526 EXIT 28
LONG POINT ROAD INTERCHANGE
LOWCOUNTRY CORRIDOR

TECHNICAL MEMORANDUM:
DRAFT HYDROLOGIC STUDY AND HYDRAULIC ANALYSIS REPORT

Prepared for:

SCDOT

Prepared by:

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July 2023

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1.0 Introduction

1.1 Project Description

This Hydraulic Report was prepared to document the hydrologic and hydraulic analysis for the proposed I-526 and S-97 (Long Point Road) Interchange improvements (I-526 Exit 28). These improvements are to address operational deficiencies and improve the safety of the current interchange configuration. The scope of work includes field surveys, pipe and box culvert inspections, and the preliminary hydraulic design of stormwater systems (pipe culverts, ditches, and closed systems).

The proposed interchange improvements will address merge and weave movements and are expected to include ramp realignment, as well as a new flyover bridge. Since Long Point Road (LPR) is the only point of access for the South Carolina Port Authority (SCPA) Wando Welch Terminal (WWT), operational conflicts between growing automobile and truck traffic have increased in recent years. After a Planning and Environmental Linkages (PEL) study for the I-526 Lowcountry Corridor was conducted, the proposed I-526 and LPR interchange improvements were identified as a means of reducing traffic conflicts that could be completed independently from the planned I-526 widening. Currently, the interchange consists of two EB and WB lanes each 12’ wide on I-526 and two NB and SB lanes of the same width on LPR. On and off-ramps in the interchange vary from 22’ to 30’ wide. The existing I-526 off-ramp to LPR also widens to 46’ wide and encompasses three turn lanes.

It is assumed video inspection will occur during the design stage to assess the condition of the existing culverts and pipes draining from median drop inlets throughout the project site and determine if replacement is required.

1.2 Design Criteria

a) Freeboard for Road Subgrades.
   1. To protect the pavement, it is recommended that the bottom of roadway subgrades be a minimum of 1.0 foot above the design high-water level.

b) Cross-Line Pipes.
   1. The design discharge for all cross-line pipes for primary routes (roads with US or SC designation) is the 50-year peak discharge. This shall apply for I-526.
   2. For secondary roads, the design discharge for cross-line pipes is the 25-year peak discharge. This shall apply for S-97 (Long Point Road), S-2523 (Seacoast Parkway and Belle Hall Parkway), and all local roads, if needed.
   3. The designer should also analyze the 100-year or overtopping flood, whichever is less. Design of pipes 48” and greater will utilize HY-8.
   4. Per scope of work: All pertinent cross-line data for pre and post discharges, drainage areas, and headwater elevations for the 10, 25, 50, and 100-year storms are to be provided for NPDES and erosion control purposes.
   5. Minimum pipe size shall be 18” within the project limits.

6. Cross-line pipes under I-526 will be sized to accommodate future lane widening and paved shoulders.
7. Open ended cross-line pipes will utilize HY-8 (or HECRAS if needed) for the analysis.

c) Storm Drains and Roadside Ditches.
1. The design storm for storm drain systems and roadside ditches is the 10-year storm for drainage areas from 0 to 40 acres, the 25-year storm for drainage areas from 40 to 500 acres, and the 50-year storm for drainage areas greater than 500 acres.
2. GEOPAK Drainage will be used to design closed systems.
   i) Catch Basins Type 25 and Type 25 DBL shall be used within the paved median.
   ii) Drop Inlets Type 112 (SCDOT Std. Drawing 719-112-01) shall be used within the grassed median. A minimum of 4' of pavement will be placed around all DI Type 112s and is incidental to their construction.
   iii) Either Concrete Flumes (SCDOT Std. Drawings 805-325-75 and 805-325-76) or Catch Basins Type 16 (SCDOT Std. Drawing 719-016-01) shall be used to discharge bridge deck drainage.
   iv) Per Pipe Culverts Smooth Wall RCP Details and Fill Height (SCDOT Std. Drawing 714-205-01), flexible pipes are prohibited from use on all interstates. As such, only RCPs will be used on I-526. Class section will be determined using the Allowable Fill Height Table on SCDOT Std. Drawing 714-205-01.
   v) Storm drain networks will be sized to accommodate future widening.
3. Hydraulic Toolbox will be used with HEC-15 guidelines to determine ditch lining material.

d) Inlet Spacing and Spread Criteria
1. Recommended maximum inlet spacing is 900 feet and recommended minimum inlet spacing is 150 feet unless specified by the hydraulic design engineer. A 100-foot inlet spacing will be used at sag points to flank low points in the roadway. The minimum time of concentration is 5 minutes.
2. For interstate facilities >45 mph (I-526) and : 10-yr Design Frequency & Design Spread is contained within the shoulder for on-grade drainage. 50-yr Design Frequency & Design Spread is contained within the shoulder + 3 ft for sag points.
   i) Spread will be analyzed for future widening and designed to be contained within the future shoulder.
3. For secondary facilities < or equal to 45 mph: 10-yr Design Frequency and Design Spread is contained within the shoulder + 3 ft for on-grade drainage.
4. Local streets < or equal to 45 mph: 10-yr Design Frequency & Design Spread is limited to ½ Travel Lane for both on-grade drainage AND sag points.
5. Inlets in grassed medians will be spaced so that the 10-year stormwater level in the median will be below the edge of the shoulder. Maximum inlet spacing will be 750 feet.
6. Temporary Drainage: Drainage design frequency shall be determined using the AASHTO Drainage Manual – Chap. 17 – Appendix 17A.

e) Minimum Ditch and Pipe Grades.
1. Minimum grade on ditches, gutters, and pipes in a storm drainage system will be 0.3 percent where possible. The minimum velocity for the design discharge in a pipe will be 3.0 feet per second. The controlling factor is velocity rather than grade.

f) Minimum Pipe Size.
1. Minimum pipe size in storm drainage systems and for cross-lines is 18 inches. A 15-inch pipe may be used to connect yard drains to a storm drainage system and for driveway pipes.

2. Minimum cover requirements shall pass Load Case 2 (Minimum Cover Under Roadway) for RCPs in SCDOT Std. Drawing 714-205-01.

g) Sediment and Erosion Control.
   1. This project must meet the requirements of the SCDOT NPDES MS4 permit and South Carolina Regulation 72-405, as applicable.

h) Hydrologic Analysis
   1. Rational Method shall be used for drainage areas up to 100 acres. NRCS TR-55 Method for Lower Coastal Plain Physiographic Region shall be used for drainage areas 100 to 640 acres, if needed. The standard Peak Rate Factor (484) will be used. USGS regression methodologies shall be used for drainage areas over 640 acres, if needed.
   2. Time of Concentration shall be calculated using the Velocity Approach Method and will consist of 3 segments (Sheet Flow, Shallow Concentrated Flow, Channelized Flow).

i) Other Design Criteria to be applied to the hydraulic design of this project:
   1. Bridge Deck Drainage
      i) Design of the bridge deck drainage shall comply with FHWA-SA-92-010 - Design of Bridge Deck Drainage HEC 21, May 1993.
      ii) Per SCDOT Bridge Design Manual (June 2006): For Interstate Routes: 10-yr Design Frequency & Design Spread is contained within the shoulder for on-grade drainage. 50-yr Design Frequency & Design Spread is contained within the shoulder + 3 ft for sag points.
      iii) Per SCDOT Bridge Design Manual (June 2006): "Avoid locating scupper outlets over the traveled way portion of an underpassing highway, sidewalk, or unpaved embankment."

j) Permitting and MS4 Considerations
   1. The classification of the receiving water bodies and downstream impairments will be determined and additional water quality treatment where outfalls discharge to 303(d) listed, TMDL, and other sensitive waters will be provided if necessary.

1.3 EXISTING WATERSHEDS

Three small watersheds are present within the project area. The project area to the east of the interchange, encompassing 80 acres, drains to a tidally influenced tributary to Hobcaw Creek before exiting the project right of way (ROW). This tributary flows underneath a series of bridges that service both lanes and two on/off ramps of I-526, all positioned approximately 800 feet from the interchange. Hobcaw Creek itself drains into the Wando River. The project area to the southwest of the interchange, encompassing 190 acres, drains to a 9'x5' and subsequent 10'x5' culvert, the latter of which outlets into a tidally influenced tributary of the Wando River, called Rathall Creek. The western portion of the project site, located between the Wando River Bridge and the area drained by the culverts, encompasses 64 acres and exits the project ROW at another tidally influenced tributary to the Wando River, which flows underneath a bridge servicing both lanes of I-526. See **Appendix A** for an aerial map of the project site that displays the existing watersheds.

Existing land uses within the three drainage areas are predominantly commercial and impervious. Some forested areas exist between developed parcels. Several acres of grassed median and open space are present immediately surrounding the roadway and interchange. The topographic information utilized in watershed delineation was obtained from the NOAA Coastal LiDAR Viewer. All culverts and cross-lines within the project area are tabulated in Table 1.1 and hydraulic analysis is provided in **Section 3**

Hydrology. Model outputs are provided in **Section 5 Culvert Data**. Existing ditches impacted by proposed alternatives will need to be reconstructed to maintain current drainage patterns.

Table 1-1: Location and Description of Existing I-526/Long Point Road Culverts

Culvert Number	Station	Alignment	Description	Drainage Area (Ac)
1	15+75	L-2523	10'x5' RC Box	229.0
2	1399+85	I-526	9'x5' RC Box	198.0
3	23+30	L-2118	(3) 36" RC Pipe	89.0
4	1355+60	I-526	24" RC Pipe	3.4
5	1378+35	I-526	24" RC Pipe	4.1

1.4 FEMA Flood Hazard Zone

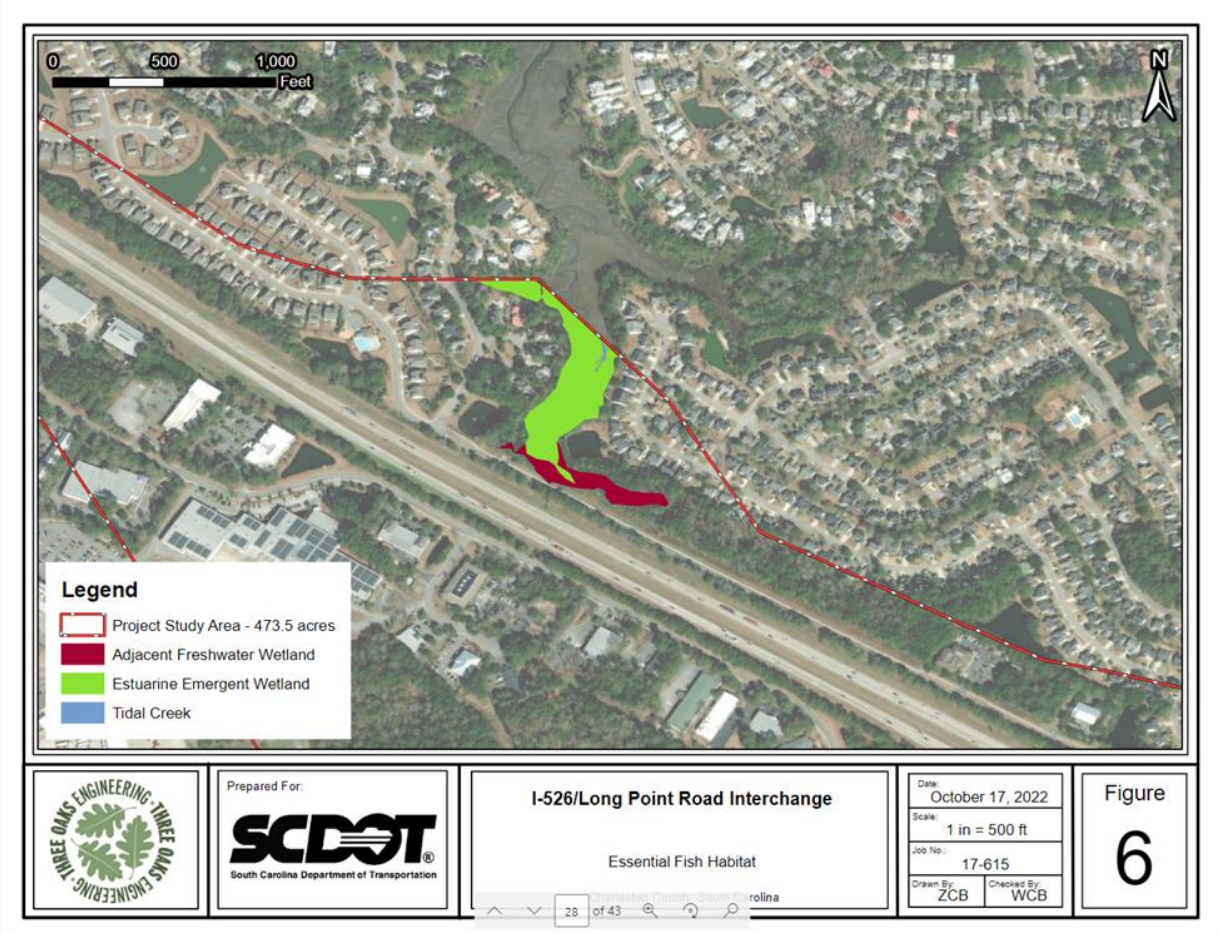
Appendix A "PROJECT MAPS" contains the Federal Emergency Management Agency (FEMA) effective flood hazard maps for the project area. The proposed improvements to the interchange site are located within flood hazard area Zone AE. Therefore, floodplain impacts are anticipated.

1.5 Water Quality Considerations

The South Carolina Department of Health and Environmental Control (SCDHEC) Water Quality Monitoring Stations (WQMS) nearest to the proposed project location is 09B-18, which is located within a TMDL watershed for Fecal Coliform (FC). The project site drains into Rathall Creek, and ultimately drains into the Wando River, where WQMS 09B-18 is located 2 miles downstream of the project site. WQMS 09B-18 is not listed as an impaired water body per the latest version of the 303(D) list. However, it is listed on the 303(D) list as a TMDL watershed for FC. The water quality report for the site can be referenced in **Section 4 Water Quality Information**.

Even though the SCDHEC Water Quality report for the project site categorizes Rathall Creek and the Tributary to Rathall Creek as Shellfish Harvesting (SFH) waters, further investigation has determined that the SFH are downstream of the project area and anything upstream of I-526 should be considered as freshwater (see **Fig. 1.1**). Therefore, permanent water quality treatment is not required on the upstream side of I-526 since the project site ultimately outfalls to a stream on the current 303(d) list for Fecal Coliform and roadway construction is not expected to aggravate this issue. However, since the project is longitudinal in nature and the roadway typical section includes grassed shoulders and vegetated roadside ditches, sheet flow from the roadways will be filtered by the mildly sloped grassed shoulders and grass-lined ditches will serve to further filter suspended pollutants before stormwater reaches the outfall points. For outfalls draining directly downstream of I-526, primarily the I-526 westbound lanes, permanent water quality will be addressed by Mechanical Treatment Devices (MTDs) as appropriate.

Figure 1-1: I-526 Essential Fish Habitat denoting Shellfish Harvesting Waters



1.6 Proposed Stormwater Management

The project site falls within three different drainage areas, a tributary to the Wando River, a tributary to Rathall Creek, and a tributary to Hobcaw Creek. At the point of interest where drainage exits the project ROW at the Wando River tributary (I-526 Sta. 1361+00), the total drainage area encompasses 0.100 sq mi (64 acres). Within the Rathall Creek tributary (L-2523 Sta. 15+75), the total drainage area at the point of interest encompasses 0.358 sq mi (229 acres). At the point of interest where drainage exits the project ROW within the tributary to Hobcaw Creek (I-526 Sta. 1444+00), the total drainage area encompasses 0.125 sq mi (80 acres).

Given the relatively small drainage area of these three watersheds, and that the proposed project is expected to increase impervious area, pre/post discharge calculations were conducted at the three points of interest and are displayed in **Appendix B**. Following the design criteria outlined in **Section 1.2**, the Rational Method was used to calculate discharges from the Hobcaw Creek tributary and the Wando River tributary, while the NCRS TR-55 Method was used to calculate the discharge from the tributary to Rathall Creek. For the latter, the program WinTR-55 was utilized. All calculations accounted for future widening and paved shoulders along I-526. Results are summarized in **Tables 1.2-1.3**. In all cases, drainage area sizes were unaffected by increases in pavement.

Table 1-2: Pre-Development Discharges

Point of Interest	Pre Development Drainage Area (AC)	Q 2 yr	Q 10 yr	Q 50 yr	Q 100 yr
Tributary to Wando River (I-526 STA. 1361+00)	64.0	54	79	131	154
Tributary to Rathall Creek (L-2523 STA. 15+75)	229.0	300	491	705	807
Tributary to Hobcaw Creek (I-526 STA 1444+00)	80.1	100	142	226	263

Table 1-3: Post-Development Discharges

Point of Interest	Post Development Drainage Area (AC)	Q 2 yr	Q 10 yr	Q 50 yr	Q 100 yr
Tributary to Wando River (I-526 STA. 1361+00)	64.0	55	81	133	157
Tributary to Rathall Creek (L-2523 STA. 15+75)	229.0	307	498	712	812
Tributary to Hobcaw Creek (I-526 STA 1444+00)	80.1	102	144	230	267

For the tributary to the Wando River (I-526 Sta. 1361+00), less than one acre of impervious area is proposed to be added to the watershed. This raised projected discharge values by 2 cfs on average. For the tributary to Hobcaw Creek (I-526 Sta.1444+00), approximately two acres of impervious area are proposed to be added to the watershed. This raised projected discharge values by 2 cfs on average.

For the tributary to Rathall Creek (L-2523 Sta. 15+75), approximately 23 acres of impervious surfaces will be added to the watershed. This increase accounts for the proposed LPR on/off ramps and realignment, truck flyover lane, and lane widening on I-526. Although this represents a significant increase in impervious area, the predominance of poorly drained D soils and existing impervious areas within the watershed means that no impact to peak discharges is expected.

Considering the comparatively insignificant rise in post-development peak discharge volumes at the three points of interest within the project area, stormwater management will not be required. However, should there be a need for stormwater management, the project site possesses available space within the interchange and surrounding grassy areas.

1.7 Sediment and Erosion Control

A description of sediment and erosion control measures will be provided during final design by the design-build team.

2.0 PROJECT MAPS

All project maps are displayed in **Appendix A**. Included in this appendix :

- aerial imagery showing existing and proposed pavement and drainage areas,
- USGS topographic maps showing existing and proposed pavement and drainage areas, and
- FEMA Flood Insurance Rate Maps (FIRM) showing the project area.

Please note that as the project exists at the boundary of two topographic maps, both maps were overlaid in the same figure.

3.0 HYDROLOGY

3.1 SCS METHOD

The NRCS (SCS) TR-55 method was used to calculate the pre- and post-development discharge of existing Culvert 1, a 10'x5' reinforced concrete box culvert (RCBC) located at L-2523 Sta. 15+75, and Culvert 2, a 9'x5' RCBC located at I-526 Sta. 1399+75. Calculations were also run for Culvert 3, a proposed (3) 48" reinforced concrete pipe (RCP) located underneath the proposed new realignment of L-2118 Sta. 23+30. Culvert 3 is proposed to replace the existing (3) 36" RCP underneath the current L-2118 alignment. Because this existing (3) 36" RCP will be replaced, its pre-development peak discharges were not calculated.

See the Hydrology Studio report for Culverts 1-3 below for a detailed analysis of these calculations.

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Basin Model

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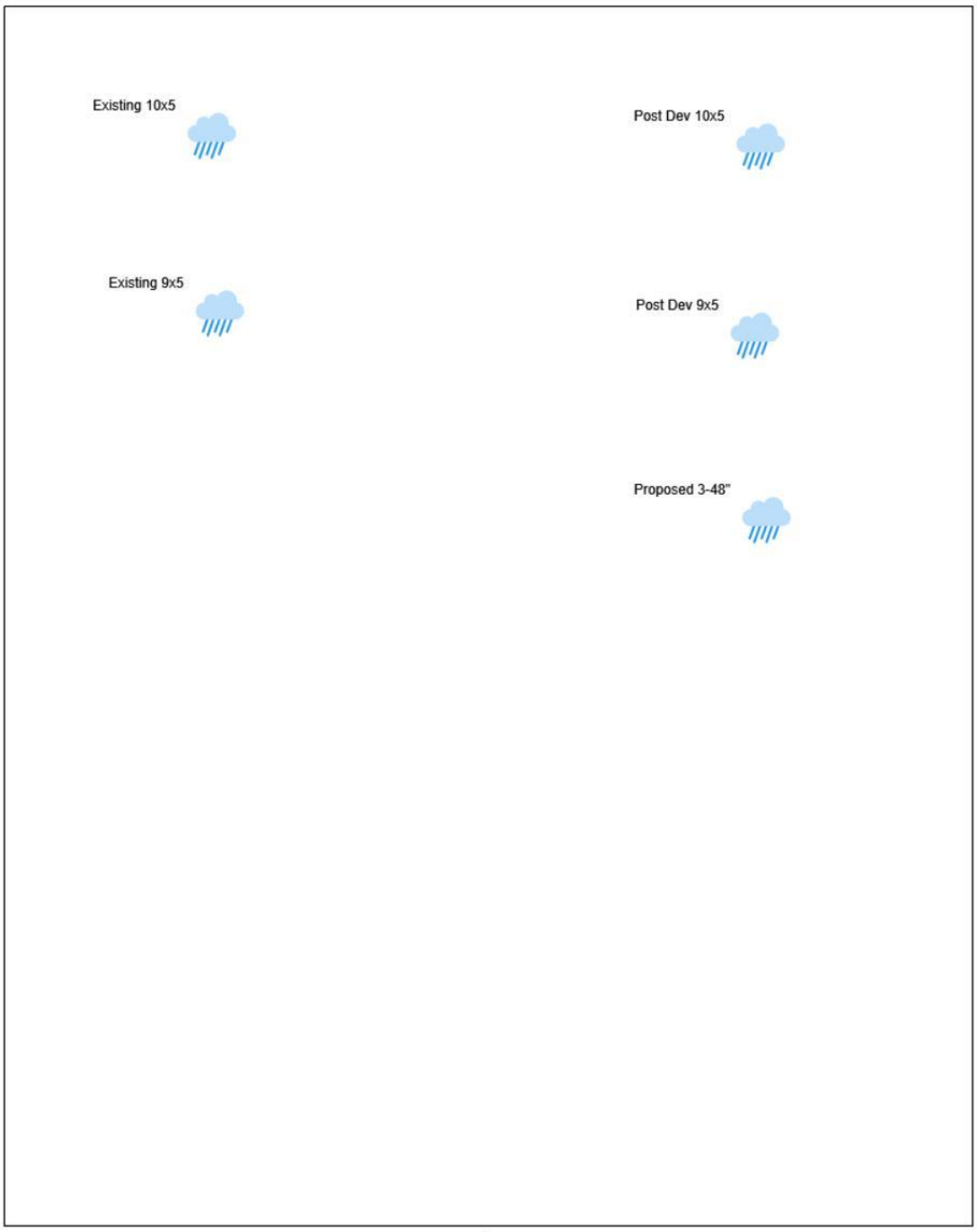

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Hydrograph by Return Period

Project Name:

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Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	NRCS Runoff	Proposed 3-48"		83.45			140.3	176.1	204.9	236.2
2	NRCS Runoff	Post Dev 10x5		231.2			379.5	472.6	547.7	628.9
3	NRCS Runoff	Post Dev 9x5		187.5			307.7	383.2	444.0	509.9
4	NRCS Runoff	Existing 10x5		207.7			341.2	425.1	492.7	565.9
5	NRCS Runoff	Existing 9x5		177.8			288.7	358.4	414.5	475.3

Hydrograph 10-yr Summary

Project Name:

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Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Proposed 3-48"	140.3	13.07	1,688,074	----		
2	NRCS Runoff	Post Dev 10x5	379.5	13.07	4,613,812	----		
3	NRCS Runoff	Post Dev 9x5	307.7	13.07	3,740,765	----		
4	NRCS Runoff	Existing 10x5	341.2	13.20	4,491,551	----		
5	NRCS Runoff	Existing 9x5	288.7	13.17	3,751,662	----		

Hydrograph Report

Project Name:

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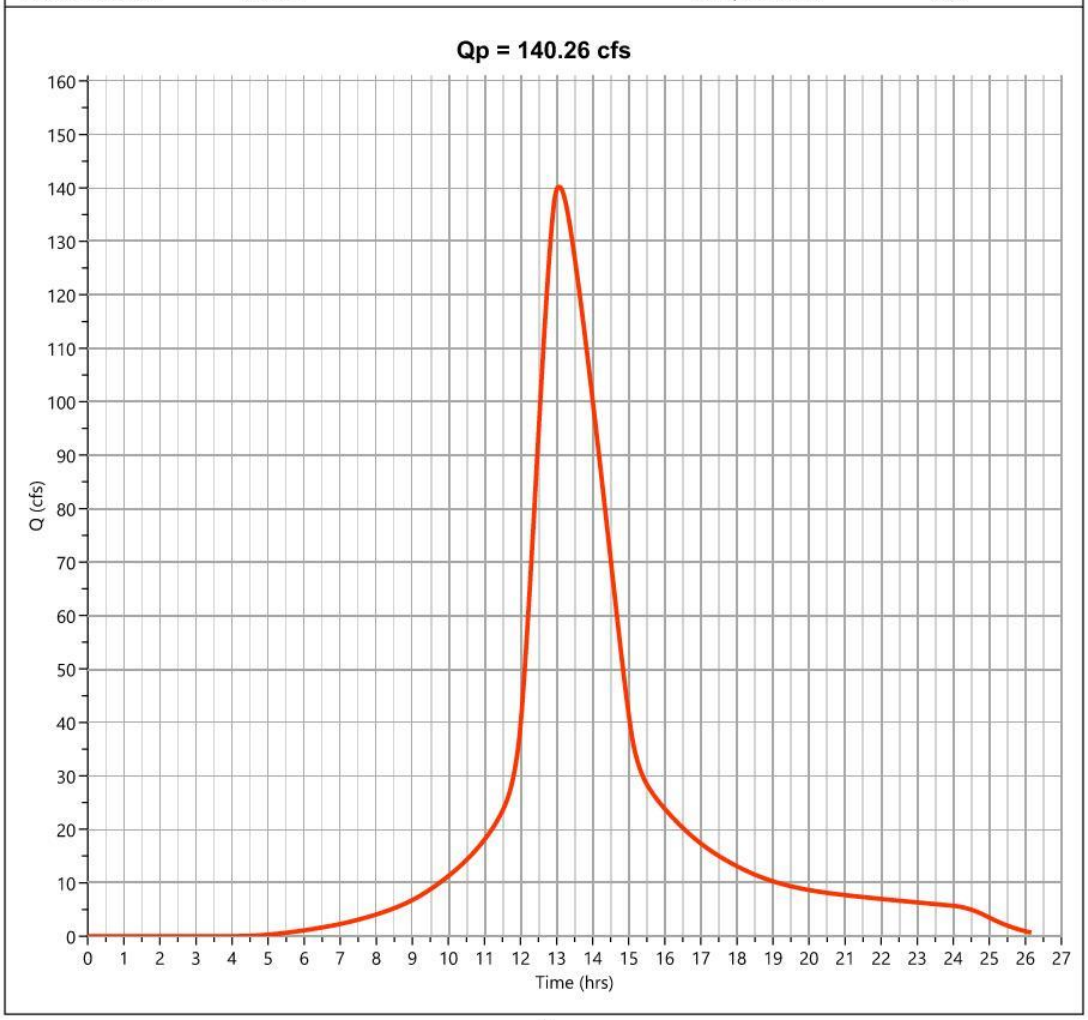
Proposed 3-48"

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 140.3 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 1,688,074 cuft
Drainage Area	= 89.0 ac	Curve Number	= 89
Tc Method	= User	Time of Conc. (Tc)	= 95.0 min
Total Rainfall	= 6.48 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Hydrograph Report

Project Name:

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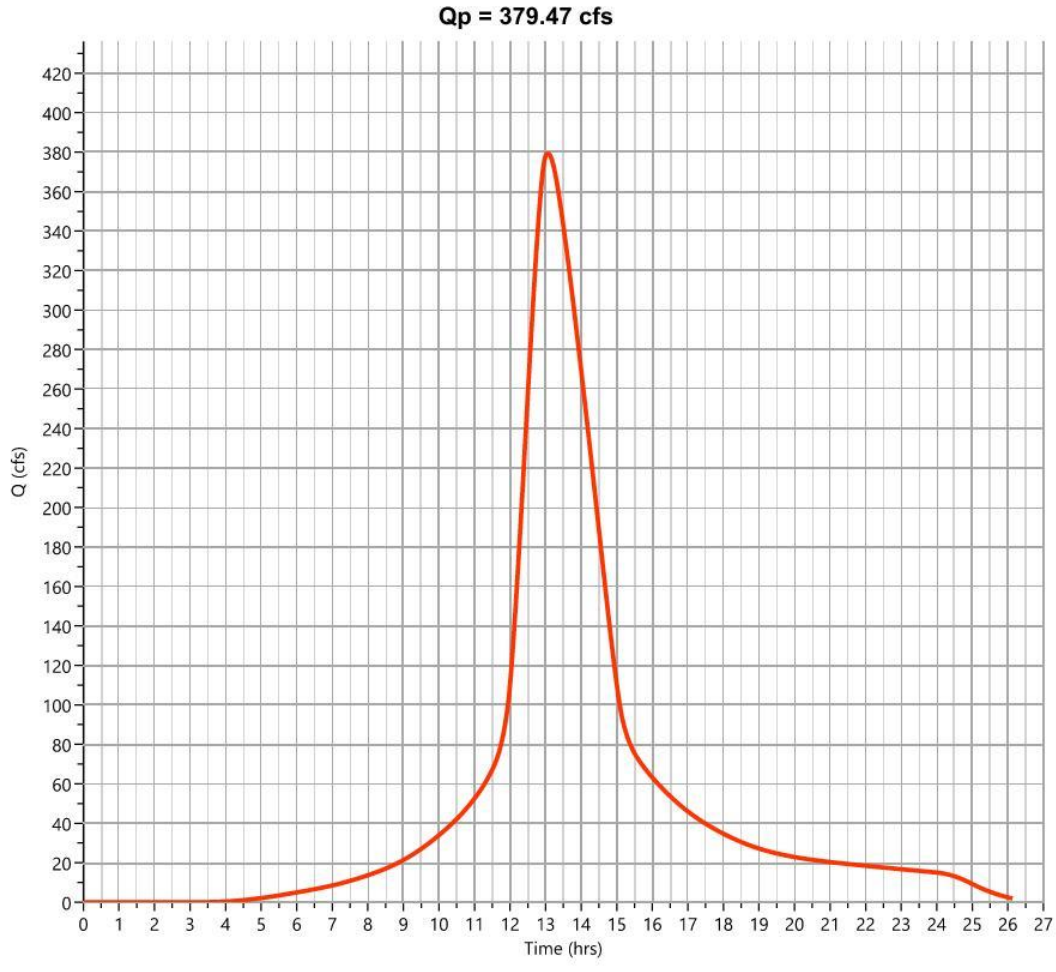
Post Dev 10x5

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 379.5 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 4,613,812 cuft
Drainage Area	= 233.11 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 98.0 min
Total Rainfall	= 6.48 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Hydrograph Report

Project Name:

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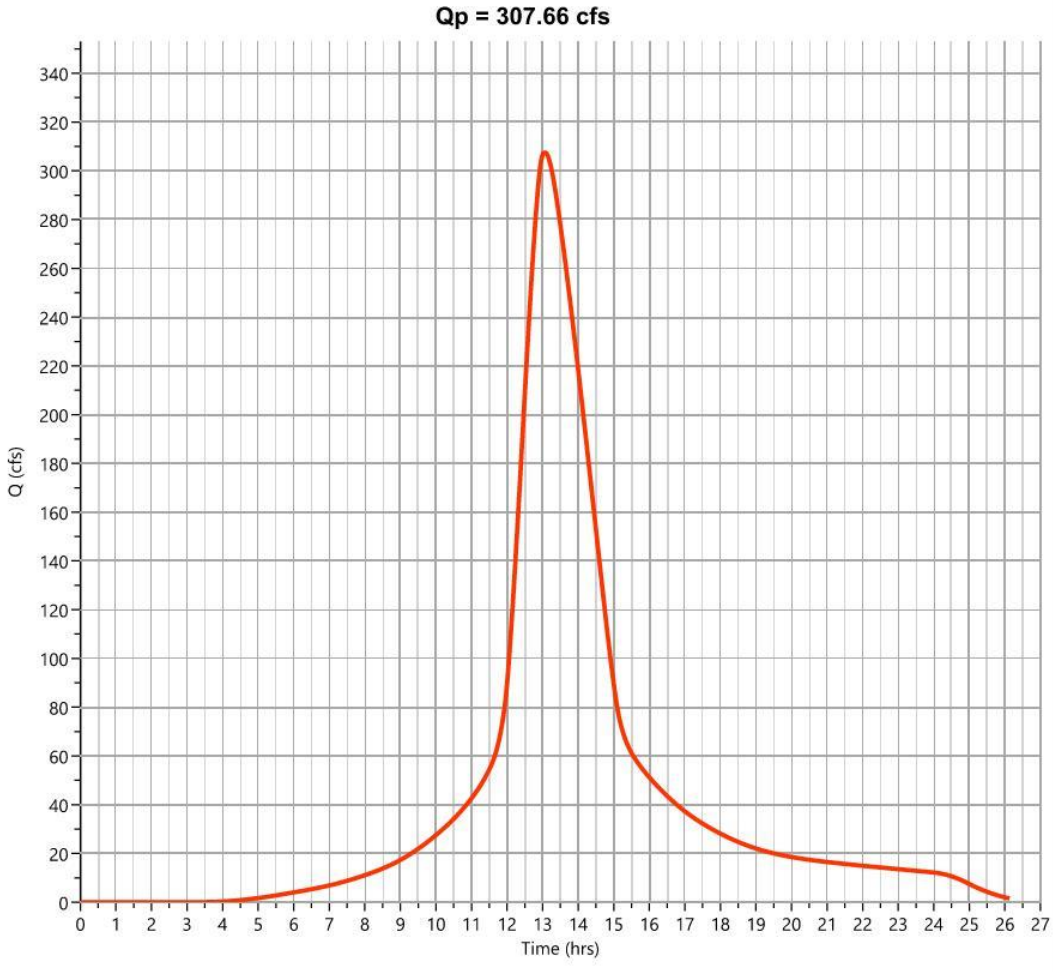
Post Dev 9x5

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 307.7 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 3,740,765 cuft
Drainage Area	= 189.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 96.0 min
Total Rainfall	= 6.48 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.27

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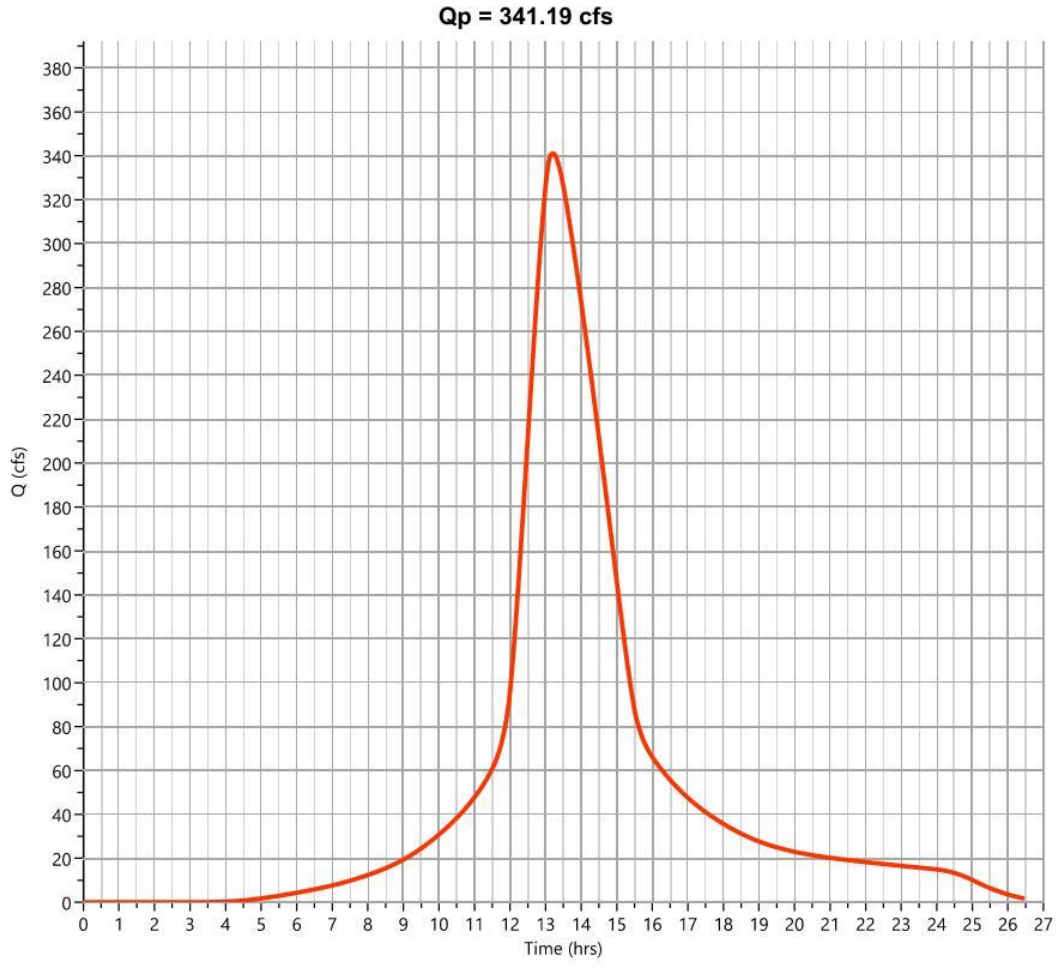
Existing 10x5

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 341.2 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.20 hrs
Time Interval	= 2 min	Runoff Volume	= 4,491,551 cuft
Drainage Area	= 229.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 109.0 min
Total Rainfall	= 6.48 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Hydrograph Report

Project Name:

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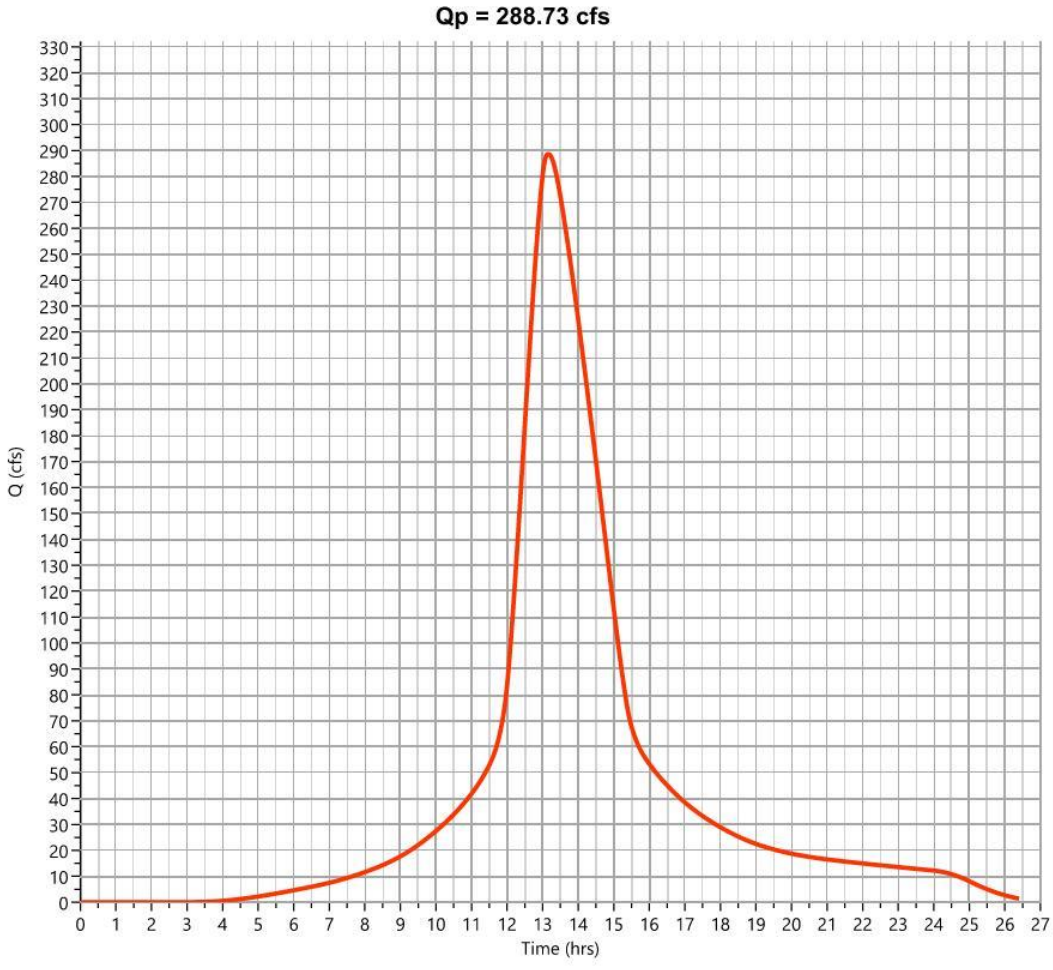
Existing 9x5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 288.7 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,751,662 cuft
Drainage Area	= 186.95 ac	Curve Number	= 92
Tc Method	= User	Time of Conc. (Tc)	= 108.0 min
Total Rainfall	= 6.48 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Design Storm Report

Custom Storm filename:

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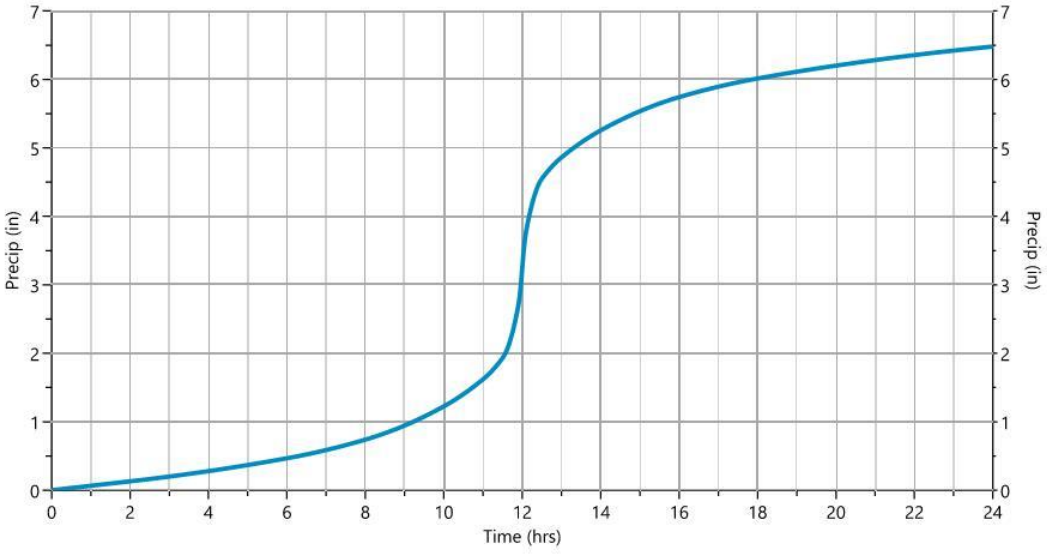
Storm Distribution: NRCS/SCS - Type III, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	✔ 10-yr	25-yr	50-yr	100-yr	
24 hrs	3.47	4.24	0.00	5.46	6.48	7.90	9.05	10.30	

Incremental Rainfall Distribution, 10-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.00	0.015682	11.37	0.022723	11.73	0.066888	12.10	0.128303	12.47	0.035208
11.03	0.016099	11.40	0.023386	11.77	0.073224	12.13	0.098758	12.50	0.028872
11.07	0.016762	11.43	0.024048	11.80	0.079560	12.17	0.092232	12.53	0.025336
11.10	0.017424	11.47	0.024710	11.83	0.085896	12.20	0.085896	12.57	0.024711
11.13	0.018086	11.50	0.025373	11.87	0.092232	12.23	0.079560	12.60	0.024048
11.17	0.018749	11.53	0.028835	11.90	0.098568	12.27	0.073224	12.63	0.023386
11.20	0.019411	11.57	0.035208	11.93	0.128489	12.30	0.066888	12.67	0.022723
11.23	0.020074	11.60	0.041544	11.97	0.181441	12.33	0.060552	12.70	0.022061
11.27	0.020736	11.63	0.047880	**12.00**	**0.234577**	12.37	0.054216	12.73	0.021399
11.30	0.021398	11.67	0.054216	12.03	0.234278	12.40	0.047880	12.77	0.020736
11.33	0.022061	11.70	0.060552	12.07	0.181439	12.43	0.041544	12.80	0.020073



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Hydrograph 25-yr Summary

Project Name:

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Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Proposed 3-48"	176.1	13.07	2,138,322	----		
2	NRCS Runoff	Post Dev 10x5	472.6	13.07	5,802,199	----		
3	NRCS Runoff	Post Dev 9x5	383.2	13.07	4,704,280	----		
4	NRCS Runoff	Existing 10x5	425.1	13.20	5,648,447	----		
5	NRCS Runoff	Existing 9x5	358.4	13.17	4,701,166	----		

Hydrograph Report

Project Name:

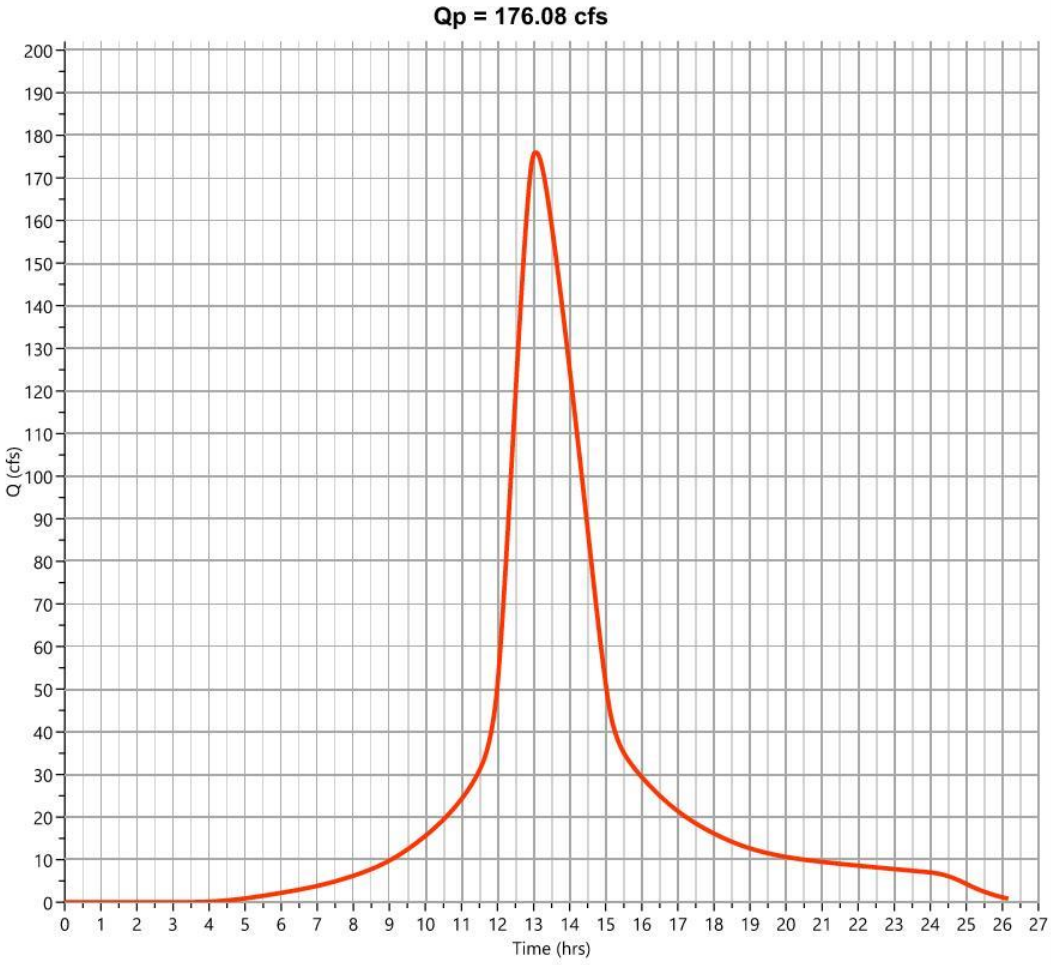
Hydrology Studio v 3.0.0.27

06-23-2023

Proposed 3-48"

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 176.1 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 2,138,322 cuft
Drainage Area	= 89.0 ac	Curve Number	= 89
Tc Method	= User	Time of Conc. (Tc)	= 95.0 min
Total Rainfall	= 7.90 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Hydrograph Report

Project Name:

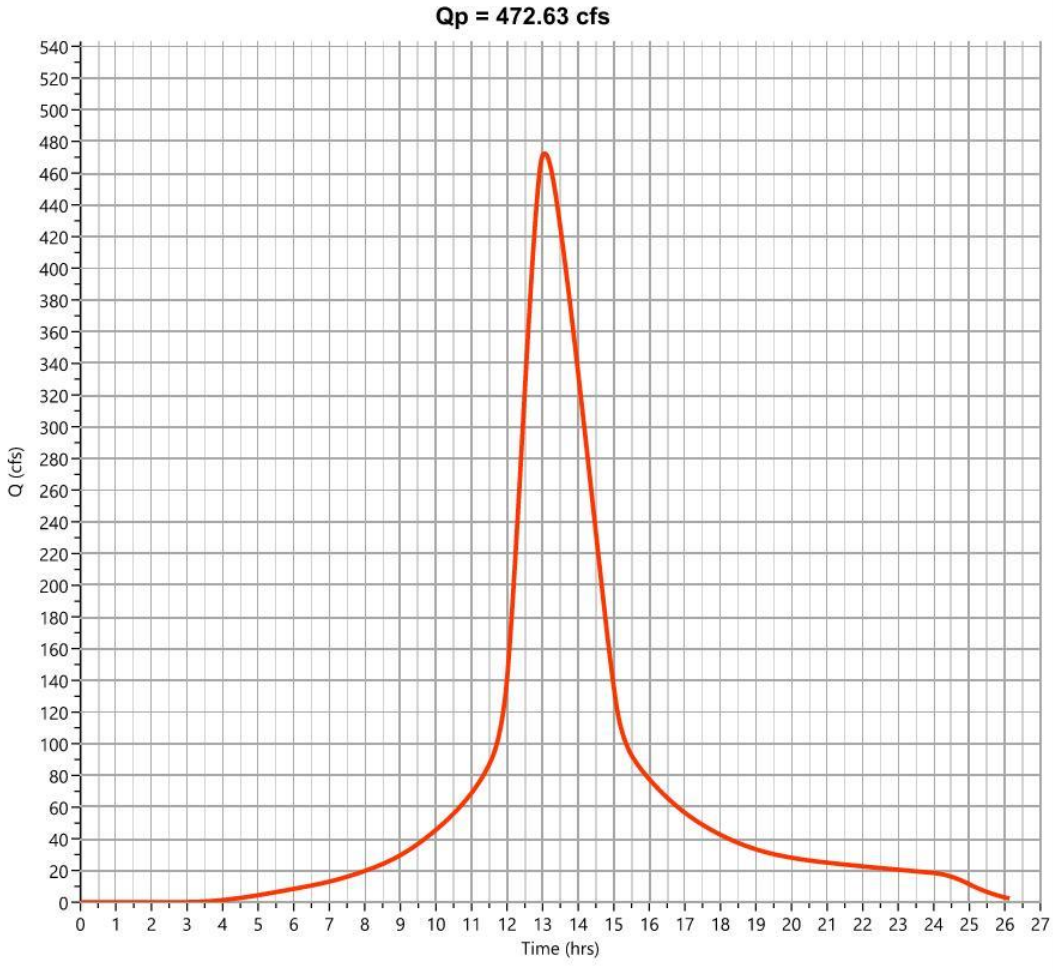
Hydrology Studio v 3.0.0.27

06-23-2023

Post Dev 10x5

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 472.6 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 5,802,199 cuft
Drainage Area	= 233.11 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 98.0 min
Total Rainfall	= 7.90 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



12

Hydrograph Report

Project Name:

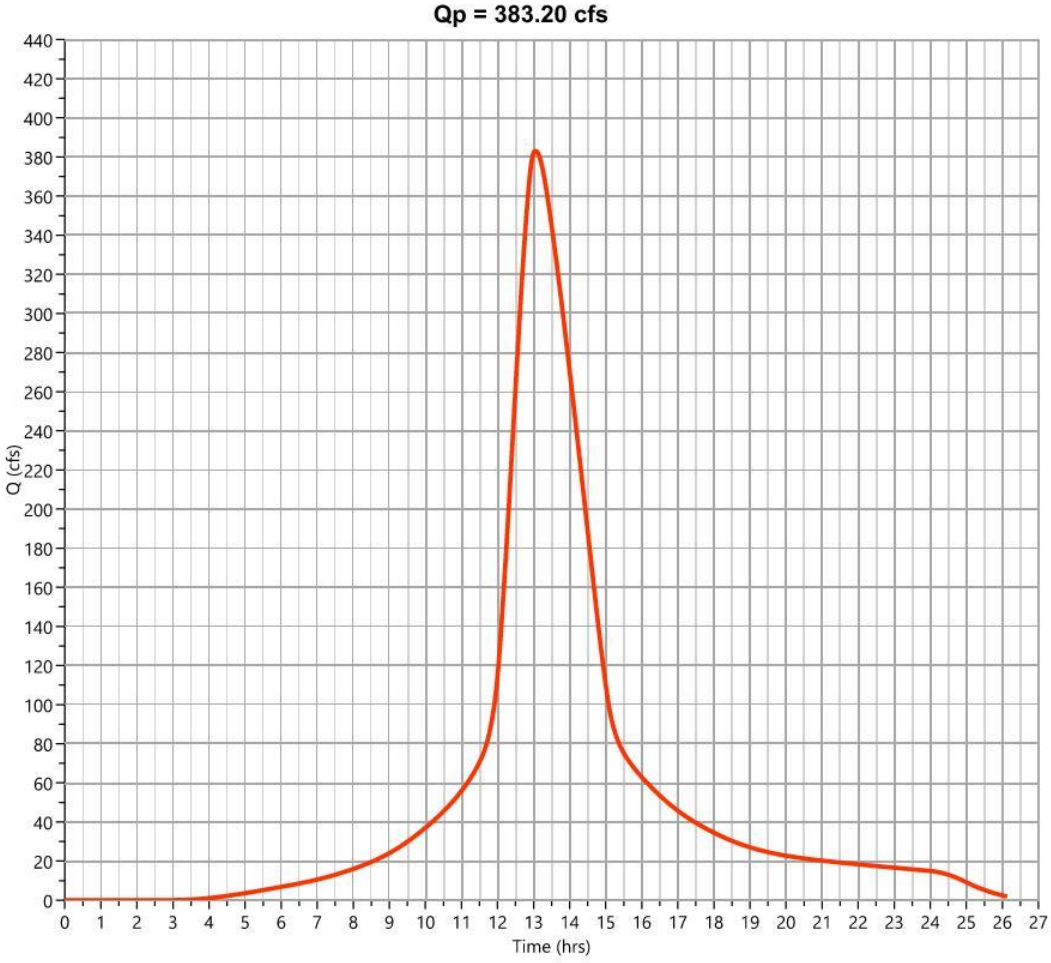
Hydrology Studio v 3.0.0.27

06-23-2023

Post Dev 9x5

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 383.2 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 4,704,280 cuft
Drainage Area	= 189.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 96.0 min
Total Rainfall	= 7.90 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



13

Hydrograph Report

Project Name:

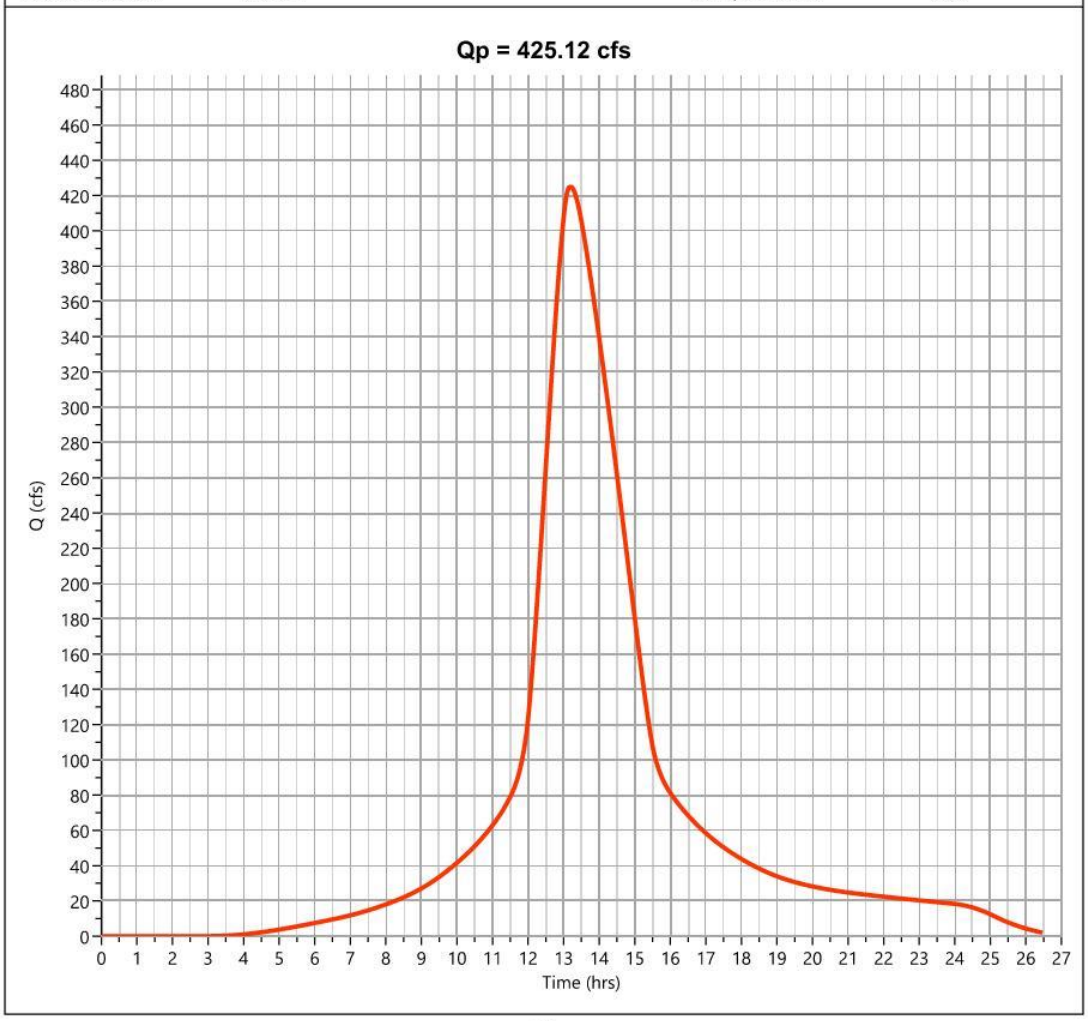
Hydrology Studio v 3.0.0.27

06-23-2023

Existing 10x5

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 425.1 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.20 hrs
Time Interval	= 2 min	Runoff Volume	= 5,648,447 cuft
Drainage Area	= 229.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 109.0 min
Total Rainfall	= 7.90 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



14

Hydrograph Report

Project Name:

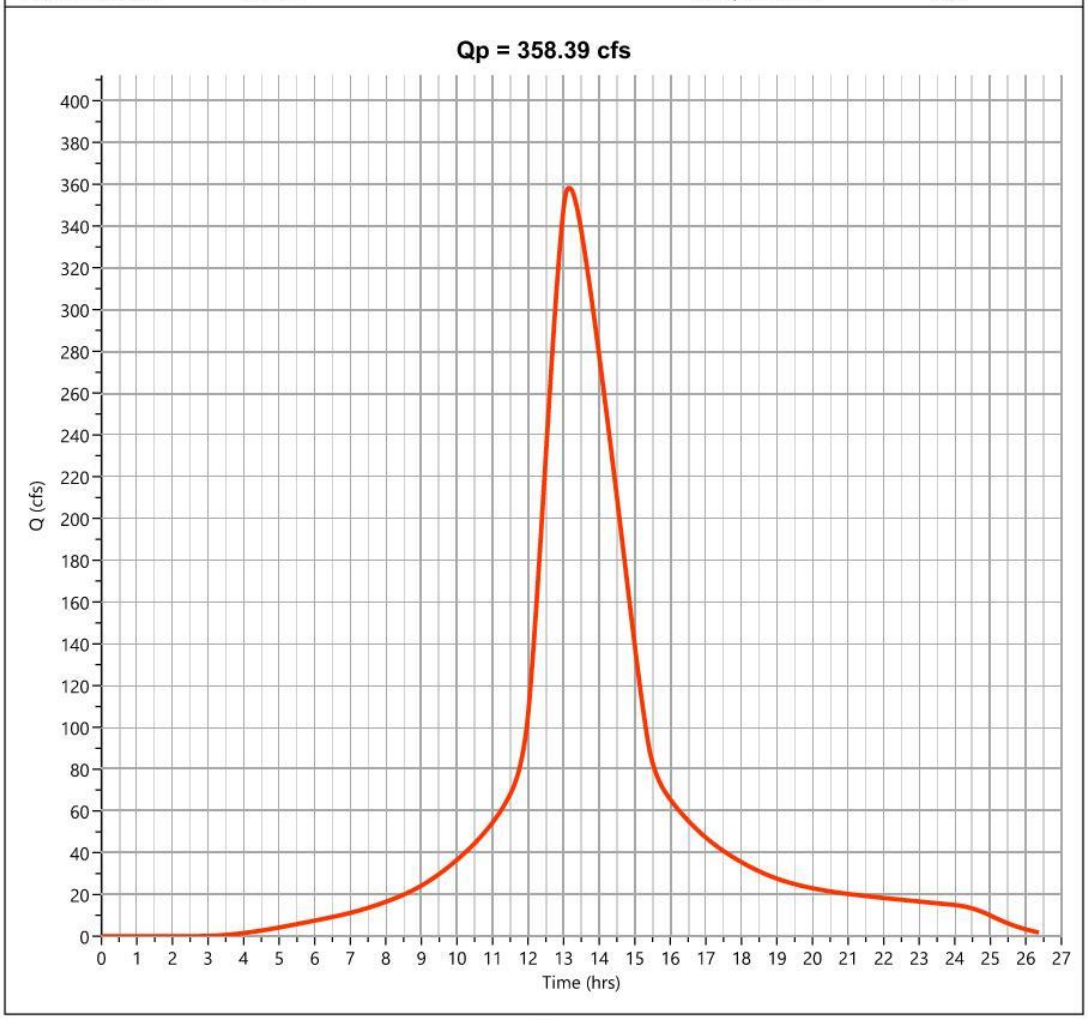
Hydrology Studio v 3.0.0.27

06-23-2023

Existing 9x5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 358.4 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.17 hrs
Time Interval	= 2 min	Runoff Volume	= 4,701,166 cuft
Drainage Area	= 186.95 ac	Curve Number	= 92
Tc Method	= User	Time of Conc. (Tc)	= 108.0 min
Total Rainfall	= 7.90 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



15

Design Storm Report

Custom Storm filename:

Hydrology Studio v 3.0.0.27

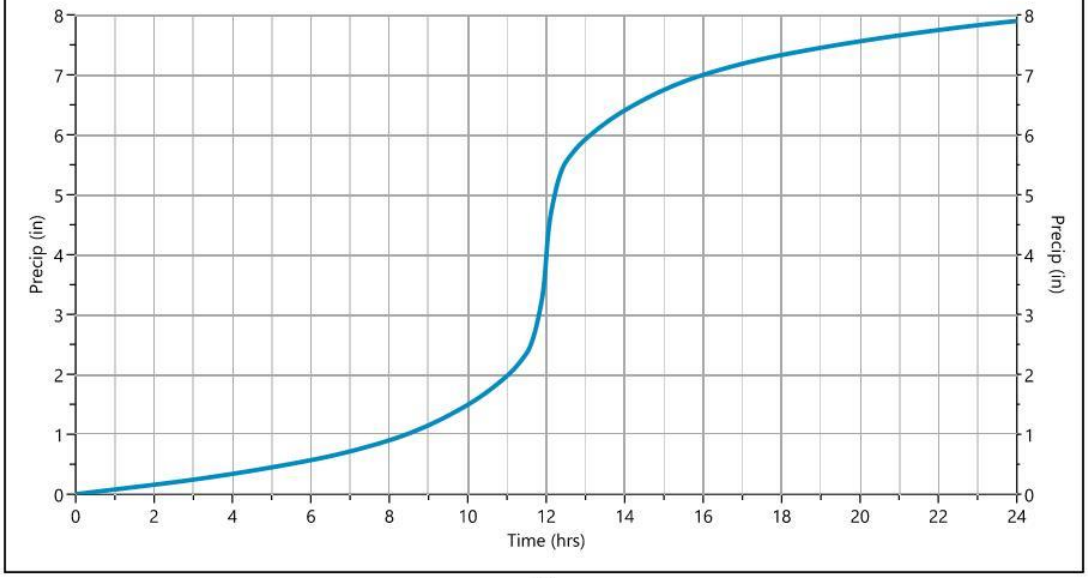
06-23-2023

Storm Distribution: NRCS/SCS - Type III, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	10-yr	✔ 25-yr	50-yr	100-yr	
24 hrs	3.47	4.24	0.00	5.46	6.48	7.90	9.05	10.30	

Incremental Rainfall Distribution, 25-yr

Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.00	0.019118	11.37	0.027703	11.73	0.081545	12.10	0.156419	12.47	0.042923
11.03	0.019626	11.40	0.028510	11.77	0.089270	12.13	0.120400	12.50	0.035199
11.07	0.020435	11.43	0.029318	11.80	0.096994	12.17	0.112443	12.53	0.030889
11.10	0.021242	11.47	0.030125	11.83	0.104719	12.20	0.104719	12.57	0.030125
11.13	0.022050	11.50	0.030933	11.87	0.112443	12.23	0.096994	12.60	0.029318
11.17	0.022857	11.53	0.035154	11.90	0.120168	12.27	0.089270	12.63	0.028510
11.20	0.023665	11.57	0.042923	11.93	0.156646	12.30	0.081546	12.67	0.027703
11.23	0.024472	11.60	0.050648	11.97	0.221201	12.33	0.073821	12.70	0.026895
11.27	0.025280	11.63	0.058372	**12.00**	**0.285981**	12.37	0.066097	12.73	0.026088
11.30	0.026088	11.67	0.066097	12.03	0.285618	12.40	0.058373	12.77	0.025280
11.33	0.026895	11.70	0.073821	12.07	0.221199	12.43	0.050648	12.80	0.024472



16

Hydrograph 50-yr Summary

Project Name:

06-23-2023

Hydrology Studio v 3.0.0.27

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Proposed 3-48"	204.9	13.07	2,505,157	----		
2	NRCS Runoff	Post Dev 10x5	547.7	13.07	6,768,565	----		
3	NRCS Runoff	Post Dev 9x5	444.0	13.07	5,487,790	----		
4	NRCS Runoff	Existing 10x5	492.7	13.20	6,589,213	----		
5	NRCS Runoff	Existing 9x5	414.5	13.17	5,472,643	----		

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Hydrograph Report

Project Name:

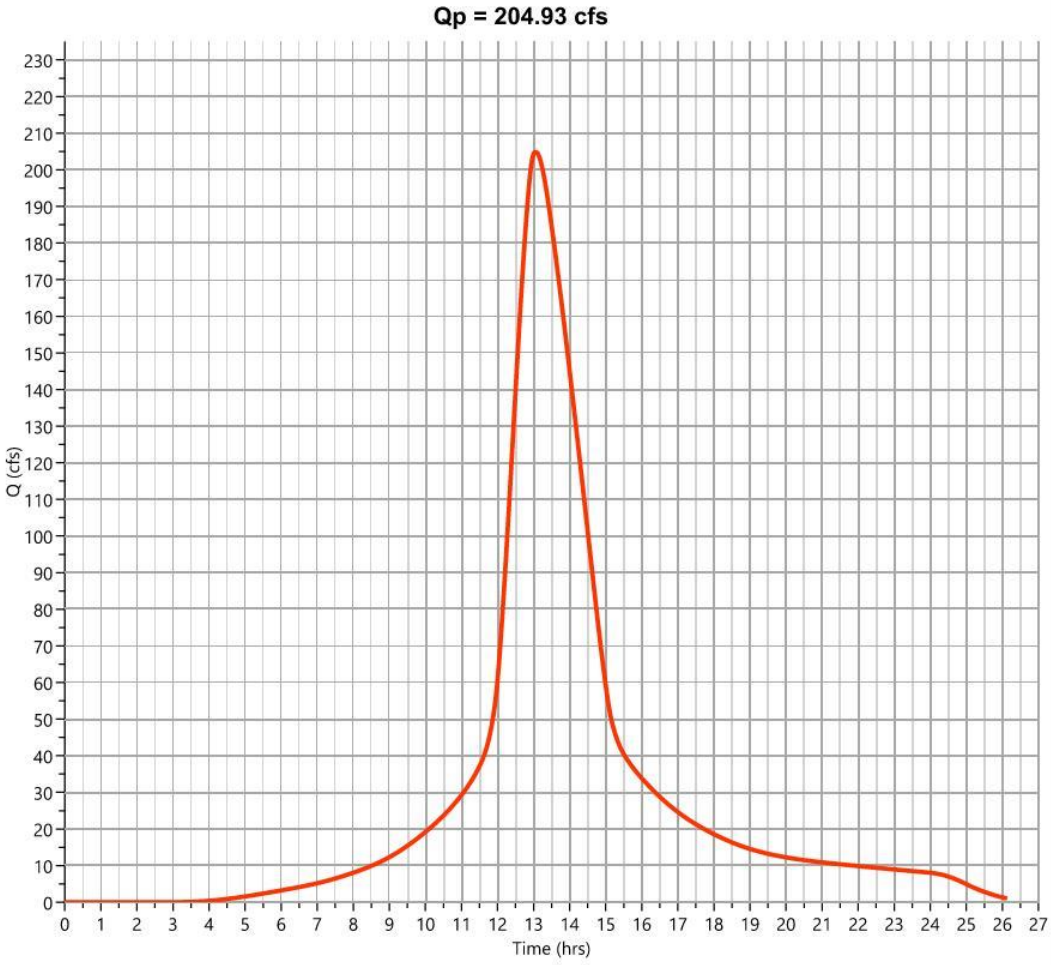
Hydrology Studio v 3.0.0.27

06-23-2023

Proposed 3-48"

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 204.9 cfs
Storm Frequency	= 50-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 2,505,157 cuft
Drainage Area	= 89.0 ac	Curve Number	= 89
Tc Method	= User	Time of Conc. (Tc)	= 95.0 min
Total Rainfall	= 9.05 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



18

Hydrograph Report

Project Name:

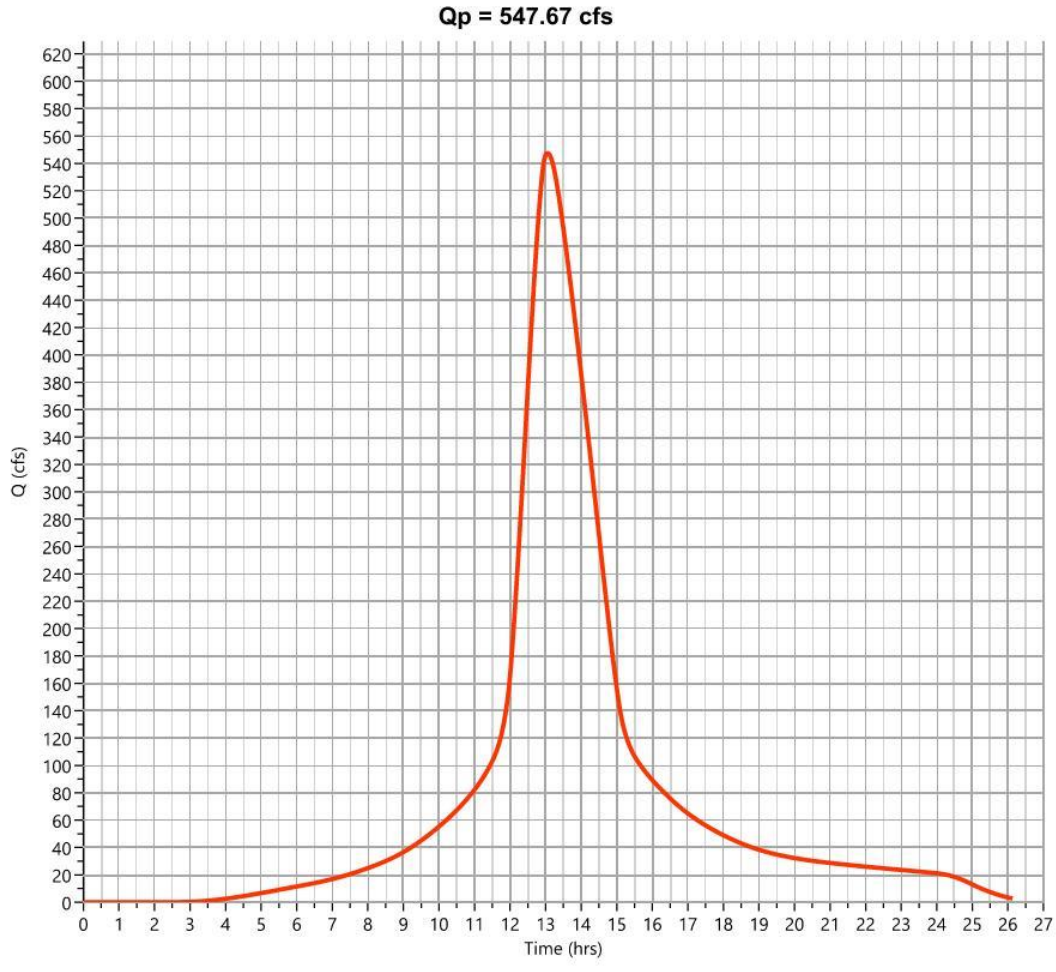
Hydrology Studio v 3.0.0.27

06-23-2023

Post Dev 10x5

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 547.7 cfs
Storm Frequency	= 50-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 6,768,565 cuft
Drainage Area	= 233.11 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 98.0 min
Total Rainfall	= 9.05 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



19

Hydrograph Report

Project Name:

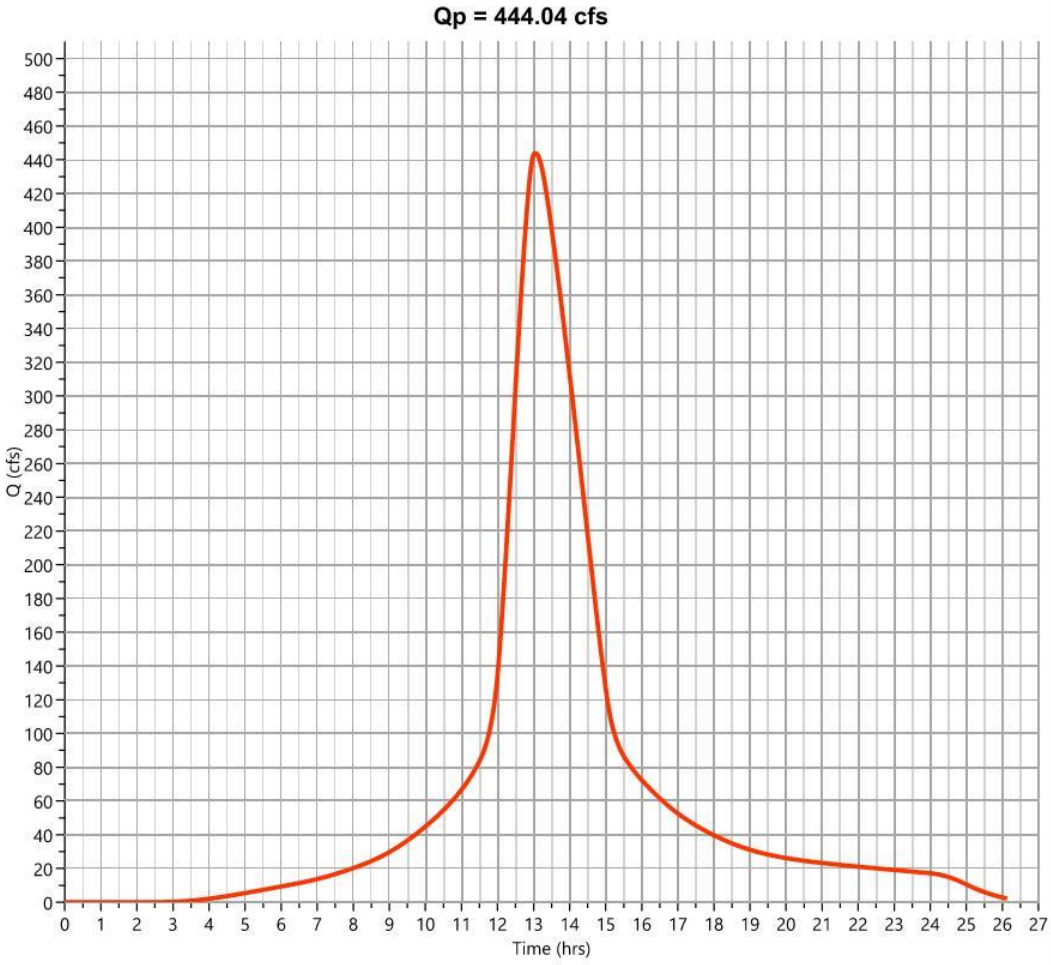
Hydrology Studio v 3.0.0.27

06-23-2023

Post Dev 9x5

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 444.0 cfs
Storm Frequency	= 50-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 5,487,790 cuft
Drainage Area	= 189.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 96.0 min
Total Rainfall	= 9.05 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



20

Hydrograph Report

Project Name:

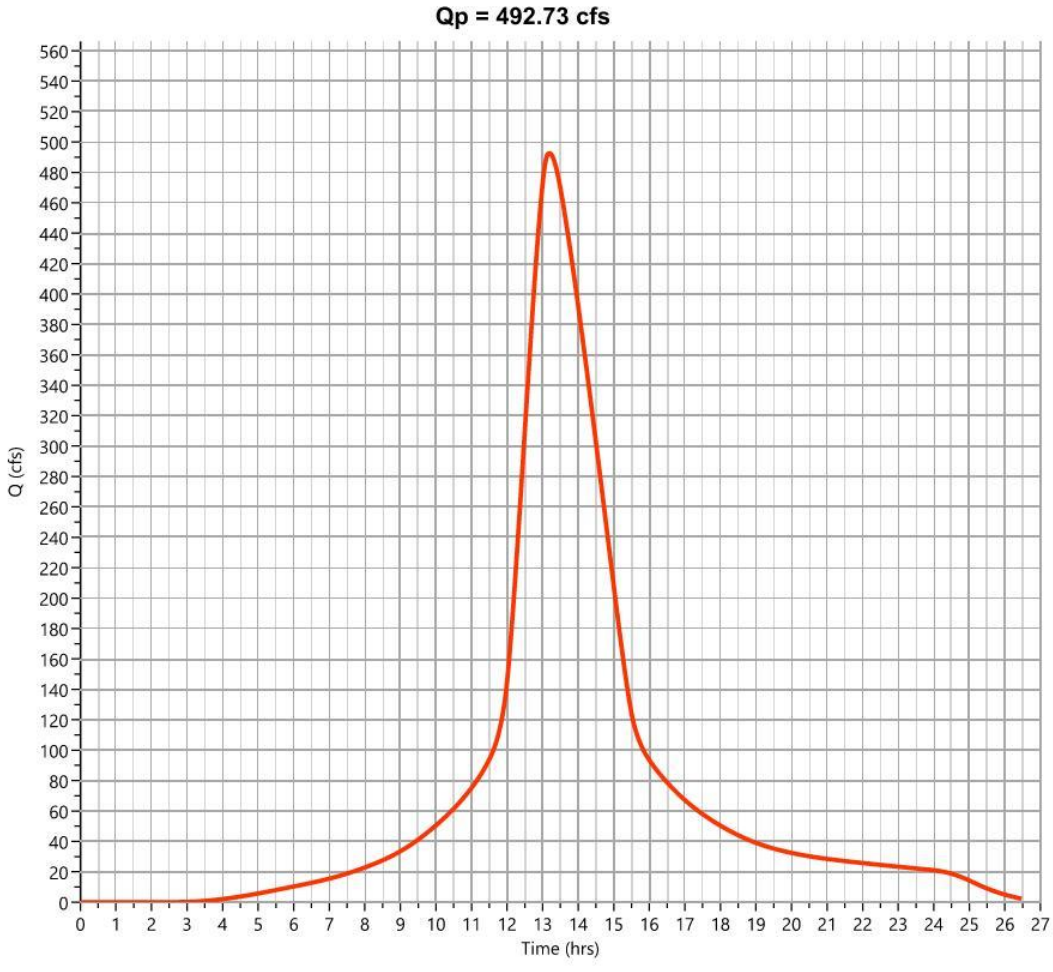
Hydrology Studio v 3.0.0.27

06-23-2023

Existing 10x5

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 492.7 cfs
Storm Frequency	= 50-yr	Time to Peak	= 13.20 hrs
Time Interval	= 2 min	Runoff Volume	= 6,589,213 cuft
Drainage Area	= 229.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 109.0 min
Total Rainfall	= 9.05 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



21

Hydrograph Report

Project Name:

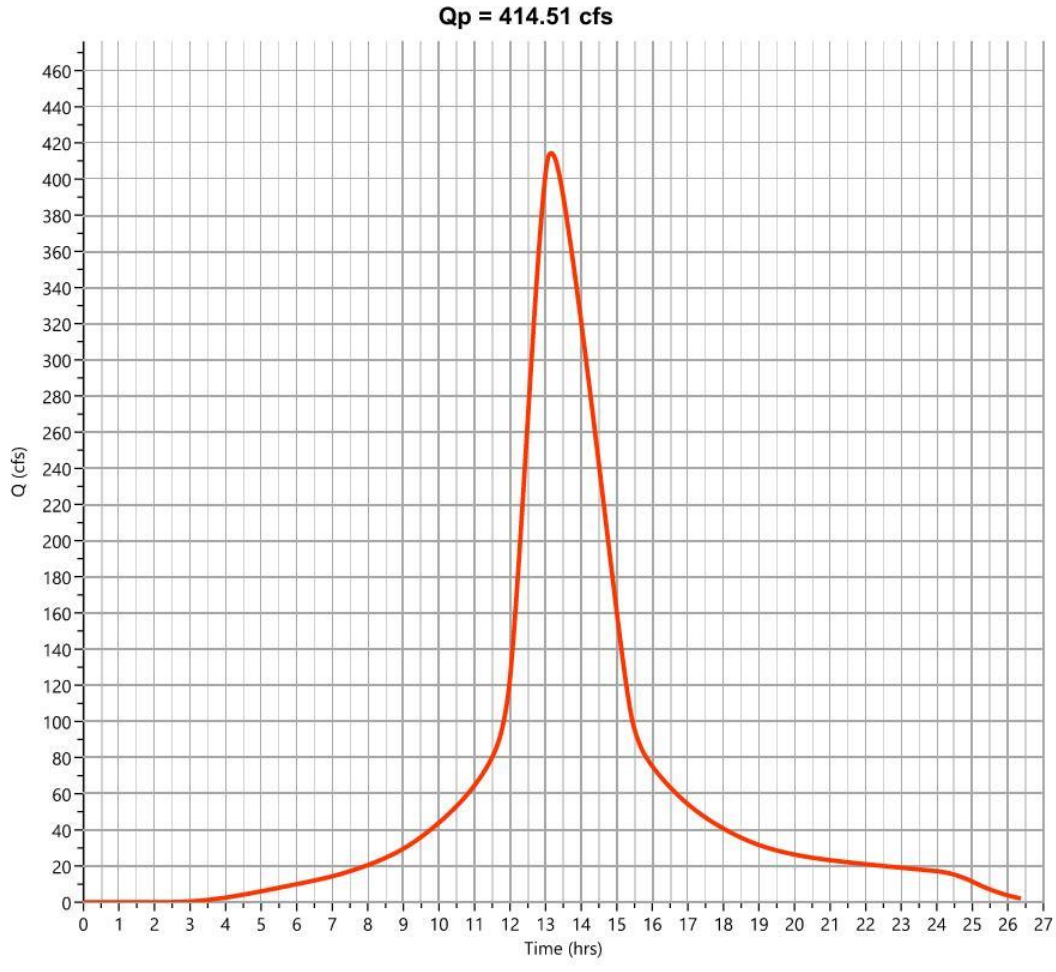
Hydrology Studio v 3.0.0.27

06-23-2023

Existing 9x5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 414.5 cfs
Storm Frequency	= 50-yr	Time to Peak	= 13.17 hrs
Time Interval	= 2 min	Runoff Volume	= 5,472,643 cuft
Drainage Area	= 186.95 ac	Curve Number	= 92
Tc Method	= User	Time of Conc. (Tc)	= 108.0 min
Total Rainfall	= 9.05 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



22

Design Storm Report

Custom Storm filename:

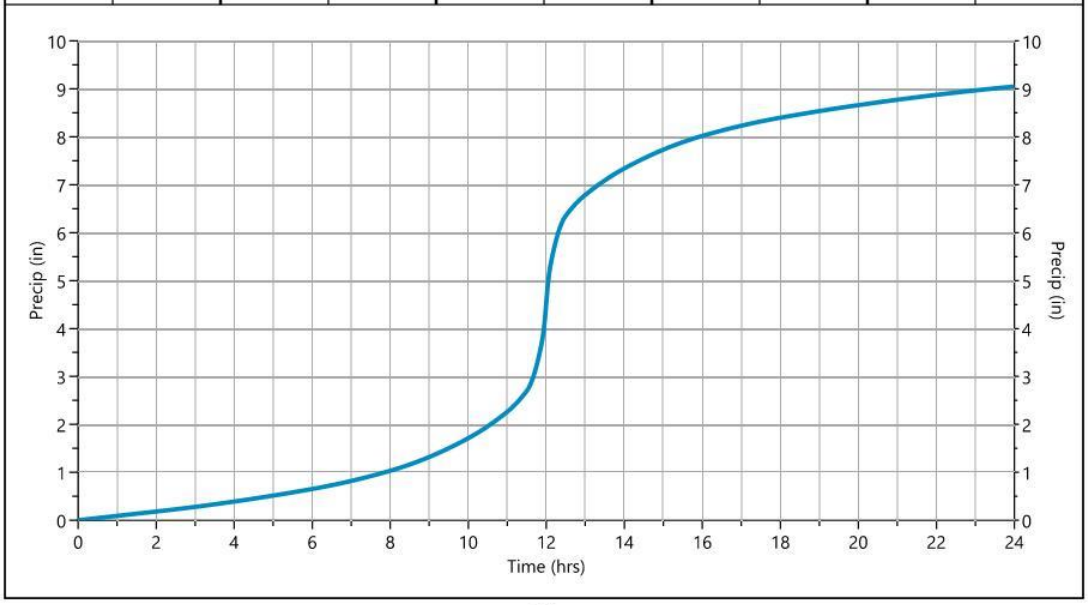
Hydrology Studio v 3.0.0.27

06-23-2023

Storm Distribution: NRCS/SCS - Type III, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	✔ 50-yr	100-yr	
24 hrs	3.47	4.24	0.00	5.46	6.48	7.90	9.05	10.30	

Incremental Rainfall Distribution, 50-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.00	0.021901	11.37	0.031735	11.73	0.093416	12.10	0.179189	12.47	0.049172
11.03	0.022483	11.40	0.032660	11.77	0.102265	12.13	0.137926	12.50	0.040323
11.07	0.023409	11.43	0.033586	11.80	0.111114	12.17	0.128812	12.53	0.035385
11.10	0.024334	11.47	0.034511	11.83	0.119963	12.20	0.119963	12.57	0.034511
11.13	0.025259	11.50	0.035436	11.87	0.128812	12.23	0.111115	12.60	0.033586
11.17	0.026185	11.53	0.040272	11.90	0.137660	12.27	0.102265	12.63	0.032660
11.20	0.027110	11.57	0.049171	11.93	0.179449	12.30	0.093416	12.67	0.031735
11.23	0.028035	11.60	0.058020	11.97	0.253401	12.33	0.084568	12.70	0.030810
11.27	0.028960	11.63	0.066869	**12.00**	**0.327611**	12.37	0.075718	12.73	0.029885
11.30	0.029885	11.67	0.075718	12.03	0.327195	12.40	0.066870	12.77	0.028960
11.33	0.030810	11.70	0.084567	12.07	0.253399	12.43	0.058021	12.80	0.028035



23

Hydrograph 100-yr Summary

Project Name:

06-23-2023

Hydrology Studio v 3.0.0.27

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Proposed 3-48"	236.2	13.07	2,905,365	----		
2	NRCS Runoff	Post Dev 10x5	628.9	13.03	7,821,603	----		
3	NRCS Runoff	Post Dev 9x5	509.9	13.03	6,341,573	----		
4	NRCS Runoff	Existing 10x5	565.9	13.20	7,614,341	----		
5	NRCS Runoff	Existing 9x5	475.3	13.17	6,312,880	----		

Hydrograph Report

Project Name:

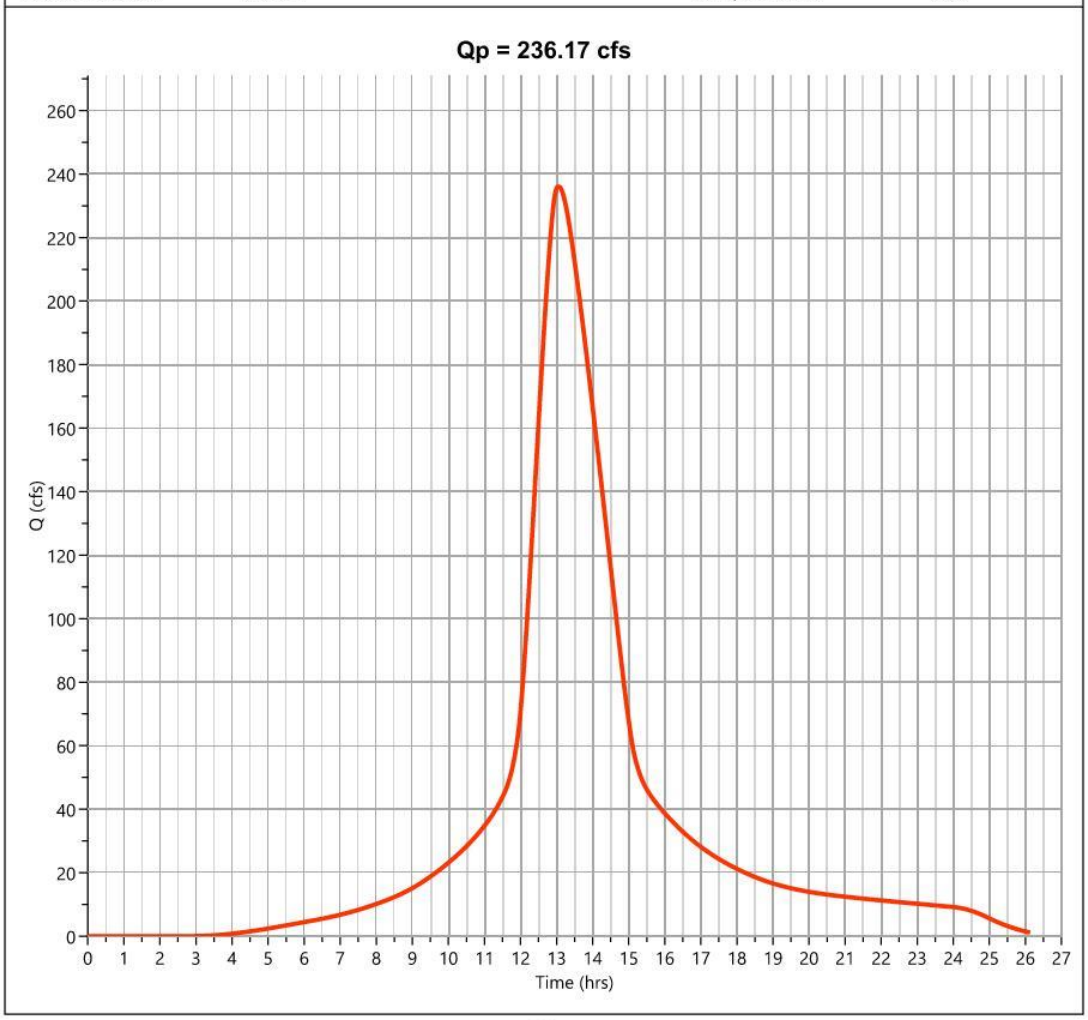
Hydrology Studio v 3.0.0.27

06-23-2023

Proposed 3-48"

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 236.2 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Runoff Volume	= 2,905,365 cuft
Drainage Area	= 89.0 ac	Curve Number	= 89
Tc Method	= User	Time of Conc. (Tc)	= 95.0 min
Total Rainfall	= 10.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



25

Hydrograph Report

Project Name:

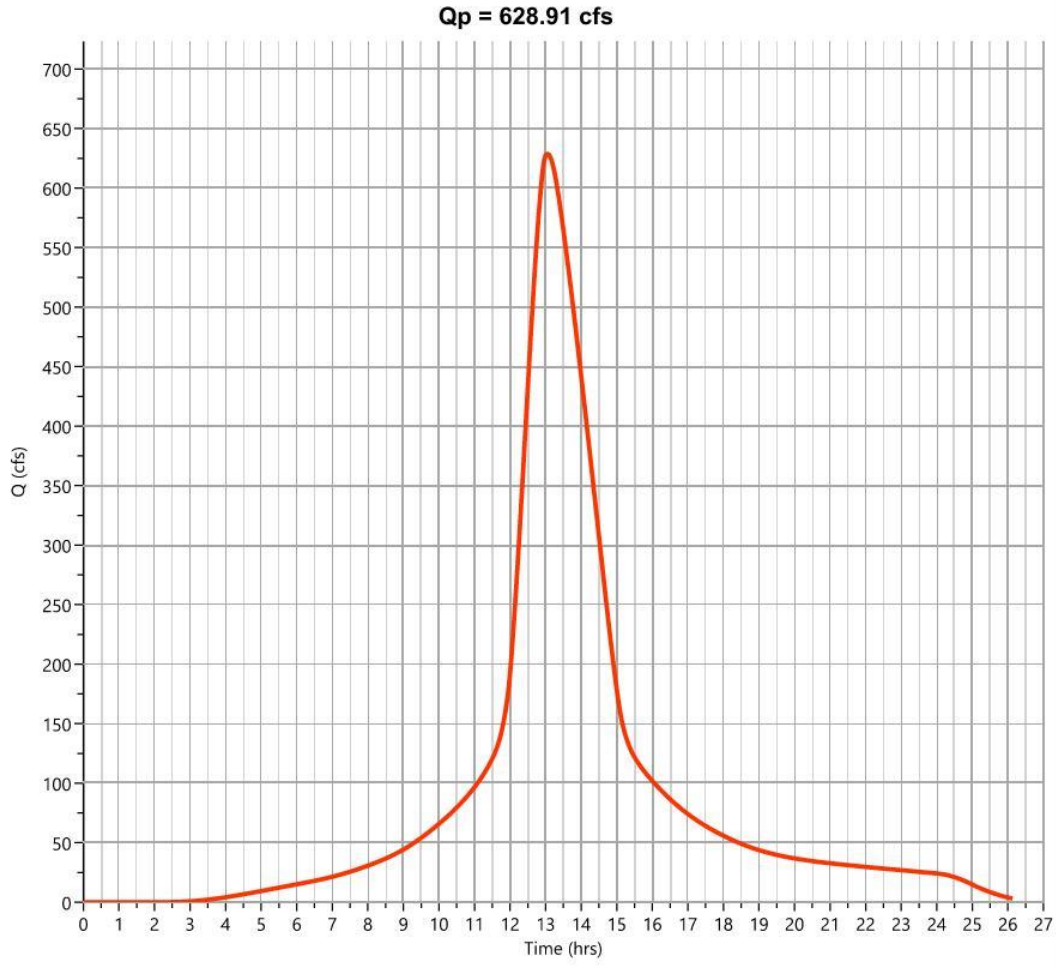
Hydrology Studio v 3.0.0.27

06-23-2023

Post Dev 10x5

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 628.9 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.03 hrs
Time Interval	= 2 min	Runoff Volume	= 7,821,603 cuft
Drainage Area	= 233.11 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 98.0 min
Total Rainfall	= 10.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



26

Hydrograph Report

Project Name:

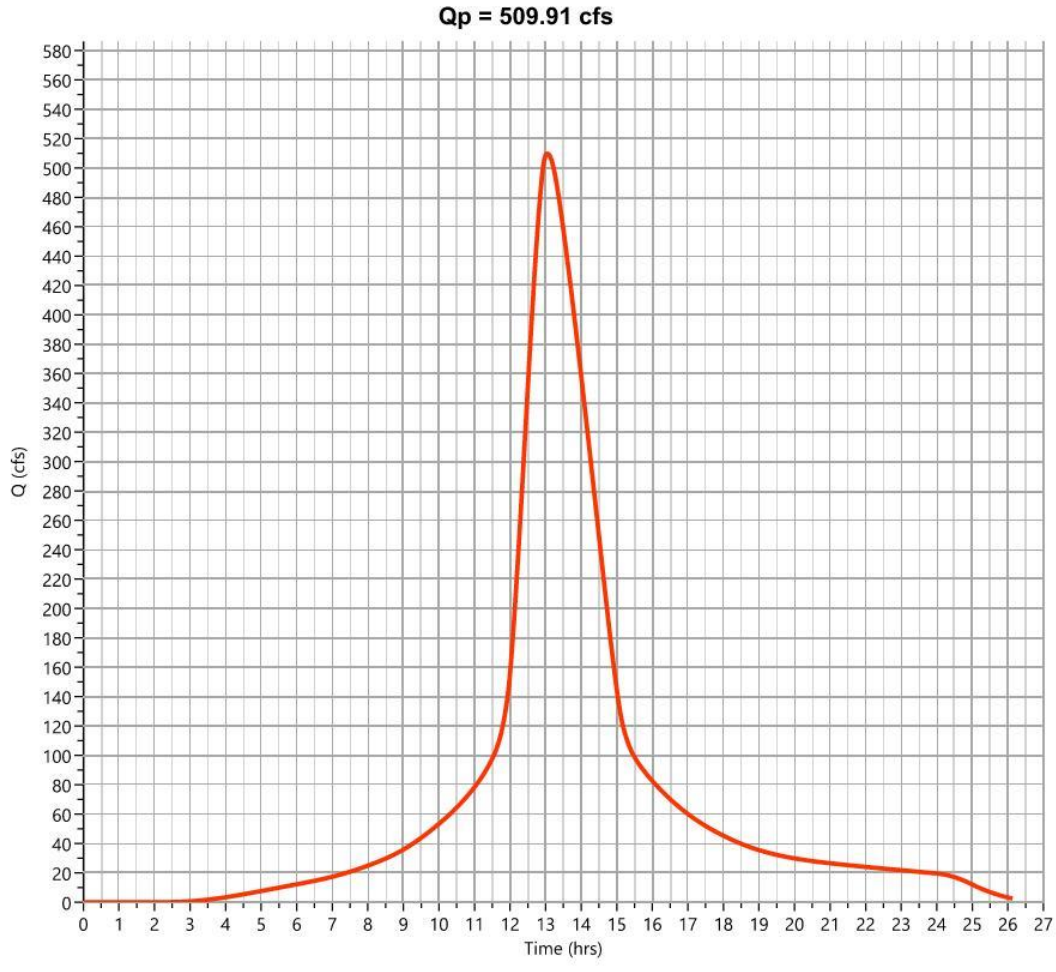
Hydrology Studio v 3.0.0.27

06-23-2023

Post Dev 9x5

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 509.9 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.03 hrs
Time Interval	= 2 min	Runoff Volume	= 6,341,573 cuft
Drainage Area	= 189.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 96.0 min
Total Rainfall	= 10.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



27

Hydrograph Report

Project Name:

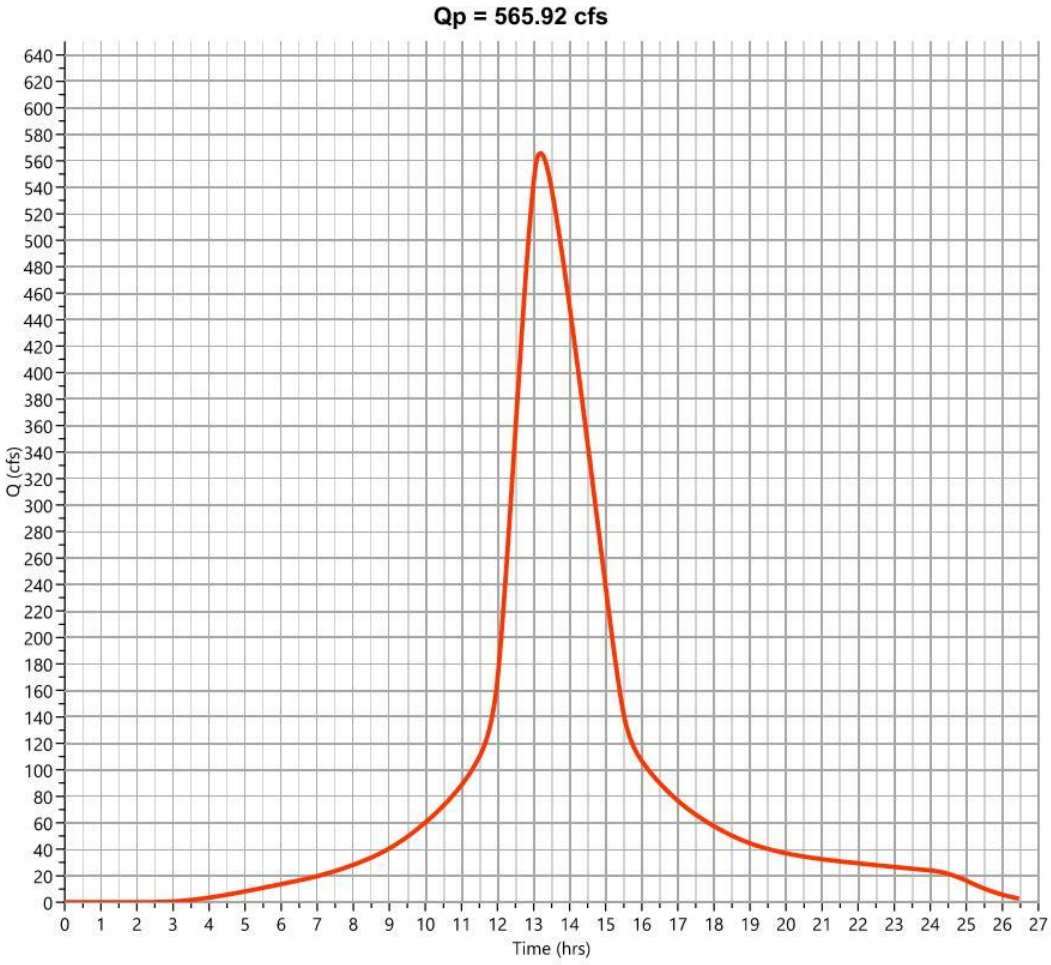
Hydrology Studio v 3.0.0.27

06-23-2023

Existing 10x5

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 565.9 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.20 hrs
Time Interval	= 2 min	Runoff Volume	= 7,614,341 cuft
Drainage Area	= 229.0 ac	Curve Number	= 91
Tc Method	= User	Time of Conc. (Tc)	= 109.0 min
Total Rainfall	= 10.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



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Hydrograph Report

Project Name:

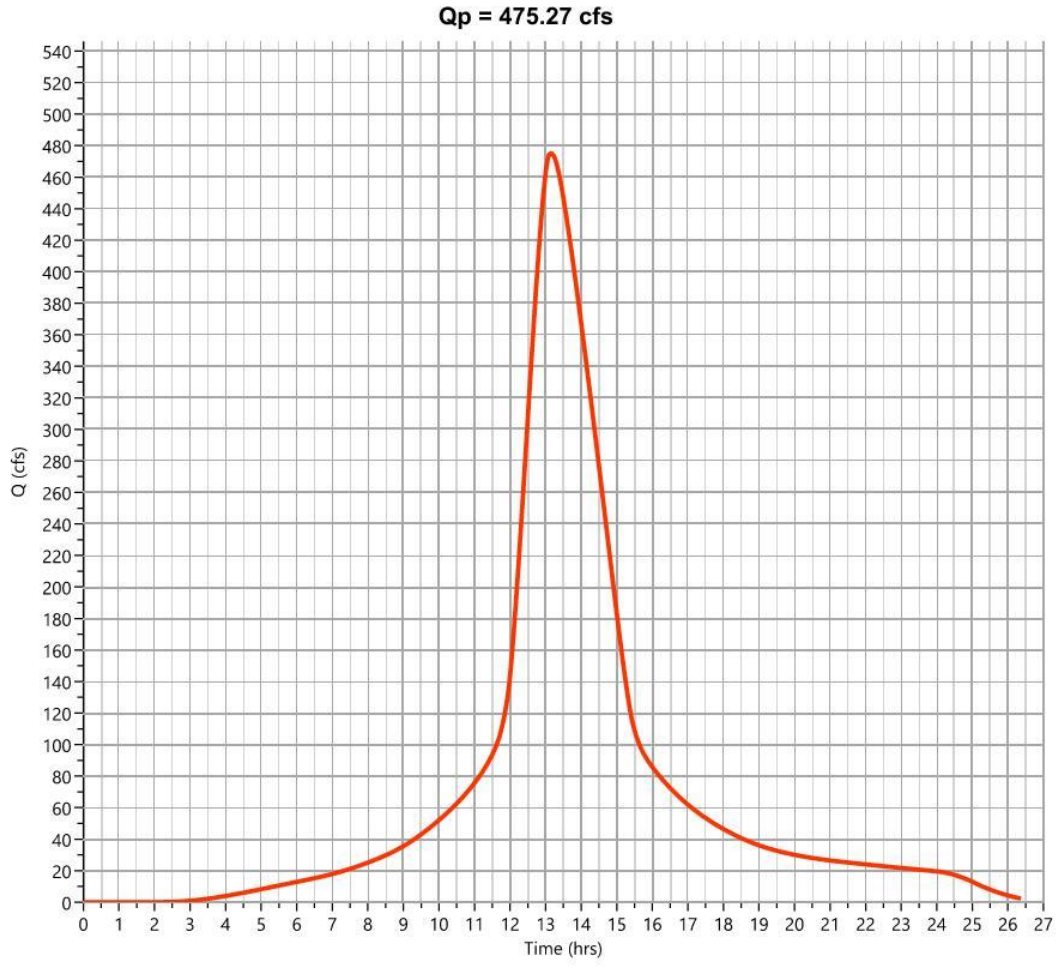
Hydrology Studio v 3.0.0.27

06-23-2023

Existing 9x5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 475.3 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.17 hrs
Time Interval	= 2 min	Runoff Volume	= 6,312,880 cuft
Drainage Area	= 186.95 ac	Curve Number	= 92
Tc Method	= User	Time of Conc. (Tc)	= 108.0 min
Total Rainfall	= 10.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 400



29

Design Storm Report

Custom Storm filename:

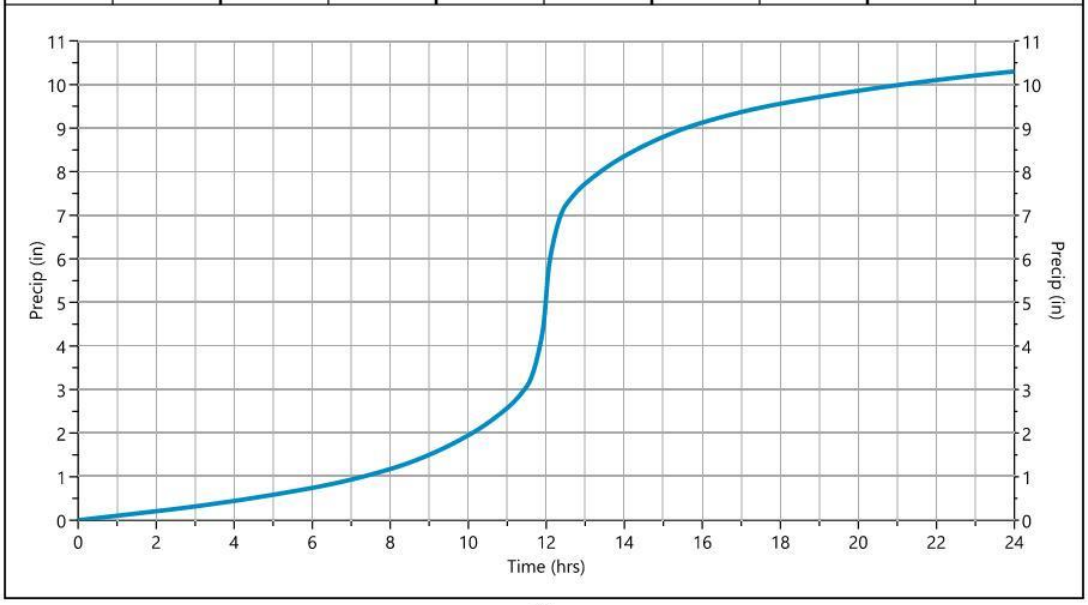
Hydrology Studio v 3.0.0.27

06-23-2023

Storm Distribution: NRCS/SCS - Type III, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	✔ 100-yr	
24 hrs	3.47	4.24	0.00	5.46	6.48	7.90	9.05	10.30	

Incremental Rainfall Distribution, 100-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.00	0.024926	11.37	0.036119	11.73	0.106319	12.10	0.203939	12.47	0.055964
11.03	0.025589	11.40	0.037172	11.77	0.116390	12.13	0.156977	12.50	0.045892
11.07	0.026643	11.43	0.038224	11.80	0.126461	12.17	0.146604	12.53	0.040272
11.10	0.027695	11.47	0.039278	11.83	0.136532	12.20	0.136532	12.57	0.039278
11.13	0.028749	11.50	0.040330	11.87	0.146603	12.23	0.126461	12.60	0.038224
11.17	0.029801	11.53	0.045834	11.90	0.156674	12.27	0.116390	12.63	0.037172
11.20	0.030854	11.57	0.055963	11.93	0.204235	12.30	0.106319	12.67	0.036119
11.23	0.031907	11.60	0.066034	11.97	0.288401	12.33	0.096248	12.70	0.035066
11.27	0.032960	11.63	0.076105	**12.00**	**0.372861**	12.37	0.086177	12.73	0.034013
11.30	0.034013	11.67	0.086177	12.03	0.372387	12.40	0.076106	12.77	0.032960
11.33	0.035066	11.70	0.096247	12.07	0.288398	12.43	0.066035	12.80	0.031907



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IDF Report

IDF filename: SampleIDF.idf

Hydrology Studio v 3.0.0.27

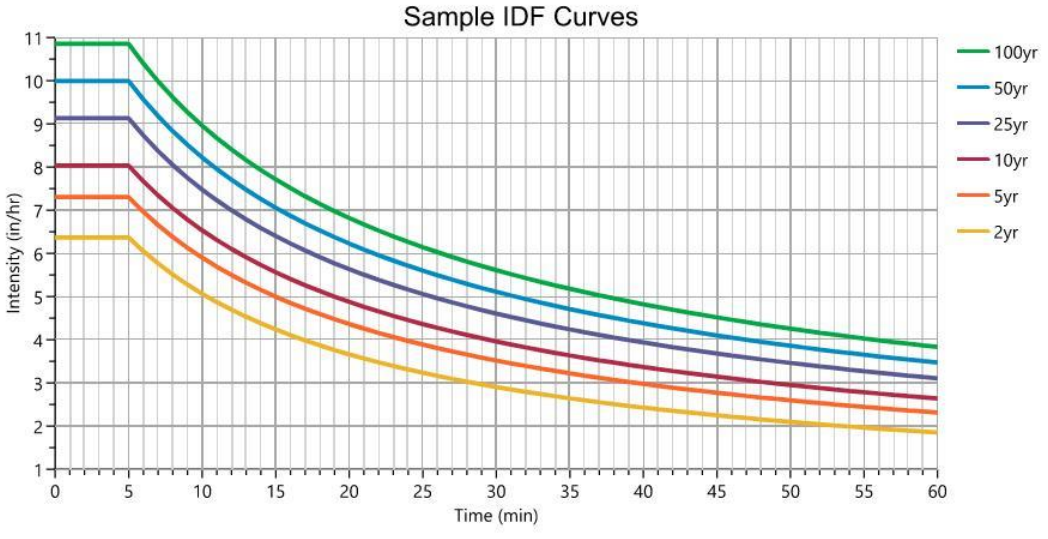
06-23-2023

Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
B	0.0000	58.1215	0.0000	57.1446	58.8780	63.5498	67.7965	72.2003	
D	0.0000	10.3000	0.0000	10.3000	10.3000	10.4000	10.5000	10.6000	
E	0.0000	0.8106	0.0000	0.7542	0.7303	0.7097	0.6986	0.6898	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	0	6.37	0	7.30	8.03	9.13	9.99	10.85	
10	0	5.06	0	5.90	6.53	7.48	8.22	8.96	
15	0	4.24	0	5.00	5.56	6.40	7.06	7.71	
20	0	3.66	0	4.36	4.88	5.63	6.23	6.82	
25	0	3.23	0	3.89	4.36	5.06	5.60	6.14	
30	0	2.90	0	3.52	3.96	4.60	5.11	5.61	
35	0	2.64	0	3.22	3.64	4.24	4.71	5.18	
40	0	2.43	0	2.98	3.37	3.94	4.38	4.82	
45	0	2.25	0	2.77	3.14	3.68	4.10	4.52	
50	0	2.10	0	2.60	2.95	3.46	3.86	4.26	
55	0	1.96	0	2.44	2.78	3.27	3.65	4.03	
60	0	1.85	0	2.31	2.64	3.10	3.47	3.83	

Cf = Correction Factor applied to Rational Method runoff coefficient.



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Precipitation Report

Precipitation filename: SamplePrecip.pcp

Hydrology Studio v 3.0.0.27 (Rainfall totals in Inches)

06-23-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔			✔	✔	✔	✔
SCS Storms	**> SCS Dimensionless Storms**								
SCS 6hr		2.58	3.10	0	3.87	4.63	5.61	6.48	7.36
Type I, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Type IA, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Type II, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Type II FL, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Type III, 24-hr	✔	3.47	4.24	0	5.46	6.48	7.90	9.05	10.30
Synthetic Storms	**> IDF-Based Synthetic Storms**								
1-hr		0	1.85	0	2.31	2.64	3.10	3.47	3.83
2-hr		0	2.24	0	2.90	3.36	4.01	4.51	5.01
3-hr		0	2.48	0	3.27	3.82	4.60	5.20	5.79
6-hr		0	2.89	0	3.96	4.70	5.73	6.53	7.32
12-hr		0	3.33	0	4.75	5.73	7.08	8.13	9.17
24-hr		0	3.82	0	5.66	6.94	8.70	10.07	11.42
Huff Distribution	**> 1st Quartile (0 to 6 hrs)**								
1-hr		1.73	2.07	0	2.52	2.94	3.46	3.92	4.37
2-hr		2.04	2.46	0	3.06	3.63	4.33	4.93	5.51
3-hr		2.18	2.62	0	3.27	3.91	4.72	5.43	6.14
6-hr		2.58	3.10	0	3.87	4.63	5.61	6.48	7.36
Huff Distribution	**> 2nd Quartile (>6 to 12 hrs)**								
8-hr		0	0	0	0	0	0	0	0
12-hr		3.00	3.60	0	4.53	5.45	6.64	7.72	8.82
Huff Distribution	**> 3rd Quartile (>12 to 24 hrs)**								
18-hr		0	0	0	0	0	0	0	0
24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Custom Storms	**> Custom Storm Distributions**								
My Custom Storm 1		0	0	0	0	0	0	0	0
My Custom Storm 2		0	0	0	0	0	0	0	0
My Custom Storm 3		0	0	0	0	0	0	0	0
My Custom Storm 4		0	0	0	0	0	0	0	0
My Custom Storm 5		0	0	0	0	0	0	0	0
My Custom Storm 6		0	0	0	0	0	0	0	0
My Custom Storm 7		0	0	0	0	0	0	0	0
My Custom Storm 8		0	0	0	0	0	0	0	0
My Custom Storm 9		0	0	0	0	0	0	0	0
My Custom Storm 10		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Precipitation filename: SamplePrecip.pcp

Rainfall totals in Inches

06-23-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔			✔	✔	✔	✔
Huff Indiana	**> Indianapolis**								
30-min		1.39	1.65	0	1.96	2.26	2.60	2.89	3.18
1-hr		1.73	2.07	0	2.52	2.94	3.46	3.92	4.37
2-hr		2.04	2.46	0	3.06	3.63	4.33	4.93	5.51
3-hr		2.18	2.62	0	3.27	3.91	4.72	5.43	6.14
6-hr		2.58	3.10	0	3.87	4.63	5.61	6.48	7.36
12-hr		3.00	3.60	0	4.53	5.45	6.64	7.72	8.82
24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Huff Indiana	**> Evansville**								
30-min		1.39	1.65	0	1.96	2.26	2.60	2.89	3.18
1-hr		1.73	2.07	0	2.52	2.94	3.46	3.92	4.37
2-hr		2.04	2.46	0	3.06	3.63	4.33	4.93	5.51
3-hr		2.18	2.62	0	3.27	3.91	4.72	5.43	6.14
6-hr		2.58	3.10	0	3.87	4.63	5.61	6.48	7.36
12-hr		3.00	3.60	0	4.53	5.45	6.64	7.72	8.82
24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Huff Indiana	**> Fort Wayne**								
30-min		1.39	1.65	0	1.96	2.26	2.60	2.89	3.18
1-hr		1.73	2.07	0	2.52	2.94	3.46	3.92	4.37
2-hr		2.04	2.46	0	3.06	3.63	4.33	4.93	5.51
3-hr		2.18	2.62	0	3.27	3.91	4.72	5.43	6.14
6-hr		2.58	3.10	0	3.87	4.63	5.61	6.48	7.36
12-hr		3.00	3.60	0	4.53	5.45	6.64	7.72	8.82
24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
Huff Indiana	**> South Bend**								
30-min		1.39	1.65	0	1.96	2.26	2.60	2.89	3.18
1-hr		1.73	2.07	0	2.52	2.94	3.46	3.92	4.37
2-hr		2.04	2.46	0	3.06	3.63	4.33	4.93	5.51
3-hr		2.18	2.62	0	3.27	3.91	4.72	5.43	6.14
6-hr		2.58	3.10	0	3.87	4.63	5.61	6.48	7.36
12-hr		3.00	3.60	0	4.53	5.45	6.64	7.72	8.82
24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20

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Precipitation Report Cont'd

Precipitation filename: SamplePrecip.pcp

Rainfall totals in Inches

06-23-2023

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔			✔	✔	✔	✔
NRCS Storms	**> NRCS Dimensionless Storms**								
NRCS MSE1, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCS MSE2, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCS MSE3, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCS MSE4, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCS MSE5, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCS MSE6, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NOAA-A, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NOAA-B, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NOAA-C, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NOAA-D, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCC-A, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCC-B, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCC-C, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
NRCC-D, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
CA-1, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
CA-2, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
CA-3, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
CA-4, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
CA-5, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
CA-6, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
FDOT Storms	**> Florida DOT Storms**								
FDOT, 1-hr		1.73	2.07	0	2.52	2.94	3.46	3.92	4.37
FDOT, 2-hr		2.04	2.46	0	3.06	3.63	4.33	4.93	5.51
FDOT, 4-hr		0	0	0	0	0	0	0	0
FDOT, 8-hr		0	0	0	0	0	0	0	0
FDOT, 24-hr		3.47	4.22	0	5.46	6.46	7.87	9.02	10.20
FDOT, 72-hr		0	0	0	0	0	0	0	0
SFWMD, 72-hr		0	0	0	0	0	0	0	0
Austin Storms	**> Austin Frequency Storms**								
Austin Zone 1, 24-hr		0	0	0	0	0	0	0	0
Austin Zone 2, 24-hr		0	0	0	0	0	0	0	0

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3.2 RATIONAL METHOD

The Rational Method was used to calculate the pre-development discharge reaching existing Culvert 4, a 24" RCP located at I-526 Sta. 1355+60, and Culvert 5, a 24" RCP located at I-526 Sta. 1378+35. See Fig. 3.1 for the Rational Method calculations of these existing culverts.

Figure 3-1: Rational Method Calculations for Existing Pipes

CDM Smith

CDM Smith
1441 Main Street, Suite 1000
Columbia, SC 29201

JOB: I-526 at Long Point Road
SUBJECT: Runoff Discharge Calculations
CALC'D BY: CJP DATE: 05-Jun-23
CHEK'D BY: DATE:

Rational Method

Culvert ID	Culvert Sta	Area Post	Tc (min)	C_{value}	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)
4	1355+60	3.42	18.6	0.52	7.4	8.6	9.8	12.2	14.7	16.6
5	1378+35	4.07	30.0	0.52	6.7	7.9	9.1	11.5	13.9	15.9

Charleston, SC i=a/(b+tc)^c Q=C*I*A*Cf
Rainfall Intensity

freq		a	b	c	i(tc=5)	i(tc=10)	factor Cf
2		72.69000	11.39000	0.83900	6.96	5.56	1
5		61.16000	9.84600	0.75730	7.93	6.36	1
10		55.13000	8.41200	0.69720	9.02	7.23	1
25		45.53000	6.25700	0.61790	10.20	8.13	1.1
50		42.68000	5.28000	0.57410	11.20	8.92	1.2
100		39.53000	4.29700	0.53090	12.10	9.63	1.25

Figure 3-2: Time of Concentration for Existing Rational Method Calculations

CDM Smith

CDM Smith
1441 Main Street, Suite 1000
Columbia, SC 29201

JOB: I-526 at Long Point Road
SUBJECT: Time of Concentration Calculations
CALC'D BY: CJP DATE:
CHEK'D BY: DATE:

TIME OF CONCENTRATION

WS	Sheet						Shallow Concentrated						Open Channel										Time Of Conc.	Time Of Conc.
ID	Slope	Length	Surface	n	P2	Time	Slope	Length	Land Cover	k	V	Time	Elevation		Length	Slope	n	SS Lt	SS Rt	BW	Depth	V	Time	Tc (min)	Tc (min)
	ft/ft	ft				hr	ft/ft	ft			ft/s	hr	To	From	ft	ft/ft		z:1	z:1	ft.	ft.	ft/s	hr		>= 5 min
	0.010	50	Bermuda grass	0.41	4.2	0.24	0.000	0	Grass	0.46	0.00	0.00	5.0	8.0	585	0.005	0.04	4.0	2.0	2.0	1.5	2.38	0.07	18.6	18.6
	0.010	100	Bermuda grass	0.41	4.2	0.42	0.001	60	Paved	0.62	0.65	0.03	5.0	8.3	470	0.007	0.04	4.0	2.0	0.0	1.5	2.46	0.05	30.0	30.0

Slope in ft/ft.
Length in feet.
n is TR55 method for Sheet and Shallow concentrated flow, Mannings method for open channel flow.
(P)aved refers to paved or unpaved velocity.
V is velocity in ft/s.
Tt is TR55 travel time in hours.
Tc is TR55 time of concentration in minutes.

The Rational Method was then used to calculate the post-development discharge of Culvert 4 and Culvert 5, as additional impervious area is expected to raise the C-value at these culverts from 0.52 to 0.54. The discharge at proposed Culvert 6, a (3) 18" RCP to be located at I-526 Line 3 Sta. 1422+00, was also calculated. See Fig. 3.3 for the Rational Method calculations of these proposed culverts.

Figure 3-3: Rational Method Calculations for Proposed Pipes

CDM Smith
1441 Main Street, Suite 1000
Columbia, SC 29201

JOB: I-526 at Long Point Road
SUBJECT: Runoff Discharge Calculations
CALC'D BY: CJP DATE: 05-Jun-23
CHEK'D BY: DATE:

Rational Method

Culvert ID	Culvert Sta	Area Post	Tc (min)	C_{value}	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)
4	1355+60	3.42	18.6	0.54	7.8	9.0	10.3	12.8	15.4	17.4
5	1378+40	4.07	30.0	0.64	8.4	9.8	11.3	14.2	17.3	19.8
6	1422+00	10.96	71.1	0.41	8.1	10.0	11.8	15.5	19.3	22.6

Charleston, SC i=a/(b+tc)^c Q=C*I*A*Cf
Rainfall Intensity

freq		a	b	c	i(tc=5)	i(tc=10)	factor Cf
2		72.69000	11.39000	0.83900	6.96	5.56	1
5		61.16000	9.84600	0.75730	7.93	6.36	1
10		55.13000	8.41200	0.69720	9.02	7.23	1
25		45.53000	6.25700	0.61790	10.20	8.13	1.1
50		42.68000	5.28000	0.57410	11.20	8.92	1.2
100		39.53000	4.29700	0.53090	12.10	9.63	1.25

Figure 3-4: Time of Concentration for Proposed Rational Method Calculations

CDM Smith
CDM Smith
1441 Main Street, Suite 1000
Columbia, SC 29201

JOB: I-526 at Long Point Road
SUBJECT: Time of Concentration Calculations
CALC'D BY: CJP DATE:
CHEK'D BY: DATE:

TIME OF CONCENTRATION

WS	Sheet						Shallow Concentrated						Open Channel											Time Of Conc.	Time Of Conc.
ID	Slope	Length	Surface	n	P2	Time	Slope	Length	Land Cover	k	V	Time	Elevation		Length	Slope	n	SS Lt	SS Rt	BW	Depth	V	Time	Tc (min)	Tc (min)
	ft/ft	ft				hr	ft/ft	ft			ft/s	hr	To	From	ft	ft/ft		z:1	z:1	ft.	ft.	ft/s	hr		>= 5 min
	0.010	50	Bermuda grass	0.41	4.2	0.24	0.000	0	Grass	0.46	0.00	0.00	5.0	8.0	585	0.005	0.04	4.0	2.0	2.0	1.5	2.38	0.07	18.6	18.6
	0.010	100	Bermuda grass	0.41	4.2	0.42	0.001	60	Paved	0.62	0.65	0.03	5.0	8.3	470	0.007	0.04	4.0	2.0	0.0	1.5	2.46	0.05	30.0	30.0
	0.001	100	Bermuda grass	0.41	4.2	1.06	0.012	350	Grass	0.46	1.62	0.06	13.9	14.8	400	0.002	0.04	4.0	2.0	2.0	1.5	1.62	0.07	71.1	71.1

Slope in ft/ft.
Length in feet.
n is TR55 method for Sheet and Shallow concentrated flow, Mannings method for open channel flow.
(P)aved refers to paved or unpaved velocity.
V is velocity in ft/s.
Tt is TR55 travel time in hours.
Tc is TR55 time of concentration in minutes.

4.0 WATER QUALITY INFORMATION

dhec Healthy People Healthy Communities

Watershed and Water Quality Information

General Information

Applicant Name: SCDOT I-526 Long Point Road
Address: 509 LONG POINT RD, MOUNT PLEASANT, SC, 29464
MS4 Designation: Small MS4
Within Coastal Critical Area: Yes
Waterbody Name: Unnamed Trib
Permit Type: Construction
Latitude/Longitude: 32.837853 / -79.870000
Monitoring Station: 09B-18
Water Classification (Provisional): SFH
Entered Waterbody Name:

Parameter Description

NH3N	Ammonia	CD	Cadmium	CR	Chromium
CU	Copper	HG	Mercury	NI	Nickel
PB	Lead	ZN	Zinc	DO	Dissolved Oxygen
PH	pH	TURBIDITY	Turbidity	ECOLI	Escherichia coli (Freshwaters)
FC	Fecal Coliform (Shellfish)	BIO	Macroinvertebrates (Bio)	TP	(Lakes) Phosphorus
TN	(Lakes) Nitrogen	CHLA	(Lakes) Chlorophyll a	ENTERO	Enterococcus (Coastal Waters)
HGF	Mercury (Fish Tissue)	PCB	PCB (Fish)		

Impaired Status (downstream sites)

Station	NH3N	CD	CR	CU	HG	NI	PB	ZN	DO	PH	TURBIDITY	ECOLI	FC	BIO	TP	TN	CHLA	ENTERO	HGF	PCB
09B-18	X	X	X	X	X	X	X	X	X	X	X	X	InTN	X	X	X	X	X	X	X

F = Standards full supported
N = Standards not supported
A = Assessed at upstream station
X = Parameter not assessed at station
WnTN = Within TMDL, parameter not supported
InTN = In TMDL, parameter not supported
WnTF = Within TMDL, parameter full supported
InTF = In TMDL, parameter full supported

Parameters to be addressed (those not supporting standards)

FC - Fecal Coliform (Shellfish)

Fish Consumption Advisory

Waters of Concern (WOC)

TMDL Information - TMDL Parameters to be addressed

In TMDL Watershed: Yes
TMDL Report No: 0506-13
TMDL Document Link: https://www.scdhec.gov/sites/default/files/docs/HomeAndEnvironment/Docs/Chas_Hbr_DO_TMDL.pdf
TMDL Site: 09B-18
TMDL Parameter: DO

Report Date: June 20, 2023

5.0 Culvert Data

5.1 Analysis of Existing Culverts

Multiple HY-8 models were created for a pre-/post-development analysis of performance for the four existing culverts located within the project site (Culverts 1, 2, 4, and 5). See **Sections 5.1.1-5.1.4** for the HY-8 reports produced for the following culverts respectively.

- Culvert 1: 10'x5' RCBC at L-2523 Sta. 15+75
- Culvert 2: 9'x5' RCBC at I-526 Sta. 1399+75
- Culvert 4: 24" RCP at I-526 Sta. 1355+60
- Culvert 5: 24" RCP at I-526 Sta. 1378+35

Based on the post-development performance of these four existing culverts, replacement culverts that could carry flow while maintaining a design highwater to depth ratio (HW/D) < 1.2 were modeled. A series of HY-8 models were also developed for two additional proposed culverts within the project site (Culverts 3 and 6).

A model results summary of the post-development culverts with their recommended replacements is displayed in **Appendix C**. Note that because Culverts 1 and 3 cross beneath a local road and not an interstate, their design and check storms are the 25-year and 50-year storms respectively.

5.1.1 CULVERT 1 – L-2523 STA. 15+75 – 10'X5' RCBC

HY-8 Culvert Analysis Report
L-2523 Sta. 15+75
Existing 10'x5' Box Culvert

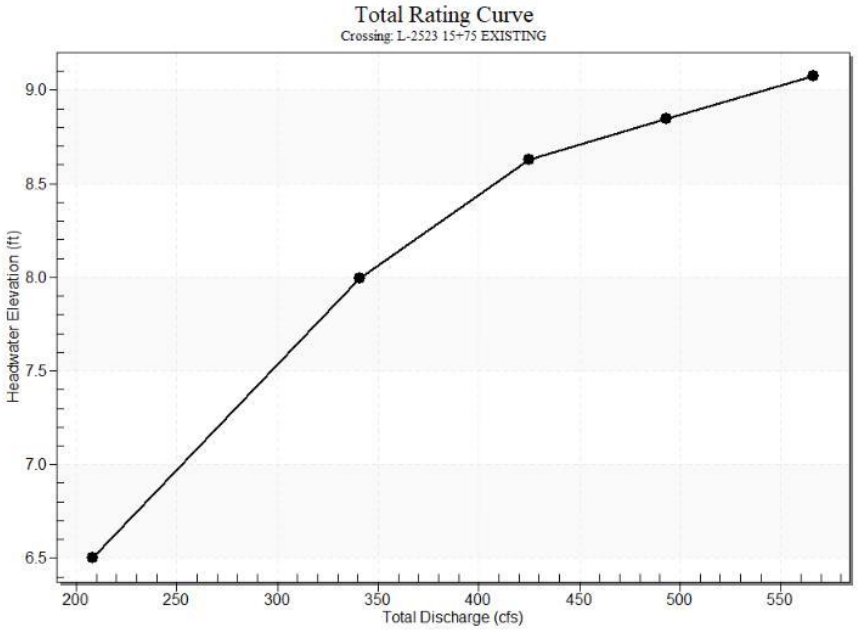
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: L-2523 15+75 EXISTING

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 EXISTING Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6.50	2 year	208.00	208.00	0.00	1
7.99	10 year	341.00	341.00	0.00	1
8.63	25 year	425.00	387.15	37.17	10
8.84	50 year	493.00	300.46	191.96	6
9.07	100 year	566.00	94.54	474.32	6
8.49	Overtopping	386.74	386.74	0.00	Overtopping

Rating Curve Plot for Crossing: L-2523 15+75 EXISTING



Culvert Data: Culvert 1 EXISTING

Table 2 - Culvert Summary Table: Culvert 1 EXISTING

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2 year	208.00 cfs	208.00 cfs	6.50	3.71	3.843	7-H2c	-1.00	2.38	2.38	2.24	8.75	0.00
10 year	341.00 cfs	341.00 cfs	7.99	5.14	5.333	7-H2t	-1.00	3.31	3.54	3.54	9.63	0.00
25 year	425.00 cfs	387.15 cfs	8.63	5.61	5.966	7-H2t	-1.00	3.60	4.54	4.54	8.53	0.00
50 year	493.00 cfs	300.46 cfs	8.84	4.73	6.184	4-FFf	-1.00	3.04	5.00	5.44	6.01	0.00
100 year	566.00 cfs	94.54 cfs	9.07	2.20	6.414	4-FFf	-1.00	1.41	5.00	6.34	1.89	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

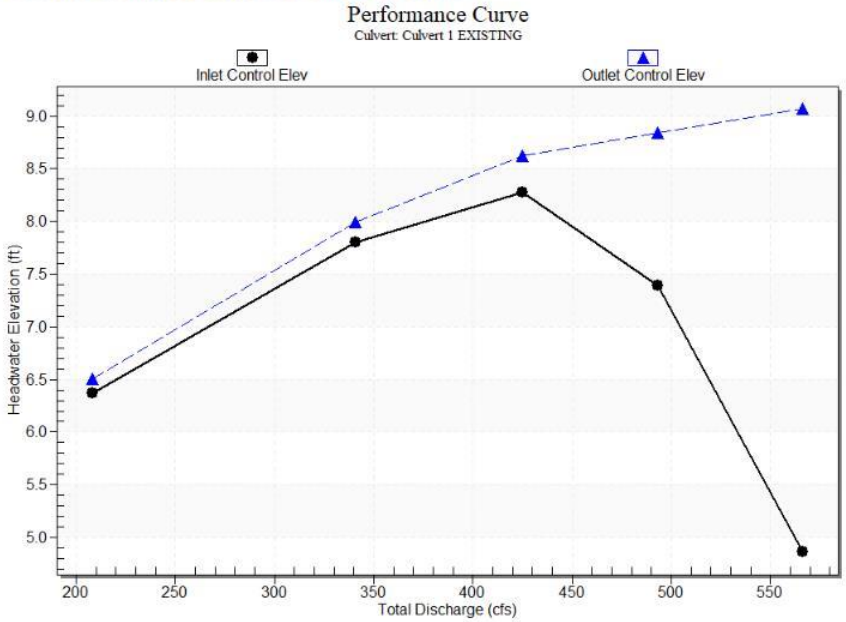
Inlet Elevation (invert): 2.66 ft,

Outlet Elevation (invert): 2.66 ft

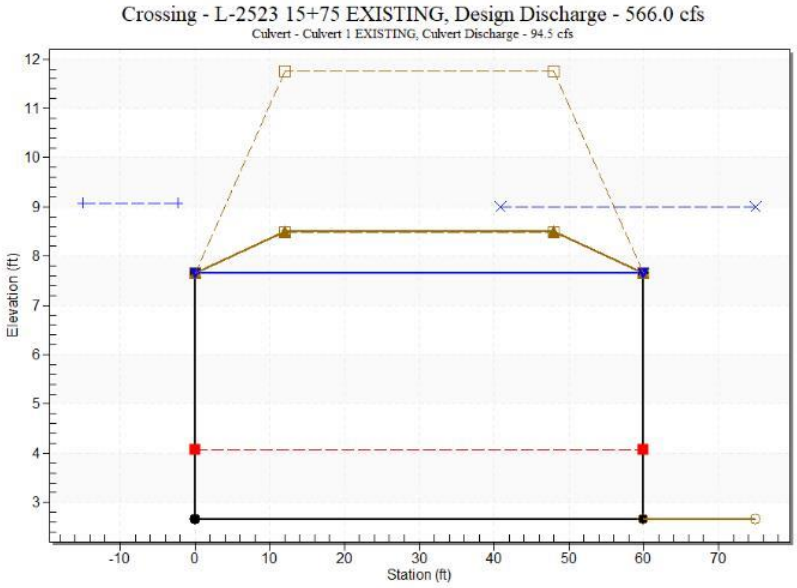
Culvert Length: 60.00 ft,

Culvert Slope: 0.0000

Culvert Performance Curve Plot: Culvert 1 EXISTING



Water Surface Profile Plot for Culvert: Culvert 1 EXISTING



Site Data - Culvert 1 EXISTING

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2.66 ft

Outlet Station: 60.00 ft

Outlet Elevation: 2.66 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1 EXISTING

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1.5:1 Bevel (18-34º flare) Wingwall

Inlet Depression: None

Tailwater Data for Crossing: L-2523 15+75 EXISTING

Table 3 - Downstream Channel Rating Curve (Crossing: L-2523 15+75 EXISTING)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
208.00	4.90	4.90	0.00
341.00	6.20	6.20	0.00
425.00	7.20	7.20	0.00
493.00	8.10	8.10	0.00
566.00	9.00	9.00	0.00

Tailwater Channel Data - L-2523 15+75 EXISTING

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: L-2523 15+75 EXISTING

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	1125.00	8.50
1	1365.00	8.49
2	1650.00	8.99
3	1900.00	10.67
4	2100.00	11.75

Roadway Surface: Paved

Roadway Top Width: 36.00 ft

HY-8 Culvert Analysis Report
L-2523 Sta. 15+75
Post-Development 10'x5' Box Culvert

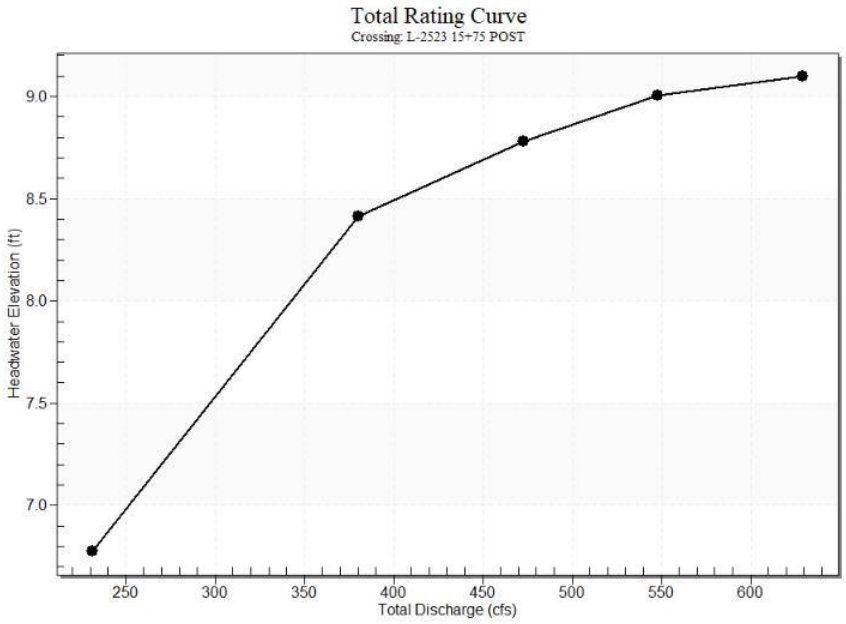
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: L-2523 15+75 POST

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 POST Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6.78	2 year	231.00	231.00	0.00	1
8.42	10 year	380.00	380.00	0.00	1
8.78	25 year	473.00	338.22	133.60	7
9.00	50 year	548.00	165.88	380.79	4
9.10	100 year	629.00	108.82	521.00	4
8.49	Overtopping	386.81	386.81	0.00	Overtopping

Rating Curve Plot for Crossing: L-2523 15+75 POST



Culvert Data: Culvert 1 POST

Table 2 - Culvert Summary Table: Culvert 1 POST

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2 year	231.00 cfs	231.00 cfs	6.78	3.98	4.118	7-H2c	-1.00	2.55	2.55	2.13	9.06	0.00
10 year	380.00 cfs	380.00 cfs	8.42	5.54	5.756	7-H2t	-1.00	3.55	4.00	4.00	9.49	0.00
25 year	473.00 cfs	338.22 cfs	8.78	5.12	6.118	4-FFf	-1.00	3.29	5.00	5.18	6.76	0.00
50 year	548.00 cfs	165.88 cfs	9.00	3.20	6.345	4-FFf	-1.00	2.04	5.00	6.12	3.32	0.00
100 year	629.00 cfs	108.82 cfs	9.10	2.42	6.438	4-FFf	-1.00	1.54	5.00	6.34	2.18	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

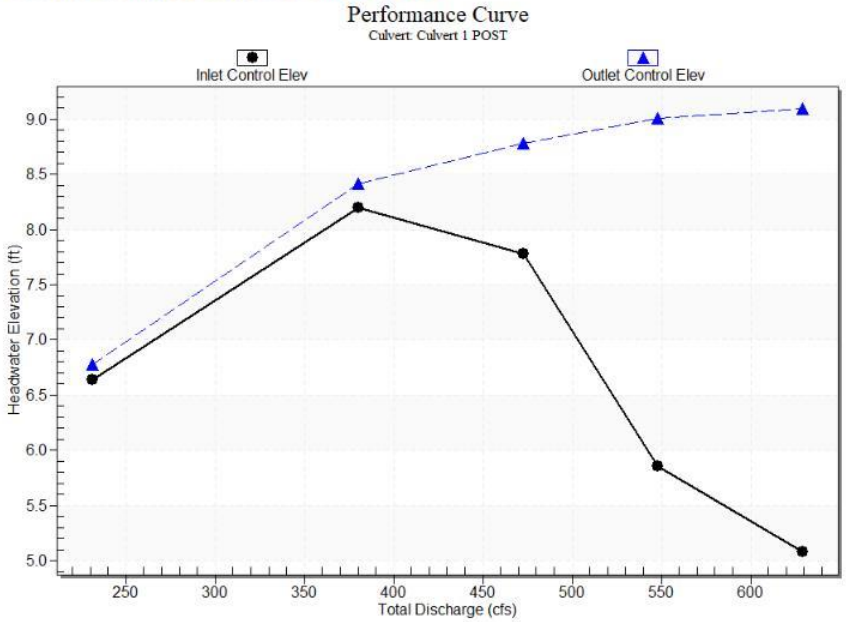
Inlet Elevation (invert): 2.66 ft,

Outlet Elevation (invert): 2.66 ft

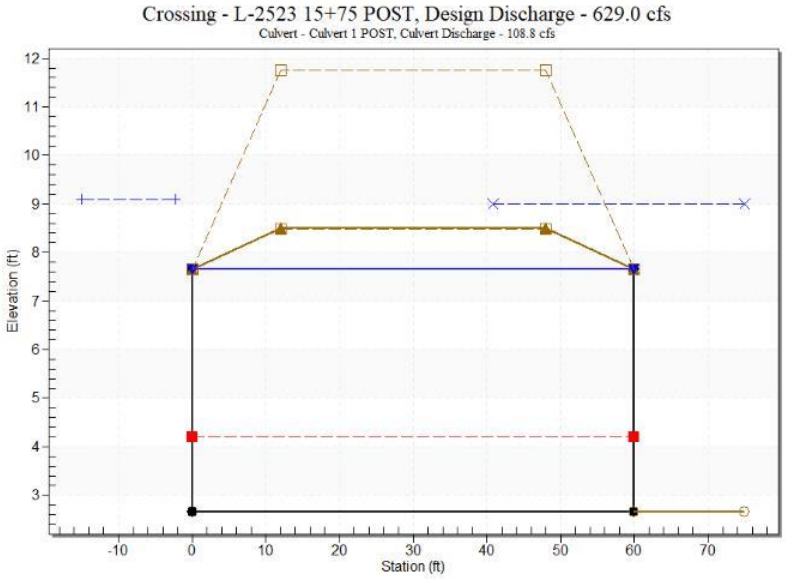
Culvert Length: 60.00 ft,

Culvert Slope: 0.0000

Culvert Performance Curve Plot: Culvert 1 POST



Water Surface Profile Plot for Culvert: Culvert 1 POST



Site Data - Culvert 1 POST

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2.66 ft

Outlet Station: 60.00 ft

Outlet Elevation: 2.66 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1 POST

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1.5:1 Bevel (18-34º flare) Wingwall

Inlet Depression: None

Tailwater Data for Crossing: L-2523 15+75 POST

Table 3 - Downstream Channel Rating Curve (Crossing: L-2523 15+75 POST)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
208.00	4.50	4.50	0.00
341.00	6.20	6.20	0.00
425.00	7.20	7.20	0.00
493.00	8.10	8.10	0.00
566.00	9.00	9.00	0.00

Tailwater Channel Data - L-2523 15+75 POST

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: L-2523 15+75 POST

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	1125.00	8.50
1	1365.00	8.49
2	1650.00	8.99
3	1900.00	10.67
4	2100.00	11.75

Roadway Surface: Paved

Roadway Top Width: 36.00 ft

5.1.2 CULVERT 2 – I-526 STA. 1399+75 – 9'X5' RCBC

HY-8 Culvert Analysis Report
I-526 Sta. 1399+75
Existing 9'x5' Box Culvert

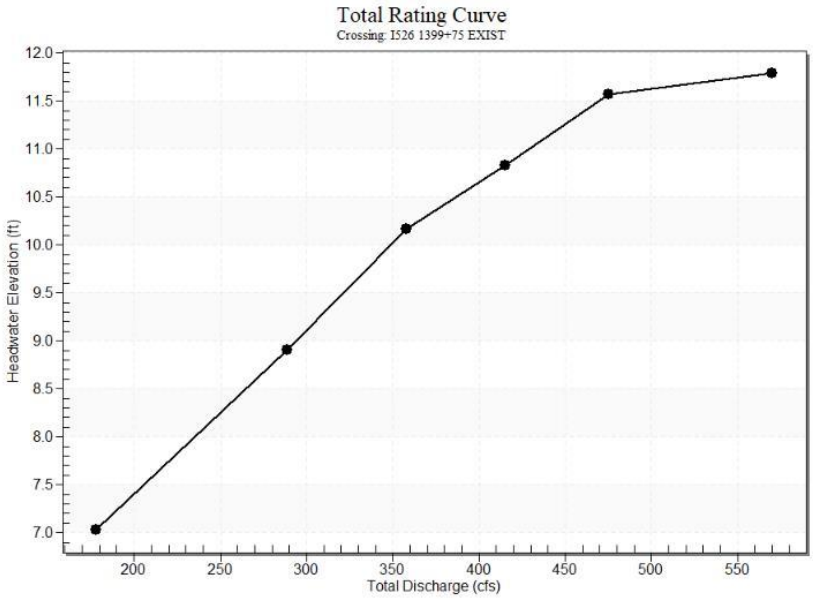
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: I526 1399+75 EXIST

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 2 EXISTING Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7.03	2 year	178.00	178.00	0.00	1
8.91	10 year	289.00	289.00	0.00	1
10.16	25 year	358.00	358.00	0.00	1
10.82	50 year	415.00	415.00	0.00	1
11.57	100 year	475.00	475.00	0.00	1
11.70	Overtopping	485.76	485.76	0.00	Overtopping

Rating Curve Plot for Crossing: I526 1399+75 EXIST



Culvert Data: Culvert 2 EXISTING

Table 2 - Culvert Summary Table: Culvert 2 EXISTING

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2 year	178.00 cfs	178.00 cfs	7.03	3.58	3.943	1-S1t	2.14	2.30	3.90	3.90	5.07	0.00
10 year	289.00 cfs	289.00 cfs	8.91	4.93	5.820	4-FFf	3.01	3.18	5.00	5.41	6.42	0.00
25 year	358.00 cfs	358.00 cfs	10.16	5.71	7.070	4-FFf	3.51	3.66	5.00	6.11	7.96	0.00
50 year	415.00 cfs	415.00 cfs	10.82	6.37	7.734	4-FFf	3.91	4.04	5.00	6.23	9.22	0.00
100 year	475.00 cfs	475.00 cfs	11.57	7.09	8.482	4-FFf	4.32	4.42	5.00	6.32	10.56	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

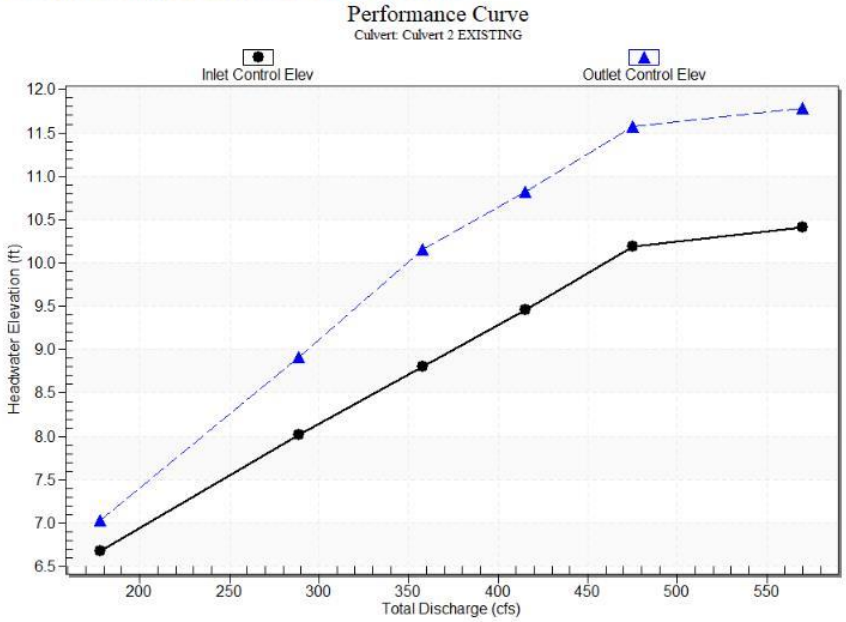
Inlet Elevation (invert): 3.09 ft,

Outlet Elevation (invert): 2.47 ft

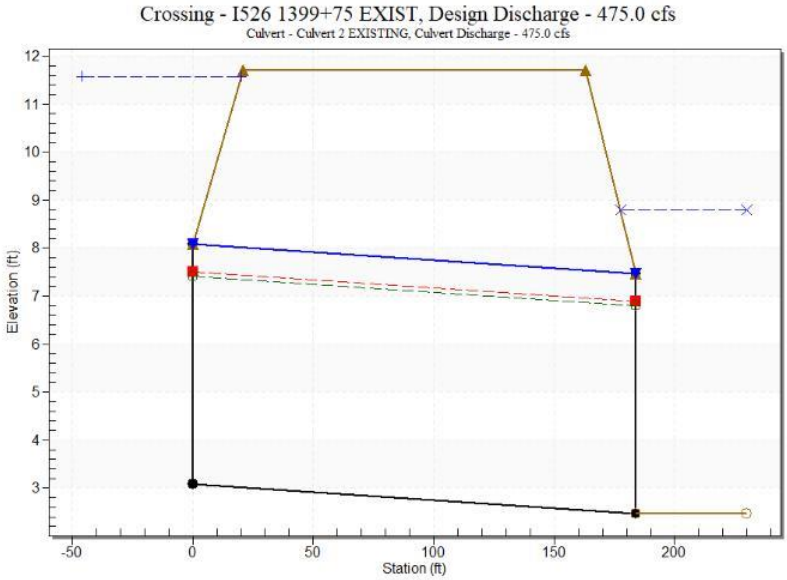
Culvert Length: 184.00 ft,

Culvert Slope: 0.0034

Culvert Performance Curve Plot: Culvert 2 EXISTING



Water Surface Profile Plot for Culvert: Culvert 2 EXISTING



Site Data - Culvert 2 EXISTING

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 3.09 ft

Outlet Station: 184.00 ft

Outlet Elevation: 2.47 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2 EXISTING

Barrel Shape: Concrete Box

Barrel Span: 9.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1.5:1 Bevel (18-34º flare) Wingwall

Inlet Depression: None

Tailwater Data for Crossing: I526 1399+75 EXIST

Table 3 - Downstream Channel Rating Curve (Crossing: I526 1399+75 EXIST)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
178.00	6.37	6.37	0.00
289.00	7.88	7.88	0.00
358.00	8.58	8.58	0.00
415.00	8.70	8.70	0.00
475.00	8.79	8.79	0.00

Tailwater Channel Data - I526 1399+75 EXIST

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: I526 1399+75 EXIST

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 11.70 ft

Roadway Surface: Paved

Roadway Top Width: 142.00 ft

HY-8 Culvert Analysis Report
I-526 Sta. 1399+75
Post-Development 9'x5' Box Culvert

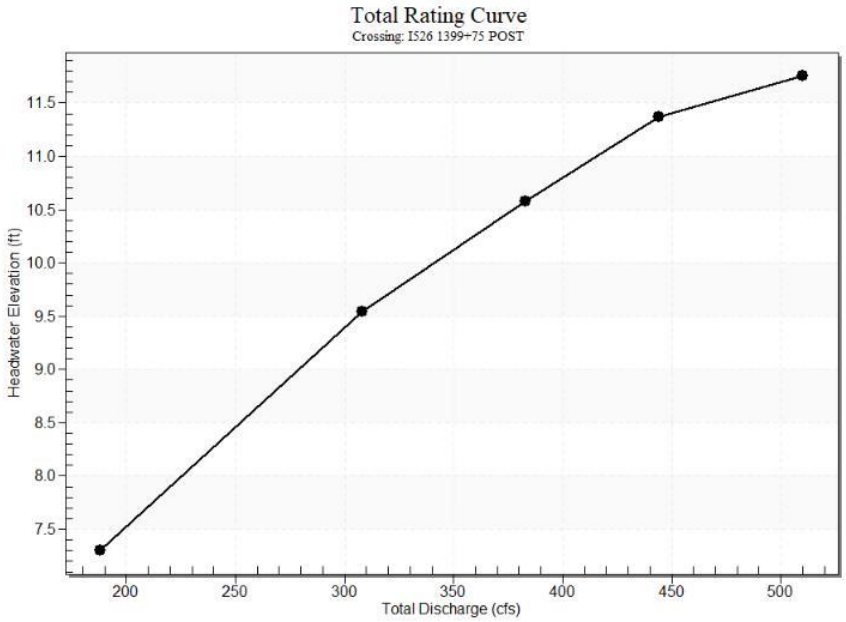
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: I526 1399+75 POST

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 2 POST Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7.30	2 year	188.00	188.00	0.00	1
9.54	10 year	308.00	308.00	0.00	1
10.58	25 year	383.00	383.00	0.00	1
11.37	50 year	444.00	444.00	0.00	1
11.75	100 year	510.00	472.40	36.16	13
11.70	Overtopping	470.44	470.44	0.00	Overtopping

Rating Curve Plot for Crossing: I526 1399+75 POST



Culvert Data: Culvert 2 POST

Table 2 - Culvert Summary Table: Culvert 2 POST

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2 year	188.00 cfs	188.00 cfs	7.30	3.72	4.215	1-S1t	2.38	2.38	4.18	4.18	5.00	0.00
10 year	308.00 cfs	308.00 cfs	9.54	5.15	6.454	4-FFf	3.38	3.31	5.00	5.84	6.84	0.00
25 year	383.00 cfs	383.00 cfs	10.58	6.00	7.489	4-FFf	3.97	3.83	5.00	6.20	8.51	0.00
50 year	444.00 cfs	444.00 cfs	11.37	6.72	8.275	4-FFf	4.43	4.23	5.00	6.33	9.87	0.00
100 year	510.00 cfs	472.40 cfs	11.75	7.06	8.664	4-FFf	4.64	4.41	5.00	6.38	10.50	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

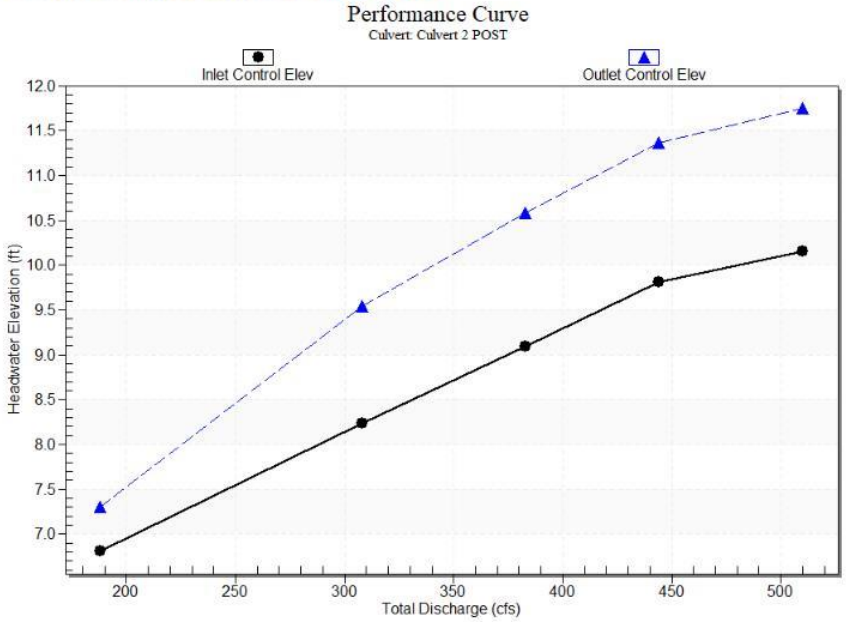
Inlet Elevation (invert): 3.09 ft,

Outlet Elevation (invert): 2.47 ft

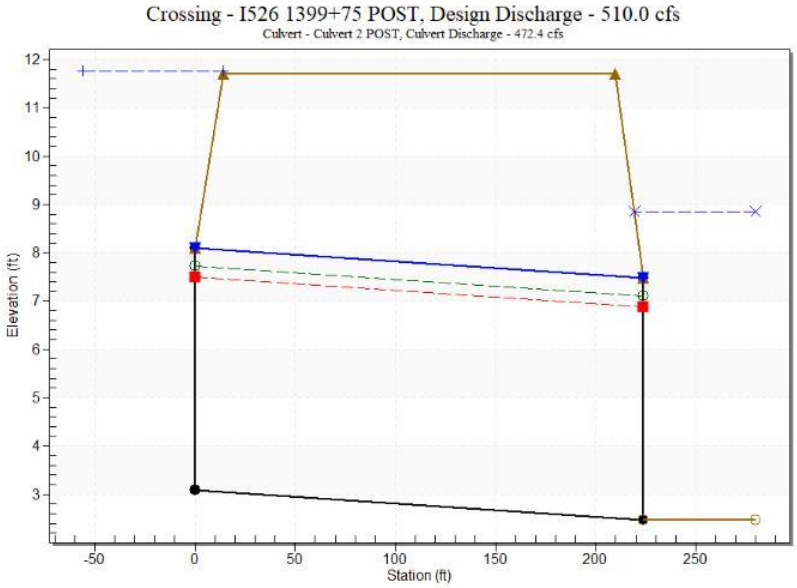
Culvert Length: 224.00 ft,

Culvert Slope: 0.0028

Culvert Performance Curve Plot: Culvert 2 POST



Water Surface Profile Plot for Culvert: Culvert 2 POST



Site Data - Culvert 2 POST

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 3.09 ft

Outlet Station: 224.00 ft

Outlet Elevation: 2.47 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2 POST

Barrel Shape: Concrete Box

Barrel Span: 9.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1.5:1 Bevel (18-34º flare) Wingwall

Inlet Depression: None

Tailwater Data for Crossing: I526 1399+75 POST

Table 3 - Downstream Channel Rating Curve (Crossing: I526 1399+75 POST)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
188.00	6.65	6.65	0.00
308.00	8.31	8.31	0.00
383.00	8.67	8.67	0.00
444.00	8.80	8.80	0.00
510.00	8.85	8.85	0.00

Tailwater Channel Data - I526 1399+75 POST

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: I526 1399+75 POST

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 11.70 ft

Roadway Surface: Paved

Roadway Top Width: 196.00 ft

5.1.3 CULVERT 4 – I-526 STA. 1355+60 – 24" RCP

HY-8 Culvert Analysis Report
I-526 Sta. 1355+60
Existing 24" RC Pipe

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 12.20 cfs

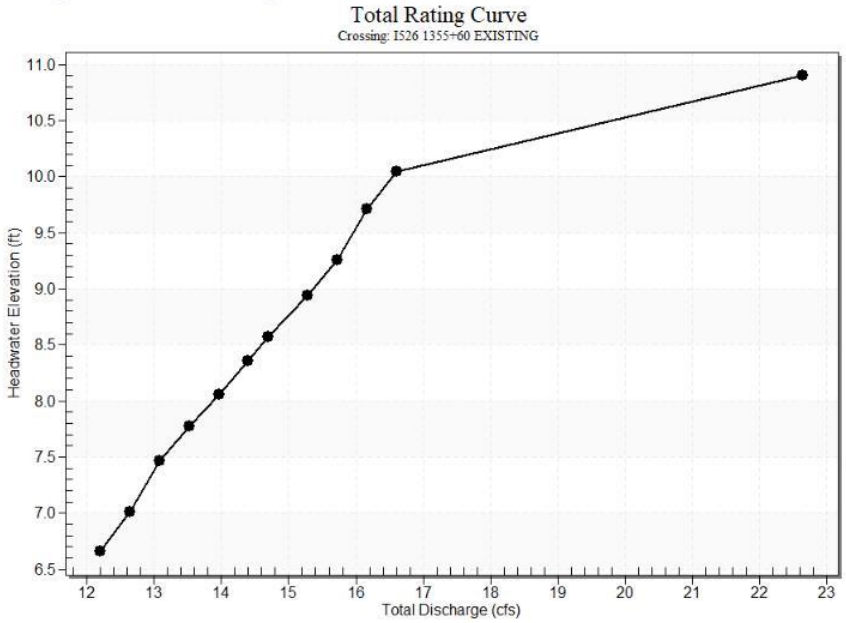
Design Flow: 14.70 cfs

Maximum Flow: 16.60 cfs

Table 1 - Summary of Culvert Flows at Crossing: I526 1355+60 EXISTING

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 4 EXISTING Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6.66	12.20	12.20	0.00	1
7.01	12.64	12.64	0.00	1
7.46	13.08	13.08	0.00	1
7.77	13.52	13.52	0.00	1
8.06	13.96	13.96	0.00	1
8.36	14.40	14.40	0.00	1
8.57	14.70	14.70	0.00	1
8.94	15.28	15.28	0.00	1
9.26	15.72	15.72	0.00	1
9.71	16.16	16.16	0.00	1
10.05	16.60	16.60	0.00	1
10.90	22.33	22.33	0.00	Overtopping

Rating Curve Plot for Crossing: I526 1355+60 EXISTING



Culvert Data: Culvert 4 EXISTING

Table 2 - Culvert Summary Table: Culvert 4 EXISTING

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
12.20 cfs	12.20 cfs	6.66	1.82	2.032	1-S1f	0.86	1.26	2.00	3.42	3.88	0.00
12.64 cfs	12.64 cfs	7.01	1.86	2.383	4-FFf	0.87	1.28	2.00	3.73	4.02	0.00
13.08 cfs	13.08 cfs	7.46	1.90	2.834	4-FFf	0.89	1.30	2.00	4.14	4.16	0.00
13.52 cfs	13.52 cfs	7.77	1.95	3.142	4-FFf	0.91	1.32	2.00	4.41	4.30	0.00
13.96 cfs	13.96 cfs	8.06	1.99	3.427	4-FFf	0.93	1.35	2.00	4.65	4.44	0.00
14.40 cfs	14.40 cfs	8.36	2.03	3.726	4-FFf	0.94	1.37	2.00	4.90	4.58	0.00
14.70 cfs	14.70 cfs	8.57	2.06	3.943	4-FFf	0.95	1.38	2.00	5.08	4.68	0.00
15.28 cfs	15.28 cfs	8.94	2.12	4.307	4-FFf	0.97	1.41	2.00	5.38	4.86	0.00
15.72 cfs	15.72 cfs	9.26	2.16	4.629	4-FFf	0.99	1.43	2.00	5.65	5.00	0.00
16.16 cfs	16.16 cfs	9.71	2.21	5.077	4-FFf	1.01	1.45	2.00	6.04	5.14	0.00
16.60 cfs	16.60 cfs	10.05	2.25	5.419	4-FFf	1.02	1.47	2.00	6.33	5.28	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

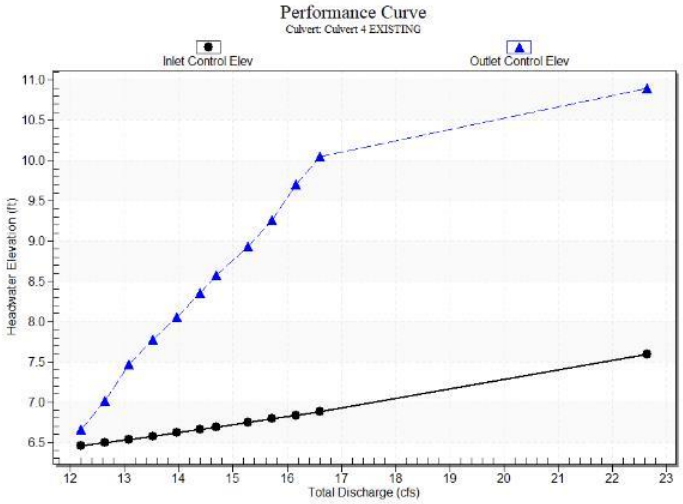
Inlet Elevation (invert): 4.63 ft,

Outlet Elevation (invert): 2.67 ft

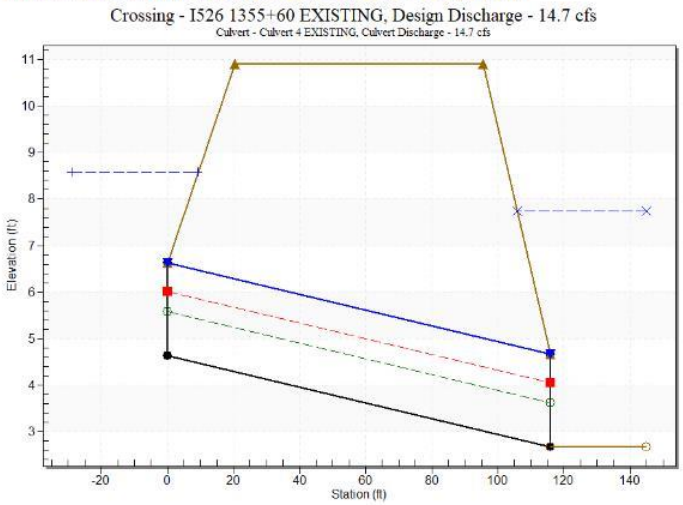
Culvert Length: 116.02 ft,

Culvert Slope: 0.0169

Culvert Performance Curve Plot: Culvert 4 EXISTING



Water Surface Profile Plot for Culvert: Culvert 4 EXISTING



Site Data - Culvert 4 EXISTING

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4.63 ft

Outlet Station: 116.00 ft

Outlet Elevation: 2.67 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 4 EXISTING

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Tailwater Data for Crossing: I526 1355+60 EXISTING

Table 3 - Downstream Channel Rating Curve (Crossing: I526 1355+60 EXISTING)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
12.00	6.00	6.00	0.00
12.46	6.20	6.20	0.00
12.90	6.70	6.70	0.00
13.38	7.00	7.00	0.00
13.84	7.25	7.25	0.00
14.30	7.50	7.50	0.00
14.60	7.70	7.70	0.00
15.20	8.00	8.00	0.00
15.70	8.30	8.30	0.00
16.14	8.70	8.70	0.00
16.60	9.00	9.00	0.00

Tailwater Channel Data - I526 1355+60 EXISTING

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: I526 1355+60 EXISTING

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 10.90 ft

Roadway Surface: Paved

Roadway Top Width: 75.00 ft

HY-8 Culvert Analysis Report
I-526 Sta. 1355+60
Post-Development 24” RC Pipe

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 12.80 cfs

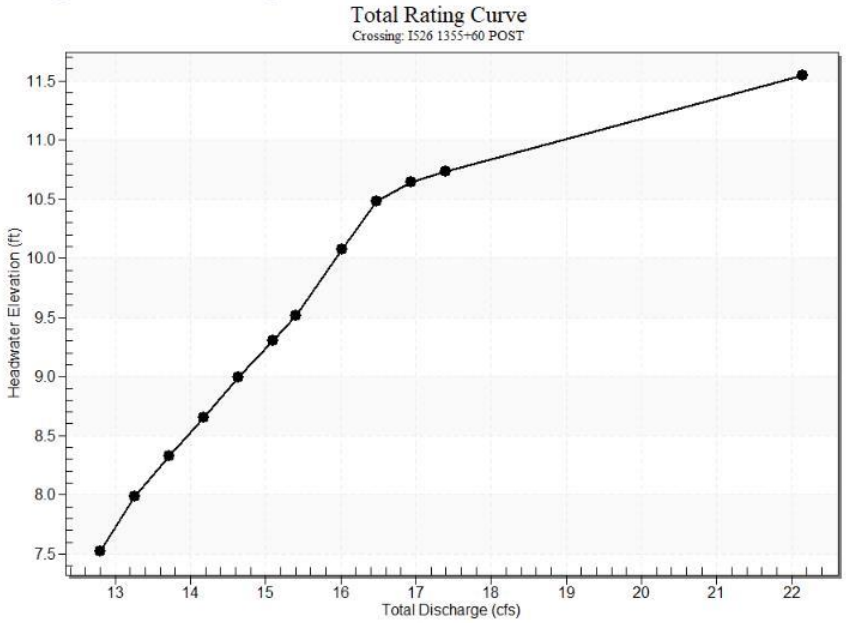
Design Flow: 15.40 cfs

Maximum Flow: 17.40 cfs

Table 1 - Summary of Culvert Flows at Crossing: I526 1355+60 POST

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 4 Post-Dev Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7.52	12.80	12.80	0.00	1
7.99	13.26	13.26	0.00	1
8.33	13.72	13.72	0.00	1
8.65	14.18	14.18	0.00	1
9.00	14.64	14.64	0.00	1
9.30	15.10	15.10	0.00	1
9.51	15.40	15.40	0.00	1
10.08	16.02	16.02	0.00	1
10.48	16.48	16.48	0.00	1
10.64	16.94	16.94	0.00	1
10.73	17.40	17.40	0.00	1
11.54	21.05	21.05	0.00	Overtopping

Rating Curve Plot for Crossing: I526 1355+60 POST



Culvert Data: Culvert 4 Post-Dev

Table 2 - Culvert Summary Table: Culvert 4 Post-Dev

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
12.80 cfs	12.80 cfs	7.52	1.89	2.895	4-FFf	1.06	1.29	2.00	3.92	4.07	0.00
13.26 cfs	13.26 cfs	7.99	1.93	3.359	4-FFf	1.08	1.31	2.00	4.31	4.22	0.00
13.72 cfs	13.72 cfs	8.33	1.97	3.701	4-FFf	1.11	1.33	2.00	4.58	4.37	0.00
14.18 cfs	14.18 cfs	8.65	2.02	4.023	4-FFf	1.13	1.36	2.00	4.83	4.51	0.00
14.64 cfs	14.64 cfs	9.00	2.06	4.368	4-FFf	1.15	1.38	2.00	5.10	4.66	0.00
15.10 cfs	15.10 cfs	9.30	2.11	4.675	4-FFf	1.18	1.40	2.00	5.33	4.81	0.00
15.40 cfs	15.40 cfs	9.51	2.14	4.885	4-FFf	1.19	1.41	2.00	5.49	4.90	0.00
16.02 cfs	16.02 cfs	10.08	2.20	5.446	4-FFf	1.22	1.44	2.00	5.94	5.10	0.00
16.48 cfs	16.48 cfs	10.48	2.25	5.851	4-FFf	1.25	1.46	2.00	6.26	5.25	0.00
16.94 cfs	16.94 cfs	10.64	2.30	6.014	4-FFf	1.27	1.48	2.00	6.33	5.39	0.00
17.40 cfs	17.40 cfs	10.73	2.35	6.104	4-FFf	1.29	1.50	2.00	6.33	5.54	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

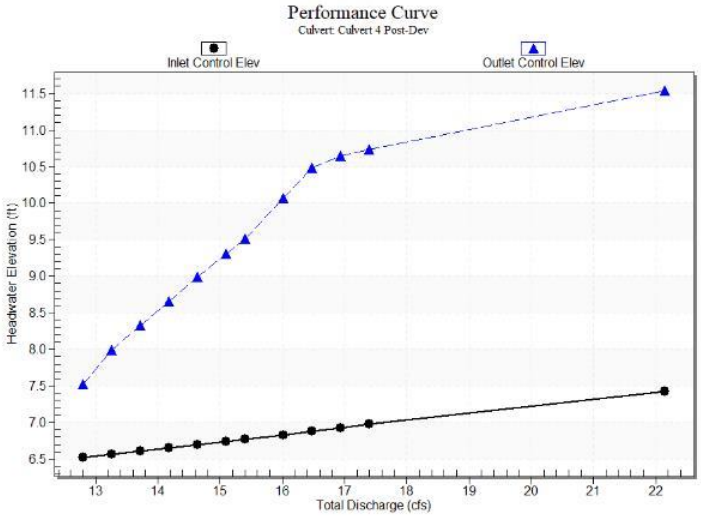
Inlet Elevation (invert): 4.63 ft,

Outlet Elevation (invert): 2.56 ft

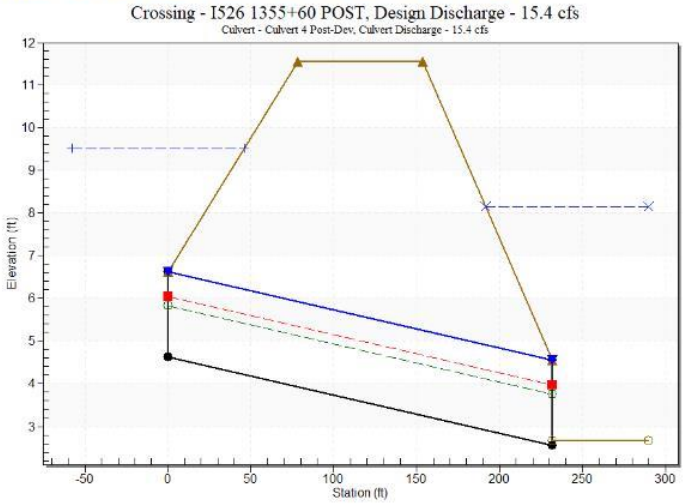
Culvert Length: 232.01 ft,

Culvert Slope: 0.0089

Culvert Performance Curve Plot: Culvert 4 Post-Dev



Water Surface Profile Plot for Culvert: Culvert 4 Post-Dev



Site Data - Culvert 4 Post-Dev

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4.63 ft

Outlet Station: 232.00 ft

Outlet Elevation: 2.56 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 4 Post-Dev

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Tailwater Data for Crossing: I526 1355+60 POST

Table 3 - Downstream Channel Rating Curve (Crossing: I526 1355+60 POST)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
12.00	6.00	6.00	0.00
12.46	6.20	6.20	0.00
12.90	6.70	6.70	0.00
13.38	7.08	7.08	0.00
13.84	7.32	7.32	0.00
14.30	7.57	7.57	0.00
14.60	7.75	7.75	0.00
15.20	8.05	8.05	0.00
15.70	8.32	8.32	0.00
16.14	8.71	8.71	0.00
16.60	9.00	9.00	0.00

Tailwater Channel Data - I526 1355+60 POST

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: I526 1355+60 POST

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 11.54 ft

Roadway Surface: Paved

Roadway Top Width: 75.00 ft

5.1.4 CULVERT 5 – I-526 STA. 1378+35 – 24" RCP

HY-8 Culvert Analysis Report
I-526 Sta. 1378+35
Existing 24" RC Pipe

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 11.50 cfs

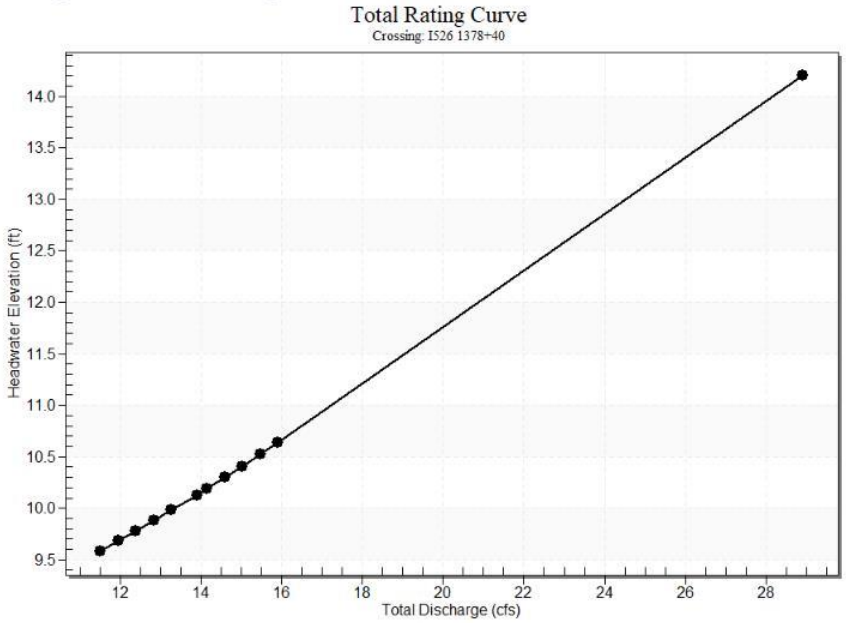
Design Flow: 13.90 cfs

Maximum Flow: 15.90 cfs

Table 1 - Summary of Culvert Flows at Crossing: I526 1378+40

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 5 EXISTING Discharge (cfs)	Roadway Discharge (cfs)	Iterations
9.58	11.50	11.50	0.00	1
9.68	11.94	11.94	0.00	1
9.78	12.38	12.38	0.00	1
9.88	12.82	12.82	0.00	1
9.98	13.26	13.26	0.00	1
10.13	13.90	13.90	0.00	1
10.19	14.14	14.14	0.00	1
10.30	14.58	14.58	0.00	1
10.41	15.02	15.02	0.00	1
10.52	15.46	15.46	0.00	1
10.63	15.90	15.90	0.00	1
14.20	28.38	28.38	0.00	Overtopping

Rating Curve Plot for Crossing: I526 1378+40



Culvert Data: Culvert 5 EXISTING

Table 2 - Culvert Summary Table: Culvert 5 EXISTING

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
11.50 cfs	11.50 cfs	9.58	1.78	3.354	4-FFf	-1.00	1.22	2.00	2.49	3.66	0.00
11.94 cfs	11.94 cfs	9.68	1.82	3.451	4-FFf	-1.00	1.24	2.00	2.52	3.80	0.00
12.38 cfs	12.38 cfs	9.78	1.86	3.550	4-FFf	-1.00	1.26	2.00	2.55	3.94	0.00
12.82 cfs	12.82 cfs	9.88	1.90	3.651	4-FFf	-1.00	1.29	2.00	2.58	4.08	0.00
13.26 cfs	13.26 cfs	9.98	1.94	3.753	4-FFf	-1.00	1.31	2.00	2.61	4.22	0.00
13.90 cfs	13.90 cfs	10.13	2.00	3.898	4-FFf	-1.00	1.34	2.00	2.64	4.42	0.00
14.14 cfs	14.14 cfs	10.19	2.02	3.958	4-FFf	-1.00	1.35	2.00	2.66	4.50	0.00
14.58 cfs	14.58 cfs	10.30	2.06	4.071	4-FFf	-1.00	1.38	2.00	2.69	4.64	0.00
15.02 cfs	15.02 cfs	10.41	2.11	4.178	4-FFf	-1.00	1.40	2.00	2.71	4.78	0.00
15.46 cfs	15.46 cfs	10.52	2.15	4.293	4-FFf	-1.00	1.42	2.00	2.74	4.92	0.00
15.90 cfs	15.90 cfs	10.63	2.20	4.402	4-FFf	-1.00	1.44	2.00	2.76	5.06	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

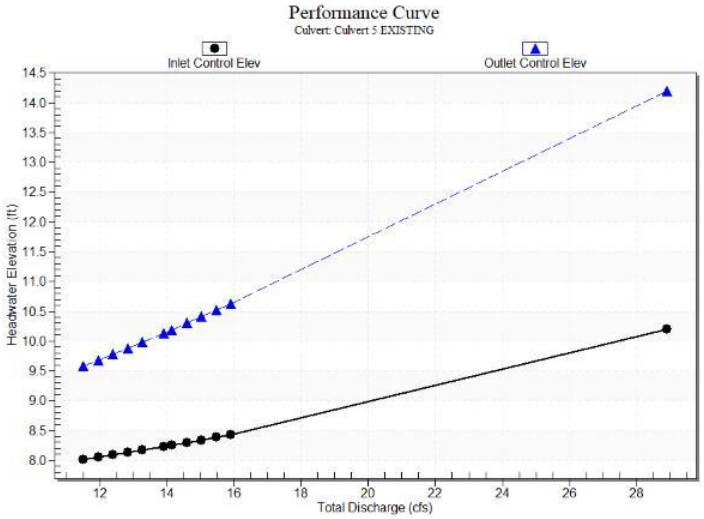
Inlet Elevation (invert): 6.23 ft,

Outlet Elevation (invert): 6.24 ft

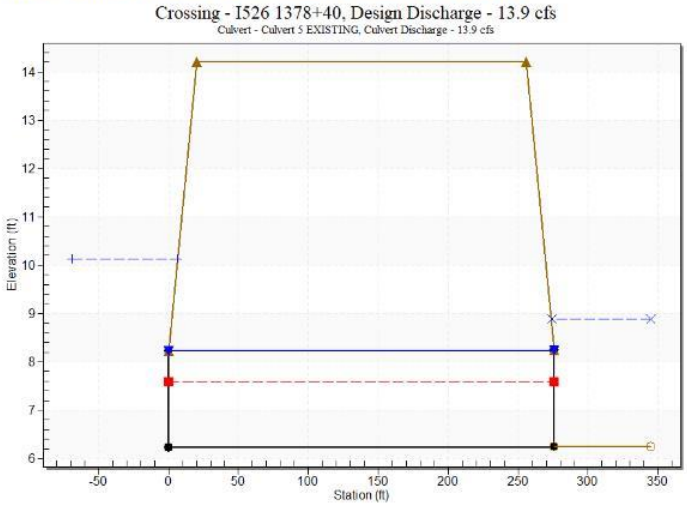
Culvert Length: 276.00 ft,

Culvert Slope: -0.0000

Culvert Performance Curve Plot: Culvert 5 EXISTING



Water Surface Profile Plot for Culvert: Culvert 5 EXISTING



Site Data - Culvert 5 EXISTING

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6.23 ft

Outlet Station: 276.00 ft

Outlet Elevation: 6.24 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 5 EXISTING

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Tailwater Data for Crossing: I526 1378+40

Table 3 - Downstream Channel Rating Curve (Crossing: I526 1378+40)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
11.50	8.73	8.73	0.00
11.94	8.76	8.76	0.00
12.38	8.79	8.79	0.00
12.82	8.82	8.82	0.00
13.30	8.85	8.85	0.00
13.70	8.87	8.87	0.00
13.90	8.88	8.88	0.00
14.60	8.93	8.93	0.00
15.00	8.95	8.95	0.00
15.46	8.98	8.98	0.00
15.90	9.00	9.00	0.00

Tailwater Channel Data - I526 1378+40

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: I526 1378+40

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 14.20 ft

Roadway Surface: Paved

Roadway Top Width: 236.00 ft

HY-8 Culvert Analysis Report
I-526 Sta. 1378+35
Post-Development 24” RC Pipe

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 14.20 cfs

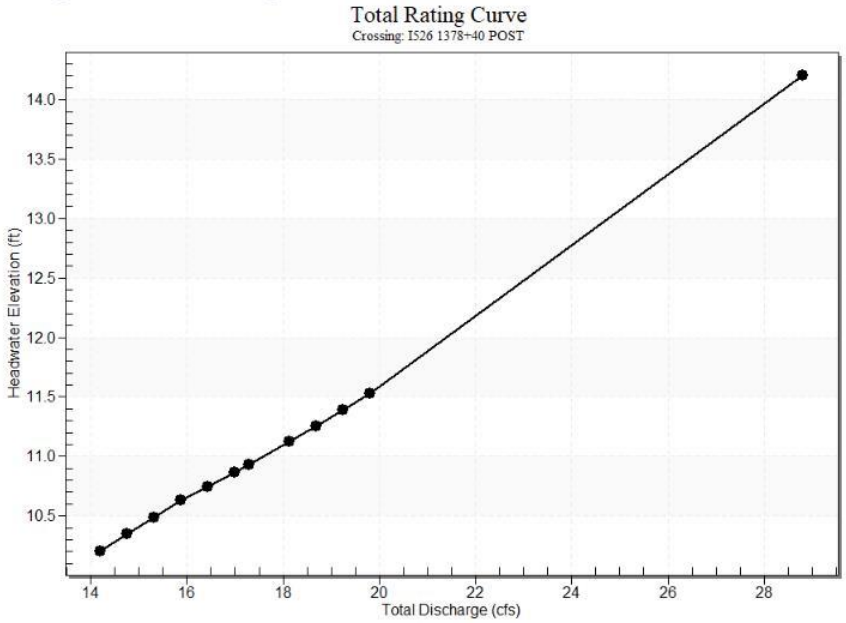
Design Flow: 17.30 cfs

Maximum Flow: 19.80 cfs

Table 1 - Summary of Culvert Flows at Crossing: I526 1378+40 POST

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 5 Post Dev Discharge (cfs)	Roadway Discharge (cfs)	Iterations
10.20	14.20	14.20	0.00	1
10.34	14.76	14.76	0.00	1
10.49	15.32	15.32	0.00	1
10.63	15.88	15.88	0.00	1
10.75	16.44	16.44	0.00	1
10.87	17.00	17.00	0.00	1
10.93	17.30	17.30	0.00	1
11.12	18.12	18.12	0.00	1
11.25	18.68	18.68	0.00	1
11.39	19.24	19.24	0.00	1
11.53	19.80	19.80	0.00	1
14.20	28.38	28.38	0.00	Overtopping

Rating Curve Plot for Crossing: I526 1378+40 POST



Culvert Data: Culvert 5 Post Dev

Table 2 - Culvert Summary Table: Culvert 5 Post Dev

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
14.20 cfs	14.20 cfs	10.20	2.03	3.974	4-FFf	-1.00	1.36	2.00	2.66	4.52	0.00
14.76 cfs	14.76 cfs	10.34	2.08	4.115	4-FFf	-1.00	1.38	2.00	2.70	4.70	0.00
15.32 cfs	15.32 cfs	10.49	2.14	4.256	4-FFf	-1.00	1.41	2.00	2.73	4.88	0.00
15.88 cfs	15.88 cfs	10.63	2.19	4.397	4-FFf	-1.00	1.44	2.00	2.76	5.05	0.00
16.44 cfs	16.44 cfs	10.75	2.25	4.515	4-FFf	-1.00	1.46	2.00	2.76	5.23	0.00
17.00 cfs	17.00 cfs	10.87	2.31	4.636	4-FFf	-1.00	1.49	2.00	2.76	5.41	0.00
17.30 cfs	17.30 cfs	10.93	2.34	4.703	4-FFf	-1.00	1.50	2.00	2.76	5.51	0.00
18.12 cfs	18.12 cfs	11.12	2.44	4.890	4-FFf	-1.00	1.53	2.00	2.76	5.77	0.00
18.68 cfs	18.68 cfs	11.25	2.50	5.023	4-FFf	-1.00	1.56	2.00	2.76	5.95	0.00
19.24 cfs	19.24 cfs	11.39	2.57	5.160	4-FFf	-1.00	1.58	2.00	2.76	6.12	0.00
19.80 cfs	19.80 cfs	11.53	2.64	5.302	4-FFf	-1.00	1.60	2.00	2.76	6.30	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

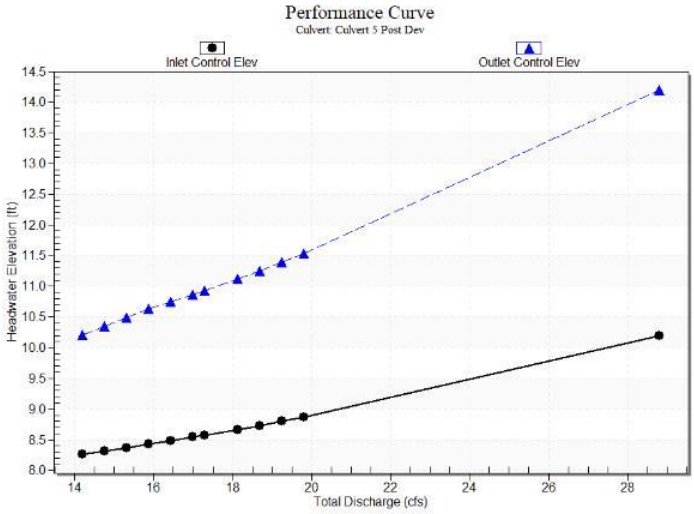
Inlet Elevation (invert): 6.23 ft,

Outlet Elevation (invert): 6.24 ft

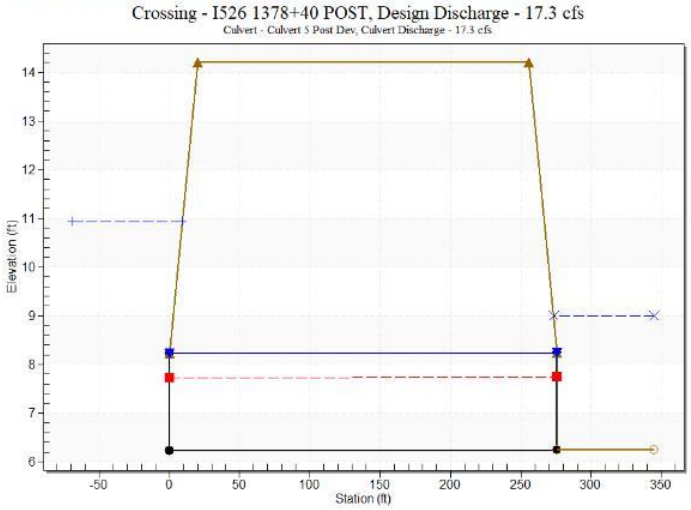
Culvert Length: 276.00 ft,

Culvert Slope: -0.0000

Culvert Performance Curve Plot: Culvert 5 Post Dev



Water Surface Profile Plot for Culvert: Culvert 5 Post Dev



Site Data - Culvert 5 Post Dev

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6.23 ft

Outlet Station: 276.00 ft

Outlet Elevation: 6.24 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 5 Post Dev

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Tailwater Data for Crossing: I526 1378+40 POST

Table 3 - Downstream Channel Rating Curve (Crossing: I526 1378+40 POST)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
11.50	8.73	8.73	0.00
11.94	8.76	8.76	0.00
12.38	8.79	8.79	0.00
12.82	8.82	8.82	0.00
13.26	8.85	8.85	0.00
13.70	8.87	8.87	0.00
13.90	8.88	8.88	0.00
14.58	8.93	8.93	0.00
15.02	8.95	8.95	0.00
15.46	8.98	8.98	0.00
15.90	9.00	9.00	0.00

Tailwater Channel Data - I526 1378+40 POST

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: Enter Rating Curve

Roadway Data for Crossing: I526 1378+40 POST

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 14.20 ft

Roadway Surface: Paved

Roadway Top Width: 236.00 ft

6.0 Existing Storm Drain System Items

A storm drain system was developed in Geopak near the realigned portion of Long Point Road. See **Appendix D** for a visual display of the system and a preliminary Geopak output table.

7.0 Half-Line Pipe Assessment

Several half-line pipes draining under both lanes of I-526 from numerous median drop inlets will need to be extended due to proposed fill limits on the new ramp and roadway alignments. See **Appendix C** for a complete summary table of half-line pipes that will be impacted by the proposed project, including retention and extension recommendations.

8.0 Outfall Analysis

As previously mentioned in **Section 1.6 Proposed Stormwater Management**, preliminary analysis of post-development discharges indicates that stormwater management will not be required for this project. Given the predominance of poorly drained soils and high levels of existing impervious areas within the project site, further changes in land use are not expected to significantly increase peak discharges leaving the project ROW. Should design reveal further increases in impervious surfaces, infield and median areas within the project limits may be used for detention storage.

9.0 Sediment and Erosion Control Measures

Sediment tubes will be installed along the ditches at the outfalls from the project area to ensure that sediment will not leave the permitted area. Inlet structure filters and silt fence will also be utilized to prevent sediment from leaving the site.

Temporary erosion control blanket will be used on all slopes steeper than 3:1 and longer than 5 feet to prevent erosion. Also, the newly graded ditches and shoulder slopes can be stabilized with erosion control blanket if needed to prevent erosion and sediment movement.

All access areas into and out of the limits of disturbance are required to be equipped with a gravel construction entrance. The use of this BMP will limit the amount of sediment being transported by construction vehicles onto existing roadways or other impervious areas. Any tracked sediment, along with any attached pollutants, deposited on impervious areas could be washed downstream during the next rain event.

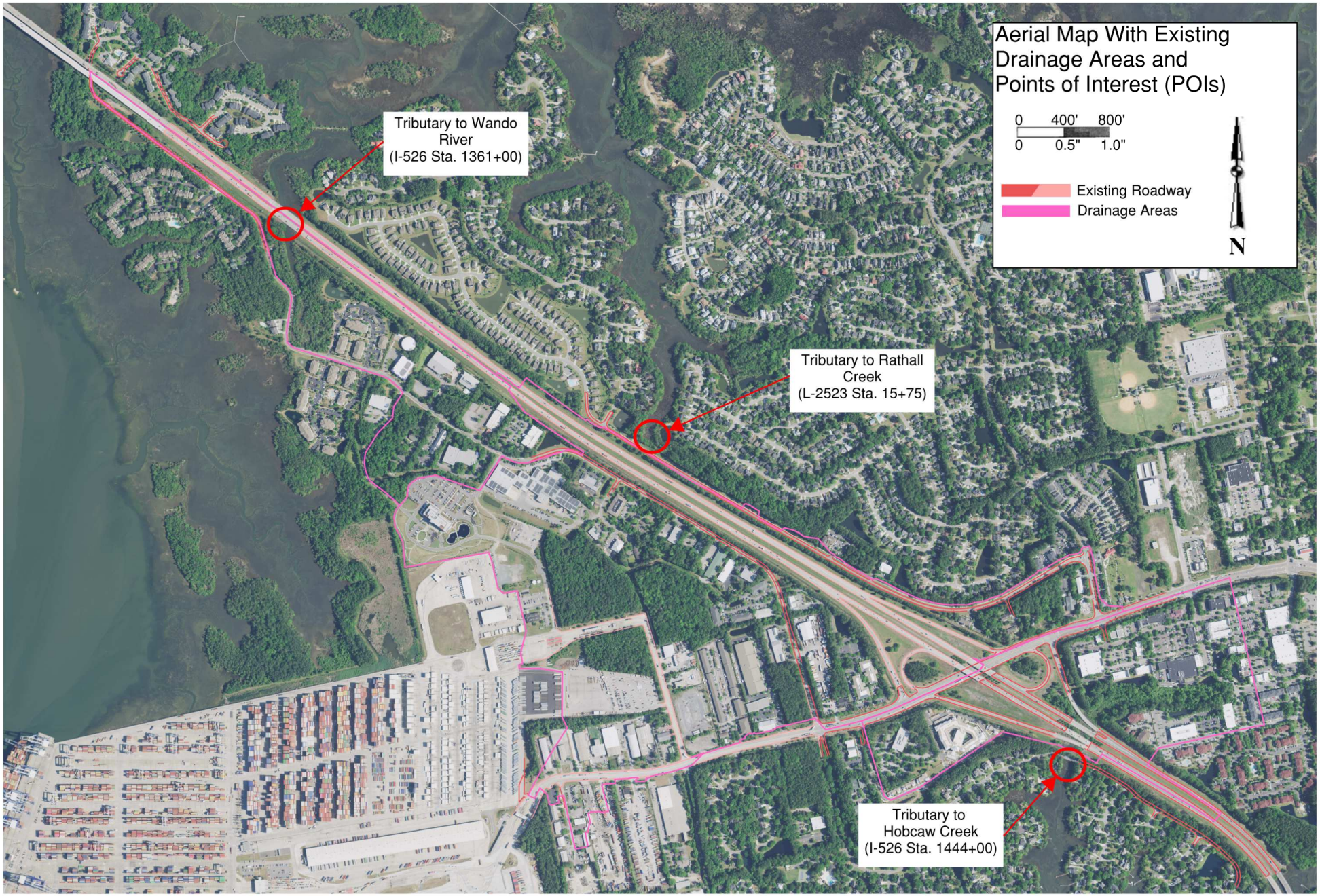
During extremely dry conditions, drought, and/or excessive winds, the construction site should be treated for dust control to prevent the suspension of fine sediment particles into the air, being carried offsite, and deposited on adjacent properties or surface waters. A water tanker used to spray the soil down may be an effective way to prevent excessive dust at a construction site.

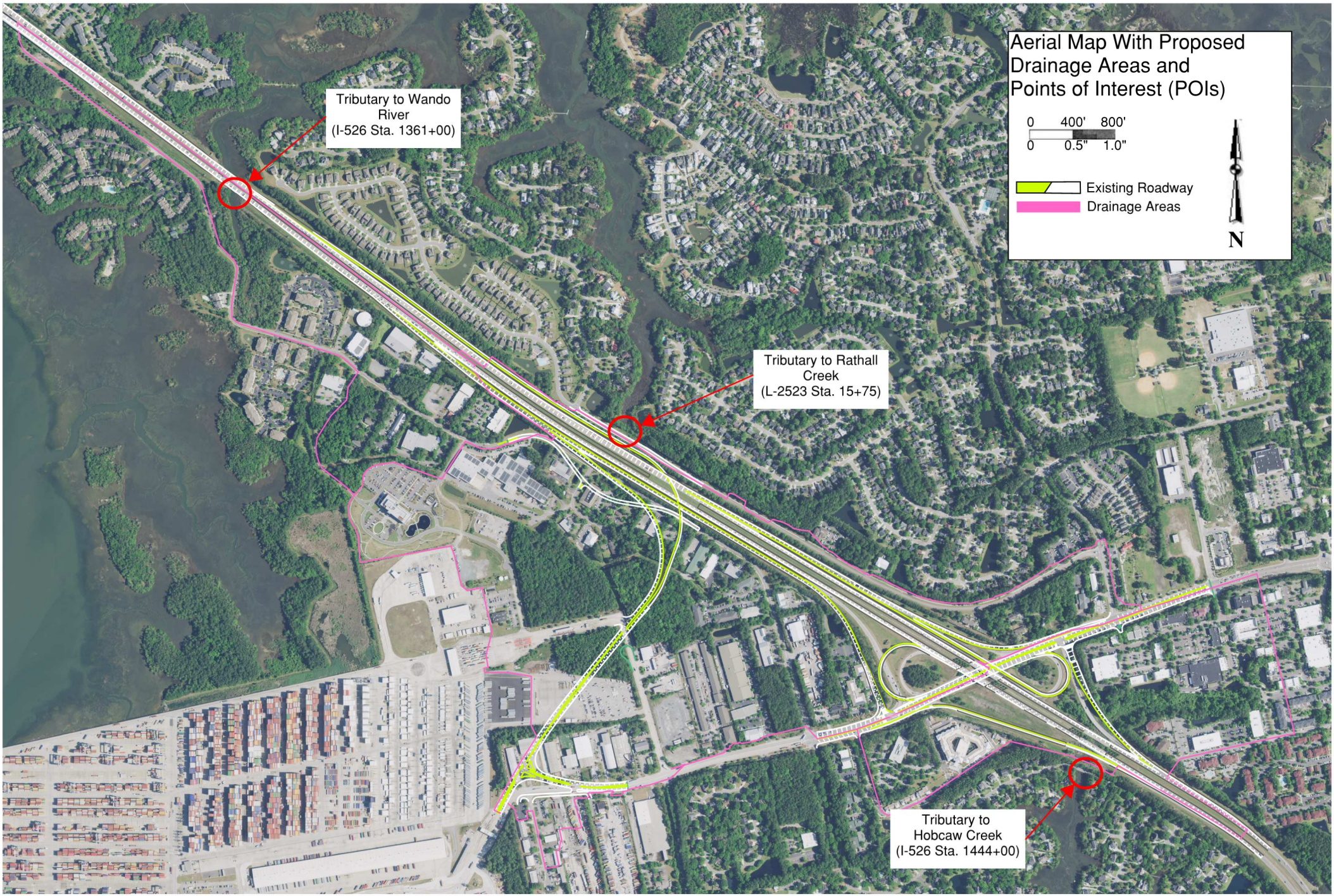
Throughout construction activities, the amount of soil exposed during construction should be kept to a minimum. This may be accomplished by minimizing the amount of disturbed area within the permitted Limits of Disturbance to only that which is necessary to complete the proposed work. For areas that have already been disturbed and where construction activities will not begin for a period of 14 days or more, temporary stabilization techniques must be implemented.

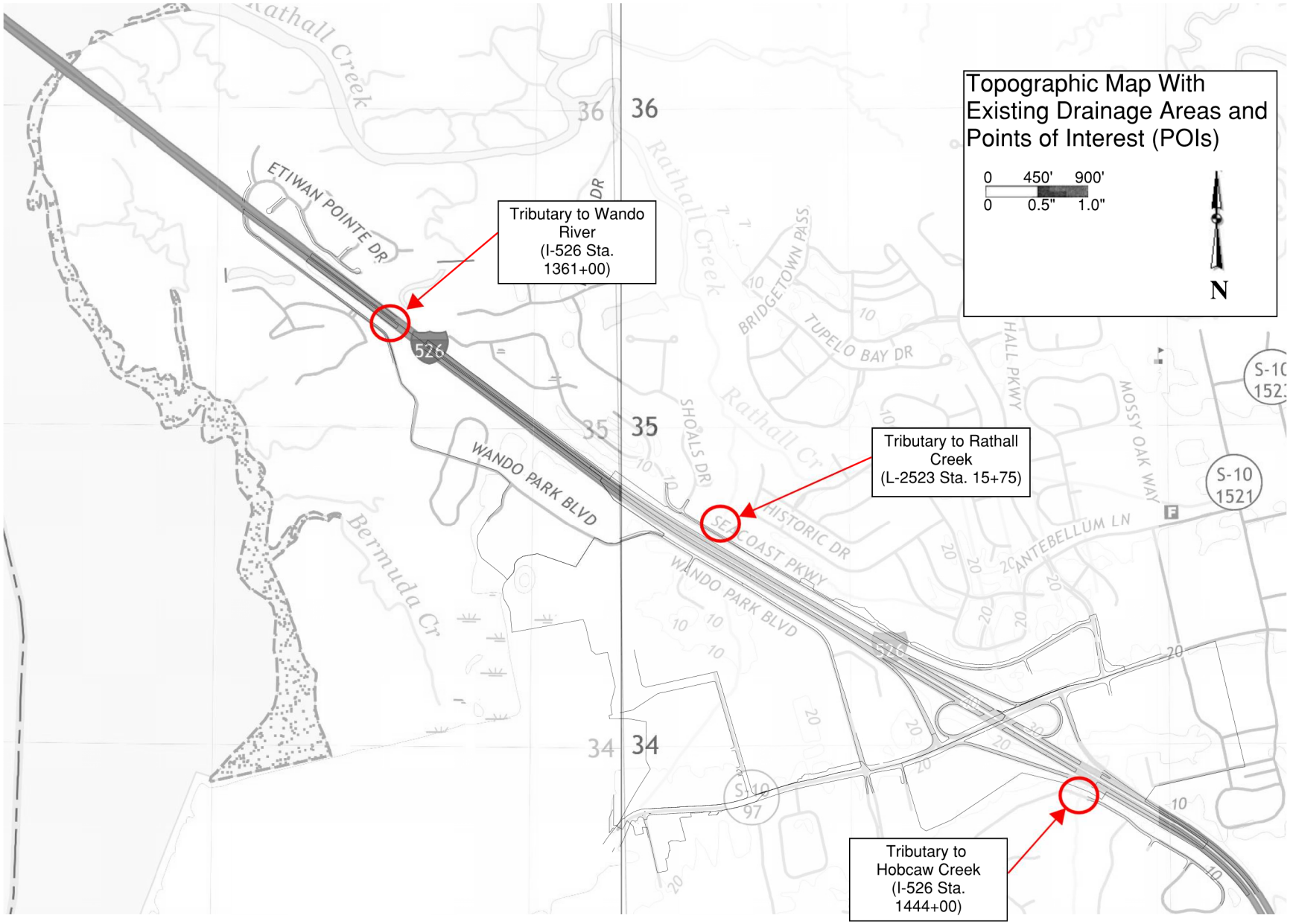
Throughout construction activities, soil stabilization techniques are to be initiated as soon as practicable whenever any clearing, grading, excavating, or other land-disturbing activities have permanently or temporarily ceased on any portion of the construction site and will not resume for a period exceeding 14 calendar days. For areas where initiating stabilization measures is infeasible, (e.g., where snow cover, frozen ground, or drought conditions preclude stabilization), initiate vegetative or non-vegetative stabilization measures as soon as practicable.

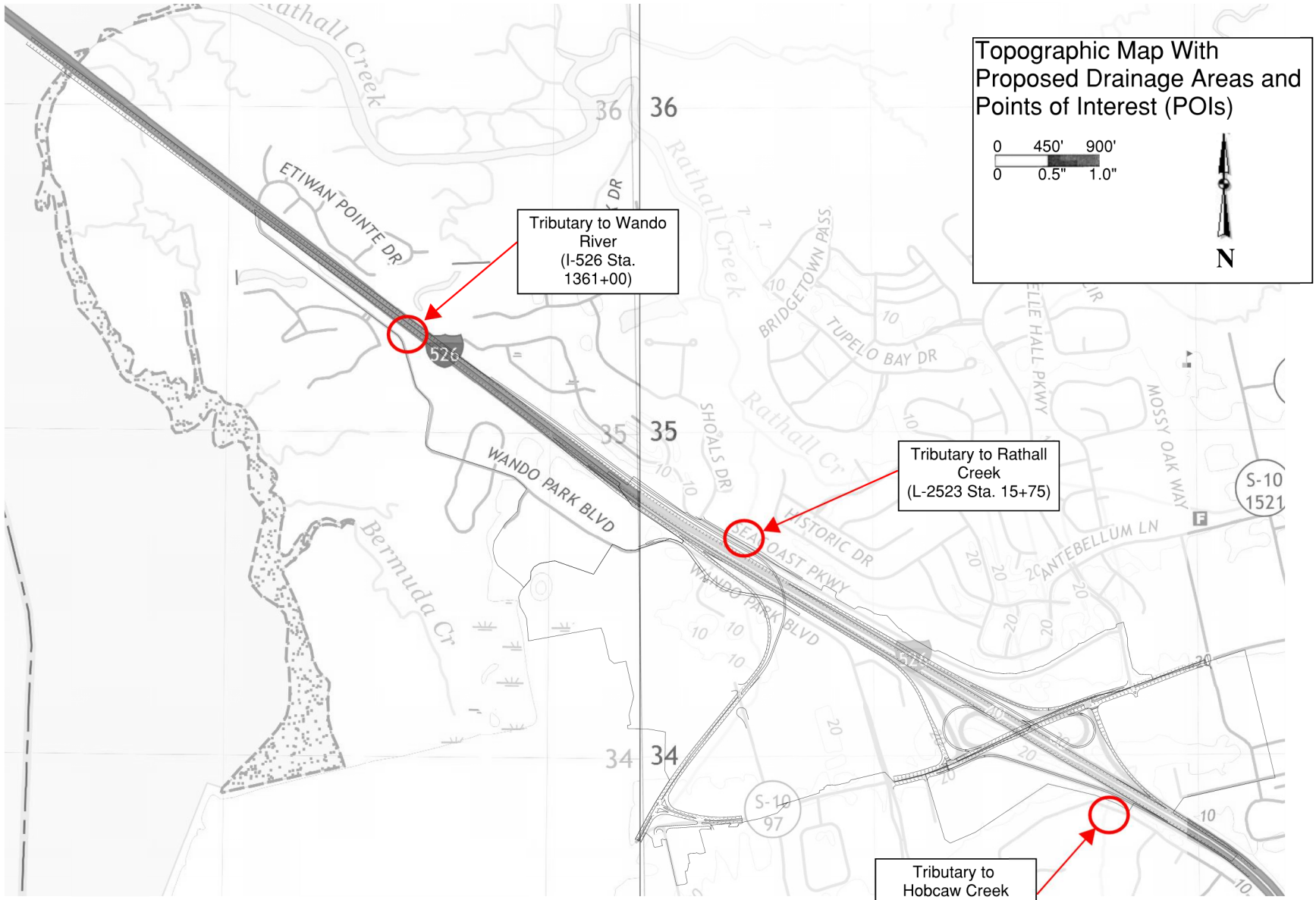
Stabilization of steep slopes should be a priority for those performing work at the construction site. At the very least, runoff control BMPs should be implemented to transport stormwater runoff from the top of the slope to the toe of the slope. All pipe slope drain outlets are to be equipped with proper outlet protection.

Appendix A – Project Maps


Aerial Map With Existing Drainage Areas and Points of Interest (POIs)
0 400' 800'
0 0.5" 1.0"
Existing Roadway
Drainage Areas
N
Tributary to Wando River (I-526 Sta. 1361+00)
Tributary to Rathall Creek (L-2523 Sta. 15+75)
Tributary to Hobcaw Creek (I-526 Sta. 1444+00)


Aerial Map With Proposed Drainage Areas and Points of Interest (POIs)
0 400' 800'
0 0.5" 1.0"
Existing Roadway
Drainage Areas
N
Tributary to Wando River (I-526 Sta. 1361+00)
Tributary to Rathall Creek (L-2523 Sta. 15+75)
Tributary to Hobcaw Creek (I-526 Sta. 1444+00)


Topographic Map With Existing Drainage Areas and Points of Interest (POIs)
0 450' 900'
0 0.5" 1.0"
N
Tributary to Wando River (I-526 Sta. 1361+00)
Tributary to Rathall Creek (L-2523 Sta. 15+75)
Tributary to Hobcaw Creek (I-526 Sta. 1444+00)
ETIWAN POINTE DR
WANDO PARK BLVD
SEACOAST PKWY
HISTORIC DR
ANTEBELLUM LN
MOSSY OAK WAY
TUPELO BAY DR
BRIDGETOWN PASS
SHOALS DR
HALL PKWY
Rathall Creek
Bermuda Cr
526
S-10 1521
S-10 97
36
35
34


Topographic Map With Proposed Drainage Areas and Points of Interest (POIs)
0 450' 900'
0 0.5" 1.0"
N
Tributary to Wando River (I-526 Sta. 1361+00)
Tributary to Rathall Creek (L-2523 Sta. 15+75)
Tributary to Hobcaw Creek (I-526 Sta. 1444+00)
ETIWAN POINTE DR
WANDO PARK BLVD
Rathall Creek
Bermuda Cr
BRIDGETOWN PASS
TUPELO BAY DR
SHOALS DR
HISTORIC DR
SEACOAST PKWY
ANTEBELLUM LN
MOSSY OAK WAY
S-10 1521
S-10 97
526
36
35
34

NOTES TO USERS

is for use in administering the National Flood Insurance Program. It does sarily identify all areas subject to flooding, particularly from local drainage of small size. The **community map repository** should be consulted for updated or additional flood hazard information.

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rmation Services
/NGS12
Geodetic Survey
#9202
t-West Highway
ring, Maryland 20910-3282
-3242

n current elevation, description, and/or location information for **bench** hown on this map, please contact the Information Services Branch National Geodetic Survey at **(301) 713-3242**, or visit its website at w.ngs.noaa.gov.

ap information shown on this FIRM was provided in digital format by n County, South Carolina.

updated topographic information, this map reflects more detailed and up- **tream channel configurations and floodplain delineations** than those the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Data tables may reflect stream channel distances that differ from what is the map. Also, the road to floodplain relationships for unrevised streams r from what is shown on previous maps.

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e questions about this map or questions concerning the National Flood Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or EMA website at https://www.fema.gov/national-flood-insurance-program.

DNR

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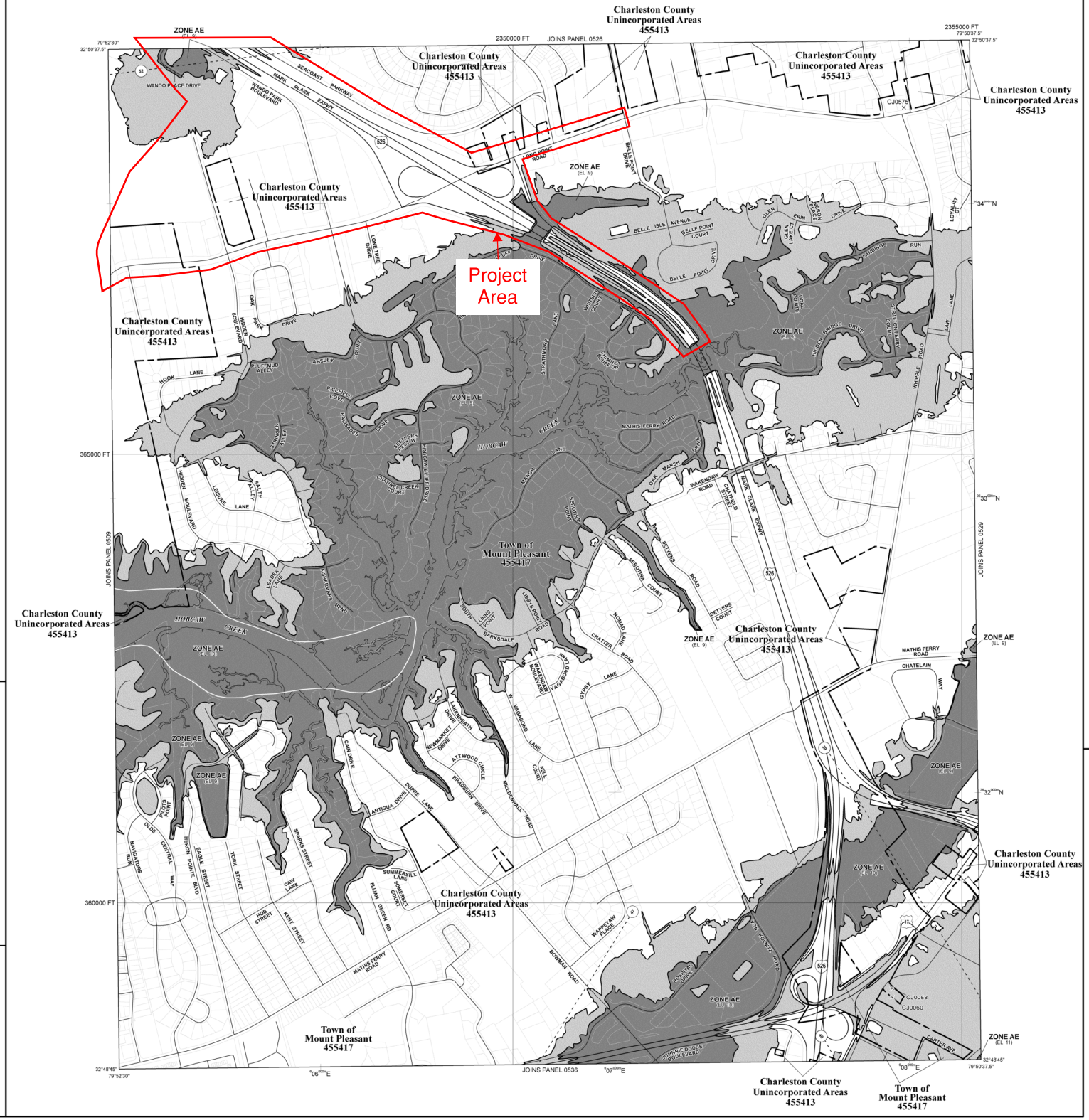
http://www.dnr.state.sc.us/



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is th that has a 1% chance of being equaled or exceeded in any given year. The Flood Hazard Area is the area subject to flooding by the 1% annual chance flood of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. Th Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Elevations determined.
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- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% chance flood by a flood control system that was subse decertified. Zone AR indicates that the former flood control sys being restored to provide protection from the 1% annual cha greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a flood protection system under construction; no Base Flood Ele determined.
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- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Ele determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that kept free of encroachment so that the 1% annual chance flood can be carried substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chanc with average depths of less than 1 foot or with drainage areas le 1 square mile; and areas protected by levees from 1% annual flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

Floodplain boundary
Floodway boundary
Zone D Boundary
Boundary dividing Special Flood Hazard Area Zones a
boundary dividing Special Flood Hazard Areas of diffe
Base Flood Elevations, flood depths and flood v
Limit of Moderate Wave Action
513 (EL 987) Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line
23 — 23 Transect line
Culvert, Flume, Penstock, or Aqueduct
Bridge
Footbridge
97° 07' 30", 32° 22' 30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
76 000mE 1000-meter Universal Transverse Mercator grid ticks, zone 1
600000 FT 5000-foot grid values: South Carolina State Plane coordinate system (FIPSZONE 3900), Lambert Conformal Conic project
DX5510 Bench mark (see explanation in Notes to Users section of th FIRM panel)
M1.5 River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
November 17, 2004

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 29, 2021 – to add Base Flood Elevations and Special Flood Hazard Areas; to char Base Flood Elevations and Special Flood Hazard Areas; to incorporate previously issued Le of Map Revision; to reflect the effects of coastal erosion, revised shoreline, and updated topographic information; and to update corporate limits, the effects of wave action, and road road names.

For community map revision history prior to countywide mapping, refer to the Communi Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insura agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0528K

FIRM
FLOOD INSURANCE RATE

CHARLESTON COUNTY, SOUTH CAROLINA
AND INCORPORATED AREAS

PANEL 528 OF 855

(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
CHARLESTON COUNTY	455413	0528
MOUNT PLEASANT, TOWN OF	455417	0528

Notice to User: The **Map Number** shown belo used when placing map orders; the **Communi** shown above should be used on insurance applica subject community.

MAP NU
450190

MAP RE
JANUARY 2

Federal Emergency Management

NOTES TO USERS

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one category has been divided by a **Limit of Moderate Wave Action.** /A represents the approximate landward limit of the 1.5-foot breaking effects of wave hazards between the VE Zone and the LiMWA (or the shoreline and the LiMWA for areas where VE Zones are not will be similar to, but less severe than those in the VE Zone.

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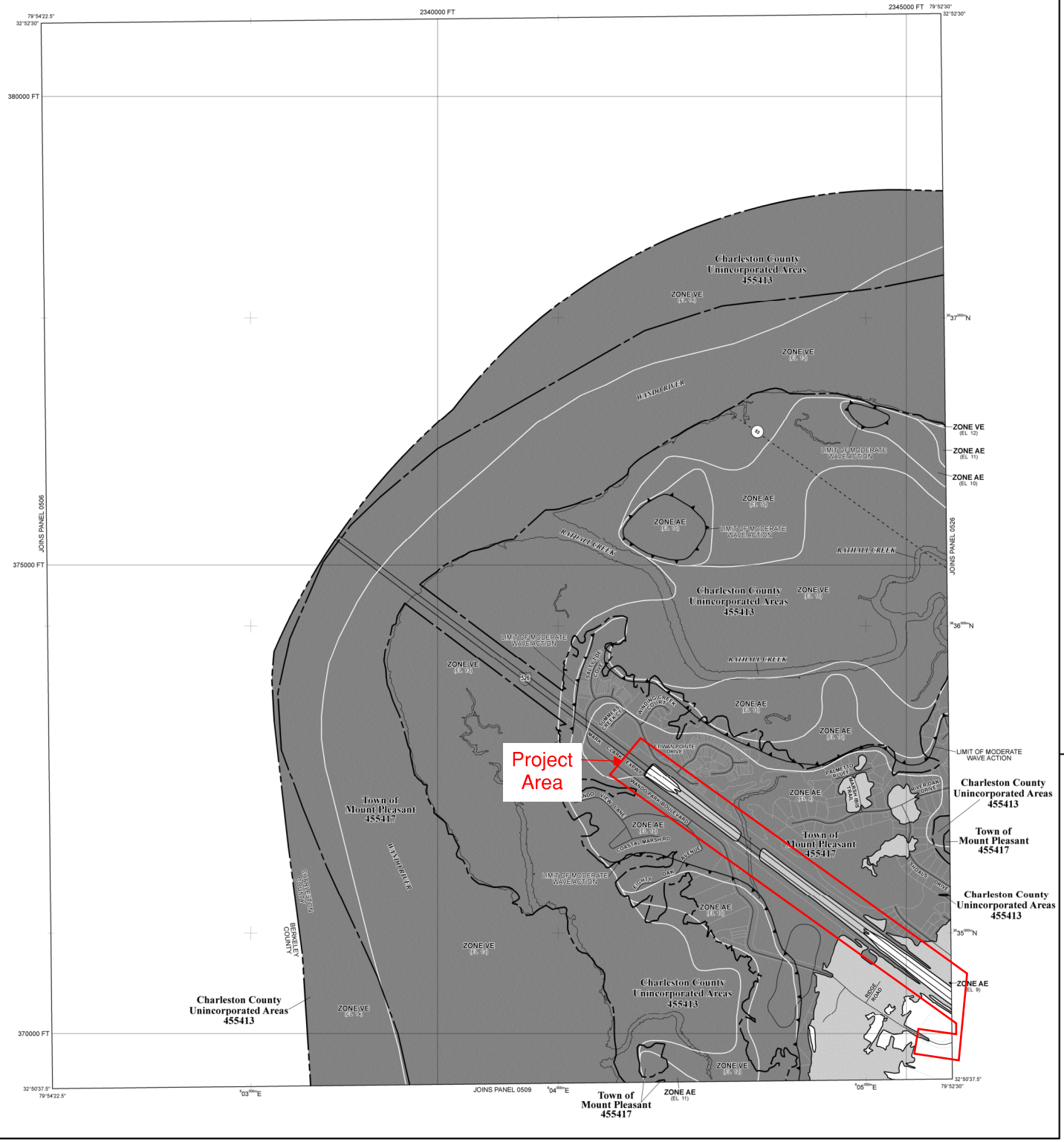

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Boundary dividing Special Flood Hazard Area Zones a
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23 — 23 Transect line
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Bridge
Footbridge
97° 07' 30", 32° 22' 30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
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M1.5 River Mile

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250 0 500 1000 FEET
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NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0507K

FIRM
FLOOD INSURANCE RATE

CHARLESTON COUNTY, SOUTH CAROLINA AND INCORPORATED AREAS

PANEL 507 OF 855

(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
CHARLESTON COUNTY	455413	0507
MOUNT PLEASANT, TOWN OF	455417	0507

Notice to User. The **Map Number** shown belo used when placing map orders; the **Communi** shown above should be used on insurance applica subject community.

MAP NU
450190

MAP RE
JANUARY 2

Federal Emergency Management

Appendix B – Pre/Post – Development Calculations

STORMWATER MANAGEMENT: PRE-DEVELOPMENT INPUTS

I-526 & LPR — **PRE-DEVELOPMENT OUTFALL DISCHARGE**

DSN BY: ERP
CHK BY: ___
DATE: ########

CDM Smith — listen. think. deliver.

Culvert DA = 0.358 Sq. MI (190 Ac)

NCRS TR-55 Method

Tc = 79 min

Surface	CN*	Area (Ac)	AxCN
Commercial B	92	30.539	2,809.59
Commercial C	94	2.966	278.80
Commercial D	95	81.971	7,787.25
Open Space B	61	3.889	237.23
Open Space C	74	4.781	353.79
Open Space D	80	23.251	1,860.08
Gravel B	85	2.223	188.96
Gravel D	91	4.328	393.85
Woods B	66	0.371	24.49
Woods D	83	28.832	2,393.06
Impervious B	98	8.456	828.69
Impervious C	98	3.975	389.55
Impervious D	98	29.945	2,934.61
Residential B	70	1.561	109.27
Residential D	85	1.877	159.55
Total Drainage Area (Ac) =		**228.97**	20748.75
Composite CN =	**90.62**		
Rounded CN =	**91**		

	TR-55	Rounded TR-55	
Q2=	299.69	300	cfs
Q5=	405.43	405	cfs
Q10=	490.86	491	cfs
Q25=	609.61	610	cfs
Q50=	704.84	705	cfs
Q100=	807.35	807	cfs

* from Win-TR55

Bridge DA = 0.1 Sq. MI (64 Ac)

Rational Method

Tc = 82 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	10.540	9.49
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	28.966	20.28
Grass Shoulders/Medians	0.25	8.349	2.09
Woodland & Forest	0.10	16.099	1.61
Total Drainage Area (Ac) =		**63.95**	33.46
Composite C =	**0.52**		

	Rational	Rounded Rational		*i*
Q2=	53.74	54	cfs	1.62
Q5=	66.33	66	cfs	1.99
Q10=	79.32	79	cfs	2.39
Q25=	104.54	105	cfs	2.86
Q50=	130.92	131	cfs	3.28
Q100=	154.13	154	cfs	3.71

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Trib to Hobcaw Creek DA = 0.125 Sq. MI (80 Ac)

Rational Method

Tc = 55 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	12.109	10.90
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	44.644	31.25
Grass Shoulders/Medians	0.25	12.031	3.01
Woodland & Forest	0.10	11.349	1.13
Total Drainage Area (Ac) =		**80.13**	46.29
Composite C =	**0.58**		

	Rational	Rounded Rational		*i*
Q2=	99.99	100	cfs	2.15
Q5=	120.66	121	cfs	2.60
Q10=	141.96	142	cfs	3.05
Q25=	183.08	183	cfs	3.58
Q50=	226.28	226	cfs	4.06
Q100=	262.89	263	cfs	4.53

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/rainfall_intensity.pdf

Frequency (years)	Rational Coefficients a	b	c
2	72.69	11.39	0.839
5	61.16	9.846	0.7573
10	55.13	8.412	0.6972
25	45.53	6.257	0.6179
50	42.68	5.28	0.5741
100	39.53	4.297	0.5309

Recurrence Interval	Cf
2	1
5	1
10	1
25	1.1
50	1.2
100	1.25

Charleston, SC

Frequency	24 Hr Rainfall (in)
2	4.3
5	5.5
10	6.6
25	8.0
50	9.2
100	10.4

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/appendixF_SC_Rainfall_Data.pdf

	Culverts															
	Commercial B	Commercial C	Commercial D	Open Space B	Open Space C	Open Space D	Gravel B	Gravel D	Woods B	Woods D	Imp B	Imp C	Imp D	Res B	Res D	Total Ac.
Sum	30.549	2.966	81.971	3.889	4.781	23.251	2.223	4.328	0.371	28.832	8.456	3.975	29.945	1.561	1.877	228.972
	7.786	1.638	2.037	0.482	2.451	0.400	2.223	1.146	0.271	4.536	0.112	1.556	1.132	1.561	1.877	
	3.186	0.655	30.847	1.329	0.437	3.080		1.109	0.100	19.231	0.094	0.133	1.045			
	0.501	0.674	4.459	0.262	0.068	2.336		0.343		2.684	0.553	1.207	0.301			
	2.870		24.703	0.289	1.062	0.840		1.731		2.381	1.261	0.346	0.406			
	0.148		11.669	0.190	0.763	1.683					2.106	0.675	1.165			
	0.020		0.199	0.710		1.599					2.947	0.057	2.513			
	0.630		0.120	0.627		1.158					1.383		0.633			
	7.221		0.022			0.145							1.092			
	0.592		2.483			1.040							0.206			
	0.233		0.193			3.345							1.086			
	0.293		0.183			5.900							4.178			
	1.952		1.136			0.133							0.028			
	0.220		1.278			0.472							0.238			
	4.899		0.045			0.037							0.118			
			2.597			1.084							0.057			
													3.617			
													4.028			
													0.245			
													0.216			
													7.644			
Count	14	3	15	7	5	15	1	4		4	7	6	20	1	1	103

	Bridge												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	28.966			8.349			0		16.099		10.54			63.954
	16.052			7.476			0.000		5.665		0.604			
	5.571			0.059					10.434		3.659			
	7.343			0.814							4.679			
											1.598			
Count	3			3			1		2		4			13
Total Area by Type	28.966			8.349			0		16.099		10.54			

	Trib to Hobcaw Creek												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	44.644			12.031			0		11.349		12.109			80.133
	31.882			0.275			0.000		9.093		4.860			
	11.886			2.233					1.080		3.756			
	0.876			0.212					0.622		3.359			
				1.491					0.221		0.134			
				0.641					0.095					
				3.540					0.238					
				0.889										
				1.521										
				1.194										
				0.035										
Count	3			10			1		6		4			24
Total Area by Type	44.644			12.031			0		11.349		12.109			

I-526 & Long Point Rd

Predevelopment to 10'x5 RBC (Seacoast Pkwy)

DRAINAGE AREA= 0.358 SQ. MILES
229.0 Acres

DSN BY: ENR
CHK BY: ___
DATE: 3/2/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	55	21	20.6	0.0073	4.30	Dense Grass (weeping, love, blue, buffalo, blue grama, and native grass mixtures)	0.240		0.08	11.4	
Shallow Concentrated	2	160	20.6	17	0.0225		Unpaved (shallow concentrated flow)	0.491		1.00	2.7	
Shallow Concentrated	4	953	14	9	0.0052		Unpaved (shallow concentrated flow)	0.491		1.17	13.5	wooded area, no defined chnl
Open Channel	3	1056	17	14	0.0028		Vegetation Lined	0.085	2	0.59	29.9	Ex 2:1 V-ditch
Open Channel	5	1309	9	2	0.0053		Vegetation Lined	0.085	3	1.06	20.6	Ex 5:1 V-ditch
Open Channel	7	55	2.58	1.36	0.0222		Vegetation Lined	0.085	4	2.61	0.4	
Closed Conduits	6	184	1.96	1.36	0.0033		Concrete Pipe	0.013	3	5.40	0.6	Ex 9'x5' RCBC
Closed Conduits												
Closed Conduits												
										Total	79.1	minutes
										Use	**79**	minutes
											1.317	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Station 1361 Bridge

DRAINAGE AREA= 0.100 SQ. MILES
64.0 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	16	15	0.0100	4.30	Woods: Light under brush	0.400		0.07	24.4	
Shallow Concentrated	2	490	15	11	0.0082	4.30	Unpaved (shallow concentrated flow)	0.491		1.00	8.2	
Shallow Concentrated	3	40	11	10	0.0250	4.30	Paved (shallow concentrated flow)	0.619		3.23	0.2	
Shallow Concentrated	4	520	10	7	0.0058	4.30	Unpaved (shallow concentrated flow)	0.491		1.23	7.0	
Open Channel	5	1475	7	3	0.0027		Vegetation Lined	0.085	2	0.58	42.7	Ex 2:1 V-ditch
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	82.6	minutes
										Use	**82**	minutes
											1.367	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Trib to Hobcaw Creek

DRAINAGE AREA= 0.125 SQ. MILES
80.1 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	21	18	0.0300	4.30	Woods: Light under brush	0.400		0.11	15.8	
Shallow Concentrated	2	820	18	13	0.0061	4.30	Paved (shallow concentrated flow)	0.619		1.00	13.7	
Shallow Concentrated	3	1260	13	5	0.0063	4.30	Unpaved (shallow concentrated flow)	0.491		1.29	16.3	
Open Channel	5	375	5	4	0.0027	4.30	Natural Channel Irregular Section with pools 1	0.095	3	0.67	9.3	Wetland Trib to Hobcaw Creek
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	55.0	minutes
										Use	**55**	minutes
											0.917	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

STORMWATER MANAGEMENT: POST-DEVELOPMENT INPUTS

I-526 & LPR — **POST-DEVELOPMENT OUTFALL DISCHARGE**

DSN BY: ERP
CHK BY: ___
DATE: ########

CDM Smith — listen. think. deliver.

L-2523 Sta. 15+75 DA = 0.3 Sq. MI (189 Ac)

Rational Method

Tc = 79 min

Surface	CN*	Area (Ac)	AxC
Commercial B	92	15.688	1,443.30
Commercial C	94	2.944	276.74
Commercial D	95	81.971	7,787.25
Open Space B	61	3.889	237.23
Open Space C	74	3.503	259.22
Open Space D	80	17.407	1,392.56
Gravel B	85	2.223	188.96
Gravel D	91	4.329	393.94
Woods B	66	0.000	--
Woods D	83	28.384	2,355.87
Impervious B	98	13.527	1,325.65
Impervious C	98	3.975	389.55
Impervious D	98	47.694	4,674.01
Residential B	70	1.561	109.27
Residential D	85	1.877	159.55
Total Drainage Area (Ac) =		**228.97**	20993.08
Composite CN =	**91.68**		
Rounded CN =	**92**		

	Rational	Rounded Rational	
Q2=	307.22	307	cfs
Q5=	411.56	412	cfs
Q10=	497.69	498	cfs
Q25=	614.34	614	cfs
Q50=	711.68	712	cfs
Q100=	812.17	812	cfs

* from Win-TR55

I-526 Sta. 1361+00 DA = 0.1 Sq. MI (64 Ac)

Rational Method

Tc = 82 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	11.465	10.32
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	28.966	20.28
Grass Shoulders/Medians	0.25	7.424	1.86
Woodland & Forest	0.10	16.099	1.61
Total Drainage Area (Ac) =		**63.95**	34.06
Composite C =	**0.53**		

	Rational	Rounded Rational		*i*
Q2=	54.77	55	cfs	1.62
Q5=	67.61	68	cfs	1.99
Q10=	80.84	81	cfs	2.39
Q25=	106.55	107	cfs	2.86
Q50=	133.44	133	cfs	3.28
Q100=	157.09	157	cfs	3.71

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Trib to Hobcaw Creek DA = 0.125 Sq. MI (80 Ac)

Rational Method

Tc = 55 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	14.086	12.68
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	44.644	31.25
Grass Shoulders/Medians	0.25	10.054	2.51
Woodland & Forest	0.10	11.349	1.13
Total Drainage Area (Ac) =		**80.13**	47.58
Composite C =	**0.59**		

	Rational	Rounded Rational		*i*
Q2=	101.72	102	cfs	2.15
Q5=	122.74	123	cfs	2.60
Q10=	144.40	144	cfs	3.05
Q25=	186.24	186	cfs	3.58
Q50=	230.18	230	cfs	4.06
Q100=	267.42	267	cfs	4.53

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/rainfall_intensity.pdf

Frequency (years)	Rational Coefficients a	b	c
2	72.69	11.39	0.839
5	61.16	9.846	0.7573
10	55.13	8.412	0.6972
25	45.53	6.257	0.6179
50	42.68	5.28	0.5741
100	39.53	4.297	0.5309

Recurrence Interval	Cf
2	1
5	1
10	1
25	1.1
50	1.2
100	1.25

Charleston, SC

Frequency	24 Hr Rainfall (in)
2	4.3
5	5.5
10	6.6
25	8.0
50	9.2
100	10.4

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/appendixF_SC_Rainfall_Data.pdf

	Culverts															
	Commercial B	Commercial C	Commercial D	Open Space B	Open Space C	Open Space D	Gravel B	Gravel D	Woods B	Woods D	Imp B	Imp C	Imp D	Res B	Res D	Total Ac.
Sum	15.688	2.944	81.971	3.889	3.503	17.407	2.223	4.329	0	28.384	13.527	3.975	47.694	1.561	1.877	228.972
	1.256	2.944	10.968	0.892	1.103	4.192	2.223	1.146		1.143	1.768	3.653	4.178	1.561	1.877	
	6.743		7.931	0.399	0.926	2.635		1.109		2.700	4.884	0.322	2.945			
	7.388		25.000	2.598	1.474	1.362		0.343		4.055	0.901		4.019			
	0.301		1.278			2.459		1.731		2.684	3.232		1.333			
			1.952			3.825				2.494	2.742		4.086			
			1.877			2.435				13.863			1.902			
			1.136			0.499				0.574			1.101			
			1.561							0.871			4.884			
			6.755										2.296			
			5.107										10.72			
			4.459										3.972			
			13.947										4.233			
													1.038			
													0.987			
Count	4	1	12	3	3	7	1	4	0	8	5	2	14	1	1	66

	Bridge												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	28.966			7.424			0		16.099		11.465			63.954
	16.052			0.923			0.000		5.665		4.212			
	5.571			2.015					10.434		7.253			
	7.343			1.718										
				2.628										
				0.140										
Count	3			5			1		2		2			13
Total Area by Type	28.966			7.424			0		16.099		11.465			

	Trib to Hobcaw Creek												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	44.644			10.054			0		11.349		14.086			80.133
	31.882			0.275			0.000		9.093		1.128			
	11.886			2.233					1.080		4.425			
	0.876			3.324					0.622		3.756			
				0.889					0.221		4.777			
				0.886					0.095					
				0.175					0.238					
				0.196										
				0.212										
				1.491										
				0.373										
Count	3			10			1		6		4			24
Total Area by Type	44.644			10.054			0		11.349		14.086			

I-526 & Long Point Rd

Predevelopment to 10'x5 RBC (Seacoast Pkwy)

DRAINAGE AREA= 0.000 SQ. MILES
0.0 Acres

DSN BY: ENR
CHK BY: ___
DATE: 3/2/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	55	21	20.6	0.0073	4.30	Dense Grass (weeping, love, blue, buffalo, blue grama, and native grass mixtures)	0.240		0.08	11.4	
Shallow Concentrated	2	160	20.6	17	0.0225		Unpaved (shallow concentrated flow)	0.491		1.00	2.7	
Shallow Concentrated	4	953	14	9	0.0052		Unpaved (shallow concentrated flow)	0.491		1.17	13.5	wooded area, no defined chnl
Open Channel	3	1056	17	14	0.0028		Vegetation Lined	0.085	2	0.59	29.9	Ex 2:1 V-ditch
Open Channel	5	1309	9	2	0.0053		Vegetation Lined	0.085	3	1.06	20.6	Ex 5:1 V-ditch
Open Channel	7	55	2.58	1.36	0.0222		Vegetation Lined	0.085	4	2.61	0.4	
Closed Conduits	6	184	1.96	1.36	0.0033		Concrete Pipe	0.013	3	5.40	0.6	Ex 9'x5' RCBC
Closed Conduits												
Closed Conduits												
										Total	79.1	minutes
										Use	**79**	minutes
											1.317	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Station 1361 Bridge

DRAINAGE AREA= 0.000 SQ. MILES
0.0 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	16	15	0.0100	4.30	Woods: Light under brush			0.07	24.4	
Shallow Concentrated	2	490	15	11	0.0082	4.30	Unpaved (shallow concentrated flow)			1.00	8.2	
Shallow Concentrated	3	40	11	10	0.0250	4.30	Paved (shallow concentrated flow)			3.23	0.2	
Shallow Concentrated	4	520	10	7	0.0058	4.30	Unpaved (shallow concentrated flow)			1.23	7.0	
Open Channel	5	1475	7	3	0.0027		Vegetation Lined		2	0.58	42.4	Ex 2:1 V-ditch
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	82.2	minutes
										Use	**82**	minutes
											1.367	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Trib to Hobcaw Creek

DRAINAGE AREA= 0.000 SQ. MILES
0.0 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	21	18	0.0300	4.30	Woods: Light under brush			0.11	15.8	
Shallow Concentrated	2	820	18	13	0.0061	4.30	Paved (shallow concentrated flow)			1.00	13.7	
Shallow Concentrated	3	1260	13	5	0.0063	4.30	Unpaved (shallow concentrated flow)			1.29	16.3	
Open Channel	5	375	5	4	0.0027	4.30	Natural Channel Irregular Section with pools 1		3	0.67	9.3	Wetland Trib to Hobcaw Creek
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	55.1	minutes
										Use	**55**	minutes
											0.917	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

Appendix C – Culvert, Cross-Line, and Half-Line Summaries

Existing Culverts and Cross-Lines																					
Culvert Data									Hydrology Data			50-Year Storm				100-Year Storm				Field Notes	50-Year Hydraulic Analysis Notes
ID	Station	Alignment	Type	Size (US/DS)	US Height (in)	Length (ft)	Inlet El.	Outlet El.	DA (ac)	Method	Tc (min)	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping		
1*	15+75	L-2523	RCBC	10'x5'	60	60	2.66	2.66	233.0	NRCS	98	425.0	8.63	1.2	Yes	493.0	8.84	1.2	Yes	Good condition	Existing HW/D = 1.2
2	1399+75	I-526	RCBC	9'x5'	60	224	3.09	2.47	189.0	NRCS	96	415	10.82	1.546	No	475	11.57	1.696	No	Outlet has settled 1.5'	Existing HW/D = 1.5
4	1355+60	I-526	RCP	24"	24	232	4.63	2.56	3.4	Rational	18.6	14.7	9.51	2.4	No	16.6	10.73	3.1	No	Good condition	Existing HW/D = 2.0
5	1378+35	I-526	RCP	24"	24	276	6.23	6.24	4.1	Rational	30	13.9	10.13	1.95	No	15.9	10.63	2.2	No	Good condition	Existing HW/D = 2.0

* Design storm for Culvert 1 is the 25-year storm

** Check storm for Culvert 1 is the 50-year storm

Post-Development Culverts and Cross-Lines with Recommended Replacements																						
Culvert Data									Hydrology Data			50-Year Storm				100-Year Storm				Field Notes	50-Year Hydraulic Analysis Notes	Recommendations
ID	Station	Alignment	Type	Size (US/DS)	US Height (in)	Length (ft)	Inlet El.	Outlet El.	DA (ac)	Method	Tc (min)	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping			
1*	15+75	L-2523	RCBC	10'x5'	60	60	2.66	2.66	229.0	NRCS	98	473	8.78	1.224	Yes	548	9	1.268	Yes	Good condition	Post-Dev. HW/D = 1.2	Retain existing
2	1399+75	I-526	RCBC	9'x5'	60	224	3.09	2.47	189.0	NRCS	96	444	11.37	1.656	No	510	11.75	1.732	No	Outlet has settled 1.5'	Post-Dev. HW/D = 1.7	11'x5' RCBC for HW/D < 1.2
3*	23+30	L-2118	RCP	(3) 48"	48	84	3.85	3	89.0	NRCS	95	176	7.99	1	No	205	9.05	1.3	No	Existing (3)36" under current L-2118 alignment	N/A	Relocated crossing. Recommendation shown
4	1355+60	I-526	RCP	24"	24	232	4.63	2.56	3.4	Rational	18.6	15.4	9.51	2.4	No	17.4	10.73	3.1	No	Good condition	Post-Dev. HW/D = 2.4	36" RCP for HW/D = 1.2
5	1378+35	I-526	RCP	24"	24	276	6.23	6.24	4.1	Rational	30	17.3	10.93	2.35	No	19.8	11.53	2.65	No	Good condition	Post-Dev. HW/D = 2.4	36" RCP for HW/D < 1.2
6	1422+00	Line 3	RCP	(3) 18"	18	84	13.55	12.4	11.0	Rational	71.1	19.3	14.99	1	No	22.6	15.15	1.1	No	No existing pipe at this location	N/A	Proposed new crossing. Recommendation shown

* Design storm for Culverts 1 and 3 is the 25-year storm

** Check storm for Culverts 1 and 3 is the 50-year storm

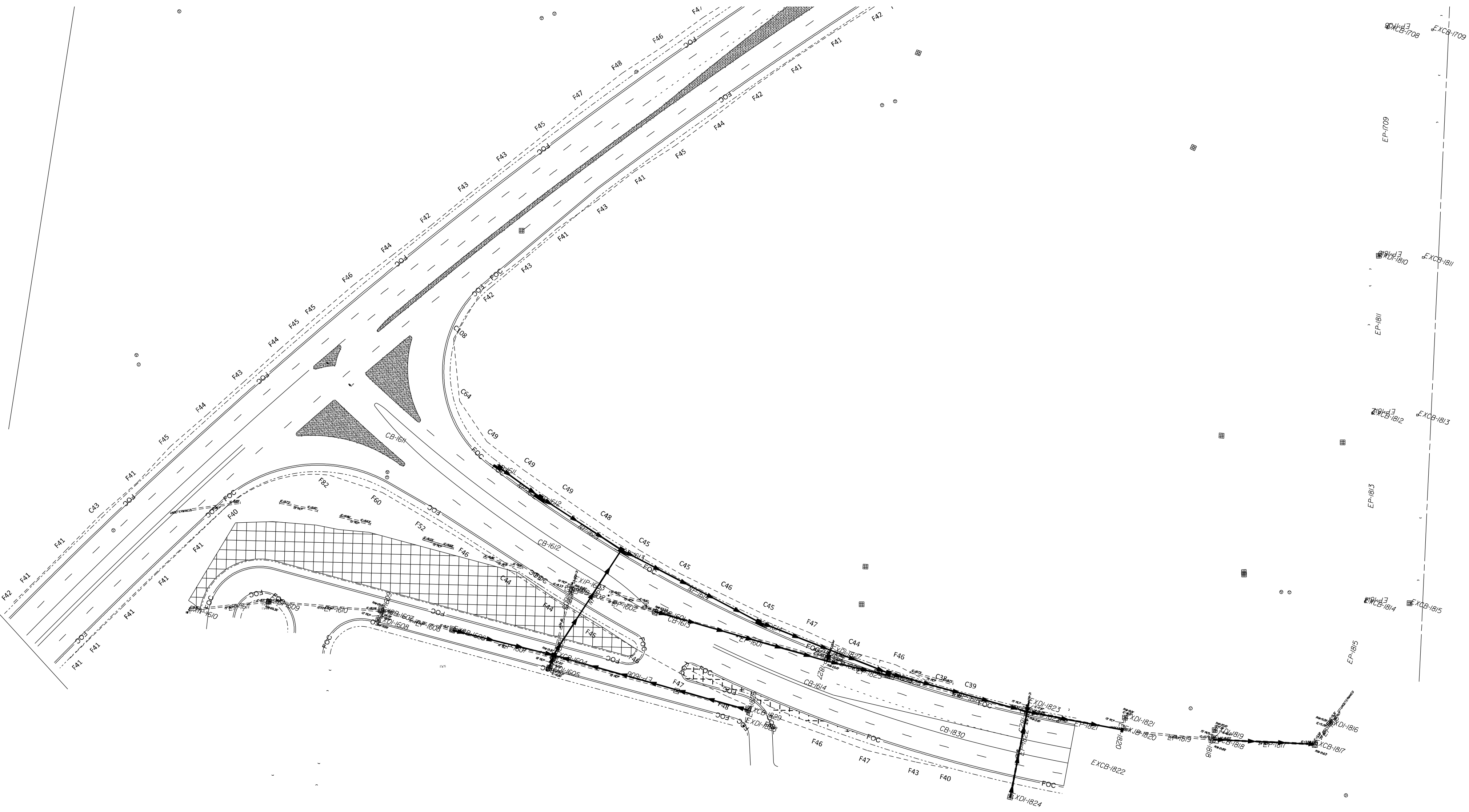
Existing Culverts and Cross-Lines with Proposed Flow Rates																
Culvert Data									Hydrology Data			10-Year Storm				Recommendation
ID	Station	Alignment	Type	Size (US/DS)	US Height (in)	Length (ft)	Inlet El.	Outlet El.	DA (ac)	Method	Tc (min)	Q (cfs)	HW Elevation (ft)	Overtopping	Exceeds Capacity?	
EP-0900	1368+00 left	I-526	RCP	18"	18	96.7	2.54	3.9	0.5	Rational	5	2.3	3.34	No	No	Possibly replace due to settlement of existing pipe. Invert out is higher than invert in by 1.5'. Otherwise retain.
EP-0902	1373+00 left	I-526	RCP	18"	18	96.4	5.51	4.84	0.6	Rational	5	2.6	6.37	No	No	Retain & Extend
EP-1000	1393+00 left	I-526	RCP	18"	18	95.5	8.09	7.03	0.9	Rational	5	3.6	9.15	No	No	Retain & Extend
EP-1100	1406+00 left	I-526	RCP	18"	18	104.6	11.44	9.63	0.7	Rational	5	2.1	12.20	No	No	Retain
EP-1200	1412+00 left	I-526	RCP	18"	18	117	12.91	12.04	0.9	Rational	5	2.4	13.74	No	No	Retain
EP-1201	1420+00 left	I-526	RCP	18"	18	135.1	14.58	13.63	1.6	Rational	5	3.9	15.70	No	No	Retain & Extend

Appendix D – Storm Drain Network Outputs

LOCATION			RUNOFF			PIPE DESIGN												
PIPE I.D.	FROM	TO	TIME OF CONC. (min)	DISCHARGE (cfs)	COMPOSITE C VALUE	INLET ELEV [ft]	OUTLET ELEV ft]	INLET HGL (ft)	OUTLET HGL (ft)	TYPE	MATERIAL	LENGTH (ft)	SLOPE (ft/ft)	DIA. (ft)	CAPACITY (cfs)	AVAILABLE FREEBOARD US (ft)	VELOCITY (ft/s)	PAY ITEM
EP-0900	EXDI-0900	EXOP-0901	5	3.98	0.9	0.14	-0.34	0.94	0.2	Pipe	Concrete	96.74	0.5	1.5	8.66	7.06	1.28	7141113
EP-0901	EXDI-0902	EXOP-0903	5	1.8	0.9	4.04	3.46	4.9	4.01	Pipe	Concrete	96.37	0.6	1.5	9.5	5.11	1.44	7141113
EP-1000	EXDI-1000	EXOP-1001	5	1.97	0.9	6.9	5.47	7.96	5.99	Pipe	Concrete	95.46	1.5	1.5	14.98	2.31	2.01	7141113
EP-1100	EXDI-1100	EXOP-1101	5	1.73	0.9	10.4	8.7	11.16	9.09	Pipe	Concrete	104.62	1.62	1.5	15.6	2.59	1.19	7141113
EP-1200	EXDI-1200	EXOP-1201	5	1.84	0.9	12.83	11.81	13.66	12.3	Pipe	Concrete	117.01	0.87	1.5	11.43	4.16	1.36	7141113
EP-1201	EXDI-1202	EXOP-1203	5	0.49	0.9	15.59	14.91	16.71	15.65	Pipe	Concrete	135.05	0.5	1.5	8.66	1.65	2.22	7141113
EP-1301	EXIP-1301	EXOP-1302	5	0.55	0.9	-1.5	-1.5	0	0	Pipe	Concrete	78.05	0	1.5	0	0	0	7141113
EP-1302	EXCB-1304	EXOP-1303	5	1.04	0.9	14.5	14.48	16.02	15.62	Pipe	Concrete	47.15	0.04	2	5.43	2.31	3.23	7141114
EP-1303	EXCB-2040	EXCB-1304	5	0.74	0.9	14.51	14.5	16.84	16.02	Pipe	Concrete	134.58	0.01	2	2.27	1.27	3.2	7141114
EP-1304	EXDI-1901	EXOP-1305	5	0.89	0.9	-2.5	-2.5	0	0	Pipe	Concrete	287.63	0	2.5	0	0	0	7141115
EP-1601	EXCB-1601	EXCB-1826	5	1.02	0.9	17.66	16.8	69.55	58.01	Pipe	Concrete	185.41	0.47	1.5	8.36	-47.32	15.96	7141113
EP-1602	EXCB-1602	EXCB-1601	5	0.81	0.9	17.75	17.66	76.78	69.55	Pipe	Concrete	88.12	0.1	1.5	3.91	-54.95	15.74	7141113
EP-1603	EXIP-1603	EXCB-1602	5	0.82	0.9	18.61	18.33	76.82	76.78	Pipe	Concrete	9.78	2.86	1.25	12.74	-56.21	1.35	7141112
EP-1605	EXDI-1605	EXCB-1604	5	0.8	0.9	18.8	17.83	84.89	84.71	Pipe	Concrete	13.85	8.53	1.5	35.75	-64.58	3.09	7141113
EP-1606	EXCB-1829	EXCB-1604	5	0.81	0.9	22.91	17.88	85.65	84.71	Pipe	Concrete	208.13	2.42	1.5	19.03	-62.85	3.68	7141113
EP-1607	EXCB-1606	EXCB-1604	5	0.94	0.9	18	17.83	86.66	84.71	Pipe	Concrete	107.5	0.16	1.5	4.87	-65.27	8.54	7141113
EP-1608	EXCB-1607	EXCB-1606	5	0.94	0.9	18.28	18.17	89.94	86.66	Pipe	Concrete	76.75	0.14	1.17	4.15	-69.07	8.2	7141141
EP-1609	EXDI-1608	EXCB-1607	5	0.52	0.83	18.54	18.4	92.12	89.94	Pipe	Concrete	9.95	1.41	1	4.92	-72.13	10.53	7141111
EP-1610	EXDI-1609	EXCB-1607	5	1.32	0.84	18.5	18.38	90.35	89.94	Pipe	Concrete	116.24	0.1	1.17	3.47	-69.99	3.61	7141141
EP-1611	EXIP-1610	EXDI-1609	5	1.01	0.86	18.41	18.17	90.74	90.35	Pipe	Concrete	83.17	0.29	1.25	4.04	-70.33	3.06	7141112
EP-1701	EXDI-1702	EXOP-1701	5	0.45	0.9	8.89	8.8	13.02	11.01	Pipe	Concrete	17.12	0.53	2.5	34.66	2.15	9	7141115
EP-1702	EXDI-1703	EXDI-1702	5	1.2	0.9	9	8.89	15.04	13.02	Pipe	Concrete	40.84	0.27	2.5	24.81	0.05	8.91	7141115
EP-1703	EXCB-1704	EXDI-1703	5	1.7	0.9	10.26	9	17.68	15.04	Pipe	Concrete	186.73	0.67	2.5	39.26	-1.79	8.81	7141115
EP-1704	EXCB-1705	EXCB-1704	5	0.69	0.9	11.05	10.51	17.69	17.68	Pipe	Concrete	47.58	1.13	1.25	8.02	-1.87	0.67	7141112
EP-1705	EXCB-1706	EXCB-1704	5	0.65	0.9	11.07	10.26	19.71	17.68	Pipe	Concrete	202.81	0.4	2.5	30.21	-3.08	8.63	7141115
EP-1706	EXCB-1707	EXCB-1706	5	0.74	0.9	12.29	11.16	19.72	19.71	Pipe	Concrete	48.32	2.34	1.25	11.51	-3.12	0.66	7141112
EP-1707	EXCB-1708	EXCB-1706	5	0.77	0.9	11.84	11.16	21.64	19.71	Pipe	Concrete	202.47	0.34	2.5	27.7	-4.22	8.44	7141115
EP-1708	EXCB-1709	EXCB-1708	5	0.47	0.9	13.16	11.84	21.66	21.64	Pipe	Concrete	47.95	2.75	1.25	12.49	-4.18	0.76	7141112
EP-1709	EXDI-1810	EXCB-1708	5	2.55	0.9	21.43	11.92	23.98	13.11	Pipe	Concrete	235.38	4.04	2.5	96.09	-5.62	8.19	7141115
EP-1801	EXCB-1801	EXCB-1914	5	1.26	0.9	-2	-2	0	0	Pipe	Concrete	203.3	0	2	0	0	0	7141114
EP-1802	EXDI-1802	EXCB-1801	5	0.85	0.9	-1.25	-1.25	0	0	Pipe	Concrete	13.13	0	1.25	0	0	0	7141112
EP-1803	EXCB-1803	EXCB-1801	5	2.04	0.9	-2	-2	0	0	Pipe	Concrete	77.66	0	2	0	0	0	7141114
EP-1804	EXIP-1804	EXCB-1803	5	2.62	0.9	-1.5	-1.5	0	0	Pipe	Concrete	91.06	0	1.5	0	0	0	7141113
EP-1805	EXCB-1805	EXCB-1803	5	1.01	0.9	-2	-2	0	0	Pipe	Concrete	71.73	0	2	0	0	0	7141114
EP-1806	EXCB-1806	EXCB-1805	5	0.5	0.9	-2	-2	0	0	Pipe	Concrete	94.47	0	2	0	0	0	7141114
EP-1807	EXCB-1807	EXCB-1806	5	0.4	0.74	-1.5	-1.5	0	0	Pipe	Concrete	32.23	0	1.5	0	0	0	7141113
EP-1808	EXCB-1808	EXCB-1807	5	1.92	0.9	-1.5	-1.5	0	0	Pipe	Concrete	156.73	0	1.5	0	0	0	7141113
EP-1809	EXCB-1809	EXCB-1808	5	1.49	0.9	-1.5	-1.5	0	0	Pipe	Concrete	71.58	0.5	1.5	0	0	0	7141113
EP-1810	EXCB-1811	EXDI-1810	5	1.08	0.9	22.73	22.68	23.99	23.98	Pipe	Concrete	46.87	0.1	1.25	2.38	-5.59	0.53	7141112
EP-1811	EXCB-1812	EXDI-1810	5	1.37	0.78	21.6	21.43	25.4	23.98	Pipe	Concrete	162.92	0.1	2.5	15.12	-6.54	8.04	7141115
EP-1812	EXCB-1813	EXCB-1812	5	0.28	0.9	14.87	13.69	25.41	25.4	Pipe	Concrete	47.67	2.48	1.25	11.84	-6.46	0.63	7141112
EP-1813	EXCB-1814	EXCB-1812	5	0.85	0.9	14.75	13.76	28.24	25.4	Pipe	Concrete	194.68	0.51	2.5	34.09	-8.49	7.87	7141115
EP-1814	EXCB-1815	EXCB-1814	5	0.73	0.9	16.32	14.87	28.37	28.24	Pipe	Concrete	47.66	3.04	1.25	13.13	-8.6	2.08	7141112
EP-1815	EXDI-1816	EXCB-1814	5	0.88	0.9	15.31	14.84	30.32	28.24	Pipe	Concrete	130.44	0.36	2.5	28.69	-11.06	7.42	7141115
EP-1816	EXCB-1817	EXDI-1816	5	1.6	0.9	15.58	15.38	32.05	30.32	Pipe	Concrete	26.77	0.75	2	22.79	-10.42	11.35	7141114
EP-1817	EXCB-1818	EXCB-1817	5	1.02	0.9	15.74	15.58	41.52	32.05	Pipe	Concrete	104.36	0.15	2	10.32	-19.63	11.07	7141114
EP-1818	EXDI-1819	EXCB-1818	5	0.44	0.9	17.19	16.47	41.52	41.52	Pipe	Concrete	10.03	7.18	1.25	20.17	-21.42	0.09	7141112
EP-1819	EXJB-1820	EXCB-1818	19.02	4.48	0.9	22.36	15.83	46.73	41.52	Pipe	Concrete	93.12	7.01	2	69.79	-24.7	10.84	7141114
EP-1820	EXDI-1821	EXJB-1820	19.08	3.66	0.9	16.37	16.3	46.74	46.73	Pipe	Concrete	13	0.5	1.25	5.32	-26.83	0.69	7141112
EP-1821	EXCB-1822	EXJB-1820	5	0.88	0.9	16.24	15.73	54.55	46.73	Pipe	Concrete	101.11	0.5	2	18.64	-32.74	10.66	7141114
EP-1822	EXDI-1824	EXCB-1822	5	0.86	0.9	22.26	16.31	54.55	54.55	Pipe	Concrete	90.08	6.61	1.5	31.46	-34.71	0.03	7141113
EP-1823	EXDI-1823	EXCB-1822	5	0.94	0.9	18.04	17.87	54.56	54.55	Pipe	Concrete	9.87	1.72	1.25	9.88	-34.52	0.76	7141112
EP-1825	EXCB-1826	EXCB-1825	5	1.22	0.9	16.52	16.46	58.01	57.07	Pipe	Concrete	64.27	0.09	2	8	-35.91	9.35	7141114
EP-1826	EXDI-1828	EXCB-1829	5	0.96	0.9	20.57	20.51	86.12	85.65	Pipe	Concrete	12.55	0.5	1.25	5.32	-63.22	4.91	7141112
EP-1827	EXDI-1827	EXCB-1826	5	0.9	0.9	18.44	18.22	58.01	58.01	Pipe	Concrete	11.78	2.32	1.25	11.47	-37.57	0.45	7141112
EP-1901	EXDI-1902	EXDI-1901	5	0.32	0.9	-3	-3	0	0	Pipe	Concrete	295.94	0	3	0	0	0	7141116
EP-1902	EXDI-1903	EXDI-1902	5	0.5	0.9	-2.5	-2.5	0	0	Pipe	Concrete	392.7	0	2.5	0	0	0	7141115
EP-1903	EXDI-1904	EXDI-1903	5	0.88	0.9	-2	-2	0	0	Pipe	Concrete	148.68	0	2	0	0	0	7141114

LOCATION			RUNOFF			PIPE DESIGN												
PIPE I.D.	FROM	TO	TIME OF CONC. (min)	DISCHARGE (cfs)	COMPOSITE C VALUE	INLET ELEV [ft]	OUTLET ELEV ft]	INLET HGL (ft)	OUTLET HGL (ft)	TYPE	MATERIAL	LENGTH (ft)	SLOPE (ft/ft)	DIA. (ft)	CAPACITY (cfs)	AVAILABLE FREEBOARD US (ft)	VELOCITY (ft/s)	PAY ITEM
EP-1904	EXDI-1905	EXDI-1904	5	0.72	0.9	-2	-2	0	0	Pipe	Concrete	251.44	0	2	0	0	0	7141114
EP-1905	EXCB-1906	EXDI-1905	5	1.2	0.9	-2.5	-2.5	0	0	Pipe	Concrete	99.27	0	2.5	0	0	0	7141115
EP-1906	EXDI-1917	EXCB-1906	10	1.09	0.9	-1.25	-1.25	0	0	Pipe	Concrete	15.12	0	1.25	0	0	0	7141112
EP-1907	EXCB-1907	EXCB-1906	5	1.5	0.9	-2	-2	0	0	Pipe	Concrete	84.57	0.5	2	0	0	0	7141114
EP-1908	EXDI-1908	EXCB-1907	102.12	21.29	0.67	-1.25	-1.25	0	0	Pipe	Concrete	11.38	0.5	1.25	0	0	0	7141112
EP-1909	EXMH-1909	EXCB-1907	5	0.82	0.8	-1.5	-1.5	0	0	Pipe	Concrete	146.78	0.5	1.5	0	0	0	7141113
EP-1910	EXCB-1910	EXCB-1907	5	0.76	0.77	-1.5	-1.5	0	0	Pipe	Concrete	87.53	0	1.5	0	0	0	7141113
EP-1911	EXIP-1911	EXCB-1910	5	2.27	0.6	-1.25	-1.25	0	0	Pipe	Concrete	10.13	0	1.25	0	0	0	7141112
EP-1912	EXCB-1912	EXCB-1910	5	2.55	0.56	-1.5	-1.5	0	0	Pipe	Concrete	104.32	0	1.5	0	0	0	7141113
EP-1913	EXDI-1913	EXCB-1912	5	3.56	0.56	-1.25	-1.25	0	0	Pipe	Concrete	14.37	0	1.25	0	0	0	7141112
EP-1914	EXCB-1914	EXCB-1906	5	2.09	0.41	-2	-2	0	0	Pipe	Concrete	121.3	0	2	0	0	0	7141114
EP-2001	EXCB-2103	EXCB-2000	5	2.4	0.35	13.24	12.86	16.61	16.18	Pipe	Concrete	170.6	0.22	2.5	22.56	3.71	4.41	7141115
EP-2002	EXCB-2000	EXCB-2001	5	3.92	0.34	12.68	12.6	16.18	16.12	Pipe	Concrete	53.71	0.15	3	30	3.37	3.07	7141116
EP-2003	EXCB-2001	EXCB-2002	5	5.45	0.69	12.7	12.53	16.12	16.06	Pipe	Concrete	52.47	0.32	3	44.24	3.43	3.08	7141116
EP-2004	EXCB-2002	EXCB-2003	12.5	8.27	0.68	12.5	12.38	16.06	15.99	Pipe	Concrete	65.12	0.18	3	33.37	3.42	3.11	7141116
EP-2005	EXCB-2004	EXCB-2003	5	2.66	0.81	15.41	15.08	16.06	15.99	Pipe	Concrete	78.21	0.42	3	50.49	3.66	0.31	7141116
EP-2006	EXCB-2005	EXCB-2004	5	0.72	0.9	15.81	15.54	16.48	16.06	Pipe	Concrete	88.03	0.31	1.5	6.78	3.24	0.85	7141113
EP-2007	EXCB-2006	EXCB-2005	5	1.06	0.9	18.12	15.81	18.45	15.96	Pipe	Concrete	64.38	3.59	1.5	23.19	1.27	0.25	7141113
EP-2008	EXDI-2007	EXCB-2005	5	0.58	0.17	16.79	16.67	17.28	16.96	Pipe	Concrete	9.33	1.29	1.25	8.54	1.63	0.68	7141112
EP-2009	EXDI-2008	EXCB-2003	5	0.65	0.9	16.23	15.21	17.65	15.93	Pipe	Concrete	96.87	1.05	2	27.05	2.04	2.22	7141114
EP-2010	EXDI-2009	EXDI-2008	5	1.01	0.48	16.81	16.41	17.91	17.65	Pipe	Concrete	170.86	0.23	2	12.76	2.11	2.06	7141114
EP-2012	EXMH-2010	EXDI-2009	5	0.11	0.45	17.7	16.85	18.78	17.65	Pipe	Concrete	107.41	0.79	1.25	6.7	2.23	3.74	7141112
EP-2013	EXIP-2011	EXMH-2010	5	0.85	0.52	19.35	17.77	19.56	17.86	Pipe	Concrete	33.85	4.67	1.25	16.26	1.09	0.13	7141112
EP-2014	EXCB-2012	EXMH-2010	5	0.93	0.31	17.81	17.71	19.19	18.78	Pipe	Concrete	24.57	0.41	1.25	4.8	2.01	3.65	7141112
EP-2015	EXCB-2013	EXDI-2009	5	0.05	0.1	16.98	16.85	18.04	17.91	Pipe	Concrete	61.48	0.21	2	12.12	3.12	1.17	7141114
EP-2016	EXCB-2003	EXMH-2015	5	0.56	0.31	12.41	11.23	15.99	15.37	Pipe	Concrete	71.7	1.65	3	99.71	3.53	3.89	7141116
EP-2017	EXDI-2014	EXMH-2015	6.4	6.03	0.65	12.63	11.23	15.47	15.37	Pipe	Concrete	25.87	5.41	1.25	17.51	1.03	2.06	7141112
EP-2018	EXMH-2015	EXOP-2016	5	0.19	0.1	11.11	9.96	15.37	11.48	Pipe	Concrete	195.9	0.59	3	59.55	1.99	3.98	7141116
EP-2019	EXCB-2017	EXCB-2018	5	0.86	0.19	16.47	16.17	17.01	16.96	Pipe	Concrete	70	0.43	1.5	8.01	2.79	0.5	7141113
EP-2020	EXCB-2018	EXCB-2019	5	0.21	0.26	16.16	15.96	16.96	16.73	Pipe	Concrete	137.28	0.15	1.5	4.67	2.68	0.98	7141113
EP-2021	EXCB-2019	EXCB-2020	5	0.56	0.3	15.86	15.6	16.73	16.58	Pipe	Concrete	140.97	0.18	1.5	5.26	2.57	1.46	7141113
EP-2022	EXCB-2020	EXCB-2021	5	0.09	0.2	15.51	15.38	16.58	16.33	Pipe	Concrete	119.93	0.11	1.5	4.03	2.37	2.08	7141113
EP-2023	EXCB-2021	EXCB-2022	49.6	1.04	0.14	15.37	15.05	16.33	15.86	Pipe	Concrete	101.13	0.32	1.5	6.89	2.28	2.53	7141113
EP-2024	EXCB-2022	EXCB-2023	5	0.09	0.16	14.56	14.54	15.57	15.35	Pipe	Concrete	35.33	0.06	2	6.26	2.85	1.67	7141114
EP-2025	EXCB-2023	EXCB-2024	5	0.28	0.3	14.49	13.25	15.34	13.79	Pipe	Concrete	55.44	2.22	2	39.31	2.99	1.75	7141114
EP-2026	EXCB-2024	EXOP-2025	47.4	0.84	0.14	13.21	11.99	14.18	12.55	Pipe	Concrete	55.21	2.2	2	39.13	3.91	1.89	7141114
EP-2027	EXCB-2026	EXOP-2027	46.5	0.58	0.13	-1.25	-1.25	0	0	Pipe	Concrete	18.71	0	1.25	0	0	0	7141112
EP-2028	EXIP-2028	EXMH-2029	46.9	1.18	0.27	16.08	16	18.05	18.01	Pipe	Concrete	94.77	0.08	2	7.66	0.05	1.18	7141114
EP-2029	EXIP-2030	EXMH-2029	5	2.53	0.37	16.55	16.51	18.15	18.01	Pipe	Concrete	33.33	0.12	1.25	2.61	0.4	2.33	7141112
EP-2030	EXMH-2029	EXDI-2032	5	0.05	0.1	16	15.82	18.01	17.95	Pipe	Concrete	33.42	0.54	2	19.35	0.58	2.07	7141114
EP-2031	EXCB-2031	EXDI-2032	7.2	4.47	0.58	16.29	16.22	17.95	17.95	Pipe	Concrete	17.64	0.39	1.5	7.69	1.34	0.41	7141113
EP-2032	EXDI-2032	EXDI-2033	5	0.58	0.18	15.82	15.71	17.95	17.88	Pipe	Concrete	65.33	0.17	2	10.82	0.72	2.17	7141114
EP-2033	EXDI-2034	EXDI-2033	5	1.49	0.4	16.27	16.01	17.92	17.88	Pipe	Concrete	20.36	1.28	2	29.79	1.48	1.42	7141114
EP-2034	EXDI-2033	EXCB-2035	5	0.24	0.26	15.61	15.48	17.88	17.55	Pipe	Concrete	84.73	0.15	2	10.33	0.48	2.85	7141114
EP-2035	EXCB-2035	EXCB-2036	5	0.39	0.16	15.48	15.14	17.55	17.38	Pipe	Concrete	108.06	0.31	2	14.78	0.88	3.01	7141114
EP-2036	EXIP-2037	EXCB-2036	5	1.66	0.37	16.05	15.25	17.4	17.38	Pipe	Aluminum	34.68	2.3	1	6.3	1.19	0.86	7144512
EP-2037	EXIP-2038	EXCB-2036	5	3.76	0.71	17.46	15.29	17.94	15.45	Pipe	Plastic	21.63	10	1.25	23.81	1.68	0.64	7141794
EP-2038	EXCB-2036	EXCB-2039	44.9	0.34	0.17	15.14	14.58	17.38	17.29	Pipe	Concrete	69.43	0.81	2	23.66	1.21	2.82	7141114
EP-2039	EXCB-2039	EXCB-2040	49	0.28	0.1	14.58	14.51	17.29	16.84	Pipe	Concrete	305.39	0.02	2	3.99	1.33	2.97	7141114
EP-2040	EXDI-2041	EXCB-2040	5	2.1	0.6	14.87	14.51	16.85	16.84	Pipe	Concrete	9.88	3.65	1.5	23.37	0.58	1.46	7141113
EP-2041	EXDI-2042	EXDI-2041	5	0.16	0.12	16.25	14.87	17.16	16.85	Pipe	Concrete	186.31	0.74	1.25	6.48	1.24	1.68	7141112
EP-2042	EXDI-2043	EXDI-2042	47.1	3.7	0.58	16.85	16.25	17.19	16.54	Pipe	Concrete	107.18	0.56	1.25	5.63	1.44	0.51	7141112
EP-2043	EXDI-2044	EXDI-2043	47	2.86	0.63	17	16.85	17.36	17.19	Pipe	Concrete	49.65	0.3	1	2.28	1.44	0.5	7141111
EP-2101	EXCB-2101	EXCB-2102	74.9	0.68	0.38	13.61	13.54	17.22	16.76	Pipe	Concrete	71.56	0.1	2.5	15.12	3.23	4.34	7141115
EP-2102	EXCB-2102	EXCB-2103	76.5	0.78	0.13	13.41	13.35	16.76	16.61	Pipe	Concrete	60.66	0.1	2.5	15.12	3.62	4.37	7141115
NP-1612	CB-1611	CB-1612				-1.5	-1.5	0	0	Pipe	Concrete	47.94	0	1.5	0	1.65	2.22	7141113
NP-1613	CB-1612	CB-1613				-1.5	-1.5	0	0	Pipe	Concrete	95.71	0	1.5	0	1.65	2.22	7141113
NP-1614	CB-1613	CB-1614				-1.5	-1.5	0	0	Pipe	Concrete	155.85	0	1.5	0	1.65	2.22	7141113

LOCATION			RUNOFF			PIPE DESIGN												
PIPE I.D.	FROM	TO	TIME OF CONC. (min)	DISCHARGE (cfs)	COMPOSITE C VALUE	INLET ELEV [ft]	OUTLET ELEV ft]	INLET HGL (ft)	OUTLET HGL (ft)	TYPE	MATERIAL	LENGTH (ft)	SLOPE (ft/ft)	DIA. (ft)	CAPACITY (cfs)	AVAILABLE FREEBOARD US (ft)	VELOCITY (ft/s)	PAY ITEM
NP-1615	CB-1614	CB-1830				-1.5	-1.5	0	0	Pipe	Concrete	140.01	0	1.5	0	1.65	2.22	7141113
NP-1616	CB-1830	EXCB-1822				-2	-2	0	0	Pipe	Concrete	146.71	0	2	0	1.65	2.22	7141114
NP-1617	EXCB-1604	CB-1613				-2	-2	0	0	Pipe	Concrete	125.37	0	2	0	1.65	2.22	7141114


EXCB-1708
EXCB-1709
EP-1708
EP-1709
EXDI-1810
EP-1810
EXCB-1811
EP-1811
EXCB-1812
EP-1812
EXCB-1813
EP-1813
EXCB-1814
EP-1814
EXCB-1815
EP-1815
EXDI-1816
EXCB-1817
EP-1817
EXCB-1818
EP-1818
EXDI-1819
EP-1819
EXJB-1820
EP-1820
EXDI-1821
EP-1821
EP-1822
EXCB-1822
EXDI-1823
EXDI-1824
EP-1825
EXDI-1827
EP-1827
EXDI-1828
EXCB-1829
CB-1830
CB-1611
CB-1612
CB-1613
CB-1614
NP-1613
NP-1614
EP-1601
EP-1602
EXIP-1603
EXCB-1604
EXDI-1605
EP-1606
EP-1607
EXCB-1607
EP-1608
EXDI-1608
EXDI-1609
EP-1610
EXIP-1610
EP-1611
FOC
UNDETERMINED
15" RCP
18" RCP
24" RCP
F40
F41
F42
F43
F44
F45
F46
F47
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C45
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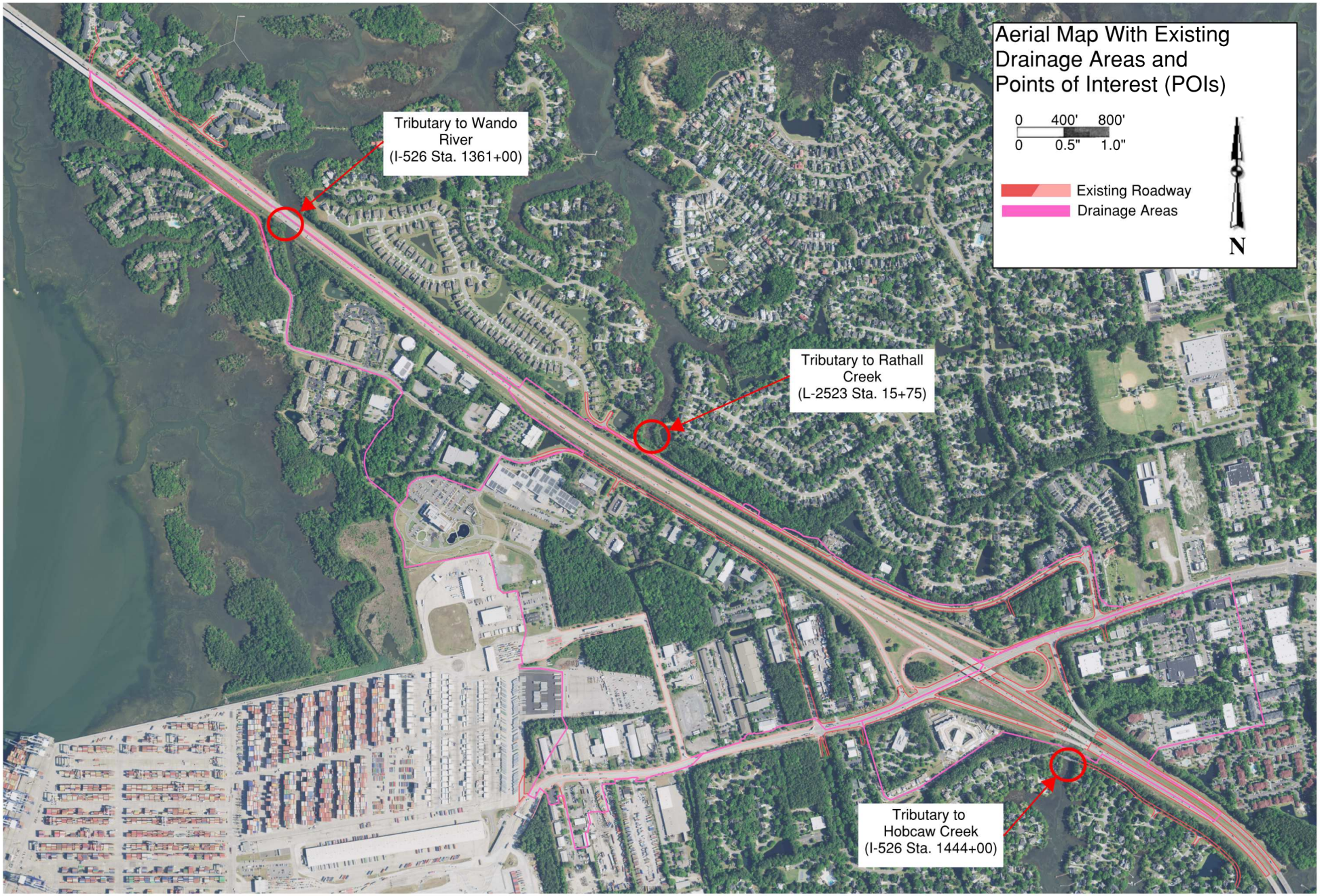
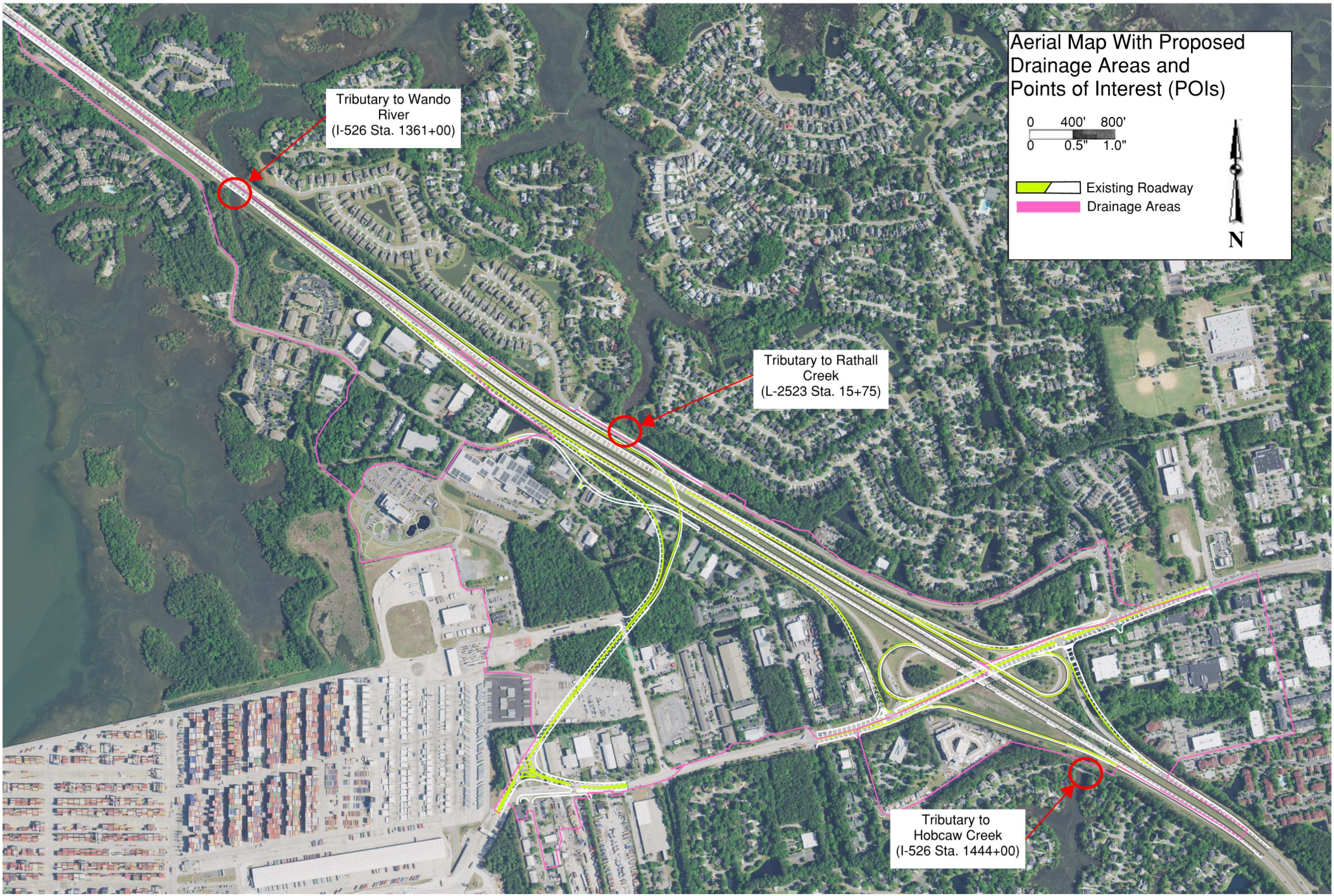
C49
C64
C108


Aerial Map With Existing Drainage Areas and Points of Interest (POIs)
0 400' 800'
0 0.5" 1.0"
Existing Roadway
Drainage Areas
N
Tributary to Wando River (I-526 Sta. 1361+00)
Tributary to Rathall Creek (L-2523 Sta. 15+75)
Tributary to Hobcaw Creek (I-526 Sta. 1444+00)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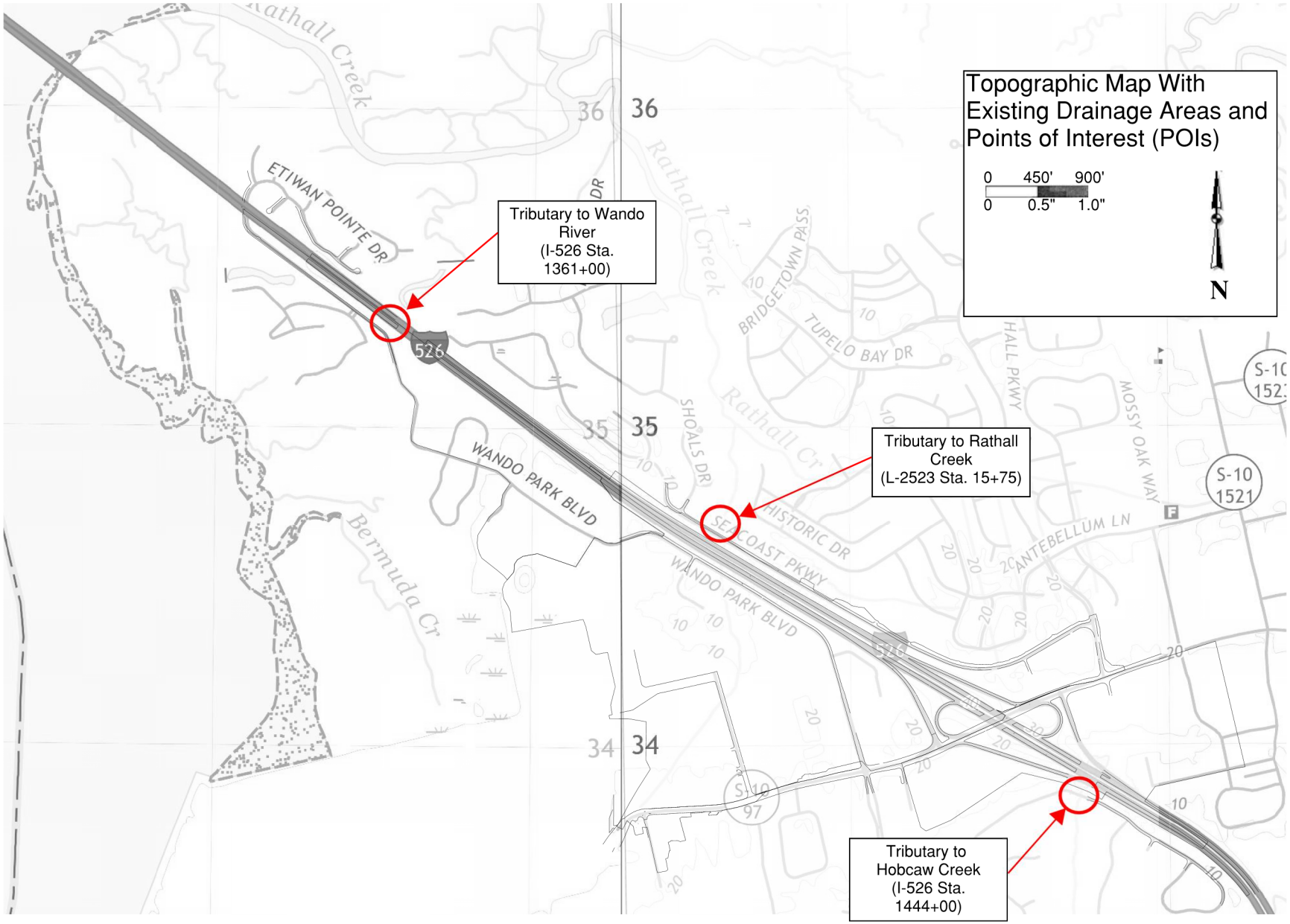
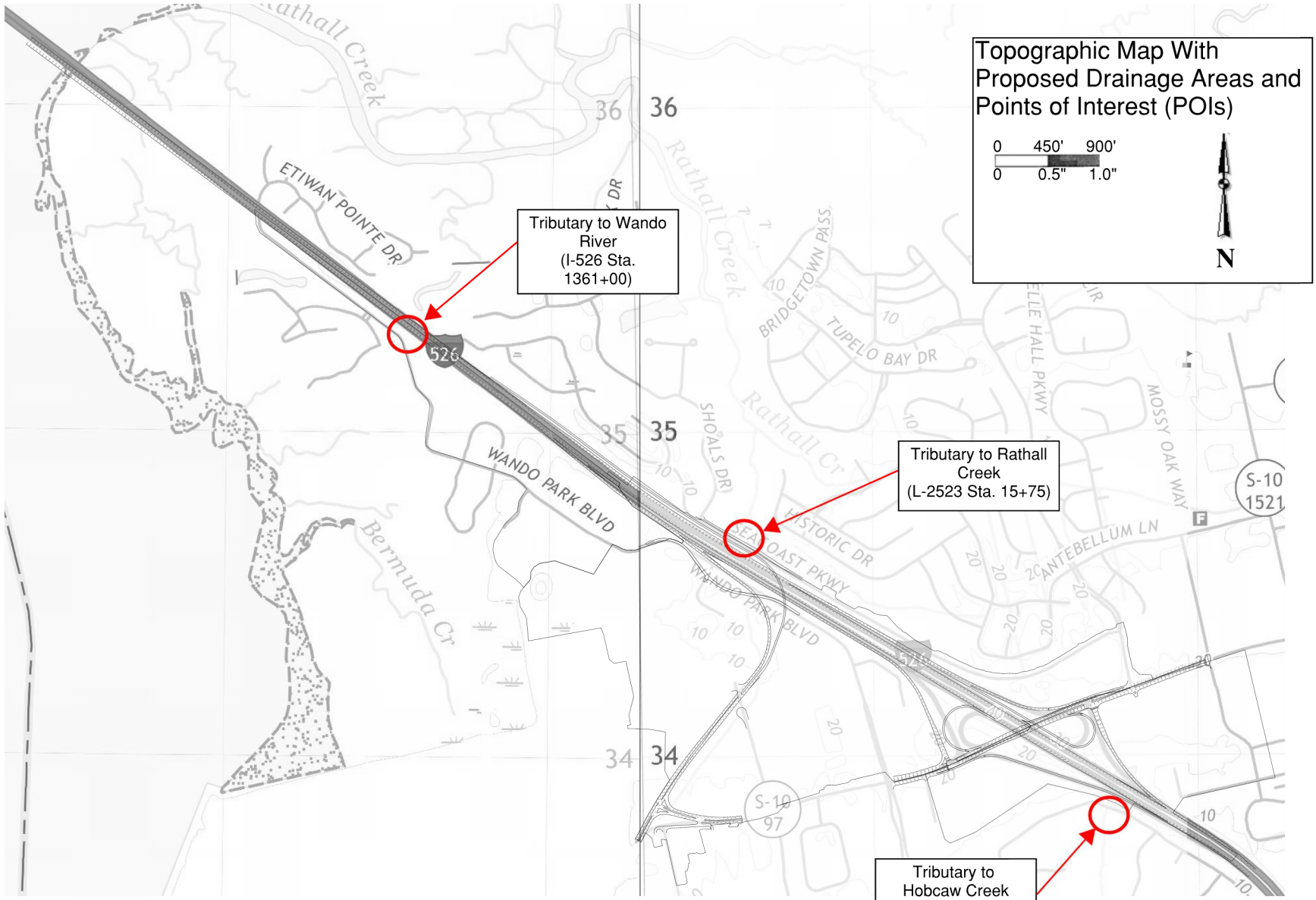

Topographic Map With Existing Drainage Areas and Points of Interest (POIs)
0 450' 900'
0 0.5" 1.0"
N
Tributary to Wando River (I-526 Sta. 1361+00)
Tributary to Rathall Creek (L-2523 Sta. 15+75)
Tributary to Hobcaw Creek (I-526 Sta. 1444+00)
ETIWAN POINTE DR
WANDO PARK BLVD
SEACOAST PKWY
HISTORIC DR
ANTEBELLUM LN
MOSSY OAK WAY
TUPELO BAY DR
BRIDGETOWN PASS
SHOALS DR
HALL PKWY
Rathall Creek
Bermuda Cr
526
S-10 1521
S-10 97
36
35
34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S-10 1521
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526
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35
34

NOTES TO USERS

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rmation Services
/NGS12
Geodetic Survey
#9202
t-West Highway
ring, Maryland 20910-3282
-3242

n current elevation, description, and/or location information for **bench** hown on this map, please contact the Information Services Branch National Geodetic Survey at **(301) 713-3242**, or visit its website at w.ngs.noaa.gov.

ap information shown on this FIRM was provided in digital format by n County, South Carolina.

updated topographic information, this map reflects more detailed and up- **tream channel configurations and floodplain delineations** than those the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Data tables may reflect stream channel distances that differ from what is the map. Also, the road to floodplain relationships for unrevised streams r from what is shown on previous maps.

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e questions about this map or questions concerning the National Flood Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or EMA website at https://www.fema.gov/national-flood-insurance-program.

DNR

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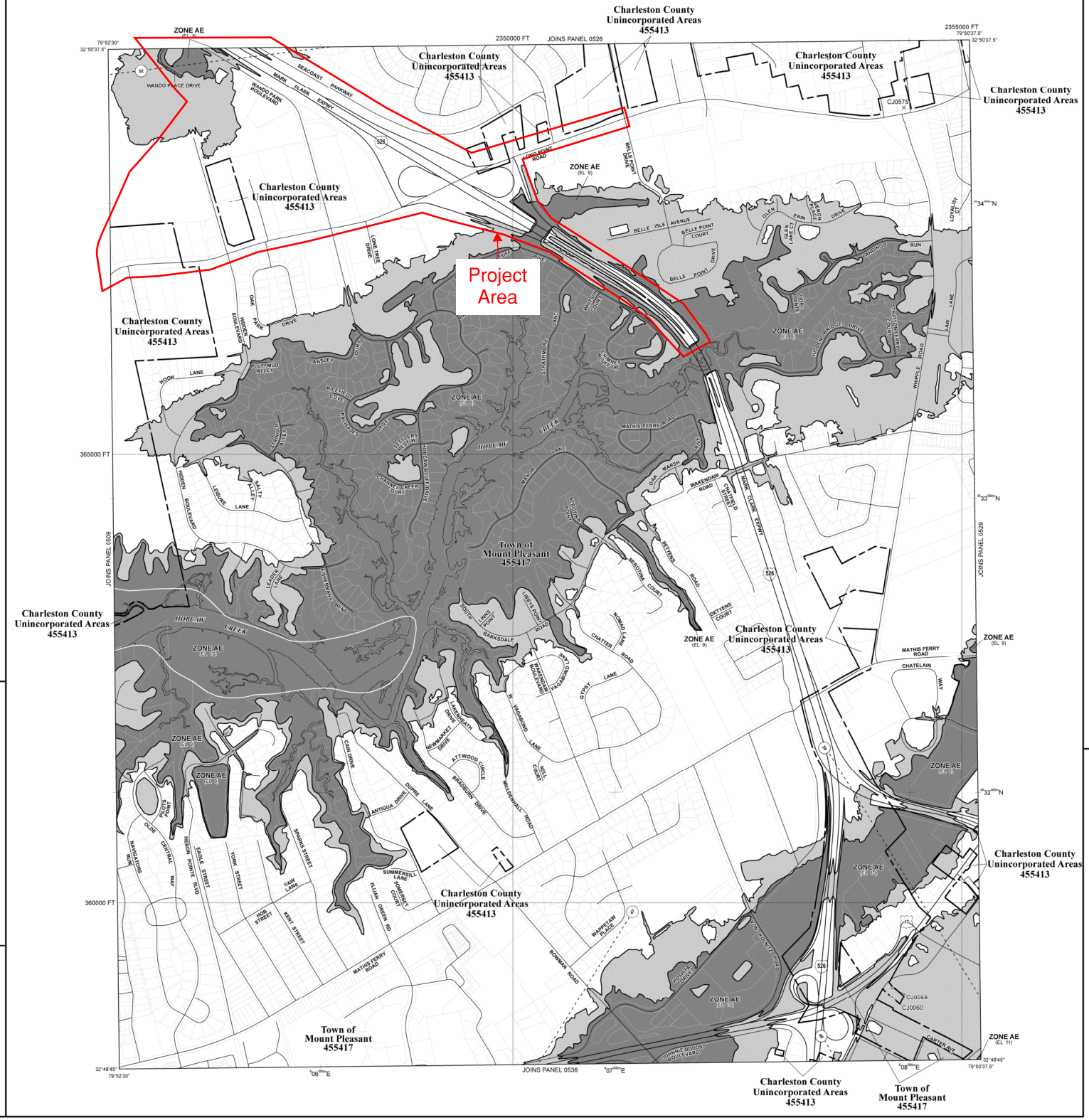
http://www.dnr.state.sc.us/



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is th that has a 1% chance of being equaled or exceeded in any given year. The Flood Hazard Area is the area subject to flooding by the 1% annual chance flood of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. Th Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping te average depths determined. For areas of alluvial fan flooding, ve also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% chance flood by a flood control system that was subse decertified. Zone AR indicates that the former flood control sys being restored to provide protection from the 1% annual cha greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a flood protection system under construction; no Base Flood Ele determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Ele determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that kept free of encroachment so that the 1% annual chance flood can be carried substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chanc with average depths of less than 1 foot or with drainage areas le 1 square mile; and areas protected by levees from 1% annual flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

Floodplain boundary
Floodway boundary
Zone D Boundary
Boundary dividing Special Flood Hazard Area Zones a
boundary dividing Special Flood Hazard Areas of diffe
Base Flood Elevations, flood depths and flood v
Limit of Moderate Wave Action
513 (EL 987) Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line
23 — 23 Transect line
Culvert, Flume, Penstock, or Aqueduct
Bridge
Footbridge
97° 07' 30", 32° 22' 30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
76 000mE 1000-meter Universal Transverse Mercator grid ticks, zone 1
600000 FT 5000-foot grid values: South Carolina State Plane coordinate system (FIPSZONE 3900), Lambert Conformal Conic project
DX5510 Bench mark (see explanation in Notes to Users section of th FIRM panel)
M1.5 River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
November 17, 2004

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 29, 2021 – to add Base Flood Elevations and Special Flood Hazard Areas; to char Base Flood Elevations and Special Flood Hazard Areas; to incorporate previously issued Le of Map Revision; to reflect the effects of coastal erosion, revised shoreline, and updated topographic information; and to update corporate limits, the effects of wave action, and road road names.

For community map revision history prior to countywide mapping, refer to the Communi Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insura agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0528K

FIRM
FLOOD INSURANCE RATE

CHARLESTON COUNTY, SOUTH CAROLINA
AND INCORPORATED AREAS

PANEL 528 OF 855

(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
CHARLESTON COUNTY	455413	0528
MOUNT PLEASANT, TOWN OF	455417	0528

Notice to User: The **Map Number** shown belo used when placing map orders; the **Communi** shown above should be used on insurance applica subject community.

MAP NU
450190

MAP RE
JANUARY 2

Federal Emergency Management

NOTES TO USERS

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one category has been divided by a **Limit of Moderate Wave Action.** /A represents the approximate landward limit of the 1.5-foot breaking effects of wave hazards between the VE Zone and the LiMWA (or the shoreline and the LiMWA for areas where VE Zones are not will be similar to, but less severe than those in the VE Zone.

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may reflect more detailed or up-to-date **stream channel configurations** e shown on the previous FIRM. The floodplains and floodways that eferred from the previous FIRM may have been adjusted to conform to w stream channel configurations and improved topographic data. The selines depicted on this map represent the hydraulic modeling baselines n the flood profiles and Floodway Data Tables if applicable, in the FIS s a result, the profile baselines may deviate significantly from the new channel representation and may appear outside of the floodplain.

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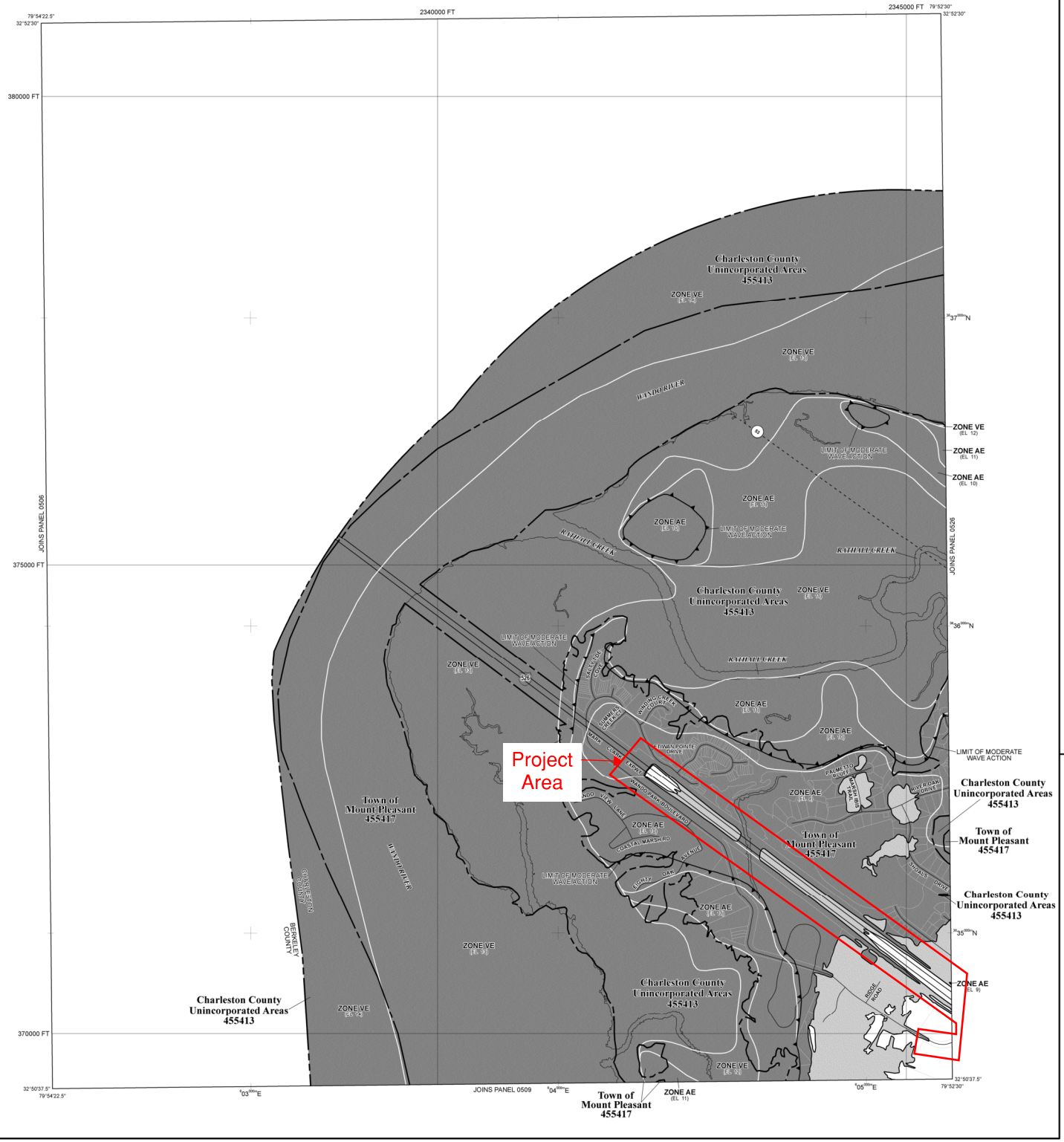

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Boundary dividing Special Flood Hazard Area Zones a
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DX5510 Bench mark (see explanation in Notes to Users section of th FIRM panel)
M1.5 River Mile

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November 17, 2004

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NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0507K

FIRM
FLOOD INSURANCE RATE

CHARLESTON COUNTY, SOUTH CAROLINA AND INCORPORATED AREAS

PANEL 507 OF 855

(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
CHARLESTON COUNTY	455413	0507
MOUNT PLEASANT, TOWN OF	455417	0507

Notice to User. The **Map Number** shown belo used when placing map orders; the **Communi** shown above should be used on insurance applica subject community.

MAP NU
450190

MAP RE
JANUARY 2

Federal Emergency Management

STORMWATER MANAGEMENT: PRE-DEVELOPMENT INPUTS

I-526 & LPR — **PRE-DEVELOPMENT OUTFALL DISCHARGE**

DSN BY: ERP
CHK BY: ___
DATE: ########

CDM Smith — listen. think. deliver.

Culvert DA = 0.358 Sq. MI (190 Ac)

NCRS TR-55 Method

Tc = 79 min

Surface	CN*	Area (Ac)	AxCN
Commercial B	92	30.539	2,809.59
Commercial C	94	2.966	278.80
Commercial D	95	81.971	7,787.25
Open Space B	61	3.889	237.23
Open Space C	74	4.781	353.79
Open Space D	80	23.251	1,860.08
Gravel B	85	2.223	188.96
Gravel D	91	4.328	393.85
Woods B	66	0.371	24.49
Woods D	83	28.832	2,393.06
Impervious B	98	8.456	828.69
Impervious C	98	3.975	389.55
Impervious D	98	29.945	2,934.61
Residential B	70	1.561	109.27
Residential D	85	1.877	159.55
Total Drainage Area (Ac) =		**228.97**	20748.75
Composite CN =	**90.62**		
Rounded CN =	**91**		

	TR-55	Rounded TR-55	
Q2=	299.69	300	cfs
Q5=	405.43	405	cfs
Q10=	490.86	491	cfs
Q25=	609.61	610	cfs
Q50=	704.84	705	cfs
Q100=	807.35	807	cfs

* from Win-TR55

Bridge DA = 0.1 Sq. MI (64 Ac)

Rational Method

Tc = 82 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	10.540	9.49
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	28.966	20.28
Grass Shoulders/Medians	0.25	8.349	2.09
Woodland & Forest	0.10	16.099	1.61
Total Drainage Area (Ac) =		**63.95**	33.46
Composite C =	**0.52**		

	Rational	Rounded Rational		*i*
Q2=	53.74	54	cfs	1.62
Q5=	66.33	66	cfs	1.99
Q10=	79.32	79	cfs	2.39
Q25=	104.54	105	cfs	2.86
Q50=	130.92	131	cfs	3.28
Q100=	154.13	154	cfs	3.71

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Trib to Hobcaw Creek DA = 0.125 Sq. MI (80 Ac)

Rational Method

Tc = 55 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	12.109	10.90
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	44.644	31.25
Grass Shoulders/Medians	0.25	12.031	3.01
Woodland & Forest	0.10	11.349	1.13
Total Drainage Area (Ac) =		**80.13**	46.29
Composite C =	**0.58**		

	Rational	Rounded Rational		*i*
Q2=	99.99	100	cfs	2.15
Q5=	120.66	121	cfs	2.60
Q10=	141.96	142	cfs	3.05
Q25=	183.08	183	cfs	3.58
Q50=	226.28	226	cfs	4.06
Q100=	262.89	263	cfs	4.53

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/rainfall_intensity.pdf

Frequency (years)	Rational Coefficients a	b	c
2	72.69	11.39	0.839
5	61.16	9.846	0.7573
10	55.13	8.412	0.6972
25	45.53	6.257	0.6179
50	42.68	5.28	0.5741
100	39.53	4.297	0.5309

Recurrence Interval	Cf
2	1
5	1
10	1
25	1.1
50	1.2
100	1.25

Charleston, SC

Frequency	24 Hr Rainfall (in)
2	4.3
5	5.5
10	6.6
25	8.0
50	9.2
100	10.4

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/appendixF_SC_Rainfall_Data.pdf

	Culverts															
	Commercial B	Commercial C	Commercial D	Open Space B	Open Space C	Open Space D	Gravel B	Gravel D	Woods B	Woods D	Imp B	Imp C	Imp D	Res B	Res D	Total Ac.
Sum	30.549	2.966	81.971	3.889	4.781	23.251	2.223	4.328	0.371	28.832	8.456	3.975	29.945	1.561	1.877	228.972
	7.786	1.638	2.037	0.482	2.451	0.400	2.223	1.146	0.271	4.536	0.112	1.556	1.132	1.561	1.877	
	3.186	0.655	30.847	1.329	0.437	3.080		1.109	0.100	19.231	0.094	0.133	1.045			
	0.501	0.674	4.459	0.262	0.068	2.336		0.343		2.684	0.553	1.207	0.301			
	2.870		24.703	0.289	1.062	0.840		1.731		2.381	1.261	0.346	0.406			
	0.148		11.669	0.190	0.763	1.683					2.106	0.675	1.165			
	0.020		0.199	0.710		1.599					2.947	0.057	2.513			
	0.630		0.120	0.627		1.158					1.383		0.633			
	7.221		0.022			0.145							1.092			
	0.592		2.483			1.040							0.206			
	0.233		0.193			3.345							1.086			
	0.293		0.183			5.900							4.178			
	1.952		1.136			0.133							0.028			
	0.220		1.278			0.472							0.238			
	4.899		0.045			0.037							0.118			
			2.597			1.084							0.057			
													3.617			
													4.028			
													0.245			
													0.216			
													7.644			
Count	14	3	15	7	5	15	1	4		4	7	6	20	1	1	103

	Bridge												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	28.966			8.349			0		16.099		10.54			63.954
	16.052			7.476			0.000		5.665		0.604			
	5.571			0.059					10.434		3.659			
	7.343			0.814							4.679			
											1.598			
Count	3			3			1		2		4			13
Total Area by Type	28.966			8.349			0		16.099		10.54			

	Trib to Hobcaw Creek												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	44.644			12.031			0		11.349		12.109			80.133
	31.882			0.275			0.000		9.093		4.860			
	11.886			2.233					1.080		3.756			
	0.876			0.212					0.622		3.359			
				1.491					0.221		0.134			
				0.641					0.095					
				3.540					0.238					
				0.889										
				1.521										
				1.194										
				0.035										
Count	3			10			1		6		4			24
Total Area by Type	44.644			12.031			0		11.349		12.109			

I-526 & Long Point Rd

Predevelopment to 10'x5 RBC (Seacoast Pkwy)

DRAINAGE AREA= 0.358 SQ. MILES
229.0 Acres

DSN BY: ENR
CHK BY: ___
DATE: 3/2/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	55	21	20.6	0.0073	4.30	Dense Grass (weeping, love, blue, buffalo, blue grama, and native grass mixtures)	0.240		0.08	11.4	
Shallow Concentrated	2	160	20.6	17	0.0225		Unpaved (shallow concentrated flow)	0.491		1.00	2.7	
Shallow Concentrated	4	953	14	9	0.0052		Unpaved (shallow concentrated flow)	0.491		1.17	13.5	wooded area, no defined chnl
Open Channel	3	1056	17	14	0.0028		Vegetation Lined	0.085	2	0.59	29.9	Ex 2:1 V-ditch
Open Channel	5	1309	9	2	0.0053		Vegetation Lined	0.085	3	1.06	20.6	Ex 5:1 V-ditch
Open Channel	7	55	2.58	1.36	0.0222		Vegetation Lined	0.085	4	2.61	0.4	
Closed Conduits	6	184	1.96	1.36	0.0033		Concrete Pipe	0.013	3	5.40	0.6	Ex 9'x5' RCBC
Closed Conduits												
Closed Conduits												
										Total	79.1	minutes
										Use	**79**	minutes
											1.317	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Station 1361 Bridge

DRAINAGE AREA= 0.100 SQ. MILES
64.0 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	16	15	0.0100	4.30	Woods: Light under brush	0.400		0.07	24.4	
Shallow Concentrated	2	490	15	11	0.0082	4.30	Unpaved (shallow concentrated flow)	0.491		1.00	8.2	
Shallow Concentrated	3	40	11	10	0.0250	4.30	Paved (shallow concentrated flow)	0.619		3.23	0.2	
Shallow Concentrated	4	520	10	7	0.0058	4.30	Unpaved (shallow concentrated flow)	0.491		1.23	7.0	
Open Channel	5	1475	7	3	0.0027		Vegetation Lined	0.085	2	0.58	42.7	Ex 2:1 V-ditch
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	82.6	minutes
										Use	**82**	minutes
											1.367	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Trib to Hobcaw Creek

DRAINAGE AREA= 0.125 SQ. MILES
80.1 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	21	18	0.0300	4.30	Woods: Light under brush	0.400		0.11	15.8	
Shallow Concentrated	2	820	18	13	0.0061	4.30	Paved (shallow concentrated flow)	0.619		1.00	13.7	
Shallow Concentrated	3	1260	13	5	0.0063	4.30	Unpaved (shallow concentrated flow)	0.491		1.29	16.3	
Open Channel	5	375	5	4	0.0027	4.30	Natural Channel Irregular Section with pools 1	0.095	3	0.67	9.3	Wetland Trib to Hobcaw Creek
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	55.0	minutes
										Use	**55**	minutes
											0.917	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

STORMWATER MANAGEMENT: POST-DEVELOPMENT INPUTS

I-526 & LPR — **POST-DEVELOPMENT OUTFALL DISCHARGE**

DSN BY: ERP
CHK BY: ___
DATE: ########

CDM Smith — listen. think. deliver.

L-2523 Sta. 15+75 DA = 0.3 Sq. MI (189 Ac)

Rational Method

Tc = 79 min

Surface	CN*	Area (Ac)	AxC
Commercial B	92	15.688	1,443.30
Commercial C	94	2.944	276.74
Commercial D	95	81.971	7,787.25
Open Space B	61	3.889	237.23
Open Space C	74	3.503	259.22
Open Space D	80	17.407	1,392.56
Gravel B	85	2.223	188.96
Gravel D	91	4.329	393.94
Woods B	66	0.000	--
Woods D	83	28.384	2,355.87
Impervious B	98	13.527	1,325.65
Impervious C	98	3.975	389.55
Impervious D	98	47.694	4,674.01
Residential B	70	1.561	109.27
Residential D	85	1.877	159.55
Total Drainage Area (Ac) =		**228.97**	20993.08
Composite CN =	**91.68**		
Rounded CN =	**92**		

	Rational	Rounded Rational	
Q2=	307.22	307	cfs
Q5=	411.56	412	cfs
Q10=	497.69	498	cfs
Q25=	614.34	614	cfs
Q50=	711.68	712	cfs
Q100=	812.17	812	cfs

* from Win-TR55

I-526 Sta. 1361+00 DA = 0.1 Sq. MI (64 Ac)

Rational Method

Tc = 82 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	11.465	10.32
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	28.966	20.28
Grass Shoulders/Medians	0.25	7.424	1.86
Woodland & Forest	0.10	16.099	1.61
Total Drainage Area (Ac) =		**63.95**	34.06
Composite C =	**0.53**		

	Rational	Rounded Rational		*i*
Q2=	54.77	55	cfs	1.62
Q5=	67.61	68	cfs	1.99
Q10=	80.84	81	cfs	2.39
Q25=	106.55	107	cfs	2.86
Q50=	133.44	133	cfs	3.28
Q100=	157.09	157	cfs	3.71

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Trib to Hobcaw Creek DA = 0.125 Sq. MI (80 Ac)

Rational Method

Tc = 55 min

Surface	C Factor*	Area (Ac)	AxC
Pavement	0.90	14.086	12.68
Gravel Surfaces	0.55	0.000	--
Industrial/Residential Areas	0.70	44.644	31.25
Grass Shoulders/Medians	0.25	10.054	2.51
Woodland & Forest	0.10	11.349	1.13
Total Drainage Area (Ac) =		**80.13**	47.58
Composite C =	**0.59**		

	Rational	Rounded Rational		*i*
Q2=	101.72	102	cfs	2.15
Q5=	122.74	123	cfs	2.60
Q10=	144.40	144	cfs	3.05
Q25=	186.24	186	cfs	3.58
Q50=	230.18	230	cfs	4.06
Q100=	267.42	267	cfs	4.53

* from SCDOT's "Requirements for Hydraulic Design Studies" (2009), flat slopes < 2%

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/rainfall_intensity.pdf

Frequency (years)	Rational Coefficients a	b	c
2	72.69	11.39	0.839
5	61.16	9.846	0.7573
10	55.13	8.412	0.6972
25	45.53	6.257	0.6179
50	42.68	5.28	0.5741
100	39.53	4.297	0.5309

Recurrence Interval	Cf
2	1
5	1
10	1
25	1.1
50	1.2
100	1.25

Charleston, SC

Frequency	24 Hr Rainfall (in)
2	4.3
5	5.5
10	6.6
25	8.0
50	9.2
100	10.4

Source: https://www.scdot.org/business/technicalPDFs/hydraulic/appendixF_SC_Rainfall_Data.pdf

	Culverts															
	Commercial B	Commercial C	Commercial D	Open Space B	Open Space C	Open Space D	Gravel B	Gravel D	Woods B	Woods D	Imp B	Imp C	Imp D	Res B	Res D	Total Ac.
Sum	15.688	2.944	81.971	3.889	3.503	17.407	2.223	4.329	0	28.384	13.527	3.975	47.694	1.561	1.877	228.972
	1.256	2.944	10.968	0.892	1.103	4.192	2.223	1.146		1.143	1.768	3.653	4.178	1.561	1.877	
	6.743		7.931	0.399	0.926	2.635		1.109		2.700	4.884	0.322	2.945			
	7.388		25.000	2.598	1.474	1.362		0.343		4.055	0.901		4.019			
	0.301		1.278			2.459		1.731		2.684	3.232		1.333			
			1.952			3.825				2.494	2.742		4.086			
			1.877			2.435				13.863			1.902			
			1.136			0.499				0.574			1.101			
			1.561							0.871			4.884			
			6.755										2.296			
			5.107										10.72			
			4.459										3.972			
			13.947										4.233			
													1.038			
													0.987			
Count	4	1	12	3	3	7	1	4	0	8	5	2	14	1	1	66

	Bridge												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	28.966			7.424			0		16.099		11.465			63.954
	16.052			0.923			0.000		5.665		4.212			
	5.571			2.015					10.434		7.253			
	7.343			1.718										
				2.628										
				0.140										
Count	3			5			1		2		2			13
Total Area by Type	28.966			7.424			0		16.099		11.465			

	Trib to Hobcaw Creek												
	Commercial			Open Space			Gravel		Woods		Impervious			Total Ac.
Sum	44.644			10.054			0		11.349		14.086			80.133
	31.882			0.275			0.000		9.093		1.128			
	11.886			2.233					1.080		4.425			
	0.876			3.324					0.622		3.756			
				0.889					0.221		4.777			
				0.886					0.095					
				0.175					0.238					
				0.196										
				0.212										
				1.491										
				0.373										
Count	3			10			1		6		4			24
Total Area by Type	44.644			10.054			0		11.349		14.086			

I-526 & Long Point Rd

Predevelopment to 10'x5 RBC (Seacoast Pkwy)

DRAINAGE AREA= 0.000 SQ. MILES
0.0 Acres

DSN BY: ENR
CHK BY: ___
DATE: 3/2/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	55	21	20.6	0.0073	4.30	Dense Grass (weeping, love, blue, buffalo, blue grama, and native grass mixtures)	0.240		0.08	11.4	
Shallow Concentrated	2	160	20.6	17	0.0225		Unpaved (shallow concentrated flow)	0.491		1.00	2.7	
Shallow Concentrated	4	953	14	9	0.0052		Unpaved (shallow concentrated flow)	0.491		1.17	13.5	wooded area, no defined chnl
Open Channel	3	1056	17	14	0.0028		Vegetation Lined	0.085	2	0.59	29.9	Ex 2:1 V-ditch
Open Channel	5	1309	9	2	0.0053		Vegetation Lined	0.085	3	1.06	20.6	Ex 5:1 V-ditch
Open Channel	7	55	2.58	1.36	0.0222		Vegetation Lined	0.085	4	2.61	0.4	
Closed Conduits	6	184	1.96	1.36	0.0033		Concrete Pipe	0.013	3	5.40	0.6	Ex 9'x5' RCBC
Closed Conduits												
Closed Conduits												
										Total	79.1	minutes
										Use	**79**	minutes
											1.317	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Station 1361 Bridge

DRAINAGE AREA= 0.000 SQ. MILES
0.0 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	16	15	0.0100	4.30	Woods: Light under brush			0.07	24.4	
Shallow Concentrated	2	490	15	11	0.0082	4.30	Unpaved (shallow concentrated flow)			1.00	8.2	
Shallow Concentrated	3	40	11	10	0.0250	4.30	Paved (shallow concentrated flow)			3.23	0.2	
Shallow Concentrated	4	520	10	7	0.0058	4.30	Unpaved (shallow concentrated flow)			1.23	7.0	
Open Channel	5	1475	7	3	0.0027		Vegetation Lined		2	0.58	42.4	Ex 2:1 V-ditch
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	82.2	minutes
										Use	**82**	minutes
											1.367	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

I-526 & Long Point Rd

Predevelopment to Trib to Hobcaw Creek

DRAINAGE AREA= 0.000 SQ. MILES
0.0 Acres

DSN BY: ERP
CHK BY: ___
DATE: 6/21/2023

CDM Smith
listen. think. deliver.

Time of Concentration Velocity Method (TR-55 Method)

Flow Type	Flow Segment	Flow Length (ft)	Elev. High	Elev. Low	Slope (ft/ft)	P_2	Surface Description	n or k	Pipe Dia. / Channel Depth (ft)	Velocity (ft/sec)	Tc (min)	Notes
Sheet Flow	1	100	21	18	0.0300	4.30	Woods: Light under brush			0.11	15.8	
Shallow Concentrated	2	820	18	13	0.0061	4.30	Paved (shallow concentrated flow)			1.00	13.7	
Shallow Concentrated	3	1260	13	5	0.0063	4.30	Unpaved (shallow concentrated flow)			1.29	16.3	
Open Channel	5	375	5	4	0.0027	4.30	Natural Channel Irregular Section with pools 1		3	0.67	9.3	Wetland Trib to Hobcaw Creek
Open Channel												
Open Channel												
Closed Conduits												
Closed Conduits												
Closed Conduits												
										Total	55.1	minutes
										Use	**55**	minutes
											0.917	hours

P2 = 2-year, 24-hour precipitation depth (in) = 4.3 Charleston, SC

(1) Sheet Flow[1] = $Tc = (0.007(nL)^{0.8} / (P_2^{0.5} S^{0.4}))$ (hr)

(2) Shallow Concentrated Flow[2] = $V = 33 * k * \sqrt{S}$ (ft/sec)

(3) Pipe or Channel Flow[1] = $V = (1.49/n) * R^{(2/3)} * \sqrt{S}$ (ft/sec), Assumes Pipe Full Flow (R=D/4) or Channel Flow Depth (R=d)

[1] USDA NRCS Part 630 NEH, eq 15-8

[2] From HEC-22 Manual

Existing Culverts and Cross-Lines																					
Culvert Data									Hydrology Data			50-Year Storm				100-Year Storm				Field Notes	50-Year Hydraulic Analysis Notes
ID	Station	Alignment	Type	Size (US/DS)	US Height (in)	Length (ft)	Inlet El.	Outlet El.	DA (ac)	Method	Tc (min)	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping		
1*	15+75	L-2523	RCBC	10'x5'	60	60	2.66	2.66	233.0	NRCS	98	425.0	8.63	1.2	Yes	493.0	8.84	1.2	Yes	Good condition	Existing HW/D = 1.2
2	1399+75	I-526	RCBC	9'x5'	60	224	3.09	2.47	189.0	NRCS	96	415	10.82	1.546	No	475	11.57	1.696	No	Outlet has settled 1.5'	Existing HW/D = 1.5
4	1355+60	I-526	RCP	24"	24	232	4.63	2.56	3.4	Rational	18.6	14.7	9.51	2.4	No	16.6	10.73	3.1	No	Good condition	Existing HW/D = 2.0
5	1378+35	I-526	RCP	24"	24	276	6.23	6.24	4.1	Rational	30	13.9	10.13	1.95	No	15.9	10.63	2.2	No	Good condition	Existing HW/D = 2.0

* Design storm for Culvert 1 is the 25-year storm

** Check storm for Culvert 1 is the 50-year storm

Post-Development Culverts and Cross-Lines with Recommended Replacements																						
Culvert Data									Hydrology Data			50-Year Storm				100-Year Storm				Field Notes	50-Year Hydraulic Analysis Notes	Recommendations
ID	Station	Alignment	Type	Size (US/DS)	US Height (in)	Length (ft)	Inlet El.	Outlet El.	DA (ac)	Method	Tc (min)	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping	Q (cfs)	HW Elevation (ft)	HW/D	Overtopping			
1*	15+75	L-2523	RCBC	10'x5'	60	60	2.66	2.66	229.0	NRCS	98	473	8.78	1.224	Yes	548	9	1.268	Yes	Good condition	Post-Dev. HW/D = 1.2	Retain existing
2	1399+75	I-526	RCBC	9'x5'	60	224	3.09	2.47	189.0	NRCS	96	444	11.37	1.656	No	510	11.75	1.732	No	Outlet has settled 1.5'	Post-Dev. HW/D = 1.7	11'x5' RCBC for HW/D < 1.2
3*	23+30	L-2118	RCP	(3) 48"	48	84	3.85	3	89.0	NRCS	95	176	7.99	1	No	205	9.05	1.3	No	Existing (3)36" under current L-2118 alignment	N/A	Relocated crossing. Recommendation shown
4	1355+60	I-526	RCP	24"	24	232	4.63	2.56	3.4	Rational	18.6	15.4	9.51	2.4	No	17.4	10.73	3.1	No	Good condition	Post-Dev. HW/D = 2.4	36" RCP for HW/D = 1.2
5	1378+35	I-526	RCP	24"	24	276	6.23	6.24	4.1	Rational	30	17.3	10.93	2.35	No	19.8	11.53	2.65	No	Good condition	Post-Dev. HW/D = 2.4	36" RCP for HW/D < 1.2
6	1422+00	Line 3	RCP	(3) 18"	18	84	13.55	12.4	11.0	Rational	71.1	19.3	14.99	1	No	22.6	15.15	1.1	No	No existing pipe at this location	N/A	Proposed new crossing. Recommendation shown

* Design storm for Culverts 1 and 3 is the 25-year storm

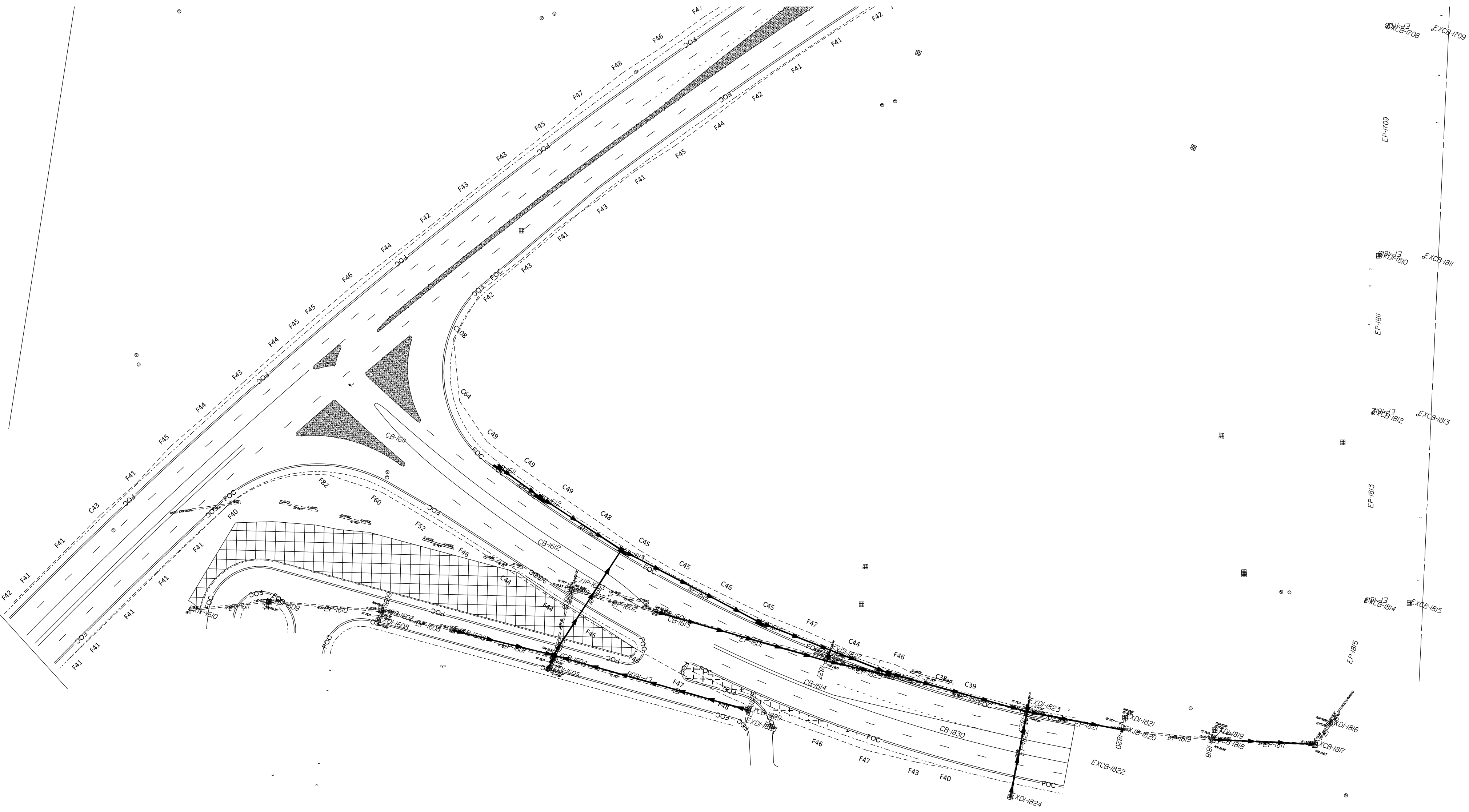
** Check storm for Culverts 1 and 3 is the 50-year storm

Existing Culverts and Cross-Lines with Proposed Flow Rates																
Culvert Data									Hydrology Data			10-Year Storm				Recommendation
ID	Station	Alignment	Type	Size (US/DS)	US Height (in)	Length (ft)	Inlet El.	Outlet El.	DA (ac)	Method	Tc (min)	Q (cfs)	HW Elevation (ft)	Overtopping	Exceeds Capacity?	
EP-0900	1368+00 left	I-526	RCP	18"	18	96.7	2.54	3.9	0.5	Rational	5	2.3	3.34	No	No	Possibly replace due to settlement of existing pipe. Invert out is higher than invert in by 1.5'. Otherwise retain.
EP-0902	1373+00 left	I-526	RCP	18"	18	96.4	5.51	4.84	0.6	Rational	5	2.6	6.37	No	No	Retain & Extend
EP-1000	1393+00 left	I-526	RCP	18"	18	95.5	8.09	7.03	0.9	Rational	5	3.6	9.15	No	No	Retain & Extend
EP-1100	1406+00 left	I-526	RCP	18"	18	104.6	11.44	9.63	0.7	Rational	5	2.1	12.20	No	No	Retain
EP-1200	1412+00 left	I-526	RCP	18"	18	117	12.91	12.04	0.9	Rational	5	2.4	13.74	No	No	Retain
EP-1201	1420+00 left	I-526	RCP	18"	18	135.1	14.58	13.63	1.6	Rational	5	3.9	15.70	No	No	Retain & Extend

LOCATION			RUNOFF			PIPE DESIGN												
PIPE I.D.	FROM	TO	TIME OF CONC. (min)	DISCHARGE (cfs)	COMPOSITE C VALUE	INLET ELEV [ft]	OUTLET ELEV ft]	INLET HGL (ft)	OUTLET HGL (ft)	TYPE	MATERIAL	LENGTH (ft)	SLOPE (ft/ft)	DIA. (ft)	CAPACITY (cfs)	AVAILABLE FREEBOARD US (ft)	VELOCITY (ft/s)	PAY ITEM
EP-0900	EXDI-0900	EXOP-0901	5	3.98	0.9	0.14	-0.34	0.94	0.2	Pipe	Concrete	96.74	0.5	1.5	8.66	7.06	1.28	7141113
EP-0901	EXDI-0902	EXOP-0903	5	1.8	0.9	4.04	3.46	4.9	4.01	Pipe	Concrete	96.37	0.6	1.5	9.5	5.11	1.44	7141113
EP-1000	EXDI-1000	EXOP-1001	5	1.97	0.9	6.9	5.47	7.96	5.99	Pipe	Concrete	95.46	1.5	1.5	14.98	2.31	2.01	7141113
EP-1100	EXDI-1100	EXOP-1101	5	1.73	0.9	10.4	8.7	11.16	9.09	Pipe	Concrete	104.62	1.62	1.5	15.6	2.59	1.19	7141113
EP-1200	EXDI-1200	EXOP-1201	5	1.84	0.9	12.83	11.81	13.66	12.3	Pipe	Concrete	117.01	0.87	1.5	11.43	4.16	1.36	7141113
EP-1201	EXDI-1202	EXOP-1203	5	0.49	0.9	15.59	14.91	16.71	15.65	Pipe	Concrete	135.05	0.5	1.5	8.66	1.65	2.22	7141113
EP-1301	EXIP-1301	EXOP-1302	5	0.55	0.9	-1.5	-1.5	0	0	Pipe	Concrete	78.05	0	1.5	0	0	0	7141113
EP-1302	EXCB-1304	EXOP-1303	5	1.04	0.9	14.5	14.48	16.02	15.62	Pipe	Concrete	47.15	0.04	2	5.43	2.31	3.23	7141114
EP-1303	EXCB-2040	EXCB-1304	5	0.74	0.9	14.51	14.5	16.84	16.02	Pipe	Concrete	134.58	0.01	2	2.27	1.27	3.2	7141114
EP-1304	EXDI-1901	EXOP-1305	5	0.89	0.9	-2.5	-2.5	0	0	Pipe	Concrete	287.63	0	2.5	0	0	0	7141115
EP-1601	EXCB-1601	EXCB-1826	5	1.02	0.9	17.66	16.8	69.55	58.01	Pipe	Concrete	185.41	0.47	1.5	8.36	-47.32	15.96	7141113
EP-1602	EXCB-1602	EXCB-1601	5	0.81	0.9	17.75	17.66	76.78	69.55	Pipe	Concrete	88.12	0.1	1.5	3.91	-54.95	15.74	7141113
EP-1603	EXIP-1603	EXCB-1602	5	0.82	0.9	18.61	18.33	76.82	76.78	Pipe	Concrete	9.78	2.86	1.25	12.74	-56.21	1.35	7141112
EP-1605	EXDI-1605	EXCB-1604	5	0.8	0.9	18.8	17.83	84.89	84.71	Pipe	Concrete	13.85	8.53	1.5	35.75	-64.58	3.09	7141113
EP-1606	EXCB-1829	EXCB-1604	5	0.81	0.9	22.91	17.88	85.65	84.71	Pipe	Concrete	208.13	2.42	1.5	19.03	-62.85	3.68	7141113
EP-1607	EXCB-1606	EXCB-1604	5	0.94	0.9	18	17.83	86.66	84.71	Pipe	Concrete	107.5	0.16	1.5	4.87	-65.27	8.54	7141113
EP-1608	EXCB-1607	EXCB-1606	5	0.94	0.9	18.28	18.17	89.94	86.66	Pipe	Concrete	76.75	0.14	1.17	4.15	-69.07	8.2	7141141
EP-1609	EXDI-1608	EXCB-1607	5	0.52	0.83	18.54	18.4	92.12	89.94	Pipe	Concrete	9.95	1.41	1	4.92	-72.13	10.53	7141111
EP-1610	EXDI-1609	EXCB-1607	5	1.32	0.84	18.5	18.38	90.35	89.94	Pipe	Concrete	116.24	0.1	1.17	3.47	-69.99	3.61	7141141
EP-1611	EXIP-1610	EXDI-1609	5	1.01	0.86	18.41	18.17	90.74	90.35	Pipe	Concrete	83.17	0.29	1.25	4.04	-70.33	3.06	7141112
EP-1701	EXDI-1702	EXOP-1701	5	0.45	0.9	8.89	8.8	13.02	11.01	Pipe	Concrete	17.12	0.53	2.5	34.66	2.15	9	7141115
EP-1702	EXDI-1703	EXDI-1702	5	1.2	0.9	9	8.89	15.04	13.02	Pipe	Concrete	40.84	0.27	2.5	24.81	0.05	8.91	7141115
EP-1703	EXCB-1704	EXDI-1703	5	1.7	0.9	10.26	9	17.68	15.04	Pipe	Concrete	186.73	0.67	2.5	39.26	-1.79	8.81	7141115
EP-1704	EXCB-1705	EXCB-1704	5	0.69	0.9	11.05	10.51	17.69	17.68	Pipe	Concrete	47.58	1.13	1.25	8.02	-1.87	0.67	7141112
EP-1705	EXCB-1706	EXCB-1704	5	0.65	0.9	11.07	10.26	19.71	17.68	Pipe	Concrete	202.81	0.4	2.5	30.21	-3.08	8.63	7141115
EP-1706	EXCB-1707	EXCB-1706	5	0.74	0.9	12.29	11.16	19.72	19.71	Pipe	Concrete	48.32	2.34	1.25	11.51	-3.12	0.66	7141112
EP-1707	EXCB-1708	EXCB-1706	5	0.77	0.9	11.84	11.16	21.64	19.71	Pipe	Concrete	202.47	0.34	2.5	27.7	-4.22	8.44	7141115
EP-1708	EXCB-1709	EXCB-1708	5	0.47	0.9	13.16	11.84	21.66	21.64	Pipe	Concrete	47.95	2.75	1.25	12.49	-4.18	0.76	7141112
EP-1709	EXDI-1810	EXCB-1708	5	2.55	0.9	21.43	11.92	23.98	13.11	Pipe	Concrete	235.38	4.04	2.5	96.09	-5.62	8.19	7141115
EP-1801	EXCB-1801	EXCB-1914	5	1.26	0.9	-2	-2	0	0	Pipe	Concrete	203.3	0	2	0	0	0	7141114
EP-1802	EXDI-1802	EXCB-1801	5	0.85	0.9	-1.25	-1.25	0	0	Pipe	Concrete	13.13	0	1.25	0	0	0	7141112
EP-1803	EXCB-1803	EXCB-1801	5	2.04	0.9	-2	-2	0	0	Pipe	Concrete	77.66	0	2	0	0	0	7141114
EP-1804	EXIP-1804	EXCB-1803	5	2.62	0.9	-1.5	-1.5	0	0	Pipe	Concrete	91.06	0	1.5	0	0	0	7141113
EP-1805	EXCB-1805	EXCB-1803	5	1.01	0.9	-2	-2	0	0	Pipe	Concrete	71.73	0	2	0	0	0	7141114
EP-1806	EXCB-1806	EXCB-1805	5	0.5	0.9	-2	-2	0	0	Pipe	Concrete	94.47	0	2	0	0	0	7141114
EP-1807	EXCB-1807	EXCB-1806	5	0.4	0.74	-1.5	-1.5	0	0	Pipe	Concrete	32.23	0	1.5	0	0	0	7141113
EP-1808	EXCB-1808	EXCB-1807	5	1.92	0.9	-1.5	-1.5	0	0	Pipe	Concrete	156.73	0	1.5	0	0	0	7141113
EP-1809	EXCB-1809	EXCB-1808	5	1.49	0.9	-1.5	-1.5	0	0	Pipe	Concrete	71.58	0.5	1.5	0	0	0	7141113
EP-1810	EXCB-1811	EXDI-1810	5	1.08	0.9	22.73	22.68	23.99	23.98	Pipe	Concrete	46.87	0.1	1.25	2.38	-5.59	0.53	7141112
EP-1811	EXCB-1812	EXDI-1810	5	1.37	0.78	21.6	21.43	25.4	23.98	Pipe	Concrete	162.92	0.1	2.5	15.12	-6.54	8.04	7141115
EP-1812	EXCB-1813	EXCB-1812	5	0.28	0.9	14.87	13.69	25.41	25.4	Pipe	Concrete	47.67	2.48	1.25	11.84	-6.46	0.63	7141112
EP-1813	EXCB-1814	EXCB-1812	5	0.85	0.9	14.75	13.76	28.24	25.4	Pipe	Concrete	194.68	0.51	2.5	34.09	-8.49	7.87	7141115
EP-1814	EXCB-1815	EXCB-1814	5	0.73	0.9	16.32	14.87	28.37	28.24	Pipe	Concrete	47.66	3.04	1.25	13.13	-8.6	2.08	7141112
EP-1815	EXDI-1816	EXCB-1814	5	0.88	0.9	15.31	14.84	30.32	28.24	Pipe	Concrete	130.44	0.36	2.5	28.69	-11.06	7.42	7141115
EP-1816	EXCB-1817	EXDI-1816	5	1.6	0.9	15.58	15.38	32.05	30.32	Pipe	Concrete	26.77	0.75	2	22.79	-10.42	11.35	7141114
EP-1817	EXCB-1818	EXCB-1817	5	1.02	0.9	15.74	15.58	41.52	32.05	Pipe	Concrete	104.36	0.15	2	10.32	-19.63	11.07	7141114
EP-1818	EXDI-1819	EXCB-1818	5	0.44	0.9	17.19	16.47	41.52	41.52	Pipe	Concrete	10.03	7.18	1.25	20.17	-21.42	0.09	7141112
EP-1819	EXJB-1820	EXCB-1818	19.02	4.48	0.9	22.36	15.83	46.73	41.52	Pipe	Concrete	93.12	7.01	2	69.79	-24.7	10.84	7141114
EP-1820	EXDI-1821	EXJB-1820	19.08	3.66	0.9	16.37	16.3	46.74	46.73	Pipe	Concrete	13	0.5	1.25	5.32	-26.83	0.69	7141112
EP-1821	EXCB-1822	EXJB-1820	5	0.88	0.9	16.24	15.73	54.55	46.73	Pipe	Concrete	101.11	0.5	2	18.64	-32.74	10.66	7141114
EP-1822	EXDI-1824	EXCB-1822	5	0.86	0.9	22.26	16.31	54.55	54.55	Pipe	Concrete	90.08	6.61	1.5	31.46	-34.71	0.03	7141113
EP-1823	EXDI-1823	EXCB-1822	5	0.94	0.9	18.04	17.87	54.56	54.55	Pipe	Concrete	9.87	1.72	1.25	9.88	-34.52	0.76	7141112
EP-1825	EXCB-1826	EXCB-1825	5	1.22	0.9	16.52	16.46	58.01	57.07	Pipe	Concrete	64.27	0.09	2	8	-35.91	9.35	7141114
EP-1826	EXDI-1828	EXCB-1829	5	0.96	0.9	20.57	20.51	86.12	85.65	Pipe	Concrete	12.55	0.5	1.25	5.32	-63.22	4.91	7141112
EP-1827	EXDI-1827	EXCB-1826	5	0.9	0.9	18.44	18.22	58.01	58.01	Pipe	Concrete	11.78	2.32	1.25	11.47	-37.57	0.45	7141112
EP-1901	EXDI-1902	EXDI-1901	5	0.32	0.9	-3	-3	0	0	Pipe	Concrete	295.94	0	3	0	0	0	7141116
EP-1902	EXDI-1903	EXDI-1902	5	0.5	0.9	-2.5	-2.5	0	0	Pipe	Concrete	392.7	0	2.5	0	0	0	7141115
EP-1903	EXDI-1904	EXDI-1903	5	0.88	0.9	-2	-2	0	0	Pipe	Concrete	148.68	0	2	0	0	0	7141114

LOCATION			RUNOFF			PIPE DESIGN												
PIPE I.D.	FROM	TO	TIME OF CONC. (min)	DISCHARGE (cfs)	COMPOSITE C VALUE	INLET ELEV [ft]	OUTLET ELEV ft]	INLET HGL (ft)	OUTLET HGL (ft)	TYPE	MATERIAL	LENGTH (ft)	SLOPE (ft/ft)	DIA. (ft)	CAPACITY (cfs)	AVAILABLE FREEBOARD US (ft)	VELOCITY (ft/s)	PAY ITEM
EP-1904	EXDI-1905	EXDI-1904	5	0.72	0.9	-2	-2	0	0	Pipe	Concrete	251.44	0	2	0	0	0	7141114
EP-1905	EXCB-1906	EXDI-1905	5	1.2	0.9	-2.5	-2.5	0	0	Pipe	Concrete	99.27	0	2.5	0	0	0	7141115
EP-1906	EXDI-1917	EXCB-1906	10	1.09	0.9	-1.25	-1.25	0	0	Pipe	Concrete	15.12	0	1.25	0	0	0	7141112
EP-1907	EXCB-1907	EXCB-1906	5	1.5	0.9	-2	-2	0	0	Pipe	Concrete	84.57	0.5	2	0	0	0	7141114
EP-1908	EXDI-1908	EXCB-1907	102.12	21.29	0.67	-1.25	-1.25	0	0	Pipe	Concrete	11.38	0.5	1.25	0	0	0	7141112
EP-1909	EXMH-1909	EXCB-1907	5	0.82	0.8	-1.5	-1.5	0	0	Pipe	Concrete	146.78	0.5	1.5	0	0	0	7141113
EP-1910	EXCB-1910	EXCB-1907	5	0.76	0.77	-1.5	-1.5	0	0	Pipe	Concrete	87.53	0	1.5	0	0	0	7141113
EP-1911	EXIP-1911	EXCB-1910	5	2.27	0.6	-1.25	-1.25	0	0	Pipe	Concrete	10.13	0	1.25	0	0	0	7141112
EP-1912	EXCB-1912	EXCB-1910	5	2.55	0.56	-1.5	-1.5	0	0	Pipe	Concrete	104.32	0	1.5	0	0	0	7141113
EP-1913	EXDI-1913	EXCB-1912	5	3.56	0.56	-1.25	-1.25	0	0	Pipe	Concrete	14.37	0	1.25	0	0	0	7141112
EP-1914	EXCB-1914	EXCB-1906	5	2.09	0.41	-2	-2	0	0	Pipe	Concrete	121.3	0	2	0	0	0	7141114
EP-2001	EXCB-2103	EXCB-2000	5	2.4	0.35	13.24	12.86	16.61	16.18	Pipe	Concrete	170.6	0.22	2.5	22.56	3.71	4.41	7141115
EP-2002	EXCB-2000	EXCB-2001	5	3.92	0.34	12.68	12.6	16.18	16.12	Pipe	Concrete	53.71	0.15	3	30	3.37	3.07	7141116
EP-2003	EXCB-2001	EXCB-2002	5	5.45	0.69	12.7	12.53	16.12	16.06	Pipe	Concrete	52.47	0.32	3	44.24	3.43	3.08	7141116
EP-2004	EXCB-2002	EXCB-2003	12.5	8.27	0.68	12.5	12.38	16.06	15.99	Pipe	Concrete	65.12	0.18	3	33.37	3.42	3.11	7141116
EP-2005	EXCB-2004	EXCB-2003	5	2.66	0.81	15.41	15.08	16.06	15.99	Pipe	Concrete	78.21	0.42	3	50.49	3.66	0.31	7141116
EP-2006	EXCB-2005	EXCB-2004	5	0.72	0.9	15.81	15.54	16.48	16.06	Pipe	Concrete	88.03	0.31	1.5	6.78	3.24	0.85	7141113
EP-2007	EXCB-2006	EXCB-2005	5	1.06	0.9	18.12	15.81	18.45	15.96	Pipe	Concrete	64.38	3.59	1.5	23.19	1.27	0.25	7141113
EP-2008	EXDI-2007	EXCB-2005	5	0.58	0.17	16.79	16.67	17.28	16.96	Pipe	Concrete	9.33	1.29	1.25	8.54	1.63	0.68	7141112
EP-2009	EXDI-2008	EXCB-2003	5	0.65	0.9	16.23	15.21	17.65	15.93	Pipe	Concrete	96.87	1.05	2	27.05	2.04	2.22	7141114
EP-2010	EXDI-2009	EXDI-2008	5	1.01	0.48	16.81	16.41	17.91	17.65	Pipe	Concrete	170.86	0.23	2	12.76	2.11	2.06	7141114
EP-2012	EXMH-2010	EXDI-2009	5	0.11	0.45	17.7	16.85	18.78	17.65	Pipe	Concrete	107.41	0.79	1.25	6.7	2.23	3.74	7141112
EP-2013	EXIP-2011	EXMH-2010	5	0.85	0.52	19.35	17.77	19.56	17.86	Pipe	Concrete	33.85	4.67	1.25	16.26	1.09	0.13	7141112
EP-2014	EXCB-2012	EXMH-2010	5	0.93	0.31	17.81	17.71	19.19	18.78	Pipe	Concrete	24.57	0.41	1.25	4.8	2.01	3.65	7141112
EP-2015	EXCB-2013	EXDI-2009	5	0.05	0.1	16.98	16.85	18.04	17.91	Pipe	Concrete	61.48	0.21	2	12.12	3.12	1.17	7141114
EP-2016	EXCB-2003	EXMH-2015	5	0.56	0.31	12.41	11.23	15.99	15.37	Pipe	Concrete	71.7	1.65	3	99.71	3.53	3.89	7141116
EP-2017	EXDI-2014	EXMH-2015	6.4	6.03	0.65	12.63	11.23	15.47	15.37	Pipe	Concrete	25.87	5.41	1.25	17.51	1.03	2.06	7141112
EP-2018	EXMH-2015	EXOP-2016	5	0.19	0.1	11.11	9.96	15.37	11.48	Pipe	Concrete	195.9	0.59	3	59.55	1.99	3.98	7141116
EP-2019	EXCB-2017	EXCB-2018	5	0.86	0.19	16.47	16.17	17.01	16.96	Pipe	Concrete	70	0.43	1.5	8.01	2.79	0.5	7141113
EP-2020	EXCB-2018	EXCB-2019	5	0.21	0.26	16.16	15.96	16.96	16.73	Pipe	Concrete	137.28	0.15	1.5	4.67	2.68	0.98	7141113
EP-2021	EXCB-2019	EXCB-2020	5	0.56	0.3	15.86	15.6	16.73	16.58	Pipe	Concrete	140.97	0.18	1.5	5.26	2.57	1.46	7141113
EP-2022	EXCB-2020	EXCB-2021	5	0.09	0.2	15.51	15.38	16.58	16.33	Pipe	Concrete	119.93	0.11	1.5	4.03	2.37	2.08	7141113
EP-2023	EXCB-2021	EXCB-2022	49.6	1.04	0.14	15.37	15.05	16.33	15.86	Pipe	Concrete	101.13	0.32	1.5	6.89	2.28	2.53	7141113
EP-2024	EXCB-2022	EXCB-2023	5	0.09	0.16	14.56	14.54	15.57	15.35	Pipe	Concrete	35.33	0.06	2	6.26	2.85	1.67	7141114
EP-2025	EXCB-2023	EXCB-2024	5	0.28	0.3	14.49	13.25	15.34	13.79	Pipe	Concrete	55.44	2.22	2	39.31	2.99	1.75	7141114
EP-2026	EXCB-2024	EXOP-2025	47.4	0.84	0.14	13.21	11.99	14.18	12.55	Pipe	Concrete	55.21	2.2	2	39.13	3.91	1.89	7141114
EP-2027	EXCB-2026	EXOP-2027	46.5	0.58	0.13	-1.25	-1.25	0	0	Pipe	Concrete	18.71	0	1.25	0	0	0	7141112
EP-2028	EXIP-2028	EXMH-2029	46.9	1.18	0.27	16.08	16	18.05	18.01	Pipe	Concrete	94.77	0.08	2	7.66	0.05	1.18	7141114
EP-2029	EXIP-2030	EXMH-2029	5	2.53	0.37	16.55	16.51	18.15	18.01	Pipe	Concrete	33.33	0.12	1.25	2.61	0.4	2.33	7141112
EP-2030	EXMH-2029	EXDI-2032	5	0.05	0.1	16	15.82	18.01	17.95	Pipe	Concrete	33.42	0.54	2	19.35	0.58	2.07	7141114
EP-2031	EXCB-2031	EXDI-2032	7.2	4.47	0.58	16.29	16.22	17.95	17.95	Pipe	Concrete	17.64	0.39	1.5	7.69	1.34	0.41	7141113
EP-2032	EXDI-2032	EXDI-2033	5	0.58	0.18	15.82	15.71	17.95	17.88	Pipe	Concrete	65.33	0.17	2	10.82	0.72	2.17	7141114
EP-2033	EXDI-2034	EXDI-2033	5	1.49	0.4	16.27	16.01	17.92	17.88	Pipe	Concrete	20.36	1.28	2	29.79	1.48	1.42	7141114
EP-2034	EXDI-2033	EXCB-2035	5	0.24	0.26	15.61	15.48	17.88	17.55	Pipe	Concrete	84.73	0.15	2	10.33	0.48	2.85	7141114
EP-2035	EXCB-2035	EXCB-2036	5	0.39	0.16	15.48	15.14	17.55	17.38	Pipe	Concrete	108.06	0.31	2	14.78	0.88	3.01	7141114
EP-2036	EXIP-2037	EXCB-2036	5	1.66	0.37	16.05	15.25	17.4	17.38	Pipe	Aluminum	34.68	2.3	1	6.3	1.19	0.86	7144512
EP-2037	EXIP-2038	EXCB-2036	5	3.76	0.71	17.46	15.29	17.94	15.45	Pipe	Plastic	21.63	10	1.25	23.81	1.68	0.64	7141794
EP-2038	EXCB-2036	EXCB-2039	44.9	0.34	0.17	15.14	14.58	17.38	17.29	Pipe	Concrete	69.43	0.81	2	23.66	1.21	2.82	7141114
EP-2039	EXCB-2039	EXCB-2040	49	0.28	0.1	14.58	14.51	17.29	16.84	Pipe	Concrete	305.39	0.02	2	3.99	1.33	2.97	7141114
EP-2040	EXDI-2041	EXCB-2040	5	2.1	0.6	14.87	14.51	16.85	16.84	Pipe	Concrete	9.88	3.65	1.5	23.37	0.58	1.46	7141113
EP-2041	EXDI-2042	EXDI-2041	5	0.16	0.12	16.25	14.87	17.16	16.85	Pipe	Concrete	186.31	0.74	1.25	6.48	1.24	1.68	7141112
EP-2042	EXDI-2043	EXDI-2042	47.1	3.7	0.58	16.85	16.25	17.19	16.54	Pipe	Concrete	107.18	0.56	1.25	5.63	1.44	0.51	7141112
EP-2043	EXDI-2044	EXDI-2043	47	2.86	0.63	17	16.85	17.36	17.19	Pipe	Concrete	49.65	0.3	1	2.28	1.44	0.5	7141111
EP-2101	EXCB-2101	EXCB-2102	74.9	0.68	0.38	13.61	13.54	17.22	16.76	Pipe	Concrete	71.56	0.1	2.5	15.12	3.23	4.34	7141115
EP-2102	EXCB-2102	EXCB-2103	76.5	0.78	0.13	13.41	13.35	16.76	16.61	Pipe	Concrete	60.66	0.1	2.5	15.12	3.62	4.37	7141115
NP-1612	CB-1611	CB-1612				-1.5	-1.5	0	0	Pipe	Concrete	47.94	0	1.5	0	1.65	2.22	7141113
NP-1613	CB-1612	CB-1613				-1.5	-1.5	0	0	Pipe	Concrete	95.71	0	1.5	0	1.65	2.22	7141113
NP-1614	CB-1613	CB-1614				-1.5	-1.5	0	0	Pipe	Concrete	155.85	0	1.5	0	1.65	2.22	7141113

LOCATION			RUNOFF			PIPE DESIGN												
PIPE I.D.	FROM	TO	TIME OF CONC. (min)	DISCHARGE (cfs)	COMPOSITE C VALUE	INLET ELEV [ft]	OUTLET ELEV ft]	INLET HGL (ft)	OUTLET HGL (ft)	TYPE	MATERIAL	LENGTH (ft)	SLOPE (ft/ft)	DIA. (ft)	CAPACITY (cfs)	AVAILABLE FREEBOARD US (ft)	VELOCITY (ft/s)	PAY ITEM
NP-1615	CB-1614	CB-1830				-1.5	-1.5	0	0	Pipe	Concrete	140.01	0	1.5	0	1.65	2.22	7141113
NP-1616	CB-1830	EXCB-1822				-2	-2	0	0	Pipe	Concrete	146.71	0	2	0	1.65	2.22	7141114
NP-1617	EXCB-1604	CB-1613				-2	-2	0	0	Pipe	Concrete	125.37	0	2	0	1.65	2.22	7141114


EXCB-1708
EXCB-1709
EP-1709
EXDI-1810
EXCB-1811
EP-1811
EXCB-1812
EXCB-1813
EP-1813
EXCB-1814
EXCB-1815
EP-1815
EXDI-1816
EXCB-1817
EP-1817
EXCB-1818
EXDI-1819
EP-1819
EXJB-1820
EXDI-1821
EP-1821
EP-1822
EXCB-1822
EXDI-1823
EXDI-1824
EP-1825
EXDI-1827
EXCB-1829
EXDI-1828
CB-1830
CB-1611
CB-1612
CB-1613
CB-1614
NP-1613
NP-1614
EP-1601
EP-1602
EXIP-1603
EXCB-1604
EXDI-1605
EP-1606
EP-1607
EXCB-1606
EP-1608
EXDI-1608
EXCB-1607
EP-1610
EP-1611
EXIP-1610
UNDETERMINED
15" RCP
18" RCP
24" RCP
FOC
F40
F41
F42
F43
F44
F45
F46
F47
F48
F52
F60
F82
C38
C39
C43
C44
C45
C46
C48
C49
C64
C108