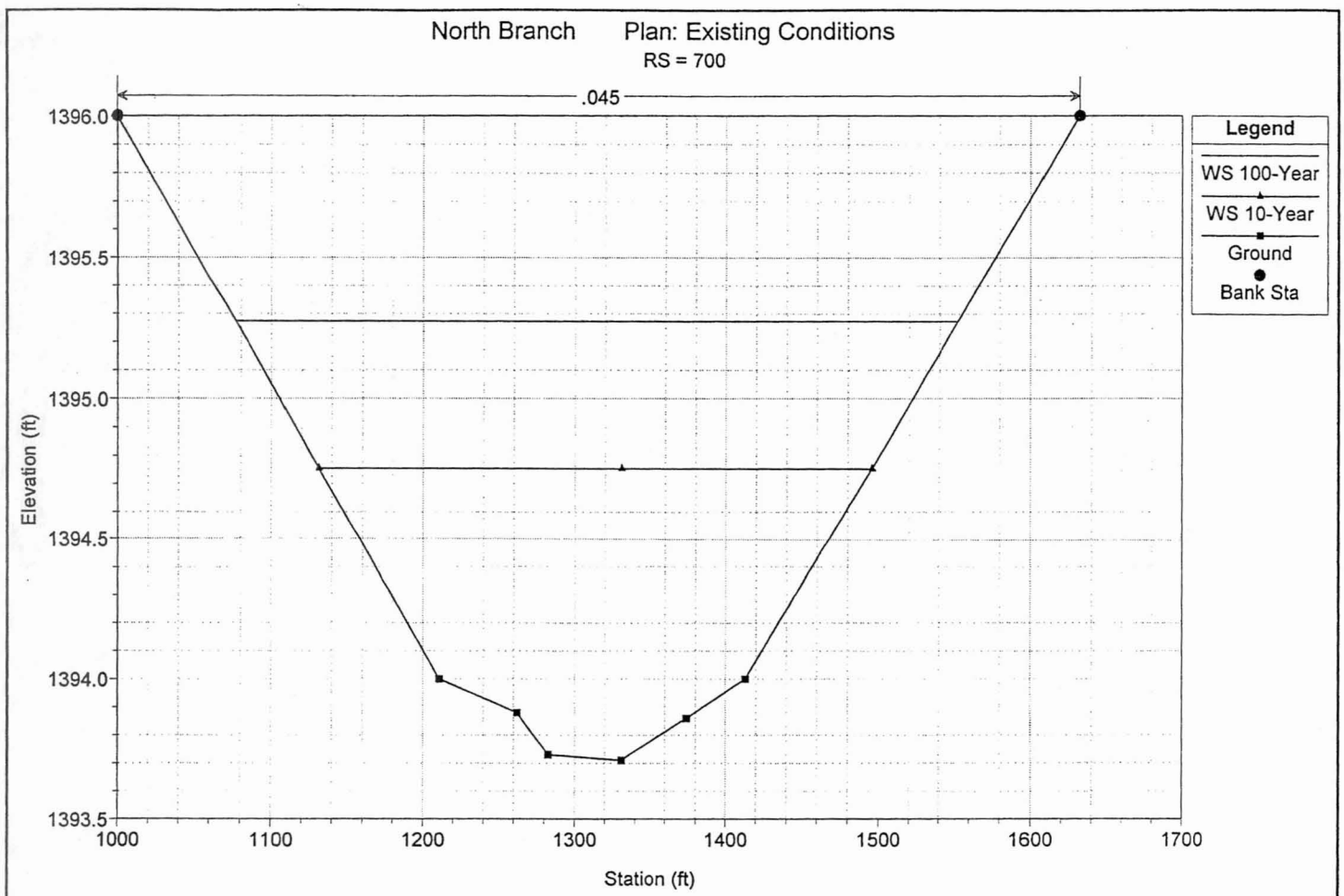
HEC-RAS Plan: Existing River: N-Branch Reach: W-Ellsworth

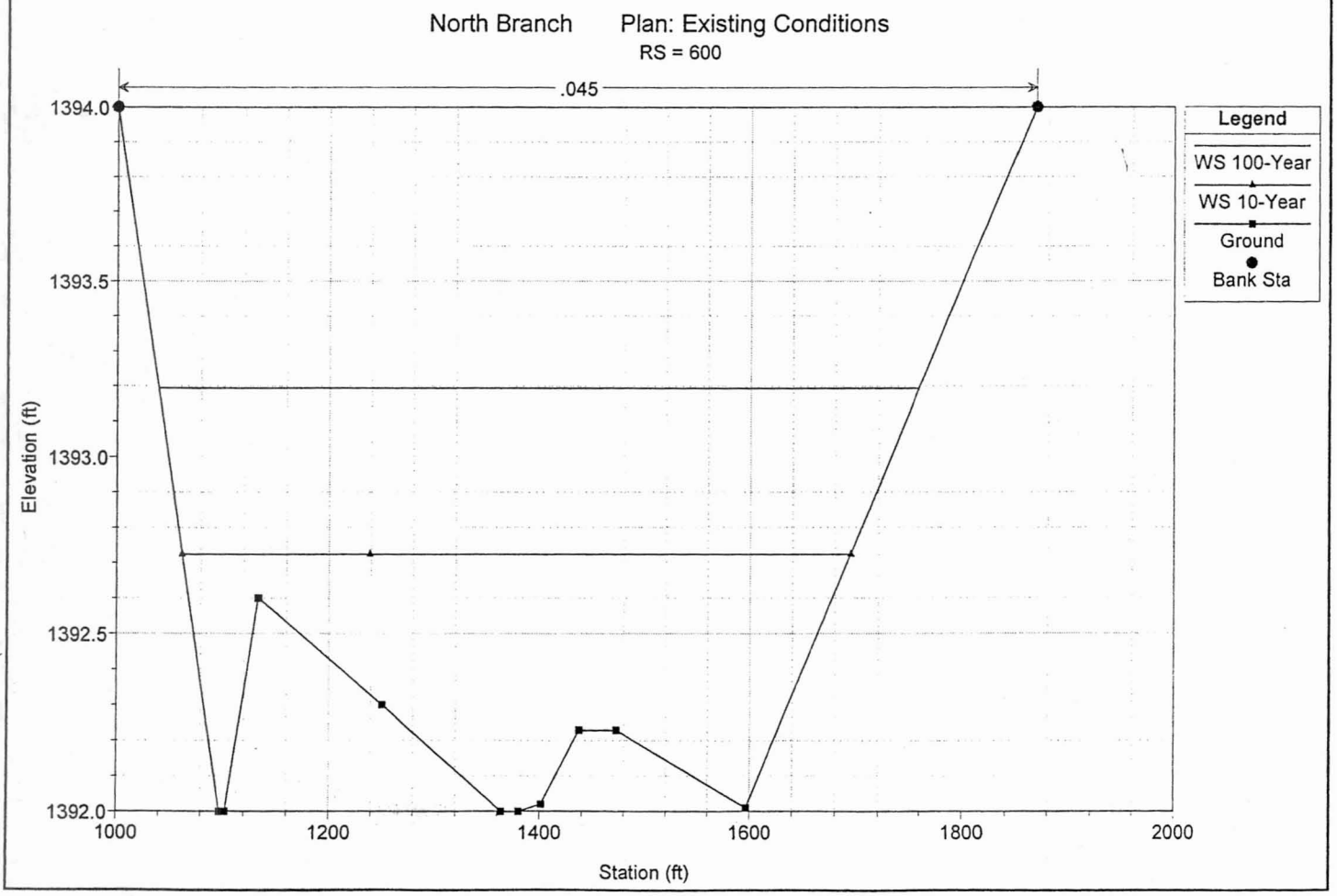
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
W-Ellsworth	900	1415.00	1397.02	1398.30	1398.30	1398.69	0.018264	5.18	311.57	439.52	0.82
W-Ellsworth	900	513.00	1397.02	1397.63	1397.63	1397.93	0.035569	4.39	116.74	196.85	1.01
W-Ellsworth	800	1415.00	1393.89	1396.18	1394.85	1396.23	0.001112	1.85	899.42	628.94	0.22
W-Ellsworth	800	513.00	1393.89	1395.37	1394.44	1395.39	0.000761	1.12	490.65	435.75	0.17
W-Ellsworth	700	1415.00	1393.71	1395.27		1395.42	0.008791	3.05	464.45	475.77	0.54
W-Ellsworth	700	513.00	1393.71	1394.76		1394.82	0.006682	2.08	246.57	364.34	0.45
W-Ellsworth	600	1415.00	1392.00	1393.19	1392.78	1393.28	0.005816	2.28	620.23	719.19	0.43
W-Ellsworth	600	513.00	1392.00	1392.72	1392.49	1392.77	0.007034	1.69	302.68	632.17	0.43
W-Ellsworth	500	1415.00	1389.02	1391.11	1390.56	1391.17	0.004224	2.05	691.25	741.54	0.37
W-Ellsworth	500	513.00	1389.02	1390.61	1390.24	1390.64	0.003724	1.43	358.31	597.75	0.33
W-Ellsworth	450	1415.00	1387.51	1389.01		1389.06	0.004141	1.85	765.16	942.35	0.36
W-Ellsworth	450	513.00	1387.51	1388.55		1388.58	0.004526	1.36	376.11	781.69	0.35
W-Ellsworth	400	1415.00	1385.51	1387.08		1387.13	0.004636	1.85	764.02	1021.75	0.38
W-Ellsworth	400	513.00	1385.51	1386.62		1386.65	0.004271	1.38	370.93	722.78	0.34
W-Ellsworth	300	1415.00	1384.00	1385.38		1385.46	0.006976	2.21	641.00	895.10	0.46
W-Ellsworth	300	513.00	1384.00	1384.96		1385.00	0.007472	1.67	306.80	684.22	0.44
W-Ellsworth	200	1415.00	1382.00	1383.57	1383.04	1383.64	0.004837	2.12	672.07	766.60	0.40
W-Ellsworth	200	513.00	1382.00	1383.02		1383.07	0.005131	1.65	313.08	543.66	0.38
W-Ellsworth	100	1415.00	1380.00	1381.44	1381.07	1381.60	0.008002	3.50	456.70	456.56	0.54
W-Ellsworth	100	513.00	1380.00	1380.87	1380.65	1380.96	0.008002	2.57	224.37	372.92	0.50

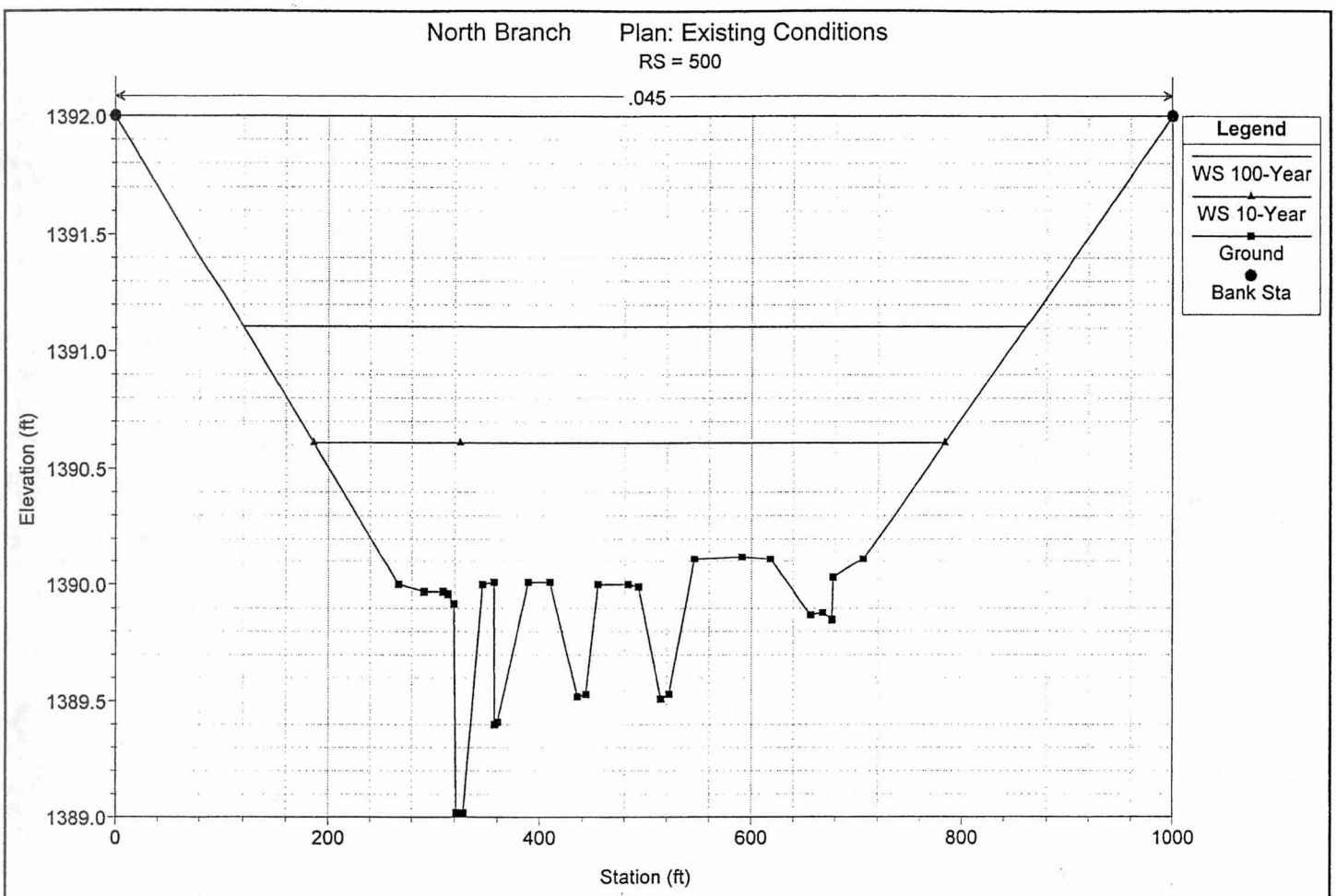

North Branch Plan: Existing Conditions
W-Ellsworth
Legend
WS 100-Year
WS 10-Year
Ground
Elevation (ft)
1400
1395
1390
1385
1380
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (ft)
200
300
400
450
500
600
700
800
900

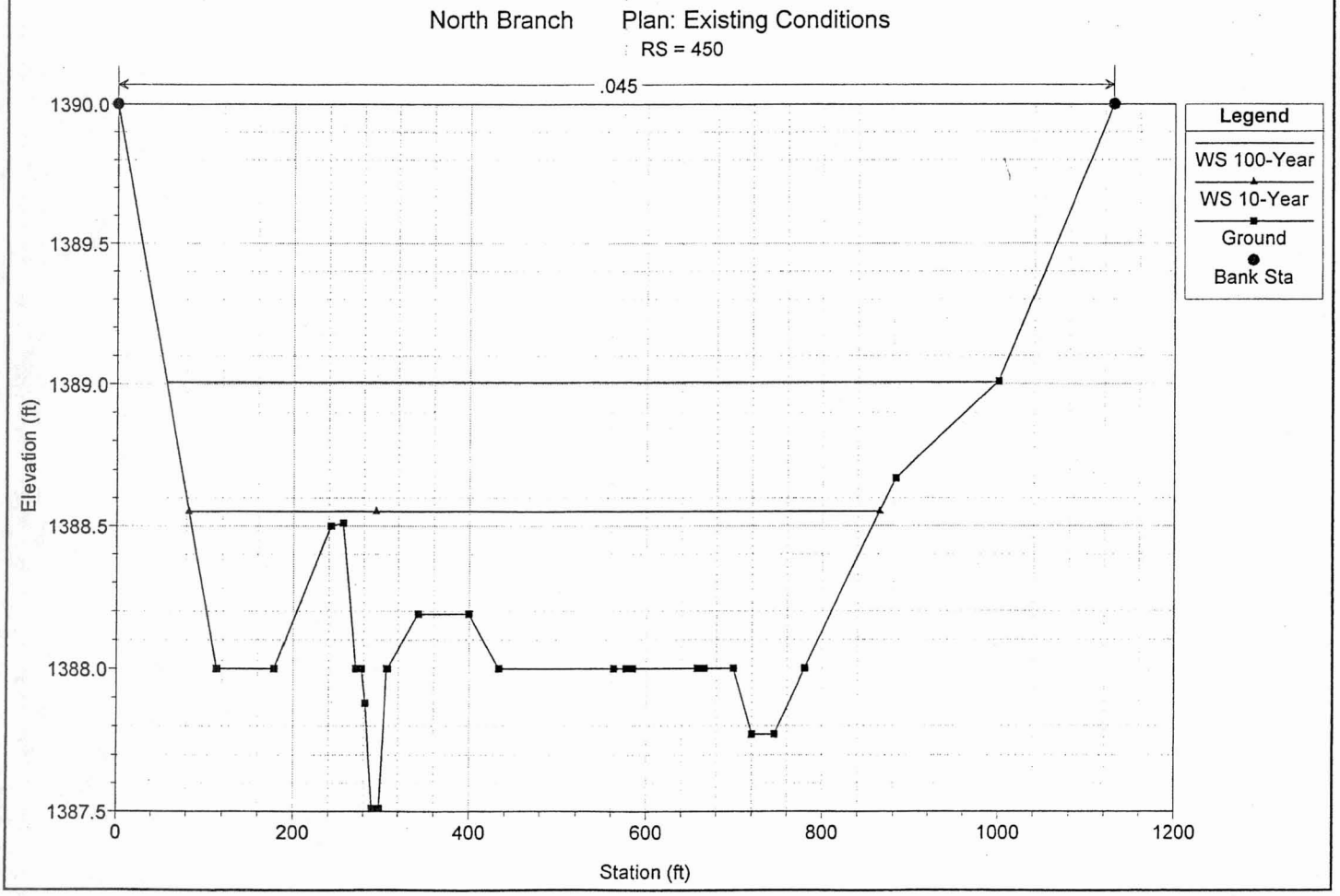

North Branch Plan: Existing Conditions
RS = 900
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1400
1398
1396
1394
1392
1000
1200
1400
1600
1800
2000
Station (ft)

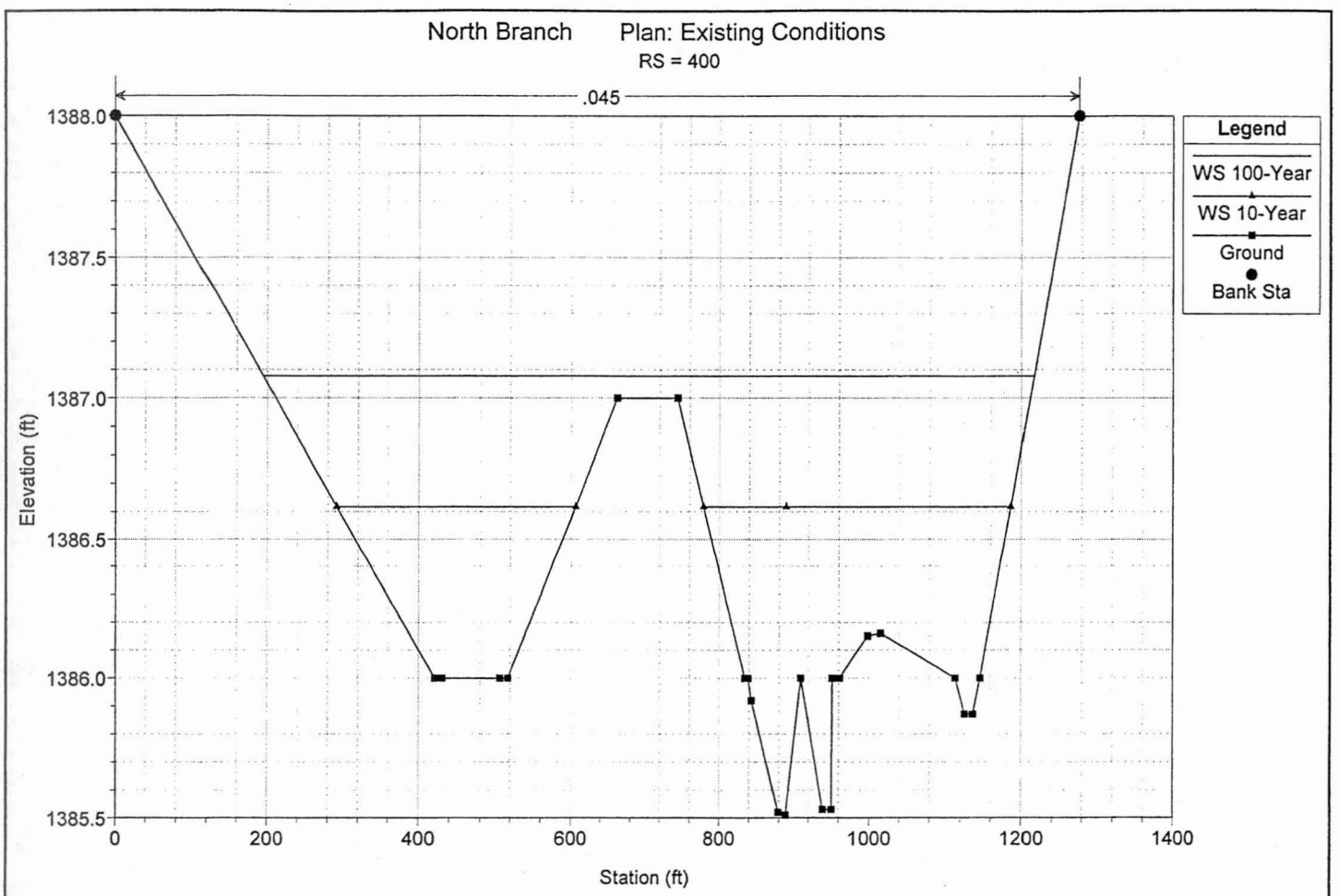

North Branch Plan: Existing Conditions
RS = 800
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1398
1397
1396
1395
1394
1393
1392
1391
1000
1200
1400
1600
1800
2000
Station (ft)

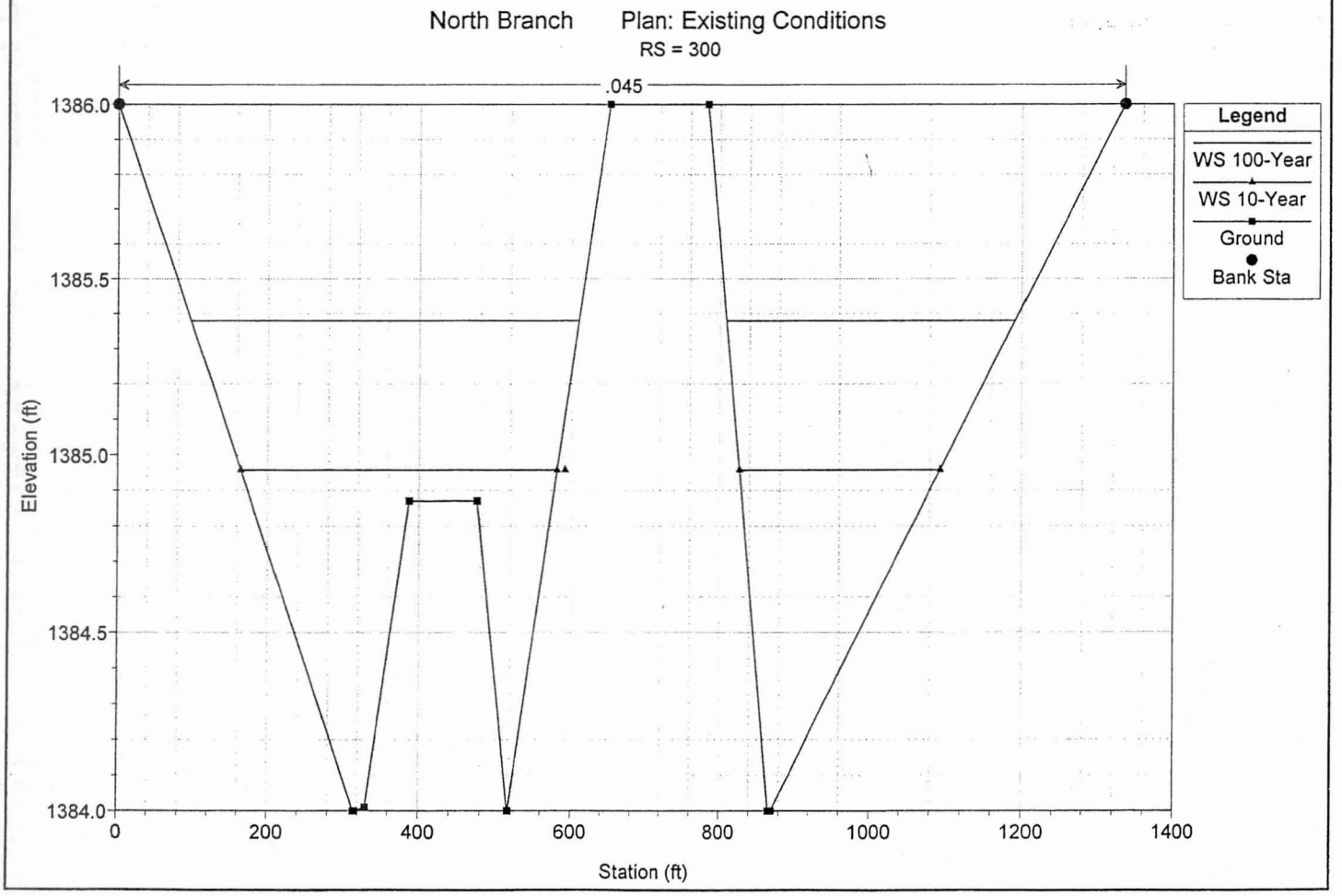

North Branch Plan: Existing Conditions
RS = 700
.045
1396.0
1395.5
1395.0
1394.5
1394.0
1393.5
Elevation (ft)
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta

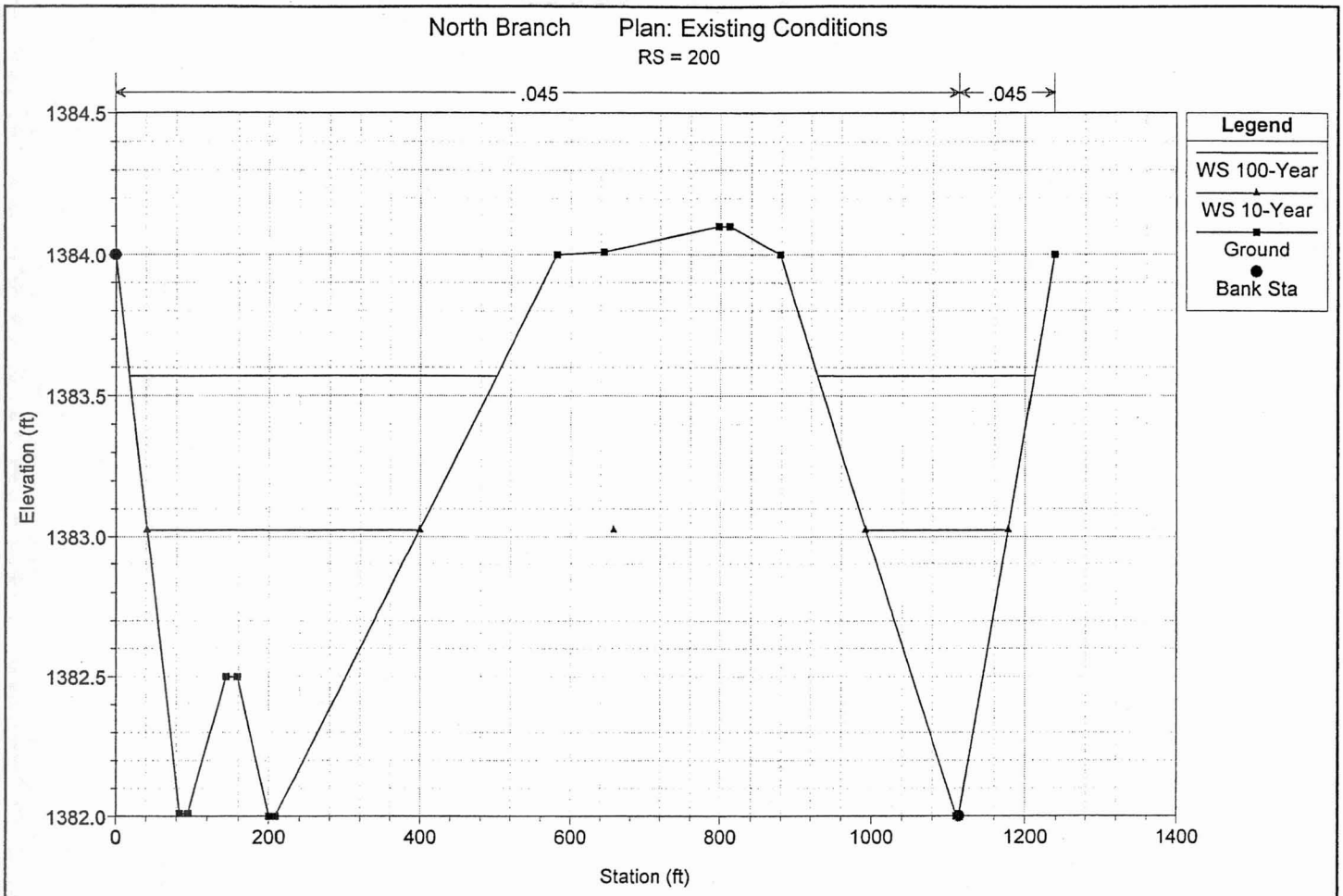

North Branch Plan: Existing Conditions
RS = 600
.045
1394.0
1393.5
1393.0
1392.5
1392.0
Elevation (ft)
1000
1200
1400
1600
1800
2000
Station (ft)
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta

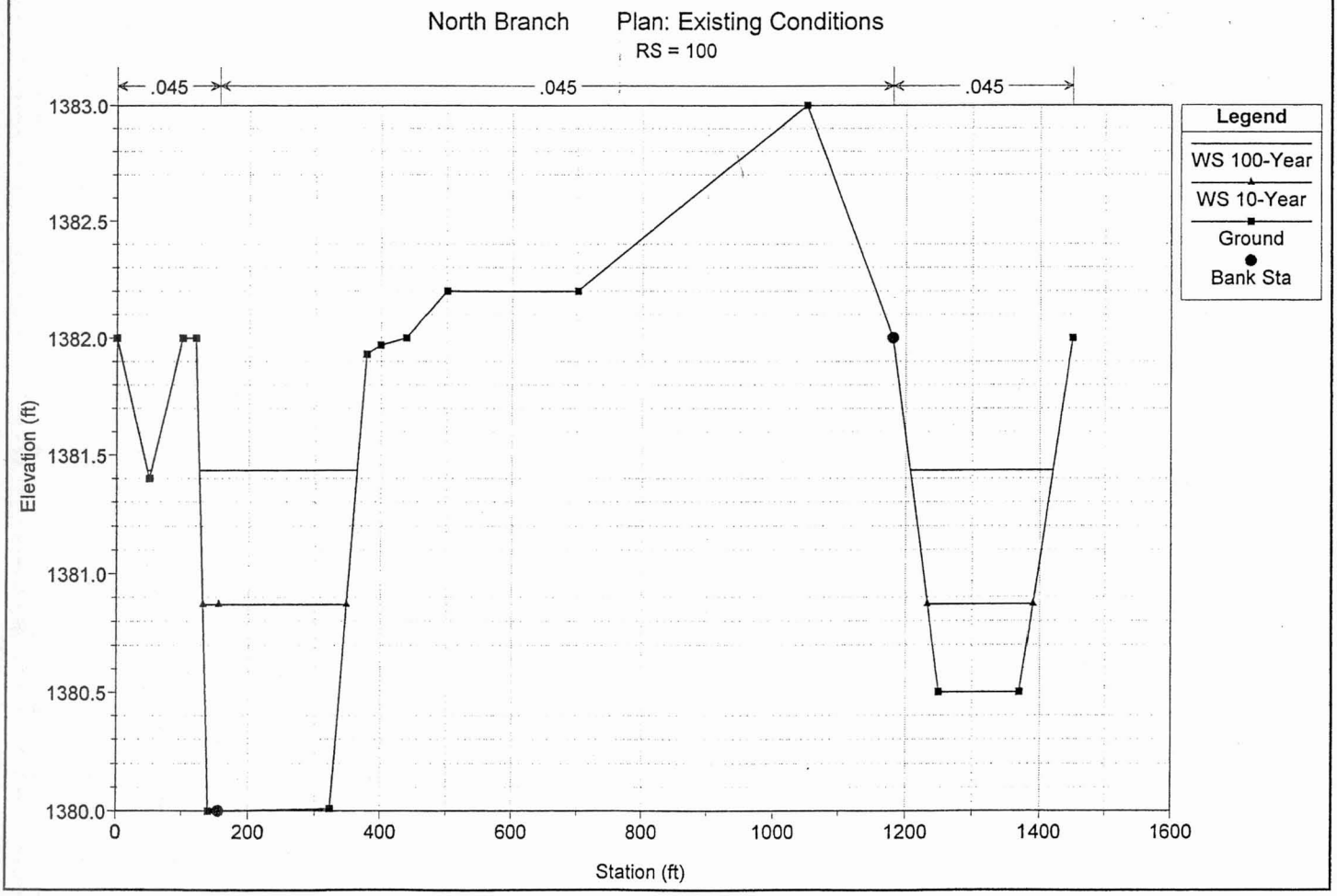

North Branch Plan: Existing Conditions
RS = 500
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1392.0
1391.5
1391.0
1390.5
1390.0
1389.5
1389.0
0
200
400
600
800
1000
Station (ft)


North Branch Plan: Existing Conditions
RS = 450
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1390.0
1389.5
1389.0
1388.5
1388.0
1387.5
0
200
400
600
800
1000
1200
Station (ft)


North Branch Plan: Existing Conditions
RS = 400
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
1388.0
1387.5
1387.0
1386.5
1386.0
1385.5
0
200
400
600
800
1000
1200
1400

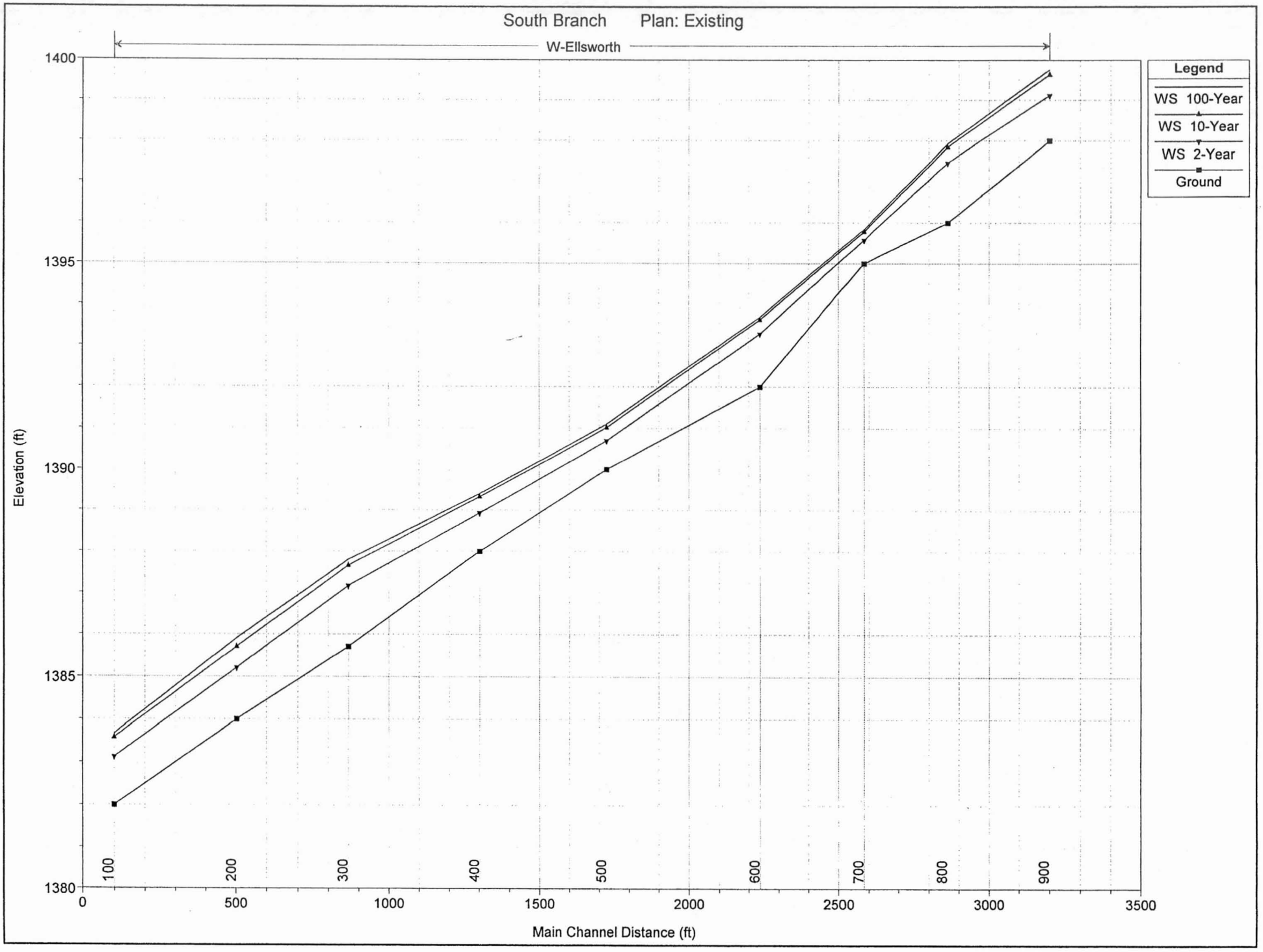

North Branch Plan: Existing Conditions
RS = 300
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
1386.0
1385.5
1385.0
1384.5
1384.0
0
200
400
600
800
1000
1200
1400

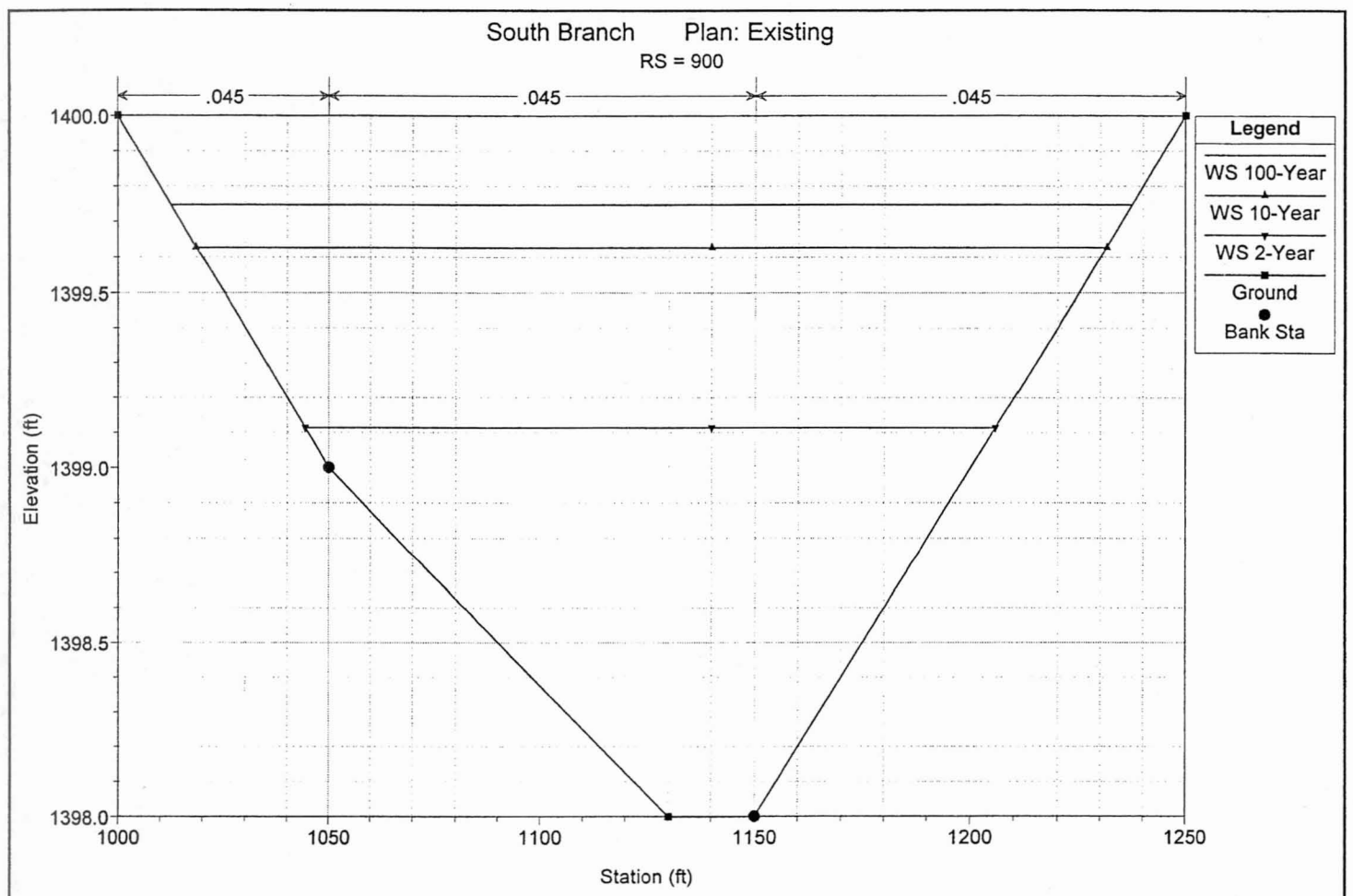

North Branch Plan: Existing Conditions
RS = 200
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1384.5
1384.0
1383.5
1383.0
1382.5
1382.0
0
200
400
600
800
1000
1200
1400
Station (ft)


North Branch Plan: Existing Conditions
RS = 100
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1383.0
1382.5
1382.0
1381.5
1381.0
1380.5
1380.0
0
200
400
600
800
1000
1200
1400
1600
Station (ft)

HEC-RAS Plan: Existing River: S-Branch Reach: W-Ellsworth

Reach	River Sta	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)	
W-Ellsworth	900	620.00	1398.00	1399.75	1399.26	1399.88	0.006037	3.13	225.24	224.83	0.48
W-Ellsworth	900	530.00	1398.00	1399.63	1399.17	1399.75	0.006252	2.99	198.83	212.76	0.48
W-Ellsworth	900	225.00	1398.00	1399.12	1398.80	1399.19	0.007597	2.30	102.83	161.45	0.48
W-Ellsworth	800	620.00	1396.00	1397.93	1397.43	1398.02	0.004965	2.59	251.52	245.52	0.42
W-Ellsworth	800	530.00	1396.00	1397.85	1397.35	1397.93	0.004608	2.38	232.58	240.85	0.40
W-Ellsworth	800	225.00	1396.00	1397.47	1397.09	1397.51	0.003481	1.57	146.35	218.32	0.33
W-Ellsworth	700	620.00	1395.00	1395.83	1395.68	1395.92	0.012694	2.36	272.85	599.76	0.59
W-Ellsworth	700	530.00	1395.00	1395.78	1395.65	1395.85	0.013828	2.28	239.78	582.98	0.60
W-Ellsworth	700	225.00	1395.00	1395.57	1395.45	1395.62	0.018116	1.74	127.62	522.08	0.62
W-Ellsworth	600	620.00	1392.00	1393.69	1393.26	1393.74	0.003761	2.88	383.64	548.48	0.39
W-Ellsworth	600	530.00	1392.00	1393.63	1393.24	1393.67	0.003615	2.75	348.68	532.49	0.38
W-Ellsworth	600	225.00	1392.00	1393.29	1392.95	1393.31	0.003441	2.29	181.36	433.49	0.36
W-Ellsworth	500	620.00	1390.00	1391.10	1390.87	1391.21	0.009695	3.47	255.92	421.47	0.58
W-Ellsworth	500	530.00	1390.00	1391.02	1390.81	1391.12	0.010414	3.41	221.25	392.20	0.60
W-Ellsworth	500	225.00	1390.00	1390.70	1390.55	1390.77	0.010834	2.71	114.18	283.32	0.57
W-Ellsworth	400	620.00	1388.00	1389.40	1388.83	1389.44	0.002372	2.02	455.18	608.65	0.30
W-Ellsworth	400	530.00	1388.00	1389.33	1388.77	1389.36	0.002274	1.90	410.77	578.33	0.29
W-Ellsworth	400	225.00	1388.00	1388.93	1388.53	1388.95	0.002342	1.52	212.60	417.00	0.28
W-Ellsworth	300	620.00	1385.71	1387.79		1387.88	0.005962	3.96	284.80	383.99	0.50
W-Ellsworth	300	530.00	1385.71	1387.65		1387.75	0.007079	4.10	233.56	339.05	0.54
W-Ellsworth	300	225.00	1385.71	1387.17		1387.25	0.007748	3.48	106.31	185.06	0.54
W-Ellsworth	200	620.00	1384.00	1385.91	1385.18	1385.96	0.004293	3.33	351.52	510.98	0.42
W-Ellsworth	200	530.00	1384.00	1385.71		1385.77	0.003924	2.95	257.16	314.83	0.40
W-Ellsworth	200	225.00	1384.00	1385.21		1385.25	0.003779	2.30	140.47	204.44	0.37
W-Ellsworth	100	620.00	1382.00	1383.67	1383.26	1383.77	0.007005	3.89	255.00	430.06	0.53
W-Ellsworth	100	530.00	1382.00	1383.58	1383.18	1383.68	0.007002	3.74	219.16	352.93	0.53
W-Ellsworth	100	225.00	1382.00	1383.12	1382.82	1383.19	0.007007	2.99	112.36	189.05	0.50


South Branch Plan: Existing
W-Ellsworth
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Elevation (ft)
1400
1395
1390
1385
1380
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (ft)
100
200
300
400
500
600
700
800
900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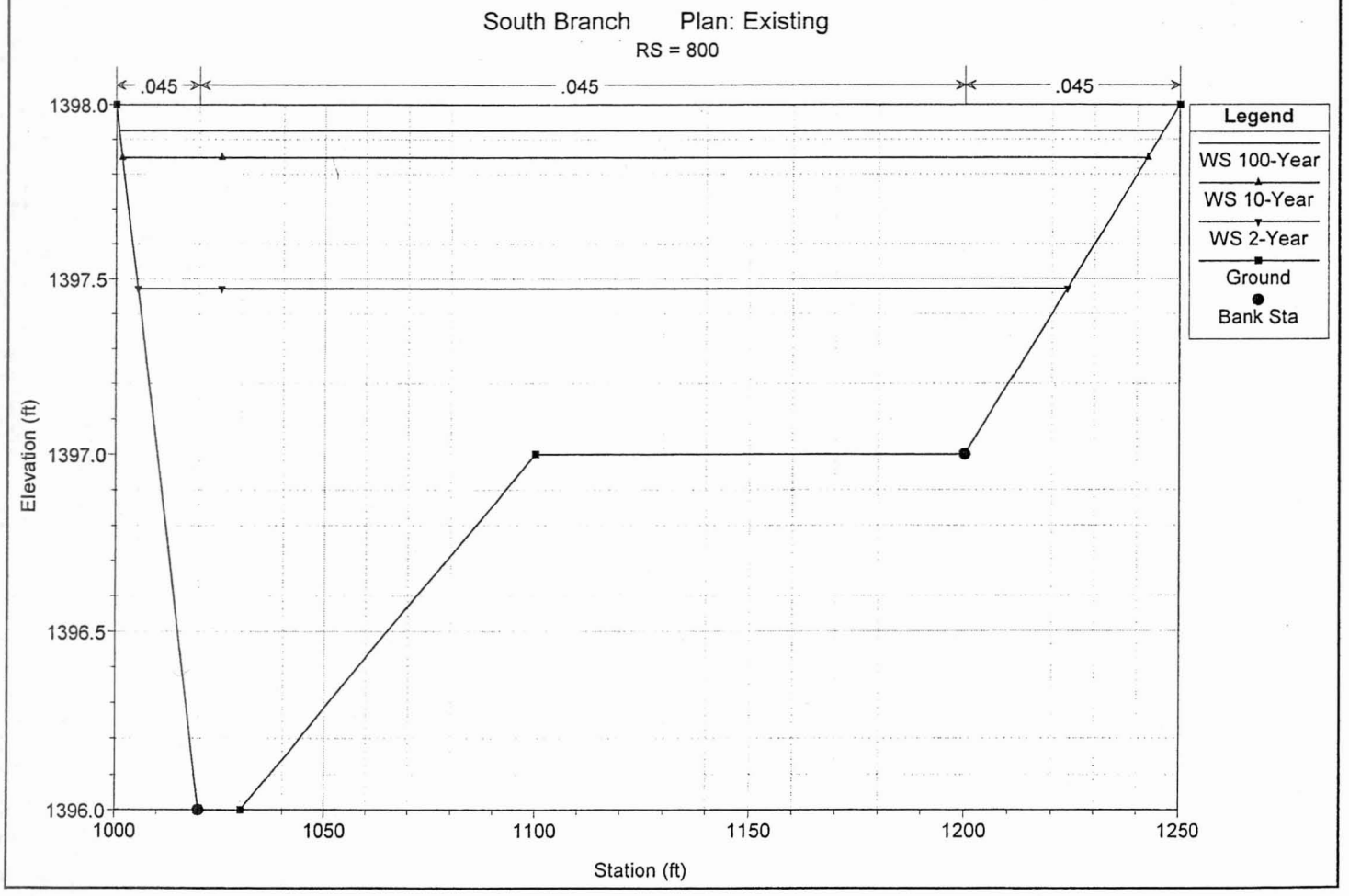
.045
.045
.045
1400.0
1399.5
1399.0
1398.5
1398.0
Elevation (ft)
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta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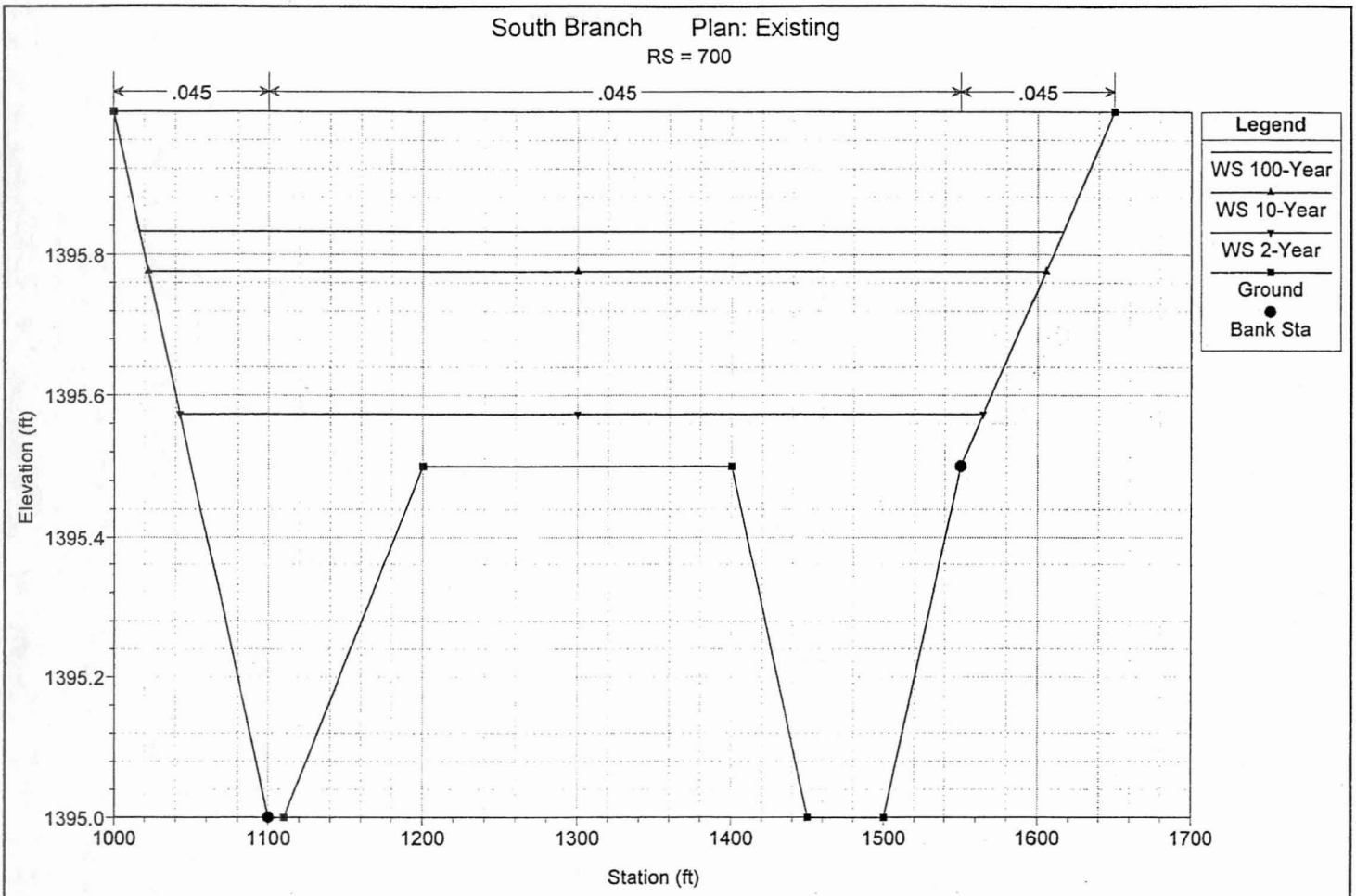
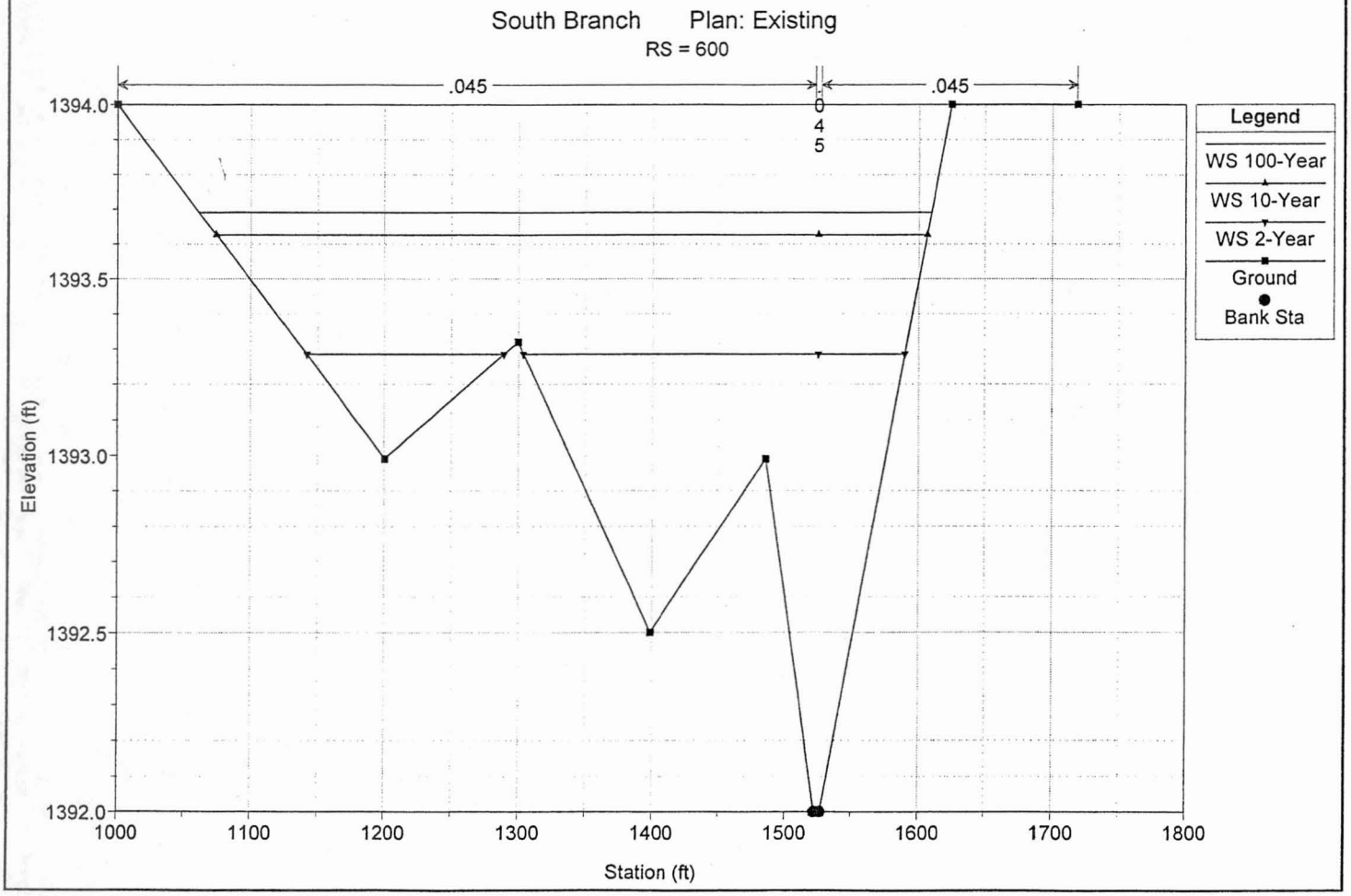
.045
.045
1398.0
1397.5
1397.0
1396.5
1396.0
Elevation (ft)
1000
1050
1100
1150
1200
1250
Station (ft)
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta


South Branch Plan: Existing
RS = 700
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1395.8
1395.6
1395.4
1395.2
1395.0
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)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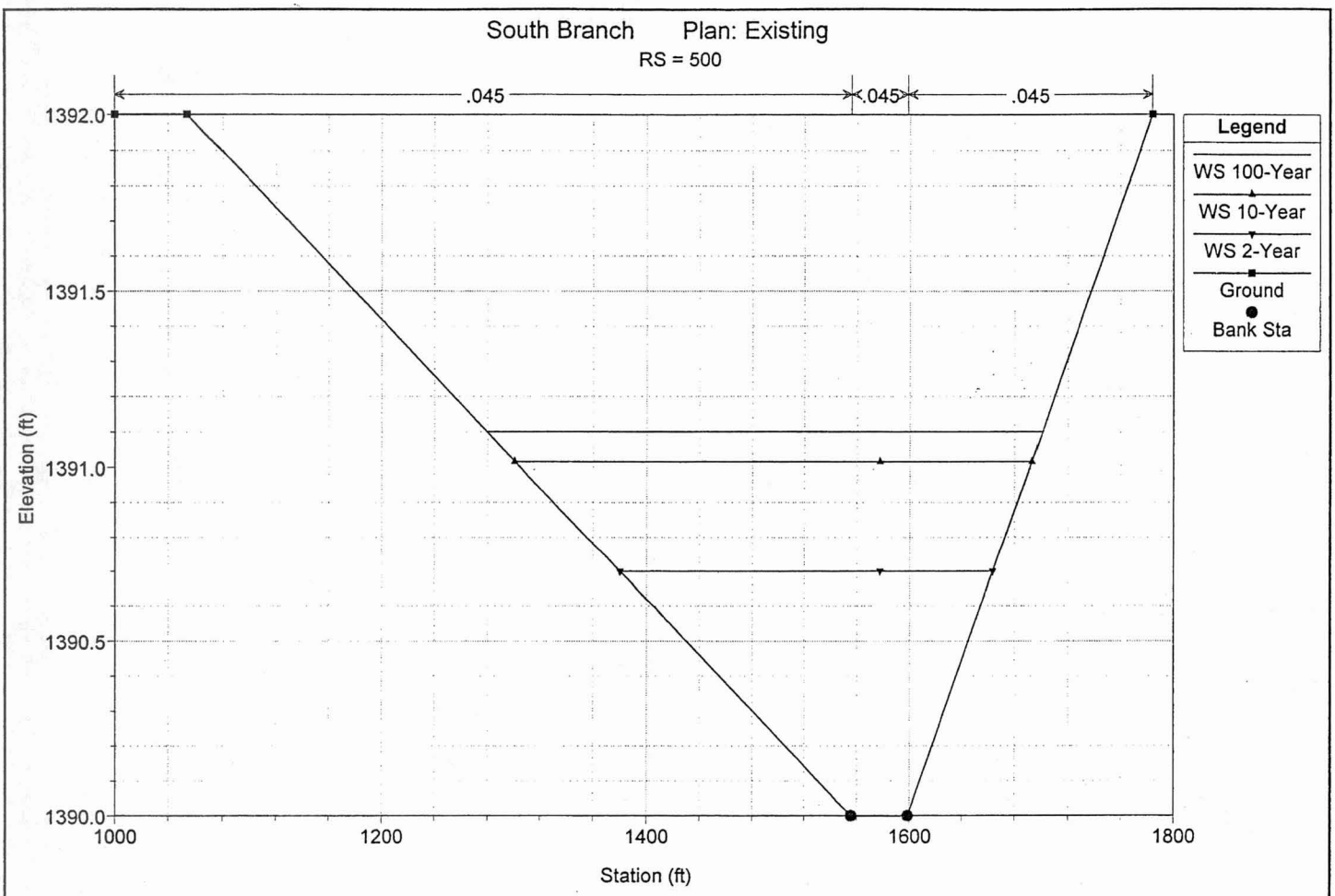
RS = 600
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1394.0
1393.5
1393.0
1392.5
1392.0
1000
1100
1200
1300
1400
1500
1600
1700
1800
Station (ft)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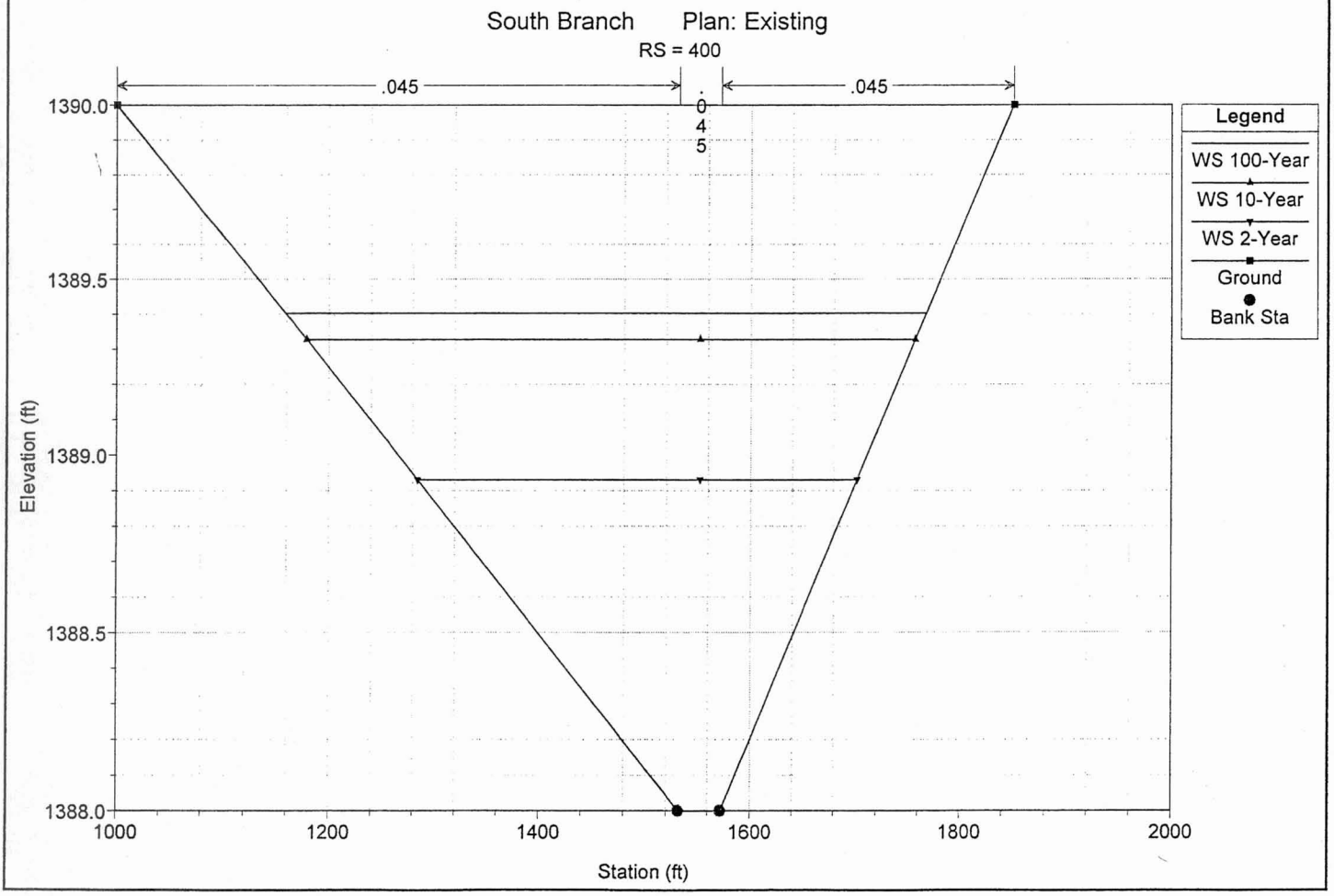
.045
.045
.045
1392.0
1391.5
1391.0
1390.5
1390.0
Elevation (ft)
1000
1200
1400
1600
1800
Station (ft)
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta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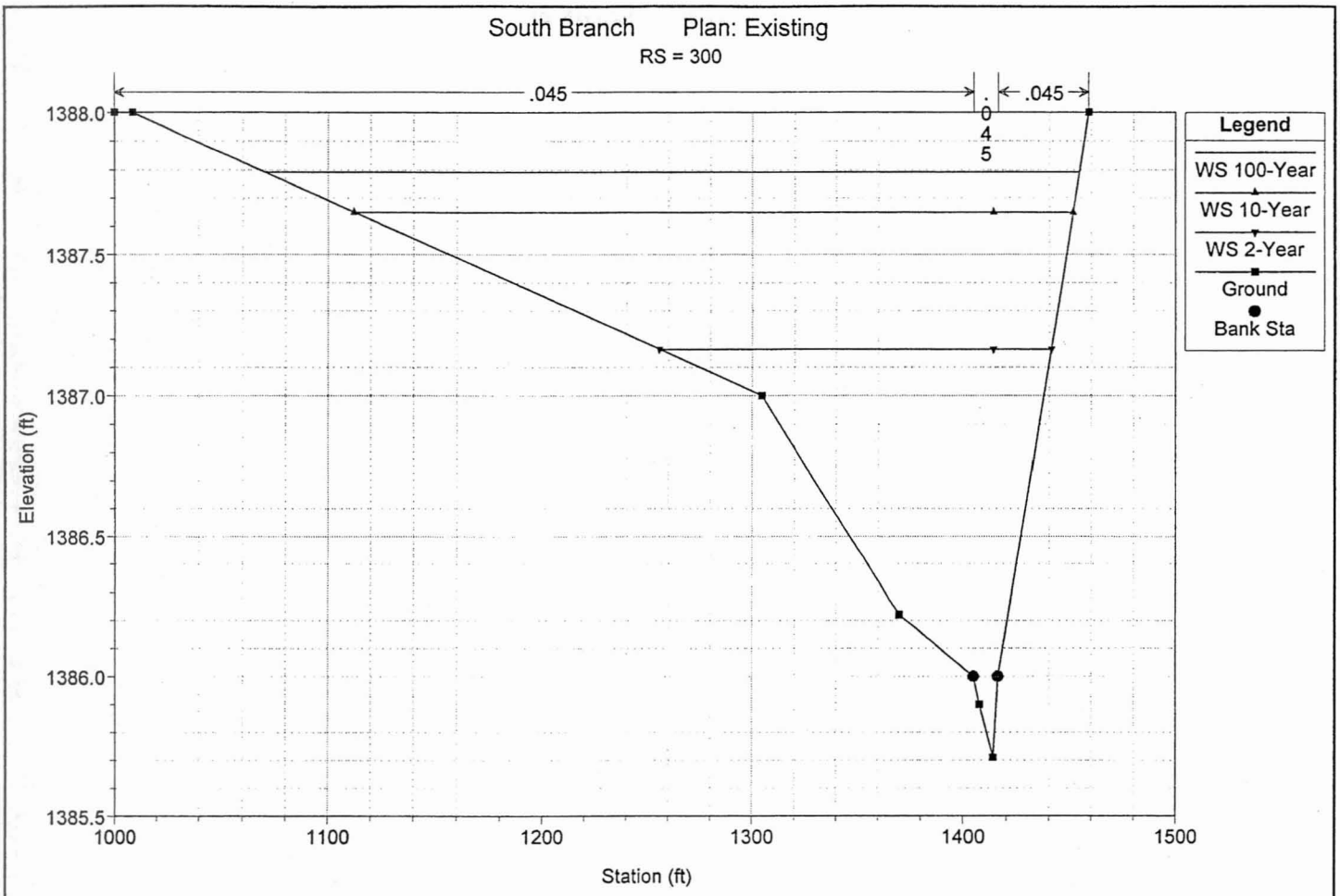
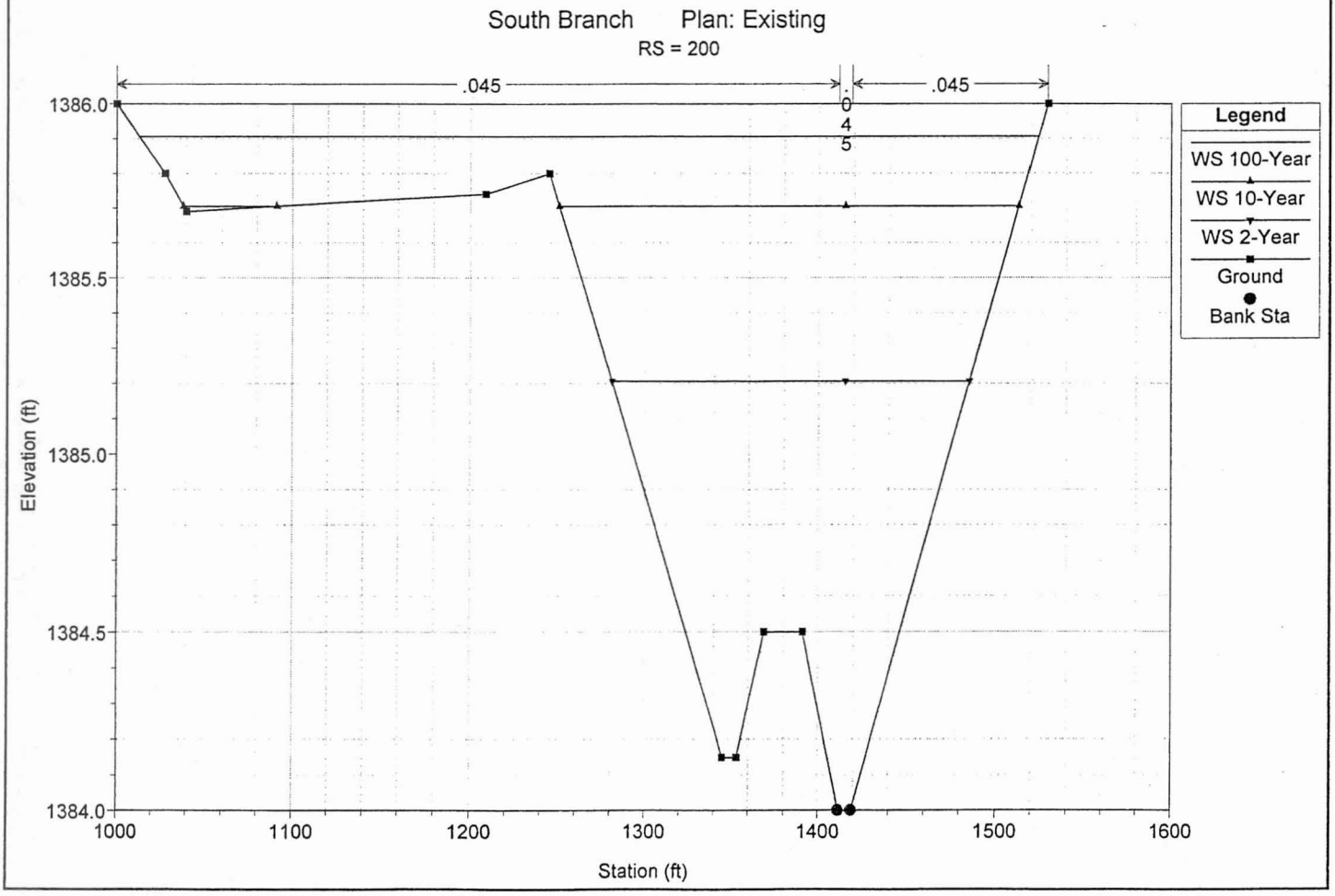
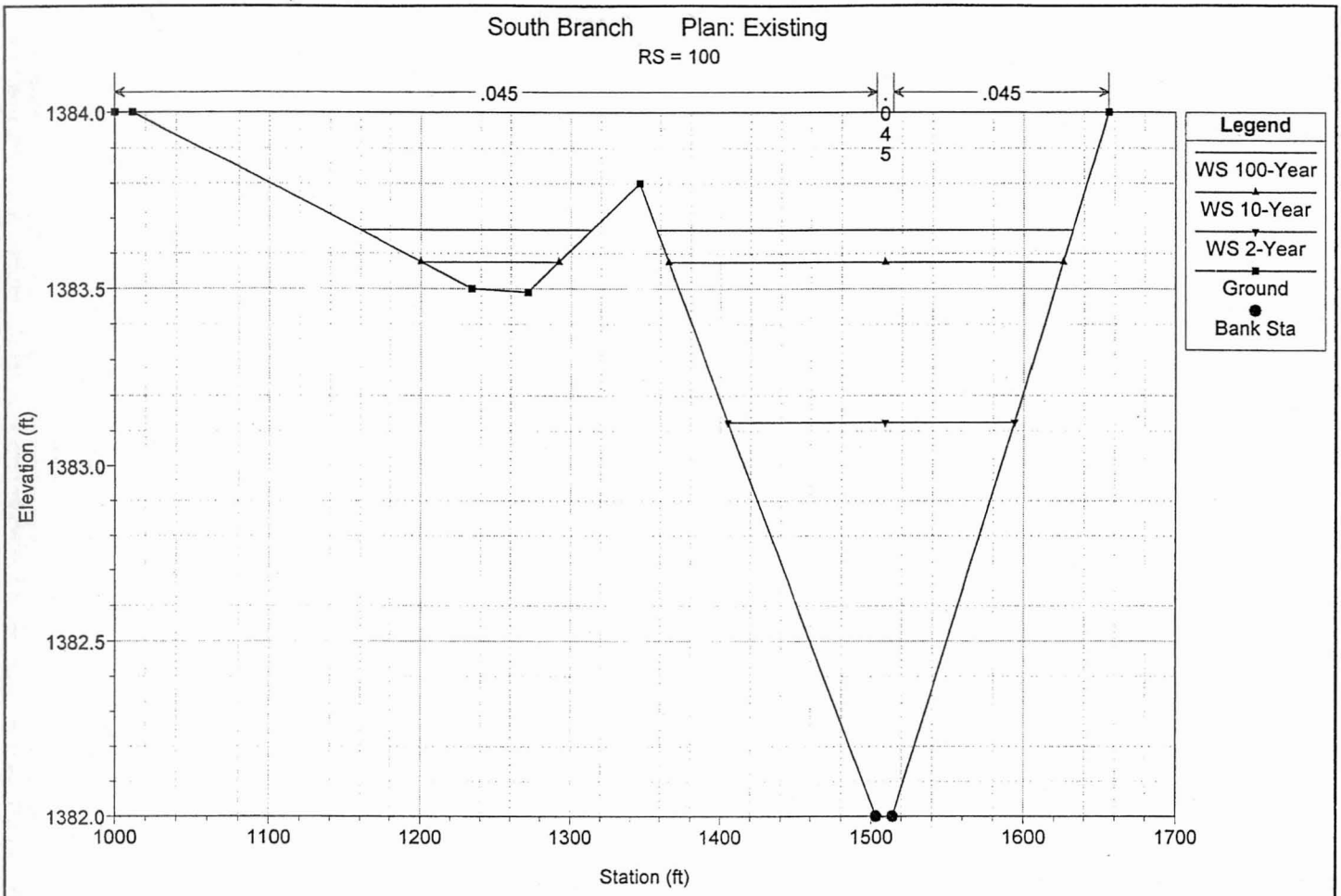
RS = 400
.045
.045
.045
1390.0
1389.5
1389.0
1388.5
1388.0
Elevation (ft)
1000
1200
1400
1600
1800
2000
Station (ft)
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta


South Branch Plan: Existing
RS = 300
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
1388.0
1387.5
1387.0
1386.5
1386.0
1385.5
1000
1100
1200
1300
1400
1500


South Branch Plan: Existing
RS = 200
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
1386.0
1385.5
1385.0
1384.5
1384.0
1000
1100
1200
1300
1400
1500
1600


South Branch Plan: Existing
RS = 100
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1384.0
1383.5
1383.0
1382.5
1382.0
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)

APPENDIX C

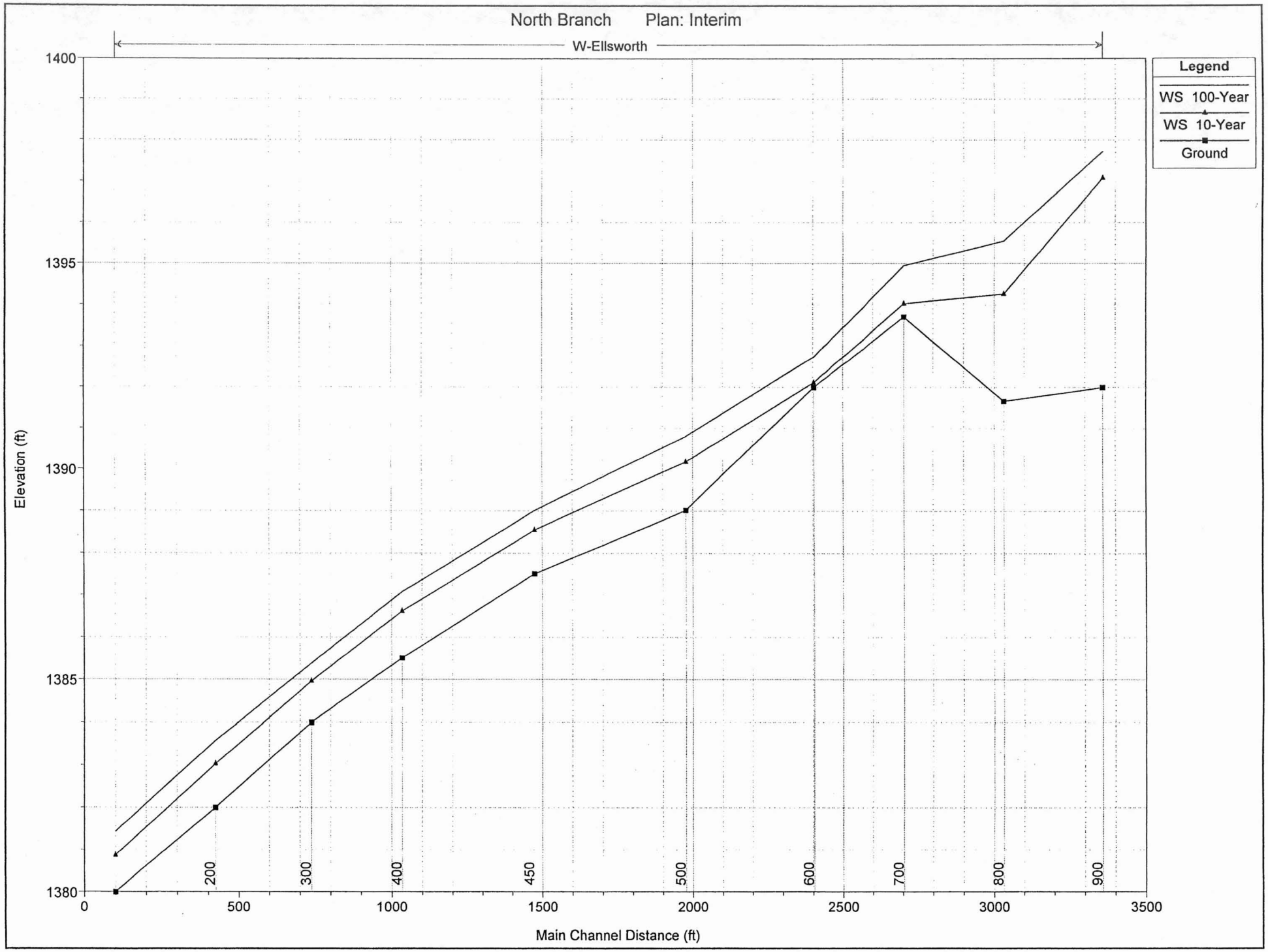
HEC-RAS MODELING RESULTS FOR INTERIM CONDITIONS

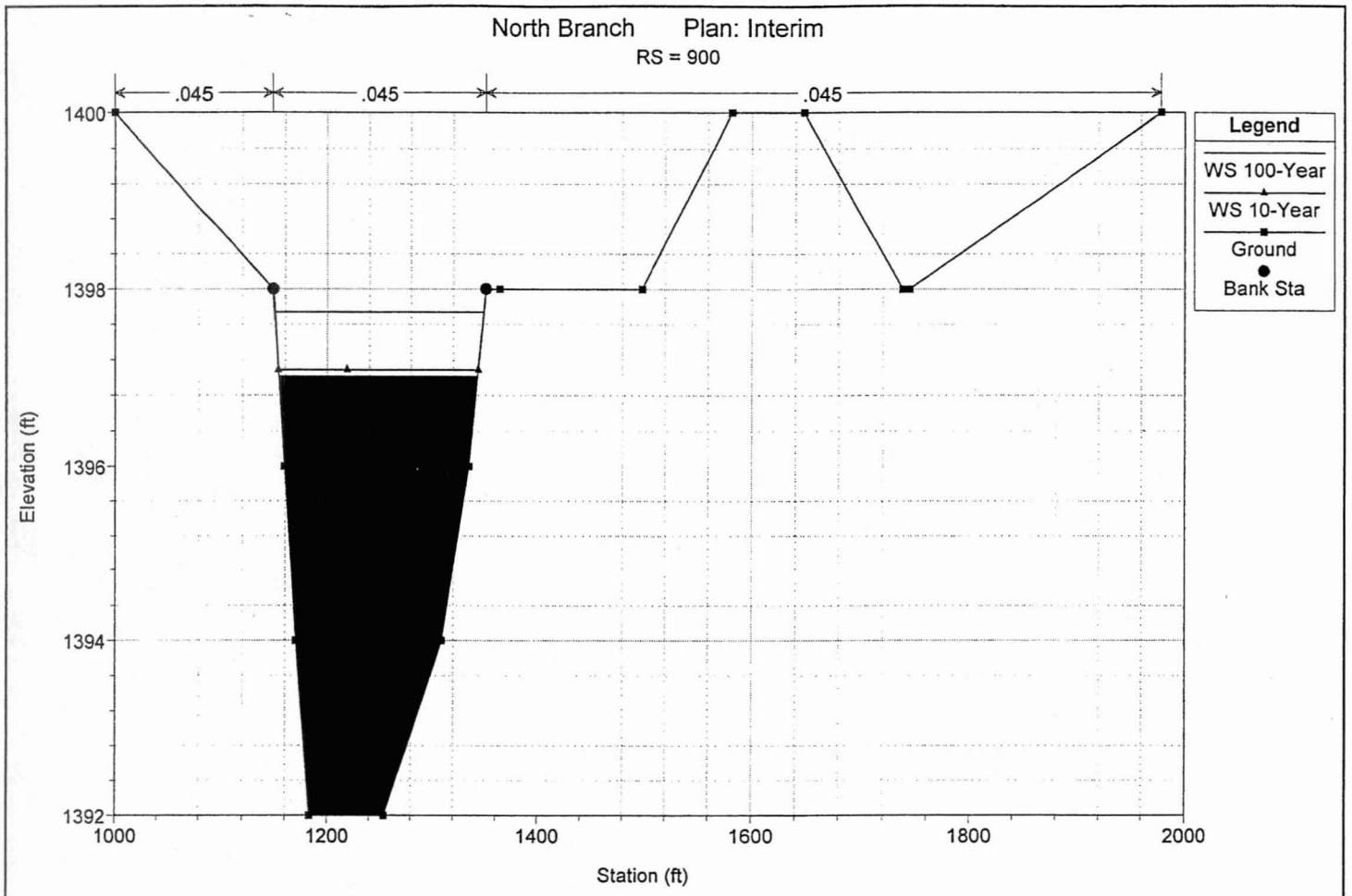
NORTH BRANCH

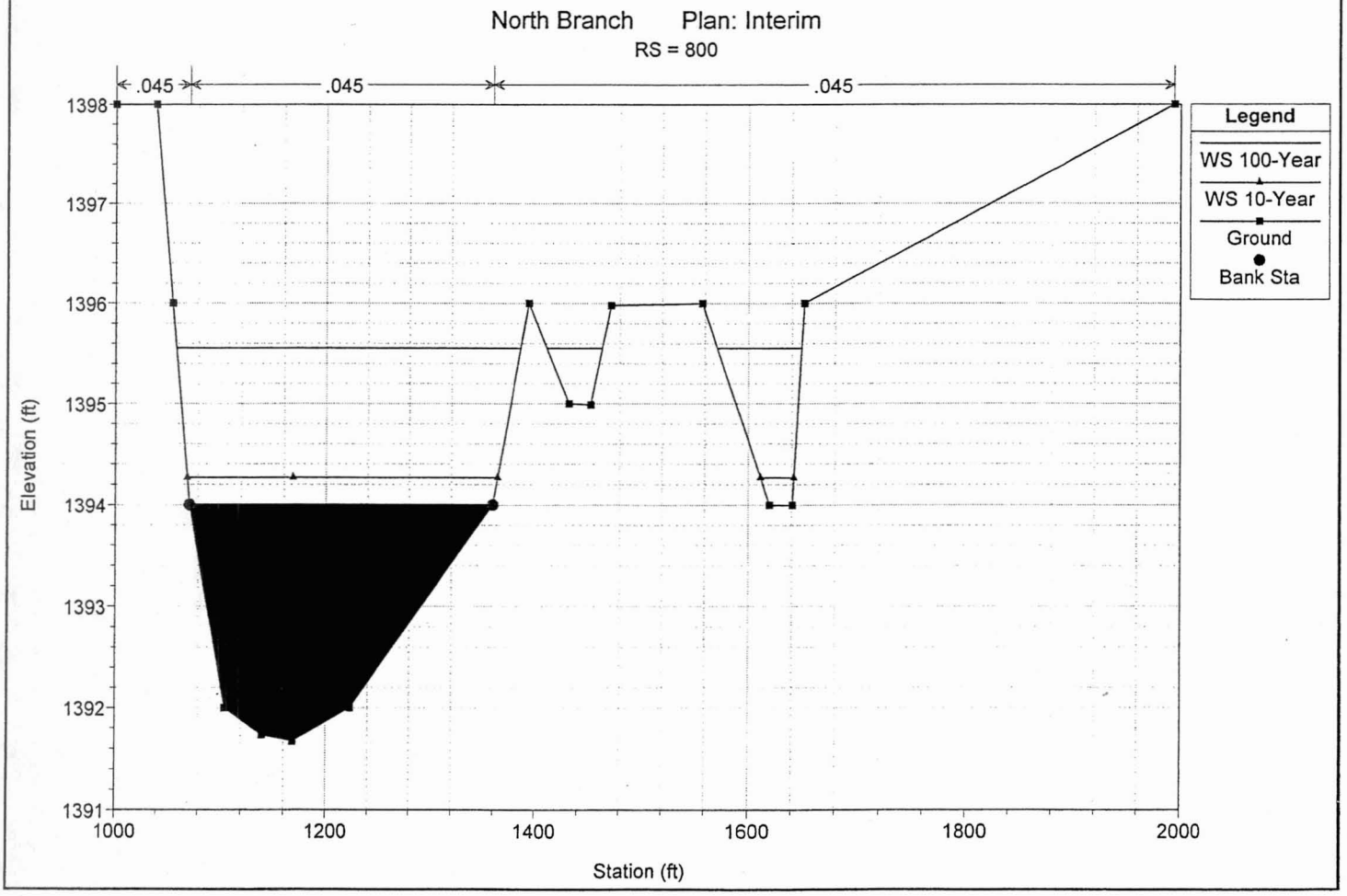
SOUTH BRANCH

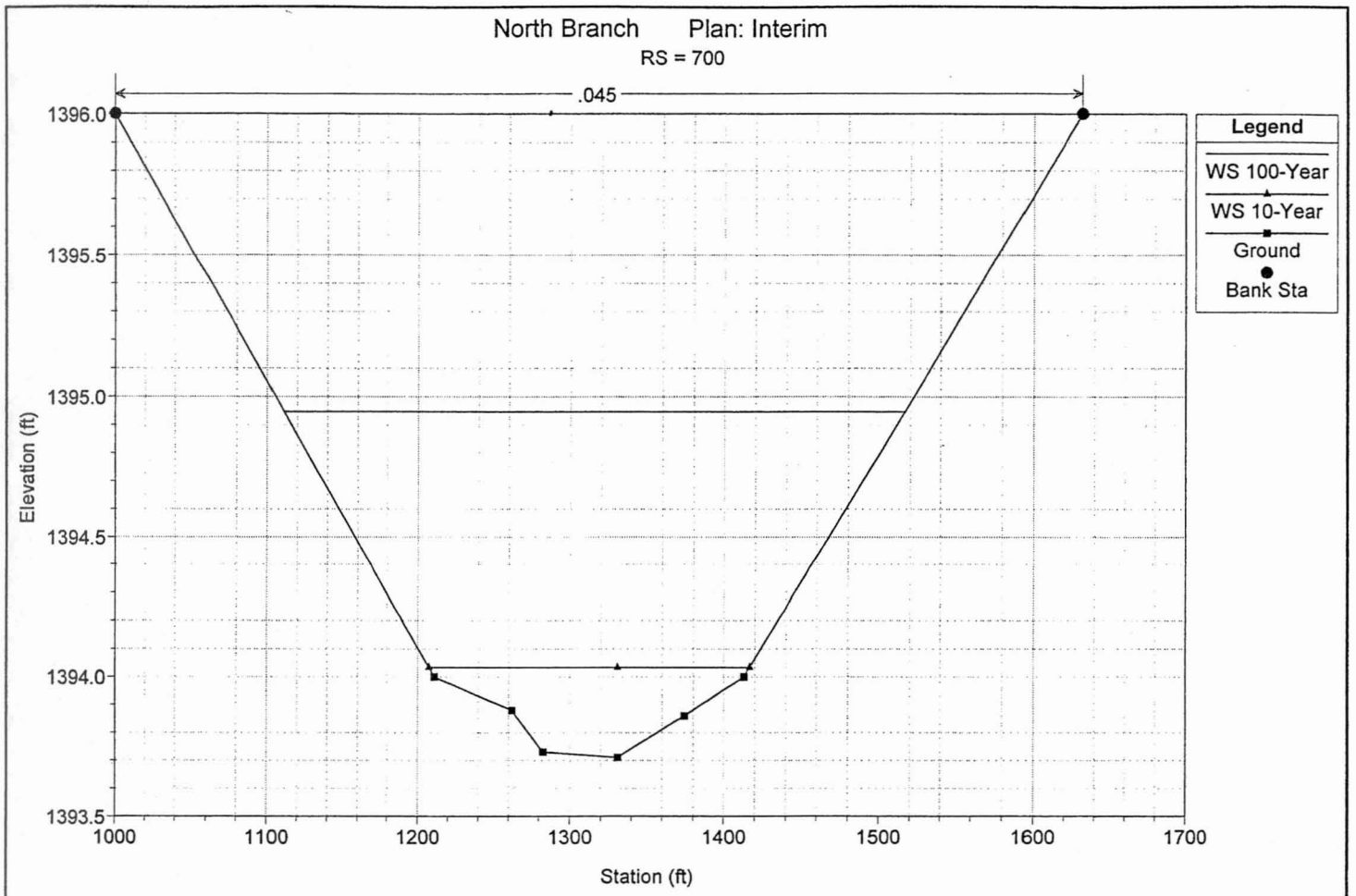
HEC-RAS Plan: Interim River: N-Branch Reach: W-Ellsworth

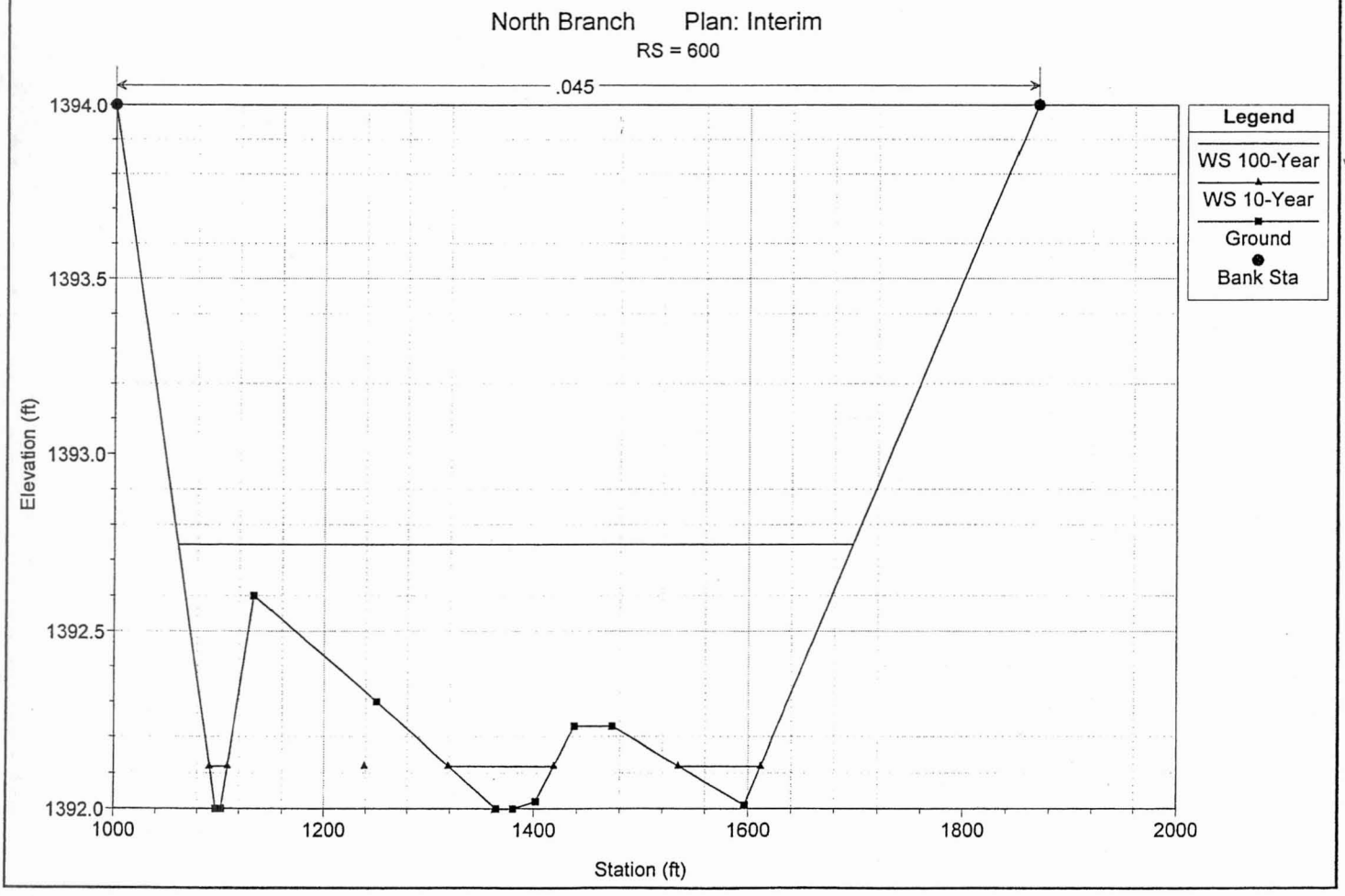
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
W-Ellsworth	900	665.00	1397.02	1397.74	1397.74	1398.09	0.033285	4.76	139.58	198.37	1.00
W-Ellsworth	900	20.00	1397.02	1397.09	1397.09	1397.13	0.075831	1.53	13.08	189.83	1.03
W-Ellsworth	800	665.00	1393.89	1395.55	1394.52	1395.58	0.000815	1.26	571.83	457.58	0.18
W-Ellsworth	800	20.00	1393.89	1394.27	1394.06	1394.27	0.000339	0.25	82.11	325.04	0.09
W-Ellsworth	700	665.00	1393.71	1394.95	1394.50	1395.01	0.005410	2.08	320.39	405.54	0.41
W-Ellsworth	700	20.00	1393.71	1394.03	1393.86	1394.04	0.002162	0.51	39.55	209.27	0.20
W-Ellsworth	600	665.00	1392.00	1392.74	1392.55	1392.81	0.010420	2.11	315.06	635.79	0.53
W-Ellsworth	600	20.00	1392.00	1392.12	1392.12	1392.15	0.071233	1.49	13.46	194.40	1.00
W-Ellsworth	500	665.00	1389.02	1390.81		1390.84	0.002604	1.38	483.61	655.58	0.28
W-Ellsworth	500	20.00	1389.02	1390.19	1389.57	1390.19	0.000120	0.15	130.82	475.11	0.05
W-Ellsworth	450	1415.00	1387.51	1389.01		1389.06	0.004141	1.85	765.16	942.35	0.36
W-Ellsworth	450	513.00	1387.51	1388.55		1388.58	0.004526	1.36	376.11	781.69	0.35
W-Ellsworth	400	1415.00	1385.51	1387.08		1387.13	0.004636	1.85	764.02	1021.75	0.38
W-Ellsworth	400	513.00	1385.51	1386.62		1386.65	0.004271	1.38	370.93	722.78	0.34
W-Ellsworth	300	1415.00	1384.00	1385.38		1385.46	0.006976	2.21	641.00	895.10	0.46
W-Ellsworth	300	513.00	1384.00	1384.96		1385.00	0.007472	1.67	306.80	684.22	0.44
W-Ellsworth	200	1415.00	1382.00	1383.57	1383.04	1383.64	0.004837	2.12	672.07	766.60	0.40
W-Ellsworth	200	513.00	1382.00	1383.02		1383.07	0.005131	1.65	313.08	543.66	0.38
W-Ellsworth	100	1415.00	1380.00	1381.44	1381.07	1381.60	0.008002	3.50	456.70	456.56	0.54
W-Ellsworth	100	513.00	1380.00	1380.87	1380.65	1380.96	0.008002	2.57	224.37	372.92	0.50

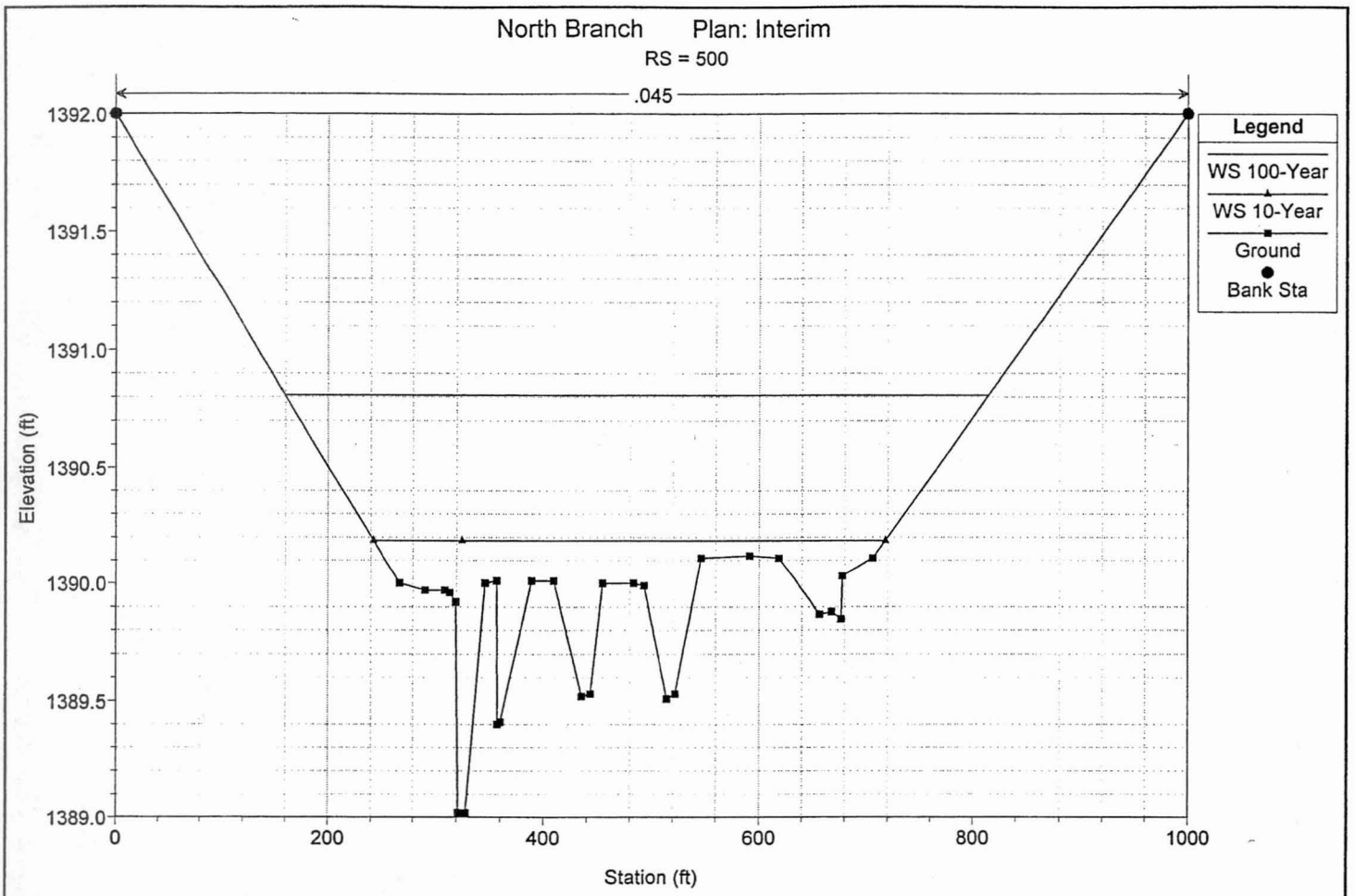

North Branch Plan: Interim
W-Ellsworth
Legend
WS 100-Year
WS 10-Year
Ground
Elevation (ft)
1400
1395
1390
1385
1380
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (ft)
200
300
400
450
500
600
700
800
900

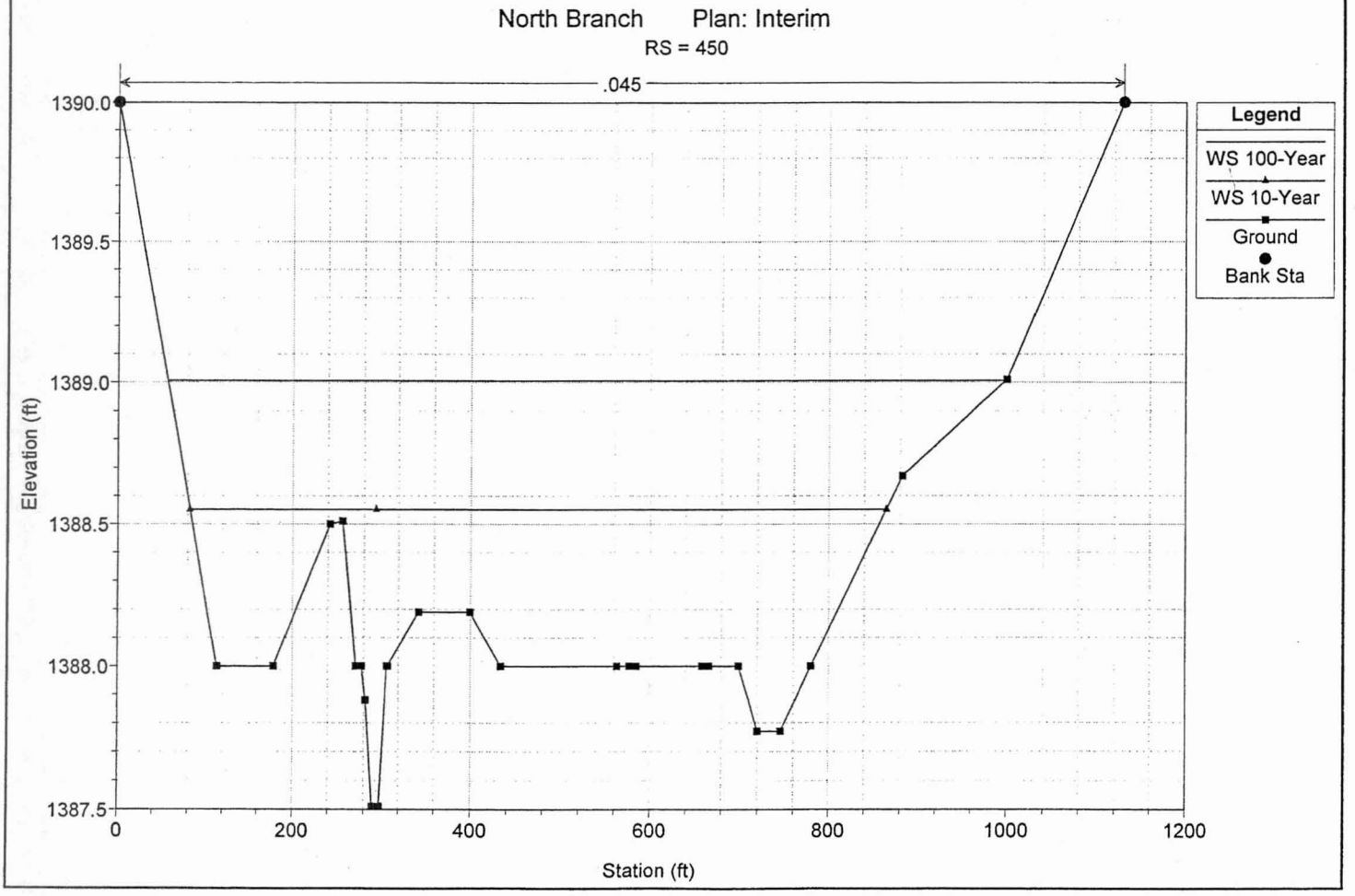

North Branch Plan: Interim
RS = 900
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1400
1398
1396
1394
1392
1000
1200
1400
1600
1800
2000
Station (ft)

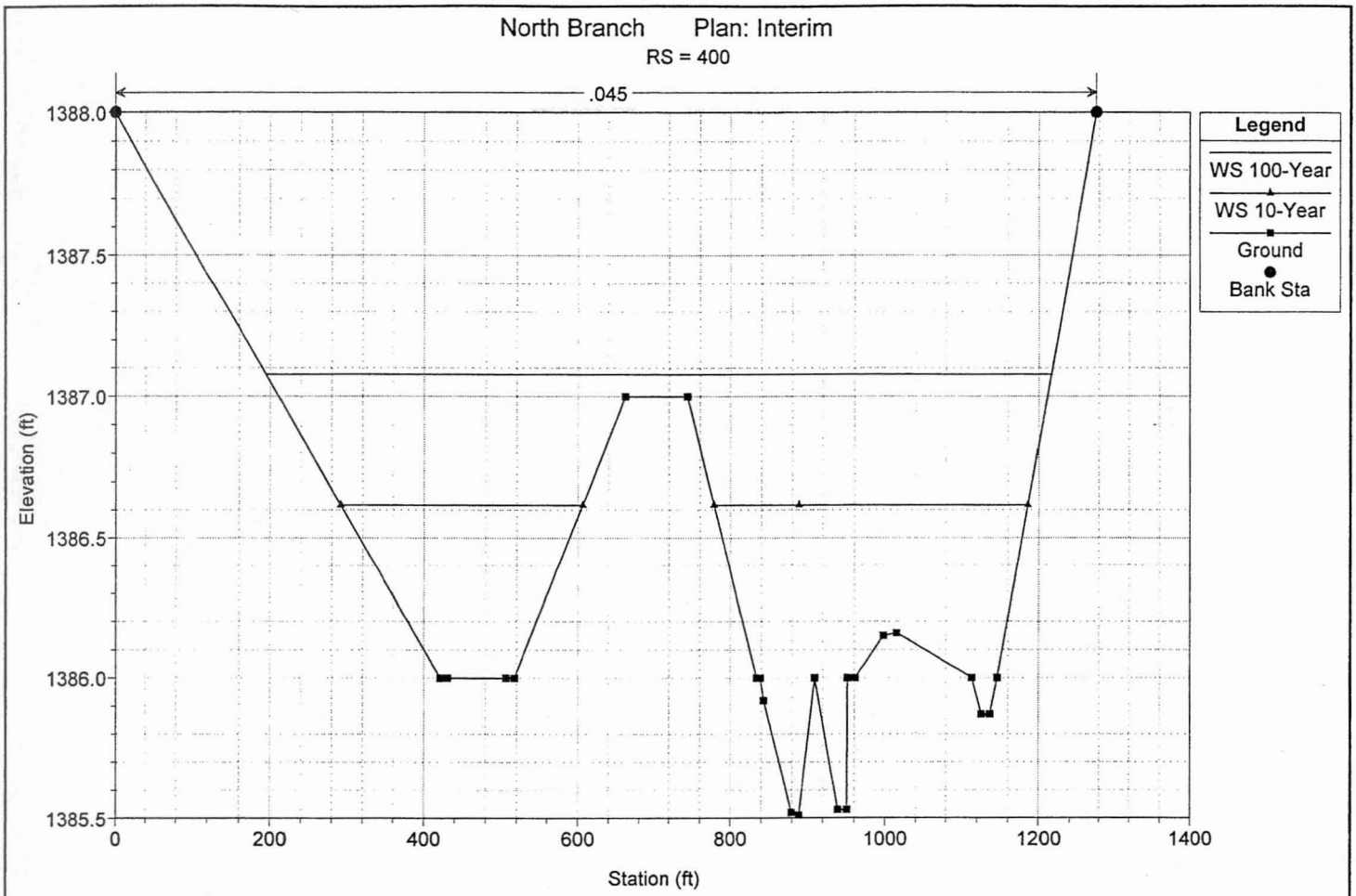

North Branch Plan: Interim
RS = 800
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1398
1397
1396
1395
1394
1393
1392
1391
1000
1200
1400
1600
1800
2000
Station (ft)

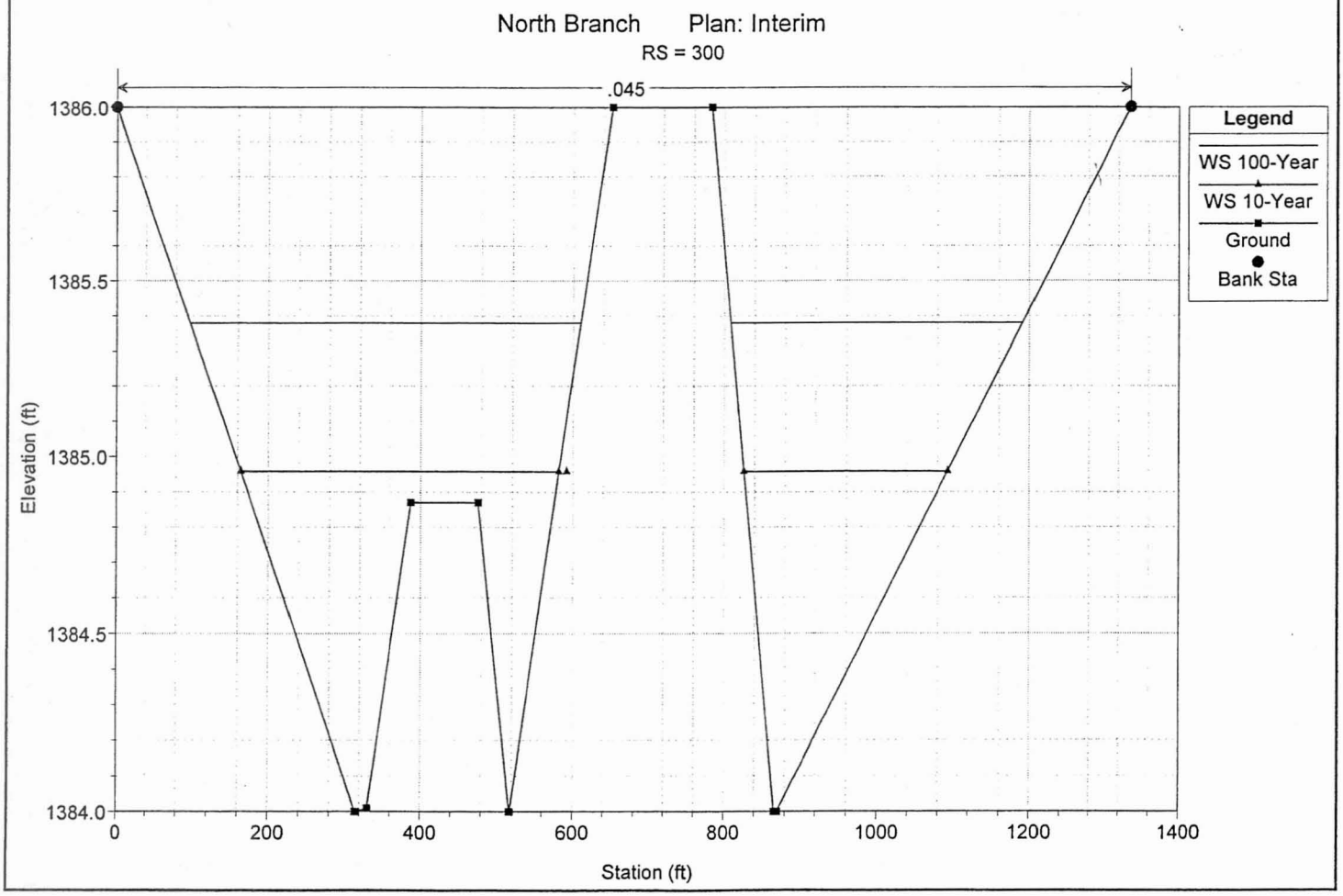

North Branch Plan: Interim
RS = 700
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1396.0
1395.5
1395.0
1394.5
1394.0
1393.5
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)

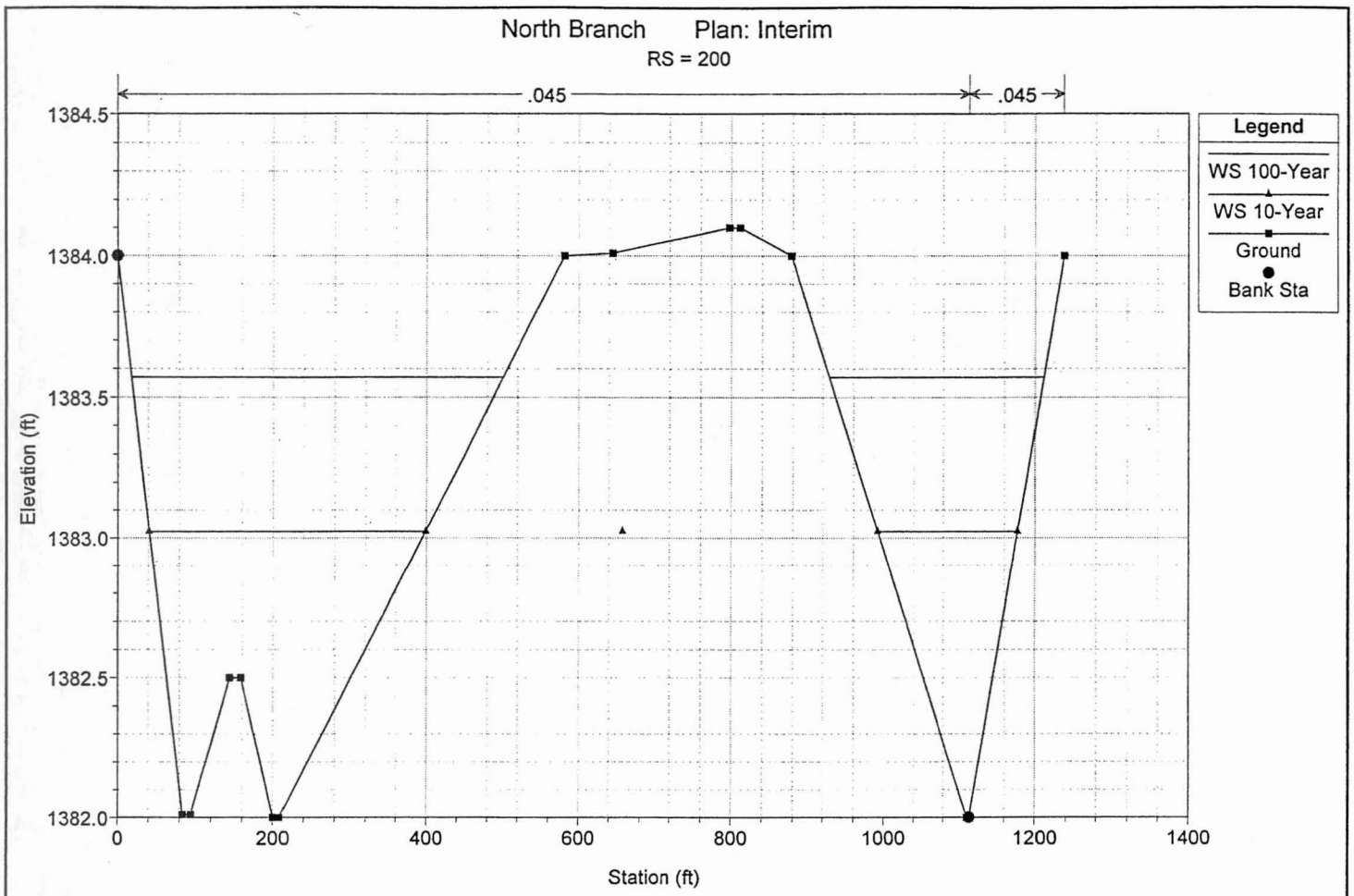

North Branch Plan: Interim
RS = 600
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1394.0
1393.5
1393.0
1392.5
1392.0
1000
1200
1400
1600
1800
2000
Station (ft)

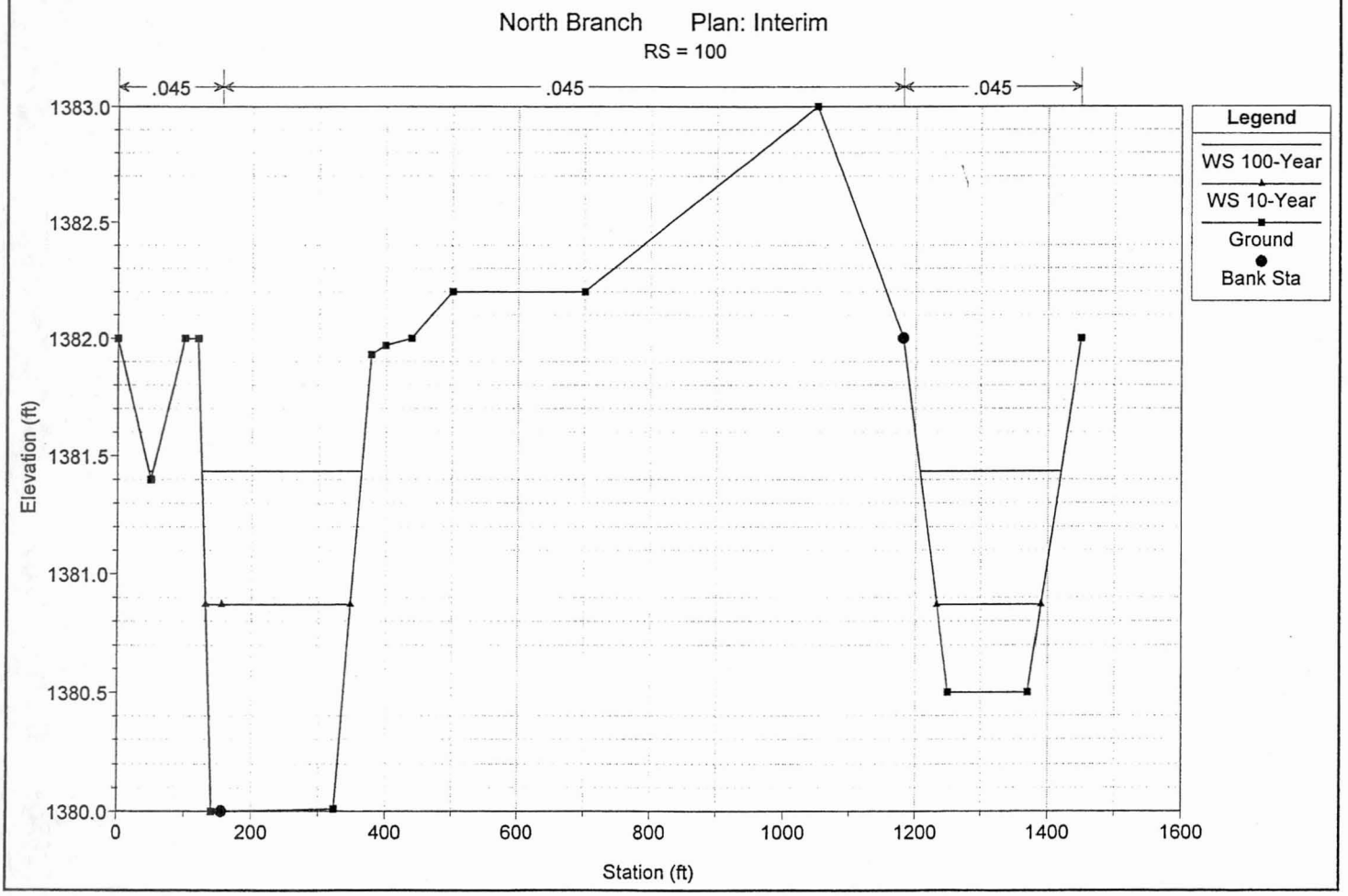

North Branch Plan: Interim
RS = 500
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1392.0
1391.5
1391.0
1390.5
1390.0
1389.5
1389.0
0
200
400
600
800
1000
Station (ft)


North Branch Plan: Interim
RS = 450
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1390.0
1389.5
1389.0
1388.5
1388.0
1387.5
0
200
400
600
800
1000
1200
Station (ft)


North Branch Plan: Interim
RS = 400
.045
1388.0
1387.5
1387.0
1386.5
1386.0
1385.5
Elevation (ft)
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta

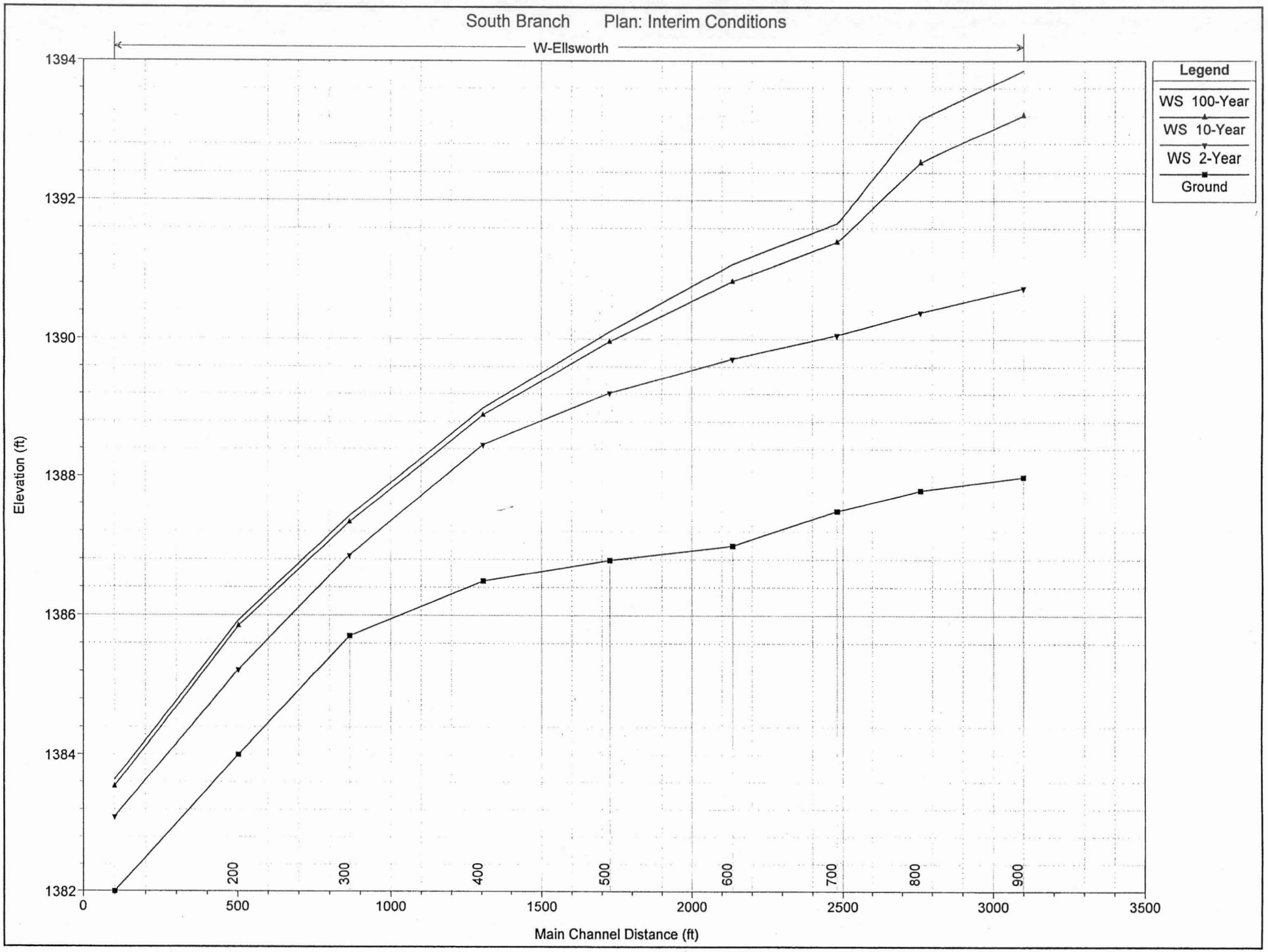

North Branch Plan: Interim
RS = 300
.045
1386.0
1385.5
1385.0
1384.5
1384.0
Elevation (ft)
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta

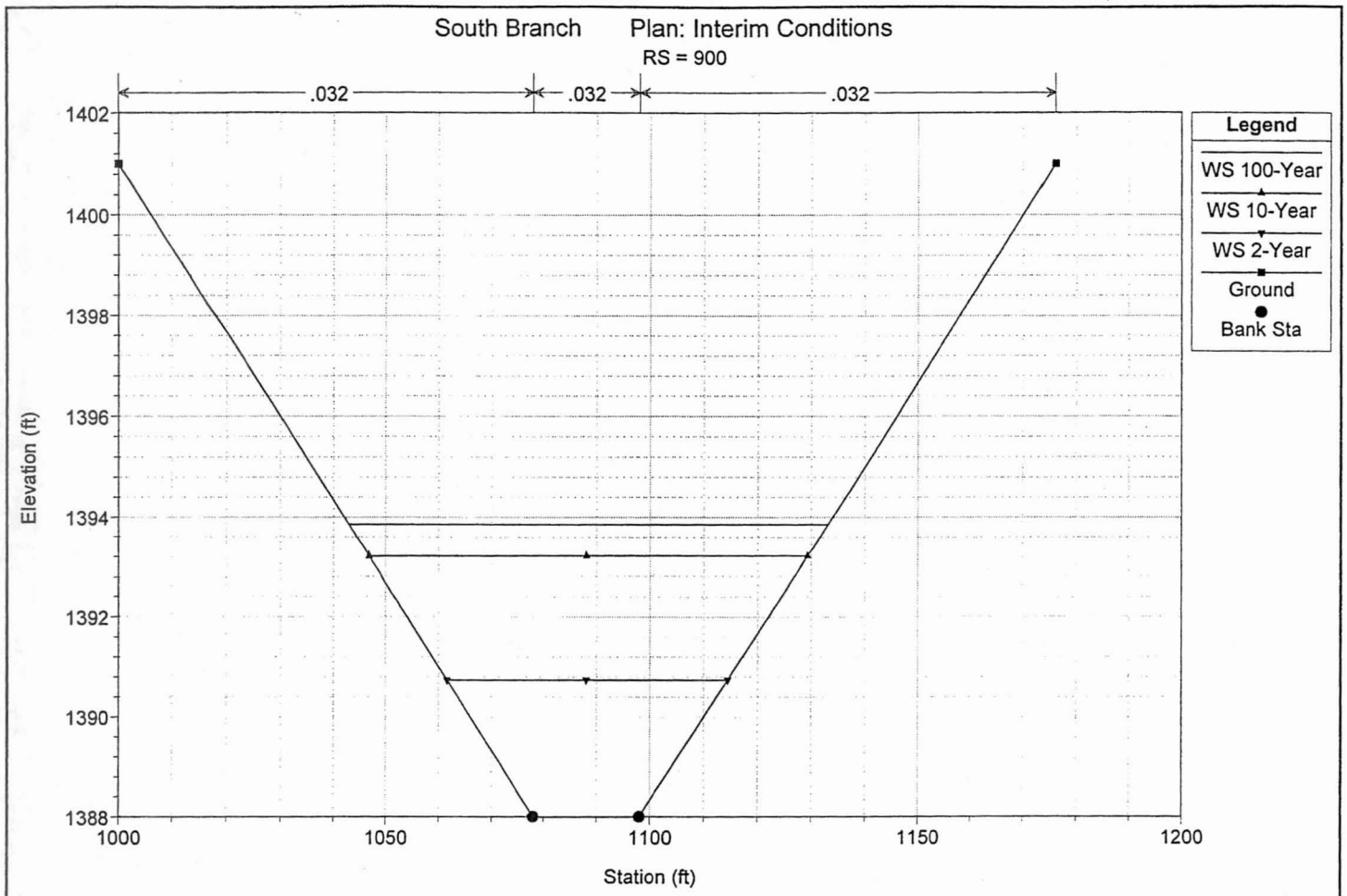

North Branch Plan: Interim
RS = 200
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1384.5
1384.0
1383.5
1383.0
1382.5
1382.0
0
200
400
600
800
1000
1200
1400
Station (ft)

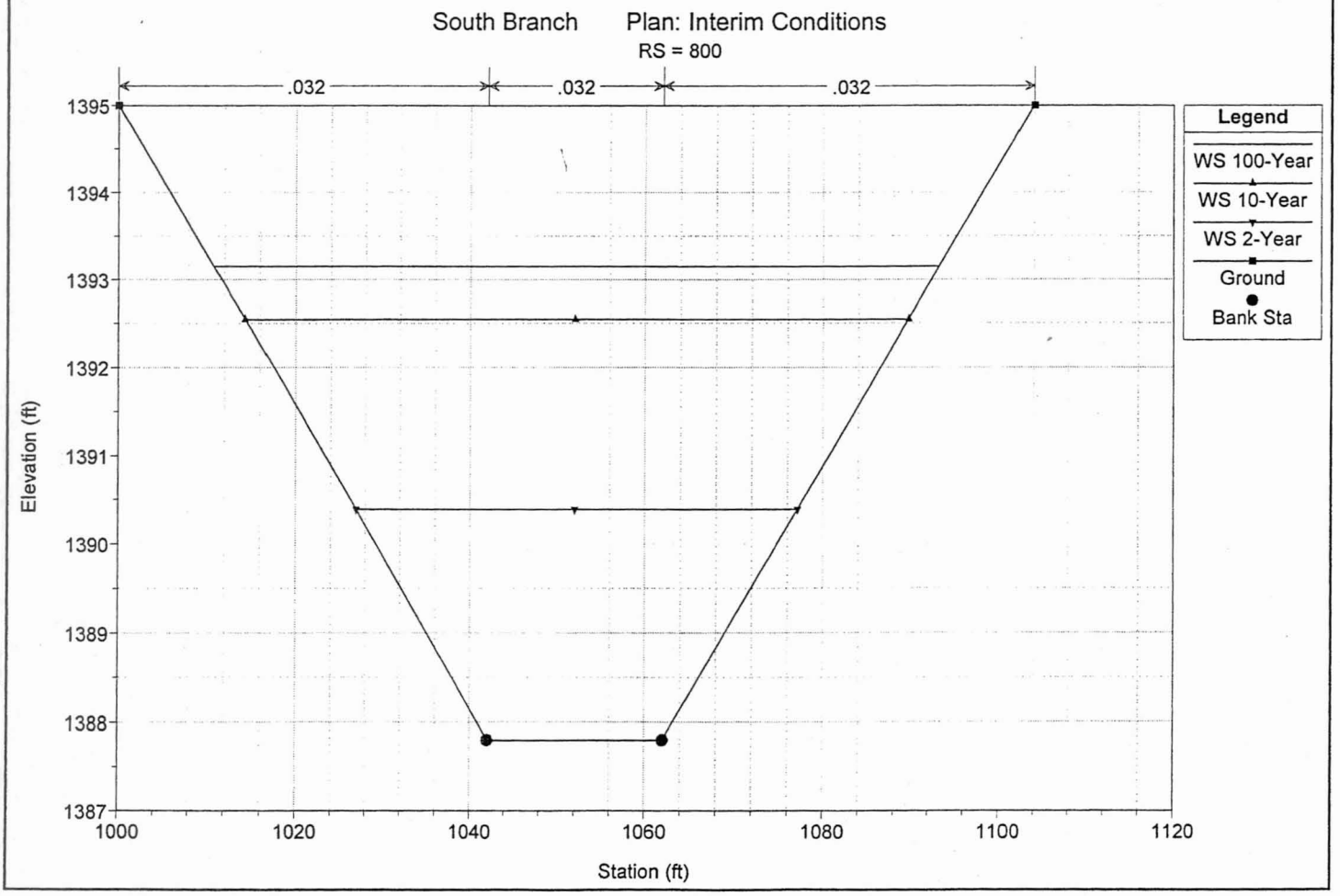

North Branch Plan: Interim
RS = 100
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
1383.0
1382.5
1382.0
1381.5
1381.0
1380.5
1380.0
0
200
400
600
800
1000
1200
1400
1600
Station (ft)

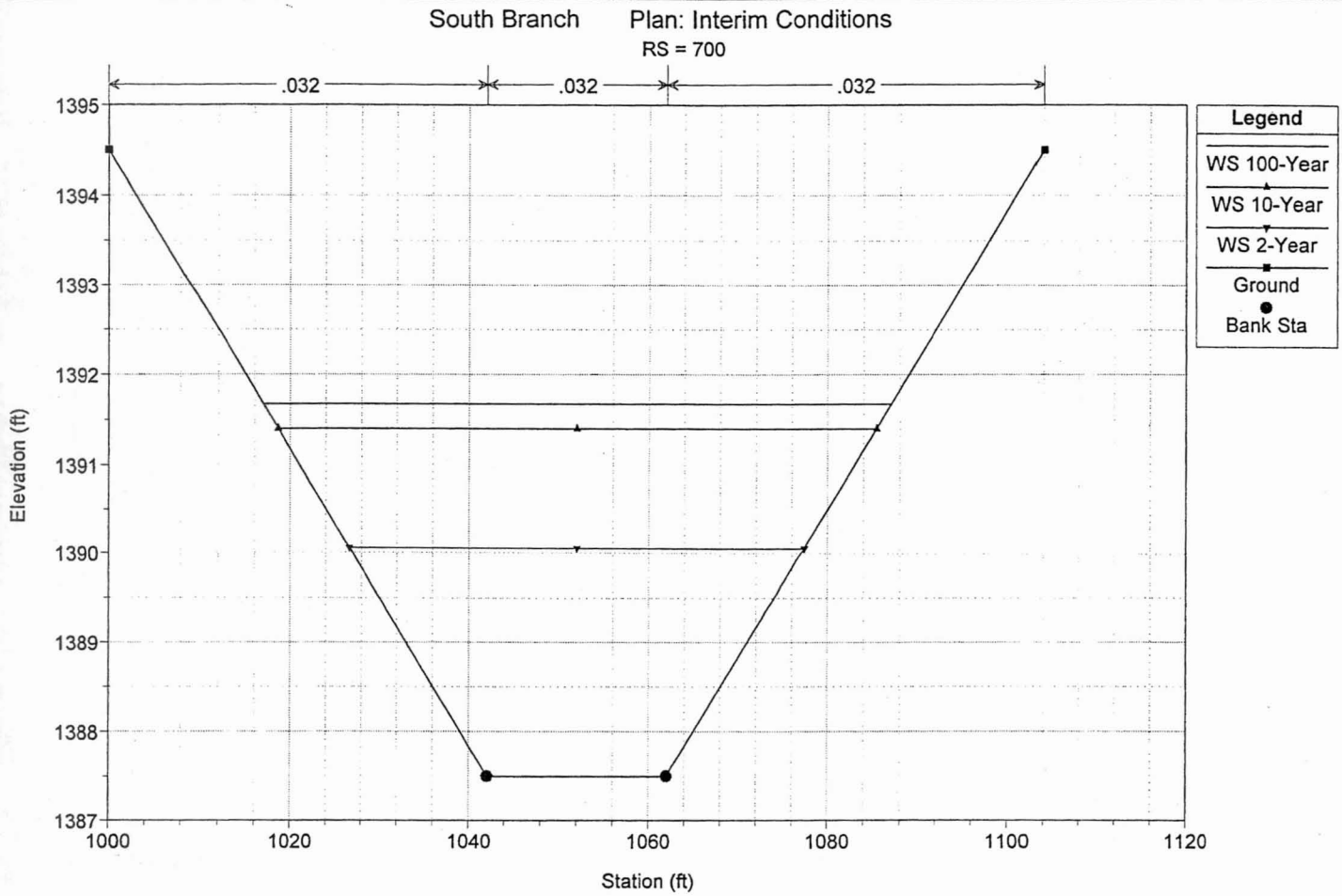
HEC-RAS Plan: Interim River: S-Branch Reach: W-Ellsworth

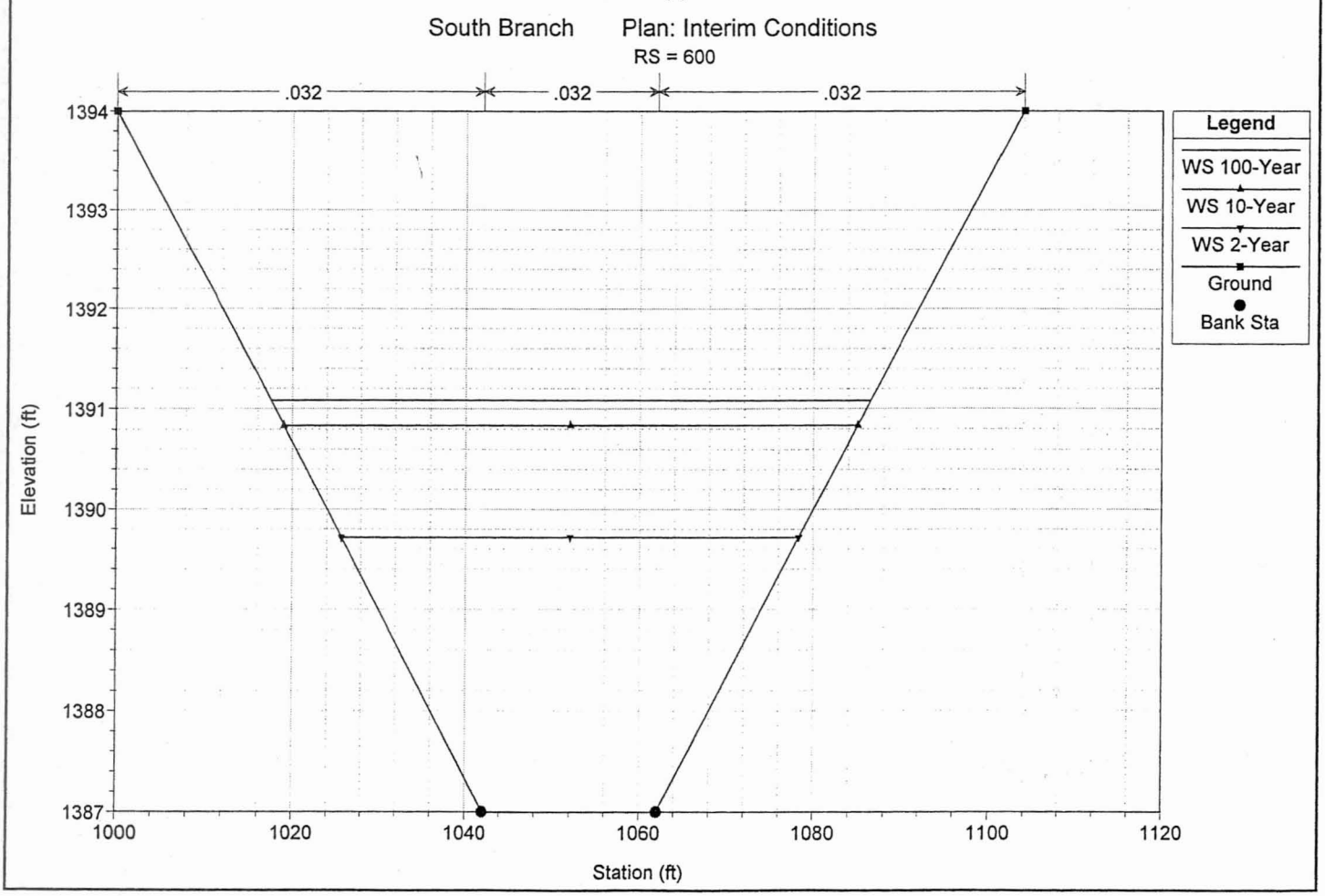
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
W-Ellsworth	900	1370.00	1388.00	1393.86	1391.82	1394.19	0.001367	5.58	322.96	90.28	0.41
W-Ellsworth	900	1043.00	1388.00	1393.21	1391.30	1393.49	0.001317	5.07	267.12	82.53	0.39
W-Ellsworth	900	225.00	1388.00	1390.74	1389.39	1390.83	0.000889	2.71	99.91	52.89	0.29
W-Ellsworth	800	1370.00	1387.80	1393.15		1393.61	0.002083	6.48	274.11	82.44	0.49
W-Ellsworth	800	1043.00	1387.80	1392.55		1392.93	0.002023	5.90	226.27	75.36	0.48
W-Ellsworth	800	225.00	1387.80	1390.39		1390.50	0.001137	2.95	90.91	50.21	0.32
W-Ellsworth	700	1370.00	1387.50	1391.67		1392.64	0.005855	9.21	188.01	70.09	0.79
W-Ellsworth	700	1043.00	1387.50	1391.40		1392.09	0.004507	7.73	169.32	66.81	0.69
W-Ellsworth	700	225.00	1387.50	1390.06		1390.17	0.001166	2.97	90.59	50.74	0.33
W-Ellsworth	600	620.00	1387.00	1391.08		1391.30	0.001314	4.30	181.79	69.01	0.37
W-Ellsworth	600	530.00	1387.00	1390.84		1391.02	0.001250	4.02	164.92	66.02	0.36
W-Ellsworth	600	225.00	1387.00	1389.72		1389.81	0.000922	2.74	98.62	52.60	0.29
W-Ellsworth	500	620.00	1386.79	1390.11		1390.49	0.003058	5.71	133.93	60.75	0.55
W-Ellsworth	500	530.00	1386.79	1389.97		1390.29	0.002672	5.19	125.45	59.01	0.51
W-Ellsworth	500	225.00	1386.79	1389.22		1389.34	0.001420	3.16	84.79	49.83	0.36
W-Ellsworth	400	620.00	1386.49	1388.99	1388.60	1389.07	0.003255	3.47	349.16	468.22	0.39
W-Ellsworth	400	530.00	1386.49	1388.89	1387.98	1388.97	0.003292	3.40	304.62	430.65	0.39
W-Ellsworth	400	225.00	1386.49	1388.47	1388.23	1388.53	0.002663	2.68	154.74	277.64	0.34
W-Ellsworth	300	620.00	1385.71	1387.42		1387.49	0.003962	2.36	312.26	354.84	0.38
W-Ellsworth	300	530.00	1385.71	1387.33		1387.39	0.003892	2.22	281.17	340.09	0.37
W-Ellsworth	300	225.00	1385.71	1386.86		1386.90	0.005423	1.82	138.27	261.80	0.40
W-Ellsworth	200	620.00	1384.00	1385.92	1385.18	1385.98	0.004006	3.23	360.28	514.30	0.41
W-Ellsworth	200	530.00	1384.00	1385.85	1385.11	1385.90	0.004058	3.16	320.70	499.15	0.41
W-Ellsworth	200	225.00	1384.00	1385.22	1384.78	1385.26	0.003547	2.25	143.68	206.25	0.36
W-Ellsworth	100	620.00	1382.00	1383.63	1383.26	1383.74	0.008015	4.09	238.75	396.95	0.57
W-Ellsworth	100	530.00	1382.00	1383.54	1383.18	1383.65	0.008001	3.93	206.01	320.02	0.56
W-Ellsworth	100	225.00	1382.00	1383.10	1382.82	1383.17	0.008001	3.14	106.87	184.38	0.53

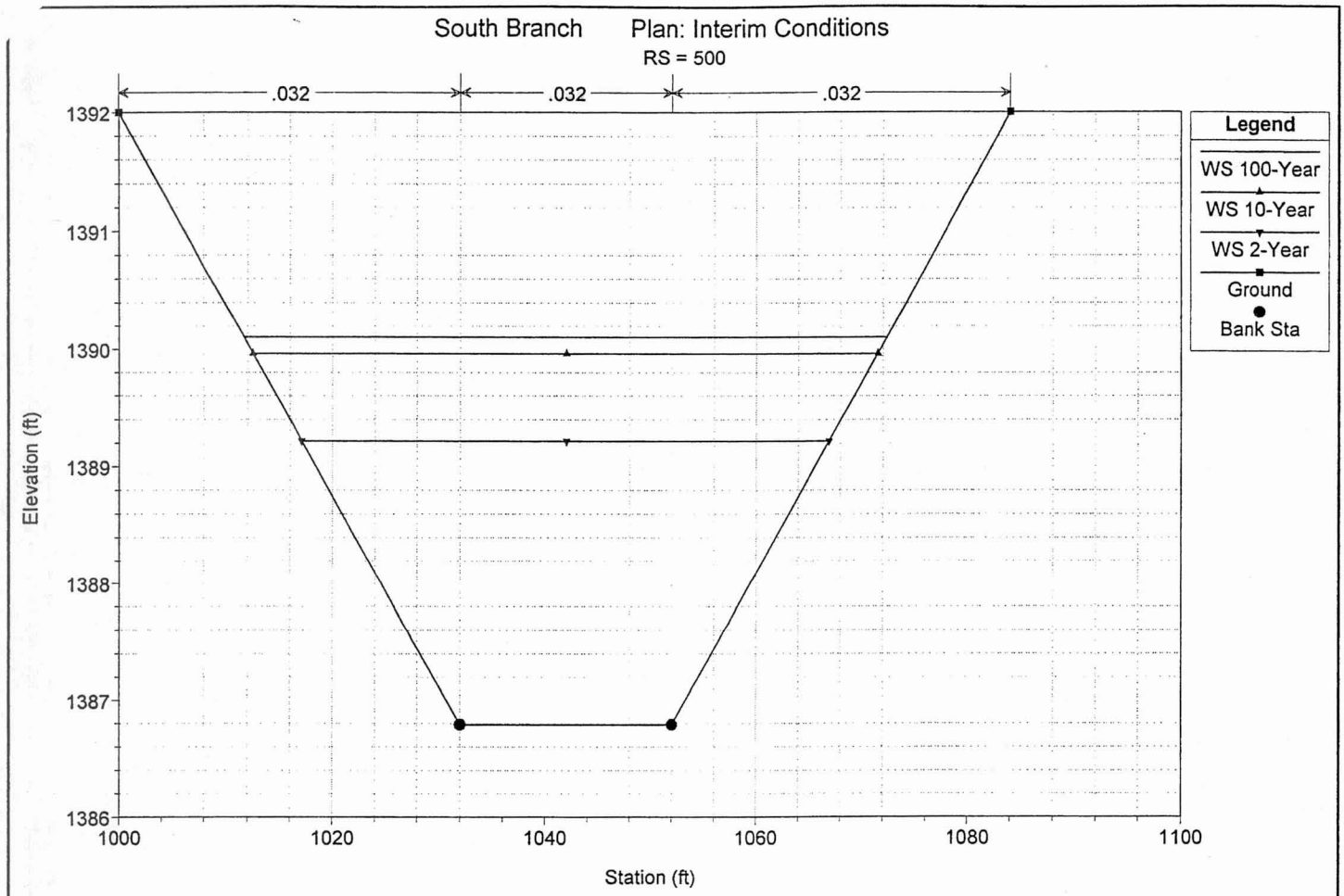

South Branch Plan: Interim Conditions
W-Ellsworth
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Elevation (ft)
1394
1392
1390
1388
1386
1384
1382
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (ft)
200
300
400
500
600
700
800
900

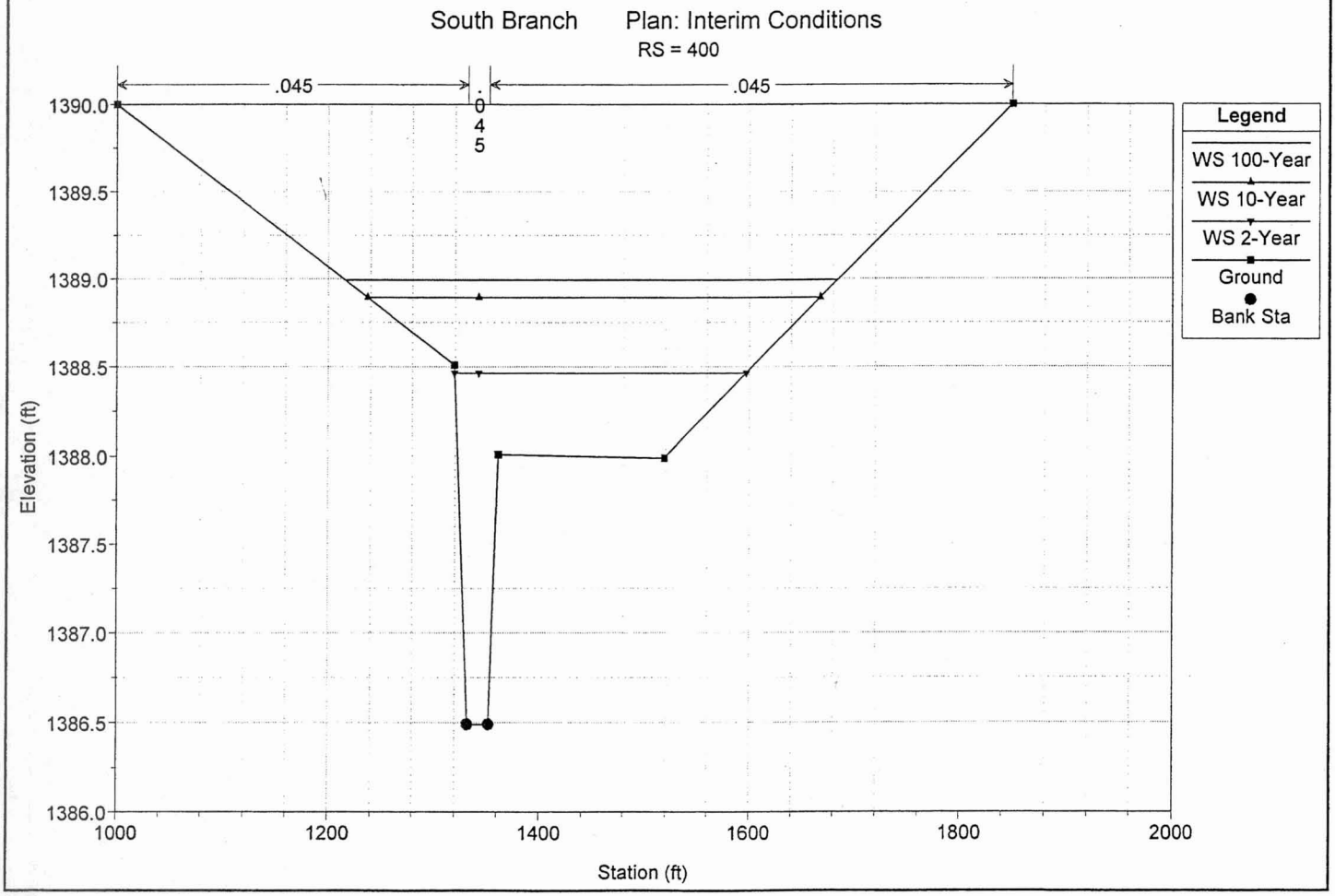

South Branch Plan: Interim Conditions
RS = 900
.032
.032
.032
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1402
1400
1398
1396
1394
1392
1390
1388
1000
1050
1100
1150
1200
Station (ft)

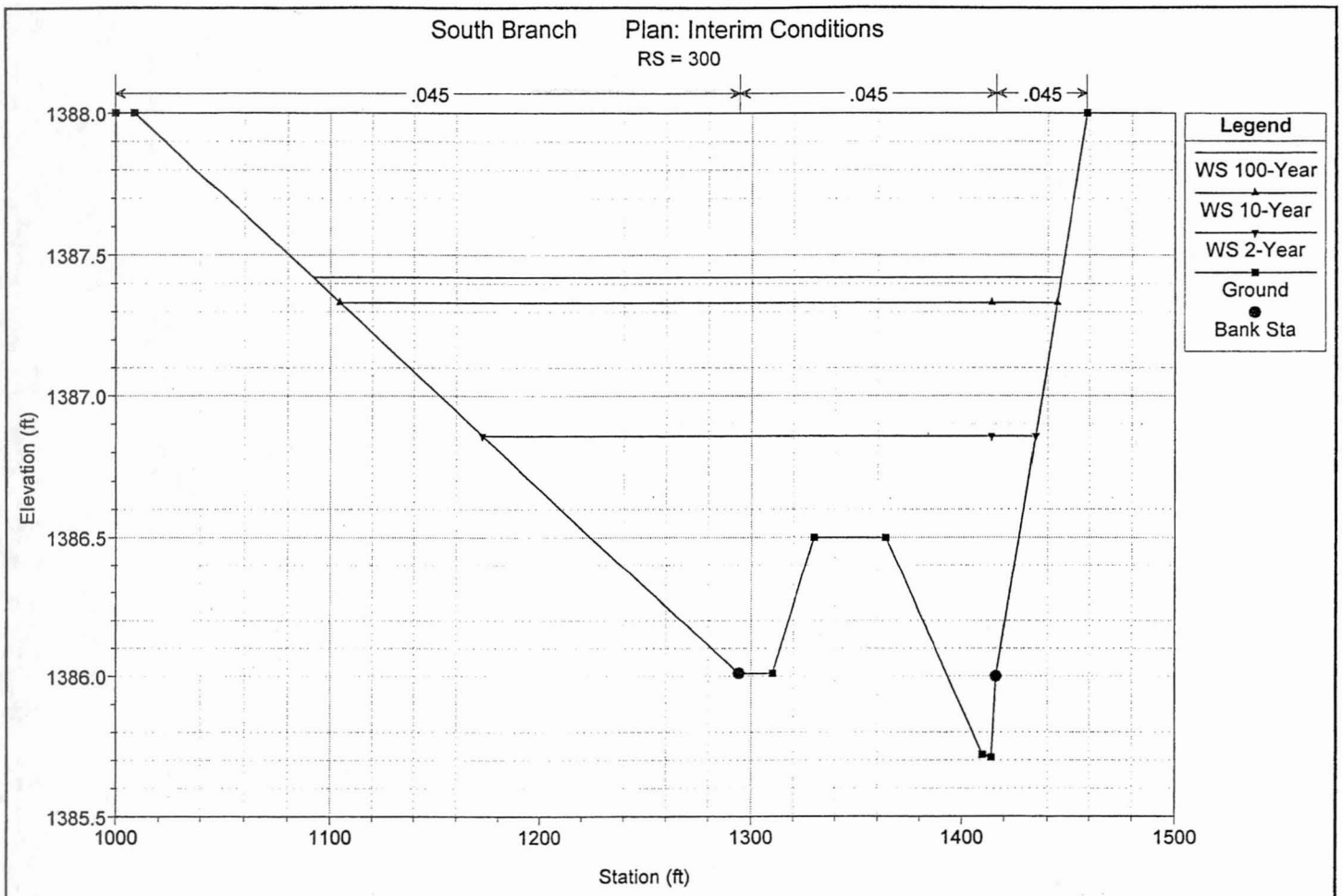

South Branch Plan: Interim Conditions
RS = 800
.032
.032
.032
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1395
1394
1393
1392
1391
1390
1389
1388
1387
1000
1020
1040
1060
1080
1100
1120
Station (ft)

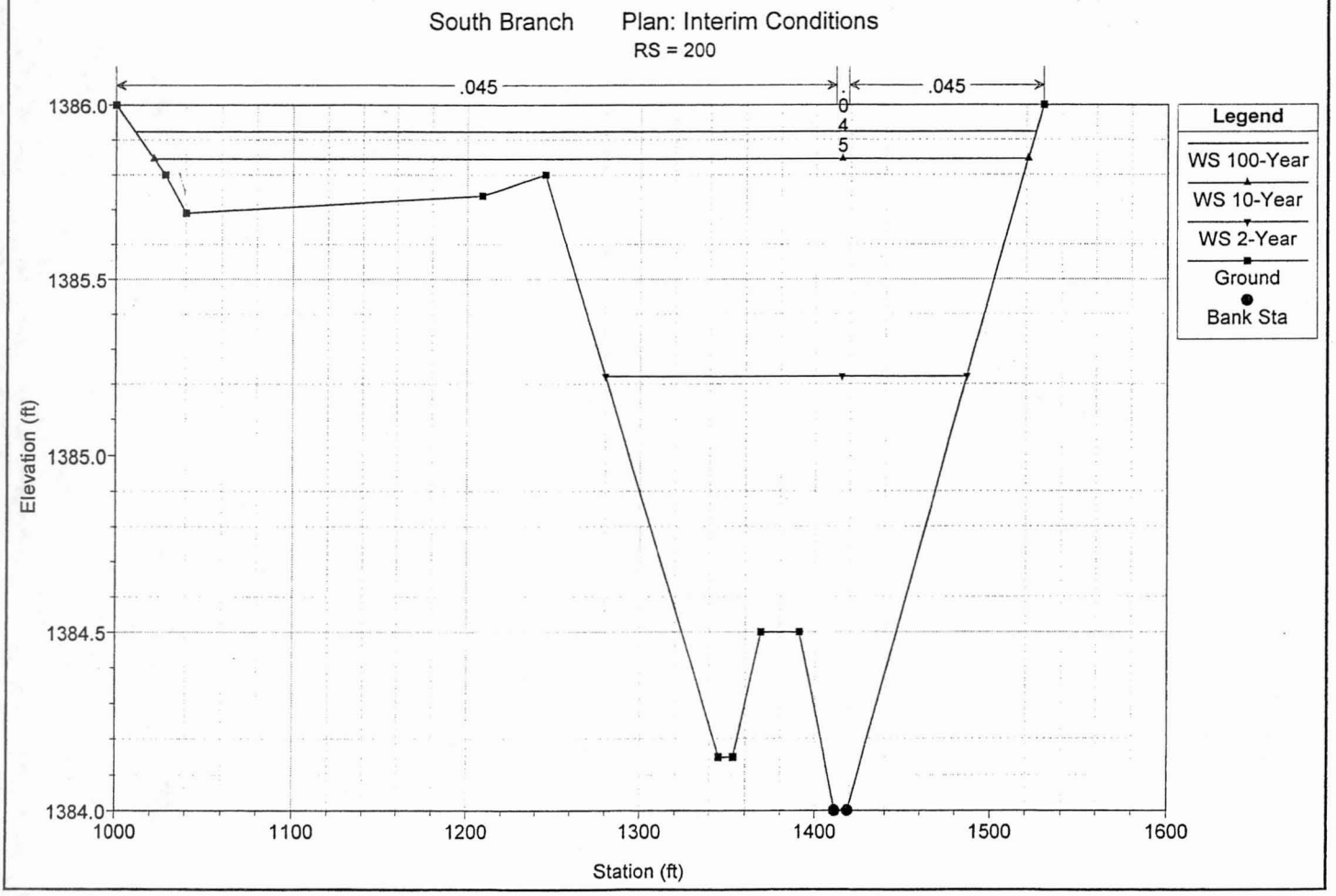

South Branch Plan: Interim Conditions
RS = 700
.032
.032
.032
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1395
1394
1393
1392
1391
1390
1389
1388
1387
1000
1020
1040
1060
1080
1100
1120
Station (ft)

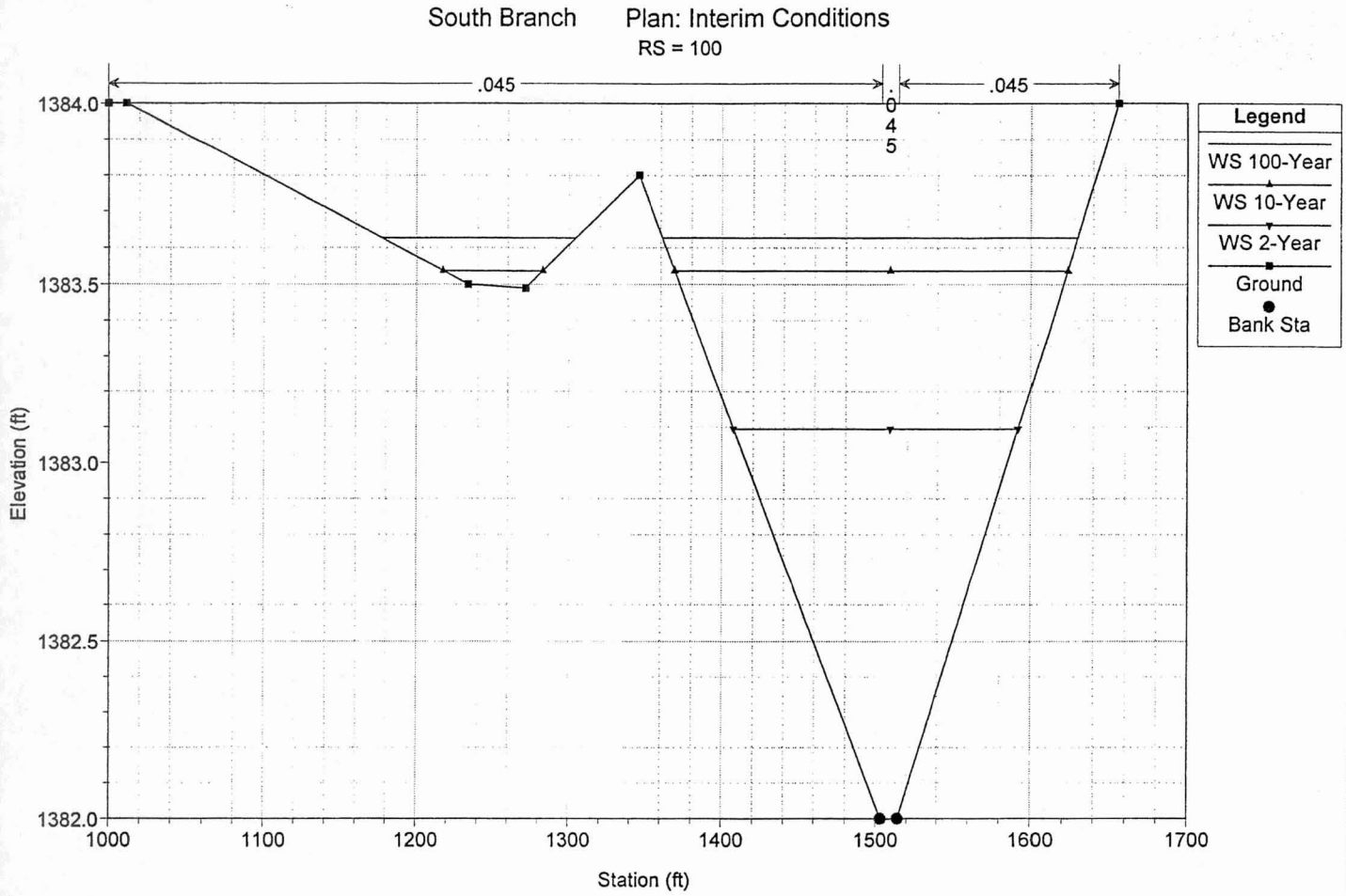

South Branch Plan: Interim Conditions
RS = 600
.032
.032
.032
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1394
1393
1392
1391
1390
1389
1388
1387
1000
1020
1040
1060
1080
1100
1120
Station (ft)


South Branch Plan: Interim Conditions
RS = 500
.032
.032
.032
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1392
1391
1390
1389
1388
1387
1386
1000
1020
1040
1060
1080
1100
Station (ft)


South Branch Plan: Interim Conditions
RS = 400
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1390.0
1389.5
1389.0
1388.5
1388.0
1387.5
1387.0
1386.5
1386.0
1000
1200
1400
1600
1800
2000
Station (ft)

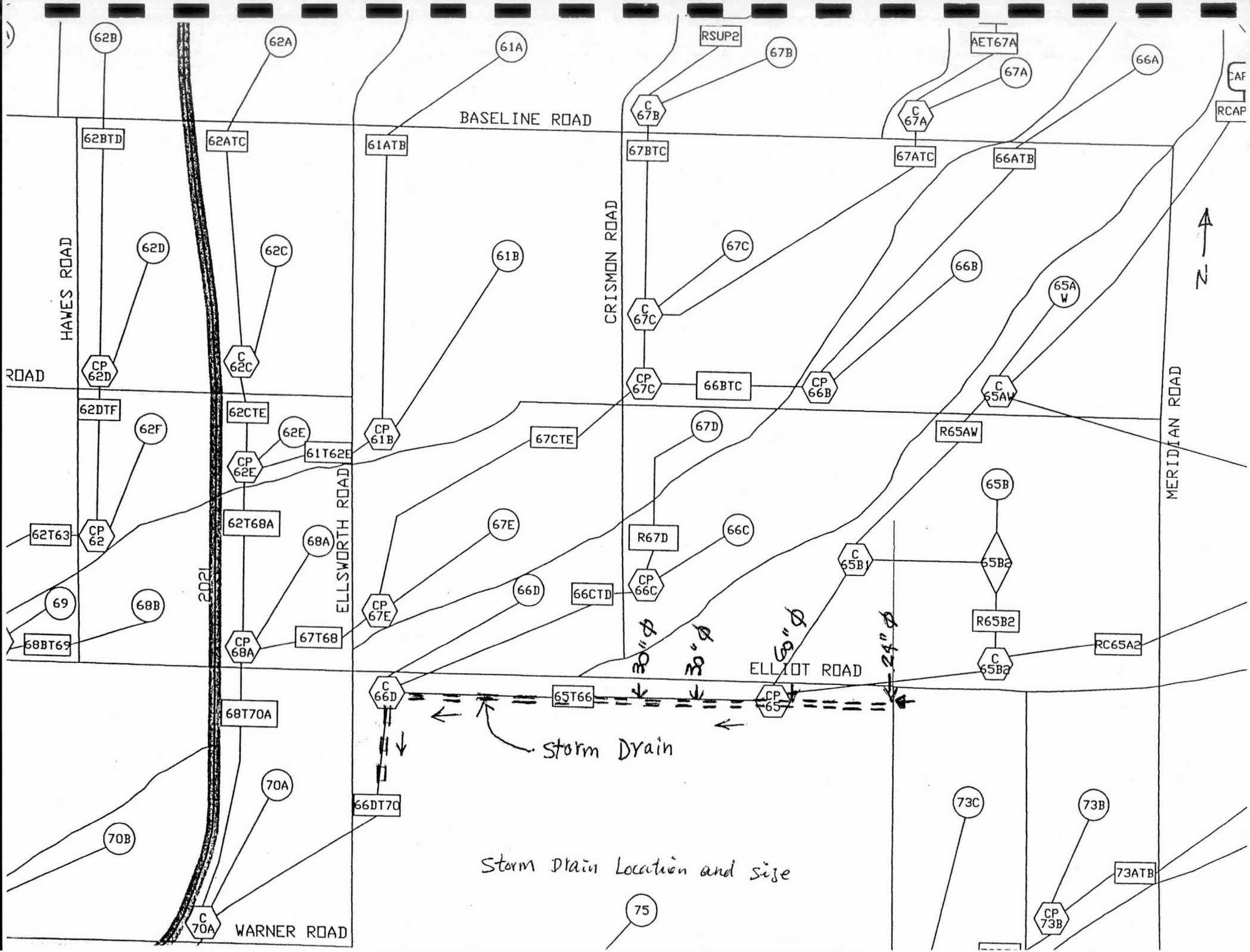

South Branch Plan: Interim Conditions
RS = 300
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1388.0
1387.5
1387.0
1386.5
1386.0
1385.5
1000
1100
1200
1300
1400
1500
Station (ft)

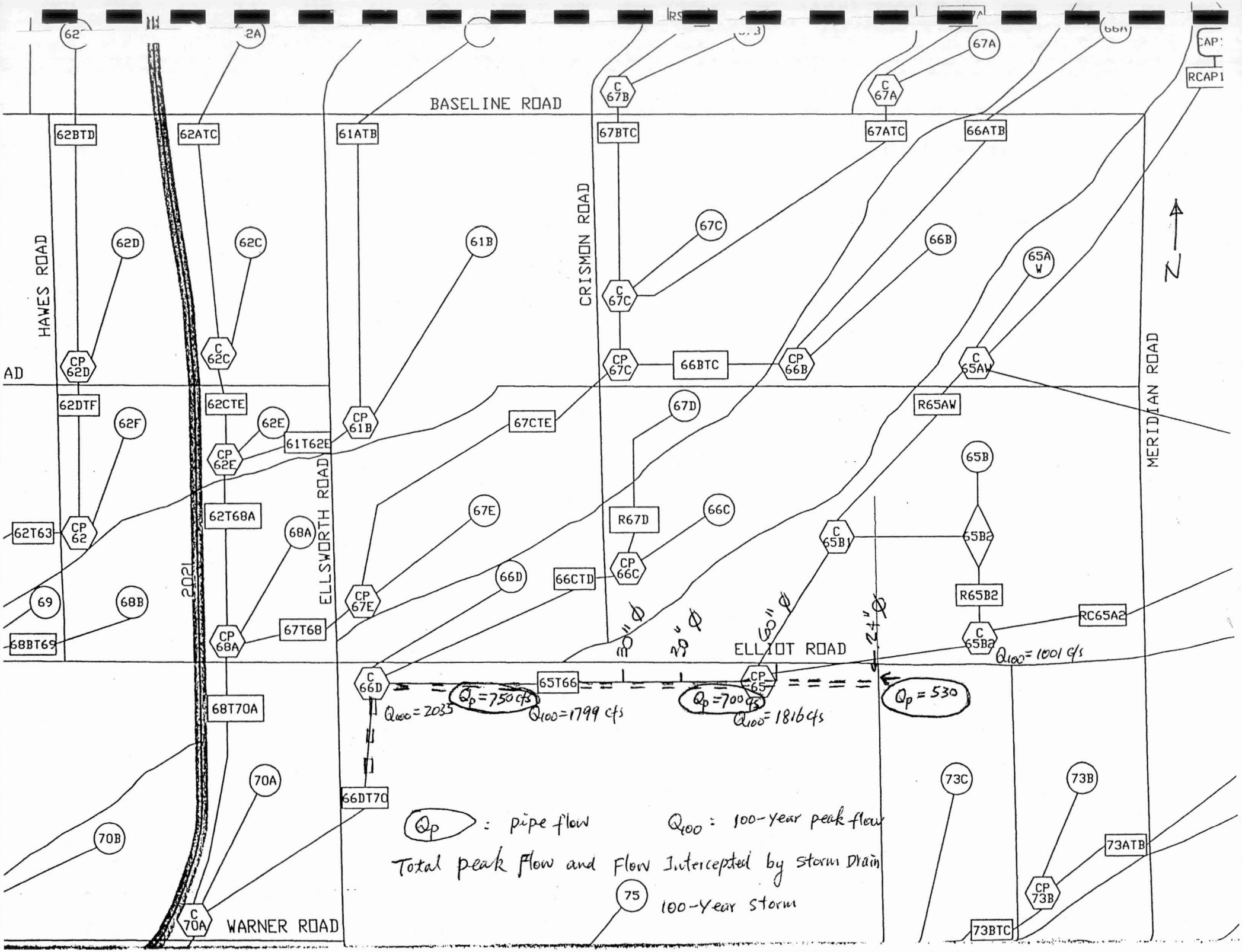

South Branch Plan: Interim Conditions
RS = 200
.045
.045
0
4
5
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1386.0
1385.5
1385.0
1384.5
1384.0
1000
1100
1200
1300
1400
1500
1600
Station (ft)

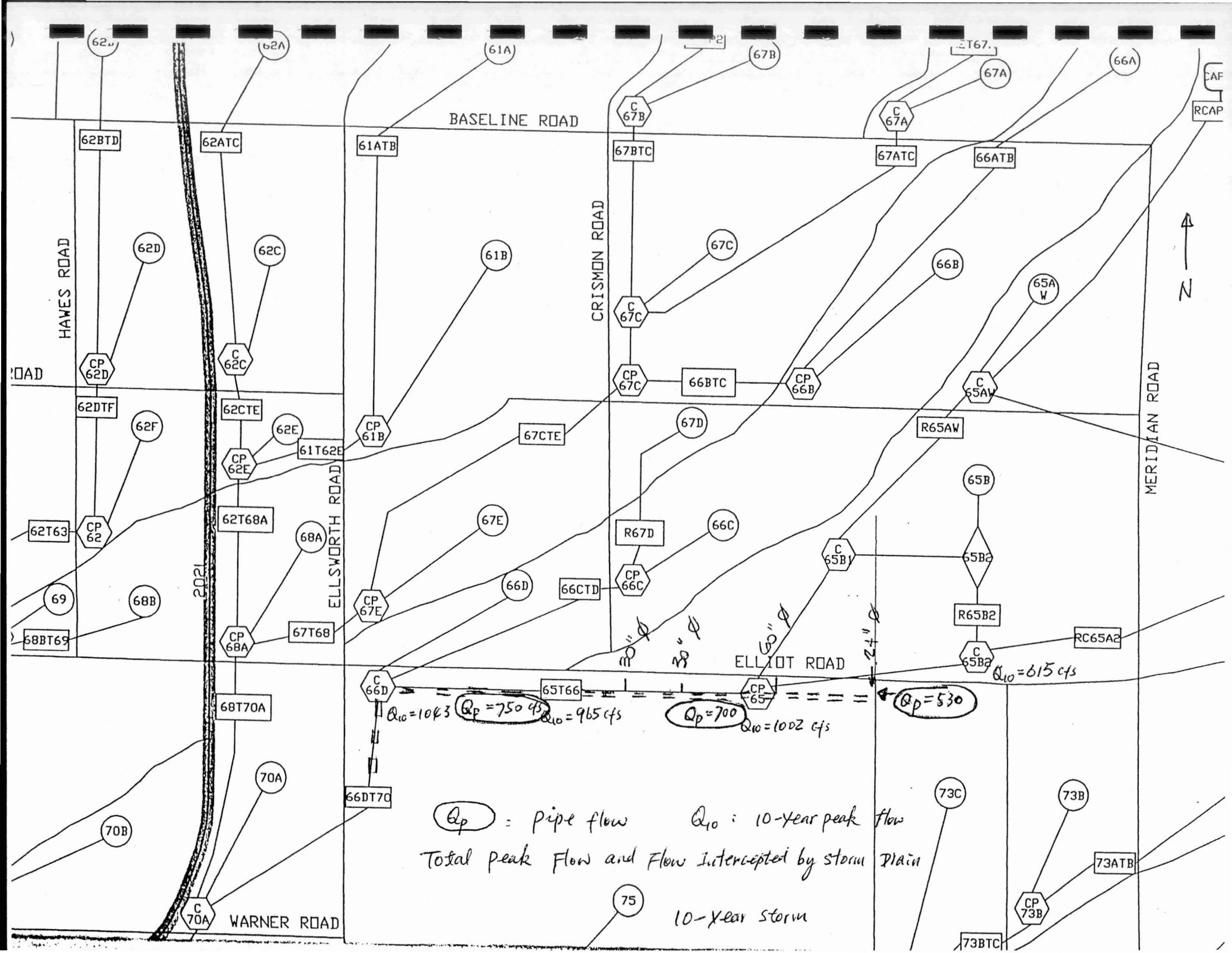

South Branch
Plan: Interim Conditions
RS = 100
.045
.045
.045
Legend
WS 100-Year
WS 10-Year
WS 2-Year
Ground
Bank Sta
Elevation (ft)
1384.0
1383.5
1383.0
1382.5
1382.0
1000
1100
1200
1300
1400
1500
1600
1700
Station (ft)

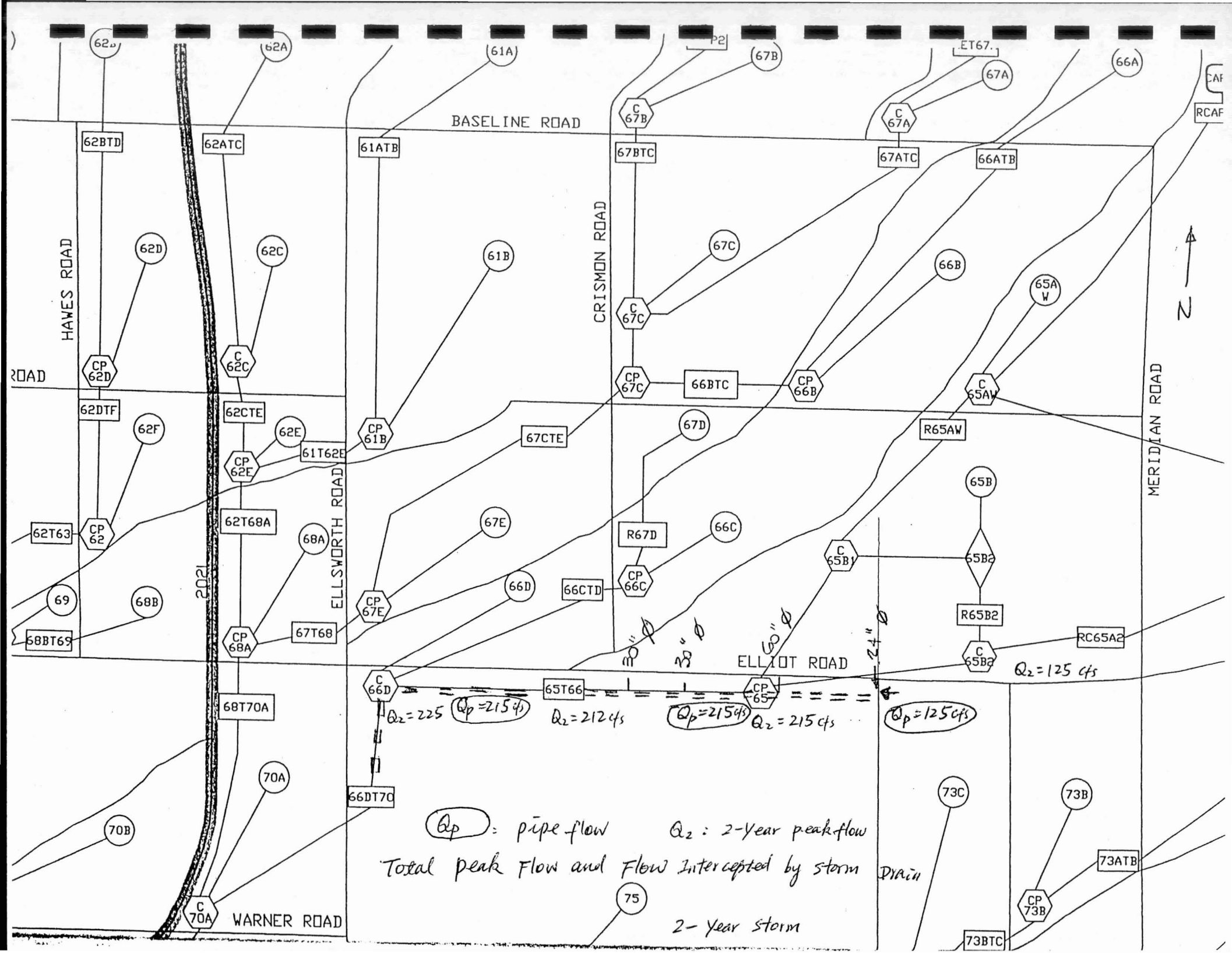
APPENDIX D

STORM DRAIN INLET LOCATIONS, SIZES, AND CAPACITY ESTIMATIONS


BASELINE ROAD
HAWES ROAD
CRISMON ROAD
ELLSWORTH ROAD
MERIDIAN ROAD
ELLIOT ROAD
WARNER ROAD
ROAD
2021
N
62B
62A
61A
RSUP2
67B
AET67A
67A
66A
RCAP
62BTD
62ATC
61ATB
67BTC
67ATC
66ATB
62D
62C
61B
67C
66B
65AW
CP 62D
C 62C
CP 67C
66BTC
CP 66B
C 65AW
62DTF
62CTE
62E
61T62E
CP 61B
67CTE
67D
R65AW
62F
CP 62E
62T68A
68A
67E
R67D
66C
65B
62T63
CP 62
69
68B
CP 67E
66D
66CTD
CP 66C
C 65B1
65B2
R65B2
68BT69
CP 68A
67T68
C 65B2
RC65A2
30"Φ
30"Φ
6"Φ
24"Φ
C 66D
65T66
CP 65
68T70A
Storm Drain
70A
66DT70
73C
73B
70B
Storm Drain Location and size
73ATB
75
C 70A
CP 73B


BASELINE ROAD
HAWES ROAD
CRISMON ROAD
ELLSWORTH ROAD
MERIDIAN ROAD
ELLIOT ROAD
WARNER ROAD
2021
N
62BTD
62ATC
61ATB
67BTC
67ATC
66ATB
RCAP1
62D
62C
61B
67C
66B
65AW
CP 62D
C 62C
C 67C
CP 67C
66BTC
CP 66B
C 65AW
62DTF
62CTE
62E
61T62E
CP 61B
67CTE
67D
R65AW
62F
CP 62E
65B
62T68A
67E
R67D
66C
62T63
CP 62
68A
C 65B1
65B2
CP 66C
66D
66CTD
69
68B
CP 67E
R65B2
RC65A2
68BT69
CP 68A
67T68
C 65B2
Q_{100}= 1001 cfs
C 66D
65T66
CP 65
Q_p = 750 cfs
Q_p = 700 cfs
Q_p = 530
Q_{100}= 2035
Q_{100}=1799 cfs
Q_{100}= 1816 cfs
68T70A
70A
73C
73B
66DT70
70B
73ATB
CP 73B
75
C 70A
73BTC
Q_p : pipe flow
Q_{100} : 100-year peak flow
Total peak flow and Flow Intercepted by storm Drain
100-Year Storm


BASELINE ROAD
HAWES ROAD
CRISMON ROAD
ELLSWORTH ROAD
MERIDIAN ROAD
ELLIOT ROAD
WARNER ROAD
2021
N
62BTD
62ATC
61ATB
67BTC
67ATC
66ATB
62DTF
62CTE
61T62E
67CTE
R65AW
62T63
62T68A
68BT69
67T68
66CTD
R67D
R65B2
RC65A2
68T70A
65T66
66DT70
73ATB
73BTC
CP 62D
C 62C
CP 62E
CP 62
CP 68A
CP 61B
CP 67E
C 66D
C 67B
C 67A
CP 67C
C 67C
CP 66B
C 65AW
CP 66C
C 65B1
C 65B2
CP 65
C 70A
CP 73B
62D
62C
62F
62E
68A
68B
69
61A
61B
67E
66D
67B
67A
67C
66B
66A
67D
66C
65B
65AW
70A
70B
73C
73B
75
30" ϕ
38" ϕ
60" ϕ
24" ϕ
Q10 = 1043
Qp = 750 cfs
Q10 = 965 cfs
Qp = 700
Q10 = 1002 cfs
Qp = 530
Q10 = 615 cfs
Qp : pipe flow
Q10 : 10-year peak flow
Total peak Flow and Flow Intercepted by storm Drain
10-Year storm


BASELINE ROAD
HAWES ROAD
CRIMSON ROAD
ELLSWORTH ROAD
MERIDIAN ROAD
ELLIOT ROAD
WARNER ROAD
202
N
62B
62A
61A
P2
67B
ET67.
67A
66A
RCAF
62BTD
62ATC
61ATB
67BTC
67ATC
66ATB
C 67B
C 67A
62D
62C
61B
67C
66B
65A W
C 67C
CP 62D
C 62C
CP 67C
66BTC
CP 66B
C 65AW
62DTF
62CTE
62F
62E
CP 61B
67CTE
67D
R65AW
CP 62E
61T62E
65B
62T63
CP 62
62T68A
68A
67E
R67D
66C
C 65B1
65B2
69
68B
66D
66CTD
CP 66C
CP 67E
R65B2
68BT69
CP 68A
67T68
RC65A2
C 65B2
Q2 = 125 cfs
C 66D
65T66
CP 65
68T70A
Q2 = 225
Qp = 215 cfs
Q2 = 212 cfs
Qp = 215 cfs
Q2 = 215 cfs
Qp = 125 cfs
70A
73C
73B
66DT70
70B
Qp : pipe flow
Q2 : 2-Year peak flow
Total peak Flow and Flow Intercepted by storm
Drain
73ATB
75
C 70A
CP 73B
2- Year storm
73BTC

Storm Drain Pipe Capacity Computation

Reference: FCDMC, 1996. Drainage Design Manual for Maricopa County, AZ
Volume II Hydraulics. p4-13.

Given Design Parameters:

D (ft) =	2.5	n =	0.014	Zup (ft) =	1455.00
L (ft) =	100	Sum(Km)=	0.5	Zdn (ft) =	1454.00

Estimated Pipe Capacity:

K =	0.0057	A (ft²) =	4.9088	DeltaZ(ft) =	1.00
Kf =	0.0107	Ko =	1.5697	V (ft/s) =	6.41

Q (cfs) = 31.44 cfs

Storm Drain Pipe Capacity Computation

Reference: FCDMC, 1996. Drainage Design Manual for Maricopa County, AZ
Volume II Hydraulics. p4-13.

Given Design Parameters:

D (ft) =	2	n =	0.014	Zup (ft) =	1455.00
L (ft) =	100	Sum(Km)=	0.5	Zdn (ft) =	1454.00

Estimated Pipe Capacity:

K =	0.0057	A (ft²) =	3.1416	DeltaZ(ft) =	1.00
Kf =	0.0144	Ko =	1.9404	V (ft/s) =	5.76

Q (cfs) = 18.10 cfs

Storm Drain Pipe Capacity Computation

Reference: FCDMC, 1996. Drainage Design Manual for Maricopa County, AZ
Volume II Hydraulics. p4-13.

Given Design Parameters:

D (ft) =	5	n =	0.014	Zup (ft) =	1455.00
L (ft) =	100	Sum(Km)=	0.5	Zdn (ft) =	1454.00

Estimated Pipe Capacity:

K =	0.0057	A (ft²) =	19.6350	DeltaZ(ft) =	1.00
Kf =	0.0042	Ko =	0.9245	V (ft/s) =	8.35

Q (cfs) = 163.88 cfs

APPENDIX E

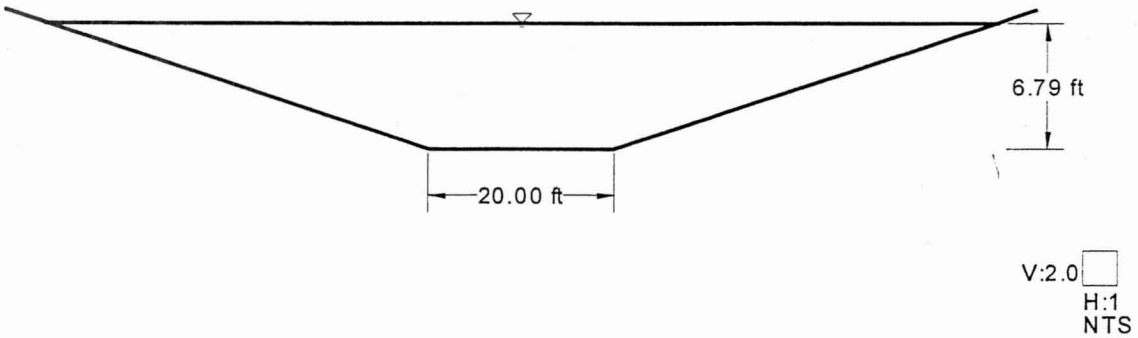
HYDRAULIC DESIGN COMPUTATIONS OF THE SPLIT STRUCTURE

Rating Curve Computations for the South Branch

South Branch - Q = 1370
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 1370
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

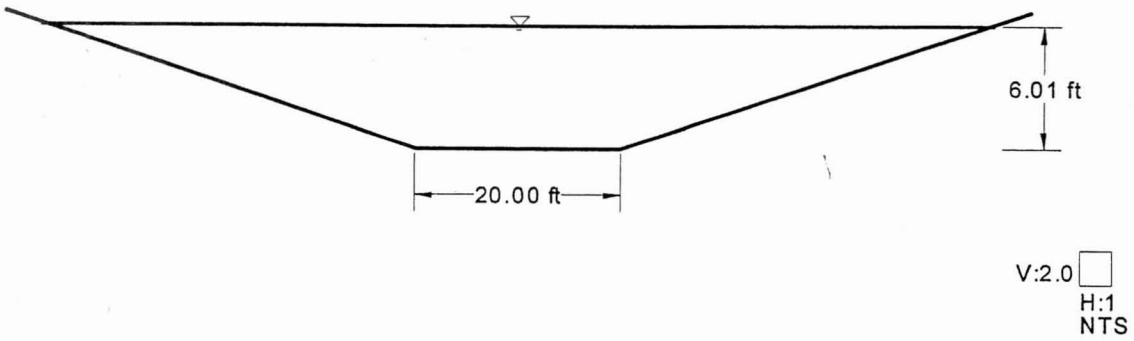
Section Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Depth	6.79	ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	20.00	ft
Discharge	1,370.00	cfs



South Branch - Q = 1043
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 1043
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Depth	6.01	ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	20.00	ft
Discharge	1,043.00	cfs



South Branch - Q=1043
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 1043
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	20.00	ft
Discharge	1,043.00	cfs

Results		
Depth	6.01	ft
Flow Area	336.9	ft²
Wetted Perimeter	93.12	ft
Top Width	92.12	ft
Critical Depth	3.20	ft
Critical Slope	0.011705	ft/ft
Velocity	3.10	ft/s
Velocity Head	0.15	ft
Specific Energy	6.16	ft
Froude Number	0.29	
Flow Type	Subcritical	

South Branch - Q=225
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 225
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	20.00	ft
Discharge	225.00	cfs

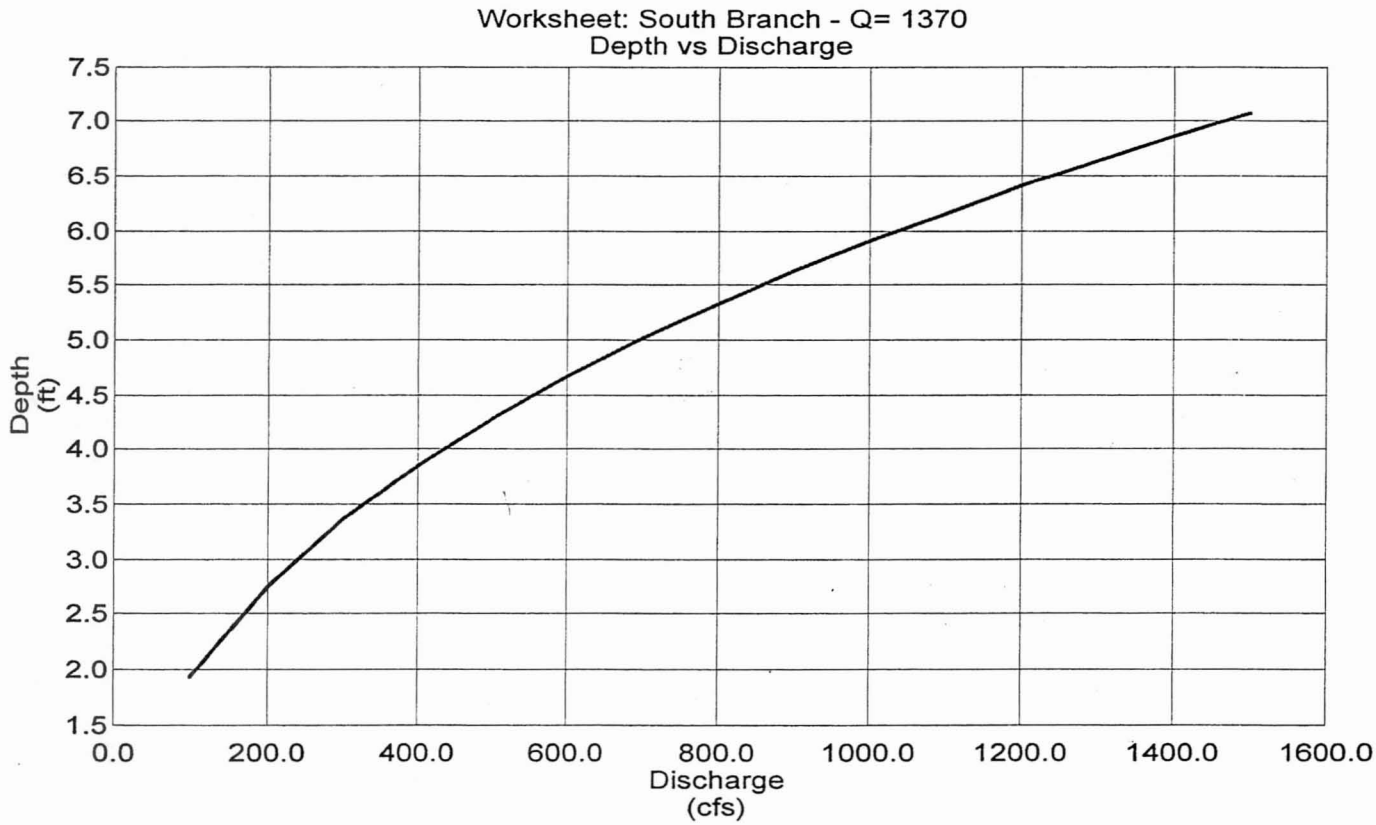
Results		
Depth	2.91	ft
Flow Area	109.1	ft²
Wetted Perimeter	55.42	ft
Top Width	54.93	ft
Critical Depth	1.37	ft
Critical Slope	0.014761	ft/ft
Velocity	2.06	ft/s
Velocity Head	0.07	ft
Specific Energy	2.98	ft
Froude Number	0.26	
Flow Type	Subcritical	

Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Worksheet	South Branch - Q= 1370
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.032	
Slope	0.000800	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	20.00	ft

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	100.00	1,500.00	100.00

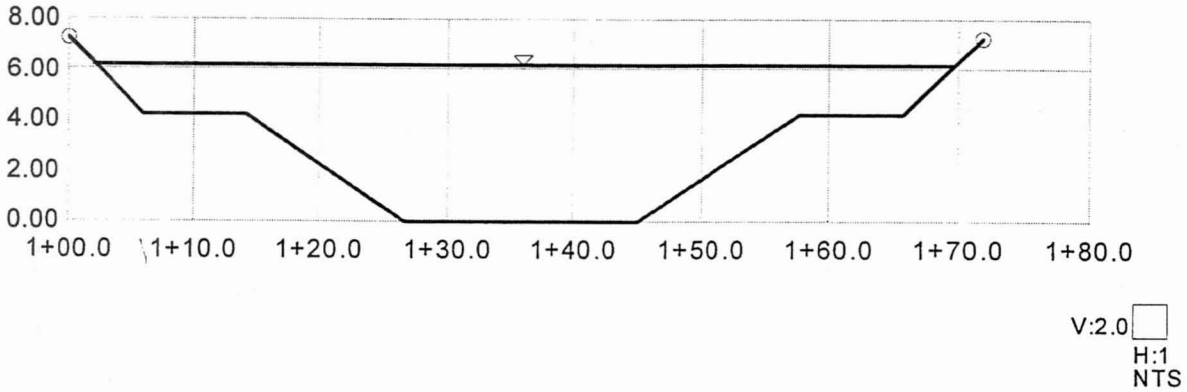


Diversion Channel Design Computations

Diversion - Q = 750
Cross Section for Irregular Channel

Project Description	
Worksheet	Diversion - Q = 750
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.032	
Slope	0.000700	ft/ft
Water Surface Elevation	6.18	ft
Elevation Range	0.00 to 7.20	
Discharge	750.00	cfs



Diversion - Q = 750
Worksheet for Irregular Channel

Project Description	
Worksheet	Diversion - Q = 750
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.000700	ft/ft
Discharge	750.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.032	
Water Surface Elevation	6.18	ft
Elevation Range	0.00 to 7.20	
Flow Area	256.6	ft²
Wetted Perimeter	69.91	ft
Top Width	67.61	ft
Actual Depth	6.18	ft
Critical Elevation	3.11	ft
Critical Slope	0.011665	ft/ft
Velocity	2.92	ft/s
Velocity Head	0.13	ft
Specific Energy	6.31	ft
Froude Number	0.26	
Flow Type	Subcritical	

Roughness Segments

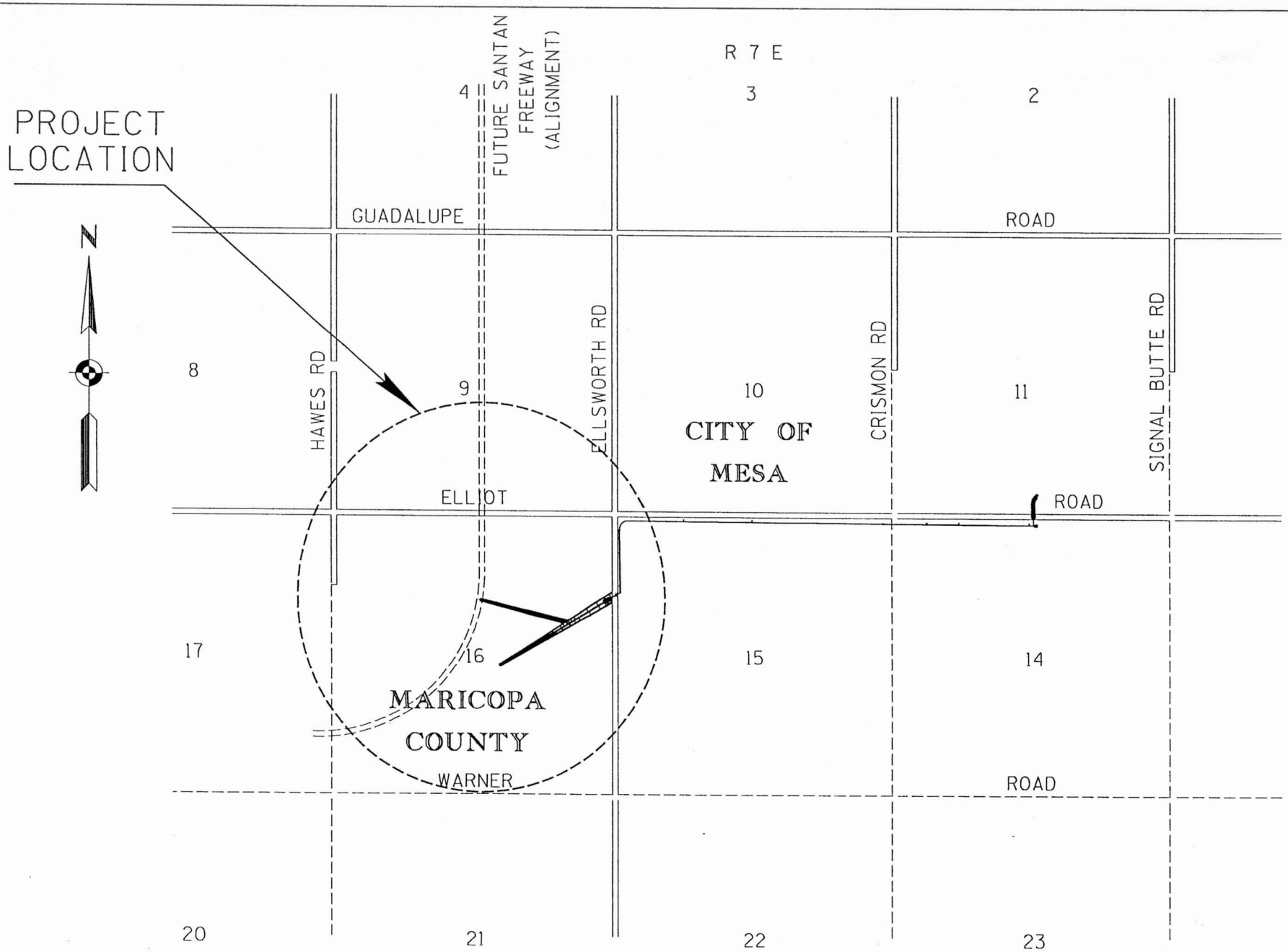
Start Station	End Station	Mannings Coefficient
1+00.0	1+71.7	0.032

Natural Channel Points

Station (ft)	Elevation (ft)
1+00.0	7.20
1+06.0	4.20
1+14.0	4.20
1+26.6	0.00
1+45.1	0.00
1+57.7	4.20
1+65.7	4.20
1+71.7	7.20

EXHIBIT A

VICINITY MAP



VICINITY MAP

Not to Scale

EXHIBIT A

EXHIBIT B

PRELIMINARY FLOODPLAIN DELINEATIONS

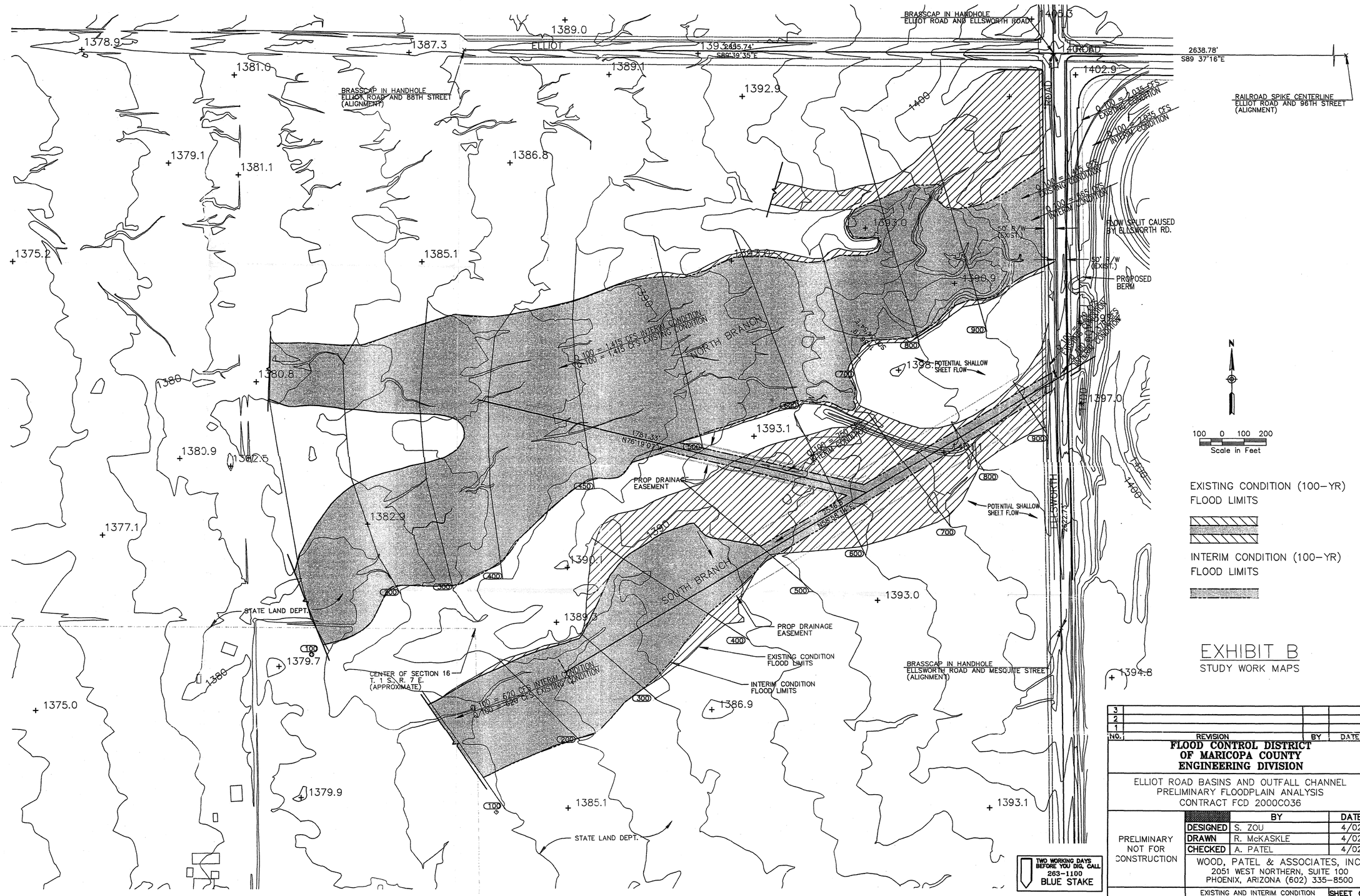


EXHIBIT B

STUDY WORK MAPS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION

ELLIOT ROAD BASINS AND OUTFALL CHANNEL
PRELIMINARY FLOODPLAIN ANALYSIS
CONTRACT FCD 2000C036

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	S. ZOU	4/02
DRAWN	R. McKASKLE	4/02
CHECKED	A. PATEL	4/02

WOOD, PATEL & ASSOCIATES, INC.
2051 WEST NORTHERN, SUITE 100
PHOENIX, ARIZONA (602) 335-8500

EXISTING AND INTERIM CONDITION
FLOOD DELINEATIONS – 100-YEAR

SHEET 1 OF 3

W:/2001Projects/011315.05_Elliot Basin Floodplains/Drawings/March2002/FP100Yr.dwg

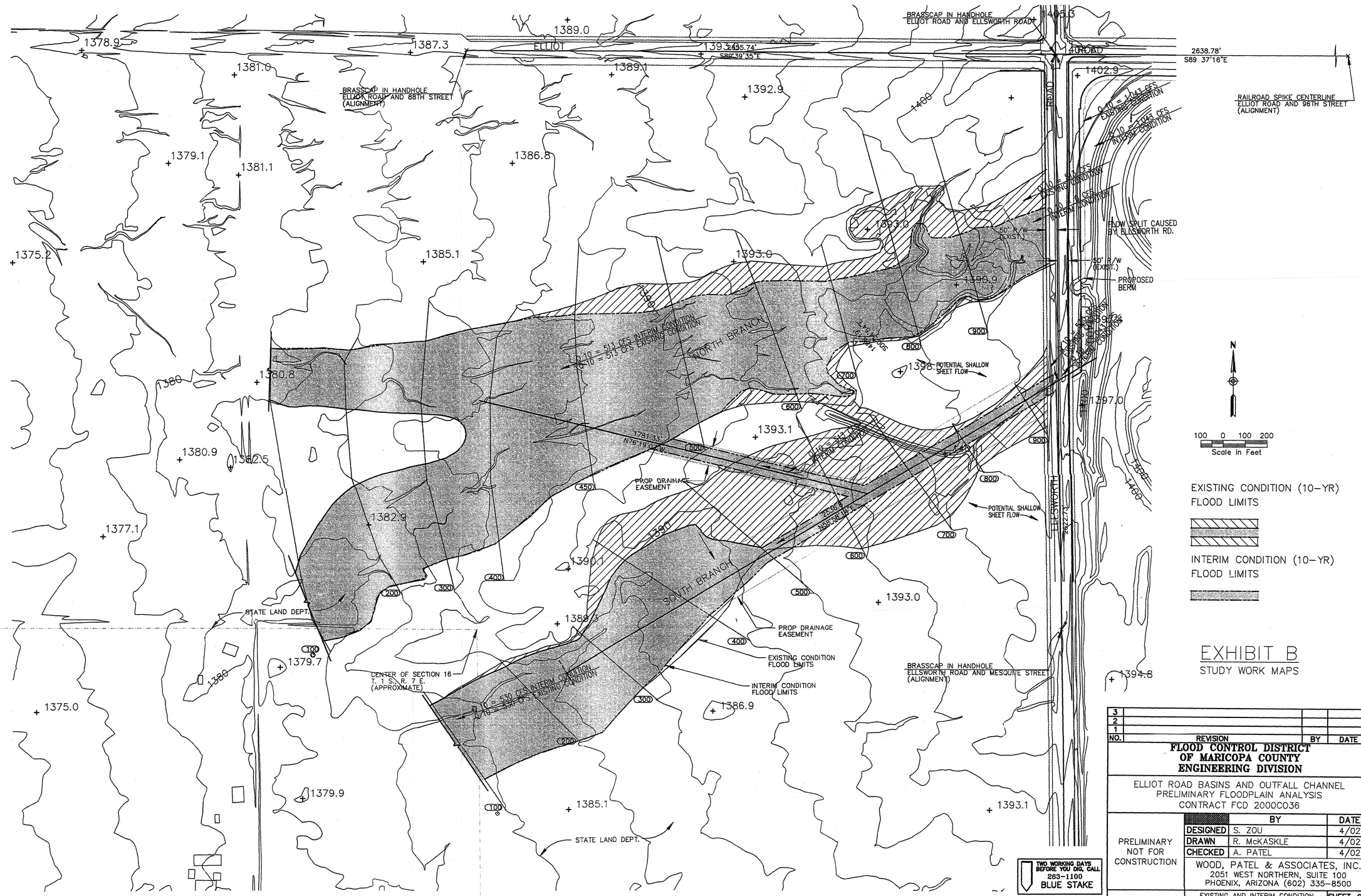


EXHIBIT B

STUDY WORK MAPS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION

ELLIOT ROAD BASINS AND OUTFALL CHANNEL
PRELIMINARY FLOODPLAIN ANALYSIS
CONTRACT FCD 2000C036

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	S. ZOU	4/02
DRAWN	R. McKASKLE	4/02
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WOOD, PATEL & ASSOCIATES, INC.
2051 WEST NORTHERN, SUITE 100
PHOENIX, ARIZONA (602) 335-8500

EXISTING AND INTERIM CONDITION
FLOOD DELINEATIONS – 10-YEAR

SHEET 2 OF 3

W:/2001Projects/011315.05_Elliot Basin Floodplains/Drawings/March2002/FP10Yr.dwg

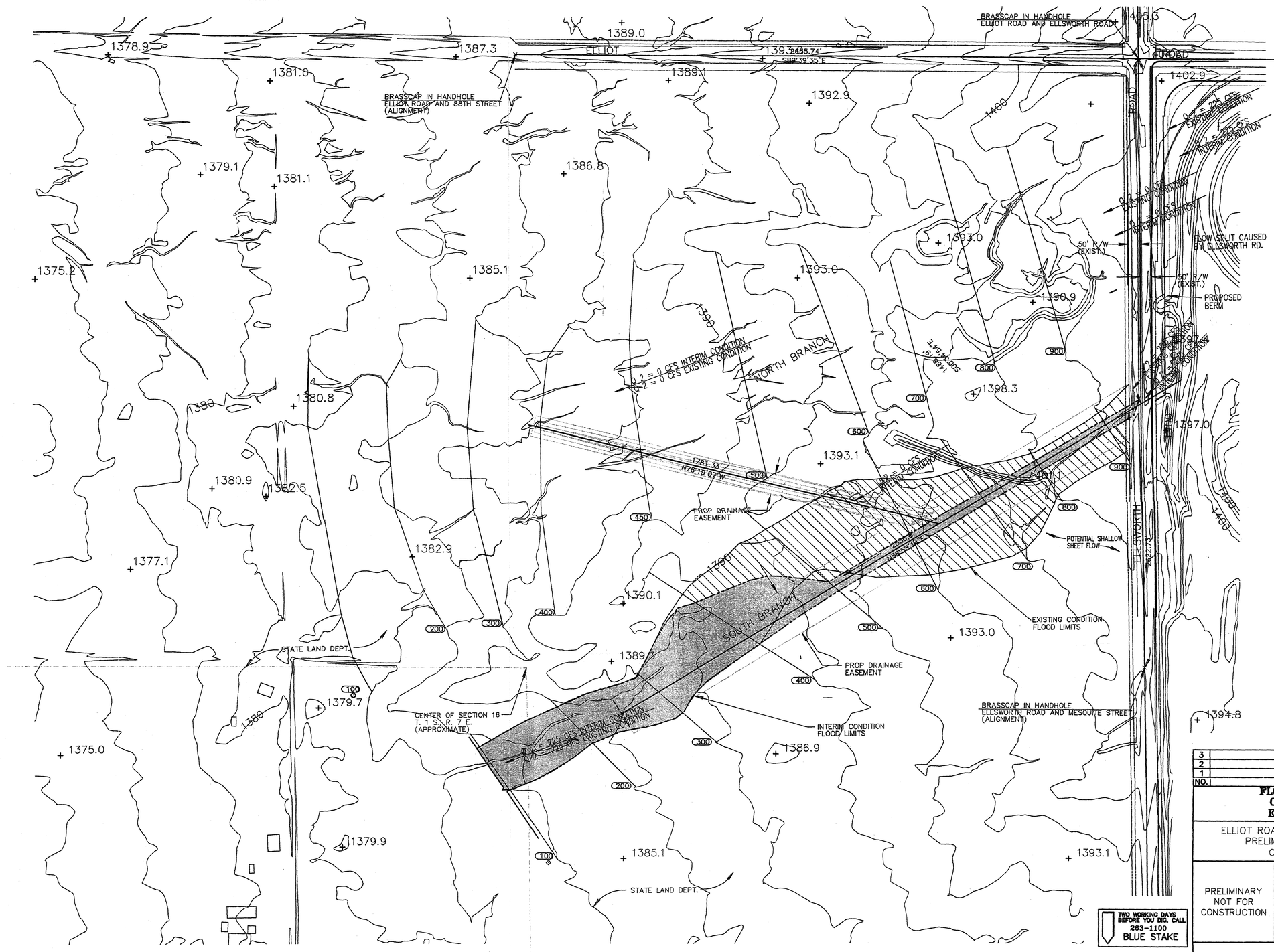


EXHIBIT B

STUDY WORK MAPS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION

ELLIOT ROAD BASINS AND OUTFALL CHANNEL
PRELIMINARY FLOODPLAIN ANALYSIS
CONTRACT FCD 2000C036

PRELIMINARY NOT FOR CONSTRUCTION

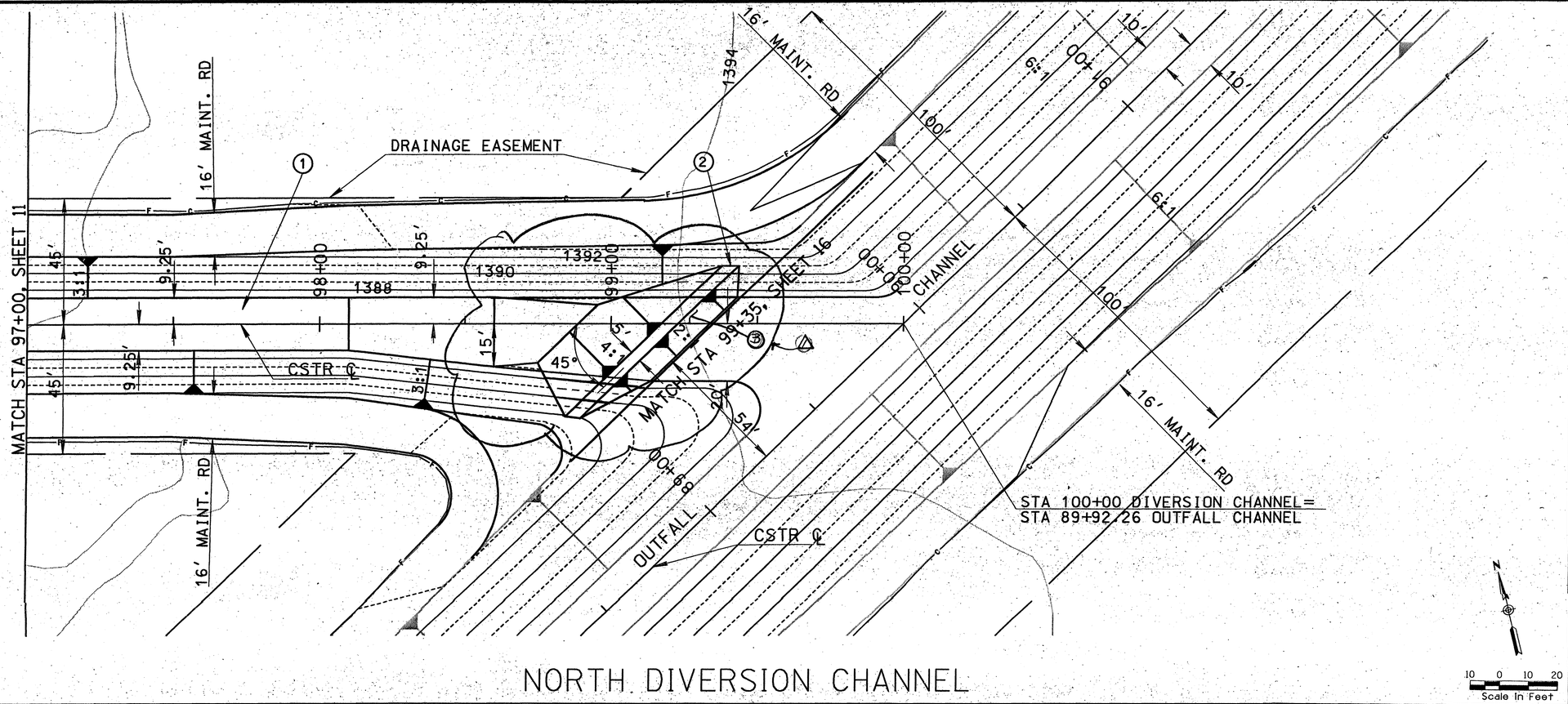
	BY	DATE
DESIGNED	S. ZOU	4/02
DRAWN	R. McKASKLE	4/02
CHECKED	A. PATEL	4/02

WOOD, PATEL & ASSOCIATES, INC.
2051 WEST NORTHERN, SUITE 100
PHOENIX, ARIZONA (602) 335-8500

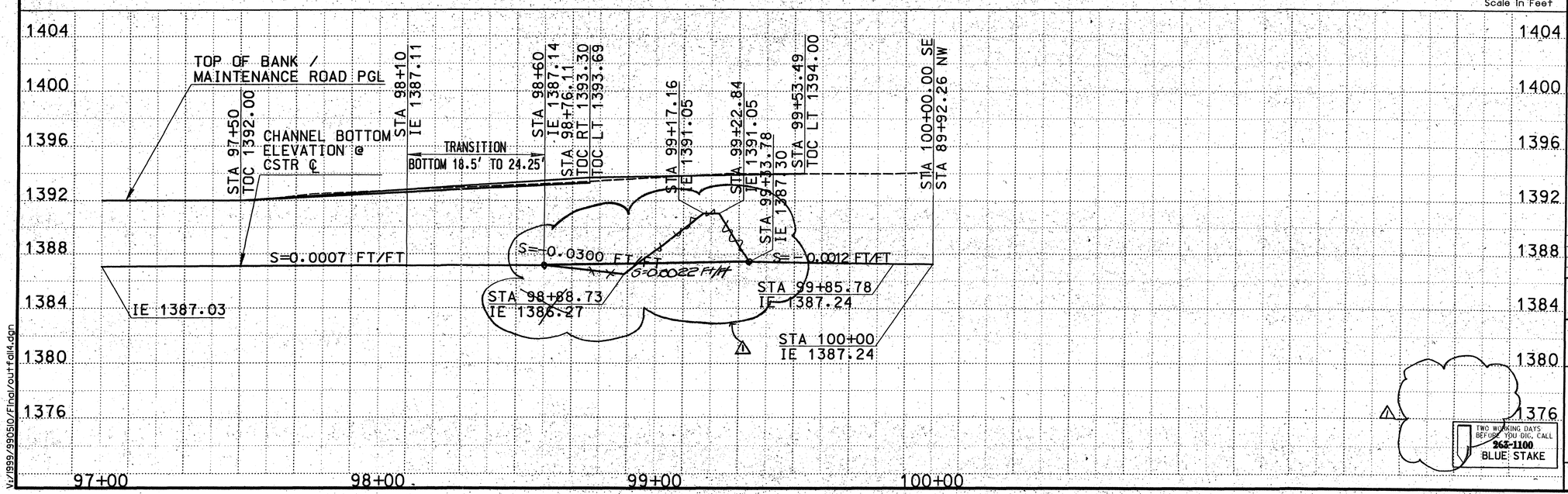
EXISTING AND INTERIM CONDITION FLOOD DELINEATIONS – 2-YEAR

SHEET 3 OF 3

V:/2001Projects/011315.05_Elliot Basin Floodplains/Drawings/March2002/FP02Yr.dwg



NORTH DIVERSION CHANNEL



TWO WORKING DAYS BEFORE YOU DIG, CALL 263-1100 BLUE STAKE

REMOVE

O CONSTRUCT O

1. CONSTRUCT TRAPEZOIDAL EARTHEN CHANNEL SEE TYPICAL SECTION DETAIL ON DRAWING NO.C5 (2,276 CY)
2. CONSTRUCT DIKE AS SHOWN ON PLAN. COMPACT TO 90% MAXIMUM DRY DENSITY (ASTM D-698) (NPI)
3. REMOVE EXIST. SUGAR DIKE AND REGRADE AS SHOWN ON PLAN

NO.	REVISION	BY	DATE
3	REMOVE SUGAR DIKE	JGT	9/24/02
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

ELLIOT ROAD DETENTION BASINS AND OUTFALL CHANNEL
PCN NO. 442 04 31

	BY	DATE
DESIGNED	J. TAILLON	05/00
DRAWN	S. RASMUSSEN	05/00
CHECKED	A. PATEL	05/00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) 10512 ASHOK C. PATEL 5/2/00 ARIZONA U.S.A.

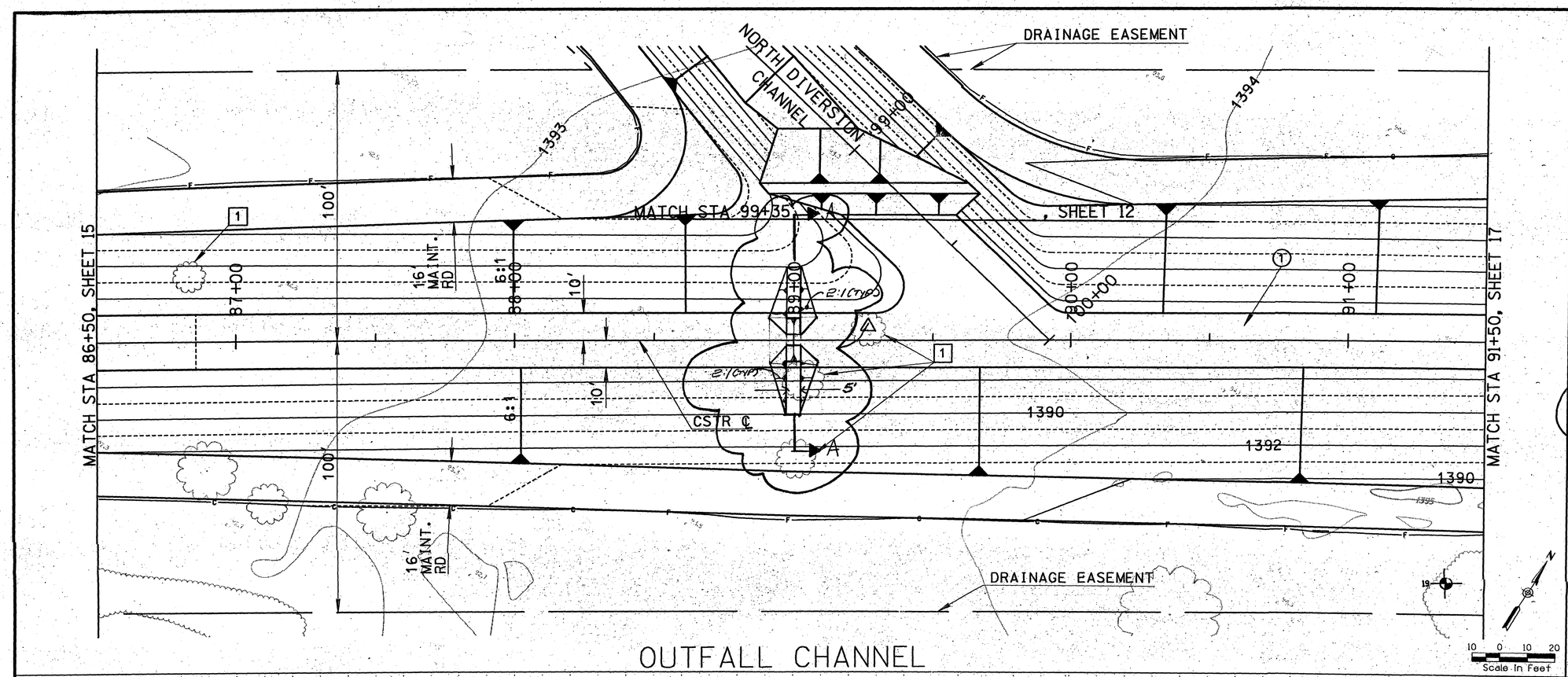
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAWING NO. C4

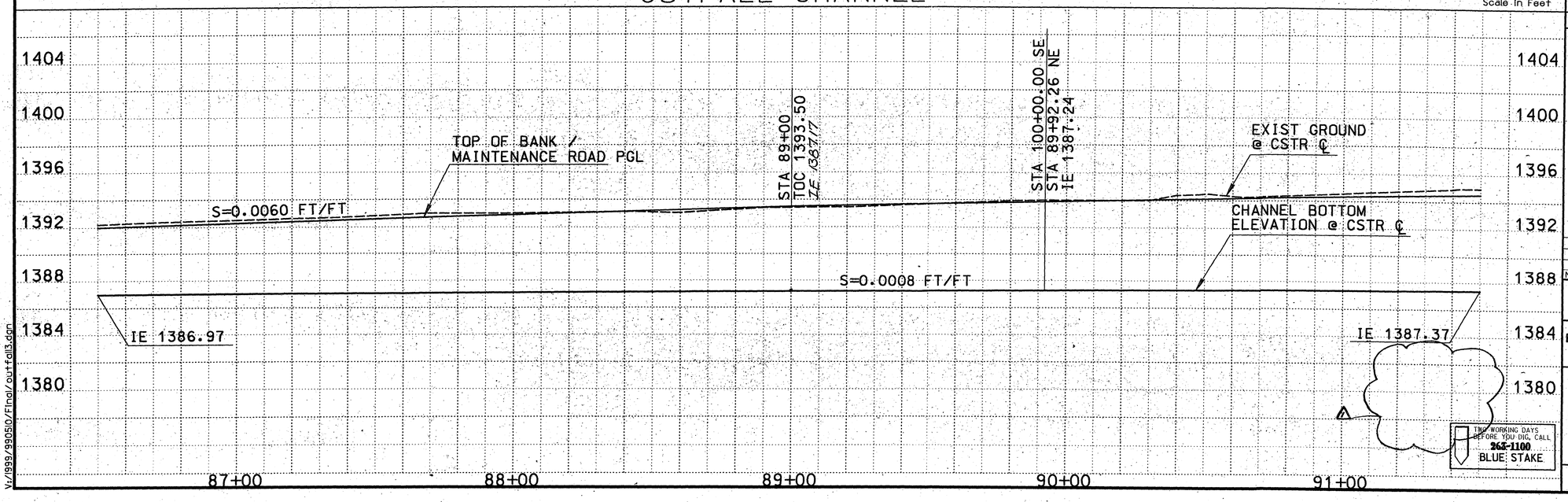
NORTH DIVERSION CHANNEL
STA 97+00 TO 100+00

SHEET 12 OF 91

V:/1999/990510/Final/outfall4.dgn

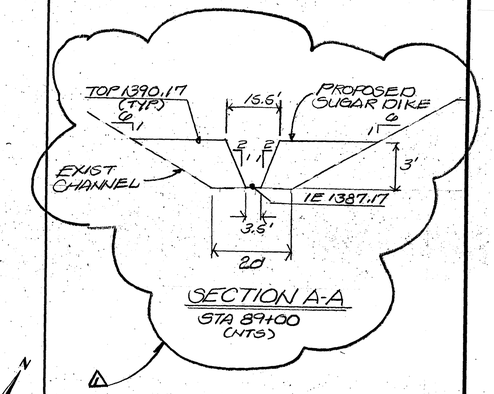


OUTFALL CHANNEL



☐ REMOVE ☐

1 EXIST TREE TO BE REMOVED (NPI)



O CONSTRUCT O

1 CONSTRUCT TRAPEZOIDAL EARTHEN CHANNEL SEE TYPICAL SECTION DETAIL ON DRAWING NO.C5 (6,329 CY)

NO.	REVISION	BY	DATE
3	ADD SUGAR DIKE	JGT	9/24/02
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

ELLIOT ROAD DETENTION BASINS AND OUTFALL CHANNEL
PCN NO. 442 04 31

	BY	DATE
DESIGNED	J. TAILLON	05/00
DRAWN	S. RASMUSSEN	05/00
CHECKED	A. PATEL	05/00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) 10512 ASHOK C. PATEL 5/1/00 ARIZONA U.S.A.

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

TWO WORKING DAYS BEFORE YOU DIG, CALL 262-1100 BLUE STAKE

DRAWING NO. C8

OUTFALL CHANNEL
STA 86+50 TO 91+50

SHEET 16 OF 91

V:/999/990510/Final/outfall3.dgn