

Kracht Wetland

Engineering Design Report

Iowa Department of Agriculture and Land
Stewardship
June 10, 2026



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& MENK**

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Submitted by:

Bolton & Menk, Inc.
1519 Baltimore Drive
Ames, IA 50010-8783
P: (515) 233-6100

Certification

Design Report

For

Kracht Water Quality Wetland
CLA953734C

Iowa Department of Agriculture and Land Stewardship
Clay County, Iowa
25X.140338.000

June 10, 2026

 The seal is circular with a dashed outer border. Inside, the text "LICENSED PROFESSIONAL ENGINEER" is written in a circle. In the center, it says "BRANDON C. SHORT" and "29449". At the bottom, it says "IOWA" flanked by two stars.	I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. (Signature) _____ (Date) <u>6/10/2026</u> Printed or typed name: Brandon C. Short, PE My renewal date is: December 31, 2026 License Number is: 29449 Pages or sheets covered by this seal: Full Document
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Real People. Real Solutions.

1519 Baltimore Drive
Ames, IA 50010-8783

Ph: (515) 233-6100
Fax: (515) 233-4430
Bolton-Menk.com

June 10, 2026

Kracht Wetland Design Report
Site No. CLA953734C
Clay County, Iowa

Project Overview

This constructed wetland is planned to provide nutrient reduction benefits to the watershed of Drainage District #103 in Clay County, Iowa. Nitrates will be converted to nitrogen gas through natural processes as the water passes through the wetland. Sediment with phosphorus will also be captured but will need to be removed from time to time.

The project location is on the property of Duane and Erneta Kracht near Rossie, Iowa. An embankment will be built over the existing stream, and the existing tile main of Drainage District #103 will be re-laid at a flatter slope to daylight into the pool. Surface runoff and the re-laid tile main will feed the wetland. Diversion berms are proposed within the permanent pool to encourage mixing and reduce short-cutting of water out of the wetland. Tile flows and storm flows will be released through the primary spillway which is a 49-foot-wide full-flow open sheet pile drop structure. The 25-foot-wide earthen spillway will act as an auxiliary outlet during larger storm events.

Site Selection & Analysis

This site was deemed viable because of the size of its watershed (990 acres) and its topography. The slopes are gentle enough to allow the impounding of a large wetland pool without an excessively large berm or a deep pool. Initial payment information was presented to the landowner, who wished to proceed with the project.

Bolton & Menk reviewed the soil survey data for the location and found the soils to be primarily silty clay loam and loam. After this review, it was determined that soil borings were unnecessary unless deep excavation work was determined to be needed. The wetland watersheds were analyzed using LiDAR data, with land uses delineated and existing ponds and culverts accounted for. A map of the contributing watersheds is included with this report. Curve number calculations and runoff analysis are provided in the attached hydrology report.

The site was surveyed with survey-grade GPS equipment, and additional topographic information was provided from a publicly available LiDAR database. LiDAR was verified with survey data. Elevations are referenced to NAVD88, and the Iowa State Plane North (Survey Foot) coordinate system was used for horizontal coordinates. Survey data was collected electronically and is available in .csv files.

Design Standards

Iowa NRCS Conservation Practice Standard (CPS) 656 Constructed Wetland, dated December 2023, was used to develop this project. CPS 378 (Pond) was used to design the primary and auxiliary spillways and the embankment. The project is NRCS Job Class IV under CPS 656 because the watershed is between 300 and 1000 acres.

Project Layout

A permanent pool elevation and embankment location were selected based on the ability to maximize pool area while minimizing the deep (greater than three feet) pool area and embankment height. The watershed information and rainfall data were used to develop hydrographs in HydroCAD. The storm distribution used was MSE 4, with rainfall depths from the National Engineering Handbook. These hydrographs and the proposed stage-storage information were used to size primary and auxiliary spillways for the wetland. Exceeding the minimum design standards of NRCS CPS 378, the auxiliary spillway is placed above the 25-year storm, and the spillways and embankment are designed to provide at least one foot of freeboard during the 100-year storm. HydroCAD outputs are provided in the appendix.

Existing Tiles

One known tile, the Drainage District #103 main, is planned to be re-laid into the wetland pool. A new tile will be installed and will tie into the new district main, to ensure proper drainage of the site. Profiles are provided in the plans for these tiles. There may be unknown tiles on the site that will be found during construction. If applicable, these tiles will be re-laid into the wetland pool and will be sized and placed such that they will not inhibit the pre-existing drainage conditions of the neighboring properties. Pipe sizing calculations are provided in the appendix.

Dam Regulation

A dam construction permit is required by the Iowa DNR if it (1) has a height of at least 25 feet and a storage of 15-acre feet at the top of the dam elevation; or (2) has a storage of at least 50 acre-feet at the top of dam and a height of at least 6 feet; or (3) is assigned a hazard potential of high hazard. This dam does not require a dam construction permit because the height is 14.5 feet, the storage at top of dam is 39.42 acre-feet, and the hazard potential is low hazard.

The dam is classified as “low hazard” if failure of the dam would result in no probable loss of human life, low economic losses, and low public damages. This dam meets the requirements of a low hazard dam.

Land Rights & Permits

The permanent easement for this project will be on the Kracht property. IDALS-DSWQ is currently in the process of updating the abstracts and will have a signed easement recorded for the area as shown in the plans. No additional land rights are needed.

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Date: June 10, 2026

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The project will be permitted under USACE Regional Permit 39. The permit will be obtained by the Iowa Department of Agriculture and Land Stewardship (IDALS). A floodplain permit application will also be obtained by IDALS if necessary.

Sincerely,

Bolton & Menk, Inc.

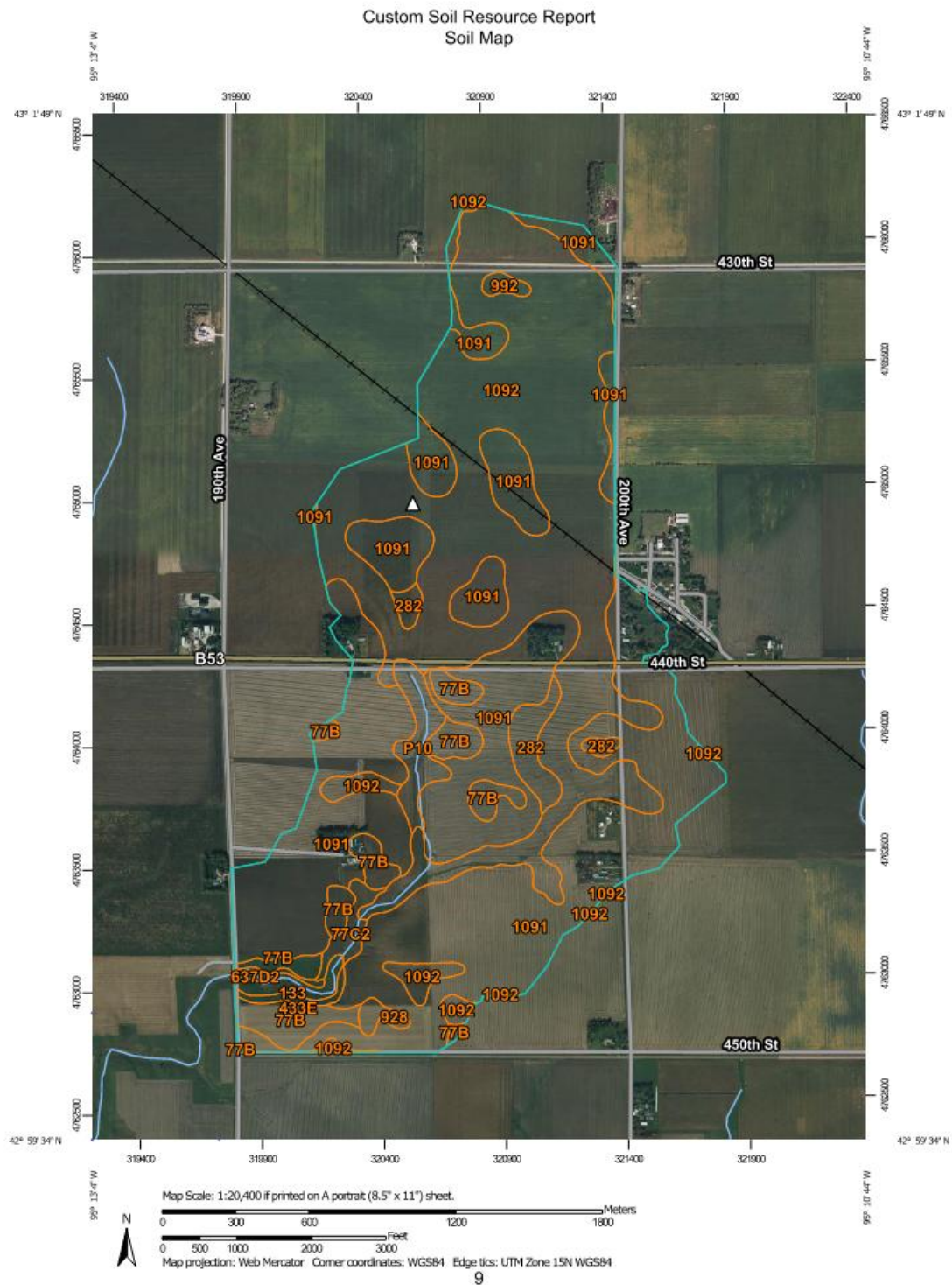
Brandon C. Short, PE

Water Resources Project Engineer

Appendices:

- A. Soil Survey Map
- B. Watershed Map
- C. Hydrology Report
- D. HydroCAD Output
- E. Stilling Basin Calculations
- F. Sheet Pile Weir Calculations
- G. Pipe Capacity Calculations

Appendix A: Soil Survey Map



Appendix B: Watershed Map



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Appendix C: Hydrology Report



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Report Summary

Design Parameters and Procedures:

Design hydrology and hydraulic study of this site was completed. The drainage area was determined and a stage-area-storage curve was developed based on the topographic survey, LIDAR data available from the Iowa Department of Natural Resources, and grading design for the wetland. Land use and treatment were determined through a site visit and aerial photo review. Hydrologic data was compiled, sediment calculations were made, the structure was flood routed using the SCS TR-55 method in HydroCAD, and all the output was reviewed.

Rainfall events used for this site were MSE 4 distribution, 24-hour, 5-, 10-, 25-, and 100-year events. The primary spillway is a 49-foot-wide sheet pile open drop structure. The auxiliary spillway is a 35-foot earthen spillway placed above the 25-year rainfall event high water level.

Hydrology Analysis Summary

25-year Event: 5.60"

100-year Event: 7.80"

- * Hydrologic Soil Groups: B, C, C/D
- * Runoff Curve Number: 85.0 (based on land use shown in this report)
- * Primary Spillway Weir Coefficient = 3.1
- * T_c = 4.4 hours determined by the sum of sheet, shallow concentrated and channel flow times.
- * Normal Pool area is 5.36 ac; surface watershed area is approx. 990.3 ac or 1.55 square miles

Summary Table:						
Overflow Elevation: 1362.50 (Data for Surface Flow)						
	$Q_{\max}$ In (cfs)	$Q_{\max}$ Out (cfs)	Max Elev. (ft)	Duration - Hours at Elevation		
				1361.00	1362.00	1363.00
5-year	371.20	363.68	1361.74	5.4	0.0	0.0
10-year	480.30	471.38	1362.06	6.8	0.8	0.0
25-year	672.04	656.99	1362.64	8.4	2.6	0.0
100-year	1029.99	1015.94	1363.49	10.7	5.1	1.9

Rainfall Data

Surface-Drained DA = 990 ac
 = 1.55 sq mi

The following rainfall data was used for the hydrologic analysis of the site. Rainfall depths from the NEH Title 210 Figure IA2-25 were used, and two additional sources are shown for reference only.

County: Clay
 Storm Distribution: MSE 4
 Iowa Climactic Section (SUDAS): Northwest

24-hr Rainfall Depths (in)			
Return Period (Years)	Data Source		
	NEH Title 210 (Figure IA2-25)	SUDAS Design Manual 2025 Edition	NOAA Atlas 14
2	2.90	2.92	2.95
5	3.70	3.67	3.73
10	4.40	4.39	4.48
25	5.60	5.50	5.67
50	6.60	6.46	6.70
100	7.80	7.50	7.85
Used			



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IDALS ID Number: CLA953734C

Job: Kracht

BMI Project Number: 25X.140338

Designed By: BCS Date: 12/18/2025

Tributary Watershed Data

Watershed	Area (ac)	Area (sq. mi.)	Tile/Surface Drained	Time of Concentration (min)
Direct	556	0.87	Tile & Surface	157.1
Northwest	308	0.48	Tile & Surface	425.4
Northeast	127	0.20	Tile & Surface	339.3

Surface Total =	990 ac.	1.55 sq. mi.
Tile Main Total =	990 ac.	1.55 sq. mi.

Average TC =	264 Min.
Average TC =	4.40 Hrs.

Runoff Curve Number

Surface-Drained DA = 990 ac
= 1.55 sq mi

Soil Name ¹	HSG ¹	Cover Type and Hyd. Condition	Portion of W/S percent	CN ²	Product
Moneta loam	B	Straight Row Crops, Good	0.4%	78	0.312
Sac silty clay loam, et al.	C	Straight Row Crops, Good	6.7%	85	5.695
McCreath and Gillett Grove silty clay loam, et al.	C/D	Straight Row Crops, Good	92.9%	85	78.965
			Total	100.0%	85.0

References

¹ USDA - NRCS Soil Survey of Clay County, Iowa.

² USDA - NRCS Technical Release 55, Chapter 2, June 1986.

Sediment Calculations

Surface-Drained DA = 990 ac

= 1.55 sq mi

DA ¹	990	acres	1.547	sqmi
Trap efficiency, very short storage time ²			73	percent
Average annual sheet and rill erosion ³			0.9	tons/ac/yr
Area of depressions not subject to sediment delivery			0	acres
Area subject to sheet and rill erosion			990	acres
Average annual sheet and rill erosion			869	tons
Delivery ratio ⁵			3.5	percent
Sheet and rill erosion delivered to site			30.4	tons/yr
Adjustment for LRA 103 ²			0.5	factor
Adjusted sheet and rill erosion delivered			15.2	tons/yr
Average annual gully erosion rate ⁴			0.2	cuft/ft
Length of gully erosion			1,700	ft
In place density of gully material			80	lb/cuft
Average annual gully erosion (100% delivered)			13.6	t/yr
Total sediment delivered			28.8	t/yr
Weight of sediment retained in resevoir at	73.0	percent trapped ²	21	t/yr
Sediment accumulation during	150	-year period	3,200	tons
Estimate	80	percent of delivered sediment will not be submerged ²	2,560	tons
Volume of submerged sediment at	1,307	t/acft ²	1.96	acft
Normal pool volume	11.6	acft, will not be full		
Estimate	20	percent of delivered sediment will be aerated ²	640	tons
Volume of aerated sediment at	1,742	t/acft ²	0.37	acft

References

¹ Determined by Engineer

² USDA-NRCS, Engr. Field Man., Chap. 11, Amend. IA 27, Fig.2, May 1986,. Adjusted. See notes.

³ Estimated by preparer.

⁴ Estimated by preparer.

⁵ Delivery curve for Des Moines lobe.

Source: Iowa Geological Survey

Stage-Storage

Surface-Drained DA = 990 ac

= 1.55 sq mi

Contour Elev. (Ft)	Area (Sq ft)	Area (Acres)	Average Area (Arces)	Incremental Volume (Ac-ft)	Cumulative Volume (Ac-ft)	Volume Above Weir (Ac-ft)
1355.00	1399	0.03	0.03	0.00	0.00	
1356.00	27566	0.63	0.33	0.33	0.33	
1357.00	47270	1.09	0.86	0.86	1.19	
1358.00	92763	2.13	1.61	1.61	2.80	
1359.00	222287	5.10	3.62	3.62	6.42	
1360.00	233629	5.36	5.23	5.23	11.65	0.00
1361.00	249452	5.73	5.55	5.55	17.19	5.55
1362.00	261002	5.99	5.86	5.86	23.05	11.40
1362.75	271900	6.24	6.12	4.59	27.64	15.99
1363.00	277298	6.37	6.30	1.59	29.23	17.58
1364.00	300382	6.90	6.63	6.63	35.86	24.21
1364.50	319122	7.33	7.11	3.56	39.42	27.77

Storage at Normal Pool =	11.65	Acre-feet
Elevation of weir =	1360.00	Feet
Storage at Overflow =	27.64	Acre-feet
Elevation =	1362.75	Feet

Average Depth =	Storage at Normal Pool Area at Normal Pool	
Average Depth =	2.17	Feet

Notes:

Storage areas include final earthwork borrow in pool area. Contour data is compiled from LIDAR, topographic survey, and proposed grading.

Weir Flow Hydraulics

DA = 990 ac

= 1.55 sq mi

Input

$$Q = CLH^{1.5}$$

Use C = 3.1

Output

Pool Elev. = 1360.00

Weir Length	35	40	49	55	60
W.S. Elev.	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)
1360.00	0.0	0.0	0.0	0.0	0.0
1360.28	16.2	18.5	22.7	25.4	27.7
1360.56	45.8	52.3	64.1	71.9	78.5
1360.84	84.1	96.1	117.7	132.1	144.2
1361.13	129.5	148.0	181.3	203.4	221.9
1361.41	180.9	206.8	253.3	284.3	310.2
1361.69	237.8	271.8	333.0	373.8	407.7
1361.97	299.7	342.5	419.6	471.0	513.8
1362.25	366.2	418.5	512.7	575.4	627.8
1362.53	437.0	499.4	611.7	686.6	749.1
1362.81	511.8	584.9	716.5	804.2	877.3
1363.09	590.4	674.8	826.6	927.8	1012.1
1363.38	672.7	768.8	941.8	1057.1	1153.3
1363.66	758.5	866.9	1062.0	1192.0	1300.4
1363.94	847.7	968.8	1186.8	1332.2	1453.3
1364.22	940.2	1074.5	1316.2	1477.4	1611.7
MAX POOL 1364.50	1035.7	1183.7	1450.0	1627.6	1775.5

USED

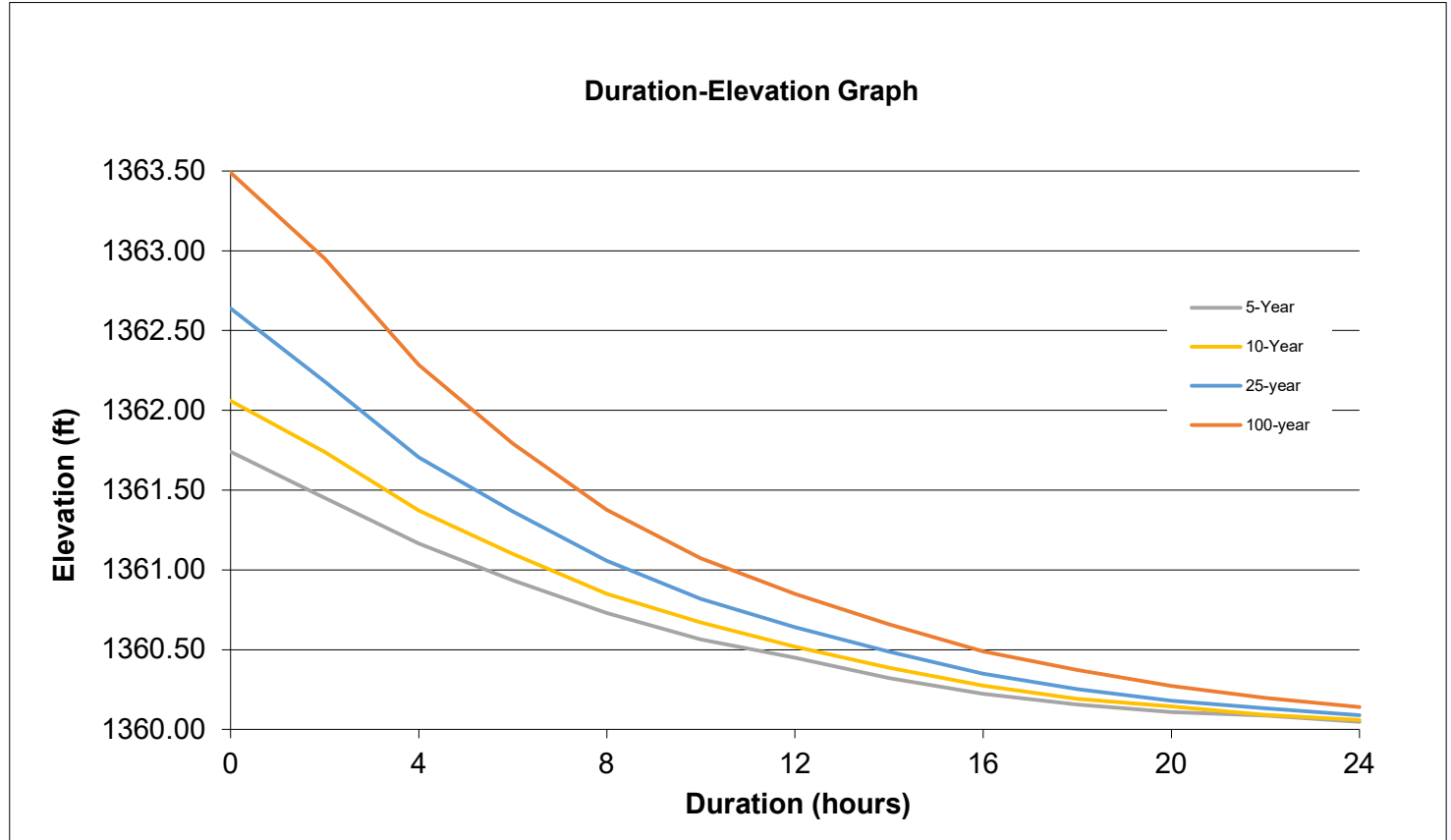
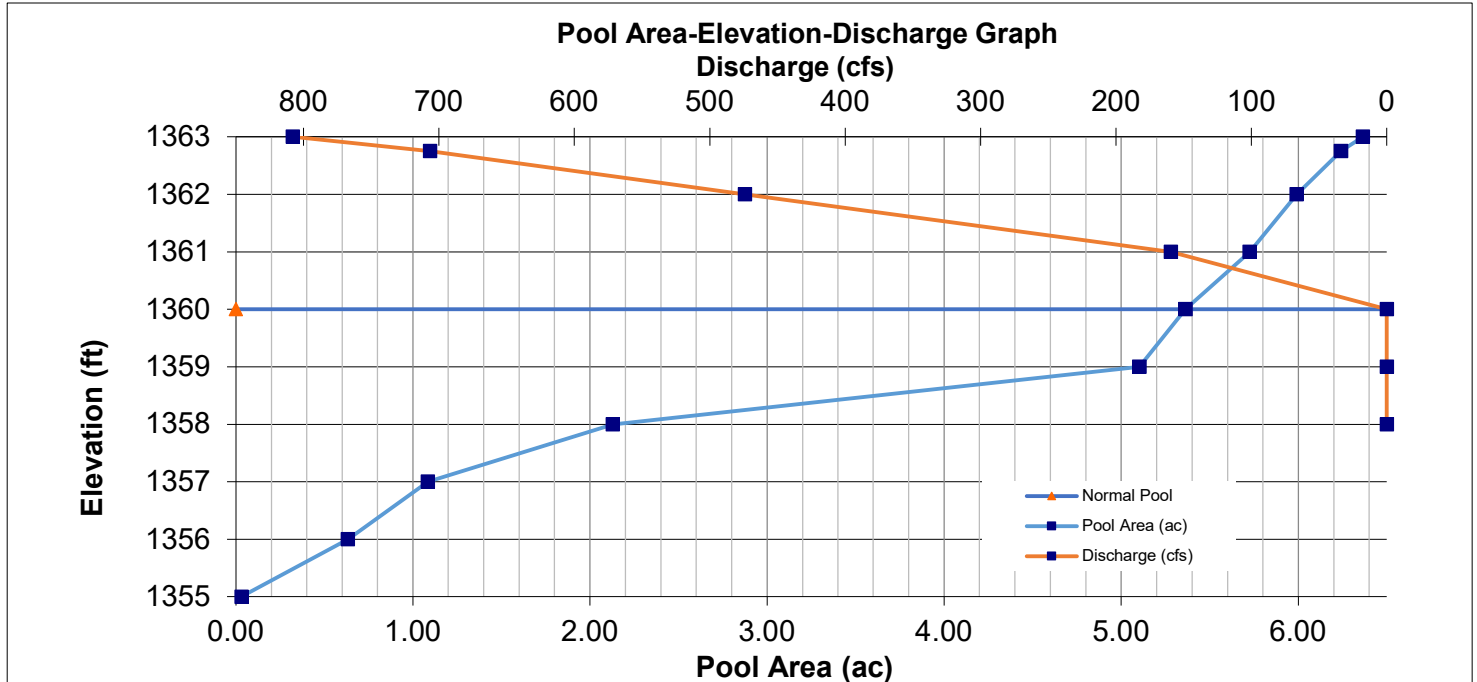


Results

Surface-Drained DA = 990 ac

= 1.55 sq mi

The following are based on surface flows and storm response. Discharge includes tile flow and overland flow.



Results

Surface-Drained DA = 990 ac

= 1.55 sq mi

The Elevation-Discharge table below shows outflows from the wetland for various elevations.

Elevation (ft)	Pool Area (ac)	Surface Discharge (cfs)
1355.00	0.03	0
1356.00	0.63	0
1357.00	1.09	0
1358.00	2.13	0
1359.00	5.10	0
1360.00	5.36	0
1361.00	5.73	159.38
1362.00	5.99	474.07
1362.75	6.24	706.68
1363.00	6.37	807.82

The Duration-Elevation table below shows the duration that the pool is at each listed elevation during the design storms. This is based on surface inflows during the design storms listed. The design for the wetland is based on tile flows, but the entire watershed is analyzed, including surface flows, to show that the proposed wetland does not have adverse impacts on surrounding properties during rainfall events.

Duration-Elevation Table

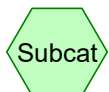
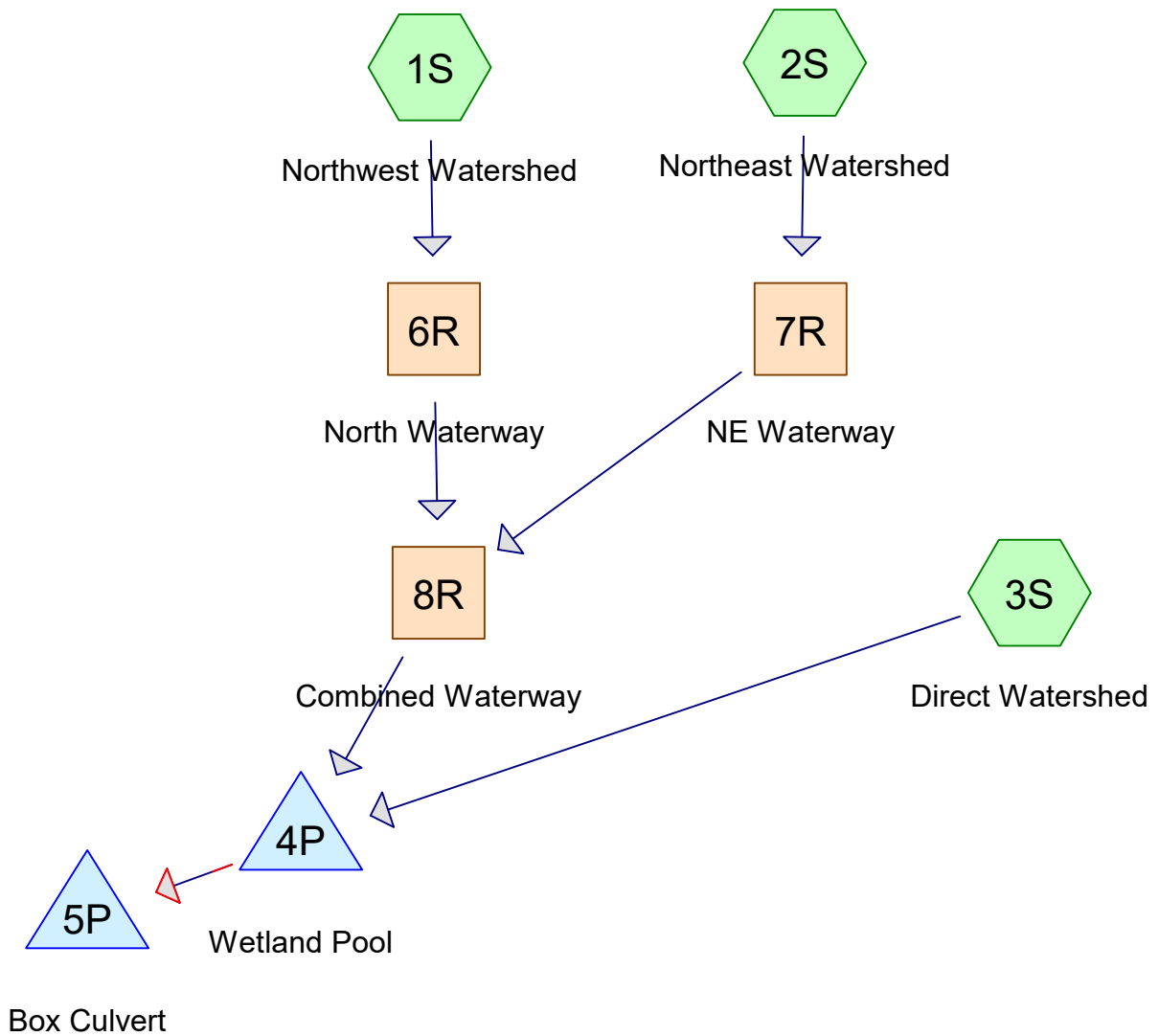
5-year		10-year		25-year		100-year	
Duration	Elevation	Duration	Elevation	Duration	Elevation	Duration	Elevation
0	1361.74	0	1362.06	0	1362.64	0	1363.49
2	1361.45	2	1361.74	2	1362.18	2	1362.95
4	1361.17	4	1361.37	4	1361.71	4	1362.28
6	1360.93	6	1361.10	6	1361.37	6	1361.79
8	1360.73	8	1360.85	8	1361.06	8	1361.38
10	1360.56	10	1360.67	10	1360.82	10	1361.07
12	1360.45	12	1360.52	12	1360.64	12	1360.85
14	1360.32	14	1360.39	14	1360.49	14	1360.66
16	1360.22	16	1360.27	16	1360.35	16	1360.49
18	1360.16	18	1360.19	18	1360.25	18	1360.37
20	1360.11	20	1360.15	20	1360.18	20	1360.27
22	1360.09	22	1360.09	22	1360.13	22	1360.20
24	1360.05	24	1360.06	24	1360.09	24	1360.14

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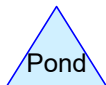
Appendix D: HydroCAD Output



Subcat



Reach



Pond



Link

Routing Diagram for Kracht HydroCAD

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Kracht HydroCAD

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	5 Year	MSE 24-hr	4	Default	24.00	1	3.70	2
2	10 Year	MSE 24-hr	4	Default	24.00	1	4.40	2
3	25 Year	MSE 24-hr	4	Default	24.00	1	5.60	2
4	50 Year	MSE 24-hr	4	Default	24.00	1	6.60	2
5	100 Year	MSE 24-hr	4	Default	24.00	1	7.80	2

Kracht HydroCAD

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
990.300	85	Row crops, straight row, Good, HSG C (1S, 2S, 3S)
990.300	85	TOTAL AREA

Kracht HydroCAD

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
990.300	HSG C	1S, 2S, 3S
0.000	HSG D	
0.000	Other	
990.300		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
0.000	0.000	990.300	0.000	0.000	990.300	Row crops, straight row, Good	1S, 2S, 3S
0.000	0.000	990.300	0.000	0.000	990.300	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	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	5P	1,349.25	1,348.88	50.0	0.0074	0.012	72.0	72.0	0.0	

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MSE 24-hr 4 5 Year Rainfall=3.70"

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Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northwest Watershed Runoff Area=308.000 ac 0.00% Impervious Runoff Depth=2.19"
Flow Length=7,732' Tc=425.4 min CN=85 Runoff=83.62 cfs 56.250 af

Subcatchment 2S: Northeast Watershed Runoff Area=126.500 ac 0.00% Impervious Runoff Depth=2.19"
Flow Length=6,220' Tc=339.3 min CN=85 Runoff=40.94 cfs 23.103 af

Subcatchment 3S: Direct Watershed Runoff Area=555.800 ac 0.00% Impervious Runoff Depth=2.19"
Flow Length=7,549' Tc=150.5 min CN=85 Runoff=338.38 cfs 101.506 af

Reach 6R: North Waterway Avg. Flow Depth=0.50' Max Vel=2.19 fps Inflow=83.62 cfs 56.250 af
n=0.025 L=2,940.0' S=0.0058 '/' Capacity=9,820.14 cfs Outflow=82.82 cfs 56.250 af

Reach 7R: NE Waterway Avg. Flow Depth=0.51' Max Vel=1.77 fps Inflow=40.94 cfs 23.103 af
n=0.025 L=4,375.0' S=0.0055 '/' Capacity=9,519.90 cfs Outflow=39.80 cfs 23.103 af

Reach 8R: Combined Waterway Avg. Flow Depth=1.47' Max Vel=2.88 fps Inflow=121.40 cfs 79.353 af
n=0.025 L=1,700.0' S=0.0035 '/' Capacity=5,235.03 cfs Outflow=121.22 cfs 79.353 af

Pond 4P: Wetland Pool Peak Elev=1,361.68' Storage=21.165 af Inflow=355.41 cfs 180.860 af
Outflow=347.33 cfs 180.859 af

Pond 5P: Box Culvert Peak Elev=1,356.97' Storage=0.655 af Inflow=347.33 cfs 180.859 af
Primary=347.02 cfs 181.376 af Secondary=0.00 cfs 0.000 af Outflow=347.02 cfs 181.376 af

Total Runoff Area = 990.300 ac Runoff Volume = 180.860 af Average Runoff Depth = 2.19"
100.00% Pervious = 990.300 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Northwest Watershed

Runoff = 83.62 cfs @ 17.50 hrs, Volume= 56.250 af, Depth= 2.19"
Routed to Reach 6R : North Waterway

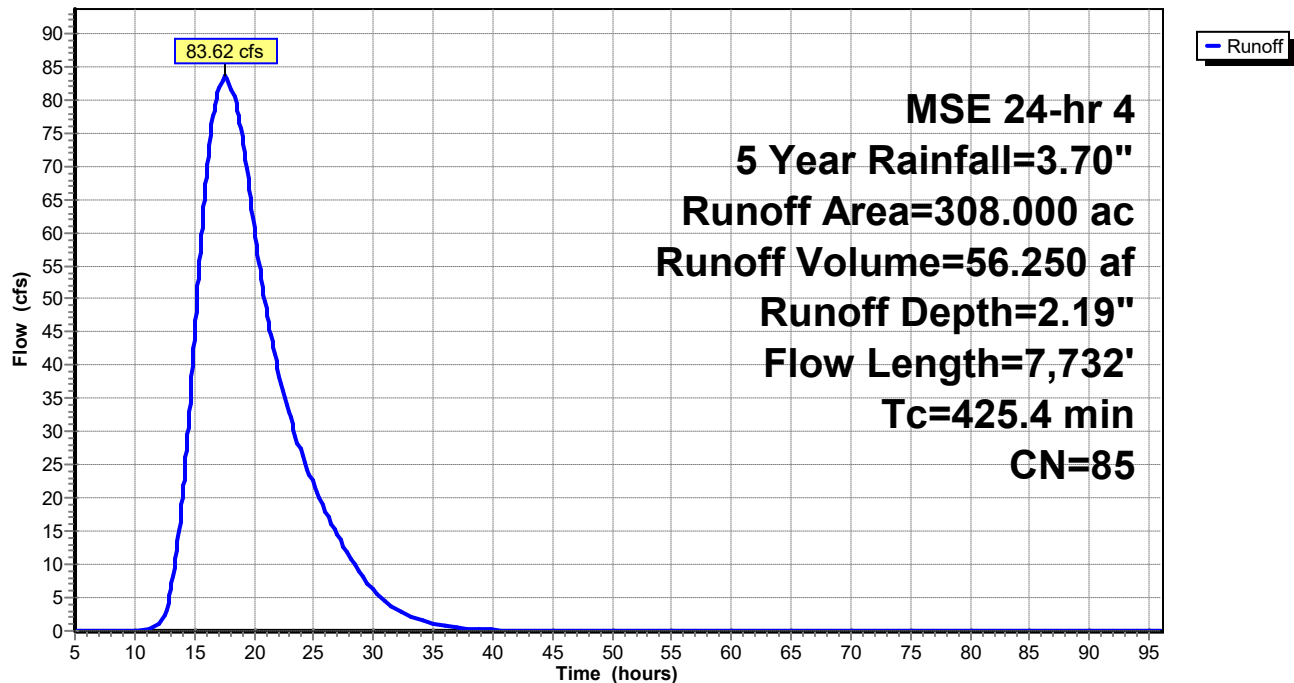
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
MSE 24-hr 4 5 Year Rainfall=3.70"

Area (ac)	CN	Description
308.000	85	Row crops, straight row, Good, HSG C
308.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
311.9	4,125	0.0006	0.22		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
93.7	3,507	0.0048	0.62		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
425.4	7,732	Total			

Subcatchment 1S: Northwest Watershed

Hydrograph



Summary for Subcatchment 2S: Northeast Watershed

Runoff = 40.94 cfs @ 16.55 hrs, Volume= 23.103 af, Depth= 2.19"
 Routed to Reach 7R : NE Waterway

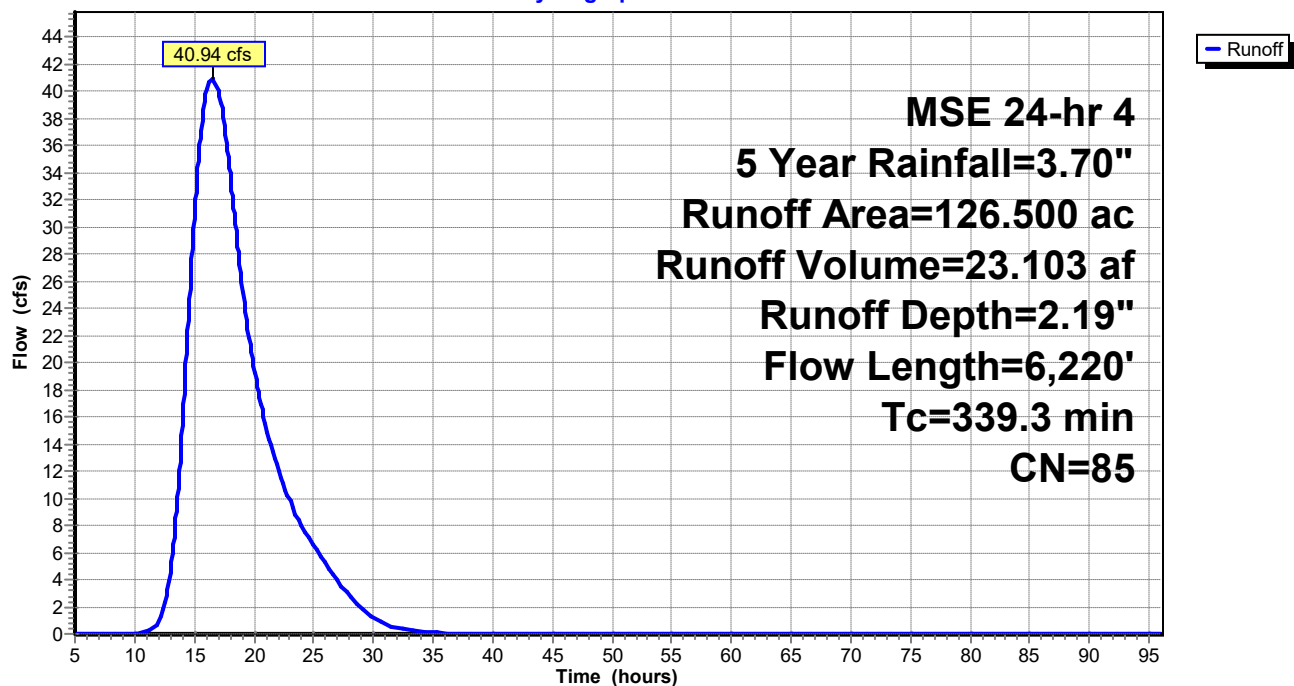
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 5 Year Rainfall=3.70"

Area (ac)	CN	Description
126.500	85	Row crops, straight row, Good, HSG C
126.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.0200	0.15		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
250.1	3,820	0.0008	0.25		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
77.8	2,300	0.0030	0.49		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
339.3	6,220	Total			

Subcatchment 2S: Northeast Watershed

Hydrograph



Summary for Subcatchment 3S: Direct Watershed

[47] Hint: Peak is 355% of capacity of segment #3

[47] Hint: Peak is 134% of capacity of segment #5

Runoff = 338.38 cfs @ 14.03 hrs, Volume= 101.506 af, Depth= 2.19"
Routed to Pond 4P : Wetland Pool

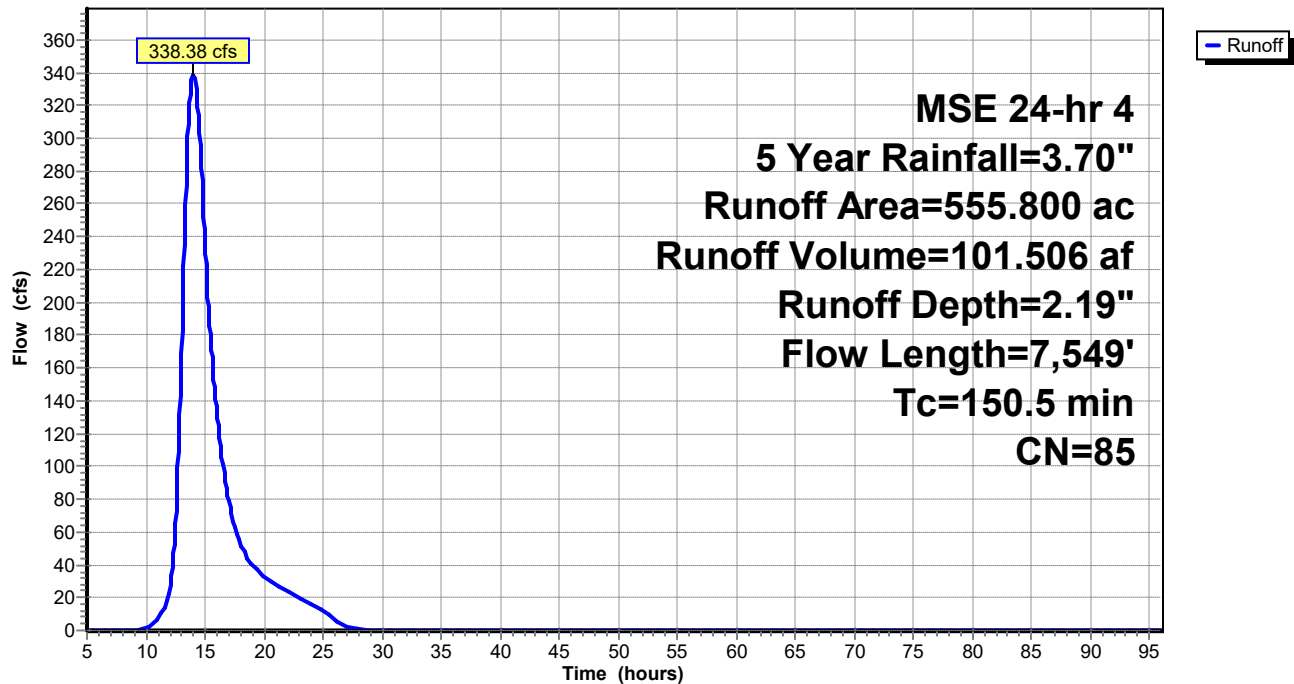
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
MSE 24-hr 4 5 Year Rainfall=3.70"

Area (ac)	CN	Description
555.800	85	Row crops, straight row, Good, HSG C
555.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
44.1	952	0.0016	0.36		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
4.5	927	0.0065	3.41	95.39	Channel Flow, Ditch Area= 28.0 sf Perim= 28.2' r= 0.99' n= 0.035 Earth, dense weeds
70.5	3,070	0.0065	0.73		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
11.6	2,500	0.0053	3.61	252.43	Channel Flow, Area= 70.0 sf Perim= 70.0' r= 1.00' n= 0.030 Earth, grassed & winding
150.5	7,549	Total			

Subcatchment 3S: Direct Watershed

Hydrograph



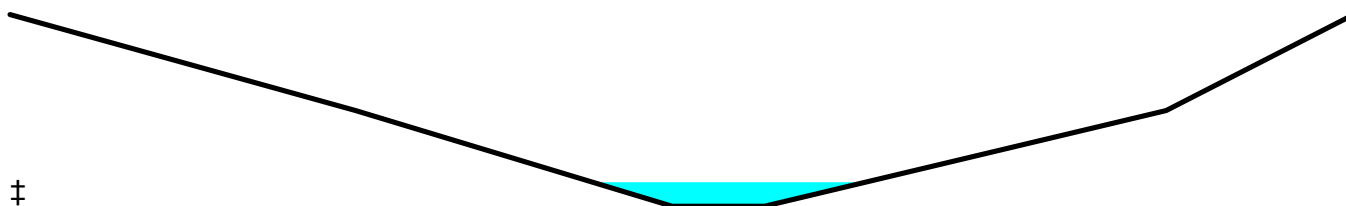
Summary for Reach 6R: North Waterway

Inflow Area = 308.000 ac, 0.00% Impervious, Inflow Depth = 2.19" for 5 Year event
 Inflow = 83.62 cfs @ 17.50 hrs, Volume= 56.250 af
 Outflow = 82.82 cfs @ 17.81 hrs, Volume= 56.250 af, Atten= 1%, Lag= 18.6 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.19 fps, Min. Travel Time= 22.4 min
 Avg. Velocity= 0.96 fps, Avg. Travel Time= 50.9 min

Peak Storage= 111,183 cf @ 17.81 hrs
 Average Depth at Peak Storage= 0.50', Surface Width= 112.21'
 Bank-Full Depth= 4.00' Flow Area= 1,256.0 sf, Capacity= 9,820.14 cfs

Custom cross-section, Length= 2,940.0' Slope= 0.0058 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,391.00', Outlet Invert= 1,374.00'



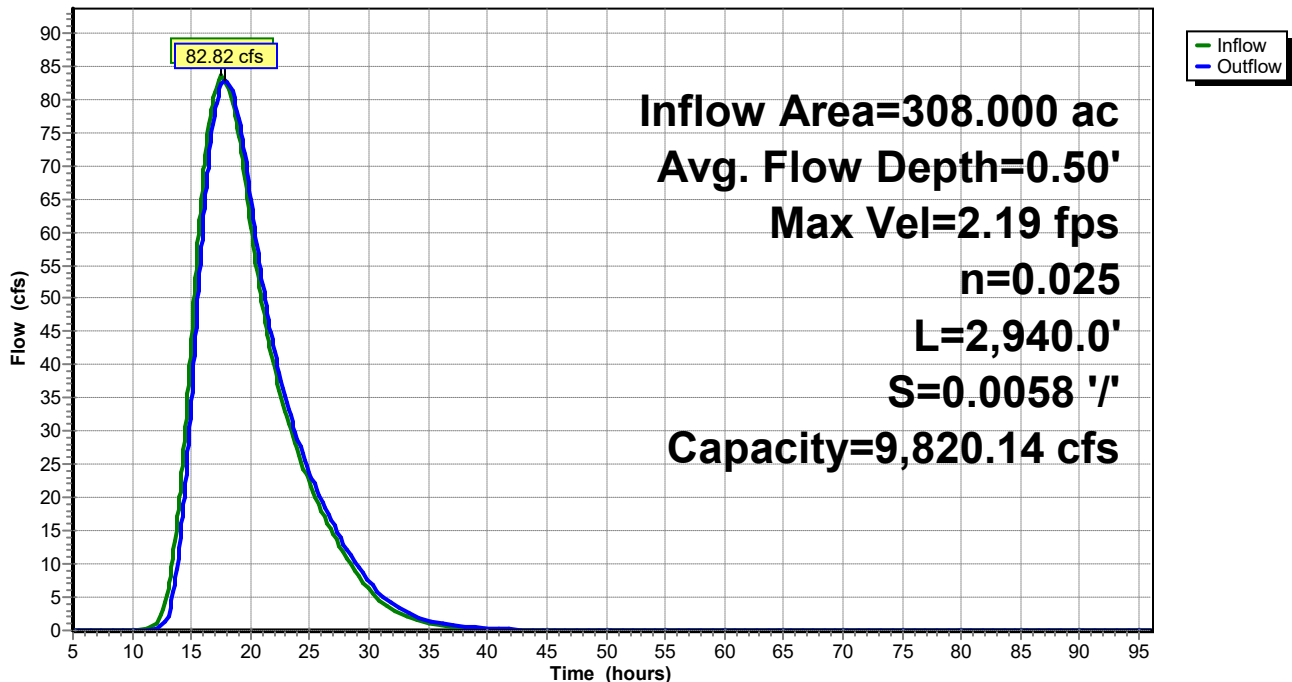
‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,384.00	0.00
142.00	1,382.00	2.00
272.00	1,380.00	4.00
310.00	1,380.00	4.00
475.00	1,382.00	2.00
552.00	1,384.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	38.0	0.0	0	0.00
2.00	371.0	333.0	333.0	1,090,740	1,802.05
4.00	1,256.0	552.1	552.0	3,692,640	9,820.14

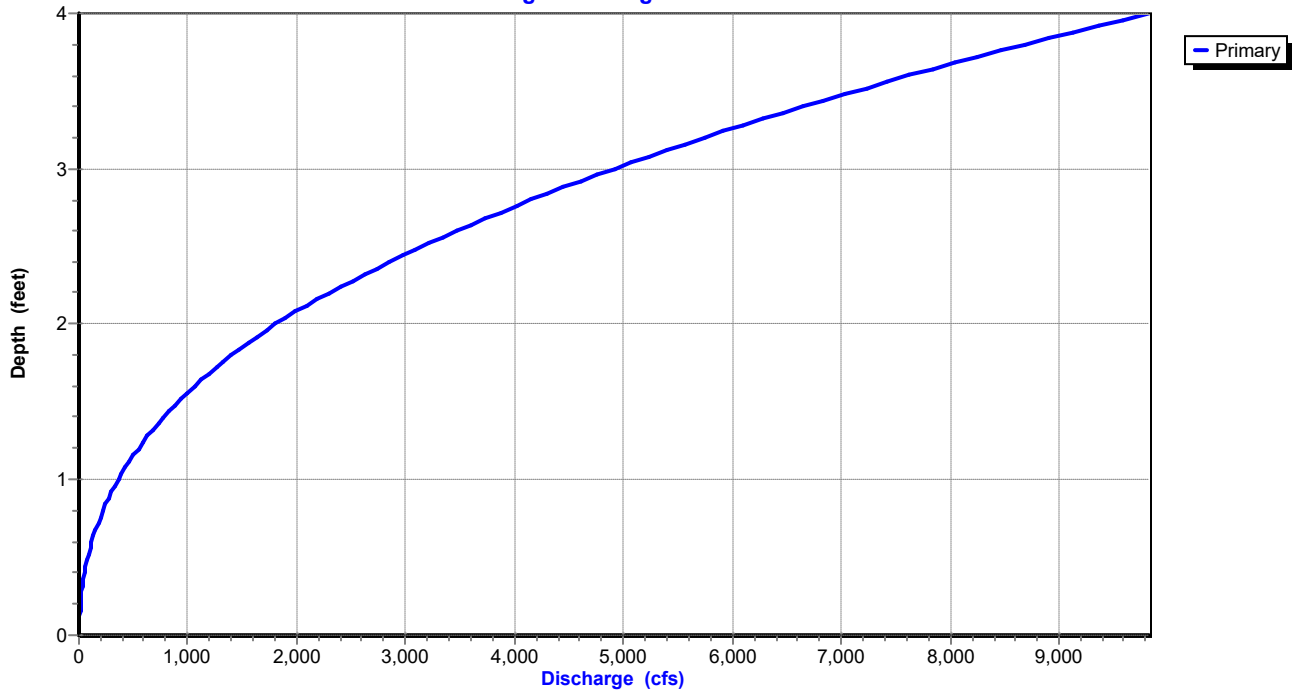
Reach 6R: North Waterway

Hydrograph

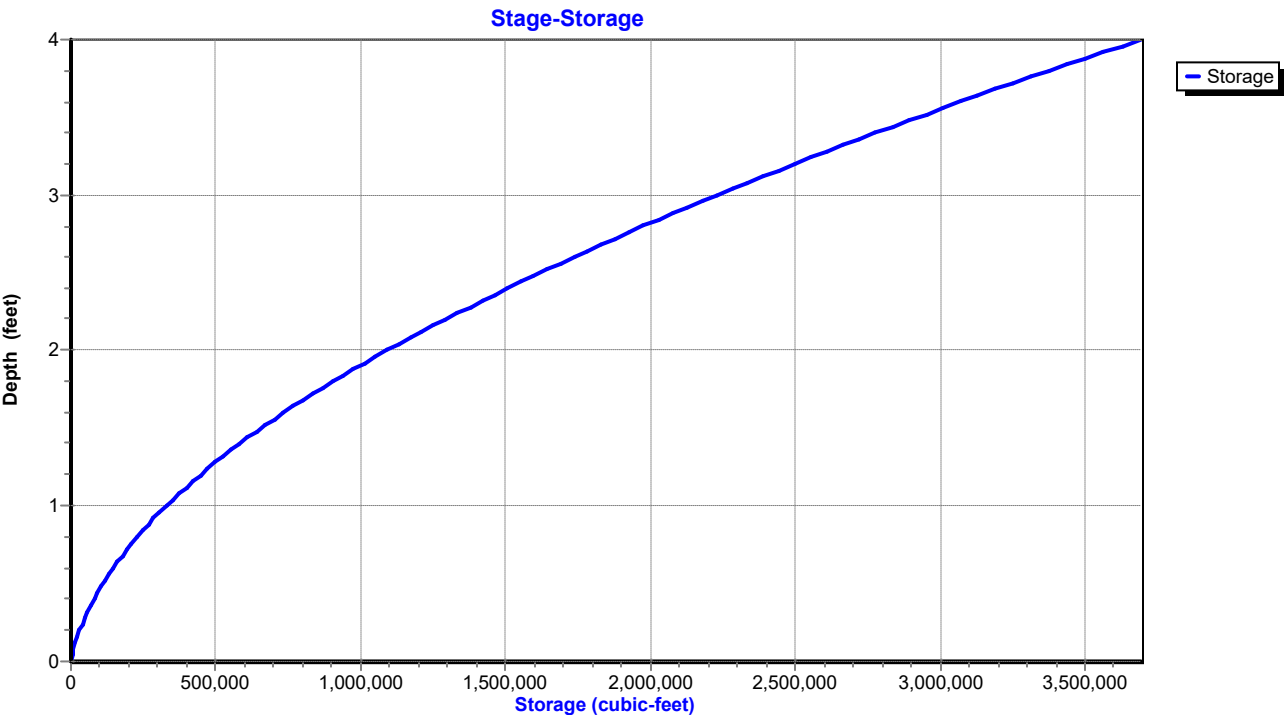


Reach 6R: North Waterway

Stage-Discharge



Reach 6R: North Waterway



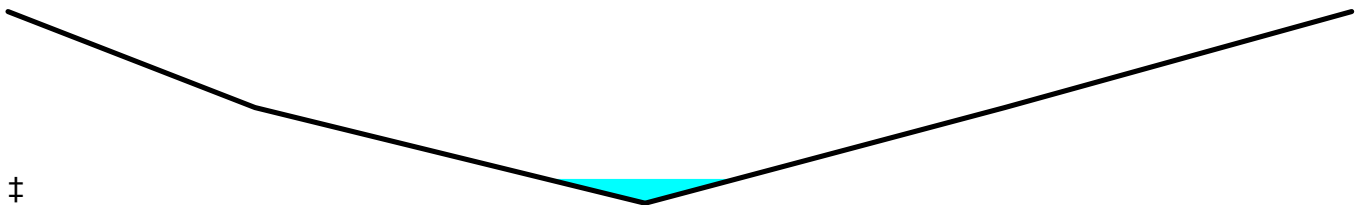
Summary for Reach 7R: NE Waterway

Inflow Area = 126.500 ac, 0.00% Impervious, Inflow Depth = 2.19" for 5 Year event
 Inflow = 40.94 cfs @ 16.55 hrs, Volume= 23.103 af
 Outflow = 39.80 cfs @ 17.09 hrs, Volume= 23.103 af, Atten= 3%, Lag= 32.5 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 1.77 fps, Min. Travel Time= 41.2 min
 Avg. Velocity= 0.66 fps, Avg. Travel Time= 110.4 min

Peak Storage= 98,305 cf @ 17.09 hrs
 Average Depth at Peak Storage= 0.51', Surface Width= 88.12'
 Bank-Full Depth= 4.00' Flow Area= 1,312.0 sf, Capacity= 9,519.90 cfs

Custom cross-section, Length= 4,375.0' Slope= 0.0055 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,399.00', Outlet Invert= 1,375.00'

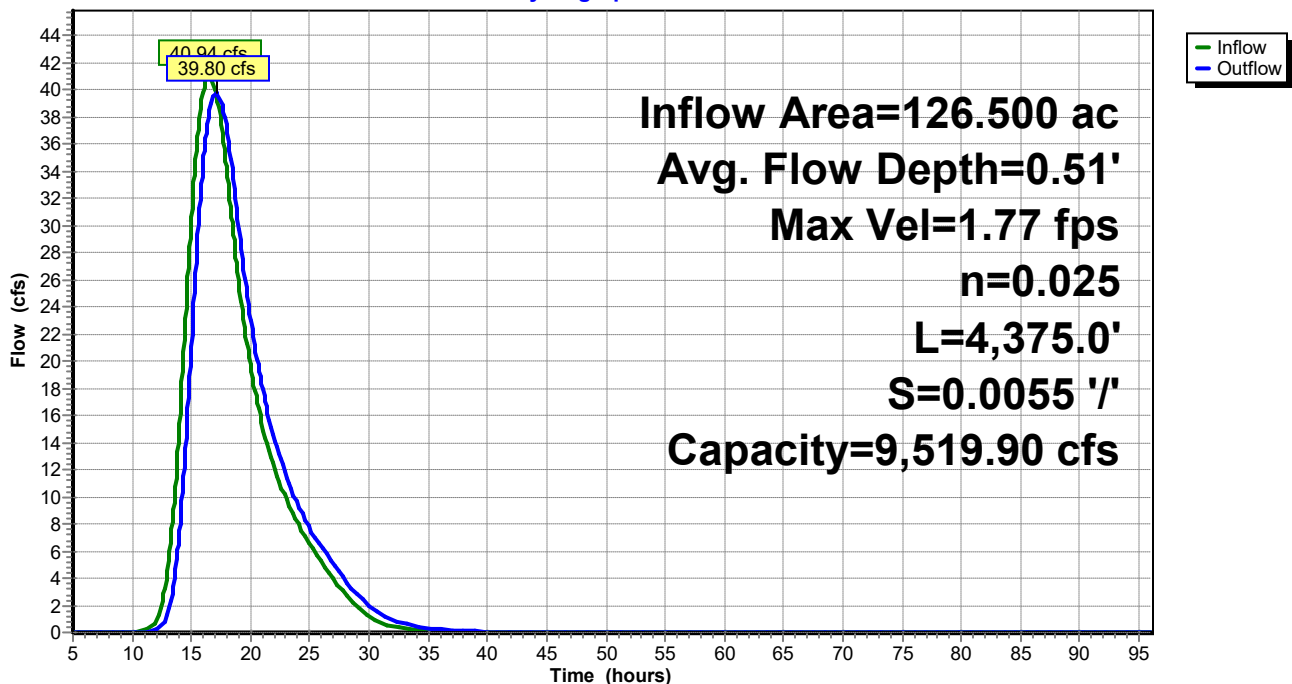


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,392.00	0.00
114.00	1,390.00	2.00
294.00	1,388.00	4.00
460.00	1,390.00	2.00
620.00	1,392.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	346.0	346.0	346.0	1,513,750	1,523.18
4.00	1,312.0	620.1	620.0	5,740,000	9,519.90

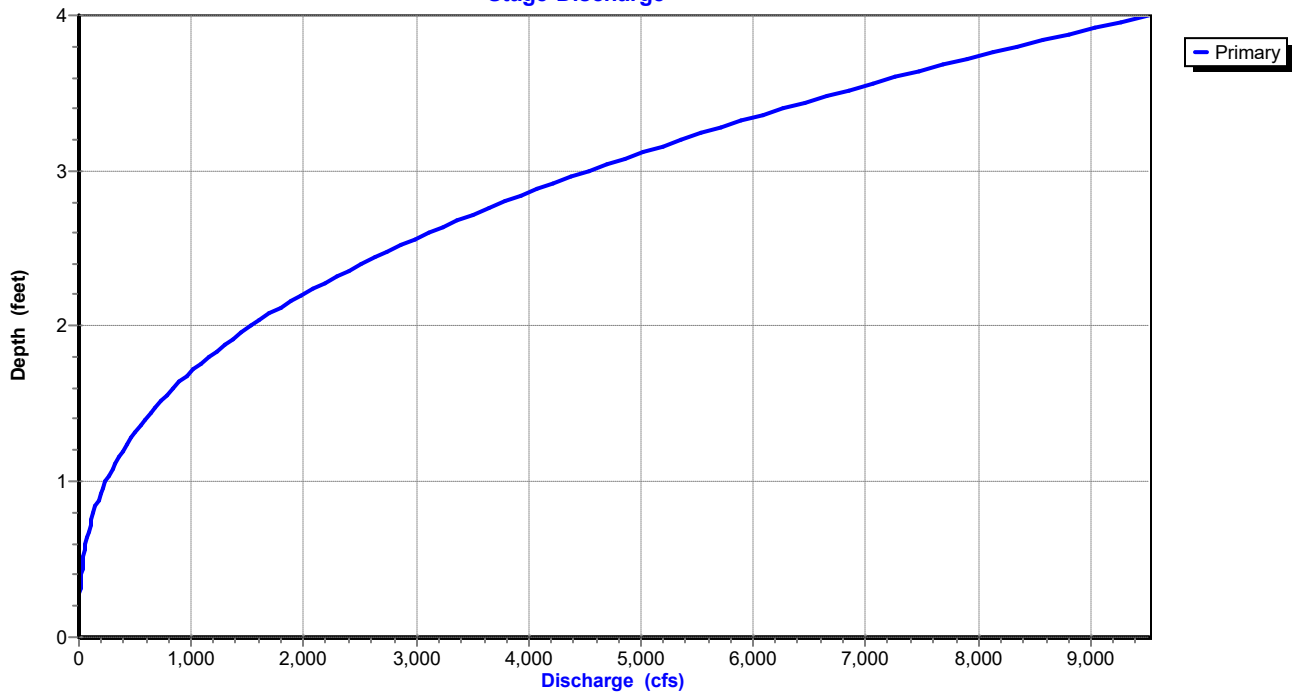
Reach 7R: NE Waterway

Hydrograph

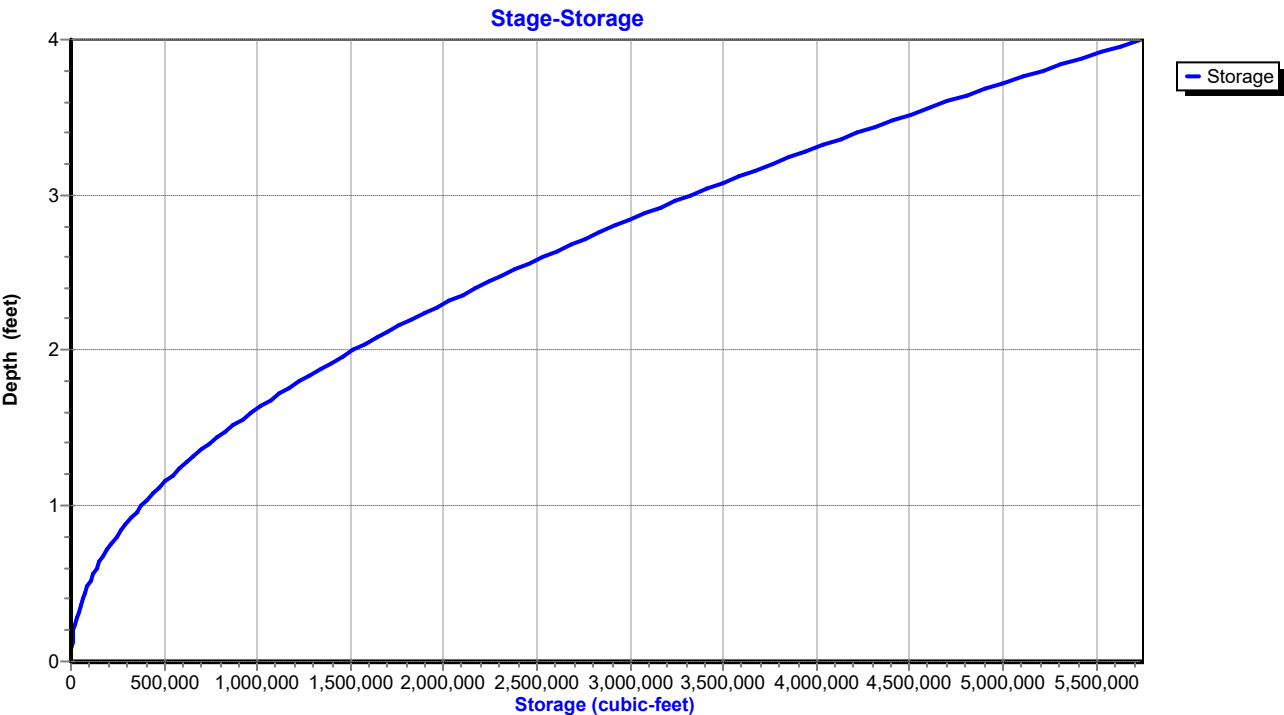


Reach 7R: NE Waterway

Stage-Discharge



Reach 7R: NE Waterway



Summary for Reach 8R: Combined Waterway

[62] Hint: Exceeded Reach 6R OUTLET depth by 0.97' @ 17.65 hrs

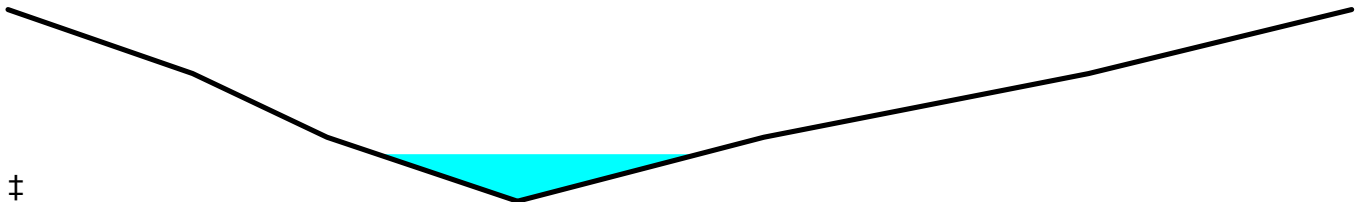
[61] Hint: Exceeded Reach 7R outlet invert by 0.47' @ 17.70 hrs

Inflow Area = 434.500 ac, 0.00% Impervious, Inflow Depth = 2.19" for 5 Year event
 Inflow = 121.40 cfs @ 17.58 hrs, Volume= 79.353 af
 Outflow = 121.22 cfs @ 17.70 hrs, Volume= 79.353 af, Atten= 0%, Lag= 7.2 min
 Routed to Pond 4P : Wetland Pool

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.88 fps, Min. Travel Time= 9.9 min
 Avg. Velocity= 1.03 fps, Avg. Travel Time= 27.5 min

Peak Storage= 71,677 cf @ 17.70 hrs
 Average Depth at Peak Storage= 1.47', Surface Width= 57.34'
 Bank-Full Depth= 6.00' Flow Area= 716.0 sf, Capacity= 5,235.03 cfs

Custom cross-section, Length= 1,700.0' Slope= 0.0035 '/' (102 Elevation Intervals)
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,374.00', Outlet Invert= 1,368.00'

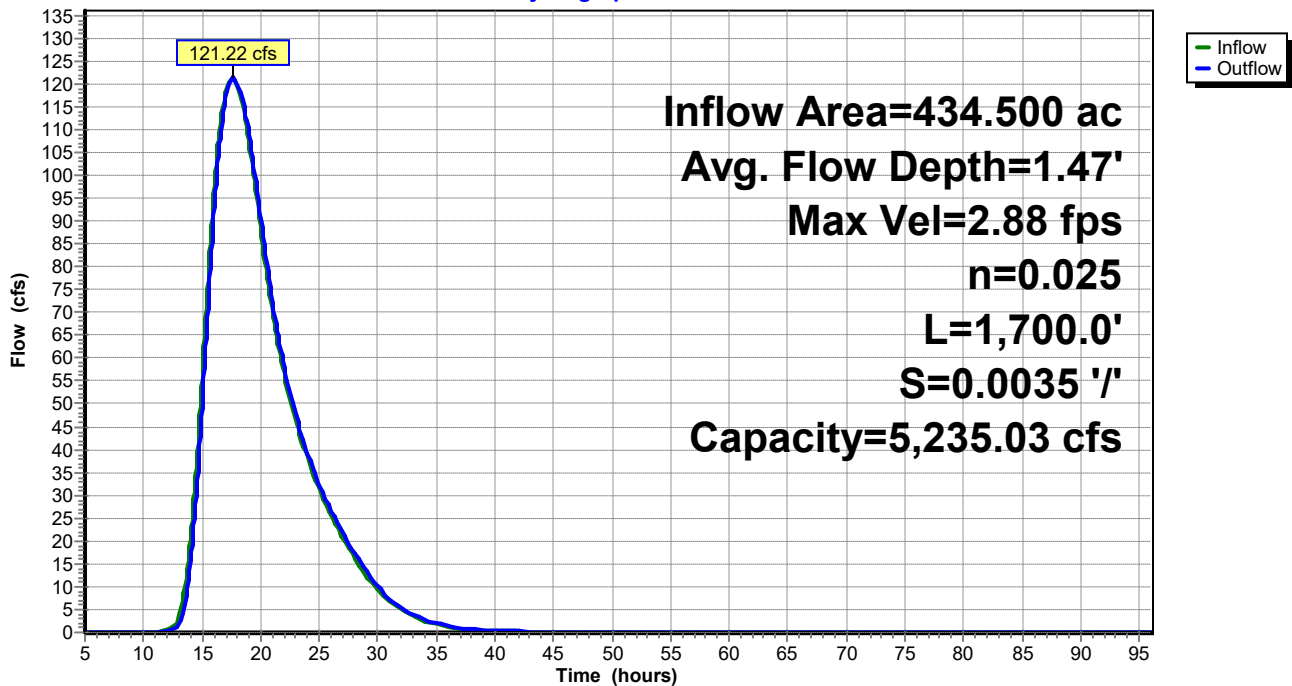


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,374.00	0.00
33.00	1,372.00	2.00
57.00	1,370.00	4.00
91.00	1,368.00	6.00
135.00	1,370.00	4.00
193.00	1,372.00	2.00
240.00	1,374.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	78.0	78.1	78.0	132,600	275.19
4.00	316.0	160.2	160.0	537,200	1,754.93
6.00	716.0	240.3	240.0	1,217,200	5,235.03

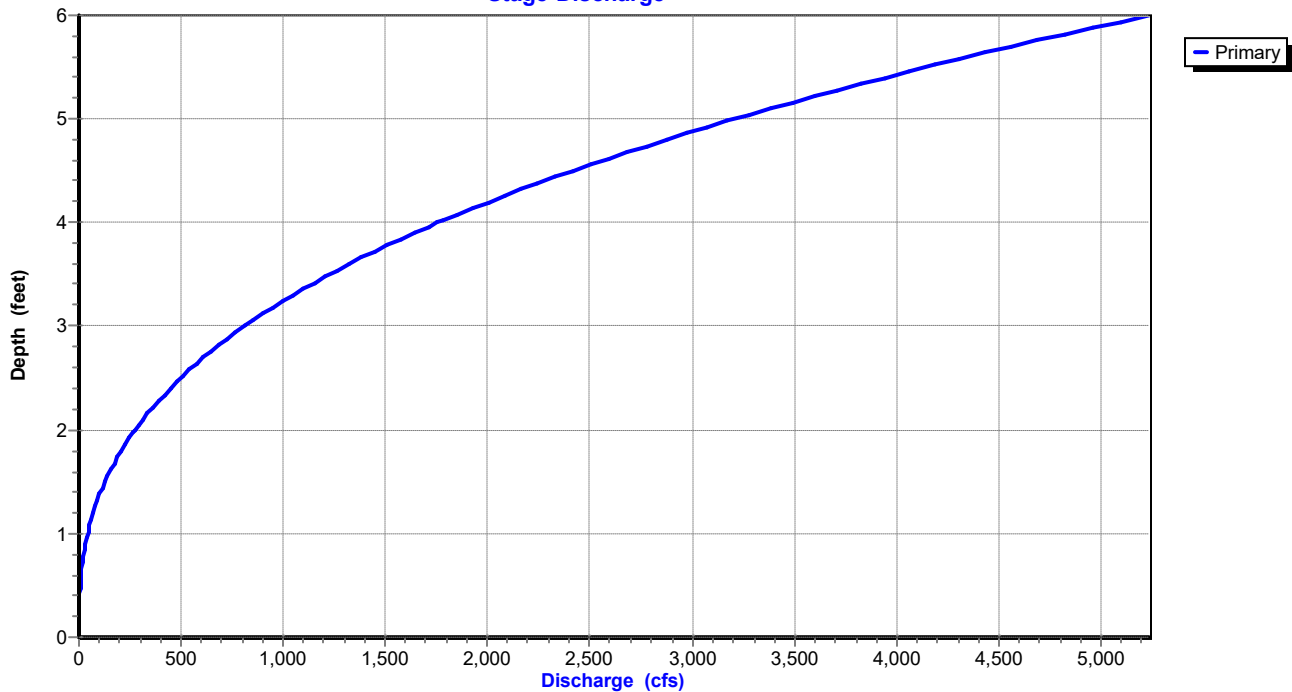
Reach 8R: Combined Waterway

Hydrograph

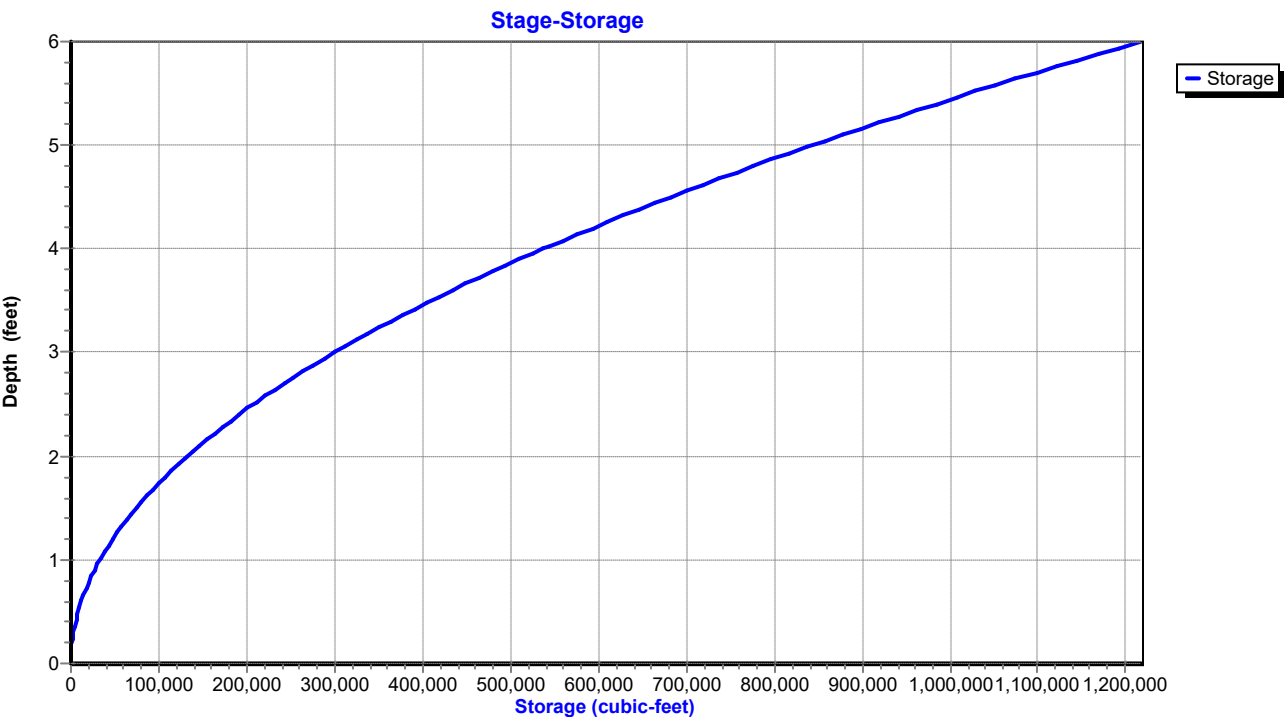


Reach 8R: Combined Waterway

Stage-Discharge



Reach 8R: Combined Waterway



Summary for Pond 4P: Wetland Pool

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 2.19" for 5 Year event
 Inflow = 355.41 cfs @ 14.18 hrs, Volume= 180.860 af
 Outflow = 347.33 cfs @ 14.37 hrs, Volume= 180.859 af, Atten= 2%, Lag= 11.7 min
 Primary = 347.33 cfs @ 14.37 hrs, Volume= 180.859 af
 Routed to Pond 5P : Box Culvert

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,360.00' Surf.Area= 5.363 ac Storage= 11.648 af
 Peak Elev= 1,361.68' @ 14.37 hrs Surf.Area= 5.908 ac Storage= 21.165 af (9.516 af above start)

Plug-Flow detention time= 93.0 min calculated for 169.210 af (94% of inflow)
 Center-of-Mass det. time= 27.2 min (1,089.6 - 1,062.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,355.00'	39.394 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,355.00	0.032	0.000	0.000
1,356.00	0.633	0.333	0.333
1,357.00	1.085	0.859	1.192
1,358.00	2.130	1.607	2.799
1,359.00	5.103	3.616	6.415
1,360.00	5.363	5.233	11.648
1,361.00	5.727	5.545	17.193
1,362.00	5.992	5.859	23.053
1,362.50	6.130	3.030	26.083
1,363.00	6.366	3.124	29.207
1,364.00	6.896	6.631	35.838
1,364.50	7.326	3.556	39.394

Device	Routing	Invert	Outlet Devices
#1	Primary	1,360.00'	49.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	1,362.75'	35.0' long + 3.0' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

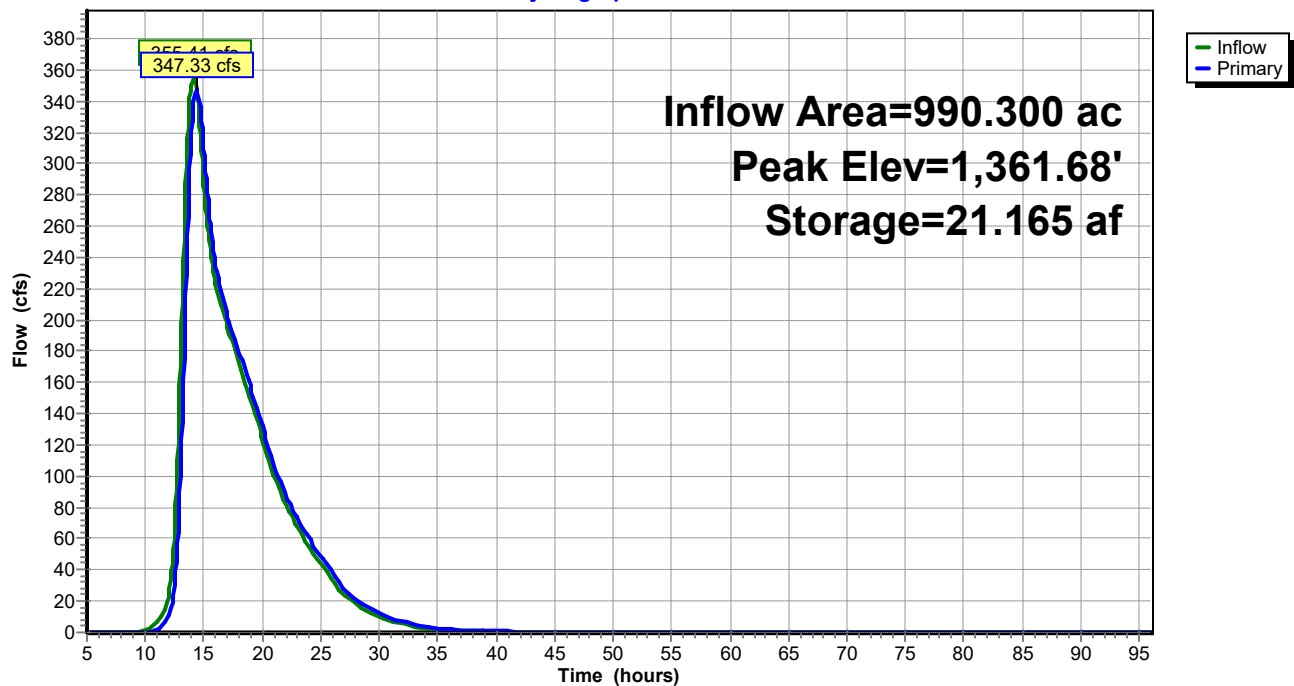
Primary OutFlow Max=347.25 cfs @ 14.37 hrs HW=1,361.68' TW=1,356.96' (Dynamic Tailwater)

1=Sharp-Crested Rectangular Weir (Weir Controls 347.25 cfs @ 4.24 fps)

2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

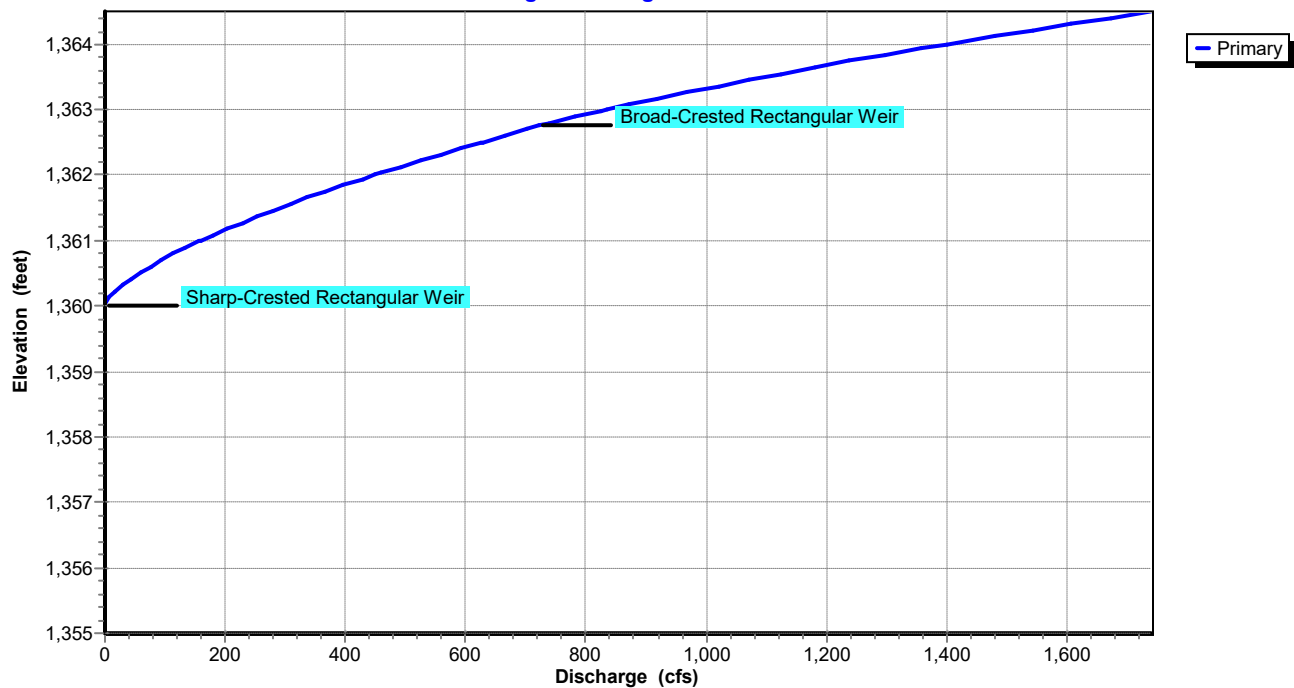
Pond 4P: Wetland Pool

Hydrograph

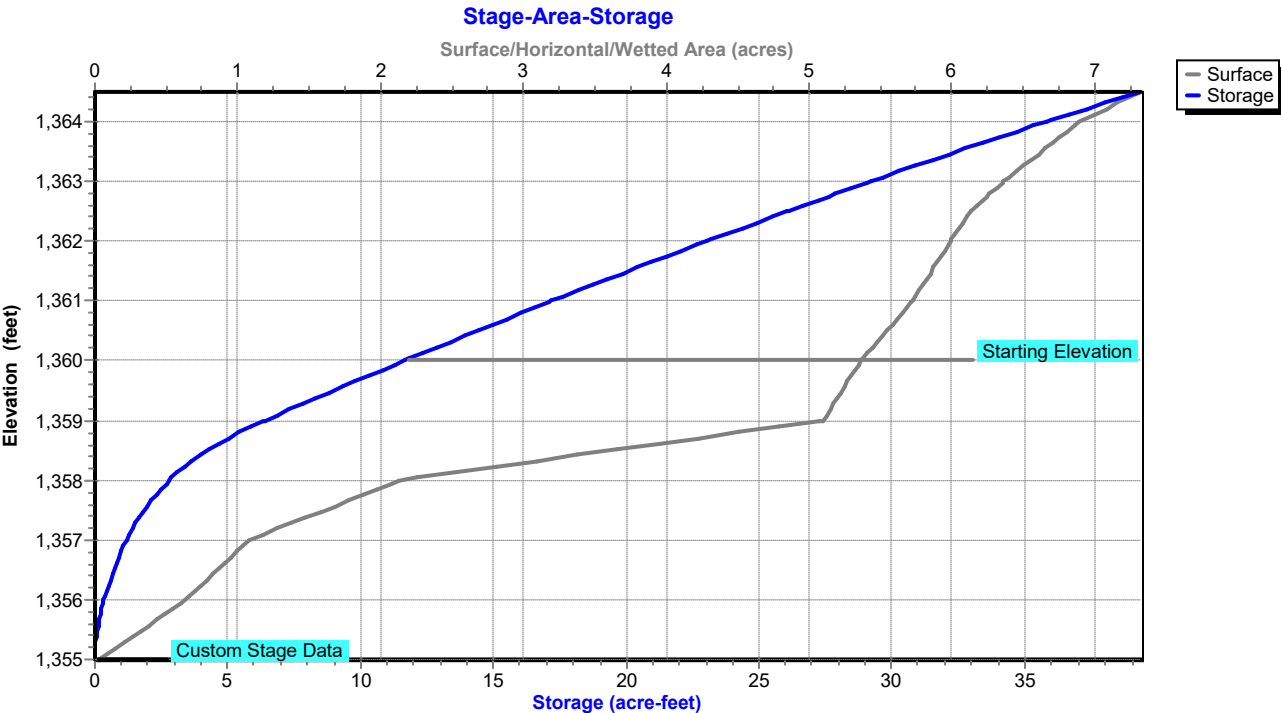


Pond 4P: Wetland Pool

Stage-Discharge



Pond 4P: Wetland Pool



Summary for Pond 5P: Box Culvert

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 2.19" for 5 Year event
 Inflow = 347.33 cfs @ 14.37 hrs, Volume= 180.859 af
 Outflow = 347.02 cfs @ 14.42 hrs, Volume= 181.376 af, Atten= 0%, Lag= 3.0 min
 Primary = 347.02 cfs @ 14.42 hrs, Volume= 181.376 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Starting Elev= 1,353.00' Surf.Area= 0.053 ac Storage= 0.089 af

Peak Elev= 1,356.97' @ 14.42 hrs Surf.Area= 0.261 ac Storage= 0.655 af (0.565 af above start)

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,349.00'	2.676 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,349.00	0.000	0.000	0.000
1,350.00	0.007	0.004	0.004
1,351.00	0.017	0.012	0.016
1,352.00	0.039	0.028	0.043
1,353.00	0.053	0.046	0.089
1,354.00	0.068	0.061	0.150
1,355.00	0.145	0.106	0.256
1,356.00	0.202	0.173	0.430
1,357.00	0.263	0.233	0.662
1,358.00	0.337	0.300	0.962
1,359.00	0.411	0.374	1.337
1,360.00	0.509	0.460	1.797
1,361.00	0.612	0.561	2.357
1,361.50	0.664	0.319	2.676

Device	Routing	Invert	Outlet Devices
#1	Primary	1,349.25'	72.0" W x 72.0" H Box Box Culvert L= 50.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 1,349.25' / 1,348.88' S= 0.0074 ' /' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 36.00 sf
#2	Secondary	1,359.83'	Roadway, Cv= 2.62 (C= 3.28) Elev. (feet) 1,359.83 1,360.00 1,360.50 1,361.00 1,361.50 1,362.00 Width (feet) 0.00 61.56 116.46 160.90 195.03 228.25

Primary OutFlow Max=346.94 cfs @ 14.42 hrs HW=1,356.97' (Free Discharge)

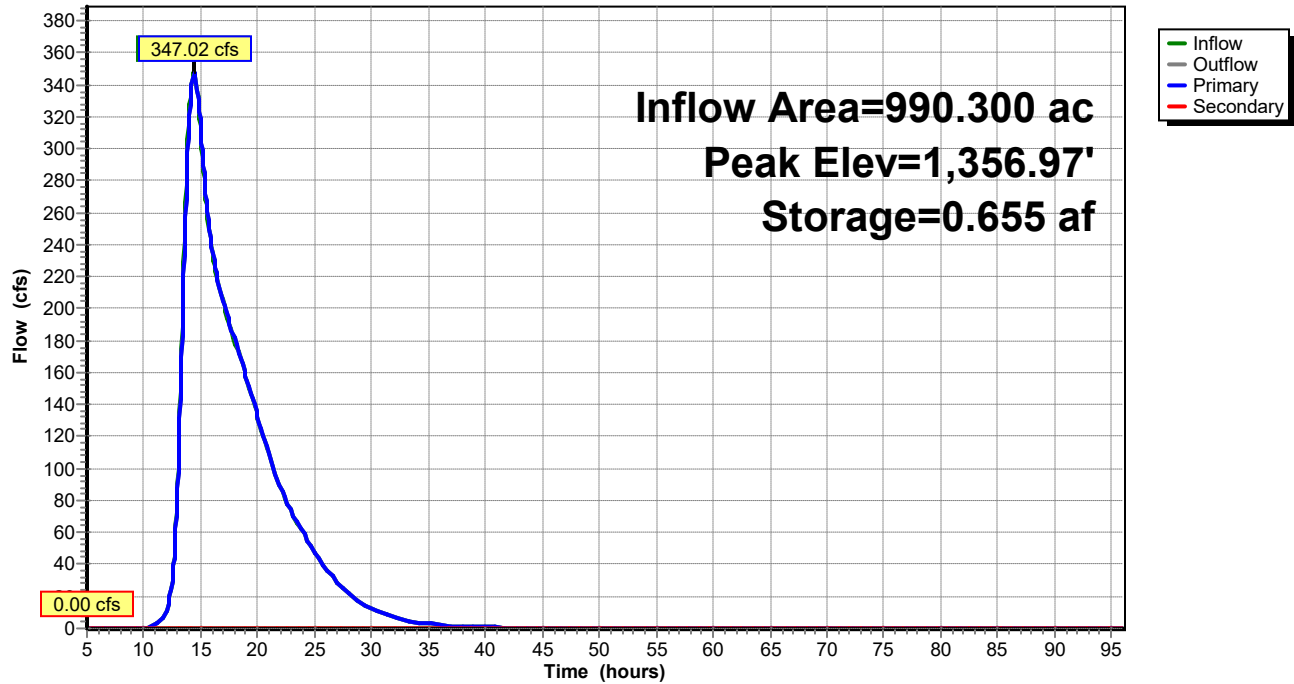
↑ **1=Box Culvert** (Barrel Controls 346.94 cfs @ 9.99 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,353.00' (Free Discharge)

↑ **2=Roadway** (Controls 0.00 cfs)

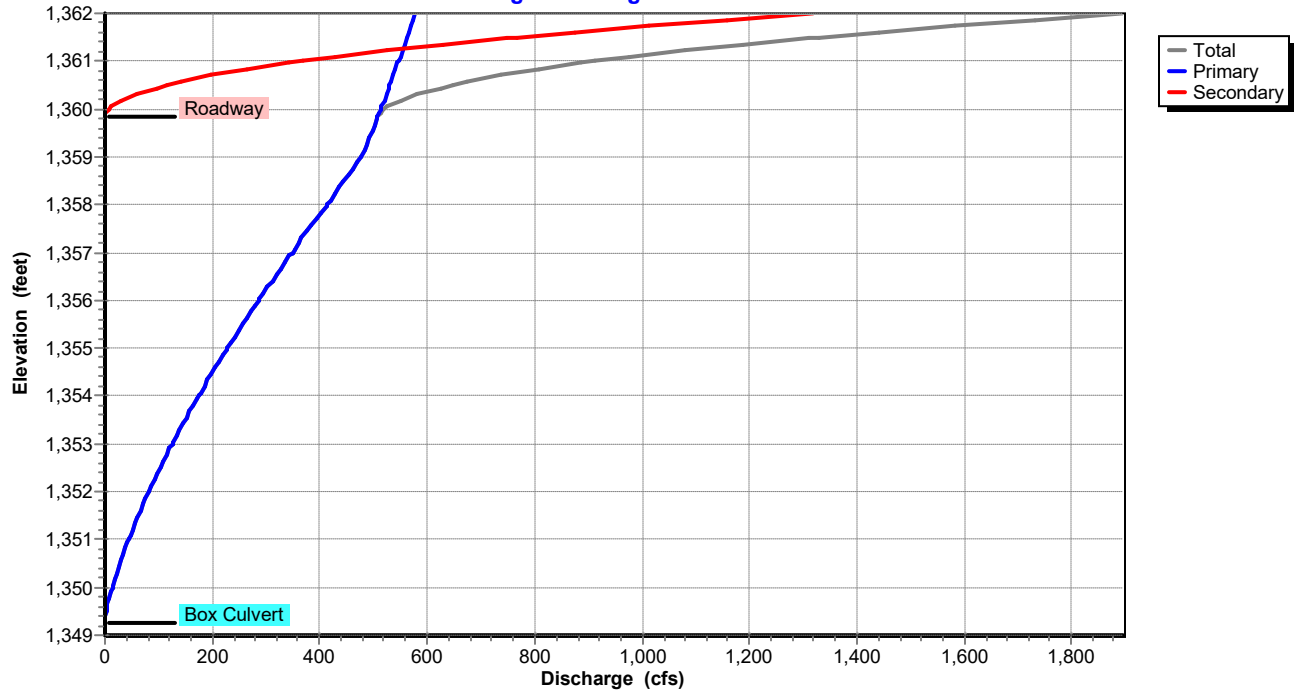
Pond 5P: Box Culvert

Hydrograph

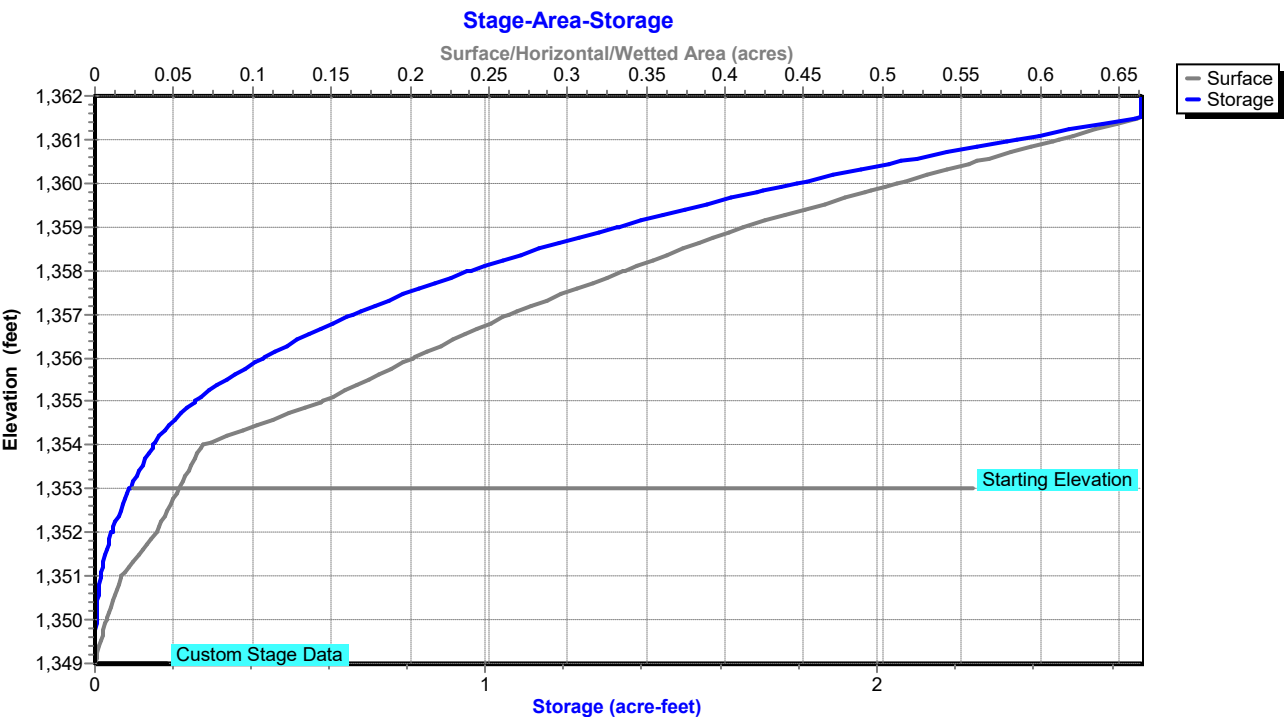


Pond 5P: Box Culvert

Stage-Discharge



Pond 5P: Box Culvert



Kracht HydroCAD

Prepared by Bolton & Menk, Inc

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MSE 24-hr 4 10 Year Rainfall=4.40"

Printed 4/29/2026

Page 27

Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northwest Watershed Runoff Area=308.000 ac 0.00% Impervious Runoff Depth=2.82"
Flow Length=7,732' Tc=425.4 min CN=85 Runoff=108.03 cfs 72.334 af

Subcatchment 2S: Northeast Watershed Runoff Area=126.500 ac 0.00% Impervious Runoff Depth=2.82"
Flow Length=6,220' Tc=339.3 min CN=85 Runoff=52.87 cfs 29.708 af

Subcatchment 3S: Direct Watershed Runoff Area=555.800 ac 0.00% Impervious Runoff Depth=2.82"
Flow Length=7,549' Tc=150.5 min CN=85 Runoff=435.60 cfs 130.529 af

Reach 6R: North Waterway Avg. Flow Depth=0.57' Max Vel=2.35 fps Inflow=108.03 cfs 72.334 af
n=0.025 L=2,940.0' S=0.0058 '/' Capacity=9,820.14 cfs Outflow=107.09 cfs 72.334 af

Reach 7R: NE Waterway Avg. Flow Depth=0.56' Max Vel=1.89 fps Inflow=52.87 cfs 29.708 af
n=0.025 L=4,375.0' S=0.0055 '/' Capacity=9,519.90 cfs Outflow=51.53 cfs 29.708 af

Reach 8R: Combined Waterway Avg. Flow Depth=1.62' Max Vel=3.06 fps Inflow=156.89 cfs 102.042 af
n=0.025 L=1,700.0' S=0.0035 '/' Capacity=5,235.03 cfs Outflow=156.69 cfs 102.042 af

Pond 4P: Wetland Pool Peak Elev=1,362.01' Storage=23.104 af Inflow=460.68 cfs 232.572 af
Outflow=452.37 cfs 232.571 af

Pond 5P: Box Culvert Peak Elev=1,358.60' Storage=1.177 af Inflow=452.37 cfs 232.571 af
Primary=451.41 cfs 233.088 af Secondary=0.00 cfs 0.000 af Outflow=451.41 cfs 233.088 af

Total Runoff Area = 990.300 ac Runoff Volume = 232.572 af Average Runoff Depth = 2.82"
100.00% Pervious = 990.300 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Northwest Watershed

Runoff = 108.03 cfs @ 17.50 hrs, Volume= 72.334 af, Depth= 2.82"
 Routed to Reach 6R : North Waterway

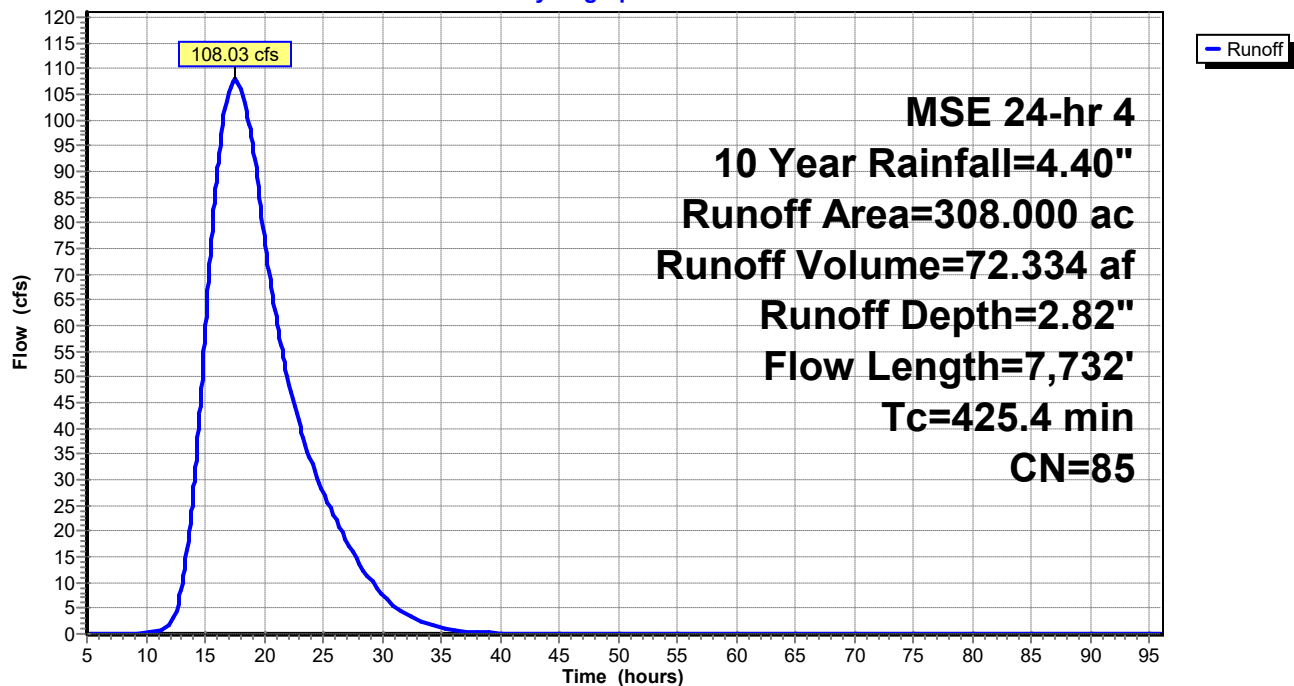
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 10 Year Rainfall=4.40"

Area (ac)	CN	Description
308.000	85	Row crops, straight row, Good, HSG C
308.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
311.9	4,125	0.0006	0.22		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
93.7	3,507	0.0048	0.62		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
425.4	7,732	Total			

Subcatchment 1S: Northwest Watershed

Hydrograph



Summary for Subcatchment 2S: Northeast Watershed

Runoff = 52.87 cfs @ 16.27 hrs, Volume= 29.708 af, Depth= 2.82"
 Routed to Reach 7R : NE Waterway

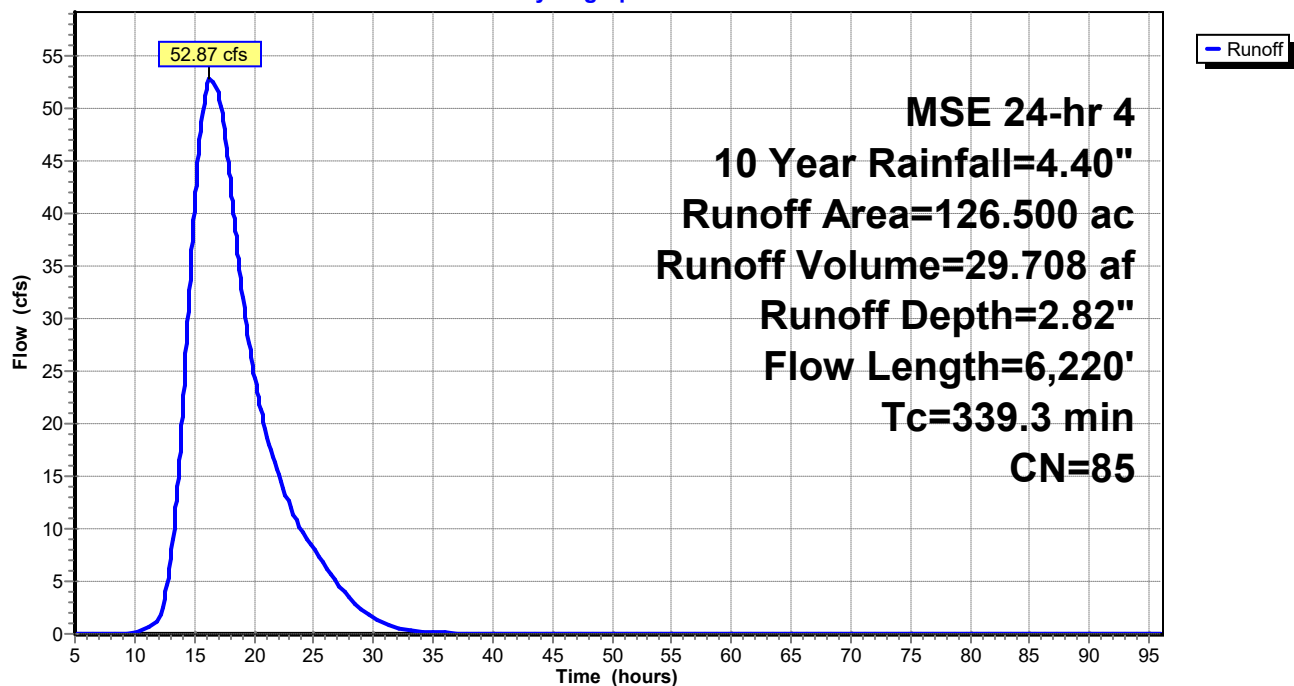
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 10 Year Rainfall=4.40"

Area (ac)	CN	Description
126.500	85	Row crops, straight row, Good, HSG C
126.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.0200	0.15		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
250.1	3,820	0.0008	0.25		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
77.8	2,300	0.0030	0.49		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
339.3	6,220	Total			

Subcatchment 2S: Northeast Watershed

Hydrograph



Summary for Subcatchment 3S: Direct Watershed

[47] Hint: Peak is 457% of capacity of segment #3

[47] Hint: Peak is 173% of capacity of segment #5

Runoff = 435.60 cfs @ 13.98 hrs, Volume= 130.529 af, Depth= 2.82"
 Routed to Pond 4P : Wetland Pool

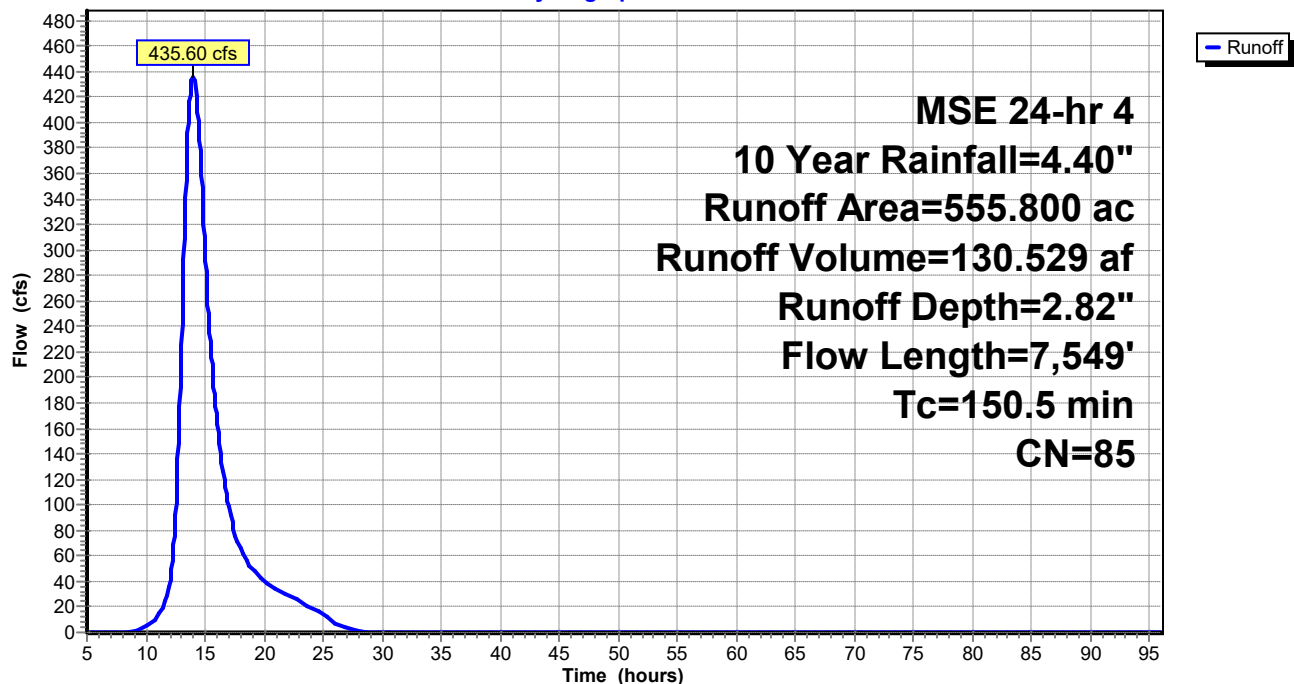
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 10 Year Rainfall=4.40"

Area (ac)	CN	Description
555.800	85	Row crops, straight row, Good, HSG C
555.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
44.1	952	0.0016	0.36		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
4.5	927	0.0065	3.41	95.39	Channel Flow, Ditch Area= 28.0 sf Perim= 28.2' r= 0.99' n= 0.035 Earth, dense weeds
70.5	3,070	0.0065	0.73		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
11.6	2,500	0.0053	3.61	252.43	Channel Flow, Area= 70.0 sf Perim= 70.0' r= 1.00' n= 0.030 Earth, grassed & winding
150.5	7,549	Total			

Subcatchment 3S: Direct Watershed

Hydrograph



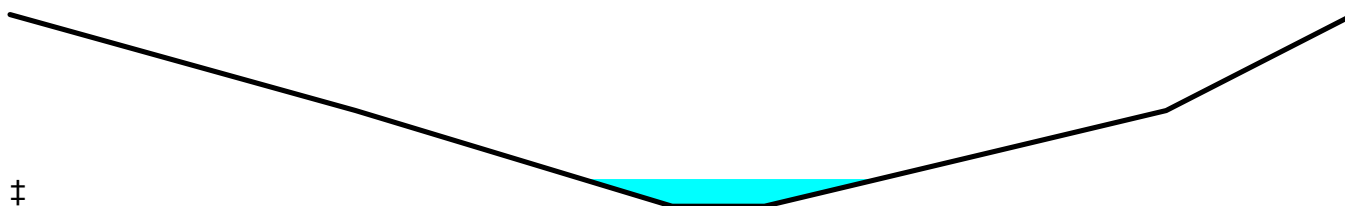
Summary for Reach 6R: North Waterway

Inflow Area = 308.000 ac, 0.00% Impervious, Inflow Depth = 2.82" for 10 Year event
 Inflow = 108.03 cfs @ 17.50 hrs, Volume= 72.334 af
 Outflow = 107.09 cfs @ 17.74 hrs, Volume= 72.334 af, Atten= 1%, Lag= 14.4 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.35 fps, Min. Travel Time= 20.9 min
 Avg. Velocity= 1.00 fps, Avg. Travel Time= 48.8 min

Peak Storage= 134,178 cf @ 17.74 hrs
 Average Depth at Peak Storage= 0.57', Surface Width= 122.07'
 Bank-Full Depth= 4.00' Flow Area= 1,256.0 sf, Capacity= 9,820.14 cfs

Custom cross-section, Length= 2,940.0' Slope= 0.0058 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,391.00', Outlet Invert= 1,374.00'

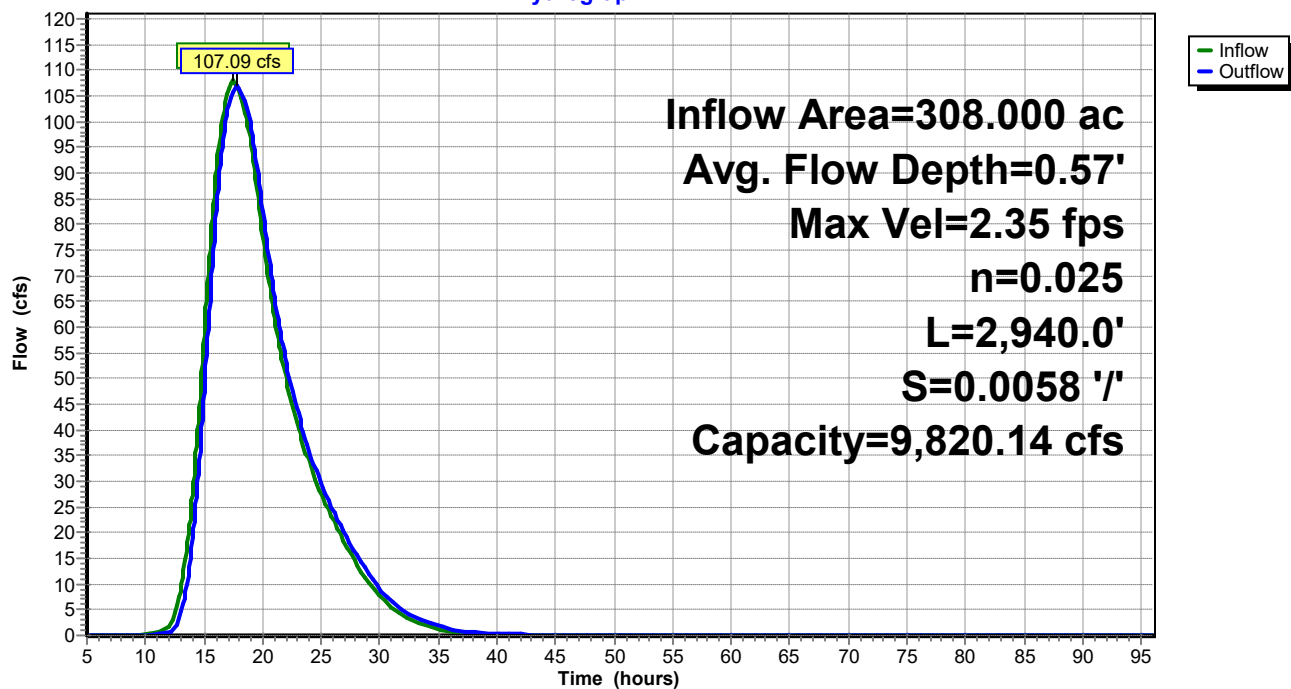


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,384.00	0.00
142.00	1,382.00	2.00
272.00	1,380.00	4.00
310.00	1,380.00	4.00
475.00	1,382.00	2.00
552.00	1,384.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	38.0	0.0	0	0.00
2.00	371.0	333.0	333.0	1,090,740	1,802.05
4.00	1,256.0	552.1	552.0	3,692,640	9,820.14

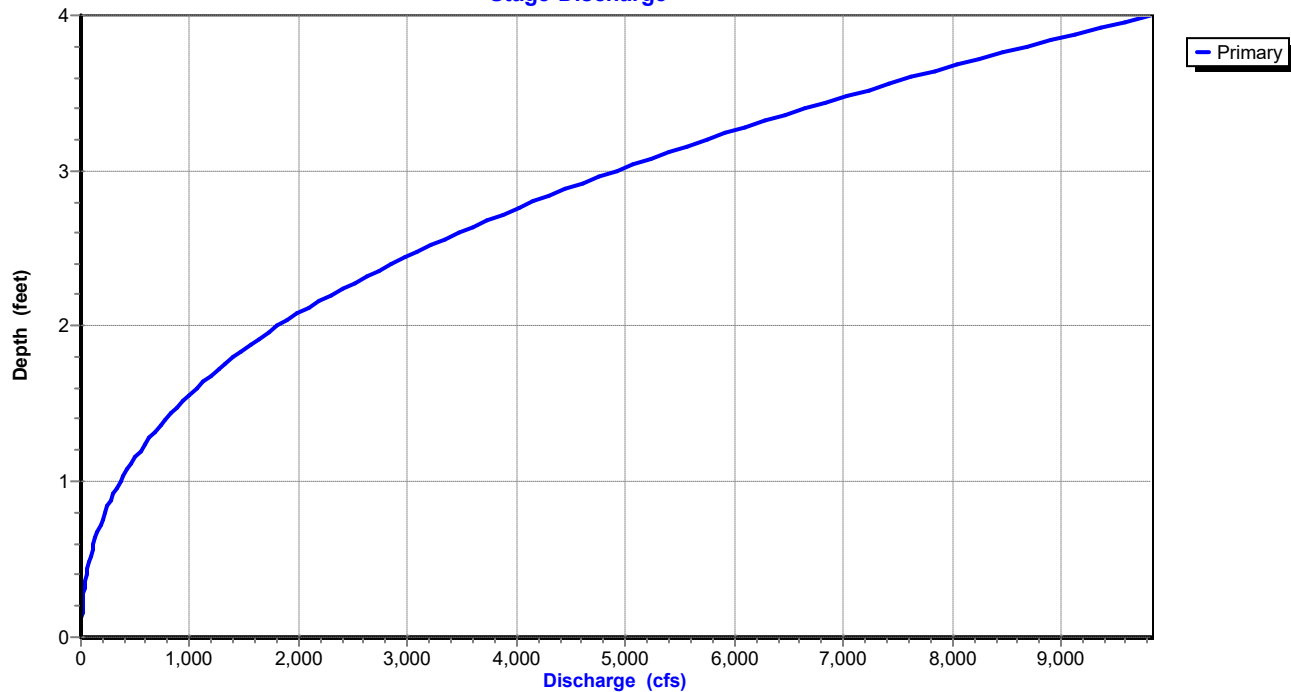
Reach 6R: North Waterway

Hydrograph

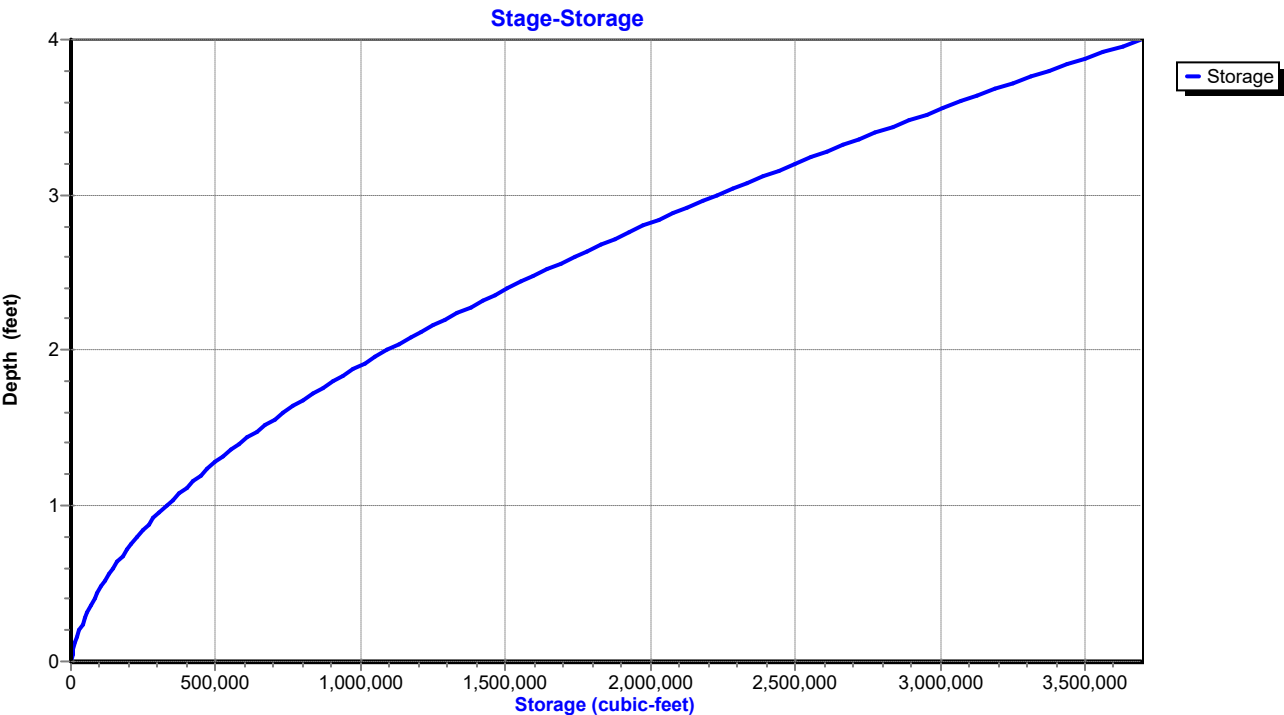


Reach 6R: North Waterway

Stage-Discharge



Reach 6R: North Waterway



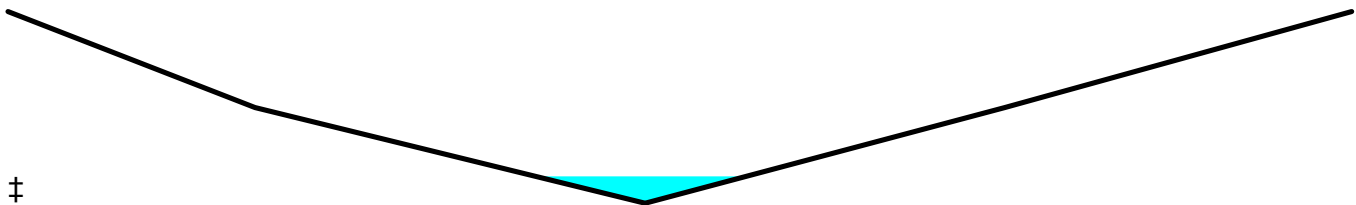
Summary for Reach 7R: NE Waterway

Inflow Area = 126.500 ac, 0.00% Impervious, Inflow Depth = 2.82" for 10 Year event
 Inflow = 52.87 cfs @ 16.27 hrs, Volume= 29.708 af
 Outflow = 51.53 cfs @ 17.02 hrs, Volume= 29.708 af, Atten= 3%, Lag= 45.1 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 1.89 fps, Min. Travel Time= 38.6 min
 Avg. Velocity= 0.69 fps, Avg. Travel Time= 106.3 min

Peak Storage= 119,399 cf @ 17.02 hrs
 Average Depth at Peak Storage= 0.56' , Surface Width= 97.16'
 Bank-Full Depth= 4.00' Flow Area= 1,312.0 sf, Capacity= 9,519.90 cfs

Custom cross-section, Length= 4,375.0' Slope= 0.0055 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,399.00', Outlet Invert= 1,375.00'

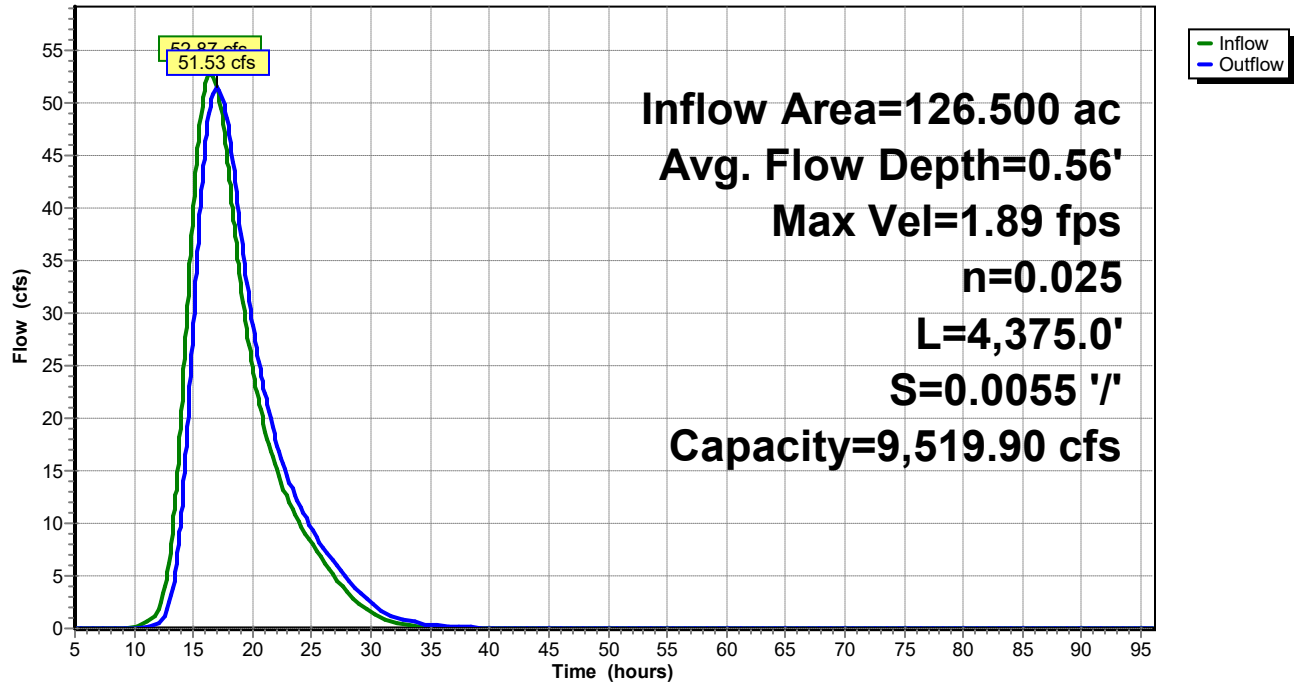


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,392.00	0.00
114.00	1,390.00	2.00
294.00	1,388.00	4.00
460.00	1,390.00	2.00
620.00	1,392.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	346.0	346.0	346.0	1,513,750	1,523.18
4.00	1,312.0	620.1	620.0	5,740,000	9,519.90

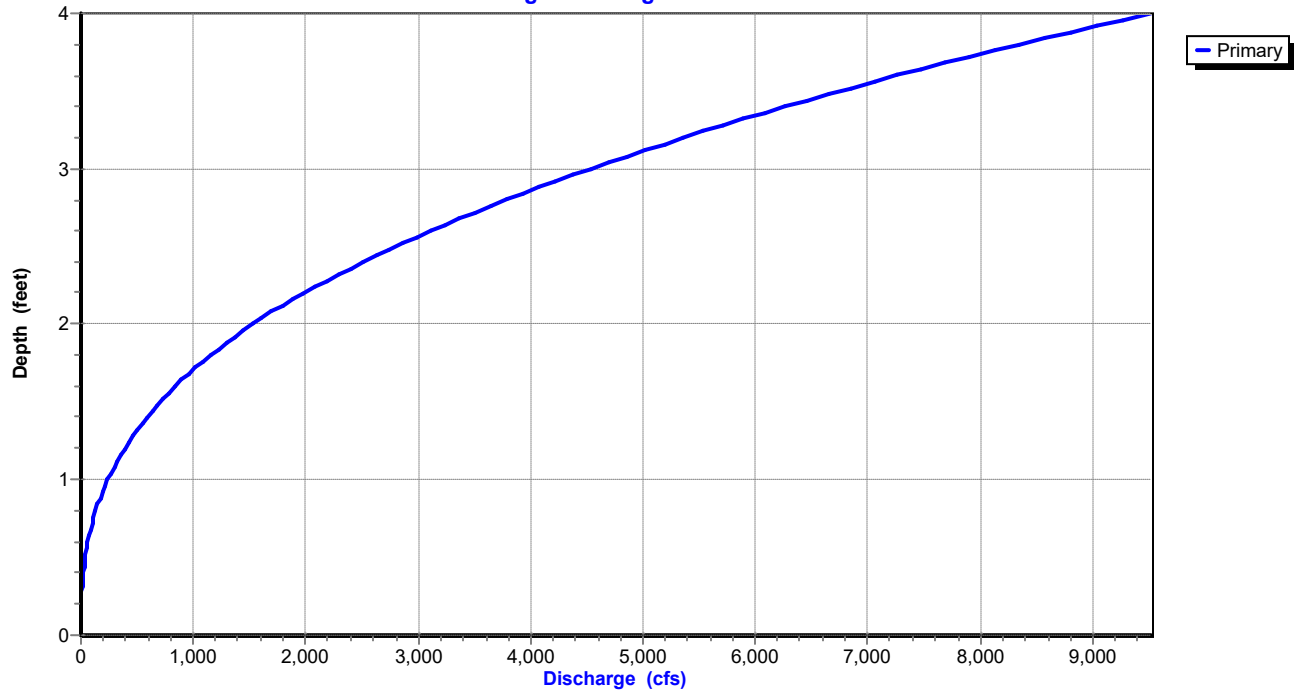
Reach 7R: NE Waterway

Hydrograph

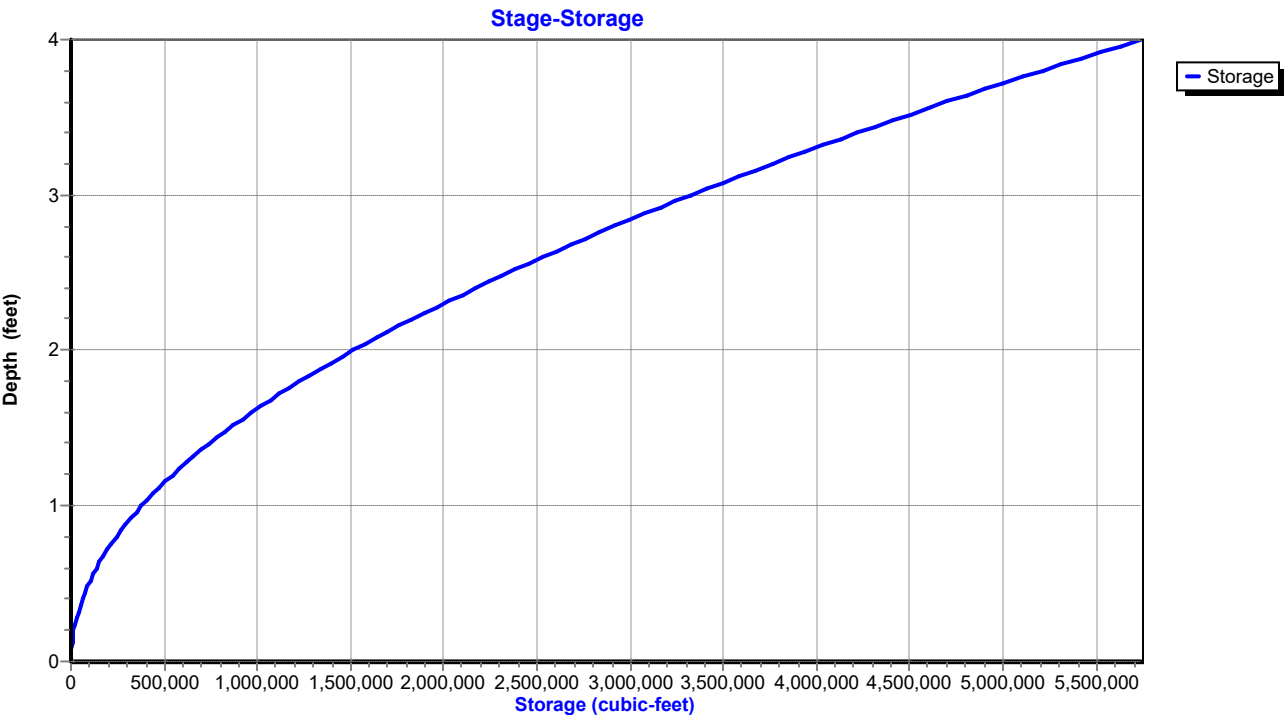


Reach 7R: NE Waterway

Stage-Discharge



Reach 7R: NE Waterway



Summary for Reach 8R: Combined Waterway

[62] Hint: Exceeded Reach 6R OUTLET depth by 1.05' @ 17.55 hrs

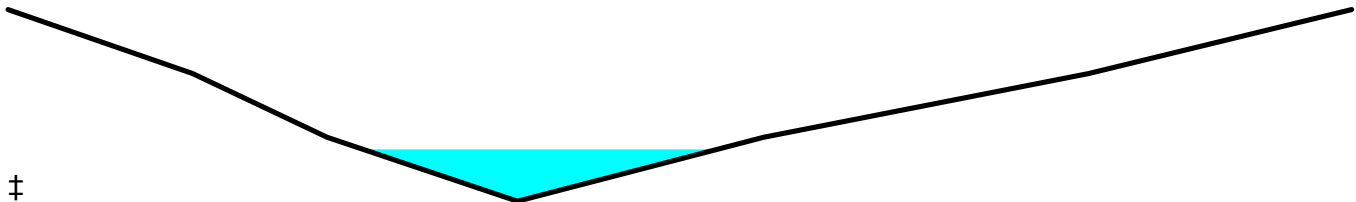
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.07' @ 18.00 hrs

Inflow Area = 434.500 ac, 0.00% Impervious, Inflow Depth = 2.82" for 10 Year event
 Inflow = 156.89 cfs @ 17.54 hrs, Volume= 102.042 af
 Outflow = 156.69 cfs @ 17.64 hrs, Volume= 102.042 af, Atten= 0%, Lag= 6.1 min
 Routed to Pond 4P : Wetland Pool

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 3.06 fps, Min. Travel Time= 9.2 min
 Avg. Velocity= 1.07 fps, Avg. Travel Time= 26.4 min

Peak Storage= 86,916 cf @ 17.64 hrs
 Average Depth at Peak Storage= 1.62', Surface Width= 63.15'
 Bank-Full Depth= 6.00' Flow Area= 716.0 sf, Capacity= 5,235.03 cfs

Custom cross-section, Length= 1,700.0' Slope= 0.0035 '/' (102 Elevation Intervals)
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,374.00', Outlet Invert= 1,368.00'

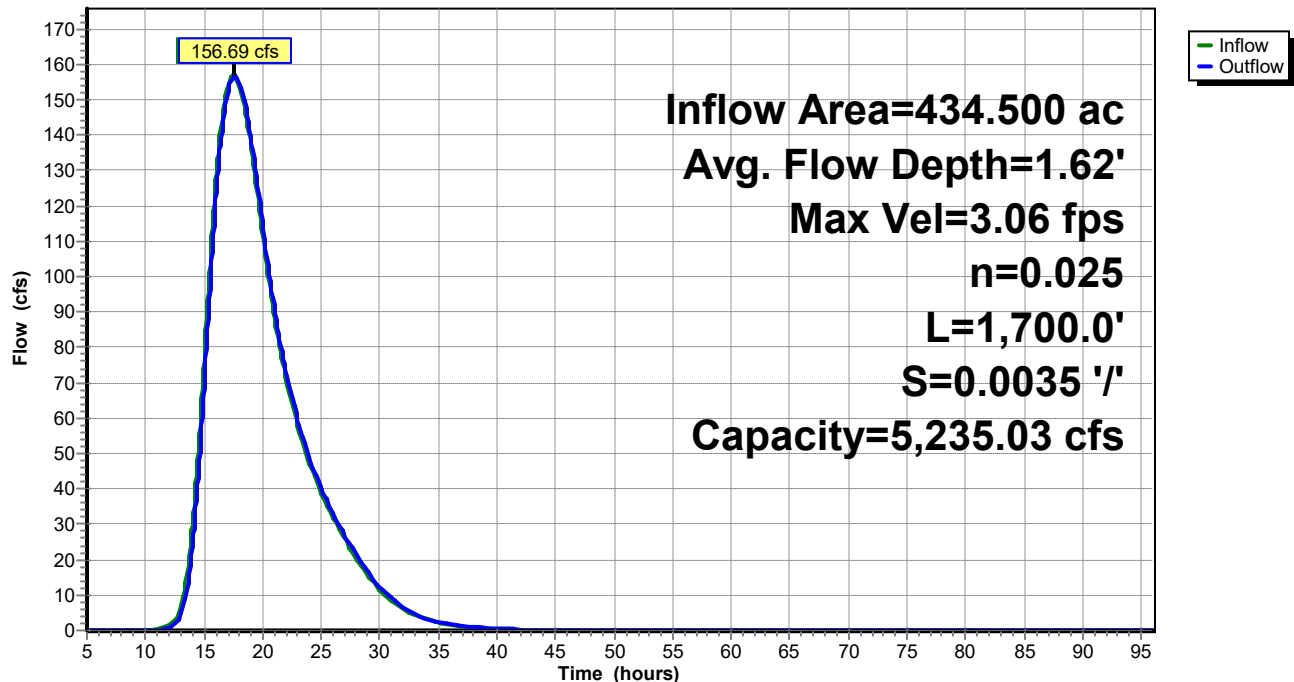


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,374.00	0.00
33.00	1,372.00	2.00
57.00	1,370.00	4.00
91.00	1,368.00	6.00
135.00	1,370.00	4.00
193.00	1,372.00	2.00
240.00	1,374.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	78.0	78.1	78.0	132,600	275.19
4.00	316.0	160.2	160.0	537,200	1,754.93
6.00	716.0	240.3	240.0	1,217,200	5,235.03

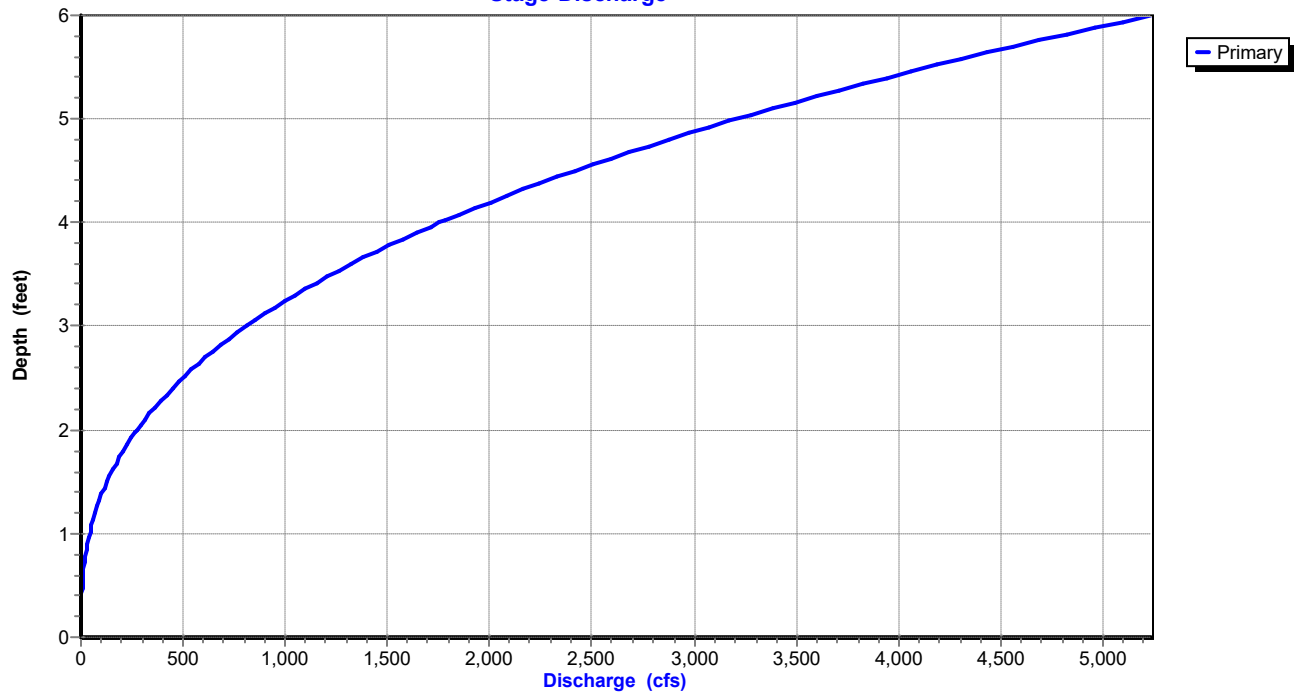
Reach 8R: Combined Waterway

Hydrograph

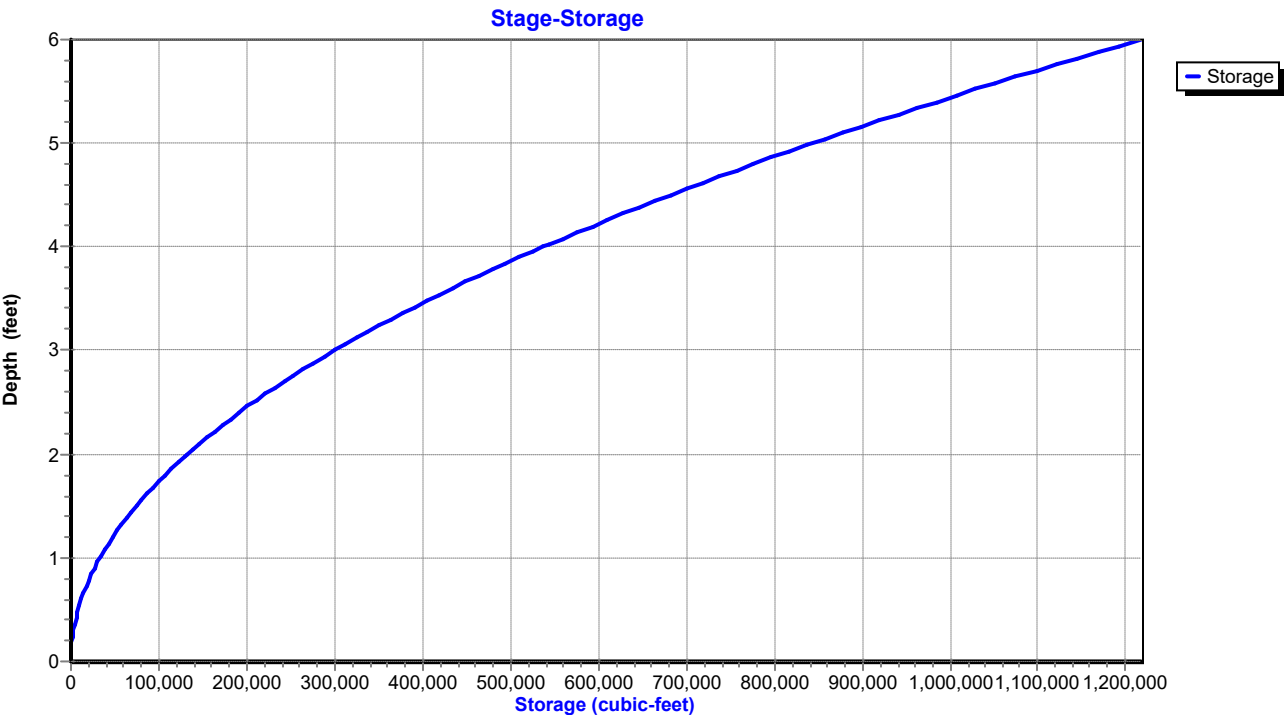


Reach 8R: Combined Waterway

Stage-Discharge



Reach 8R: Combined Waterway



Summary for Pond 4P: Wetland Pool

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 2.82" for 10 Year event
 Inflow = 460.68 cfs @ 14.05 hrs, Volume= 232.572 af
 Outflow = 452.37 cfs @ 14.33 hrs, Volume= 232.571 af, Atten= 2%, Lag= 17.1 min
 Primary = 452.37 cfs @ 14.33 hrs, Volume= 232.571 af
 Routed to Pond 5P : Box Culvert

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,360.00' Surf.Area= 5.363 ac Storage= 11.648 af
 Peak Elev= 1,362.01' @ 14.33 hrs Surf.Area= 5.994 ac Storage= 23.104 af (11.456 af above start)

Plug-Flow detention time= 77.2 min calculated for 220.801 af (95% of inflow)
 Center-of-Mass det. time= 25.1 min (1,080.4 - 1,055.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,355.00'	39.394 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,355.00	0.032	0.000	0.000
1,356.00	0.633	0.333	0.333
1,357.00	1.085	0.859	1.192
1,358.00	2.130	1.607	2.799
1,359.00	5.103	3.616	6.415
1,360.00	5.363	5.233	11.648
1,361.00	5.727	5.545	17.193
1,362.00	5.992	5.859	23.053
1,362.50	6.130	3.030	26.083
1,363.00	6.366	3.124	29.207
1,364.00	6.896	6.631	35.838
1,364.50	7.326	3.556	39.394

Device	Routing	Invert	Outlet Devices
#1	Primary	1,360.00'	49.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	1,362.75'	35.0' long + 3.0' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

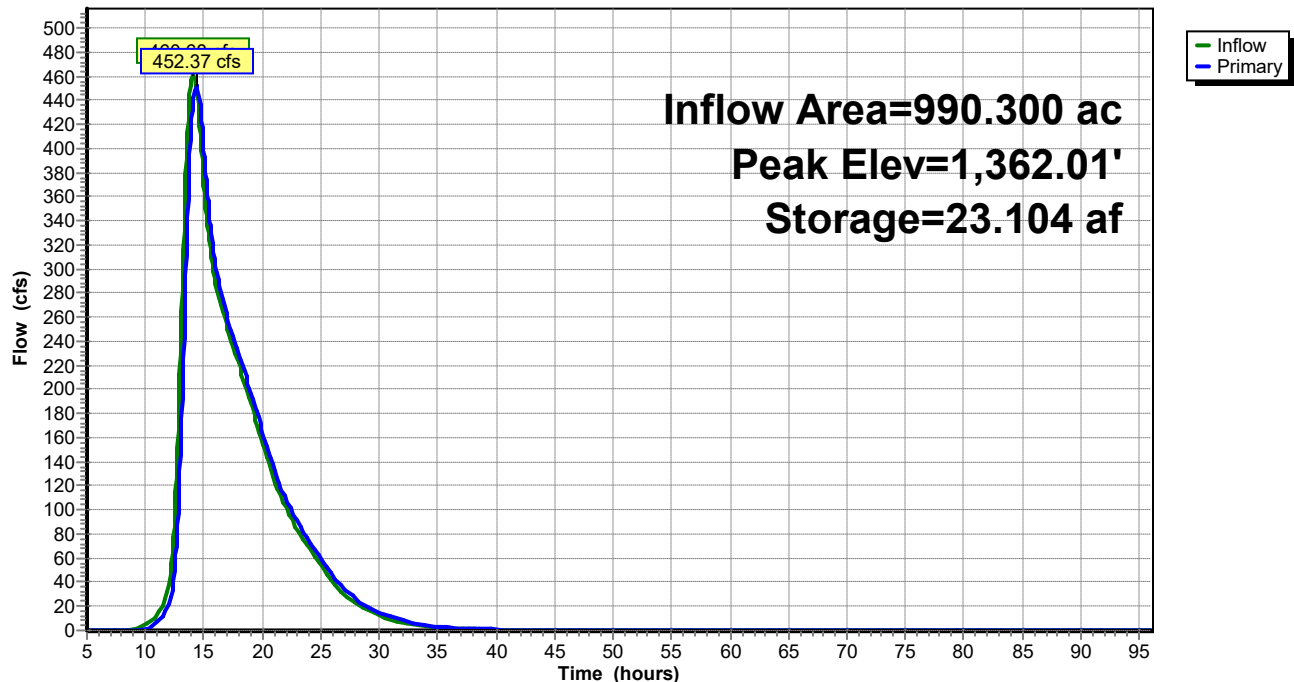
Primary OutFlow Max=452.29 cfs @ 14.33 hrs HW=1,362.01' TW=1,358.58' (Dynamic Tailwater)

1=Sharp-Crested Rectangular Weir (Weir Controls 452.29 cfs @ 4.63 fps)

2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

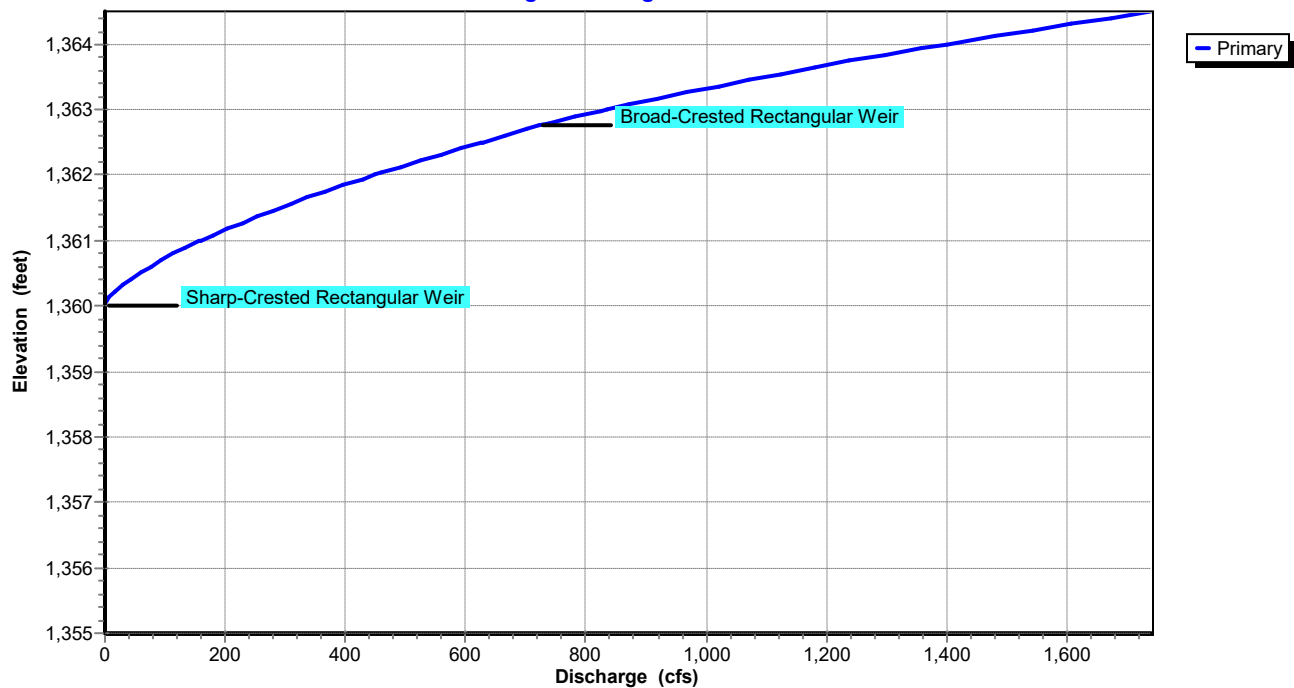
Pond 4P: Wetland Pool

Hydrograph

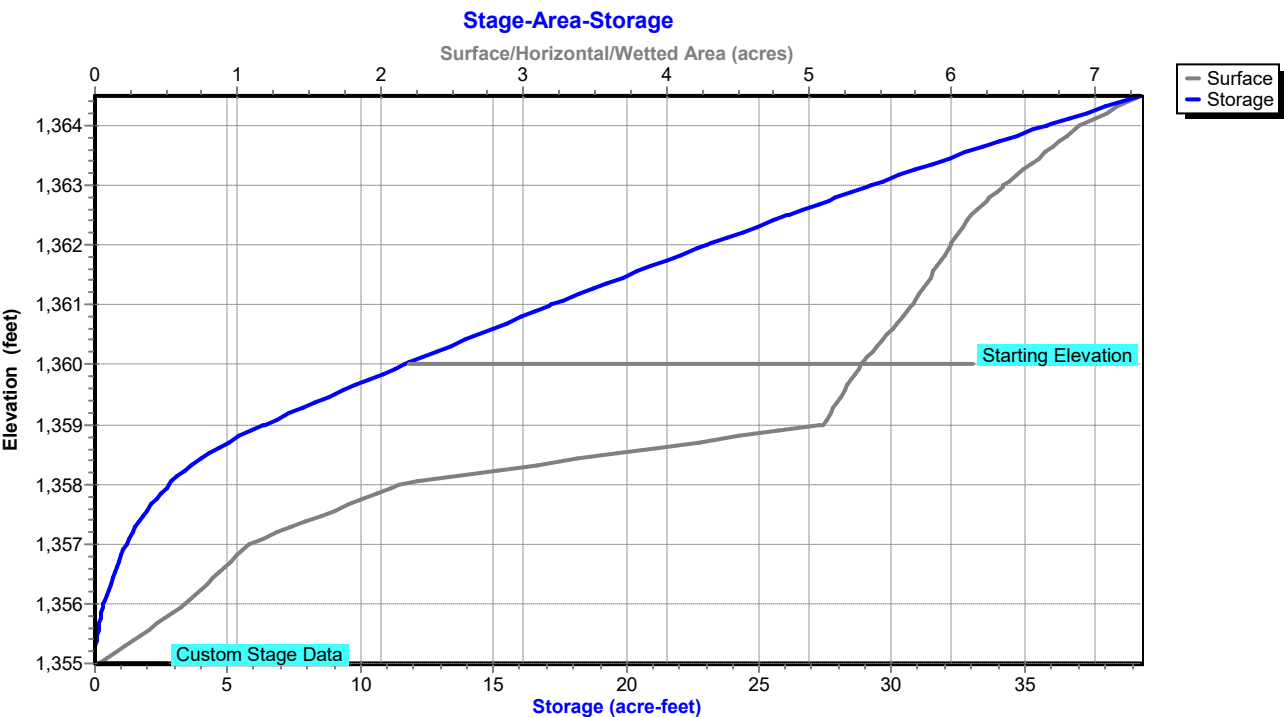


Pond 4P: Wetland Pool

Stage-Discharge



Pond 4P: Wetland Pool



Summary for Pond 5P: Box Culvert

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 2.82" for 10 Year event
 Inflow = 452.37 cfs @ 14.33 hrs, Volume= 232.571 af
 Outflow = 451.41 cfs @ 14.41 hrs, Volume= 233.088 af, Atten= 0%, Lag= 4.7 min
 Primary = 451.41 cfs @ 14.41 hrs, Volume= 233.088 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Starting Elev= 1,353.00' Surf.Area= 0.053 ac Storage= 0.089 af

Peak Elev= 1,358.60' @ 14.41 hrs Surf.Area= 0.381 ac Storage= 1.177 af (1.088 af above start)

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,349.00'	2.676 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,349.00	0.000	0.000	0.000
1,350.00	0.007	0.004	0.004
1,351.00	0.017	0.012	0.016
1,352.00	0.039	0.028	0.043
1,353.00	0.053	0.046	0.089
1,354.00	0.068	0.061	0.150
1,355.00	0.145	0.106	0.256
1,356.00	0.202	0.173	0.430
1,357.00	0.263	0.233	0.662
1,358.00	0.337	0.300	0.962
1,359.00	0.411	0.374	1.337
1,360.00	0.509	0.460	1.797
1,361.00	0.612	0.561	2.357
1,361.50	0.664	0.319	2.676

Device	Routing	Invert	Outlet Devices
#1	Primary	1,349.25'	72.0" W x 72.0" H Box Box Culvert L= 50.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 1,349.25' / 1,348.88' S= 0.0074 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 36.00 sf
#2	Secondary	1,359.83'	Roadway, Cv= 2.62 (C= 3.28) Elev. (feet) 1,359.83 1,360.00 1,360.50 1,361.00 1,361.50 1,362.00 Width (feet) 0.00 61.56 116.46 160.90 195.03 228.25

Primary OutFlow Max=451.33 cfs @ 14.41 hrs HW=1,358.60' (Free Discharge)

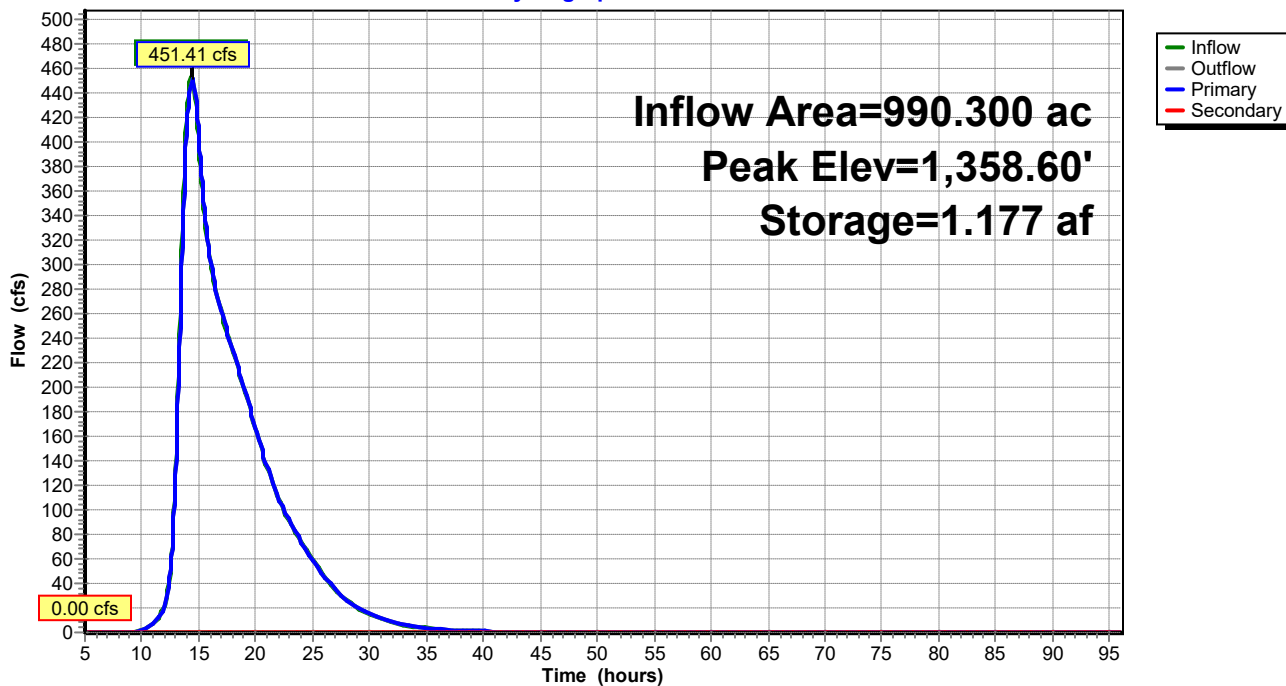
↑ **1=Box Culvert** (Barrel Controls 451.33 cfs @ 12.54 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,353.00' (Free Discharge)

↑ **2=Roadway** (Controls 0.00 cfs)

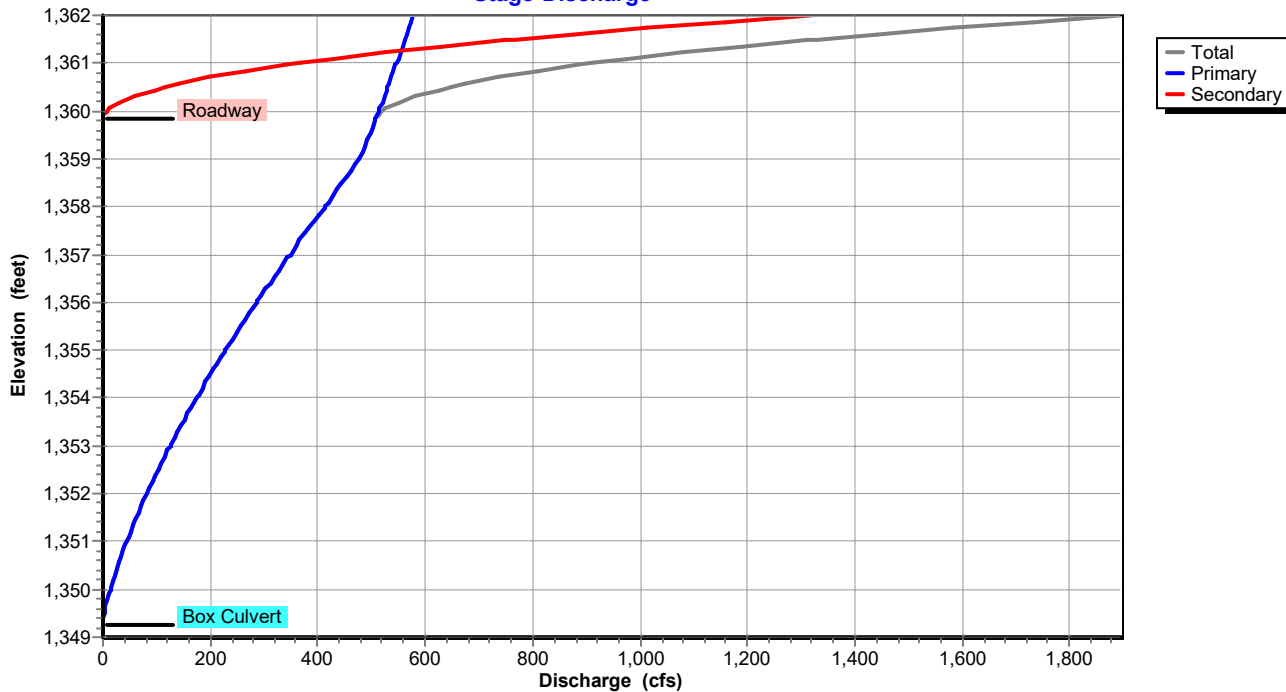
Pond 5P: Box Culvert

Hydrograph



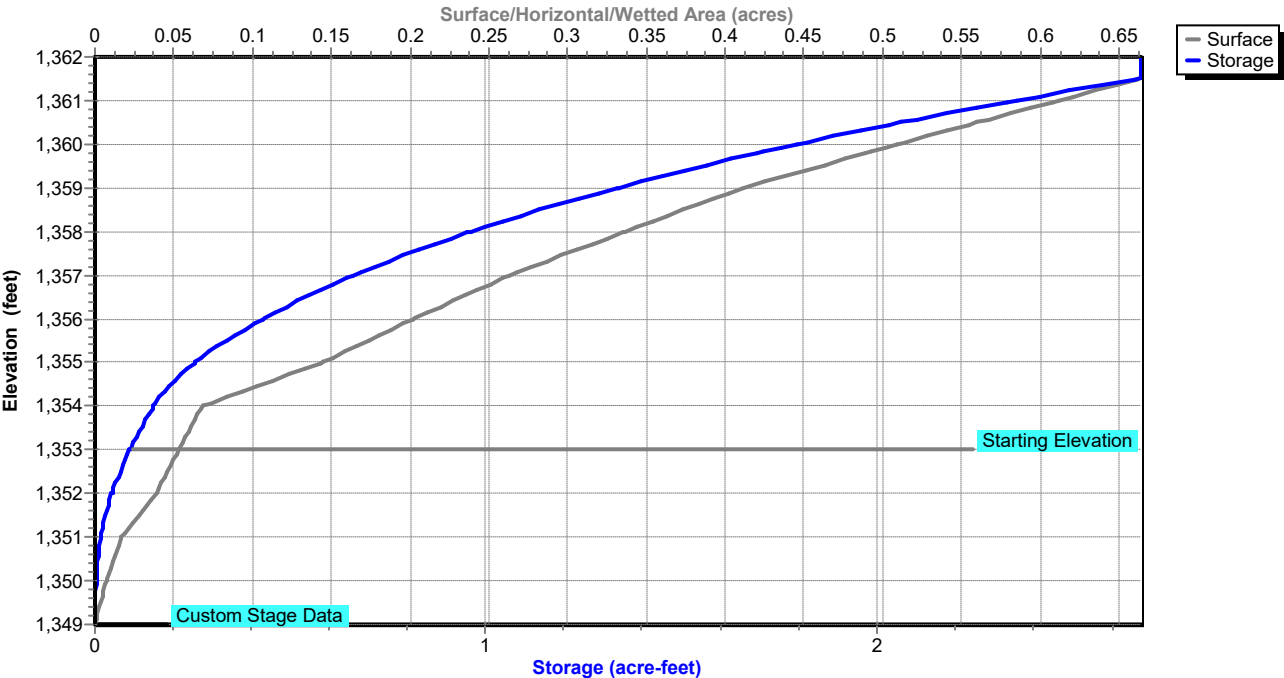
Pond 5P: Box Culvert

Stage-Discharge



Pond 5P: Box Culvert

Stage-Area-Storage



Kracht HydroCAD

Prepared by Bolton & Menk, Inc

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MSE 24-hr 4 25 Year Rainfall=5.60"

Printed 4/29/2026

Page 47

Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northwest Watershed Runoff Area=308.000 ac 0.00% Impervious Runoff Depth=3.93"
Flow Length=7,732' Tc=425.4 min CN=85 Runoff=150.94 cfs 100.780 af

Subcatchment 2S: Northeast Watershed Runoff Area=126.500 ac 0.00% Impervious Runoff Depth=3.93"
Flow Length=6,220' Tc=339.3 min CN=85 Runoff=73.92 cfs 41.392 af

Subcatchment 3S: Direct Watershed Runoff Area=555.800 ac 0.00% Impervious Runoff Depth=3.93"
Flow Length=7,549' Tc=150.5 min CN=85 Runoff=606.96 cfs 181.862 af

Reach 6R: North Waterway Avg. Flow Depth=0.67' Max Vel=2.57 fps Inflow=150.94 cfs 100.780 af
n=0.025 L=2,940.0' S=0.0058 '/' Capacity=9,820.14 cfs Outflow=149.82 cfs 100.780 af

Reach 7R: NE Waterway Avg. Flow Depth=0.64' Max Vel=2.05 fps Inflow=73.92 cfs 41.392 af
n=0.025 L=4,375.0' S=0.0055 '/' Capacity=9,519.90 cfs Outflow=72.18 cfs 41.392 af

Reach 8R: Combined Waterway Avg. Flow Depth=1.84' Max Vel=3.33 fps Inflow=219.23 cfs 142.172 af
n=0.025 L=1,700.0' S=0.0035 '/' Capacity=5,235.03 cfs Outflow=219.06 cfs 142.172 af

Pond 4P: Wetland Pool Peak Elev=1,362.57' Storage=26.518 af Inflow=647.68 cfs 324.034 af
Outflow=633.70 cfs 324.033 af

Pond 5P: Box Culvert Peak Elev=1,360.47' Storage=2.045 af Inflow=633.70 cfs 324.033 af
Primary=529.33 cfs 315.866 af Secondary=104.28 cfs 8.684 af Outflow=633.61 cfs 324.550 af

Total Runoff Area = 990.300 ac Runoff Volume = 324.034 af Average Runoff Depth = 3.93"
100.00% Pervious = 990.300 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Northwest Watershed

Runoff = 150.94 cfs @ 17.49 hrs, Volume= 100.780 af, Depth= 3.93"

Routed to Reach 6R : North Waterway

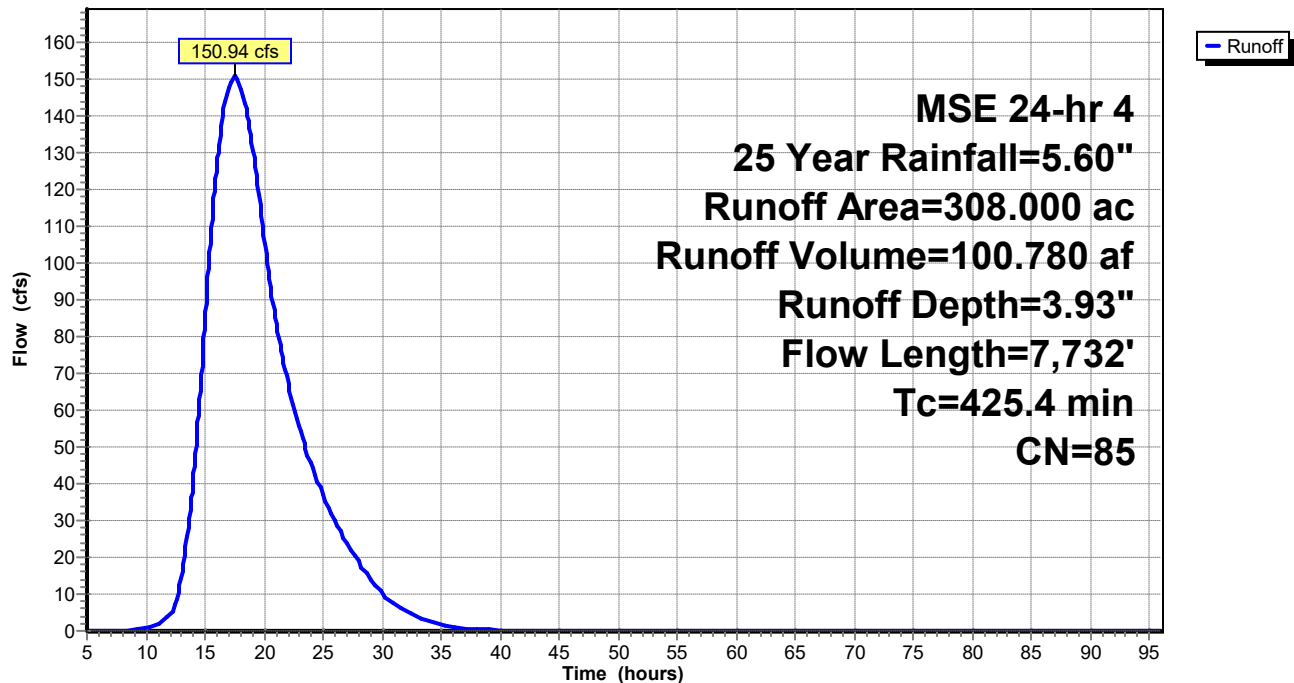
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
MSE 24-hr 4 25 Year Rainfall=5.60"

Area (ac)	CN	Description
308.000	85	Row crops, straight row, Good, HSG C
308.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
311.9	4,125	0.0006	0.22		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
93.7	3,507	0.0048	0.62		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
425.4	7,732	Total			

Subcatchment 1S: Northwest Watershed

Hydrograph



Summary for Subcatchment 2S: Northeast Watershed

Runoff = 73.92 cfs @ 16.25 hrs, Volume= 41.392 af, Depth= 3.93"
 Routed to Reach 7R : NE Waterway

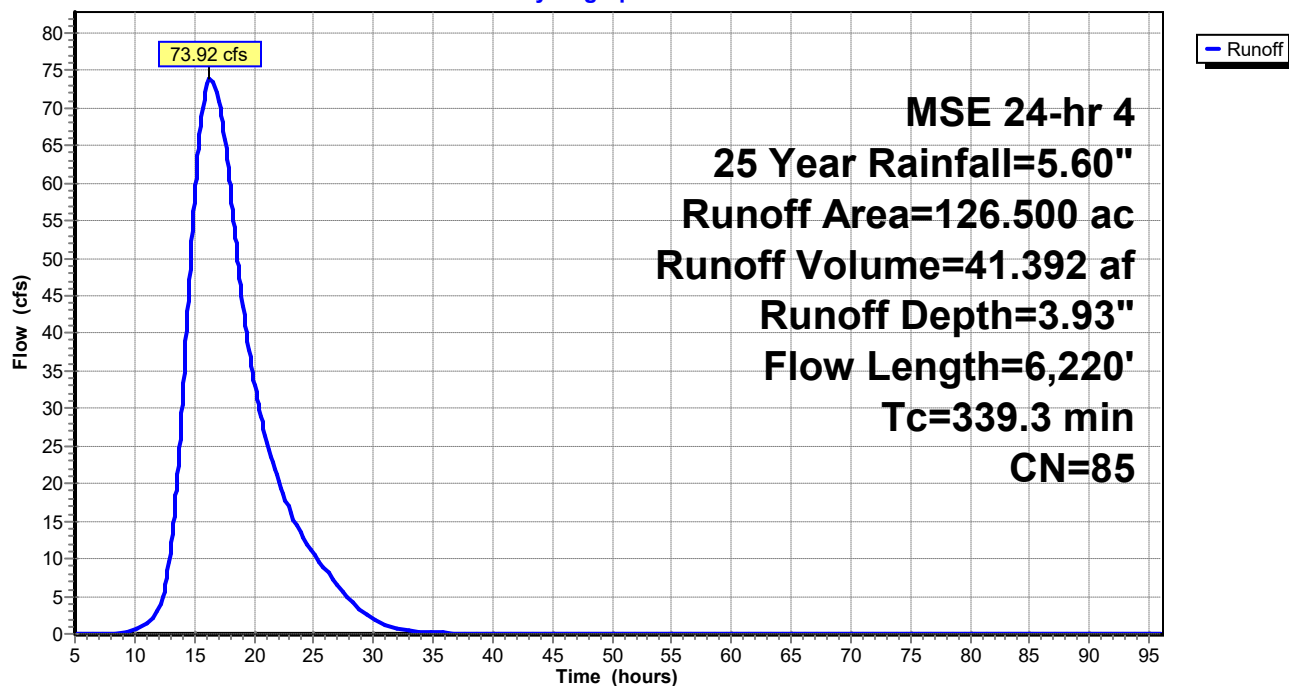
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 25 Year Rainfall=5.60"

Area (ac)	CN	Description
126.500	85	Row crops, straight row, Good, HSG C
126.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.0200	0.15		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
250.1	3,820	0.0008	0.25		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
77.8	2,300	0.0030	0.49		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
339.3	6,220	Total			

Subcatchment 2S: Northeast Watershed

Hydrograph



Summary for Subcatchment 3S: Direct Watershed

[47] Hint: Peak is 636% of capacity of segment #3

[47] Hint: Peak is 240% of capacity of segment #5

Runoff = 606.96 cfs @ 13.92 hrs, Volume= 181.862 af, Depth= 3.93"
 Routed to Pond 4P : Wetland Pool

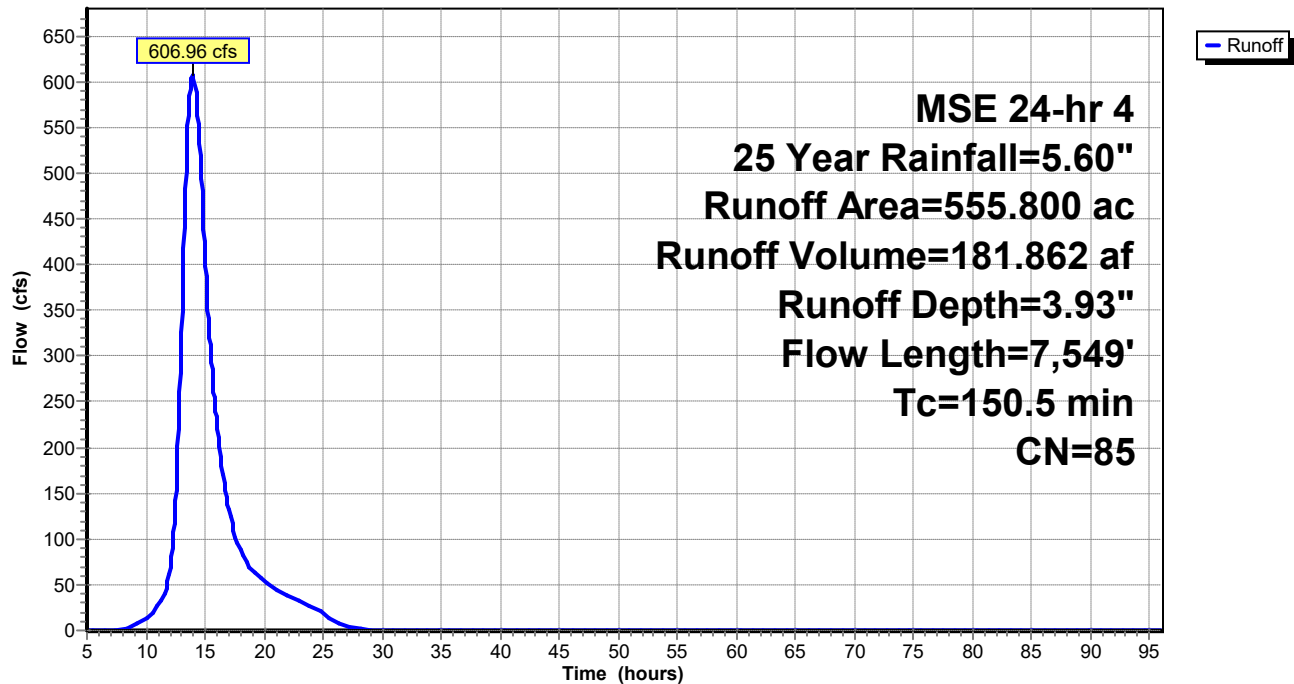
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 25 Year Rainfall=5.60"

Area (ac)	CN	Description
555.800	85	Row crops, straight row, Good, HSG C
555.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
44.1	952	0.0016	0.36		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
4.5	927	0.0065	3.41	95.39	Channel Flow, Ditch Area= 28.0 sf Perim= 28.2' r= 0.99' n= 0.035 Earth, dense weeds
70.5	3,070	0.0065	0.73		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
11.6	2,500	0.0053	3.61	252.43	Channel Flow, Area= 70.0 sf Perim= 70.0' r= 1.00' n= 0.030 Earth, grassed & winding
150.5	7,549	Total			

Subcatchment 3S: Direct Watershed

Hydrograph



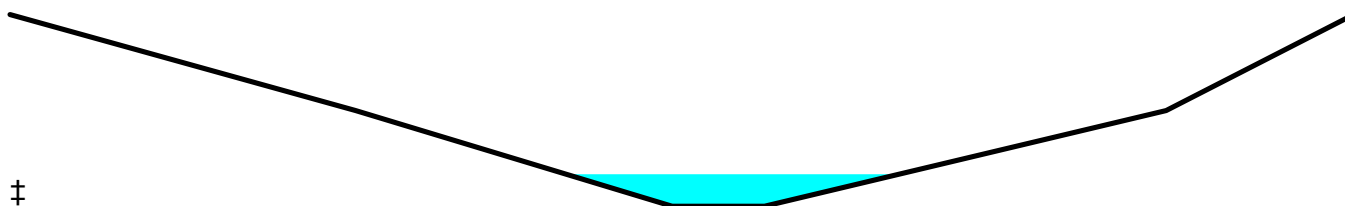
Summary for Reach 6R: North Waterway

Inflow Area = 308.000 ac, 0.00% Impervious, Inflow Depth = 3.93" for 25 Year event
 Inflow = 150.94 cfs @ 17.49 hrs, Volume= 100.780 af
 Outflow = 149.82 cfs @ 17.67 hrs, Volume= 100.780 af, Atten= 1%, Lag= 10.8 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.57 fps, Min. Travel Time= 19.1 min
 Avg. Velocity= 1.07 fps, Avg. Travel Time= 45.9 min

Peak Storage= 171,693 cf @ 17.67 hrs
 Average Depth at Peak Storage= 0.67', Surface Width= 136.62'
 Bank-Full Depth= 4.00' Flow Area= 1,256.0 sf, Capacity= 9,820.14 cfs

Custom cross-section, Length= 2,940.0' Slope= 0.0058 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,391.00', Outlet Invert= 1,374.00'



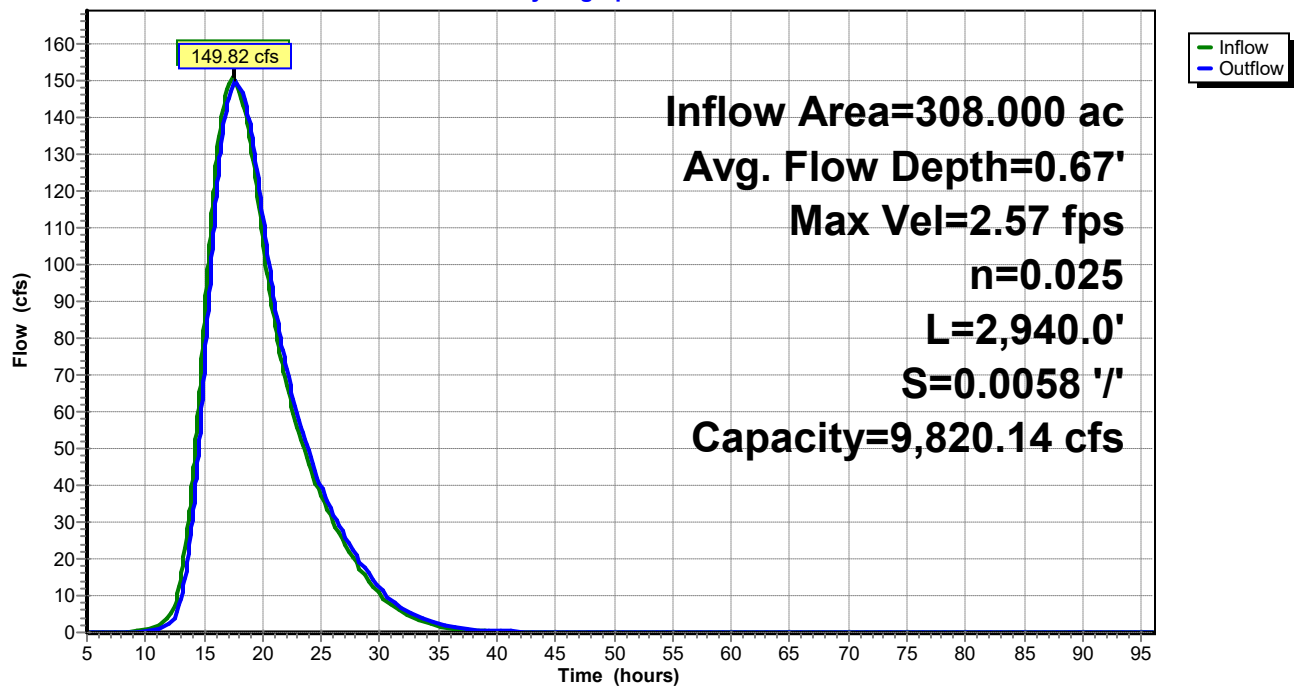
‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,384.00	0.00
142.00	1,382.00	2.00
272.00	1,380.00	4.00
310.00	1,380.00	4.00
475.00	1,382.00	2.00
552.00	1,384.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	38.0	0.0	0	0.00
2.00	371.0	333.0	333.0	1,090,740	1,802.05
4.00	1,256.0	552.1	552.0	3,692,640	9,820.14

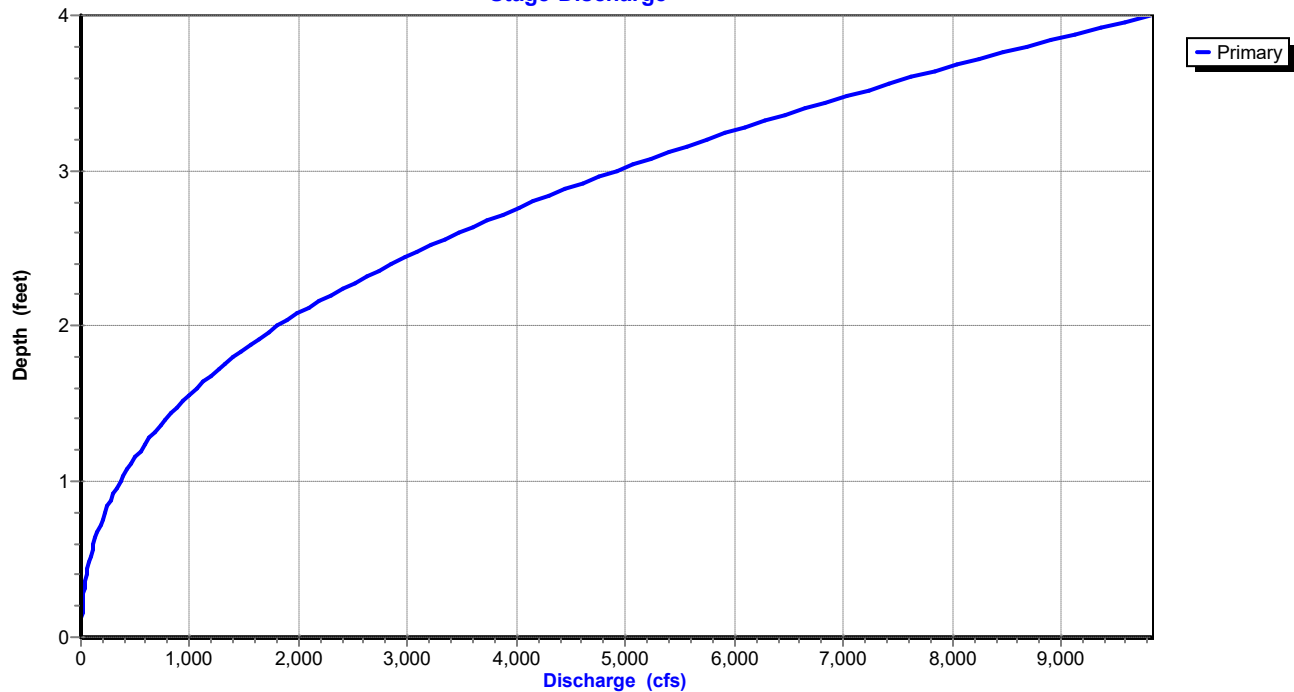
Reach 6R: North Waterway

Hydrograph

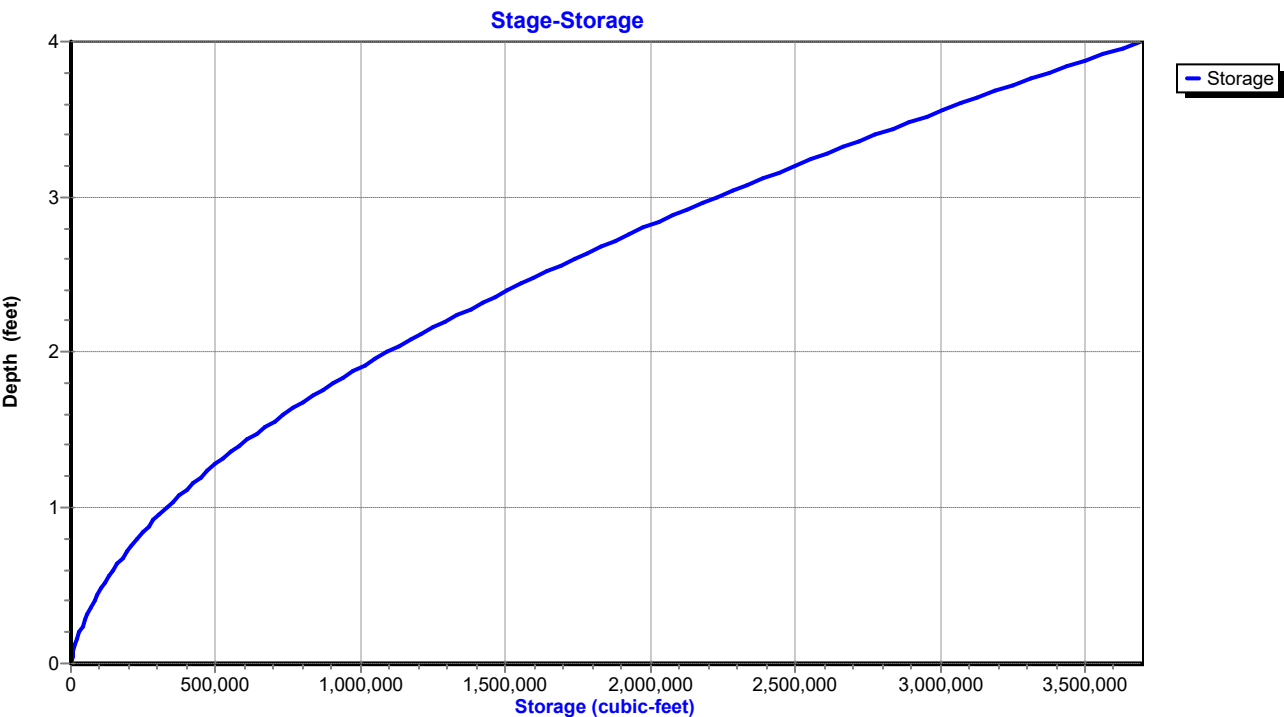


Reach 6R: North Waterway

Stage-Discharge



Reach 6R: North Waterway



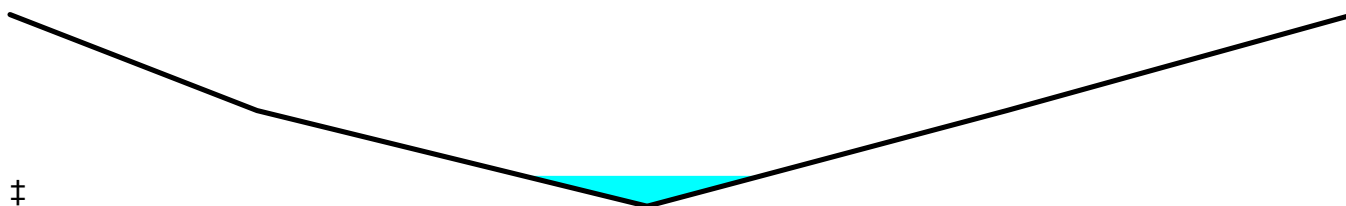
Summary for Reach 7R: NE Waterway

Inflow Area = 126.500 ac, 0.00% Impervious, Inflow Depth = 3.93" for 25 Year event
 Inflow = 73.92 cfs @ 16.25 hrs, Volume= 41.392 af
 Outflow = 72.18 cfs @ 16.93 hrs, Volume= 41.392 af, Atten= 2%, Lag= 40.6 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.05 fps, Min. Travel Time= 35.5 min
 Avg. Velocity= 0.73 fps, Avg. Travel Time= 100.5 min

Peak Storage= 153,715 cf @ 16.93 hrs
 Average Depth at Peak Storage= 0.64' , Surface Width= 110.24'
 Bank-Full Depth= 4.00' Flow Area= 1,312.0 sf, Capacity= 9,519.90 cfs

Custom cross-section, Length= 4,375.0' Slope= 0.0055 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,399.00', Outlet Invert= 1,375.00'

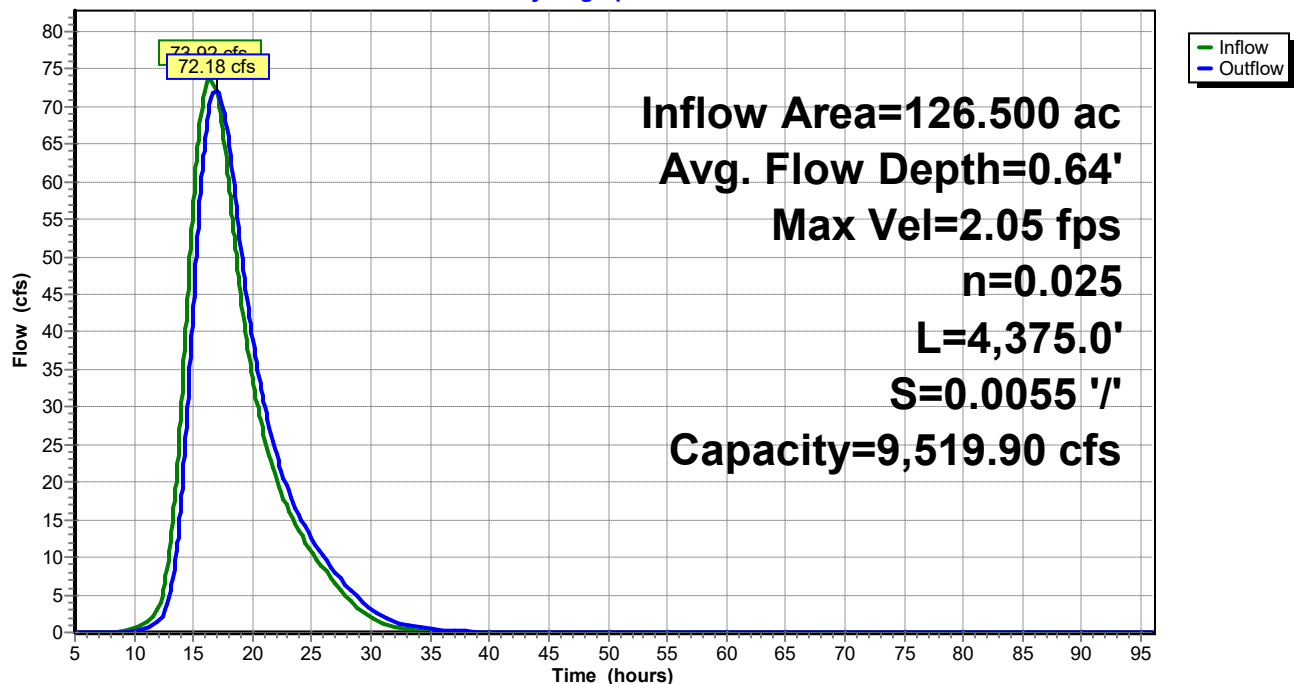


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,392.00	0.00
114.00	1,390.00	2.00
294.00	1,388.00	4.00
460.00	1,390.00	2.00
620.00	1,392.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	346.0	346.0	346.0	1,513,750	1,523.18
4.00	1,312.0	620.1	620.0	5,740,000	9,519.90

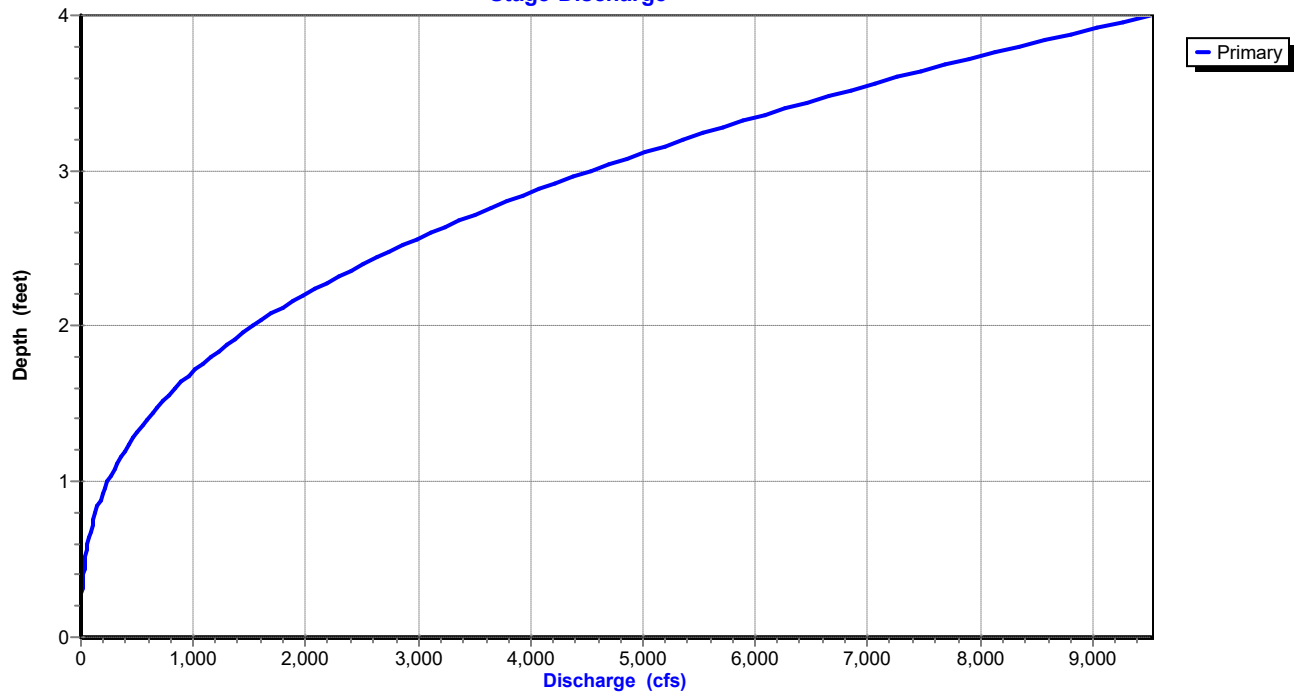
Reach 7R: NE Waterway

Hydrograph

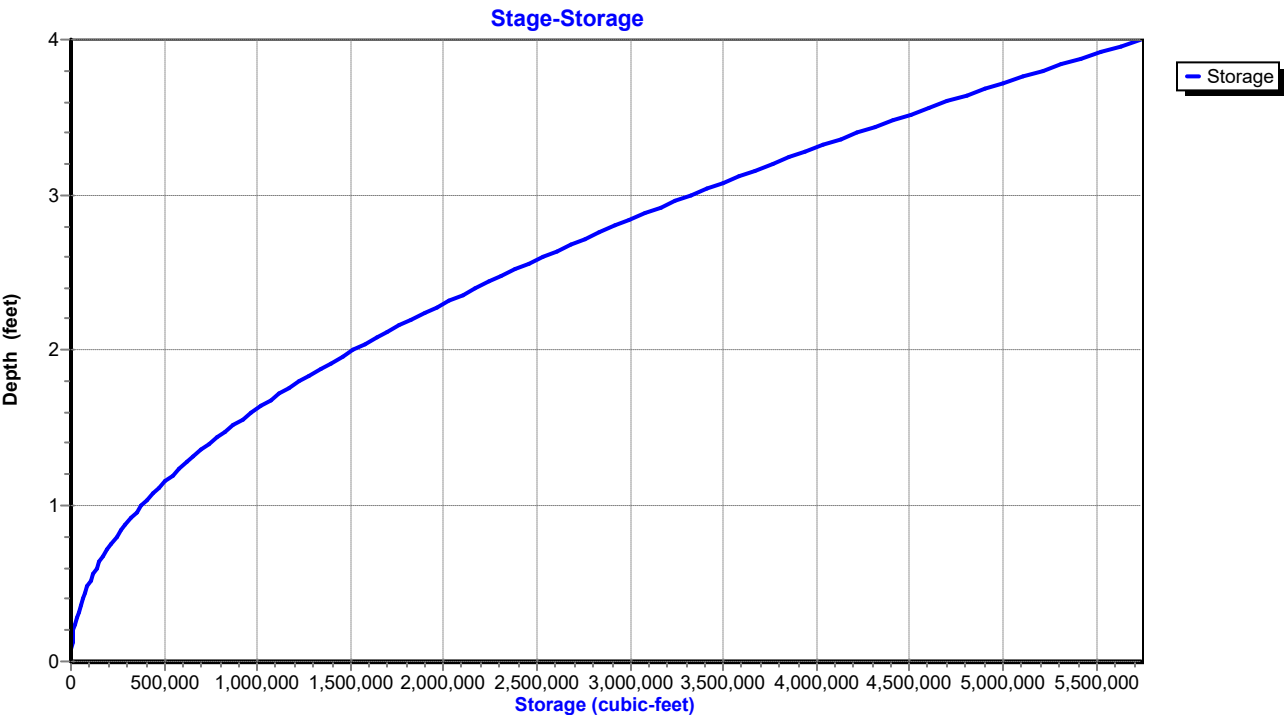


Reach 7R: NE Waterway

Stage-Discharge



Reach 7R: NE Waterway



Summary for Reach 8R: Combined Waterway

[62] Hint: Exceeded Reach 6R OUTLET depth by 1.17' @ 17.35 hrs

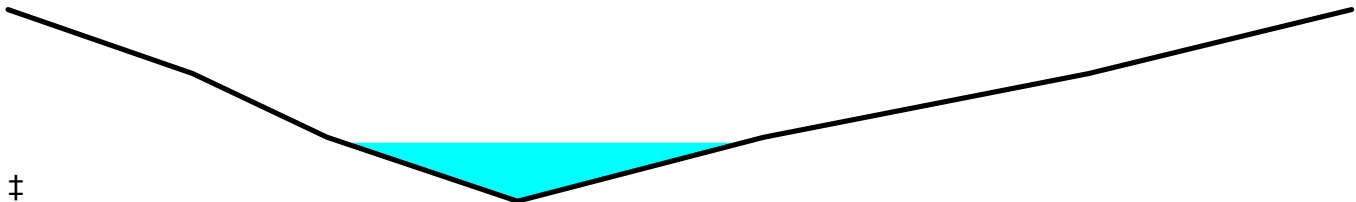
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.21' @ 17.90 hrs

Inflow Area = 434.500 ac, 0.00% Impervious, Inflow Depth = 3.93" for 25 Year event
 Inflow = 219.23 cfs @ 17.48 hrs, Volume= 142.172 af
 Outflow = 219.06 cfs @ 17.57 hrs, Volume= 142.172 af, Atten= 0%, Lag= 5.0 min
 Routed to Pond 4P : Wetland Pool

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 3.33 fps, Min. Travel Time= 8.5 min
 Avg. Velocity= 1.14 fps, Avg. Travel Time= 24.8 min

Peak Storage= 111,729 cf @ 17.57 hrs
 Average Depth at Peak Storage= 1.84' , Surface Width= 71.59'
 Bank-Full Depth= 6.00' Flow Area= 716.0 sf, Capacity= 5,235.03 cfs

Custom cross-section, Length= 1,700.0' Slope= 0.0035 '/' (102 Elevation Intervals)
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,374.00', Outlet Invert= 1,368.00'

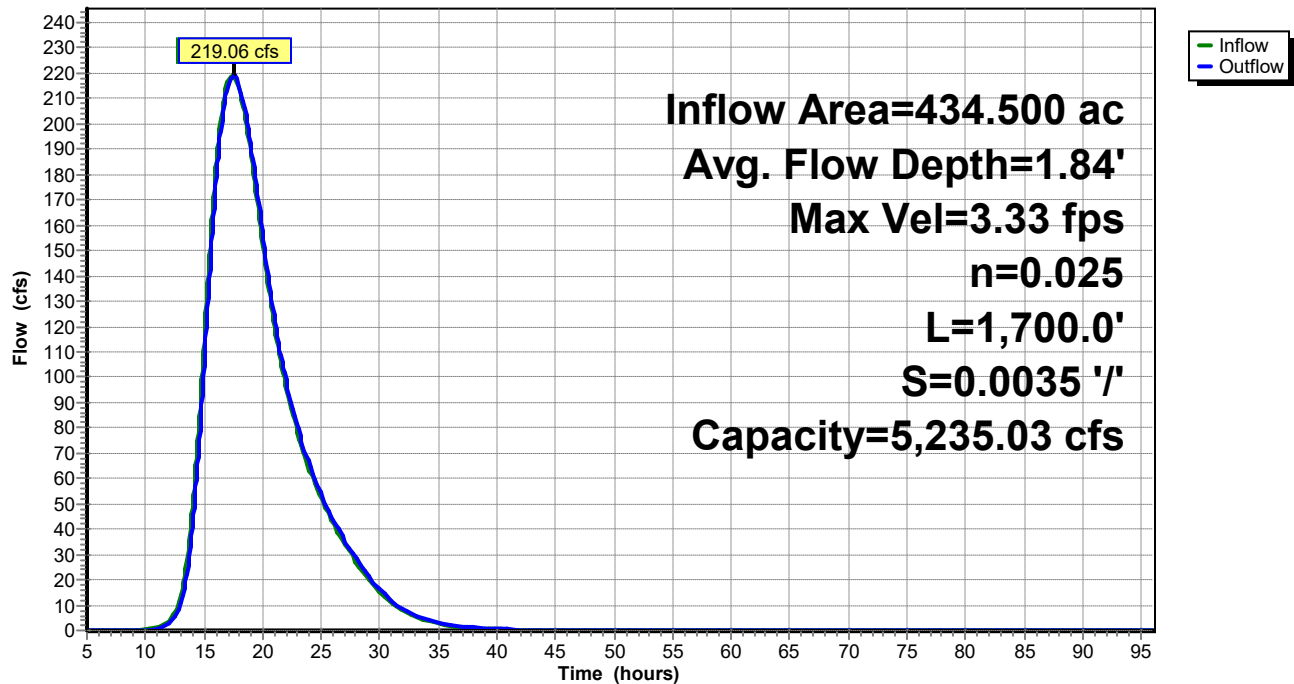


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,374.00	0.00
33.00	1,372.00	2.00
57.00	1,370.00	4.00
91.00	1,368.00	6.00
135.00	1,370.00	4.00
193.00	1,372.00	2.00
240.00	1,374.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	78.0	78.1	78.0	132,600	275.19
4.00	316.0	160.2	160.0	537,200	1,754.93
6.00	716.0	240.3	240.0	1,217,200	5,235.03

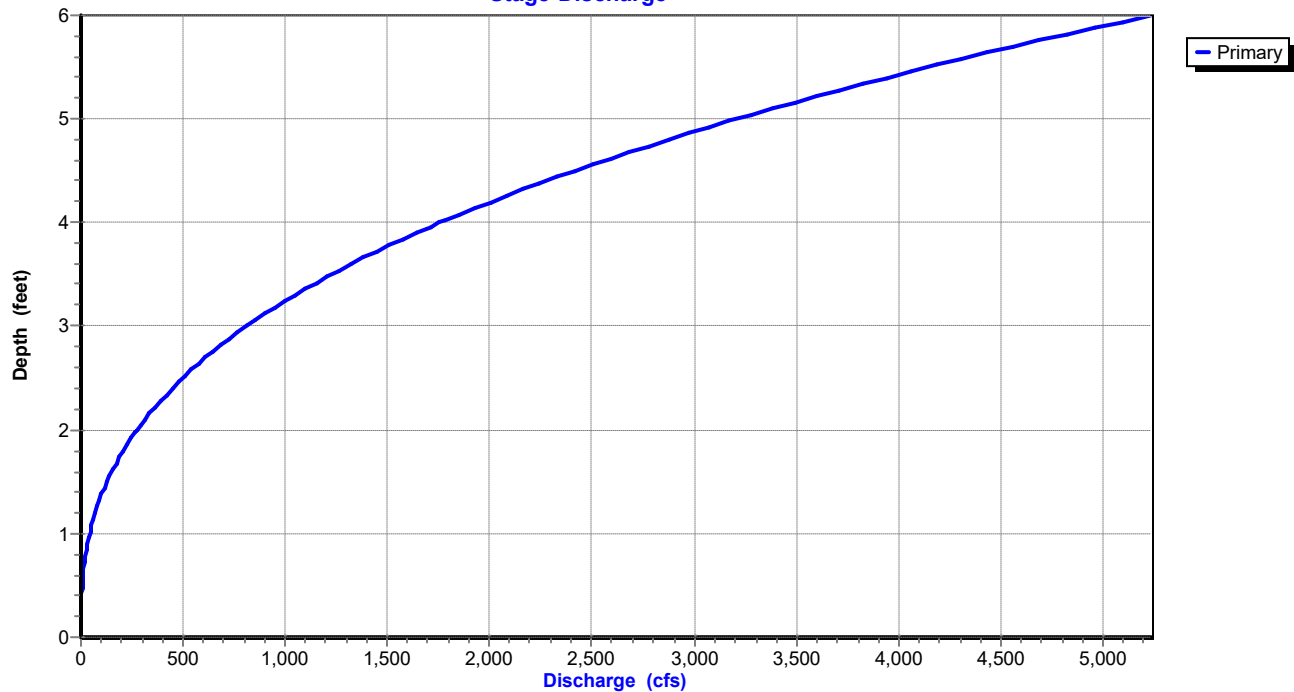
Reach 8R: Combined Waterway

Hydrograph

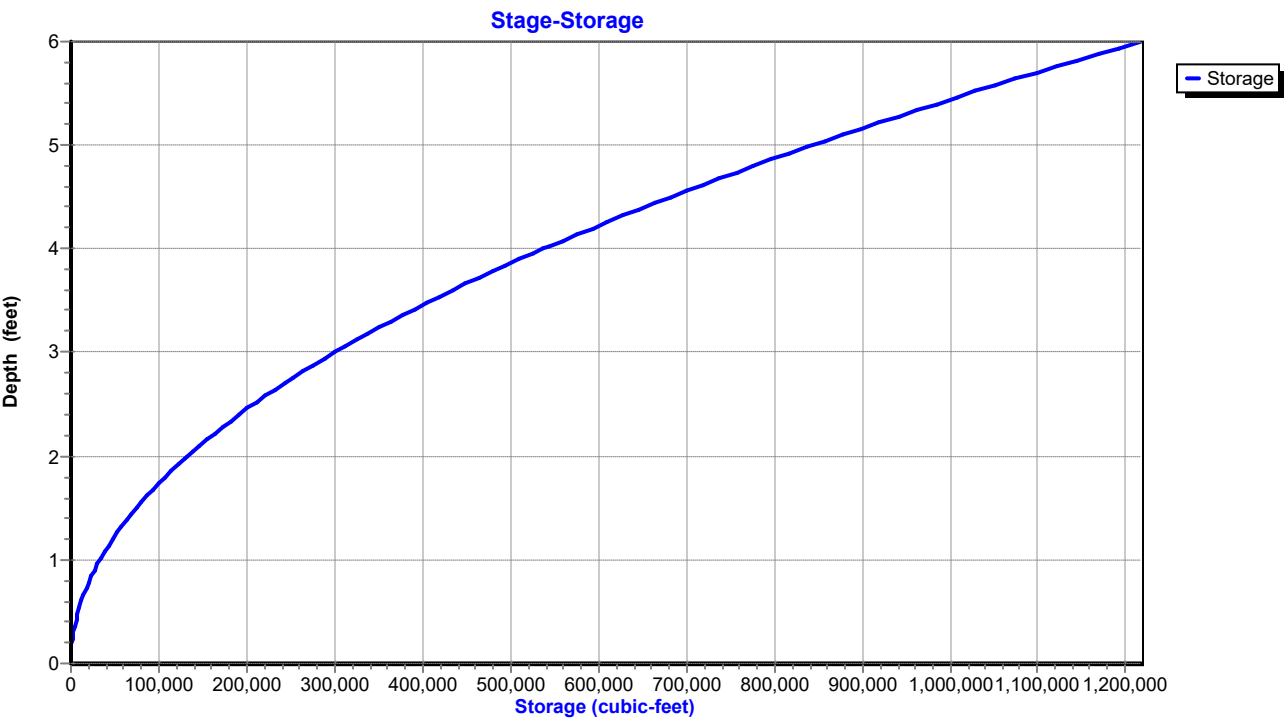


Reach 8R: Combined Waterway

Stage-Discharge



Reach 8R: Combined Waterway



Summary for Pond 4P: Wetland Pool

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 3.93" for 25 Year event
 Inflow = 647.68 cfs @ 14.06 hrs, Volume= 324.034 af
 Outflow = 633.70 cfs @ 14.32 hrs, Volume= 324.033 af, Atten= 2%, Lag= 15.6 min
 Primary = 633.70 cfs @ 14.32 hrs, Volume= 324.033 af
 Routed to Pond 5P : Box Culvert

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,360.00' Surf.Area= 5.363 ac Storage= 11.648 af
 Peak Elev= 1,362.57' @ 14.33 hrs Surf.Area= 6.163 ac Storage= 26.518 af (14.869 af above start)

Plug-Flow detention time= 62.5 min calculated for 312.213 af (96% of inflow)
 Center-of-Mass det. time= 22.8 min (1,068.7 - 1,045.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,355.00'	39.394 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,355.00	0.032	0.000	0.000
1,356.00	0.633	0.333	0.333
1,357.00	1.085	0.859	1.192
1,358.00	2.130	1.607	2.799
1,359.00	5.103	3.616	6.415
1,360.00	5.363	5.233	11.648
1,361.00	5.727	5.545	17.193
1,362.00	5.992	5.859	23.053
1,362.50	6.130	3.030	26.083
1,363.00	6.366	3.124	29.207
1,364.00	6.896	6.631	35.838
1,364.50	7.326	3.556	39.394

Device	Routing	Invert	Outlet Devices
#1	Primary	1,360.00'	49.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	1,362.75'	35.0' long + 3.0' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

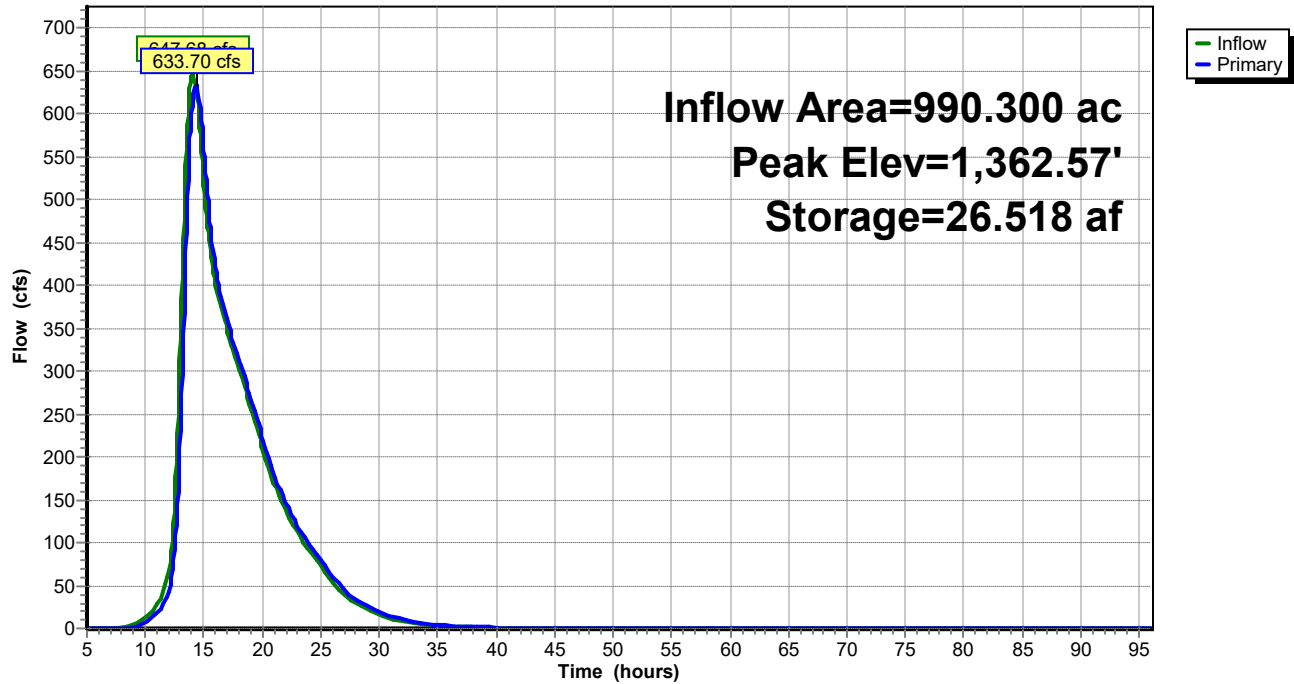
Primary OutFlow Max=633.36 cfs @ 14.32 hrs HW=1,362.57' TW=1,360.47' (Dynamic Tailwater)

1=Sharp-Crested Rectangular Weir (Weir Controls 633.36 cfs @ 5.08 fps)

2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

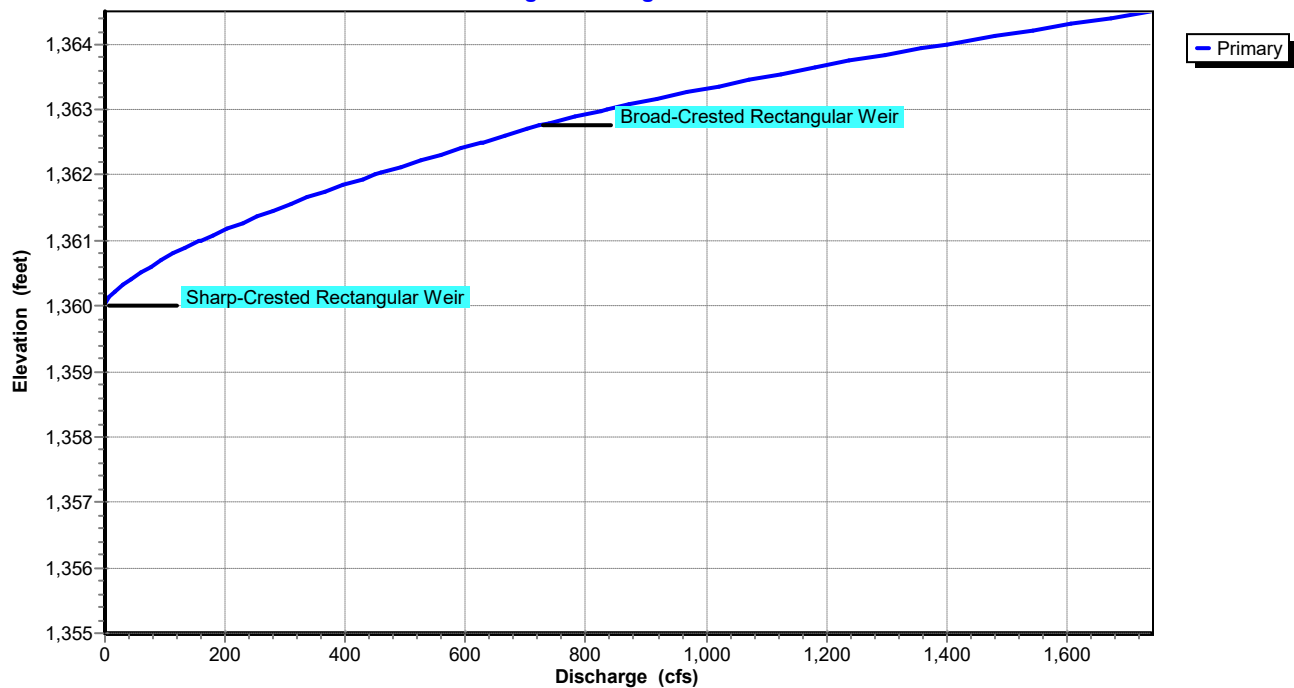
Pond 4P: Wetland Pool

Hydrograph



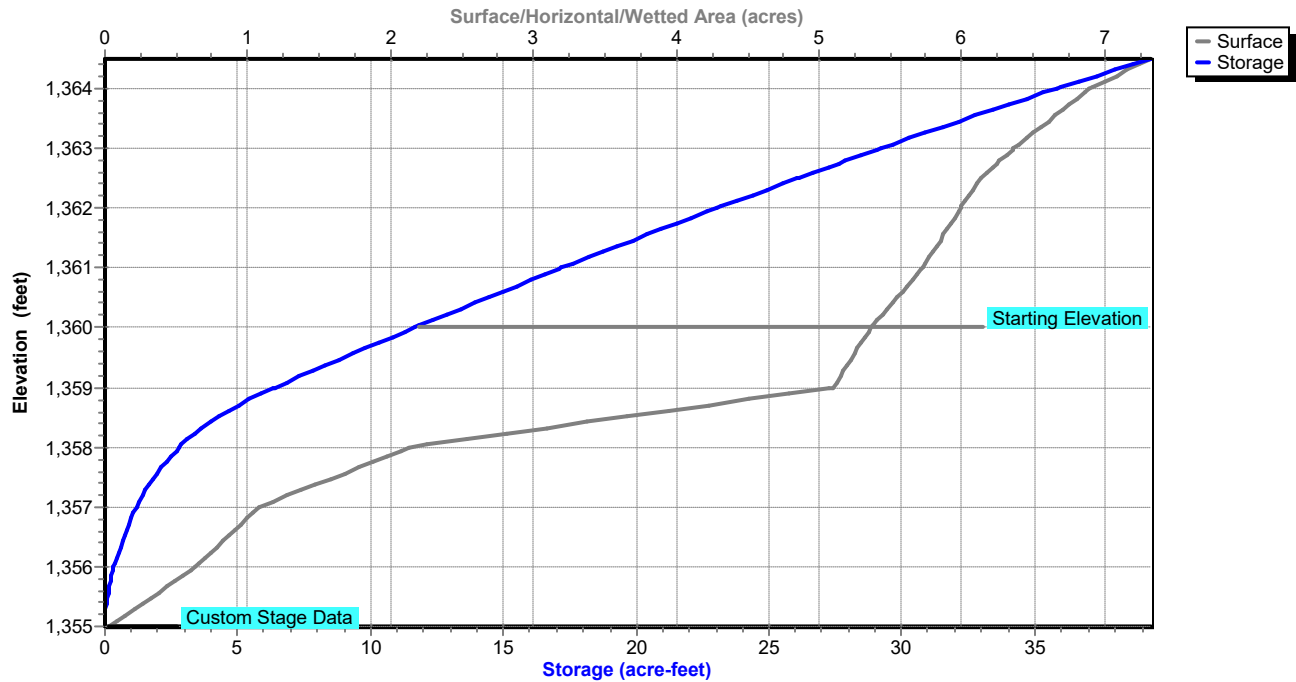
Pond 4P: Wetland Pool

Stage-Discharge



Pond 4P: Wetland Pool

Stage-Area-Storage



Summary for Pond 5P: Box Culvert

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 3.93" for 25 Year event
 Inflow = 633.70 cfs @ 14.32 hrs, Volume= 324.033 af
 Outflow = 633.61 cfs @ 14.34 hrs, Volume= 324.550 af, Atten= 0%, Lag= 1.2 min
 Primary = 529.33 cfs @ 14.34 hrs, Volume= 315.866 af
 Secondary = 104.28 cfs @ 14.34 hrs, Volume= 8.684 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Starting Elev= 1,353.00' Surf.Area= 0.053 ac Storage= 0.089 af

Peak Elev= 1,360.47' @ 14.34 hrs Surf.Area= 0.557 ac Storage= 2.045 af (1.956 af above start)

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 0.2 min (1,068.9 - 1,068.7)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,349.00'	2.676 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,349.00	0.000	0.000	0.000
1,350.00	0.007	0.004	0.004
1,351.00	0.017	0.012	0.016
1,352.00	0.039	0.028	0.043
1,353.00	0.053	0.046	0.089
1,354.00	0.068	0.061	0.150
1,355.00	0.145	0.106	0.256
1,356.00	0.202	0.173	0.430
1,357.00	0.263	0.233	0.662
1,358.00	0.337	0.300	0.962
1,359.00	0.411	0.374	1.337
1,360.00	0.509	0.460	1.797
1,361.00	0.612	0.561	2.357
1,361.50	0.664	0.319	2.676

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,349.25'	72.0" W x 72.0" H Box Box Culvert L= 50.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 1,349.25' / 1,348.88' S= 0.0074 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 36.00 sf
#2	Secondary	1,359.83'	Roadway, Cv= 2.62 (C= 3.28) Elev. (feet) 1,359.83 1,360.00 1,360.50 1,361.00 1,361.50 1,362.00 Width (feet) 0.00 61.56 116.46 160.90 195.03 228.25

Primary OutFlow Max=529.32 cfs @ 14.34 hrs HW=1,360.47' (Free Discharge)

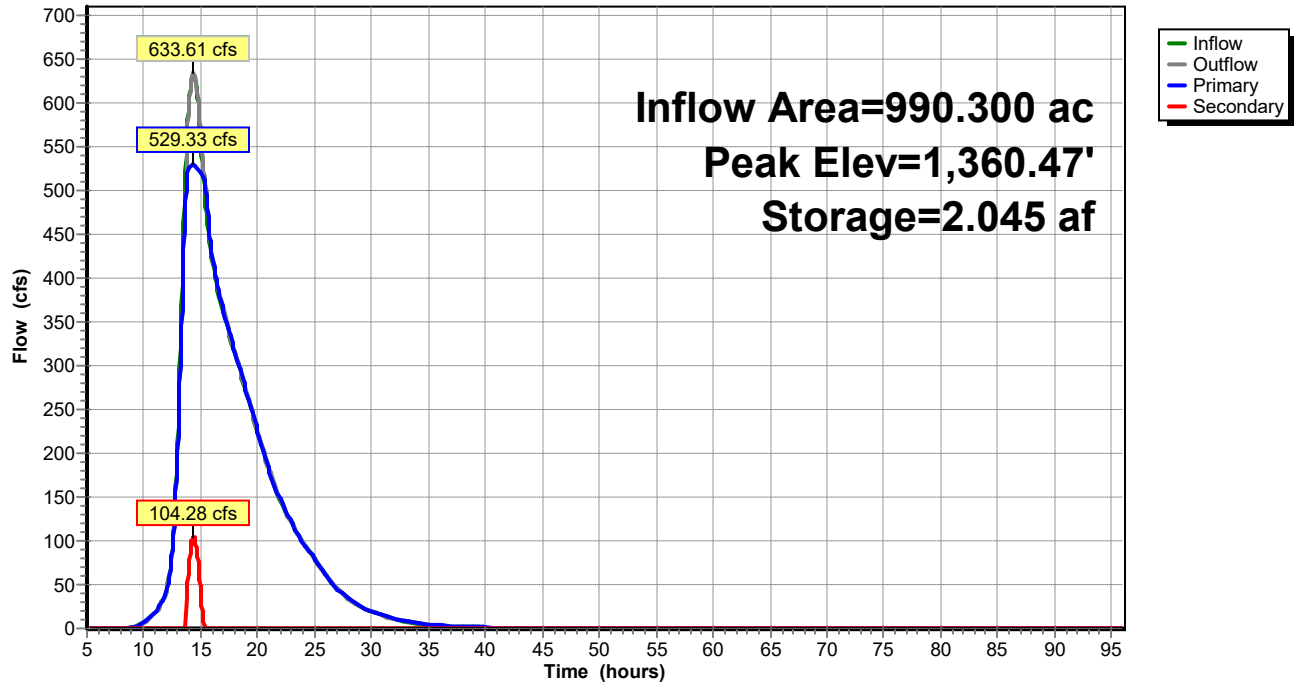
↑ **1=Box Culvert** (Inlet Controls 529.32 cfs @ 14.70 fps)

Secondary OutFlow Max=104.22 cfs @ 14.34 hrs HW=1,360.47' (Free Discharge)

↑ **2=Roadway** (Weir Controls 104.22 cfs @ 2.27 fps)

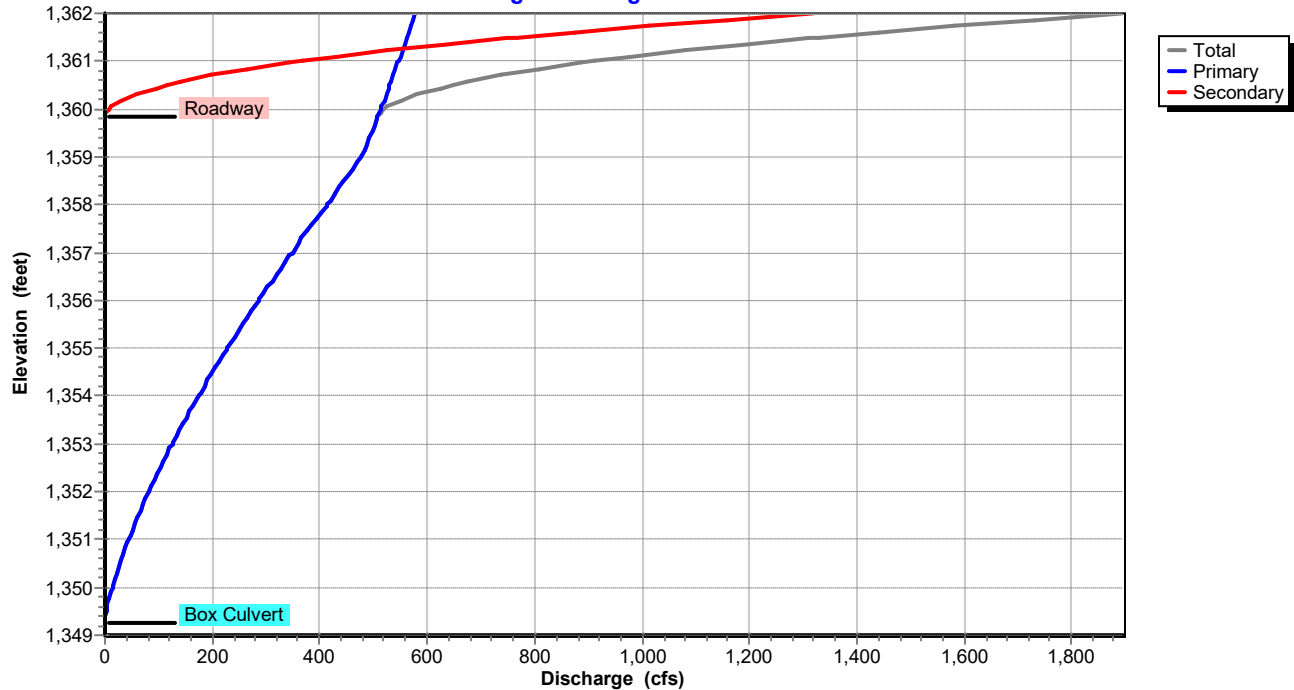
Pond 5P: Box Culvert

Hydrograph



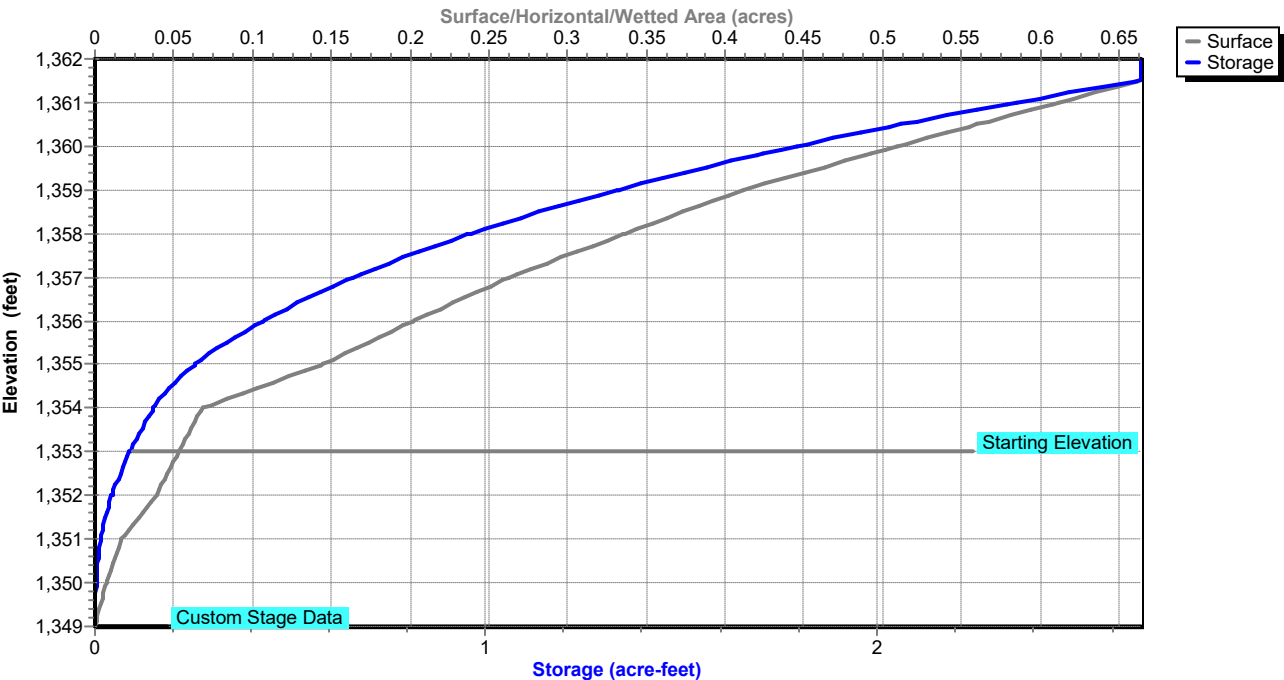
Pond 5P: Box Culvert

Stage-Discharge



Pond 5P: Box Culvert

Stage-Area-Storage



Kracht HydroCAD

Prepared by Bolton & Menk, Inc

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MSE 24-hr 4 50 Year Rainfall=6.60"

Printed 4/29/2026

Page 67

Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northwest Watershed Runoff Area=308.000 ac 0.00% Impervious Runoff Depth=4.87"
Flow Length=7,732' Tc=425.4 min CN=85 Runoff=187.26 cfs 125.024 af

Subcatchment 2S: Northeast Watershed Runoff Area=126.500 ac 0.00% Impervious Runoff Depth=4.87"
Flow Length=6,220' Tc=339.3 min CN=85 Runoff=91.73 cfs 51.349 af

Subcatchment 3S: Direct Watershed Runoff Area=555.800 ac 0.00% Impervious Runoff Depth=4.87"
Flow Length=7,549' Tc=150.5 min CN=85 Runoff=750.96 cfs 225.611 af

Reach 6R: North Waterway Avg. Flow Depth=0.74' Max Vel=2.72 fps Inflow=187.26 cfs 125.024 af
n=0.025 L=2,940.0' S=0.0058 '/' Capacity=9,820.14 cfs Outflow=186.05 cfs 125.024 af

Reach 7R: NE Waterway Avg. Flow Depth=0.69' Max Vel=2.17 fps Inflow=91.73 cfs 51.349 af
n=0.025 L=4,375.0' S=0.0055 '/' Capacity=9,519.90 cfs Outflow=89.70 cfs 51.349 af

Reach 8R: Combined Waterway Avg. Flow Depth=1.99' Max Vel=3.52 fps Inflow=271.97 cfs 176.373 af
n=0.025 L=1,700.0' S=0.0035 '/' Capacity=5,235.03 cfs Outflow=271.83 cfs 176.373 af

Pond 4P: Wetland Pool Peak Elev=1,363.01' Storage=29.271 af Inflow=806.15 cfs 401.984 af
Outflow=793.11 cfs 401.983 af

Pond 5P: Box Culvert Peak Elev=1,360.81' Storage=2.241 af Inflow=793.11 cfs 401.983 af
Primary=540.42 cfs 371.666 af Secondary=252.66 cfs 30.834 af Outflow=793.09 cfs 402.500 af

Total Runoff Area = 990.300 ac Runoff Volume = 401.984 af Average Runoff Depth = 4.87"
100.00% Pervious = 990.300 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Northwest Watershed

Runoff = 187.26 cfs @ 17.49 hrs, Volume= 125.024 af, Depth= 4.87"
 Routed to Reach 6R : North Waterway

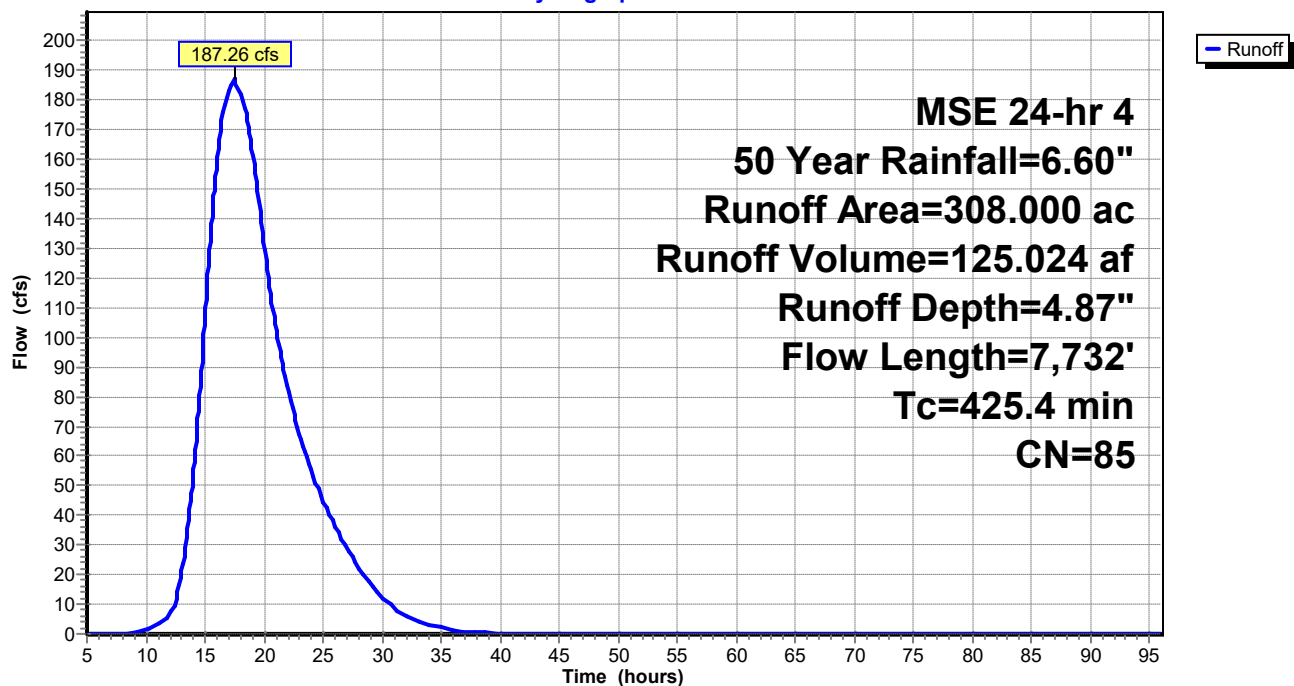
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 50 Year Rainfall=6.60"

Area (ac)	CN	Description
308.000	85	Row crops, straight row, Good, HSG C
308.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
311.9	4,125	0.0006	0.22		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
93.7	3,507	0.0048	0.62		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
425.4	7,732	Total			

Subcatchment 1S: Northwest Watershed

Hydrograph



Summary for Subcatchment 2S: Northeast Watershed

Runoff = 91.73 cfs @ 16.24 hrs, Volume= 51.349 af, Depth= 4.87"
 Routed to Reach 7R : NE Waterway

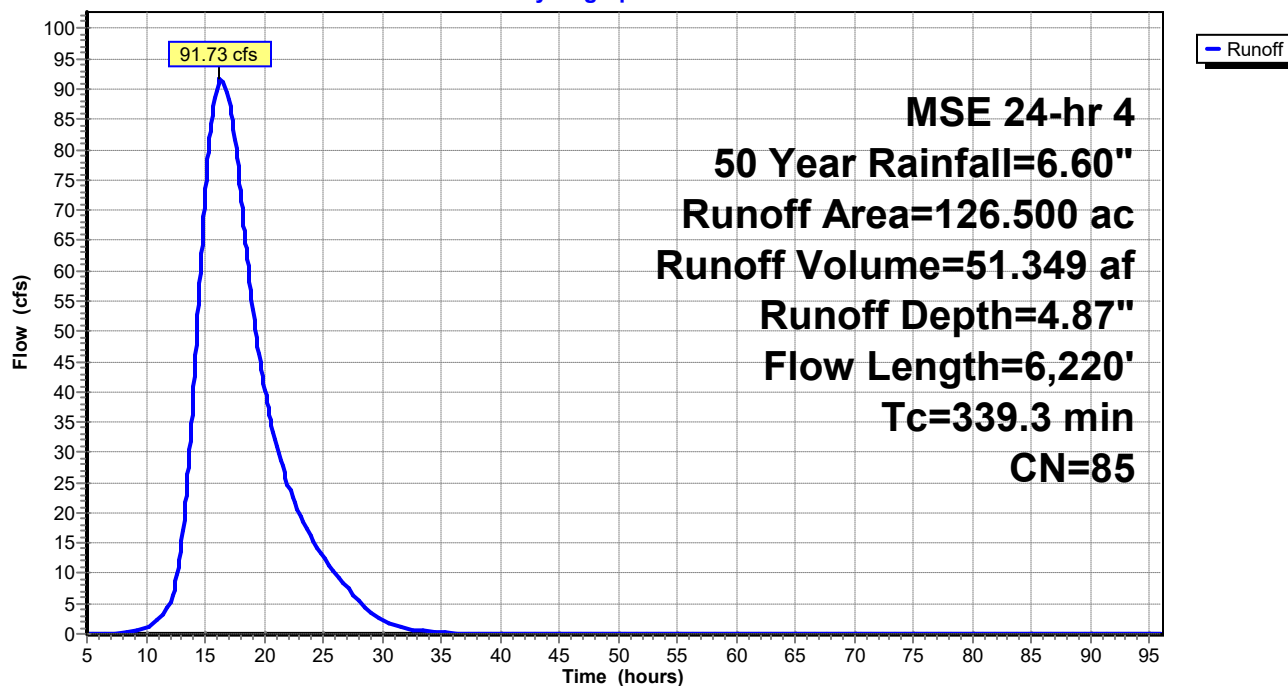
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 50 Year Rainfall=6.60"

Area (ac)	CN	Description
126.500	85	Row crops, straight row, Good, HSG C
126.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.0200	0.15		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
250.1	3,820	0.0008	0.25		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
77.8	2,300	0.0030	0.49		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
339.3	6,220	Total			

Subcatchment 2S: Northeast Watershed

Hydrograph



Summary for Subcatchment 3S: Direct Watershed

[47] Hint: Peak is 787% of capacity of segment #3

[47] Hint: Peak is 297% of capacity of segment #5

Runoff = 750.96 cfs @ 13.91 hrs, Volume= 225.611 af, Depth= 4.87"
 Routed to Pond 4P : Wetland Pool

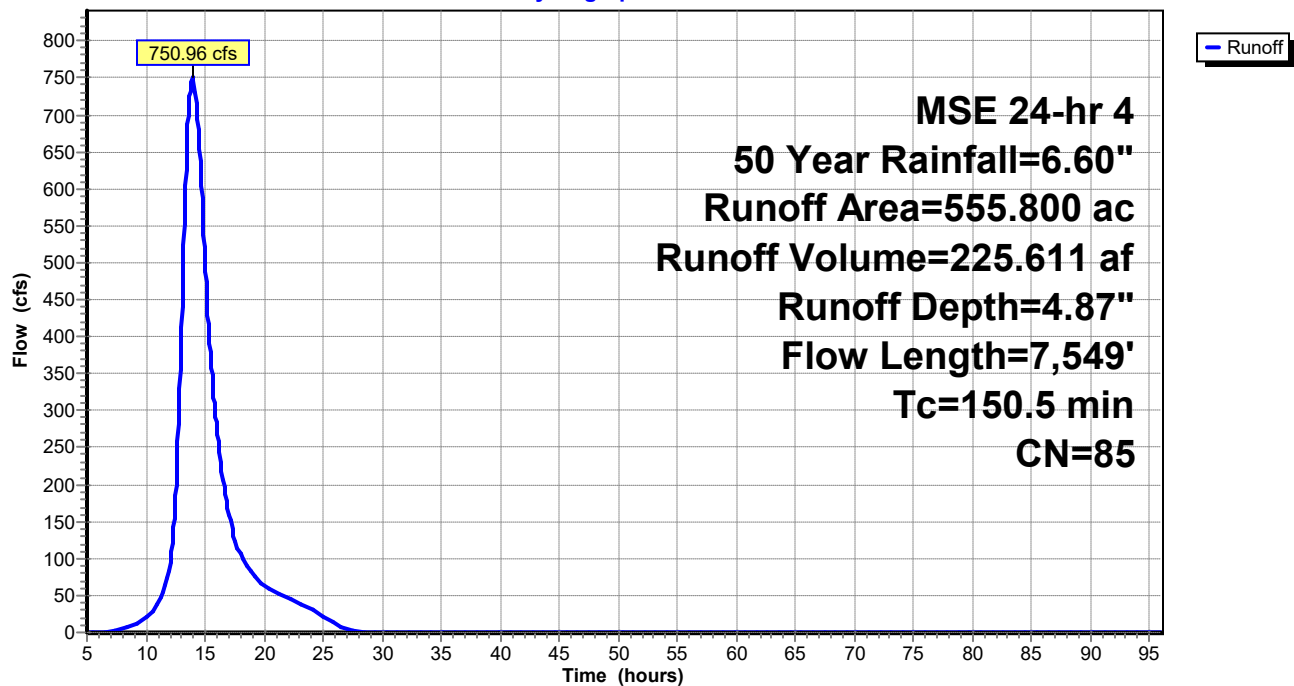
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 50 Year Rainfall=6.60"

Area (ac)	CN	Description
555.800	85	Row crops, straight row, Good, HSG C
555.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
44.1	952	0.0016	0.36		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
4.5	927	0.0065	3.41	95.39	Channel Flow, Ditch Area= 28.0 sf Perim= 28.2' r= 0.99' n= 0.035 Earth, dense weeds
70.5	3,070	0.0065	0.73		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
11.6	2,500	0.0053	3.61	252.43	Channel Flow, Area= 70.0 sf Perim= 70.0' r= 1.00' n= 0.030 Earth, grassed & winding
150.5	7,549	Total			

Subcatchment 3S: Direct Watershed

Hydrograph



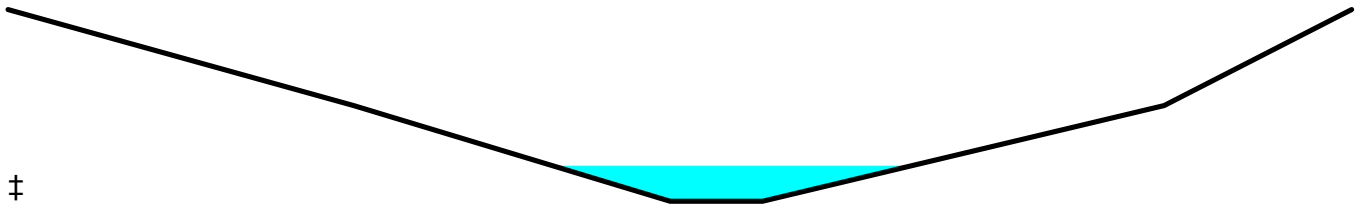
Summary for Reach 6R: North Waterway

Inflow Area = 308.000 ac, 0.00% Impervious, Inflow Depth = 4.87" for 50 Year event
 Inflow = 187.26 cfs @ 17.49 hrs, Volume= 125.024 af
 Outflow = 186.05 cfs @ 17.64 hrs, Volume= 125.024 af, Atten= 1%, Lag= 9.0 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.72 fps, Min. Travel Time= 18.0 min
 Avg. Velocity= 1.11 fps, Avg. Travel Time= 44.0 min

Peak Storage= 201,392 cf @ 17.64 hrs
 Average Depth at Peak Storage= 0.74' , Surface Width= 147.12'
 Bank-Full Depth= 4.00' Flow Area= 1,256.0 sf, Capacity= 9,820.14 cfs

Custom cross-section, Length= 2,940.0' Slope= 0.0058 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,391.00', Outlet Invert= 1,374.00'



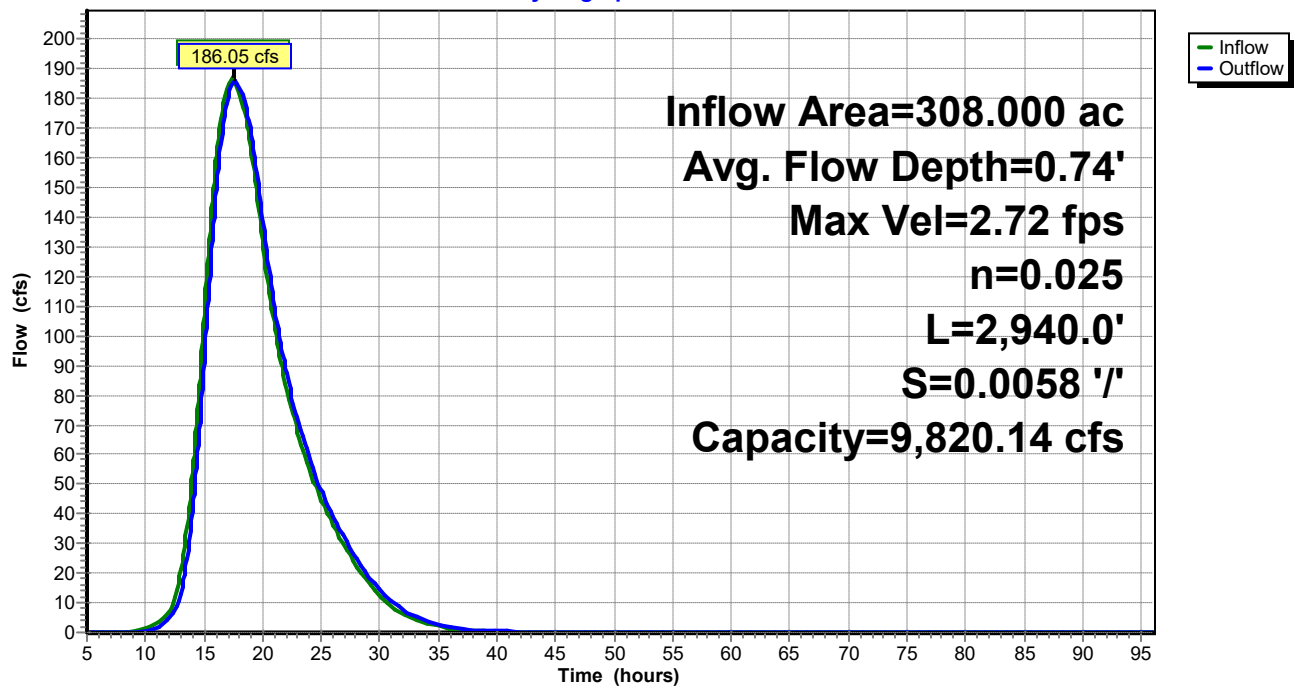
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Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,384.00	0.00
142.00	1,382.00	2.00
272.00	1,380.00	4.00
310.00	1,380.00	4.00
475.00	1,382.00	2.00
552.00	1,384.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	38.0	0.0	0	0.00
2.00	371.0	333.0	333.0	1,090,740	1,802.05
4.00	1,256.0	552.1	552.0	3,692,640	9,820.14

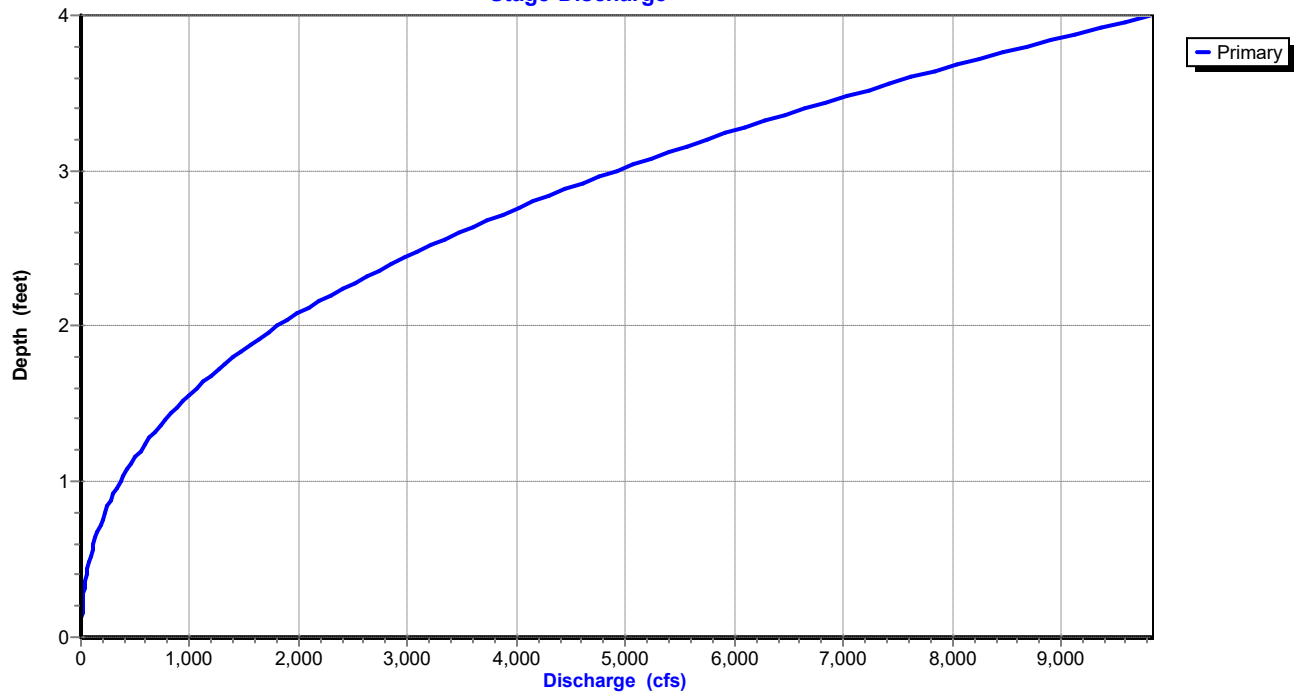
Reach 6R: North Waterway

Hydrograph

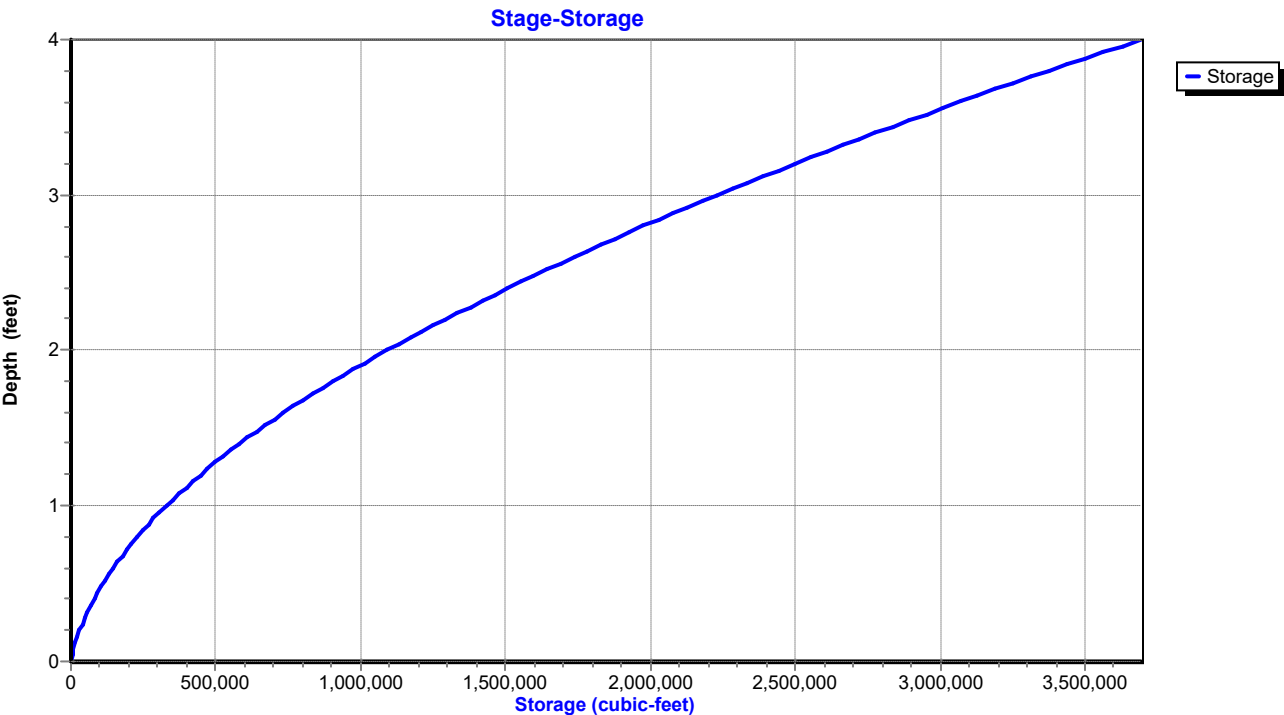


Reach 6R: North Waterway

Stage-Discharge



Reach 6R: North Waterway



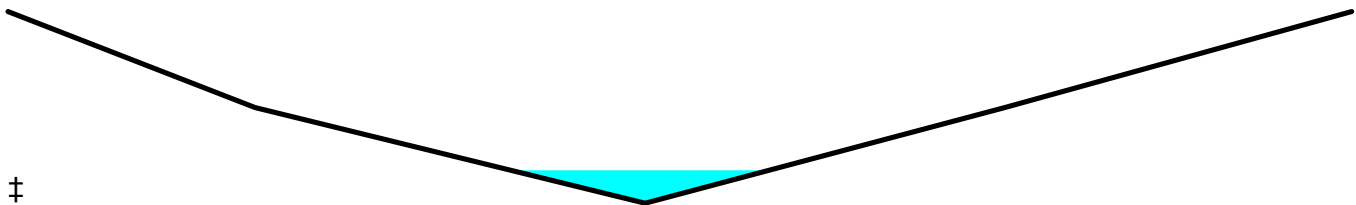
Summary for Reach 7R: NE Waterway

Inflow Area = 126.500 ac, 0.00% Impervious, Inflow Depth = 4.87" for 50 Year event
 Inflow = 91.73 cfs @ 16.24 hrs, Volume= 51.349 af
 Outflow = 89.70 cfs @ 16.84 hrs, Volume= 51.349 af, Atten= 2%, Lag= 36.0 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.17 fps, Min. Travel Time= 33.6 min
 Avg. Velocity= 0.75 fps, Avg. Travel Time= 96.9 min

Peak Storage= 180,885 cf @ 16.84 hrs
 Average Depth at Peak Storage= 0.69' , Surface Width= 119.56'
 Bank-Full Depth= 4.00' Flow Area= 1,312.0 sf, Capacity= 9,519.90 cfs

Custom cross-section, Length= 4,375.0' Slope= 0.0055 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,399.00', Outlet Invert= 1,375.00'

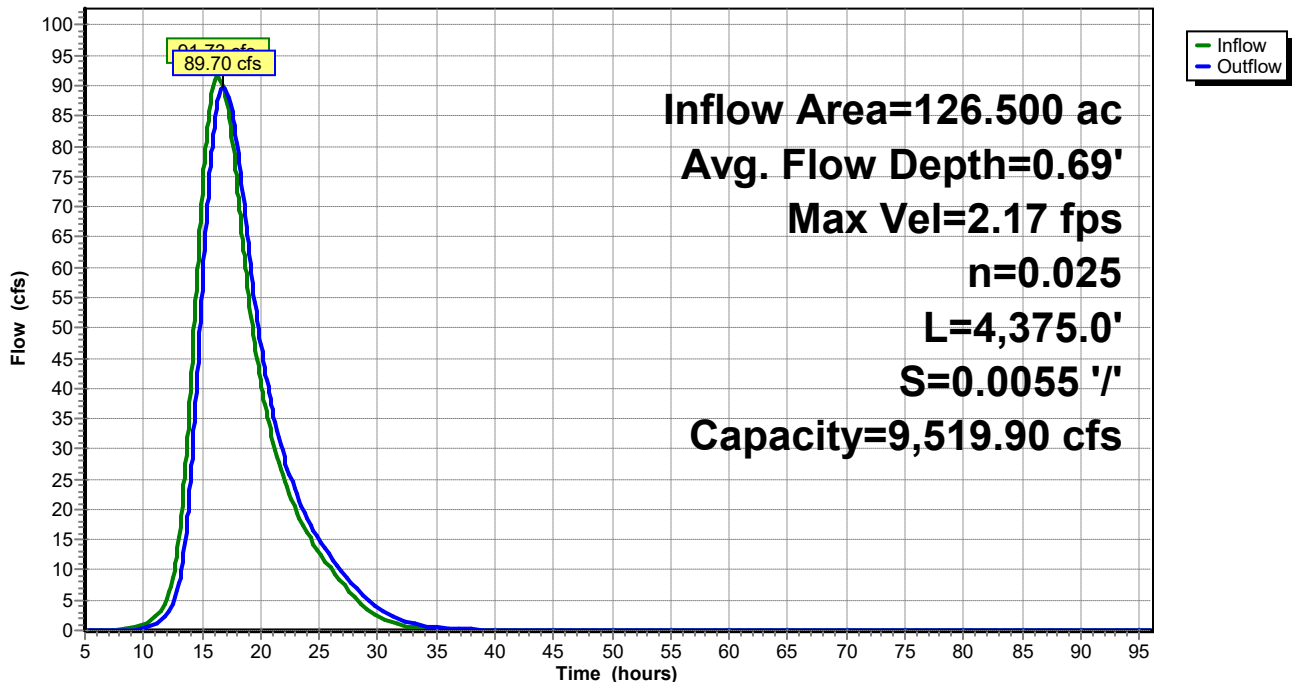


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,392.00	0.00
114.00	1,390.00	2.00
294.00	1,388.00	4.00
460.00	1,390.00	2.00
620.00	1,392.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	346.0	346.0	346.0	1,513,750	1,523.18
4.00	1,312.0	620.1	620.0	5,740,000	9,519.90

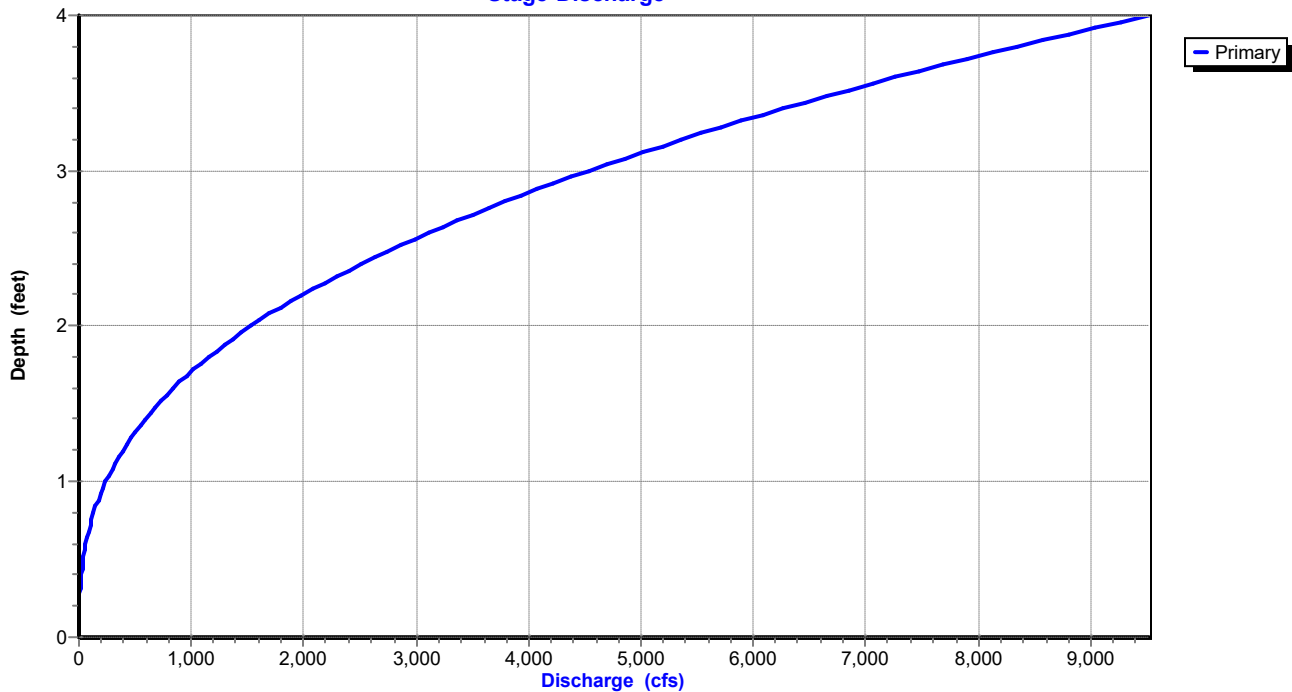
Reach 7R: NE Waterway

Hydrograph

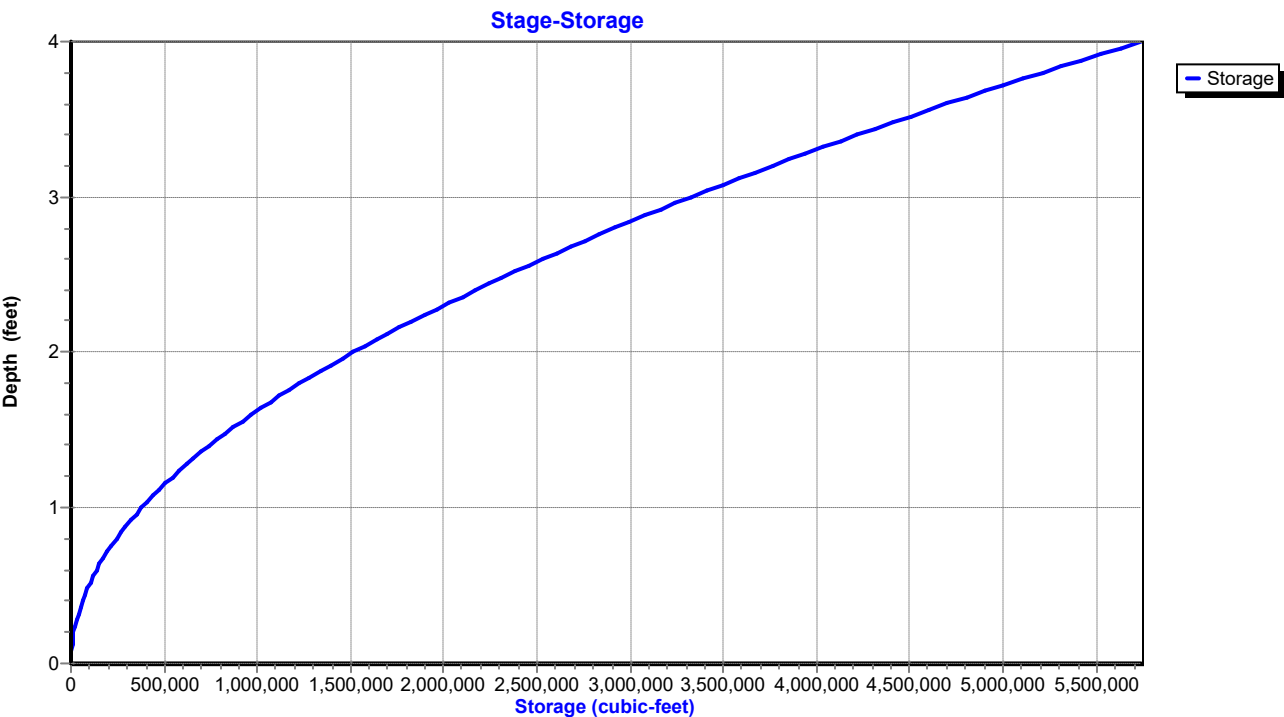


Reach 7R: NE Waterway

Stage-Discharge



Reach 7R: NE Waterway



Summary for Reach 8R: Combined Waterway

[62] Hint: Exceeded Reach 6R OUTLET depth by 1.25' @ 17.30 hrs

[62] Hint: Exceeded Reach 7R OUTLET depth by 0.31' @ 17.85 hrs

Inflow Area = 434.500 ac, 0.00% Impervious, Inflow Depth = 4.87" for 50 Year event
 Inflow = 271.97 cfs @ 17.42 hrs, Volume= 176.373 af
 Outflow = 271.83 cfs @ 17.51 hrs, Volume= 176.373 af, Atten= 0%, Lag= 5.5 min
 Routed to Pond 4P : Wetland Pool

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.52 fps, Min. Travel Time= 8.1 min

Avg. Velocity= 1.19 fps, Avg. Travel Time= 23.7 min

Peak Storage= 131,380 cf @ 17.51 hrs

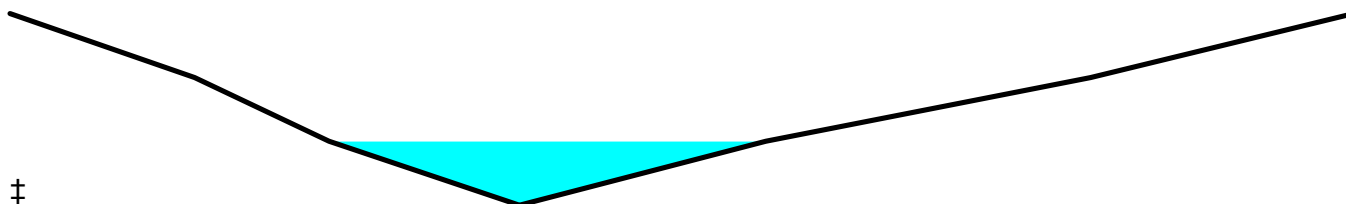
Average Depth at Peak Storage= 1.99', Surface Width= 77.64'

Bank-Full Depth= 6.00' Flow Area= 716.0 sf, Capacity= 5,235.03 cfs

Custom cross-section, Length= 1,700.0' Slope= 0.0035 '/' (102 Elevation Intervals)

Constant n= 0.025 Earth, clean & straight

Inlet Invert= 1,374.00', Outlet Invert= 1,368.00'

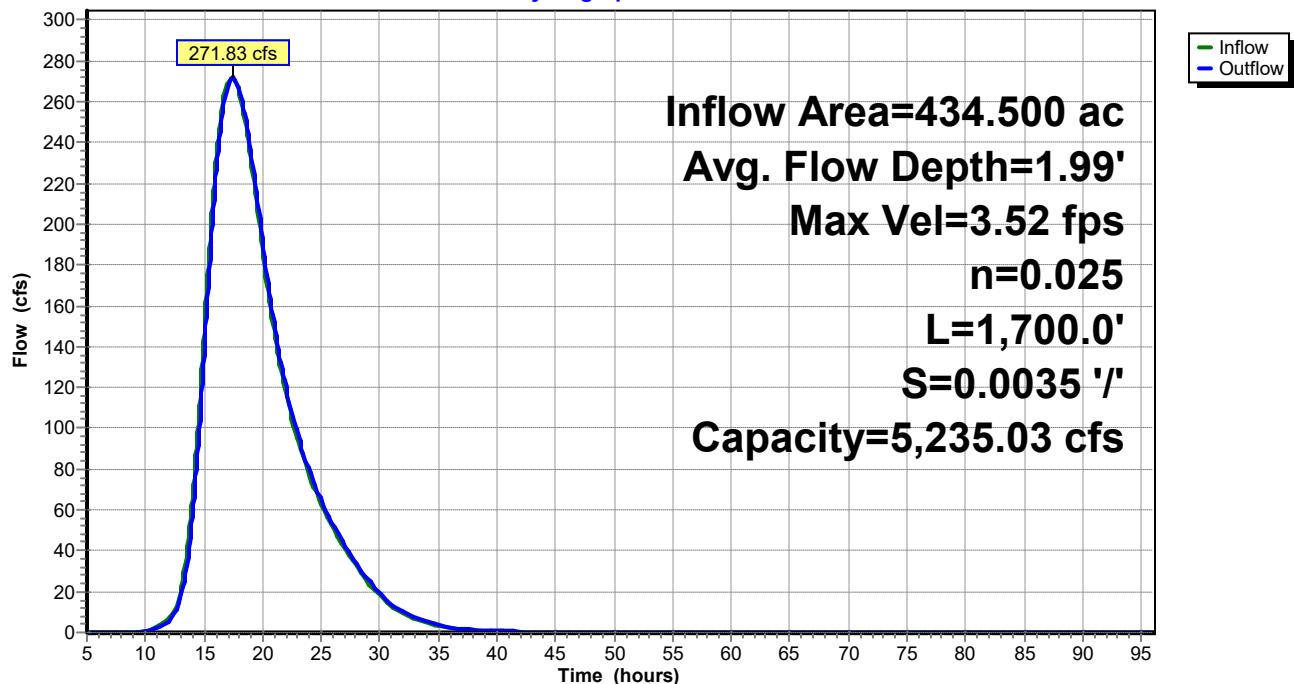


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,374.00	0.00
33.00	1,372.00	2.00
57.00	1,370.00	4.00
91.00	1,368.00	6.00
135.00	1,370.00	4.00
193.00	1,372.00	2.00
240.00	1,374.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	78.0	78.1	78.0	132,600	275.19
4.00	316.0	160.2	160.0	537,200	1,754.93
6.00	716.0	240.3	240.0	1,217,200	5,235.03

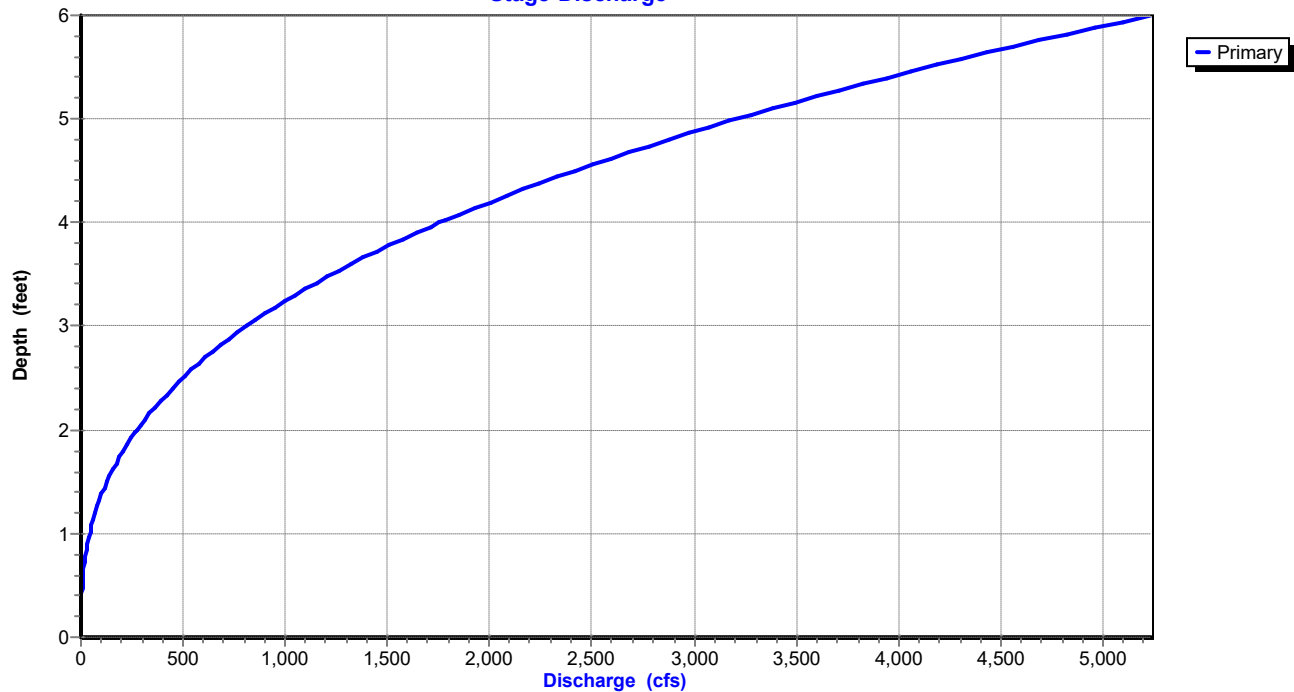
Reach 8R: Combined Waterway

Hydrograph

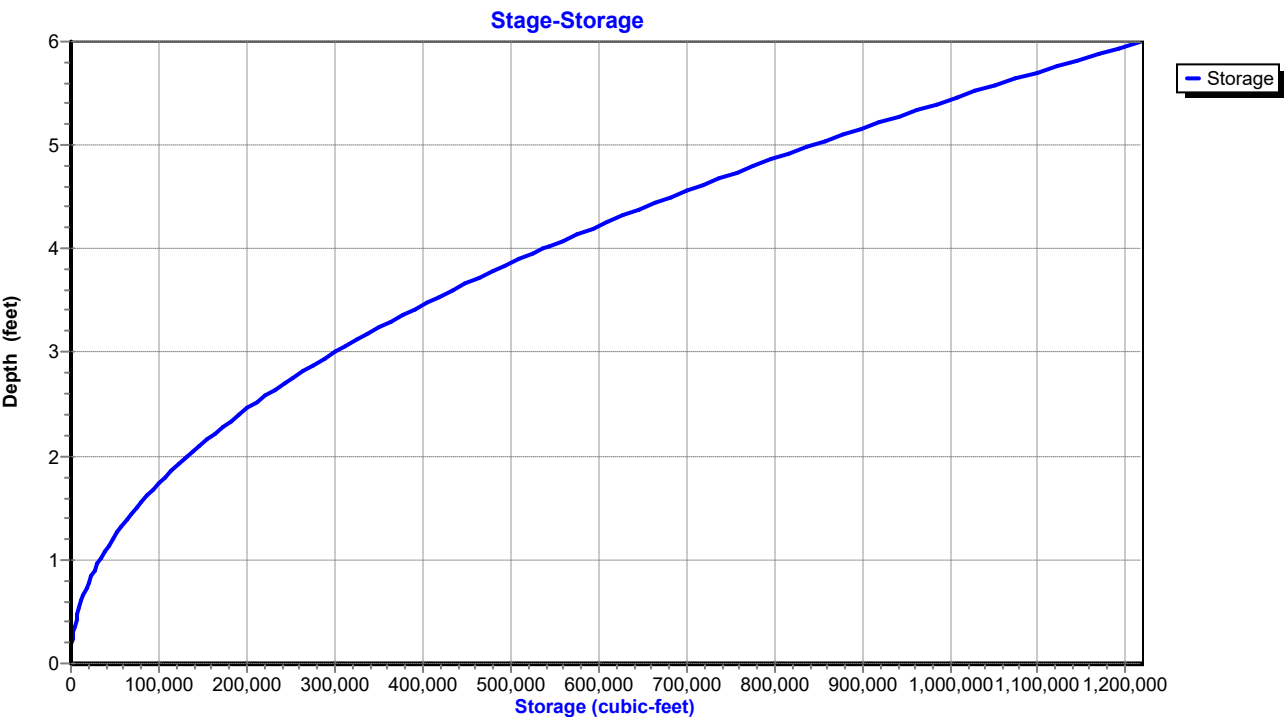


Reach 8R: Combined Waterway

Stage-Discharge



Reach 8R: Combined Waterway



Summary for Pond 4P: Wetland Pool

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 4.87" for 50 Year event
 Inflow = 806.15 cfs @ 14.06 hrs, Volume= 401.984 af
 Outflow = 793.11 cfs @ 14.28 hrs, Volume= 401.983 af, Atten= 2%, Lag= 13.6 min
 Primary = 793.11 cfs @ 14.28 hrs, Volume= 401.983 af
 Routed to Pond 5P : Box Culvert

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,360.00' Surf.Area= 5.363 ac Storage= 11.648 af
 Peak Elev= 1,363.01' @ 14.29 hrs Surf.Area= 6.371 ac Storage= 29.271 af (17.622 af above start)

Plug-Flow detention time= 55.0 min calculated for 390.120 af (97% of inflow)
 Center-of-Mass det. time= 21.5 min (1,061.4 - 1,039.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,355.00'	39.394 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,355.00	0.032	0.000	0.000
1,356.00	0.633	0.333	0.333
1,357.00	1.085	0.859	1.192
1,358.00	2.130	1.607	2.799
1,359.00	5.103	3.616	6.415
1,360.00	5.363	5.233	11.648
1,361.00	5.727	5.545	17.193
1,362.00	5.992	5.859	23.053
1,362.50	6.130	3.030	26.083
1,363.00	6.366	3.124	29.207
1,364.00	6.896	6.631	35.838
1,364.50	7.326	3.556	39.394

Device	Routing	Invert	Outlet Devices
#1	Primary	1,360.00'	49.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	1,362.75'	35.0' long + 3.0' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

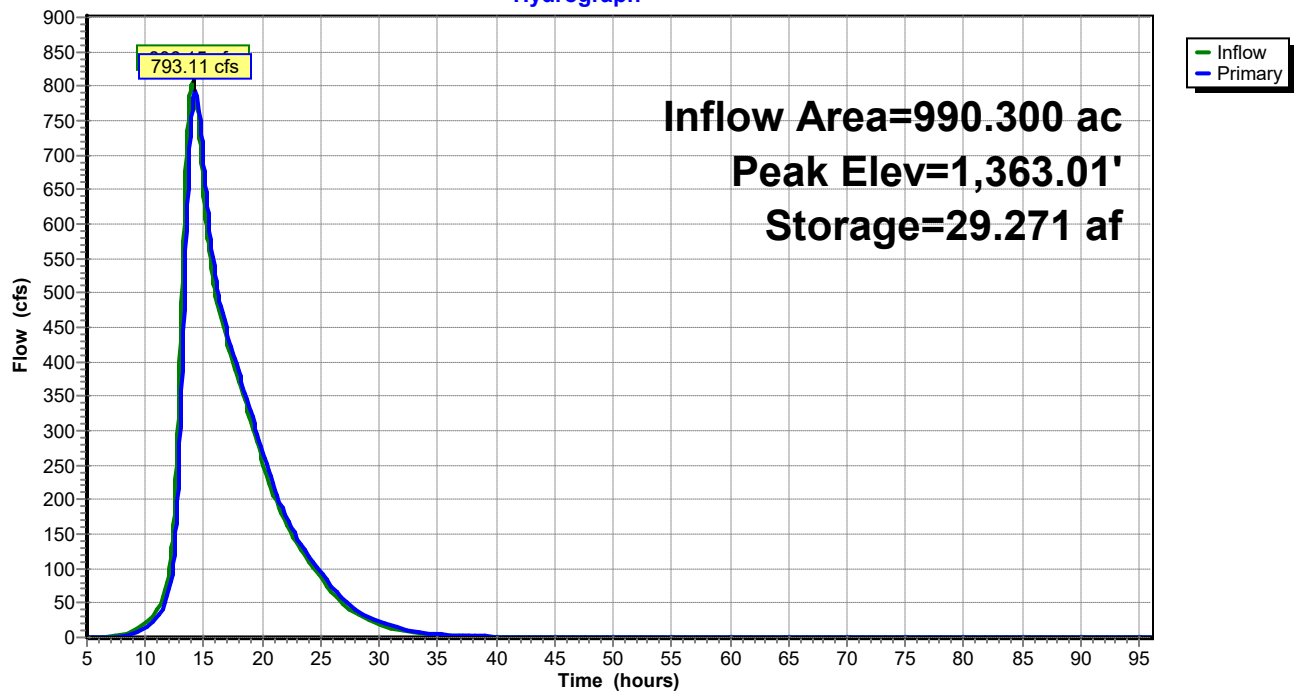
Primary OutFlow Max=792.71 cfs @ 14.28 hrs HW=1,363.01' TW=1,360.81' (Dynamic Tailwater)

1=Sharp-Crested Rectangular Weir (Weir Controls 780.07 cfs @ 5.36 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 12.64 cfs @ 1.36 fps)

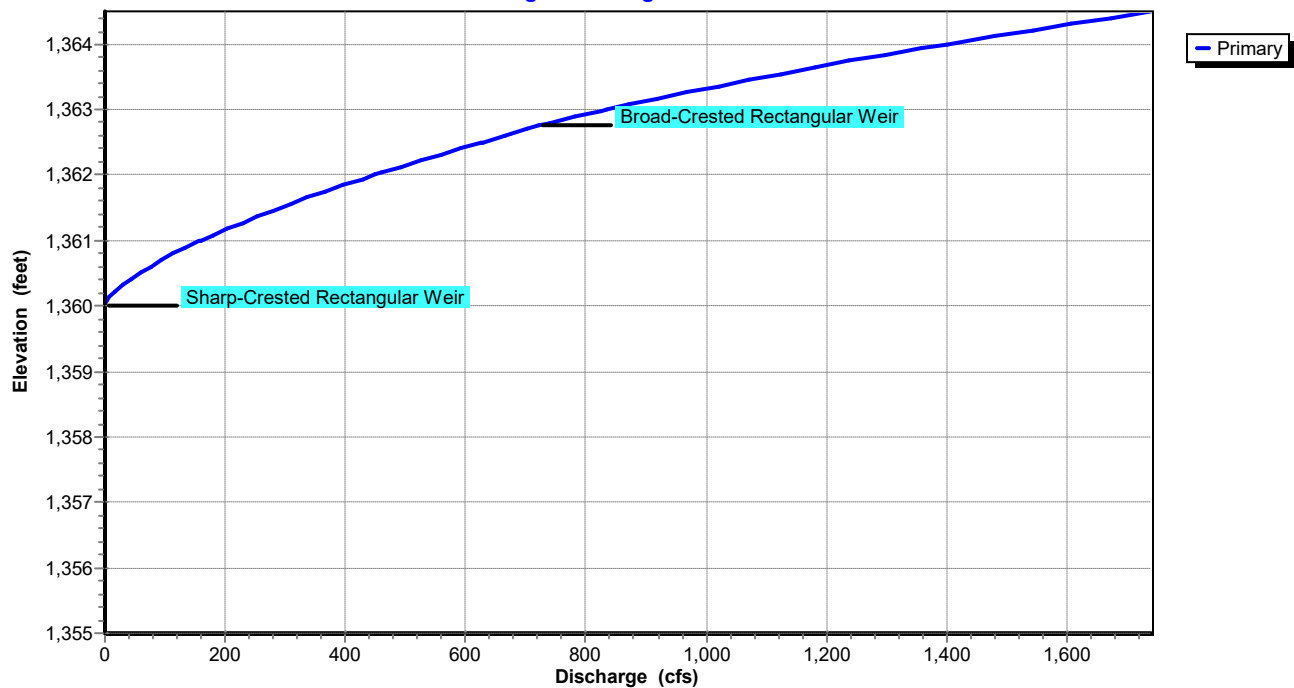
Pond 4P: Wetland Pool

Hydrograph

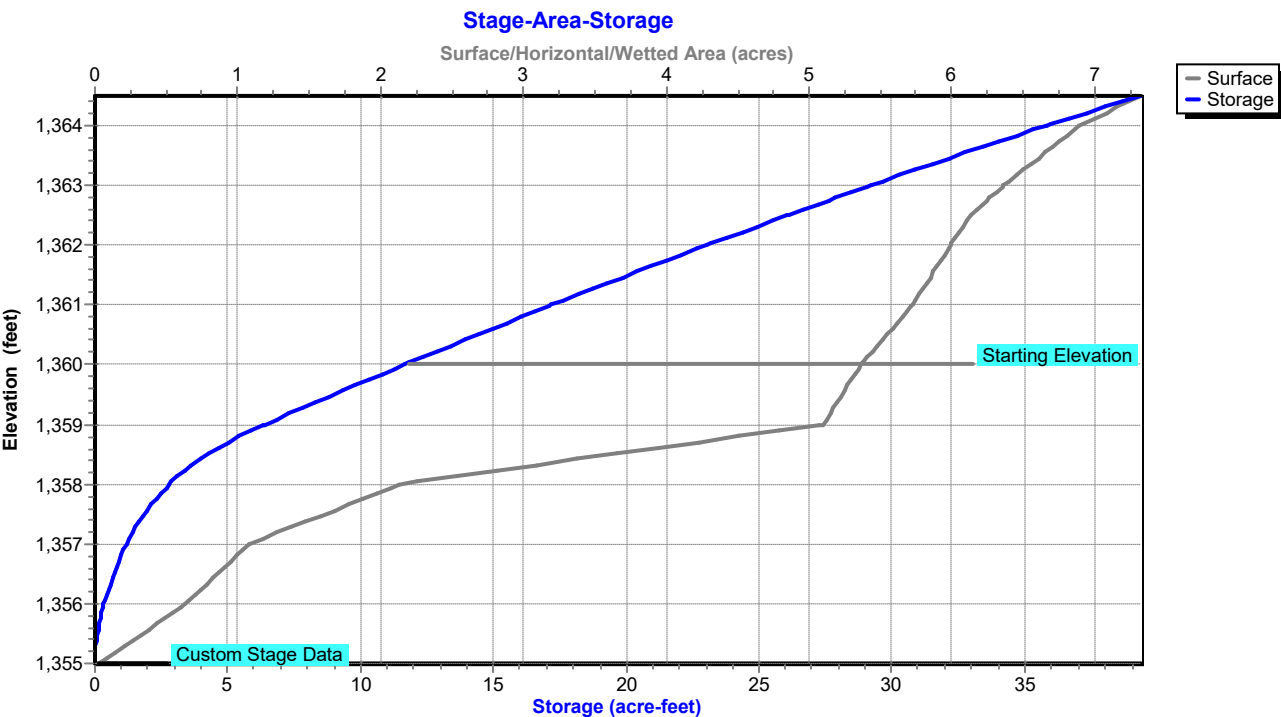


Pond 4P: Wetland Pool

Stage-Discharge



Pond 4P: Wetland Pool



Summary for Pond 5P: Box Culvert

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 4.87" for 50 Year event
 Inflow = 793.11 cfs @ 14.28 hrs, Volume= 401.983 af
 Outflow = 793.09 cfs @ 14.30 hrs, Volume= 402.500 af, Atten= 0%, Lag= 0.9 min
 Primary = 540.42 cfs @ 14.30 hrs, Volume= 371.666 af
 Secondary = 252.66 cfs @ 14.30 hrs, Volume= 30.834 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Starting Elev= 1,353.00' Surf.Area= 0.053 ac Storage= 0.089 af

Peak Elev= 1,360.81' @ 14.30 hrs Surf.Area= 0.592 ac Storage= 2.241 af (2.151 af above start)

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 0.6 min (1,062.0 - 1,061.4)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,349.00'	2.676 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,349.00	0.000	0.000	0.000
1,350.00	0.007	0.004	0.004
1,351.00	0.017	0.012	0.016
1,352.00	0.039	0.028	0.043
1,353.00	0.053	0.046	0.089
1,354.00	0.068	0.061	0.150
1,355.00	0.145	0.106	0.256
1,356.00	0.202	0.173	0.430
1,357.00	0.263	0.233	0.662
1,358.00	0.337	0.300	0.962
1,359.00	0.411	0.374	1.337
1,360.00	0.509	0.460	1.797
1,361.00	0.612	0.561	2.357
1,361.50	0.664	0.319	2.676

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,349.25'	72.0" W x 72.0" H Box Box Culvert L= 50.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 1,349.25' / 1,348.88' S= 0.0074 ' / Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 36.00 sf
#2	Secondary	1,359.83'	Roadway, Cv= 2.62 (C= 3.28) Elev. (feet) 1,359.83 1,360.00 1,360.50 1,361.00 1,361.50 1,362.00 Width (feet) 0.00 61.56 116.46 160.90 195.03 228.25

Primary OutFlow Max=540.42 cfs @ 14.30 hrs HW=1,360.81' (Free Discharge)

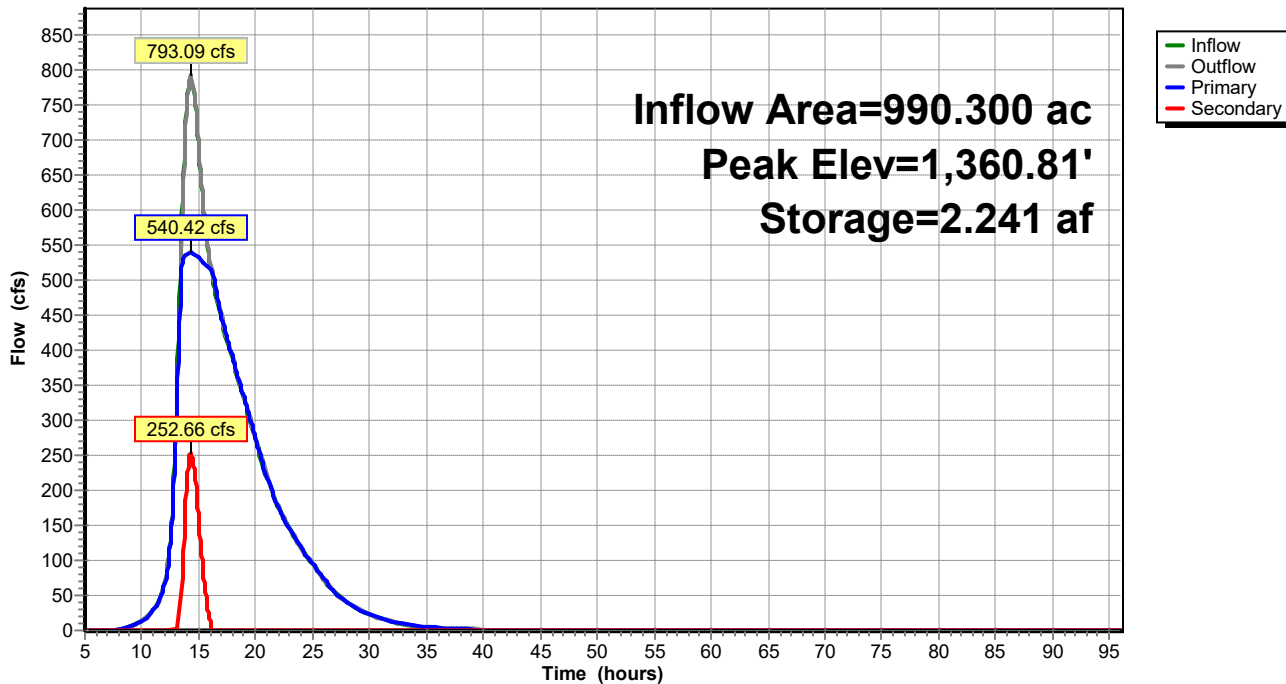
↑ **1=Box Culvert** (Inlet Controls 540.42 cfs @ 15.01 fps)

Secondary OutFlow Max=252.59 cfs @ 14.30 hrs HW=1,360.81' (Free Discharge)

↑ **2=Roadway** (Weir Controls 252.59 cfs @ 2.82 fps)

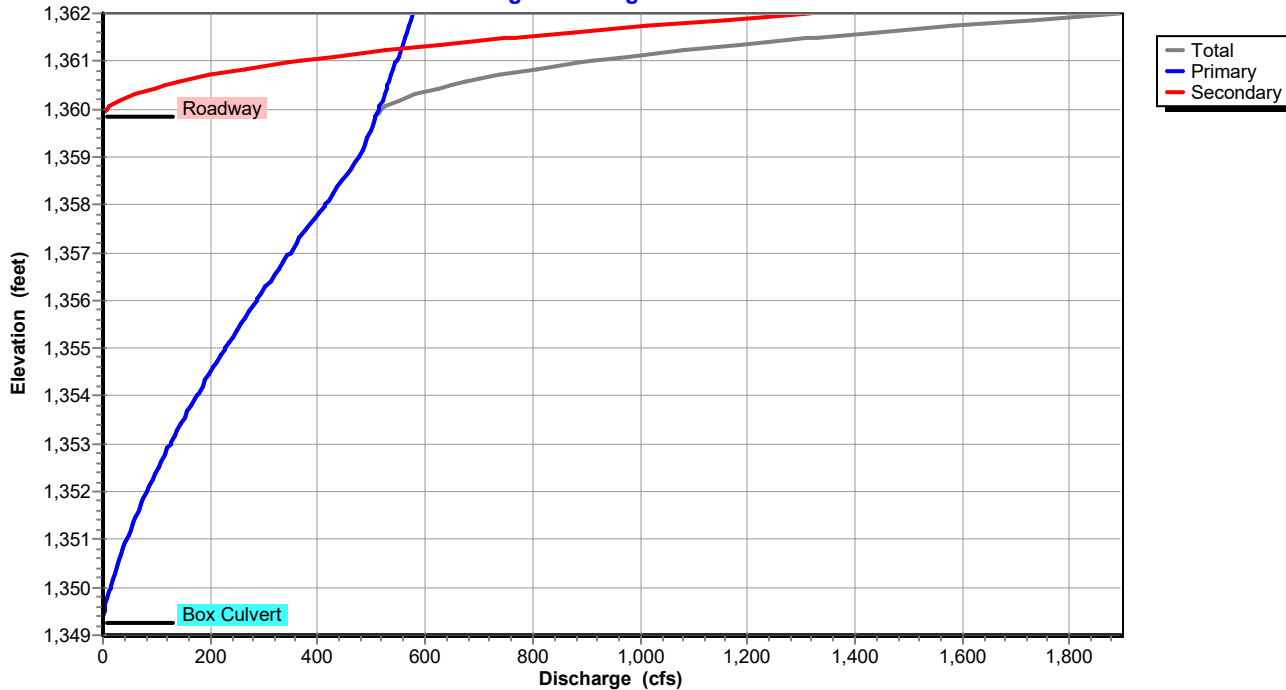
Pond 5P: Box Culvert

Hydrograph



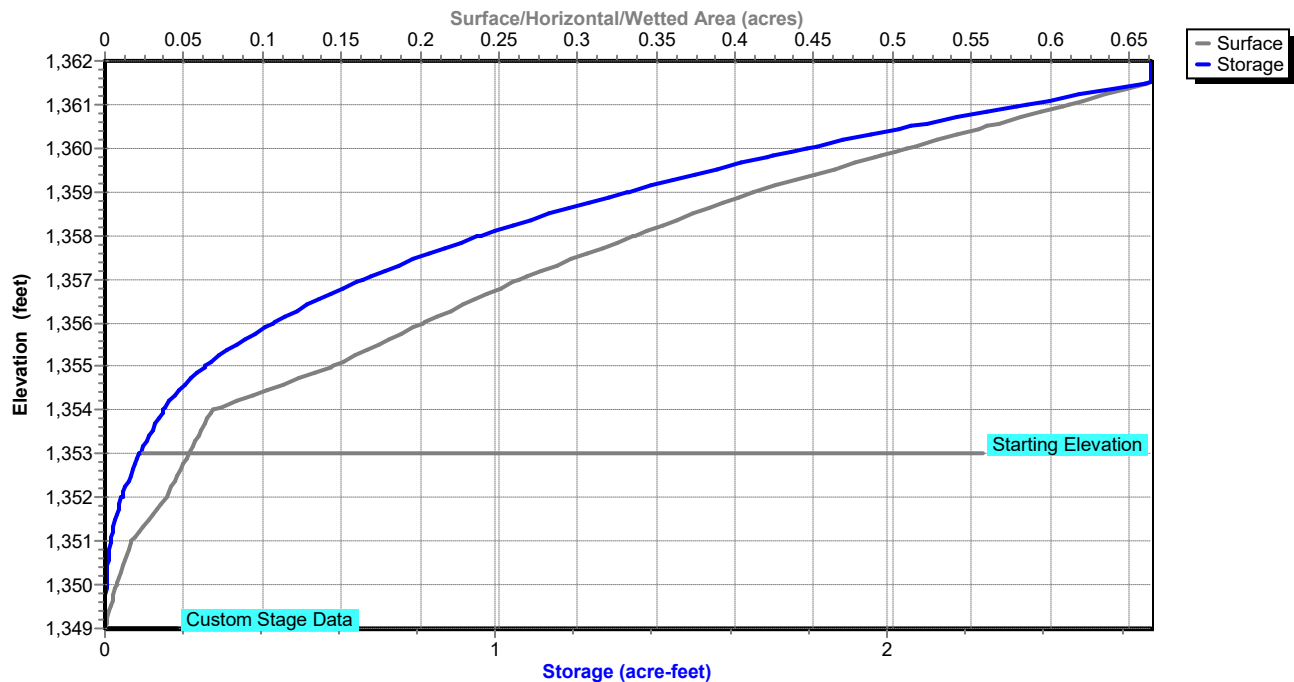
Pond 5P: Box Culvert

Stage-Discharge



Pond 5P: Box Culvert

Stage-Area-Storage



Kracht HydroCAD

Prepared by Bolton & Menk, Inc

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MSE 24-hr 4 100 Year Rainfall=7.80"

Printed 4/29/2026

Page 87

Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northwest Watershed Runoff Area=308.000 ac 0.00% Impervious Runoff Depth=6.02"
Flow Length=7,732' Tc=425.4 min CN=85 Runoff=231.17 cfs 154.524 af

Subcatchment 2S: Northeast Watershed Runoff Area=126.500 ac 0.00% Impervious Runoff Depth=6.02"
Flow Length=6,220' Tc=339.3 min CN=85 Runoff=113.25 cfs 63.465 af

Subcatchment 3S: Direct Watershed Runoff Area=555.800 ac 0.00% Impervious Runoff Depth=6.02"
Flow Length=7,549' Tc=150.5 min CN=85 Runoff=924.27 cfs 278.846 af

Reach 6R: North Waterway Avg. Flow Depth=0.82' Max Vel=2.87 fps Inflow=231.17 cfs 154.524 af
n=0.025 L=2,940.0' S=0.0058 '/' Capacity=9,820.14 cfs Outflow=229.87 cfs 154.524 af

Reach 7R: NE Waterway Avg. Flow Depth=0.75' Max Vel=2.29 fps Inflow=113.25 cfs 63.465 af
n=0.025 L=4,375.0' S=0.0055 '/' Capacity=9,519.90 cfs Outflow=110.89 cfs 63.465 af

Reach 8R: Combined Waterway Avg. Flow Depth=2.16' Max Vel=3.70 fps Inflow=335.86 cfs 217.989 af
n=0.025 L=1,700.0' S=0.0035 '/' Capacity=5,235.03 cfs Outflow=335.70 cfs 217.989 af

Pond 4P: Wetland Pool Peak Elev=1,363.43' Storage=32.022 af Inflow=997.95 cfs 496.835 af
Outflow=986.41 cfs 496.834 af

Pond 5P: Box Culvert Peak Elev=1,361.10' Storage=2.420 af Inflow=986.41 cfs 496.834 af
Primary=549.86 cfs 427.043 af Secondary=436.49 cfs 70.308 af Outflow=986.34 cfs 497.351 af

Total Runoff Area = 990.300 ac Runoff Volume = 496.835 af Average Runoff Depth = 6.02"
100.00% Pervious = 990.300 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Northwest Watershed

Runoff = 231.17 cfs @ 17.48 hrs, Volume= 154.524 af, Depth= 6.02"
 Routed to Reach 6R : North Waterway

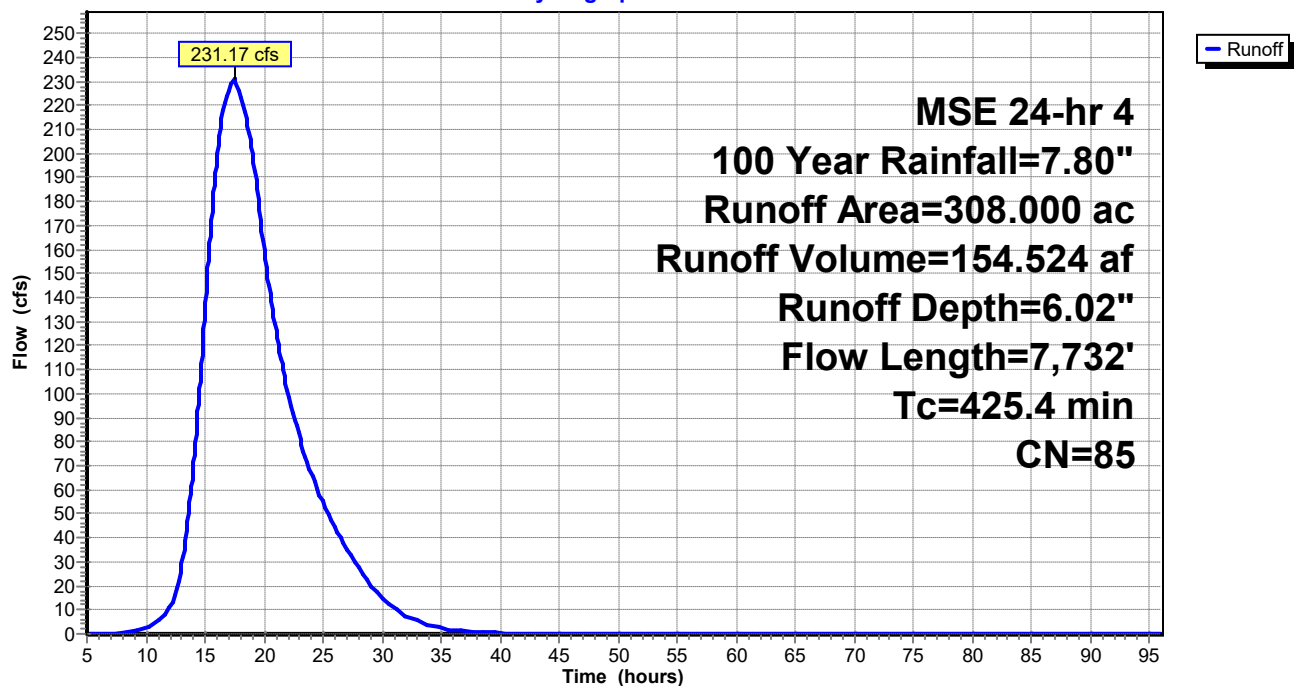
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 MSE 24-hr 4 100 Year Rainfall=7.80"

Area (ac)	CN	Description
308.000	85	Row crops, straight row, Good, HSG C
308.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
311.9	4,125	0.0006	0.22		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
93.7	3,507	0.0048	0.62		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
425.4	7,732	Total			

Subcatchment 1S: Northwest Watershed

Hydrograph



Summary for Subcatchment 2S: Northeast Watershed

Runoff = 113.25 cfs @ 16.23 hrs, Volume= 63.465 af, Depth= 6.02"

Routed to Reach 7R : NE Waterway

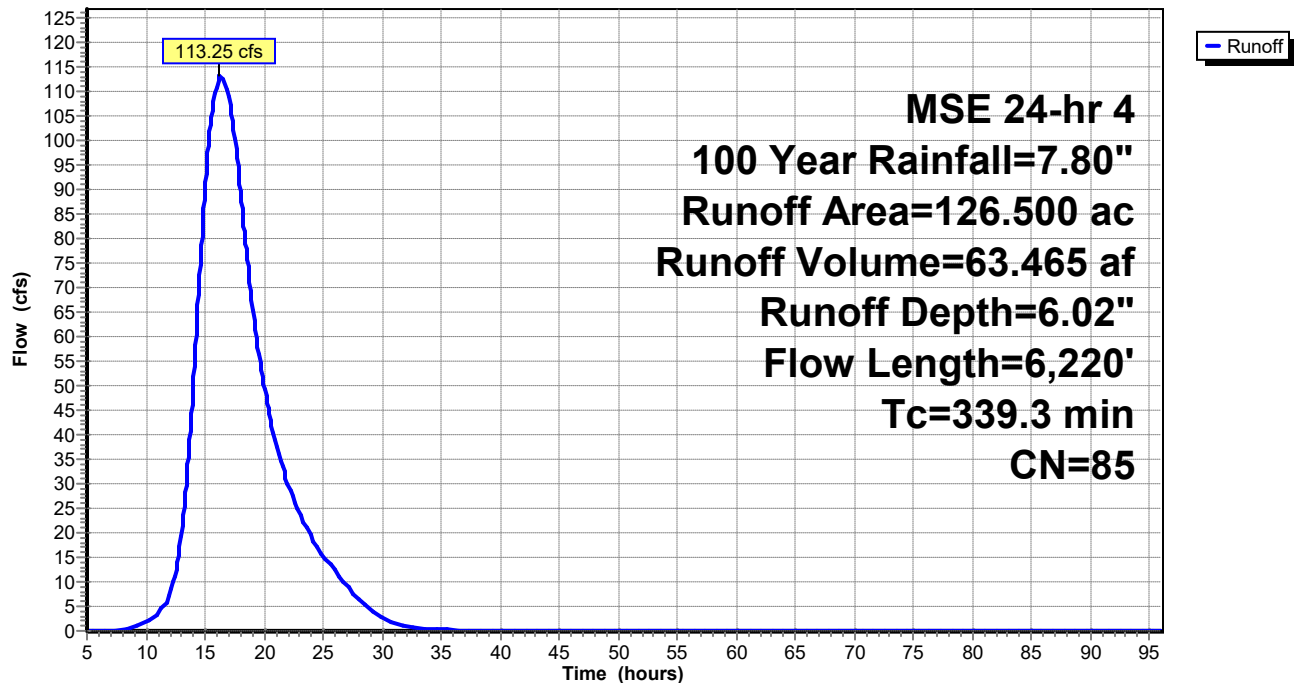
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
MSE 24-hr 4 100 Year Rainfall=7.80"

Area (ac)	CN	Description
126.500	85	Row crops, straight row, Good, HSG C
126.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.0200	0.15		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
250.1	3,820	0.0008	0.25		Shallow Concentrated Flow, Shallow, Flat Cultivated Straight Rows Kv= 9.0 fps
77.8	2,300	0.0030	0.49		Shallow Concentrated Flow, Shallow, Steep Cultivated Straight Rows Kv= 9.0 fps
339.3	6,220	Total			

Subcatchment 2S: Northeast Watershed

Hydrograph



Summary for Subcatchment 3S: Direct Watershed

[47] Hint: Peak is 969% of capacity of segment #3

[47] Hint: Peak is 366% of capacity of segment #5

Runoff = 924.27 cfs @ 13.91 hrs, Volume= 278.846 af, Depth= 6.02"
Routed to Pond 4P : Wetland Pool

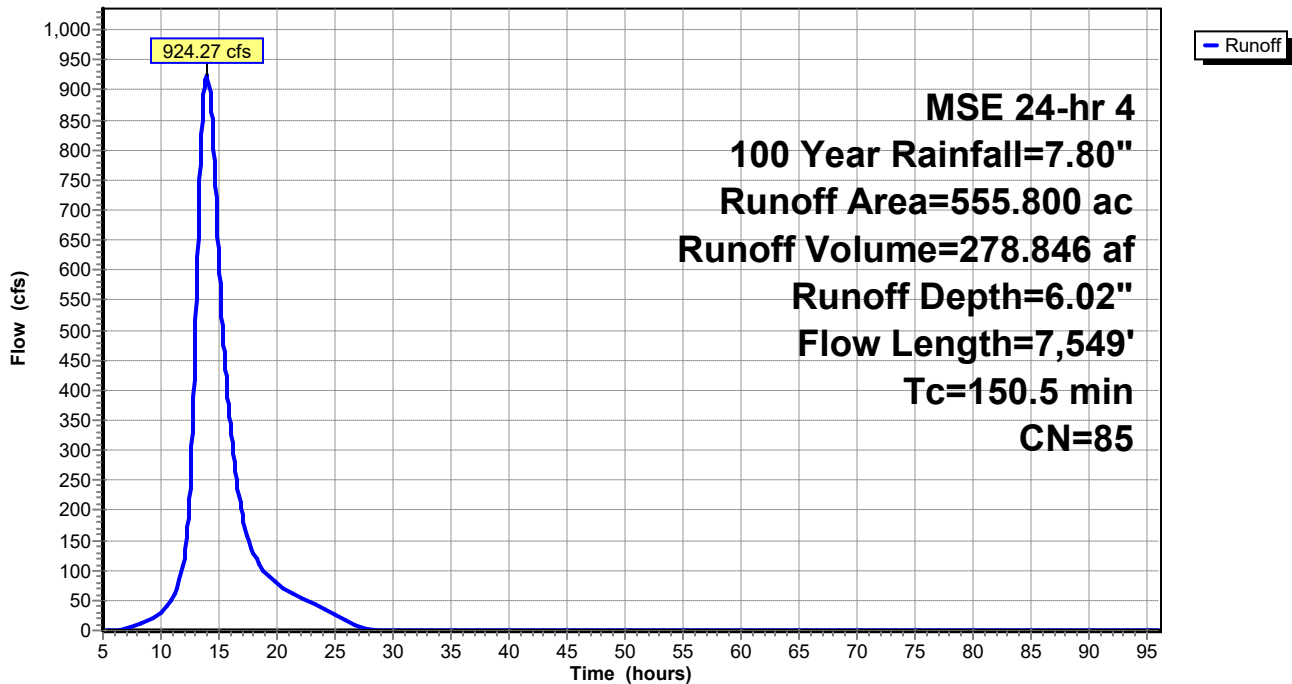
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
MSE 24-hr 4 100 Year Rainfall=7.80"

Area (ac)	CN	Description
555.800	85	Row crops, straight row, Good, HSG C
555.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	100	0.0050	0.08		Sheet Flow, Sheet Flow Cultivated: Residue>20% n= 0.170 P2= 2.90"
44.1	952	0.0016	0.36		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
4.5	927	0.0065	3.41	95.39	Channel Flow, Ditch Area= 28.0 sf Perim= 28.2' r= 0.99' n= 0.035 Earth, dense weeds
70.5	3,070	0.0065	0.73		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
11.6	2,500	0.0053	3.61	252.43	Channel Flow, Area= 70.0 sf Perim= 70.0' r= 1.00' n= 0.030 Earth, grassed & winding
150.5	7,549	Total			

Subcatchment 3S: Direct Watershed

Hydrograph



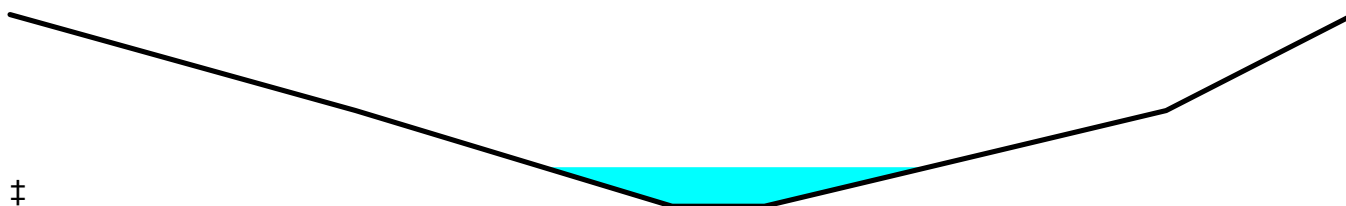
Summary for Reach 6R: North Waterway

Inflow Area = 308.000 ac, 0.00% Impervious, Inflow Depth = 6.02" for 100 Year event
 Inflow = 231.17 cfs @ 17.48 hrs, Volume= 154.524 af
 Outflow = 229.87 cfs @ 17.61 hrs, Volume= 154.524 af, Atten= 1%, Lag= 7.6 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.87 fps, Min. Travel Time= 17.1 min
 Avg. Velocity= 1.16 fps, Avg. Travel Time= 42.1 min

Peak Storage= 235,456 cf @ 17.61 hrs
 Average Depth at Peak Storage= 0.82', Surface Width= 158.31'
 Bank-Full Depth= 4.00' Flow Area= 1,256.0 sf, Capacity= 9,820.14 cfs

Custom cross-section, Length= 2,940.0' Slope= 0.0058 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,391.00', Outlet Invert= 1,374.00'

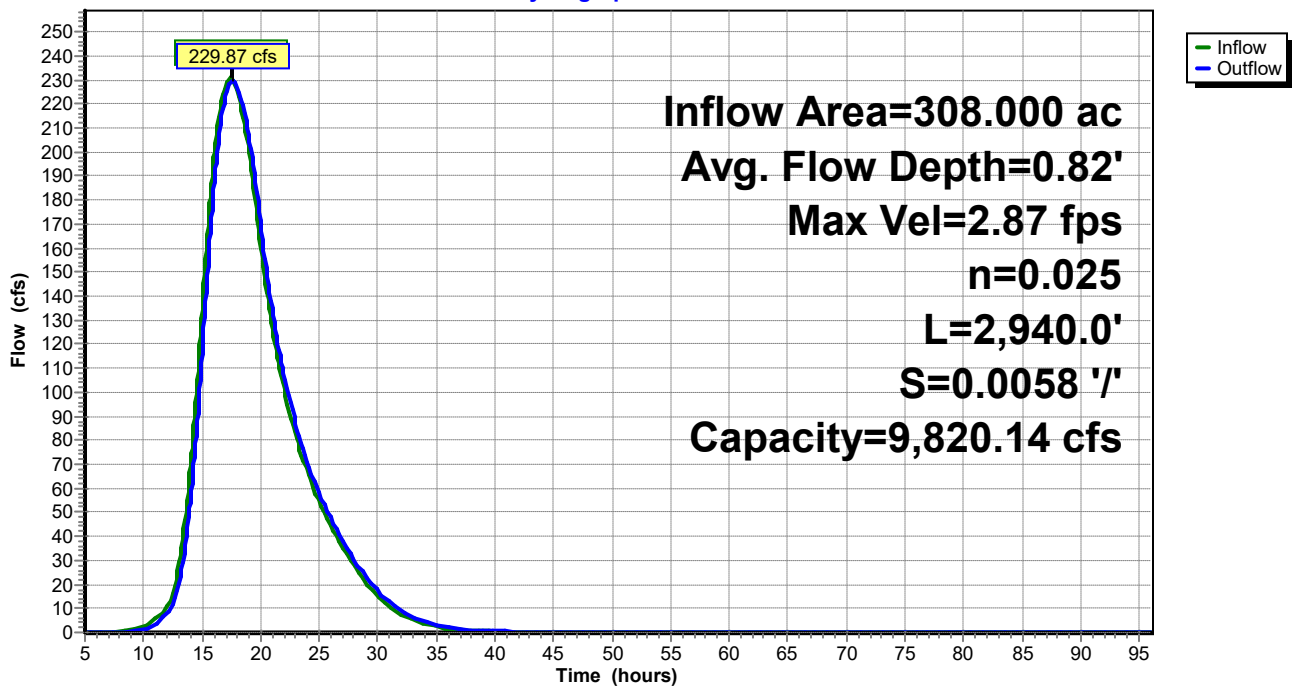


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,384.00	0.00
142.00	1,382.00	2.00
272.00	1,380.00	4.00
310.00	1,380.00	4.00
475.00	1,382.00	2.00
552.00	1,384.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	38.0	0.0	0	0.00
2.00	371.0	333.0	333.0	1,090,740	1,802.05
4.00	1,256.0	552.1	552.0	3,692,640	9,820.14

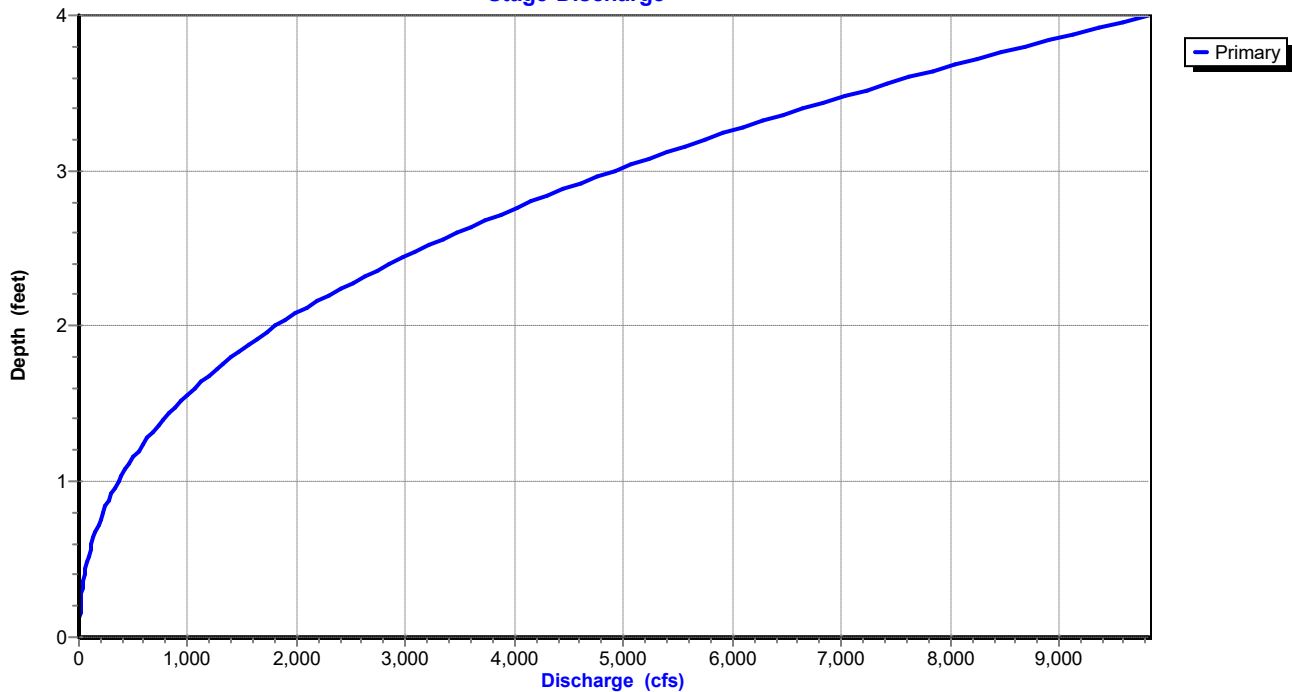
Reach 6R: North Waterway

Hydrograph

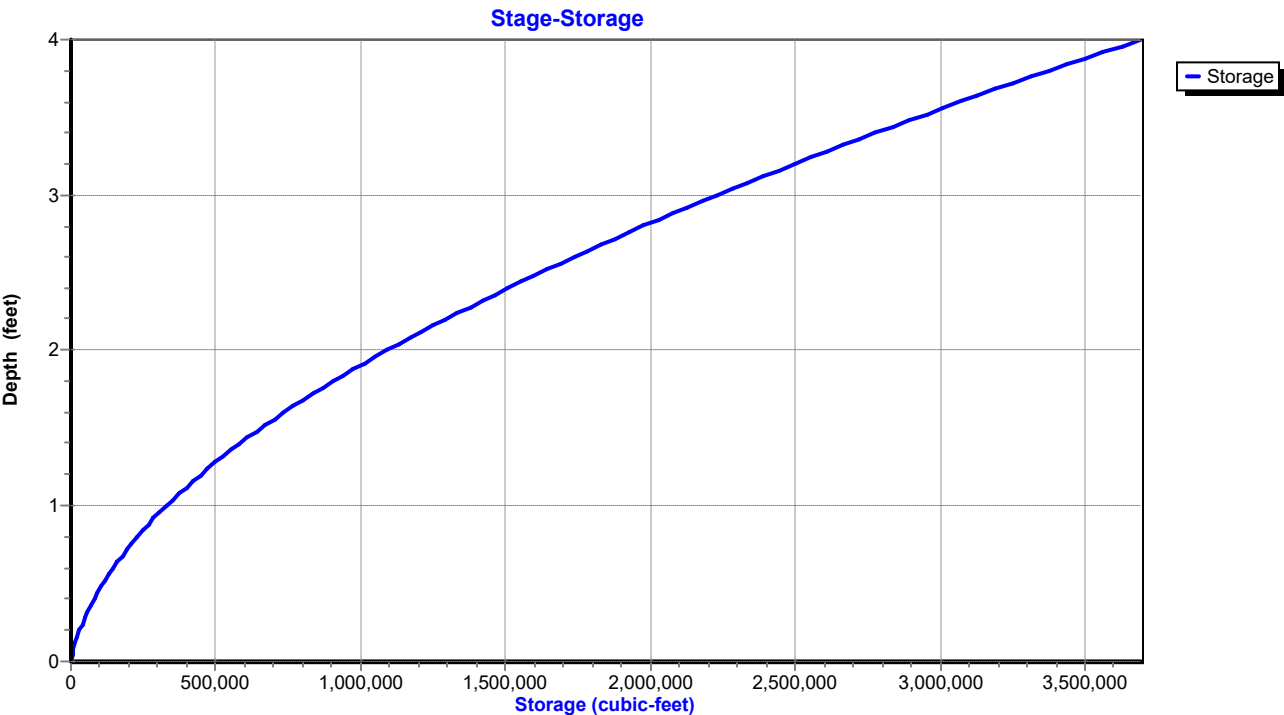


Reach 6R: North Waterway

Stage-Discharge



Reach 6R: North Waterway



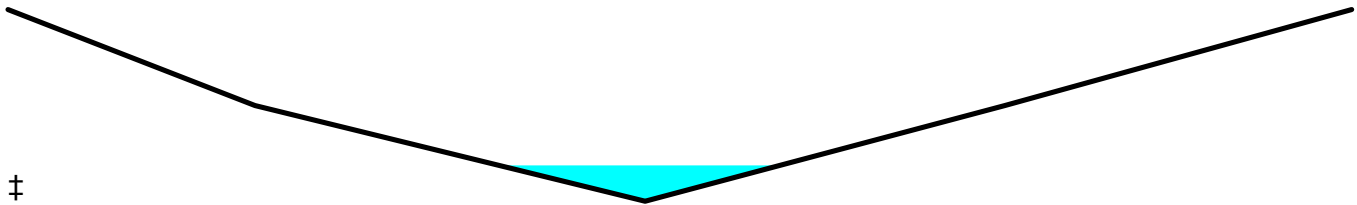
Summary for Reach 7R: NE Waterway

Inflow Area = 126.500 ac, 0.00% Impervious, Inflow Depth = 6.02" for 100 Year event
 Inflow = 113.25 cfs @ 16.23 hrs, Volume= 63.465 af
 Outflow = 110.89 cfs @ 16.77 hrs, Volume= 63.465 af, Atten= 2%, Lag= 32.7 min
 Routed to Reach 8R : Combined Waterway

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.29 fps, Min. Travel Time= 31.9 min
 Avg. Velocity= 0.78 fps, Avg. Travel Time= 93.3 min

Peak Storage= 212,071 cf @ 16.77 hrs
 Average Depth at Peak Storage= 0.75' , Surface Width= 129.47'
 Bank-Full Depth= 4.00' Flow Area= 1,312.0 sf, Capacity= 9,519.90 cfs

Custom cross-section, Length= 4,375.0' Slope= 0.0055 '/'
 Constant n= 0.025 Earth, clean & straight
 Inlet Invert= 1,399.00', Outlet Invert= 1,375.00'

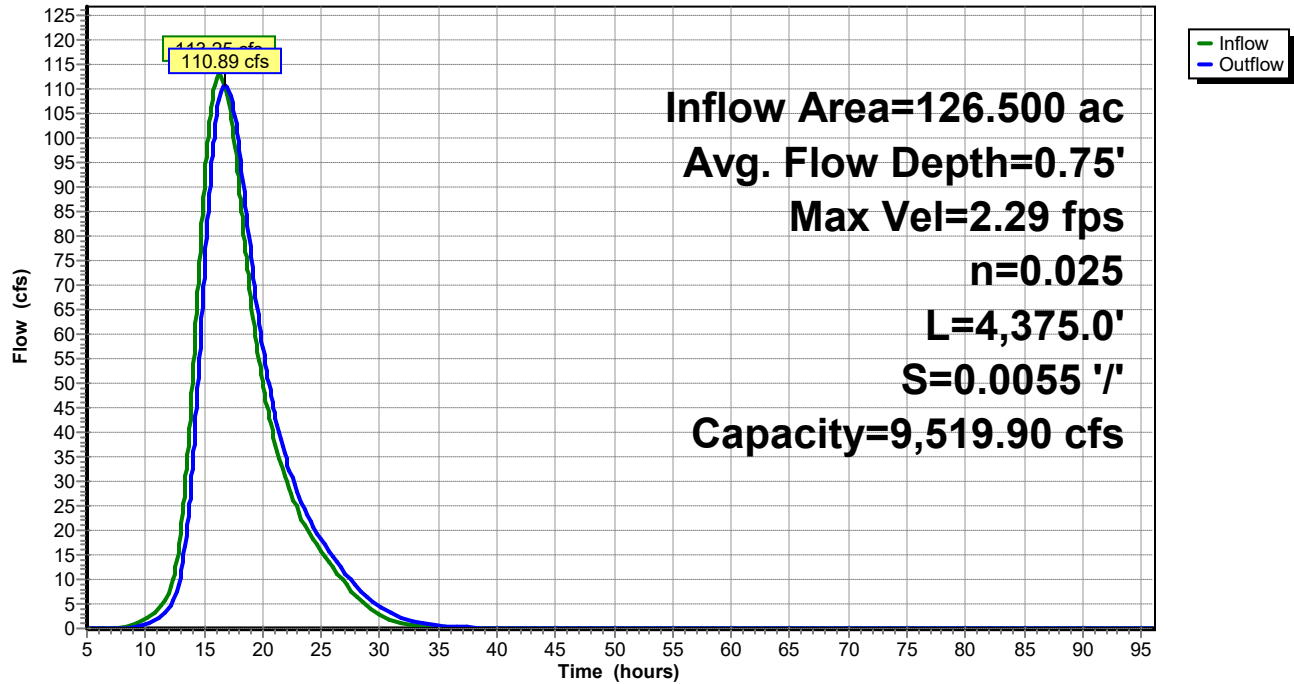


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,392.00	0.00
114.00	1,390.00	2.00
294.00	1,388.00	4.00
460.00	1,390.00	2.00
620.00	1,392.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	346.0	346.0	346.0	1,513,750	1,523.18
4.00	1,312.0	620.1	620.0	5,740,000	9,519.90

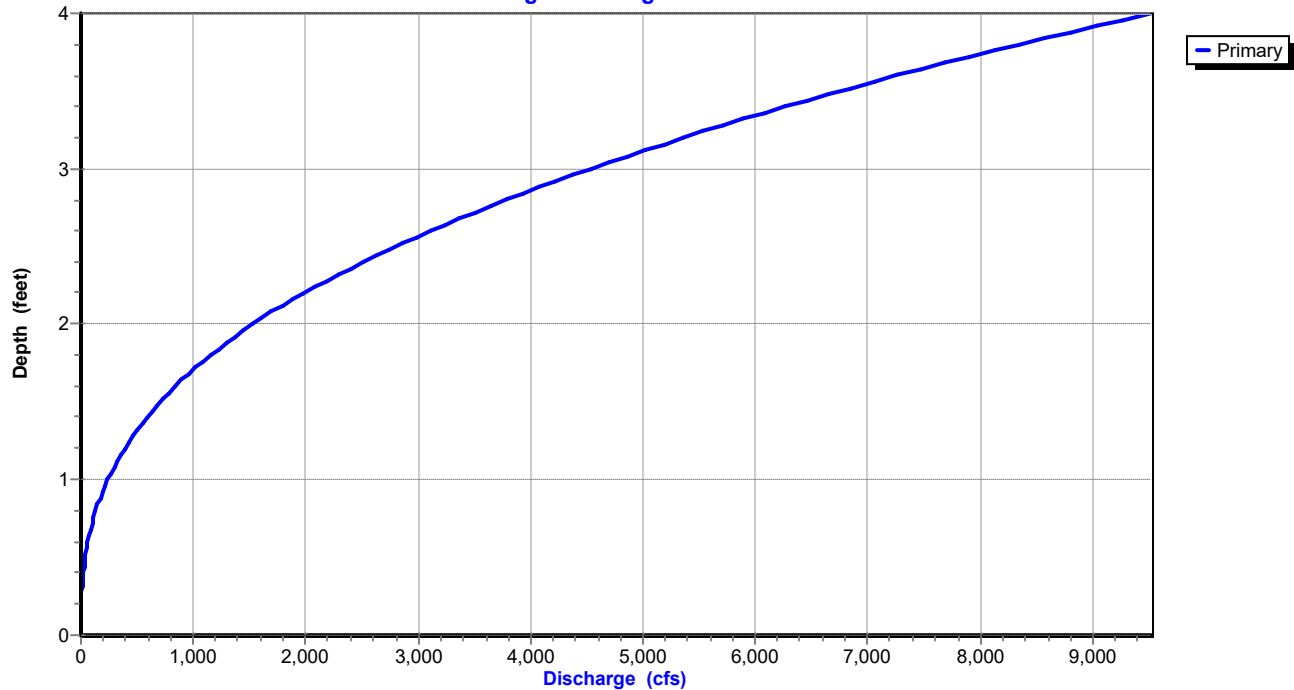
Reach 7R: NE Waterway

Hydrograph

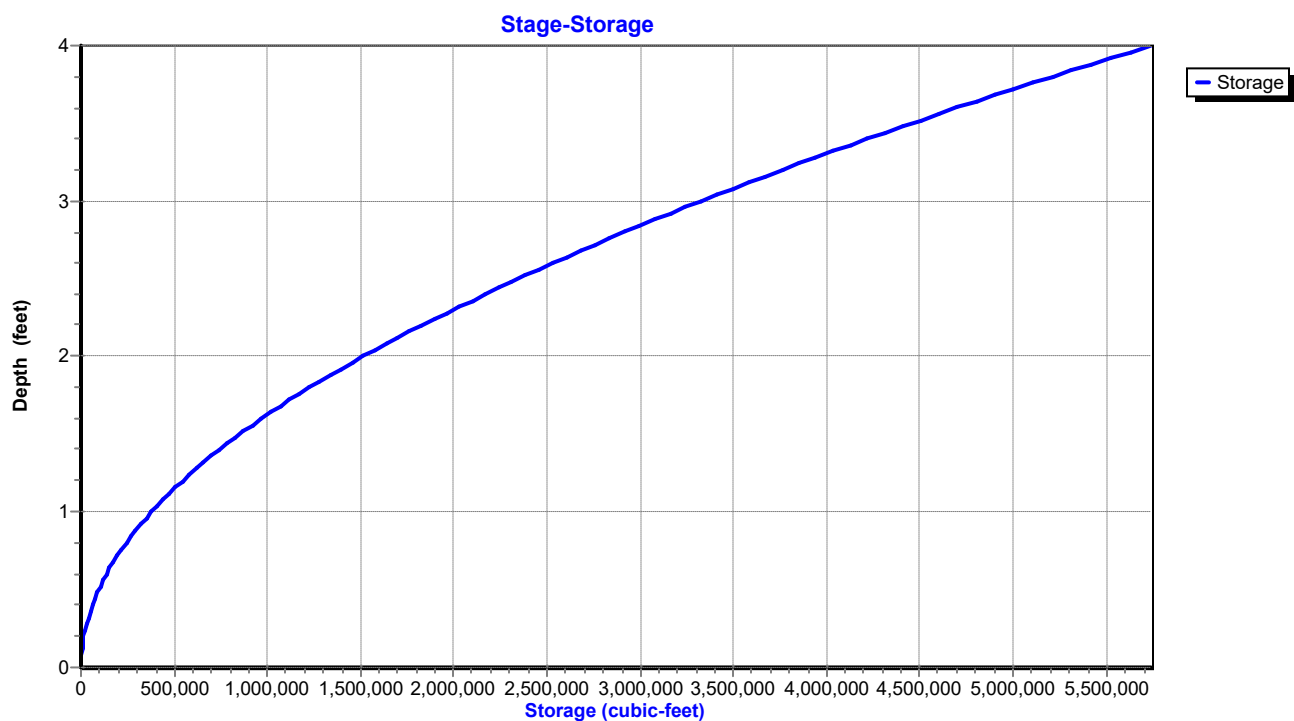


Reach 7R: NE Waterway

Stage-Discharge



Reach 7R: NE Waterway



Summary for Reach 8R: Combined Waterway

[62] Hint: Exceeded Reach 6R OUTLET depth by 1.34' @ 17.25 hrs

[62] Hint: Exceeded Reach 7R OUTLET depth by 0.42' @ 17.75 hrs

Inflow Area = 434.500 ac, 0.00% Impervious, Inflow Depth = 6.02" for 100 Year event
 Inflow = 335.86 cfs @ 17.35 hrs, Volume= 217.989 af
 Outflow = 335.70 cfs @ 17.45 hrs, Volume= 217.989 af, Atten= 0%, Lag= 6.3 min
 Routed to Pond 4P : Wetland Pool

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.70 fps, Min. Travel Time= 7.7 min

Avg. Velocity= 1.25 fps, Avg. Travel Time= 22.7 min

Peak Storage= 154,185 cf @ 17.45 hrs

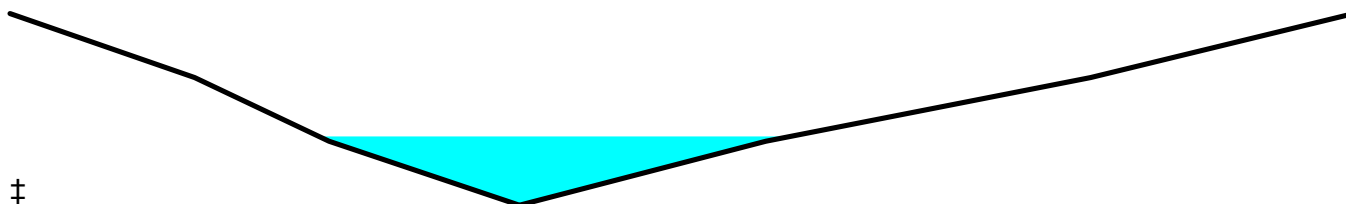
Average Depth at Peak Storage= 2.16' , Surface Width= 84.41'

Bank-Full Depth= 6.00' Flow Area= 716.0 sf, Capacity= 5,235.03 cfs

Custom cross-section, Length= 1,700.0' Slope= 0.0035 '/' (102 Elevation Intervals)

Constant n= 0.025 Earth, clean & straight

Inlet Invert= 1,374.00', Outlet Invert= 1,368.00'



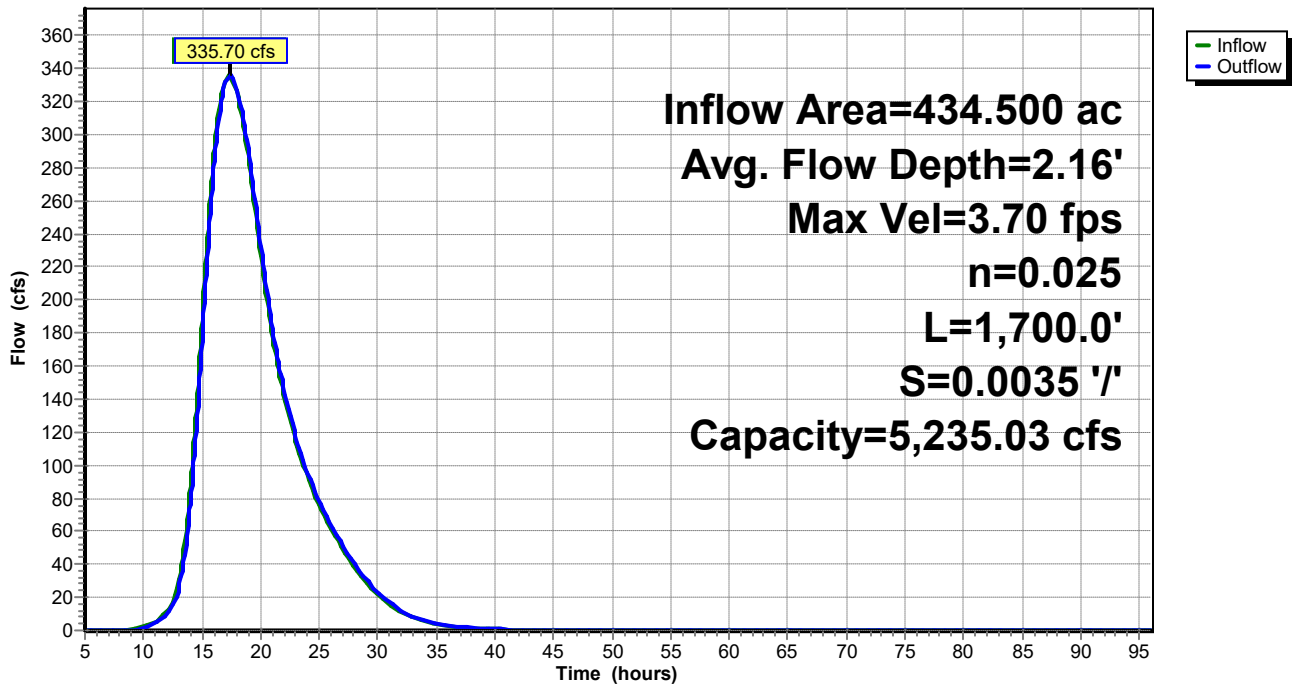
‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,374.00	0.00
33.00	1,372.00	2.00
57.00	1,370.00	4.00
91.00	1,368.00	6.00
135.00	1,370.00	4.00
193.00	1,372.00	2.00
240.00	1,374.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
2.00	78.0	78.1	78.0	132,600	275.19
4.00	316.0	160.2	160.0	537,200	1,754.93
6.00	716.0	240.3	240.0	1,217,200	5,235.03

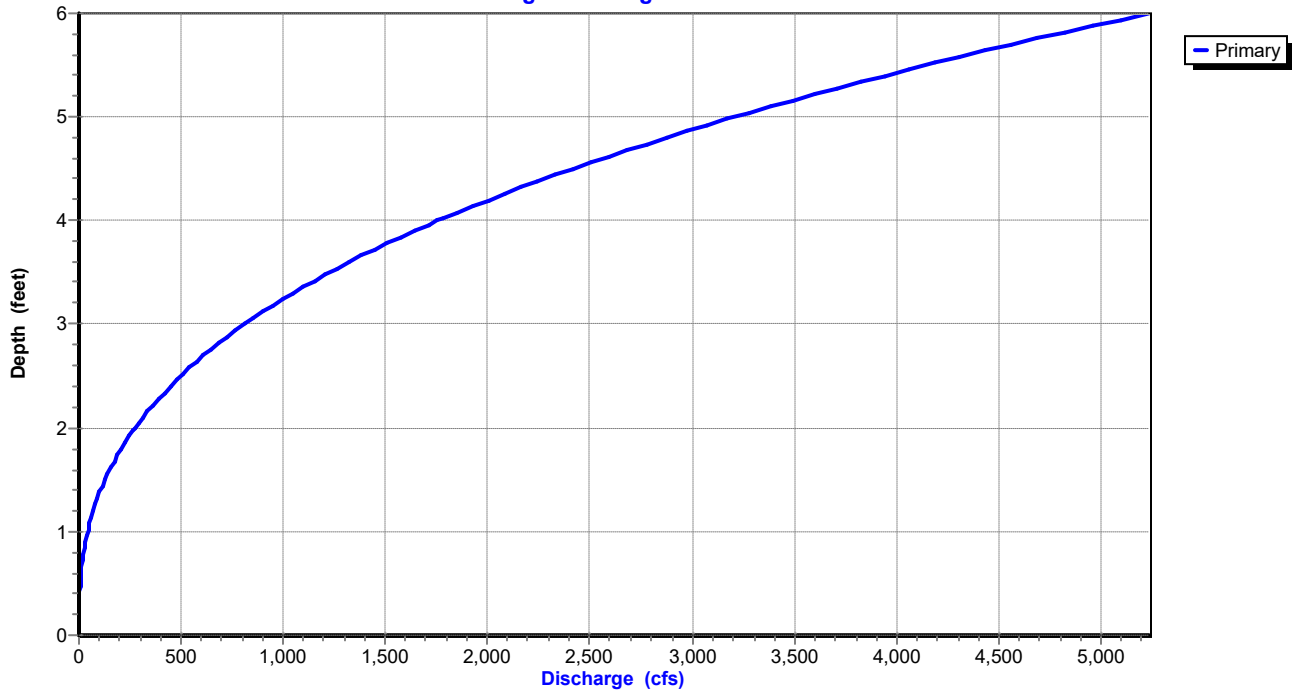
Reach 8R: Combined Waterway

Hydrograph

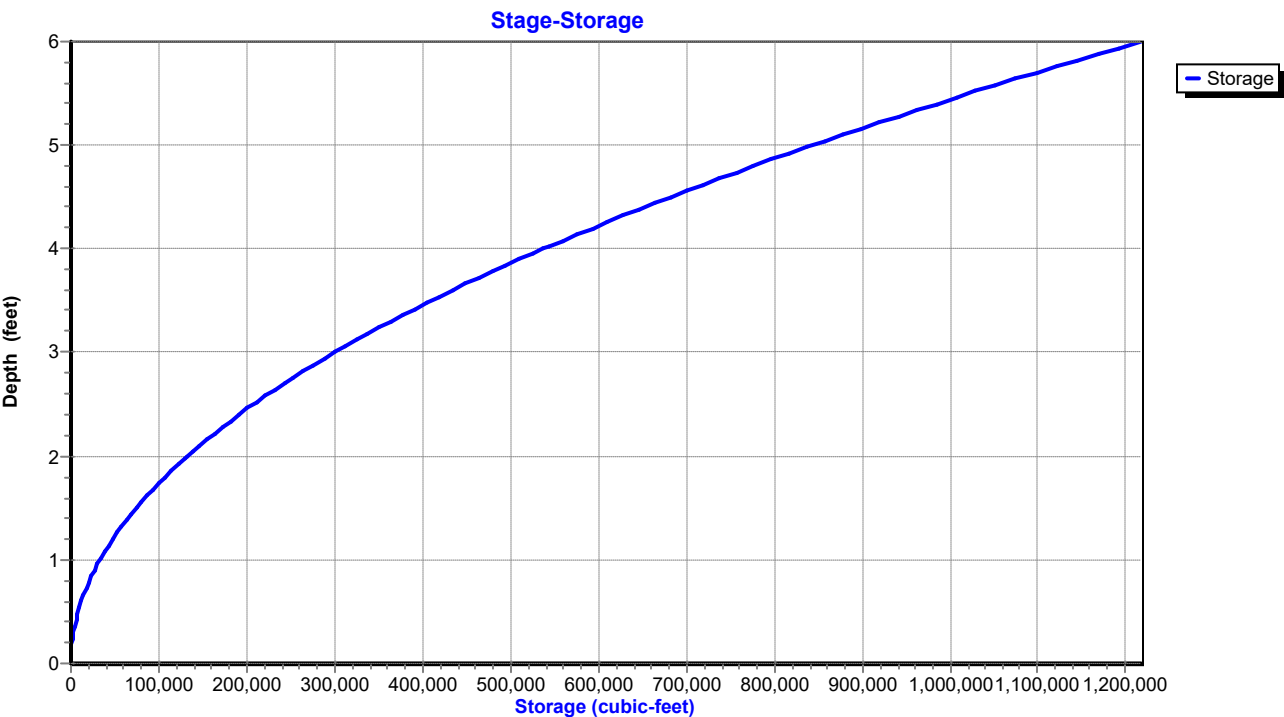


Reach 8R: Combined Waterway

Stage-Discharge



Reach 8R: Combined Waterway



Summary for Pond 4P: Wetland Pool

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 6.02" for 100 Year event
 Inflow = 997.95 cfs @ 14.05 hrs, Volume= 496.835 af
 Outflow = 986.41 cfs @ 14.25 hrs, Volume= 496.834 af, Atten= 1%, Lag= 11.8 min
 Primary = 986.41 cfs @ 14.25 hrs, Volume= 496.834 af
 Routed to Pond 5P : Box Culvert

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Starting Elev= 1,360.00' Surf.Area= 5.363 ac Storage= 11.648 af
 Peak Elev= 1,363.43' @ 14.25 hrs Surf.Area= 6.596 ac Storage= 32.022 af (20.374 af above start)

Plug-Flow detention time= 50.1 min calculated for 485.186 af (98% of inflow)
 Center-of-Mass det. time= 20.3 min (1,054.4 - 1,034.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,355.00'	39.394 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,355.00	0.032	0.000	0.000
1,356.00	0.633	0.333	0.333
1,357.00	1.085	0.859	1.192
1,358.00	2.130	1.607	2.799
1,359.00	5.103	3.616	6.415
1,360.00	5.363	5.233	11.648
1,361.00	5.727	5.545	17.193
1,362.00	5.992	5.859	23.053
1,362.50	6.130	3.030	26.083
1,363.00	6.366	3.124	29.207
1,364.00	6.896	6.631	35.838
1,364.50	7.326	3.556	39.394

Device	Routing	Invert	Outlet Devices
#1	Primary	1,360.00'	49.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	1,362.75'	35.0' long + 3.0' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

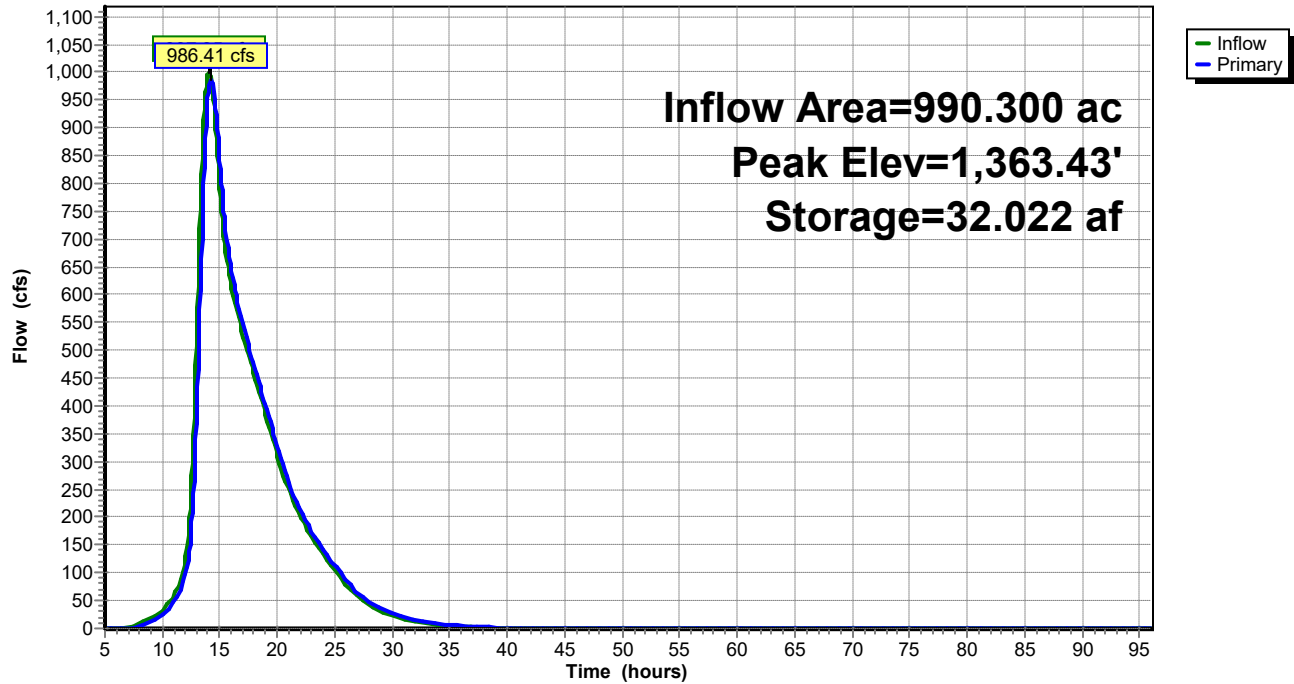
Primary OutFlow Max=986.10 cfs @ 14.25 hrs HW=1,363.43' TW=1,361.10' (Dynamic Tailwater)

1=Sharp-Crested Rectangular Weir (Weir Controls 930.65 cfs @ 5.61 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 55.45 cfs @ 2.19 fps)

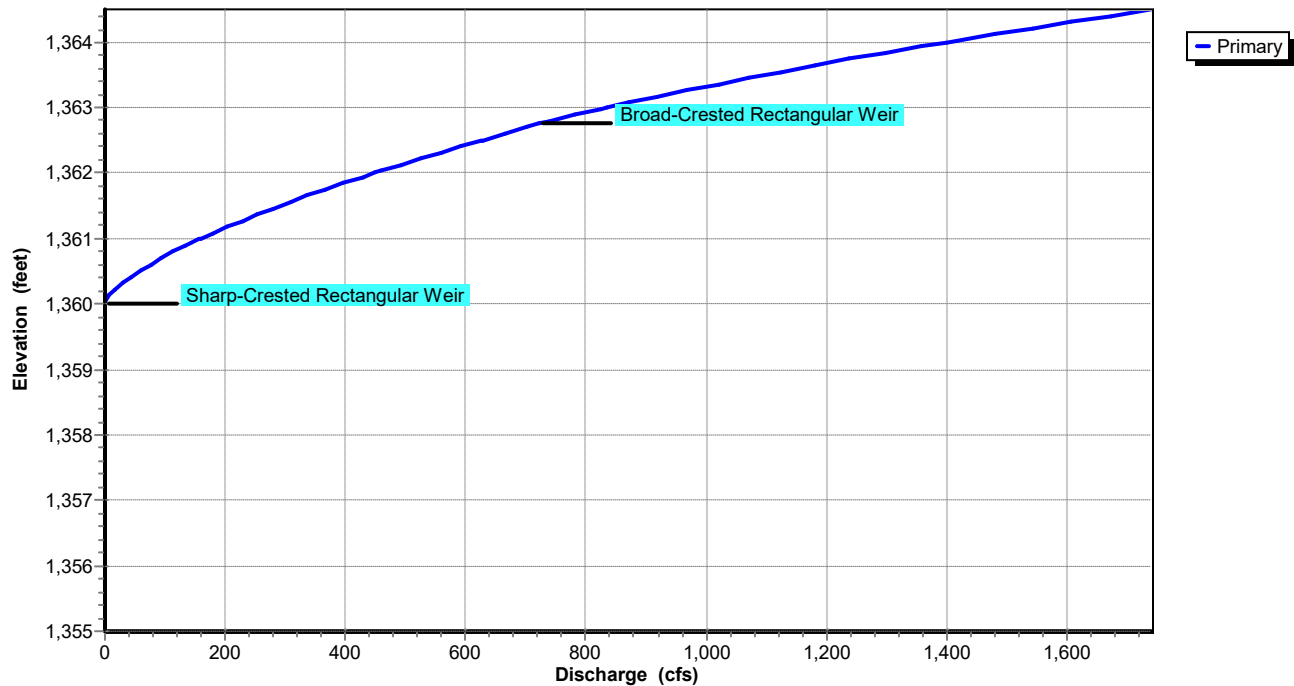
Pond 4P: Wetland Pool

Hydrograph

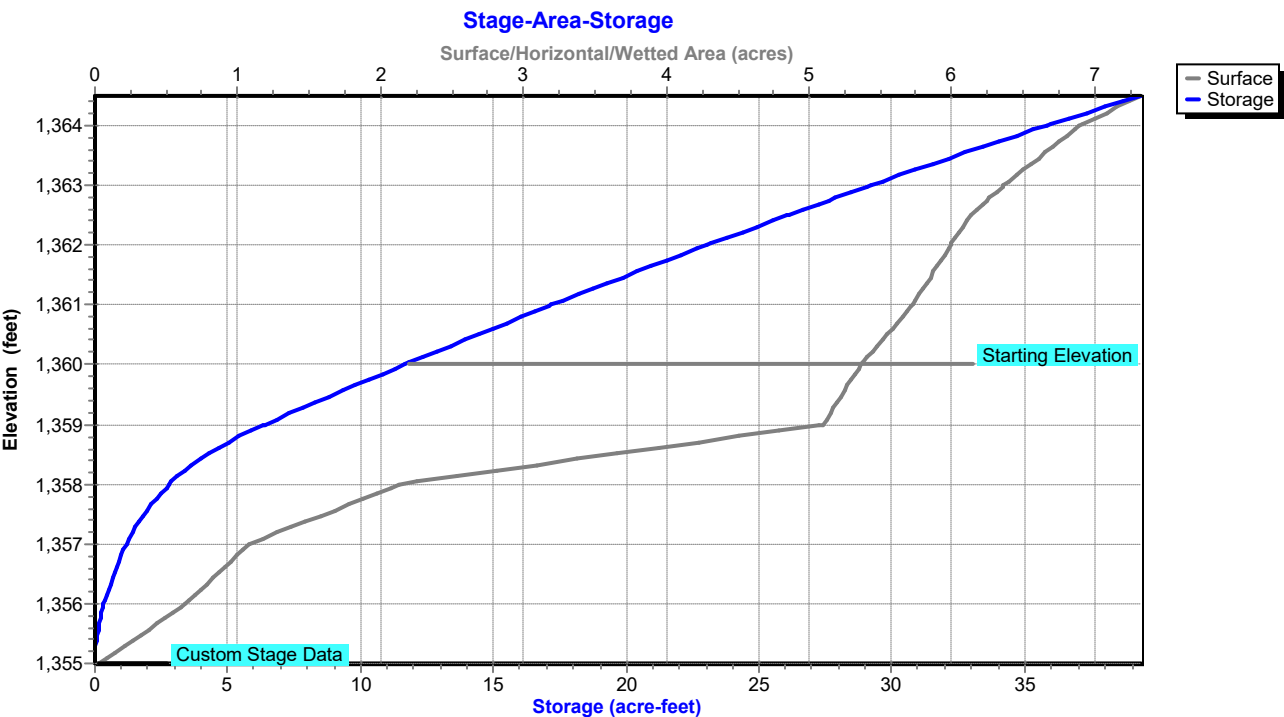


Pond 4P: Wetland Pool

Stage-Discharge



Pond 4P: Wetland Pool



Summary for Pond 5P: Box Culvert

Inflow Area = 990.300 ac, 0.00% Impervious, Inflow Depth = 6.02" for 100 Year event
Inflow = 986.41 cfs @ 14.25 hrs, Volume= 496.834 af
Outflow = 986.34 cfs @ 14.26 hrs, Volume= 497.351 af, Atten= 0%, Lag= 0.6 min
Primary = 549.86 cfs @ 14.26 hrs, Volume= 427.043 af
Secondary = 436.49 cfs @ 14.26 hrs, Volume= 70.308 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Starting Elev= 1,353.00' Surf.Area= 0.053 ac Storage= 0.089 af

Peak Elev= 1,361.10' @ 14.26 hrs Surf.Area= 0.623 ac Storage= 2.420 af (2.330 af above start)

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 0.9 min (1,055.3 - 1,054.4)

Volume Invert Avail.Storage Storage Description

#1 1,349.00' 2.676 af **Custom Stage Data (Prismatic) Listed below (Recalc)**

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,349.00	0.000	0.000	0.000
1,350.00	0.007	0.004	0.004
1,351.00	0.017	0.012	0.016
1,352.00	0.039	0.028	0.043
1,353.00	0.053	0.046	0.089
1,354.00	0.068	0.061	0.150
1,355.00	0.145	0.106	0.256
1,356.00	0.202	0.173	0.430
1,357.00	0.263	0.233	0.662
1,358.00	0.337	0.300	0.962
1,359.00	0.411	0.374	1.337
1,360.00	0.509	0.460	1.797
1,361.00	0.612	0.561	2.357
1,361.50	0.664	0.319	2.676

Device Routing Invert Outlet Devices

#1 Primary 1,349.25' **72.0" W x 72.0" H Box Box Culvert**
L= 50.0' Box, 30-75° wingwalls, square crown, Ke= 0.400
Inlet / Outlet Invert= 1,349.25' / 1,348.88' S= 0.0074 ' / Cc= 0.900
n= 0.012 Concrete pipe, finished, Flow Area= 36.00 sf

#2 Secondary 1,359.83' **Roadway, Cv= 2.62 (C= 3.28)**
Elev. (feet) 1,359.83 1,360.00 1,360.50 1,361.00 1,361.50
1,362.00
Width (feet) 0.00 61.56 116.46 160.90 195.03 228.25

Primary OutFlow Max=549.85 cfs @ 14.26 hrs HW=1,361.10' (Free Discharge)

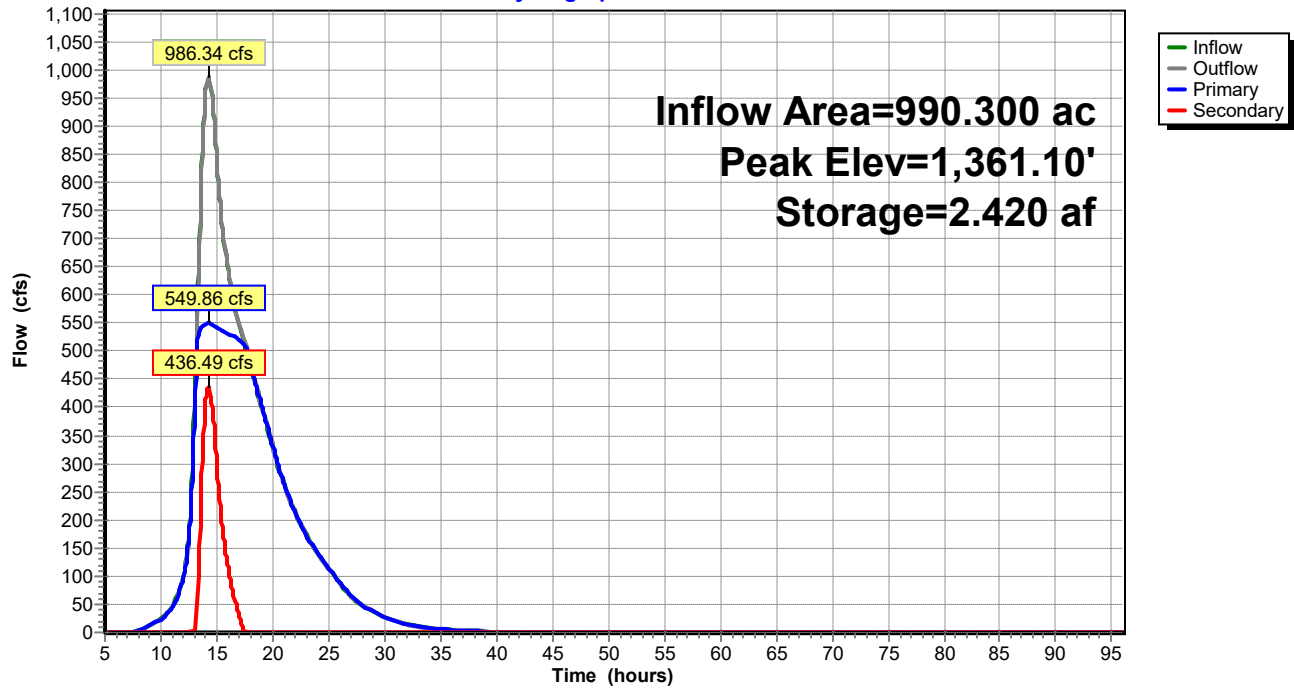
↑ **1=Box Culvert** (Inlet Controls 549.85 cfs @ 15.27 fps)

Secondary OutFlow Max=436.38 cfs @ 14.26 hrs HW=1,361.10' (Free Discharge)

↑ **2=Roadway** (Weir Controls 436.38 cfs @ 3.21 fps)

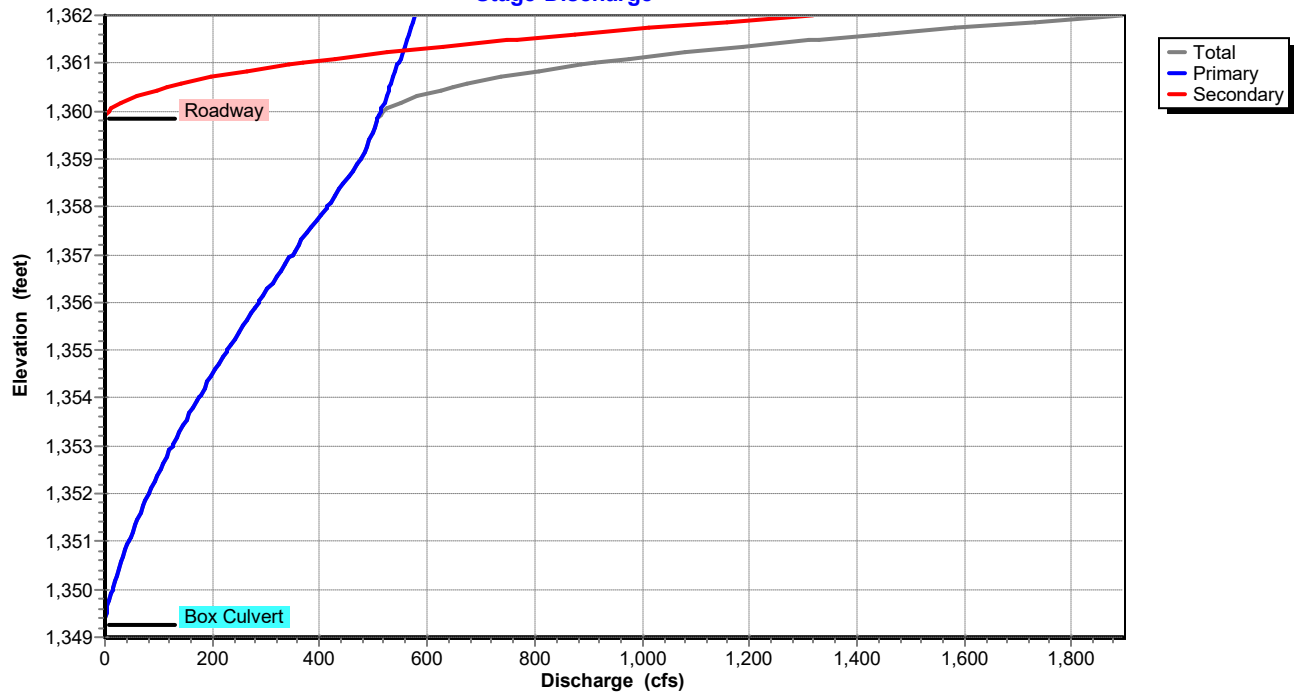
Pond 5P: Box Culvert

Hydrograph



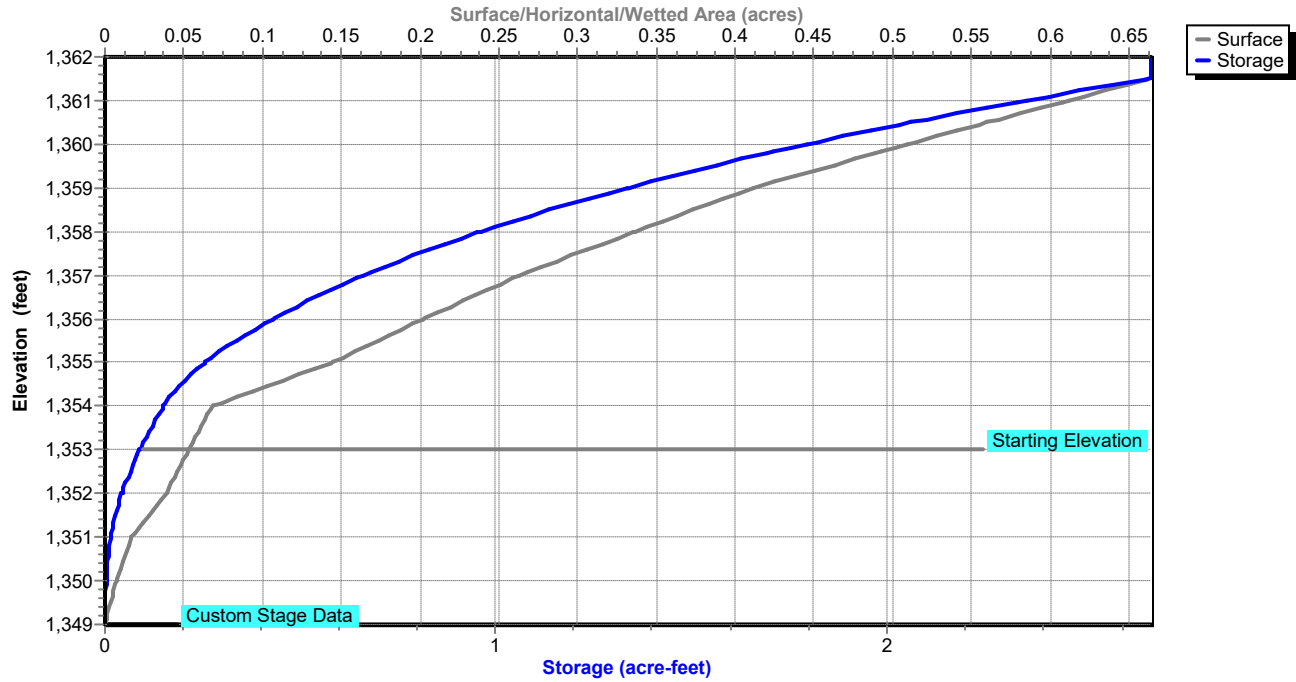
Pond 5P: Box Culvert

Stage-Discharge



Pond 5P: Box Culvert

Stage-Area-Storage



Events for Subcatchment 1S: Northwest Watershed

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
5 Year	3.70	83.62	56.250	2.19
10 Year	4.40	108.03	72.334	2.82
25 Year	5.60	150.94	100.780	3.93
50 Year	6.60	187.26	125.024	4.87
100 Year	7.80	231.17	154.524	6.02

Events for Subcatchment 2S: Northeast Watershed

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
5 Year	3.70	40.94	23.103	2.19
10 Year	4.40	52.87	29.708	2.82
25 Year	5.60	73.92	41.392	3.93
50 Year	6.60	91.73	51.349	4.87
100 Year	7.80	113.25	63.465	6.02

Events for Subcatchment 3S: Direct Watershed

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
5 Year	3.70	338.38	101.506	2.19
10 Year	4.40	435.60	130.529	2.82
25 Year	5.60	606.96	181.862	3.93
50 Year	6.60	750.96	225.611	4.87
100 Year	7.80	924.27	278.846	6.02

Events for Reach 6R: North Waterway

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
5 Year	83.62	82.82	1,391.50	111,183
10 Year	108.03	107.09	1,391.57	134,178
25 Year	150.94	149.82	1,391.67	171,693
50 Year	187.26	186.05	1,391.74	201,392
100 Year	231.17	229.87	1,391.82	235,456

Events for Reach 7R: NE Waterway

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
5 Year	40.94	39.80	1,399.51	98,305
10 Year	52.87	51.53	1,399.56	119,399
25 Year	73.92	72.18	1,399.64	153,715
50 Year	91.73	89.70	1,399.69	180,885
100 Year	113.25	110.89	1,399.75	212,071

Events for Reach 8R: Combined Waterway

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
5 Year	121.40	121.22	1,375.47	71,677
10 Year	156.89	156.69	1,375.62	86,916
25 Year	219.23	219.06	1,375.84	111,729
50 Year	271.97	271.83	1,375.99	131,380
100 Year	335.86	335.70	1,376.16	154,185

Events for Pond 4P: Wetland Pool

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
5 Year	355.41	347.33	1,361.68	21.165
10 Year	460.68	452.37	1,362.01	23.104
25 Year	647.68	633.70	1,362.57	26.518
50 Year	806.15	793.11	1,363.01	29.271
100 Year	997.95	986.41	1,363.43	32.022

Events for Pond 5P: Box Culvert

Event	Inflow (cfs)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)	Elevation (feet)	Storage (acre-feet)
5 Year	347.33	347.02	347.02	0.00	1,356.97	0.655
10 Year	452.37	451.41	451.41	0.00	1,358.60	1.177
25 Year	633.70	633.61	529.33	104.28	1,360.47	2.045
50 Year	793.11	793.09	540.42	252.66	1,360.81	2.241
100 Year	986.41	986.34	549.86	436.49	1,361.10	2.420

Appendix E: Stilling Basin Calculations

Weir & Stilling Basin Dimensions				
Project: Clay - Kracht				
Project No.: CLA953734C				
By: BCS				
Date: December 17, 2025				
Note: Ignore angled weir sides. Assume Q_{10} = capacity w/o free board				
Item	Variable	Q_{100}	Explanation	
Weir Width (ft)	L	49	Hydrology Report	
Constructed Weir Height (ft)	h	4.5	Hydrology Report	
Peak discharge (cfs)		946	Hydrology Report	
Weir Elev (ft)		1360.00	Phase 2 Site Plan	
Tail Water Elev (ft)		1361.14	Hydrology Report	
Transverse Sill Elev (ft)		1351.50	Determine from Phase 2 Site Plan	
Headwater Elev (ft)		1363.48	Pool Elev. Upstream of Weir	
Tail water depth (ft)	t	9.64	Tail Water Elev. - Transverse Sill Elev.	
Headwater depth (ft)	H	3.48	Headwater Elev. - Weir Elev.	
h/t	h/t	0.47	for use in chart to find L_B/F	
Unit Flow Rate (cfs/ft)	q	19.31	for use in chart to find d_c	
Weir Critical Depth (ft)	d_c	2.264	Use Chart ES-111 on 5-19 for Critical Depth	
Tail Water Check		4.26	OK (t/d_c is greater than 1.75)	
Calculated Transverse Sill Height (Min ft.)	(s)	0.9056	0.4 times d_c	
Used Transverse Sill Height (ft)	s	1.5		
Stilling Basin Elev (ft)		1350.00		
Cantilever Height (ft)	F	8.50	Weir Elev. - Transverse Sill Elev	
h/F	h/F	0.53	for use in chart to find L_B/F	
L_B/F	L_B/F	2.8	Use Chart ES-111 on 5-21 for L_B/F	
Calculated Stilling basin length, (Min ft.)	(L_B)	23.8	$L_B/F * F$	
Used Stilling basin length, (ft.)	L_B	24.5	(Create a 20' minimum flat bottom length)	
Sheetpile Cantilever Design Height		10.00	Weir Elev. - Stilling Basin Elev.	

Name: Kracht Wetland Design Report

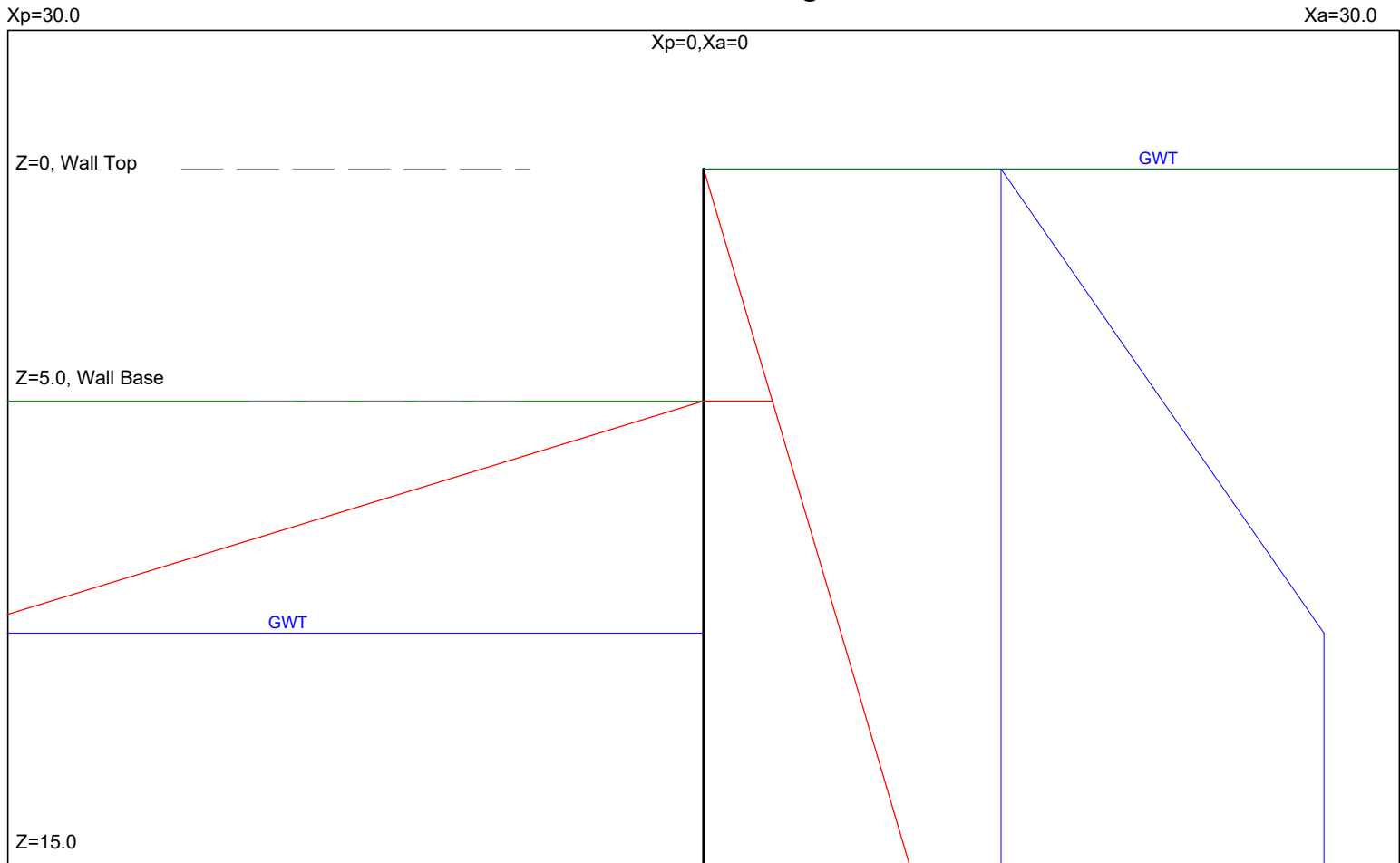
Date: June 10, 2026

Page: 9

Appendix F: Sheet Pile Weir Calculations

IDALS Stilling Basin - 5ft

Earth Press - Strength



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UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 2/25/2026

File: C:\Users\eric.berning\OneDrive - Bolton & Menk, Inc\Desktop\Shoring Suite\LC1 - Dynamic Water 2.ep8

* INPUT DATA *

Wall Height=5.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	32	0.0	5	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	5.0	0.0	5.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	10.0	0.0
2	10.0	800.0

Wall Friction Options: 1.* No wall friction

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 0.33 per one linear foot (or meter) width along wall height

Total Static Force above Base= 0.33

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	5.00	0.13	0.0265	0.4609

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
5.00	0.13	15.00	0.40	0.0265	0.4609

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 0.75

Z1	Pp1	Z2	Pp2	Slope	Kp
5.00	0.00	10.00	1.46	0.293	2.4409
10.00	1.46	15.00	2.17	0.141	2.4409

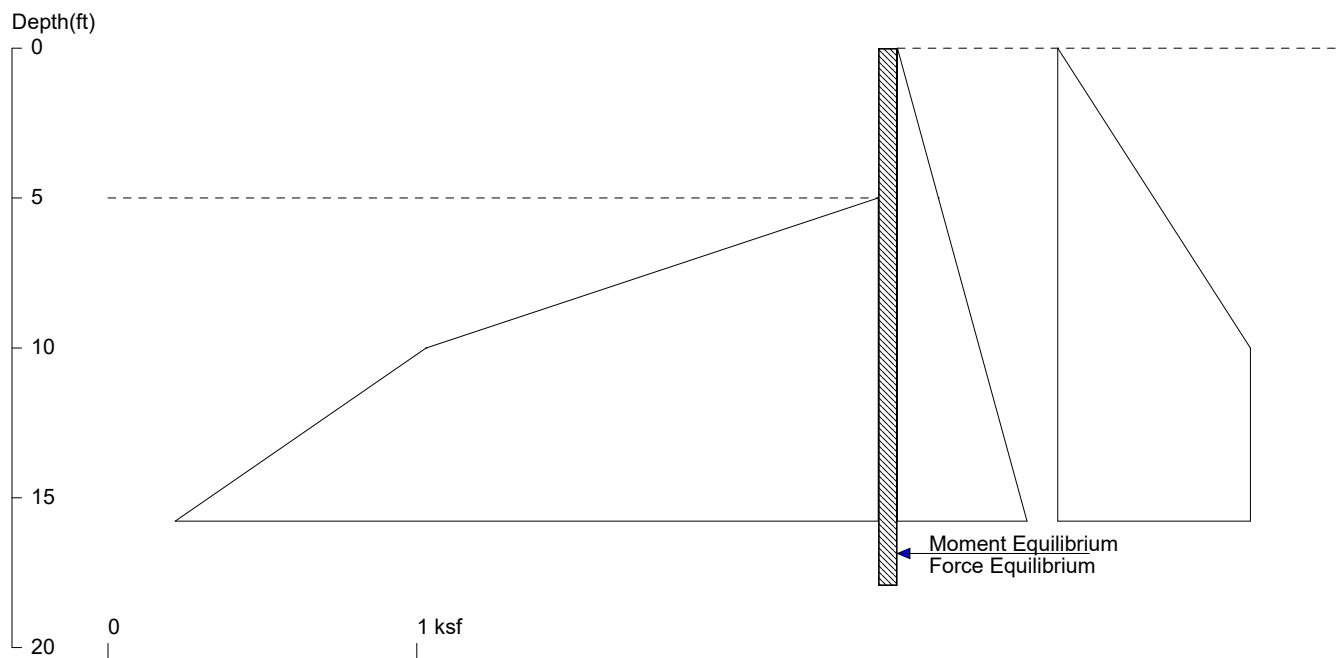
Water Pressure - Output to Shoring - Multiplier of Pressure = 1

No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	10.00	0.62	0.06
1	10.00	0.62	15.00	0.62	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 2/25/2026 File Name: C:\Users\eric.berning\OneDrive - Bolton & Menk, Inc\Desktop\Shoring Suite\LC1 - Dynamic Water 2.ep8

IDALS Stilling Basin - 5ft Shoring - Strength



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Date: 2/25/2026

File: C:\Users\eric.berning\OneDrive - Bolton & Menk, Inc\Desktop\Shoring Suite\LC1 - Dynamic Water.sh8

Wall Height=5.0

Pile Diameter=1.0

Pile Spacing=1.0

Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=10.78 Min. Pile Length=15.78

MOMENT IN PILE: Max. Moment=9.22 per Pile Spacing=1.0 at Depth=11.22

PILE SELECTION:

Request Min. Section Modulus = 2.5 in³/ft=132.23 cm³/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	5.000	0.133	0.026547
*	Below	Base		
5.000	0.133	50.000	1.327	0.026547
*	Water	Pres.		
0.000	0.000	10.000	0.624	0.062400
10.000	0.624	50.000	0.624	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
5.000	0.000	10.000	1.465	0.292913
10.000	1.465	50.000	7.088	0.140598

ACTIVE SPACING:

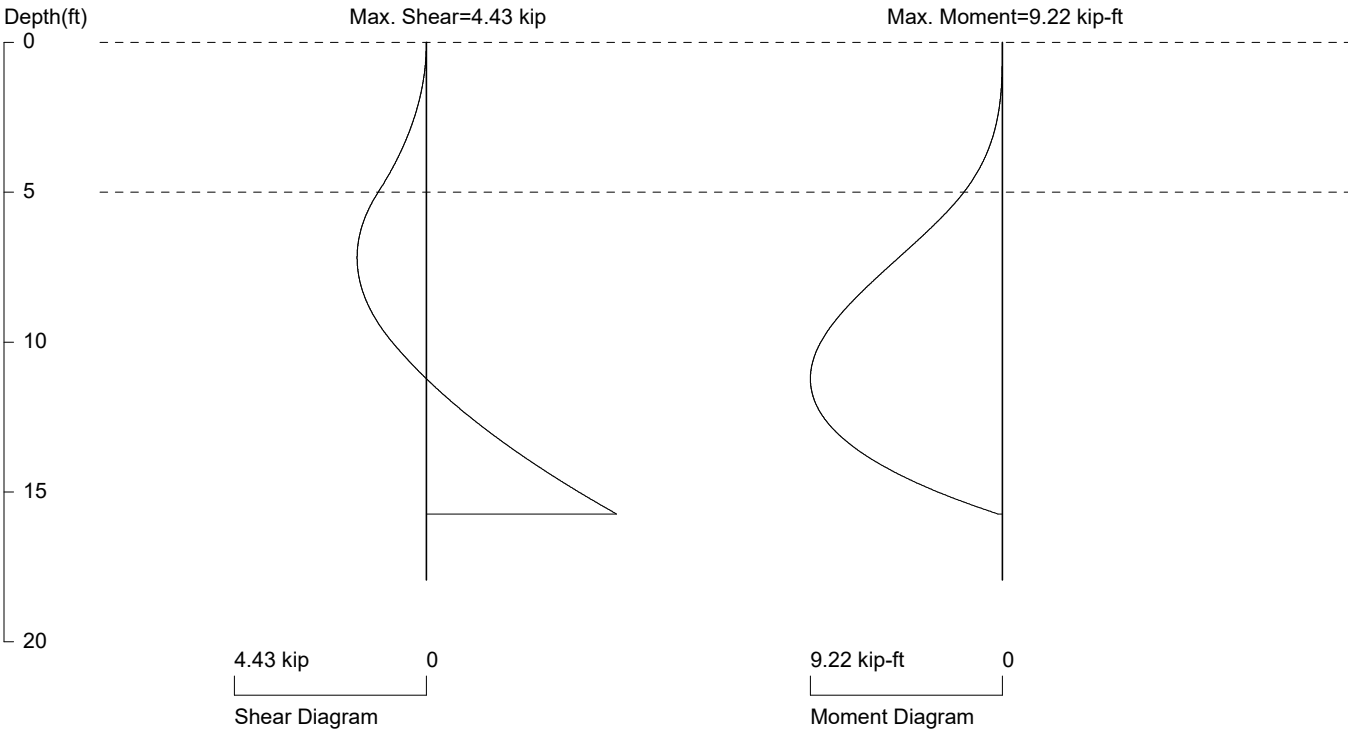
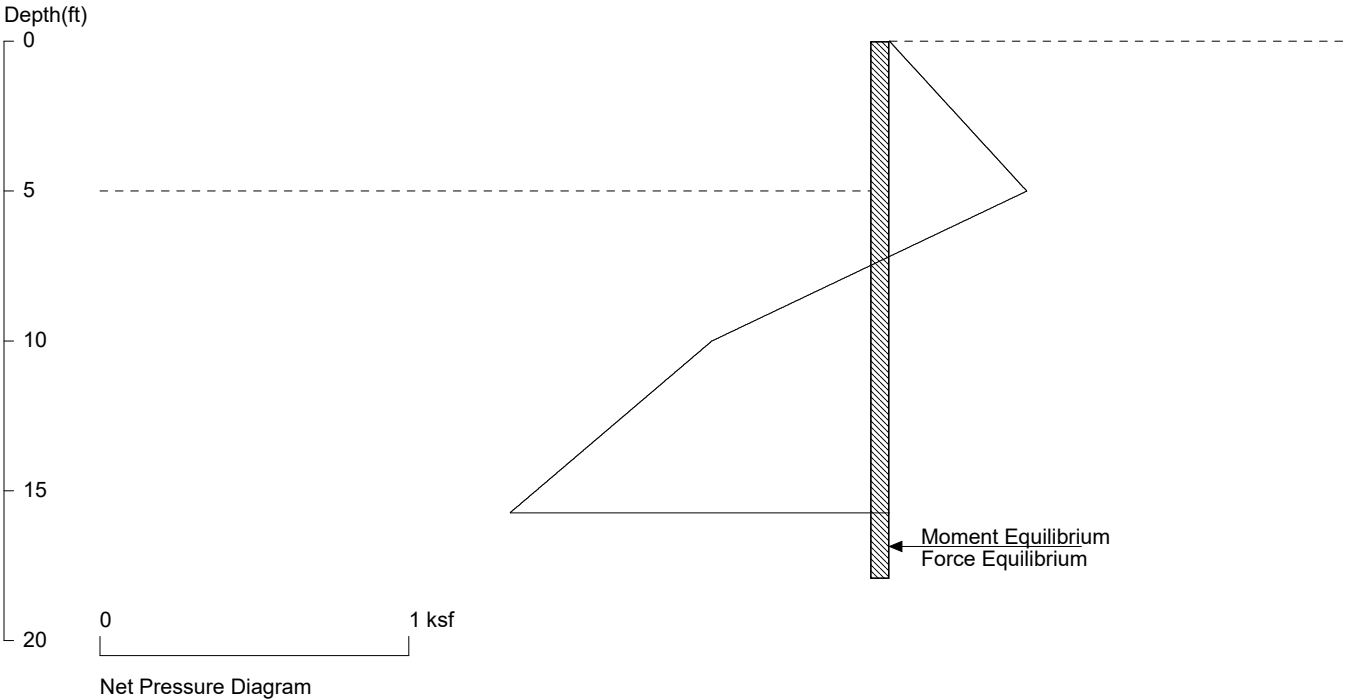
No.	Z depth	Spacing
1	0.00	1.00
2	5.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

**IDALS Stilling Basin - 5ft
Shoring - Strength**



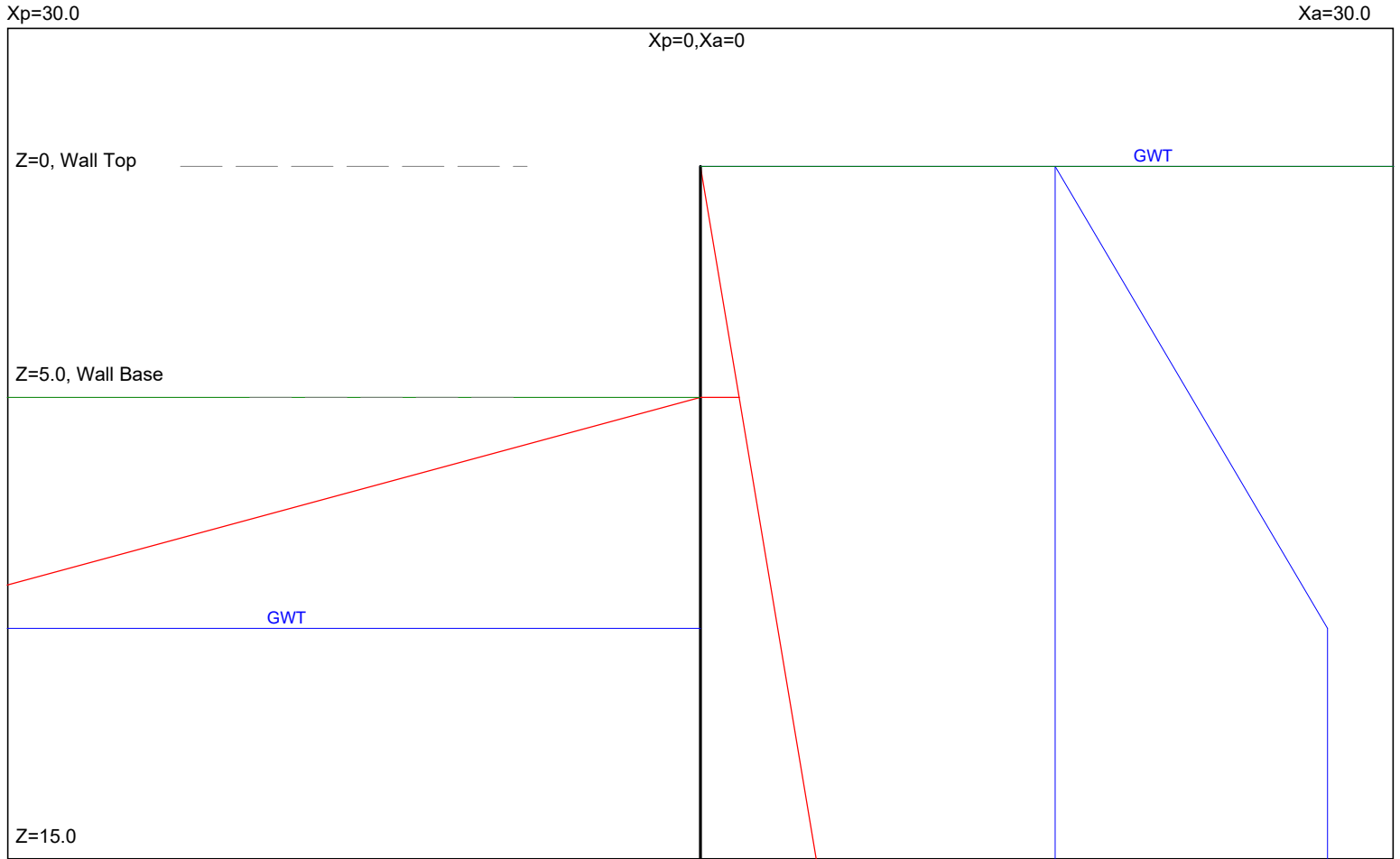
PRESSURE, SHEAR, AND MOMENT DIAGRAM

Based on pile spacing: 1.0 foot or meter

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IDALS Stilling Basin - 5ft

Earth Press - Service



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UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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* INPUT DATA *

Wall Height=5.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	32	0.0	5	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	5.0	0.0	5.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	10.0	0.0
2	10.0	800.0

Wall Friction Options: 1.* No wall friction

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 0.22 per one linear foot (or meter) width along wall height

Total Static Force above Base= 0.22

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	5.00	0.09	0.0177	0.3073

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
5.00	0.09	15.00	0.27	0.0177	0.3073

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
5.00	0.00	10.00	1.95	0.391	3.2546
10.00	1.95	15.00	2.89	0.187	3.2546

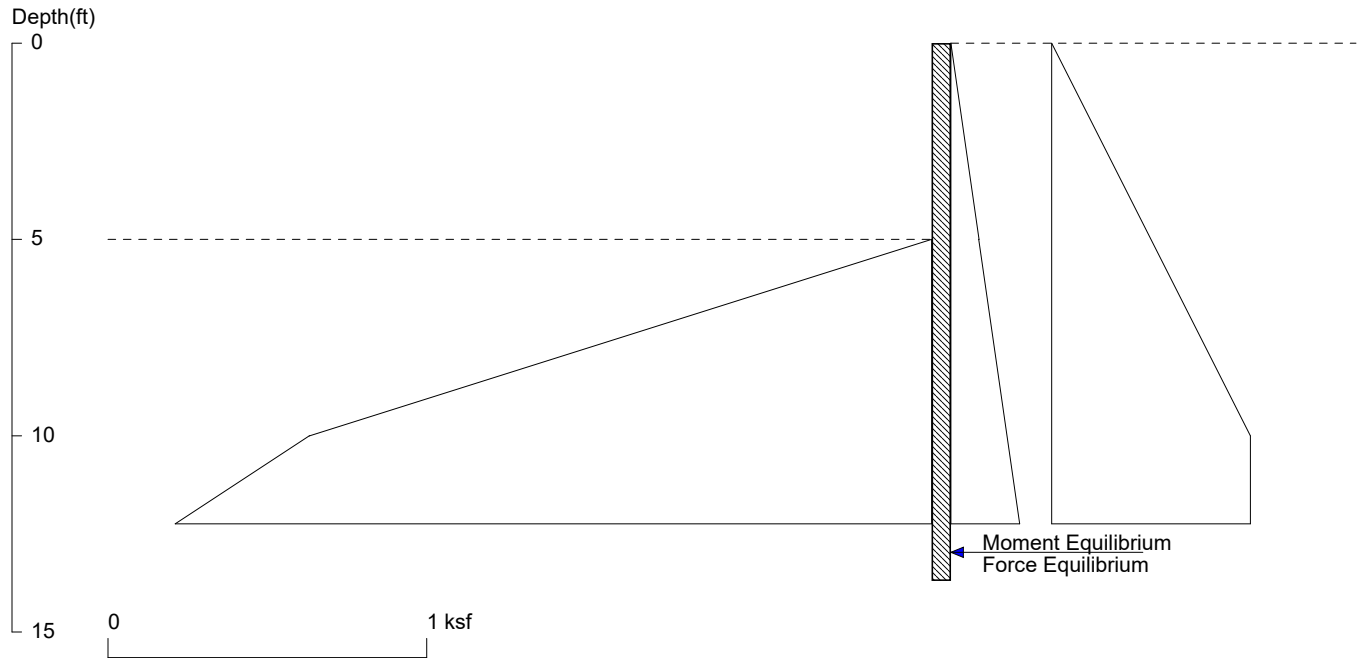
Water Pressure - Output to Shoring - Multiplier of Pressure = 1

No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	10.00	0.62	0.06
1	10.00	0.62	15.00	0.62	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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IDALS Stilling Basin - 5ft Shoring - Service



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Wall Height=5.0

Pile Diameter=1.0

Pile Spacing=1.0

Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=7.25 Min. Pile Length=12.25

MOMENT IN PILE: Max. Moment=5.57 per Pile Spacing=1.0 at Depth=9.13

PILE SELECTION:

Request Min. Section Modulus = 1.5 in³/ft=79.85 cm³/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.9

User Input I (Moment of Inertia):

Top Deflection = 0.89(in) based on E (ksi)=29000.00 and I (in⁴)/foot=30.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	5.000	0.088	0.017698
*	Below	Base		
5.000	0.088	50.000	0.885	0.017698
*	Water	Pres.		
0.000	0.000	10.000	0.624	0.062400
10.000	0.624	50.000	0.624	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
5.000	0.000	10.000	1.953	0.390551
10.000	1.953	50.000	9.451	0.187464

ACTIVE SPACING:

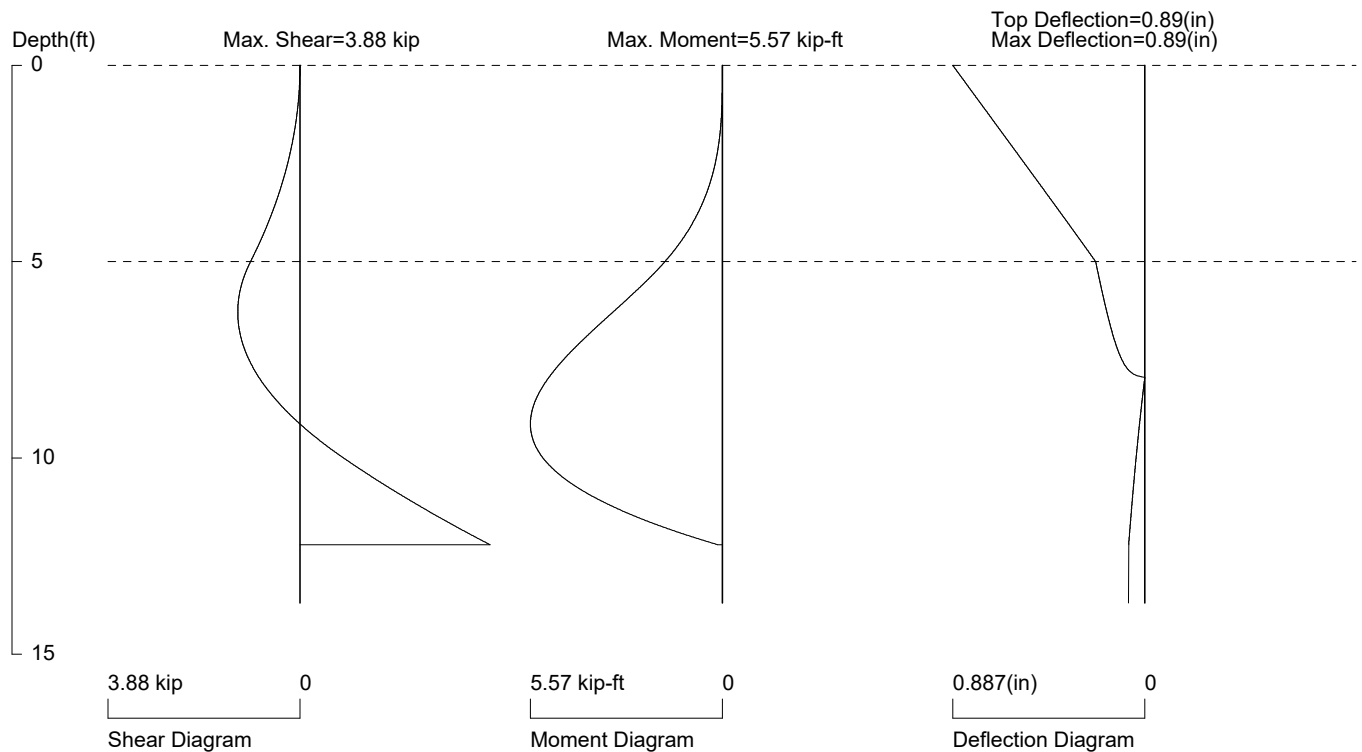
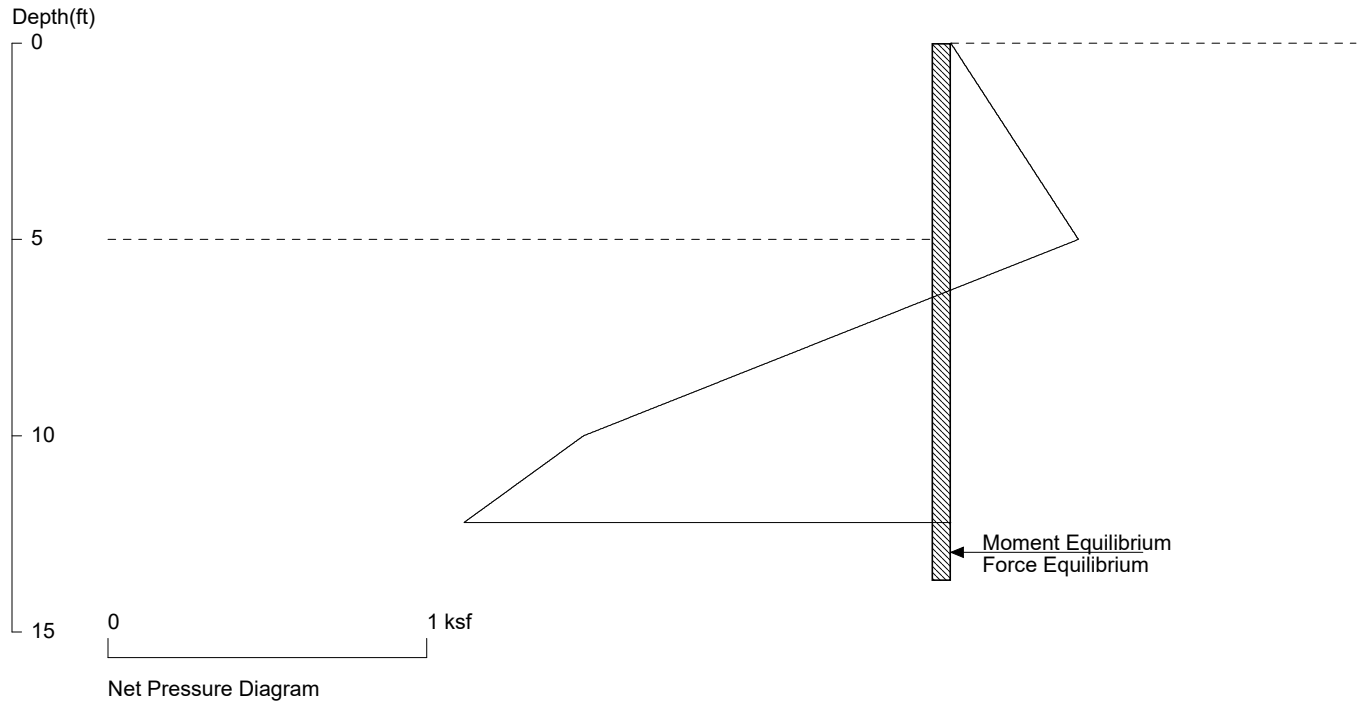
No.	Z depth	Spacing
1	0.00	1.00
2	5.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

IDALS Stilling Basin - 5ft Shoring - Service



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in⁴)/foot=30.0

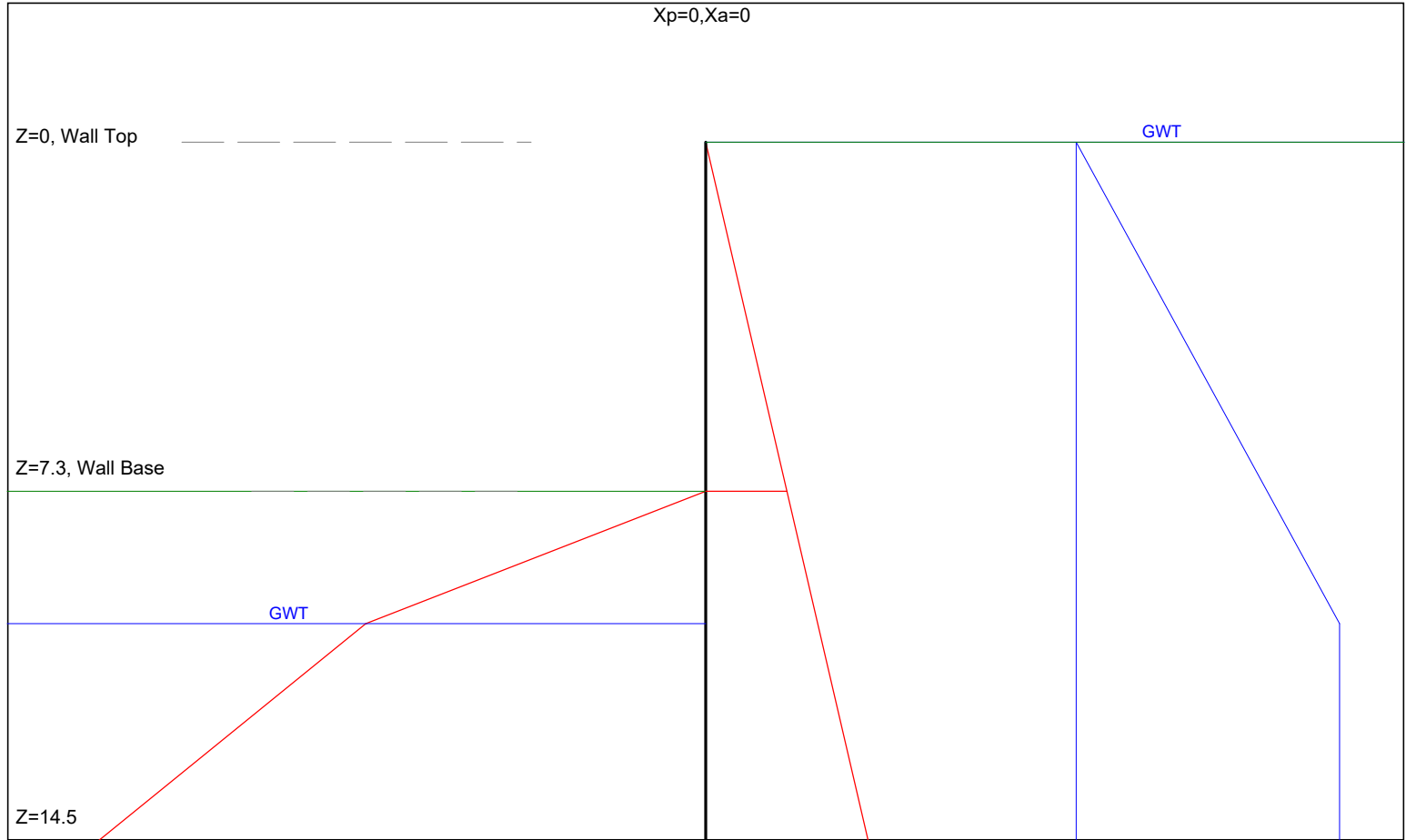
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IDALS Stilling Basin - 7.25ft

Earth Press - Strength

Xp=29.0

Xa=29.0



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Date: 2/25/2026

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* INPUT DATA *

Wall Height=7.3 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	32	0.0	5	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	7.3	0.0	7.3	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	10.0	0.0
2	10.0	800.0

Wall Friction Options: 1.* No wall friction

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 0.70 per one linear foot (or meter) width along wall height

Total Static Force above Base= 0.70

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	7.25	0.19	0.0265	0.4609

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
7.25	0.19	14.50	0.38	0.0265	0.4609

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 0.75

Z1	Pp1	Z2	Pp2	Slope	Kp
7.25	0.00	10.00	0.81	0.293	2.4409
10.00	0.81	14.50	1.44	0.141	2.4409

Water Pressure - Output to Shoring - Multiplier of Pressure = 1

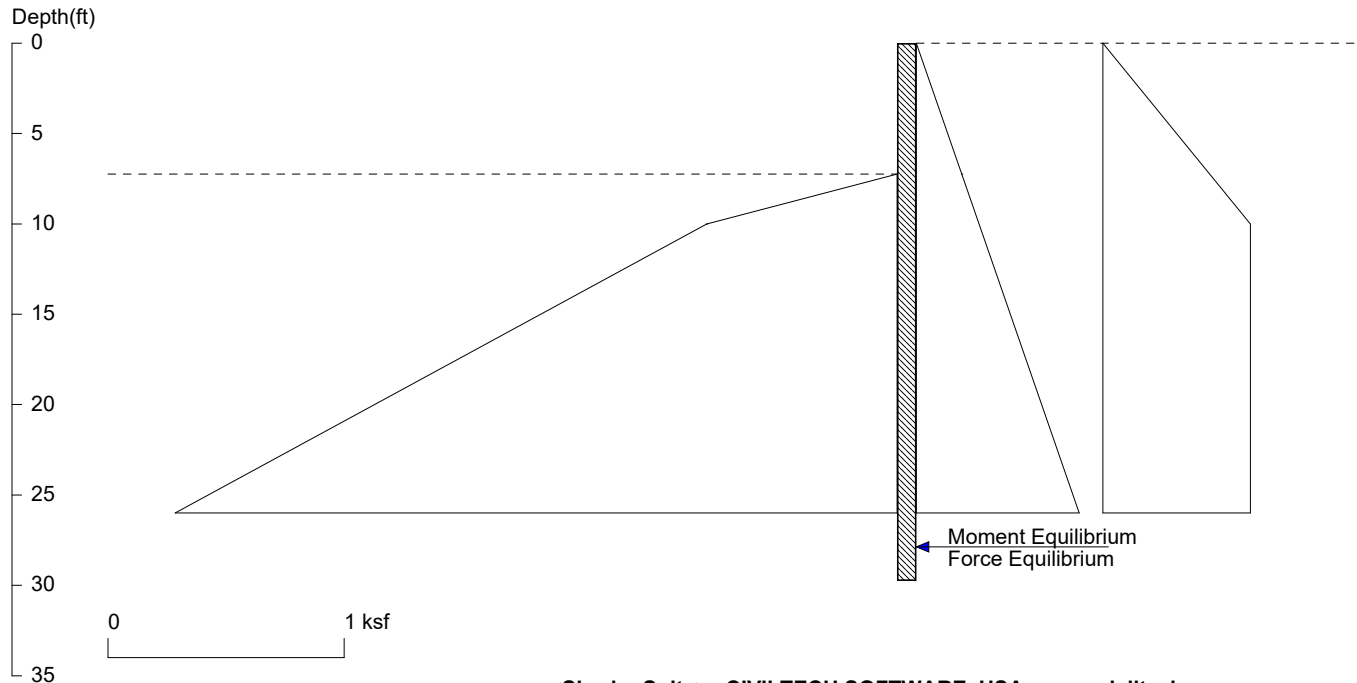
No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	10.00	0.62	0.06
1	10.00	0.62	14.50	0.62	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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IDALS Stilling Basin - 7.25ft

Shoring - Strength



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Wall Height=7.3

Pile Diameter=1.0

Pile Spacing=1.0

Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=18.75 Min. Pile Length=26.00

MOMENT IN PILE: Max. Moment=33.51 per Pile Spacing=1.0 at Depth=18.43

PILE SELECTION:

Request Min. Section Modulus = 8.9 in³/ft=480.44 cm³/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	7.250	0.192	0.026547
*	Below	Base		
7.250	0.192	65.250	1.732	0.026547
*	Water	Pres.		
0.000	0.000	10.000	0.624	0.062400
10.000	0.624	65.250	0.624	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
7.250	0.000	10.000	0.806	0.292913
10.000	0.806	65.250	8.574	0.140598

ACTIVE SPACING:

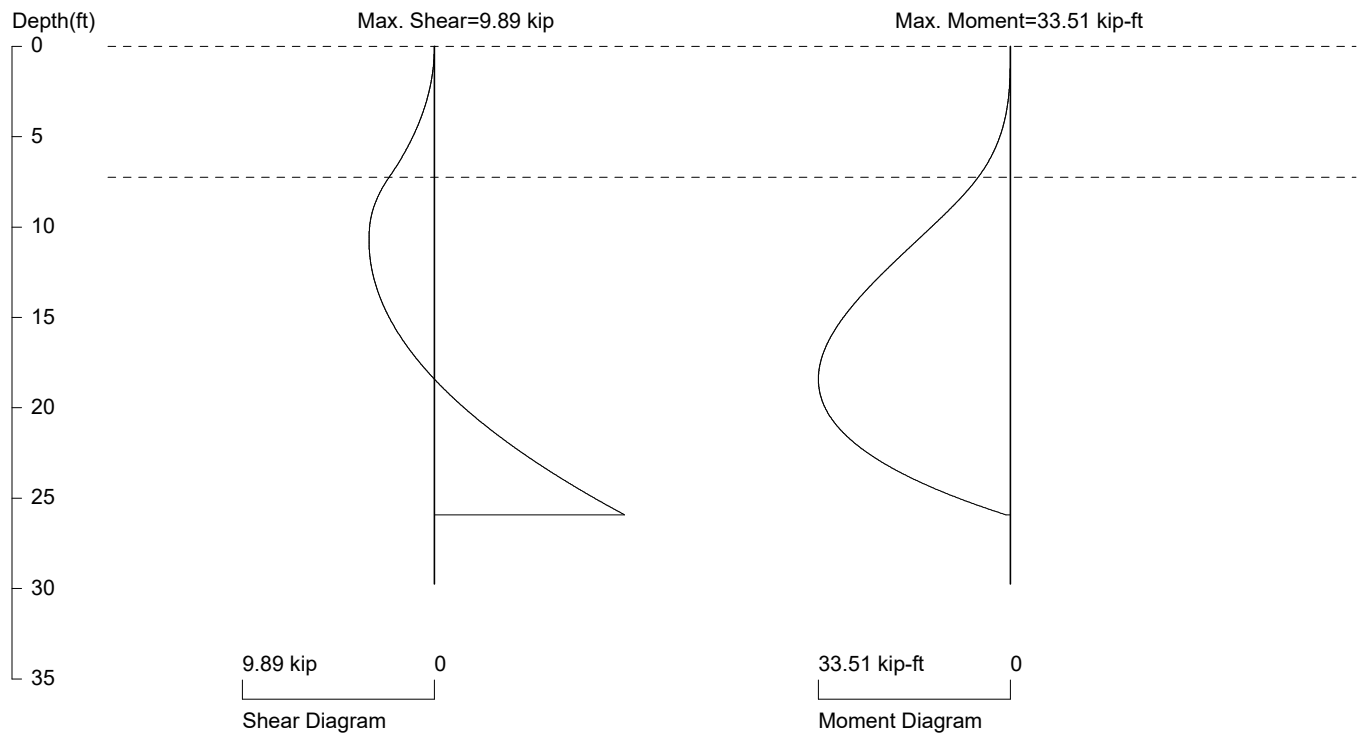
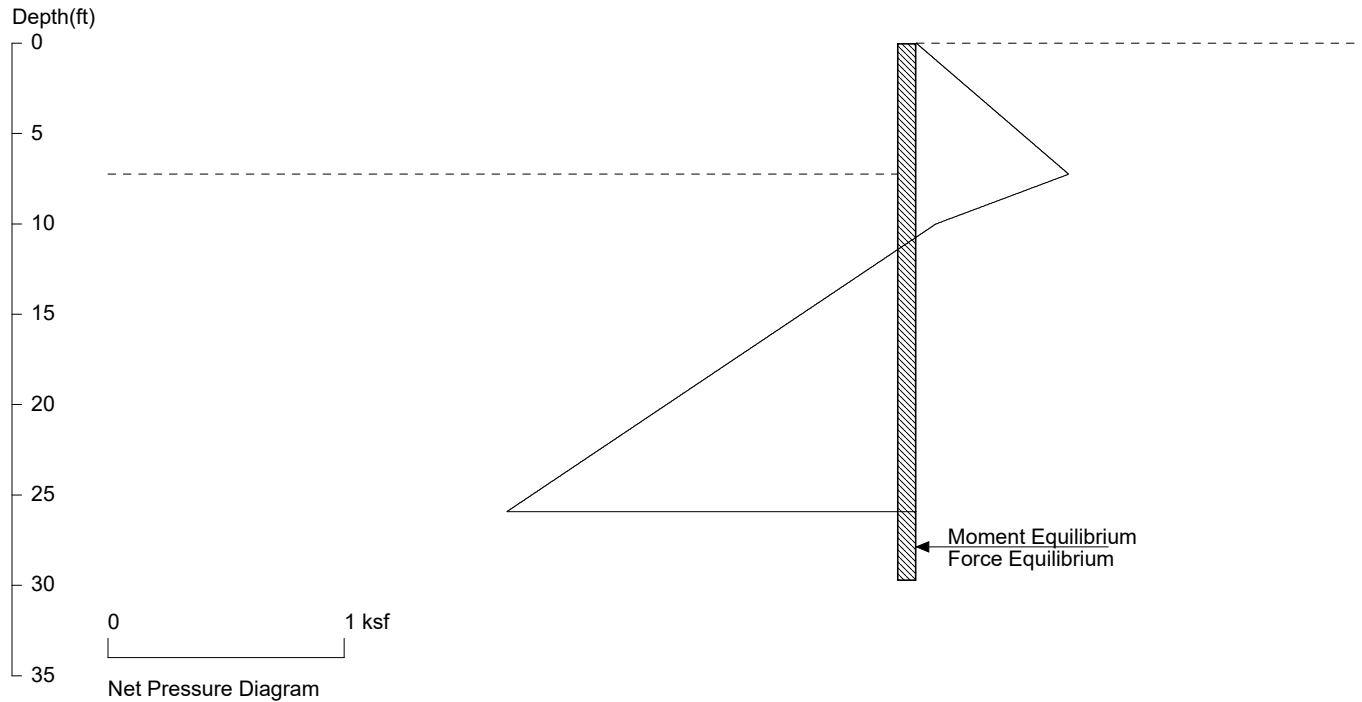
No.	Z depth	Spacing
1	0.00	1.00
2	7.25	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

IDALS Stilling Basin - 7.25ft Shoring - Strength



PRESSURE, SHEAR, AND MOMENT DIAGRAMS

Based on pile spacing: 1.0 foot or meter

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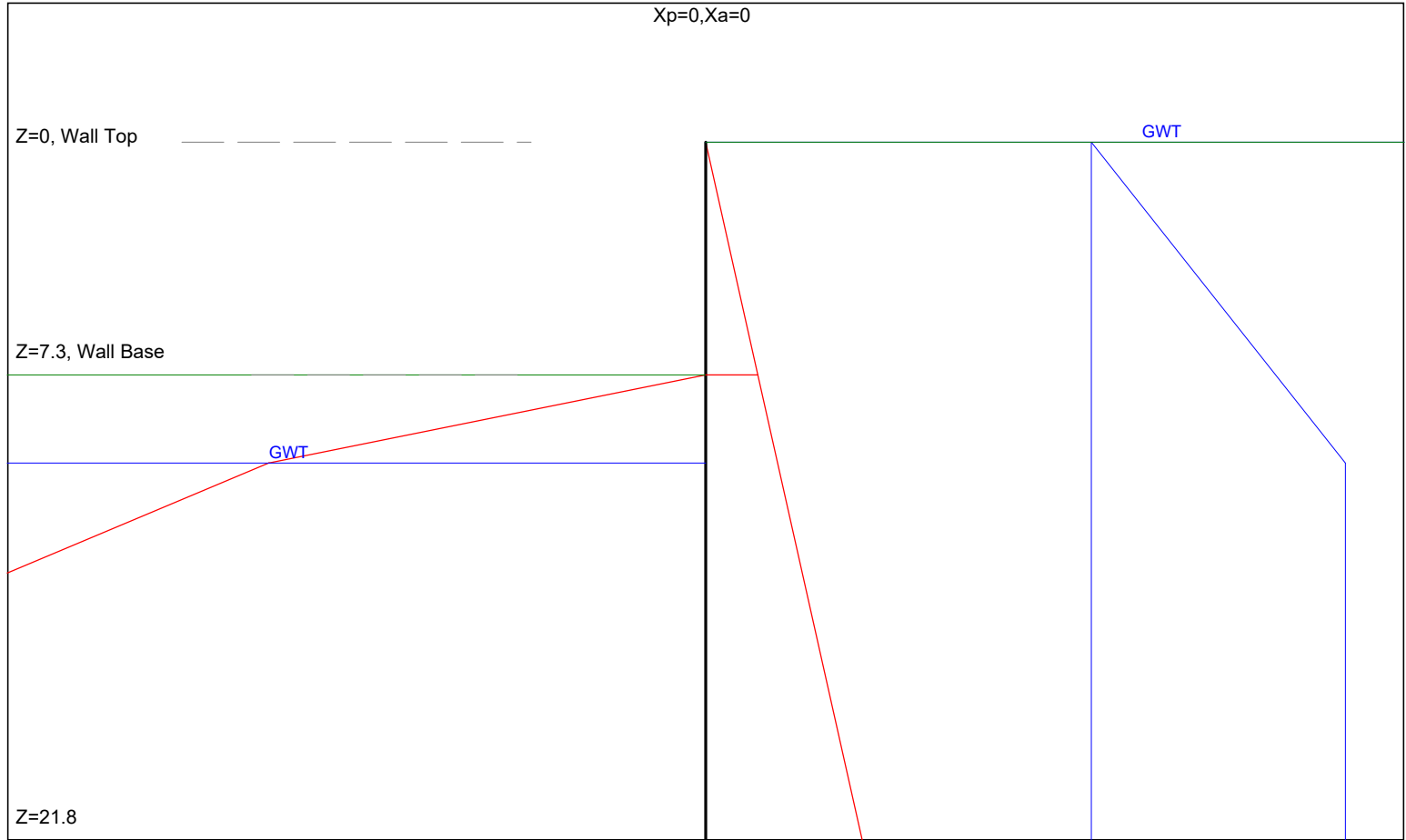
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IDALS Stilling Basin - 7.25ft

Earth Press - Service

Xp=43.5

Xa=43.5



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Date: 2/25/2026

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* INPUT DATA *

Wall Height=7.3 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	32	0.0	5	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	7.3	0.0	7.3	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	10.0	0.0
2	10.0	800.0

Wall Friction Options: 1.* No wall friction

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 0.47 per one linear foot (or meter) width along wall height

Total Static Force above Base= 0.47

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	7.25	0.13	0.0177	0.3073

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
7.25	0.13	21.75	0.38	0.0177	0.3073

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
7.25	0.00	10.00	1.07	0.391	3.2546
10.00	1.07	21.75	3.28	0.187	3.2546

Water Pressure - Output to Shoring - Multiplier of Pressure = 1

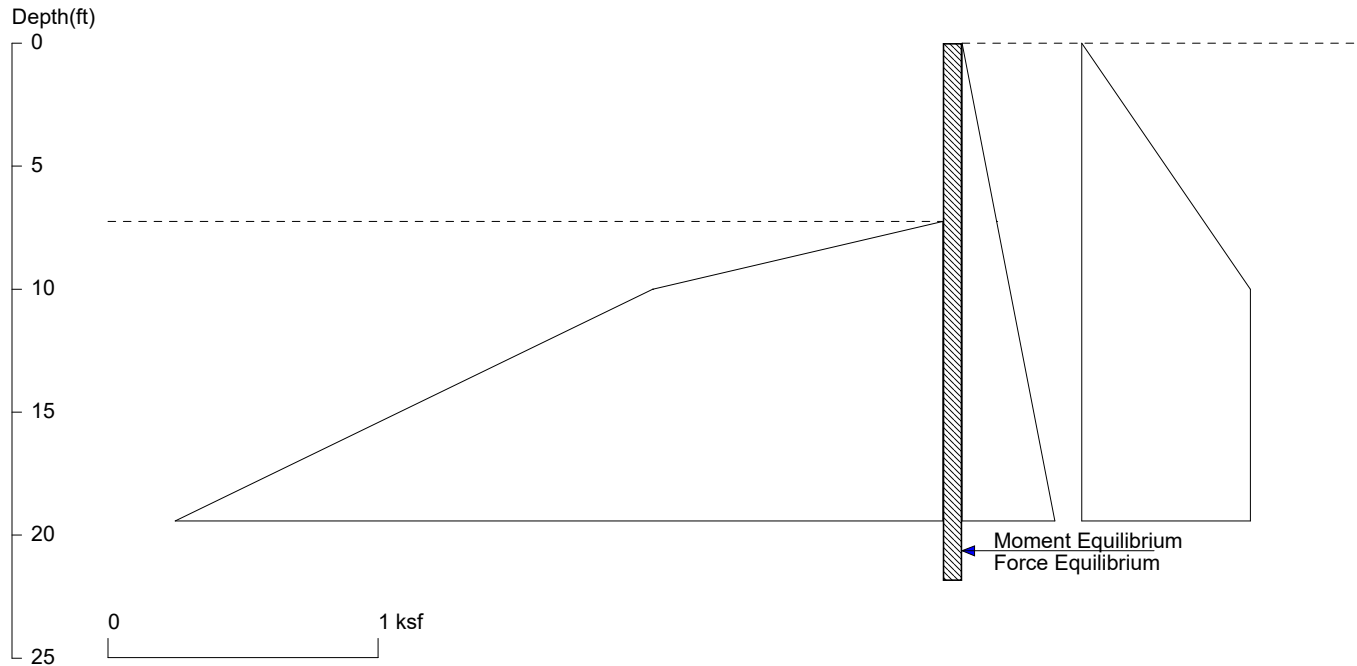
No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	10.00	0.62	0.06
1	10.00	0.62	21.75	0.62	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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IDALS Stilling Basin - 7.25ft

Shoring - Service



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Wall Height=7.3

Pile Diameter=1.0

Pile Spacing=1.0

Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=12.17 Min. Pile Length=19.42

MOMENT IN PILE: Max. Moment=18.11 per Pile Spacing=1.0 at Depth=14.07

PILE SELECTION:

Request Min. Section Modulus = 4.8 in³/ft=259.62 cm³/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.9

User Input I (Moment of Inertia):

Top Deflection = 0.99(in) based on E (ksi)=29000.00 and I (in⁴)/foot=65.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	7.250	0.128	0.017698
*	Below	Base		
7.250	0.128	65.250	1.155	0.017698
*	Water	Pres.		
0.000	0.000	10.000	0.624	0.062400
10.000	0.624	65.250	0.624	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
7.250	0.000	10.000	1.074	0.390551
10.000	1.074	65.250	11.431	0.187464

ACTIVE SPACING:

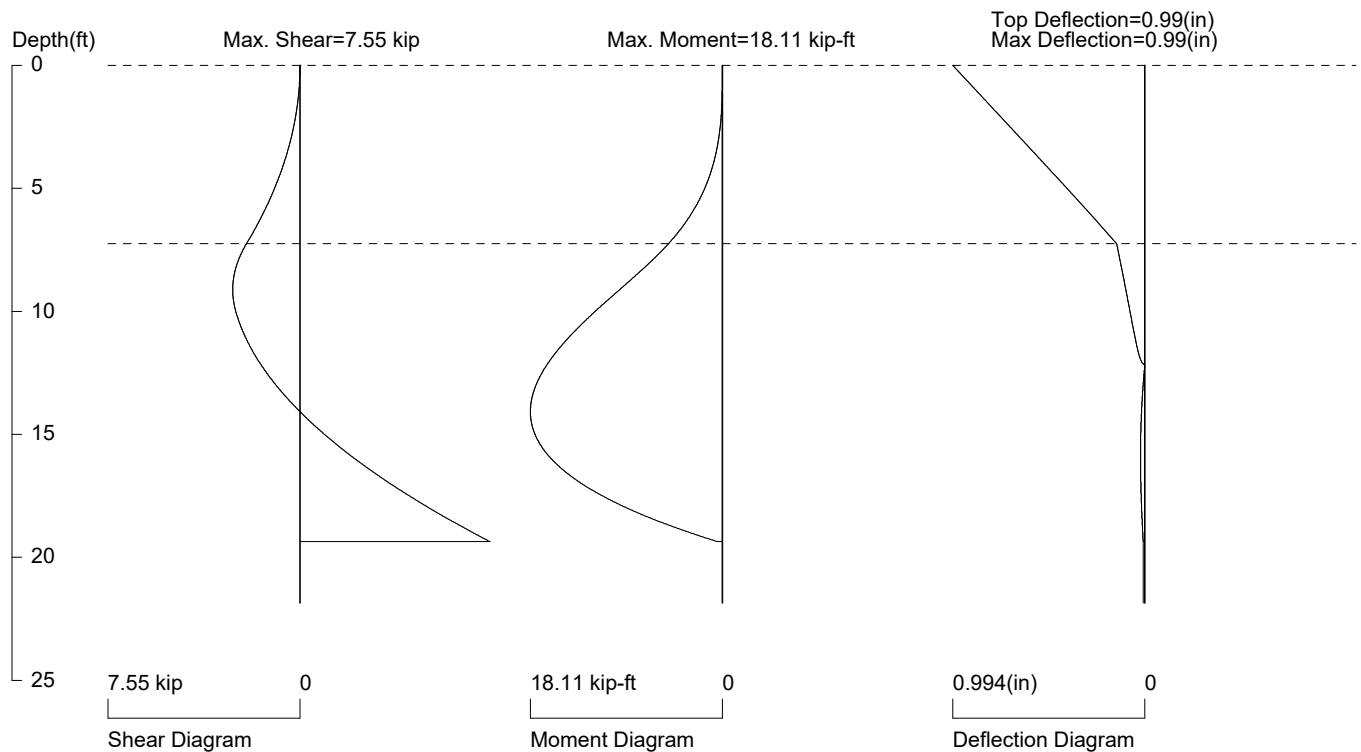
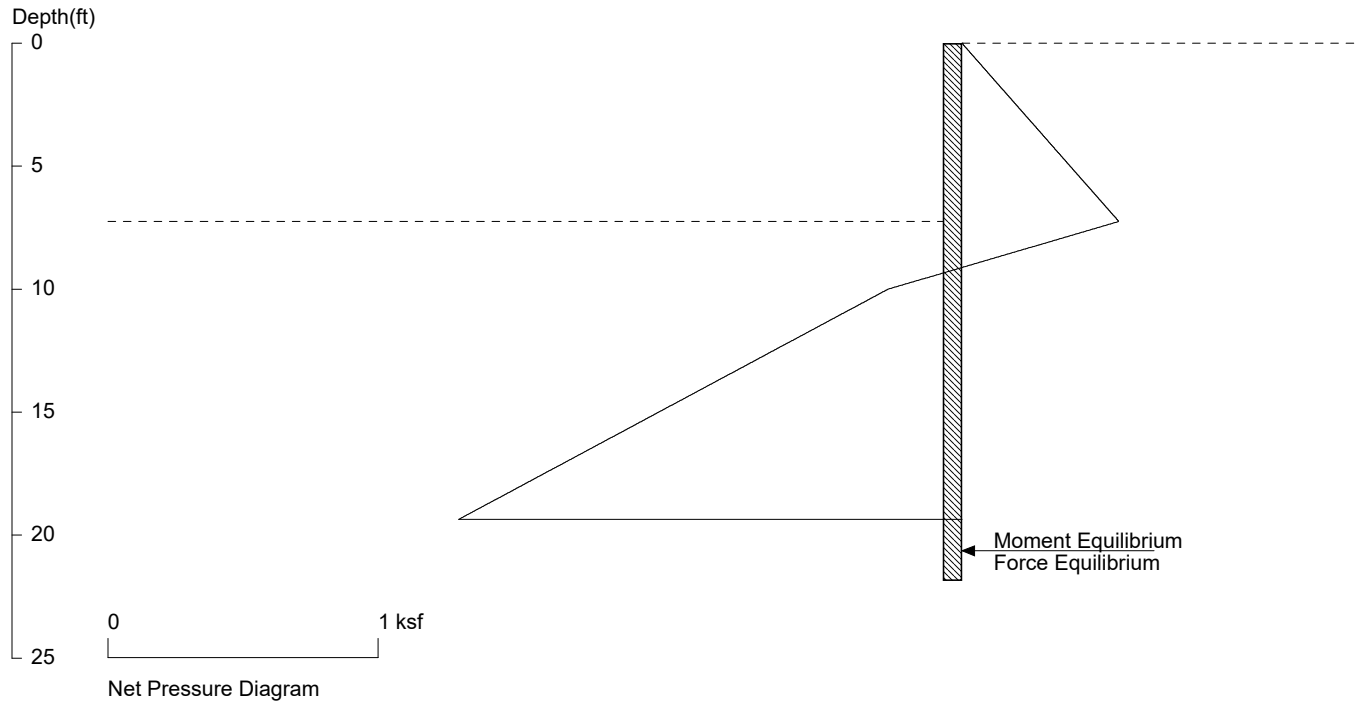
No.	Z depth	Spacing
1	0.00	1.00
2	7.25	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

IDALS Stilling Basin - 7.25ft **Shoring - Service**



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

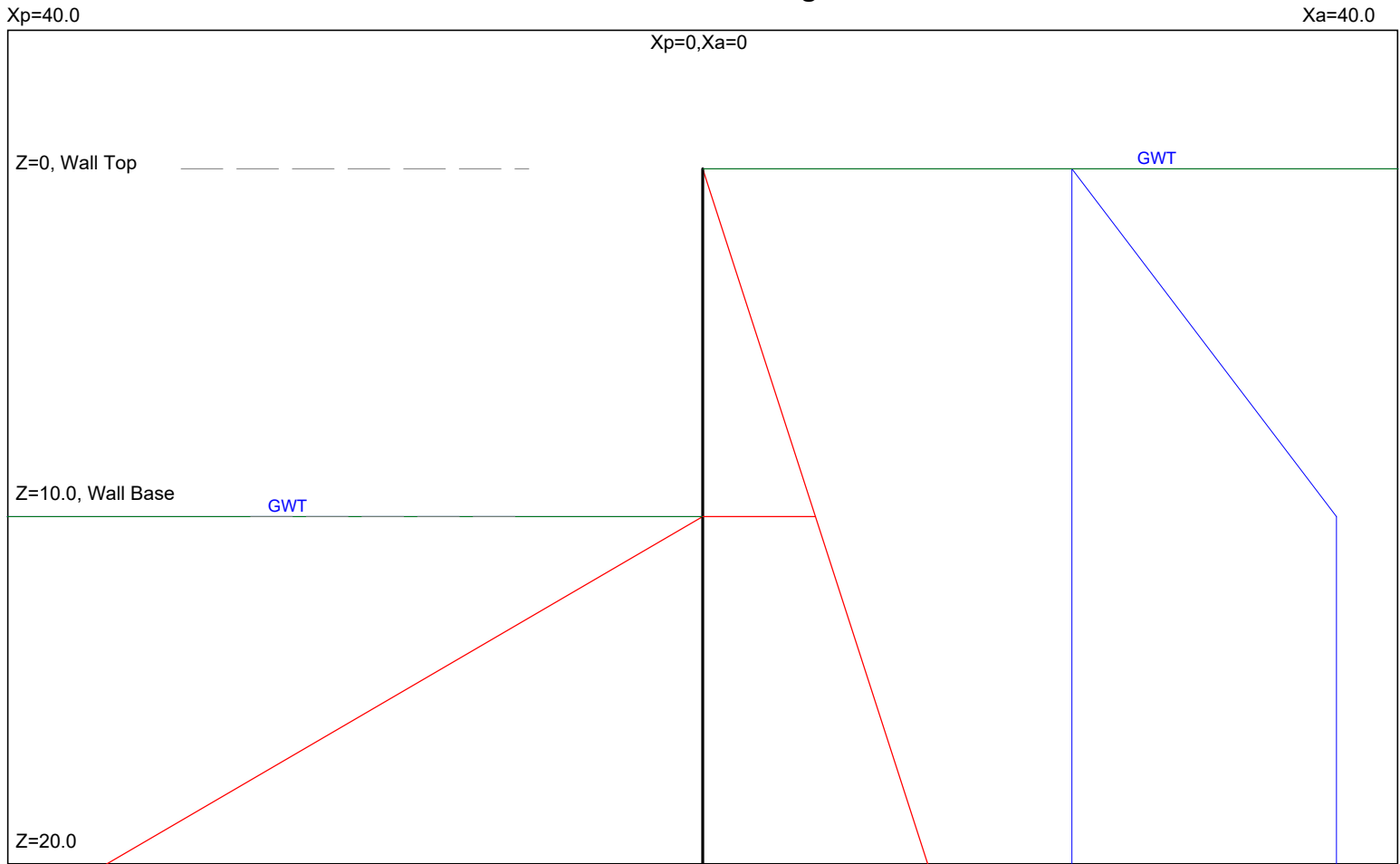
Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in4)/foot=65.0

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IDALS Stilling Basin - 10ft

Earth Press - Strength



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UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 2/25/2026

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* INPUT DATA *

Wall Height=10.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	32	0.0	5	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	10.0	0.0	10.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	10.0	0.0
2	10.0	800.0

Wall Friction Options: 1.* No wall friction

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 1.33 per one linear foot (or meter) width along wall height

Total Static Force above Base= 1.33

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	10.00	0.27	0.0265	0.4609

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
10.00	0.27	20.00	0.53	0.0265	0.4609

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 0.75

Z1	Pp1	Z2	Pp2	Slope	Kp
10.00	0.00	20.00	1.41	0.141	2.4409

Water Pressure - Output to Shoring - Multiplier of Pressure = 1

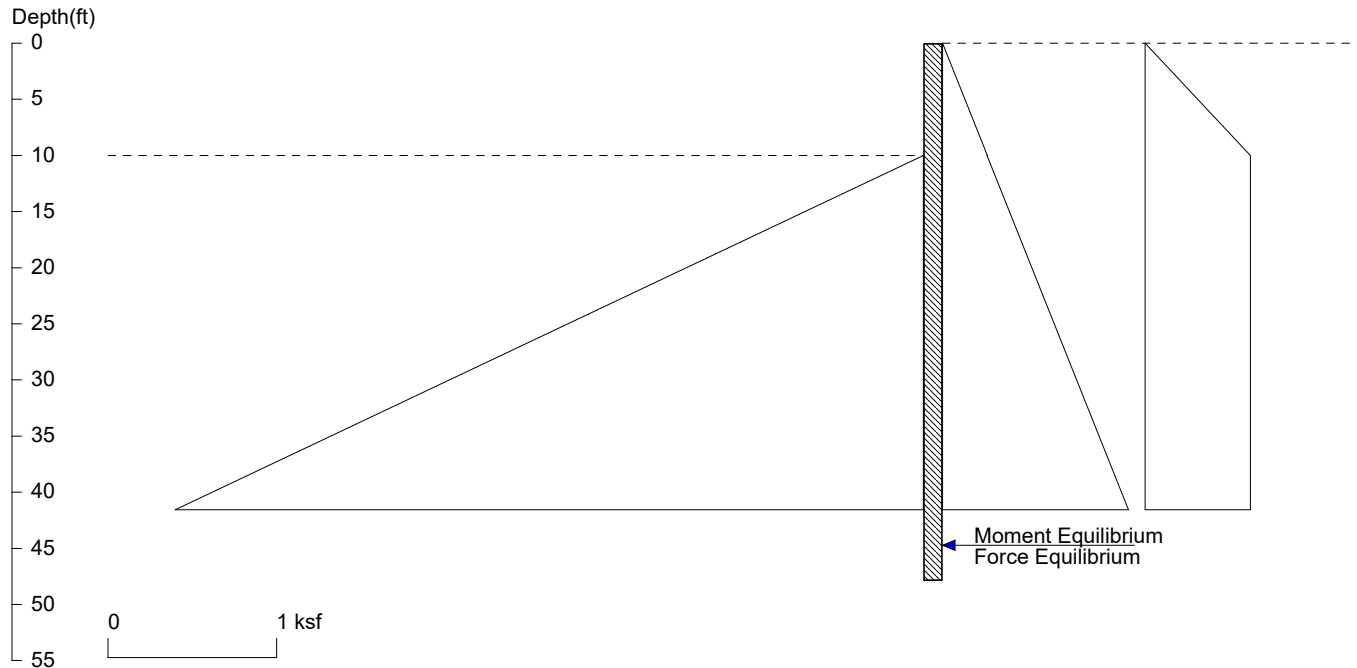
No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	10.00	0.62	0.06
1	10.00	0.62	20.00	0.62	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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IDALS Stilling Basin - 10ft

Shoring - Strength



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Wall Height=10.0

Pile Diameter=1.0

Pile Spacing=1.0

Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=31.58 Min. Pile Length=41.58

MOMENT IN PILE: Max. Moment=129.63 per Pile Spacing=1.0 at Depth=29.56

PILE SELECTION:

Request Min. Section Modulus = 34.6 in³/ft=1858.33 cm³/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.9

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	10.000	0.265	0.026547
*	Below	Base		
10.000	0.265	90.000	2.389	0.026547
*	Water	Pres.		
0.000	0.000	10.000	0.624	0.062400
10.000	0.624	90.000	0.624	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
10.000	0.000	90.000	11.248	0.140598

ACTIVE SPACING:

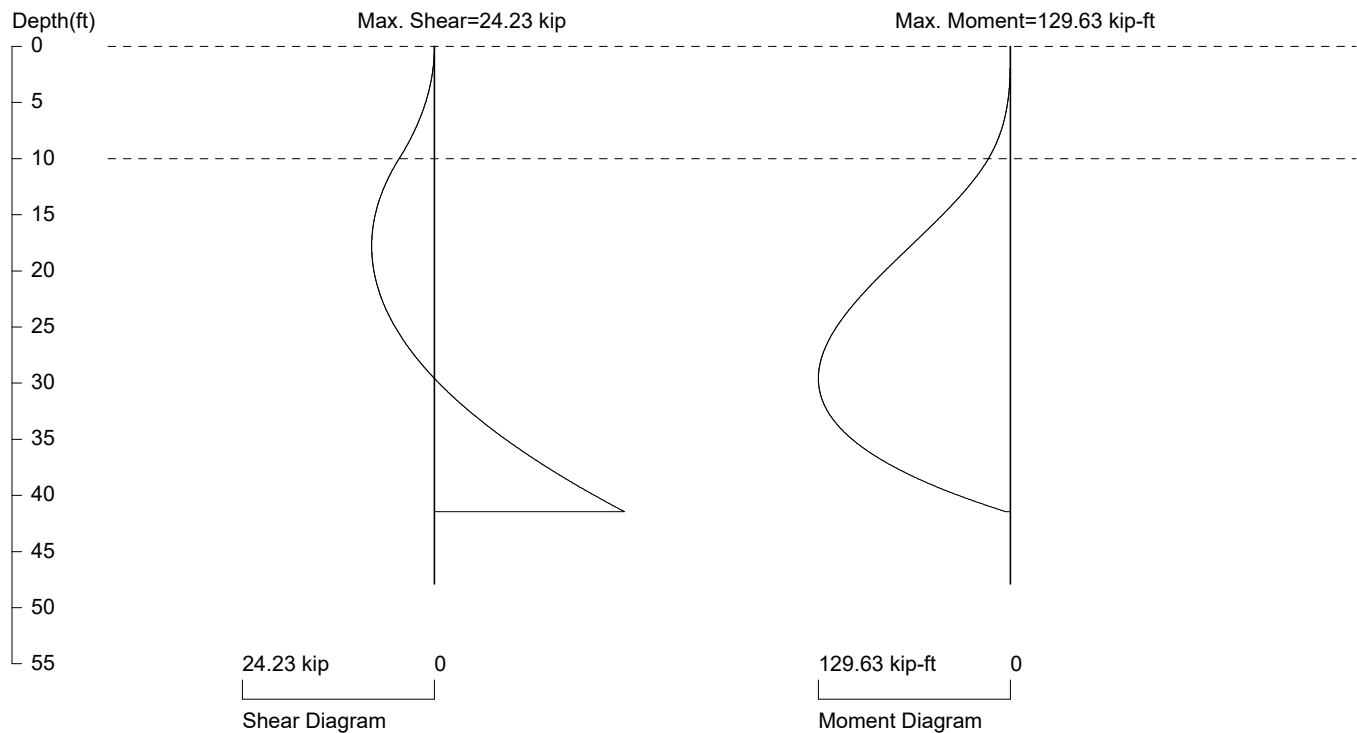
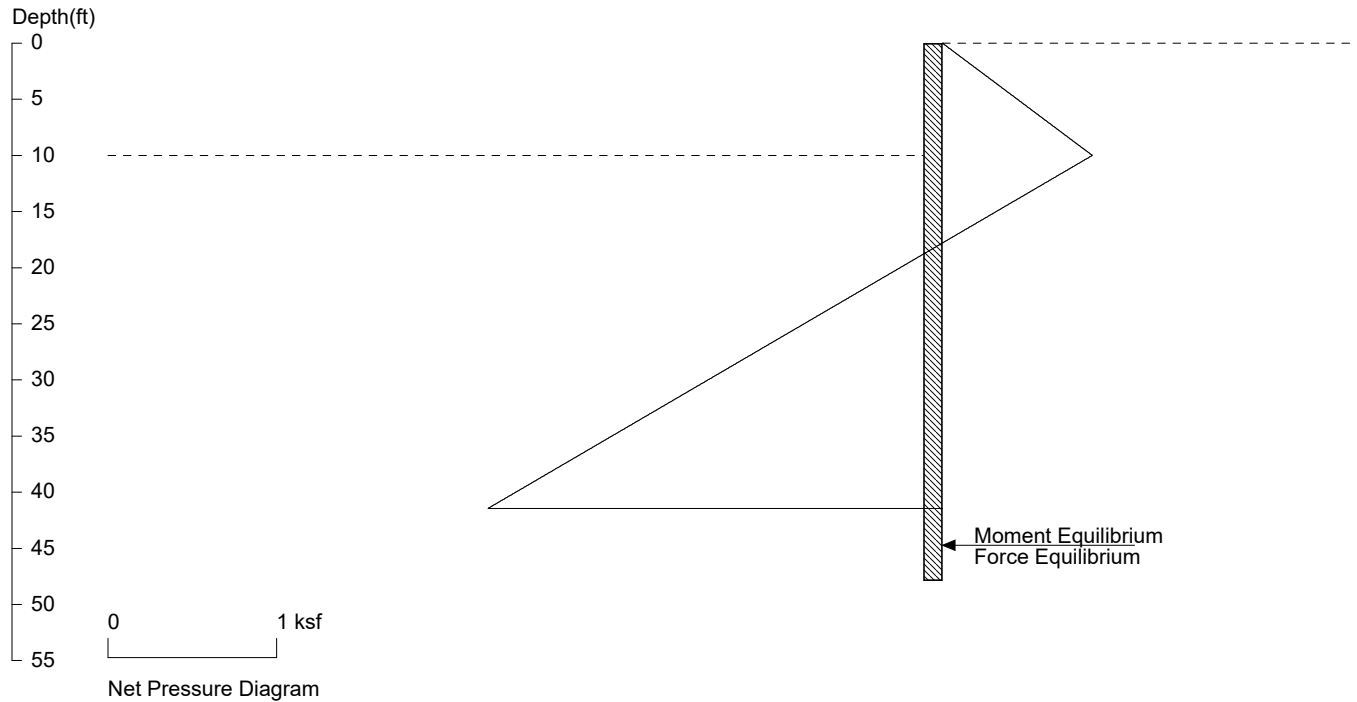
No.	Z depth	Spacing
1	0.00	1.00
2	10.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

IDALS Stilling Basin - 10ft Shoring - Strength



PRESSURE, SHEAR, AND MOMENT DIAGRAMS

Based on pile spacing: 1.0 foot or meter

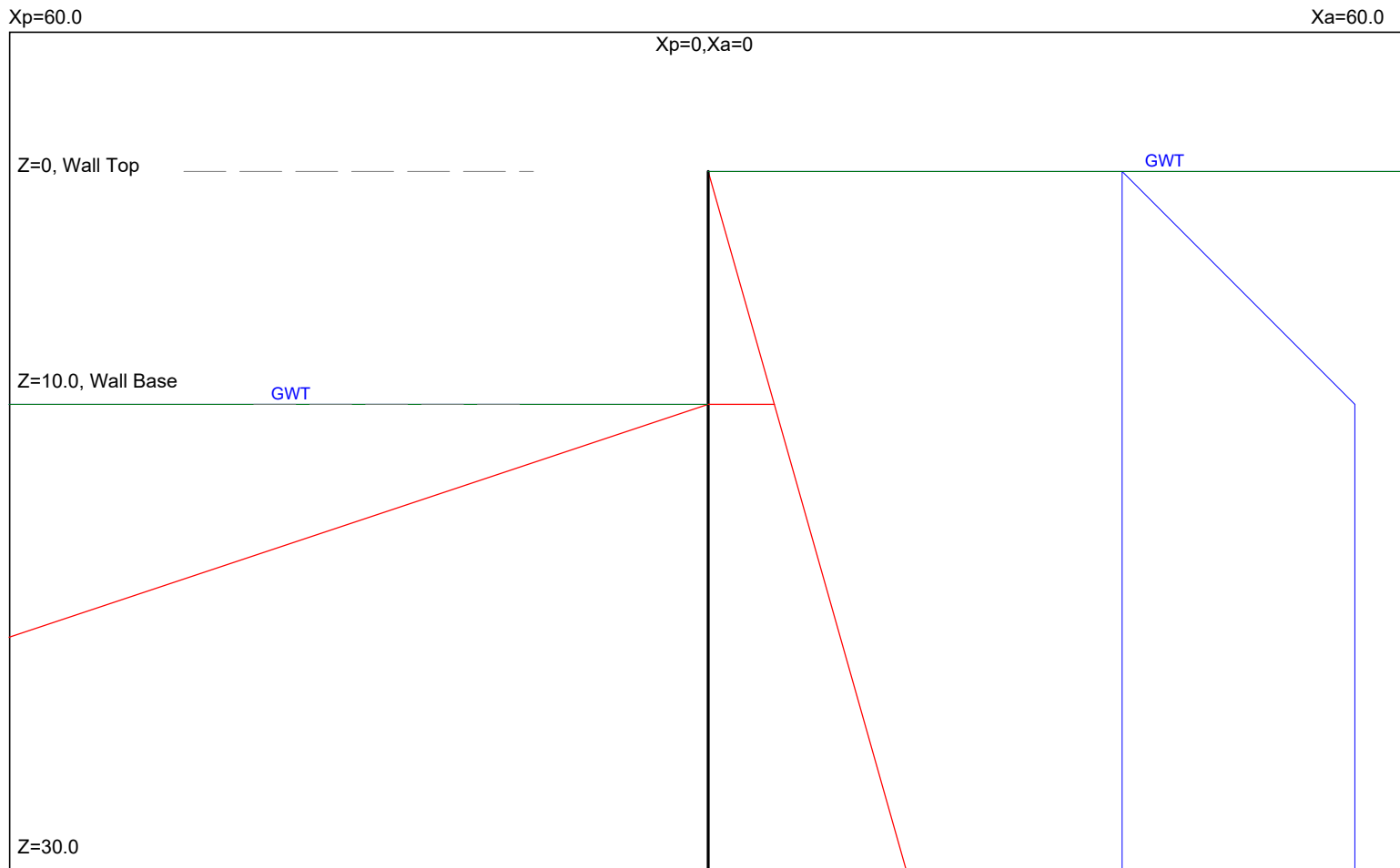
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IDALS Stilling Basin - 10ft

Earth Press - Service



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UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 2/25/2026

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* INPUT DATA *

Wall Height=10.0 Total Soil Types= 1

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	120.0	120.0	32	0.0	5	4	Sand

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand

Water Table at Active Side:

Point	Z-water	X-water
1	0.0	0.0
2	0.0	800.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	10.0	0.0	10.0	800.0	1	Sand

Water Table at Passive Side:

Point	Z-water	X-water
1	10.0	0.0
2	10.0	800.0

Wall Friction Options: 1.* No wall friction

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 0.88 per one linear foot (or meter) width along wall height

Total Static Force above Base= 0.88

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Coef.
0.00	0.00	10.00	0.18	0.0177	0.3073

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
10.00	0.18	30.00	0.53	0.0177	0.3073

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
10.00	0.00	30.00	3.75	0.187	3.2546

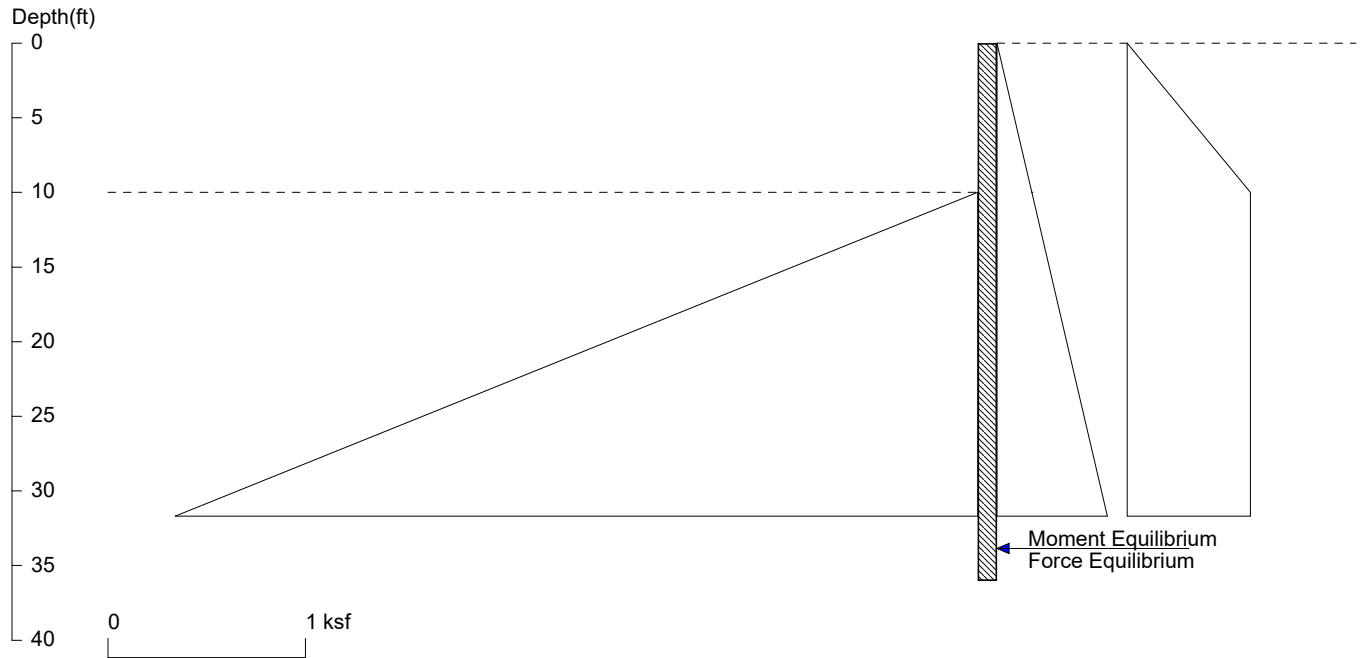
Water Pressure - Output to Shoring - Multiplier of Pressure = 1

No	Z1	Pw1	Z2	Pw2	kw1
0	0.00	0.00	10.00	0.62	0.06
1	10.00	0.62	30.00	0.62	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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IDALS Stilling Basin - 10ft Shoring - Service



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Wall Height=10.0

Pile Diameter=1.0

Pile Spacing=1.0

Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=21.69 Min. Pile Length=31.69

MOMENT IN PILE: Max. Moment=70.94 per Pile Spacing=1.0 at Depth=23.05

PILE SELECTION:

Request Min. Section Modulus = 18.9 in³/ft=1016.95 cm³/m, F_y= 50 ksi = 345 MPa, F_b/F_y=0.9

User Input I (Moment of Inertia):

Top Deflection = 1.00(in) based on E (ksi)=29000.00 and I (in⁴)/foot=305.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	10.000	0.177	0.017698
*	Below	Base		
10.000	0.177	90.000	1.593	0.017698
*	Water	Pres.		
0.000	0.000	10.000	0.624	0.062400
10.000	0.624	90.000	0.624	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
10.000	0.000	90.000	14.997	0.187464

ACTIVE SPACING:

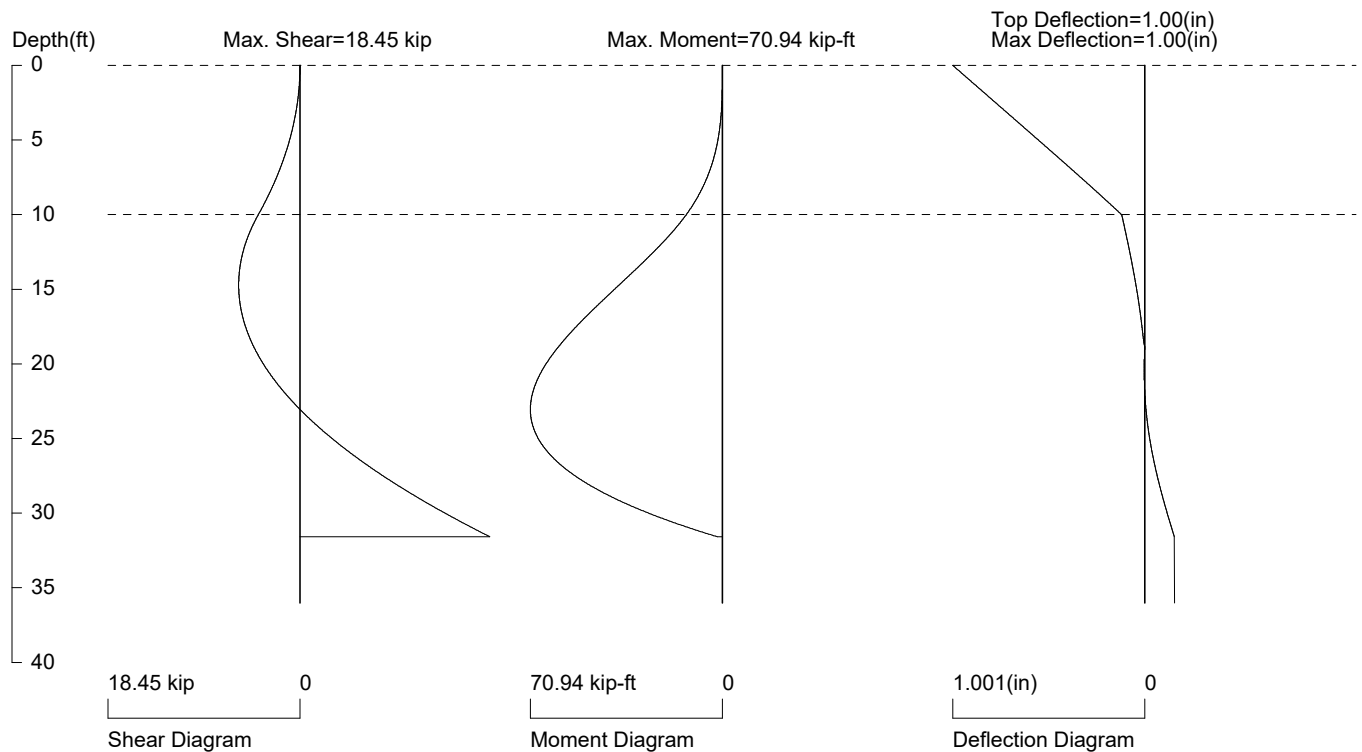
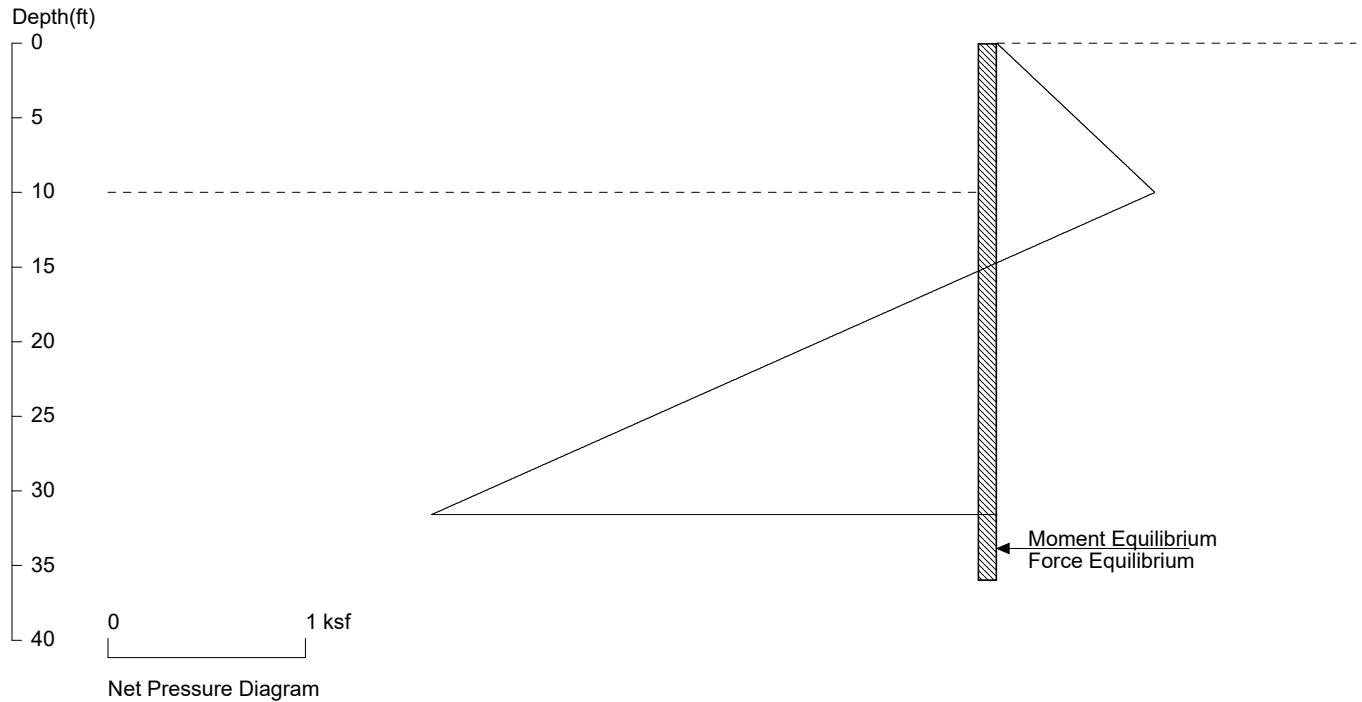
No.	Z depth	Spacing
1	0.00	1.00
2	10.00	1.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

IDALS Stilling Basin - 10ft Shoring - Service



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input I: E (ksi)=29000.0, I (in⁴)/foot=305.0

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Appendix G: Pipe Capacity Calculations

Pipe Capacity Calculations							
Name	Dia (in)	A (sf)	P (ft)	R _h (ft)	s (%)	n	Q (cfs)
Existing DD #103 Main	18.00	1.767	4.712	0.375	0.60%	0.015	7.05
Proposed DD #103 Main Re-lay	30.00	4.909	7.854	0.625	0.06%	0.011	11.87
Proposed 6" Dia. Tile Installation	6.00	0.196	1.571	0.125	0.10%	0.020	0.12
Drawdown Pipe	12.00	0.785	3.142	0.250	1.87%	0.011	5.76
Toe Drain 1	6.00	0.196	1.571	0.125	3.07%	0.020	0.64
Toe Drain 2	6.00	0.196	1.571	0.125	7.22%	0.020	0.98