

APPENDIX B: HYDROLOGY

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Planning & Development
Town of Waterford, CT

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Planning & Development
Town of Waterford, CT



Drainage Area Map

Mamacoke Brook Outfall
Channel Stabilization
and Restoration

New London, CT



Watersheds



Parcels



Point of Analysis



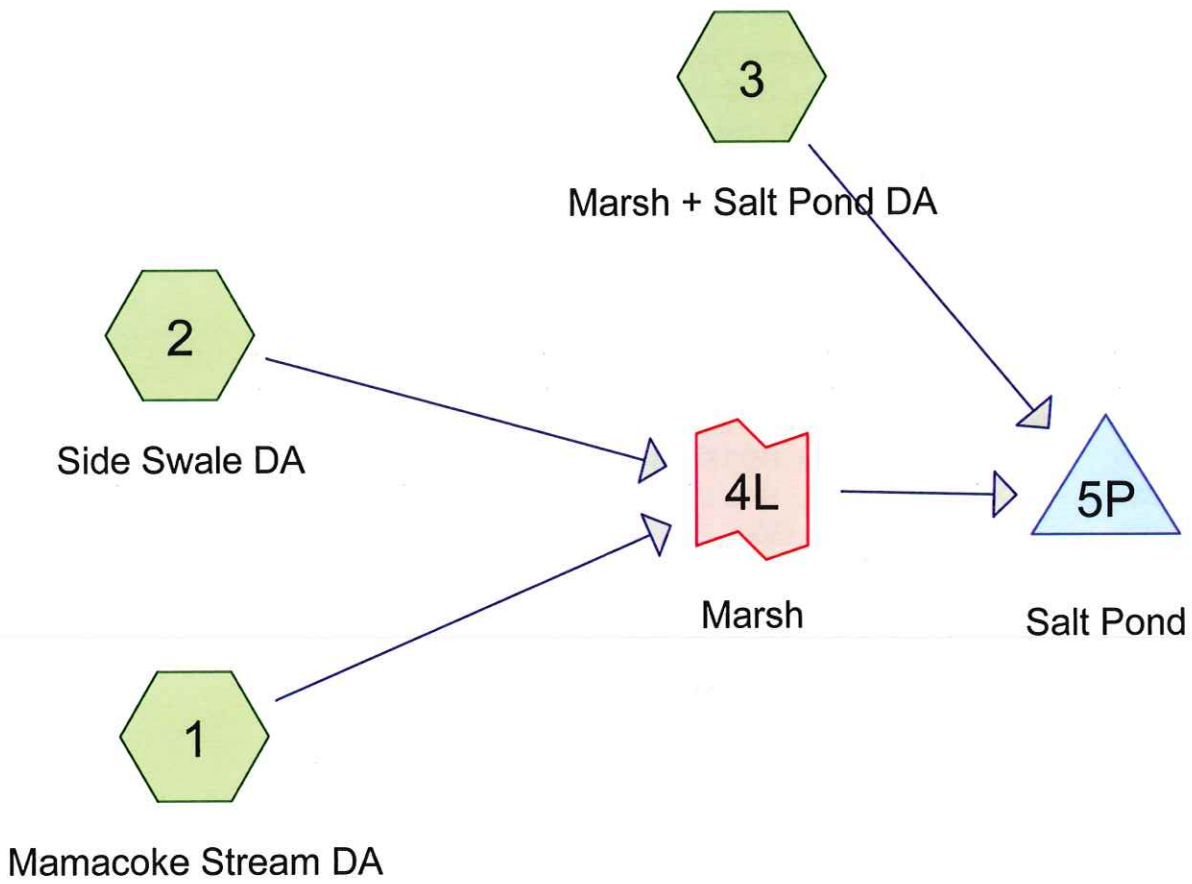
USGS Contours (1-ft)

0 250 500
Feet



October, 2025

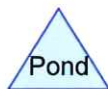
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) GreenStreet Map
Contributors, and the GIS User Community. USDA FSA



Subcat



Reach



Pond



Link

Routing Diagram for Mamacoke Stream_Existing Cond
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Mamacoke Stream_Existing Cond

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.562	39	>75% Grass cover, Good, HSG A (3)
3.056	61	>75% Grass cover, Good, HSG B (1)
1.802	74	>75% Grass cover, Good, HSG C (1)
0.081	80	>75% Grass cover, Good, HSG D (1)
0.303	96	Gravel surface, HSG A (3)
1.539	30	Meadow, non-grazed, HSG A (3)
0.540	58	Meadow, non-grazed, HSG B (1, 2, 3)
0.321	71	Meadow, non-grazed, HSG C (1)
3.117	78	Meadow, non-grazed, HSG D (1, 2, 3)
0.177	98	Paved parking, HSG A (3)
4.374	98	Paved parking, HSG B (1, 2)
4.627	98	Paved parking, HSG C (1)
0.095	98	Paved parking, HSG D (1)
0.024	98	Water Surface, HSG A (3)
0.000	98	Water Surface, HSG B (3)
1.581	98	Water Surface, HSG D (3)
1.976	36	Woods, Fair, HSG A (3)
31.543	60	Woods, Fair, HSG B (1, 2, 3)
11.266	73	Woods, Fair, HSG C (1)
9.038	79	Woods, Fair, HSG D (1, 2, 3)
0.094	43	Woods/grass comb., Fair, HSG A (3)
0.369	65	Woods/grass comb., Fair, HSG B (1)
0.112	76	Woods/grass comb., Fair, HSG C (1)
0.050	82	Woods/grass comb., Fair, HSG D (3)
76.644	70	TOTAL AREA

Mamacoke Stream_Existing Cond

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.673	HSG A	3
39.882	HSG B	1, 2, 3
18.128	HSG C	1
13.960	HSG D	1, 2, 3
0.000	Other	
76.644		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.562	3.056	1.802	0.081	0.000	5.501	>75% Grass cover, Good	1, 3
0.303	0.000	0.000	0.000	0.000	0.303	Gravel surface	3
1.539	0.540	0.321	3.117	0.000	5.517	Meadow, non-grazed	1, 2, 3
0.177	4.374	4.627	0.095	0.000	9.273	Paved parking	1, 2, 3
0.024	0.000	0.000	1.581	0.000	1.605	Water Surface	3
1.976	31.543	11.266	9.038	0.000	53.822	Woods, Fair	1, 2, 3
0.094	0.369	0.112	0.050	0.000	0.624	Woods/grass comb., Fair	1, 3
4.673	39.882	18.128	13.960	0.000	76.644	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1	0.00	0.00	80.0	0.0375	0.013	18.0	0.0	0.0
2	1	0.00	0.00	11.0	0.0455	0.013	24.0	0.0	0.0
3	1	0.00	0.00	24.0	0.0417	0.013	15.0	0.0	0.0
4	1	0.00	0.00	218.0	0.0417	0.013	24.0	0.0	0.0
5	1	0.00	0.00	65.0	0.1846	0.013	24.0	0.0	0.0
6	5P	0.40	-0.13	46.0	0.0115	0.035	36.0	36.0	12.0

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Notes Listing (all nodes)

Line#	Node Number	Notes
1	Project	Rainfall events imported from "NRCS-Rain.txt" for 810 CT New London

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 1-Year Rainfall=2.89"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=0.79"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=21.95 cfs 3.509 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=0.32"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=1.17 cfs 0.297 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=0.29"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=1.02 cfs 0.304 af

Total Runoff Area = 76.644 ac Runoff Volume = 4.110 af Average Runoff Depth = 0.64"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 1-Year Rainfall=2.89"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 21.95 cfs @ 12.53 hrs, Volume= 3.509 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 1-Year Rainfall=2.89"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 '/' Top.W=16.00' n= 0.045
34.6	2,868	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

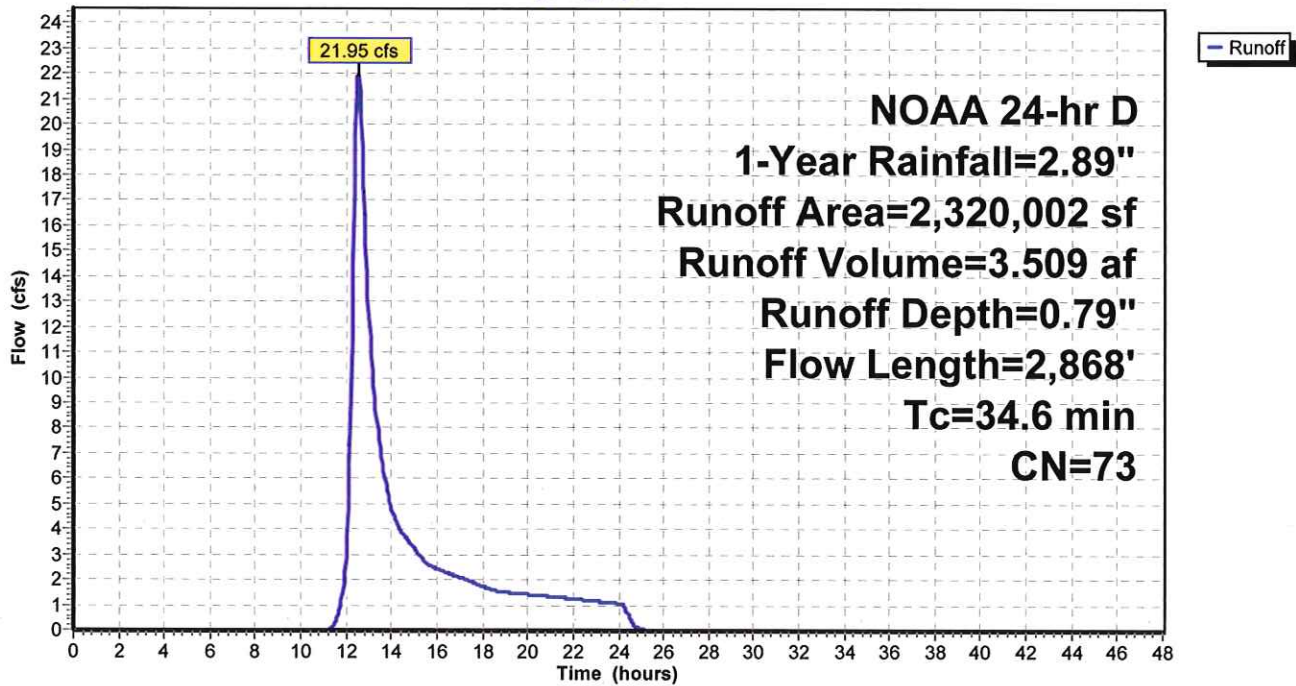
NOAA 24-hr D 1-Year Rainfall=2.89"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 1-Year Rainfall=2.89"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 1.17 cfs @ 12.61 hrs, Volume= 0.297 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 1-Year Rainfall=2.89"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

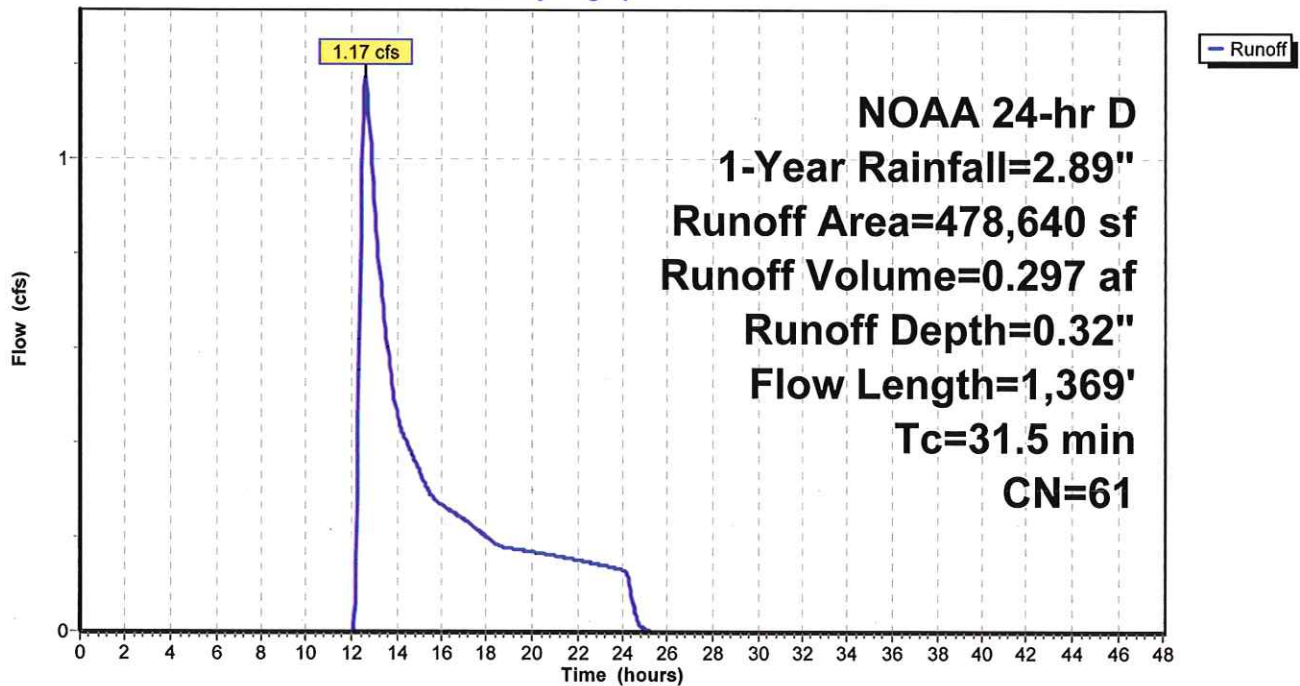
NOAA 24-hr D 1-Year Rainfall=2.89"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 1-Year Rainfall=2.89"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 1.02 cfs @ 12.80 hrs, Volume= 0.304 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 1-Year Rainfall=2.89"

Area (sf)	CN	Description
13,188	96	Gravel surface, HSG A
814	98	Water Surface, HSG D
2	36	Woods, Fair, HSG A
3,713	79	Woods, Fair, HSG D
67,020	30	Meadow, non-grazed, HSG A
4,743	58	Meadow, non-grazed, HSG B
35,684	78	Meadow, non-grazed, HSG D
181	98	Water Surface, HSG D
7,704	98	Paved parking, HSG A
86,051	36	Woods, Fair, HSG A
183,080	60	Woods, Fair, HSG B
38,165	79	Woods, Fair, HSG D
9,120	98	Water Surface, HSG D
24,475	39	>75% Grass cover, Good, HSG A
906	98	Water Surface, HSG A
1	98	Water Surface, HSG B
1	98	Water Surface, HSG D
57,141	98	Water Surface, HSG D
4,075	43	Woods/grass comb., Fair, HSG A
2,165	82	Woods/grass comb., Fair, HSG D
140	98	Water Surface, HSG A
17	98	Water Surface, HSG D
1,586	98	Water Surface, HSG D
539,972	60	Weighted Average
462,361		85.63% Pervious Area
77,611		14.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

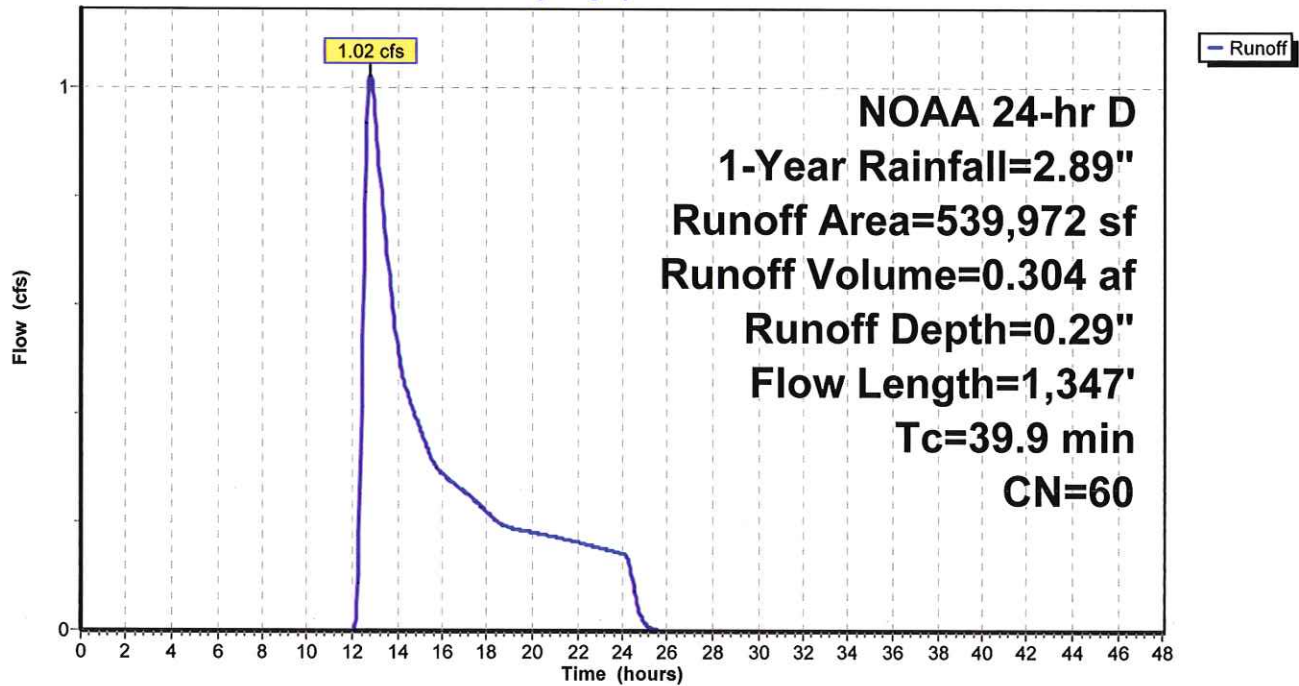
NOAA 24-hr D 1-Year Rainfall=2.89"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 2-Year Rainfall=3.45"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=1.15"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=33.37 cfs 5.087 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=0.55"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=2.60 cfs 0.504 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=0.51"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=2.31 cfs 0.527 af

Total Runoff Area = 76.644 ac Runoff Volume = 6.118 af Average Runoff Depth = 0.96"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 2-Year Rainfall=3.45"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 33.37 cfs @ 12.51 hrs, Volume= 5.087 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.45"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 '/' Top.W=16.00' n= 0.045
34.6	2,868	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

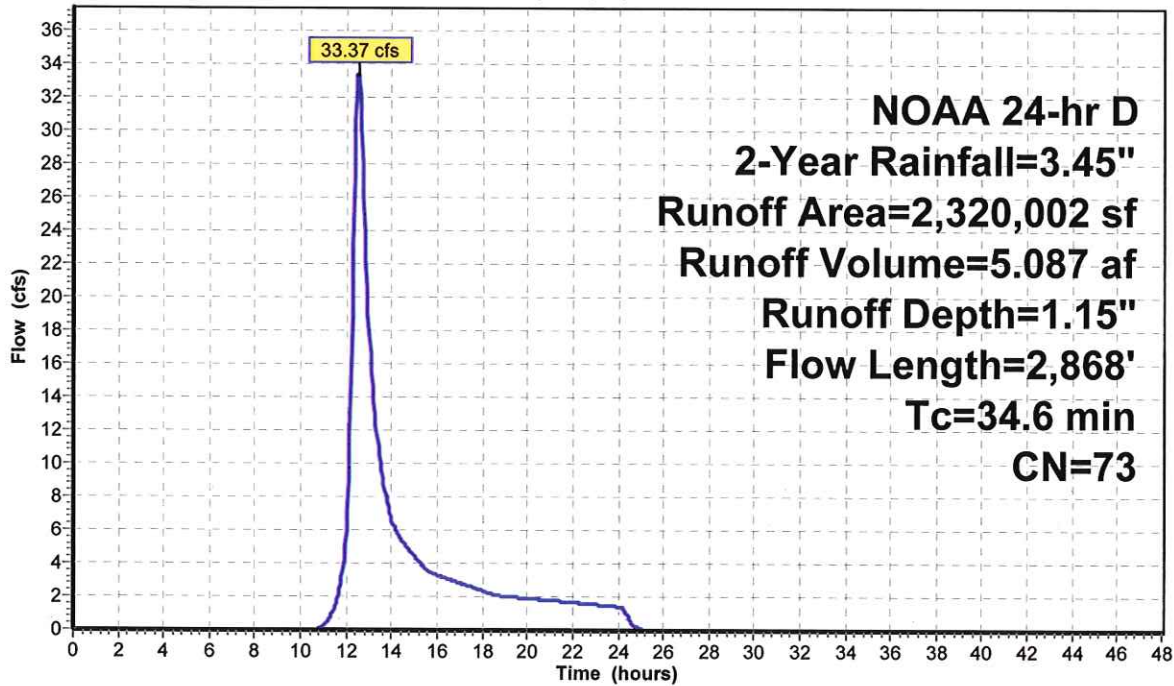
NOAA 24-hr D 2-Year Rainfall=3.45"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 2-Year Rainfall=3.45"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 2.60 cfs @ 12.54 hrs, Volume= 0.504 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.45"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

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Mamacoke Stream - Existing Conditions Model

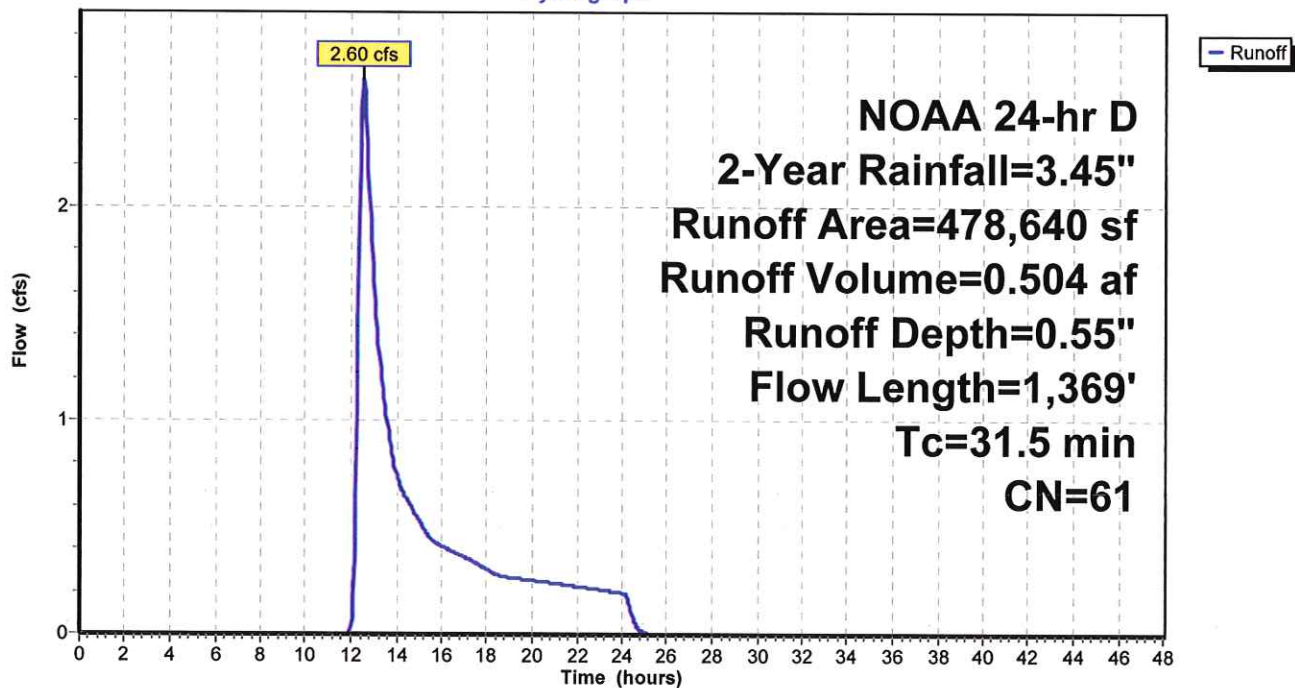
NOAA 24-hr D 2-Year Rainfall=3.45"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 2-Year Rainfall=3.45"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 2.31 cfs @ 12.70 hrs, Volume= 0.527 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.45"

Area (sf)	CN	Description
13,188	96	Gravel surface, HSG A
814	98	Water Surface, HSG D
2	36	Woods, Fair, HSG A
3,713	79	Woods, Fair, HSG D
67,020	30	Meadow, non-grazed, HSG A
4,743	58	Meadow, non-grazed, HSG B
35,684	78	Meadow, non-grazed, HSG D
181	98	Water Surface, HSG D
7,704	98	Paved parking, HSG A
86,051	36	Woods, Fair, HSG A
183,080	60	Woods, Fair, HSG B
38,165	79	Woods, Fair, HSG D
9,120	98	Water Surface, HSG D
24,475	39	>75% Grass cover, Good, HSG A
906	98	Water Surface, HSG A
1	98	Water Surface, HSG B
1	98	Water Surface, HSG D
57,141	98	Water Surface, HSG D
4,075	43	Woods/grass comb., Fair, HSG A
2,165	82	Woods/grass comb., Fair, HSG D
140	98	Water Surface, HSG A
17	98	Water Surface, HSG D
1,586	98	Water Surface, HSG D
539,972	60	Weighted Average
462,361		85.63% Pervious Area
77,611		14.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

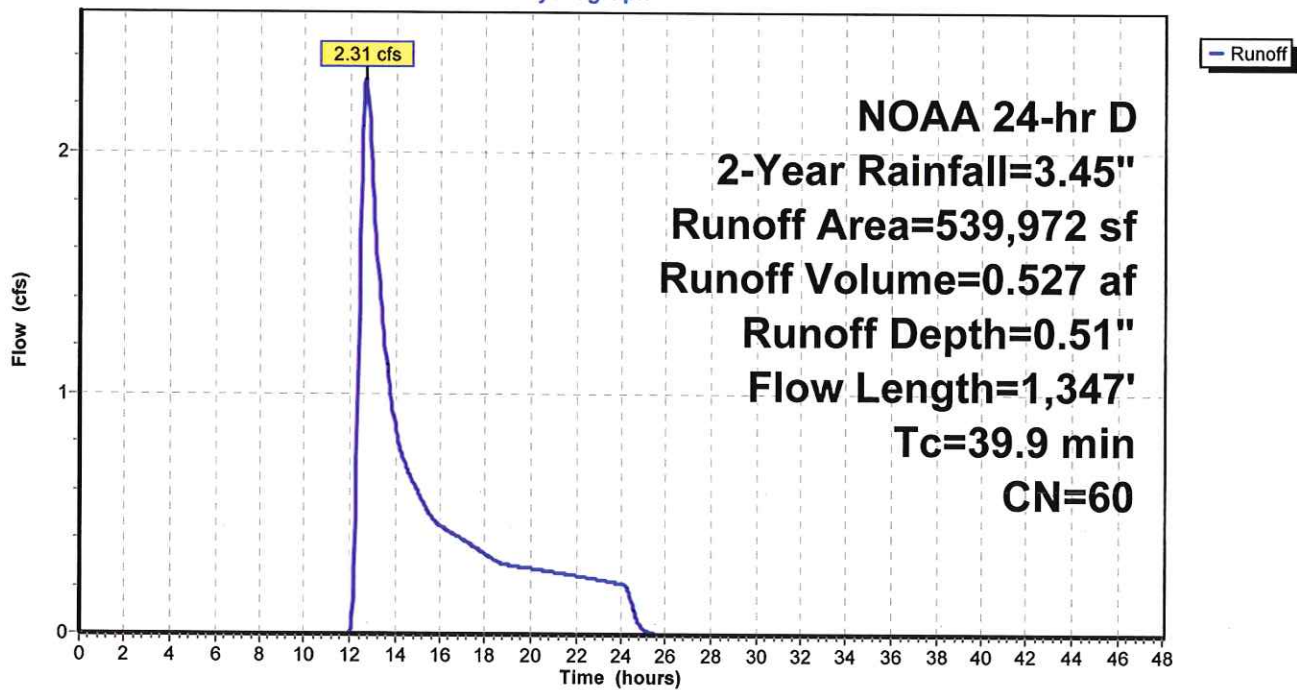
NOAA 24-hr D 2-Year Rainfall=3.45"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 5-Year Rainfall=4.36"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=1.79"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=53.89 cfs 7.948 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=1.00"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=5.69 cfs 0.918 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=0.95"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=5.21 cfs 0.976 af

Total Runoff Area = 76.644 ac Runoff Volume = 9.842 af Average Runoff Depth = 1.54"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 5-Year Rainfall=4.36"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 53.89 cfs @ 12.50 hrs, Volume= 7.948 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 5-Year Rainfall=4.36"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 ' /' Top.W=16.00' n= 0.045
34.6	2,868	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

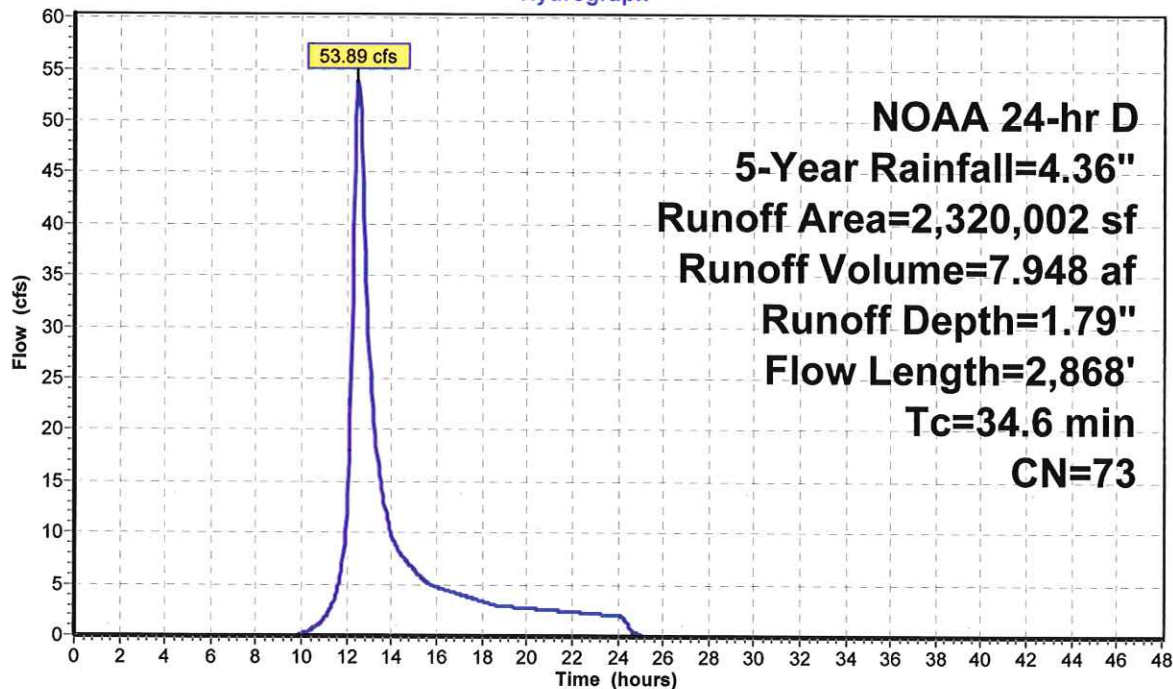
NOAA 24-hr D 5-Year Rainfall=4.36"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 5-Year Rainfall=4.36"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 5.69 cfs @ 12.49 hrs, Volume= 0.918 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 5-Year Rainfall=4.36"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

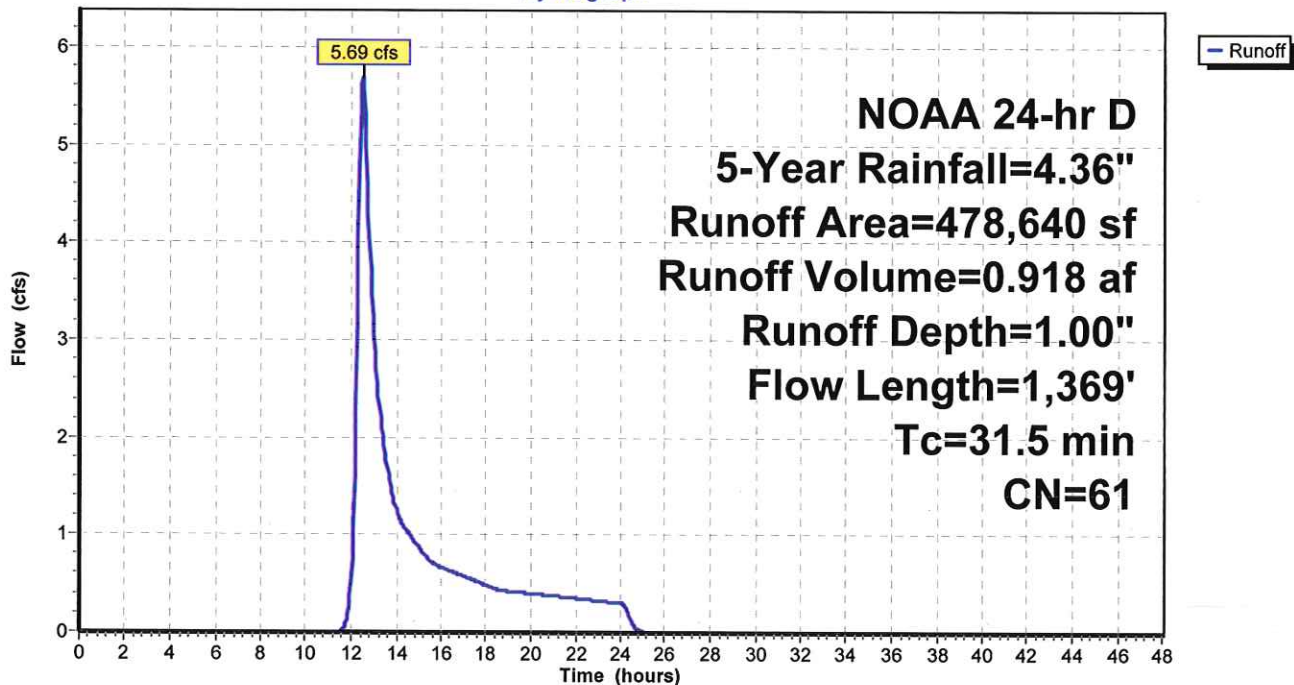
NOAA 24-hr D 5-Year Rainfall=4.36"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 5-Year Rainfall=4.36"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 5.21 cfs @ 12.63 hrs, Volume= 0.976 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 5-Year Rainfall=4.36"

Area (sf)	CN	Description
13,188	96	Gravel surface, HSG A
814	98	Water Surface, HSG D
2	36	Woods, Fair, HSG A
3,713	79	Woods, Fair, HSG D
67,020	30	Meadow, non-grazed, HSG A
4,743	58	Meadow, non-grazed, HSG B
35,684	78	Meadow, non-grazed, HSG D
181	98	Water Surface, HSG D
7,704	98	Paved parking, HSG A
86,051	36	Woods, Fair, HSG A
183,080	60	Woods, Fair, HSG B
38,165	79	Woods, Fair, HSG D
9,120	98	Water Surface, HSG D
24,475	39	>75% Grass cover, Good, HSG A
906	98	Water Surface, HSG A
1	98	Water Surface, HSG B
1	98	Water Surface, HSG D
57,141	98	Water Surface, HSG D
4,075	43	Woods/grass comb., Fair, HSG A
2,165	82	Woods/grass comb., Fair, HSG D
140	98	Water Surface, HSG A
17	98	Water Surface, HSG D
1,586	98	Water Surface, HSG D
539,972	60	Weighted Average
462,361		85.63% Pervious Area
77,611		14.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

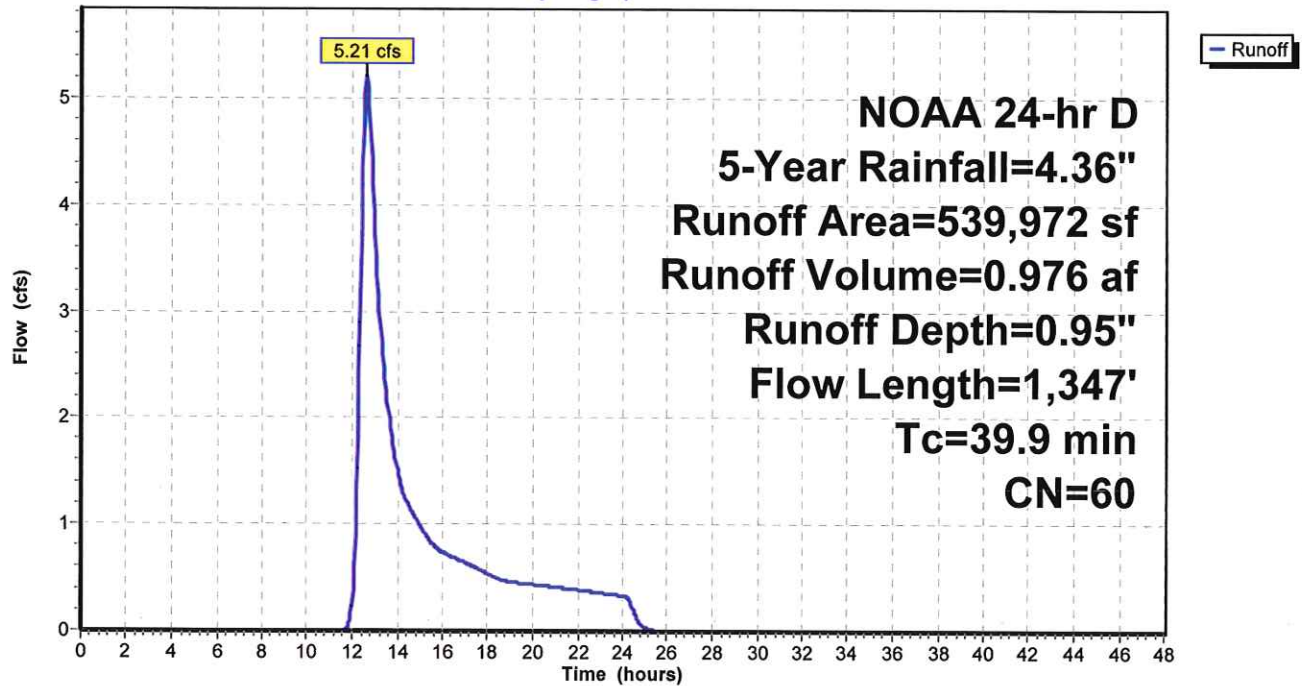
NOAA 24-hr D 5-Year Rainfall=4.36"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 10-Year Rainfall=5.11"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=2.37"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=72.09 cfs 10.506 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=1.44"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=8.70 cfs 1.315 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=1.37"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=8.10 cfs 1.411 af

Total Runoff Area = 76.644 ac Runoff Volume = 13.231 af Average Runoff Depth = 2.07"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 10-Year Rainfall=5.11"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 72.09 cfs @ 12.50 hrs, Volume= 10.506 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.11"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 ' / ' Top.W=16.00' n= 0.045
34.6	2,868	Total			

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Mamacoke Stream - Existing Conditions Model

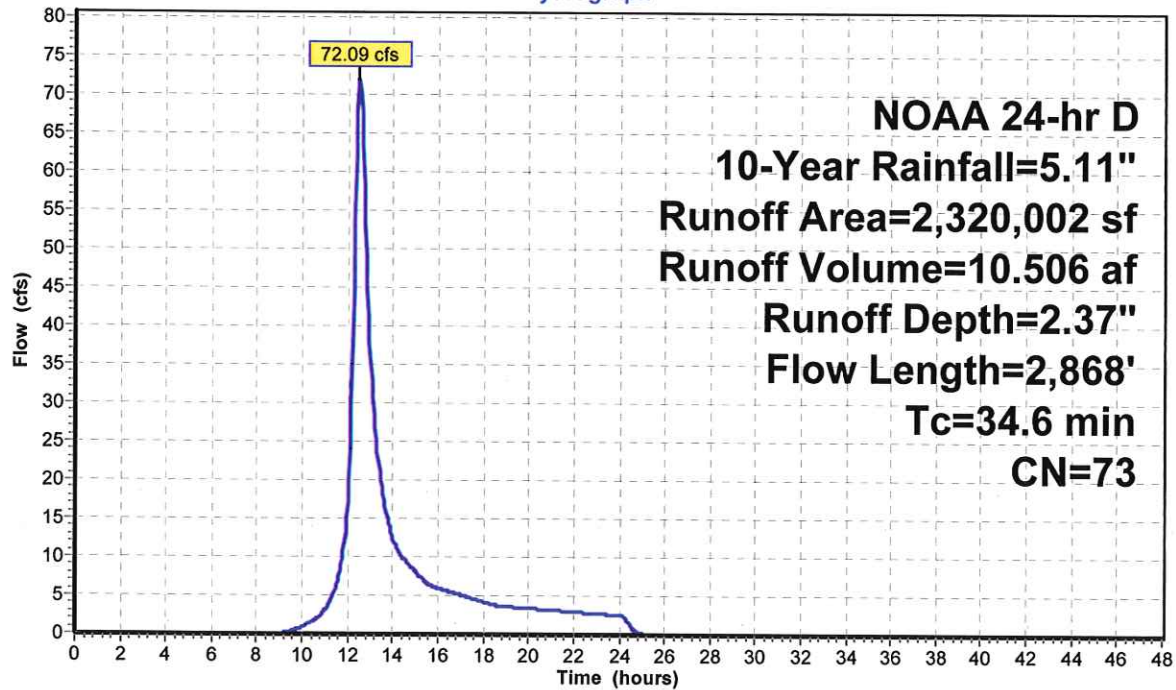
NOAA 24-hr D 10-Year Rainfall=5.11"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 10-Year Rainfall=5.11"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 8.70 cfs @ 12.48 hrs, Volume= 1.315 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.11"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

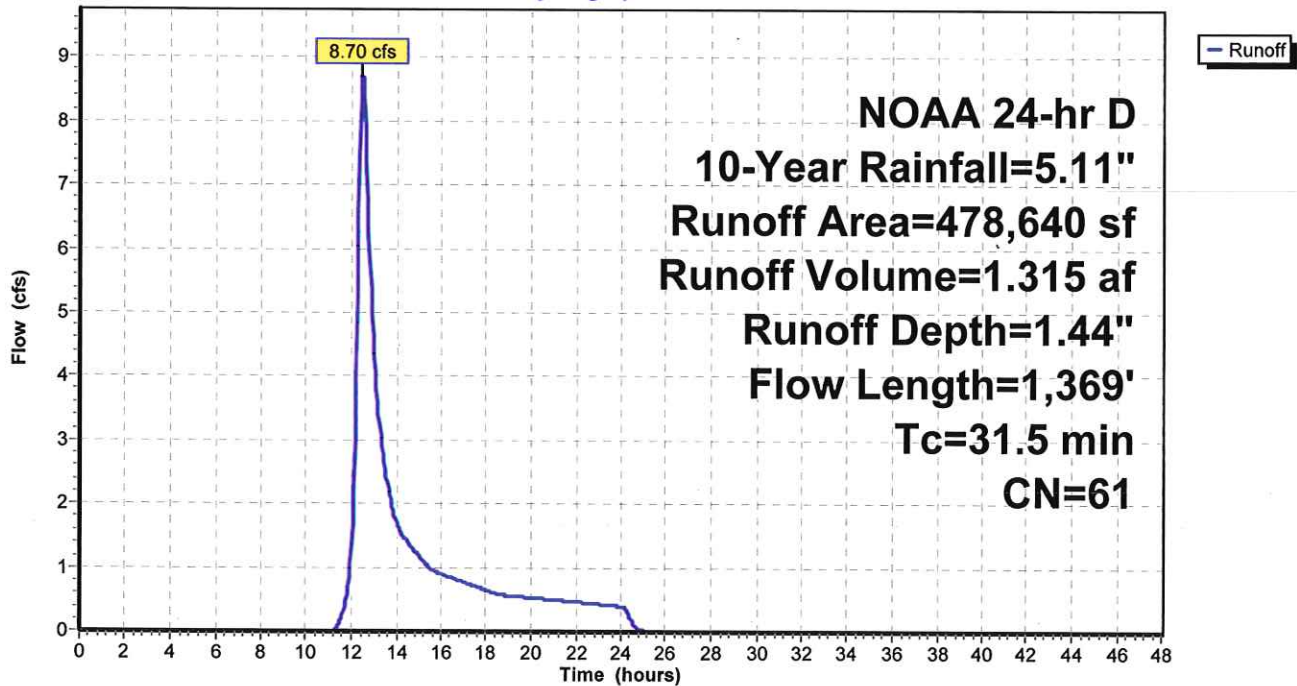
NOAA 24-hr D 10-Year Rainfall=5.11"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 10-Year Rainfall=5.11"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 8.10 cfs @ 12.61 hrs, Volume= 1.411 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.11"

Area (sf)	CN	Description
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2	36	Woods, Fair, HSG A
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35,684	78	Meadow, non-grazed, HSG D
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24,475	39	>75% Grass cover, Good, HSG A
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1	98	Water Surface, HSG B
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27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

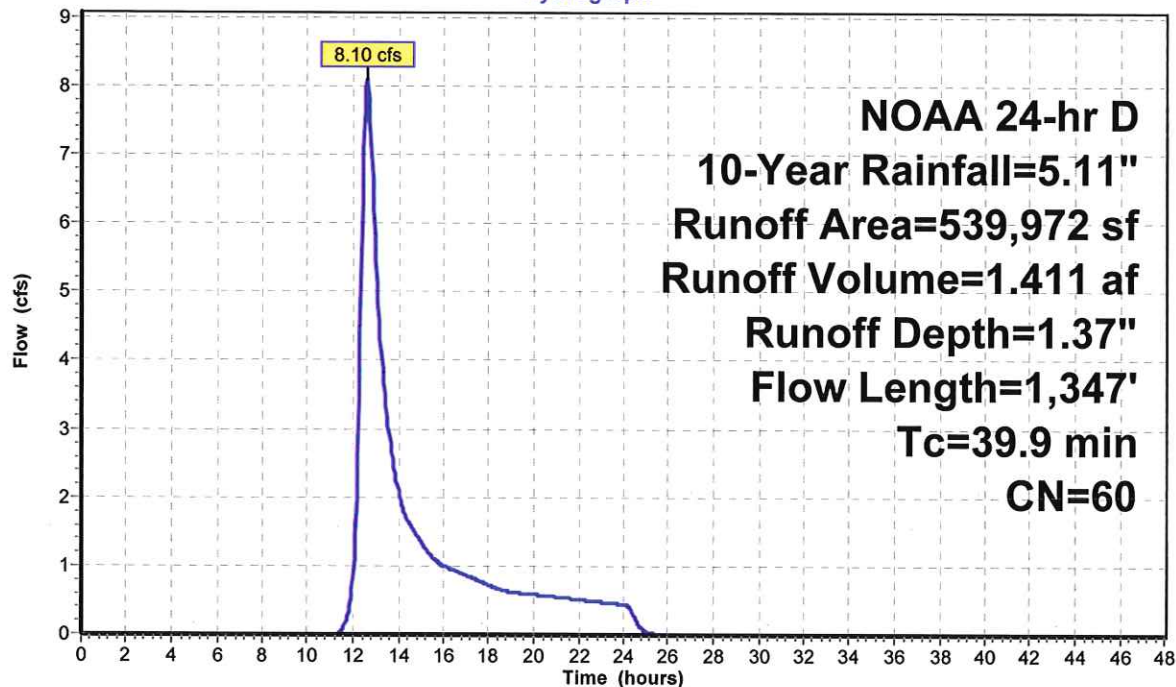
NOAA 24-hr D 10-Year Rainfall=5.11"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 25-Year Rainfall=6.15"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=3.21"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=98.53 cfs 14.262 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=2.11"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=13.37 cfs 1.929 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=2.02"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=12.61 cfs 2.087 af

Total Runoff Area = 76.644 ac Runoff Volume = 18.278 af Average Runoff Depth = 2.86"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 25-Year Rainfall=6.15"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 98.53 cfs @ 12.49 hrs, Volume= 14.262 af, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.15"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 '/' Top.W=16.00' n= 0.045
34.6	2,868	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

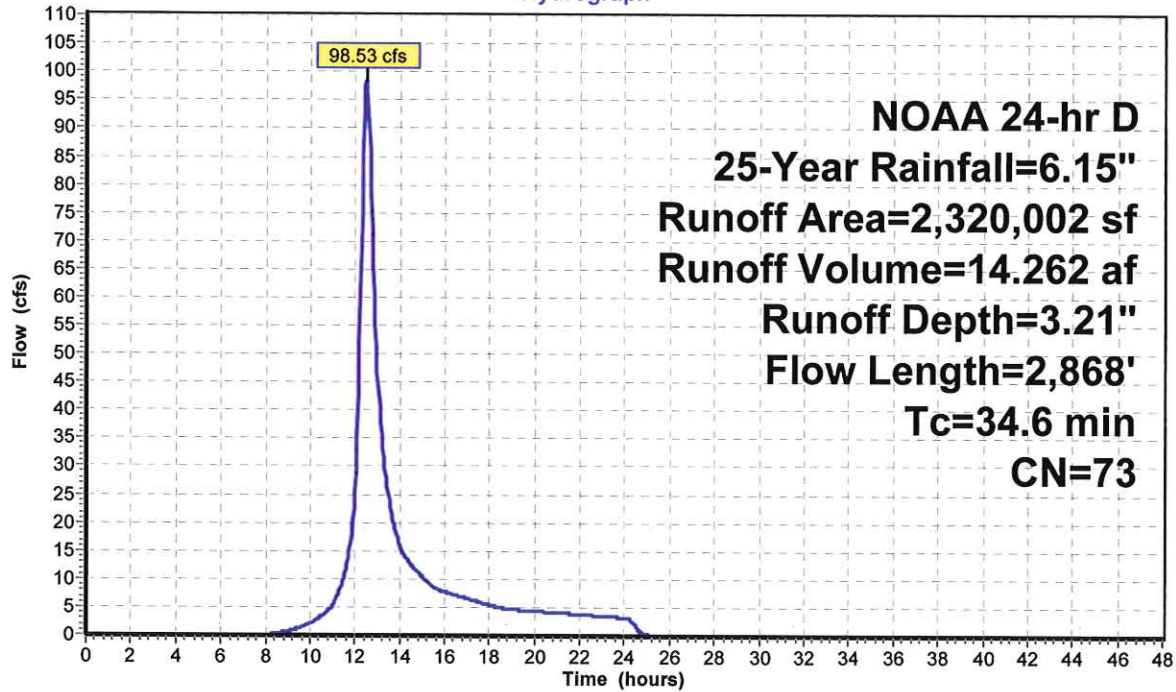
NOAA 24-hr D 25-Year Rainfall=6.15"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model
NOAA 24-hr D 25-Year Rainfall=6.15"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 13.37 cfs @ 12.47 hrs, Volume= 1.929 af, Depth= 2.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.15"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

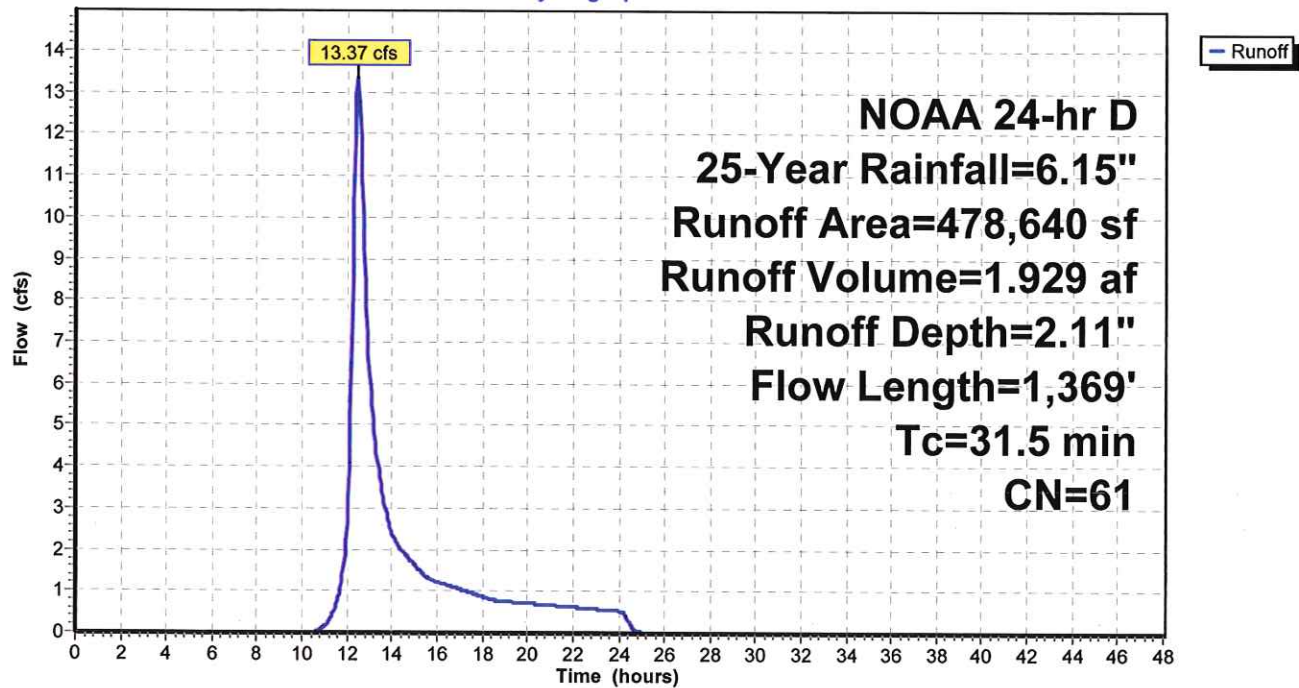
NOAA 24-hr D 25-Year Rainfall=6.15"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 25-Year Rainfall=6.15"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 12.61 cfs @ 12.59 hrs, Volume= 2.087 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.15"

Area (sf)	CN	Description
13,188	96	Gravel surface, HSG A
814	98	Water Surface, HSG D
2	36	Woods, Fair, HSG A
3,713	79	Woods, Fair, HSG D
67,020	30	Meadow, non-grazed, HSG A
4,743	58	Meadow, non-grazed, HSG B
35,684	78	Meadow, non-grazed, HSG D
181	98	Water Surface, HSG D
7,704	98	Paved parking, HSG A
86,051	36	Woods, Fair, HSG A
183,080	60	Woods, Fair, HSG B
38,165	79	Woods, Fair, HSG D
9,120	98	Water Surface, HSG D
24,475	39	>75% Grass cover, Good, HSG A
906	98	Water Surface, HSG A
1	98	Water Surface, HSG B
1	98	Water Surface, HSG D
57,141	98	Water Surface, HSG D
4,075	43	Woods/grass comb., Fair, HSG A
2,165	82	Woods/grass comb., Fair, HSG D
140	98	Water Surface, HSG A
17	98	Water Surface, HSG D
1,586	98	Water Surface, HSG D
539,972	60	Weighted Average
462,361		85.63% Pervious Area
77,611		14.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

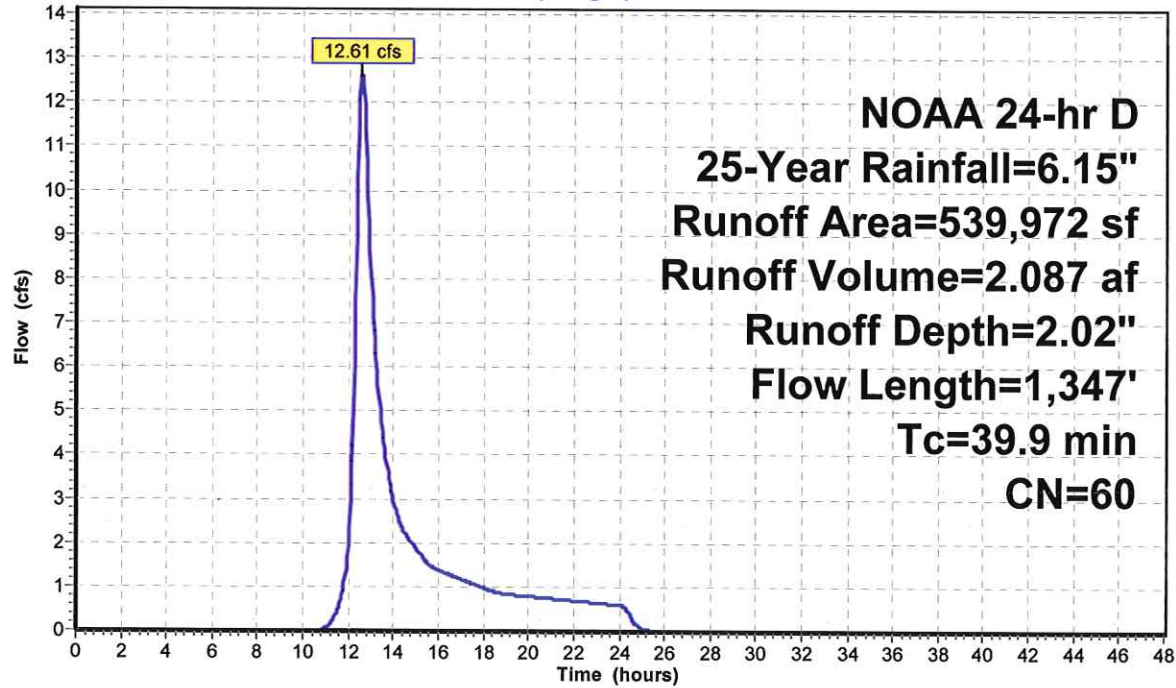
NOAA 24-hr D 25-Year Rainfall=6.15"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 50-Year Rainfall=6.93"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=3.87"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=118.98 cfs 17.199 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=2.65"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=17.14 cfs 2.428 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=2.55"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=16.28 cfs 2.638 af

Total Runoff Area = 76.644 ac Runoff Volume = 22.265 af Average Runoff Depth = 3.49"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 50-Year Rainfall=6.93"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 118.98 cfs @ 12.49 hrs, Volume= 17.199 af, Depth= 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-Year Rainfall=6.93"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 ' /' Top.W=16.00' n= 0.045
34.6	2,868	Total			

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Mamacoke Stream - Existing Conditions Model

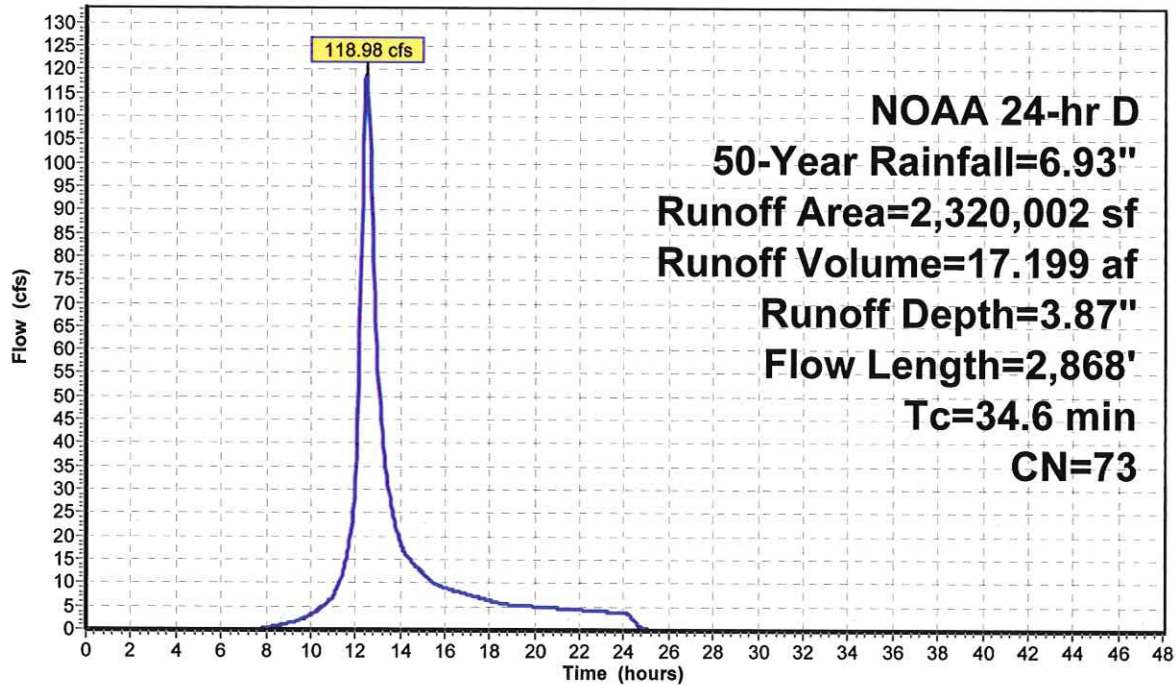
NOAA 24-hr D 50-Year Rainfall=6.93"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 50-Year Rainfall=6.93"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 17.14 cfs @ 12.46 hrs, Volume= 2.428 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-Year Rainfall=6.93"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

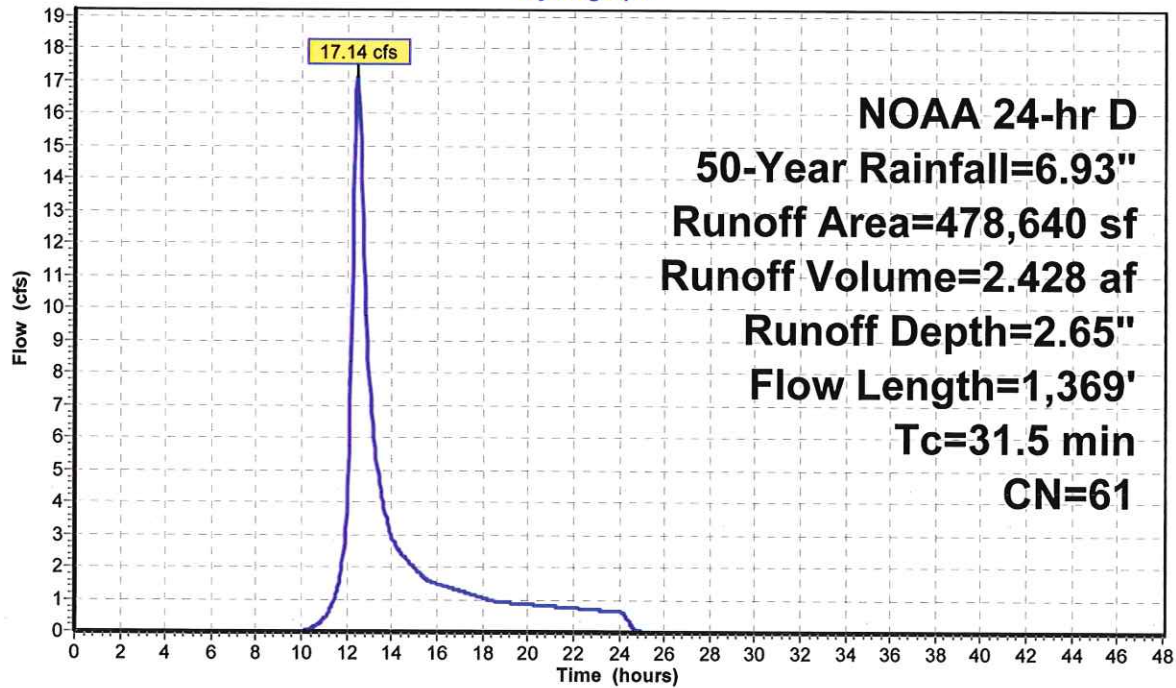
NOAA 24-hr D 50-Year Rainfall=6.93"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 50-Year Rainfall=6.93"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 16.28 cfs @ 12.58 hrs, Volume= 2.638 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-Year Rainfall=6.93"

Area (sf)	CN	Description
13,188	96	Gravel surface, HSG A
814	98	Water Surface, HSG D
2	36	Woods, Fair, HSG A
3,713	79	Woods, Fair, HSG D
67,020	30	Meadow, non-grazed, HSG A
4,743	58	Meadow, non-grazed, HSG B
35,684	78	Meadow, non-grazed, HSG D
181	98	Water Surface, HSG D
7,704	98	Paved parking, HSG A
86,051	36	Woods, Fair, HSG A
183,080	60	Woods, Fair, HSG B
38,165	79	Woods, Fair, HSG D
9,120	98	Water Surface, HSG D
24,475	39	>75% Grass cover, Good, HSG A
906	98	Water Surface, HSG A
1	98	Water Surface, HSG B
1	98	Water Surface, HSG D
57,141	98	Water Surface, HSG D
4,075	43	Woods/grass comb., Fair, HSG A
2,165	82	Woods/grass comb., Fair, HSG D
140	98	Water Surface, HSG A
17	98	Water Surface, HSG D
1,586	98	Water Surface, HSG D
539,972	60	Weighted Average
462,361		85.63% Pervious Area
77,611		14.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

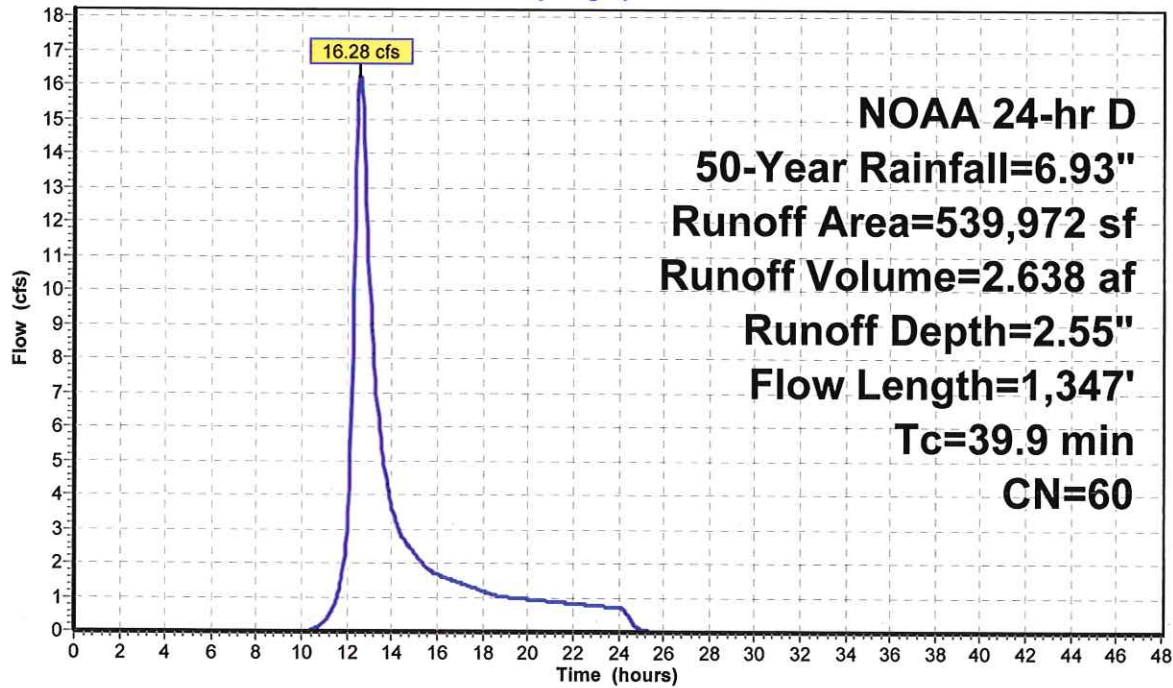
NOAA 24-hr D 50-Year Rainfall=6.93"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 100-Year Rainfall=7.76"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Mamacoke Stream DA Runoff Area=2,320,002 sf 17.03% Impervious Runoff Depth=4.60"
Flow Length=2,868' Tc=34.6 min CN=73 Runoff=141.12 cfs 20.407 af

Subcatchment2: Side Swale DA Runoff Area=478,640 sf 0.23% Impervious Runoff Depth=3.26"
Flow Length=1,369' Tc=31.5 min CN=61 Runoff=21.35 cfs 2.988 af

Subcatchment3: Marsh + Salt Pond DA Runoff Area=539,972 sf 14.37% Impervious Runoff Depth=3.15"
Flow Length=1,347' Tc=39.9 min CN=60 Runoff=20.41 cfs 3.259 af

Total Runoff Area = 76.644 ac Runoff Volume = 26.653 af Average Runoff Depth = 4.17"
85.81% Pervious = 65.767 ac 14.19% Impervious = 10.877 ac

Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 100-Year Rainfall=7.76"

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Summary for Subcatchment 1: Mamacoke Stream DA

Runoff = 141.12 cfs @ 12.48 hrs, Volume= 20.407 af, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=7.76"

Area (sf)	CN	Description
1,173	79	Woods, Fair, HSG D
589	58	Meadow, non-grazed, HSG B
13,985	71	Meadow, non-grazed, HSG C
92,123	78	Meadow, non-grazed, HSG D
189,429	98	Paved parking, HSG B
201,565	98	Paved parking, HSG C
4,122	98	Paved parking, HSG D
749,434	60	Woods, Fair, HSG B
490,744	73	Woods, Fair, HSG C
340,738	79	Woods, Fair, HSG D
133,138	61	>75% Grass cover, Good, HSG B
78,490	74	>75% Grass cover, Good, HSG C
3,510	80	>75% Grass cover, Good, HSG D
16,079	65	Woods/grass comb., Fair, HSG B
4,883	76	Woods/grass comb., Fair, HSG C
2,320,002	73	Weighted Average
1,924,886		82.97% Pervious Area
395,116		17.03% Impervious Area

Mamacoke Stream_Existing Cond

Prepared by Biohabitats, Inc.

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		Sheet Flow, Sheet Woods: Light underbrush n= 0.400 P2= 3.45"
0.5	73	0.0274	2.48		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
2.1	268	0.0112	2.15		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.6	92	0.0326	2.71		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
4.1	433	0.1247	1.77		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.7	179	0.0503	4.55		Shallow Concentrated Flow, Shallow - Paved Paved Kv= 20.3 fps
0.1	80	0.0375	11.51	20.34	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.0	11	0.0455	15.36	48.26	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	24	0.0417	10.75	13.19	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.2	218	0.0417	14.70	46.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
0.0	65	0.1846	30.94	97.20	Pipe Channel, RCP_Round 24" 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
4.7	521	0.1373	1.85		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.9	804	0.0672	14.35	574.16	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=4.00' D=4.00' Z= 1.5 ' Top.W=16.00' n= 0.045
34.6	2,868	Total			

Mamacoke Stream_Existing Cond

Prepared by Biohabitats, Inc.

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Mamacoke Stream - Existing Conditions Model

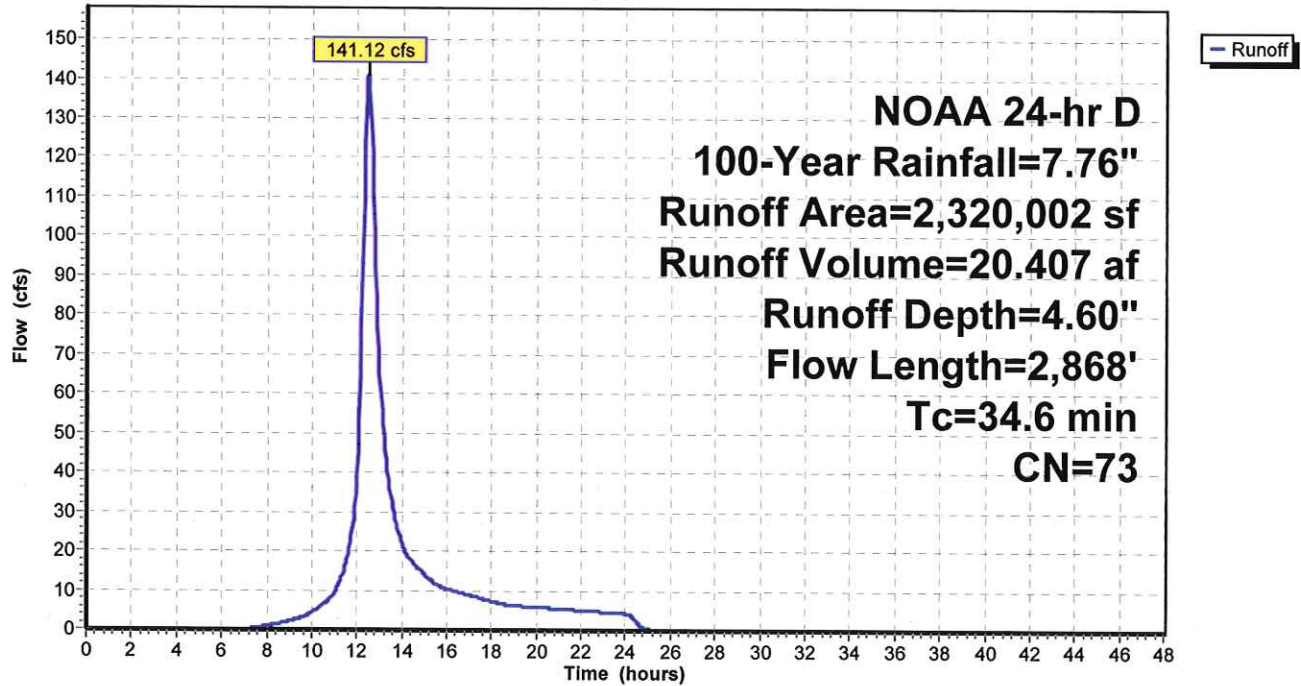
NOAA 24-hr D 100-Year Rainfall=7.76"

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Subcatchment 1: Mamacoke Stream DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 100-Year Rainfall=7.76"

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Summary for Subcatchment 2: Side Swale DA

Runoff = 21.35 cfs @ 12.45 hrs, Volume= 2.988 af, Depth= 3.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=7.76"

Area (sf)	CN	Description
18,188	58	Meadow, non-grazed, HSG B
7,974	78	Meadow, non-grazed, HSG D
1,093	98	Paved parking, HSG B
441,497	60	Woods, Fair, HSG B
9,888	79	Woods, Fair, HSG D
478,640	61	Weighted Average
477,547		99.77% Pervious Area
1,093		0.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet Woods: Dense underbrush n= 0.800 P2= 3.45"
3.8	1,183	0.1175	5.14		Shallow Concentrated Flow, Shallow - Grass Grassed Waterway Kv= 15.0 fps
0.4	86	0.0174	3.46	27.64	Trap/Vee/Rect Channel Flow, Channel to POI Bot.W=5.00' D=1.00' Z= 3.0 ' Top.W=11.00' n= 0.045
31.5	1,369	Total			

Mamacoke Stream_Existing Cond

Prepared by Biohabitats, Inc.

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Mamacoke Stream - Existing Conditions Model

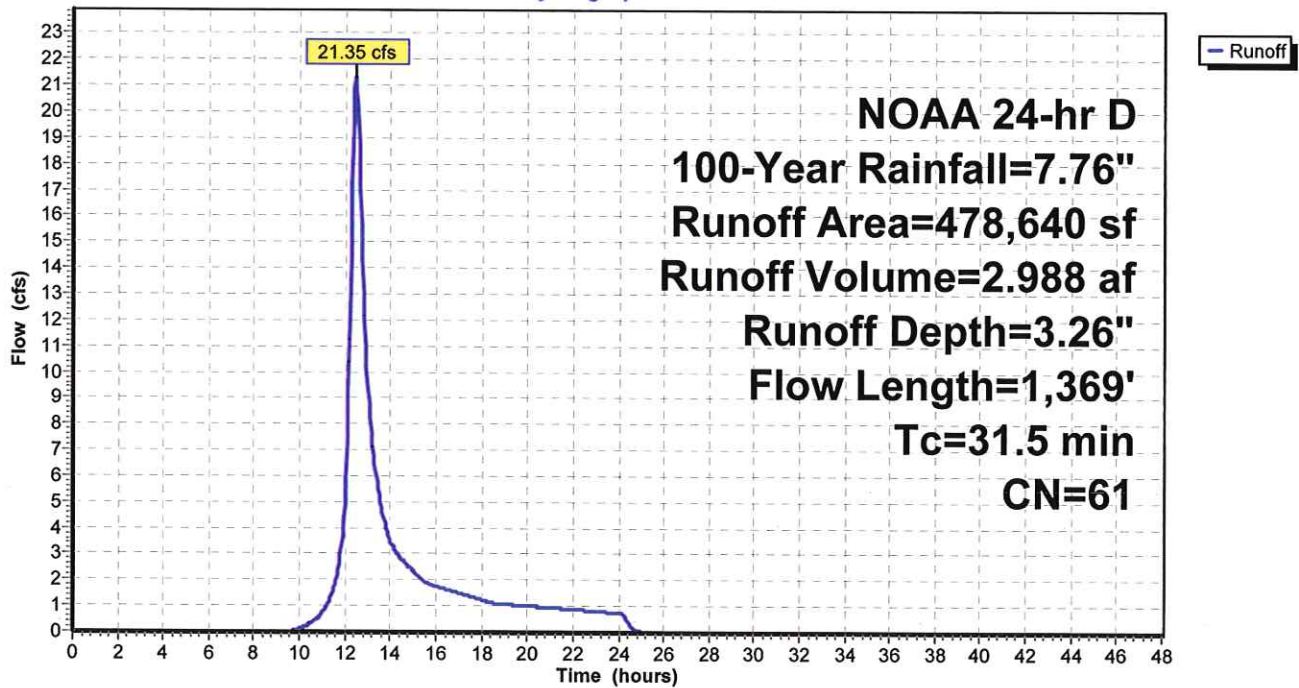
NOAA 24-hr D 100-Year Rainfall=7.76"

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Subcatchment 2: Side Swale DA

Hydrograph



Mamacoke Stream_Existing Cond

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Mamacoke Stream - Existing Conditions Model

NOAA 24-hr D 100-Year Rainfall=7.76"

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Summary for Subcatchment 3: Marsh + Salt Pond DA

Runoff = 20.41 cfs @ 12.57 hrs, Volume= 3.259 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=7.76"

Area (sf)	CN	Description
13,188	96	Gravel surface, HSG A
814	98	Water Surface, HSG D
2	36	Woods, Fair, HSG A
3,713	79	Woods, Fair, HSG D
67,020	30	Meadow, non-grazed, HSG A
4,743	58	Meadow, non-grazed, HSG B
35,684	78	Meadow, non-grazed, HSG D
181	98	Water Surface, HSG D
7,704	98	Paved parking, HSG A
86,051	36	Woods, Fair, HSG A
183,080	60	Woods, Fair, HSG B
38,165	79	Woods, Fair, HSG D
9,120	98	Water Surface, HSG D
24,475	39	>75% Grass cover, Good, HSG A
906	98	Water Surface, HSG A
1	98	Water Surface, HSG B
1	98	Water Surface, HSG D
57,141	98	Water Surface, HSG D
4,075	43	Woods/grass comb., Fair, HSG A
2,165	82	Woods/grass comb., Fair, HSG D
140	98	Water Surface, HSG A
17	98	Water Surface, HSG D
1,586	98	Water Surface, HSG D
539,972	60	Weighted Average
462,361		85.63% Pervious Area
77,611		14.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.3	100	0.0400	0.06		Sheet Flow, Sheet - Woods Woods: Dense underbrush n= 0.800 P2= 3.45"
2.5	226	0.0885	1.49		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
1.1	197	0.0406	3.02		Shallow Concentrated Flow, Shallow - Grassed Grassed Waterway Kv= 15.0 fps
8.2	332	0.0181	0.67		Shallow Concentrated Flow, Shallow - Woods Woodland Kv= 5.0 fps
0.8	492		9.83		Lake or Reservoir, Pond Mean Depth= 3.00'
39.9	1,347	Total			

Mamacoke Stream_Existing Cond

Prepared by Biohabitats, Inc.

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Mamacoke Stream - Existing Conditions Model

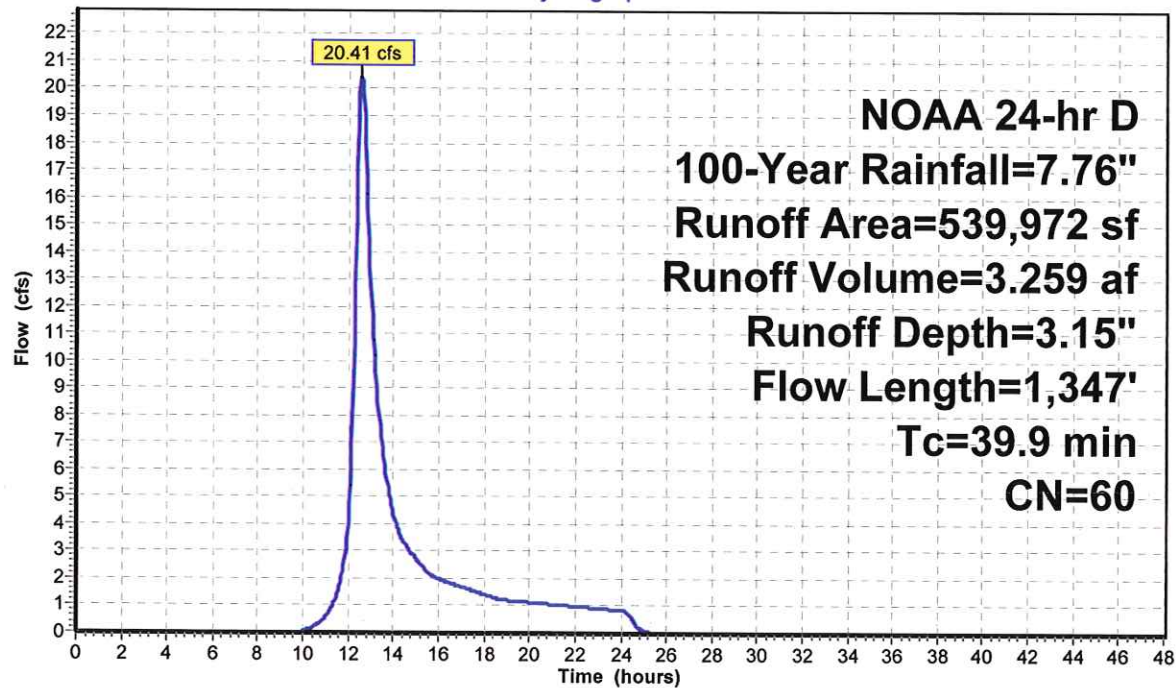
NOAA 24-hr D 100-Year Rainfall=7.76"

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Subcatchment 3: Marsh + Salt Pond DA

Hydrograph



APPENDIX C: NDDB REQUEST RESPONSE



Connecticut
Department of Energy &
Environmental Protection



12/5/2025

Josh Wilson
BIOHABITATS, INC.
363 Main St
Middletown, CT 06457
jwilson@biohabitats.com

Subject: Mamacoke Brook Channel Restoration

Filing #: 135296

NDDB - New Determination Number: 202508660

Expiration Date: 12/5/2027

Location Description: 435 Mohegan Ave. Parkway, Waterford, CT.

Dear Josh Wilson,

I have reviewed Natural Diversity Data Base (NDDB) maps and files regarding the proposed Mamacoke Brook Channel Restoration project located at 435 Mohegan Ave. Parkway, Waterford, CT. Our records show that there's a documented occurrence of the state-listed (RCSA Sec. 26-306) Special Concern *Bolboschoenus maritimus* ssp. *paludosus* (Bayonet Grass) plant within a part of the proposed project area near the southwestern end of Mamacoke Pond. NDDB requires a botanical survey for this species before any Phragmites removal or wetland restoration activities can begin in this part of the project area. NDDB does not anticipate negative impacts to any other state-listed species within the rest of the project area outside of Mamacoke Pond.

Botanical surveys must be done by a qualified botanist or plant ecologist at the appropriate time(s) of year to confidently identify this state-listed plant down to the species taxonomic level.

A botanical survey report for state-listed plants should include the following elements at a minimum:

1. Survey date(s) and duration.
2. Site descriptions and photographs.
3. A description of the morphologic characters that distinguish the target State-listed plants from other similar plants that are not State-listed.
4. List of component species within the survey area (including scientific binomials).
5. Data regarding population numbers and/or area occupied by State-listed species. The NDDB rare plant forms must be submitted for any and all state listed species observed. *Please note that we now have an online reporting form via the ESRI Survey123 app that we encourage people to use as an alternative to the Word/PDF document. Both versions of the rare plant reporting forms can be found here: [Contribute Data to the NDDB \(ct.gov\)](https://portal.ct.gov/DEEP/Forms/ContributeDataToTheNDDB).

6. Detailed maps of the area surveyed including the survey route and locations of State-listed species.
7. A discussion of the characters used to identify each target listed plant, and any other listed plants discovered during the survey.
8. Conservation strategies or protection plans that indicate how impacts may be avoided for all state-listed species present on the site.
9. Statement/résumé indicating the surveyor's qualifications. Please be sure you hire a consulting qualified botanist or plant ecologist to help conduct this site survey.

State-listed Plants:

Plant: ***Bolboschoenus maritimus ssp. paludosus* (Bayonet Grass)**

State Protection Status: **Special Concern**

Habitat: Brackish intertidal high marshes, i.e., so-called "brackish meadows", areas dominated relatively low vegetation, such as *Spartina patens*, *Schoenoplectus pungens*, etc..

Fruits: July - September

Instructions for submitting your survey information or other additional reporting requirements can be found at the end of this letter.

Your submission information indicates that your project requires a state permit, license, registration, or authorization, or utilizes state funding or involves state agency action. This NDDDB - New determination may be utilized to fulfill the Endangered and Threatened Species requirements for state-issued permit applications, licenses, registration submissions, and authorizations.

Please be aware of the following limitations and conditions:

Natural Diversity Database information includes all information regarding listed species available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, land owners, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as enhance existing data. Such new information is incorporated into the Database and accessed through the ezFile portal as it becomes available. New information may result in additional review, and new or modified restrictions or conditions may be necessary to remain in compliance with certain state permits.

- During your work listed species may be encountered on site. A report must be submitted by the observer to the Natural Diversity Database promptly and additional review and restrictions or conditions may be necessary to remain in compliance with certain state permits. Please fill out the [appropriate survey form](#) and follow the instructions for submittal.
- Your project involves the state permit application process or other state involvement, including state funding or state agency actions; please note that consultations with your permit analyst or the agency may result in additional requirements. In this situation, additional evaluation of the proposal by the DEEP Wildlife Division may be necessary and additional information, including but not limited to species-specific site surveys, may be required. Any additional review may result in specific restrictions or conditions relating to listed species that may be found at or in the vicinity of the site.
- If your project involves preparing an Environmental Impact Assessment, this NDDDB consultation and determination should not be substituted for biological field surveys assessing on-site habitat and species presence.
- The NDDDB - New determination for the Mamacoke Brook Channel Restoration as described in the

submitted information and summarized at the end of this document is valid until 12/5/2027. This determination applies only to the project as described in the submission and summarized at the end of this letter. Please re-submit an updated Request for Review if the project's scope of work and/or timeframe changes, including if work has not begun by 12/5/2027.

Additional reporting requirements indicated above have been requested. Include the Project Name Mamacoke Brook Channel Restoration and Determination Number 202508660 on all correspondence. Please note that, as stated above, survey data indicating the presence of listed species not described in this letter may necessitate additional review and restrictions or conditions. Forward additional reporting requirements to each of the following two addresses:

1. Vincent.Long@ct.gov
2. deep.nddbrequest@ct.gov

If you have further questions, please contact me at the following:

Vincent Long
CT DEEP Bureau of Natural Resources
Wildlife Division
Natural Diversity Database
79 Elm Street
Hartford, CT 06106-5127
(860) 502-9786
Vincent.Long@ct.gov

Please reference the Determination Number 202508660 when you e-mail or write. Thank you for consulting the Natural Diversity Data Base.

Vincent Long
Wildlife Division- Natural Diversity Data Base
79 Elm Street
Hartford, CT 06106-5127
(860) 502-9786
Vincent.Long@ct.gov

Application Details:

Project involves federal funds or federal permit:	Yes
Project involves state funds, state agency action, or relates to CEPA request:	No
Project requires state permit, license, registration, or authorization:	Yes
DEEP enforcement action related to project:	
Project Type:	Stream channel/Streambank modification
Project Sub-type:	Stream channel/Streambank modification
Project Name:	Mamacoke Brook Channel Restoration
Project Description:	

APPENDIX D: ARCHAEOLOGICAL AND CULTURAL RESOURCE INVENTORY CONSULTATION REPORT

APPENDIX E: EXISTING STREAM CONDITION DOCUMENTATION

Modified Environmental Protection Agency Rapid Bioassessment Habitat Assessment Field Data Sheet (High Gradient Ephemeral/Intermittent Streams)

[illegible]

Station ID/ Stream Name	Mamacoche - Reach 3					Date						SLOPE (%)						CHANNEL TYPE				
Reach Length (m)						LAT (DD)						LONG (DD)						Step-Pool		(Circle one)		
																		Gradual				
HABITAT PARAMETER	CATEGORY																					
	Optimal					Sub-optimal					Marginal					Poor						
1. SUBSTRATE DIVERSITY/ AVAILABLE BENTHIC, SALAMANDER, CRAYFISH, AND LAND SNAIL COVER SCORE:	Greater than 70% of substrate consisting of mix of boulder slabs, boulders, cobble, snags, or other stable habitat providing cover for salamanders and aquatic or terrestrial invertebrates. LWD in moderate to advanced stage of decay and within active channel; Substrate roughness capable of trapping lots of organic matter. If moss covered, rate high.					40 to 70% cover and mix of diverse stable habitat (boulder, cobble, LWD); well suited for full cover potential; adequate habitat for maintenance of populations; presence of additional LWD in the form of new fall. Substrate roughness still capable of trapping organic matter.					20 to 40% mix of stable cover; habitat availability less than desirable; substrate frequently disturbed or removed. LWD low in density and/or may be new fall or in early decay stage. Some areas suitable for trapping organic matter. If lg. boulders are absent, score low.					Less than 20% stable cover; lack of habitat is obvious; substrate unstable or lacking. Few areas suitable for trapping organic matter.						
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
2. EMBEDDEDNESS Examine at least 10 particles (e.g., 5 particles from 2 different steps) SCORE:	Lg. cobble, small boulder, or wood particles are between 0 and 25% surrounded by fine sediment; layering of cobble or boulders provides a diversity of niche space.					Lg. cobble, small boulder, or wood particles are between 25 and 50% surrounded by fine sediment.					Lg. cobble, small boulder, or wood particles are between 50 and 75% surrounded by fine sediment.					Cobble, small boulder, or wood particles are over 75% surrounded by fine sediment.						
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
3. CHANNEL ALTERATION SCORE:	Channelization, culverting, or other channel disturbance absent or minimal; stream with normal pattern. No crossings (fords) in assessment reach.					Minor channelization present, usually in areas of culverts, fords, or bridge abutments; evidence of past channel disturbance, i.e. dredging, or realignment (> than past 20 years) may be present, but no evidence of recent channel disturbance.					Channelization may be extensive; Embankments, berms or shoring structures present on both banks; and 40% to 80% of the stream reach channelized or disrupted.					Banks shored with gabion or cement; over 80% of the stream reach is channelized and disrupted. Instream habitat greatly altered or entirely removed. Stream channel may be used as a road or logging skid trail.						
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
4. FINE SEDIMENT DEPOSITION Consider non-natural sources of sediment SCORE:	Little or no enlargement of mid-channel bars or point bars (at bends) and less than 5% of the bottom is affected by fine sediment deposition (silt, sand, fine gravel). Pool rocks with minimal silt layering; leafpacks relatively clean.					Some new increase in bar formation, mostly from fine gravel, sand, or silt; 5 to 30% of the bottom is affected; some deposition of fines in pools. Leafpacks moderately covered in silt.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of bottom is affected; sediment deposits at obstructions, constrictions, and bends; deposition of fines in pools prevalent; leafpacks may be heavily silted.					Heavy deposits of fine material; increased bar development; more than 50% of bottom is fines and changing frequently with flow; pools almost absent due to substantial sediment deposition.						
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

↳ Non-managed meadow outside of forested riparian corridor, forest cleared and meadow planted 2005

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Mamacoke - Reach 4	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET # _____	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY EEB	DATE 9/5/2025 TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category																				
		Optimal					Suboptimal					Marginal					Poor					
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).					30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

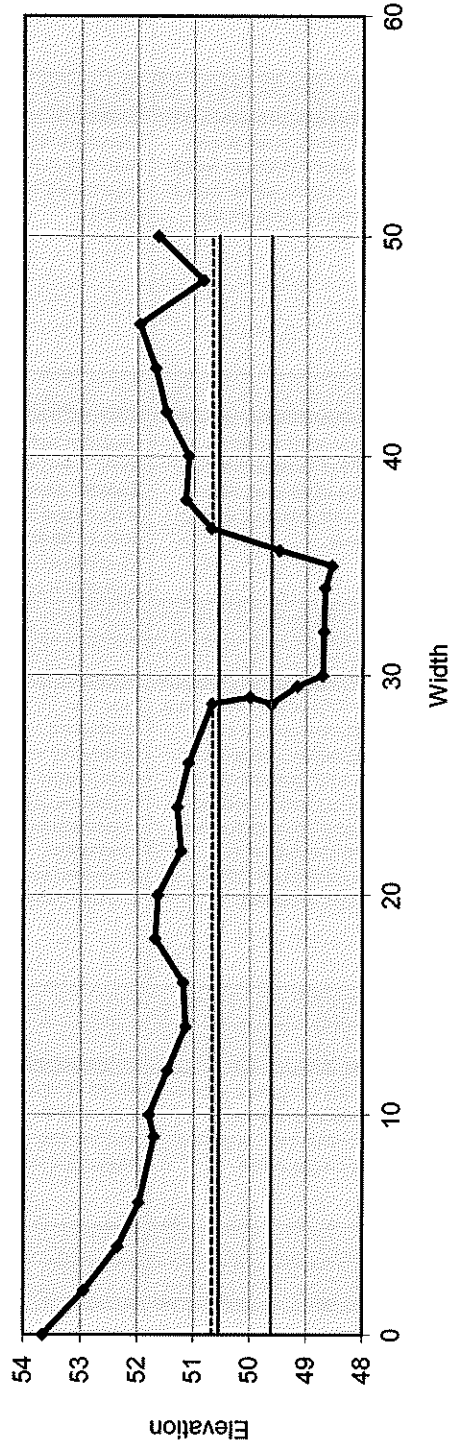
HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)					The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.					The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE ____ (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE ____ (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.					
SCORE ____ (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE ____ (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.					
SCORE ____ (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE ____ (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					

Total Score _____

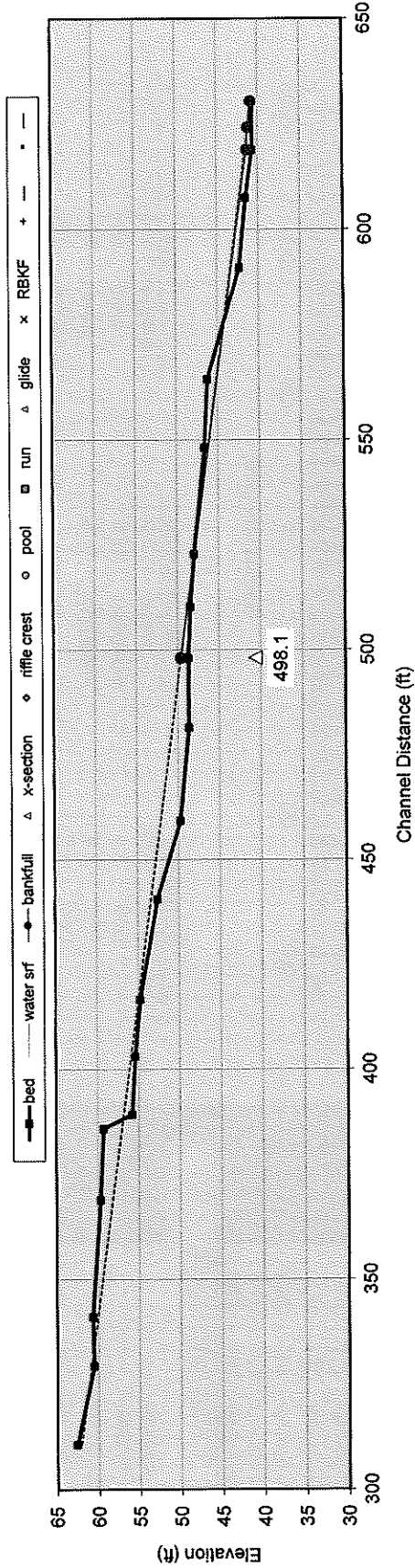
Cross Section Reach 2

Mamacoke Stream, Riffle



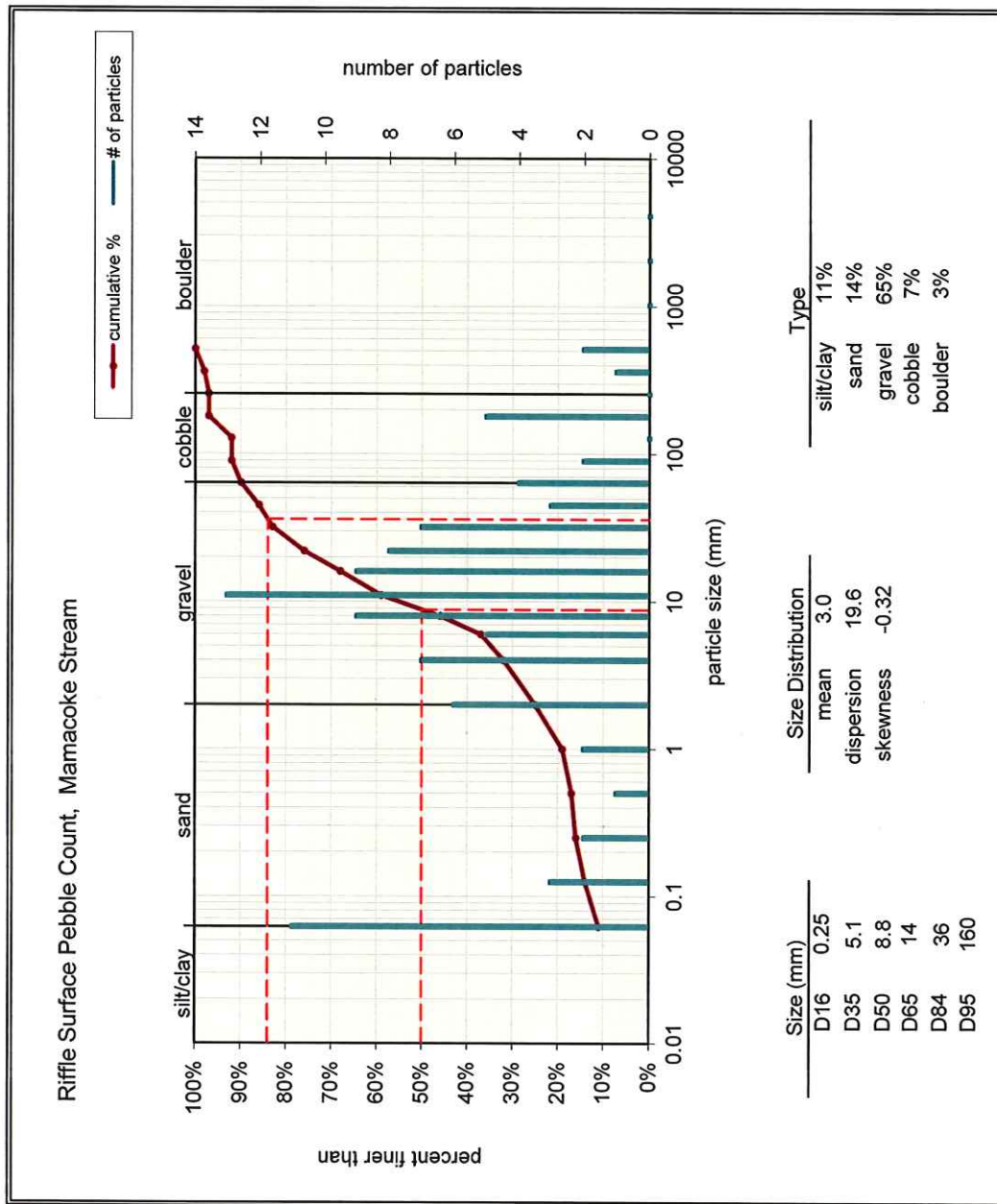
Longitudinal Slope Profile

Mamacoke Stream



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	6.8	---	630.4 (88.6 channel widths)	---	---	---
rifle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---

Riffle Surface			
Material	Size Range (mm)	Count	
silt/clay	0 - 0.062	11	
very fine sand	0.062 - 0.125	3	
fine sand	0.125 - 0.25	2	
medium sand	0.25 - 0.5	1	
coarse sand	0.5 - 1	2	
very coarse sand	1 - 2	6	
very fine gravel	2 - 4	7	
fine gravel	4 - 6	5	
fine gravel	6 - 8	9	
medium gravel	8 - 11	13	
medium gravel	11 - 16	9	
coarse gravel	16 - 22	8	
coarse gravel	22 - 32	7	
very coarse gravel	32 - 45	3	
very coarse gravel	45 - 64	4	
small cobble	64 - 90	2	
medium cobble	90 - 128	0	
large cobble	128 - 180	5	
very large cobble	180 - 256	0	
small boulder	256 - 362	1	
small boulder	362 - 512	2	
medium boulder	512 - 1024	0	
large boulder	1024 - 2048	0	
very large boulder	2048 - 4096	0	
total particle count:		100	
bedrock	-----		
clay hardpan	-----		
detritus/wood	-----		
artificial	-----		
total count:		100	
Note:			



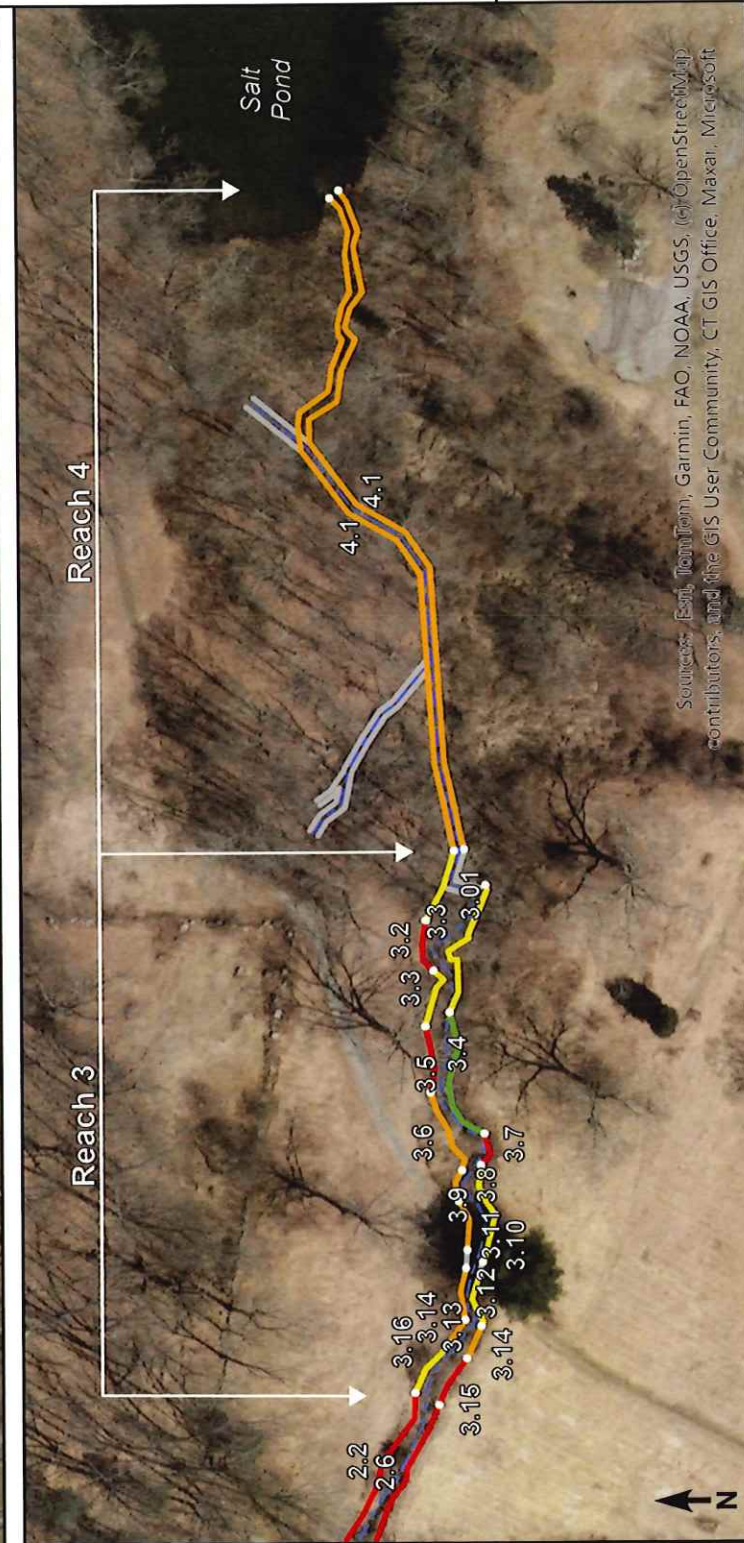
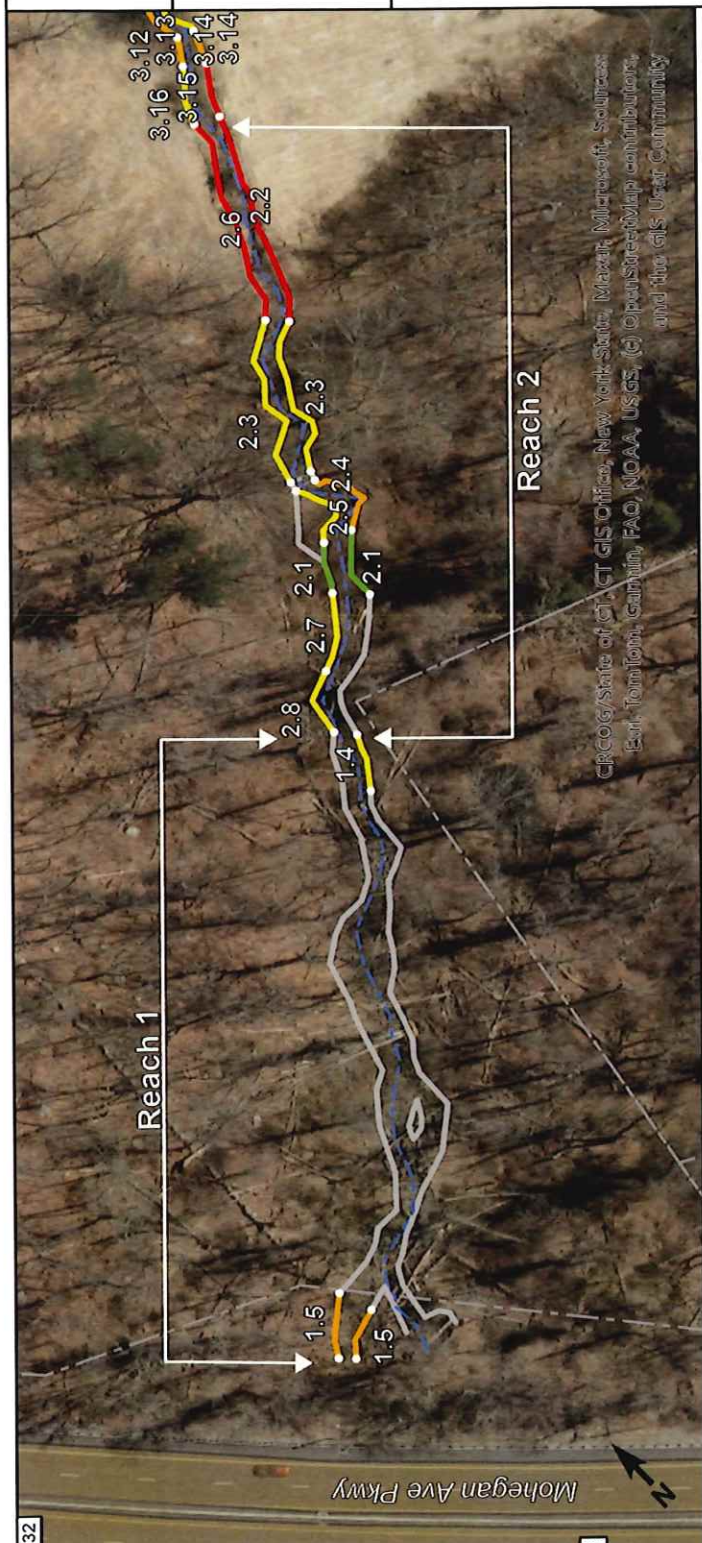
Mamaco Stream
Restoration
New London County,
Connecticut

BEHI Map

BEHI_Rating
Very High
High
Moderate
Low
Non-Erosive Banks

0
100
Feet

September, 2025



Modified Environmental Protection Agency Rapid Bioassessment Habitat Assessment Field Data Sheet (High Gradient Ephemeral/Intermittent Streams)

[illegible]

Field Data Sheet (High Gradient Ephemeral/Intermittent Streams)

% Canopy (Densitometer)	75	Compass Bearing (facing downstream) (0-360°)	160 (East)
-------------------------	----	--	------------

Sheet (High Gradient Ephemeral/Intermittent Streams)

[illegible]

Station ID/ Stream Name	Mamacoke - Reach 2					Date						SLOPE (%)						CHANNEL TYPE					
Reach Length (m)						LAT (DD)						LONG (DD)						Step-Pool					(Circle one)
																		Gradual					
HABITAT PARAMETER	CATEGORY																						
	Optimal					Sub-optimal					Marginal					Poor							
1. SUBSTRATE DIVERSITY/ AVAILABLE BENTHIC, SALAMANDER, CRAYFISH, AND LAND SNAIL COVER SCORE:	Greater than 70% of substrate consisting of mix of boulder slabs, boulders, cobble, snags, or other stable habitat providing cover for salamanders and aquatic or terrestrial invertebrates. LWD in moderate to advanced stage of decay and within- active channel; Substrate roughness capable of trapping lots of organic matter. If moss covered, rate high.					40 to 70% cover and mix of diverse stable habitat (boulder, cobble, LWD); well suited for full cover potential; adequate habitat for maintenance of populations; presence of additional LWD in the form of new fall. Substrate roughness still capable of trapping organic matter.					20 to 40% mix of stable cover; habitat availability less than desirable; substrate frequently disturbed or removed. LWD low in density and/or may be new fall or in early decay stage. Some areas suitable for trapping organic matter. If lg. boulders are absent, score low.					Less than 20% stable cover; lack of habitat is obvious; substrate unstable or lacking. Few areas suitable for trapping organic matter.							
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
2. EMBEDDED- NESS Examine at least 10 particles (e.g., 5 particles from 2 different steps) SCORE:	Lg. cobble, small boulder, or wood particles are between 0 and 25% surrounded by fine sediment; layering of cobble or boulders provides a diversity of niche space.					Lg. cobble, small boulder, or wood particles are between 25 and 50% surrounded by fine sediment.					Lg. cobble, small boulder, or wood particles are between 50 and 75% surrounded by fine sediment.					Cobble, small boulder, or wood particles are over 75% surrounded by fine sediment.							
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
3. CHANNEL ALTERATION SCORE:	Channelization, culverting, or other channel disturbance absent or minimal; stream with normal pattern. No crossings (fords) in assessment reach.					Minor channelization present, usually in areas of culverts, fords, or bridge abutments; evidence of past channel disturbance, i.e. dredging, or realignment (> than past 20 years) may be present, but no evidence of recent channel disturbance. Pedestrian Bridge					Channelization may be extensive; Embankments, berms or shoring structures present on both banks; and 40% to 80% of the stream reach channelized or disrupted.					Banks shored with gabion or cement; over 80% of the stream reach is channelized and disrupted. Instream habitat greatly altered or entirely removed. Stream channel may be used as a road or logging skid trail.							
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
4. FINE SEDIMENT DEPOSITION Consider non- natural sources of sediment SCORE:	Little or no enlargement of mid-channel bars or point bars (at bends) and less than 5% of the bottom is affected by fine sediment deposition (silt, sand, fine gravel). Pool rocks with minimal silt layering; leafpacks relatively clean.					Some new increase in bar formation, mostly from fine gravel, sand, or silt; 5 to 30% of the bottom is affected; some deposition of fines in pools. Leafpacks moderately covered in silt.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of bottom is affected; sediment deposits at obstructions, constrictions, and bends; deposition of fines in pools prevalent; leafpacks may be heavily silted.					Heavy deposits of fine material; increased bar development; more than 50% of bottom is fines and changing frequently with flow; pools almost absent due to substantial sediment deposition.							
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		

RAPID HABITAT ASSESSMENT STEEP Ephemeral/Intermittent >>							
Reviewers Initials		Station ID/ Stream Name		Date			
HABITAT PARAMETER	CATEGORY						
	Optimal		Sub-optimal		Marginal		Poor
5. BANK STABILITY** (score each bank) determine left/right by facing downstream	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems (<5% of bank affected).		Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.		Moderately unstable; 30-60% of bank in reach has areas of erosion; high potential during floods.		Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
LEFT:	10	9	8	(7)	6	5 4 3	2 1 0
RIGHT:	10	9	8	7	6	(5) 4 3	2 1 0
6. BANK** VEGETATIVE PROTECTION (rate from bottom of bank to crest-over at top of bank - large roots count) **In very steep constrained channels with continuous bank-riparian zone (no distinct crest) score bank from toe to ~2 m.	More than 90% of the streambank surfaces and immediate riparian zones (crest-over) covered by vegetation including trees, understory shrubs, and non-woody plants (herbs, ferns, mosses); vegetative disruption through grazing or other encroachment minimal or not evident; almost all plants allowed to grow naturally. Branches overhanging channel important.		70-90% of the streambank surfaces are covered by vegetation, but one class of plants is not well represented; disruption evident, but not affecting plant growth potential to any great extent; more than one-half of the potential plant stubble remaining. In the case of non-native plants, score low.		50-70% of the streambank surfaces are covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. In the case of non-native plants, score low.		Less than 50% of the streambank surfaces are covered by vegetation; disruption of streambank vegetation very high; vegetation has been removed to 2 inches or less in average stubble height.
If assessed in winter or early spring look for remnants of herbs, and saplings.							
LEFT:	10	9	8	7	(6)	5 4 3	2 1 0
RIGHT:	10	9	8	7	6	5 (4) 3	2 1 0
7. WIDTH OF UNDISTURBED VEG. ZONE (undisturbed veg. is trees, shrubs, and non-woody herbs)	Width of undisturbed vegetative zone is >18 meters; human activities (roadbeds, clearcuts, mining, pasture) have not impacted this zone. Tree and shrub layers present		Zone width is between 12 and 18 meters; human activities have only minimally impacted this zone. Some selective logging may be present but not clearcuts. Tree and shrub layers still present.		Zone width is between 6 and 12 meters; human activities have impacted the zone a great deal. Trees or shrubs sparse in zone.		Width of zone is less than 6 meters; little or no undisturbed vegetation due to man-induced activities. Trees typically absent or in narrow row at top of bank.
LEFT:	(10)	9	8	7	6	5 4 3	2 1 0
RIGHT:	(10)	9	8	7	6	5 4 3	2 1 0
TOTAL: (max=140)	Max Pool Depth (if water is present; otherwise "NA") <u>N/A</u> cm Average Channel Width (Toe of Banks) <u>1-1.5</u> m				Total from front _____ + Total from back _____ = Score Percentage= Total Score /140 X 100 _____ %		
Average Width Intact Rip Vegetative Zone (m)			Left <u>>600</u> m		Right <u>>600</u> m		
→ What is the dominant vegetation type in the reach? ☒ Deciduous ☐ Coniferous (spruce, pine, hemlock) ☐ Mixed (>10%)			Estimated age of forest: ☒ >50 yrs ☐ 25-50 yrs ☐ 5-25 yrs ☐ <5 yrs Number of strata (e.g., canopy, subcanopy, shrub, herb (4 max)) <u>5</u>				
Stream Surface Shading (%) (average of lower, middle, upper reach)			Indicate % based on cloudless day in summer at noon. Fill in square that applies.				
☐ Fully exposed (0-25%)			☐ Partly shaded (25-50%)		☐ Partly exposed (50-75%)		☒ Fully shaded (75-100%)
% Canopy (Densimeter)		<u>50</u>	Compass Bearing (facing downstream) (0-360°)		<u>60 (EAST)</u>		

APPENDIX F: STREAM DESIGN SUPPORTING COMPUTATIONS

SPSC Sizing Spreadsheet

(Based on Anne Arundel County SPSC Guidelines, Revised 07/2022)

Mamacoke Stream Restoration, EB/DS, 1/29/2026

<i>Designer must select/input</i>
<i>Calculated value/Designer shall not change</i>
<i>Default values provided. Advanced designer may change to customize to site specific design</i>

Riffle Weir Sizing			
	Q ₁₀	Q ₅	Q ₂
Design Flow (cfs)	72.0	54.0	34.0
Width (ft)	10.0	10.0	10.0
L, Length (ft)	10.0	10.0	10.0
H, Height (ft)	1.0	1.0	1.0
Design Depth of flow (ft)	1.40	1.25	1.05
D50 (in)	12	12	12
P _D , Parabolic Depth (ft)	1.00	1.00	1.00
Width Depth Ratio (W/P _D)	10.0	10.0	10.0
Manning's n Value	0.062	0.064	0.070
Slope (ft/ft)	10.00%	10.00%	10.00%
Rock Unit Weight (lbs/cf)	165.0	165.0	165.0
Top Width at Depth	11.8	11.2	10.2
Flow area (sf)	11.0	9.3	7.2
Hydraulic Radius	0.90	0.81	0.68
Froude	1.06	1.00	0.90
Isbash Maximum Velocity (ft/s)	8.85	12.35	12.35
Depth ("A") at TW/4 offset from centerline	0.75	0.75	0.75
Calculated Flow at Design Depth (cfs)	78.7	59.0	37.5
Calculated Velocity (ft/s)	7.12	6.33	5.23
Does the proposed section provide adequate conveyance?	YES	YES	YES
Is the proposed velocity less than the maximum allowable velocity?	YES	YES	YES

SPSC Sizing Spreadsheet
(Based on Anne Arundel County SPSC Guidelines, 2022)

Mamacoke Stream Restoration, EB/DS, 1/29/2026

<i>Designer must select/input</i>
<i>Calculated value/Designer shall not change</i>
<i>Default values provided. Advanced designer may change to customize to site specific design</i>

Cascade Weir Sizing			
	Q ₁₀₀	Q ₁₀	Q ₂
Design Flow (cfs)	140.0	72.0	34.0
Width (ft)	10.0	10.0	10.0
L, Length (ft)	10.0	10.0	10.0
H, Height (ft)	2.2	2.2	2.2
Design Depth of flow (ft)	1.65	1.25	0.85
D50 (in)	30	30	30
P _D , Parabolic Depth (ft)	2.00	2.00	2.00
Manning's n Value	0.050	0.050	0.050
Slope (ft/ft)	22.00%	22.00%	22.00%
Rock Unit Weight (lbs/cf)	165.0	165.0	165.0
Top Width at Depth	9.1	7.9	6.5
Flow area (sf)	10.0	6.6	3.7
Hydraulic Radius	1.01	0.78	0.54
Froude	1.93	1.87	1.78
Isbash Maximum Velocity (ft/s)	13.99	13.99	13.99
Depth ("A") at TW/4 offset from centerline	1.50	1.50	1.50
Calculated Flow at Design Depth (cfs)	140.7	78.1	34.3
Calculated Velocity (ft/s)	14.1	11.9	9.3
Does the proposed section provide adequate conveyance?	YES	YES	YES
Is the proposed velocity less than the maximum allowable velocity?	NO	YES	YES
Does the proposed cascade have a slope of <= 0.5 ft/ft?	YES		

Floodplain Width Spreadsheet
Date
Project
Designer

developed by SRH based on Parola design -6/2011
9/29/2025
Mamacoke Stream
DS/EB

Note that the floodplain is defined here as that part of the valley that is inundated by the Q 100

1. Floodplain width: Compute floodplain widths required to satisfy each of the stress conditions provided below

Q	140	ft ³ /s - flow	*use 100 year flow
n	0.07	Manning's coefficient - use .07 for densely vegetated floodplain	
S _{fp}	0.02	ft/ft - average channel slope	
Y	62.4	lb/ft ³ - unit weight of water	
S _f	0.02	ft/ft - friction slope - for conditions without backwater, S _f ≈ S _{fp}	

$$Y_{fp} = \tau_{fo}/S_{fp}Y$$

$$W_{fp} = Qn/1.486Y_{fp}^{1.667}S_f^{-.5}$$

		Flow Depth on Floodplain		Width of Flow on Floodplain	
		Low End	High End	Low End	High End
Stress Conditions	τ _{fo} (psf)	Y _{fp} (ft)	Y _{fp} (ft)	W _{fp} (ft)	W _{fp} (ft)
Low Stress- Channel doesn't need to conform to floodplain alignment. If space allows, channel can be highly sinuous.	< 1.0	0.80		67.47	
Medium Stress _channel planform is highly dependent floodplain planform and curvature	1.0-1.5	0.80	1.20	67.47	34.32
High Stress _Erosion in floodplain will cause floodplain channels to form and the potential development of an anabranching channel network. Provide grade control and plan for anabranching channel network	1.5-2.0	1.20	1.60	34.32	21.25
very high floodplain stress - need to protect high stress regions of the floodpalin with rock or other vertical control to prevent degradation unless floodplain is covered with mature brushy vegetation that has a complete coverage of the high stress regions of the floodplain.	>2.0	1.60		21.25	

HY-8 Culvert Analysis Report

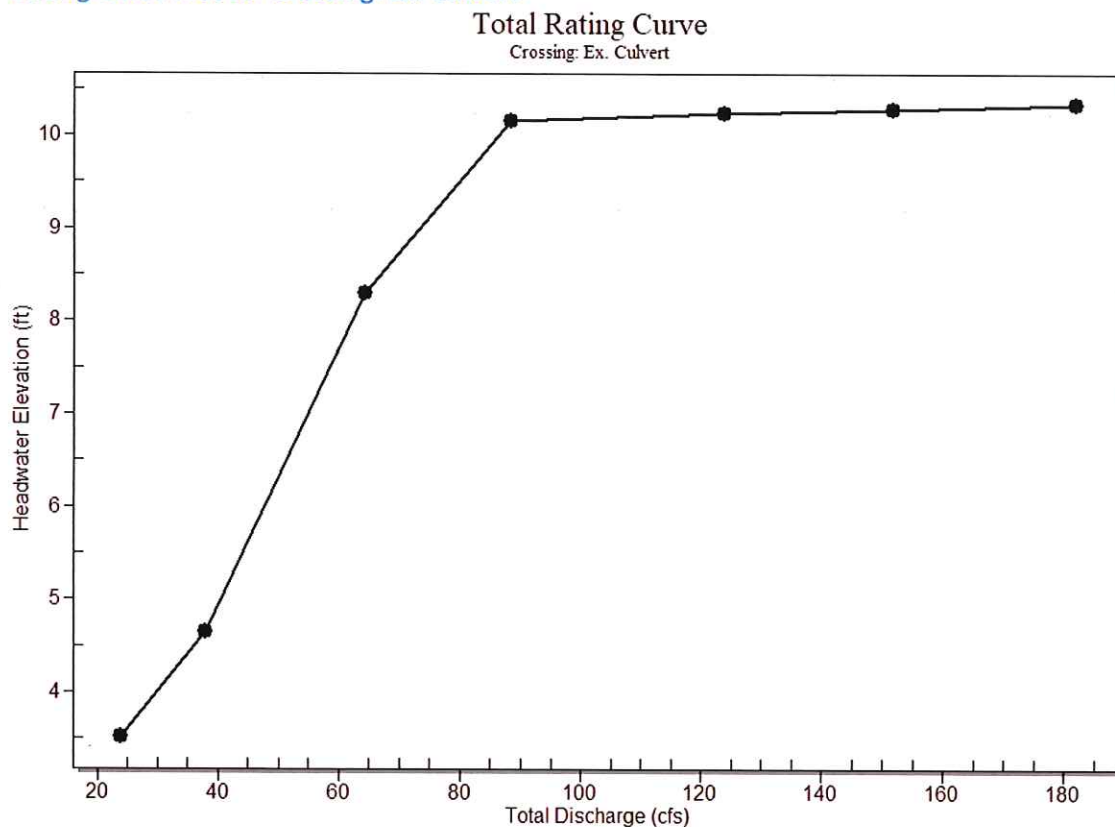
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: Ex. Culvert

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Ex. 3x3 Box Discharge (cfs)	Roadway Discharge (cfs)	Iterations
3.52	1 year	23.82	23.82	0.00	1
4.64	2 year	37.92	37.92	0.00	1
8.30	5 year	64.38	64.38	0.00	1
10.15	10 year	88.39	74.54	13.65	19
10.23	25 year	123.84	74.96	48.84	6
10.28	50 year	151.59	75.21	76.36	5
10.33	100 year	181.90	75.45	106.42	4
10.00	Overtopping	73.77	73.77	0.00	Overtopping

Rating Curve Plot for Crossing: Ex. Culvert



Culvert Data: Ex. 3x3 Box

Table 1 - Culvert Summary Table: Ex. 3x3 Box

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1 year	23.82 cfs	23.82 cfs	3.52	2.12	1.501	6-FFc	1.51	1.25	1.25	4.21	6.35	0.00
2 year	37.92 cfs	37.92 cfs	4.64	3.16	3.244	6-FFc	2.00	1.71	1.71	4.21	7.41	0.00
5 year	64.38 cfs	64.38 cfs	8.30	6.25	6.900	6-FFc	2.00	2.00	2.00	4.21	10.73	0.00
10 year	88.39 cfs	74.54 cfs	10.15	8.04	8.750	6-FFc	2.00	2.00	2.00	4.21	12.42	0.00
25 year	123.84 cfs	74.96 cfs	10.23	8.12	8.832	6-FFc	2.00	2.00	2.00	4.21	12.49	0.00
50 year	151.59 cfs	75.21 cfs	10.28	8.17	8.881	6-FFc	2.00	2.00	2.00	4.21	12.53	0.00
100 year	181.90 cfs	75.45 cfs	10.33	8.22	8.928	6-FFc	2.00	2.00	2.00	4.21	12.57	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 1.40 ft,

Outlet Elevation (invert): 0.87 ft

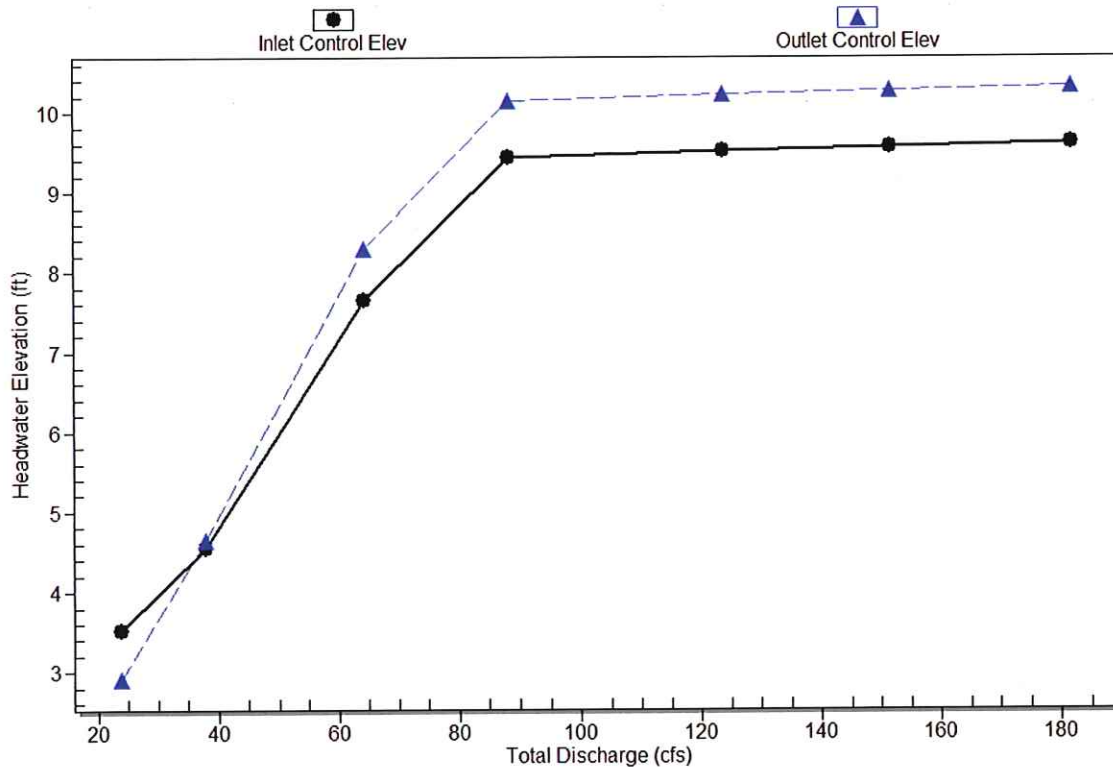
Culvert Length: 46.00 ft,

Culvert Slope: 0.0115

Culvert Performance Curve Plot: Ex. 3x3 Box

Performance Curve

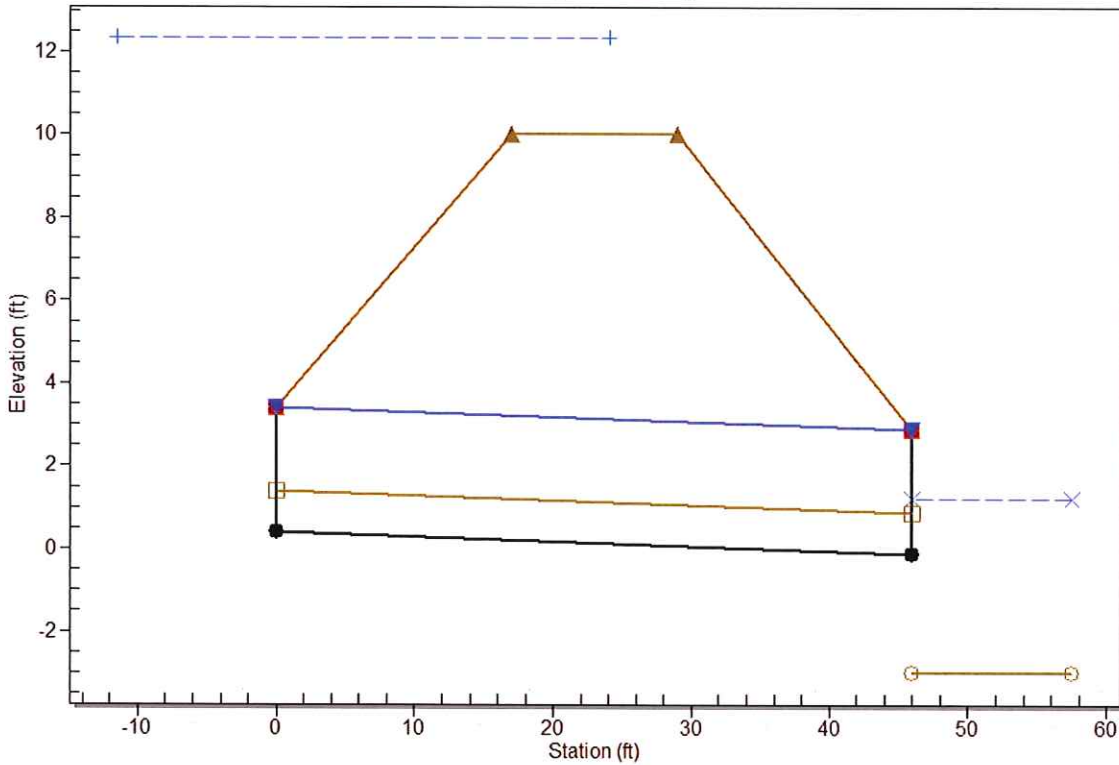
Culvert: Ex. 3x3 Box



Water Surface Profile Plot for Culvert: Ex. 3x3 Box

Crossing - Ex. Culvert, Design Discharge - 181.9 cfs

Culvert - Ex. 3x3 Box, Culvert Discharge - 75.4 cfs



Site Data - Ex. 3x3 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 0.40 ft

Outlet Station: 46.00 ft

Outlet Elevation: -0.13 ft

Number of Barrels: 1

Culvert Data Summary - Ex. 3x3 Box

Barrel Shape: Concrete Box

Barrel Span: 3.00 ft

Barrel Rise: 3.00 ft

Barrel Material: Concrete

Embedment: 12.00 in

Barrel Manning's n: 0.0130 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (90°) Headwall

Inlet Depression: None

Tailwater Data for Crossing: Ex. Culvert

Table 2 - Downstream Channel Rating Curve (Crossing: Ex. Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
23.82	1.21	4.21
37.92	1.21	4.21
64.38	1.21	4.21
88.39	1.21	4.21
123.84	1.21	4.21
151.59	1.21	4.21
181.90	1.21	4.21

Tailwater Channel Data - Ex. Culvert

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 1.21 ft

Roadway Data for Crossing: Ex. Culvert

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 350.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Gravel
Roadway Top Width: 12.00 ft

Crossing Discharge Data

Discharge Selection Method: Recurrence

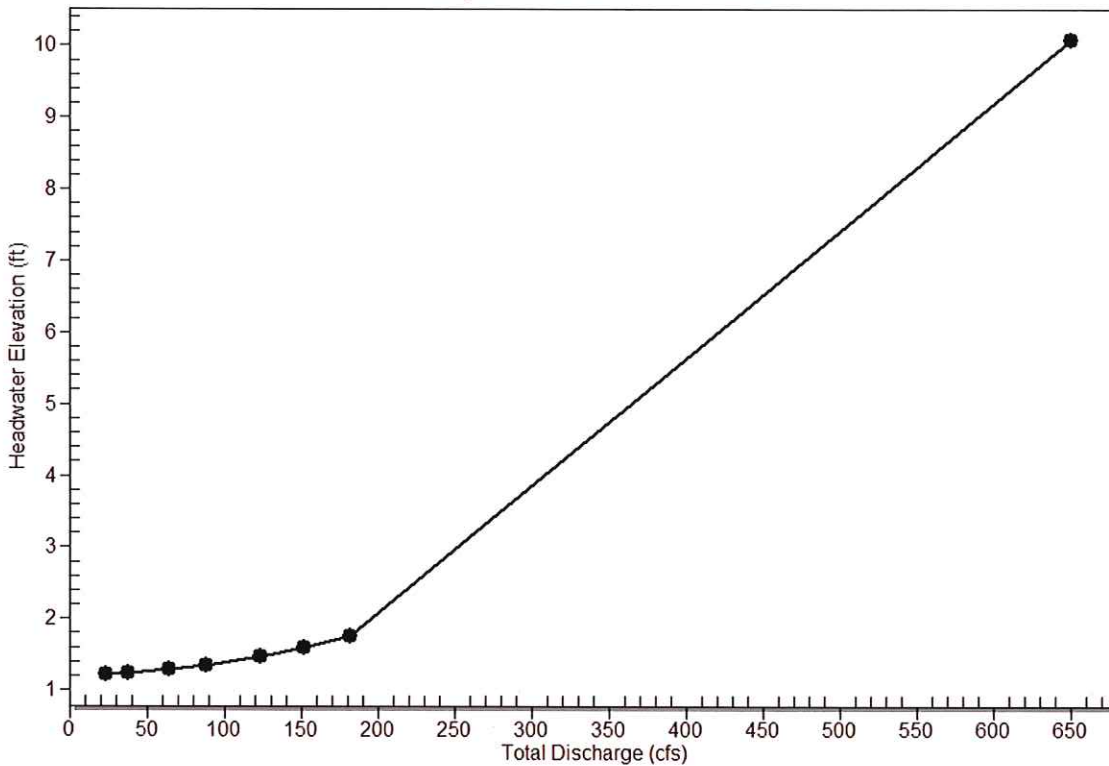
Table 3 - Summary of Culvert Flows at Crossing: Pr. Culvert - decommission ex. culvert

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Pr. Box Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1.22	1 year	23.82	23.82	0.00	1
1.23	2 year	37.92	37.92	0.00	1
1.28	5 year	64.38	64.38	0.00	1
1.34	10 year	88.39	88.39	0.00	1
1.47	25 year	123.84	123.84	0.00	1
1.59	50 year	151.59	151.59	0.00	1
1.76	100 year	181.90	181.90	0.00	1
10.00	Overtopping	628.66	628.66	0.00	Overtopping

Rating Curve Plot for Crossing: Pr. Culvert - decommission ex. culvert

Total Rating Curve

Crossing: Pr. Culvert - decommission ex. culvert



Culvert Data: Pr. Box

Table 2 - Culvert Summary Table: Pr. Box

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1 year	23.82 cfs	23.82 cfs	1.22	0.85	3.220	7-H2t	-1.00	0.50	3.21	4.21	0.62	0.00
2 year	37.92 cfs	37.92 cfs	1.23	1.16	3.234	7-H2t	-1.00	0.68	3.21	4.21	0.98	0.00
5 year	64.38 cfs	64.38 cfs	1.28	1.65	3.280	7-H2t	-1.00	0.96	3.21	4.21	1.67	0.00
10 year	88.39 cfs	88.39 cfs	1.34	2.03	3.341	7-H2t	-1.00	1.19	3.21	4.21	2.29	0.00
25 year	123.84 cfs	123.84 cfs	1.47	2.53	3.466	7-H2t	-1.00	1.49	3.21	4.21	3.21	0.00
50 year	151.59 cfs	151.59 cfs	1.59	2.89	3.593	7-H2t	-1.00	1.70	3.21	4.21	3.94	0.00
100 year	181.90 cfs	181.90 cfs	1.76	3.26	3.760	7-H2t	-1.00	1.93	3.21	4.21	4.72	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): -2.00 ft,

Outlet Elevation (invert): -2.00 ft

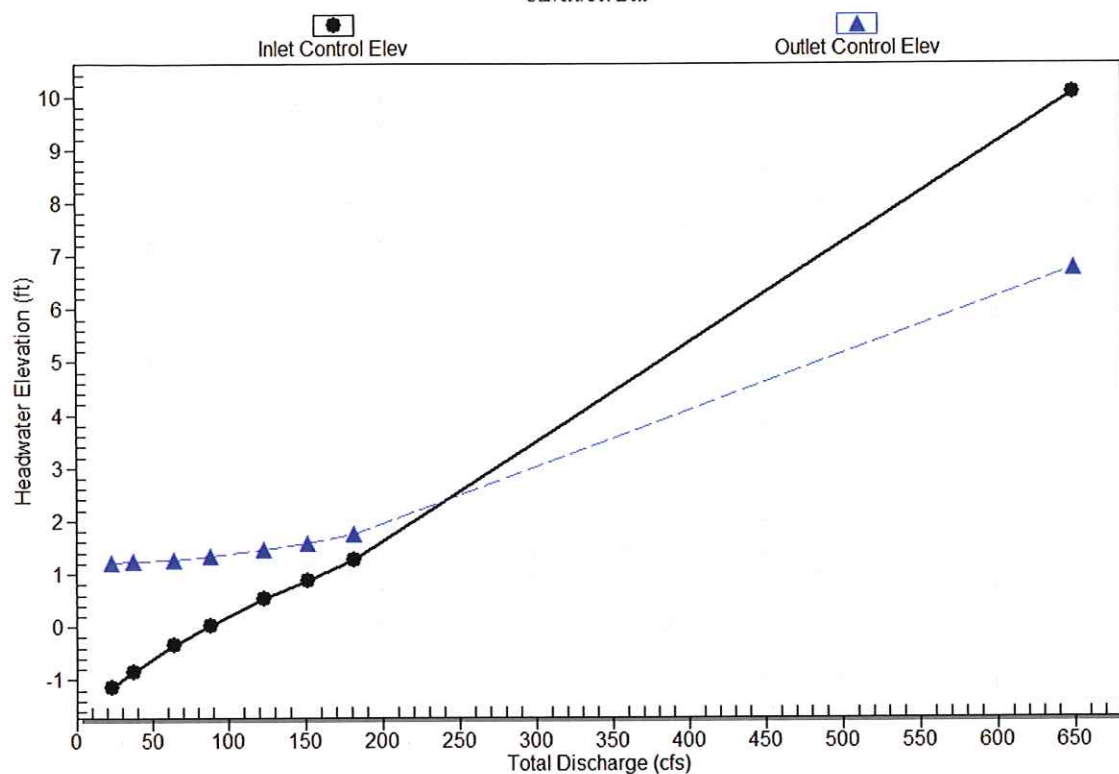
Culvert Length: 56.00 ft,

Culvert Slope: 0.0000

Culvert Performance Curve Plot: Pr. Box

Performance Curve

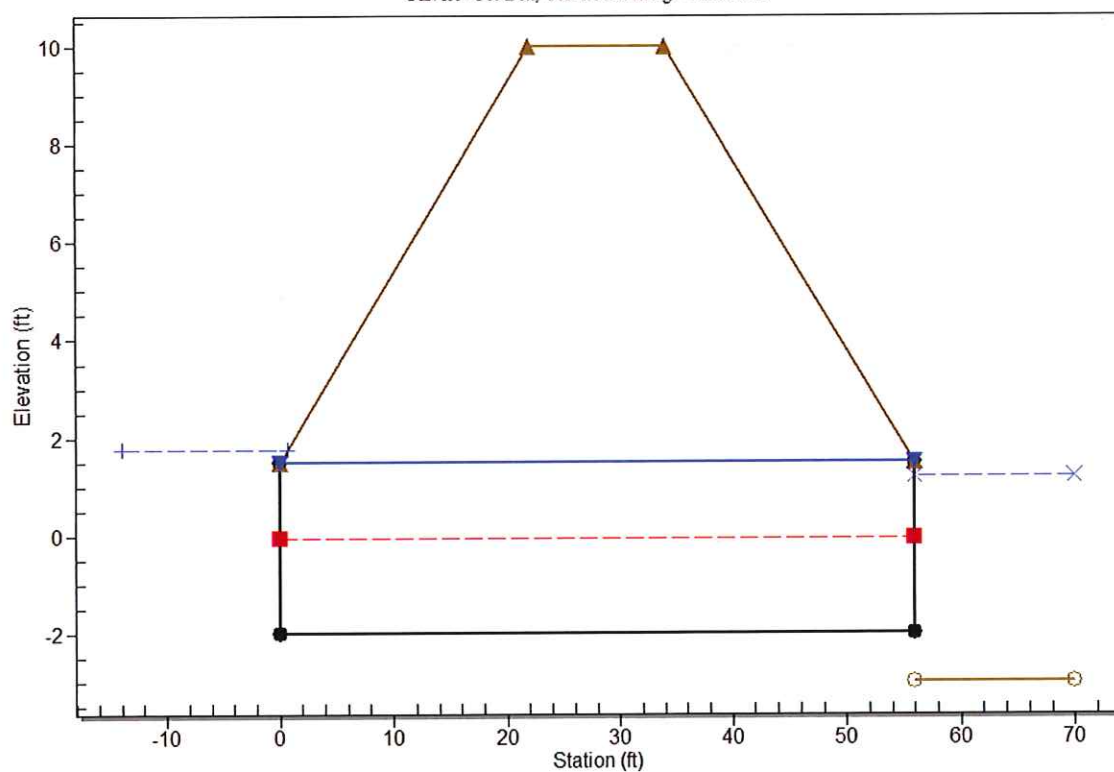
Culvert: Pr. Box



Water Surface Profile Plot for Culvert: Pr. Box

Crossing - Pr. Culvert - decommision ex. culvert, Design Discharge - 181.9 cfs

Culvert - Pr. Box, Culvert Discharge - 181.9 cfs



Site Data - Pr. Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: -2.00 ft
Outlet Station: 56.00 ft
Outlet Elevation: -2.00 ft
Number of Barrels: 1

Culvert Data Summary - Pr. Box

Barrel Shape: Concrete Box
Barrel Span: 12.00 ft
Barrel Rise: 3.50 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0130
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: None

Tailwater Data for Crossing: Pr. Culvert - decommission ex. culvert

Table 4 - Downstream Channel Rating Curve (Crossing: Pr. Culvert - decommission ex. culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
23.82	1.21	4.21
37.92	1.21	4.21
64.38	1.21	4.21
88.39	1.21	4.21
123.84	1.21	4.21
151.59	1.21	4.21
181.90	1.21	4.21

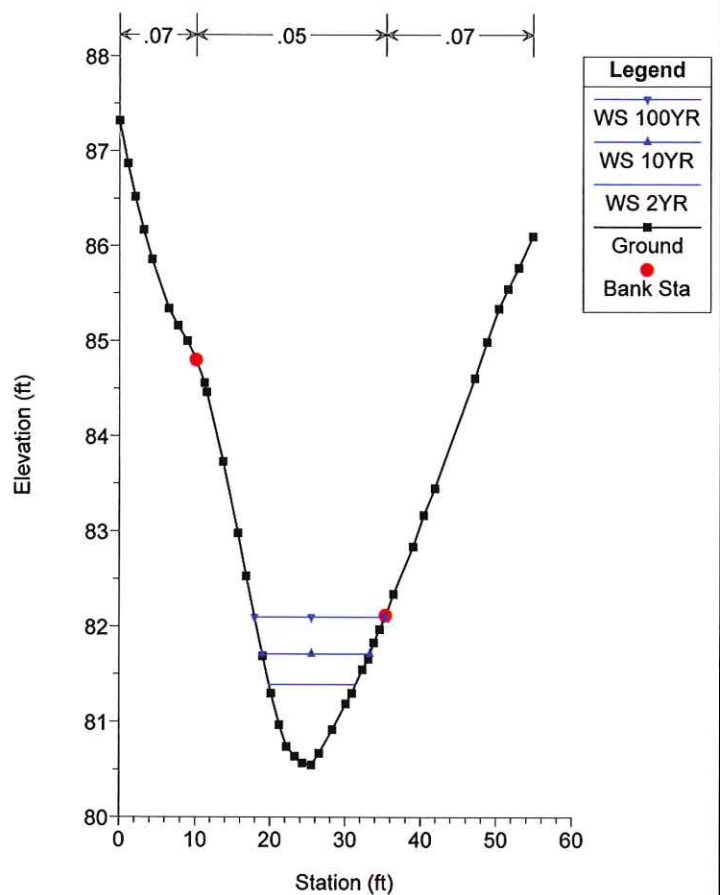
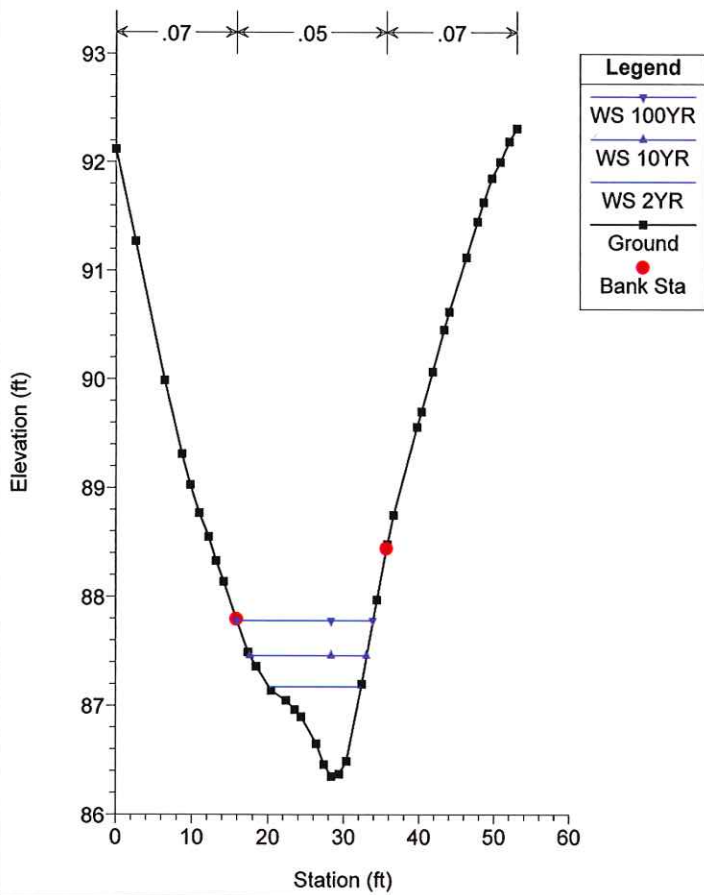
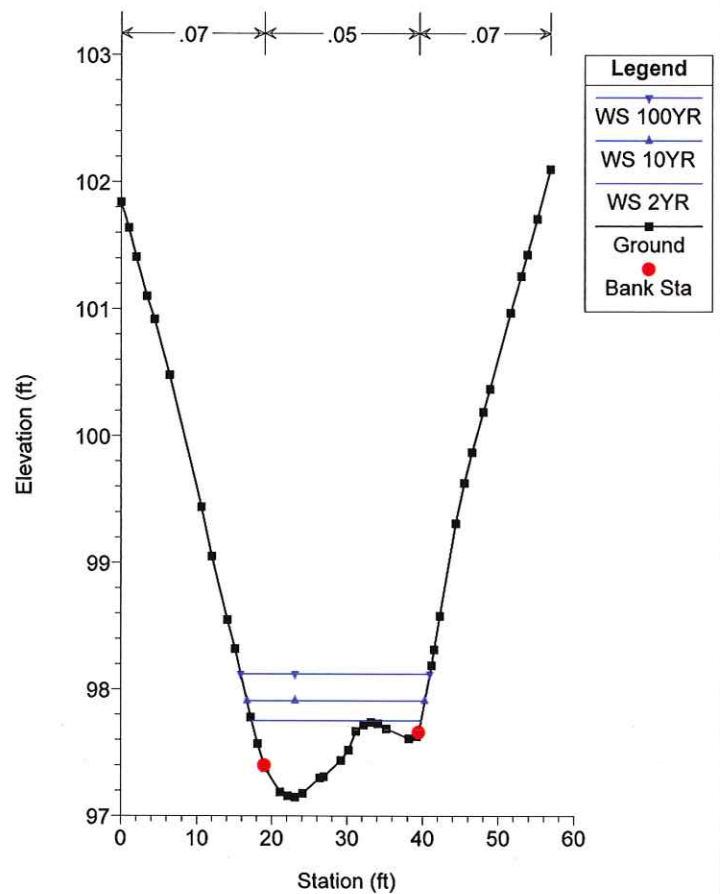
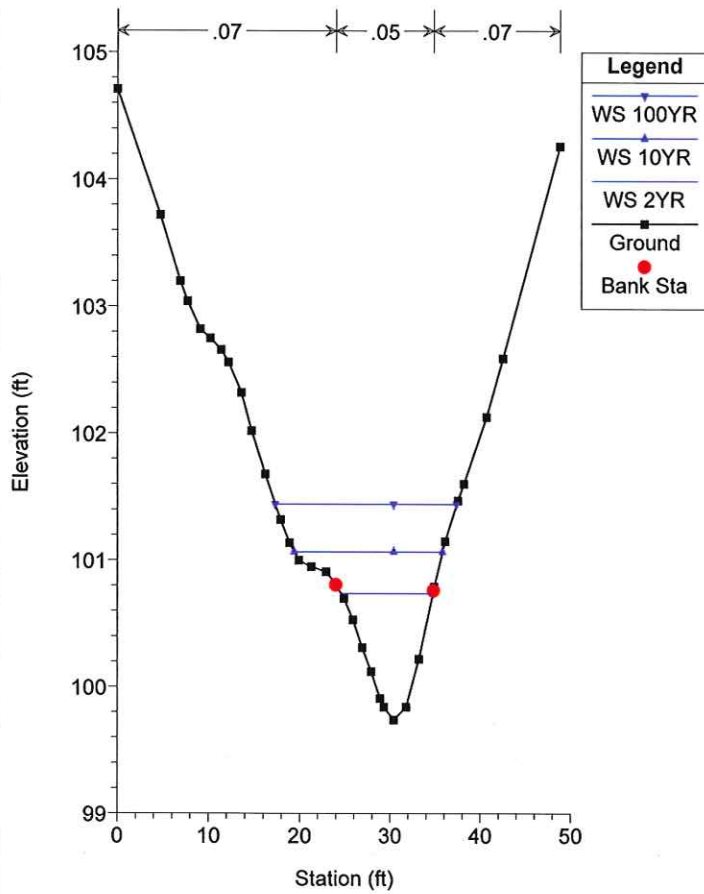
Tailwater Channel Data - Pr. Culvert - decommission ex. culvert

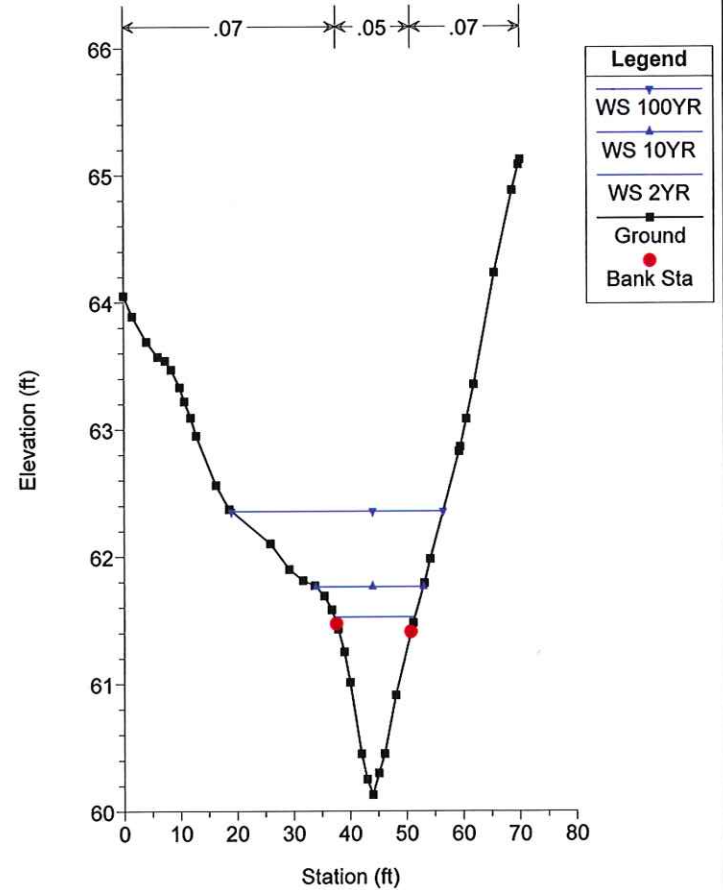
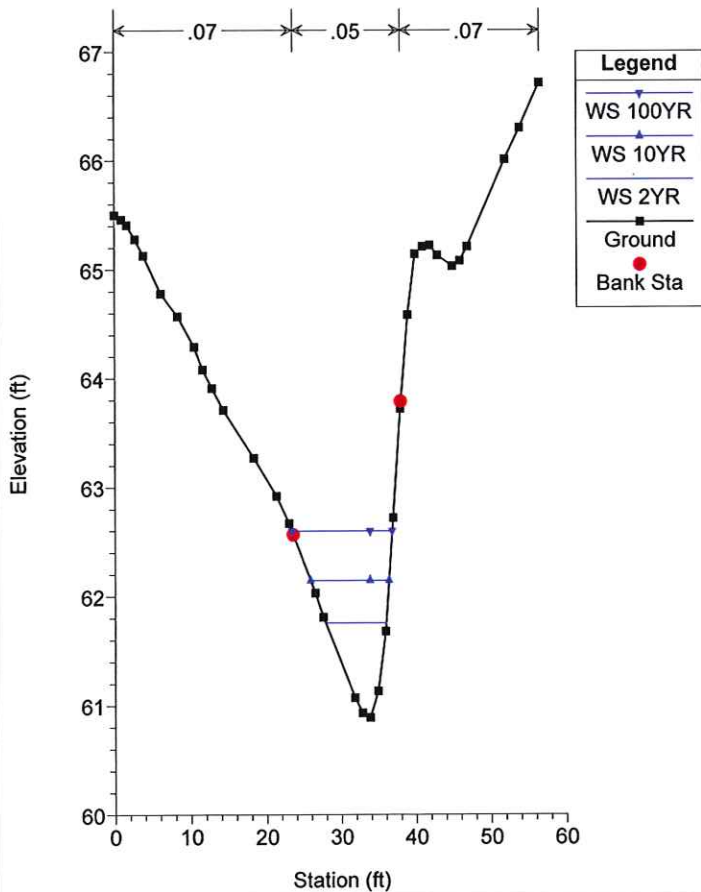
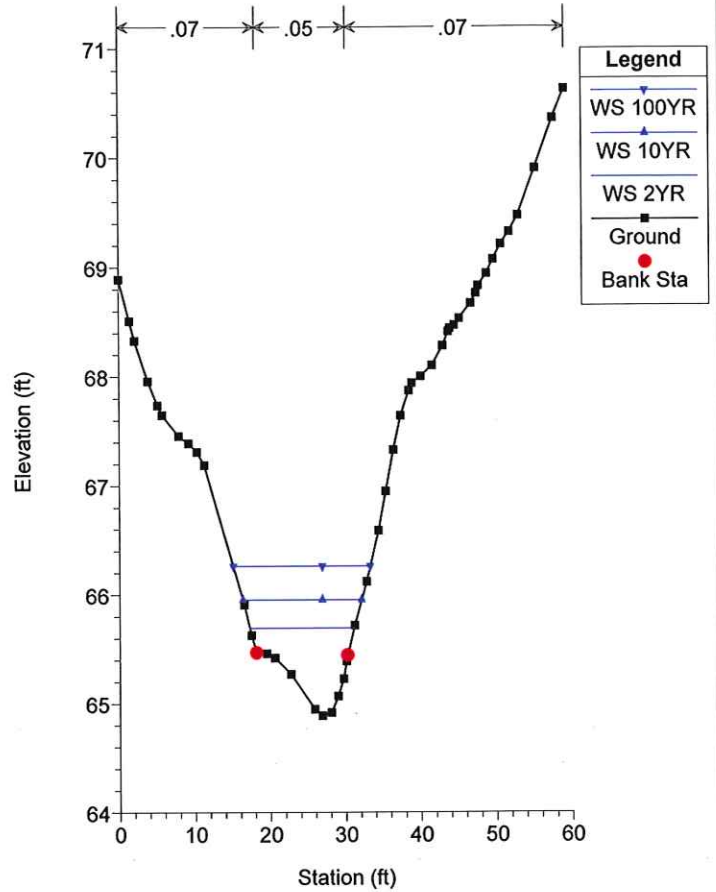
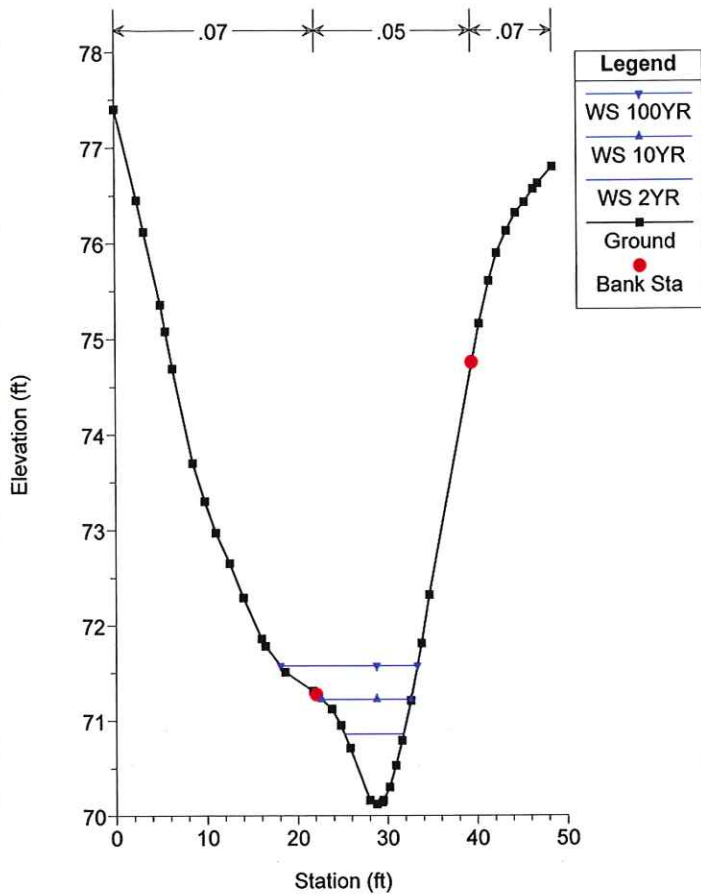
Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 1.21 ft

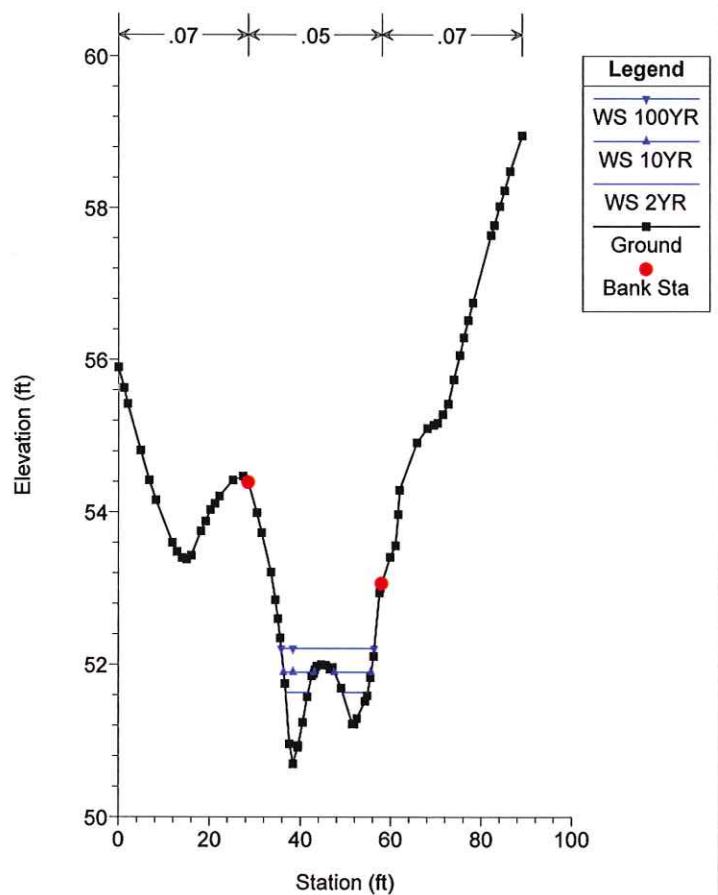
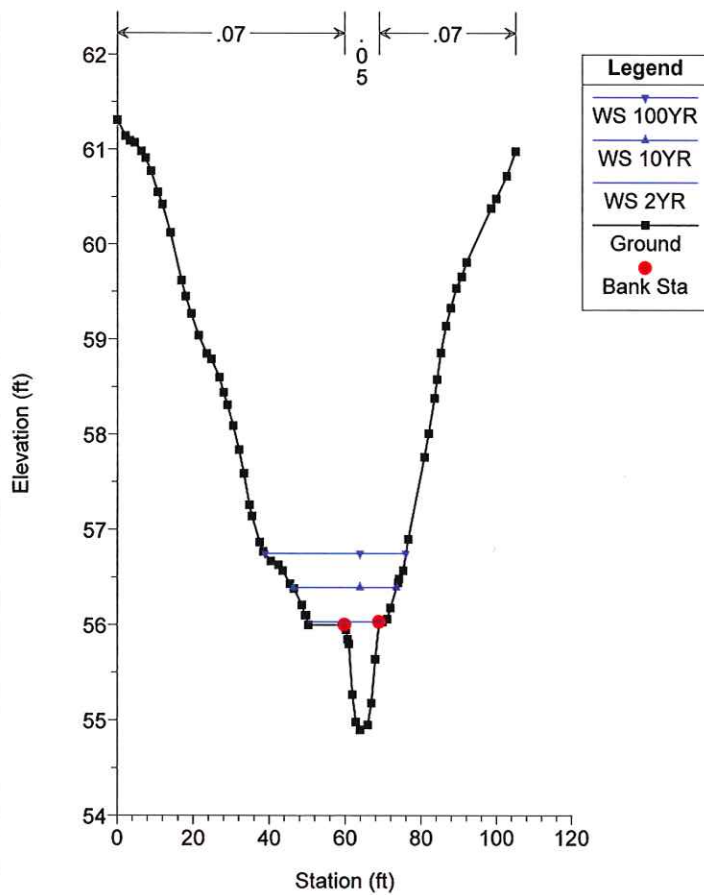
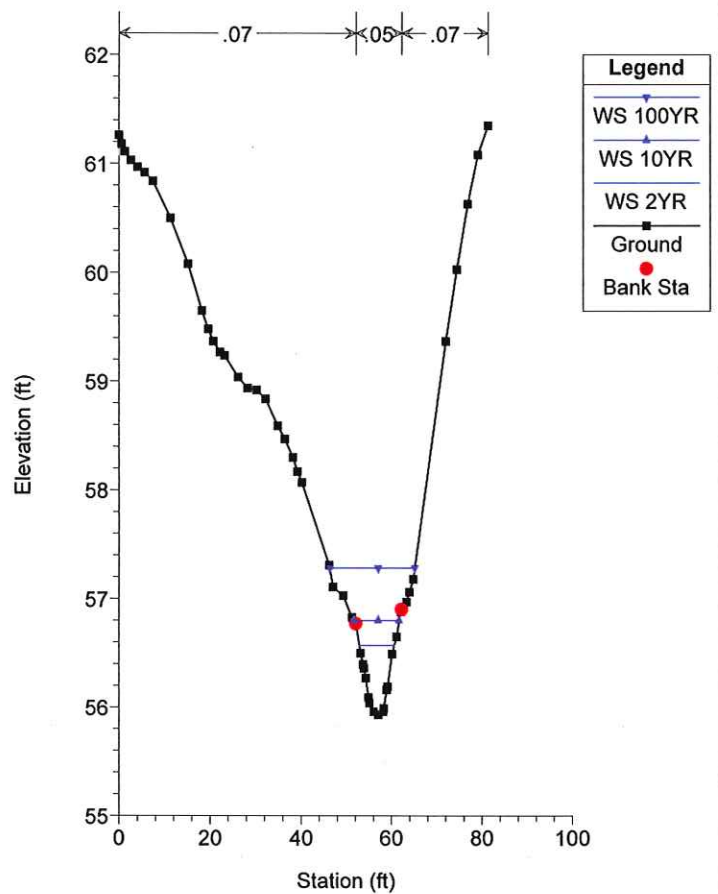
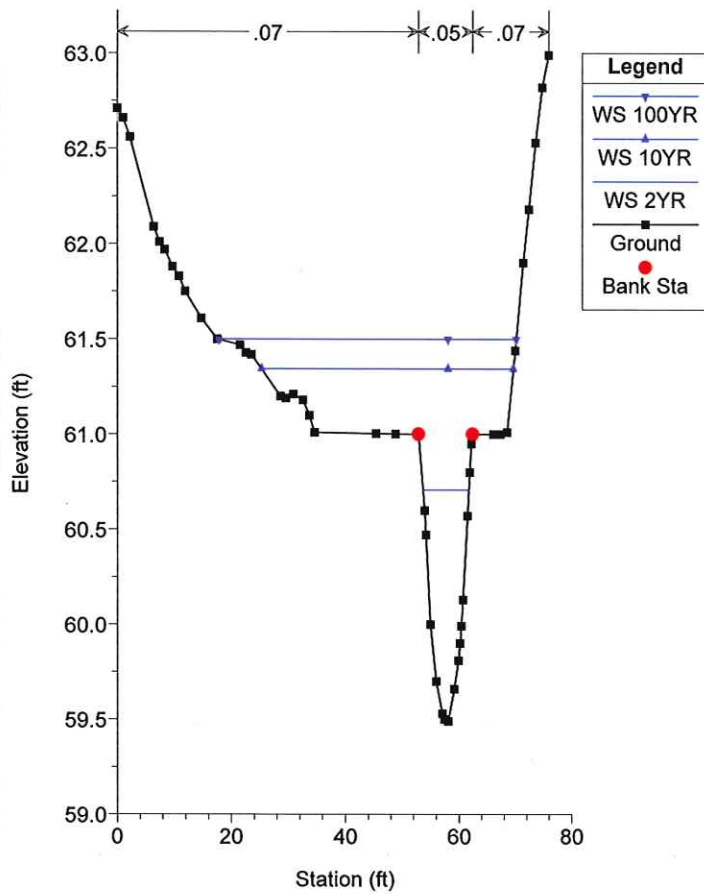
Roadway Data for Crossing: Pr. Culvert - decommission ex. culvert

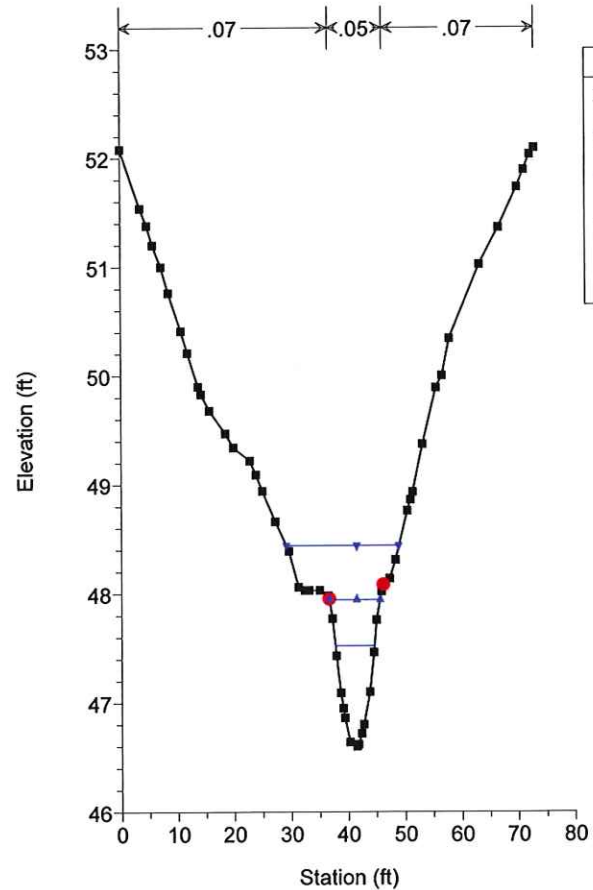
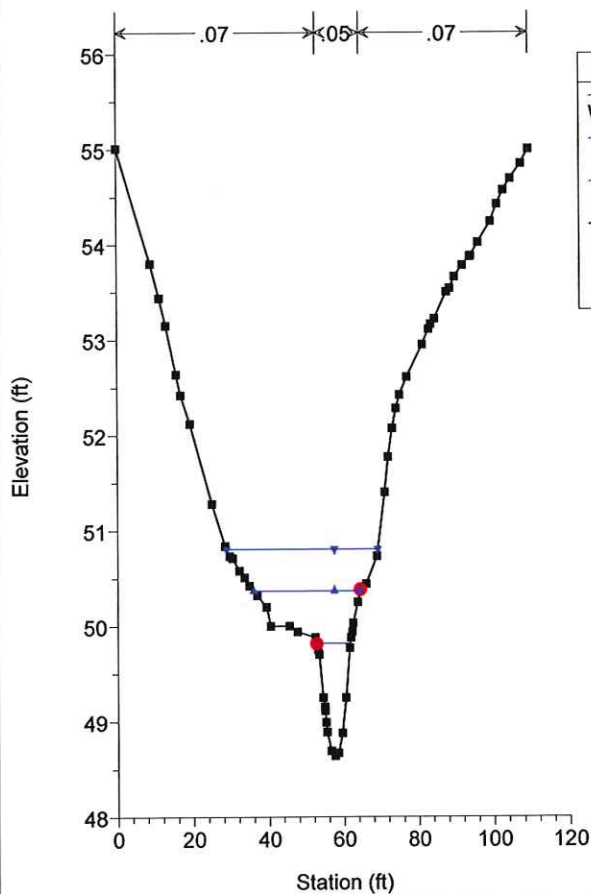
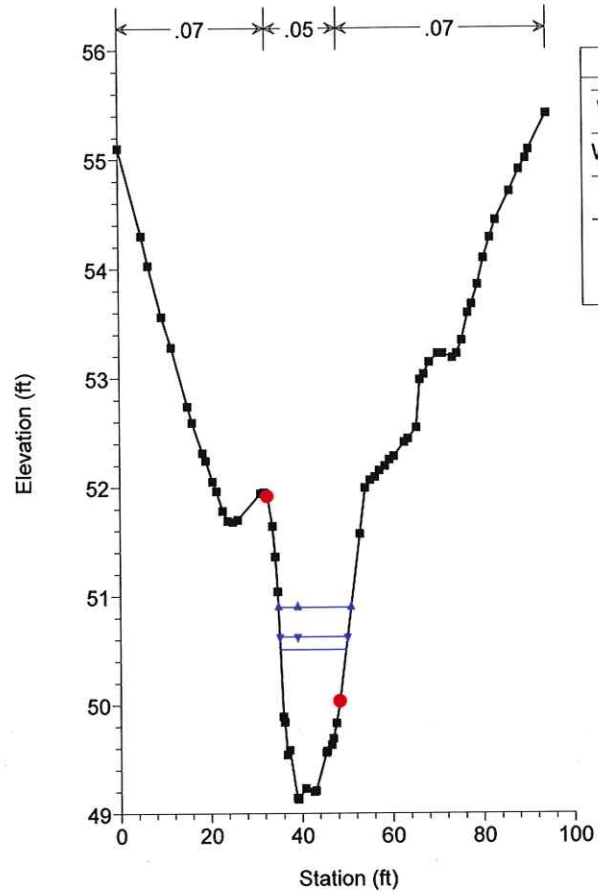
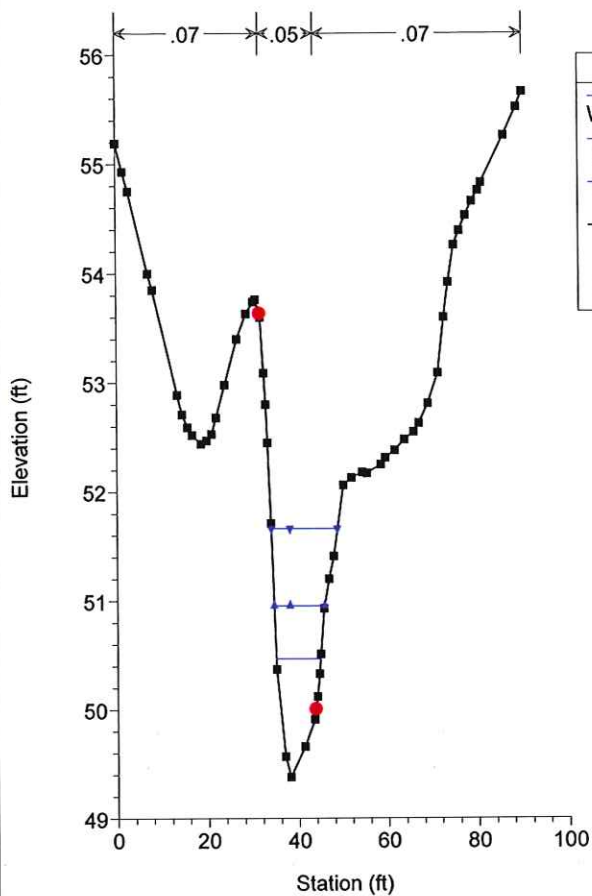
Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 350.00 ft
Crest Elevation: 10.00 ft
Roadway Surface: Gravel
Roadway Top Width: 12.00 ft

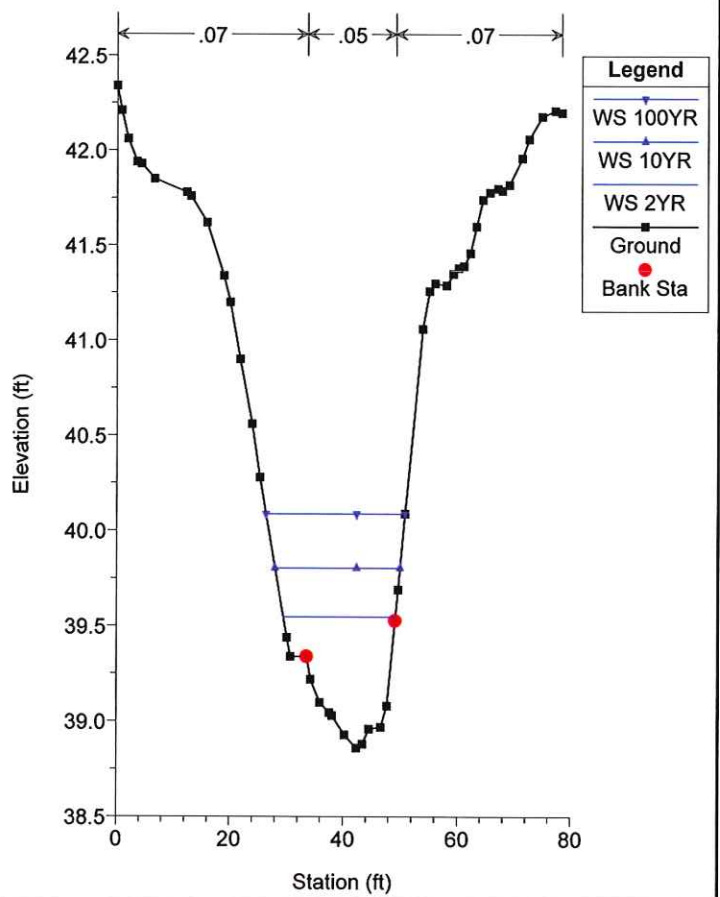
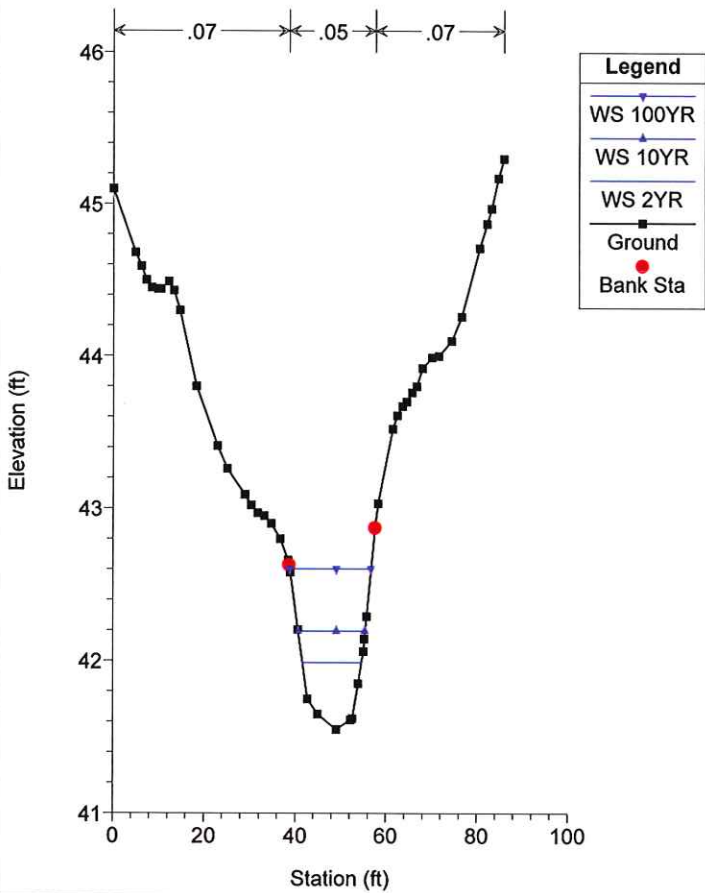
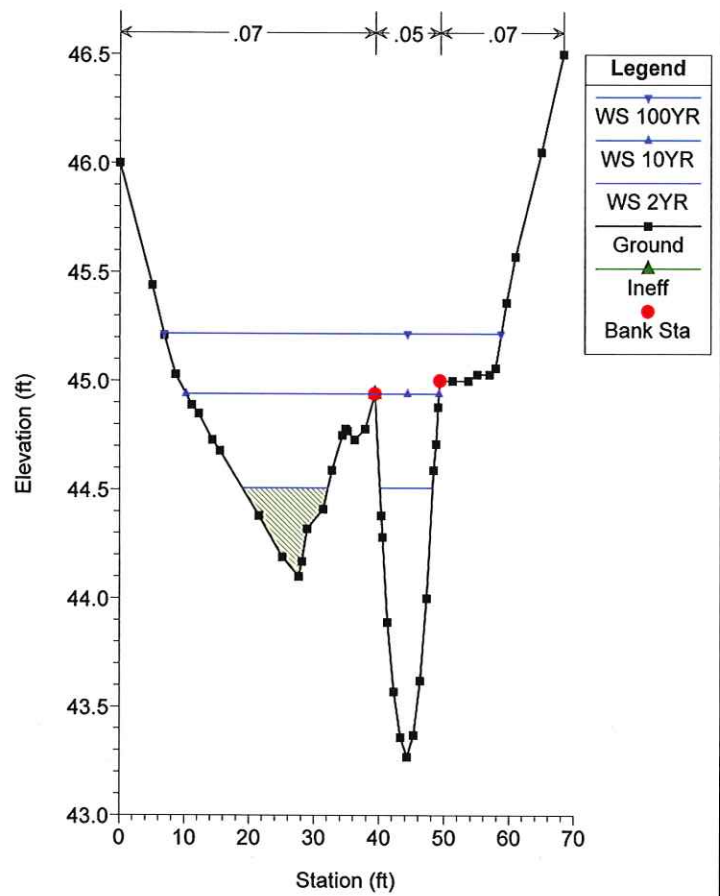
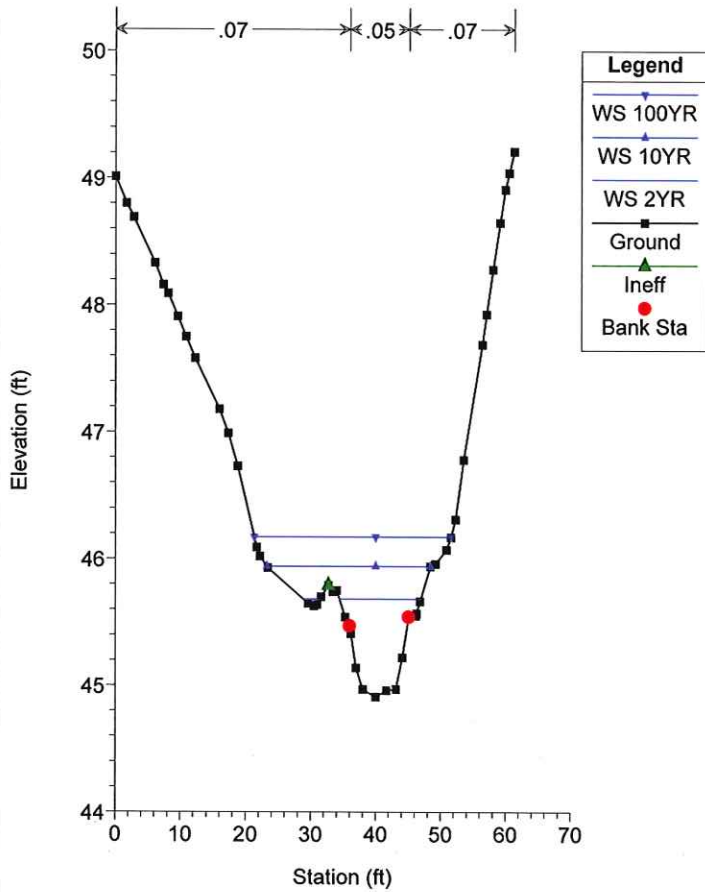
APPENDIX H: HYDRAULICS

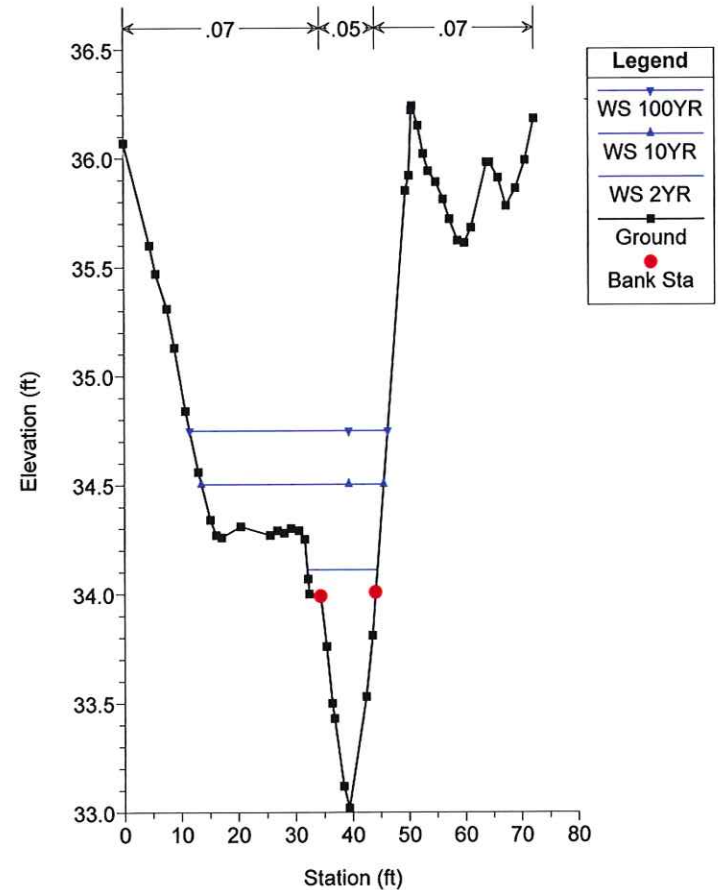
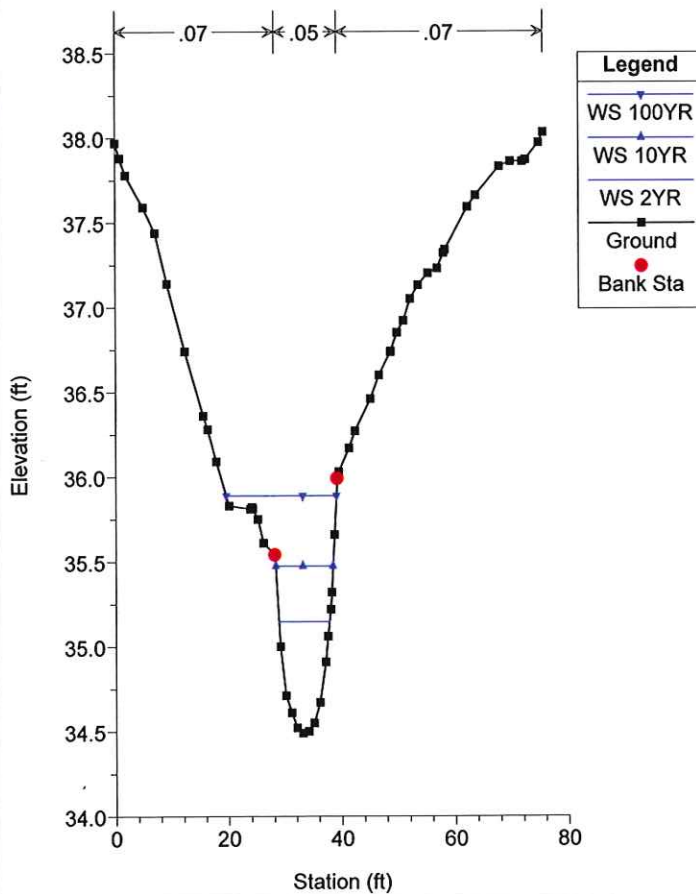
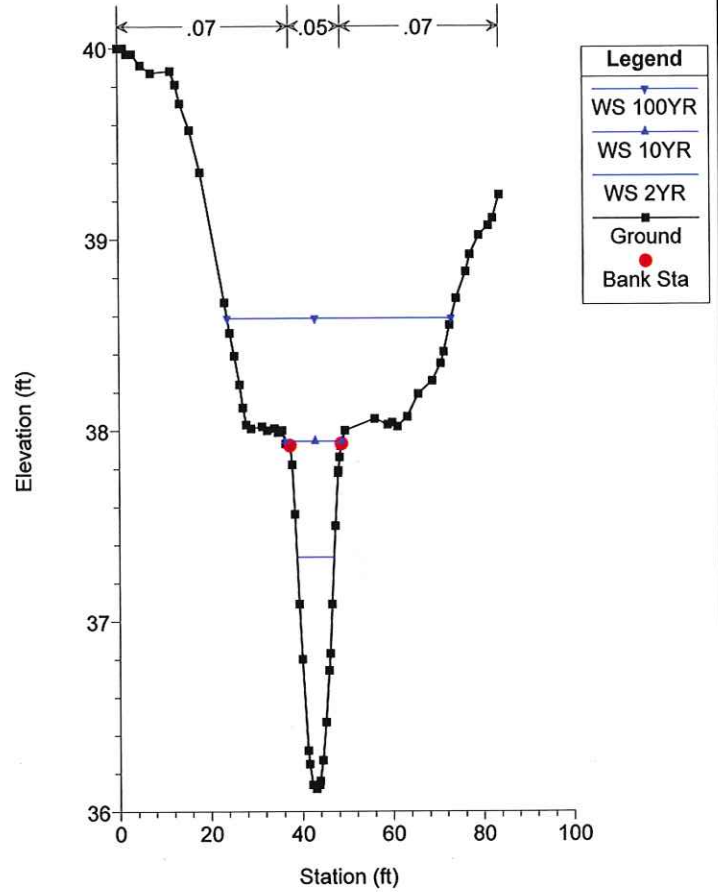
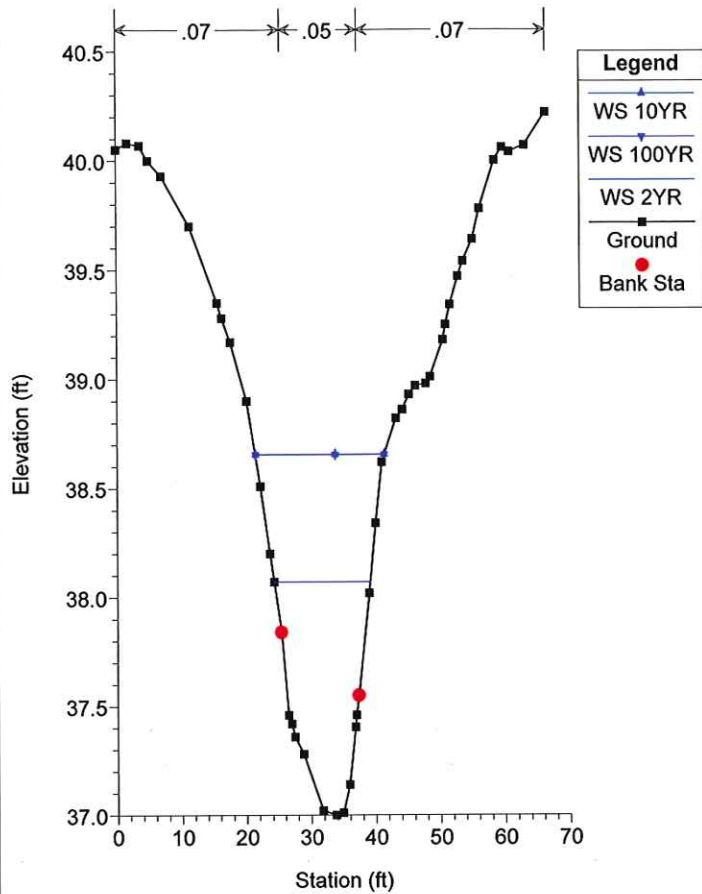


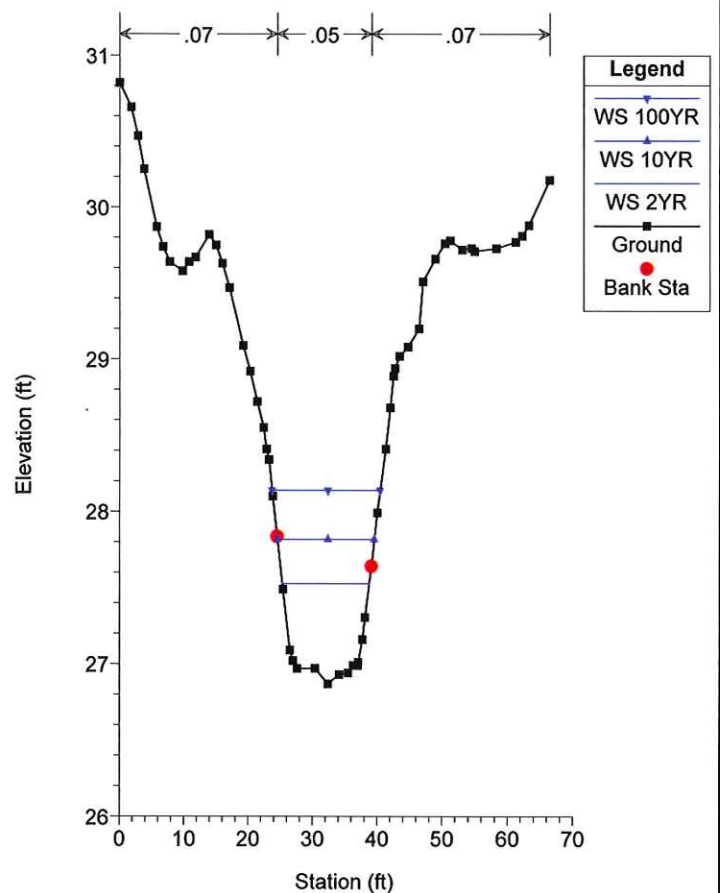
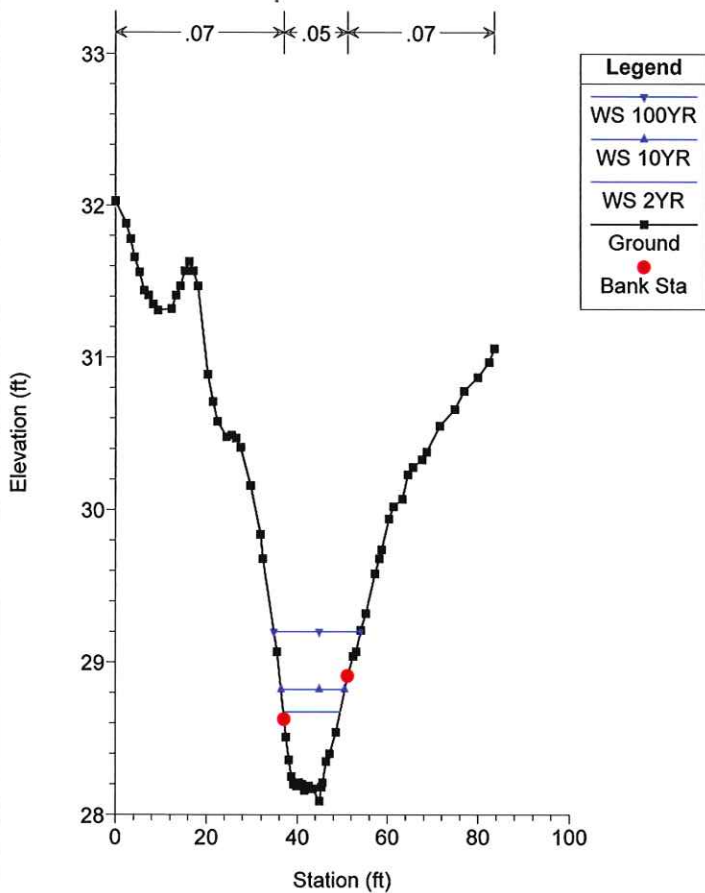
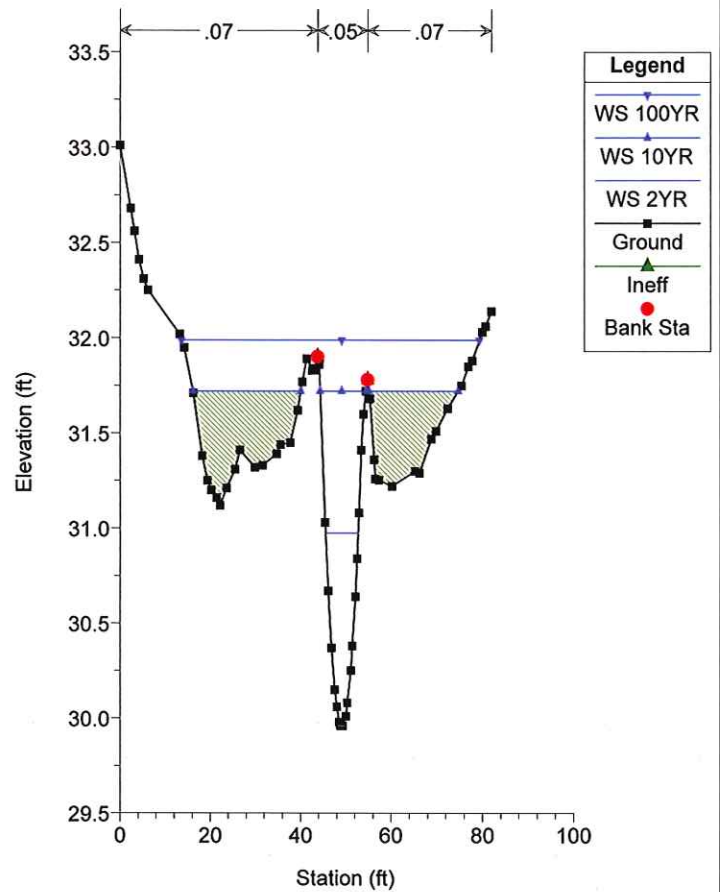
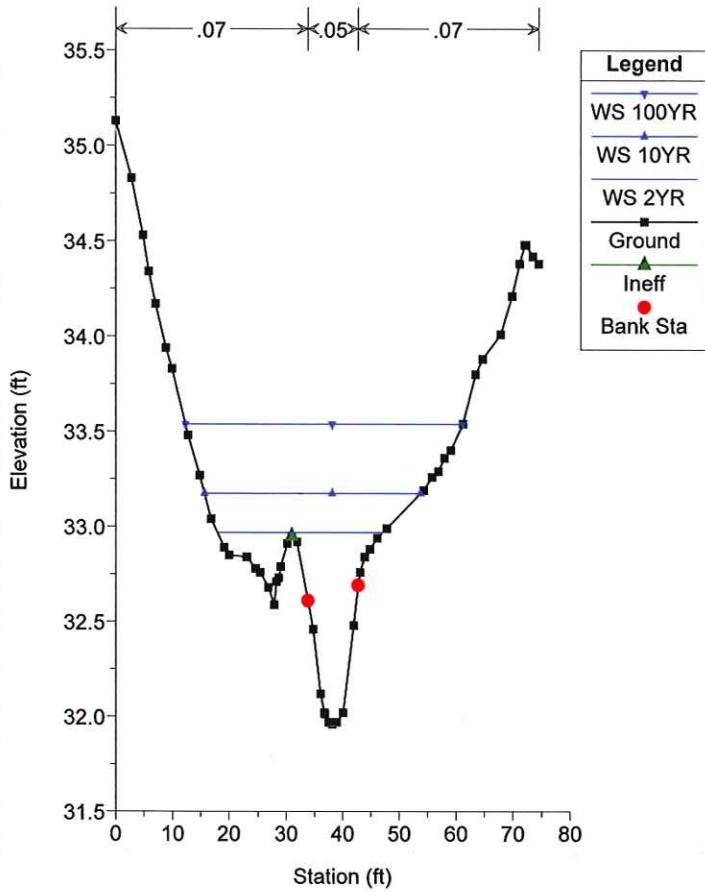


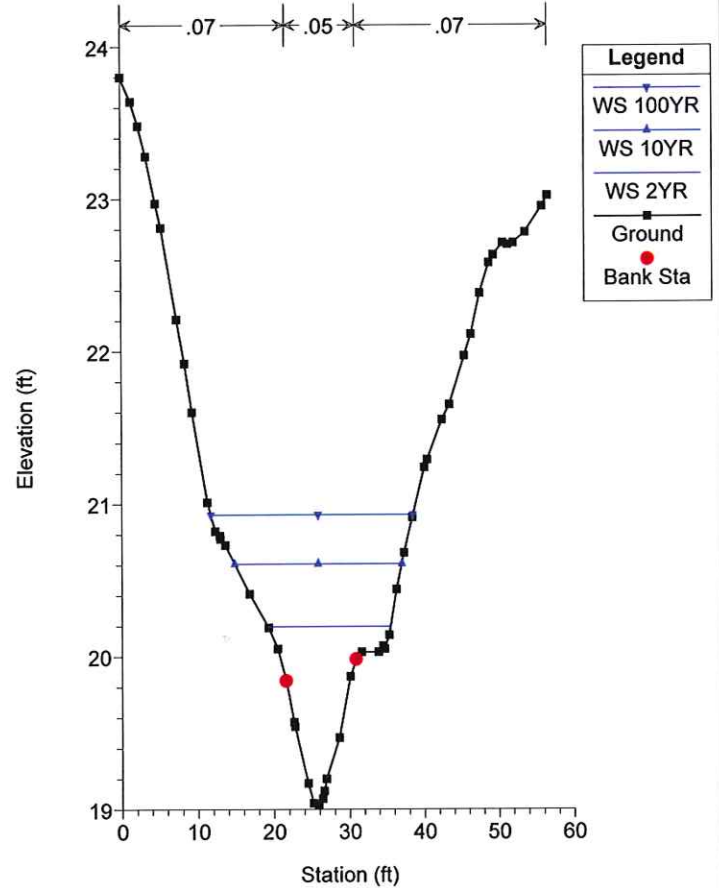
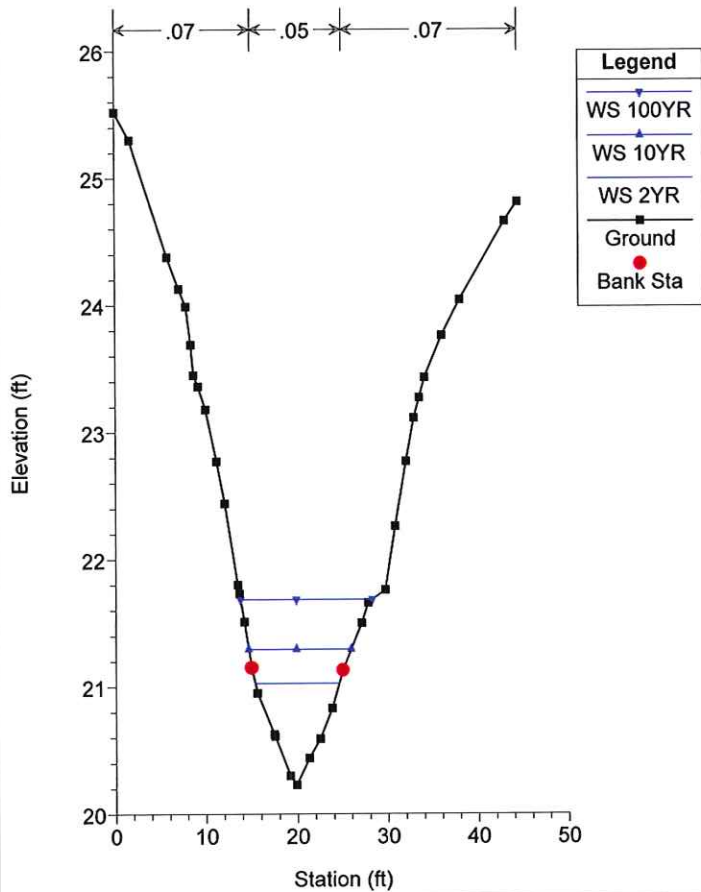
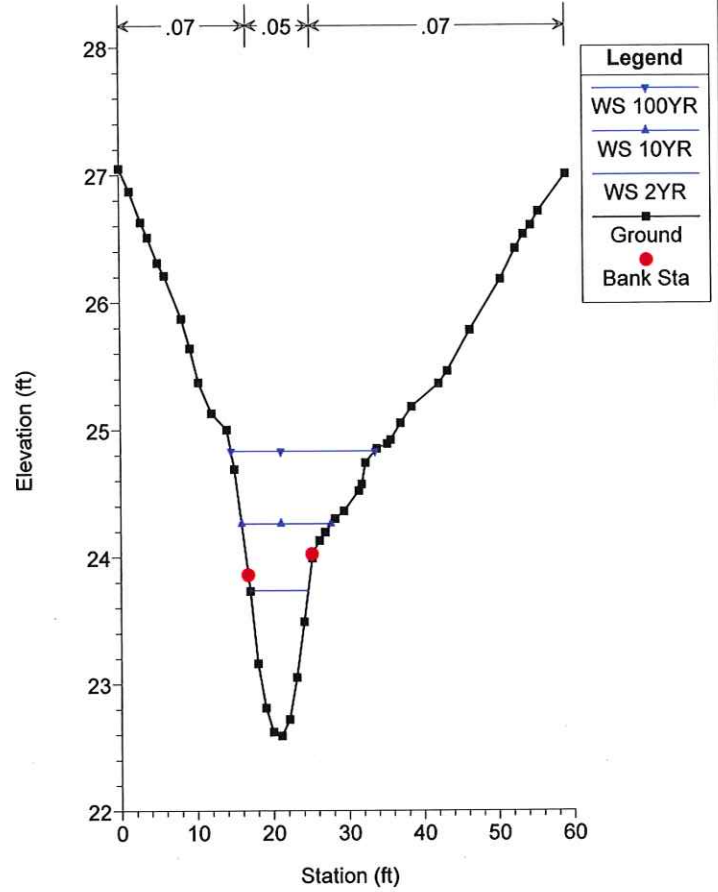
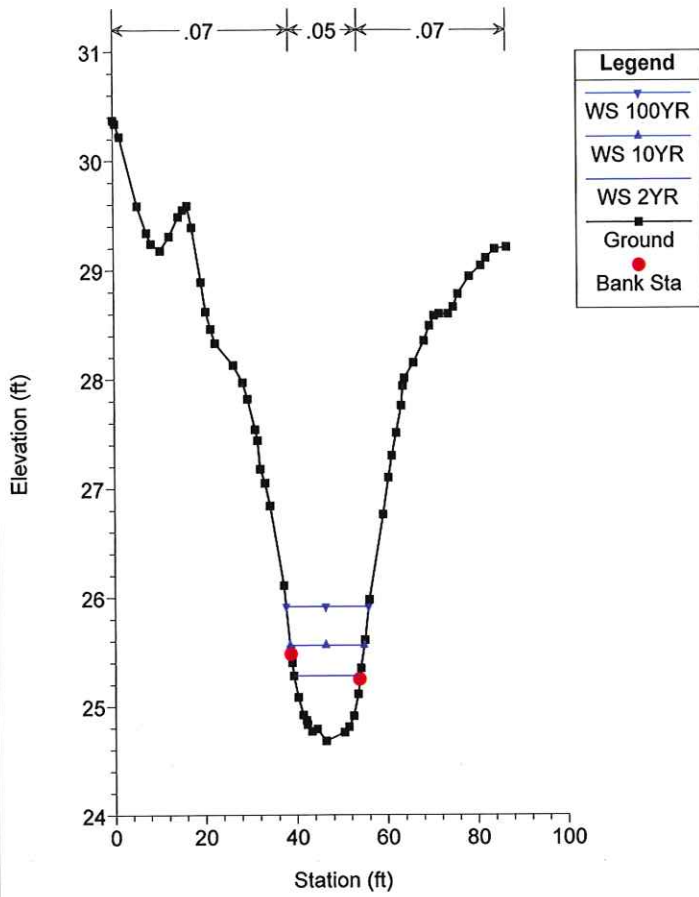


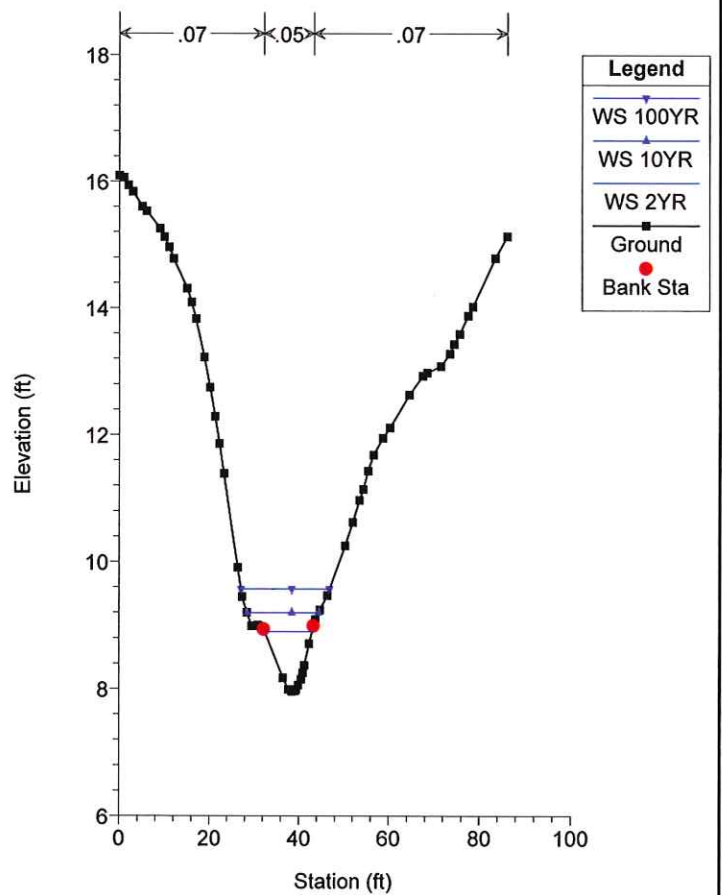
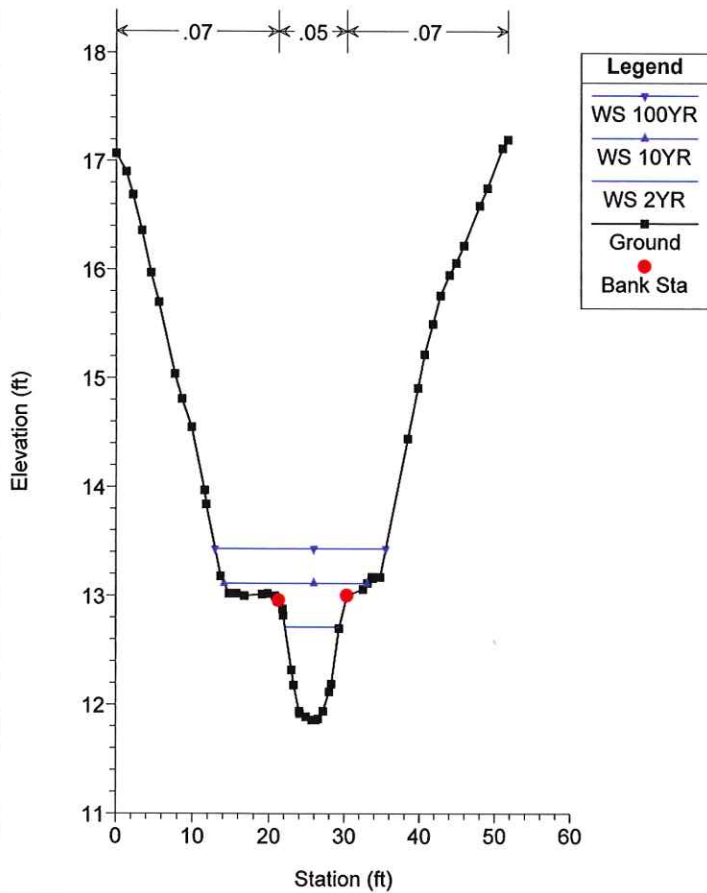
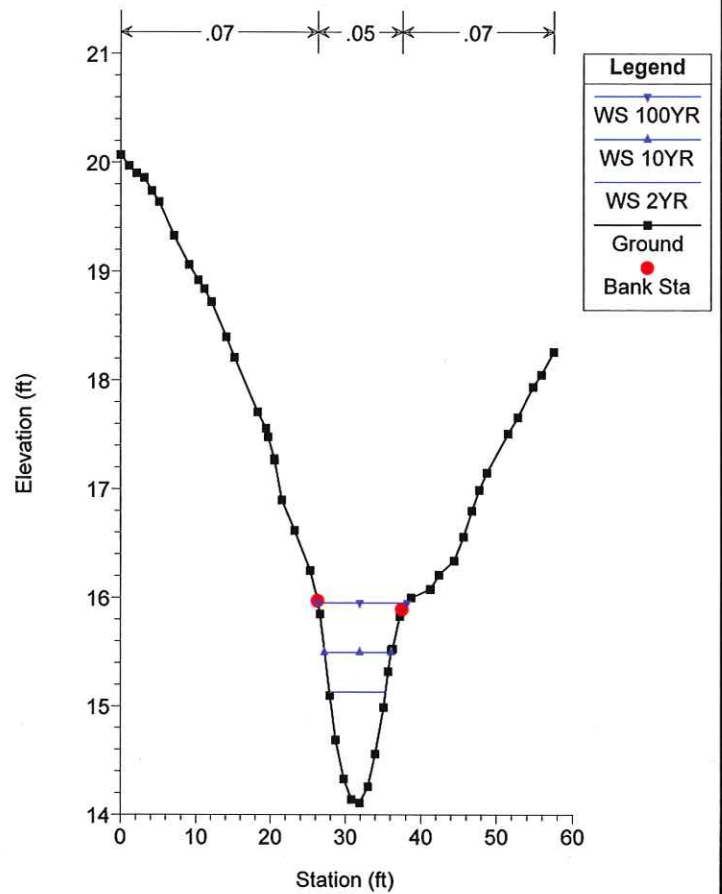
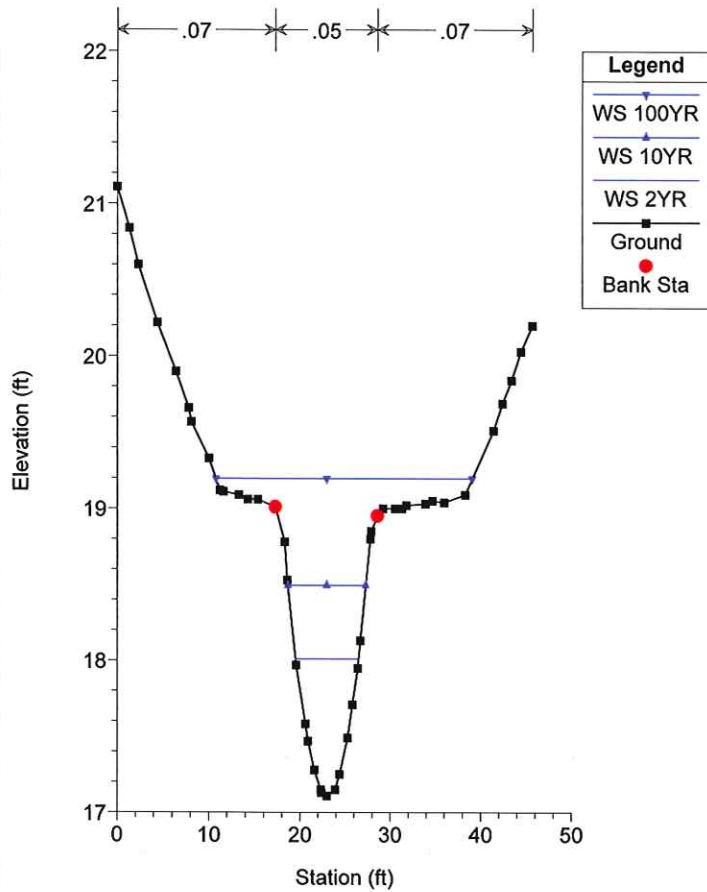


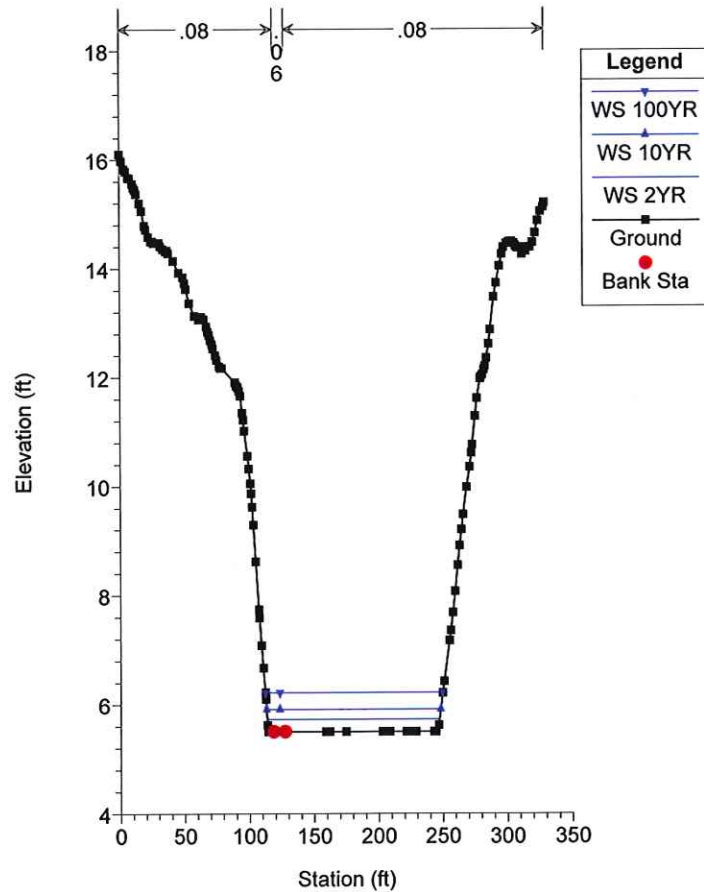
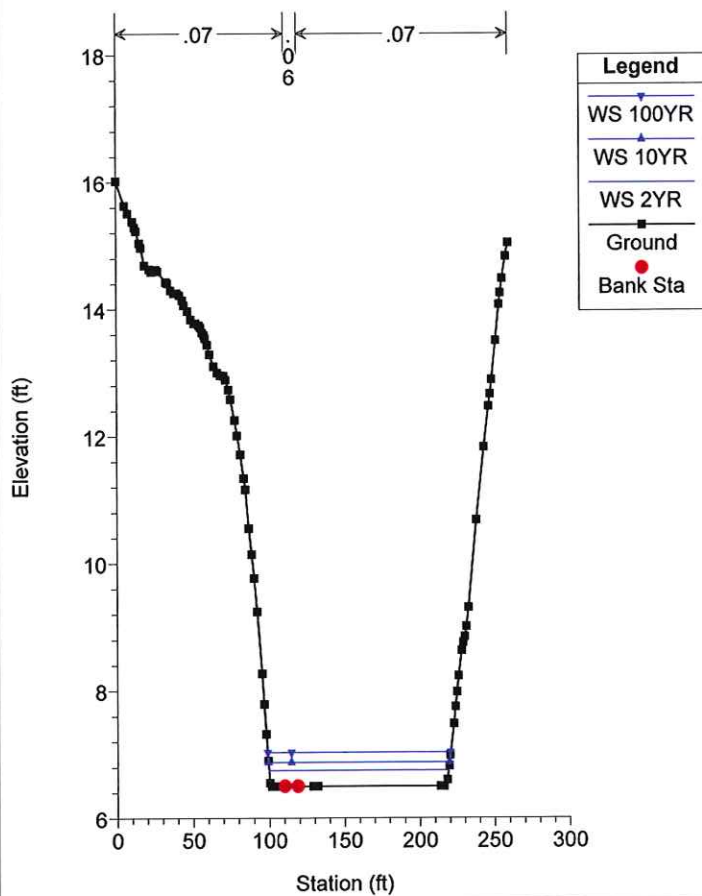
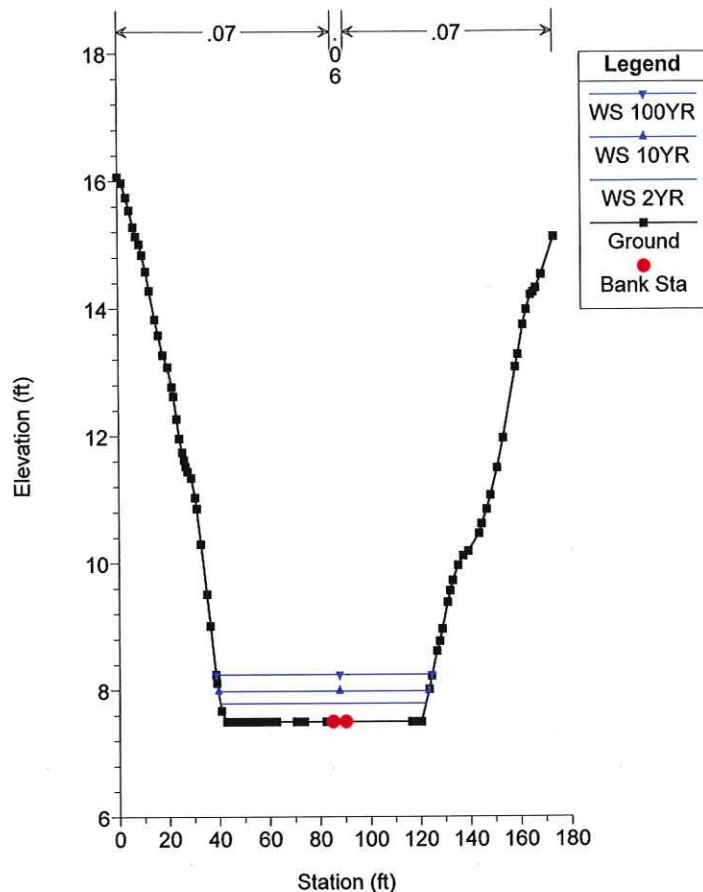
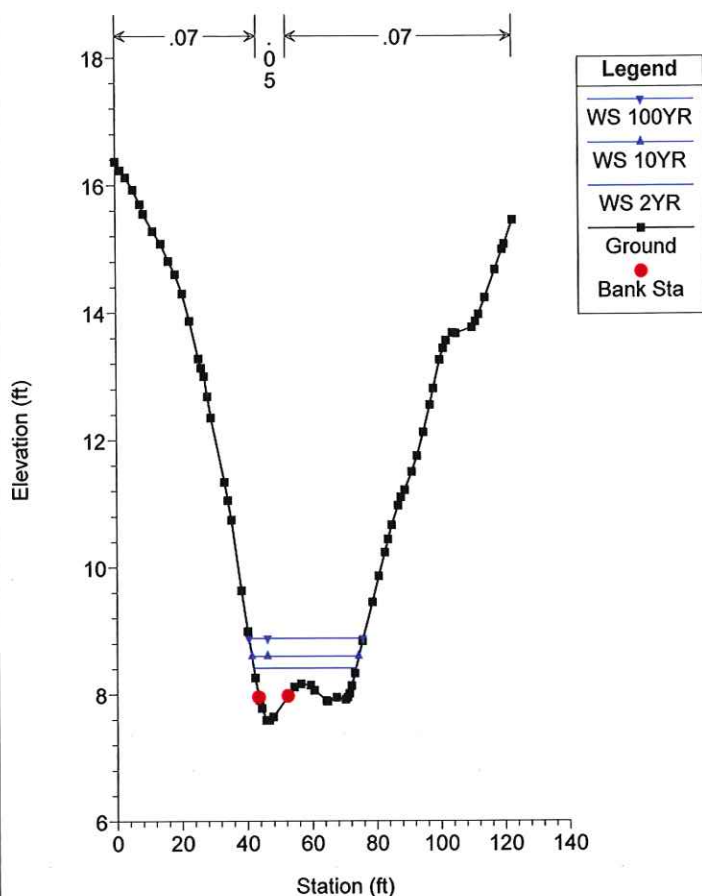


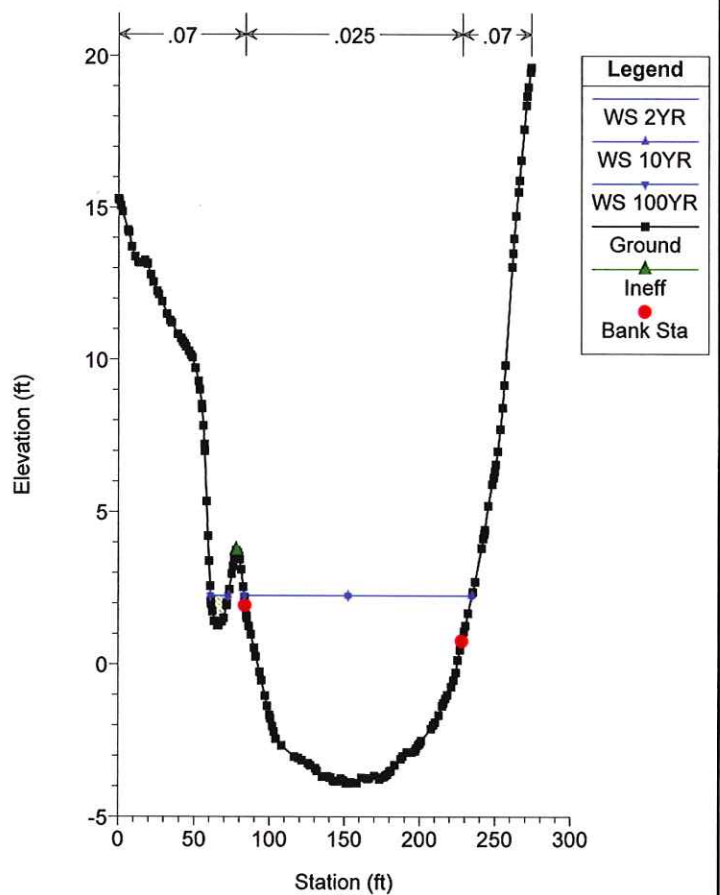
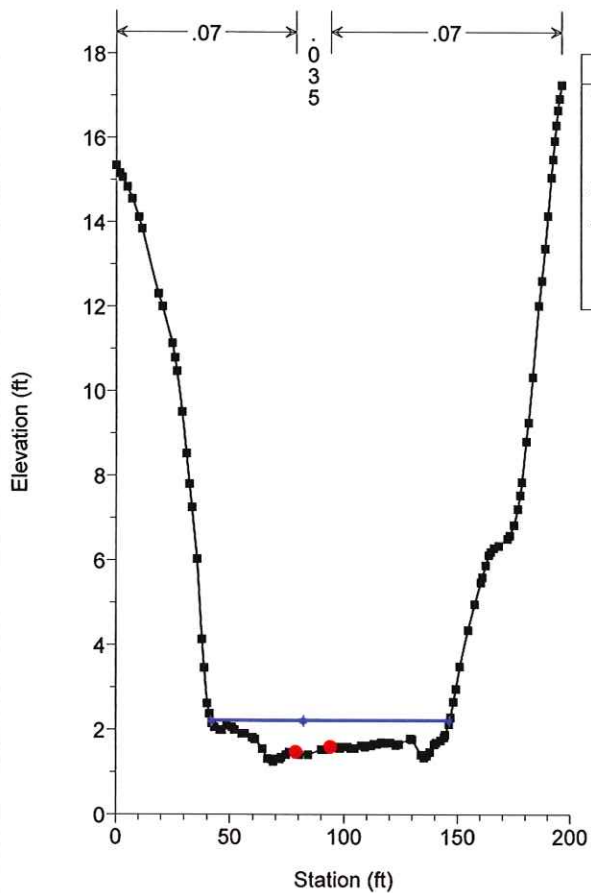
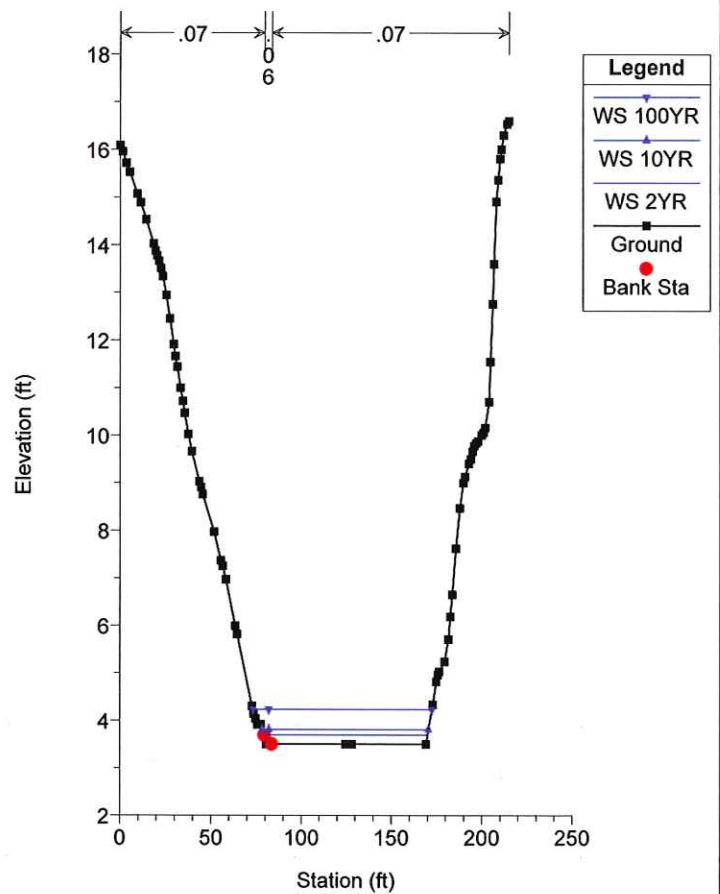
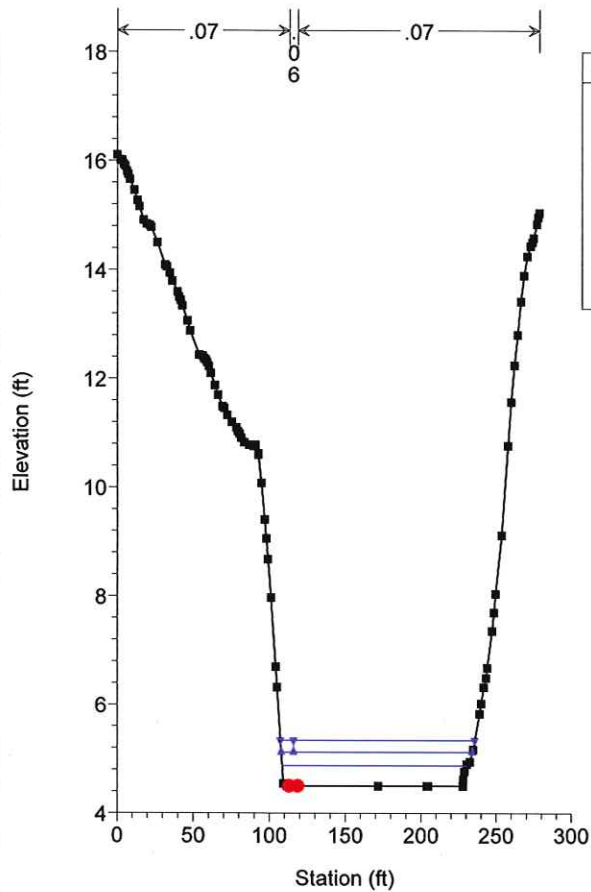


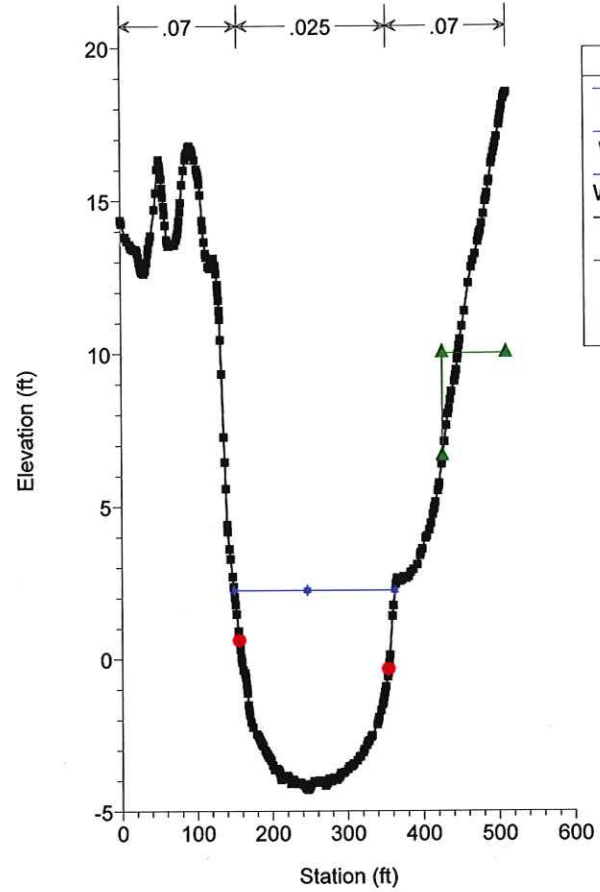
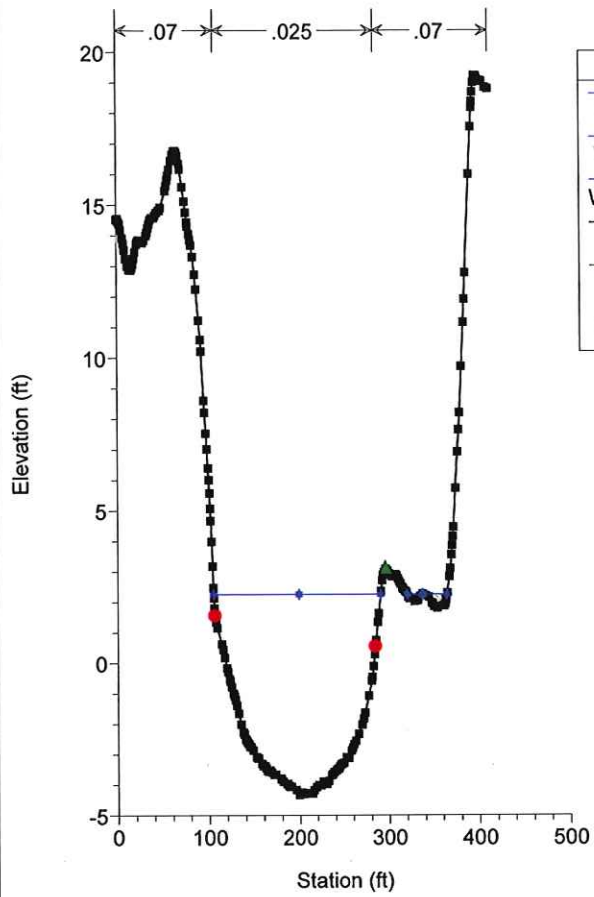












2 YR EX												
Reach	River Sta	Profile	2 YR EX Q Total (cfs)	2 YR EX Min Ch El (ft)	2 YR EX W.S. Elev (ft)	2 YR EX Froude # Chl	2 YR EX Vel Chnl (ft/s)	2 YR EX Vel Left (ft/s)	2 YR EX Vel Right (ft/s)	2 YR EX Shear Chan (lb/sq ft)	2 YR EX Shear LOB (lb/sq ft)	2 YR EX Shear ROB (lb/sq ft)
Reach 1	1972	2YR	33.37	99.74	100.64	1.66	6.85			2.65		
Reach 1	1945	2YR	33.37	97.15	97.70	2.14	6.53	2.45	0.59	2.92	1.55	
Reach 1	1885	2YR	33.37	86.35	87.10	2.33	8.12			4.14		
Reach 1	1835	2YR	33.37	80.55	81.31	1.70	6.58			2.53		
Reach 1	1781	2YR	33.37	70.12	70.81	3.39	12.52			9.54		
Reach 1	1743	2YR	33.37	64.89	65.61	1.74	6.44	1.16	1.20	2.50	0.44	0.47
Reach 1	1715	2YR	33.37	60.89	61.71	2.24	8.86			4.57		
Reach 1	1684	2YR	33.37	60.13	61.32	1.01	4.54			1.09		
Reach 1	1663	2YR	33.37	59.25	59.98	1.75	8.13	2.86	2.72	3.43	1.66	1.54
Reach 1	1637	2YR	33.37	55.32	56.09	2.42	9.29			5.11		
Reach 1	1615	2YR	33.37	53.49	54.51	1.41	6.20			2.09		
Reach 1	1580	2YR	33.37	50.05	50.83	2.27	7.58			3.74		
Reach 1	1541	2YR	33.37	48.56	50.05	0.75	4.32		0.87	0.86		0.18
Reach 1	1538.5	Bridge										
Reach 1	1534	2YR	33.37	48.28	49.58	1.01	4.92		0.38	1.23		0.06
Reach 1	1513	2YR	33.37	47.08	47.90	1.92	7.72			3.42		
Reach 1	1491	2YR	33.37	45.77	47.00	1.12	5.52		1.37	1.53		0.44
Reach 1	1470	2YR	33.37	42.66	43.49	3.05	11.96			8.40		
Reach 1	1440	2YR	33.37	41.03	42.37	1.11	5.74			1.63		
Reach 1	1420	2YR	33.37	40.43	41.77	1.07	5.29			1.41		
Reach 1	1389	2YR	33.37	36.92	37.75	2.96	11.71			8.01		
Reach 1	1361	2YR	33.37	35.23	36.70	1.12	5.98			1.75		
Reach 1	1341	2YR	33.37	34.25	35.33	1.63	7.60			3.04		
Reach 1	1321	2YR	33.37	33.36	34.79	1.03	5.26			1.37		
Reach 1	1301	2YR	33.37	33.18	34.39	0.89	4.18	0.95	1.37	0.90	0.14	0.24
Reach 1	1272	2YR	33.37	31.25	32.29	1.76	8.00	1.60		3.42	0.43	
Reach 1	1260.5	Culvert										
Reach 1	1245	2YR	33.37	28.74	29.91	1.01	5.01			1.26		
Reach 1	1228	2YR	33.37	26.20	26.91	2.93	11.74			7.99		
Reach 1	1215	2YR	33.37	25.31	26.58	1.36	6.88			2.39		
Reach 1	1187	2YR	33.37	23.86	24.99	1.50	6.63			2.39		
Reach 1	1168	2YR	33.37	21.10	22.37	2.06	9.66			4.98		
Reach 1	1148	2YR	33.37	19.37	20.56	1.71	8.14			3.46		
Reach 1	1122	2YR	33.37	16.24	17.24	2.15	9.75			5.14		
Reach 1	1100	2YR	33.37	15.74	17.27	0.98	5.41		1.85	1.38		0.39
Reach 1	1073	2YR	33.37	12.49	13.22	3.50	12.89			10.12		
Reach 1	1053	2YR	33.37	10.60	11.22	1.74	7.08	3.94		2.84	1.65	
Reach 1	1014	2YR	33.37	7.96	8.92	1.26	5.42			1.61		
Reach 1	987	2YR	33.37	7.59	8.32	1.02	4.20	1.20	1.64	0.99	0.35	0.56
Reach 1	963	2YR	33.37	6.41	7.05	1.53	6.30	1.48	1.81	1.70	0.48	0.74
Reach 1	913	2YR	37.92	5.17	5.45	1.30	3.19		2.22	0.62		1.01
Reach 1	877	2YR	37.92	4.27	4.84	0.57	1.72		1.03	0.16		0.20
Reach 1	834	2YR	37.92	3.67	4.19	0.55	1.73	0.40	1.08	0.15	0.05	0.21
Reach 1	768	2YR	37.92	2.68	2.71	0.91	0.66		3.12			1.12
Reach 1	694	2YR	37.92	1.41	2.24	0.23	1.15	0.45	0.49	0.05	0.03	0.04
Reach 1	564	2YR	37.92	-3.91	2.25	0.00	0.05	0.00	0.01	0.00	0.00	0.00
Reach 1	443	2YR	37.92	-4.33	2.25	0.00	0.04	0.00	0.00	0.00	0.00	0.00
Reach 1	354	2YR	37.92	-4.30	2.25	0.00	0.04	0.00	0.00	0.00	0.00	0.00

10 YR EX												
Reach	River Sta	Profile	10 YR EX Q Total (cfs)	10 YR EX Min Ch El (ft)	10 YR EX W.S. Elev (ft)	10 YR EX Froude # Chl	10 YR EX Vel Chnl (ft/s)	10 YR EX Vel Left (ft/s)	10 YR EX Vel Right (ft/s)	10 YR EX Shear Chan (lb/sq ft)	10 YR EX Shear LOB (lb/sq ft)	10 YR EX Shear ROB (lb/sq ft)
Reach 1	1972	10YR	72.09	99.74	100.96	1.77	8.74	0.88	1.29	3.81	0.28	0.50
Reach 1	1945	10YR	72.09	97.15	97.86	2.39	8.57	3.47	1.87	4.52	2.69	1.06
Reach 1	1885	10YR	72.09	86.35	87.37	2.31	9.48			5.07		
Reach 1	1835	10YR	72.09	80.55	81.60	1.85	8.40			3.73		
Reach 1	1781	10YR	72.09	70.12	71.15	3.22	13.88			10.58		
Reach 1	1743	10YR	72.09	64.89	65.83	1.99	9.07	2.28	2.20	4.31	1.26	1.19
Reach 1	1715	10YR	72.09	60.89	62.07	2.21	10.42			5.63		
Reach 1	1684	10YR	72.09	60.13	61.75	0.97	5.49	0.74	0.97	1.38	0.16	0.24
Reach 1	1663	10YR	72.09	59.25	60.23	2.00	10.88	3.87	4.02	5.52	2.71	2.87
Reach 1	1637	10YR	72.09	55.32	56.45	2.28	10.30			5.62		
Reach 1	1615	10YR	72.09	53.49	54.88	1.56	7.84			3.05		
Reach 1	1580	10YR	72.09	50.05	51.05	2.33	8.89			4.70		
Reach 1	1541	10YR	72.09	48.56	50.79	0.71	5.17		1.56	1.06		0.41
Reach 1	1538.5	Bridge										
Reach 1	1534	10YR	72.09	48.28	50.09	0.98	6.07		1.80	1.61		0.60
Reach 1	1513	10YR	72.09	47.08	48.24	2.00	9.53			4.66		
Reach 1	1491	10YR	72.09	45.77	47.45	1.21	7.02	0.50	2.27	2.22	0.10	0.95
Reach 1	1470	10YR	72.09	42.66	43.89	2.70	12.99		1.24	8.66		0.59
Reach 1	1440	10YR	72.09	41.03	42.87	1.23	7.38		0.43	2.45		
Reach 1	1420	10YR	72.09	40.43	42.24	1.18	6.69			2.06		
Reach 1	1389	10YR	72.09	36.92	38.17	2.61	12.63			8.19		
Reach 1	1361	10YR	72.09	35.23	37.27	1.20	7.49			2.49		
Reach 1	1341	10YR	72.09	34.25	35.80	1.64	9.13			3.92		
Reach 1	1321	10YR	72.09	33.36	35.26	1.15	6.91	1.57		2.13	0.32	
Reach 1	1301	10YR	72.09	33.18	34.51	1.39	7.07	2.34	2.55	2.45	0.65	0.74
Reach 1	1272	10YR	72.09	31.25	32.81	1.38	8.05	2.87	1.13	2.93	0.87	0.22
Reach 1	1260.5	Culvert										
Reach 1	1245	10YR	72.09	28.74	30.45	1.01	6.06			1.63		
Reach 1	1228	10YR	72.09	26.20	27.34	2.58	12.91			8.38		
Reach 1	1215	10YR	72.09	25.31	27.07	1.49	8.76			3.52		
Reach 1	1187	10YR	72.09	23.86	25.37	1.63	8.30			3.41		
Reach 1	1168	10YR	72.09	21.10	22.91	1.90	10.86		1.98	5.52		0.60
Reach 1	1148	10YR	72.09	19.37	20.97	1.93	10.59			5.35		
Reach 1	1122	10YR	72.09	16.24	17.69	2.13	11.59		1.85	6.44		0.58
Reach 1	1100	10YR	72.09	15.74	17.95	0.97	6.05		2.62	1.59		0.63
Reach 1	1073	10YR	72.09	12.49	13.56	3.20	14.39			11.07		
Reach 1	1053	10YR	72.09	10.60	11.47	2.04	9.77	5.92		4.85	3.20	
Reach 1	1014	10YR	72.09	7.96	9.26	1.33	7.12	1.68	1.07	2.40	0.64	0.32
Reach 1	987	10YR	72.09	7.59	8.50	1.31	6.20	1.90	2.66	1.96	0.77	1.28
Reach 1	963	10YR	72.09	6.41	7.23	1.54	7.33	1.70	2.51	2.09	0.66	1.19
Reach 1	913	10YR	88.39	5.17	5.65	1.49	4.67		2.85	1.13		1.40
Reach 1	877	10YR	88.39	4.27	5.10	0.59	2.35	0.62	1.31	0.24	0.09	0.26
Reach 1	834	10YR	88.39	3.67	4.43	0.67	2.80	0.85	1.48	0.33	0.16	0.32
Reach 1	768	10YR	88.39	2.68	3.08	1.04	2.66		2.66	0.43		1.13
Reach 1	694	10YR	88.39	1.41	2.21	0.59	2.86	1.10	1.21	0.31	0.21	0.24
Reach 1	564	10YR	88.39	-3.91	2.25	0.01	0.13	0.00	0.01	0.00	0.00	0.00
Reach 1	443	10YR	88.39	-4.33	2.25	0.01	0.10	0.01	0.01	0.00	0.00	0.00
Reach 1	354	10YR	88.39	-4.30	2.25	0.01	0.08	0.01	0.01	0.00	0.00	0.00

100 YR EX												
Reach	River Sta	Profile	100 YR EX Q Total	100 YR EX Min Ch El	100 YR EX W.S. Elev	100 YR EX Froude # Chl	100 YR EX Vel Chnl	100 YR EX Vel Left	100 YR EX Vel Right	100 YR EX Shear Chan	100 YR EX Shear LOB	100 YR EX Shear ROB
			(cfs)	(ft)	(ft)		(ft/s)	(ft/s)	(ft/s)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
Reach 1	1972	100YR	141.12	99.74	101.31	1.88	11.24	2.80	2.41	5.56	1.60	1.28
Reach 1	1945	100YR	141.12	97.15	98.04	2.61	11.32	4.46	2.98	6.93	3.96	2.17
Reach 1	1885	100YR	141.12	86.35	87.66	2.40	11.52			6.74		
Reach 1	1835	100YR	141.12	80.55	81.95	1.97	10.30			5.10		
Reach 1	1781	100YR	141.12	70.12	71.50	3.11	15.81	2.44		12.31	1.73	
Reach 1	1743	100YR	141.12	64.89	66.11	2.23	12.16	3.41	3.34	6.89	2.37	2.30
Reach 1	1715	100YR	141.12	60.89	62.47	2.28	12.35			7.23		
Reach 1	1684	100YR	141.12	60.13	62.19	1.04	7.00	1.48	1.71	1.99	0.45	0.56
Reach 1	1663	100YR	141.12	59.25	60.56	2.09	13.25	4.75	5.20	7.38	3.67	4.20
Reach 1	1637	100YR	141.12	55.32	56.85	2.24	11.65			6.56		
Reach 1	1615	100YR	141.12	53.49	55.28	1.68	9.69	0.89		4.25	0.28	
Reach 1	1580	100YR	141.12	50.05	51.31	2.33	10.99			6.26		
Reach 1	1541	100YR	141.12	48.56	51.62	0.73	6.33		2.77	1.44		0.96
Reach 1	1538.5	Bridge										
Reach 1	1534	100YR	141.12	48.28	50.73	1.00	7.47		3.21	2.16		1.41
Reach 1	1513	100YR	141.12	47.08	48.65	2.03	11.22		1.88	5.86		0.93
Reach 1	1491	100YR	141.12	45.77	47.93	1.30	9.10	1.65	2.97	3.28	0.59	1.42
Reach 1	1470	100YR	141.12	42.66	44.39	2.40	14.49		3.49	9.32		2.55
Reach 1	1440	100YR	141.12	41.03	43.38	1.40	9.68		2.42	3.83		0.67
Reach 1	1420	100YR	141.12	40.43	42.71	1.36	8.52	0.89		3.12	0.15	
Reach 1	1389	100YR	141.12	36.92	38.70	2.36	13.35			8.27		
Reach 1	1361	100YR	141.12	35.23	37.96	1.25	8.89		1.45	3.21		0.29
Reach 1	1341	100YR	141.12	34.25	36.37	1.65	10.83		2.42	4.95		0.73
Reach 1	1321	100YR	141.12	33.36	35.74	1.34	9.09	2.02		3.40	0.50	
Reach 1	1301	100YR	141.12	33.18	34.69	1.77	9.97	4.19	3.94	4.54	1.73	1.57
Reach 1	1272	100YR	141.12	31.25	33.19	1.37	9.31	3.82	2.04	3.53	1.30	0.51
Reach 1	1260.5	Culvert										
Reach 1	1245	100YR	141.12	28.74	31.14	0.99	7.06		1.32	1.98		0.23
Reach 1	1228	100YR	141.12	26.20	27.90	2.32	13.99			8.76		
Reach 1	1215	100YR	141.12	25.31	27.65	1.61	10.60			4.77		
Reach 1	1187	100YR	141.12	23.86	25.78	1.78	10.31		1.75	4.81		0.47
Reach 1	1168	100YR	141.12	21.10	23.56	1.80	12.21		4.08	6.23		1.68
Reach 1	1148	100YR	141.12	19.37	21.48	1.99	12.93		2.97	7.16		1.10
Reach 1	1122	100YR	141.12	16.24	18.20	2.20	14.04		4.37	8.50		2.06
Reach 1	1100	100YR	141.12	15.74	18.37	1.22	8.20	0.86	3.66	2.77	0.13	1.15
Reach 1	1073	100YR	141.12	12.49	14.06	2.64	14.71		3.34	10.06		1.52
Reach 1	1053	100YR	141.12	10.60	11.77	2.31	13.06	7.96	2.37	7.77	5.17	0.84
Reach 1	1014	100YR	141.12	7.96	9.63	1.48	9.38	2.96	2.13	3.72	1.52	0.93
Reach 1	987	100YR	141.12	7.59	8.71	1.61	8.73	2.78	3.94	3.57	1.48	2.51
Reach 1	963	100YR	141.12	6.41	7.42	1.61	8.66	2.56	3.22	2.70	1.23	1.73
Reach 1	913	100YR	181.90	5.17	5.89	1.52	5.76	0.42	3.37	1.52	0.08	1.79
Reach 1	877	100YR	181.90	4.27	5.44	0.61	3.14	1.04	1.59	0.37	0.20	0.37
Reach 1	834	100YR	181.90	3.67	4.65	0.87	4.34	1.42	2.06	0.71	0.38	0.66
Reach 1	768	100YR	181.90	2.68	3.66	0.71	3.08		2.21	0.41		0.70
Reach 1	694	100YR	181.90	1.41	2.20	1.25	6.02	2.31	2.53	1.40	0.94	1.08
Reach 1	564	100YR	181.90	-3.91	2.25	0.02	0.26	0.01	0.03	0.00	0.00	0.00
Reach 1	443	100YR	181.90	-4.33	2.25	0.02	0.20	0.01	0.02	0.00	0.00	0.00
Reach 1	354	100YR	181.90	-4.30	2.25	0.01	0.17	0.02	0.02	0.00	0.00	0.00

2 YR PR												
Reach	River Sta	Profile	2 YR PR Q Total (cfs)	2 YR PR Min Ch El (ft)	2 YR PR W.S. Elev (ft)	2 YR PR Froude # Chl	2 YR PR Vel Chnl (ft/s)	2 YR PR Vel Left (ft/s)	2 YR PR Vel Right (ft/s)	2 YR PR Shear Chan (lb/sq ft)	2 YR PR Shear LOB (lb/sq ft)	2 YR PR Shear ROB (lb/sq ft)
Reach 1	1972	2YR	33.37	99.74	100.74	1.35	5.77			2.86		
Reach 1	1945	2YR	33.37	97.15	97.75	1.74	5.36	2.77	1.08	3.05	1.88	0.46
Reach 1	1885	2YR	33.37	86.35	87.17	1.87	6.76			4.38		
Reach 1	1835	2YR	33.37	80.55	81.39	1.37	5.58			2.75		
Reach 1	1781	2YR	33.37	70.12	70.86	2.97	11.29			11.87		
Reach 1	1743	2YR	33.37	64.89	65.69	1.34	5.41	1.43	1.49	2.61	0.59	0.62
Reach 1	1715	2YR	33.37	60.89	61.76	2.00	8.10			5.87		
Reach 1	1684	2YR	33.37	60.13	61.52	0.68	3.35	0.25	0.42	0.88	0.03	0.06
Reach 1	1663	2YR	33.37	59.49	60.71	1.00	5.12			2.03		
Reach 1	1637	2YR	33.37	55.93	56.57	2.97	10.70			11.02		
Reach 1	1615	2YR	33.37	54.90	56.03	1.03	5.01	0.44		2.00	0.09	
Reach 1	1580	2YR	33.37	50.70	51.63	2.49	8.57			7.35		
Reach 1	1541	2YR	33.37	49.38	50.47	0.97	4.84		1.59	1.82		0.57
Reach 1	1534	2YR	33.37	49.13	50.51	0.42	2.45		0.65	0.42		0.10
Reach 1	1513	2YR	33.37	48.64	49.82	1.02	5.00	0.12		1.97		
Reach 1	1491	2YR	33.37	46.60	47.52	1.81	8.00			5.43		
Reach 1	1470	2YR	33.37	44.91	45.68	1.30	5.82	1.38	1.31	2.83	0.54	0.50
Reach 1	1440	2YR	33.37	43.27	44.51	1.01	5.12			2.03		
Reach 1	1420	2YR	33.37	41.55	41.99	2.50	8.02			6.67		
Reach 1	1389	2YR	33.37	38.86	39.55	0.99	4.04	1.42	0.21	1.44	0.50	
Reach 1	1361	2YR	33.37	37.00	38.07	0.61	3.21	0.60	1.02	0.77	0.10	0.23
Reach 1	1341	2YR	33.37	36.12	37.34	1.01	5.14			2.05		
Reach 1	1321	2YR	33.37	34.49	35.15	2.00	7.83			5.58		
Reach 1	1301	2YR	33.37	33.02	34.11	1.10	5.12	1.09	0.65	2.13	0.35	0.16
Reach 1	1272	2YR	33.37	31.96	32.97	0.89	4.43	1.11	0.78	1.53	0.32	0.19
Reach 1	1245	2YR	33.37	29.96	30.97	1.47	6.84			3.83		
Reach 1	1228	2YR	33.37	28.09	28.67	2.00	7.02	0.80		4.81		
Reach 1	1215	2YR	33.37	26.87	27.53	1.21	4.90			2.14		
Reach 1	1187	2YR	33.37	24.68	25.28	1.39	5.23		0.40	2.55		
Reach 1	1168	2YR	33.37	22.59	23.74	1.18	5.79			2.65		
Reach 1	1148	2YR	33.37	20.23	21.02	2.20	8.27			6.39		
Reach 1	1122	2YR	33.37	19.03	20.19	0.90	4.47	1.10	1.09	1.55	0.31	0.31
Reach 1	1100	2YR	33.37	17.11	18.01	1.88	8.15			5.69		
Reach 1	1073	2YR	33.37	14.11	15.13	1.42	6.62			3.59		
Reach 1	1053	2YR	33.37	11.86	12.71	1.73	7.63			4.93		
Reach 1	1014	2YR	33.37	7.96	8.90	1.33	5.65			2.76		
Reach 1	987	2YR	33.37	7.59	8.41	0.73	3.38	1.19	1.65	0.93	0.32	0.52
Reach 1	963	2YR	33.37	7.50	7.79	0.56	1.71	1.44	1.44	0.45	0.44	0.44
Reach 1	913	2YR	37.92	6.50	6.75	0.54	1.52	1.26	1.30	0.38	0.36	0.37
Reach 1	877	2YR	37.92	5.50	5.72	0.63	1.68	1.20	1.25	0.48	0.44	0.47
Reach 1	834	2YR	37.92	4.50	4.88	0.28	0.98	0.76	0.83	0.14	0.12	0.13
Reach 1	768	2YR	37.92	3.50	3.69	0.99	2.36		2.16	1.02		1.12
Reach 1	694	2YR	37.92	1.41	2.24	0.23	1.15	0.45	0.49	0.05	0.03	0.04
Reach 1	564	2YR	37.92	-3.91	2.25	0.00	0.05	0.00	0.01	0.00	0.00	0.00
Reach 1	443	2YR	37.92	-4.33	2.25	0.00	0.04	0.00	0.00	0.00	0.00	0.00
Reach 1	354	2YR	37.92	-4.30	2.25	0.00	0.04	0.00	0.00	0.00	0.00	0.00

10 YR PR												
Reach	River Sta	Profile	10 YR PR Q Total	10 YR PR Min Ch El	10 YR PR W.S. Elev	10 YR PR Froude # Chl	10 YR PR Vel Chnl	10 YR PR Vel Left	10 YR PR Vel Right	10 YR PR Shear Chan	10 YR PR Shear LOB	10 YR PR Shear ROB
			(cfs)	(ft)	(ft)		(ft/s)	(ft/s)	(ft/s)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
Reach 1	1972	10YR	72.09	99.74	101.07	1.44	7.61	1.55	1.68	4.33	0.66	0.74
Reach 1	1945	10YR	72.09	97.15	97.91	1.97	7.52	3.77	2.21	5.21	3.07	1.37
Reach 1	1885	10YR	72.09	86.35	87.46	1.87	8.08			5.57		
Reach 1	1835	10YR	72.09	80.55	81.71	1.49	7.11			4.04		
Reach 1	1781	10YR	72.09	70.12	71.22	2.82	12.27			12.82		
Reach 1	1743	10YR	72.09	64.89	65.95	1.52	7.54	2.50	2.46	4.41	1.40	1.36
Reach 1	1716	10YR	72.09	60.89	62.14	1.92	9.35			6.94		
Reach 1	1684	10YR	72.09	60.13	61.76	0.96	5.44	0.92	1.21	2.11	0.24	0.37
Reach 1	1663	10YR	72.09	59.49	61.34	0.75	4.82	1.26	1.39	1.53	0.34	0.39
Reach 1	1637	10YR	72.09	55.93	56.80	3.38	14.05	0.91		17.29		
Reach 1	1615	10YR	72.09	54.90	56.39	1.05	6.19	2.03	1.70	2.67	0.83	0.64
Reach 1	1580	10YR	72.09	50.70	51.90	2.54	10.03			9.19		
Reach 1	1541	10YR	72.09	49.38	50.95	1.00	6.22		2.37	2.61		1.02
Reach 1	1534	10YR	72.09	49.13	50.89	0.57	3.78		1.23	0.92		0.28
Reach 1	1513	10YR	72.09	48.64	50.37	0.88	5.09	1.74		1.83	0.61	
Reach 1	1491	10YR	72.09	46.60	47.94	1.86	9.67			7.15		
Reach 1	1470	10YR	72.09	44.91	45.94	1.51	8.02	2.21	2.56	4.78	1.15	1.43
Reach 1	1440	10YR	72.09	43.27	44.94	0.83	4.82	1.88		1.65	0.67	
Reach 1	1420	10YR	72.09	41.55	42.19	2.61	10.24			9.51		
Reach 1	1389	10YR	72.09	38.86	39.80	1.13	5.62	2.38	1.25	2.43	1.11	0.42
Reach 1	1361	10YR	72.09	37.00	38.66	0.57	3.90	1.20	1.38	0.96	0.27	0.33
Reach 1	1341	10YR	72.09	36.12	37.94	1.00	5.91	0.27	0.14	2.45	0.04	
Reach 1	1321	10YR	72.09	34.49	35.47	2.02	9.74			7.54		
Reach 1	1301	10YR	72.09	33.02	34.50	1.05	6.16	1.66	1.63	2.65	0.61	0.60
Reach 1	1272	10YR	72.09	31.96	33.17	1.15	6.42	2.26	1.50	2.96	1.02	0.55
Reach 1	1245	10YR	72.09	29.96	31.72	1.07	6.43			2.89		
Reach 1	1228	10YR	72.09	28.09	28.82	2.71	10.79	2.58		10.44	2.02	
Reach 1	1215	10YR	72.09	26.87	27.82	1.35	6.61		1.09	3.42		0.38
Reach 1	1187	10YR	72.09	24.68	25.56	1.44	6.83	0.74	1.67	3.73	0.22	0.75
Reach 1	1168	10YR	72.09	22.59	24.26	1.14	7.07	1.50	1.08	3.40	0.55	0.34
Reach 1	1148	10YR	72.09	20.23	21.29	2.33	10.79	1.65	1.90	9.47	0.94	1.16
Reach 1	1122	10YR	72.09	19.03	20.61	0.91	5.61	1.74	2.18	2.12	0.61	0.85
Reach 1	1100	10YR	72.09	17.11	18.49	1.69	9.16			6.25		
Reach 1	1073	10YR	72.09	14.11	15.50	1.66	8.97			5.99		
Reach 1	1053	10YR	72.09	11.86	13.11	1.75	9.15	1.58	1.27	6.34	0.76	0.54
Reach 1	1014	10YR	72.09	7.96	9.19	1.50	7.71	2.03	1.26	4.51	1.01	0.49
Reach 1	987	10YR	72.09	7.59	8.59	0.98	5.11	1.91	2.70	1.95	0.74	1.25
Reach 1	963	10YR	72.09	7.50	7.98	0.56	2.19	1.84	1.82	0.62	0.61	0.59
Reach 1	913	10YR	88.39	6.50	6.88	0.66	2.31	1.89	1.96	0.75	0.70	0.74
Reach 1	877	10YR	88.39	5.50	5.91	0.59	2.14	1.49	1.59	0.63	0.56	0.62
Reach 1	834	10YR	88.39	4.50	5.12	0.31	1.39	1.04	1.16	0.23	0.19	0.22
Reach 1	768	10YR	88.39	3.50	3.81	1.15	3.52	1.06	3.14	1.90	0.39	2.02
Reach 1	694	10YR	88.39	1.41	2.21	0.59	2.86	1.10	1.21	0.31	0.21	0.24
Reach 1	564	10YR	88.39	-3.91	2.25	0.01	0.13	0.00	0.01	0.00	0.00	0.00
Reach 1	443	10YR	88.39	-4.33	2.25	0.01	0.10	0.01	0.01	0.00	0.00	0.00
Reach 1	354	10YR	88.39	-4.30	2.25	0.01	0.08	0.01	0.01	0.00	0.00	0.00

100 YR PR												
Reach	River Sta	Profile	100 YR PR Q Total	100 YR PR Min Ch El	100 YR PR W.S. Elev	100 YR PR Froude # Chl	100 YR PR Vel Chnl	100 YR PR Vel Left	100 YR PR Vel Right	100 YR PR Shear Chan	100 YR PR Shear LOB	100 YR PR Shear ROB
			(cfs)	(ft)	(ft)		(ft/s)	(ft/s)	(ft/s)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
Reach 1	1972	100YR	141.12	99.74	101.44	1.53	9.69	3.34	2.76	6.22	2.09	1.57
Reach 1	1945	100YR	141.12	97.15	98.12	2.14	9.87	4.82	3.38	7.91	4.47	2.63
Reach 1	1885	100YR	141.12	86.35	87.78	1.95	9.87			7.47		
Reach 1	1835	100YR	141.12	80.55	82.10	1.58	8.67			5.47		
Reach 1	1781	100YR	141.12	70.12	71.58	2.72	14.33	3.39		15.42	2.94	
Reach 1	1743	100YR	141.12	64.89	66.26	1.73	10.15	3.66	3.70	7.13	2.56	2.60
Reach 1	1715	100YR	141.12	60.89	62.60	1.90	10.75	0.52		8.33		
Reach 1	1684	100YR	141.12	60.13	62.35	0.83	5.92	1.67	1.91	2.14	0.53	0.65
Reach 1	1663	100YR	141.12	59.49	61.50	1.12	7.66	2.19	2.57	3.74	0.95	1.20
Reach 1	1637	100YR	141.12	55.93	57.28	2.33	13.17	4.15	3.71	12.38	3.63	3.07
Reach 1	1615	100YR	141.12	54.90	56.75	1.14	7.81	2.81	2.69	3.87	1.38	1.30
Reach 1	1580	100YR	141.12	50.70	52.21	2.38	10.78			9.68		
Reach 1	1541	100YR	141.12	49.38	51.66	0.95	7.29		2.81	3.16		1.25
Reach 1	1534	100YR	141.12	49.13	50.62	1.53	9.27		2.66	5.88		1.50
Reach 1	1513	100YR	141.12	48.64	50.81	0.87	5.98	2.43	1.39	2.24	0.96	0.42
Reach 1	1491	100YR	141.12	46.60	48.44	1.68	10.77	3.34	2.51	7.69	2.20	1.43
Reach 1	1470	100YR	141.12	44.91	46.17	1.83	10.92	3.99	3.45	8.18	2.99	2.41
Reach 1	1440	100YR	141.12	43.27	45.22	0.96	6.22	2.82	1.28	2.55	1.29	0.39
Reach 1	1420	100YR	141.12	41.55	42.60	2.08	10.31			8.27		
Reach 1	1389	100YR	141.12	38.86	40.09	1.33	7.75	3.47	2.23	4.17	2.07	1.07
Reach 1	1361	100YR	141.12	37.00	38.65	1.13	7.65	2.34	2.71	3.69	1.04	1.29
Reach 1	1341	100YR	141.12	36.12	38.59	0.76	5.64	1.82	1.73	1.91	0.58	0.54
Reach 1	1321	100YR	141.12	34.49	35.89	1.99	11.70	2.25		9.57	1.33	
Reach 1	1301	100YR	141.12	33.02	34.75	1.31	8.50	3.04	2.57	4.71	1.67	1.29
Reach 1	1272	100YR	141.12	31.96	33.54	1.07	7.04	3.03	2.29	3.20	1.49	0.98
Reach 1	1245	100YR	141.12	29.96	31.99	0.86	5.51	2.27	2.22	2.02	0.89	0.85
Reach 1	1228	100YR	141.12	28.09	29.20	2.20	11.51	3.74	2.62	9.92	3.04	1.78
Reach 1	1215	100YR	141.12	26.87	28.14	1.53	8.97	1.69	2.29	5.60	0.76	1.20
Reach 1	1187	100YR	141.12	24.68	25.92	1.49	8.71	2.13	2.84	5.28	1.06	1.63
Reach 1	1168	100YR	141.12	22.59	24.83	1.15	8.66	2.46	2.52	4.47	1.12	1.17
Reach 1	1148	100YR	141.12	20.23	21.68	2.22	12.94	3.50	3.66	11.69	2.73	2.91
Reach 1	1122	100YR	141.12	19.03	20.93	1.14	7.90	2.75	3.29	3.88	1.32	1.73
Reach 1	1100	100YR	141.12	17.11	19.20	1.41	9.18	1.39	1.66	5.55	0.54	0.71
Reach 1	1073	100YR	141.12	14.11	15.95	1.85	11.17		0.76	8.65		0.25
Reach 1	1053	100YR	141.12	11.86	13.43	1.88	11.53	4.02	3.50	9.06	3.08	2.50
Reach 1	1014	100YR	141.12	7.96	9.57	1.57	9.75	3.73	2.65	6.36	2.49	1.50
Reach 1	987	100YR	141.12	7.59	8.88	1.11	6.72	2.64	3.77	3.07	1.25	2.13
Reach 1	963	100YR	141.12	7.50	8.24	0.56	2.74	2.29	2.25	0.84	0.81	0.79
Reach 1	913	100YR	181.90	6.50	7.03	0.81	3.34	2.71	2.84	1.41	1.29	1.38
Reach 1	877	100YR	181.90	5.50	6.21	0.52	2.51	1.68	1.86	0.72	0.60	0.70
Reach 1	834	100YR	181.90	4.50	5.35	0.40	2.08	1.53	1.74	0.47	0.37	0.45
Reach 1	768	100YR	181.90	3.50	4.23	0.64	3.08	1.46	2.66	1.09	0.44	1.10
Reach 1	694	100YR	181.90	1.41	2.20	1.25	6.02	2.31	2.53	1.40	0.94	1.08
Reach 1	564	100YR	181.90	-3.91	2.25	0.02	0.26	0.01	0.03	0.00	0.00	0.00
Reach 1	443	100YR	181.90	-4.33	2.25	0.02	0.20	0.01	0.02	0.00	0.00	0.00
Reach 1	354	100YR	181.90	-4.30	2.25	0.01	0.17	0.02	0.02	0.00	0.00	0.00

EXISTING VS. PROPOSED WATER SURFACE ELEVATION (FT)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	100.64	100.74	0.10	100.96	101.07	0.11	101.31	101.44	0.13
1945	97.70	97.75	0.05	97.86	97.91	0.05	98.04	98.12	0.08
1885	87.10	87.17	0.07	87.37	87.46	0.09	87.66	87.78	0.12
1835	81.31	81.39	0.08	81.60	81.71	0.11	81.95	82.10	0.15
1781	70.81	70.86	0.05	71.15	71.22	0.07	71.50	71.58	0.08
1743	65.61	65.69	0.08	65.83	65.95	0.12	66.11	66.26	0.15
1715	61.71	61.76	0.05	62.07	62.14	0.07	62.47	62.60	0.13
1684	61.32	61.52	0.20	61.75	61.76	0.01	62.19	62.35	0.16
1663	59.98	60.71	0.73	60.23	61.34	1.11	60.56	61.50	0.94
1637	56.09	56.57	0.48	56.45	56.80	0.35	56.85	57.28	0.43
1615	54.51	56.03	1.52	54.88	56.39	1.51	55.28	56.75	1.47
1580	50.83	51.63	0.80	51.05	51.90	0.85	51.31	52.21	0.90
1541	50.05	50.47	0.42	50.79	50.95	0.16	51.62	51.66	0.04
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	49.58	50.51	0.93	50.09	50.89	0.80	50.73	50.62	-0.11
1513	47.90	49.82	1.92	48.24	50.37	2.13	48.65	50.81	2.16
1491	47.00	47.52	0.52	47.45	47.94	0.49	47.93	48.44	0.51
1470	43.49	45.68	2.19	43.89	45.94	2.05	44.39	46.17	1.78
1440	42.37	44.51	2.14	42.87	44.94	2.07	43.38	45.22	1.84
1420	41.77	41.99	0.22	42.24	42.19	-0.05	42.71	42.60	-0.11
1389	37.75	39.55	1.80	38.17	39.80	1.63	38.70	40.09	1.39
1361	36.70	38.07	1.37	37.27	38.66	1.39	37.96	38.65	0.69
1341	35.33	37.34	2.01	35.80	37.94	2.14	36.37	38.59	2.22
1321	34.79	35.15	0.36	35.26	35.47	0.21	35.74	35.89	0.15
1301	34.39	34.11	-0.28	34.51	34.50	-0.01	34.69	34.75	0.06
1272	32.29	32.97	0.68	32.81	33.17	0.36	33.19	33.54	0.35
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	29.91	30.97	1.06	30.45	31.72	1.27	31.14	31.99	0.85
1228	26.91	28.67	1.76	27.34	28.82	1.48	27.90	29.20	1.30
1215	26.58	27.53	0.95	27.07	27.82	0.75	27.65	28.14	0.49
1187	24.99	25.28	0.29	25.37	25.56	0.19	25.78	25.92	0.14
1168	22.37	23.74	1.37	22.91	24.26	1.35	23.56	24.83	1.27
1148	20.56	21.02	0.46	20.97	21.29	0.32	21.48	21.68	0.20
1122	17.24	20.19	2.95	17.69	20.61	2.92	18.20	20.93	2.73
1100	17.27	18.01	0.74	17.95	18.49	0.54	18.37	19.20	0.83
1073	13.22	15.13	1.91	13.56	15.50	1.94	14.06	15.95	1.89
1053	11.22	12.71	1.49	11.47	13.11	1.64	11.77	13.43	1.66
1014	8.92	8.90	-0.02	9.26	9.19	-0.07	9.63	9.57	-0.06
987	8.32	8.41	0.09	8.50	8.59	0.09	8.71	8.88	0.17
963	7.05	7.79	0.74	7.23	7.98	0.75	7.42	8.24	0.82
913	5.45	6.75	1.30	5.65	6.88	1.23	5.89	7.03	1.14
877	4.84	5.72	0.88	5.10	5.91	0.81	5.44	6.21	0.77
834	4.19	4.88	0.69	4.43	5.12	0.69	4.65	5.35	0.70
768	2.71	3.69	0.98	3.08	3.81	0.73	3.66	4.23	0.57
694	2.24	2.24	0.00	2.21	2.21	0.00	2.20	2.20	0.00
564	2.25	2.25	0.00	2.25	2.25	0.00	2.25	2.25	0.00
443	2.25	2.25	0.00	2.25	2.25	0.00	2.25	2.25	0.00
354	2.25	2.25	0.00	2.25	2.25	0.00	2.25	2.25	0.00

EXISTING VS. PROPOSED CHANNEL VELOCITY (FT/S)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	6.85	5.77	-1.08	8.74	7.61	-1.13	11.24	9.69	-1.55
1945	6.53	5.36	-1.17	8.57	7.52	-1.05	11.32	9.87	-1.45
1885	8.12	6.76	-1.36	9.48	8.08	-1.40	11.52	9.87	-1.65
1835	6.58	5.58	-1.00	8.40	7.11	-1.29	10.30	8.67	-1.63
1781	12.52	11.29	-1.23	13.88	12.27	-1.61	15.81	14.33	-1.48
1743	6.44	5.41	-1.03	9.07	7.54	-1.53	12.16	10.15	-2.01
1715	8.86	8.10	-0.76	10.42	9.35	-1.07	12.35	10.75	-1.60
1684	4.54	3.35	-1.19	5.49	5.44	-0.05	7.00	5.92	-1.08
1663	8.13	5.12	-3.01	10.88	4.82	-6.06	13.25	7.66	-5.59
1637	9.29	10.70	1.41	10.30	14.05	3.75	11.65	13.17	1.52
1615	6.20	5.01	-1.19	7.84	6.19	-1.65	9.69	7.81	-1.88
1580	7.58	8.57	0.99	8.89	10.03	1.14	10.99	10.78	-0.21
1541	4.32	4.84	0.52	5.17	6.22	1.05	6.33	7.29	0.96
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	4.92	2.45	-2.47	6.07	3.78	-2.29	7.47	9.27	1.80
1513	7.72	5.00	-2.72	9.53	5.09	-4.44	11.22	5.98	-5.24
1491	5.52	8.00	2.48	7.02	9.67	2.65	9.10	10.77	1.67
1470	11.96	5.82	-6.14	12.99	8.02	-4.97	14.49	10.92	-3.57
1440	5.74	5.12	-0.62	7.38	4.82	-2.56	9.68	6.22	-3.46
1420	5.29	8.02	2.73	6.69	10.24	3.55	8.52	10.31	1.79
1389	11.71	4.04	-7.67	12.63	5.62	-7.01	13.35	7.75	-5.60
1361	5.98	3.21	-2.77	7.49	3.90	-3.59	8.89	7.65	-1.24
1341	7.60	5.14	-2.46	9.13	5.91	-3.22	10.83	5.64	-5.19
1321	5.26	7.83	2.57	6.91	9.74	2.83	9.09	11.70	2.61
1301	4.18	5.12	0.94	7.07	6.16	-0.91	9.97	8.50	-1.47
1272	8.00	4.43	-3.57	8.05	6.42	-1.63	9.31	7.04	-2.27
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	5.01	6.84	1.83	6.06	6.43	0.37	7.06	5.51	-1.55
1228	11.74	7.02	-4.72	12.91	10.79	-2.12	13.99	11.51	-2.48
1215	6.88	4.90	-1.98	8.76	6.61	-2.15	10.60	8.97	-1.63
1187	6.63	5.23	-1.40	8.30	6.83	-1.47	10.31	8.71	-1.60
1168	9.66	5.79	-3.87	10.86	7.07	-3.79	12.21	8.66	-3.55
1148	8.14	8.27	0.13	10.59	10.79	0.20	12.93	12.94	0.01
1122	9.75	4.47	-5.28	11.59	5.61	-5.98	14.04	7.90	-6.14
1100	5.41	8.15	2.74	6.05	9.16	3.11	8.20	9.18	0.98
1073	12.89	6.62	-6.27	14.39	8.97	-5.42	14.71	11.17	-3.54
1053	7.08	7.63	0.55	9.77	9.15	-0.62	13.06	11.53	-1.53
1014	5.42	5.65	0.23	7.12	7.71	0.59	9.38	9.75	0.37
987	4.20	3.38	-0.82	6.20	5.11	-1.09	8.73	6.72	-2.01
963	6.30	1.71	-4.59	7.33	2.19	-5.14	8.66	2.74	-5.92
913	3.19	1.52	-1.67	4.67	2.31	-2.36	5.76	3.34	-2.42
877	1.72	1.68	-0.04	2.35	2.14	-0.21	3.14	2.51	-0.63
834	1.73	0.98	-0.75	2.80	1.39	-1.41	4.34	2.08	-2.26
768	0.66	2.36	1.70	2.66	3.52	0.86	3.08	3.08	0.00
694	1.15	1.15	0.00	2.86	2.86	0.00	6.02	6.02	0.00
564	0.05	0.05	0.00	0.13	0.13	0.00	0.26	0.26	0.00
443	0.04	0.04	0.00	0.10	0.10	0.00	0.20	0.20	0.00
354	0.04	0.04	0.00	0.08	0.08	0.00	0.17	0.17	0.00

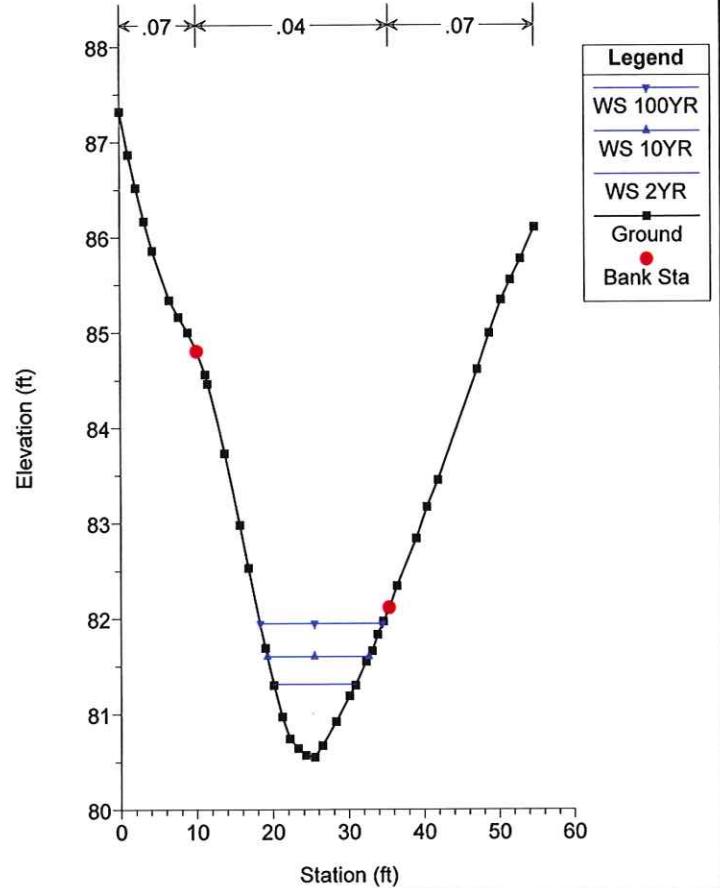
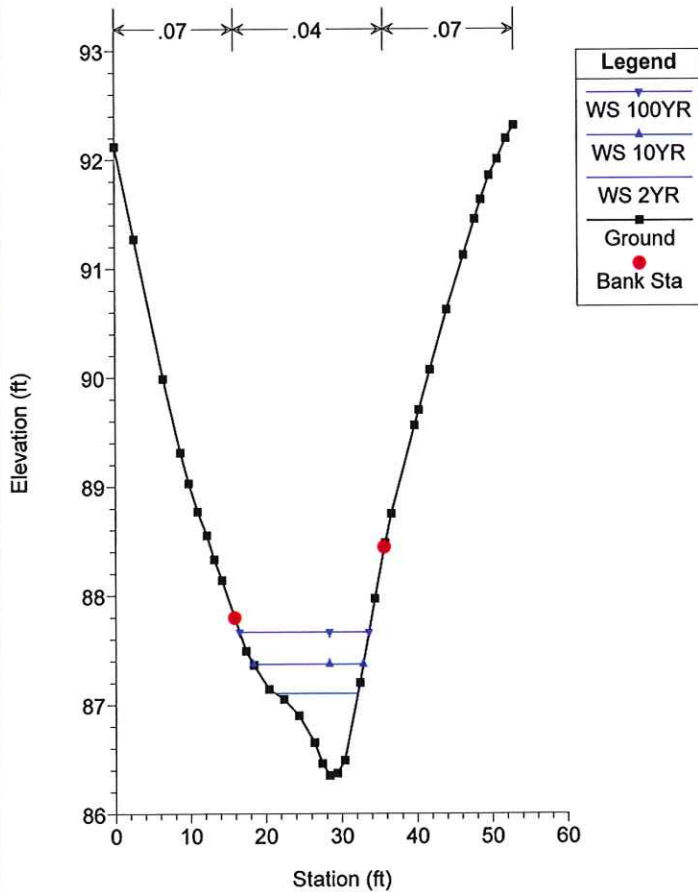
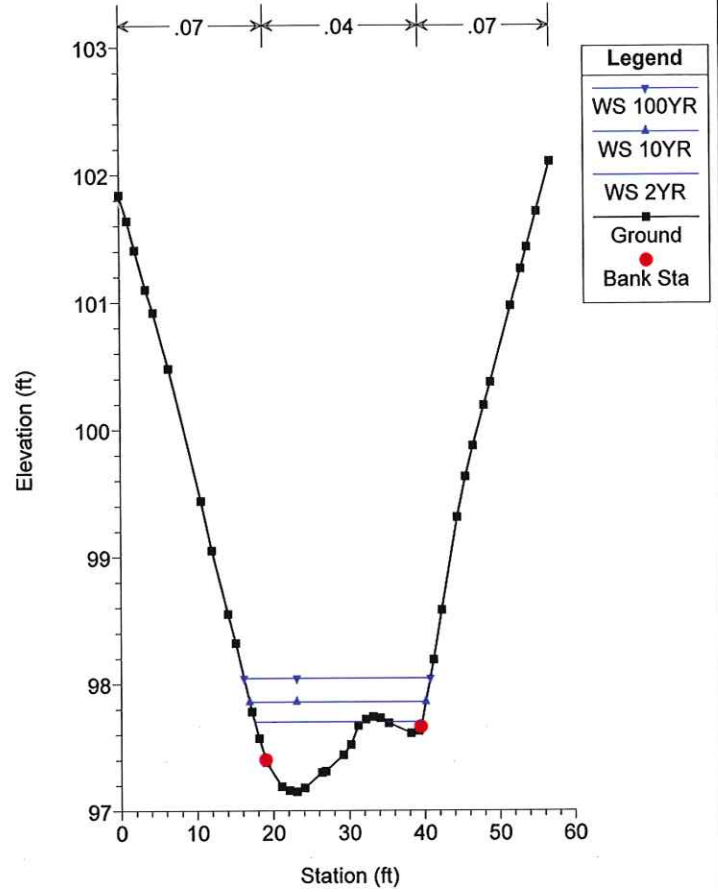
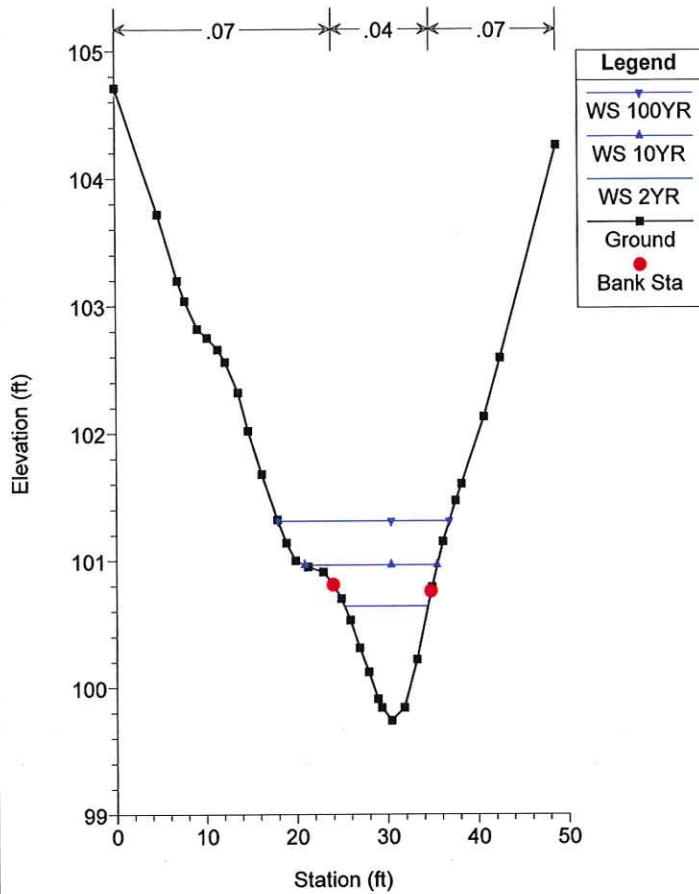
EXISTING VS. PROPOSED LEFT OVERBANK VELOCITY (FT/S)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	0.00	0.00	0.00	0.88	1.55	0.67	2.80	3.34	0.54
1945	2.45	2.77	0.32	3.47	3.77	0.30	4.46	4.82	0.36
1885	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1835	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1781	0.00	0.00	0.00	0.00	0.00	0.00	2.44	3.39	0.95
1743	1.16	1.43	0.27	2.28	2.50	0.22	3.41	3.66	0.25
1715	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.52
1684	0.00	0.25	0.25	0.74	0.92	0.18	1.48	1.67	0.19
1663	2.86	0.00	-2.86	3.87	1.26	-2.61	4.75	2.19	-2.56
1637	0.00	0.00	0.00	0.00	0.91	0.91	0.00	4.15	4.15
1615	0.00	0.44	0.44	0.00	2.03	2.03	0.89	2.81	1.92
1580	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1541	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1513	0.00	0.12	0.12	0.00	1.74	1.74	0.00	2.43	2.43
1491	0.00	0.00	0.00	0.50	0.00	-0.50	1.65	3.34	1.69
1470	0.00	1.38	1.38	0.00	2.21	2.21	0.00	3.99	3.99
1440	0.00	0.00	0.00	0.00	1.88	1.88	0.00	2.82	2.82
1420	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	-0.89
1389	0.00	1.42	1.42	0.00	2.38	2.38	0.00	3.47	3.47
1361	0.00	0.60	0.60	0.00	1.20	1.20	0.00	2.34	2.34
1341	0.00	0.00	0.00	0.00	0.27	0.27	0.00	1.82	1.82
1321	0.00	0.00	0.00	1.57	0.00	-1.57	2.02	2.25	0.23
1301	0.95	1.09	0.14	2.34	1.66	-0.68	4.19	3.04	-1.15
1272	1.60	1.11	-0.49	2.87	2.26	-0.61	3.82	3.03	-0.79
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.27	2.27
1228	0.00	0.80	0.80	0.00	2.58	2.58	0.00	3.74	3.74
1215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.69	1.69
1187	0.00	0.00	0.00	0.00	0.74	0.74	0.00	2.13	2.13
1168	0.00	0.00	0.00	0.00	1.50	1.50	0.00	2.46	2.46
1148	0.00	0.00	0.00	0.00	1.65	1.65	0.00	3.50	3.50
1122	0.00	1.10	1.10	0.00	1.74	1.74	0.00	2.75	2.75
1100	0.00	0.00	0.00	0.00	0.00	0.00	0.86	1.39	0.53
1073	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1053	3.94	0.00	-3.94	5.92	1.58	-4.34	7.96	4.02	-3.94
1014	0.00	0.00	0.00	1.68	2.03	0.35	2.96	3.73	0.77
987	1.20	1.19	-0.01	1.90	1.91	0.01	2.78	2.64	-0.14
963	1.48	1.44	-0.04	1.70	1.84	0.14	2.56	2.29	-0.27
913	0.00	1.26	1.26	0.00	1.89	1.89	0.42	2.71	2.29
877	0.00	1.20	1.20	0.62	1.49	0.87	1.04	1.68	0.64
834	0.40	0.76	0.36	0.85	1.04	0.19	1.42	1.53	0.11
768	0.00	0.00	0.00	0.00	1.06	1.06	0.00	1.46	1.46
694	0.45	0.45	0.00	1.10	1.10	0.00	2.31	2.31	0.00
564	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
443	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
354	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.02	0.00

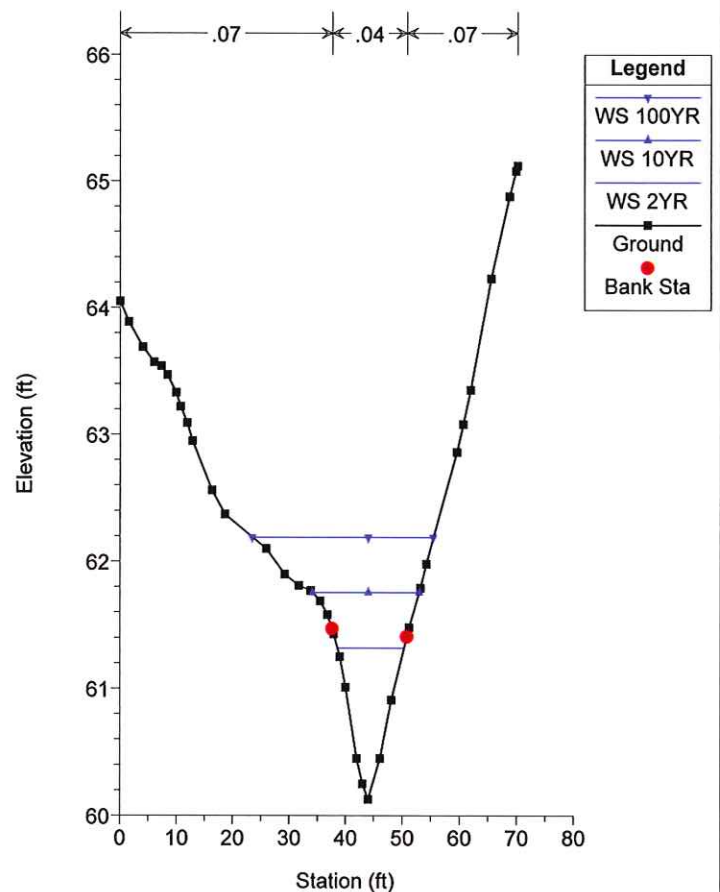
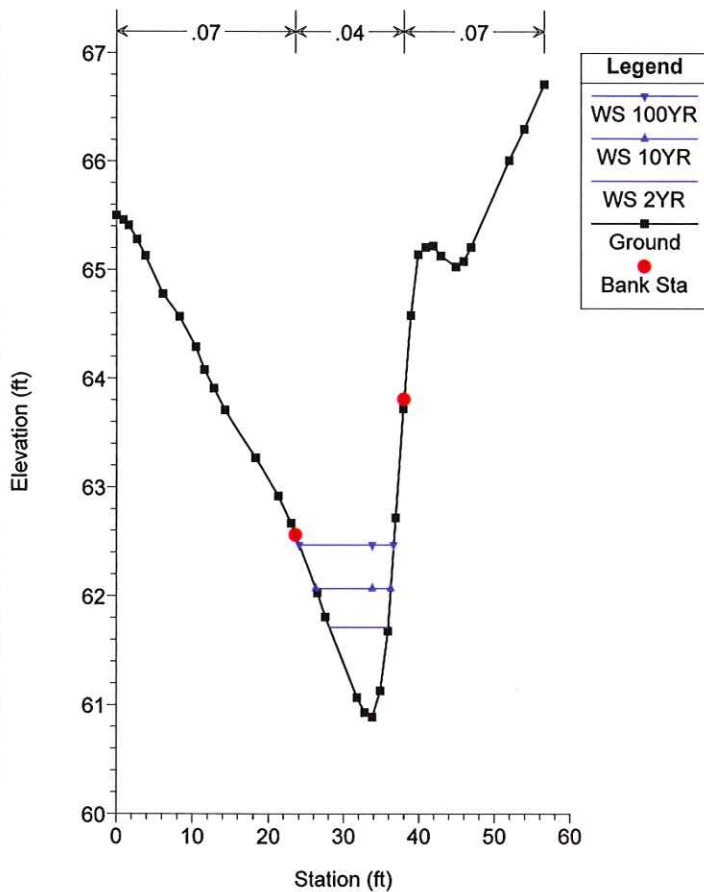
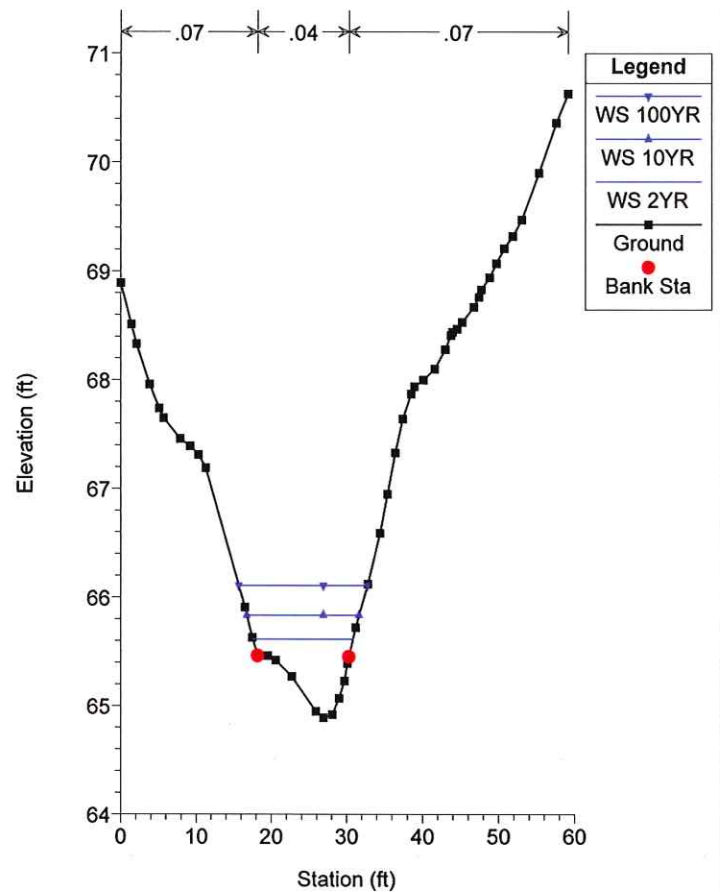
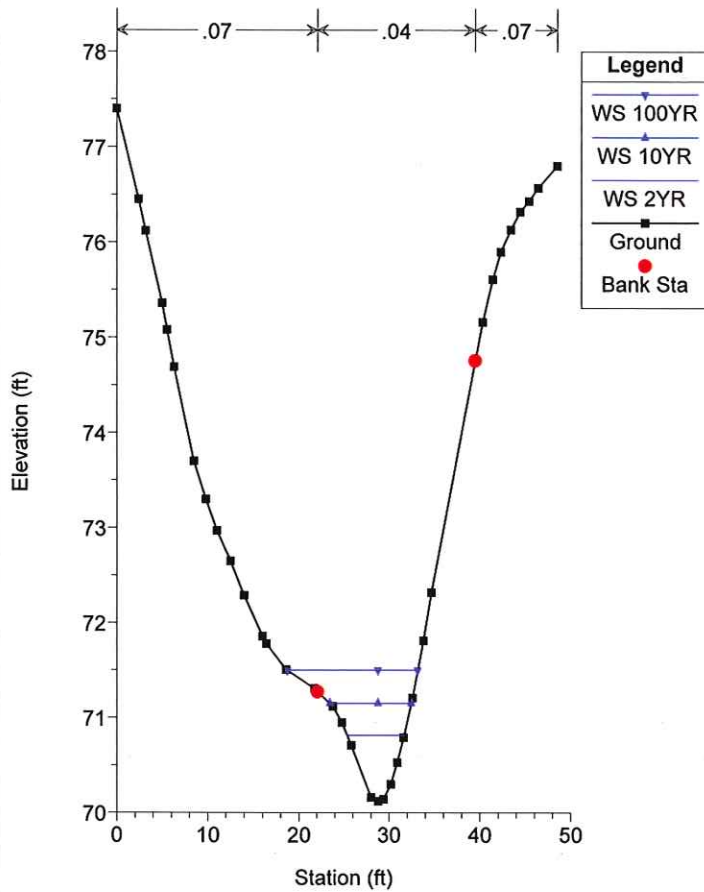
EXISTING VS. PROPOSED RIGHT OVERBANK VELOCITY (FT/S)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	0.00	0.00	0.00	1.29	1.68	0.39	2.41	2.76	0.35
1945	0.59	1.08	0.49	1.87	2.21	0.34	2.98	3.38	0.40
1885	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1835	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1781	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1743	1.20	1.49	0.29	2.20	2.46	0.26	3.34	3.70	0.36
1715	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1684	0.00	0.42	0.42	0.97	1.21	0.24	1.71	1.91	0.20
1663	2.72	0.00	-2.72	4.02	1.39	-2.63	5.20	2.57	-2.63
1637	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.71	3.71
1615	0.00	0.00	0.00	0.00	1.70	1.70	0.00	2.69	2.69
1580	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1541	0.87	1.59	0.72	1.56	2.37	0.81	2.77	2.81	0.04
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	0.38	0.65	0.27	1.80	1.23	-0.57	3.21	2.66	-0.55
1513	0.00	0.00	0.00	0.00	0.00	0.00	1.88	1.39	-0.49
1491	1.37	0.00	-1.37	2.27	0.00	-2.27	2.97	2.51	-0.46
1470	0.00	1.31	1.31	1.24	2.56	1.32	3.49	3.45	-0.04
1440	0.00	0.00	0.00	0.43	0.00	-0.43	2.42	1.28	-1.14
1420	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1389	0.00	0.21	0.21	0.00	1.25	1.25	0.00	2.23	2.23
1361	0.00	1.02	1.02	0.00	1.38	1.38	1.45	2.71	1.26
1341	0.00	0.00	0.00	0.00	0.14	0.14	2.42	1.73	-0.69
1321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1301	1.37	0.65	-0.72	2.55	1.63	-0.92	3.94	2.57	-1.37
1272	0.00	0.78	0.78	1.13	1.50	0.37	2.04	2.29	0.25
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	0.00	0.00	0.00	0.00	0.00	0.00	1.32	2.22	0.90
1228	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.62	2.62
1215	0.00	0.00	0.00	0.00	1.09	1.09	0.00	2.29	2.29
1187	0.00	0.40	0.40	0.00	1.67	1.67	1.75	2.84	1.09
1168	0.00	0.00	0.00	1.98	1.08	-0.90	4.08	2.52	-1.56
1148	0.00	0.00	0.00	0.00	1.90	1.90	2.97	3.66	0.69
1122	0.00	1.09	1.09	1.85	2.18	0.33	4.37	3.29	-1.08
1100	1.85	0.00	-1.85	2.62	0.00	-2.62	3.66	1.66	-2.00
1073	0.00	0.00	0.00	0.00	0.00	0.00	3.34	0.76	-2.58
1053	0.00	0.00	0.00	0.00	1.27	1.27	2.37	3.50	1.13
1014	0.00	0.00	0.00	1.07	1.26	0.19	2.13	2.65	0.52
987	1.64	1.65	0.01	2.66	2.70	0.04	3.94	3.77	-0.17
963	1.81	1.44	-0.37	2.51	1.82	-0.69	3.22	2.25	-0.97
913	2.22	1.30	-0.92	2.85	1.96	-0.89	3.37	2.84	-0.53
877	1.03	1.25	0.22	1.31	1.59	0.28	1.59	1.86	0.27
834	1.08	0.83	-0.25	1.48	1.16	-0.32	2.06	1.74	-0.32
768	3.12	2.16	-0.96	2.66	3.14	0.48	2.21	2.66	0.45
694	0.49	0.49	0.00	1.21	1.21	0.00	2.53	2.53	0.00
564	0.01	0.01	0.00	0.01	0.01	0.00	0.03	0.03	0.00
443	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.02	0.00
354	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.02	0.00

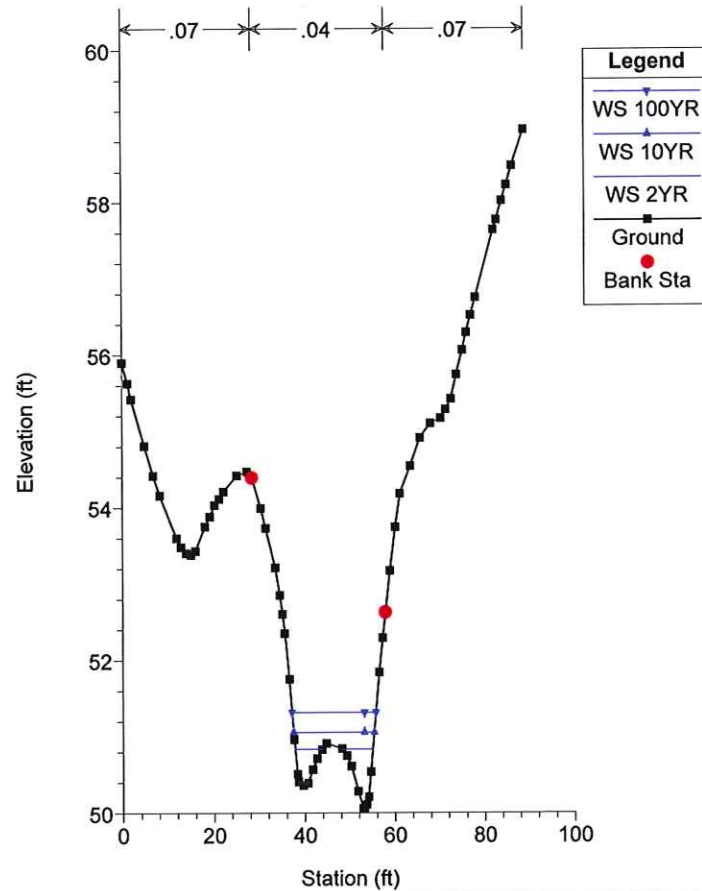
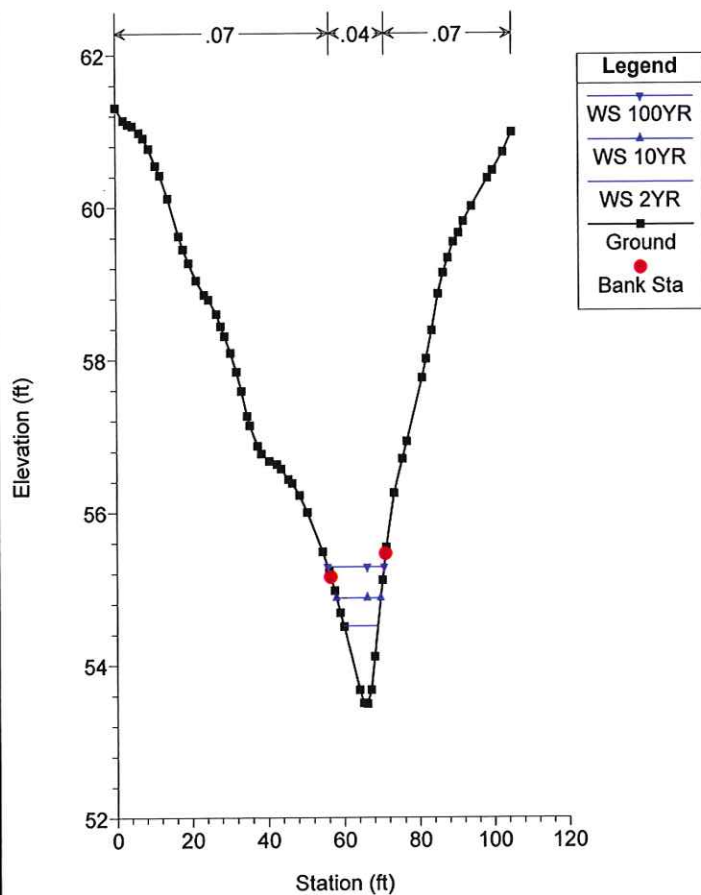
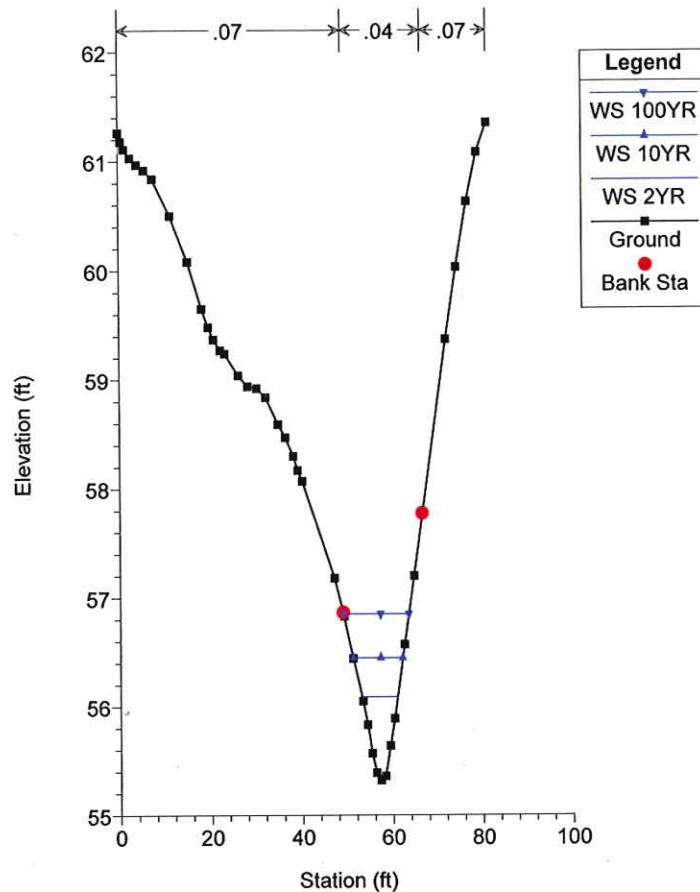
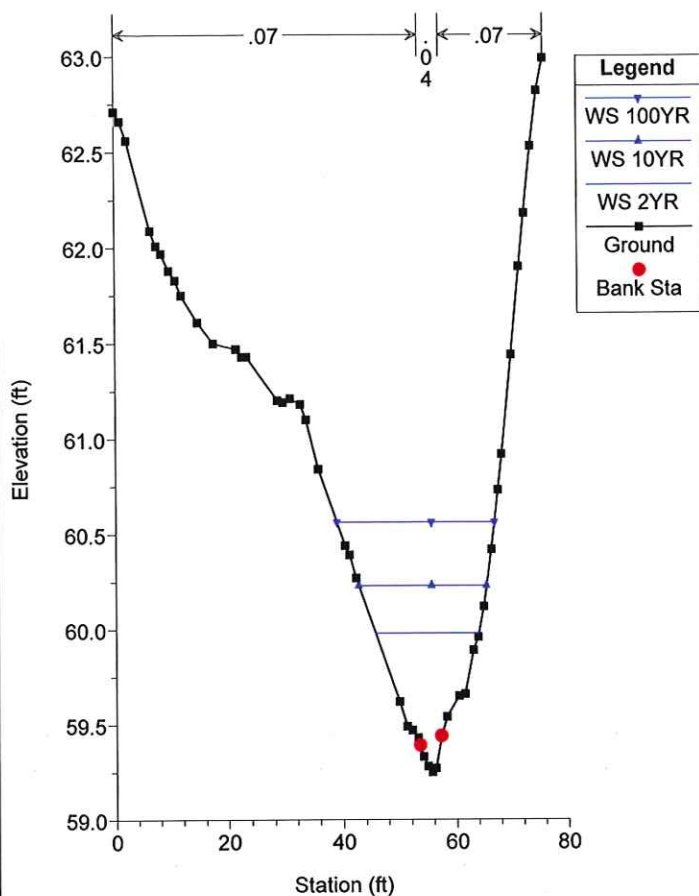
EXISTING VS. PROPOSED CHANNEL SHEAR (LB/SQ FT)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	2.65	2.86	0.21	3.81	4.33	0.52	5.56	6.22	0.66
1945	2.92	3.05	0.13	4.52	5.21	0.69	6.93	7.91	0.98
1885	4.14	4.38	0.24	5.07	5.57	0.50	6.74	7.47	0.73
1835	2.53	2.75	0.22	3.73	4.04	0.31	5.10	5.47	0.37
1781	9.54	11.87	2.33	10.58	12.82	2.24	12.31	15.42	3.11
1743	2.50	2.61	0.11	4.31	4.41	0.10	6.89	7.13	0.24
1715	4.57	5.87	1.30	5.63	6.94	1.31	7.23	8.33	1.10
1684	1.09	0.88	-0.21	1.38	2.11	0.73	1.99	2.14	0.15
1663	3.43	2.03	-1.40	5.52	1.53	-3.99	7.38	3.74	-3.64
1637	5.11	11.02	5.91	5.62	17.29	11.67	6.56	12.38	5.82
1615	2.09	2.00	-0.09	3.05	2.67	-0.38	4.25	3.87	-0.38
1580	3.74	7.35	3.61	4.70	9.19	4.49	6.26	9.68	3.42
1541	0.86	1.82	0.96	1.06	2.61	1.55	1.44	3.16	1.72
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	1.23	0.42	-0.81	1.61	0.92	-0.69	2.16	5.88	3.72
1513	3.42	1.97	-1.45	4.66	1.83	-2.83	5.86	2.24	-3.62
1491	1.53	5.43	3.90	2.22	7.15	4.93	3.28	7.69	4.41
1470	8.40	2.83	-5.57	8.66	4.78	-3.88	9.32	8.18	-1.14
1440	1.63	2.03	0.40	2.45	1.65	-0.80	3.83	2.55	-1.28
1420	1.41	6.67	5.26	2.06	9.51	7.45	3.12	8.27	5.15
1389	8.01	1.44	-6.57	8.19	2.43	-5.76	8.27	4.17	-4.10
1361	1.75	0.77	-0.98	2.49	0.96	-1.53	3.21	3.69	0.48
1341	3.04	2.05	-0.99	3.92	2.45	-1.47	4.95	1.91	-3.04
1321	1.37	5.58	4.21	2.13	7.54	5.41	3.40	9.57	6.17
1301	0.90	2.13	1.23	2.45	2.65	0.20	4.54	4.71	0.17
1272	3.42	1.53	-1.89	2.93	2.96	0.03	3.53	3.20	-0.33
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	1.26	3.83	2.57	1.63	2.89	1.26	1.98	2.02	0.04
1228	7.99	4.81	-3.18	8.38	10.44	2.06	8.76	9.92	1.16
1215	2.39	2.14	-0.25	3.52	3.42	-0.10	4.77	5.60	0.83
1187	2.39	2.55	0.16	3.41	3.73	0.32	4.81	5.28	0.47
1168	4.98	2.65	-2.33	5.52	3.40	-2.12	6.23	4.47	-1.76
1148	3.46	6.39	2.93	5.35	9.47	4.12	7.16	11.69	4.53
1122	5.14	1.55	-3.59	6.44	2.12	-4.32	8.50	3.88	-4.62
1100	1.38	5.69	4.31	1.59	6.25	4.66	2.77	5.55	2.78
1073	10.12	3.59	-6.53	11.07	5.99	-5.08	10.06	8.65	-1.41
1053	2.84	4.83	2.09	4.85	6.34	1.49	7.77	9.06	1.29
1014	1.61	2.76	1.15	2.40	4.51	2.11	3.72	6.36	2.64
987	0.99	0.93	-0.06	1.96	1.95	-0.01	3.57	3.07	-0.50
963	1.70	0.45	-1.25	2.09	0.62	-1.47	2.70	0.84	-1.86
913	0.62	0.38	-0.24	1.13	0.75	-0.38	1.52	1.41	-0.11
877	0.16	0.48	0.32	0.24	0.63	0.39	0.37	0.72	0.35</

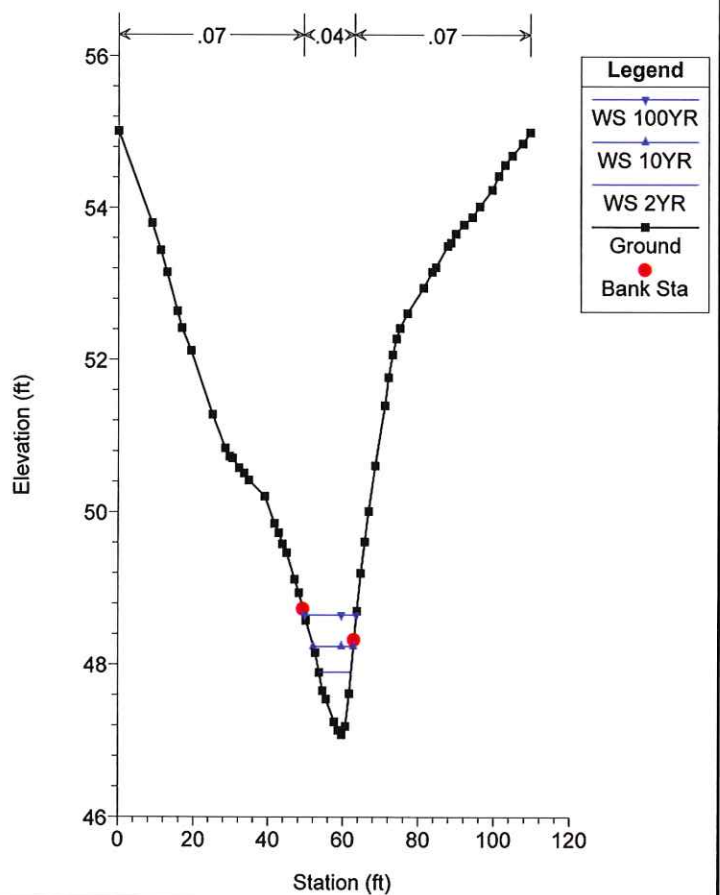
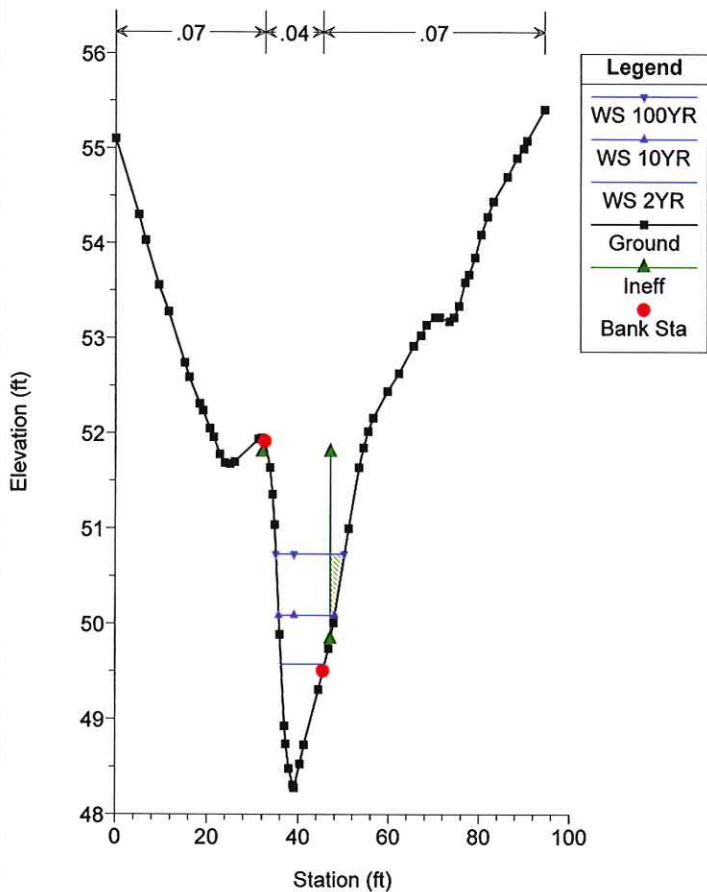
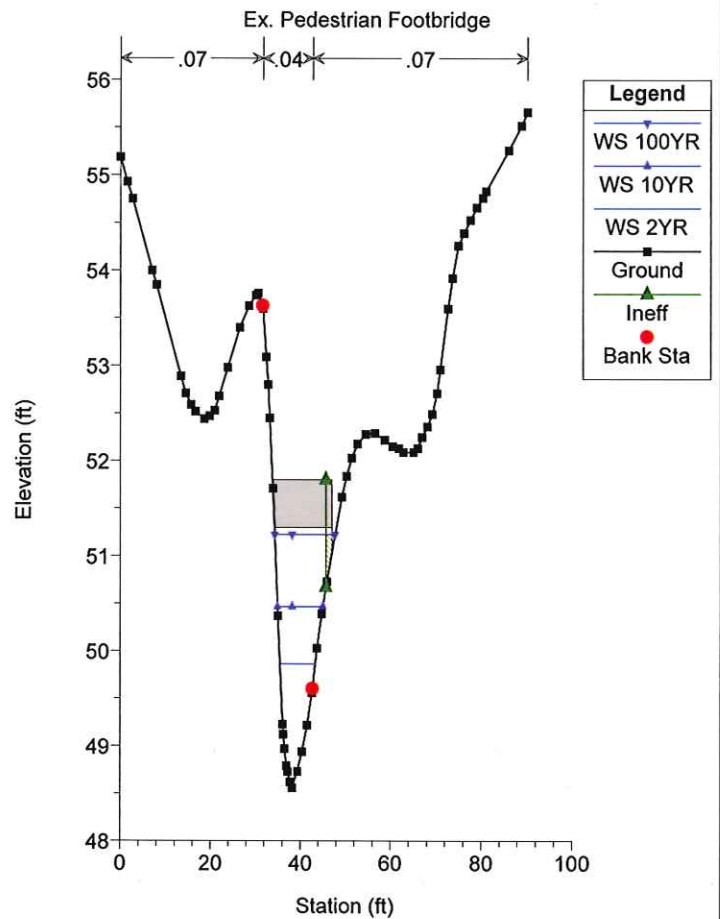
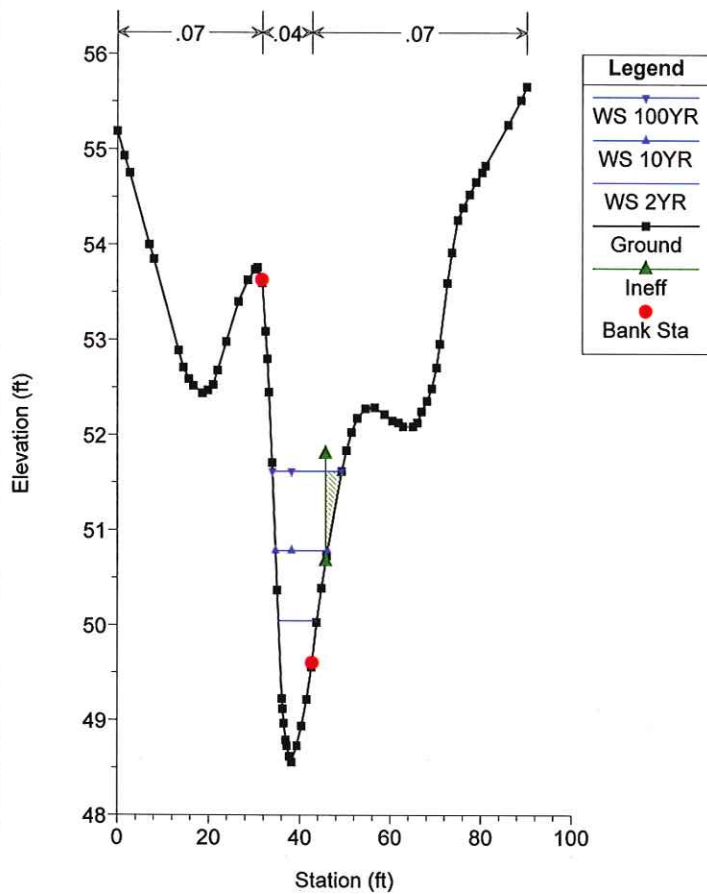
EXISTING VS. PROPOSED LEFT OVERBANK SHEAR (LB/SQ FT)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	0.00	0.00	0.00	0.28	0.66	0.38	1.60	2.09	0.49
1945	1.55	1.88	0.33	2.69	3.07	0.38	3.96	4.47	0.51
1885	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1835	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1781	0.00	0.00	0.00	0.00	0.00	0.00	1.73	2.94	1.21
1743	0.44	0.59	0.15	1.26	1.40	0.14	2.37	2.56	0.19
1715	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1684	0.00	0.03	0.03	0.16	0.24	0.08	0.45	0.53	0.08
1663	1.66	0.00	-1.66	2.71	0.34	-2.37	3.67	0.95	-2.72
1637	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.63	3.63
1615	0.00	0.09	0.09	0.00	0.83	0.83	0.28	1.38	1.10
1580	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1541	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1513	0.00	0.00	0.00	0.00	0.61	0.61	0.00	0.96	0.96
1491	0.00	0.00	0.00	0.10	0.00	-0.10	0.59	2.20	1.61
1470	0.00	0.54	0.54	0.00	1.15	1.15	0.00	2.99	2.99
1440	0.00	0.00	0.00	0.00	0.67	0.67	0.00	1.29	1.29
1420	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	-0.15
1389	0.00	0.50	0.50	0.00	1.11	1.11	0.00	2.07	2.07
1361	0.00	0.10	0.10	0.00	0.27	0.27	0.00	1.04	1.04
1341	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.58	0.58
1321	0.00	0.00	0.00	0.32	0.00	-0.32	0.50	1.33	0.83
1301	0.14	0.35	0.21	0.65	0.61	-0.04	1.73	1.67	-0.06
1272	0.43	0.32	-0.11	0.87	1.02	0.15	1.30	1.49	0.19
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.89
1228	0.00	0.00	0.00	0.00	2.02	2.02	0.00	3.04	3.04
1215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.76
1187	0.00	0.00	0.00	0.00	0.22	0.22	0.00	1.06	1.06
1168	0.00	0.00	0.00	0.00	0.55	0.55	0.00	1.12	1.12
1148	0.00	0.00	0.00	0.00	0.94	0.94	0.00	2.73	2.73
1122	0.00	0.31	0.31	0.00	0.61	0.61	0.00	1.32	1.32
1100	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.54	0.41
1073	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1053	1.65	0.00	-1.65	3.20	0.76	-2.44	5.17	3.08	-2.09
1014	0.00	0.00	0.00	0.64	1.01	0.37	1.52	2.49	0.97
987	0.35	0.32	-0.03	0.77	0.74	-0.03	1.48	1.25	-0.23
963	0.48	0.44	-0.04	0.66	0.61	-0.05	1.23	0.81	-0.42
913	0.00	0.36	0.36	0.00	0.70	0.70	0.08	1.29	1.21
877	0.00	0.44	0.44	0.09	0.56	0.47	0.20	0.60	0.40
834	0.05	0.12	0.07	0.16	0.19	0.03	0.38	0.37	-0.01
768	0.00	0.00	0.00	0.00	0.39	0.39	0.00	0.44	0.44
694	0.03	0.03	0.00	0.21	0.21	0.00	0.94	0.94	0.00
564	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
443	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
354	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

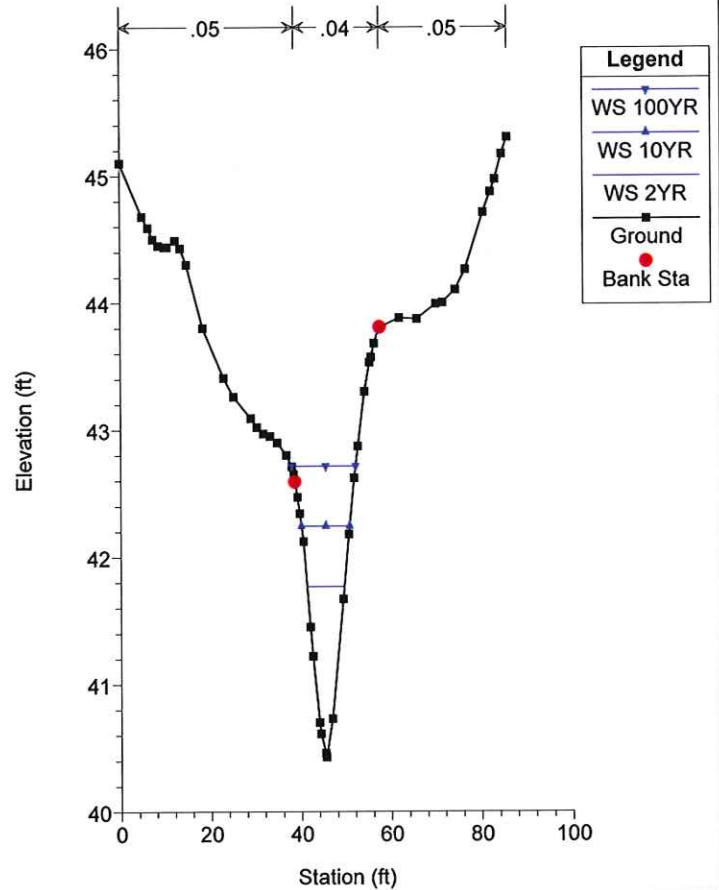
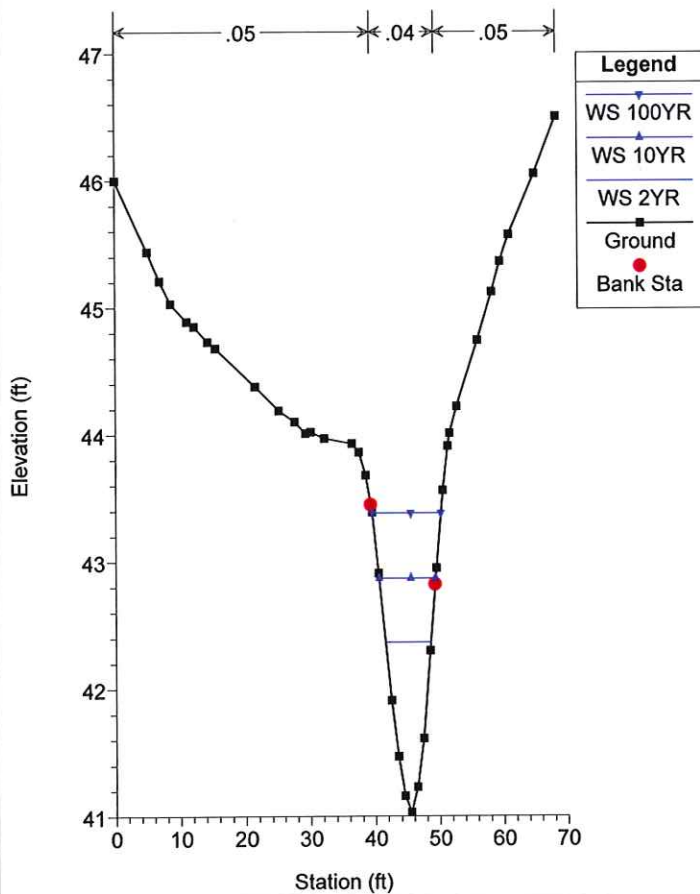
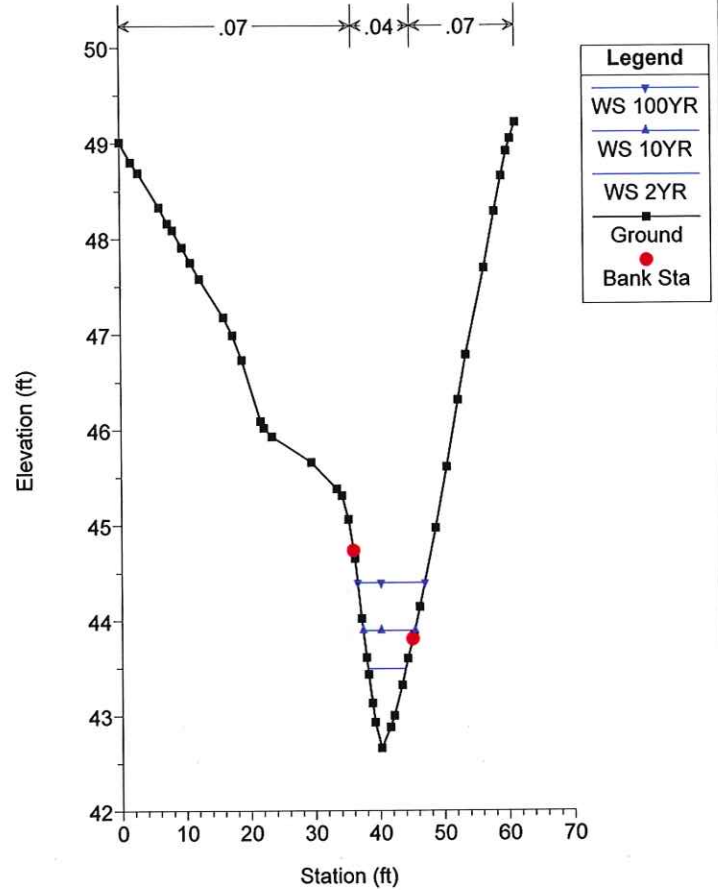
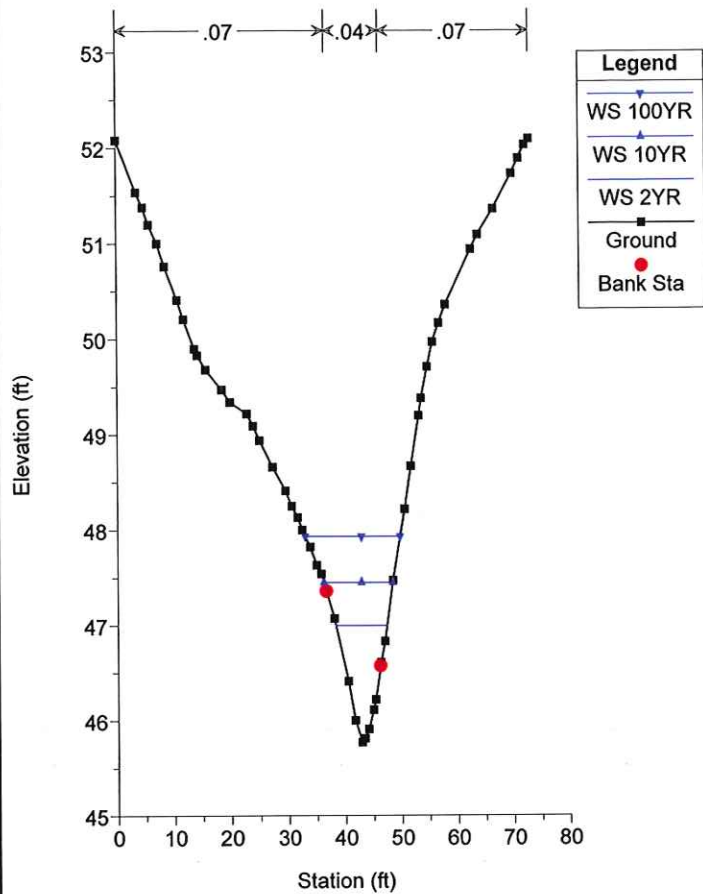
EXISTING VS. PROPOSED RIGHT OVERBANK SHEAR (LB/SQ FT)									
XS ID	2 YR			10 YR			100 YR		
	EX	PR	DIFF	EX	PR	DIFF	EX	PR	DIFF
1972	0.00	0.00	0.00	0.50	0.74	0.24	1.28	1.57	0.29
1945	0.00	0.46	0.46	1.06	1.37	0.31	2.17	2.63	0.46
1885	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1835	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1781	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1743	0.47	0.62	0.15	1.19	1.36	0.17	2.30	2.60	0.30
1715	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1684	0.00	0.06	0.06	0.24	0.37	0.13	0.56	0.65	0.09
1663	1.54	0.00	-1.54	2.87	0.39	-2.48	4.20	1.20	-3.00
1637	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.07	3.07
1615	0.00	0.00	0.00	0.00	0.64	0.64	0.00	1.30	1.30
1580	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1541	0.18	0.57	0.39	0.41	1.02	0.61	0.96	1.25	0.29
1538.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1534	0.06	0.10	0.04	0.60	0.28	-0.32	1.41	1.50	0.09
1513	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.42	-0.51
1491	0.44	0.00	-0.44	0.95	0.00	-0.95	1.42	1.43	0.01
1470	0.00	0.50	0.50	0.59	1.43	0.84	2.55	2.41	-0.14
1440	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.39	-0.28
1420	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1389	0.00	0.00	0.00	0.00	0.42	0.42	0.00	1.07	1.07
1361	0.00	0.23	0.23	0.00	0.33	0.33	0.29	1.29	1.00
1341	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.54	-0.19
1321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1301	0.24	0.16	-0.08	0.74	0.60	-0.14	1.57	1.29	-0.28
1272	0.00	0.19	0.19	0.22	0.55	0.33	0.51	0.98	0.47
1260.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1245	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.85	0.62
1228	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.78	1.78
1215	0.00	0.00	0.00	0.00	0.38	0.38	0.00	1.20	1.20
1187	0.00	0.00	0.00	0.00	0.75	0.75	0.47	1.63	1.16
1168	0.00	0.00	0.00	0.60	0.34	-0.26	1.68	1.17	-0.51
1148	0.00	0.00	0.00	0.00	1.16	1.16	1.10	2.91	1.81
1122	0.00	0.31	0.31	0.58	0.85	0.27	2.06	1.73	-0.33
1100	0.39	0.00	-0.39	0.63	0.00	-0.63	1.15	0.71	-0.44
1073	0.00	0.00	0.00	0.00	0.00	0.00	1.52	0.25	-1.27
1053	0.00	0.00	0.00	0.00	0.54	0.54	0.84	2.50	1.66
1014	0.00	0.00	0.00	0.32	0.49	0.17	0.93	1.50	0.57
987	0.56	0.52	-0.04	1.28	1.25	-0.03	2.51	2.13	-0.38
963	0.74	0.44	-0.30	1.19	0.59	-0.60	1.73	0.79	-0.94
913	1.01	0.37	-0.64	1.40	0.74	-0.66	1.79	1.38	-0.41
877	0.20	0.47	0.27	0.26	0.62	0.36	0.37	0.70	0.33
834	0.21	0.13	-0.08	0.32	0.22	-0.10	0.66	0.45	-0.21
768	1.12	1.12	0.00	1.13	2.02	0.89	0.70	1.10	0.40
694	0.04	0.04	0.00	0.24	0.24	0.00	1.08	1.08	0.00
564	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
443	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
354	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

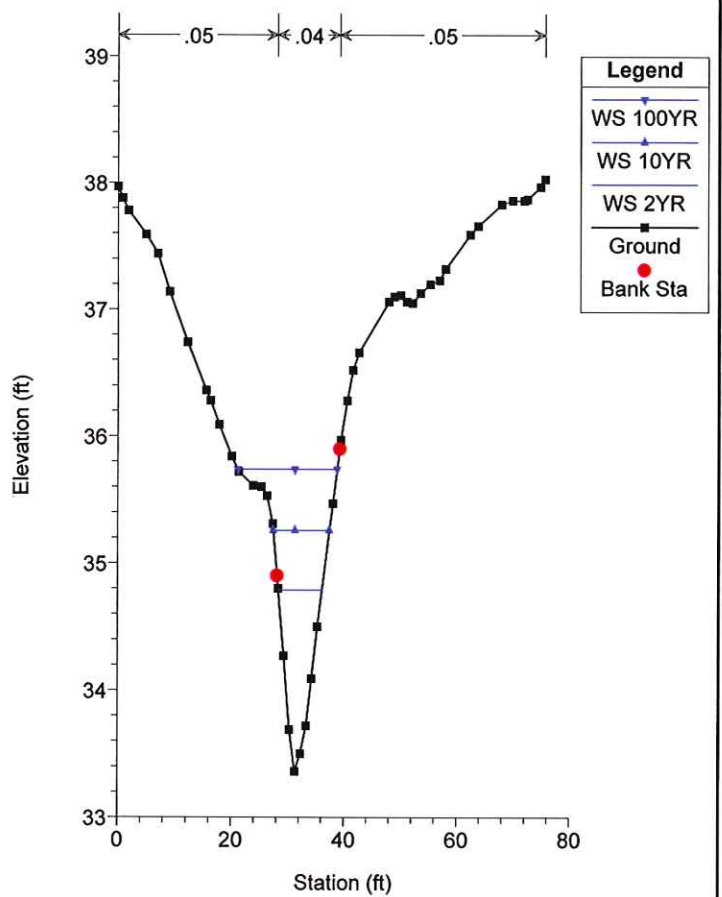
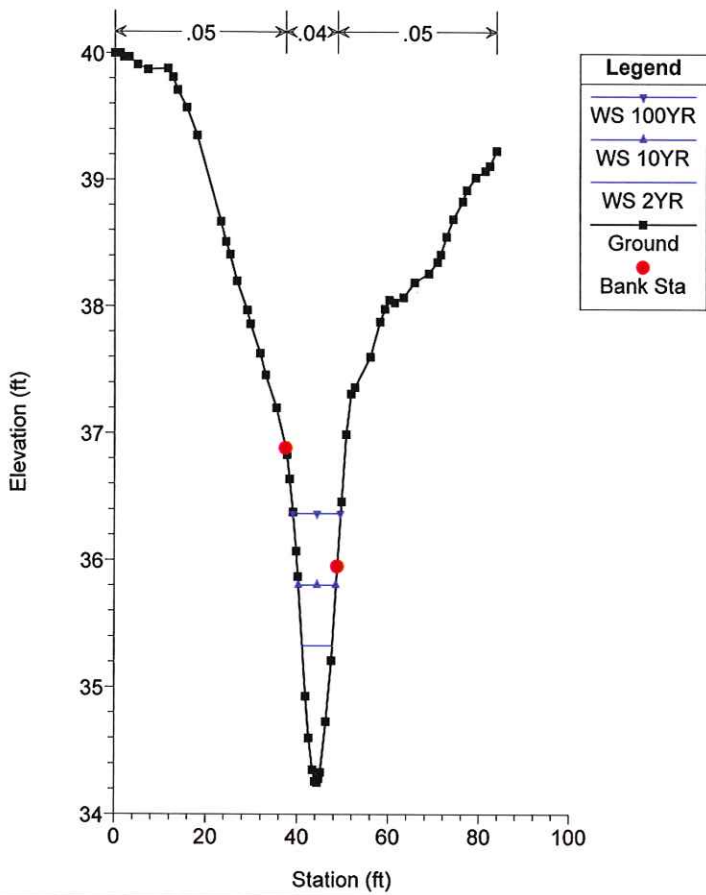
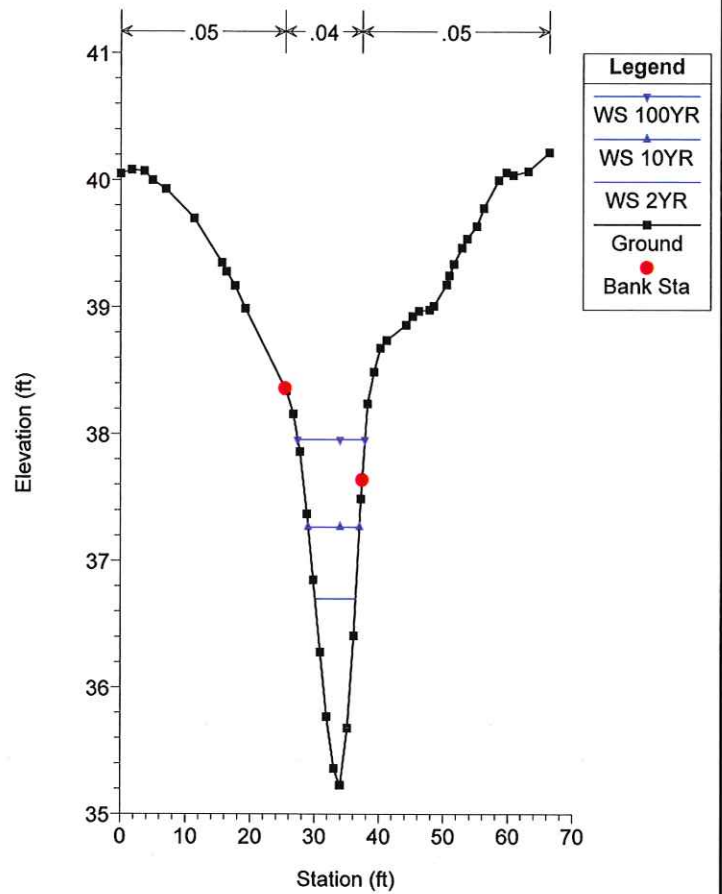
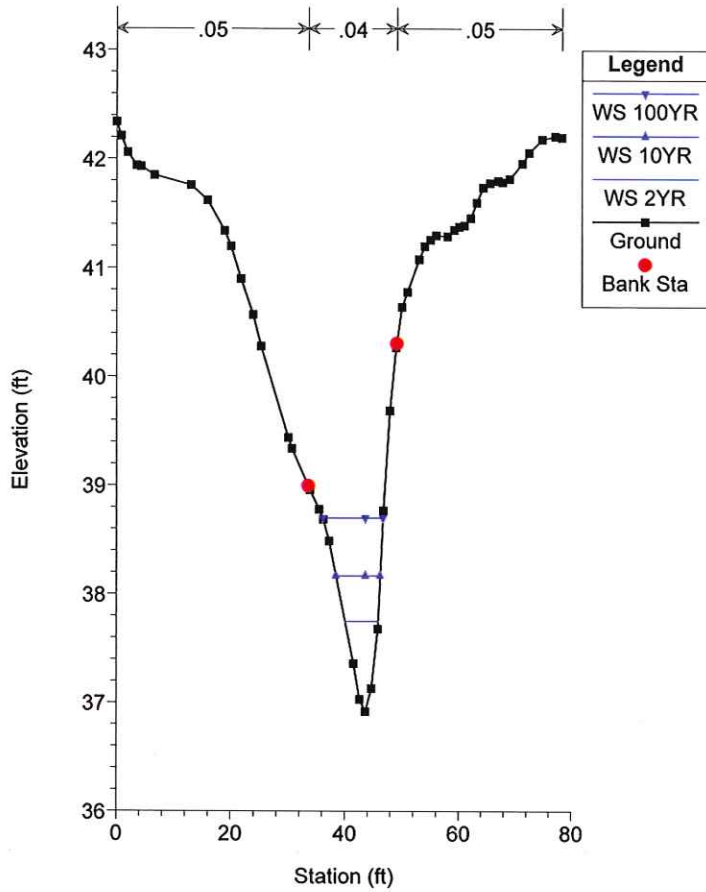


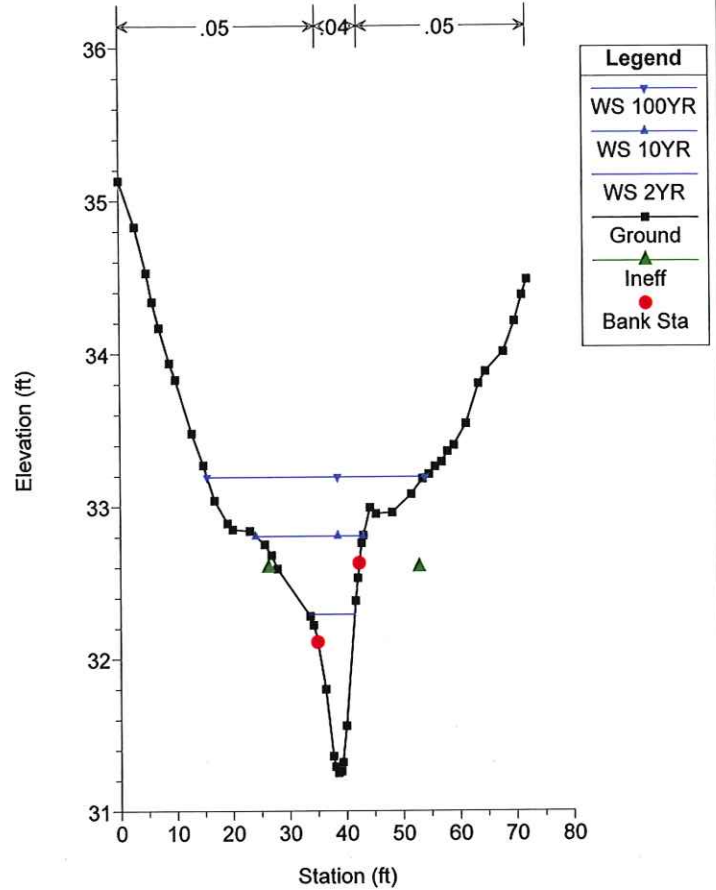
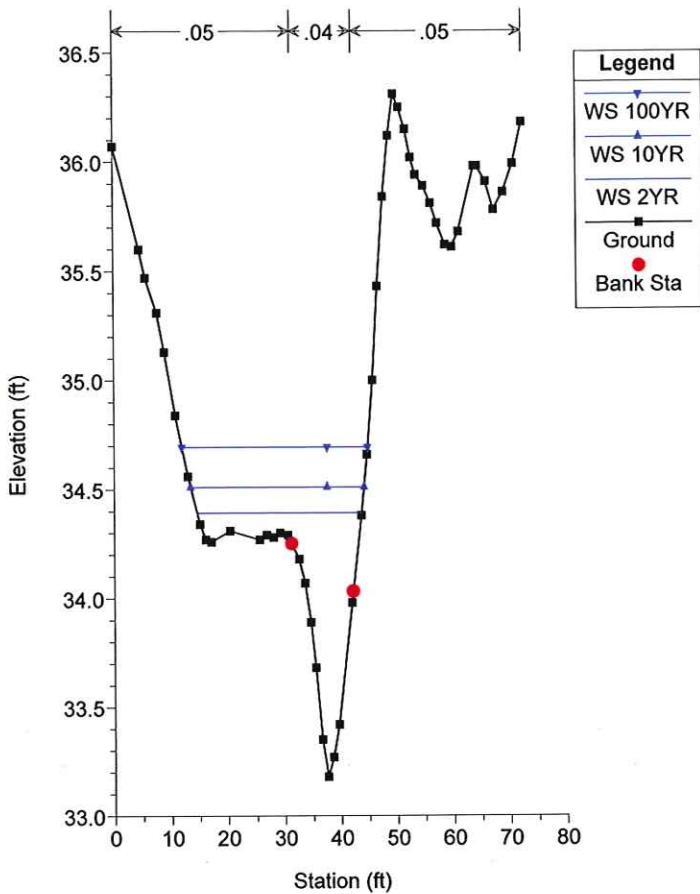












Ex. 24" RCP and Timber Mat Footbridge

