STORMWATER POLLUTION PREVENTION PLAN
(SWPPP)

Prepared for:

SUNSET RIDGE ESTATES &
LAKEWOOD CUSTOM HOMES
3535 STATE ROUTE 364
TOWN OF CANANDAIGUA, NY 14424

Date:
February 1, 2021

REVISED:
December 19, 2022

Prepared by:

MarksEngineering

42 Beeman St
Canandaigua, NY 14424
(585)329-6138

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1. 0 INTRODUCTION

This SWPPP is prepared in accordance with the requirements of Article 17, Titles 7, 8, and Article 70 of the New York State Environmental Conservation Law to obtain coverage by the SPDES General Permit for Stormwater Discharge from Construction Activities (GP-0-20-001). A Construction Notice of Intent (NOI) has been filed with the NYSDEC (APPENDIX D), and the Town of Canandaigua will review the SWPPP and indicate its approval through signature on the MS4 Stormwater Pollution Prevention Plan Acceptance Form (APPENDIX E).

The design standards and practices outlined herein are in accordance with the New York Standards and Specifications for Erosion and Sediment Control and the New York State Stormwater Management Design Manual (SWDM).

The SWPPP includes the following:

- Identification of the SWPPP coordinator with a description of this person's duties.
- Description of the existing site conditions including existing land use of the site (i.e., wooded areas, open grassed areas, pavement, buildings, etc.), soil types at the site, as well as the location of surface waters which are located on or next to the site (wetlands, streams, rivers, lakes, ponds, etc.).
- Identification of the body of water(s) which will receive runoff from the construction site, including the ultimate body of water that receives the stormwater.
- Identification of drainage areas and potential stormwater contaminants.
- Description of construction stormwater management controls necessary to reduce erosion, sediment, and pollutants in stormwater discharge.
- Description of the facility's monitoring plan and how controls will be coordinated with construction activities.
- Description of post-construction stormwater management practices for runoff quality and quantity control.

2.0 FACILITIES DESCRIPTION

2.1 Site Location

The proposed project is in the Town of Canandaigua located east of the corner of Otetiana Point and NYS State Route 364 (East Lake Road). The subject property of this project extends up to the Canandaigua-Hopewell Townline between State Route 364 and County Road 18 (FIGURE 1). The site is bounded by neighboring vacant rural, and early/mid-successional lands.

We have reviewed the project with The State Historic Preservation Office (SHPO) and they have notified us that it is an archeological sensitive site. The owner has completed an Archeological Phase 1 survey and a no impact letter from SHPO has been received. The site is not within a 100 year floodplain as mapped by FEMA. A small wetland has been mapped on the site and we are working with NYSDEC and USACE on a jurisdictional determination.

2.2. Project Description

Existing:

The area of the subject property is 33.1798 acres in Canandaigua. The lots directly to the north of the proposed development are vacant early/mid successional land and a residential mobile home adjacent to East Lake Road. The lots directly to the west currently contain vacant land and residential homes. Land to the south and east are early/mid successional vacant lands as well as some agricultural fields. This community is a mixture of residential, vacant, and agricultural land uses. The site is not in a NYS DEC Brownfield remediation program and no know contamination is present.

Proposed:

The proposed project will include the new development of thirty one single-family homes and roads and sidewalks to provide access to dwellings. The remaining lands will be used for private drives, driveway parking, stormwater management and/or maintained as lawn.

2.3 Type of Construction

The development construction activities will generally consist of the following:

- Stripping of topsoil
- Earthwork (regrading of earth with cuts and fills)
- Rough grading of site
- Excavations for the installation of underground utilities
- Building construction
- Driveway installation
- Construction of stormwater management facilities
- Final grading
- Landscaping, topsoil, and seeding of disturbed areas

2.4 Existing Site Hydrology

In general, the site drains west toward East Lake Road. The site ultimately drains to Canandaigua Lake after collecting in a low area in the northwestern region of the property and entering an unclassified stream that flows around Lakeview Mobile Home Park. The unclassified stream crosses underneath East Lake Road via a cross culvert along Sandy Beach Drive prior to flowing into Canandaigua Lake. The site as it exists consists of just one main drainage area however, we have modeled the site as two separate drainage areas for Canandaigua and Hopewell. As it exists, the Hopewell drainage area flows into the Canandaigua drainage area.

Drainage Area 1 (DA-1) (FIGURE 5A) is currently vacant early/ mid-successional lands. DA-1 flow from stormwater ultimately discharges into the Canandaigua Lake, which is not a TMDL water body or a 303d stream segment.

Drainage Area 2 (DA-2) (FIGURE 5B) is currently vacant early/ mid-successional lands. DA-2 flow from stormwater ultimately discharges into the Canandaigua Lake.

DA-1 consists of the entire parcel located within the Town of Canandaigua and

DA-2 consists of the entire parcel located within the Town of Hopewell.

2.4 Proposed Site Hydrology

The purpose of the Stormwater Management Plan is to safely control and convey all runoff from the site and to effectively reduce post-development runoff flows from new impervious areas while providing treatment of water quality.

The sites proposed drainage patterns will ultimately remain consistent with existing patterns. Runoff from new disconnected rooftops and new impervious roads and parking areas in the lower portion of the site (Phases 1 and 2) will be directed to dry swales or vegetative swales/filter strips prior to collection in one of two proposed stormwater management ponds in the northwest and northern-central region of the Canandaigua parcel. Storm water collected in swales will be conveyed to the stormwater management ponds or safely diverted through the site via a total of 220 linear foot subsurface 36” HDPE pipe that outlets at the existing low point in the northwestern region of the parcel.

Existing drainage from phases three and four will be diverted via a temporary diversion swale to an existing outfall in the center of the north parcel boundary.

Runoff from new impervious roads and parking areas in the upper portion (Phases 3 and 4) of the site will be directed to stormwater management ponds via vegetative swales allowing for filtration prior to collection in a proposed stormwater management pond in the northwestern region of the Canandaigua parcel. All storm sewers have been designed to convey the 10-year design flows. 100-year storm flows will result in controlled overland flow to the detention basin.

As the ponds will be placed in existing low regions, this will allow for minimal changes in drainage patterns. Stormwater will continue to undergo treatment in the ponds and retention for larger storms is provided. In the event of any overflow, stormwater from the ponds will flow north towards the unnamed unclassified stream via an existing vegetative channel. Existing DA-1 (Figure 5) has been broken up into 3 proposed subcatchments (Figure 6) each of which contains a varying degree of new impervious surfaces. The total percentage of impervious surfaces proposed across the entire site is 18.9%.

Two proposed stormwater management ponds have been designed as a Wet Ponds (P-2), a stormwater management practice that is intended to provide storage for the entire water quality volume in a permanent pool.

The site development provides Green Infrastructure (GI) design as required by chapter 5 of the SWDM. See Appendix C for GI information and design. The first part of GI is consideration low impact planning of the proposed site development. We have considered and applied the following planning principles in this design: reduction of clearing, locating development in less sensitive areas, soil restoration, roadway, sidewalk, parking, and driveway reduction. Additionally, we have provided GI practices before runoff drains to a wet pond. Runoff from new impervious areas is filtered through an approximate total of 710 linear feet of dry swales, as well as many various sized vegetative swales and filter strips prior to conveyance to the wet ponds. The total length of all vegetative swales is approximately 5,500 linear feet. This network of filter strips and swales is intended to provide channel protection volume by providing filtration prior to conveyance to the wet pond.

3.0 CONSTRUCTION STORMWATER MANAGEMENT

3.1 Stormwater Management Controls

The purpose of this section is to identify the types of temporary and permanent erosion and sediment controls that will be used on the site. The controls will provide soil stabilization for disturbed areas and structural controls to divert runoff and remove sediment. This section will also address control of other potential stormwater pollutant sources such as epoxy, concrete dust, grease, fuel oil, waste disposal, and sanitary waste disposal.

a. <u>Temporary and Permanent Erosion Control Practices</u>

To limit soil migration, the following measures will be implemented:

- Silt fencing will be placed along the perimeter of the area to be cleared and graded before any work takes place.
- Where soil disturbance activities have temporarily or permanently ceased, soil stabilization measures shall be initiated by the end of the next business day and completed within 14 days (7 days if over 5-acres of disturbance, or 3 days if between November 15th and April 1st).
- Within 14 days after clearing and grading, ground agricultural limestone, 5-0-10 fertilizer will be applied to each acre to be stabilized by vegetation. The limestone should be at a pH of 6.0, and the fertilizer should be added at a rate of 600 pounds per acre. Phosphorus shall not be applied unless soil test by horticultural lab indicates it is necessary. Such lab paperwork shall be provided to the Town. If required it shall be applied at a minimum.
- After fertilizer, all areas which will not be impacted by further construction shall be permanently seeded. The permanent seed mix shall be 65% Kentucky Blue Grass blend at 85-114 pounds per acre, 20% perennial rye grass at 26-35 pounds per acre, and 15% fine fescue at 19-26 pounds per acre. An alternative seed would be 100% tall fescue, turf type fine leaf at 150-200 pounds per acre.
- After seeding, disturbed areas will be mulched with 4,000 pounds per acre of straw or hydroseeded with an appropriate tackifier.
- Topsoil stockpiles will be stabilized with temporary seed and mulch no later than 7 days from placement of the stockpile. The temporary seed shall be rye (grain) applied at the rate of 120 pounds per acre.
- Areas of the site which are to be paved will be temporarily stabilized by applying geotextile and stone sub-base until asphalt is applied.

- Stabilized construction entrances will be placed at the entrances to the site.

- All catch basins will be will have at least 1.0-foot sumps which will trap sediment from parking lot runoff following completion and stabilizations of the project. During construction, each basin will be protected from sediment laden inflow in accordance with the New York Standards and Specifications for Erosion and Sediment Control.

b. Control Structure Design

All erosion and sediment control structures are designed and shall be installed in accordance with the New York Standards and Specifications for Erosion and Sediment Control.

c. Construction Practices to Minimize Stormwater Contamination

All waste materials will be collected and stored in a secure metal dumpster supplied by a waste handler which is a licensed solid waste management company. All trash and construction debris from the site shall be deposited in the dumpster. The dumpster will be emptied on an as-needed basis and the trash will be hauled to an approved landfill. No construction materials will be buried on-site. All personnel will be instructed regarding the correct procedure for waste disposal. All sanitary waste will be collected from the portable units by a licensed sanitary sewer waste management contractor. Good housekeeping and spill control practices will be followed during construction to minimize stormwater contamination from petroleum products, fertilizers, paints, and concrete. To prevent stormwater contamination from the site, good housekeeping practices are listed below:

- Fertilizers will be applied only in the minimum amounts recommended by the manufacturer, unless specified otherwise by the engineer and will be worked into the soil to limit exposure to stormwater.

- Fertilizers and hazardous materials/waste shall be stored in a covered shed or a sealable bin to avoid spills.

- All construction vehicles on site shall be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage.

- Petroleum products shall be stored in tightly sealed containers which are clearly labeled. Storage shall comply w/ NYSDEC standard requirements for the material(s) contained.

- Sanitary waste shall be collected from portable units as needed to avoid overfilling.

- All curing compounds shall be tightly sealed and stored when not required for use. Excess compounds shall not be discharged to the storm system and shall be properly disposed according to the manufacturer's instructions.

- Materials and equipment necessary for spill cleanup shall be kept in the temporary material storage trailer onsite. Equipment shall include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, fast absorbent material, sand, saw dust, and plastic and metal trash containers.

- Petroleum spills must be reported to the DEC. Consult NYDEC regulations for spills.

  All reportable petroleum spills and most hazardous spills must be reported to the DEC hotline (1-800-457-7362) and the National Response Center (1-800-424-8802). Report the spill to local authorities, if required. For spills not deemed reportable, facts concerning the incident shall be documented by the spiller and a record maintained for one year.

- Concrete trucks shall only be allowed to wash out or discharge surplus concrete or drum wash water to a correctly installed and maintained concrete wash-out area.

- When testing/cleaning of water supply lines occurs, the discharge from the tested pipe will be collected and conveyed to a completed stormwater collection system for ultimate discharge into the stormwater management facility.

- Stabilized construction entrances shall be constructed to reduce vehicle tracking of sediments onto public roadways.

- The paved roads at the site entrances shall be swept daily to remove excess mud, dirt, or rock tracked from the site.
- Dump trucks hauling fine and dusty material from the construction site shall be covered with a tarpaulin.
- All ruts caused by equipment used for site clearing and grading shall be eliminated by re-grading.

d. Coordination of Stormwater Management Control Structures with Construction Activities

Stormwater Management Control Structures shall be coordinated with construction activities, so the control plan is in place before construction begins. The following control structures will be coordinated with construction activities:

- The temporary perimeter controls (silt fences, stabilized construction entrance, sediment basins and check dams) shall be installed before any work begins.
- Clearing and grading shall not occur in an area until it is necessary for construction to proceed.
- Once construction activity ceases permanently in an area, that area will be immediately stabilized with permanent seed and mulch.
- The proposed detention basin shall initially be constructed as a sediment trap during construction (See Construction Documents).
- The temporary perimeter controls (silt fencing) shall not be removed until all construction activities at the site are complete and soils have been stabilized.

e. Certification of Compliance with Federal, State, and Local Regulation

This SWPPP reflects local, state, and federal requirements for stormwater management and erosion and sediment control, as established in SPDES General Permit for Stormwater Discharge from Construction Activity, Permit No. GP-0-20-001. There are no other applicable State or Federal requirements for sediment and erosion site plans (or permits), or stormwater management site plans (or permits).

3.2 Maintenance/Inspection Procedures

a. Inspections

Visual inspections of all cleared and graded areas of the construction site will be performed weekly as required by the SPDES General Permit for Stormwater Discharge from Construction Activities (GP-0-20-001). Inspection Reports will be submitted to the developer, the construction contractor(s), and the Town of Canandaigua.

The site inspections will be conducted by a qualified professional whom the DEC defines as a person knowledgeable in principals and practice of erosion and sediment controls, such as a licensed professional engineer, Certified Professional in Erosion and Sediment Control (CPESC), or soil scientist. The inspections will verify that the control structures described in Section 3 of this SWPPP are being utilized correctly to control erosion and sedimentation. The inspector shall also have the capacity to require additional controls as required to control erosion and sediment on the site. The inspection will also verify that the procedures used to prevent stormwater contamination from construction materials and petroleum products are effective.

The Inspection Report will be completed after each inspection. A copy of the report form to be completed by the SWPPP coordinator is provided in APPENDIX A of this SWPPP. Completed forms will be maintained on-site during the entire construction project. A copy shall also be submitted to the governing agency. The developer will be responsible for reviewing each report and making all necessary repairs to the stormwater management facilities as indicated in the report. Following construction, the completed forms shall be retained at the owner’s office for a minimum of one year.

If construction activities change or design modifications are made to the site plan which could impact stormwater, this SWPPP will be amended appropriately by recommendations and requirements set forth by the inspector. The inspection report shall serve as an amendment to this SWPPP.

b. <u>Maintenance</u>

1. Construction

During construction and until such time as the site is stabilized, all erosion/sediment control measures shall be maintained as specified in the New York Standards and Specifications for Erosion and Sediment Control and as summarized below:

- Silt Fence - Remove accumulated sediment when bulges appear in the fencing or when sediment is one-foot deep.
- Sediment Trap - Remove sediment and restore trap to original dimensions when sediment has accumulated to one-half of the design depth of the trap.
- Stabilized Construction Entrance - Periodic top dressing with stone is required to help prevent tracking of sediment onto public roads.

2. Post-Construction

APPENDIX F includes the recommended Maintenance and Management Inspection Checklists taken from the New York State Stormwater Management Design Manual for the stormwater management facility.

Maintenance of the site by the owner will also include but not be limited to the following:

- Periodic sweeping of the pavement to remove accumulated sediment.

- Periodic mowing of the banks of the pond area and maintenance of the vegetation.

3. 3. Employee Training

An employee training program shall be developed and implemented by the owner(s) and contractors to educate employees about the requirements of the SWPPP. This education program will include background on the components and goals of the SWPPP and hands-on training in erosion controls, spill prevention and response, good housekeeping, proper material handling, disposal and control of waste, equipment fueling, and proper storage, washing, and inspection procedures. All employees shall be trained prior to their first day on the site.

3.4 SWPPP COORDINATOR AND DUTIES

A construction site SWPPP coordinator for the facility shall be appointed by the developer and/or contractor. The duties of the construction site SWPPP coordinator include the following:

- Implement the SWPPP plan with the aid of the SWPPP team; Oversee maintenance practices identified in the SWPPP
- Implement and oversee employee training
- Conduct or provide for inspection and monitoring activities
- Identify other potential pollutant sources and make sure they are added to the plan
- Identify any deficiencies in the SWPPP and make sure they are corrected, and ensure that any changes in construction plans are addressed in the SWPPP
- Ensure that all housekeeping and monitoring procedures are implemented

4.0 POST-CONSTRUCTION STORMWATER MANAGEMENT

4.1 Collection and Conveyance Facilities

Permanent stormwater collection and conveyance facilities are designed to control the developed, post-construction stormwater runoff from the proposed development, employing the following standards:

Facilities	Design Standard
Underground storm sewer and catch basins	- developed 10-year storm
Swales	- developed 10-year storm
Major culverts	- developed 25-year storm
Overland stabilized flood routes	- developed 100-year storm

(1) Pipe velocity <15 fps, rip-rap aprons provided at outlets in accordance with New York Standards and Specifications for Erosion and Sediment Control.

(2) If calculated channel velocity exceeds 6 fps, then erosion protection (i.e. stone lining, pavement, staked mesh) will be provided in accordance with New York Standards and Specifications for Erosion and Sediment Control.

4.2 Stormwater Peak Runoff Rates and Water Quality Management

Due to the construction of additional impervious surfaces, peak stormwater runoff rates, volumes, and pollutant loads will increase when the new areas are developed. Mitigation of this impact is achieved through employment of stormwater management measures that achieve pollutant removal goals, reduce channel erosion, prevent overbank flooding, and help control extreme floods. This project will meet all NYSDEC Water quality treatment requirements for the improvements. In addition, this project will meet the Town of Canandaigua required Enhanced Phosphorous Removal as outlined in Chapter 10 of the SWDM.

No phosphorous shall be used at planting time unless soil testing has been completed and tested by a horticultural testing lab and the soil tests specifically indicate a phosphorus deficiency that is harmful or will prevent new lawns and plantings from establishing properly. If soil tests indicate a phosphorous deficiency that will impact plant and lawn establishment, phosphorous shall be applied at the minimum recommended level prescribed in the soil test following all NYS DEC requirements.

Green infrastructure has been implemented (Appendix C) to reduce, infiltrate and treat the required water quality volume. The proposed wet pond has been designed using the unified stormwater sizing criteria in accordance with the New York State Stormwater Design Manual, Detail P-2 ("Wet Pond"). The following is a summary of how the design standards have been met.

Water Quality/Runoff Reduction- Green Infrastructure (APPENDIX C).

Channel Protection	-	Provided in the P-2 Pond above permanent pool.
Overbank Flood	-	Provided in the P-2 Pond above bottom. Use catch basin to safely outlet these flows.
Extreme Storm	-	Provided in the P-2 Pond. Use 10' wide emergency spillway to convey these flows out of the pond.

Computations for the design are included in APPENDICES B and C. FIGURES 5 and 6 show existing and proposed tributary drainage areas.

5.0 GREEN INFRASTRUCTURE TECHNIQUES

This project has incorporated several of the required practices outlined by the SWDM as "Green Infrastructure Techniques and Practices". The intent of these practices is to preserve natural areas and features as well as promote infiltration and groundwater recharge. Appendix C explains the design and implementation of these practices.

Dry swales are applied to receive runoff from newly impervious areas. This practice is a total of approximately 710 linear feet of grass channel totaling approximately 32,905 cubic feet of storage capacity. Runoff will be collected in these swales and filtered through a vegetative and soil media before conveyance to the wet pond. Overflow from the pond will flow into a vegetative channel and discharge north to the unnamed unclassified stream.

6.0 NOTICE OF TERMINATION

Following the completion of construction, the owner/operator shall file a Notice of Termination (NOT) with the DEC (APPENDIX H). Prior to filing the NOT, the operator shall have the qualified professional perform a final site inspection, at which time the qualified professional shall certify that the site has undergone final stabilization. “Final Stabilization” means that all soil-disturbing activities at the site have been completed and a uniform, perennial vegetative cover with a density of 80% has been established or equivalent stabilization measures (such as the use of mulches or geotextile) have been employed on all unpaved areas and areas not covered by permanent structures.

6.0 Certification

Engineer's Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manages the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law."

____
Name

Project Engineer
Title

____
Date

Corporate Certification (Owner)

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manages the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law."

____

Name

____

Title

____

Date

The General Contractor shall be responsible for the coordination of the installation and maintenance of all erosion and sediment controls for the project, including the work of all subcontractors. Final stabilization of the site, including removal of temporary controls and placement of permanent stormwater management practices shall also be coordinated by the General Contractor.

Contractor Certification (General Contractor)

"I hereby certify that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the *owner or operator* must comply with the terms and conditions of the New York State Pollutant Discharge Eliminate System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I understand that certifying false, incorrect, or inaccurate information is a violation of the referenced permit and the laws of the State of New York and subject me to criminal, civil, and/or administrative proceedings."

____
Name

____
Title

____
Date

The excavation and grading subcontractor shall be responsible for erosion and sediment control during all aspects of general excavation and grading including, but not limited to; clearing and grubbing, installation of temporary stabilization controls (silt fence, sediment traps, diversion swales, temporary seeding, etc.) earthwork, utility installations, paving, and other permanent, non-vegetative cover.

Contractor Certification (Excavations and Grading Subcontractor)

"I hereby certify that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the *owner or operator* must comply with the terms and conditions of the New York State Pollutant Discharge Eliminate System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I understand that certifying false, incorrect, or inaccurate information is a violation of the referenced permit and the laws of the State of New York and subject me to criminal, civil, and/or administrative proceedings."

____
Name

____
Title

____
Date

The Landscaping Contractor shall be responsible for erosion and sediment control practices, including permanent vegetative cover, during and directly related to all landscaping for the project.

Contractor Certification (Landscaping Subcontractor)

"I hereby certify that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the *owner or operator* must comply with the terms and conditions of the New York State Pollutant Discharge Eliminate System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I understand that certifying false, incorrect, or inaccurate information is a violation of the referenced permit and the laws of the State of New York and subject me to criminal, civil, and/or administrative proceedings."

____

Name

____

Title

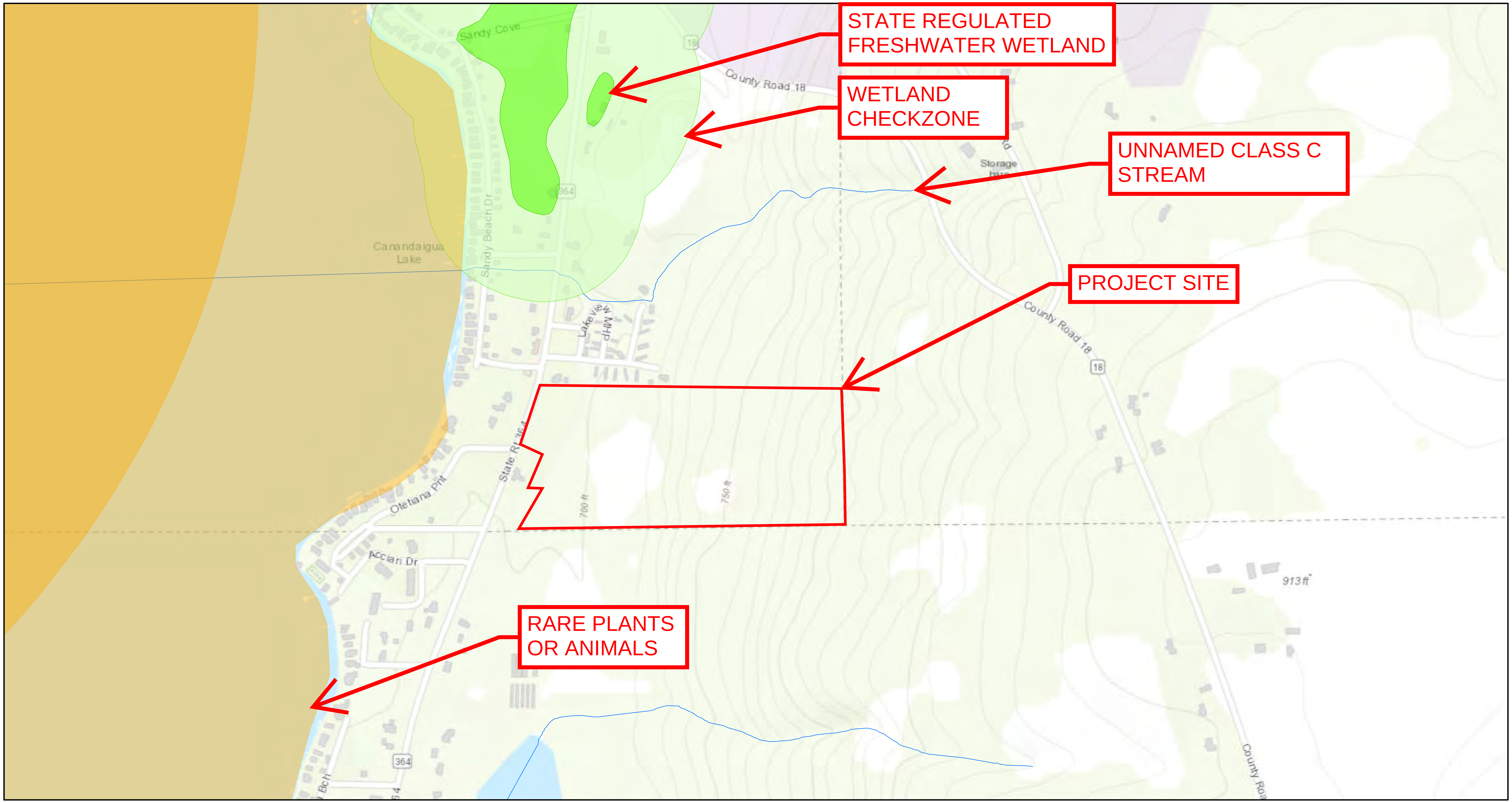
____

Date

FIGURE 1

LOCATION MAP

Figure-1 LOCATION MAP



April 19, 2021

1:9,028

0 0.07 0.15 0.3 mi

0 0.13 0.25 0.5 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Author: Marks Engineering
Not a legal document

FIGURE 2

AERIAL PHOTO

Figure-2 AERIAL MAP

April 6, 2021

1:9,028

0 0.07 0.15 0.3 mi

0 0.13 0.25 0.5 km

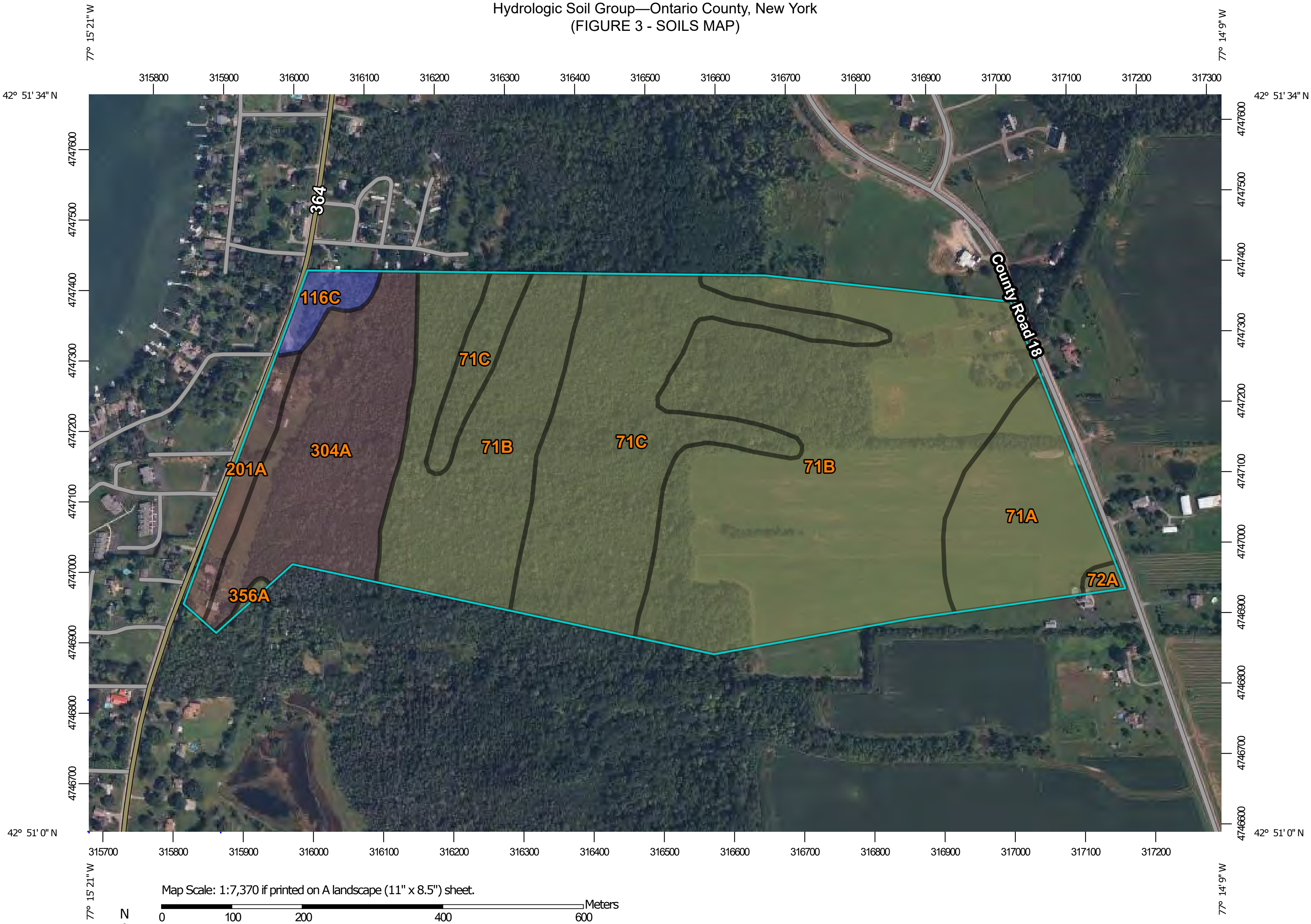
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Author: Marks Engineering
Not a legal document

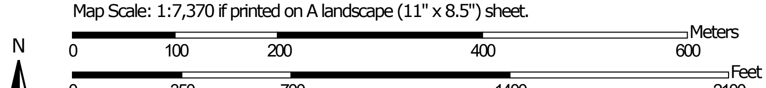
FIGURE 3

SOIL MAP

Hydrologic Soil Group—Ontario County, New York
(FIGURE 3 - SOILS MAP)



Map Scale: 1:7,370 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ontario County, New York
Survey Area Data: Version 19, Sep 1, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 3, 2021—Nov 7, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71A	Darien silt loam, 0 to 3 percent slopes	C/D	12.5	9.0%
71B	Darien silt loam, 3 to 8 percent slopes	C/D	71.8	51.8%
71C	Darien silt loam, 8 to 15 percent slopes	C/D	29.4	21.2%
72A	Darien-Ilion silt loams, 0 to 3 percent slopes	C/D	0.5	0.3%
116C	Ontario loam, 8 to 15 percent slopes	B	2.1	1.5%
201A	Lima loam, 0 to 3 percent slopes	B/D	3.3	2.4%
304A	Kendaia loam, 0 to 3 percent slopes	B/D	18.9	13.6%
356A	Ovid silt loam, 0 to 3 percent slopes	C/D	0.3	0.2%
Totals for Area of Interest			**138.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

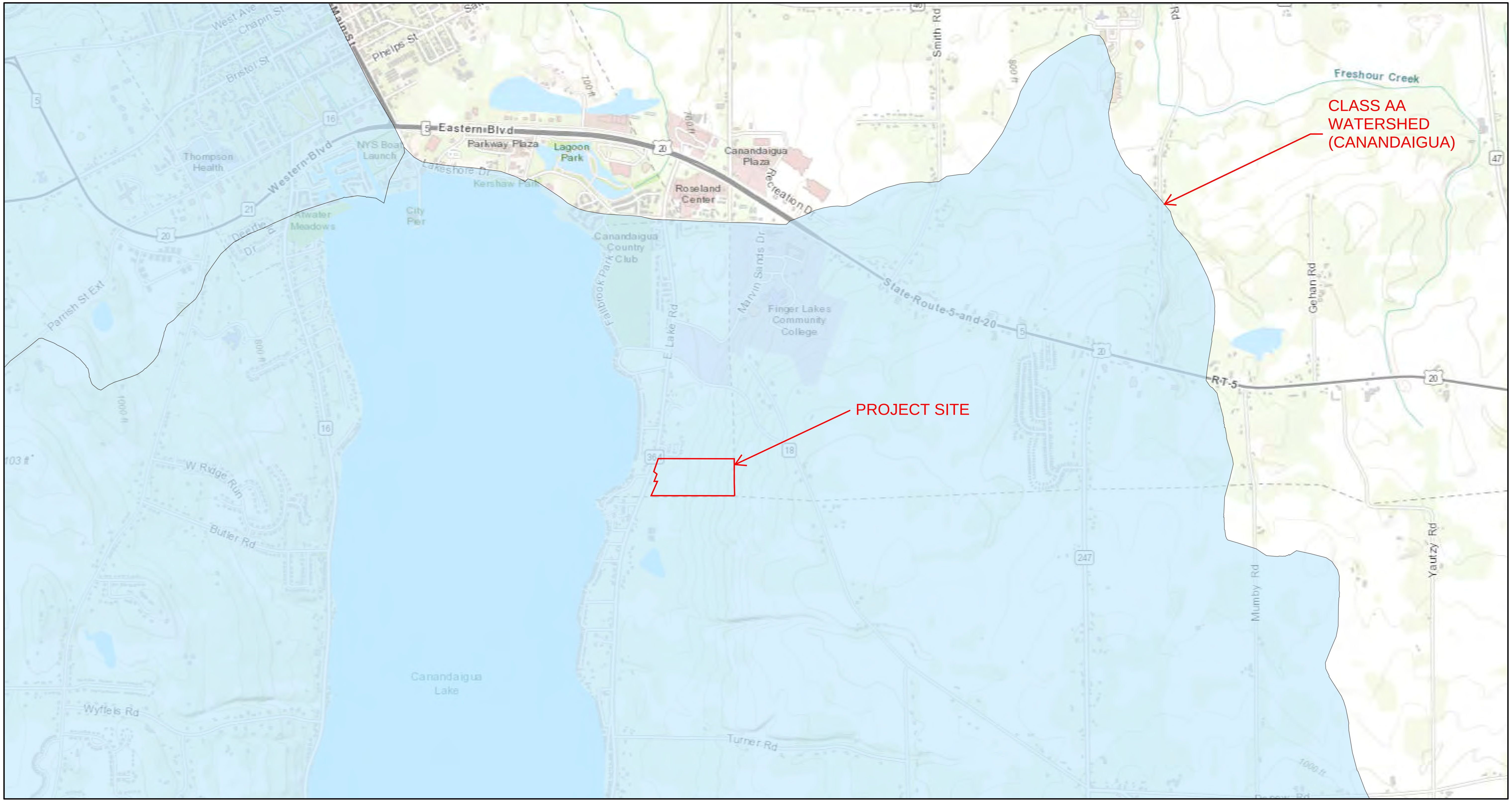
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FIGURE 4

NYS DEC STORMWATER MAPPER MAP

Figure - 4 STORMWATER MAP



April 6, 2021

1:36,112

0 0.33 0.65 1.3 mi

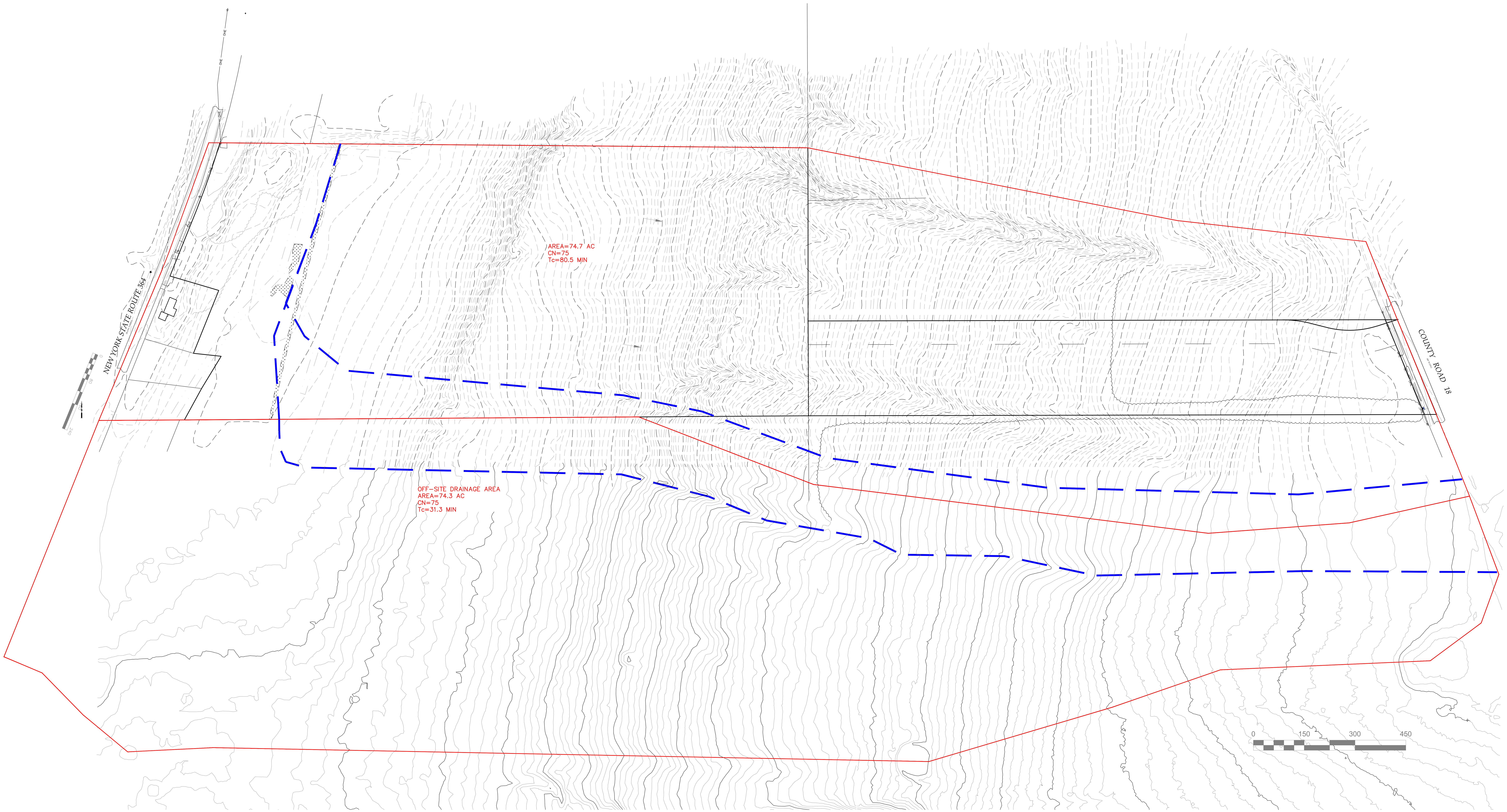
0 0.5 1 2 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Author: Marks Engineering
Not a legal document

FIGURE 5

EXISTING DRAINAGE MAP



1 FIGURE 5A – EXISTING DRAINAGE AREA MAP
1"=150'

MarksEngineering
4 2 BEEMAN ST
CANANDAIGUA, NY 14424
www.marksengineering.com
Phone 585-905-0360
Fax: 585-485-6205
bmarks@marksengineering.com

STATE OF NEW YORK · BRENNAN A MARKS · 093182 · LICENSED PROFESSIONAL ENGINEER

STAMP

STAMP

REVISIONS

NO.	DATE	DESCRIPTION OF REVISION	BY
1			
2			
3			
4			
5			
6			
7	12/19/22	PER MRB COMMENTS	BAM

SITE DEVELOPMENT PLANS PREPARED FOR:
SUNSET RIDGE ESTATES/ LAKEWOOD CUSTOM HOMES
RESIDENTIAL DEVELOPMENT
SHOWING LAND IN:
3535 STATE ROUTE 364 /0000 COUNTY ROAD 18
TOWN OF CANANDAIGUA/HOPEWELL
COUNTY OF ONTARIO STATE OF NEW YORK

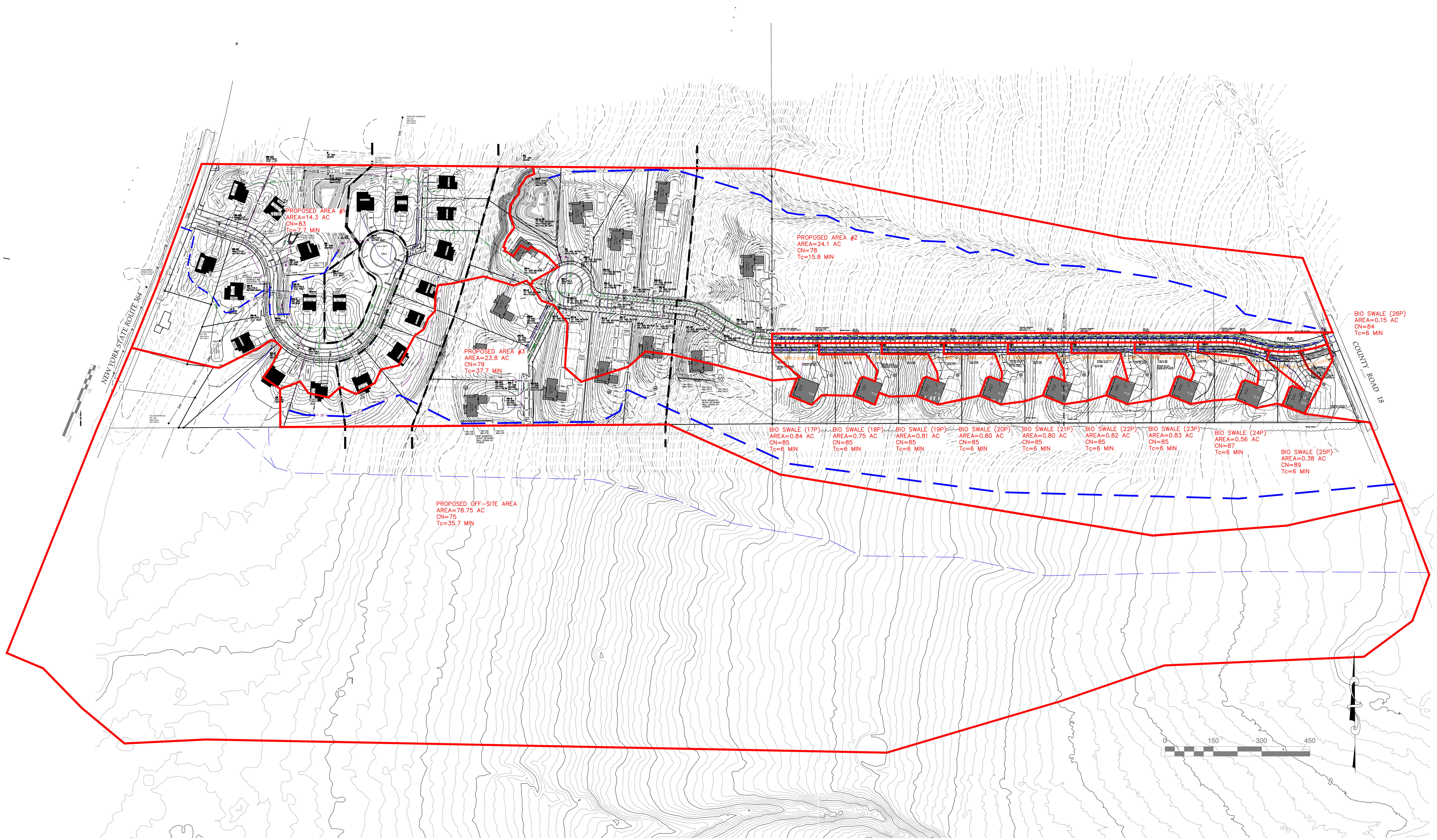
DRAWING TITLE:
SWPPP FIGURE

DRAWN BY:	XXX
DESIGNED BY:	XXX
CHECKED BY:	BAM
SCALE:	AS NOTED
JOB NO.:	20-243
DATE:	02/01/2023
TAX MAP#:	98.19-1-20.10

FIG. 5A

FIGURE 6

PROPOSED DRAINAGE MAP



1 FIGURE 6 – PROPOSED DRAINAGE AREA MAP
1"=150'

MarksEngineering
4 2 BEEMAN ST
CANANDAIGUA, NY 14424
www.marksengineering.com
Phone 585-905-0360
Fax: 585-485-6205
bmarks@marksengineering.com

STATE OF NEW YORK · BRENNAN A MARKS · 093182 · LICENSED PROFESSIONAL ENGINEER

STAMP

REVISIONS

NO.	DATE	DESCRIPTION OF REVISION	BY
1	12/19/22	PER MRB COMMENTS	BAM
2			
3			
4			
5			
6			

SITE DEVELOPMENT PLANS PREPARED FOR:
SUNSET RIDGE ESTATES/ LAKEWOOD CUSTOM HOMES
RESIDENTIAL DEVELOPMENT
SHOWING LAND IN:
3535 STATE ROUTE 364 /0000 COUNTY ROAD 18
TOWN OF CANANDAIGUA/HOPEWELL
COUNTY OF ONTARIO
STATE OF NEW YORK

DRAWING TITLE:
SWPPP FIGURE

DRAWN BY:	JPS
DESIGNED BY:	XXX
CHECKED BY:	BAM
SCALE:	AS NOTED
JOB NO.:	20-243
DATE:	02/01/2023
TAX MAP#:	98.19-1-20.10

FIG. 6

APPENDIX A

Inspection Report Form

MARKS ENGINEERING, P.C.

42 BEEMAN STREET, CANANDAIGUA, NY 14424 phone 585.329.6138 fax 585.486.6205

SWPPP INSPECTION REPORT

PROJECT: ____________________ SPDES PERMIT NO. : ____________________

PROJECT NO.: WEATHER:

CONSTRUCTION STAGE: LASTSIGNINFICANT PERCIPITATION EVENT:

	COMPONENT	CONDITION		DEFICIENCIES AND RECOMMENDATIONS
1	GENERAL HOUSEKEEPING	ACCEPT		
		DEFICIENT	N/A	
2	SILT FENCE/ PERIMETER CONTROLS	ACCEPT		
		DEFICIENT	N/A	
3	SEDIMENT BASINS, TRAPS & PONDS	ACCEPT		
		DEFICIENT	N/A	
4	INLET PROTECTION	ACCEPT		
		DEFICIENT	N/A	
5	PAVEMENT/ ROADWAY/ OFF-SITE	ACCEPT		
		DEFICIENT	N/A	
6	CONSTRUCTION ACCESS	ACCEPT		
		DEFICIENT	N/A	
7	STABILIZATION (SEED/MULCH)	ACCEPT		
		DEFICIENT	N/A	
8	CHECK DAMS	ACCEPT		
		DEFICIENT	N/A	
9	SWALES & DIKES	ACCEPT		
		DEFICIENT	N/A	
10	STOCKPILES & MATERIAL MANAGEMENT	ACCEPT		
		DEFICIENT	N/A	
11	STABLIZED OUTLET PROTECTION & LEVEL SPREADERS	ACCEPT		
		DEFICIENT	N/A	
12	DEWATERING	ACCEPT		
		DEFICIENT	N/A	
13	CONCRETE WASH-OUT	ACCEPT		
		DEFICIENT	N/A	
14	RECORD KEEPING & POSTINGS	ACCEPT		
		DEFICIENT	N/A	
	CRITICAL / REPORT			
	SOIL CONDITIONS:	DRY	WET	none

ADDITIONAL COMMENTS:

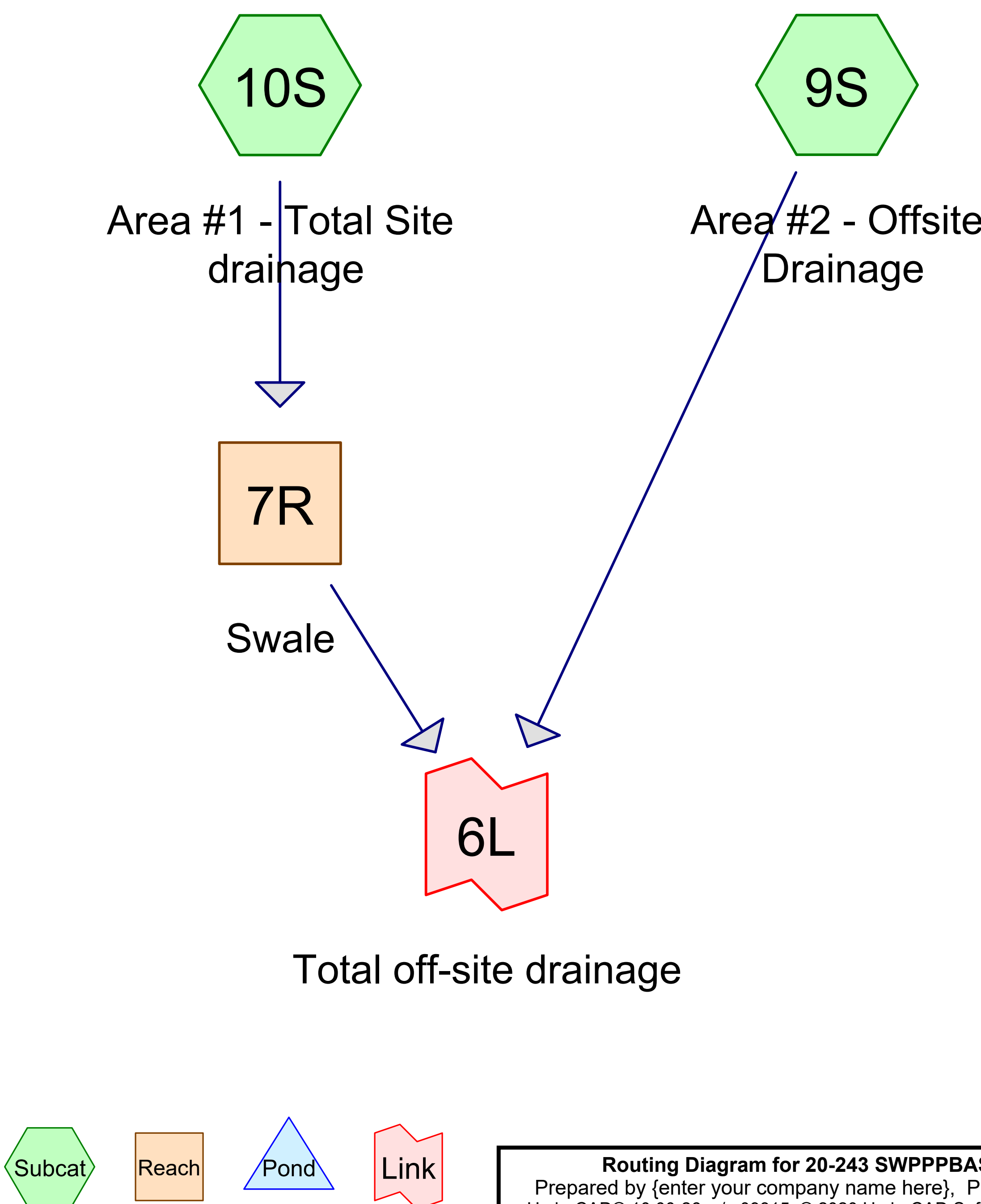
INSPECTION BY: ____________ TIME: ____________ DATE OF INSPECTION: ____________

SIGNATURE OF INSPECTOR: ____________ INSPECTIONS FREQUENCY Weekly

APPENDIX B

Existing and Proposed Peak Runoff Computations

Exsiting Drainage



Routing Diagram for 20-243 SWPPPBASE EX 9.1
Prepared by {enter your company name here}, Printed 2/27/2023

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.570	61	>75% Grass cover, Good, HSG B (10S)
7.100	80	>75% Grass cover, Good, HSG D (9S, 10S)
99.830	73	Brush, Good, HSG D (9S, 10S)
39.900	78	Meadow, non-grazed, HSG D (9S, 10S)
1.600	98	Paved parking, HSG D (9S, 10S)
149.000	**75**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.570	HSG B	10S
0.000	HSG C	
148.430	HSG D	9S, 10S
0.000	Other	
149.000		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.570	0.000	7.100	0.000	7.670	>75% Grass cover, Good	9S, 10S
0.000	0.000	0.000	99.830	0.000	99.830	Brush, Good	9S, 10S
0.000	0.000	0.000	39.900	0.000	39.900	Meadow, non-grazed	9S, 10S
0.000	0.000	0.000	1.600	0.000	1.600	Paved parking	9S, 10S
0.000	**0.570**	**0.000**	**148.430**	**0.000**	**149.000**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment9S: Area #2 - Offsite Runoff Area=74.300 ac 0.67% Impervious Runoff Depth>0.33"
Flow Length=3,745' Tc=31.3 min CN=75 Runoff=14.58 cfs 2.014 af

Subcatchment10S: Area #1 - Total Site Runoff Area=74.700 ac 1.47% Impervious Runoff Depth>0.32"
Flow Length=4,104' Tc=80.5 min CN=75 Runoff=8.53 cfs 1.988 af

Reach 7R: Swale Avg. Flow Depth=0.18' Max Vel=0.93 fps Inflow=8.53 cfs 1.988 af
n=0.030 L=847.0' S=0.0060 '/' Capacity=181.24 cfs Outflow=8.13 cfs 1.960 af

Link 6L: Total off-site drainage Inflow=14.94 cfs 3.974 af
Primary=14.94 cfs 3.974 af

Total Runoff Area = 149.000 ac Runoff Volume = 4.002 af Average Runoff Depth = 0.32"
98.93% Pervious = 147.400 ac 1.07% Impervious = 1.600 ac

Summary for Subcatchment 9S: Area #2 - Offsite Drainage

CarlsonPlanXYPos|642280.8804|1040430.0233|
CarlsonSurface||

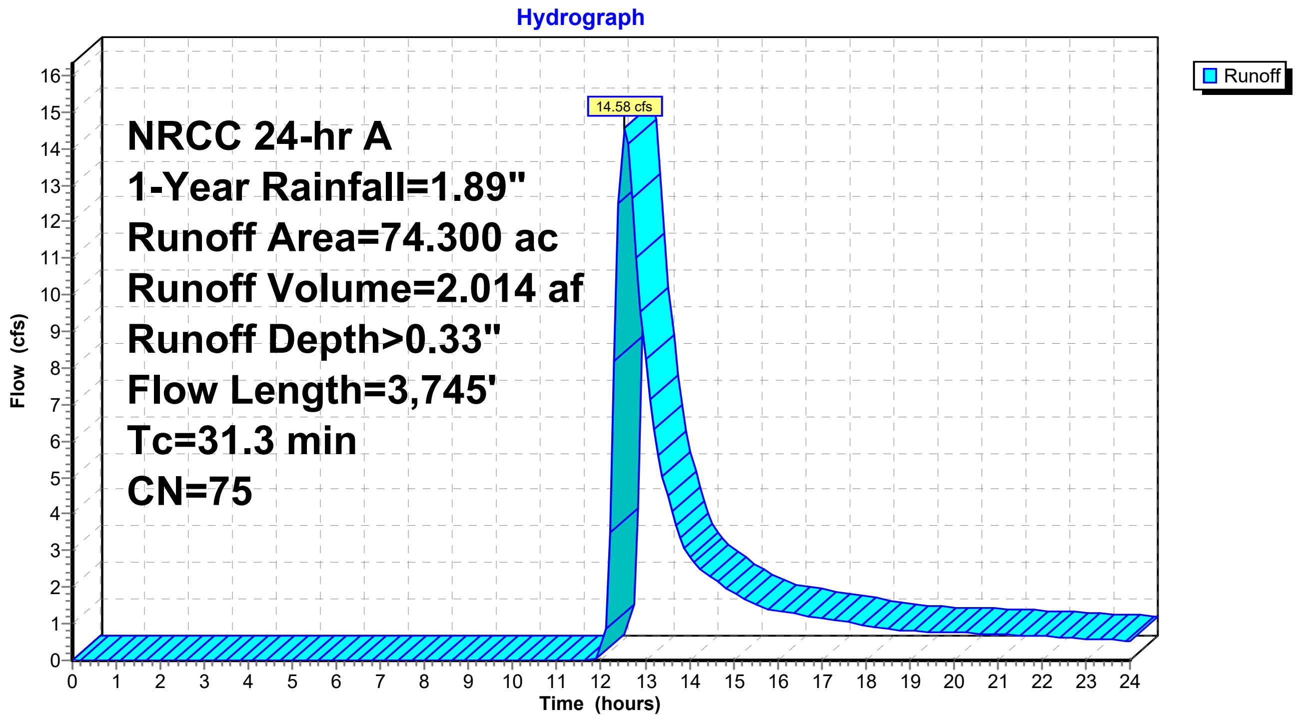
Runoff = 14.58 cfs @ 12.54 hrs, Volume= 2.014 af, Depth> 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.500	98	Paved parking, HSG D
22.000	78	Meadow, non-grazed, HSG D
3.200	80	>75% Grass cover, Good, HSG D
48.600	73	Brush, Good, HSG D
74.300	75	Weighted Average
73.800		99.33% Pervious Area
0.500		0.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
10.8	1,165	0.0400	1.80		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
1.2	1,445	0.0850	19.33	1,352.84	**Channel Flow, Channel Flow** Area= 70.0 sf Perim= 72.0' r= 0.97' n= 0.022 Earth, clean & straight
7.3	560	0.0650	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
1.2	115	0.1000	1.58		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
10.5	445	0.0200	0.71		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
31.3	3,745	Total			

Subcatchment 9S: Area #2 - Offsite Drainage



Summary for Subcatchment 10S: Area #1 - Total Site drainage

CarlsonPlanXYPos|641529.7843|1041282.6220|
CarlsonSurface||

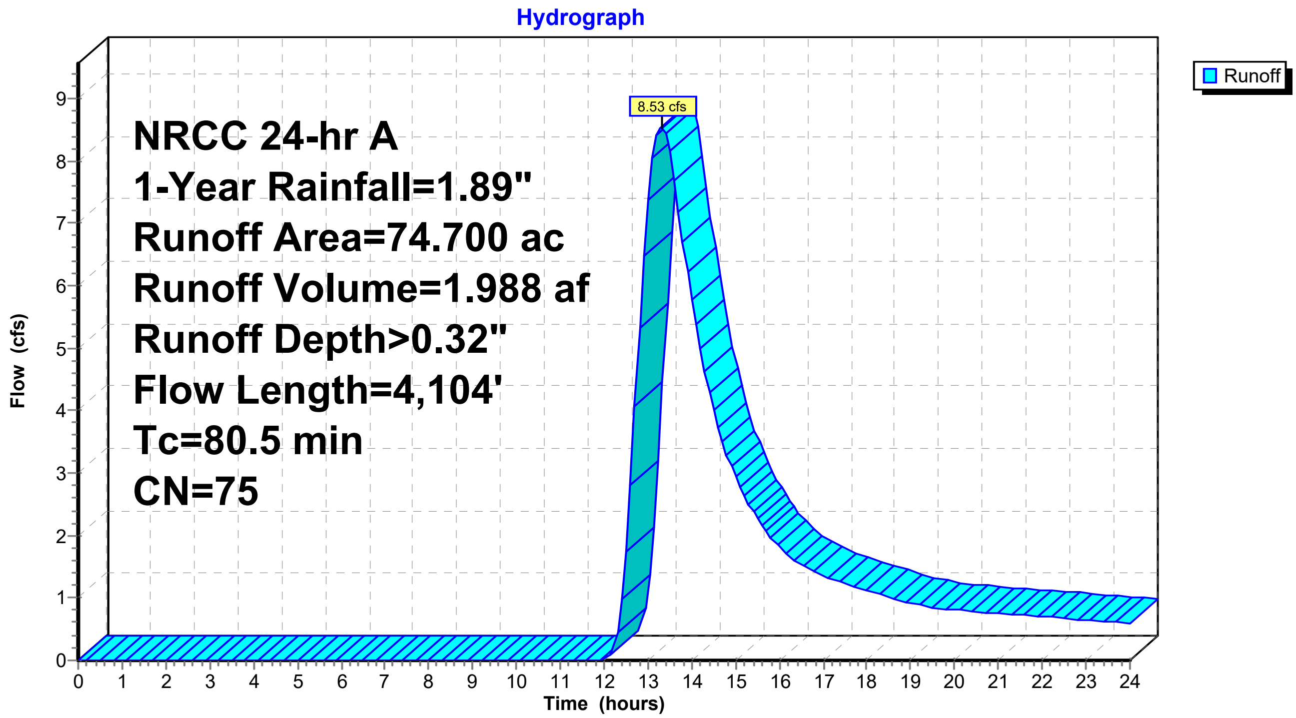
Runoff = 8.53 cfs @ 13.31 hrs, Volume= 1.988 af, Depth> 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.570	61	>75% Grass cover, Good, HSG B
1.100	98	Paved parking, HSG D
17.900	78	Meadow, non-grazed, HSG D
51.230	73	Brush, Good, HSG D
3.900	80	>75% Grass cover, Good, HSG D
74.700	75	Weighted Average
73.600		98.53% Pervious Area
1.100		1.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.19"
11.5	85	0.0200	0.12		**Sheet Flow, Sheet flow** Cultivated: Residue>20% n= 0.170 P2= 2.19"
5.0	385	0.0200	1.27		**Shallow Concentrated Flow, Shallow concentrated** Cultivated Straight Rows Kv= 9.0 fps
10.2	1,400	0.0640	2.28		**Shallow Concentrated Flow, Shallow concentrated** Cultivated Straight Rows Kv= 9.0 fps
3.9	307	0.0700	1.32		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.2	323	0.1100	1.66		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
5.7	395	0.0530	1.15		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
2.0	184	0.0920	1.52		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
7.1	367	0.0300	0.87		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
15.3	145	0.0010	0.16		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
16.3	498	0.0070	0.51	29.22	**Channel Flow, Channel Flow** Area= 57.5 sf Perim= 220.0' r= 0.26' n= 0.100 Heavy timber, flow below branches
80.5	4,104	Total			

Subcatchment 10S: Area #1 - Total Site drainage



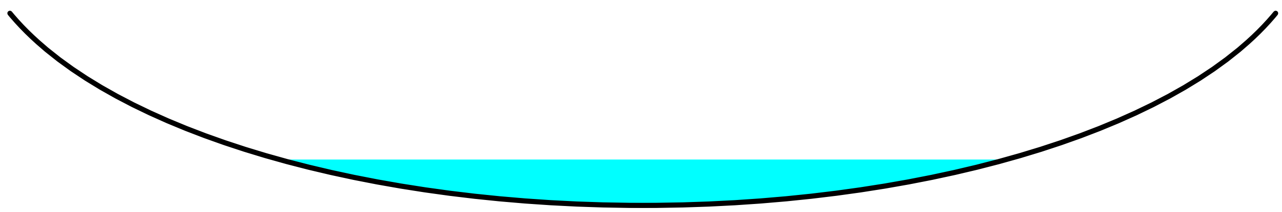
Summary for Reach 7R: Swale

Inflow Area = 74.700 ac, 1.47% Impervious, Inflow Depth > 0.32" for 1-Year event
Inflow = 8.53 cfs @ 13.31 hrs, Volume= 1.988 af
Outflow = 8.13 cfs @ 13.51 hrs, Volume= 1.960 af, Atten= 5%, Lag= 12.1 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 0.93 fps, Min. Travel Time= 15.2 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 25.9 min

Peak Storage= 7,404 cf @ 13.51 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 0.75' Flow Area= 75.0 sf, Capacity= 181.24 cfs

150.00' x 0.75' deep Parabolic Channel, n= 0.030 Short grass
Length= 847.0' Slope= 0.0060 '/'
Inlet Invert= 705.50', Outlet Invert= 700.42'



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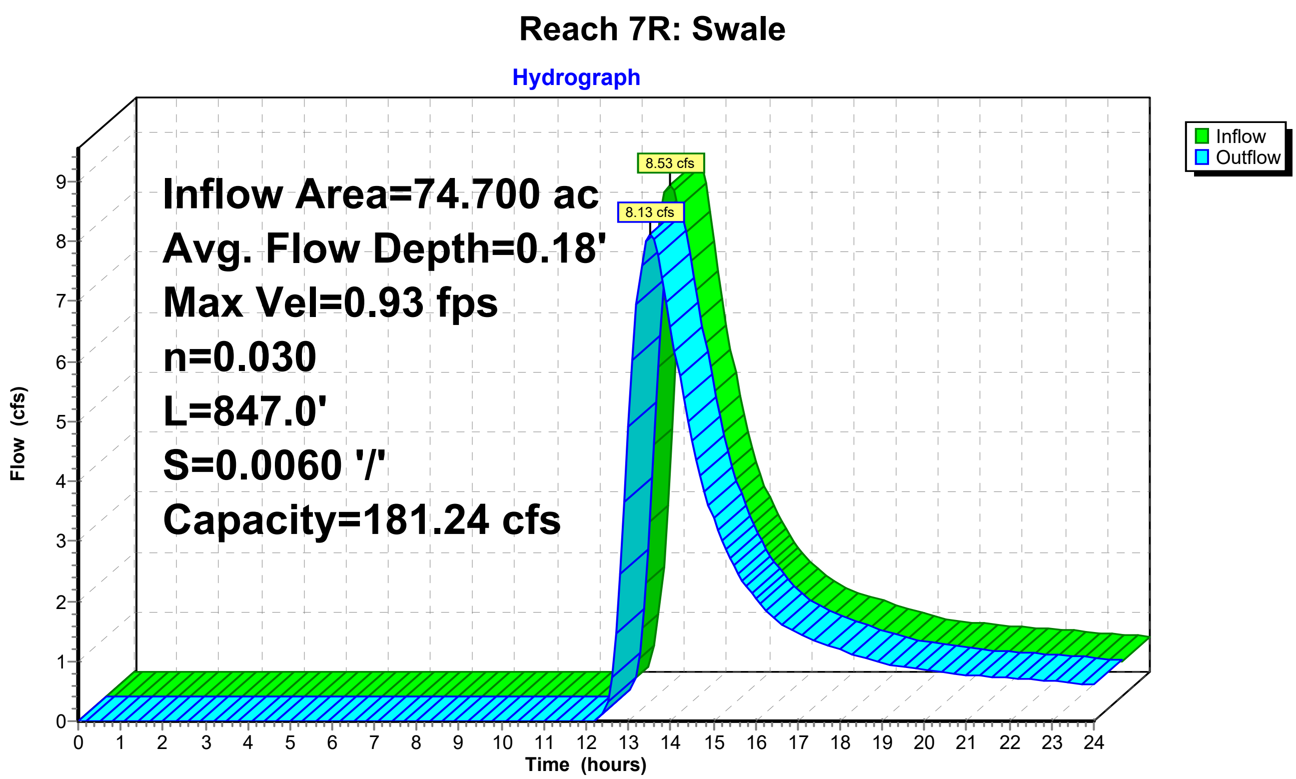
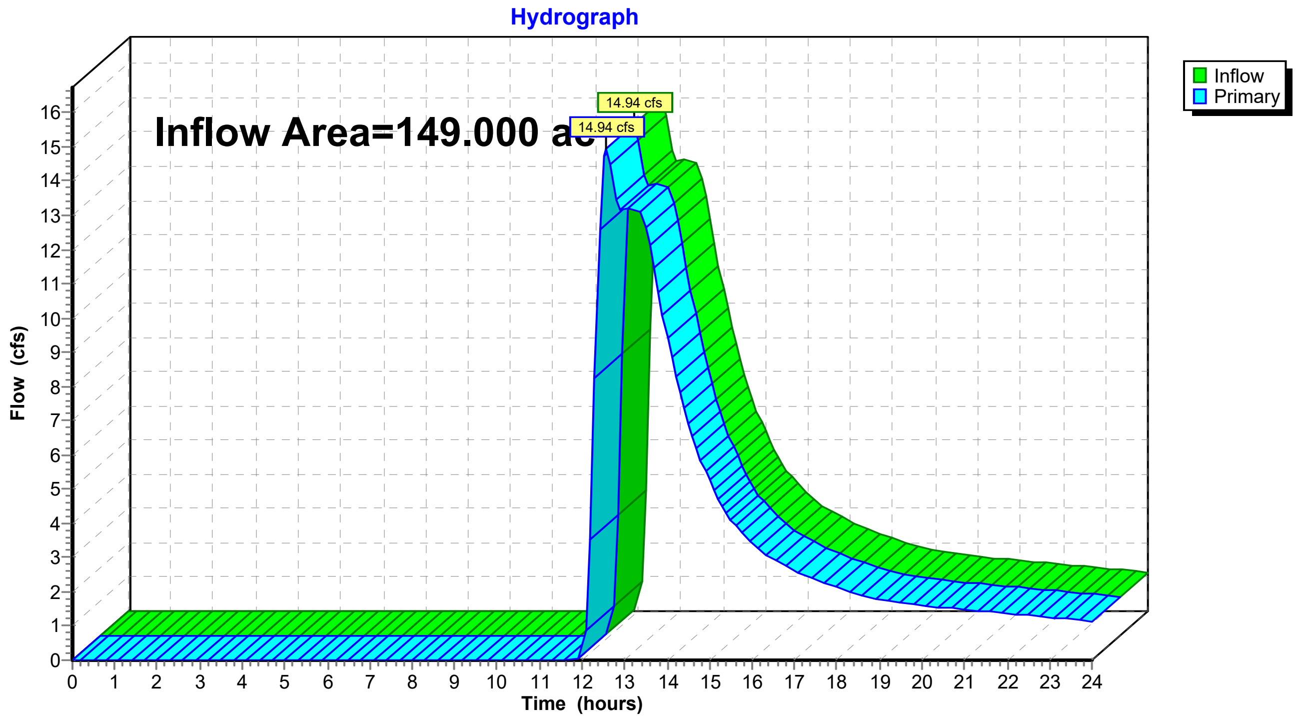


Summary for Link 6L: Total off-site drainage

Inflow Area = 149.000 ac, 1.07% Impervious, Inflow Depth > 0.32" for 1-Year event
Inflow = 14.94 cfs @ 12.56 hrs, Volume= 3.974 af
Primary = 14.94 cfs @ 12.56 hrs, Volume= 3.974 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs

Link 6L: Total off-site drainage



Time span=0.00-24.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment9S: Area #2 - Offsite Runoff Area=74.300 ac 0.67% Impervious Runoff Depth>1.05"
Flow Length=3,745' Tc=31.3 min CN=75 Runoff=57.37 cfs 6.475 af

Subcatchment10S: Area #1 - Total Site Runoff Area=74.700 ac 1.47% Impervious Runoff Depth>1.03"
Flow Length=4,104' Tc=80.5 min CN=75 Runoff=32.54 cfs 6.423 af

Reach 7R: Swale Avg. Flow Depth=0.34' Max Vel=1.42 fps Inflow=32.54 cfs 6.423 af
n=0.030 L=847.0' S=0.0060 '/' Capacity=181.24 cfs Outflow=31.83 cfs 6.372 af

Link 6L: Total off-site drainage Inflow=62.70 cfs 12.847 af
Primary=62.70 cfs 12.847 af

Total Runoff Area = 149.000 ac Runoff Volume = 12.898 af Average Runoff Depth = 1.04"
98.93% Pervious = 147.400 ac 1.07% Impervious = 1.600 ac

Summary for Subcatchment 9S: Area #2 - Offsite Drainage

CarlsonPlanXYPos|642280.8804|1040430.0233|
CarlsonSurface||

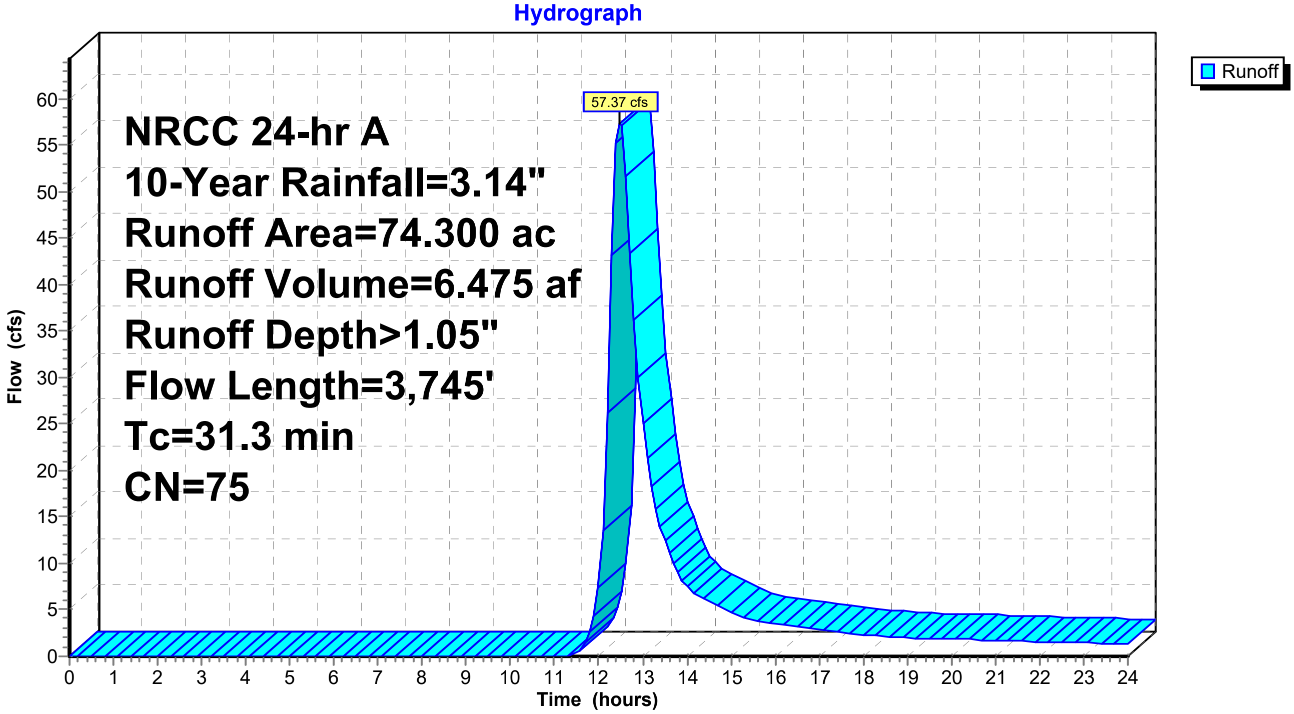
Runoff = 57.37 cfs @ 12.48 hrs, Volume= 6.475 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.500	98	Paved parking, HSG D
22.000	78	Meadow, non-grazed, HSG D
3.200	80	>75% Grass cover, Good, HSG D
48.600	73	Brush, Good, HSG D
74.300	75	Weighted Average
73.800		99.33% Pervious Area
0.500		0.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
10.8	1,165	0.0400	1.80		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
1.2	1,445	0.0850	19.33	1,352.84	**Channel Flow, Channel Flow** Area= 70.0 sf Perim= 72.0' r= 0.97' n= 0.022 Earth, clean & straight
7.3	560	0.0650	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
1.2	115	0.1000	1.58		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
10.5	445	0.0200	0.71		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
31.3	3,745	Total			

Subcatchment 9S: Area #2 - Offsite Drainage



Summary for Subcatchment 10S: Area #1 - Total Site drainage

CarlsonPlanXYPos|641529.7843|1041282.6220|
CarlsonSurface||

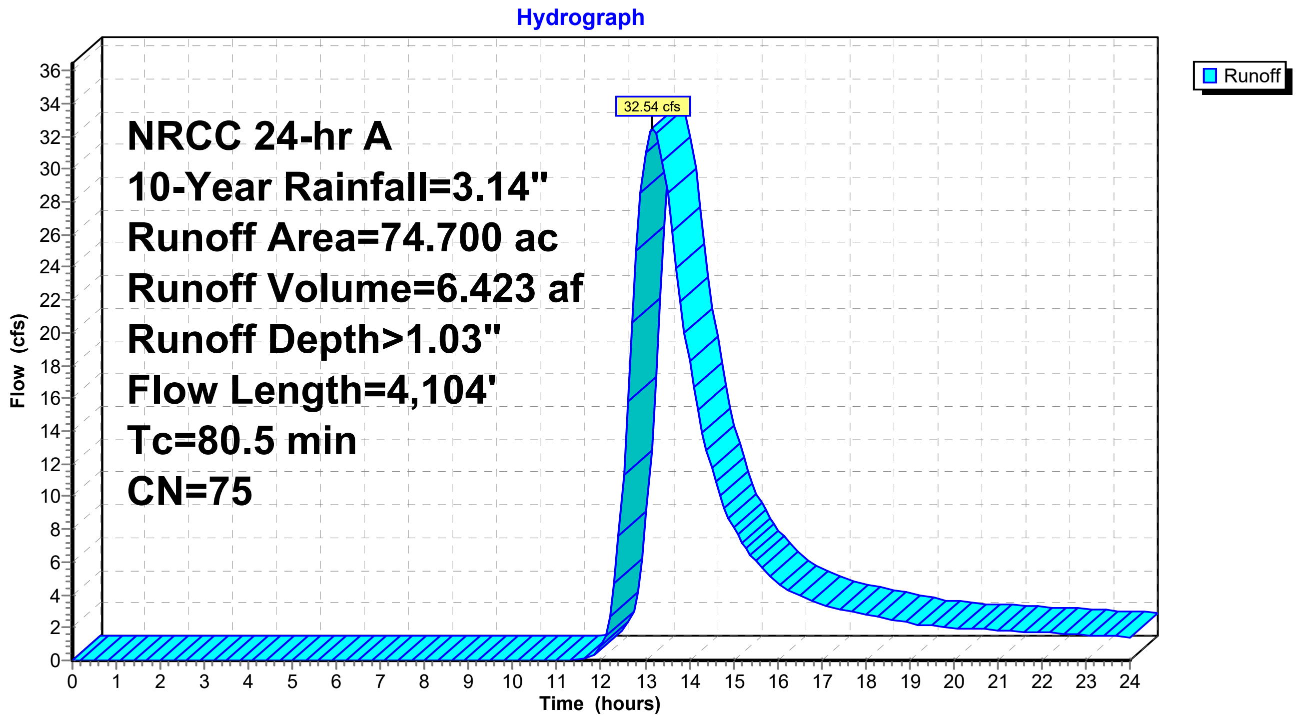
Runoff = 32.54 cfs @ 13.18 hrs, Volume= 6.423 af, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.570	61	>75% Grass cover, Good, HSG B
1.100	98	Paved parking, HSG D
17.900	78	Meadow, non-grazed, HSG D
51.230	73	Brush, Good, HSG D
3.900	80	>75% Grass cover, Good, HSG D
74.700	75	Weighted Average
73.600		98.53% Pervious Area
1.100		1.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.19"
11.5	85	0.0200	0.12		**Sheet Flow, Sheet flow** Cultivated: Residue>20% n= 0.170 P2= 2.19"
5.0	385	0.0200	1.27		**Shallow Concentrated Flow, Shallow concentrated** Cultivated Straight Rows Kv= 9.0 fps
10.2	1,400	0.0640	2.28		**Shallow Concentrated Flow, Shallow concentrated** Cultivated Straight Rows Kv= 9.0 fps
3.9	307	0.0700	1.32		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.2	323	0.1100	1.66		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
5.7	395	0.0530	1.15		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
2.0	184	0.0920	1.52		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
7.1	367	0.0300	0.87		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
15.3	145	0.0010	0.16		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
16.3	498	0.0070	0.51	29.22	**Channel Flow, Channel Flow** Area= 57.5 sf Perim= 220.0' r= 0.26' n= 0.100 Heavy timber, flow below branches
80.5	4,104	Total			

Subcatchment 10S: Area #1 - Total Site drainage



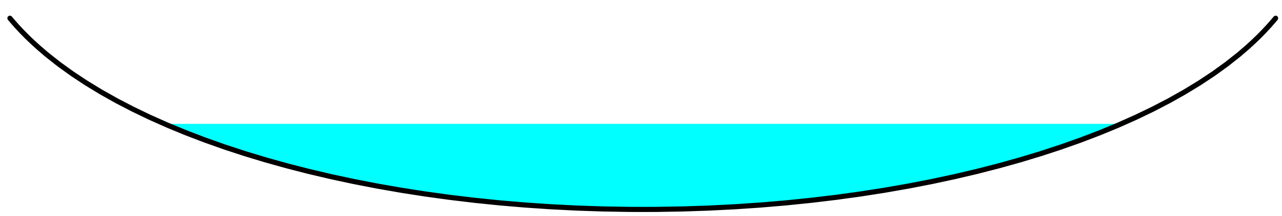
Summary for Reach 7R: Swale

Inflow Area = 74.700 ac, 1.47% Impervious, Inflow Depth > 1.03" for 10-Year event
Inflow = 32.54 cfs @ 13.18 hrs, Volume= 6.423 af
Outflow = 31.83 cfs @ 13.31 hrs, Volume= 6.372 af, Atten= 2%, Lag= 7.7 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 1.42 fps, Min. Travel Time= 10.0 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 19.5 min

Peak Storage= 19,054 cf @ 13.31 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 0.75' Flow Area= 75.0 sf, Capacity= 181.24 cfs

150.00' x 0.75' deep Parabolic Channel, n= 0.030 Short grass
Length= 847.0' Slope= 0.0060 '/'
Inlet Invert= 705.50', Outlet Invert= 700.42'



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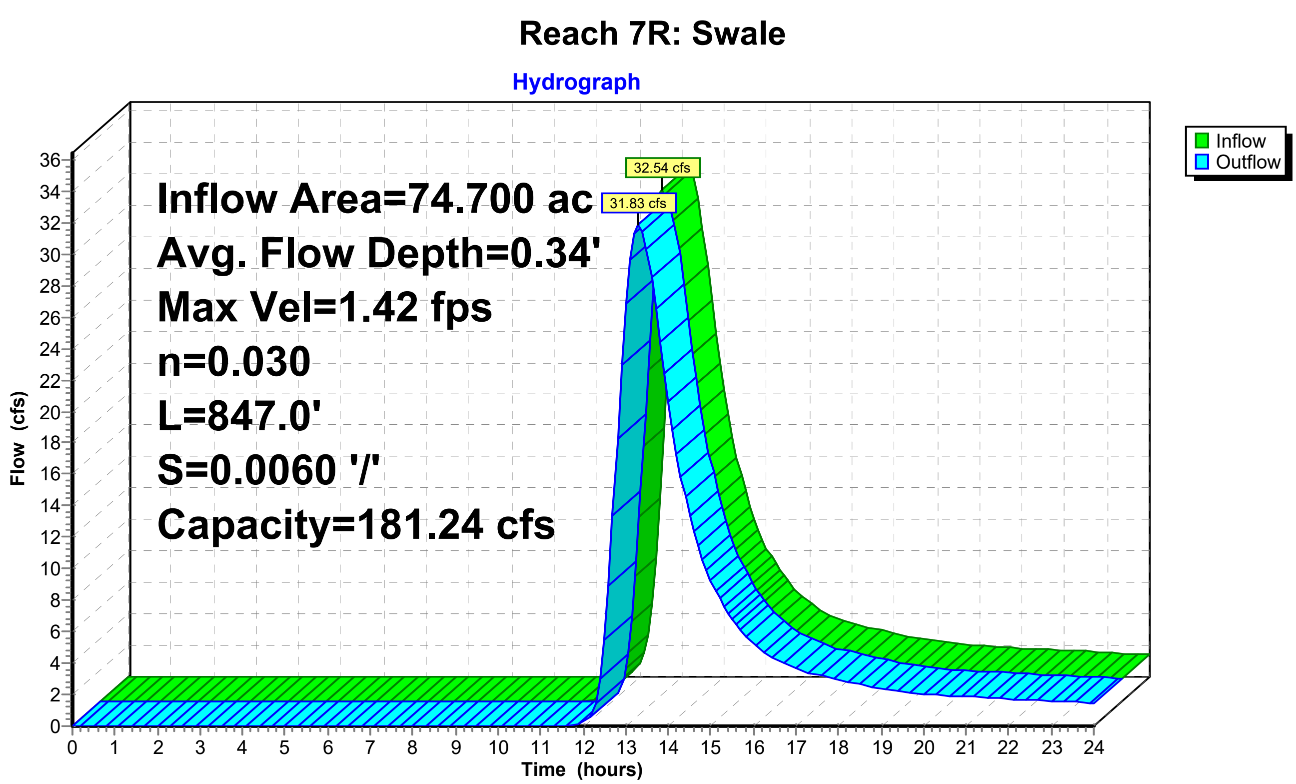
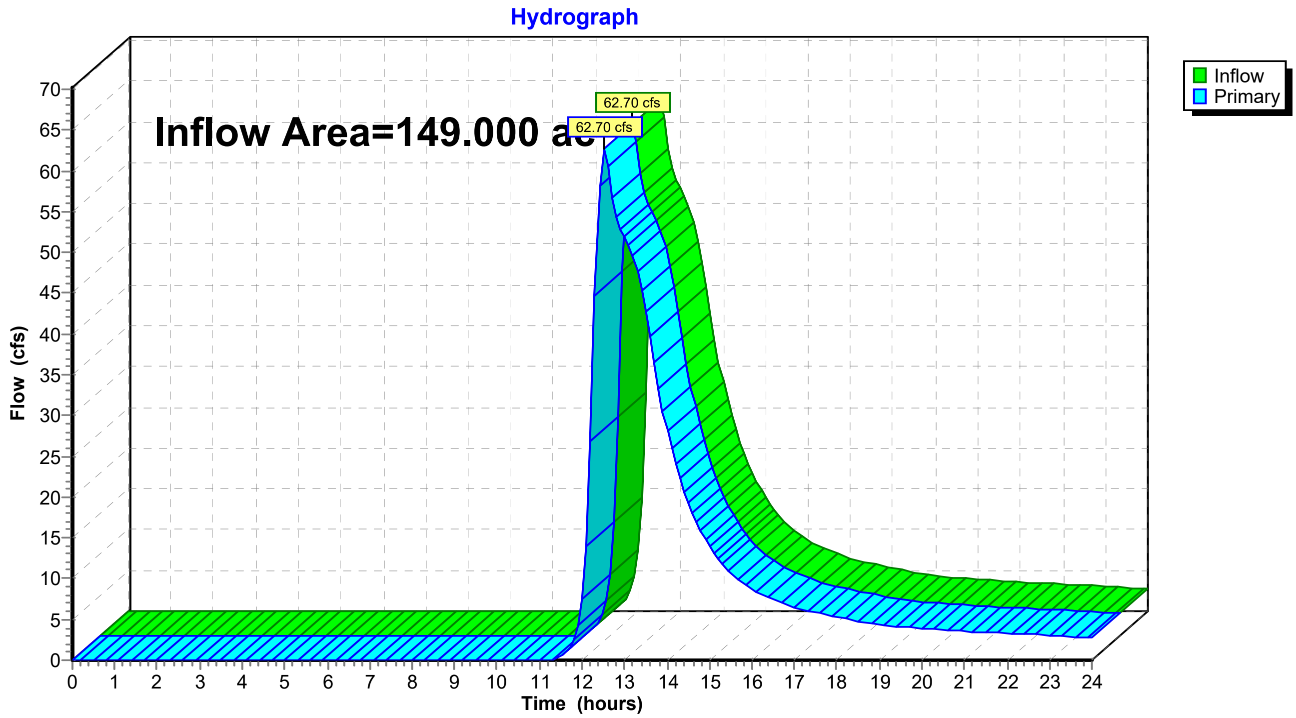


Summary for Link 6L: Total off-site drainage

Inflow Area =	149.000 ac,	1.07% Impervious, Inflow Depth > 1.03"	for 10-Year event	
Inflow =	62.70 cfs @	12.52 hrs, Volume=	12.847 af	
Primary =	62.70 cfs @	12.52 hrs, Volume=	12.847 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs

Link 6L: Total off-site drainage



Time span=0.00-24.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment9S: Area #2 - Offsite Runoff Area=74.300 ac 0.67% Impervious Runoff Depth>2.67"
Flow Length=3,745' Tc=31.3 min CN=75 Runoff=154.27 cfs 16.534 af

Subcatchment10S: Area #1 - Total Site Runoff Area=74.700 ac 1.47% Impervious Runoff Depth>2.64"
Flow Length=4,104' Tc=80.5 min CN=75 Runoff=87.44 cfs 16.443 af

Reach 7R: Swale Avg. Flow Depth=0.53' Max Vel=1.92 fps Inflow=87.44 cfs 16.443 af
n=0.030 L=847.0' S=0.0060 '/' Capacity=181.24 cfs Outflow=86.45 cfs 16.358 af

Link 6L: Total off-site drainage Inflow=178.55 cfs 32.893 af
Primary=178.55 cfs 32.893 af

Total Runoff Area = 149.000 ac Runoff Volume = 32.978 af Average Runoff Depth = 2.66"
98.93% Pervious = 147.400 ac 1.07% Impervious = 1.600 ac

Summary for Subcatchment 9S: Area #2 - Offsite Drainage

CarlsonPlanXYPos|642280.8804|1040430.0233|
CarlsonSurface||

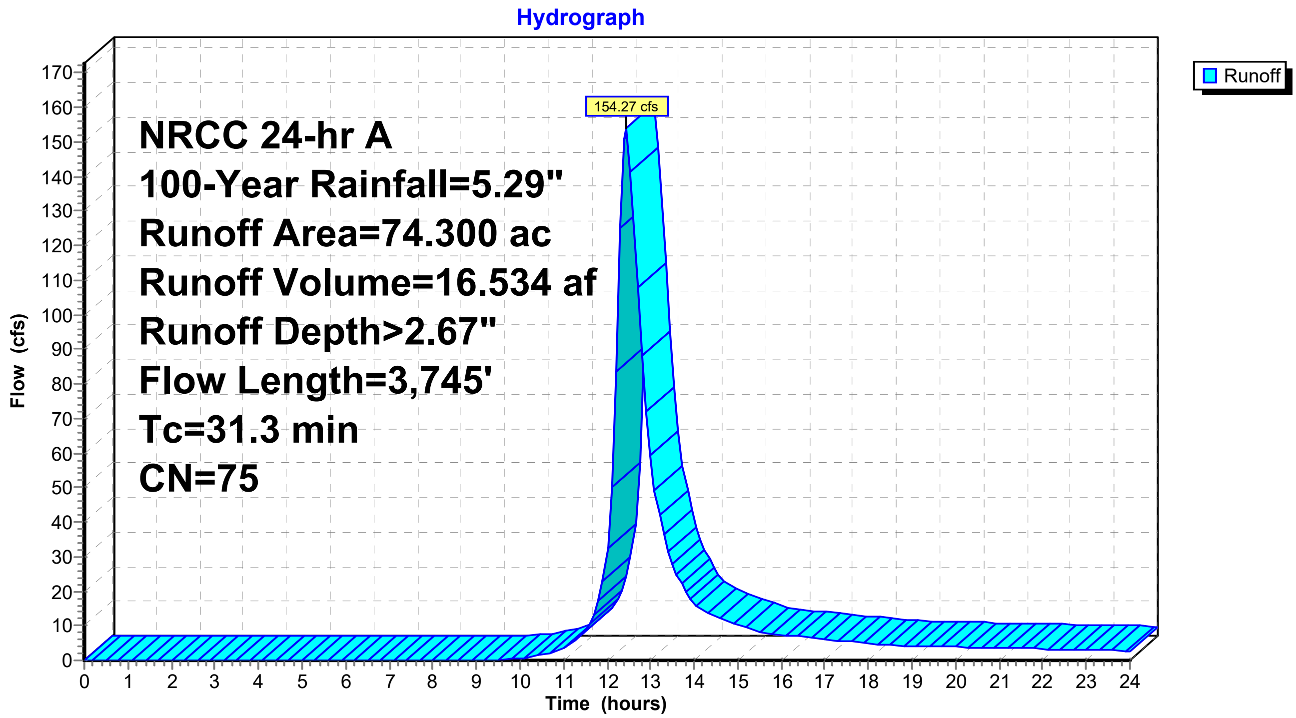
Runoff = 154.27 cfs @ 12.45 hrs, Volume= 16.534 af, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.500	98	Paved parking, HSG D
22.000	78	Meadow, non-grazed, HSG D
3.200	80	>75% Grass cover, Good, HSG D
48.600	73	Brush, Good, HSG D
74.300	75	Weighted Average
73.800		99.33% Pervious Area
0.500		0.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
10.8	1,165	0.0400	1.80		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
1.2	1,445	0.0850	19.33	1,352.84	**Channel Flow, Channel Flow** Area= 70.0 sf Perim= 72.0' r= 0.97' n= 0.022 Earth, clean & straight
7.3	560	0.0650	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
1.2	115	0.1000	1.58		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
10.5	445	0.0200	0.71		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
31.3	3,745	Total			

Subcatchment 9S: Area #2 - Offsite Drainage



Summary for Subcatchment 10S: Area #1 - Total Site drainage

CarlsonPlanXYPos|641529.7843|1041282.6220|
CarlsonSurface||

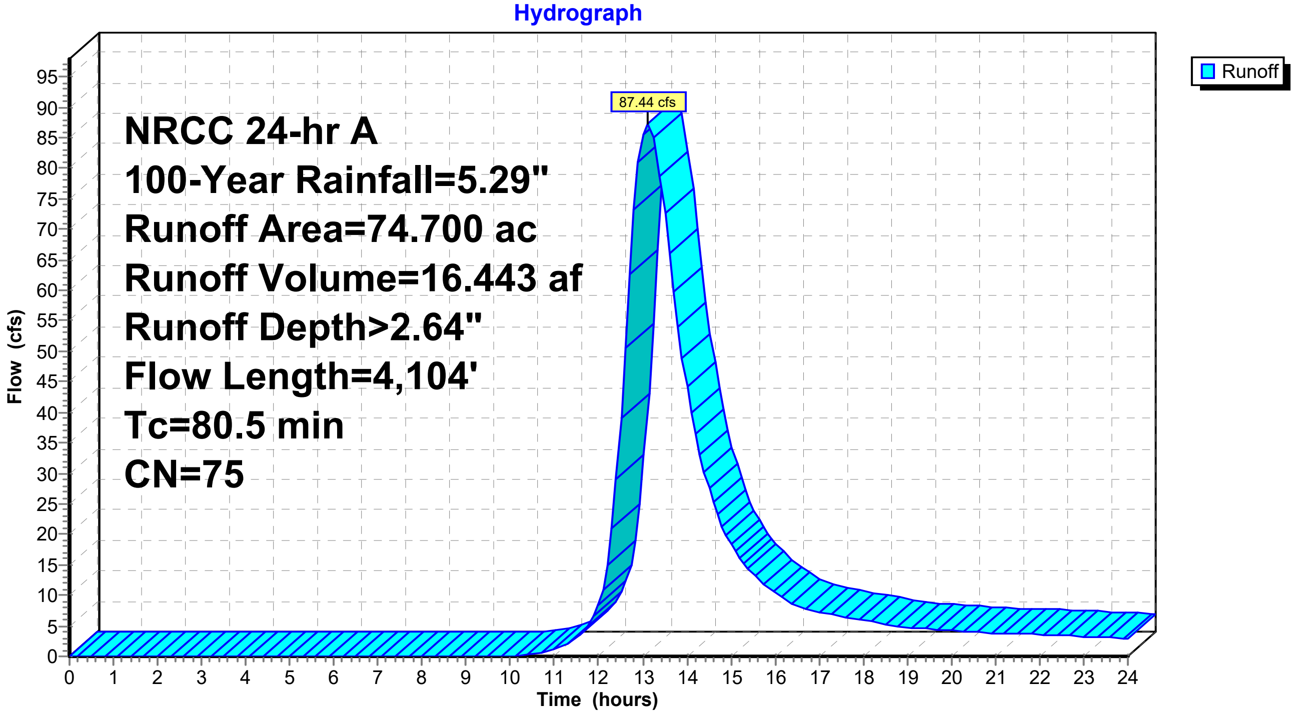
Runoff = 87.44 cfs @ 13.12 hrs, Volume= 16.443 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.570	61	>75% Grass cover, Good, HSG B
1.100	98	Paved parking, HSG D
17.900	78	Meadow, non-grazed, HSG D
51.230	73	Brush, Good, HSG D
3.900	80	>75% Grass cover, Good, HSG D
74.700	75	Weighted Average
73.600		98.53% Pervious Area
1.100		1.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.19"
11.5	85	0.0200	0.12		**Sheet Flow, Sheet flow** Cultivated: Residue>20% n= 0.170 P2= 2.19"
5.0	385	0.0200	1.27		**Shallow Concentrated Flow, Shallow concentrated** Cultivated Straight Rows Kv= 9.0 fps
10.2	1,400	0.0640	2.28		**Shallow Concentrated Flow, Shallow concentrated** Cultivated Straight Rows Kv= 9.0 fps
3.9	307	0.0700	1.32		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
3.2	323	0.1100	1.66		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
5.7	395	0.0530	1.15		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
2.0	184	0.0920	1.52		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
7.1	367	0.0300	0.87		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
15.3	145	0.0010	0.16		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
16.3	498	0.0070	0.51	29.22	**Channel Flow, Channel Flow** Area= 57.5 sf Perim= 220.0' r= 0.26' n= 0.100 Heavy timber, flow below branches
80.5	4,104	Total			

Subcatchment 10S: Area #1 - Total Site drainage



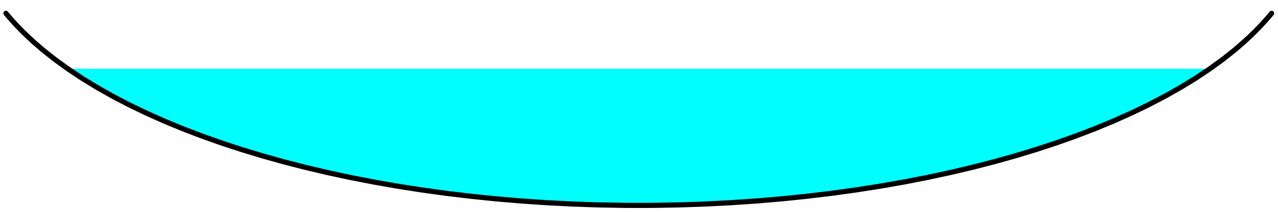
Summary for Reach 7R: Swale

Inflow Area = 74.700 ac, 1.47% Impervious, Inflow Depth > 2.64" for 100-Year event
Inflow = 87.44 cfs @ 13.12 hrs, Volume= 16.443 af
Outflow = 86.45 cfs @ 13.21 hrs, Volume= 16.358 af, Atten= 1%, Lag= 5.5 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 1.92 fps, Min. Travel Time= 7.3 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 15.9 min

Peak Storage= 38,051 cf @ 13.21 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 0.75' Flow Area= 75.0 sf, Capacity= 181.24 cfs

150.00' x 0.75' deep Parabolic Channel, n= 0.030 Short grass
Length= 847.0' Slope= 0.0060 '/'
Inlet Invert= 705.50', Outlet Invert= 700.42'



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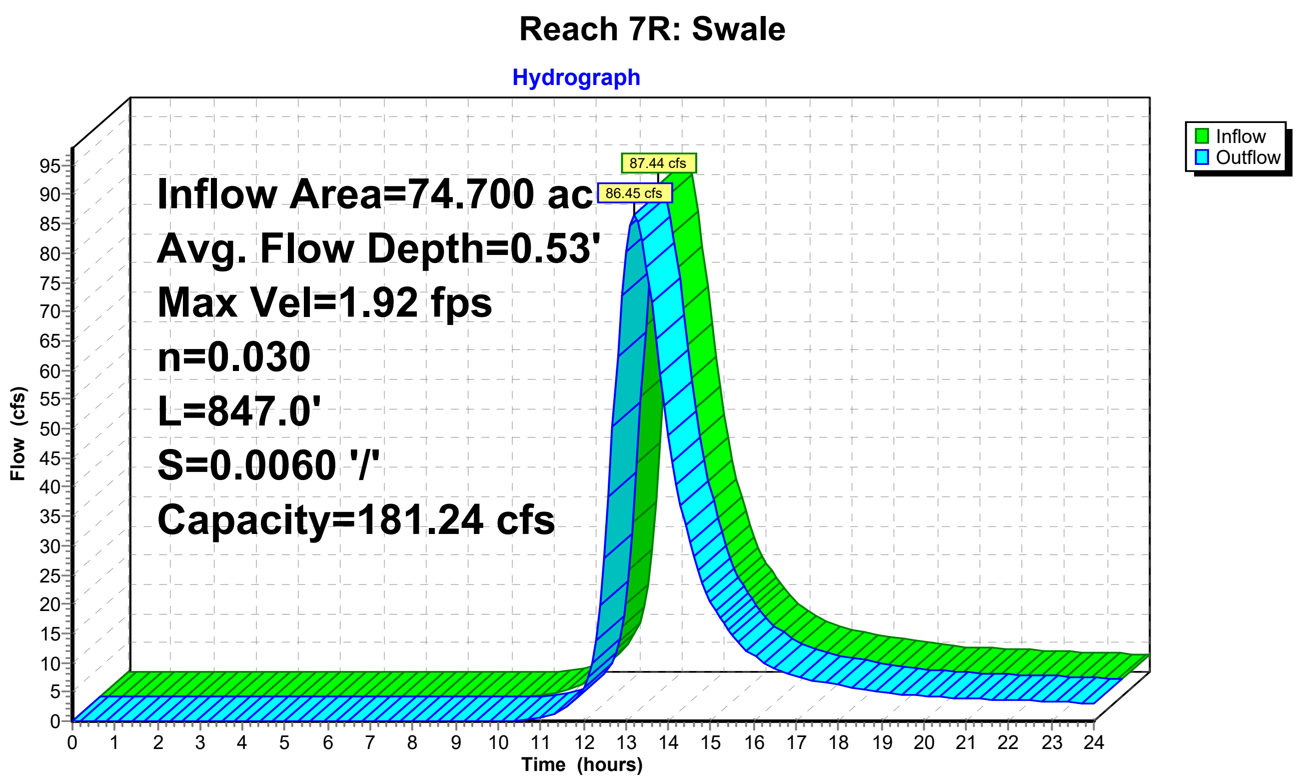
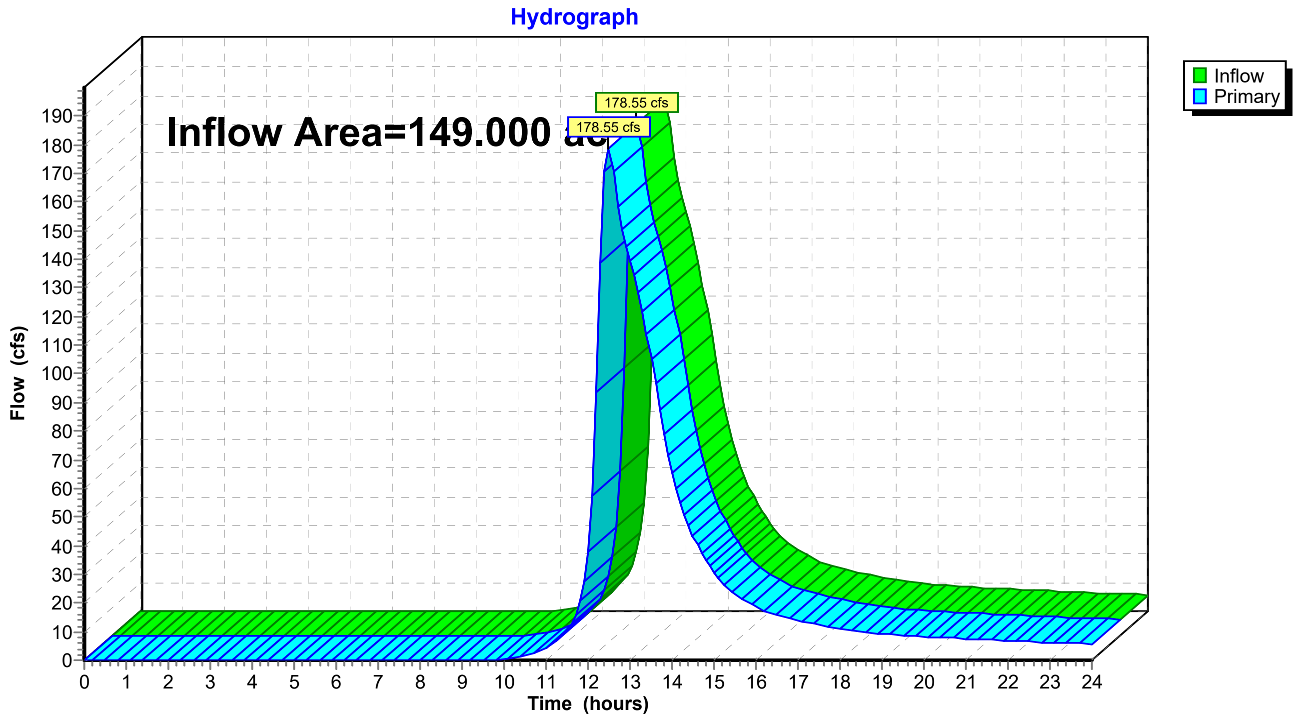


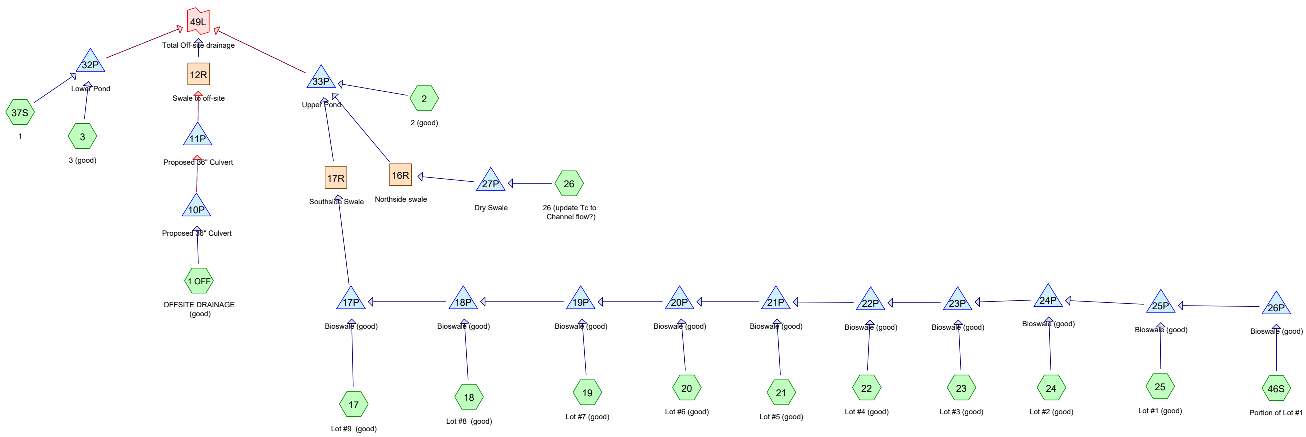
Summary for Link 6L: Total off-site drainage

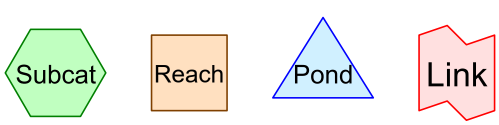
Inflow Area = 149.000 ac, 1.07% Impervious, Inflow Depth > 2.65" for 100-Year event
Inflow = 178.55 cfs @ 12.50 hrs, Volume= 32.893 af
Primary = 178.55 cfs @ 12.50 hrs, Volume= 32.893 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs

Link 6L: Total off-site drainage







Routing Diagram for 20-243 SWPPPBASE PRO 1.19.22 Canandaigua JJ
Prepared by {enter your company name here}, Printed 2/28/2023
HydroCAD® 10.00-26 s/n 09315 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.100	61	>75% Grass cover, Good, HSG B (37S)
36.170	80	>75% Grass cover, Good, HSG D (1 OFF, 2, 3, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 37S, 46S)
68.210	73	Brush, Good, HSG D (1 OFF, 2, 3, 37S)
33.760	78	Meadow, non-grazed, HSG D (1 OFF, 2, 3)
1.860	98	Paved parking HSG B (37S)
1.340	98	Paved parking HSG C (37S)
0.090	98	Paved parking HSG D (2)
5.780	98	Paved parking, HSG D (1 OFF, 2, 3, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 46S)
0.260	98	Water Surface HSG B (37S)
0.430	98	Water Surface, HSG D (2)
149.000	**77**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.220	HSG B	37S
1.340	HSG C	37S
144.440	HSG D	1 OFF, 2, 3, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 37S, 46S
0.000	Other	
149.000		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	1.100	0.000	36.170	0.000	37.270	>75% Grass cover, Good	1 OFF, 2, 3, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 37S, 46S
0.000	0.000	0.000	68.210	0.000	68.210	Brush, Good	1 OFF, 2, 3, 37S
0.000	0.000	0.000	33.760	0.000	33.760	Meadow, non-grazed	1 OFF, 2, 3
0.000	1.860	1.340	5.870	0.000	9.070	Paved parking	1 OFF, 2, 3, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 37S, 46S
0.000	0.260	0.000	0.430	0.000	0.690	Water Surface	2, 37S
0.000	**3.220**	**1.340**	**144.440**	**0.000**	**149.000**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	37S	0.00	0.00	114.0	0.0040	0.012	15.0	0.0	0.0
2	37S	0.00	0.00	113.0	0.0040	0.012	18.0	0.0	0.0
3	37S	0.00	0.00	35.0	0.0040	0.012	24.0	0.0	0.0
4	37S	0.00	0.00	279.0	0.0080	0.012	24.0	0.0	0.0
5	10P	704.50	704.00	122.0	0.0041	0.012	36.0	0.0	0.0
6	11P	703.30	703.00	65.0	0.0046	0.012	36.0	0.0	0.0
7	18P	812.50	812.00	46.0	0.0109	0.012	24.0	0.0	0.0
8	19P	827.50	827.00	46.0	0.0109	0.012	18.0	0.0	0.0
9	20P	842.50	840.50	46.0	0.0435	0.012	15.0	0.0	0.0
10	21P	856.50	854.00	47.0	0.0532	0.012	15.0	0.0	0.0
11	22P	867.50	866.00	47.0	0.0319	0.012	12.0	0.0	0.0
12	23P	878.50	877.00	45.0	0.0333	0.012	12.0	0.0	0.0
13	24P	889.50	888.00	45.0	0.0333	0.012	12.0	0.0	0.0
14	25P	901.50	901.00	58.0	0.0086	0.012	12.0	0.0	0.0
15	26P	905.50	905.00	58.0	0.0086	0.012	12.0	0.0	0.0
16	32P	700.00	699.80	21.0	0.0095	0.020	18.0	0.0	0.0
17	33P	737.50	735.00	35.0	0.0714	0.020	24.0	0.0	0.0

Time span=0.00-37.00 hrs, dt=0.01 hrs, 3701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1 OFF: OFFSITE DRAINAGE Runoff Area=78.750 ac 0.89% Impervious Runoff Depth=0.33"
Flow Length=4,105' Tc=35.7 min CN=75 Runoff=14.52 cfs 2.155 af

Subcatchment2: 2 (good) Runoff Area=24.100 ac 9.34% Impervious Runoff Depth=0.42"
Flow Length=2,474' Tc=15.8 min CN=78 Runoff=9.78 cfs 0.851 af

Subcatchment3: 3 (good) Runoff Area=23.800 ac 3.66% Impervious Runoff Depth=0.46"
Flow Length=3,643' Tc=37.7 min CN=79 Runoff=6.74 cfs 0.911 af

Subcatchment17: Lot #9 (good) Runoff Area=0.840 ac 26.19% Impervious Runoff Depth=0.72"
Slope=0.0866 '/' Tc=6.0 min CN=85 Runoff=0.94 cfs 0.050 af

Subcatchment18: Lot #8 (good) Runoff Area=0.750 ac 29.33% Impervious Runoff Depth=0.72"
Slope=0.0953 '/' Tc=6.0 min CN=85 Runoff=0.84 cfs 0.045 af

Subcatchment19: Lot #7 (good) Runoff Area=0.810 ac 27.16% Impervious Runoff Depth=0.72"
Slope=0.0933 '/' Tc=6.0 min CN=85 Runoff=0.91 cfs 0.048 af

Subcatchment20: Lot #6 (good) Runoff Area=0.800 ac 27.50% Impervious Runoff Depth=0.72"
Slope=0.0759 '/' Tc=6.0 min CN=85 Runoff=0.90 cfs 0.048 af

Subcatchment21: Lot #5 (good) Runoff Area=0.800 ac 27.50% Impervious Runoff Depth=0.72"
Slope=0.0663 '/' Tc=6.0 min CN=85 Runoff=0.90 cfs 0.048 af

Subcatchment22: Lot #4 (good) Runoff Area=0.820 ac 26.83% Impervious Runoff Depth=0.72"
Slope=0.0589 '/' Tc=6.0 min CN=85 Runoff=0.92 cfs 0.049 af

Subcatchment23: Lot #3 (good) Runoff Area=0.830 ac 26.51% Impervious Runoff Depth=0.72"
Slope=0.0568 '/' Tc=6.0 min CN=85 Runoff=0.93 cfs 0.049 af

Subcatchment24: Lot #2 (good) Runoff Area=0.560 ac 39.29% Impervious Runoff Depth=0.82"
Slope=0.0563 '/' Tc=6.0 min CN=87 Runoff=0.72 cfs 0.038 af

Subcatchment25: Lot #1 (good) Runoff Area=0.380 ac 52.63% Impervious Runoff Depth=0.94"
Flow Length=120' Slope=0.0700 '/' Tc=7.3 min CN=89 Runoff=0.53 cfs 0.030 af

Subcatchment26: 26 (update Tc to Runoff Area=1.310 ac 37.40% Impervious Runoff Depth=0.82"
Tc=8.0 min CN=87 Runoff=1.55 cfs 0.090 af

Subcatchment37S: 1 Runoff Area=14.300 ac 24.20% Impervious Runoff Depth=0.62"
Flow Length=932' Tc=7.7 min CN=83 Runoff=12.74 cfs 0.740 af

Subcatchment46S: Portion of Lot #1 Runoff Area=0.150 ac 20.00% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=84 Runoff=0.16 cfs 0.008 af

Reach 12R: Swale to off-site Avg. Flow Depth=0.29' Max Vel=1.37 fps Inflow=4.06 cfs 2.139 af
n=0.030 L=293.0' S=0.0068 '/' Capacity=58.17 cfs Outflow=4.06 cfs 2.138 af

Reach 16R: Northside swale Avg. Flow Depth=0.09' Max Vel=2.23 fps Inflow=0.66 cfs 0.046 af
n=0.030 L=655.0' S=0.0885 '/' Capacity=111.61 cfs Outflow=0.59 cfs 0.046 af

Reach 17R: Southside Swale Avg. Flow Depth=0.28' Max Vel=4.69 fps Inflow=7.60 cfs 0.408 af
n=0.030 L=710.0' S=0.0831 '/' Capacity=108.12 cfs Outflow=7.07 cfs 0.408 af

Pond 10P: Proposed 36" Culvert Peak Elev=705.35' Storage=34,005 cf Inflow=14.52 cfs 2.155 af
Primary=4.06 cfs 2.140 af Secondary=0.00 cfs 0.000 af Outflow=4.06 cfs 2.140 af

Pond 11P: Proposed 36" Culvert Peak Elev=704.16' Storage=1,062 cf Inflow=4.06 cfs 2.140 af
Primary=4.06 cfs 2.139 af Secondary=0.00 cfs 0.000 af Outflow=4.06 cfs 2.139 af

Pond 17P: Bioswale (good) Peak Elev=807.68' Storage=237 cf Inflow=7.61 cfs 0.412 af
Discarded=0.00 cfs 0.002 af Primary=7.60 cfs 0.408 af Outflow=7.60 cfs 0.410 af

Pond 18P: Bioswale (good) Peak Elev=815.13' Storage=184 cf Inflow=6.70 cfs 0.362 af
Discarded=0.00 cfs 0.000 af Primary=6.69 cfs 0.361 af Outflow=6.69 cfs 0.362 af

Pond 19P: Bioswale (good) Peak Elev=829.79' Storage=84 cf Inflow=5.88 cfs 0.317 af
Discarded=0.00 cfs 0.000 af Primary=5.88 cfs 0.317 af Outflow=5.88 cfs 0.317 af

Pond 20P: Bioswale (good) Peak Elev=844.76' Storage=76 cf Inflow=4.99 cfs 0.269 af
Discarded=0.00 cfs 0.000 af Primary=4.99 cfs 0.269 af Outflow=4.99 cfs 0.269 af

Pond 21P: Bioswale (good) Peak Elev=858.73' Storage=67 cf Inflow=4.11 cfs 0.222 af
Discarded=0.00 cfs 0.000 af Primary=4.11 cfs 0.222 af Outflow=4.11 cfs 0.222 af

Pond 22P: Bioswale (good) Peak Elev=869.69' Storage=57 cf Inflow=3.23 cfs 0.174 af
Discarded=0.00 cfs 0.000 af Primary=3.22 cfs 0.174 af Outflow=3.23 cfs 0.174 af

Pond 23P: Bioswale (good) Peak Elev=880.66' Storage=46 cf Inflow=2.32 cfs 0.126 af
Outflow=2.32 cfs 0.126 af

Pond 24P: Bioswale (good) Peak Elev=891.61' Storage=31 cf Inflow=1.40 cfs 0.076 af
Discarded=0.00 cfs 0.000 af Primary=1.40 cfs 0.076 af Outflow=1.40 cfs 0.076 af

Pond 25P: Bioswale (good) Peak Elev=903.59' Storage=12 cf Inflow=0.69 cfs 0.038 af
Discarded=0.00 cfs 0.000 af Primary=0.69 cfs 0.038 af Outflow=0.69 cfs 0.038 af

Pond 26P: Bioswale (good) Peak Elev=907.53' Storage=7 cf Inflow=0.16 cfs 0.008 af
Discarded=0.00 cfs 0.000 af Primary=0.15 cfs 0.008 af Outflow=0.15 cfs 0.008 af

Pond 27P: Dry Swale Peak Elev=807.67' Storage=1,403 cf Inflow=1.55 cfs 0.090 af
Discarded=0.02 cfs 0.032 af Primary=0.66 cfs 0.046 af Outflow=0.68 cfs 0.079 af

Pond 32P: Lower Pond Peak Elev=703.16' Storage=56,865 cf Inflow=13.84 cfs 1.651 af
Primary=0.41 cfs 0.898 af Secondary=0.00 cfs 0.000 af Outflow=0.41 cfs 0.898 af

Pond 33P: Upper Pond Peak Elev=740.34' Storage=41,386 cf Inflow=15.22 cfs 1.306 af
Primary=0.39 cfs 0.742 af Secondary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.742 af

Link 49L: Total Off-site drainage

Inflow=4.79 cfs 3.779 af
Primary=4.79 cfs 3.779 af

Total Runoff Area = 149.000 ac Runoff Volume = 5.161 af Average Runoff Depth = 0.42"
93.45% Pervious = 139.240 ac 6.55% Impervious = 9.760 ac

Summary for Subcatchment 1 OFF: OFFSITE DRAINAGE (good)

CarlsonPlanXYPos|642280.8804|1040430.0233|
CarlsonSurface||

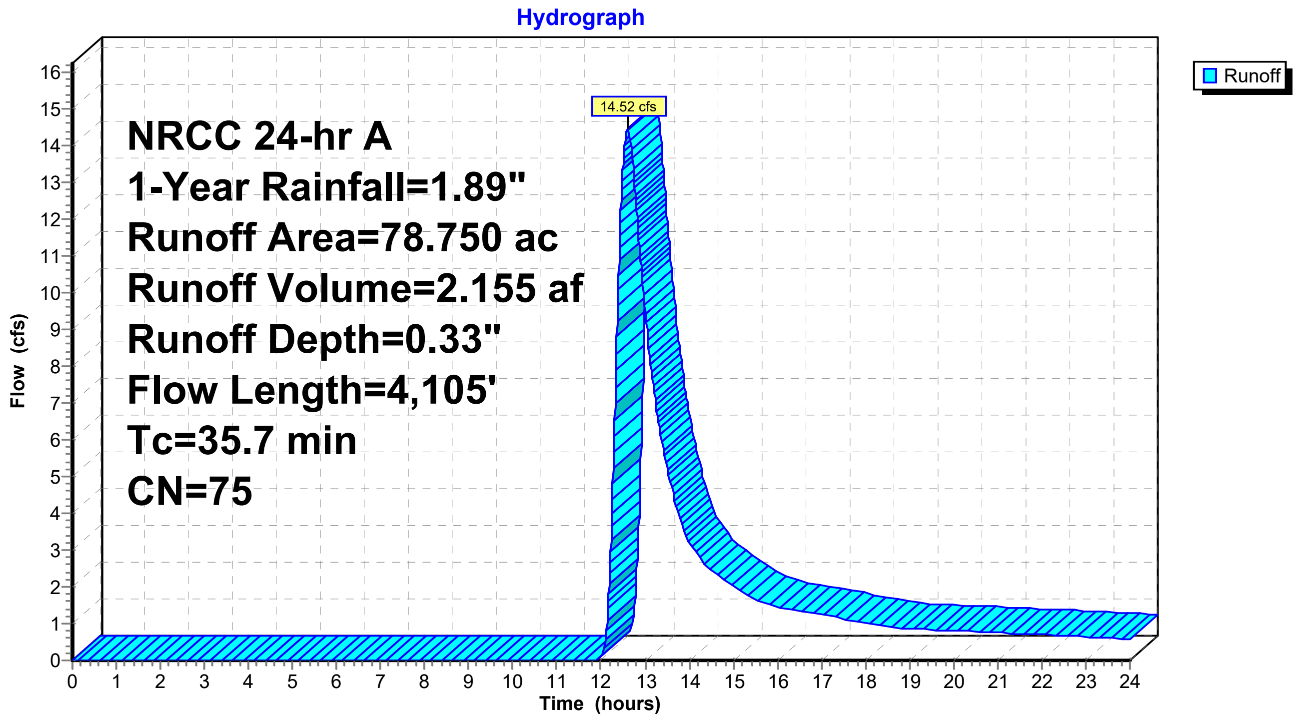
Runoff = 14.52 cfs @ 12.61 hrs, Volume= 2.155 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.700	98	Paved parking, HSG D
18.800	78	Meadow, non-grazed, HSG D
5.000	80	>75% Grass cover, Good, HSG D
54.250	73	Brush, Good, HSG D
78.750	75	Weighted Average
78.050		99.11% Pervious Area
0.700		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
10.8	1,165	0.0400	1.80		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
1.2	1,445	0.0850	19.33	1,352.84	**Channel Flow, Channel Flow** Area= 70.0 sf Perim= 72.0' r= 0.97' n= 0.022 Earth, clean & straight
7.3	560	0.0650	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
1.2	115	0.1000	1.58		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
12.6	535	0.0200	0.71		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
2.3	270	0.0150	1.97		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
35.7	4,105	Total			

Subcatchment 1 OFF: OFFSITE DRAINAGE (good)



Summary for Subcatchment 2: 2 (good)

CarlsonPlanXYPos|642014.4586|1041354.4458|
CarlsonSurface||

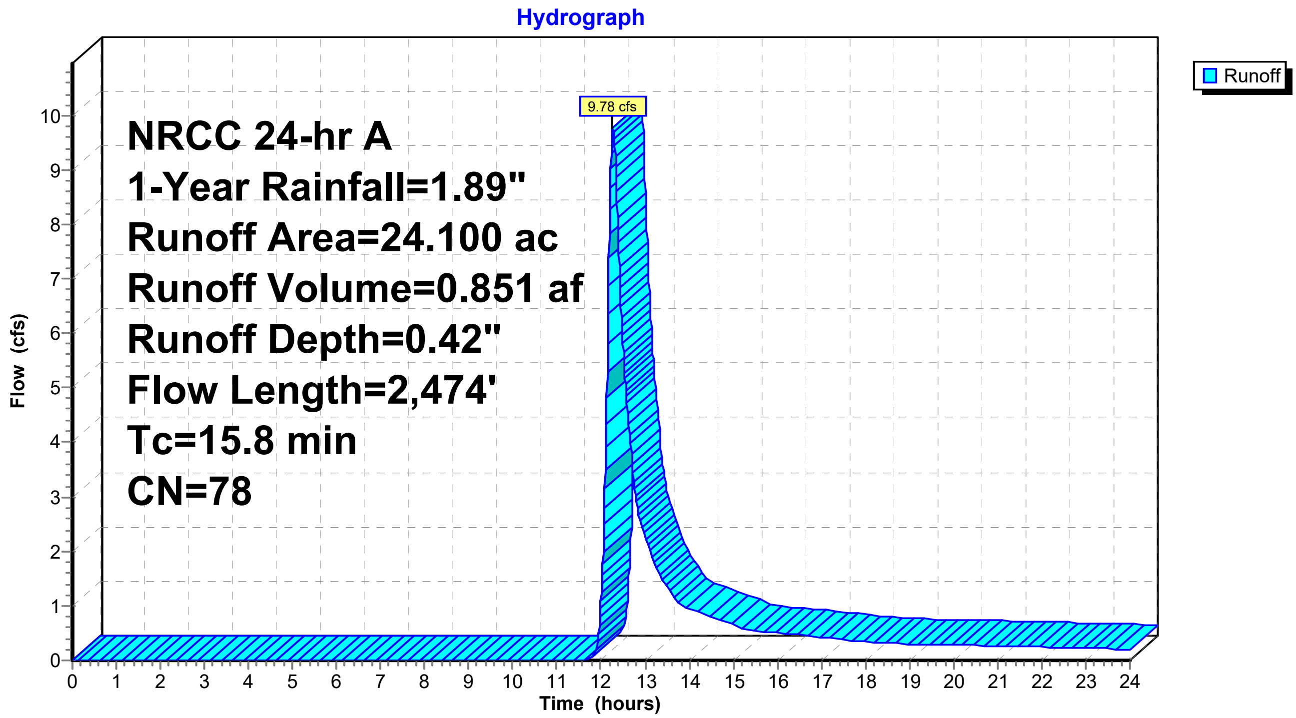
Runoff = 9.78 cfs @ 12.27 hrs, Volume= 0.851 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.430	98	Water Surface, HSG D
1.730	98	Paved parking, HSG D
0.090	98	Paved parking HSG D
2.150	80	>75% Grass cover, Good, HSG D
2.300	78	Meadow, non-grazed, HSG D
10.900	73	Brush, Good, HSG D
6.000	80	>75% Grass cover, Good, HSG D
0.500	80	>75% Grass cover, Good, HSG D
24.100	78	Weighted Average
21.850		90.66% Pervious Area
2.250		9.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	100	0.0350	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.7	192	0.0830	4.64		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.8	230	0.0870	4.75		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.1	180	0.0280	2.69		**Shallow Concentrated Flow, Shallow concentrated** Unpaved Kv= 16.1 fps
1.1	1,194	0.0750	17.98	413.55	**Channel Flow, Channel Flow** Area= 23.0 sf Perim= 24.0' r= 0.96' n= 0.022 Earth, clean & straight
2.2	165	0.0600	1.22		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	413	0.0720	17.36	260.42	**Channel Flow, Channel Flow** Area= 15.0 sf Perim= 16.0' r= 0.94' n= 0.022 Earth, clean & straight
15.8	2,474	Total			

Subcatchment 2: 2 (good)



Summary for Subcatchment 3: 3 (good)

CarlsonPlanXYPos|641681.4005|1041128.2504|
CarlsonSurface||

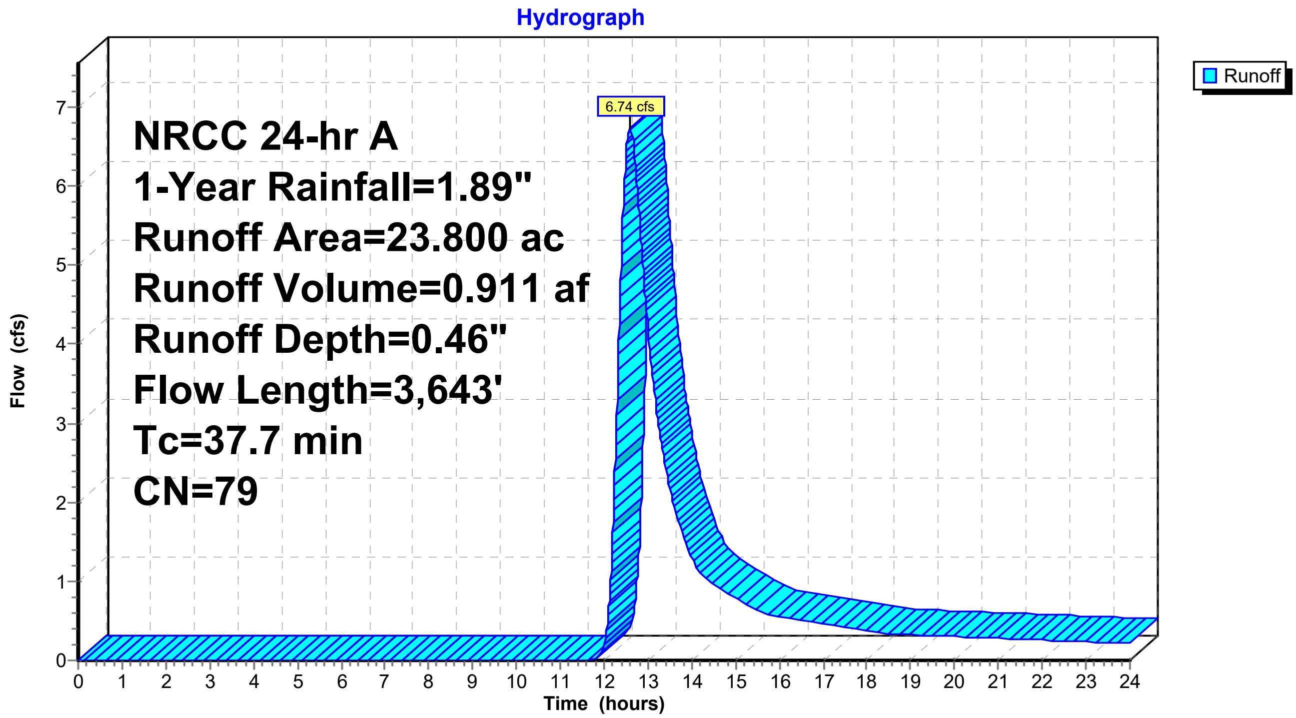
Runoff = 6.74 cfs @ 12.61 hrs, Volume= 0.911 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.440	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
0.430	98	Paved parking, HSG D
12.660	78	Meadow, non-grazed, HSG D
2.500	73	Brush, Good, HSG D
5.720	80	>75% Grass cover, Good, HSG D
1.520	80	>75% Grass cover, Good, HSG D
23.800	79	Weighted Average
22.930		96.34% Pervious Area
0.870		3.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
11.5	85	0.0200	0.12		**Sheet Flow, Sheet Flow** Cultivated: Residue>20% n= 0.170 P2= 2.19"
5.0	385	0.0200	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
10.2	1,400	0.0640	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
6.4	560	0.0840	1.45		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	435	0.0640	16.37	245.52	**Channel Flow, Channel Flow** Area= 15.0 sf Perim= 16.0' r= 0.94' n= 0.022 Earth, clean & straight
0.9	209	0.0570	3.84		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
2.2	197	0.0870	1.47		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.2	125	0.0320	11.48	286.96	**Channel Flow, Channel Flow** Area= 25.0 sf Perim= 27.0' r= 0.93' n= 0.022 Earth, clean & straight
0.6	232	0.0100	6.42	160.42	**Channel Flow, Channel Flow** Area= 25.0 sf Perim= 27.0' r= 0.93' n= 0.022 Earth, clean & straight
37.7	3,643	Total			

Subcatchment 3: 3 (good)



Summary for Subcatchment 17: Lot #9 (good)

CarlsonPlanXYPos|642702.7045|1040980.9144|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

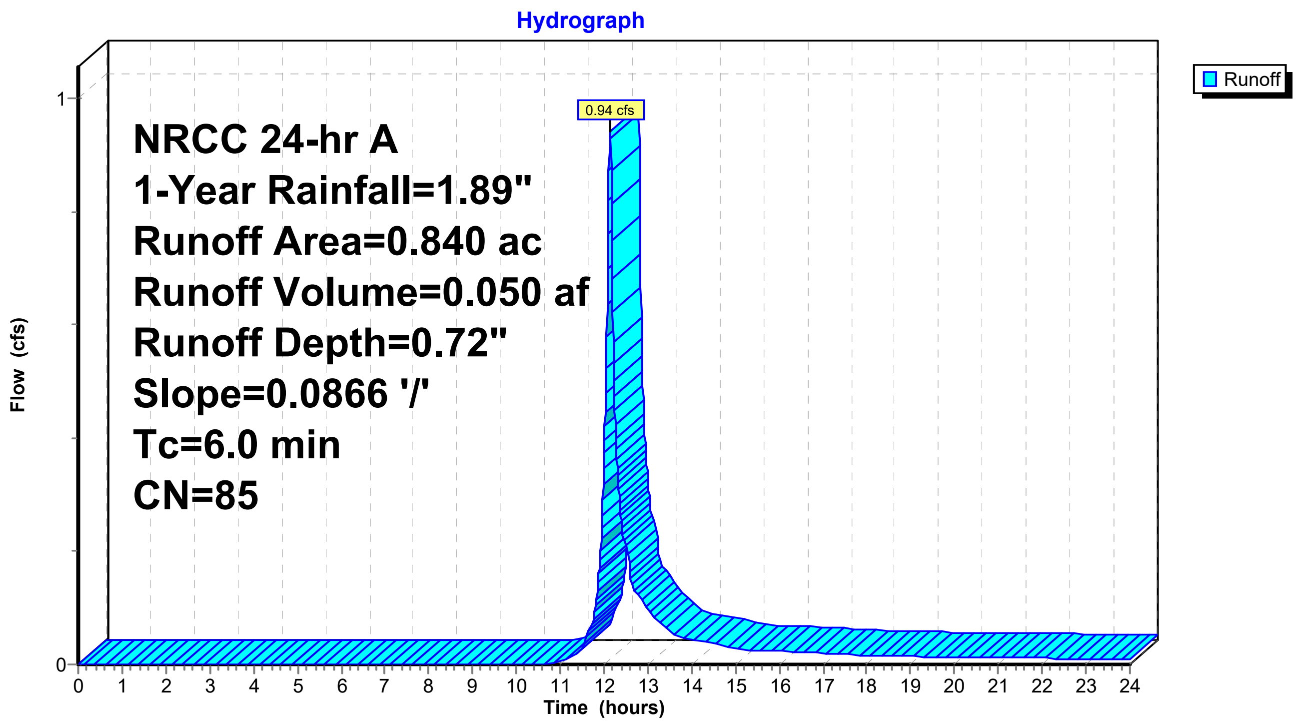
Runoff = 0.94 cfs @ 12.14 hrs, Volume= 0.050 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.540	80	>75% Grass cover, Good, HSG D
0.080	80	>75% Grass cover, Good, HSG D
0.840	85	Weighted Average
0.620		73.81% Pervious Area
0.220		26.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0866			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 17: Lot #9 (good)



Summary for Subcatchment 18: Lot #8 (good)

CarlsonPlanXYPos|642920.0895|1040980.2941|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

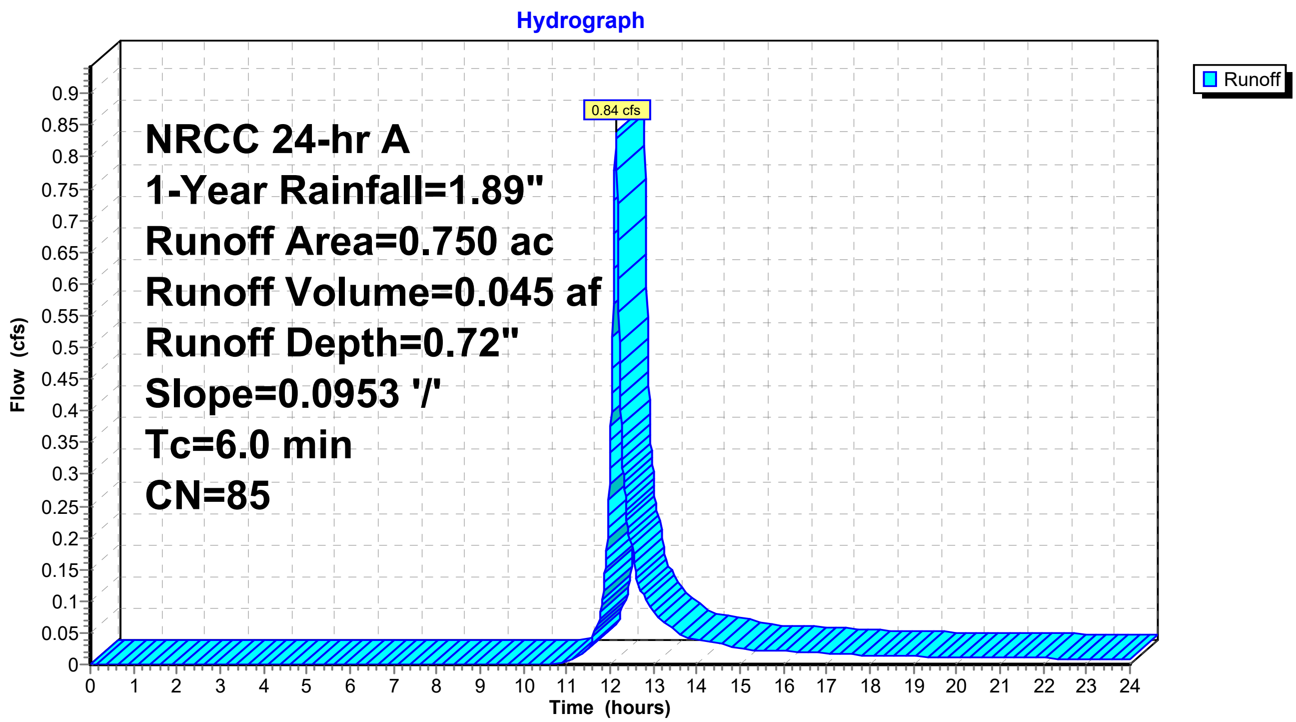
Runoff = 0.84 cfs @ 12.14 hrs, Volume= 0.045 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.480	80	>75% Grass cover, Good, HSG D
0.050	80	>75% Grass cover, Good, HSG D
0.750	85	Weighted Average
0.530		70.67% Pervious Area
0.220		29.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0953			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 18: Lot #8 (good)



Summary for Subcatchment 19: Lot #7 (good)

CarlsonPlanXYPos|643107.1559|1040981.5048|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

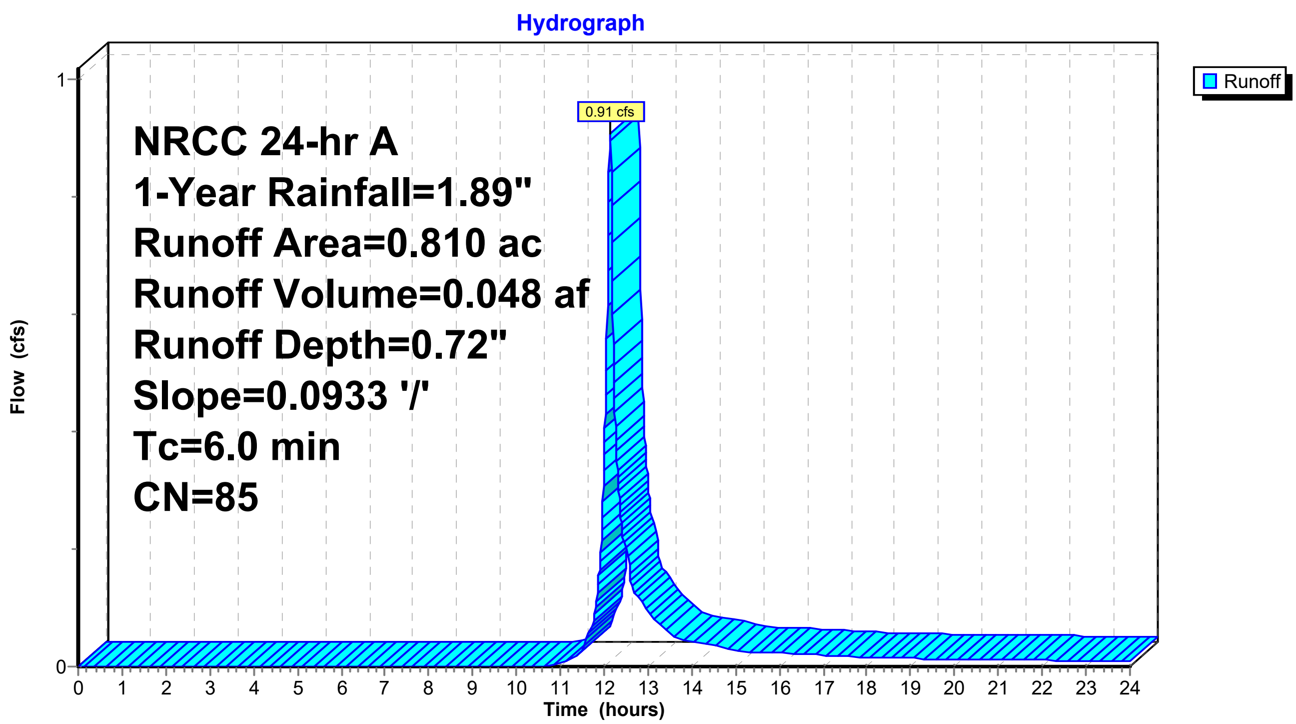
Runoff = 0.91 cfs @ 12.14 hrs, Volume= 0.048 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.590	80	>75% Grass cover, Good, HSG D
0.810	85	Weighted Average
0.590		72.84% Pervious Area
0.220		27.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0933			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 19: Lot #7 (good)



Summary for Subcatchment 20: Lot #6 (good)

CarlsonPlanXYPos|643312.2303|1040980.2663|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

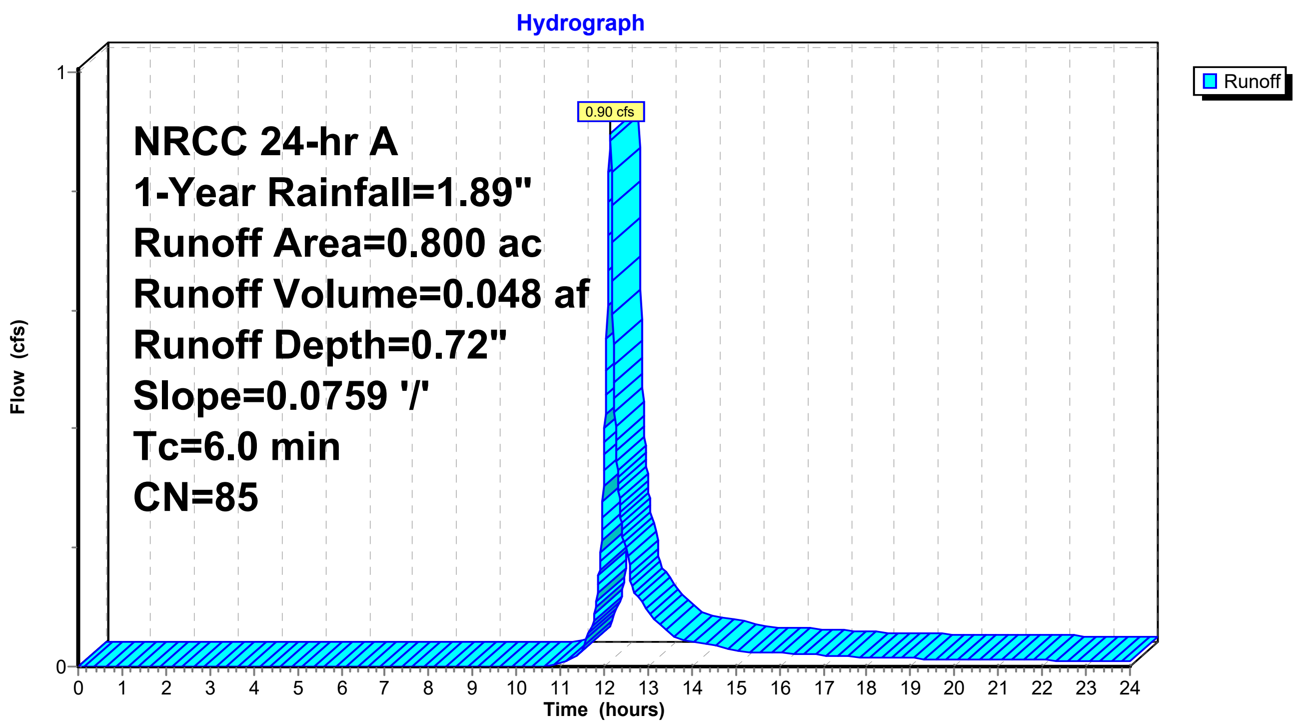
Runoff = 0.90 cfs @ 12.14 hrs, Volume= 0.048 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.580	80	>75% Grass cover, Good, HSG D
0.800	85	Weighted Average
0.580		72.50% Pervious Area
0.220		27.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0759			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 20: Lot #6 (good)



Summary for Subcatchment 21: Lot #5 (good)

CarlsonPlanXYPos|643492.4579|1040982.7482|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

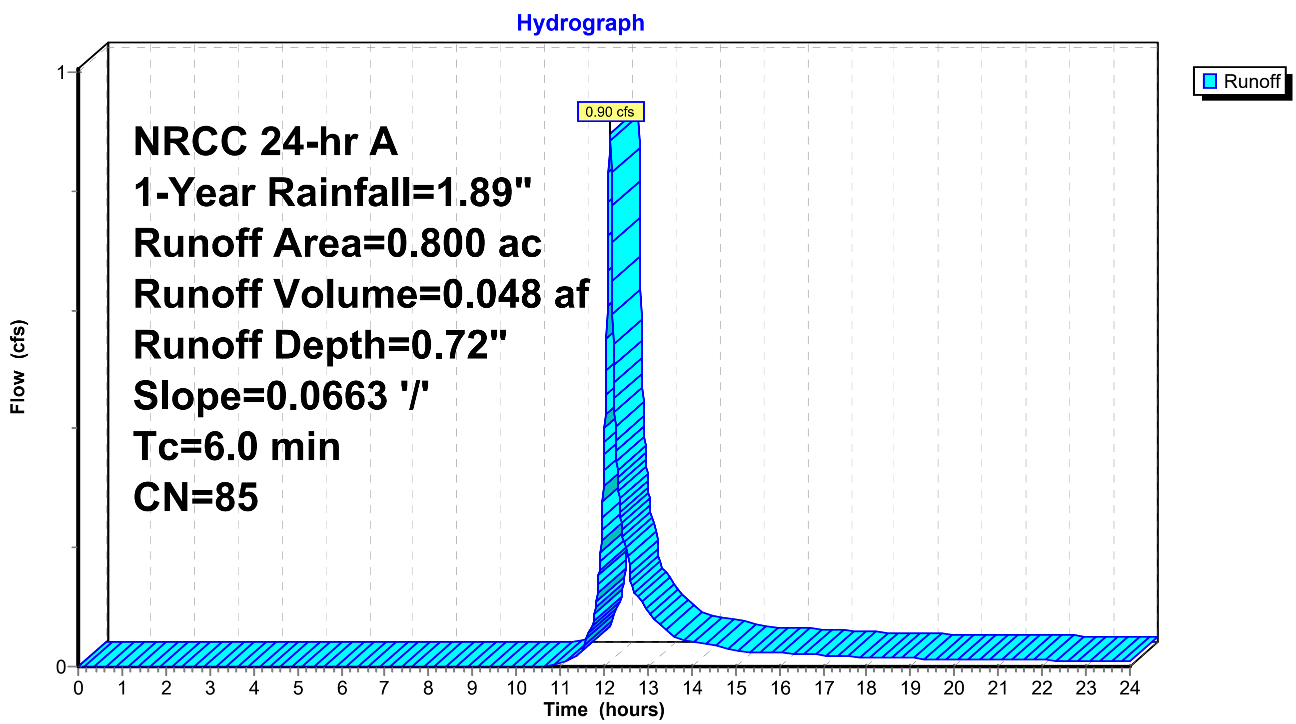
Runoff = 0.90 cfs @ 12.14 hrs, Volume= 0.048 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.580	80	>75% Grass cover, Good, HSG D
0.800	85	Weighted Average
0.580		72.50% Pervious Area
0.220		27.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0663			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 21: Lot #5 (good)



Summary for Subcatchment 22: Lot #4 (good)

CarlsonPlanXYPos|643706.8551|1040983.3562|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

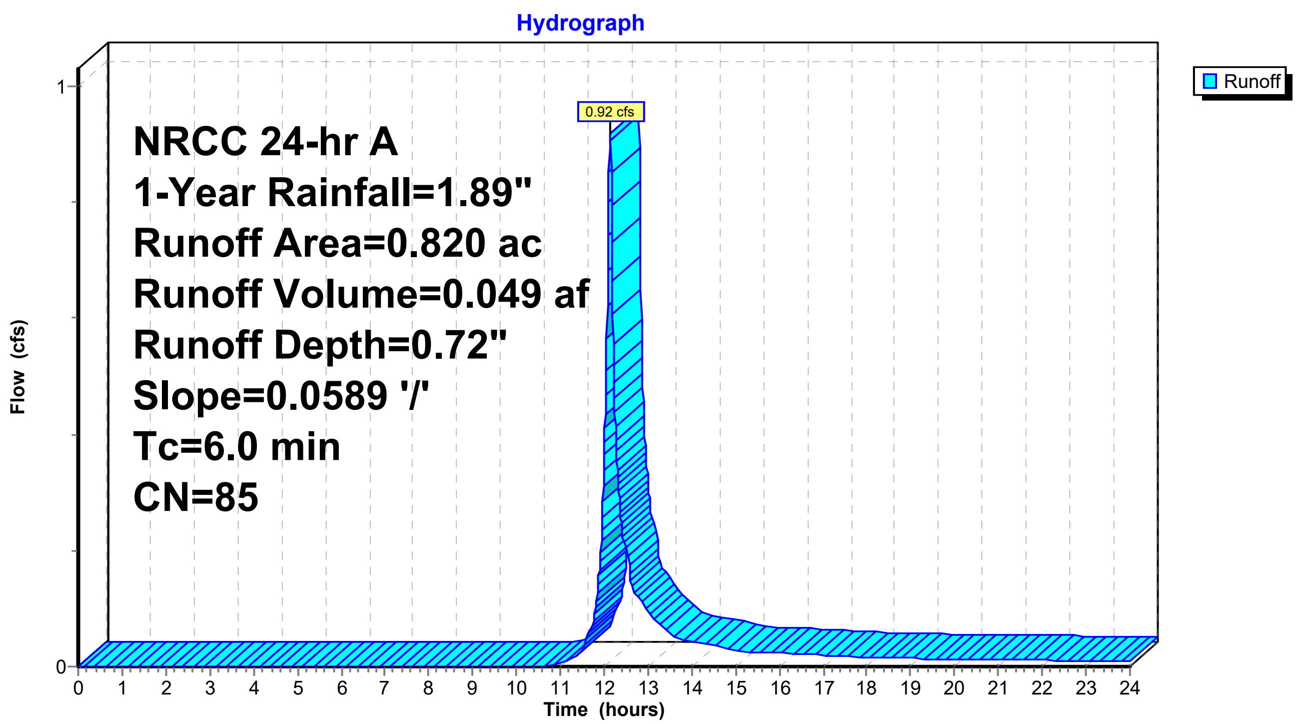
Runoff = 0.92 cfs @ 12.14 hrs, Volume= 0.049 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.600	80	>75% Grass cover, Good, HSG D
0.820	85	Weighted Average
0.600		73.17% Pervious Area
0.220		26.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0589			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 22: Lot #4 (good)



Summary for Subcatchment 23: Lot #3 (good)

CarlsonPlanXYPos|643896.4054|1040980.2593|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

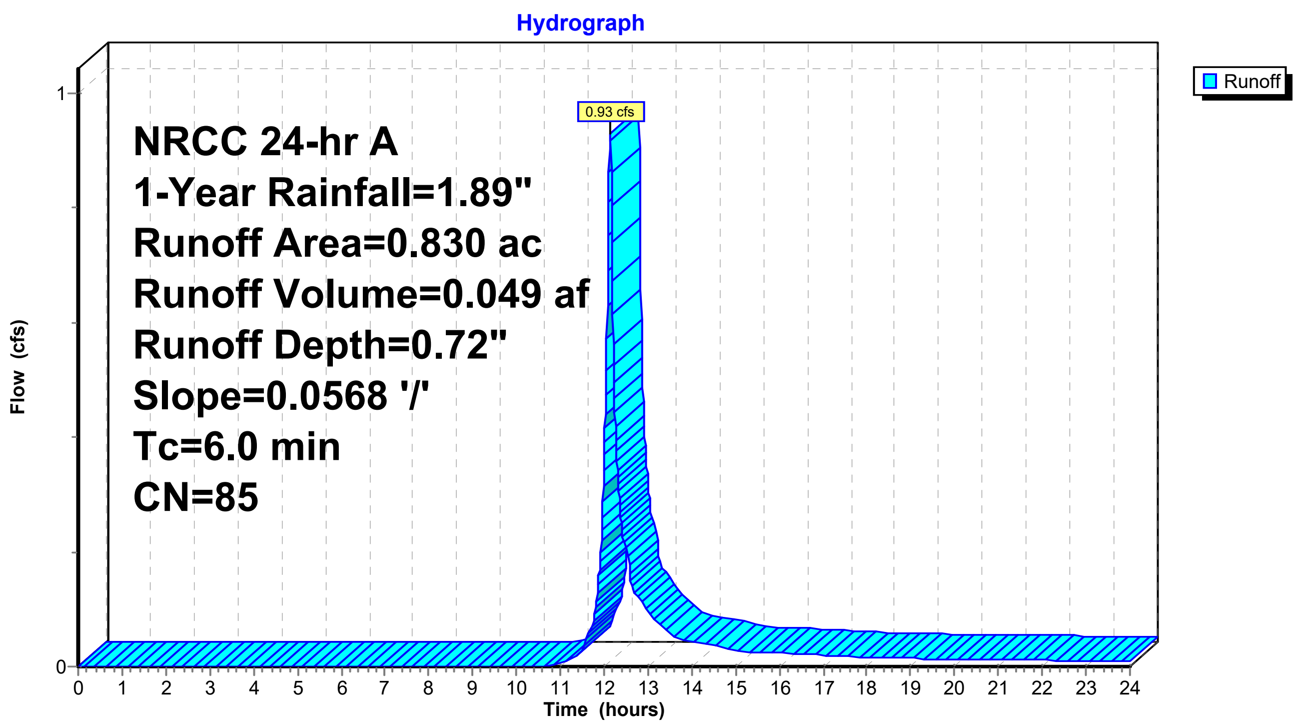
Runoff = 0.93 cfs @ 12.14 hrs, Volume= 0.049 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.610	80	>75% Grass cover, Good, HSG D
0.830	85	Weighted Average
0.610		73.49% Pervious Area
0.220		26.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0568			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 23: Lot #3 (good)



Summary for Subcatchment 24: Lot #2 (good)

CarlsonPlanXYPos|644102.7886|1040984.5776|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

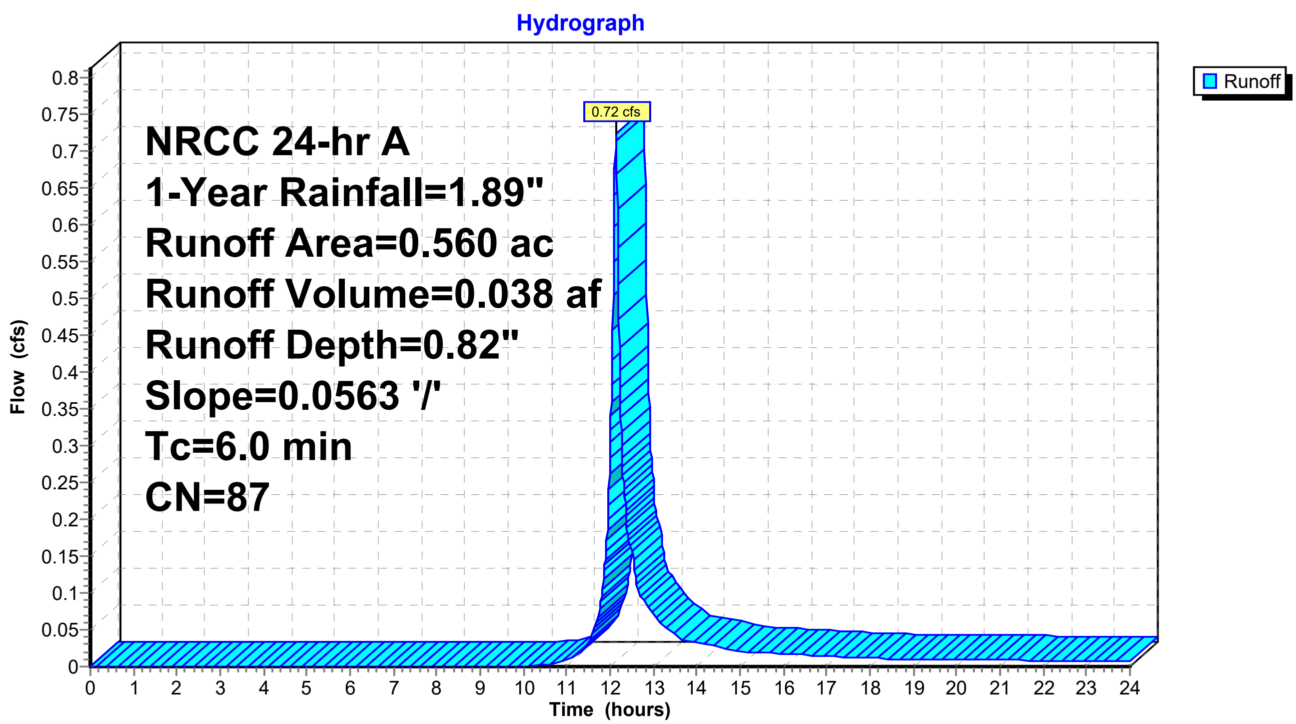
Runoff = 0.72 cfs @ 12.14 hrs, Volume= 0.038 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.340	80	>75% Grass cover, Good, HSG D
0.560	87	Weighted Average
0.340		60.71% Pervious Area
0.220		39.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0563			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 24: Lot #2 (good)



Summary for Subcatchment 25: Lot #1 (good)

CarlsonPlanXYPos|644284.7705|1040971.5435|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

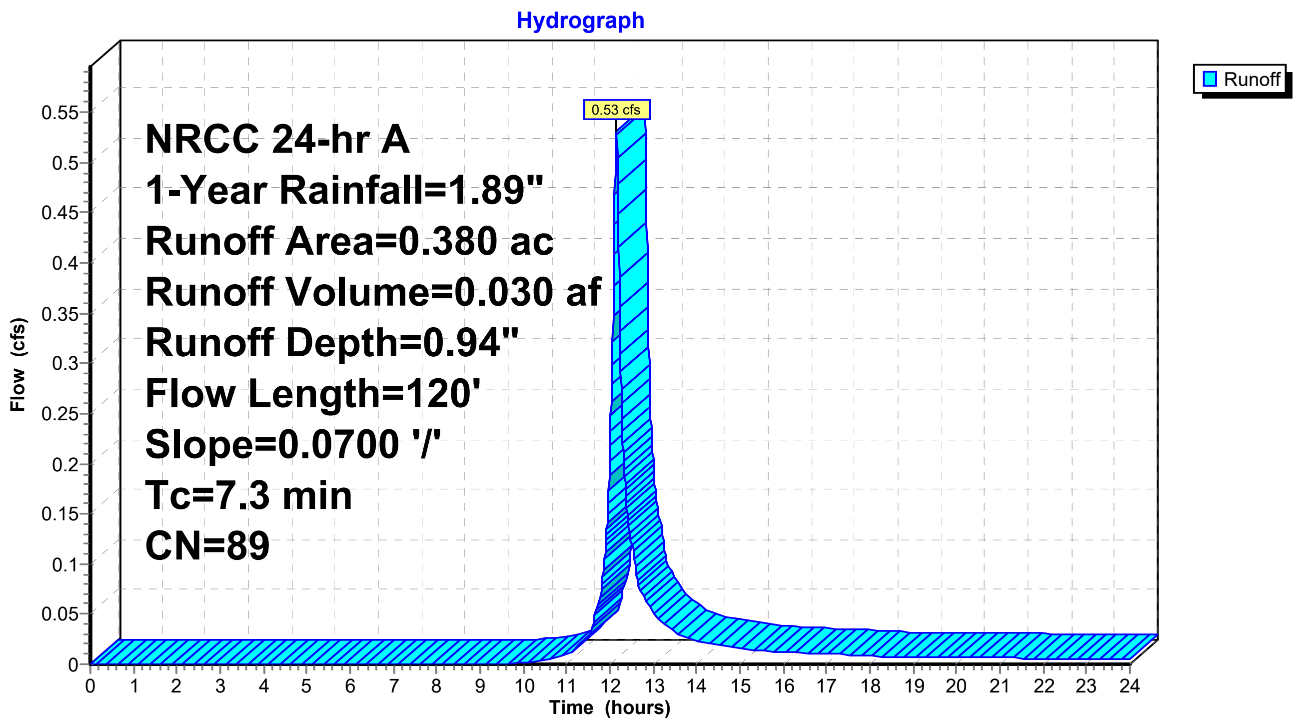
Runoff = 0.53 cfs @ 12.15 hrs, Volume= 0.030 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.200	98	Paved parking, HSG D
0.180	80	>75% Grass cover, Good, HSG D
0.380	89	Weighted Average
0.180		47.37% Pervious Area
0.200		52.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0700	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.1	20	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentated** Unpaved Kv= 16.1 fps
7.3	120	Total			

Subcatchment 25: Lot #1 (good)



Summary for Subcatchment 26: 26 (update Tc to Channel flow?)

CarlsonPlanXYPos|644192.3159|1041141.7328|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

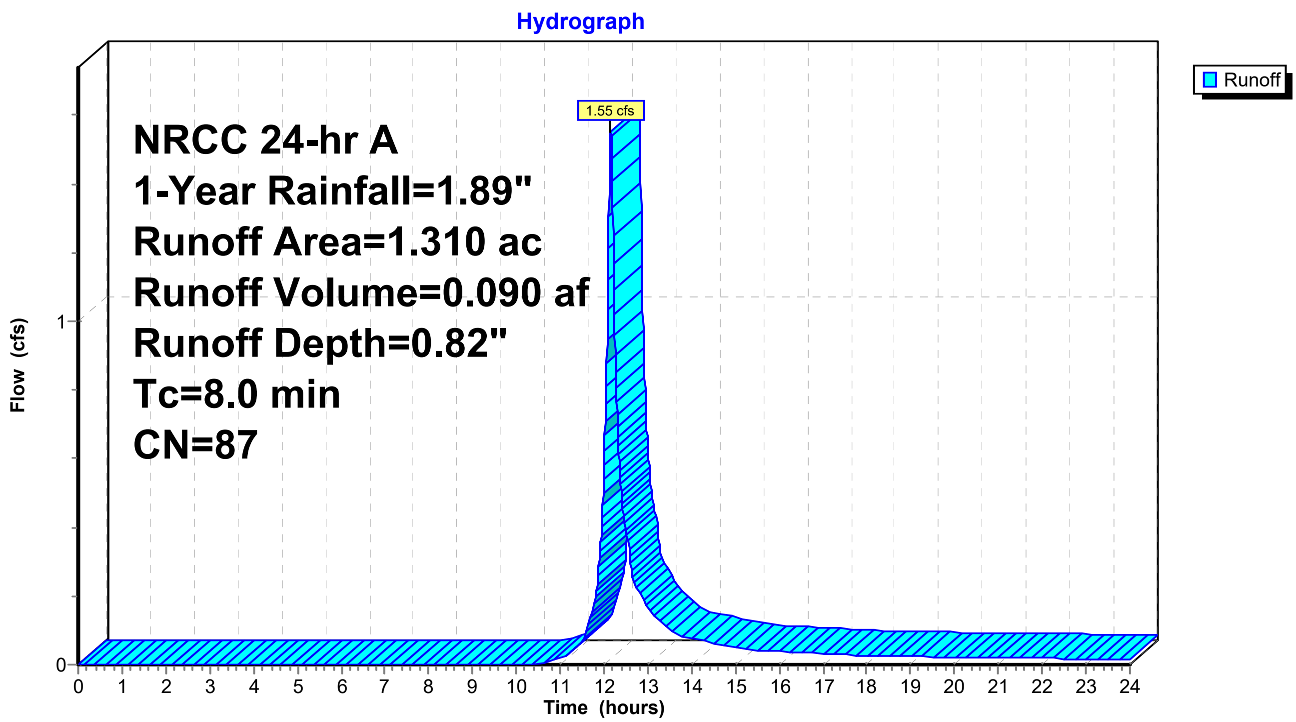
Runoff = 1.55 cfs @ 12.16 hrs, Volume= 0.090 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.490	98	Paved parking, HSG D
0.820	80	>75% Grass cover, Good, HSG D
1.310	87	Weighted Average
0.820		62.60% Pervious Area
0.490		37.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0					**Direct Entry,**

Subcatchment 26: 26 (update Tc to Channel flow?)



Summary for Subcatchment 37S: 1

CarlsonPlanXYPos|641307.9585|1041455.1221|
CarlsonSurface||

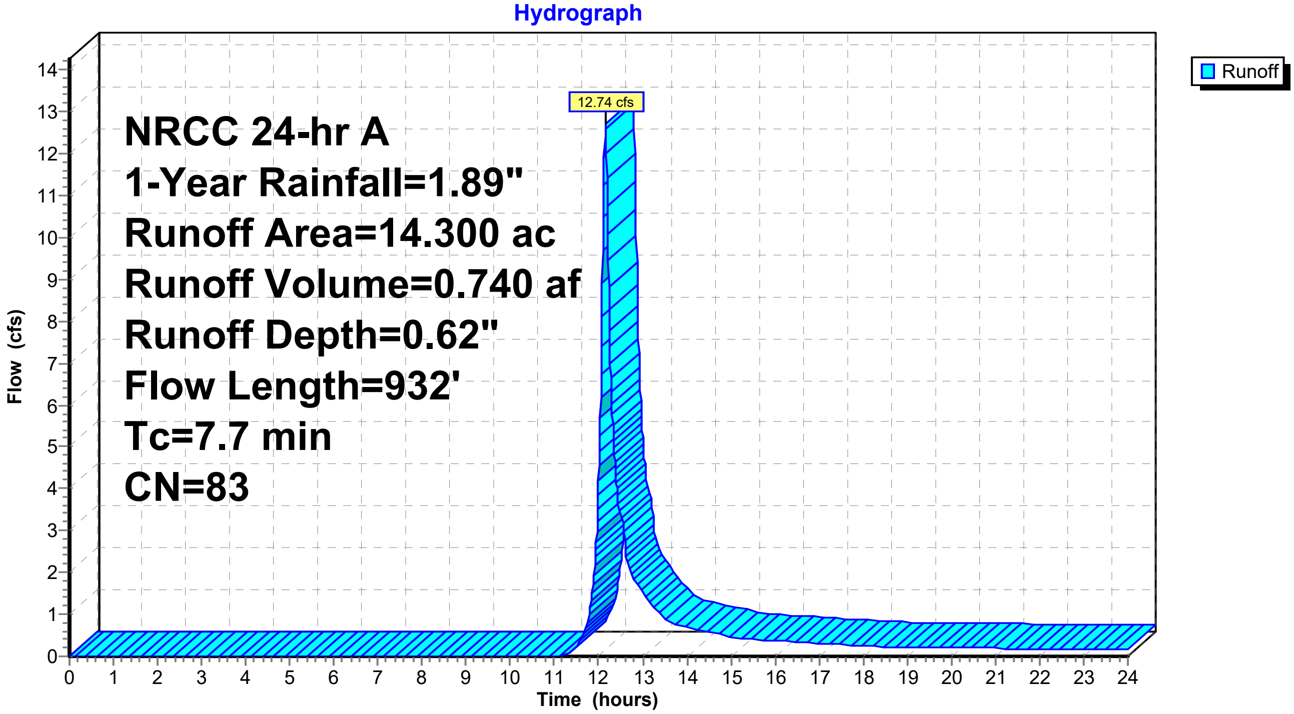
Runoff = 12.74 cfs @ 12.16 hrs, Volume= 0.740 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.260	98	Water Surface HSG B
1.860	98	Paved parking HSG B
1.340	98	Paved parking HSG C
1.100	61	>75% Grass cover, Good, HSG B
9.180	80	>75% Grass cover, Good, HSG D
0.560	73	Brush, Good, HSG D
14.300	83	Weighted Average
10.840		75.80% Pervious Area
3.460		24.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
3.9	25	0.0200	0.11		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.3	81	0.0150	5.11	89.50	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
0.1	58	0.0340	7.70	134.75	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
0.2	132	0.0600	10.23	179.01	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
1.1	80	0.0060	1.16		**Shallow Concentrated Flow, Shallow Concentrated** Grassed Waterway Kv= 15.0 fps
0.5	114	0.0040	3.61	4.43	**Pipe Channel, Pipe Channel** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Corrugated PP, smooth interior
0.5	113	0.0040	4.07	7.20	**Pipe Channel, Pipe Channel** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Corrugated PP, smooth interior
0.1	35	0.0040	4.93	15.50	**Pipe Channel, Pipe Channel** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
0.7	279	0.0080	6.98	21.92	**Pipe Channel, Pipe Channel** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
7.7	932	Total			

Subcatchment 37S: 1



Summary for Subcatchment 46S: Portion of Lot #1

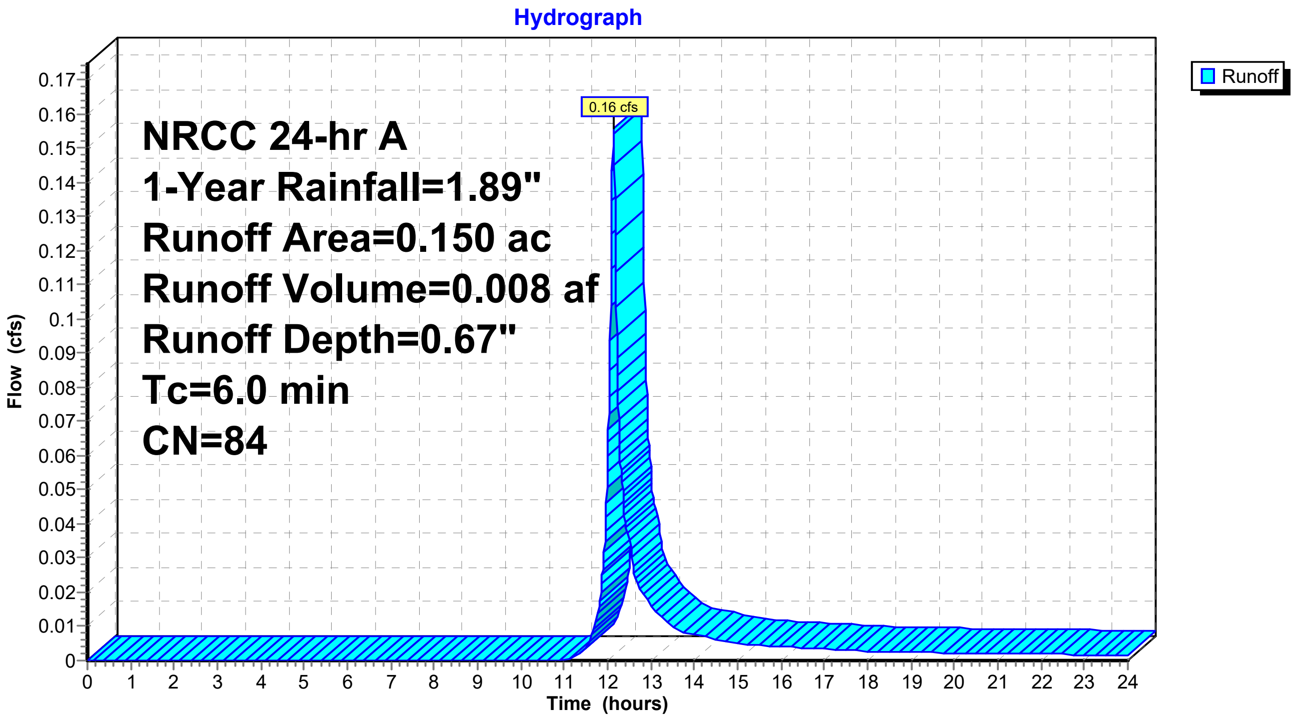
Runoff = 0.16 cfs @ 12.14 hrs, Volume= 0.008 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 1-Year Rainfall=1.89"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG D
0.120	80	>75% Grass cover, Good, HSG D
0.150	84	Weighted Average
0.120		80.00% Pervious Area
0.030		20.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 46S: Portion of Lot #1



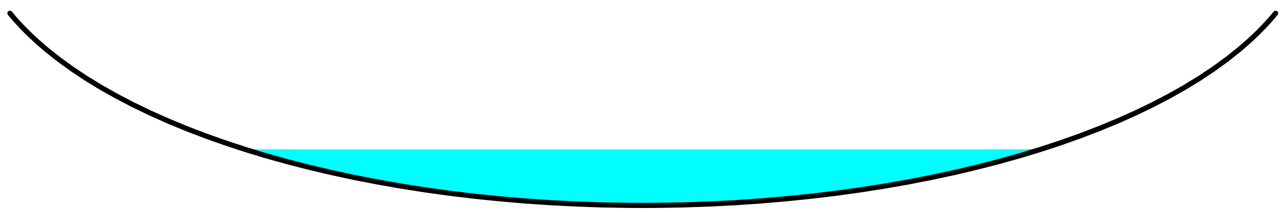
Summary for Reach 12R: Swale to off-site

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth > 0.33" for 1-Year event
Inflow = 4.06 cfs @ 13.81 hrs, Volume= 2.139 af
Outflow = 4.06 cfs @ 13.85 hrs, Volume= 2.138 af, Atten= 0%, Lag= 2.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.37 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.75 fps, Avg. Travel Time= 6.5 min

Peak Storage= 864 cf @ 13.85 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00' Flow Area= 18.7 sf, Capacity= 58.17 cfs

28.00' x 1.00' deep Parabolic Channel, n= 0.030 Short grass
Length= 293.0' Slope= 0.0068 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



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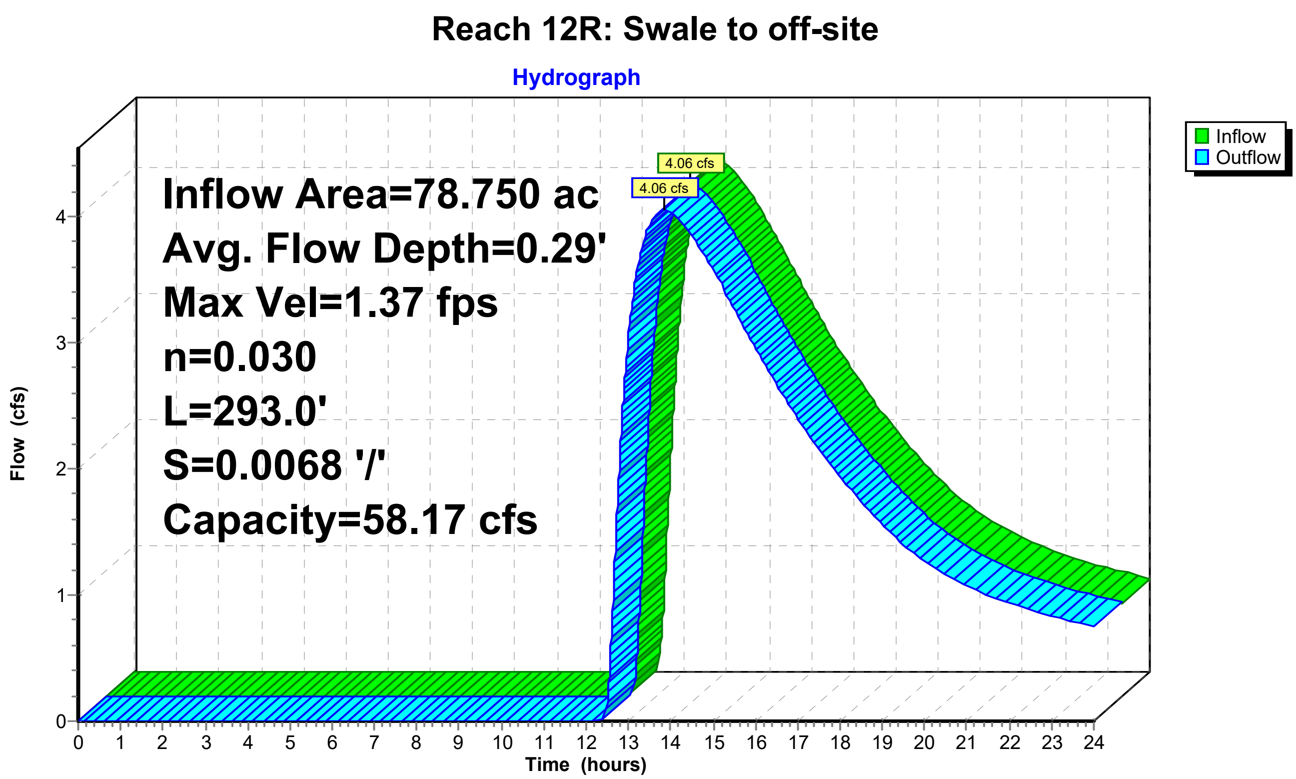


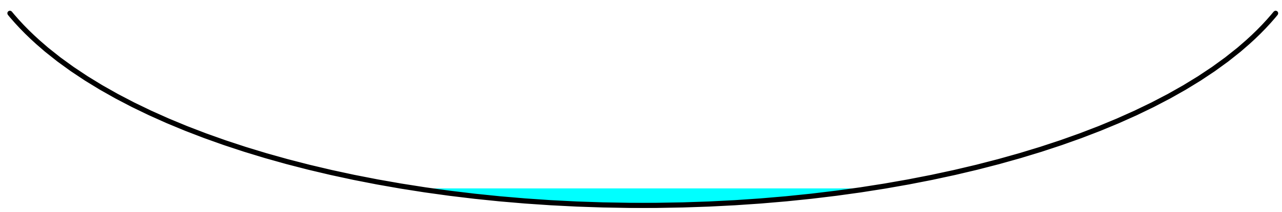
Summary for Reach 16R: Northside swale

Inflow Area = 1.310 ac, 37.40% Impervious, Inflow Depth = 0.43" for 1-Year event
Inflow = 0.66 cfs @ 12.31 hrs, Volume= 0.046 af
Outflow = 0.59 cfs @ 12.40 hrs, Volume= 0.046 af, Atten= 11%, Lag= 5.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.23 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 13.2 min

Peak Storage= 172 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 111.61 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 655.0' Slope= 0.0885 '/'
Inlet Invert= 804.00', Outlet Invert= 746.00'



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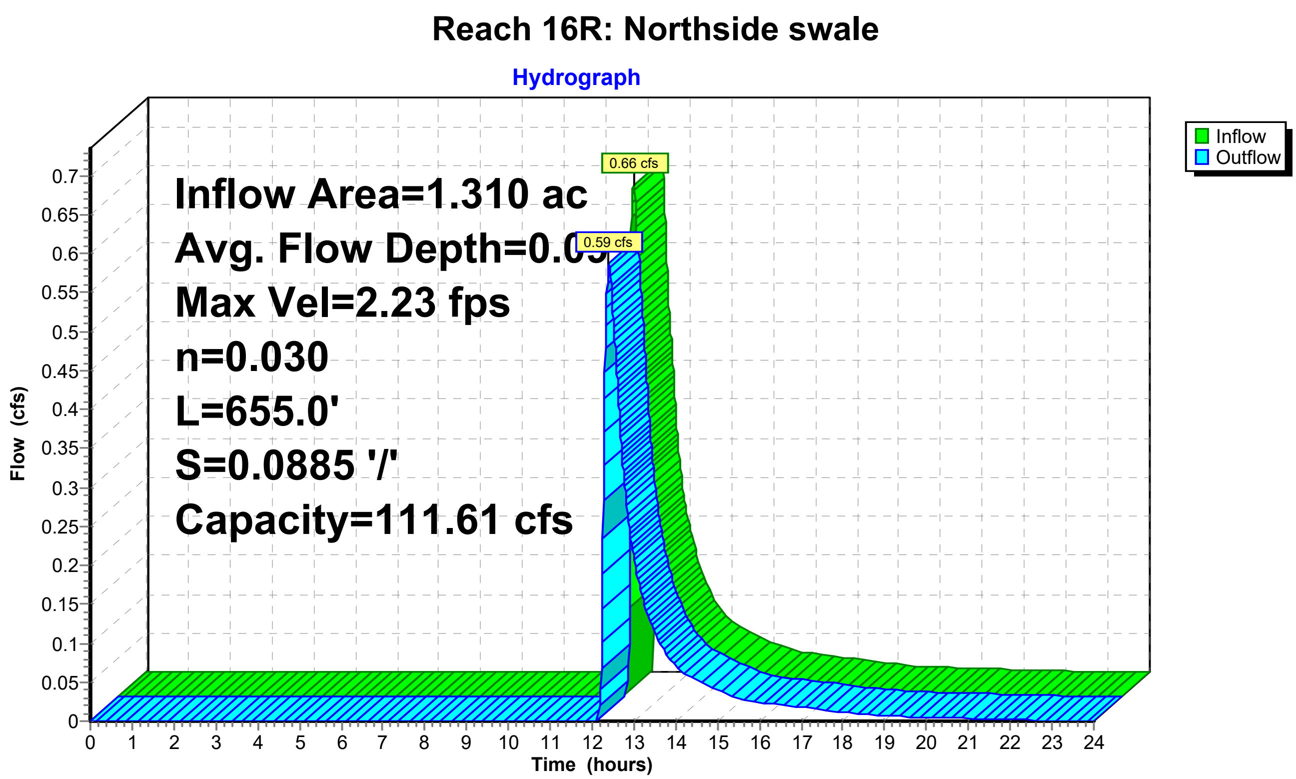


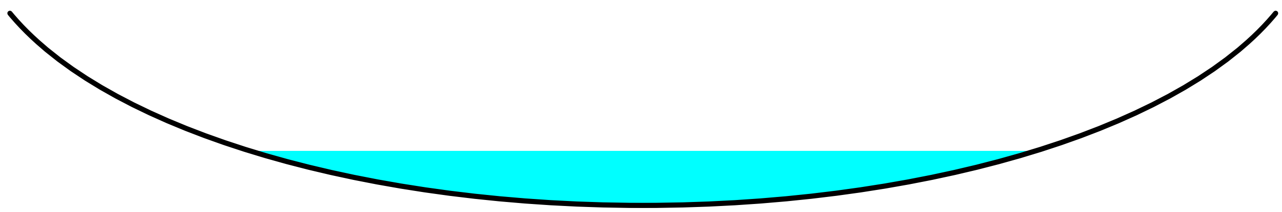
Summary for Reach 17R: Southside Swale

Inflow Area = 6.740 ac, 29.53% Impervious, Inflow Depth = 0.73" for 1-Year event
Inflow = 7.60 cfs @ 12.15 hrs, Volume= 0.408 af
Outflow = 7.07 cfs @ 12.18 hrs, Volume= 0.408 af, Atten= 7%, Lag= 1.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.69 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 8.1 min

Peak Storage= 1,070 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 108.12 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 710.0' Slope= 0.0831 '/'
Inlet Invert= 804.00', Outlet Invert= 745.00'



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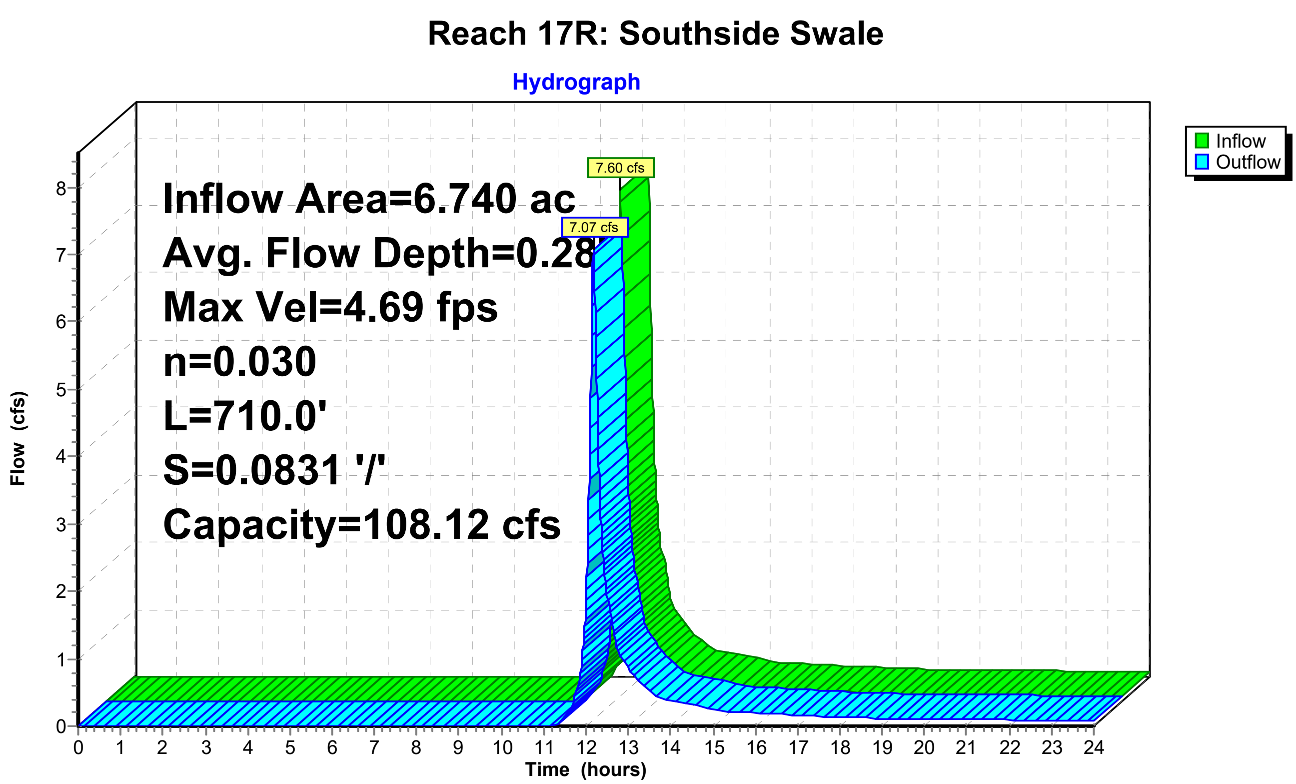


Summary for Pond 10P: Proposed 36" Culvert

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth = 0.33" for 1-Year event
Inflow = 14.52 cfs @ 12.61 hrs, Volume= 2.155 af
Outflow = 4.06 cfs @ 13.75 hrs, Volume= 2.140 af, Atten= 72%, Lag= 68.4 min
Primary = 4.06 cfs @ 13.75 hrs, Volume= 2.140 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 705.35' @ 13.75 hrs Surf.Area= 85,358 sf Storage= 34,005 cf

Plug-Flow detention time= 142.3 min calculated for 2.139 af (99% of inflow)
Center-of-Mass det. time= 138.3 min (1,045.9 - 907.6)

Volume	Invert	Avail.Storage	Storage Description
#1	704.50'	609,456 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

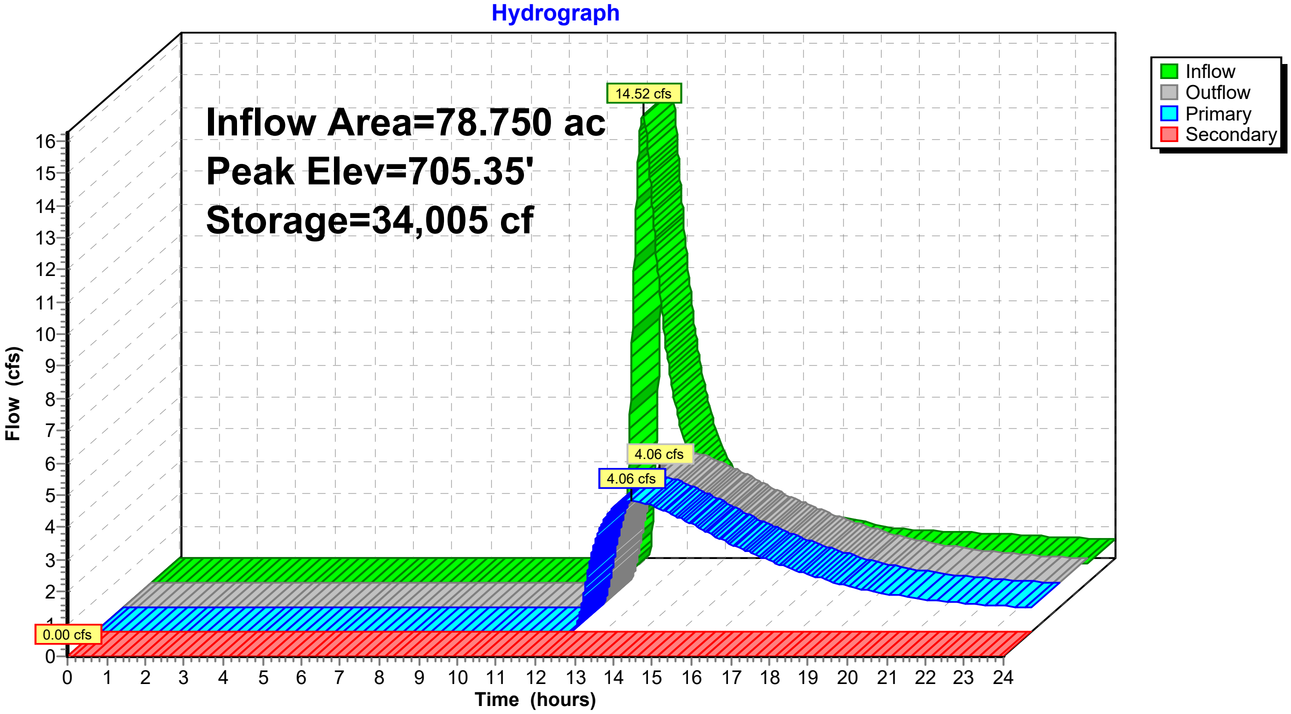
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.50	9,287	0	0
705.00	39,370	12,164	12,164
706.00	170,682	105,026	117,190
707.00	256,925	213,804	330,994
708.00	300,000	278,463	609,456

Device	Routing	Invert	Outlet Devices
#1	Primary	704.50'	**36.0" Round 36" Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 704.50' / 704.00' S= 0.0041 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Secondary	705.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.06 cfs @ 13.75 hrs HW=705.35' TW=704.16' (Dynamic Tailwater)
└─**1=36" Culvert** (Barrel Controls 4.06 cfs @ 3.70 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=704.50' TW=703.30' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 10P: Proposed 36" Culvert



Summary for Pond 11P: Proposed 36" Culvert

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth > 0.33" for 1-Year event
Inflow = 4.06 cfs @ 13.75 hrs, Volume= 2.140 af
Outflow = 4.06 cfs @ 13.81 hrs, Volume= 2.139 af, Atten= 0%, Lag= 3.5 min
Primary = 4.06 cfs @ 13.81 hrs, Volume= 2.139 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 704.16' @ 13.81 hrs Surf.Area= 1,780 sf Storage= 1,062 cf

Plug-Flow detention time= 5.7 min calculated for 2.138 af (100% of inflow)
Center-of-Mass det. time= 5.2 min (1,051.1 - 1,045.9)

Volume	Invert	Avail.Storage	Storage Description
#1	703.30'	12,772 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

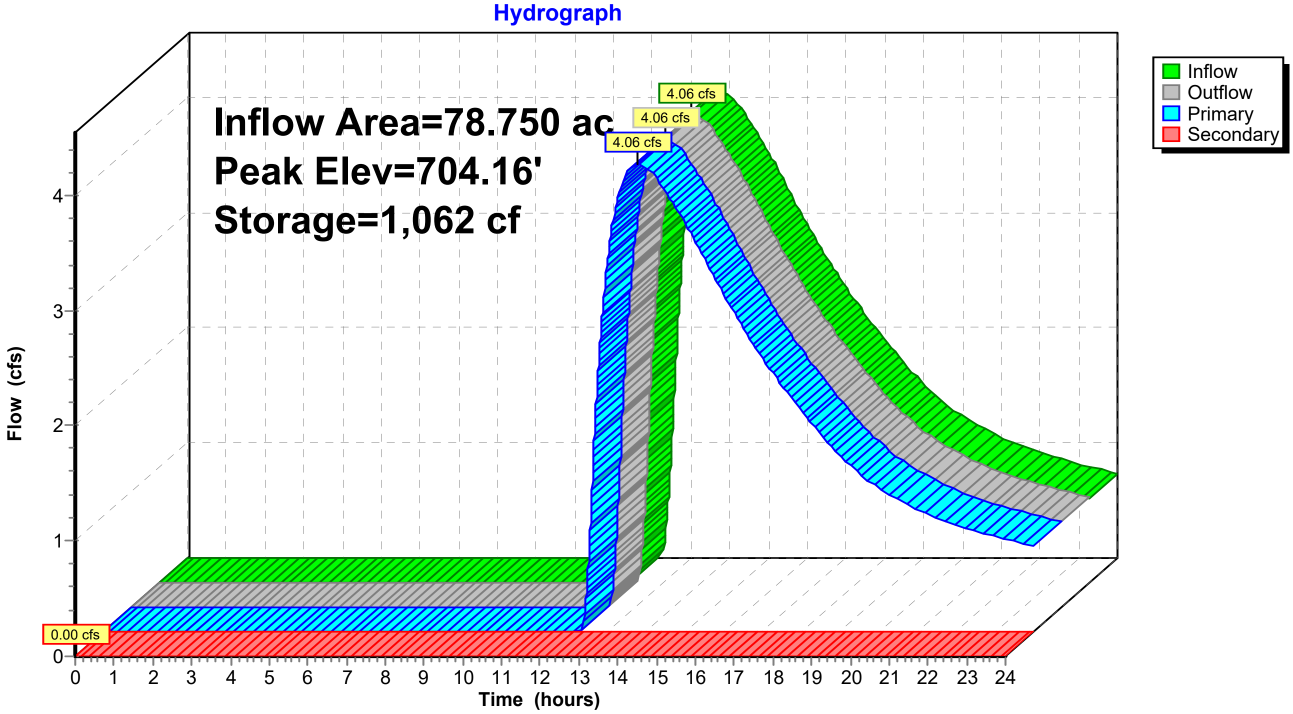
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
703.30	707	0	0
704.00	1,575	799	799
705.00	2,882	2,229	3,027
706.00	4,304	3,593	6,620
707.00	8,000	6,152	12,772

Device	Routing	Invert	Outlet Devices
#1	Primary	703.30'	**36.0" Round 36" cuvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 703.30' / 703.00' S= 0.0046 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Secondary	706.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.06 cfs @ 13.81 hrs HW=704.16' TW=703.29' (Dynamic Tailwater)
1=36" cuvert (Barrel Controls 4.06 cfs @ 3.65 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=703.30' TW=703.00' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 11P: Proposed 36" Culvert



Summary for Pond 17P: Bioswale (good)

Inflow Area = 6.740 ac, 29.53% Impervious, Inflow Depth = 0.73" for 1-Year event
Inflow = 7.61 cfs @ 12.15 hrs, Volume= 0.412 af
Outflow = 7.60 cfs @ 12.15 hrs, Volume= 0.410 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.002 af
Primary = 7.60 cfs @ 12.15 hrs, Volume= 0.408 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 807.68' @ 12.15 hrs Surf.Area= 284 sf Storage= 237 cf

Plug-Flow detention time= 5.7 min calculated for 0.410 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (842.1 - 838.9)

Volume	Invert	Avail.Storage	Storage Description
#1	806.50'	2,012 cf	**SWALE STORAGE ABOVE BOTTOM (Conic)** Listed below

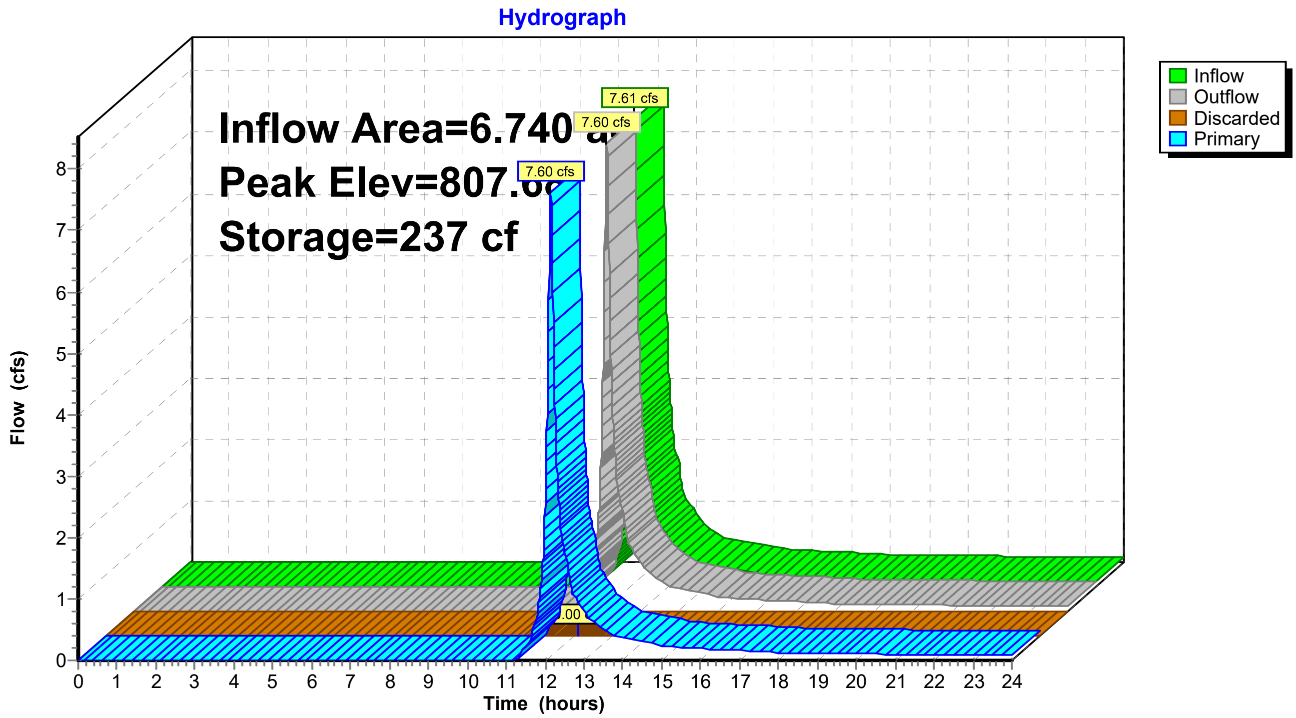
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
806.50	0	0	0	0
809.00	600	500	500	610
809.50	6,500	1,512	2,012	6,510

Device	Routing	Invert	Outlet Devices
#1	Discarded	806.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Primary	807.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=807.68' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=7.59 cfs @ 12.15 hrs HW=807.68' TW=804.28' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 7.59 cfs @ 2.22 fps)

Pond 17P: Bioswale (good)



Summary for Pond 18P: Bioswale (good)

Inflow Area = 5.900 ac, 30.00% Impervious, Inflow Depth = 0.74" for 1-Year event
Inflow = 6.70 cfs @ 12.15 hrs, Volume= 0.362 af
Outflow = 6.69 cfs @ 12.15 hrs, Volume= 0.362 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 6.69 cfs @ 12.15 hrs, Volume= 0.361 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 815.13' @ 12.15 hrs Surf.Area= 220 sf Storage= 184 cf

Plug-Flow detention time= 1.5 min calculated for 0.362 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (839.2 - 837.6)

Volume	Invert	Avail.Storage	Storage Description
#1	814.50'	3,041 cf	**SWALE STORAGE (Conic)** Listed below

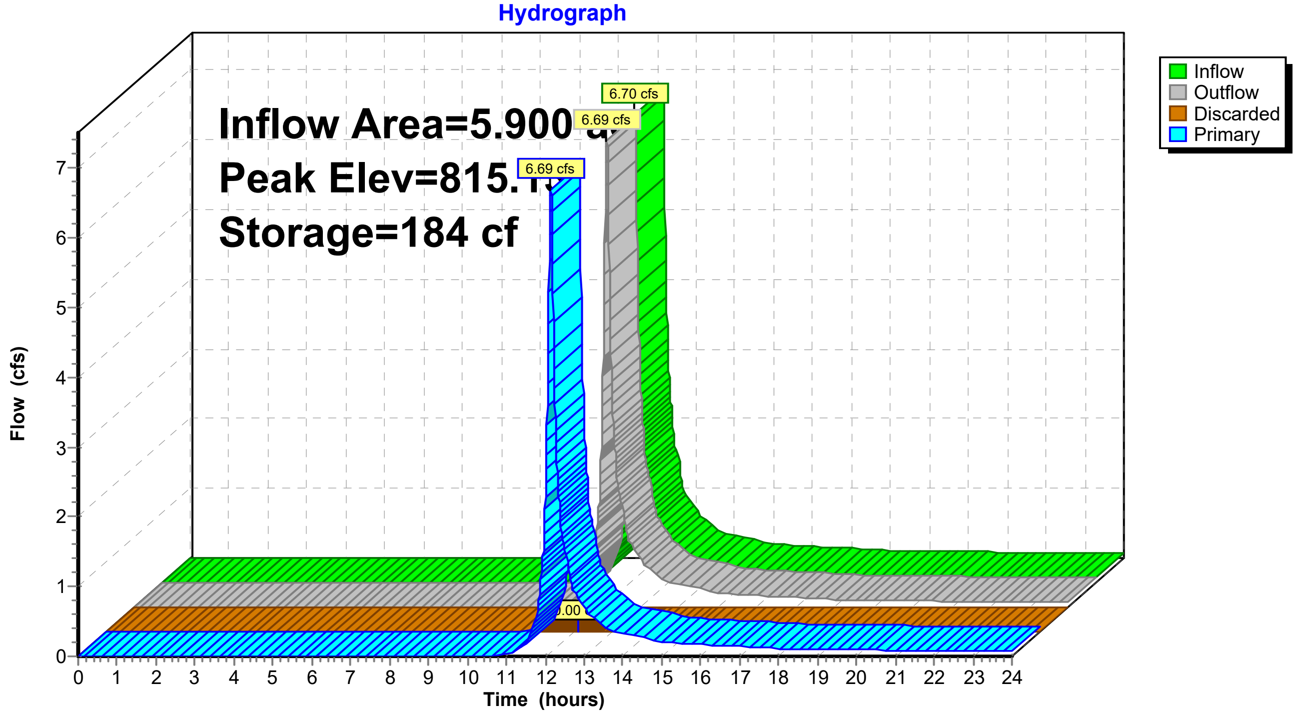
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
814.50	0	0	0	0
817.00	880	733	733	890
817.50	10,000	2,308	3,041	10,010

Device	Routing	Invert	Outlet Devices
#1	Discarded	814.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Device 3	814.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	812.50'	**24.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 812.50' / 812.00' S= 0.0109 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#4	Primary	814.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=815.13' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=6.69 cfs @ 12.15 hrs HW=815.13' TW=807.68' (Dynamic Tailwater)
├─**3=Culvert** (Passes 3.18 cfs of 15.23 cfs potential flow)
│ └─**2=Orifice/Grate** (Orifice Controls 3.18 cfs @ 2.54 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 3.51 cfs @ 1.65 fps)

Pond 18P: Bioswale (good)



Summary for Pond 19P: Bioswale (good)

Inflow Area = 5.150 ac, 30.10% Impervious, Inflow Depth = 0.74" for 1-Year event
Inflow = 5.88 cfs @ 12.15 hrs, Volume= 0.317 af
Outflow = 5.88 cfs @ 12.15 hrs, Volume= 0.317 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 5.88 cfs @ 12.15 hrs, Volume= 0.317 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 829.79' @ 12.15 hrs Surf.Area= 505 sf Storage= 84 cf

Plug-Flow detention time= 0.6 min calculated for 0.317 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (837.7 - 837.2)

Volume	Invert	Avail.Storage	Storage Description
#1	829.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

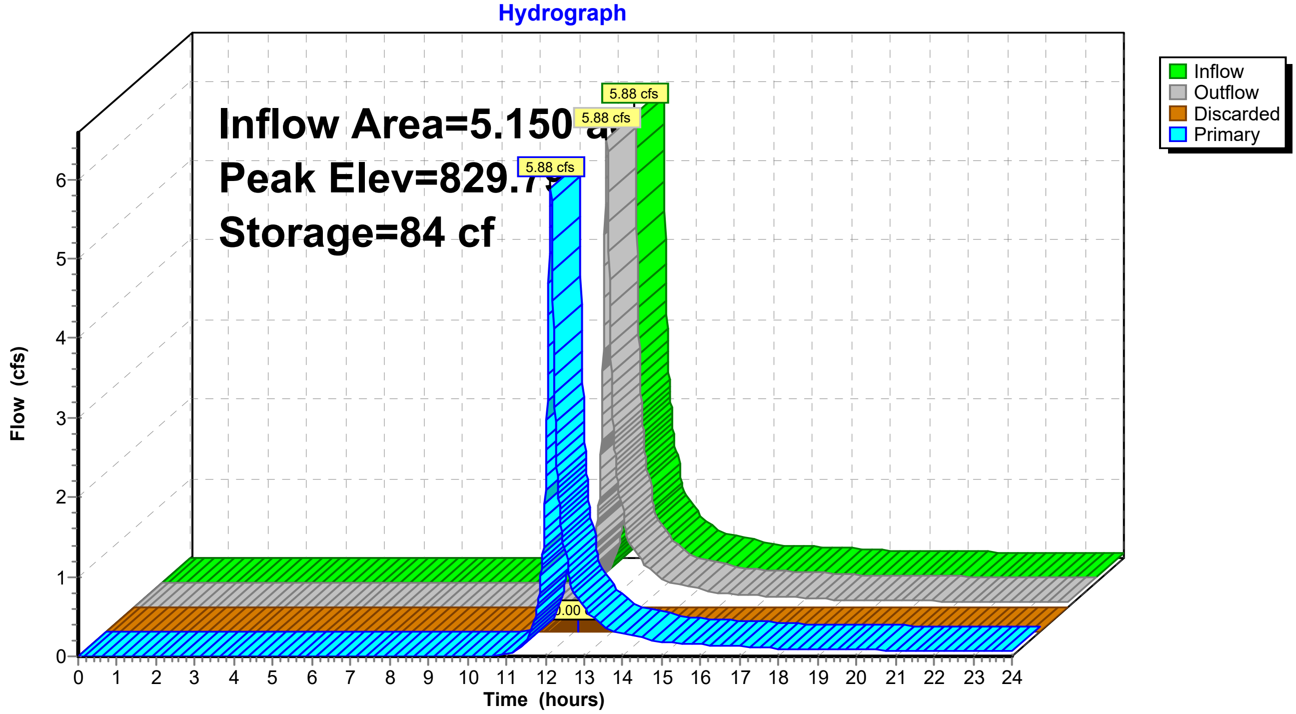
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
829.50	0	0	0	0
830.00	880	147	147	880
832.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Discarded	829.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.01'
#2	Device 3	829.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	827.50'	**18.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 827.50' / 827.00' S= 0.0109 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#4	Primary	829.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=829.79' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=5.86 cfs @ 12.15 hrs HW=829.79' TW=815.13' (Dynamic Tailwater)
├─**3=Culvert** (Passes 4.02 cfs of 8.33 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 4.02 cfs @ 1.75 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 1.85 cfs @ 1.29 fps)

Pond 19P: Bioswale (good)



Summary for Pond 20P: Bioswale (good)

Inflow Area =	4.340 ac, 30.65% Impervious, Inflow Depth = 0.74" for 1-Year event		
Inflow =	4.99 cfs @ 12.14 hrs, Volume=	0.269 af	
Outflow =	4.99 cfs @ 12.15 hrs, Volume=	0.269 af,	Atten= 0%, Lag= 0.2 min
Discarded =	0.00 cfs @ 12.15 hrs, Volume=	0.000 af	
Primary =	4.99 cfs @ 12.15 hrs, Volume=	0.269 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 844.76' @ 12.15 hrs Surf.Area= 454 sf Storage= 76 cf

Plug-Flow detention time= 0.6 min calculated for 0.269 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (837.2 - 836.6)

Volume	Invert	Avail.Storage	Storage Description
#1	844.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

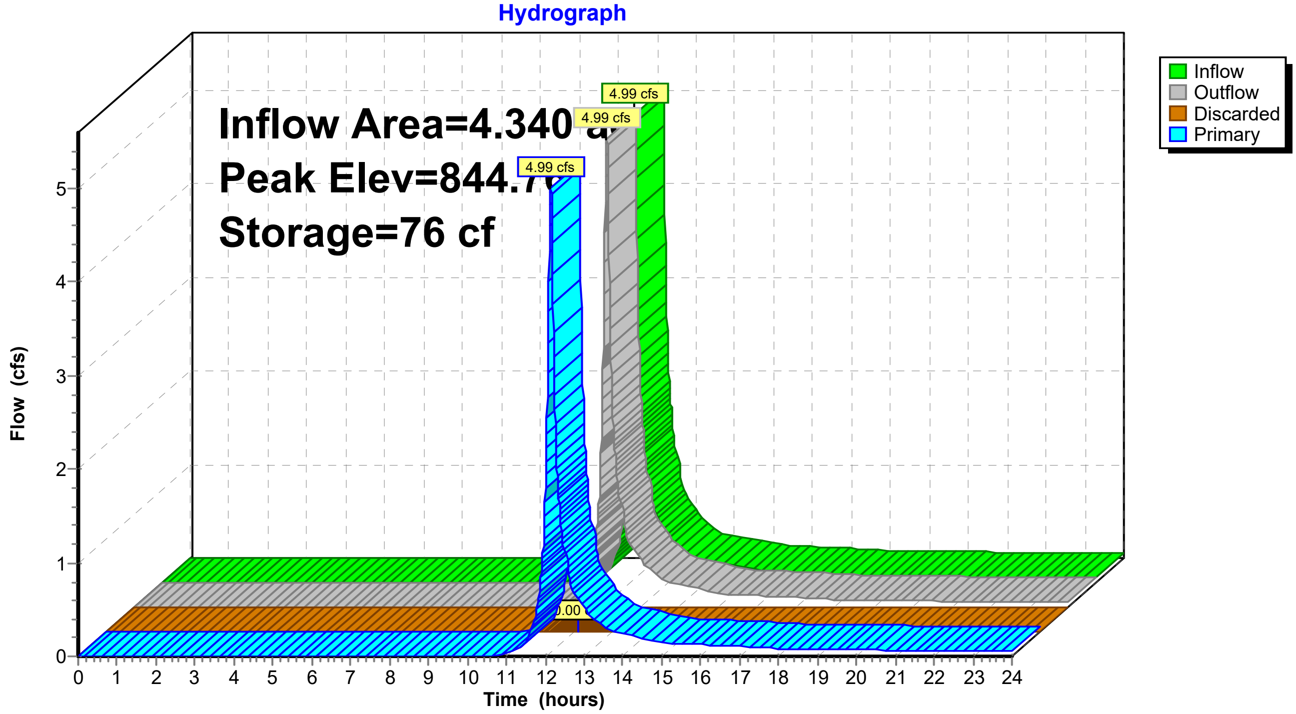
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
844.50	0	0	0	0
845.00	880	147	147	880
847.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Discarded	844.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	844.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	842.50'	**15.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 842.50' / 840.50' S= 0.0435 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#4	Primary	844.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=844.76' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=4.97 cfs @ 12.15 hrs HW=844.76' TW=829.79' (Dynamic Tailwater)
├─**3=Culvert** (Passes 3.42 cfs of 5.96 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 3.42 cfs @ 1.66 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 1.56 cfs @ 1.21 fps)

Pond 20P: Bioswale (good)



Summary for Pond 21P: Bioswale (good)

Inflow Area = 3.540 ac, 31.36% Impervious, Inflow Depth = 0.75" for 1-Year event
Inflow = 4.11 cfs @ 12.14 hrs, Volume= 0.222 af
Outflow = 4.11 cfs @ 12.15 hrs, Volume= 0.222 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 4.11 cfs @ 12.15 hrs, Volume= 0.222 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 858.73' @ 12.15 hrs Surf.Area= 400 sf Storage= 67 cf

Plug-Flow detention time= 0.6 min calculated for 0.222 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (836.5 - 835.8)

Volume	Invert	Avail.Storage	Storage Description
#1	858.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

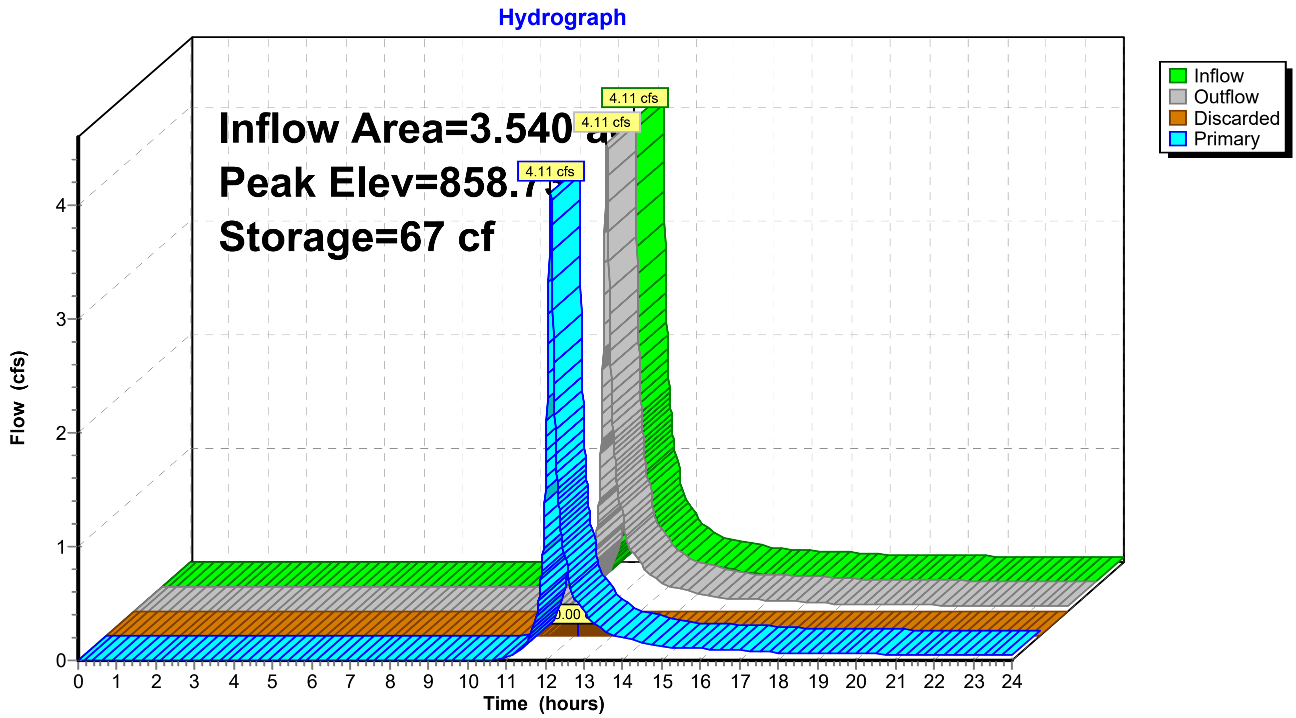
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
858.50	0	0	0	0
859.00	880	147	147	880
861.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Device 3	858.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	858.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#3	Primary	856.50'	**15.0" Round Culvert** L= 47.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 856.50' / 854.00' S= 0.0532 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#4	Primary	858.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=858.73' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=4.10 cfs @ 12.15 hrs HW=858.73' TW=844.76' (Dynamic Tailwater)
├─**3=Culvert** (Passes 2.82 cfs of 5.90 cfs potential flow)
│ └─**1=Orifice/Grate** (Weir Controls 2.82 cfs @ 1.56 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 1.27 cfs @ 1.12 fps)

Pond 21P: Bioswale (good)



Summary for Pond 22P: Bioswale (good)

Inflow Area = 2.740 ac, 32.48% Impervious, Inflow Depth = 0.76" for 1-Year event
Inflow = 3.23 cfs @ 12.14 hrs, Volume= 0.174 af
Outflow = 3.23 cfs @ 12.15 hrs, Volume= 0.174 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 3.22 cfs @ 12.15 hrs, Volume= 0.174 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 869.69' @ 12.15 hrs Surf.Area= 341 sf Storage= 57 cf

Plug-Flow detention time= 0.7 min calculated for 0.174 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (835.4 - 834.8)

Volume	Invert	Avail.Storage	Storage Description
#1	869.50'	13,006 cf	**SWALE STORAGE (Conic)** Listed below

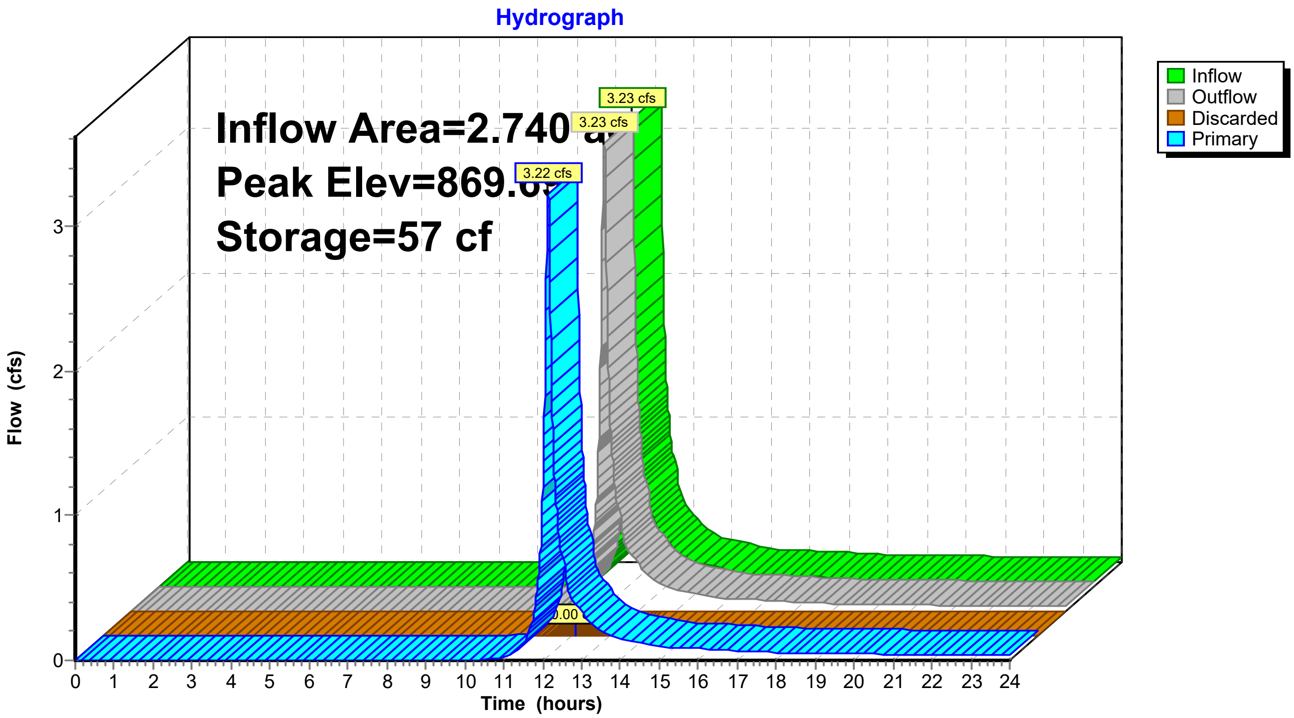
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
869.50	0	0	0	0
870.00	880	147	147	880
872.00	14,800	12,859	13,006	14,811

Device	Routing	Invert	Outlet Devices
#1	Discarded	869.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Device 3	869.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	867.50'	**12.0" Round CMP_Round 12"** L= 47.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 867.50' / 866.00' S= 0.0319 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	869.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=869.69' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=3.21 cfs @ 12.15 hrs HW=869.69' TW=858.73' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 2.22 cfs of 3.88 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 2.22 cfs @ 1.44 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.99 cfs @ 1.03 fps)

Pond 22P: Bioswale (good)



Summary for Pond 23P: Bioswale (good)

Inflow Area = 1.920 ac, 34.90% Impervious, Inflow Depth = 0.79" for 1-Year event
Inflow = 2.32 cfs @ 12.14 hrs, Volume= 0.126 af
Outflow = 2.32 cfs @ 12.15 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.2 min
Primary = 2.32 cfs @ 12.15 hrs, Volume= 0.126 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 880.66' @ 12.15 hrs Surf.Area= 273 sf Storage= 46 cf

Plug-Flow detention time= 0.8 min calculated for 0.126 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (833.6 - 832.9)

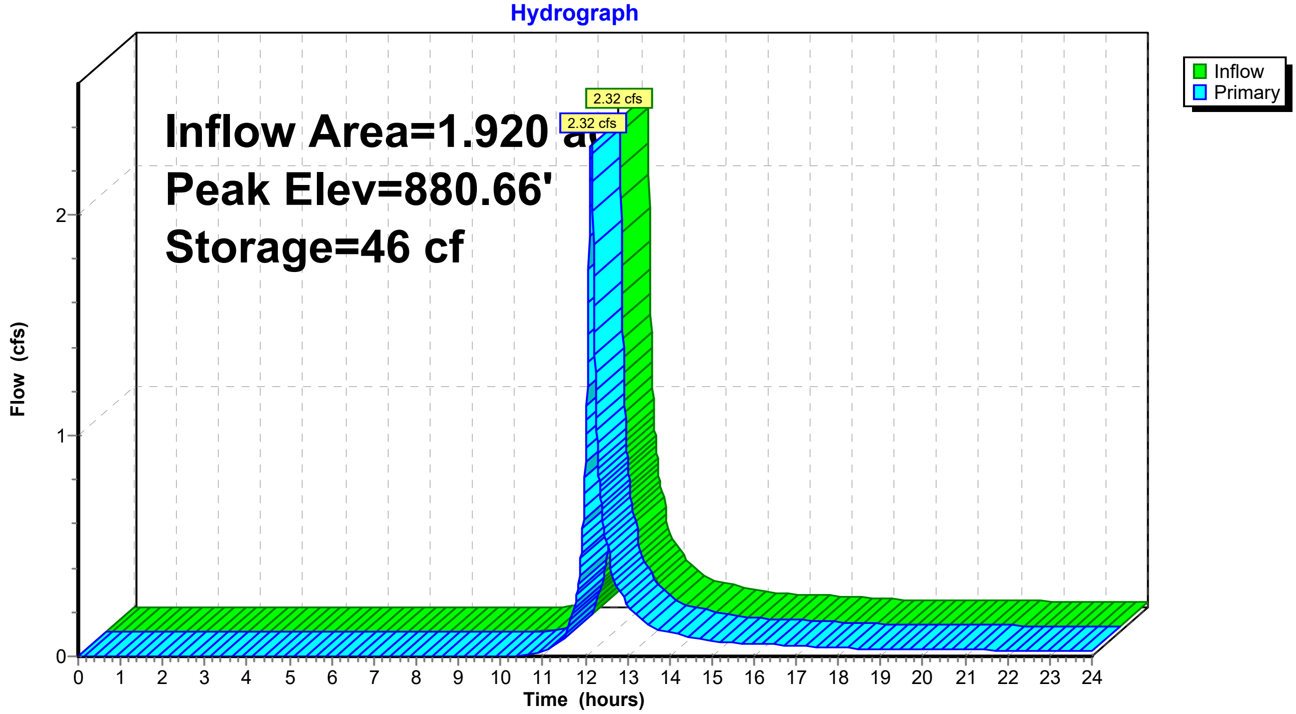
Volume	Invert	Avail.Storage	Storage Description
#1	880.50'	4,762 cf	**SWALE STORAGE (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
880.50	0	0	0	0
881.00	880	147	147	880
882.00	10,000	4,615	4,762	10,003

Device	Routing	Invert	Outlet Devices
#1	Device 3	880.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	880.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	878.50'	**12.0" Round CMP_Round 12"** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 878.50' / 877.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	880.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.31 cfs @ 12.15 hrs HW=880.65' TW=869.69' (Dynamic Tailwater)
—**3=CMP_Round 12"** (Passes 1.60 cfs of 3.84 cfs potential flow)
—**1=Exfiltration** (Controls 0.00 cfs)
—**2=Orifice/Grate** (Weir Controls 1.60 cfs @ 1.29 fps)
—**4=Broad-Crested Rectangular Weir** (Weir Controls 0.71 cfs @ 0.92 fps)

Pond 23P: Bioswale (good)



Summary for Pond 24P: Bioswale (good)

Inflow Area = 1.090 ac, 41.28% Impervious, Inflow Depth = 0.84" for 1-Year event
Inflow = 1.40 cfs @ 12.14 hrs, Volume= 0.076 af
Outflow = 1.40 cfs @ 12.15 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 1.40 cfs @ 12.15 hrs, Volume= 0.076 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 891.61' @ 12.15 hrs Surf.Area= 184 sf Storage= 31 cf

Plug-Flow detention time= 0.9 min calculated for 0.076 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (829.9 - 829.1)

Volume	Invert	Avail.Storage	Storage Description
#1	891.50'	5,468 cf	**SWALE STORAGE (Conic)** Listed below

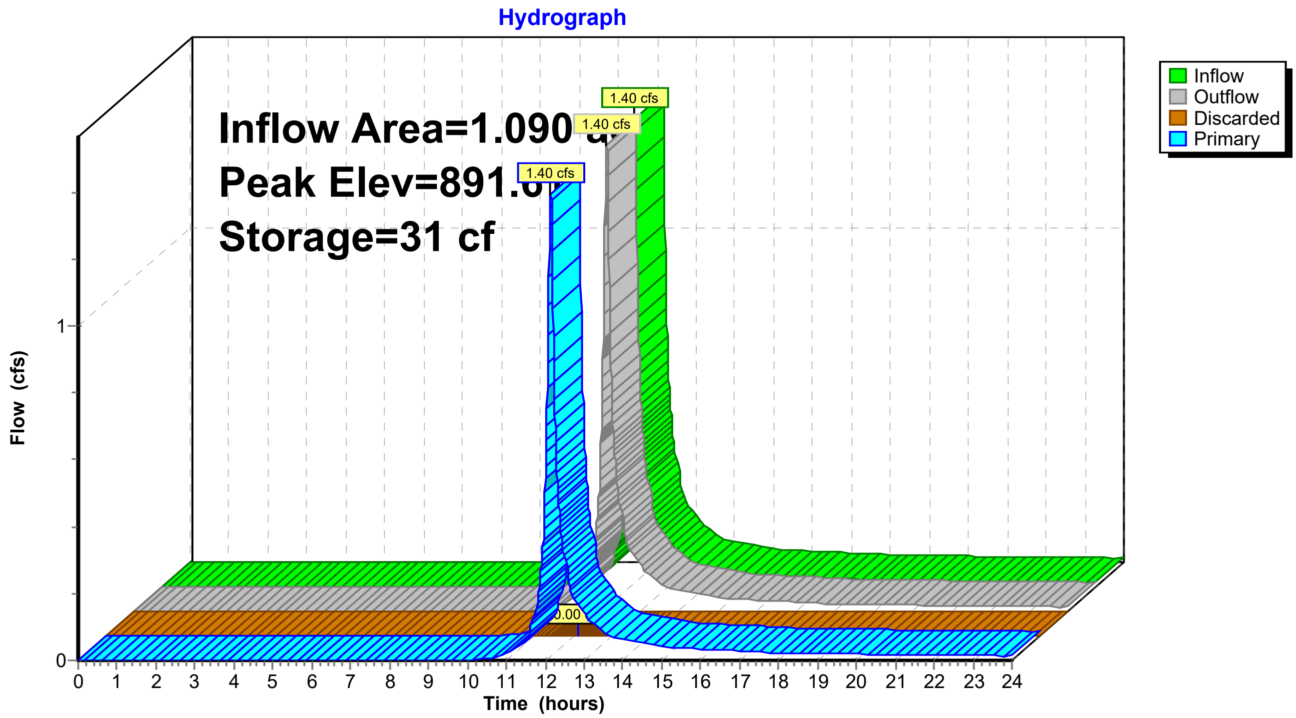
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
891.50	0	0	0	0
892.00	831	139	139	831
893.00	12,000	5,330	5,468	12,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	891.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	891.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	889.50'	**12.0" Round Culvert** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 889.50' / 888.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	891.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=891.61' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.39 cfs @ 12.15 hrs HW=891.61' TW=880.65' (Dynamic Tailwater)
├─**3=Culvert** (Passes 0.96 cfs of 3.79 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 0.96 cfs @ 1.09 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.43 cfs @ 0.78 fps)

Pond 24P: Bioswale (good)



Summary for Pond 25P: Bioswale (good)

Inflow Area = 0.530 ac, 43.40% Impervious, Inflow Depth = 0.86" for 1-Year event
Inflow = 0.69 cfs @ 12.15 hrs, Volume= 0.038 af
Outflow = 0.69 cfs @ 12.15 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 0.69 cfs @ 12.15 hrs, Volume= 0.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 903.59' @ 12.15 hrs Surf.Area= 70 sf Storage= 12 cf

Plug-Flow detention time= 0.6 min calculated for 0.038 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (828.2 - 827.6)

Volume	Invert	Avail.Storage	Storage Description
#1	903.50'	2,142 cf	**SWALE STORAGE (Conic)** Listed below

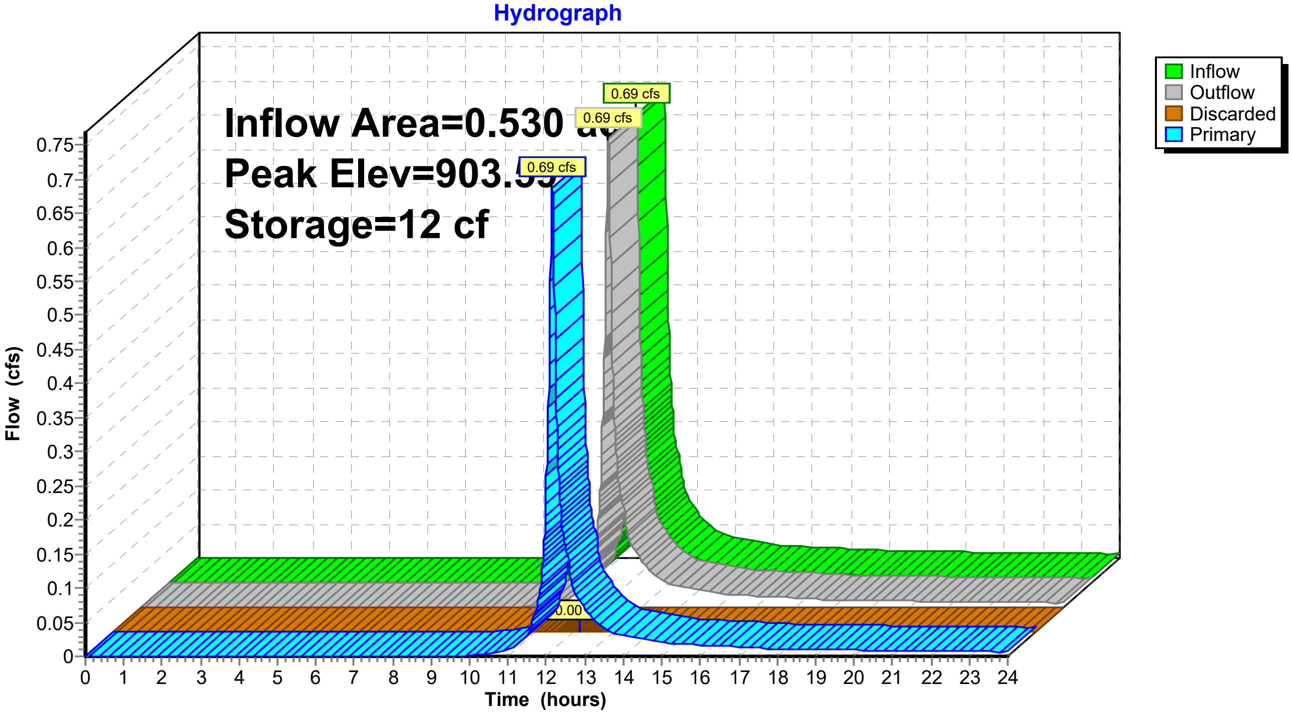
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
903.50	0	0	0	0
904.00	395	66	66	395
905.00	4,500	2,076	2,142	4,503

Device	Routing	Invert	Outlet Devices
#1	Discarded	903.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	903.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	901.50'	**12.0" Round CMP_Round 12"** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 901.50' / 901.00' S= 0.0086 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	903.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=903.59' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.69 cfs @ 12.15 hrs HW=903.59' TW=891.61' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 0.69 cfs of 3.76 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 0.69 cfs @ 0.97 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 25P: Bioswale (good)



Summary for Pond 26P: Bioswale (good)

Inflow Area = 0.150 ac, 20.00% Impervious, Inflow Depth = 0.67" for 1-Year event
Inflow = 0.16 cfs @ 12.14 hrs, Volume= 0.008 af
Outflow = 0.15 cfs @ 12.14 hrs, Volume= 0.008 af, Atten= 1%, Lag= 0.5 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 0.15 cfs @ 12.14 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 907.53' @ 12.14 hrs Surf.Area= 41 sf Storage= 7 cf

Plug-Flow detention time= 1.8 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (843.2 - 841.5)

Volume	Invert	Avail.Storage	Storage Description
#1	907.50'	2,578 cf	**SWALE STORAGE (Conic)** Listed below

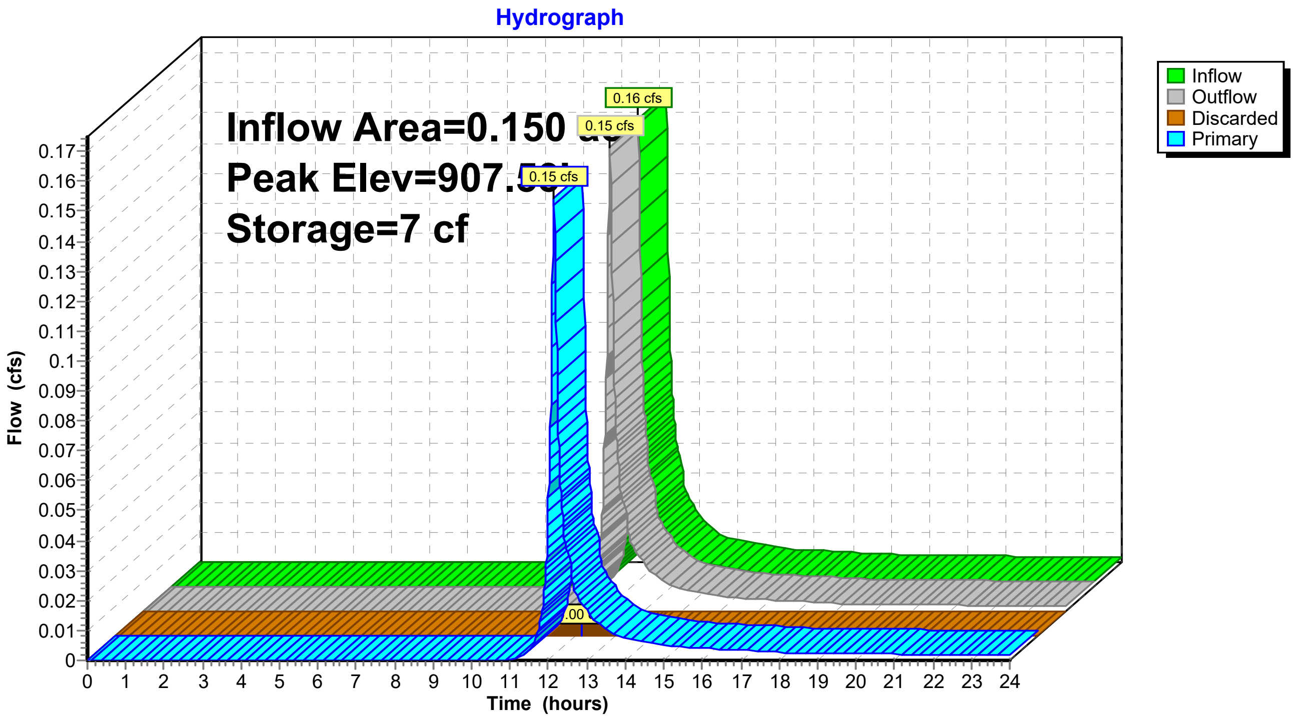
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
907.50	0	0	0	0
908.00	635	106	106	635
909.00	5,000	2,472	2,578	5,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	907.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	907.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	905.50'	**12.0" Round CMP_Round 12"** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 905.50' / 905.00' S= 0.0086 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	907.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=907.53' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.15 cfs @ 12.14 hrs HW=907.53' TW=903.59' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 0.15 cfs of 3.70 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 0.15 cfs @ 0.59 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: Bioswale (good)



Summary for Pond 27P: Dry Swale

Inflow Area =	1.310 ac, 37.40% Impervious, Inflow Depth = 0.82" for 1-Year event			
Inflow =	1.55 cfs @	12.16 hrs, Volume=	0.090 af	
Outflow =	0.68 cfs @	12.31 hrs, Volume=	0.079 af,	Atten= 56%, Lag= 9.5 min
Discarded =	0.02 cfs @	12.31 hrs, Volume=	0.032 af	
Primary =	0.66 cfs @	12.31 hrs, Volume=	0.046 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 807.67' @ 12.31 hrs Surf.Area= 4,210 sf Storage= 1,403 cf

Plug-Flow detention time= 260.9 min calculated for 0.079 af (88% of inflow)
Center-of-Mass det. time= 205.7 min (1,037.6 - 831.9)

Volume	Invert	Avail.Storage	Storage Description
#1	807.00'	10,179 cf	**Custom Stage Data (Conic)** Listed below

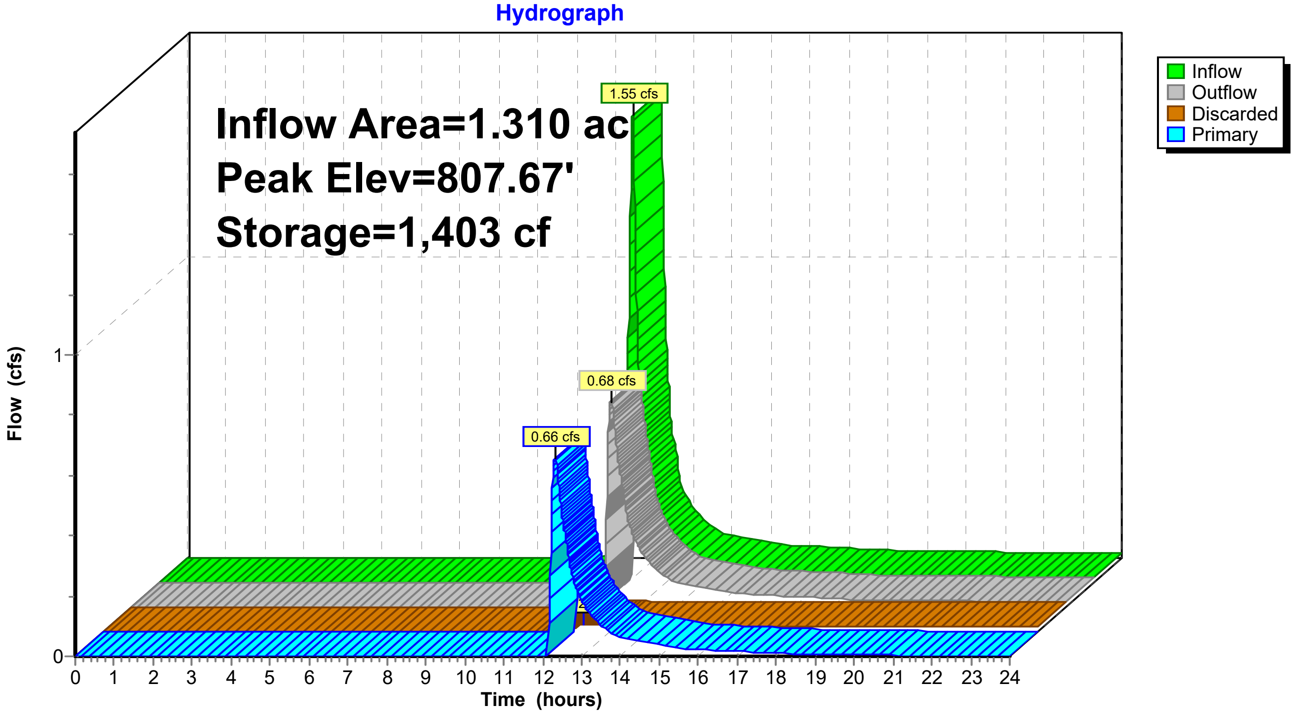
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
807.00	0	0	0	0
808.00	6,300	2,100	2,100	6,302
809.00	10,000	8,079	10,179	10,015

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	**4.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	807.00'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 700.00'

Discarded OutFlow Max=0.02 cfs @ 12.31 hrs HW=807.67' (Free Discharge)
└─**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.66 cfs @ 12.31 hrs HW=807.67' TW=804.08' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 0.66 cfs @ 0.98 fps)

Pond 27P: Dry Swale



Summary for Pond 32P: Lower Pond

Inflow Area = 38.100 ac, 11.36% Impervious, Inflow Depth = 0.52" for 1-Year event
Inflow = 13.84 cfs @ 12.16 hrs, Volume= 1.651 af
Outflow = 0.41 cfs @ 22.53 hrs, Volume= 0.898 af, Atten= 97%, Lag= 622.0 min
Primary = 0.41 cfs @ 22.53 hrs, Volume= 0.898 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Starting Elev= 700.50' Surf.Area= 14,196 sf Storage= 6,497 cf
Peak Elev= 703.16' @ 22.53 hrs Surf.Area= 23,385 sf Storage= 56,865 cf (50,368 cf above start)

Plug-Flow detention time= 770.4 min calculated for 0.749 af (45% of inflow)
Center-of-Mass det. time= 468.8 min (1,340.0 - 871.2)

Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	124,144 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

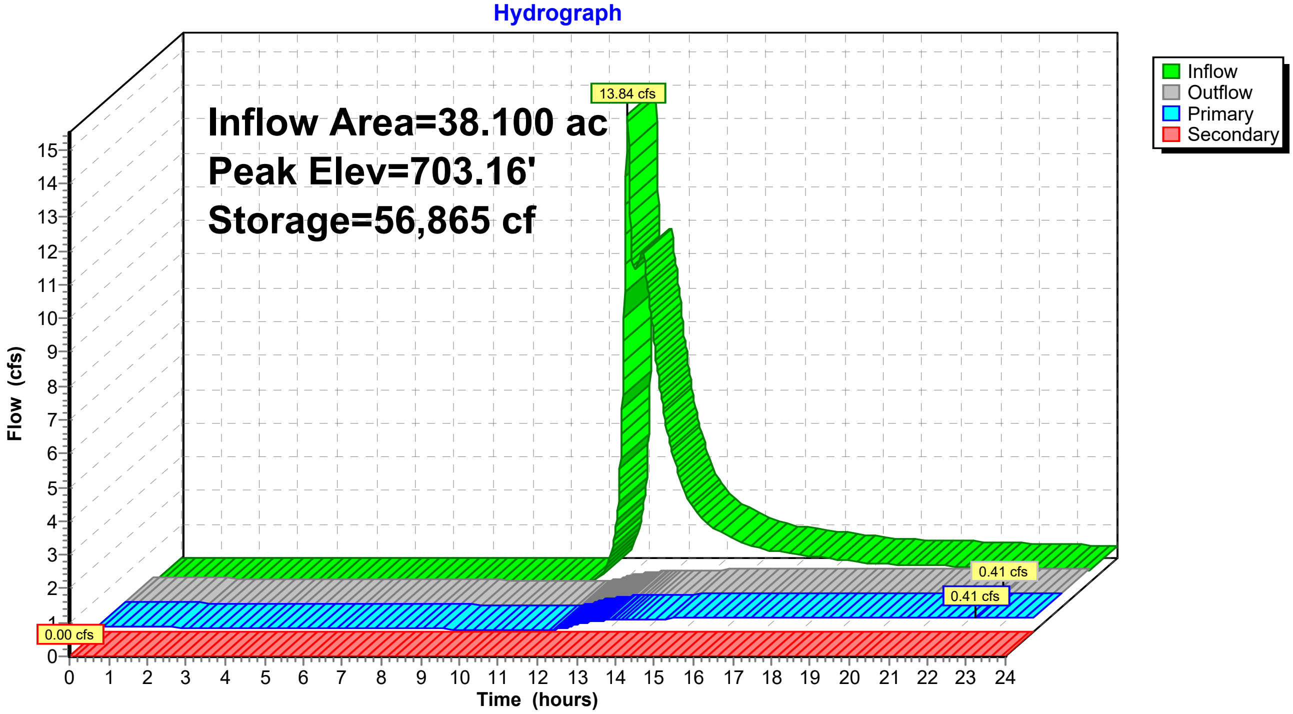
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	11,792	0	0
701.00	16,599	14,196	14,196
702.00	19,522	18,061	32,256
703.00	22,479	21,001	53,257
704.00	28,237	25,358	78,615
705.00	34,230	31,234	109,848
705.40	37,252	14,296	124,144

Device	Routing	Invert	Outlet Devices
#1	Secondary	703.60'	**27.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 4	703.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	700.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	700.00'	**18.0" Round Culvert** L= 21.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 700.00' / 699.80' S= 0.0095 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 1.77 sf

Primary OutFlow Max=0.41 cfs @ 22.53 hrs HW=703.16' TW=0.00' (Dynamic Tailwater)
└─**4=Culvert** (Passes 0.41 cfs of 10.42 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.41 cfs @ 8.38 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=700.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 32P: Lower Pond



Summary for Pond 33P: Upper Pond

Inflow Area = 32.150 ac, 14.71% Impervious, Inflow Depth = 0.49" for 1-Year event
Inflow = 15.22 cfs @ 12.22 hrs, Volume= 1.306 af
Outflow = 0.39 cfs @ 20.13 hrs, Volume= 0.742 af, Atten= 97%, Lag= 474.3 min
Primary = 0.39 cfs @ 20.13 hrs, Volume= 0.742 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Starting Elev= 705.00' Surf.Area= 0 sf Storage= 0 cf
Peak Elev= 740.34' @ 20.13 hrs Surf.Area= 17,478 sf Storage= 41,386 cf

Plug-Flow detention time= 711.5 min calculated for 0.742 af (57% of inflow)
Center-of-Mass det. time= 594.4 min (1,458.0 - 863.6)

Volume	Invert	Avail.Storage	Storage Description
#1	737.50'	149,518 cf	**prop (Conic)** Listed below (Recalc)

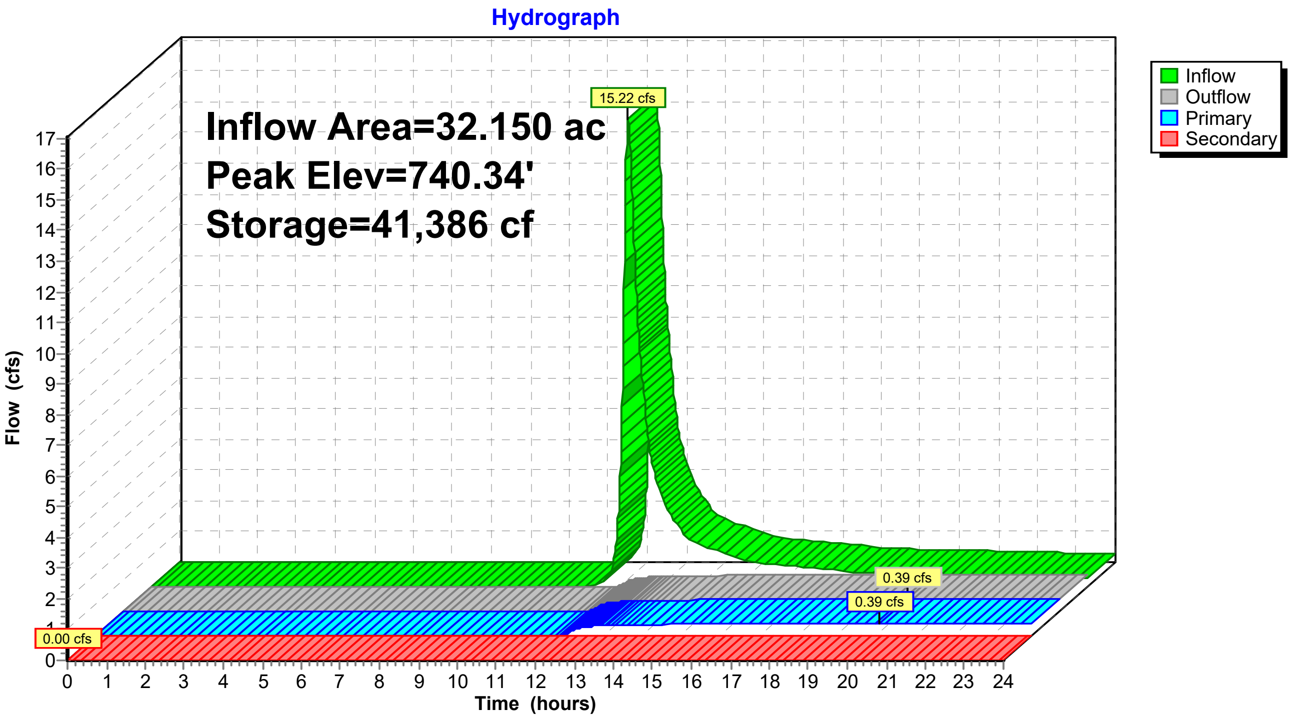
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
737.50	11,903	0	0	11,903
738.00	12,777	6,169	6,169	12,799
739.00	14,602	13,679	19,848	14,670
740.00	16,711	15,645	35,493	16,825
741.00	18,984	17,835	53,328	19,147
742.00	21,350	20,155	73,484	21,566
743.00	23,873	22,600	96,083	24,145
744.00	26,452	25,151	121,235	26,784
745.00	30,154	28,283	149,518	30,534

Device	Routing	Invert	Outlet Devices
#1	Secondary	743.00'	**31.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 4	741.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	737.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	737.50'	**24.0" Round Culvert** L= 35.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 737.50' / 735.00' S= 0.0714 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.39 cfs @ 20.13 hrs HW=740.34' TW=0.00' (Dynamic Tailwater)
└─**4=Culvert** (Passes 0.39 cfs of 16.22 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.39 cfs @ 7.94 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=737.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 33P: Upper Pond

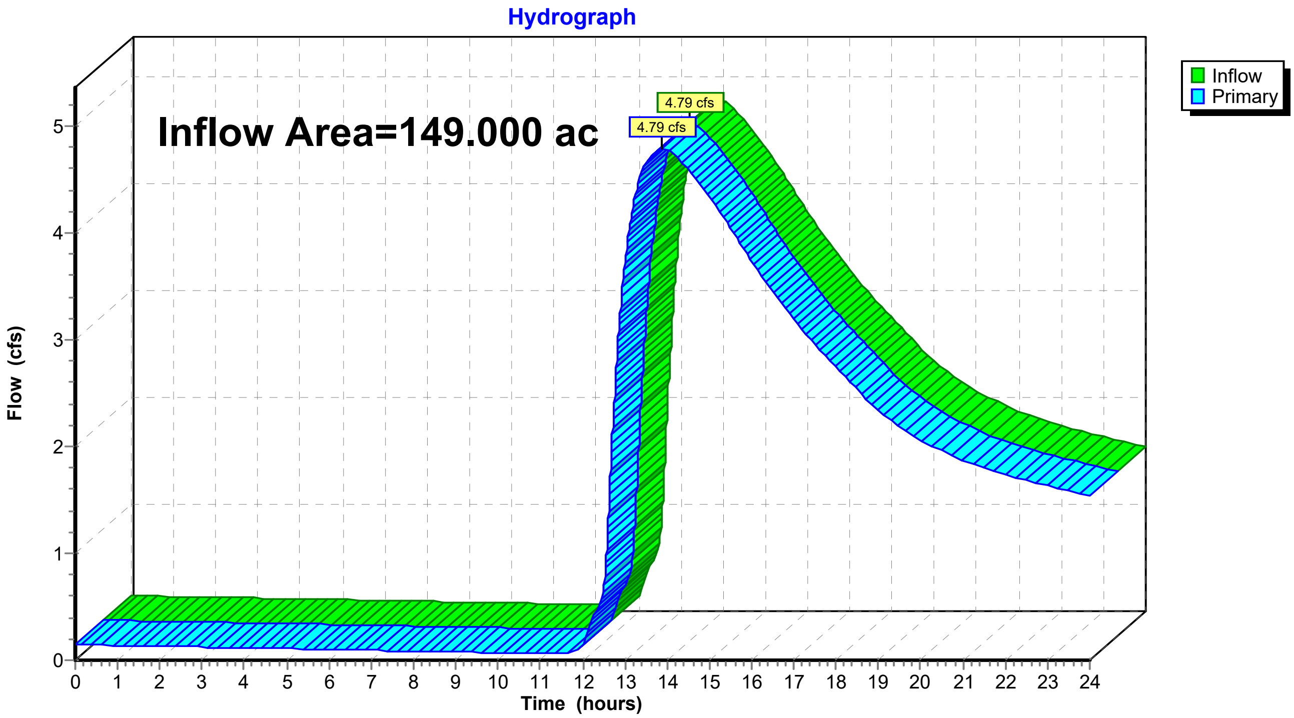


Summary for Link 49L: Total Off-site drainage

Inflow Area =	149.000 ac,	6.55% Impervious,	Inflow Depth > 0.30"	for 1-Year event	
Inflow =	4.79 cfs @	13.88 hrs,	Volume=	3.779 af	
Primary =	4.79 cfs @	13.88 hrs,	Volume=	3.779 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs

Link 49L: Total Off-site drainage



Time span=0.00-37.00 hrs, dt=0.01 hrs, 3701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1 OFF: OFFSITE DRAINAGE Runoff Area=78.750 ac 0.89% Impervious Runoff Depth=1.05"
Flow Length=4,105' Tc=35.7 min CN=75 Runoff=57.03 cfs 6.914 af

Subcatchment2: 2 (good) Runoff Area=24.100 ac 9.34% Impervious Runoff Depth=1.23"
Flow Length=2,474' Tc=15.8 min CN=78 Runoff=31.92 cfs 2.469 af

Subcatchment3: 3 (good) Runoff Area=23.800 ac 3.66% Impervious Runoff Depth=1.29"
Flow Length=3,643' Tc=37.7 min CN=79 Runoff=21.11 cfs 2.562 af

Subcatchment17: Lot #9 (good) Runoff Area=0.840 ac 26.19% Impervious Runoff Depth=1.71"
Slope=0.0866 '/' Tc=6.0 min CN=85 Runoff=2.25 cfs 0.119 af

Subcatchment18: Lot #8 (good) Runoff Area=0.750 ac 29.33% Impervious Runoff Depth=1.71"
Slope=0.0953 '/' Tc=6.0 min CN=85 Runoff=2.01 cfs 0.107 af

Subcatchment19: Lot #7 (good) Runoff Area=0.810 ac 27.16% Impervious Runoff Depth=1.71"
Slope=0.0933 '/' Tc=6.0 min CN=85 Runoff=2.17 cfs 0.115 af

Subcatchment20: Lot #6 (good) Runoff Area=0.800 ac 27.50% Impervious Runoff Depth=1.71"
Slope=0.0759 '/' Tc=6.0 min CN=85 Runoff=2.14 cfs 0.114 af

Subcatchment21: Lot #5 (good) Runoff Area=0.800 ac 27.50% Impervious Runoff Depth=1.71"
Slope=0.0663 '/' Tc=6.0 min CN=85 Runoff=2.14 cfs 0.114 af

Subcatchment22: Lot #4 (good) Runoff Area=0.820 ac 26.83% Impervious Runoff Depth=1.71"
Slope=0.0589 '/' Tc=6.0 min CN=85 Runoff=2.19 cfs 0.117 af

Subcatchment23: Lot #3 (good) Runoff Area=0.830 ac 26.51% Impervious Runoff Depth=1.71"
Slope=0.0568 '/' Tc=6.0 min CN=85 Runoff=2.22 cfs 0.118 af

Subcatchment24: Lot #2 (good) Runoff Area=0.560 ac 39.29% Impervious Runoff Depth=1.86"
Slope=0.0563 '/' Tc=6.0 min CN=87 Runoff=1.62 cfs 0.087 af

Subcatchment25: Lot #1 (good) Runoff Area=0.380 ac 52.63% Impervious Runoff Depth=2.03"
Flow Length=120' Slope=0.0700 '/' Tc=7.3 min CN=89 Runoff=1.13 cfs 0.064 af

Subcatchment26: 26 (update Tc to Runoff Area=1.310 ac 37.40% Impervious Runoff Depth=1.86"
Tc=8.0 min CN=87 Runoff=3.50 cfs 0.203 af

Subcatchment37S: 1 Runoff Area=14.300 ac 24.20% Impervious Runoff Depth=1.56"
Flow Length=932' Tc=7.7 min CN=83 Runoff=32.73 cfs 1.859 af

Subcatchment46S: Portion of Lot #1 Runoff Area=0.150 ac 20.00% Impervious Runoff Depth=1.63"
Tc=6.0 min CN=84 Runoff=0.38 cfs 0.020 af

Reach 12R: Swale to off-site Avg. Flow Depth=0.60' Max Vel=2.21 fps Inflow=18.93 cfs 6.894 af
n=0.030 L=293.0' S=0.0068 '/' Capacity=58.17 cfs Outflow=18.92 cfs 6.893 af

Reach 16R: Northside swale Avg. Flow Depth=0.18' Max Vel=3.61 fps Inflow=3.00 cfs 0.157 af
n=0.030 L=655.0' S=0.0885 '/' Capacity=111.61 cfs Outflow=2.82 cfs 0.157 af

Reach 17R: Southside Swale Avg. Flow Depth=0.42' Max Vel=6.13 fps Inflow=17.47 cfs 0.969 af
n=0.030 L=710.0' S=0.0831 '/' Capacity=108.12 cfs Outflow=16.89 cfs 0.969 af

Pond 10P: Proposed 36" Culvert Peak Elev=705.99' Storage=115,778 cf Inflow=57.03 cfs 6.914 af
Primary=10.03 cfs 5.449 af Secondary=9.05 cfs 1.446 af Outflow=18.96 cfs 6.895 af

Pond 11P: Proposed 36" Culvert Peak Elev=705.33' Storage=4,071 cf Inflow=18.96 cfs 6.895 af
Primary=18.93 cfs 6.894 af Secondary=0.00 cfs 0.000 af Outflow=18.93 cfs 6.894 af

Pond 17P: Bioswale (good) Peak Elev=808.20' Storage=340 cf Inflow=17.46 cfs 0.972 af
Discarded=0.00 cfs 0.002 af Primary=17.47 cfs 0.969 af Outflow=17.47 cfs 0.970 af

Pond 18P: Bioswale (good) Peak Elev=815.47' Storage=285 cf Inflow=15.22 cfs 0.853 af
Discarded=0.00 cfs 0.000 af Primary=15.23 cfs 0.853 af Outflow=15.23 cfs 0.853 af

Pond 19P: Bioswale (good) Peak Elev=829.99' Storage=143 cf Inflow=13.26 cfs 0.747 af
Discarded=0.00 cfs 0.001 af Primary=13.24 cfs 0.746 af Outflow=13.25 cfs 0.747 af

Pond 20P: Bioswale (good) Peak Elev=845.01' Storage=202 cf Inflow=11.65 cfs 0.632 af
Discarded=0.01 cfs 0.001 af Primary=11.19 cfs 0.632 af Outflow=11.20 cfs 0.632 af

Pond 21P: Bioswale (good) Peak Elev=858.91' Storage=121 cf Inflow=9.59 cfs 0.519 af
Discarded=0.00 cfs 0.001 af Primary=9.55 cfs 0.519 af Outflow=9.56 cfs 0.519 af

Pond 22P: Bioswale (good) Peak Elev=869.91' Storage=121 cf Inflow=7.50 cfs 0.406 af
Discarded=0.00 cfs 0.000 af Primary=7.47 cfs 0.405 af Outflow=7.47 cfs 0.406 af

Pond 23P: Bioswale (good) Peak Elev=880.77' Storage=79 cf Inflow=5.32 cfs 0.289 af
Outflow=5.32 cfs 0.289 af

Pond 24P: Bioswale (good) Peak Elev=891.69' Storage=52 cf Inflow=3.12 cfs 0.171 af
Discarded=0.00 cfs 0.000 af Primary=3.11 cfs 0.171 af Outflow=3.11 cfs 0.171 af

Pond 25P: Bioswale (good) Peak Elev=903.65' Storage=20 cf Inflow=1.51 cfs 0.085 af
Discarded=0.00 cfs 0.000 af Primary=1.51 cfs 0.084 af Outflow=1.51 cfs 0.085 af

Pond 26P: Bioswale (good) Peak Elev=907.56' Storage=13 cf Inflow=0.38 cfs 0.020 af
Discarded=0.00 cfs 0.000 af Primary=0.38 cfs 0.020 af Outflow=0.38 cfs 0.020 af

Pond 27P: Dry Swale Peak Elev=807.94' Storage=1,973 cf Inflow=3.50 cfs 0.203 af
Discarded=0.03 cfs 0.035 af Primary=3.00 cfs 0.157 af Outflow=3.03 cfs 0.192 af

Pond 32P: Lower Pond Peak Elev=703.89' Storage=75,607 cf Inflow=39.12 cfs 4.421 af
Primary=11.91 cfs 2.820 af Secondary=10.76 cfs 0.661 af Outflow=22.67 cfs 3.481 af

Pond 33P: Upper Pond Peak Elev=741.93' Storage=71,975 cf Inflow=47.99 cfs 3.595 af
Primary=15.19 cfs 2.593 af Secondary=0.00 cfs 0.000 af Outflow=15.19 cfs 2.593 af

Link 49L: Total Off-site drainage

Inflow=48.29 cfs 12.967 af
Primary=48.29 cfs 12.967 af

Total Runoff Area = 149.000 ac Runoff Volume = 14.982 af Average Runoff Depth = 1.21"
93.45% Pervious = 139.240 ac 6.55% Impervious = 9.760 ac

Summary for Subcatchment 1 OFF: OFFSITE DRAINAGE (good)

CarlsonPlanXYPos|642280.8804|1040430.0233|
CarlsonSurface||

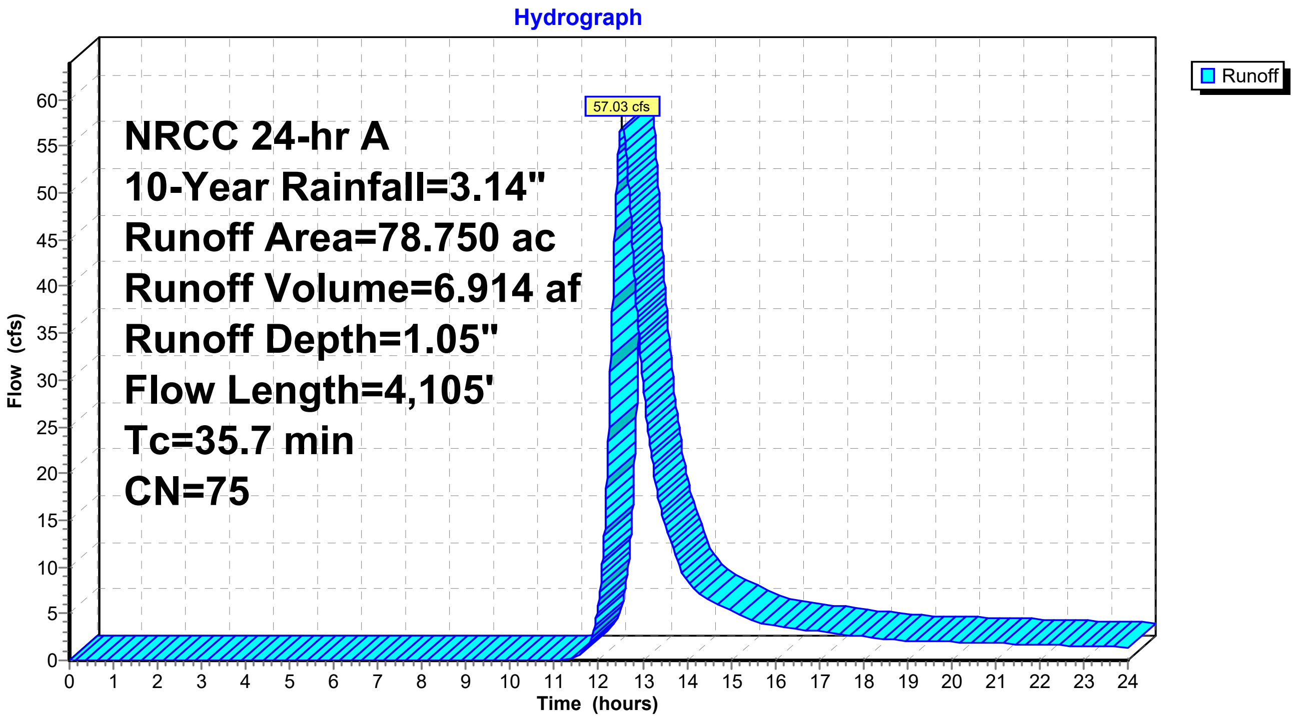
Runoff = 57.03 cfs @ 12.54 hrs, Volume= 6.914 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.700	98	Paved parking, HSG D
18.800	78	Meadow, non-grazed, HSG D
5.000	80	>75% Grass cover, Good, HSG D
54.250	73	Brush, Good, HSG D
78.750	75	Weighted Average
78.050		99.11% Pervious Area
0.700		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
10.8	1,165	0.0400	1.80		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
1.2	1,445	0.0850	19.33	1,352.84	**Channel Flow, Channel Flow** Area= 70.0 sf Perim= 72.0' r= 0.97' n= 0.022 Earth, clean & straight
7.3	560	0.0650	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
1.2	115	0.1000	1.58		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
12.6	535	0.0200	0.71		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
2.3	270	0.0150	1.97		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
35.7	4,105	Total			

Subcatchment 1 OFF: OFFSITE DRAINAGE (good)



Summary for Subcatchment 2: 2 (good)

CarlsonPlanXYPos|642014.4586|1041354.4458|
CarlsonSurface||

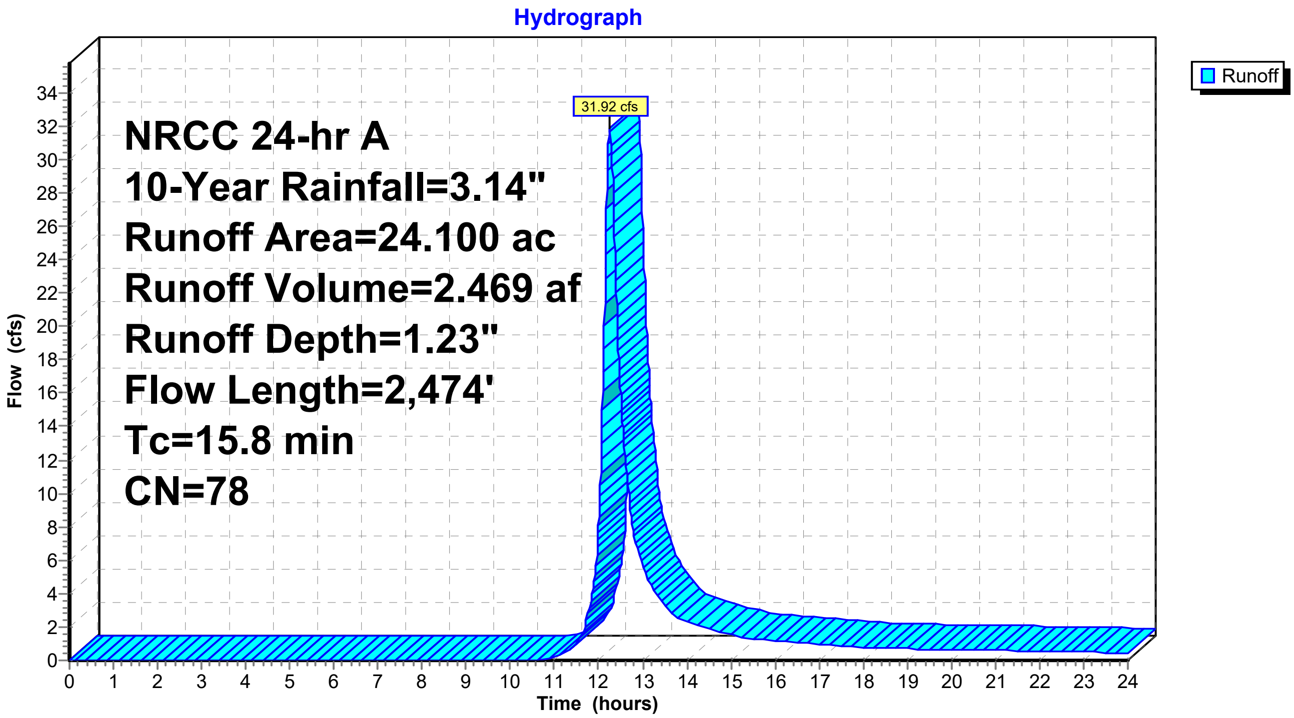
Runoff = 31.92 cfs @ 12.25 hrs, Volume= 2.469 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.430	98	Water Surface, HSG D
1.730	98	Paved parking, HSG D
0.090	98	Paved parking HSG D
2.150	80	>75% Grass cover, Good, HSG D
2.300	78	Meadow, non-grazed, HSG D
10.900	73	Brush, Good, HSG D
6.000	80	>75% Grass cover, Good, HSG D
0.500	80	>75% Grass cover, Good, HSG D
24.100	78	Weighted Average
21.850		90.66% Pervious Area
2.250		9.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	100	0.0350	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.7	192	0.0830	4.64		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.8	230	0.0870	4.75		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.1	180	0.0280	2.69		**Shallow Concentrated Flow, Shallow concentrated** Unpaved Kv= 16.1 fps
1.1	1,194	0.0750	17.98	413.55	**Channel Flow, Channel Flow** Area= 23.0 sf Perim= 24.0' r= 0.96' n= 0.022 Earth, clean & straight
2.2	165	0.0600	1.22		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	413	0.0720	17.36	260.42	**Channel Flow, Channel Flow** Area= 15.0 sf Perim= 16.0' r= 0.94' n= 0.022 Earth, clean & straight
15.8	2,474	Total			

Subcatchment 2: 2 (good)



Summary for Subcatchment 3: 3 (good)

CarlsonPlanXYPos|641681.4005|1041128.2504|
CarlsonSurface||

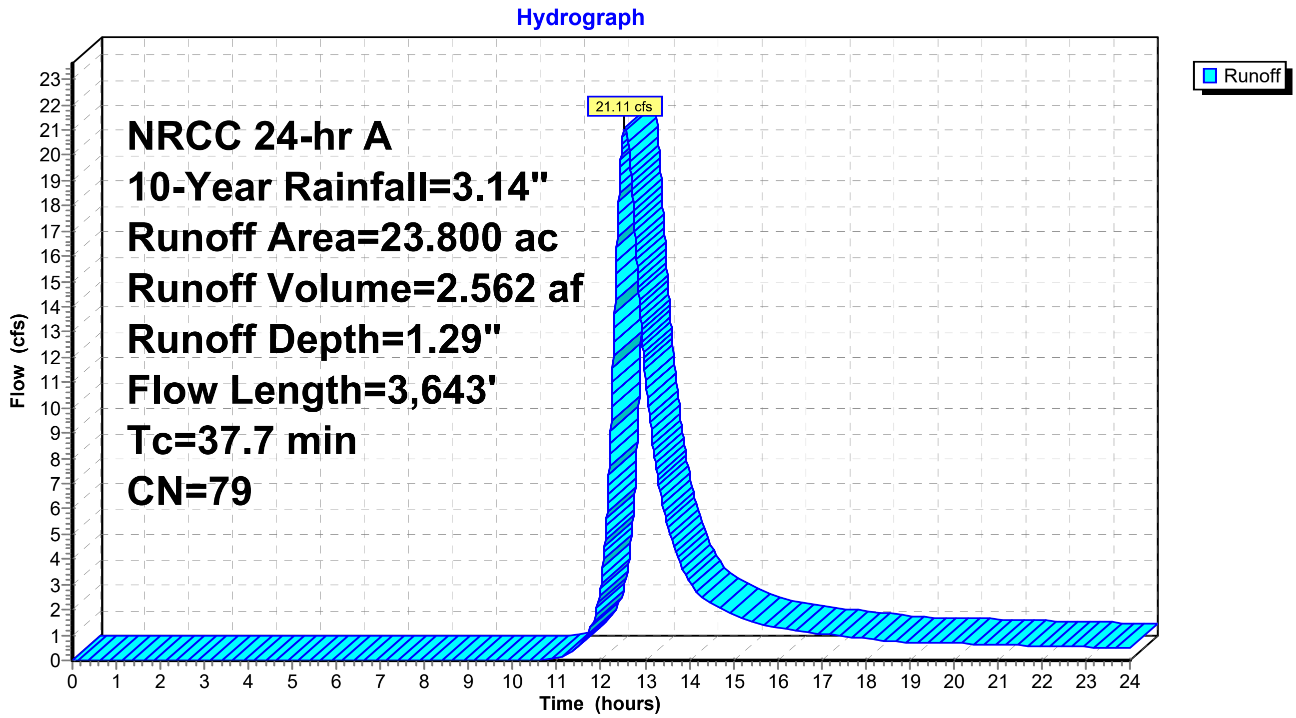
Runoff = 21.11 cfs @ 12.53 hrs, Volume= 2.562 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.440	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
0.430	98	Paved parking, HSG D
12.660	78	Meadow, non-grazed, HSG D
2.500	73	Brush, Good, HSG D
5.720	80	>75% Grass cover, Good, HSG D
1.520	80	>75% Grass cover, Good, HSG D
23.800	79	Weighted Average
22.930		96.34% Pervious Area
0.870		3.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
11.5	85	0.0200	0.12		**Sheet Flow, Sheet Flow** Cultivated: Residue>20% n= 0.170 P2= 2.19"
5.0	385	0.0200	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
10.2	1,400	0.0640	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
6.4	560	0.0840	1.45		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	435	0.0640	16.37	245.52	**Channel Flow, Channel Flow** Area= 15.0 sf Perim= 16.0' r= 0.94' n= 0.022 Earth, clean & straight
0.9	209	0.0570	3.84		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
2.2	197	0.0870	1.47		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.2	125	0.0320	11.48	286.96	**Channel Flow, Channel Flow** Area= 25.0 sf Perim= 27.0' r= 0.93' n= 0.022 Earth, clean & straight
0.6	232	0.0100	6.42	160.42	**Channel Flow, Channel Flow** Area= 25.0 sf Perim= 27.0' r= 0.93' n= 0.022 Earth, clean & straight
37.7	3,643	Total			

Subcatchment 3: 3 (good)



Summary for Subcatchment 17: Lot #9 (good)

CarlsonPlanXYPos|642702.7045|1040980.9144|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

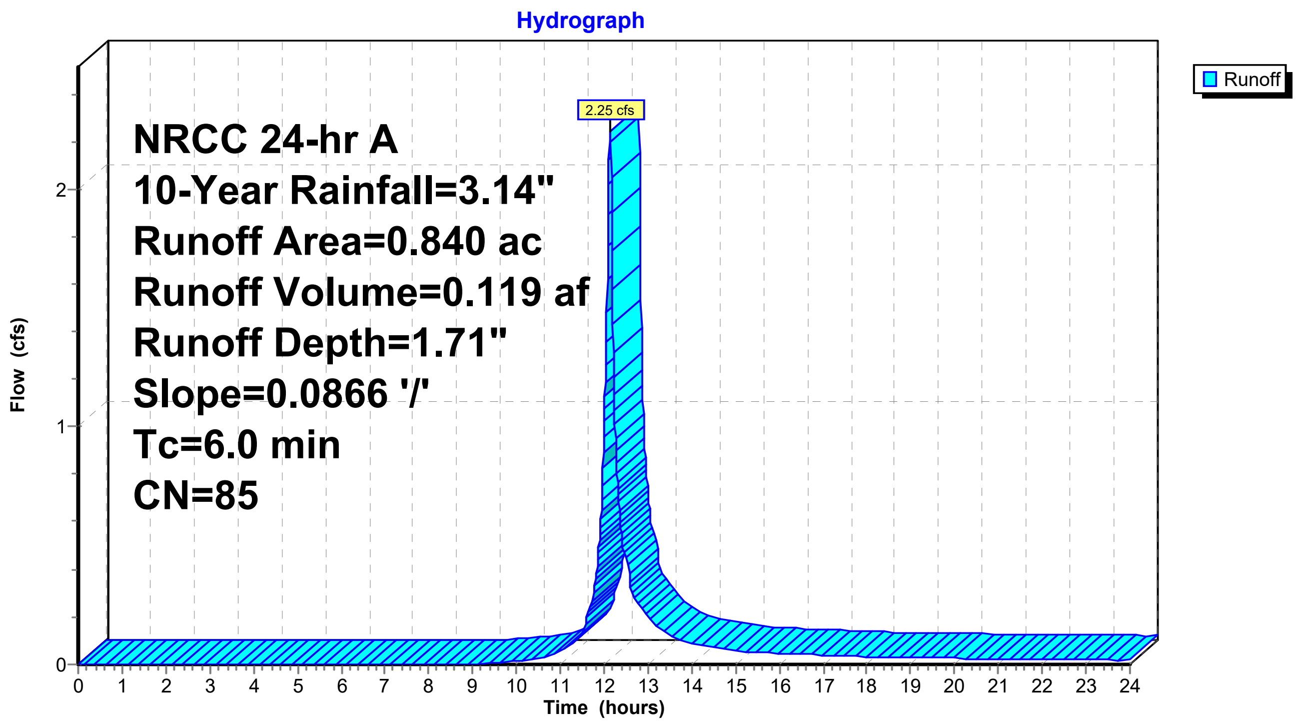
Runoff = 2.25 cfs @ 12.13 hrs, Volume= 0.119 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.540	80	>75% Grass cover, Good, HSG D
0.080	80	>75% Grass cover, Good, HSG D
0.840	85	Weighted Average
0.620		73.81% Pervious Area
0.220		26.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0866			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 17: Lot #9 (good)



Summary for Subcatchment 18: Lot #8 (good)

CarlsonPlanXYPos|642920.0895|1040980.2941|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

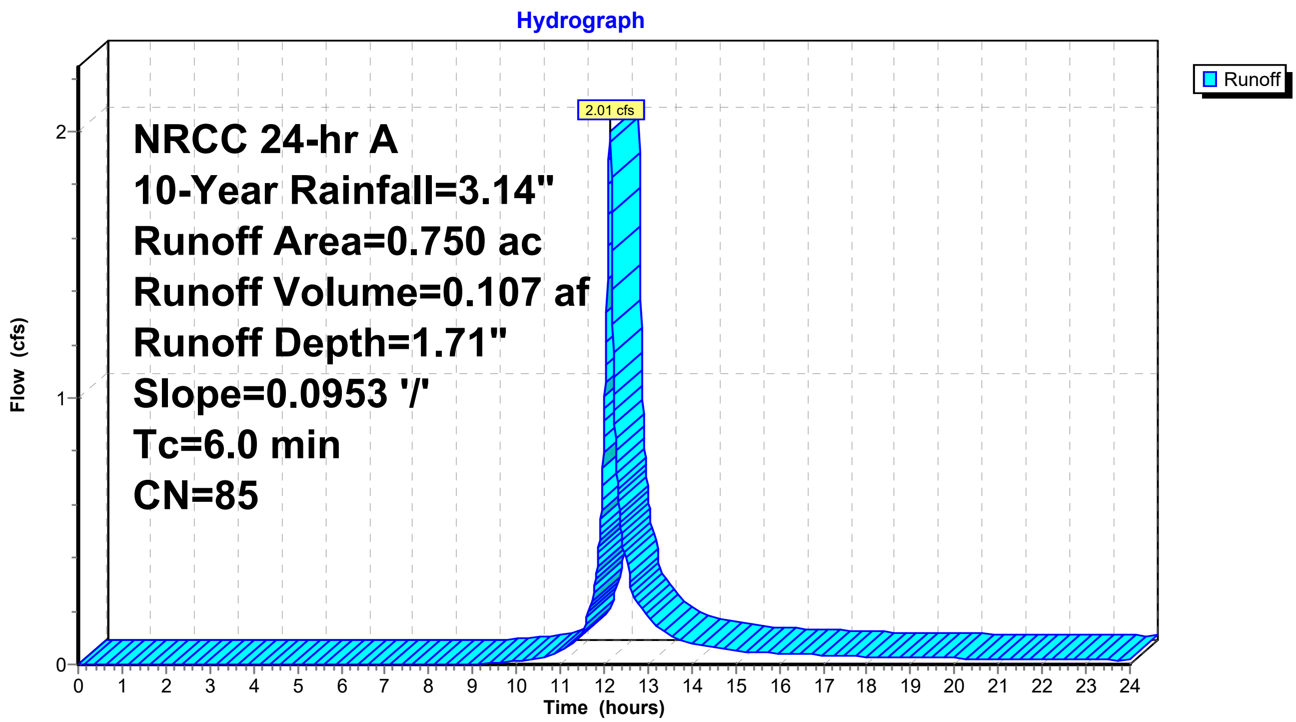
Runoff = 2.01 cfs @ 12.13 hrs, Volume= 0.107 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.480	80	>75% Grass cover, Good, HSG D
0.050	80	>75% Grass cover, Good, HSG D
0.750	85	Weighted Average
0.530		70.67% Pervious Area
0.220		29.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0953			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 18: Lot #8 (good)



Summary for Subcatchment 19: Lot #7 (good)

CarlsonPlanXYPos|643107.1559|1040981.5048|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

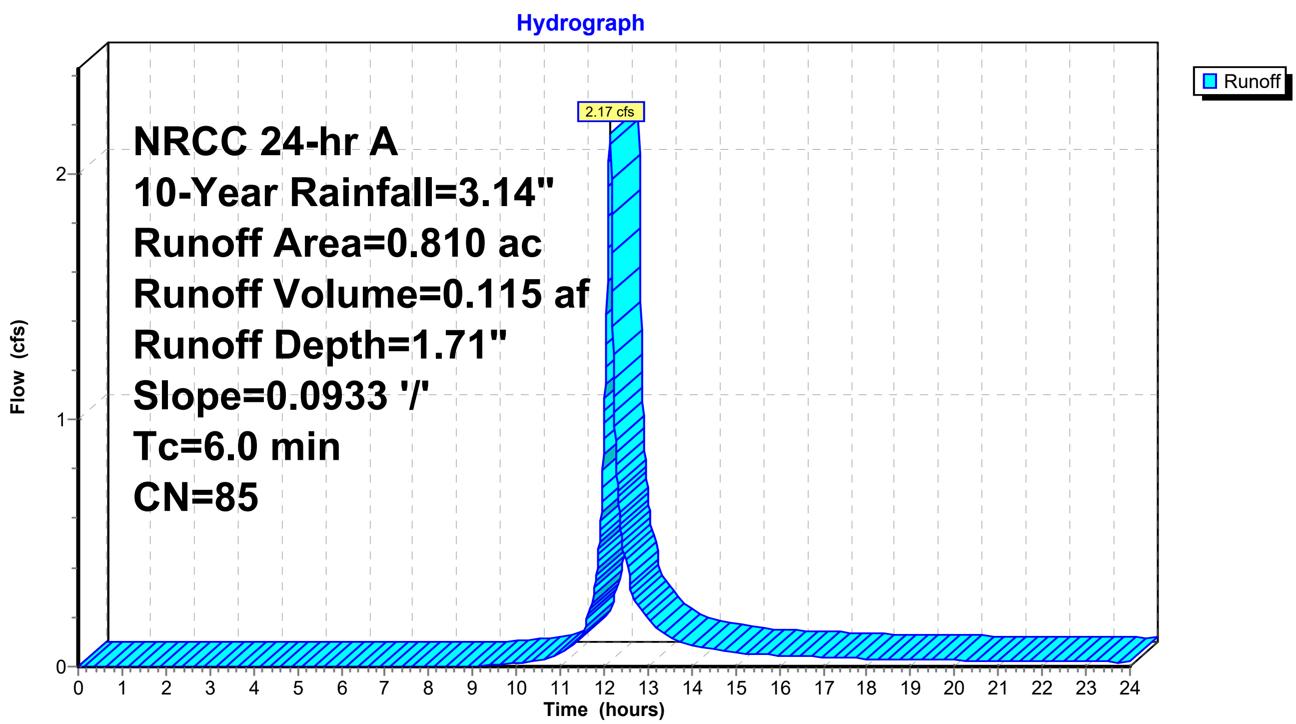
Runoff = 2.17 cfs @ 12.13 hrs, Volume= 0.115 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.590	80	>75% Grass cover, Good, HSG D
0.810	85	Weighted Average
0.590		72.84% Pervious Area
0.220		27.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0933			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 19: Lot #7 (good)



Summary for Subcatchment 20: Lot #6 (good)

CarlsonPlanXYPos|643312.2303|1040980.2663|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

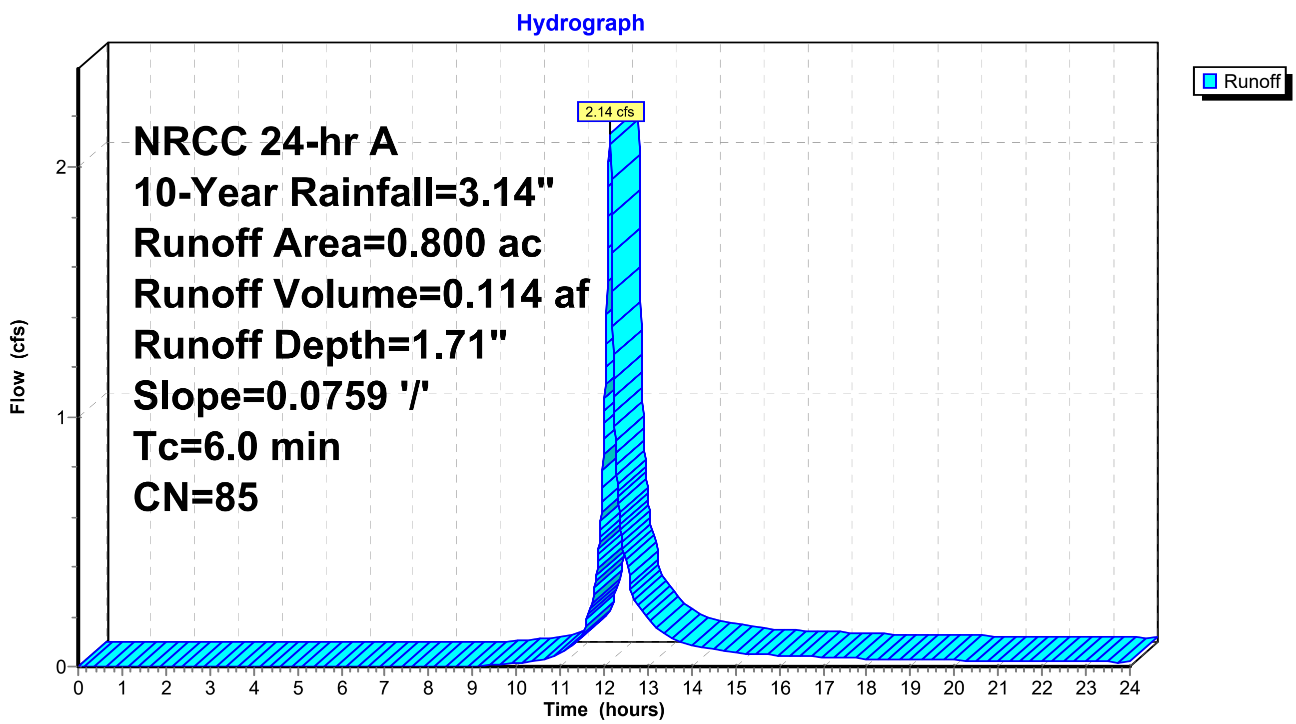
Runoff = 2.14 cfs @ 12.13 hrs, Volume= 0.114 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.580	80	>75% Grass cover, Good, HSG D
0.800	85	Weighted Average
0.580		72.50% Pervious Area
0.220		27.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0759			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 20: Lot #6 (good)



Summary for Subcatchment 21: Lot #5 (good)

CarlsonPlanXYPos|643492.4579|1040982.7482|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

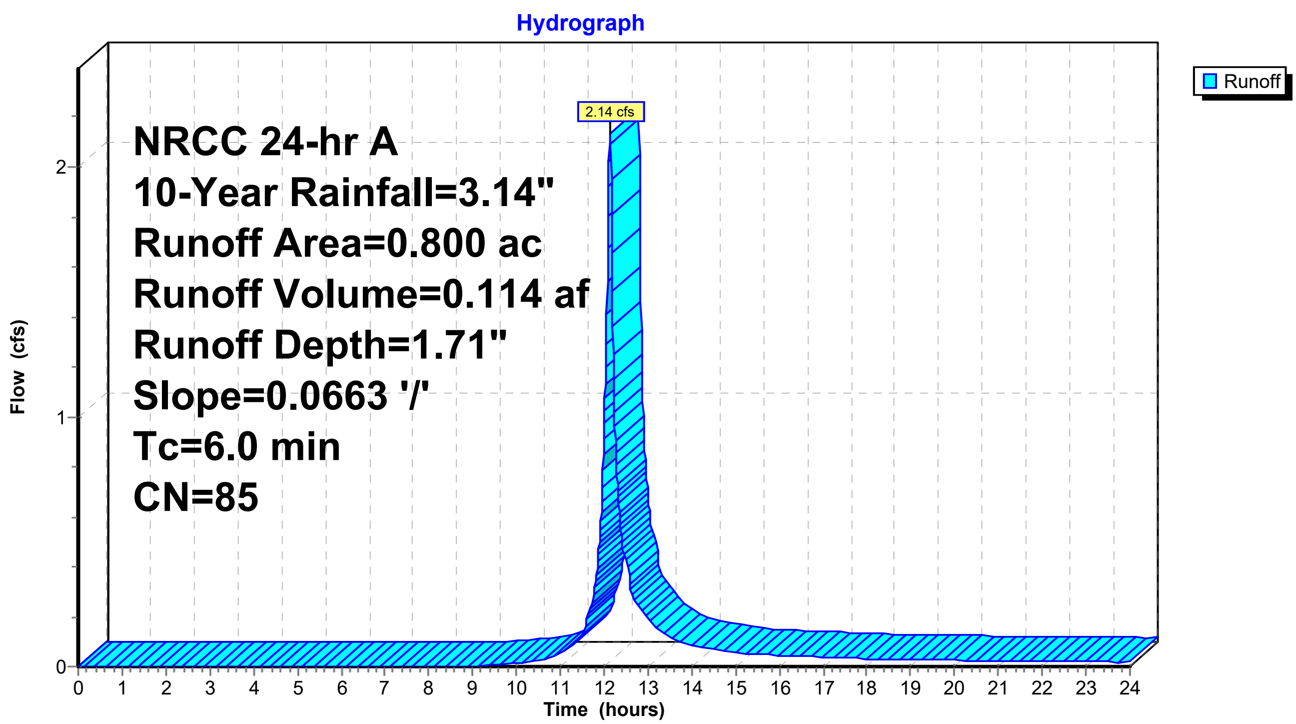
Runoff = 2.14 cfs @ 12.13 hrs, Volume= 0.114 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.580	80	>75% Grass cover, Good, HSG D
0.800	85	Weighted Average
0.580		72.50% Pervious Area
0.220		27.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0663			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 21: Lot #5 (good)



Summary for Subcatchment 22: Lot #4 (good)

CarlsonPlanXYPos|643706.8551|1040983.3562|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

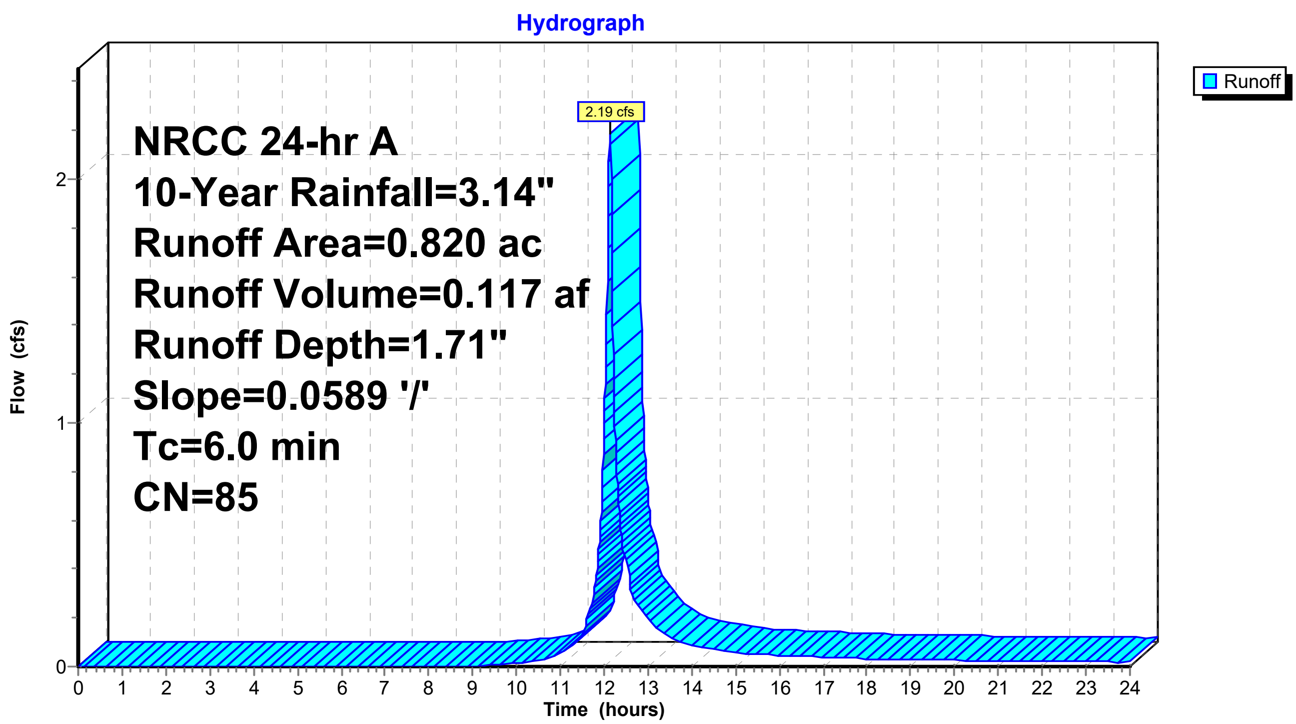
Runoff = 2.19 cfs @ 12.13 hrs, Volume= 0.117 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.600	80	>75% Grass cover, Good, HSG D
0.820	85	Weighted Average
0.600		73.17% Pervious Area
0.220		26.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0589			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 22: Lot #4 (good)



Summary for Subcatchment 23: Lot #3 (good)

CarlsonPlanXYPos|643896.4054|1040980.2593|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

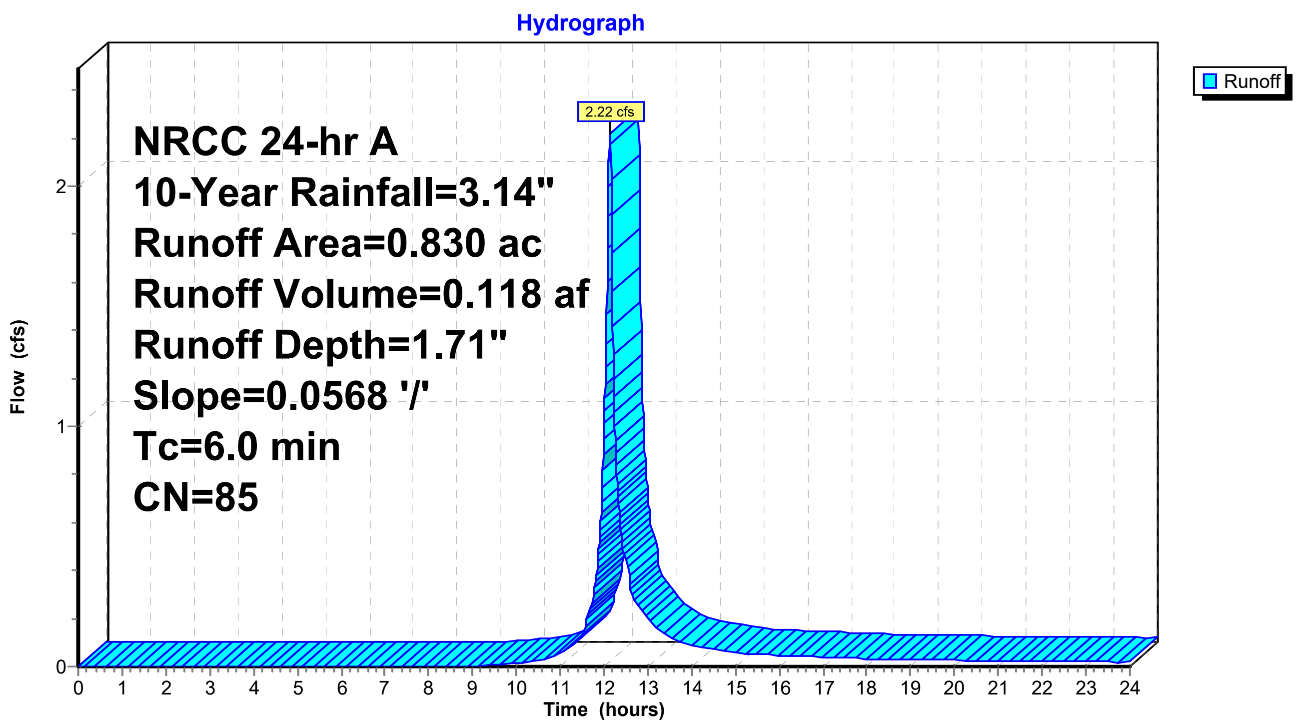
Runoff = 2.22 cfs @ 12.13 hrs, Volume= 0.118 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.610	80	>75% Grass cover, Good, HSG D
0.830	85	Weighted Average
0.610		73.49% Pervious Area
0.220		26.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0568			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 23: Lot #3 (good)



Summary for Subcatchment 24: Lot #2 (good)

CarlsonPlanXYPos|644102.7886|1040984.5776|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

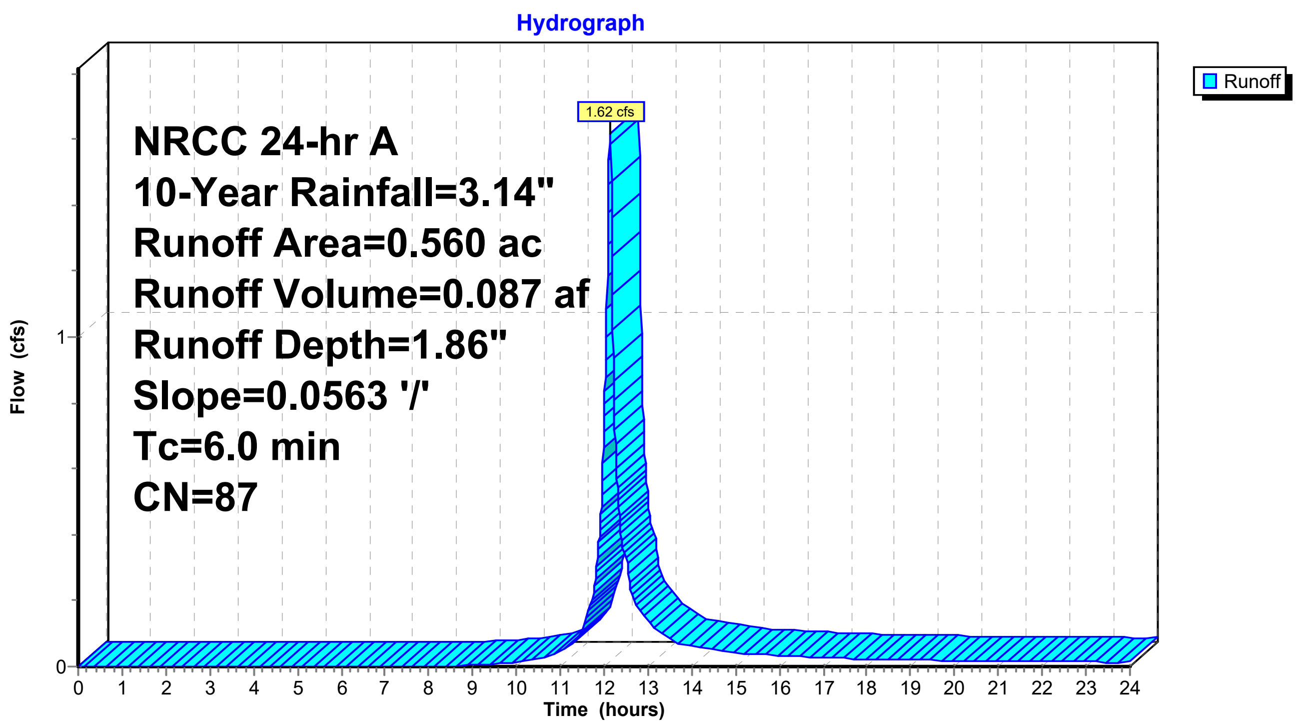
Runoff = 1.62 cfs @ 12.13 hrs, Volume= 0.087 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.340	80	>75% Grass cover, Good, HSG D
0.560	87	Weighted Average
0.340		60.71% Pervious Area
0.220		39.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0563			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 24: Lot #2 (good)



Summary for Subcatchment 25: Lot #1 (good)

CarlsonPlanXYPos|644284.7705|1040971.5435|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

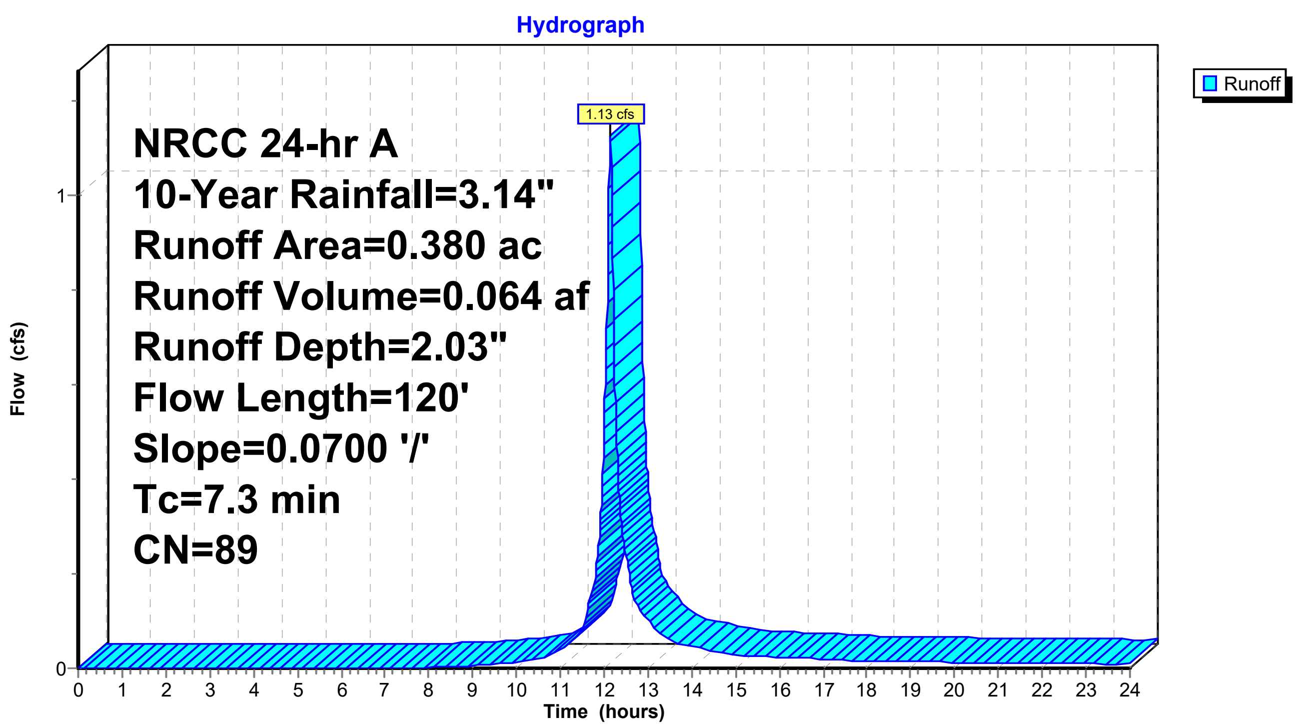
Runoff = 1.13 cfs @ 12.15 hrs, Volume= 0.064 af, Depth= 2.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.200	98	Paved parking, HSG D
0.180	80	>75% Grass cover, Good, HSG D
0.380	89	Weighted Average
0.180		47.37% Pervious Area
0.200		52.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0700	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.1	20	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentated** Unpaved Kv= 16.1 fps
7.3	120	Total			

Subcatchment 25: Lot #1 (good)



Summary for Subcatchment 26: 26 (update Tc to Channel flow?)

CarlsonPlanXYPos|644192.3159|1041141.7328|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

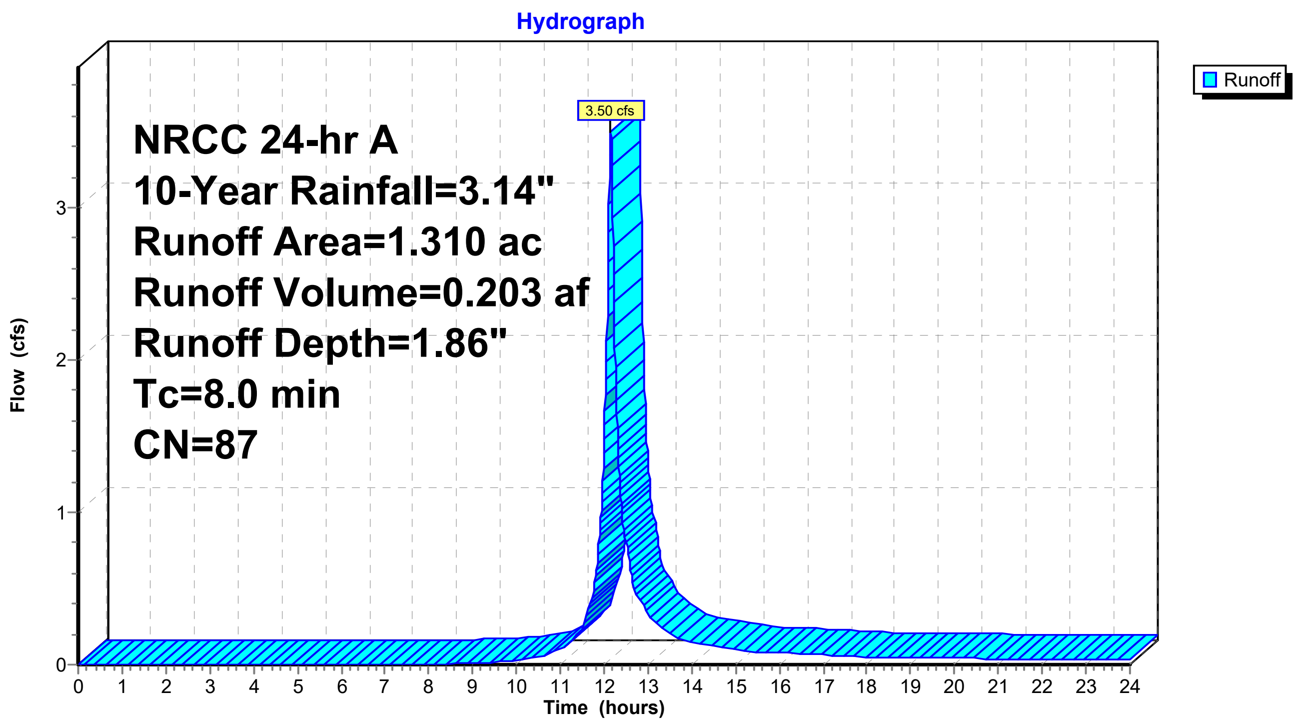
Runoff = 3.50 cfs @ 12.15 hrs, Volume= 0.203 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.490	98	Paved parking, HSG D
0.820	80	>75% Grass cover, Good, HSG D
1.310	87	Weighted Average
0.820		62.60% Pervious Area
0.490		37.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0					**Direct Entry,**

Subcatchment 26: 26 (update Tc to Channel flow?)



Summary for Subcatchment 37S: 1

CarlsonPlanXYPos|641307.9585|1041455.1221|
CarlsonSurface||

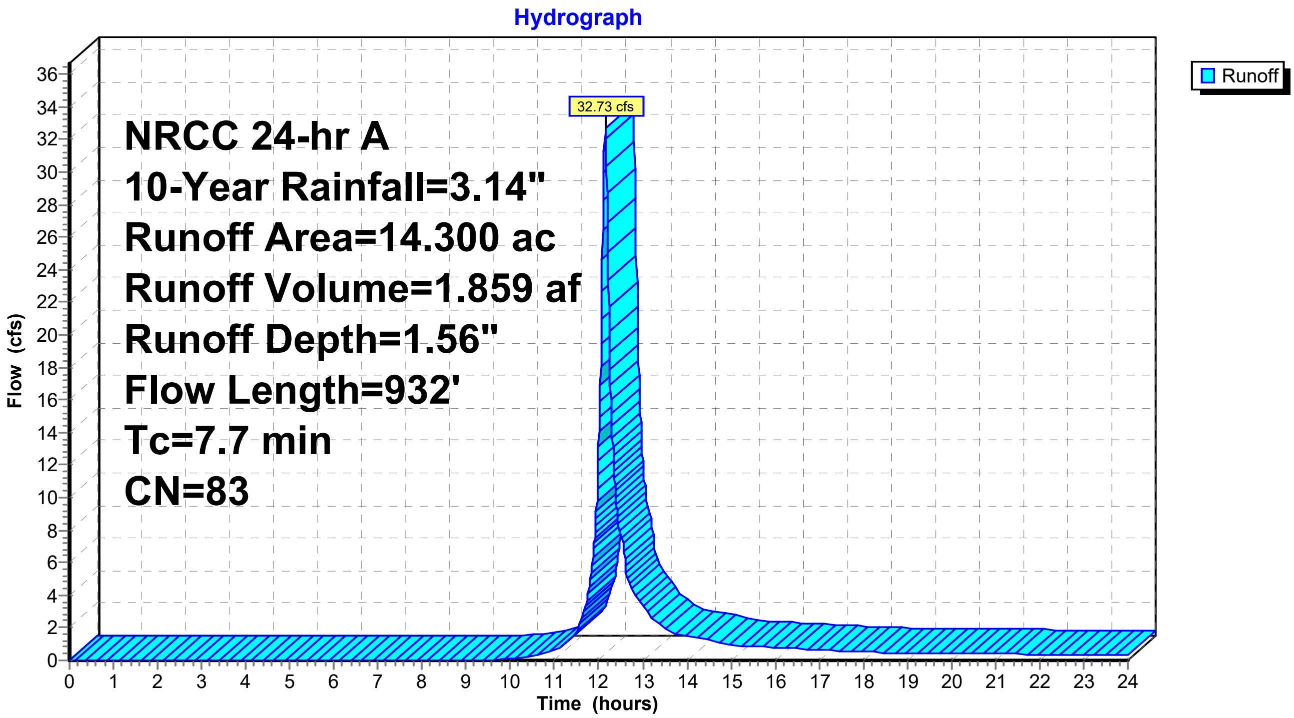
Runoff = 32.73 cfs @ 12.15 hrs, Volume= 1.859 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.260	98	Water Surface HSG B
1.860	98	Paved parking HSG B
1.340	98	Paved parking HSG C
1.100	61	>75% Grass cover, Good, HSG B
9.180	80	>75% Grass cover, Good, HSG D
0.560	73	Brush, Good, HSG D
14.300	83	Weighted Average
10.840		75.80% Pervious Area
3.460		24.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
3.9	25	0.0200	0.11		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.3	81	0.0150	5.11	89.50	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
0.1	58	0.0340	7.70	134.75	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
0.2	132	0.0600	10.23	179.01	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
1.1	80	0.0060	1.16		**Shallow Concentrated Flow, Shallow Concentrated** Grassed Waterway Kv= 15.0 fps
0.5	114	0.0040	3.61	4.43	**Pipe Channel, Pipe Channel** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Corrugated PP, smooth interior
0.5	113	0.0040	4.07	7.20	**Pipe Channel, Pipe Channel** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Corrugated PP, smooth interior
0.1	35	0.0040	4.93	15.50	**Pipe Channel, Pipe Channel** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
0.7	279	0.0080	6.98	21.92	**Pipe Channel, Pipe Channel** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
7.7	932	Total			

Subcatchment 37S: 1



Summary for Subcatchment 46S: Portion of Lot #1

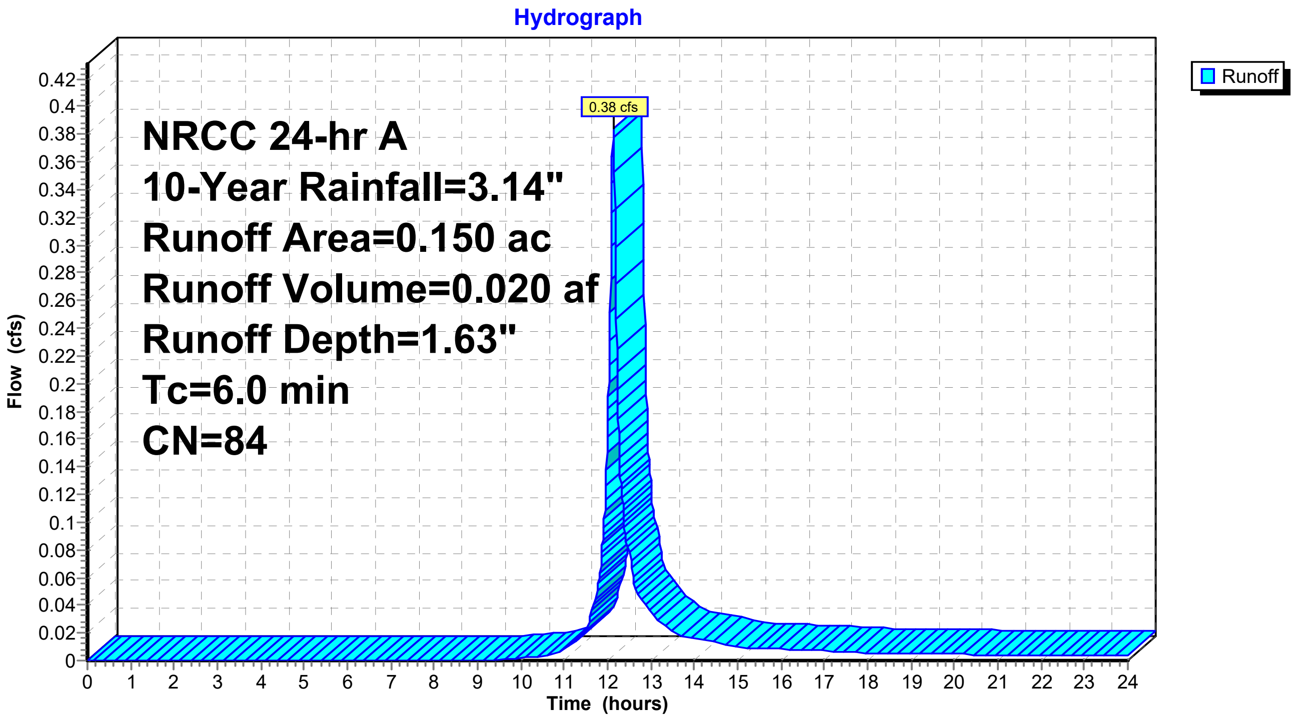
Runoff = 0.38 cfs @ 12.13 hrs, Volume= 0.020 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 10-Year Rainfall=3.14"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG D
0.120	80	>75% Grass cover, Good, HSG D
0.150	84	Weighted Average
0.120		80.00% Pervious Area
0.030		20.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 46S: Portion of Lot #1



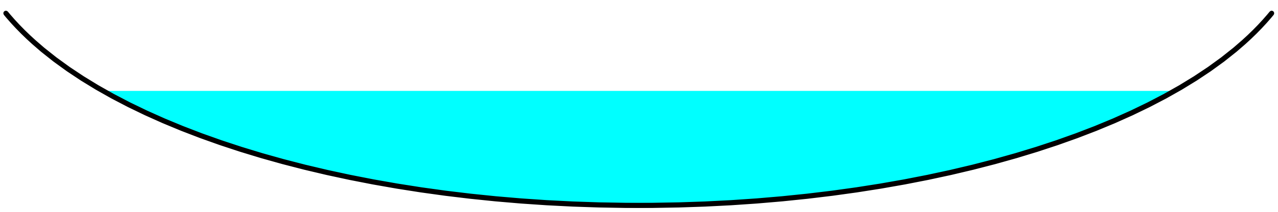
Summary for Reach 12R: Swale to off-site

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth > 1.05" for 10-Year event
Inflow = 18.93 cfs @ 13.34 hrs, Volume= 6.894 af
Outflow = 18.92 cfs @ 13.37 hrs, Volume= 6.893 af, Atten= 0%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.21 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 4.9 min

Peak Storage= 2,512 cf @ 13.37 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.00' Flow Area= 18.7 sf, Capacity= 58.17 cfs

28.00' x 1.00' deep Parabolic Channel, n= 0.030 Short grass
Length= 293.0' Slope= 0.0068 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



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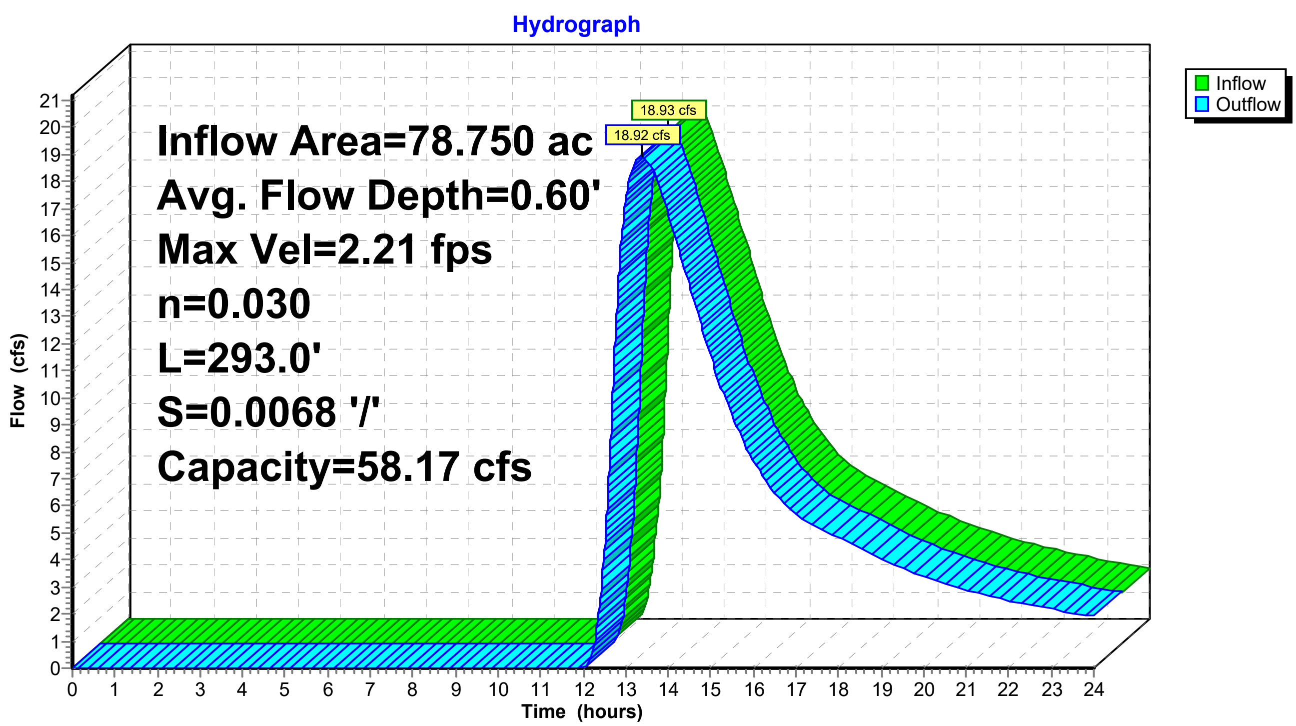
Reach 12R: Swale to off-site



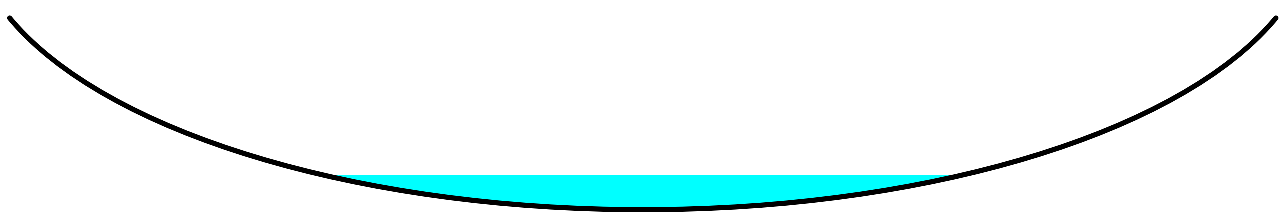
Summary for Reach 16R: Northside swale

Inflow Area = 1.310 ac, 37.40% Impervious, Inflow Depth = 1.44" for 10-Year event
Inflow = 3.00 cfs @ 12.20 hrs, Volume= 0.157 af
Outflow = 2.82 cfs @ 12.23 hrs, Volume= 0.157 af, Atten= 6%, Lag= 2.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 10.1 min

Peak Storage= 510 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 111.61 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 655.0' Slope= 0.0885 '/'
Inlet Invert= 804.00', Outlet Invert= 746.00'



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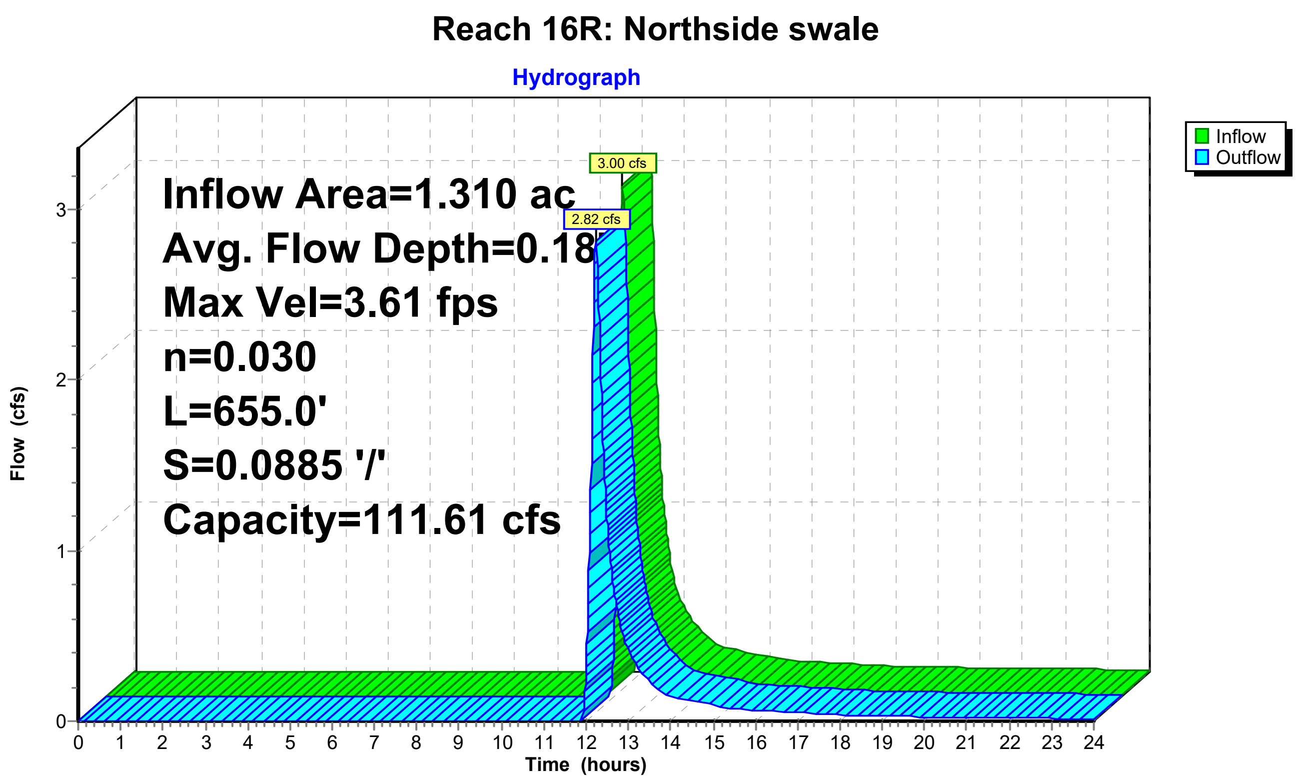


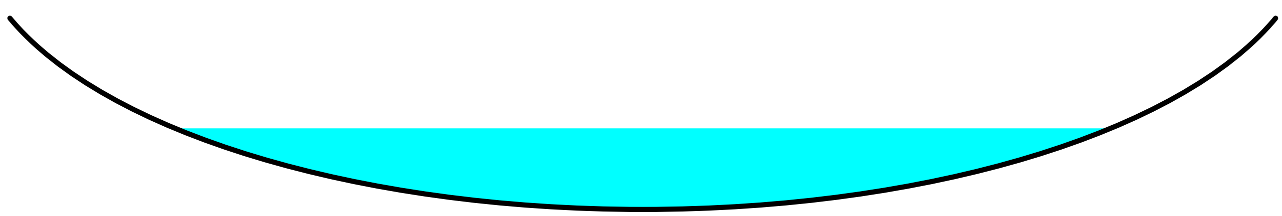
Summary for Reach 17R: Southside Swale

Inflow Area = 6.740 ac, 29.53% Impervious, Inflow Depth = 1.72" for 10-Year event
Inflow = 17.47 cfs @ 12.14 hrs, Volume= 0.969 af
Outflow = 16.89 cfs @ 12.17 hrs, Volume= 0.969 af, Atten= 3%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.13 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.78 fps, Avg. Travel Time= 6.6 min

Peak Storage= 1,957 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 108.12 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 710.0' Slope= 0.0831 '/'
Inlet Invert= 804.00', Outlet Invert= 745.00'



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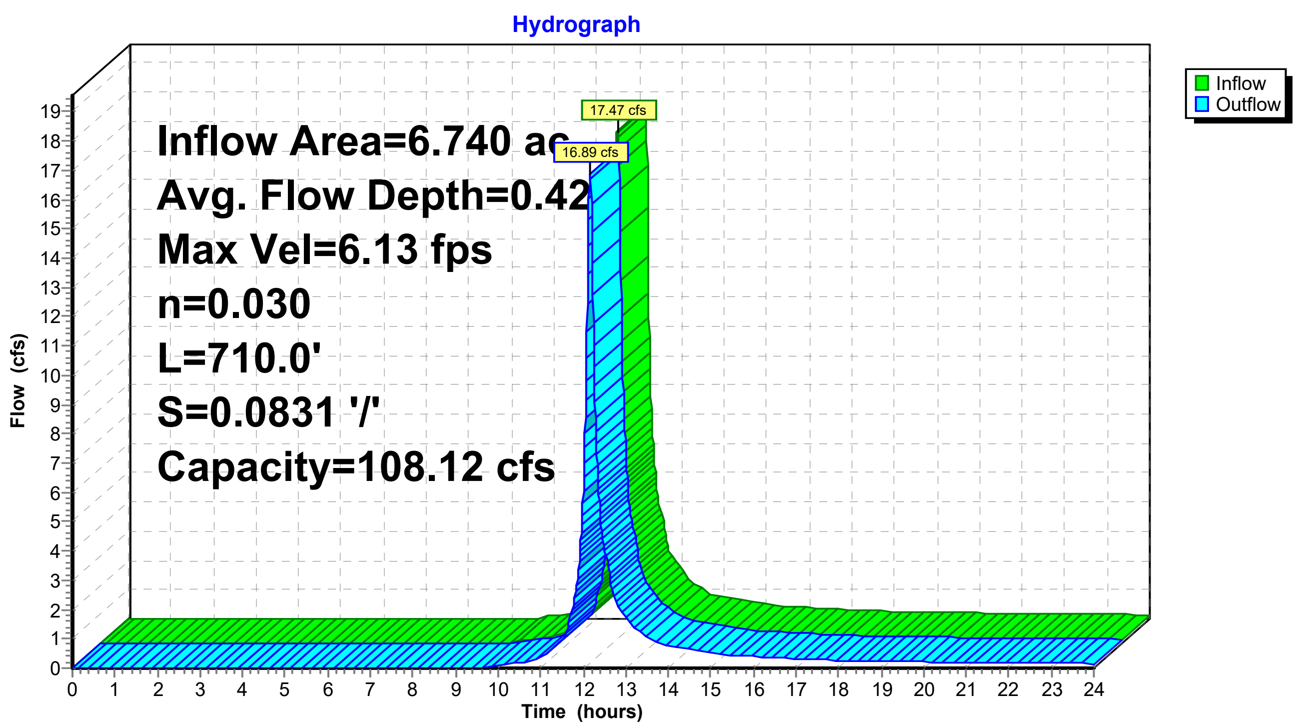
Reach 17R: Southside Swale



Summary for Pond 10P: Proposed 36" Culvert

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth = 1.05" for 10-Year event
Inflow = 57.03 cfs @ 12.54 hrs, Volume= 6.914 af
Outflow = 18.96 cfs @ 13.27 hrs, Volume= 6.895 af, Atten= 67%, Lag= 44.3 min
Primary = 10.03 cfs @ 12.83 hrs, Volume= 5.449 af
Secondary = 9.05 cfs @ 13.30 hrs, Volume= 1.446 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 705.99' @ 13.30 hrs Surf.Area= 169,592 sf Storage= 115,778 cf

Plug-Flow detention time= 122.2 min calculated for 6.893 af (100% of inflow)
Center-of-Mass det. time= 120.7 min (992.5 - 871.8)

Volume	Invert	Avail.Storage	Storage Description
#1	704.50'	609,456 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

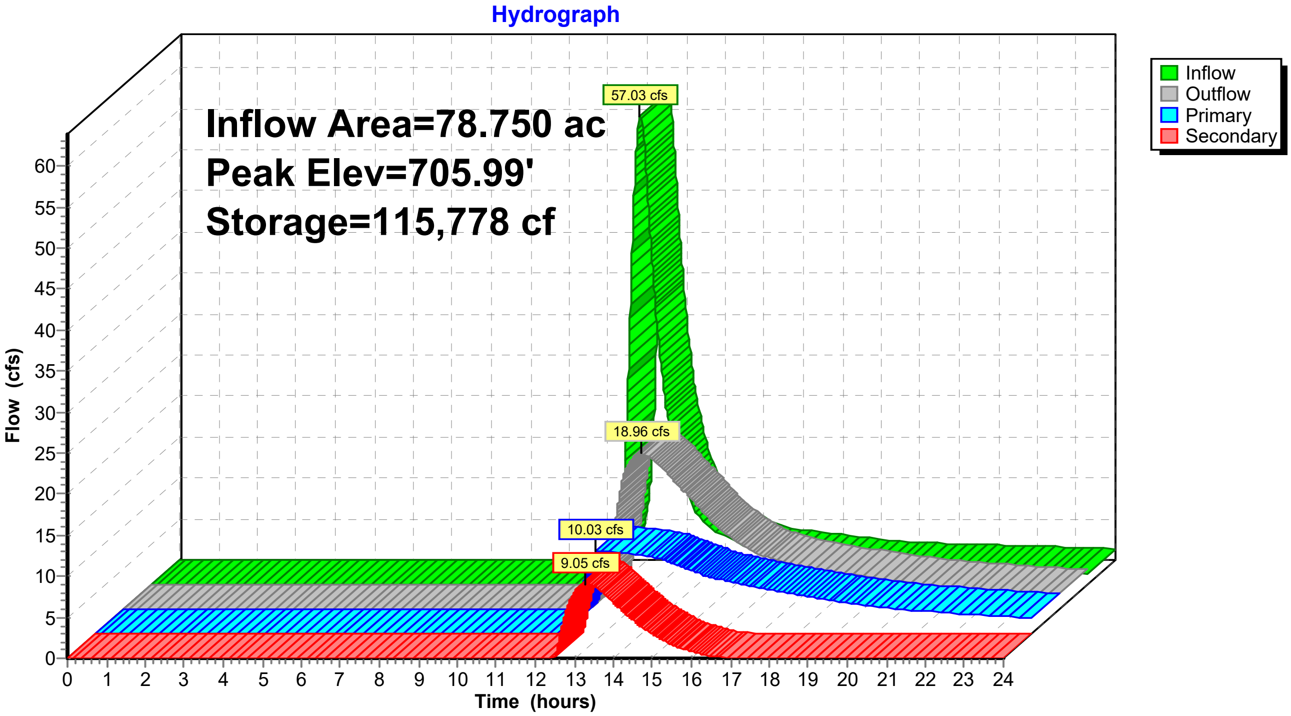
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.50	9,287	0	0
705.00	39,370	12,164	12,164
706.00	170,682	105,026	117,190
707.00	256,925	213,804	330,994
708.00	300,000	278,463	609,456

Device	Routing	Invert	Outlet Devices
#1	Primary	704.50'	**36.0" Round 36" Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 704.50' / 704.00' S= 0.0041 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Secondary	705.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=9.93 cfs @ 12.83 hrs HW=705.89' TW=705.07' (Dynamic Tailwater)
└—**1=36" Culvert** (Outlet Controls 9.93 cfs @ 4.54 fps)

Secondary OutFlow Max=9.05 cfs @ 13.30 hrs HW=705.99' TW=705.33' (Dynamic Tailwater)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 9.05 cfs @ 1.84 fps)

Pond 10P: Proposed 36" Culvert



Summary for Pond 11P: Proposed 36" Culvert

Inflow Area =	78.750 ac,	0.89% Impervious, Inflow Depth > 1.05"	for 10-Year event
Inflow =	18.96 cfs @	13.27 hrs, Volume=	6.895 af
Outflow =	18.93 cfs @	13.34 hrs, Volume=	6.894 af, Atten= 0%, Lag= 3.9 min
Primary =	18.93 cfs @	13.34 hrs, Volume=	6.894 af
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 705.33' @ 13.34 hrs Surf.Area= 3,358 sf Storage= 4,071 cf

Plug-Flow detention time= 4.2 min calculated for 6.894 af (100% of inflow)
Center-of-Mass det. time= 4.0 min (996.5 - 992.5)

Volume	Invert	Avail.Storage	Storage Description
#1	703.30'	12,772 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

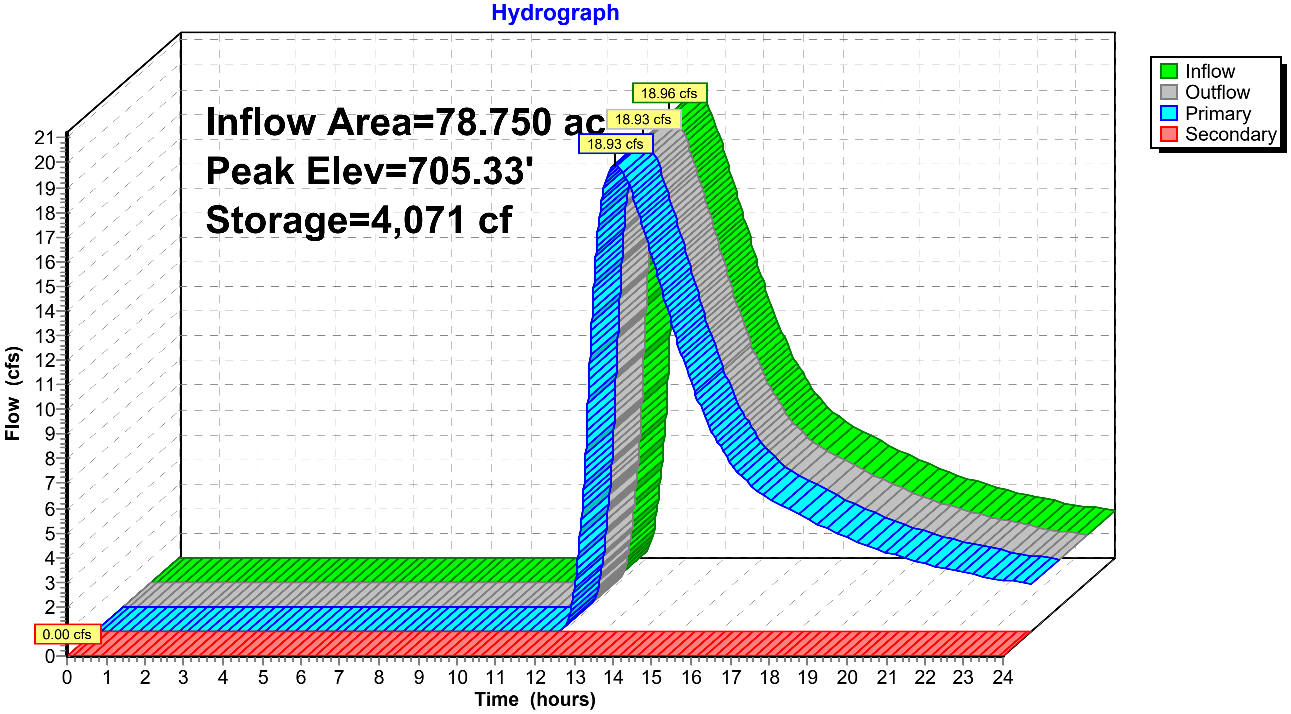
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
703.30	707	0	0
704.00	1,575	799	799
705.00	2,882	2,229	3,027
706.00	4,304	3,593	6,620
707.00	8,000	6,152	12,772

Device	Routing	Invert	Outlet Devices
#1	Primary	703.30'	**36.0" Round 36" cuvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 703.30' / 703.00' S= 0.0046 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Secondary	706.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=18.93 cfs @ 13.34 hrs HW=705.33' TW=703.60' (Dynamic Tailwater)
└─**1=36" cuvert** (Barrel Controls 18.93 cfs @ 5.24 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=703.30' TW=703.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 11P: Proposed 36" Culvert



Summary for Pond 17P: Bioswale (good)

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 6.740 ac, 29.53% Impervious, Inflow Depth = 1.73" for 10-Year event
Inflow = 17.46 cfs @ 12.14 hrs, Volume= 0.972 af
Outflow = 17.47 cfs @ 12.14 hrs, Volume= 0.970 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.002 af
Primary = 17.47 cfs @ 12.14 hrs, Volume= 0.969 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 808.20' @ 12.14 hrs Surf.Area= 408 sf Storage= 340 cf

Plug-Flow detention time= 2.7 min calculated for 0.970 af (100% of inflow)
Center-of-Mass det. time= 1.8 min (818.9 - 817.1)

Volume	Invert	Avail.Storage	Storage Description
#1	806.50'	2,012 cf	**SWALE STORAGE ABOVE BOTTOM (Conic)** Listed below

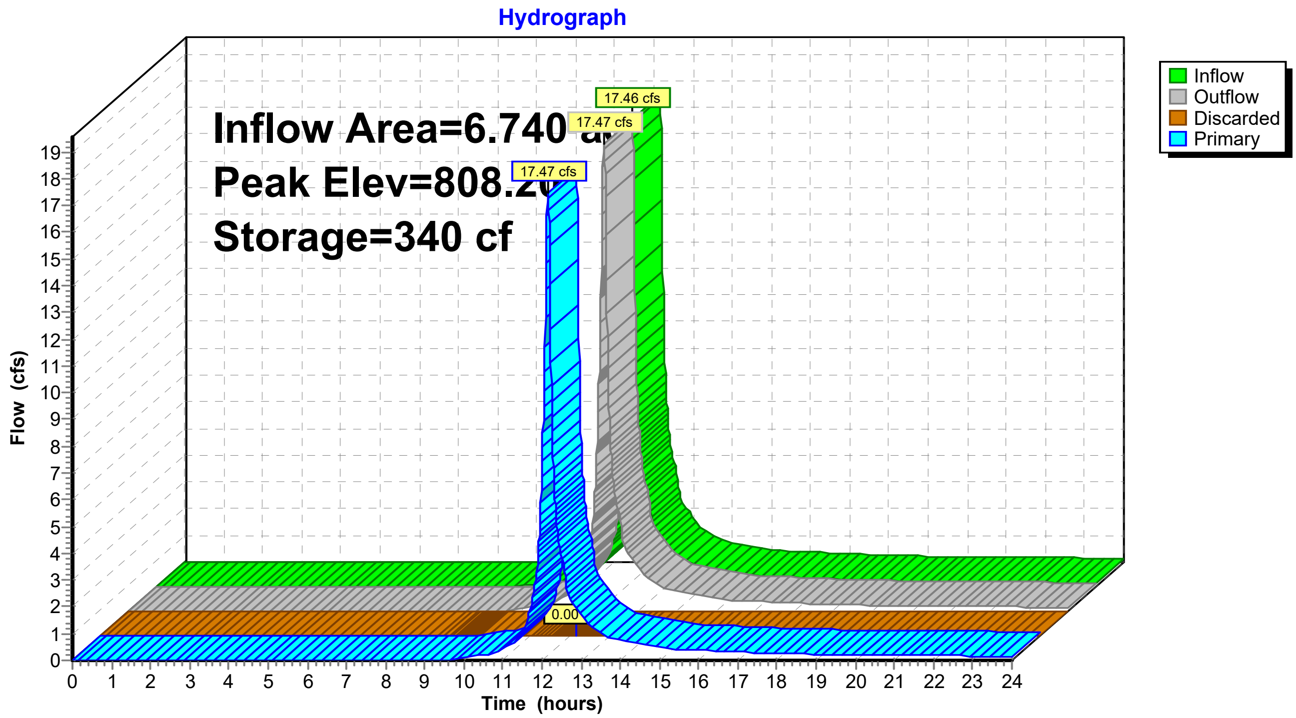
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
806.50	0	0	0	0
809.00	600	500	500	610
809.50	6,500	1,512	2,012	6,510

Device	Routing	Invert	Outlet Devices
#1	Discarded	806.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Primary	807.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=808.20' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=17.44 cfs @ 12.14 hrs HW=808.20' TW=804.42' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 17.44 cfs @ 2.91 fps)

Pond 17P: Bioswale (good)



Summary for Pond 18P: Bioswale (good)

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

```
Inflow Area =      5.900 ac, 30.00% Impervious, Inflow Depth =  1.73"   for 10-Year event
Inflow      =     15.22 cfs @  12.14 hrs, Volume=         0.853 af
Outflow     =     15.23 cfs @  12.14 hrs, Volume=         0.853 af, Atten= 0%, Lag= 0.2 min
Discarded   =      0.00 cfs @  12.14 hrs, Volume=         0.000 af
Primary     =     15.23 cfs @  12.14 hrs, Volume=         0.853 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 815.47' @ 12.14 hrs Surf.Area= 342 sf Storage= 285 cf

Plug-Flow detention time= 1.1 min calculated for 0.853 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (817.3 - 816.2)

Volume	Invert	Avail.Storage	Storage Description
#1	814.50'	3,041 cf	**SWALE STORAGE (Conic)** Listed below

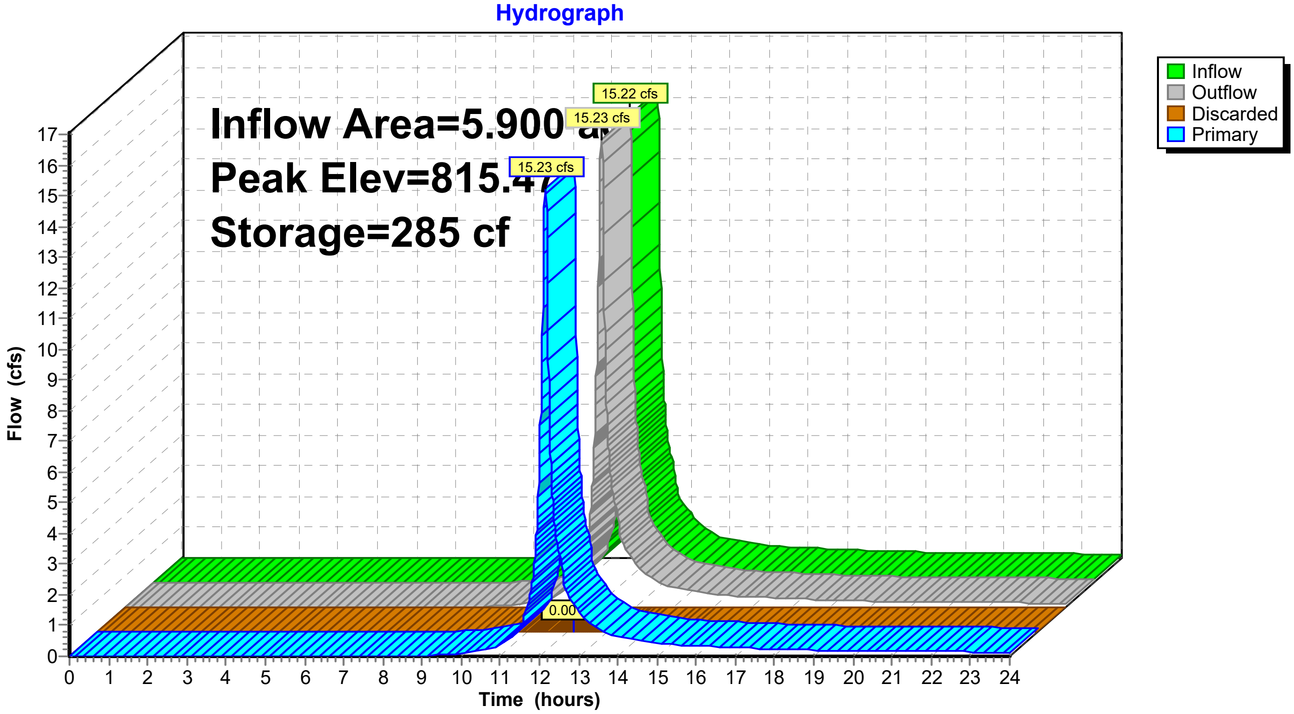
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
814.50	0	0	0	0
817.00	880	733	733	890
817.50	10,000	2,308	3,041	10,010

Device	Routing	Invert	Outlet Devices
#1	Discarded	814.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Device 3	814.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	812.50'	**24.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 812.50' / 812.00' S= 0.0109 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#4	Primary	814.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=815.47' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=15.21 cfs @ 12.14 hrs HW=815.47' TW=808.20' (Dynamic Tailwater)
├─**3=Culvert** (Passes 6.14 cfs of 16.76 cfs potential flow)
│ └─**2=Orifice/Grate** (Orifice Controls 6.14 cfs @ 3.16 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 9.07 cfs @ 2.36 fps)

Pond 18P: Bioswale (good)



Summary for Pond 19P: Bioswale (good)

Inflow Area = 5.150 ac, 30.10% Impervious, Inflow Depth = 1.74" for 10-Year event
Inflow = 13.26 cfs @ 12.15 hrs, Volume= 0.747 af
Outflow = 13.25 cfs @ 12.15 hrs, Volume= 0.747 af, Atten= 0%, Lag= 0.1 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.001 af
Primary = 13.24 cfs @ 12.15 hrs, Volume= 0.746 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 829.99' @ 12.15 hrs Surf.Area= 856 sf Storage= 143 cf

Plug-Flow detention time= 0.4 min calculated for 0.747 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (816.3 - 815.9)

Volume	Invert	Avail.Storage	Storage Description
#1	829.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

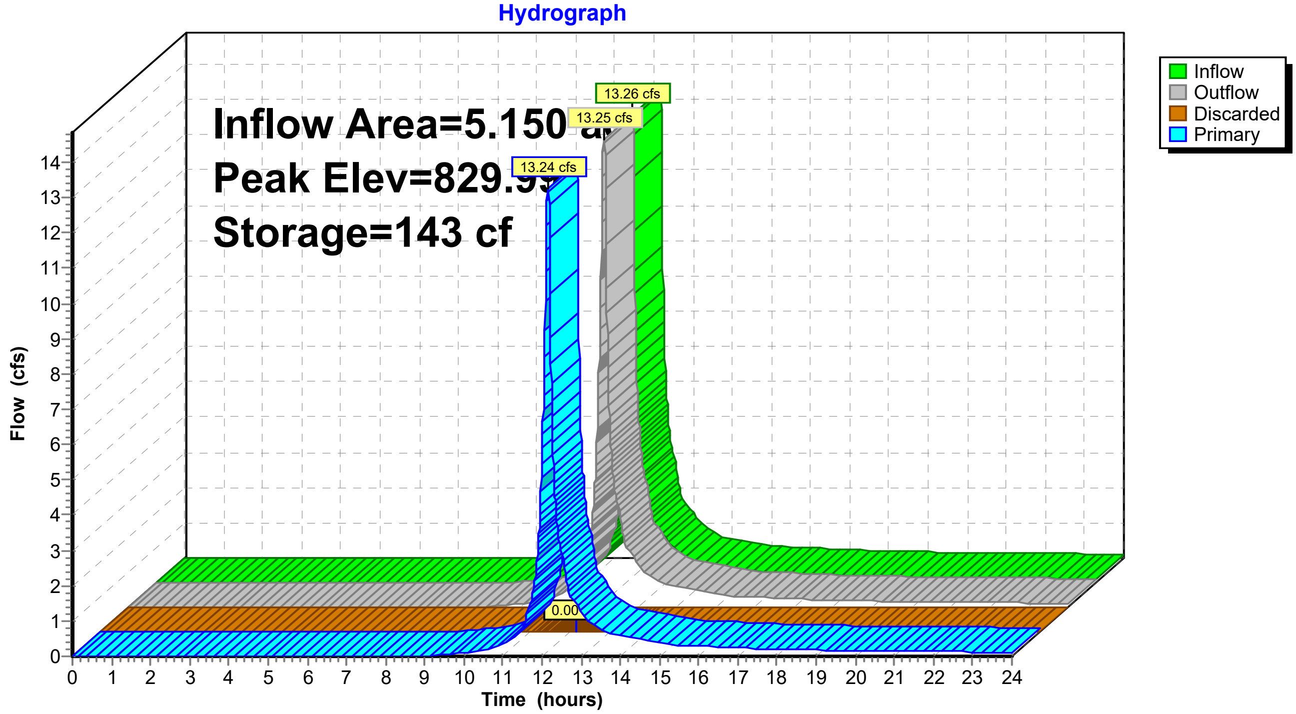
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
829.50	0	0	0	0
830.00	880	147	147	880
832.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Discarded	829.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.01'
#2	Device 3	829.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	827.50'	**18.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 827.50' / 827.00' S= 0.0109 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#4	Primary	829.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=829.99' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=13.24 cfs @ 12.15 hrs HW=829.99' TW=815.47' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 8.85 cfs @ 5.01 fps)
│ └─**2=Orifice/Grate** (Passes 8.85 cfs of 8.87 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 4.39 cfs @ 1.80 fps)

Pond 19P: Bioswale (good)



Summary for Pond 20P: Bioswale (good)

Inflow Area = 4.340 ac, 30.65% Impervious, Inflow Depth = 1.75" for 10-Year event
Inflow = 11.65 cfs @ 12.14 hrs, Volume= 0.632 af
Outflow = 11.20 cfs @ 12.16 hrs, Volume= 0.632 af, Atten= 4%, Lag= 1.0 min
Discarded = 0.01 cfs @ 12.16 hrs, Volume= 0.001 af
Primary = 11.19 cfs @ 12.16 hrs, Volume= 0.632 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 845.01' @ 12.16 hrs Surf.Area= 924 sf Storage= 202 cf

Plug-Flow detention time= 0.5 min calculated for 0.632 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (815.9 - 815.4)

Volume	Invert	Avail.Storage	Storage Description
#1	844.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

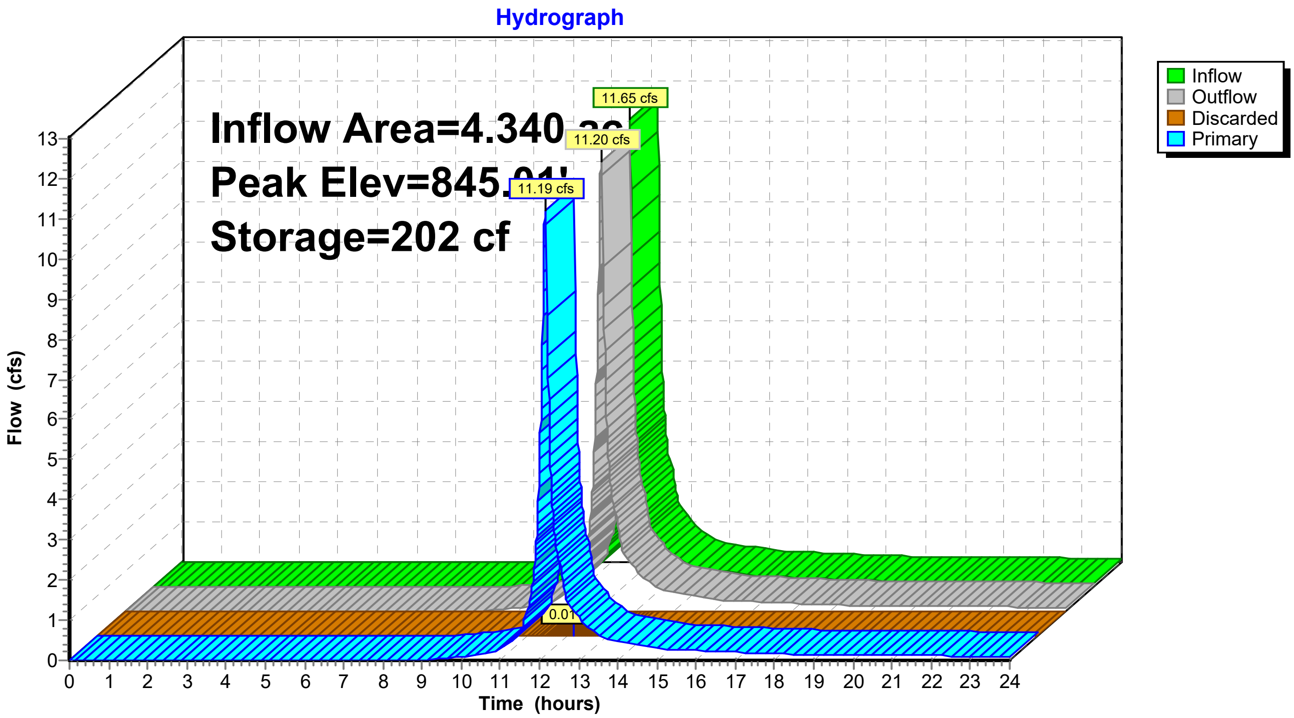
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
844.50	0	0	0	0
845.00	880	147	147	880
847.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Discarded	844.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	844.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	842.50'	**15.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 842.50' / 840.50' S= 0.0435 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#4	Primary	844.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.01 cfs @ 12.16 hrs HW=845.01' (Free Discharge)
└─**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=11.19 cfs @ 12.16 hrs HW=845.01' TW=829.98' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 6.41 cfs @ 5.22 fps)
│ └─**2=Orifice/Grate** (Passes 6.41 cfs of 9.58 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 4.78 cfs @ 1.87 fps)

Pond 20P: Bioswale (good)



Summary for Pond 21P: Bioswale (good)

Inflow Area = 3.540 ac, 31.36% Impervious, Inflow Depth = 1.76" for 10-Year event
Inflow = 9.59 cfs @ 12.14 hrs, Volume= 0.519 af
Outflow = 9.56 cfs @ 12.15 hrs, Volume= 0.519 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.001 af
Primary = 9.55 cfs @ 12.15 hrs, Volume= 0.519 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 858.91' @ 12.15 hrs Surf.Area= 724 sf Storage= 121 cf

Plug-Flow detention time= 0.5 min calculated for 0.519 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (815.3 - 814.8)

Volume	Invert	Avail.Storage	Storage Description
#1	858.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

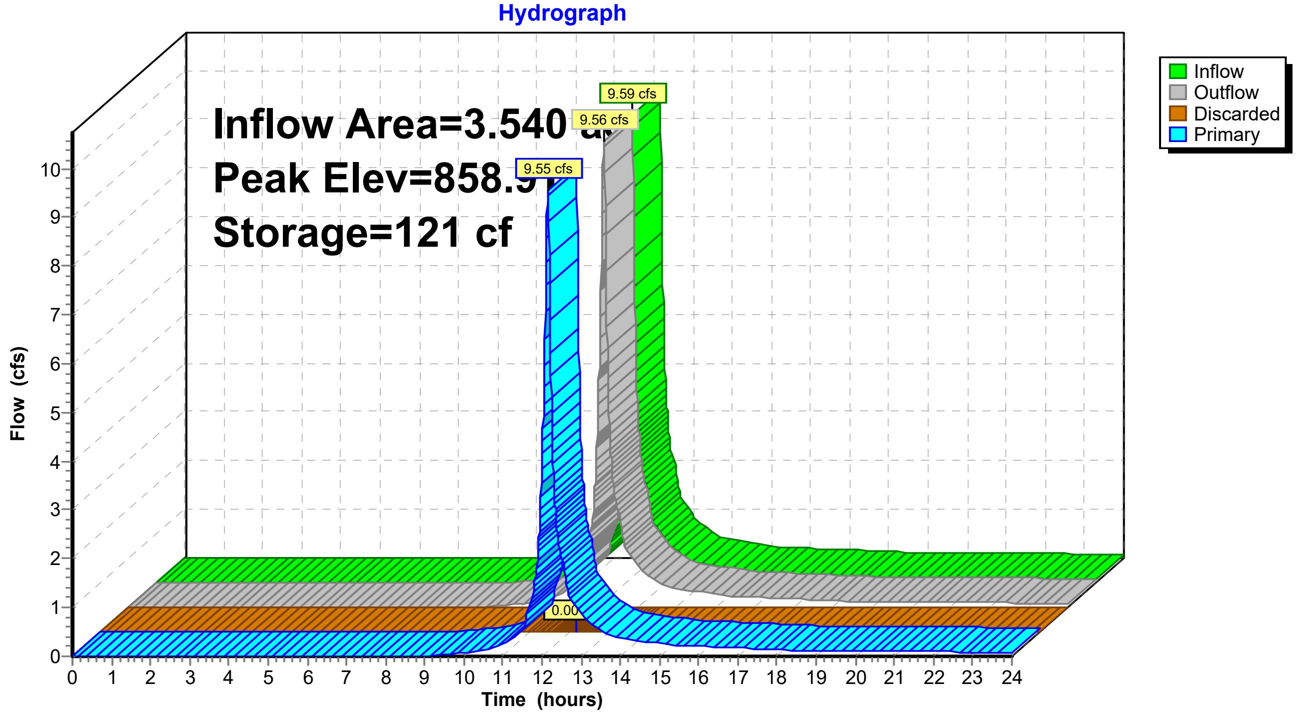
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
858.50	0	0	0	0
859.00	880	147	147	880
861.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Device 3	858.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	858.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#3	Primary	856.50'	**15.0" Round Culvert** L= 47.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 856.50' / 854.00' S= 0.0532 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#4	Primary	858.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=858.91' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=9.53 cfs @ 12.15 hrs HW=858.91' TW=845.01' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 6.23 cfs @ 5.08 fps)
│ └─**1=Orifice/Grate** (Passes 6.23 cfs of 6.87 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 3.29 cfs @ 1.61 fps)

Pond 21P: Bioswale (good)



Summary for Pond 22P: Bioswale (good)

Inflow Area = 2.740 ac, 32.48% Impervious, Inflow Depth = 1.78" for 10-Year event
Inflow = 7.50 cfs @ 12.14 hrs, Volume= 0.406 af
Outflow = 7.47 cfs @ 12.14 hrs, Volume= 0.406 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 7.47 cfs @ 12.14 hrs, Volume= 0.405 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 869.91' @ 12.14 hrs Surf.Area= 727 sf Storage= 121 cf

Plug-Flow detention time= 0.5 min calculated for 0.406 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (814.5 - 814.0)

Volume	Invert	Avail.Storage	Storage Description
#1	869.50'	13,006 cf	**SWALE STORAGE (Conic)** Listed below

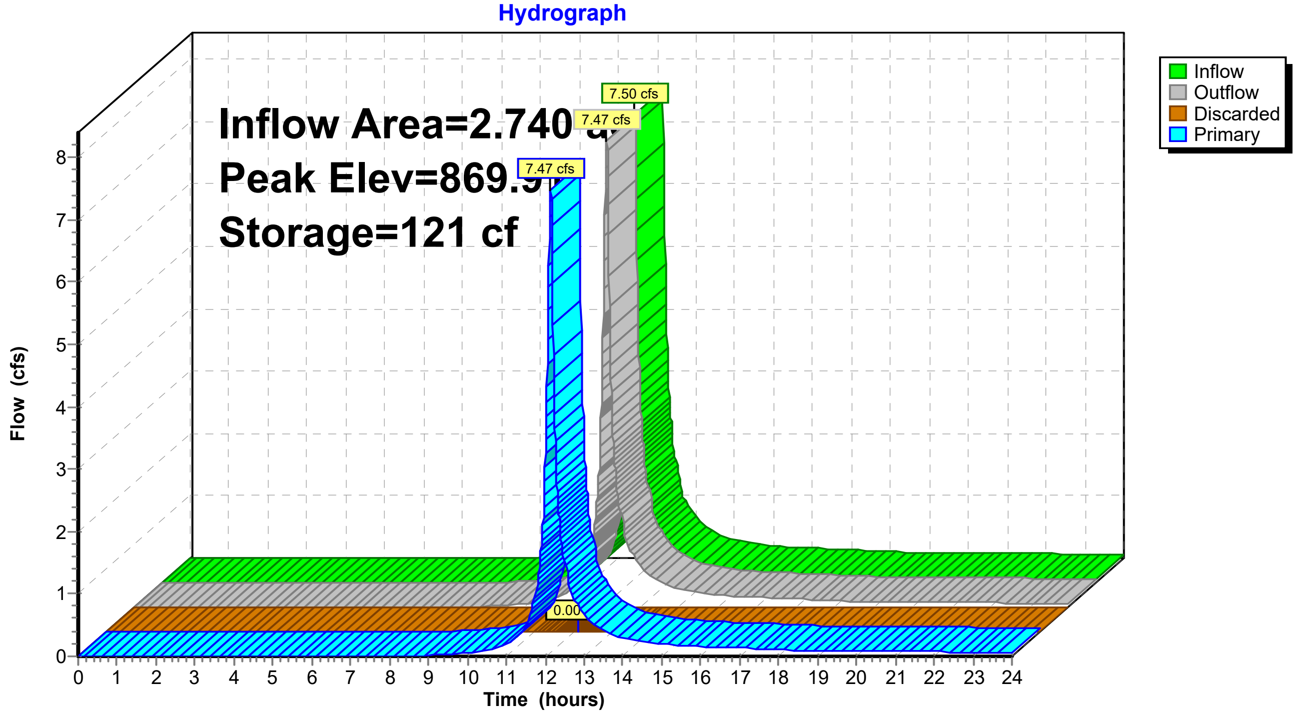
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
869.50	0	0	0	0
870.00	880	147	147	880
872.00	14,800	12,859	13,006	14,811

Device	Routing	Invert	Outlet Devices
#1	Discarded	869.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Device 3	869.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	867.50'	**12.0" Round CMP_Round 12"** L= 47.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 867.50' / 866.00' S= 0.0319 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	869.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=869.91' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=7.45 cfs @ 12.14 hrs HW=869.91' TW=858.91' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Inlet Controls 4.13 cfs @ 5.26 fps)
│ └─**2=Orifice/Grate** (Passes 4.13 cfs of 6.92 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 3.32 cfs @ 1.61 fps)

Pond 22P: Bioswale (good)



Summary for Pond 23P: Bioswale (good)

Inflow Area = 1.920 ac, 34.90% Impervious, Inflow Depth = 1.81" for 10-Year event
Inflow = 5.32 cfs @ 12.14 hrs, Volume= 0.289 af
Outflow = 5.32 cfs @ 12.14 hrs, Volume= 0.289 af, Atten= 0%, Lag= 0.2 min
Primary = 5.32 cfs @ 12.14 hrs, Volume= 0.289 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 880.77' @ 12.14 hrs Surf.Area= 473 sf Storage= 79 cf

Plug-Flow detention time= 0.6 min calculated for 0.289 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (813.1 - 812.6)

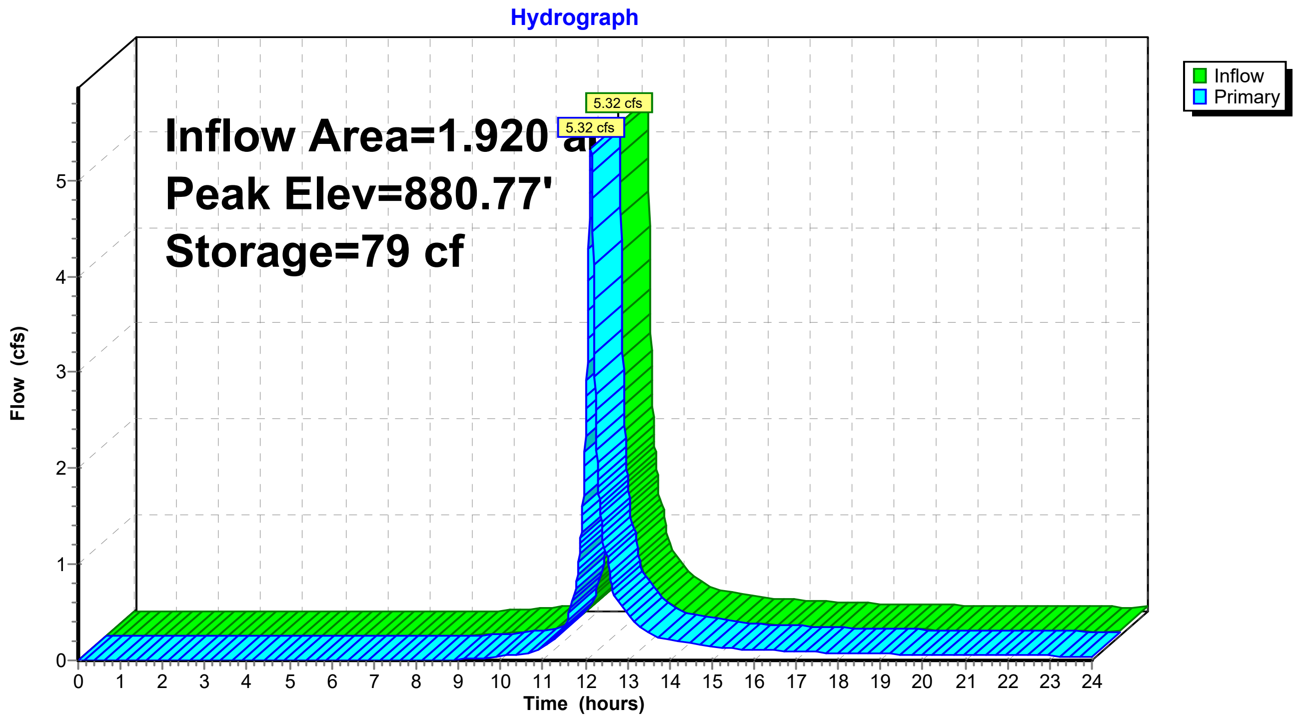
Volume	Invert	Avail.Storage	Storage Description
#1	880.50'	4,762 cf	**SWALE STORAGE (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
880.50	0	0	0	0
881.00	880	147	147	880
882.00	10,000	4,615	4,762	10,003

Device	Routing	Invert	Outlet Devices
#1	Device 3	880.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	880.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	878.50'	**12.0" Round CMP_Round 12"** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 878.50' / 877.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	880.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.31 cfs @ 12.14 hrs HW=880.77' TW=869.91' (Dynamic Tailwater)
3=CMP_Round 12" (Passes 3.65 cfs of 3.97 cfs potential flow)
1=Exfiltration (Controls 0.00 cfs)
2=Orifice/Grate (Weir Controls 3.64 cfs @ 1.69 fps)
4=Broad-Crested Rectangular Weir (Weir Controls 1.67 cfs @ 1.24 fps)

Pond 23P: Bioswale (good)



Summary for Pond 24P: Bioswale (good)

Inflow Area = 1.090 ac, 41.28% Impervious, Inflow Depth = 1.89" for 10-Year event
Inflow = 3.12 cfs @ 12.14 hrs, Volume= 0.171 af
Outflow = 3.11 cfs @ 12.14 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 3.11 cfs @ 12.14 hrs, Volume= 0.171 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 891.69' @ 12.14 hrs Surf.Area= 314 sf Storage= 52 cf

Plug-Flow detention time= 0.7 min calculated for 0.171 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (810.2 - 809.5)

Volume	Invert	Avail.Storage	Storage Description
#1	891.50'	5,468 cf	**SWALE STORAGE (Conic)** Listed below

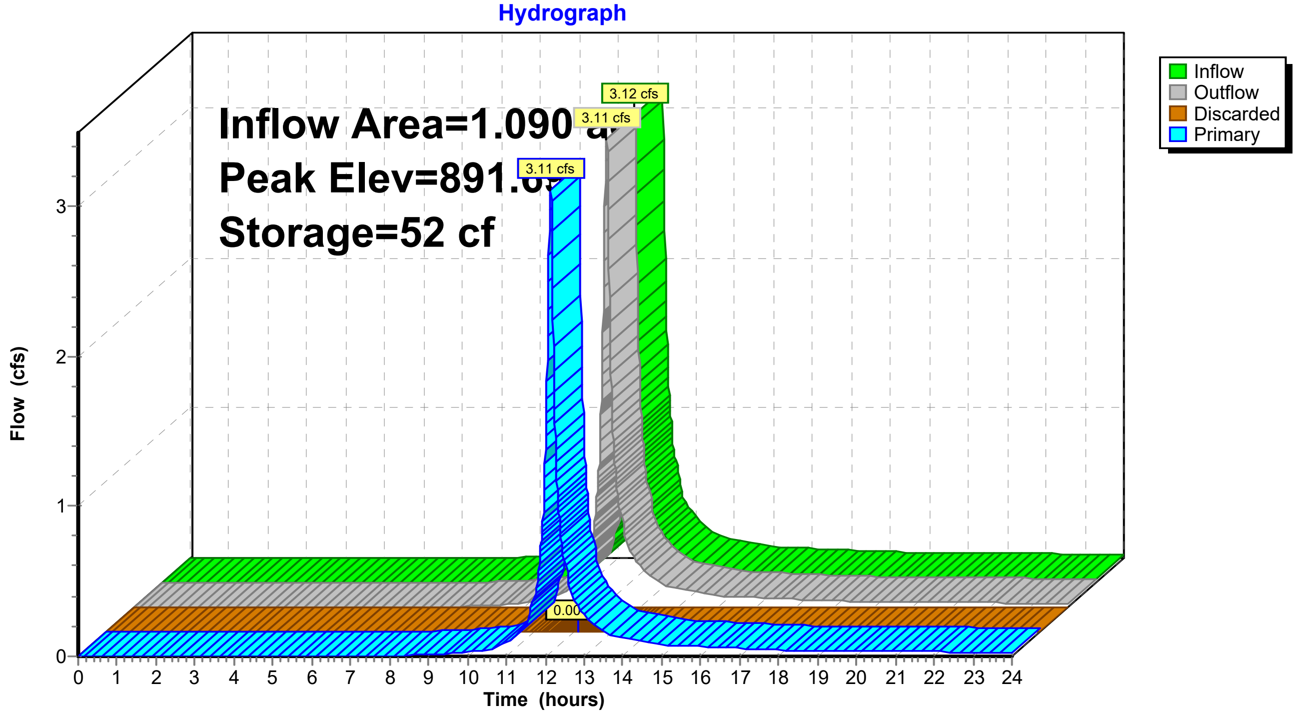
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
891.50	0	0	0	0
892.00	831	139	139	831
893.00	12,000	5,330	5,468	12,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	891.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	891.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	889.50'	**12.0" Round Culvert** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 889.50' / 888.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	891.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=891.69' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=3.11 cfs @ 12.14 hrs HW=891.69' TW=880.77' (Dynamic Tailwater)
├─**3=Culvert** (Passes 2.15 cfs of 3.88 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 2.15 cfs @ 1.42 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.96 cfs @ 1.02 fps)

Pond 24P: Bioswale (good)



Summary for Pond 25P: Bioswale (good)

Inflow Area = 0.530 ac, 43.40% Impervious, Inflow Depth = 1.91" for 10-Year event
Inflow = 1.51 cfs @ 12.14 hrs, Volume= 0.085 af
Outflow = 1.51 cfs @ 12.15 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.000 af
Primary = 1.51 cfs @ 12.15 hrs, Volume= 0.084 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 903.65' @ 12.15 hrs Surf.Area= 118 sf Storage= 20 cf

Plug-Flow detention time= 0.5 min calculated for 0.085 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (809.0 - 808.5)

Volume	Invert	Avail.Storage	Storage Description
#1	903.50'	2,142 cf	**SWALE STORAGE (Conic)** Listed below

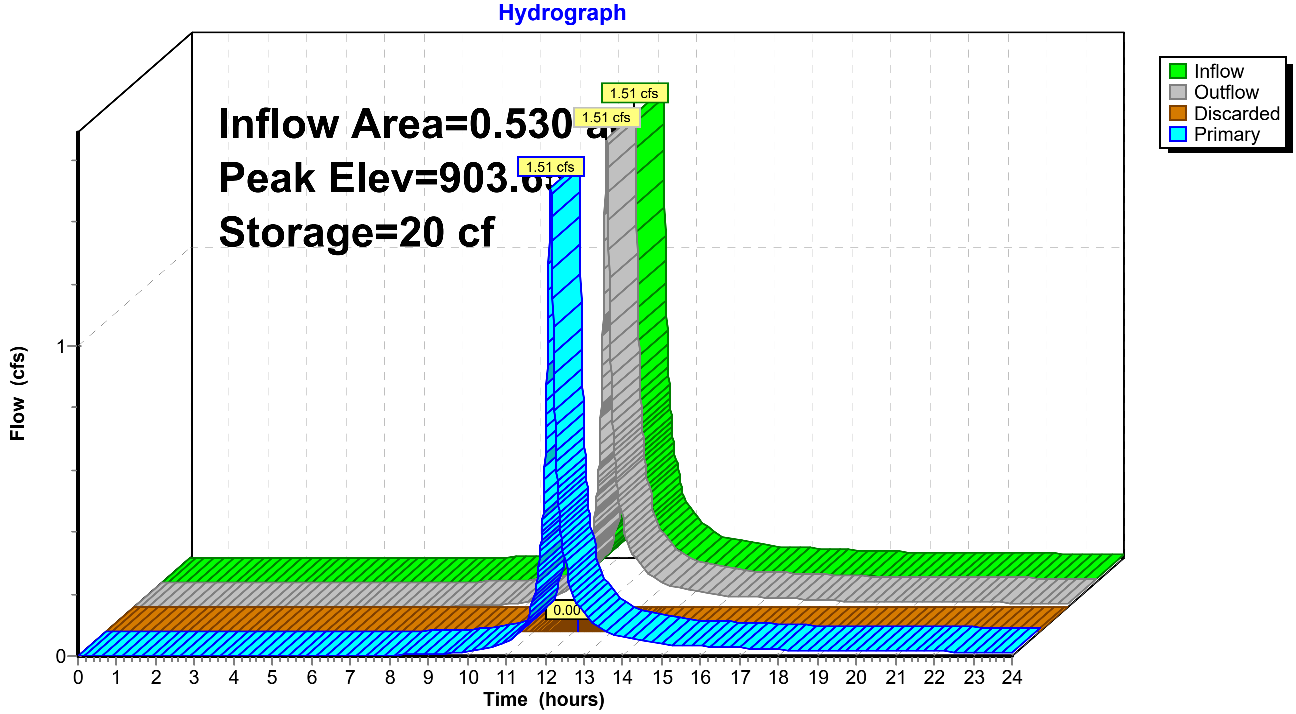
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
903.50	0	0	0	0
904.00	395	66	66	395
905.00	4,500	2,076	2,142	4,503

Device	Routing	Invert	Outlet Devices
#1	Discarded	903.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	903.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	901.50'	**12.0" Round CMP_Round 12"** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 901.50' / 901.00' S= 0.0086 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	903.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=903.65' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=1.50 cfs @ 12.15 hrs HW=903.65' TW=891.69' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 1.50 cfs of 3.83 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 1.50 cfs @ 1.26 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 25P: Bioswale (good)



Summary for Pond 26P: Bioswale (good)

Inflow Area = 0.150 ac, 20.00% Impervious, Inflow Depth = 1.63" for 10-Year event
Inflow = 0.38 cfs @ 12.13 hrs, Volume= 0.020 af
Outflow = 0.38 cfs @ 12.14 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 0.38 cfs @ 12.14 hrs, Volume= 0.020 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 907.56' @ 12.14 hrs Surf.Area= 76 sf Storage= 13 cf

Plug-Flow detention time= 1.2 min calculated for 0.020 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (820.4 - 819.1)

Volume	Invert	Avail.Storage	Storage Description
#1	907.50'	2,578 cf	**SWALE STORAGE (Conic)** Listed below

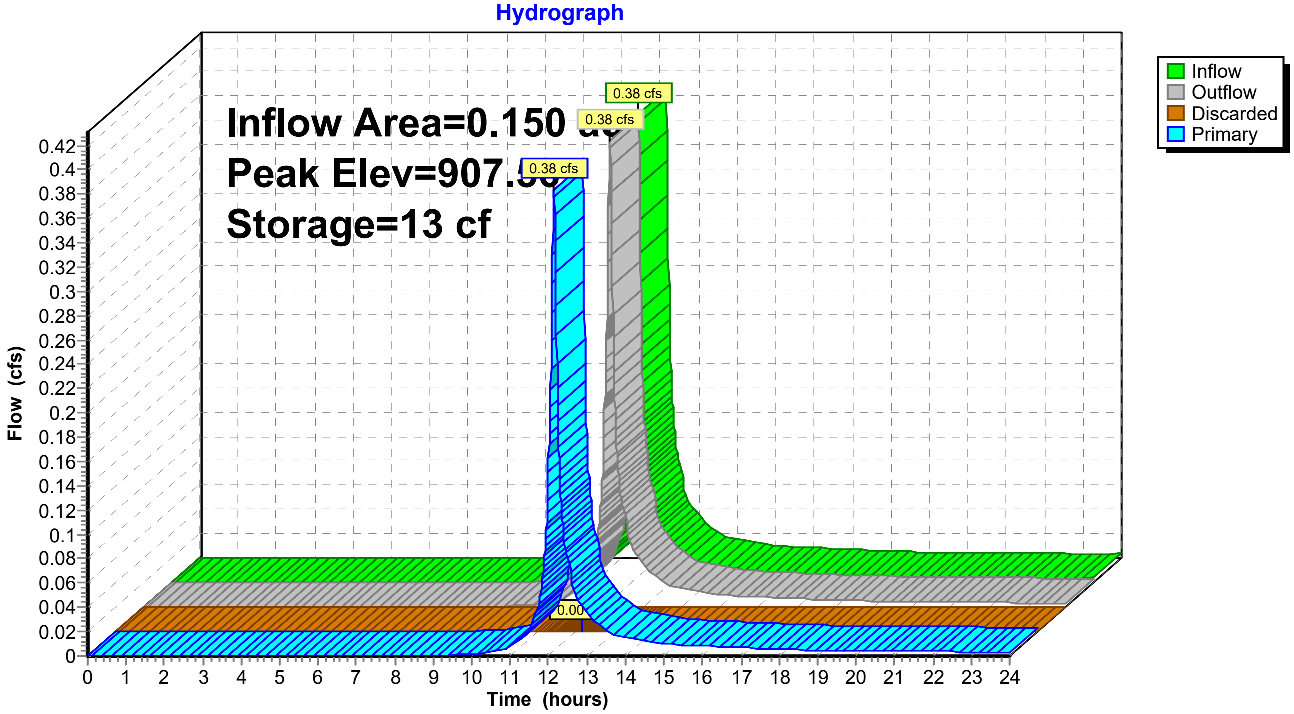
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
907.50	0	0	0	0
908.00	635	106	106	635
909.00	5,000	2,472	2,578	5,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	907.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	907.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	905.50'	**12.0" Round CMP_Round 12"** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 905.50' / 905.00' S= 0.0086 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	907.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=907.56' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.38 cfs @ 12.14 hrs HW=907.56' TW=903.65' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 0.38 cfs of 3.73 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 0.38 cfs @ 0.80 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: Bioswale (good)



Summary for Pond 27P: Dry Swale

Inflow Area = 1.310 ac, 37.40% Impervious, Inflow Depth = 1.86" for 10-Year event
Inflow = 3.50 cfs @ 12.15 hrs, Volume= 0.203 af
Outflow = 3.03 cfs @ 12.20 hrs, Volume= 0.192 af, Atten= 13%, Lag= 2.6 min
Discarded = 0.03 cfs @ 12.20 hrs, Volume= 0.035 af
Primary = 3.00 cfs @ 12.20 hrs, Volume= 0.157 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 807.94' @ 12.20 hrs Surf.Area= 5,920 sf Storage= 1,973 cf

Plug-Flow detention time= 122.6 min calculated for 0.192 af (95% of inflow)
Center-of-Mass det. time= 93.4 min (905.4 - 812.0)

Volume	Invert	Avail.Storage	Storage Description
#1	807.00'	10,179 cf	**Custom Stage Data (Conic)** Listed below

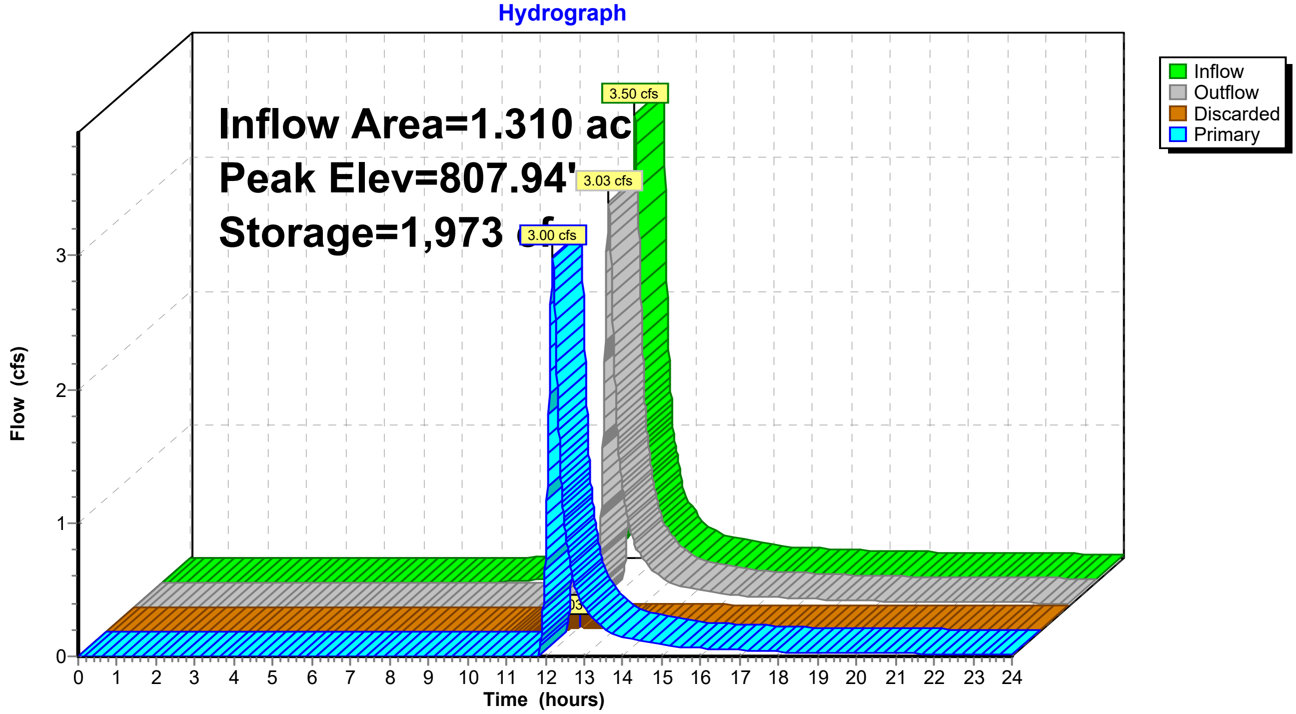
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
807.00	0	0	0	0
808.00	6,300	2,100	2,100	6,302
809.00	10,000	8,079	10,179	10,015

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	**4.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	807.00'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 700.00'

Discarded OutFlow Max=0.03 cfs @ 12.20 hrs HW=807.94' (Free Discharge)
└─**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=2.99 cfs @ 12.20 hrs HW=807.94' TW=804.18' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 2.99 cfs @ 1.70 fps)

Pond 27P: Dry Swale



Summary for Pond 32P: Lower Pond

Inflow Area = 38.100 ac, 11.36% Impervious, Inflow Depth = 1.39" for 10-Year event
Inflow = 39.12 cfs @ 12.16 hrs, Volume= 4.421 af
Outflow = 22.67 cfs @ 12.73 hrs, Volume= 3.481 af, Atten= 42%, Lag= 34.2 min
Primary = 11.91 cfs @ 12.73 hrs, Volume= 2.820 af
Secondary = 10.76 cfs @ 12.73 hrs, Volume= 0.661 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Starting Elev= 700.50' Surf.Area= 14,196 sf Storage= 6,497 cf
Peak Elev= 703.89' @ 12.73 hrs Surf.Area= 27,617 sf Storage= 75,607 cf (69,111 cf above start)

Plug-Flow detention time= 274.6 min calculated for 3.332 af (75% of inflow)
Center-of-Mass det. time= 164.0 min (1,010.1 - 846.1)

Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	124,144 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

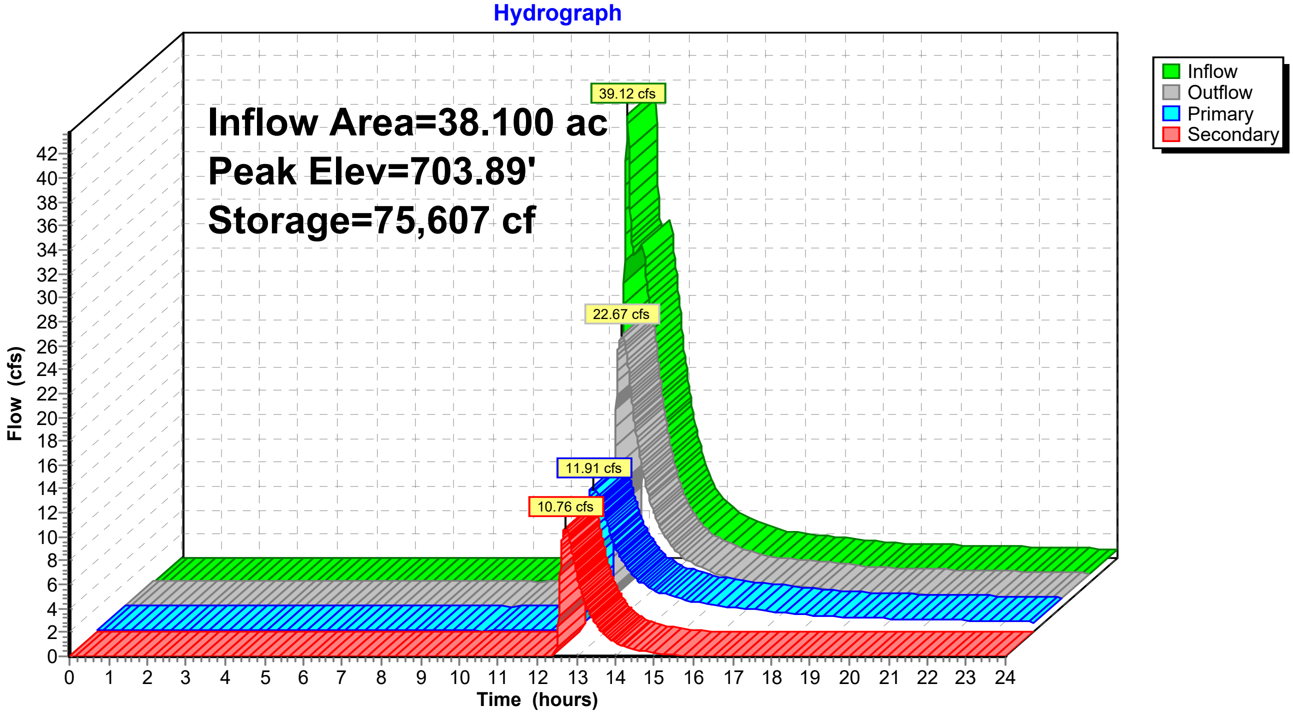
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	11,792	0	0
701.00	16,599	14,196	14,196
702.00	19,522	18,061	32,256
703.00	22,479	21,001	53,257
704.00	28,237	25,358	78,615
705.00	34,230	31,234	109,848
705.40	37,252	14,296	124,144

Device	Routing	Invert	Outlet Devices
#1	Secondary	703.60'	**27.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 4	703.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	700.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	700.00'	**18.0" Round Culvert** L= 21.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 700.00' / 699.80' S= 0.0095 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 1.77 sf

Primary OutFlow Max=11.91 cfs @ 12.73 hrs HW=703.89' TW=0.00' (Dynamic Tailwater)
└─**4=Culvert** (Inlet Controls 11.91 cfs @ 6.74 fps)
  ├─**2=Orifice/Grate** (Passes < 12.86 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 0.46 cfs potential flow)

Secondary OutFlow Max=10.76 cfs @ 12.73 hrs HW=703.89' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 10.76 cfs @ 1.36 fps)

Pond 32P: Lower Pond



Summary for Pond 33P: Upper Pond

Inflow Area = 32.150 ac, 14.71% Impervious, Inflow Depth = 1.34" for 10-Year event
Inflow = 47.99 cfs @ 12.20 hrs, Volume= 3.595 af
Outflow = 15.19 cfs @ 12.64 hrs, Volume= 2.593 af, Atten= 68%, Lag= 25.9 min
Primary = 15.19 cfs @ 12.64 hrs, Volume= 2.593 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Starting Elev= 705.00' Surf.Area= 0 sf Storage= 0 cf
Peak Elev= 741.93' @ 12.64 hrs Surf.Area= 21,178 sf Storage= 71,975 cf

Plug-Flow detention time= 334.7 min calculated for 2.593 af (72% of inflow)
Center-of-Mass det. time= 244.9 min (1,082.4 - 837.5)

Volume	Invert	Avail.Storage	Storage Description
#1	737.50'	149,518 cf	**prop (Conic)** Listed below (Recalc)

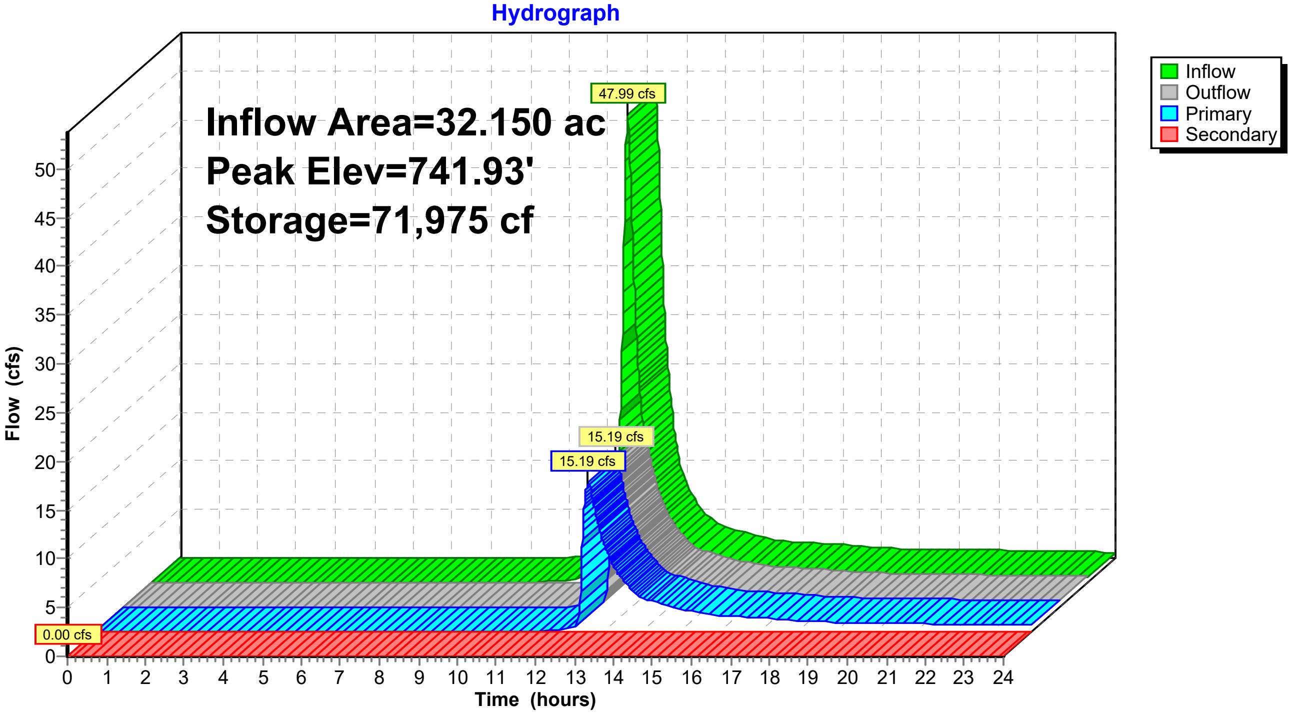
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
737.50	11,903	0	0	11,903
738.00	12,777	6,169	6,169	12,799
739.00	14,602	13,679	19,848	14,670
740.00	16,711	15,645	35,493	16,825
741.00	18,984	17,835	53,328	19,147
742.00	21,350	20,155	73,484	21,566
743.00	23,873	22,600	96,083	24,145
744.00	26,452	25,151	121,235	26,784
745.00	30,154	28,283	149,518	30,534

Device	Routing	Invert	Outlet Devices
#1	Secondary	743.00'	**31.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 4	741.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	737.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	737.50'	**24.0" Round Culvert** L= 35.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 737.50' / 735.00' S= 0.0714 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 3.14 sf

Primary OutFlow Max=15.19 cfs @ 12.64 hrs HW=741.93' TW=0.00' (Dynamic Tailwater)
└─**4=Culvert** (Passes 15.19 cfs of 22.11 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 14.70 cfs @ 2.14 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.49 cfs @ 9.99 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=737.50' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 33P: Upper Pond

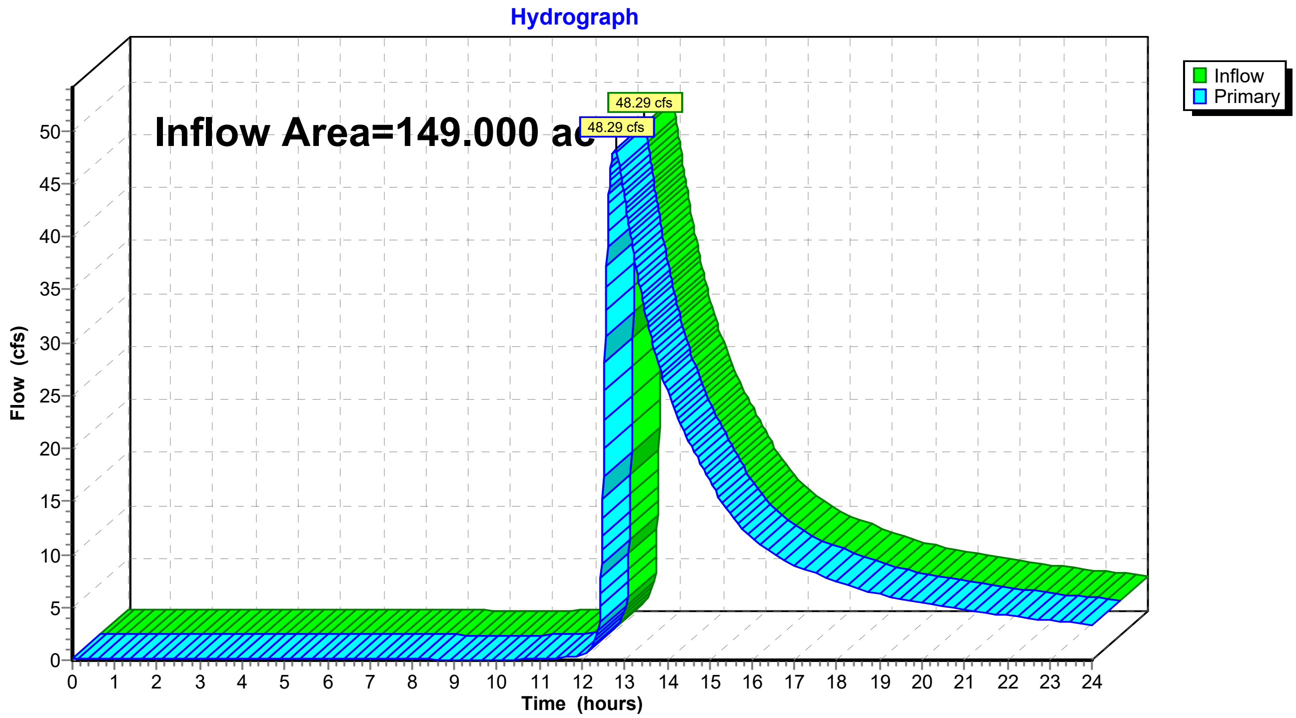


Summary for Link 49L: Total Off-site drainage

Inflow Area =	149.000 ac,	6.55% Impervious,	Inflow Depth > 1.04"	for 10-Year event
Inflow =	48.29 cfs @	12.78 hrs, Volume=	12.967 af	
Primary =	48.29 cfs @	12.78 hrs, Volume=	12.967 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs

Link 49L: Total Off-site drainage



Time span=0.00-37.00 hrs, dt=0.01 hrs, 3701 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1 OFF: OFFSITE DRAINAGE Runoff Area=78.750 ac 0.89% Impervious Runoff Depth=2.69"
Flow Length=4,105' Tc=35.7 min CN=75 Runoff=152.87 cfs 17.630 af

Subcatchment2: 2 (good) Runoff Area=24.100 ac 9.34% Impervious Runoff Depth=2.96"
Flow Length=2,474' Tc=15.8 min CN=78 Runoff=78.27 cfs 5.944 af

Subcatchment3: 3 (good) Runoff Area=23.800 ac 3.66% Impervious Runoff Depth=3.05"
Flow Length=3,643' Tc=37.7 min CN=79 Runoff=51.04 cfs 6.055 af

Subcatchment17: Lot #9 (good) Runoff Area=0.840 ac 26.19% Impervious Runoff Depth=3.64"
Slope=0.0866 '/' Tc=6.0 min CN=85 Runoff=4.65 cfs 0.255 af

Subcatchment18: Lot #8 (good) Runoff Area=0.750 ac 29.33% Impervious Runoff Depth=3.64"
Slope=0.0953 '/' Tc=6.0 min CN=85 Runoff=4.15 cfs 0.227 af

Subcatchment19: Lot #7 (good) Runoff Area=0.810 ac 27.16% Impervious Runoff Depth=3.64"
Slope=0.0933 '/' Tc=6.0 min CN=85 Runoff=4.48 cfs 0.245 af

Subcatchment20: Lot #6 (good) Runoff Area=0.800 ac 27.50% Impervious Runoff Depth=3.64"
Slope=0.0759 '/' Tc=6.0 min CN=85 Runoff=4.43 cfs 0.242 af

Subcatchment21: Lot #5 (good) Runoff Area=0.800 ac 27.50% Impervious Runoff Depth=3.64"
Slope=0.0663 '/' Tc=6.0 min CN=85 Runoff=4.43 cfs 0.242 af

Subcatchment22: Lot #4 (good) Runoff Area=0.820 ac 26.83% Impervious Runoff Depth=3.64"
Slope=0.0589 '/' Tc=6.0 min CN=85 Runoff=4.54 cfs 0.249 af

Subcatchment23: Lot #3 (good) Runoff Area=0.830 ac 26.51% Impervious Runoff Depth=3.64"
Slope=0.0568 '/' Tc=6.0 min CN=85 Runoff=4.59 cfs 0.252 af

Subcatchment24: Lot #2 (good) Runoff Area=0.560 ac 39.29% Impervious Runoff Depth=3.84"
Slope=0.0563 '/' Tc=6.0 min CN=87 Runoff=3.23 cfs 0.179 af

Subcatchment25: Lot #1 (good) Runoff Area=0.380 ac 52.63% Impervious Runoff Depth=4.05"
Flow Length=120' Slope=0.0700 '/' Tc=7.3 min CN=89 Runoff=2.17 cfs 0.128 af

Subcatchment26: 26 (update Tc to Runoff Area=1.310 ac 37.40% Impervious Runoff Depth=3.84"
Tc=8.0 min CN=87 Runoff=7.01 cfs 0.419 af

Subcatchment37S: 1 Runoff Area=14.300 ac 24.20% Impervious Runoff Depth=3.44"
Flow Length=932' Tc=7.7 min CN=83 Runoff=70.74 cfs 4.097 af

Subcatchment46S: Portion of Lot #1 Runoff Area=0.150 ac 20.00% Impervious Runoff Depth=3.54"
Tc=6.0 min CN=84 Runoff=0.81 cfs 0.044 af

Reach 12R: Swale to off-site Avg. Flow Depth=0.85' Max Vel=2.81 fps Inflow=41.42 cfs 17.606 af
n=0.030 L=293.0' S=0.0068 '/' Capacity=58.17 cfs Outflow=41.41 cfs 17.605 af

Reach 16R: Northside swale Avg. Flow Depth=0.24' Max Vel=4.31 fps Inflow=5.10 cfs 0.369 af
n=0.030 L=655.0' S=0.0885 '/' Capacity=111.61 cfs Outflow=5.01 cfs 0.369 af

Reach 17R: Southside Swale Avg. Flow Depth=0.51' Max Vel=6.91 fps Inflow=25.42 cfs 2.055 af
n=0.030 L=710.0' S=0.0831 '/' Capacity=108.12 cfs Outflow=25.05 cfs 2.055 af

Pond 10P: Proposed 36" Culvert Peak Elev=706.99' Storage=329,245 cf Inflow=152.87 cfs 17.630 af
Primary=13.16 cfs 9.131 af Secondary=28.51 cfs 8.476 af Outflow=41.58 cfs 17.607 af

Pond 11P: Proposed 36" Culvert Peak Elev=706.73' Storage=10,762 cf Inflow=41.58 cfs 17.607 af
Primary=41.42 cfs 17.606 af Secondary=0.00 cfs 0.000 af Outflow=41.42 cfs 17.606 af

Pond 17P: Bioswale (good) Peak Elev=808.54' Storage=409 cf Inflow=25.43 cfs 2.059 af
Discarded=0.00 cfs 0.002 af Primary=25.42 cfs 2.055 af Outflow=25.42 cfs 2.057 af

Pond 18P: Bioswale (good) Peak Elev=815.68' Storage=346 cf Inflow=21.19 cfs 1.805 af
Discarded=0.00 cfs 0.001 af Primary=21.19 cfs 1.804 af Outflow=21.19 cfs 1.805 af

Pond 19P: Bioswale (good) Peak Elev=830.27' Storage=1,394 cf Inflow=19.71 cfs 1.579 af
Discarded=0.01 cfs 0.001 af Primary=18.62 cfs 1.578 af Outflow=18.63 cfs 1.579 af

Pond 20P: Bioswale (good) Peak Elev=845.31' Storage=1,563 cf Inflow=17.78 cfs 1.334 af
Discarded=0.01 cfs 0.001 af Primary=16.60 cfs 1.333 af Outflow=16.61 cfs 1.334 af

Pond 21P: Bioswale (good) Peak Elev=859.19' Storage=1,027 cf Inflow=15.61 cfs 1.093 af
Discarded=0.01 cfs 0.001 af Primary=14.43 cfs 1.092 af Outflow=14.44 cfs 1.093 af

Pond 22P: Bioswale (good) Peak Elev=870.18' Storage=1,334 cf Inflow=14.03 cfs 0.851 af
Discarded=0.01 cfs 0.001 af Primary=12.04 cfs 0.850 af Outflow=12.05 cfs 0.851 af

Pond 23P: Bioswale (good) Peak Elev=881.05' Storage=398 cf Inflow=10.72 cfs 0.603 af
Outflow=9.76 cfs 0.603 af

Pond 24P: Bioswale (good) Peak Elev=891.81' Storage=87 cf Inflow=6.19 cfs 0.351 af
Discarded=0.00 cfs 0.000 af Primary=6.16 cfs 0.351 af Outflow=6.16 cfs 0.351 af

Pond 25P: Bioswale (good) Peak Elev=903.73' Storage=30 cf Inflow=2.98 cfs 0.172 af
Discarded=0.00 cfs 0.000 af Primary=2.98 cfs 0.172 af Outflow=2.98 cfs 0.172 af

Pond 26P: Bioswale (good) Peak Elev=907.60' Storage=21 cf Inflow=0.81 cfs 0.044 af
Discarded=0.00 cfs 0.000 af Primary=0.81 cfs 0.044 af Outflow=0.81 cfs 0.044 af

Pond 27P: Dry Swale Peak Elev=808.11' Storage=2,973 cf Inflow=7.01 cfs 0.419 af
Discarded=0.04 cfs 0.039 af Primary=5.10 cfs 0.369 af Outflow=5.14 cfs 0.408 af

Pond 32P: Lower Pond Peak Elev=704.43' Storage=91,323 cf Inflow=89.57 cfs 10.151 af
Primary=12.89 cfs 4.682 af Secondary=54.93 cfs 4.519 af Outflow=67.82 cfs 9.201 af

Pond 33P: Upper Pond Peak Elev=743.78' Storage=115,573 cf Inflow=106.60 cfs 8.368 af
Primary=27.45 cfs 5.945 af Secondary=57.87 cfs 1.412 af Outflow=85.32 cfs 7.357 af

Link 49L: Total Off-site drainage

Inflow=164.57 cfs 34.163 af
Primary=164.57 cfs 34.163 af

Total Runoff Area = 149.000 ac Runoff Volume = 36.209 af Average Runoff Depth = 2.92"
93.45% Pervious = 139.240 ac 6.55% Impervious = 9.760 ac

Summary for Subcatchment 1 OFF: OFFSITE DRAINAGE (good)

CarlsonPlanXYPos|642280.8804|1040430.0233|
CarlsonSurface||

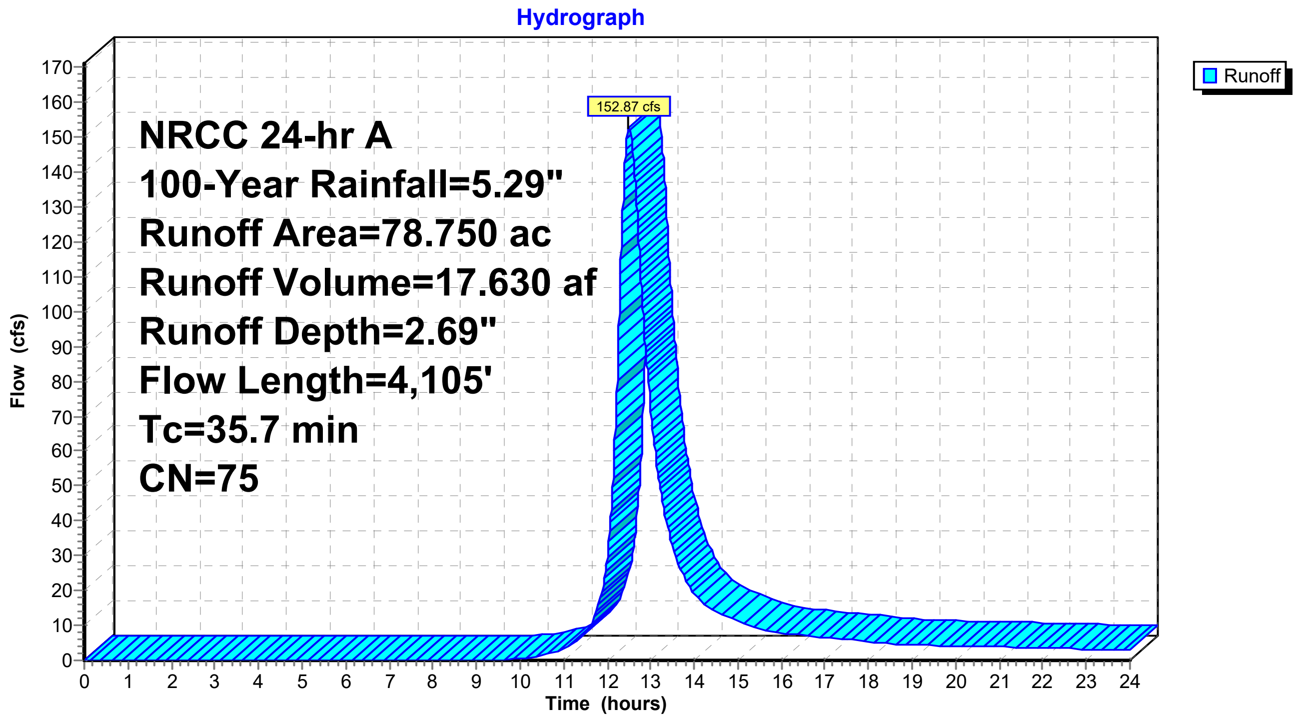
Runoff = 152.87 cfs @ 12.50 hrs, Volume= 17.630 af, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.700	98	Paved parking, HSG D
18.800	78	Meadow, non-grazed, HSG D
5.000	80	>75% Grass cover, Good, HSG D
54.250	73	Brush, Good, HSG D
78.750	75	Weighted Average
78.050		99.11% Pervious Area
0.700		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
10.8	1,165	0.0400	1.80		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
1.2	1,445	0.0850	19.33	1,352.84	**Channel Flow, Channel Flow** Area= 70.0 sf Perim= 72.0' r= 0.97' n= 0.022 Earth, clean & straight
7.3	560	0.0650	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
1.2	115	0.1000	1.58		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
12.6	535	0.0200	0.71		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
2.3	270	0.0150	1.97		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
35.7	4,105	Total			

Subcatchment 1 OFF: OFFSITE DRAINAGE (good)



Summary for Subcatchment 2: 2 (good)

CarlsonPlanXYPos|642014.4586|1041354.4458|
CarlsonSurface||

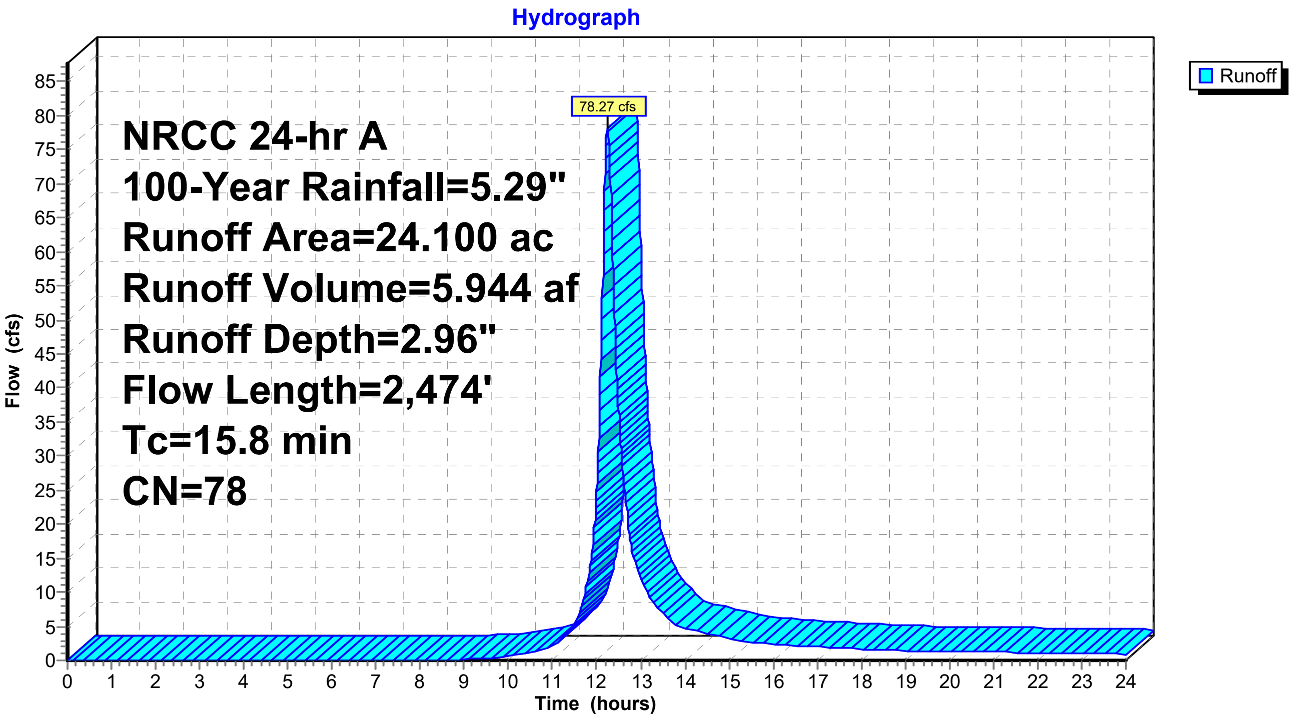
Runoff = 78.27 cfs @ 12.24 hrs, Volume= 5.944 af, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.430	98	Water Surface, HSG D
1.730	98	Paved parking, HSG D
0.090	98	Paved parking HSG D
2.150	80	>75% Grass cover, Good, HSG D
2.300	78	Meadow, non-grazed, HSG D
10.900	73	Brush, Good, HSG D
6.000	80	>75% Grass cover, Good, HSG D
0.500	80	>75% Grass cover, Good, HSG D
24.100	78	Weighted Average
21.850		90.66% Pervious Area
2.250		9.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	100	0.0350	0.18		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.7	192	0.0830	4.64		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.8	230	0.0870	4.75		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.1	180	0.0280	2.69		**Shallow Concentrated Flow, Shallow concentrated** Unpaved Kv= 16.1 fps
1.1	1,194	0.0750	17.98	413.55	**Channel Flow, Channel Flow** Area= 23.0 sf Perim= 24.0' r= 0.96' n= 0.022 Earth, clean & straight
2.2	165	0.0600	1.22		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	413	0.0720	17.36	260.42	**Channel Flow, Channel Flow** Area= 15.0 sf Perim= 16.0' r= 0.94' n= 0.022 Earth, clean & straight
15.8	2,474	Total			

Subcatchment 2: 2 (good)



Summary for Subcatchment 3: 3 (good)

CarlsonPlanXYPos|641681.4005|1041128.2504|
CarlsonSurface||

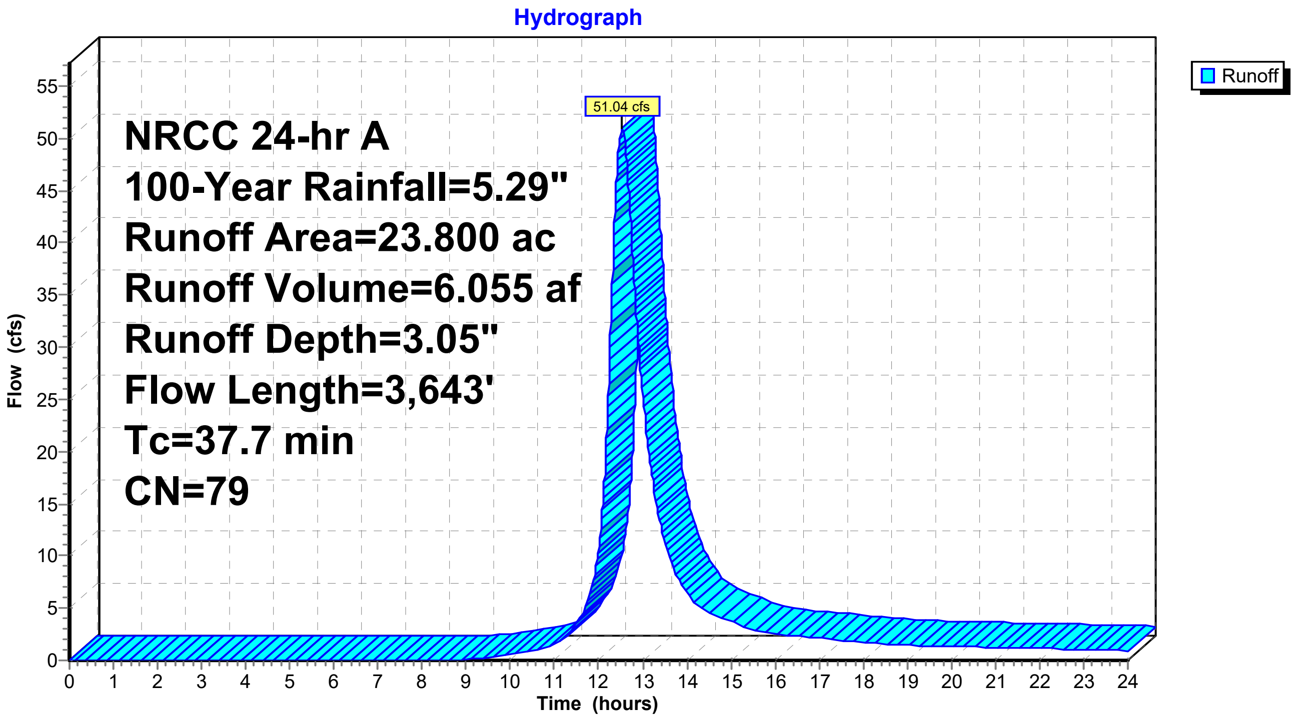
Runoff = 51.04 cfs @ 12.53 hrs, Volume= 6.055 af, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.440	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
0.430	98	Paved parking, HSG D
12.660	78	Meadow, non-grazed, HSG D
2.500	73	Brush, Good, HSG D
5.720	80	>75% Grass cover, Good, HSG D
1.520	80	>75% Grass cover, Good, HSG D
23.800	79	Weighted Average
22.930		96.34% Pervious Area
0.870		3.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
11.5	85	0.0200	0.12		**Sheet Flow, Sheet Flow** Cultivated: Residue>20% n= 0.170 P2= 2.19"
5.0	385	0.0200	1.27		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
10.2	1,400	0.0640	2.28		**Shallow Concentrated Flow, Shallow Concentrated** Cultivated Straight Rows Kv= 9.0 fps
6.4	560	0.0840	1.45		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	435	0.0640	16.37	245.52	**Channel Flow, Channel Flow** Area= 15.0 sf Perim= 16.0' r= 0.94' n= 0.022 Earth, clean & straight
0.9	209	0.0570	3.84		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
2.2	197	0.0870	1.47		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.2	125	0.0320	11.48	286.96	**Channel Flow, Channel Flow** Area= 25.0 sf Perim= 27.0' r= 0.93' n= 0.022 Earth, clean & straight
0.6	232	0.0100	6.42	160.42	**Channel Flow, Channel Flow** Area= 25.0 sf Perim= 27.0' r= 0.93' n= 0.022 Earth, clean & straight
37.7	3,643	Total			

Subcatchment 3: 3 (good)



Summary for Subcatchment 17: Lot #9 (good)

CarlsonPlanXYPos|642702.7045|1040980.9144|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

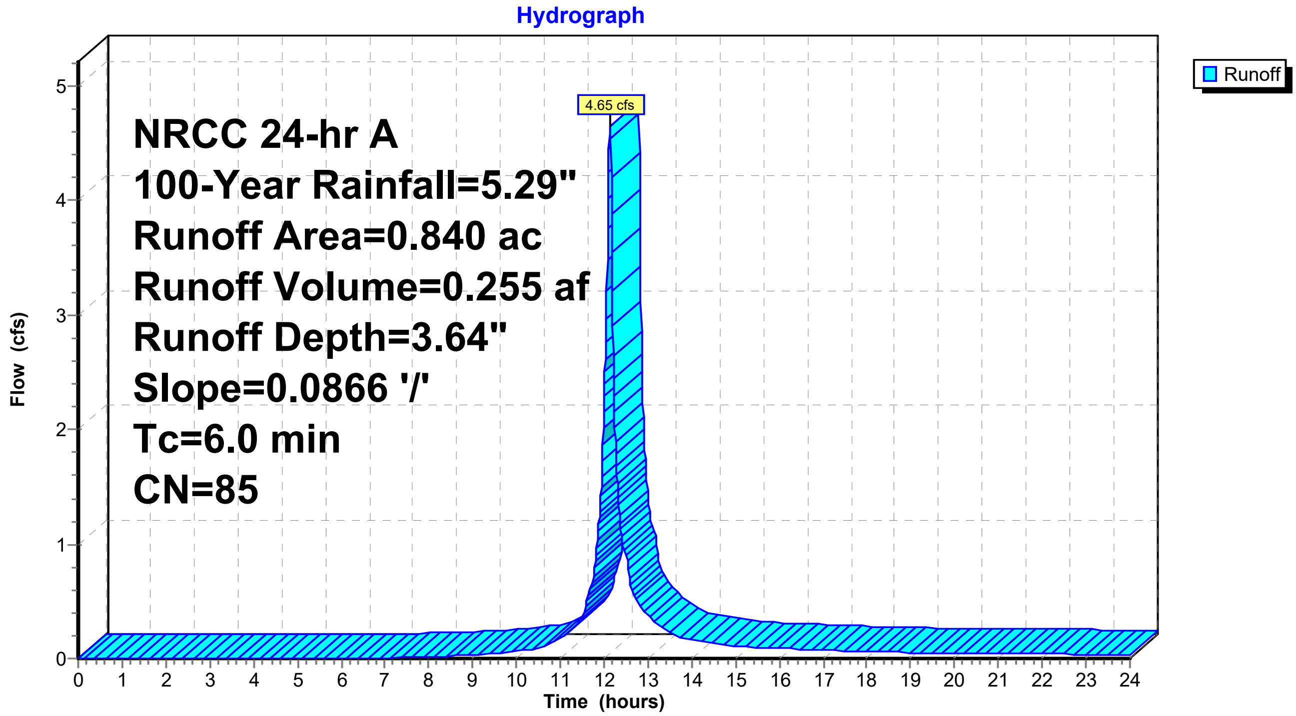
Runoff = 4.65 cfs @ 12.13 hrs, Volume= 0.255 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.540	80	>75% Grass cover, Good, HSG D
0.080	80	>75% Grass cover, Good, HSG D
0.840	85	Weighted Average
0.620		73.81% Pervious Area
0.220		26.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0866			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 17: Lot #9 (good)



Summary for Subcatchment 18: Lot #8 (good)

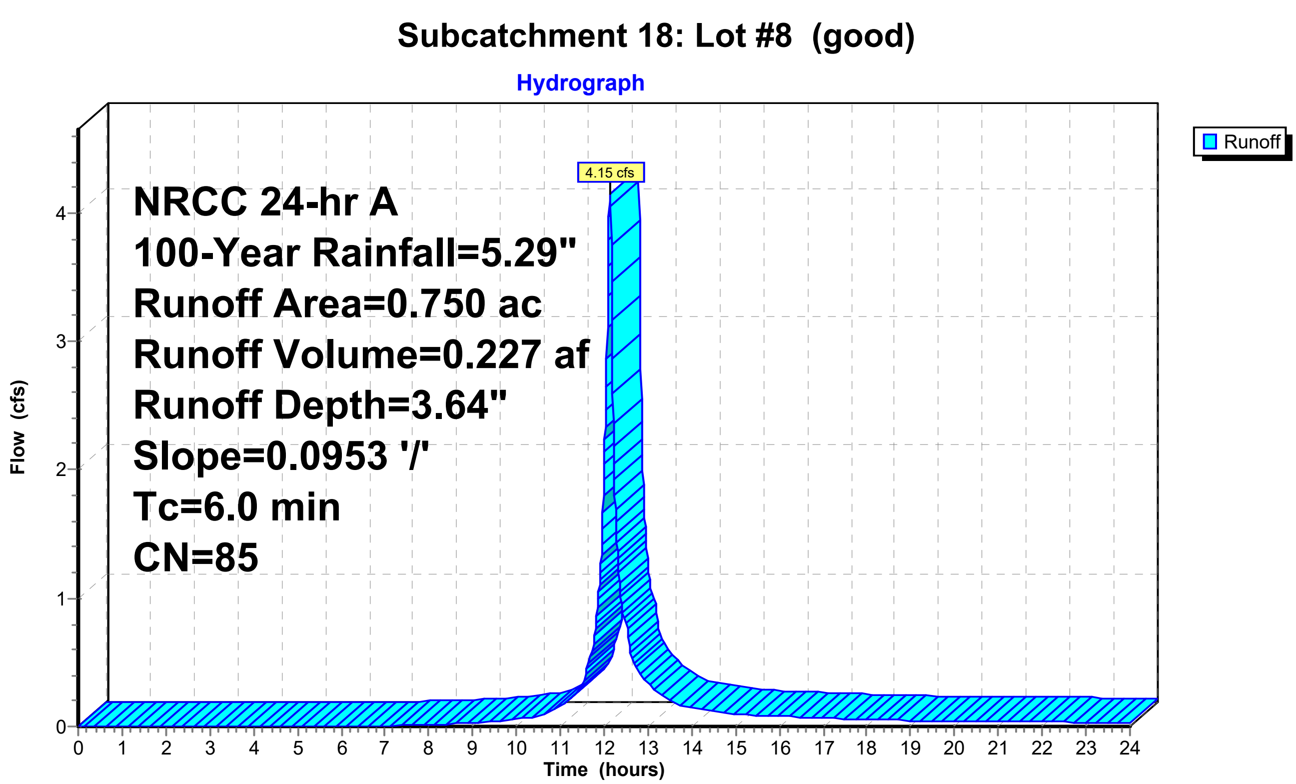
CarlsonPlanXYPos|642920.0895|1040980.2941|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

Runoff = 4.15 cfs @ 12.13 hrs, Volume= 0.227 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.480	80	>75% Grass cover, Good, HSG D
0.050	80	>75% Grass cover, Good, HSG D
0.750	85	Weighted Average
0.530		70.67% Pervious Area
0.220		29.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0953			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			



Summary for Subcatchment 19: Lot #7 (good)

CarlsonPlanXYPos|643107.1559|1040981.5048|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

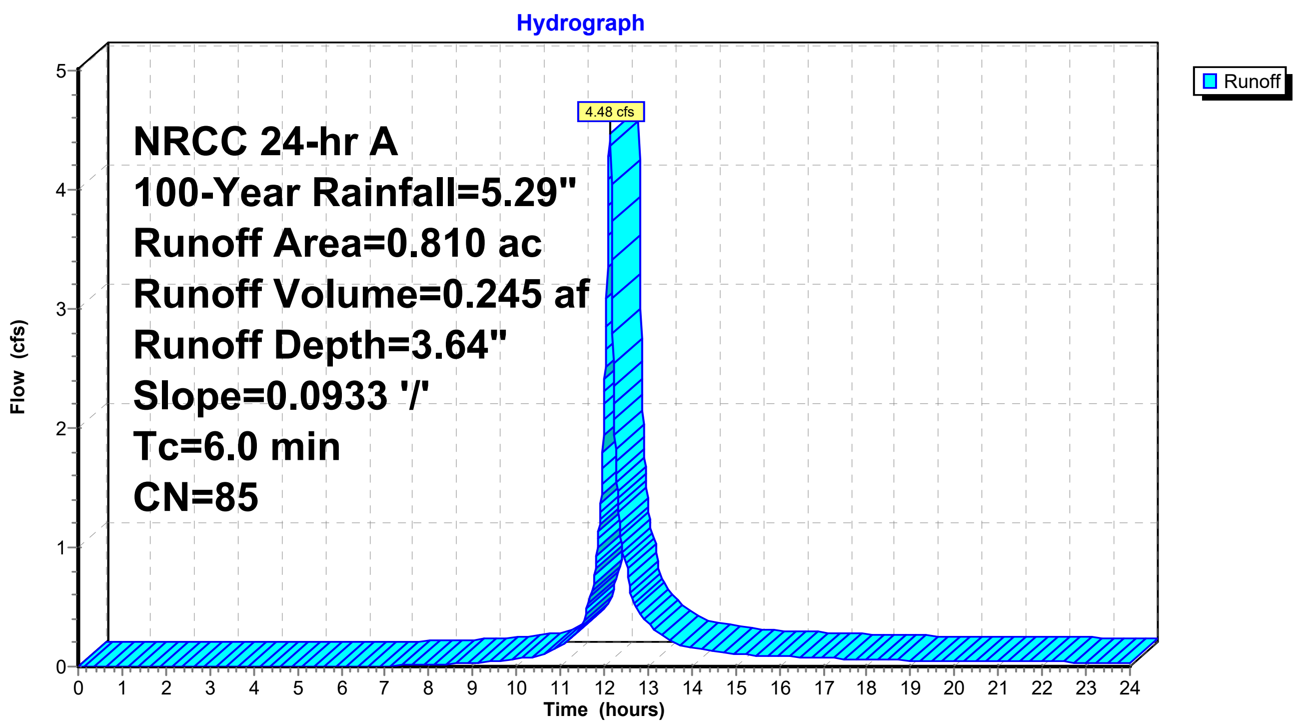
Runoff = 4.48 cfs @ 12.13 hrs, Volume= 0.245 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.590	80	>75% Grass cover, Good, HSG D
0.810	85	Weighted Average
0.590		72.84% Pervious Area
0.220		27.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0933			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 19: Lot #7 (good)



Summary for Subcatchment 20: Lot #6 (good)

CarlsonPlanXYPos|643312.2303|1040980.2663|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

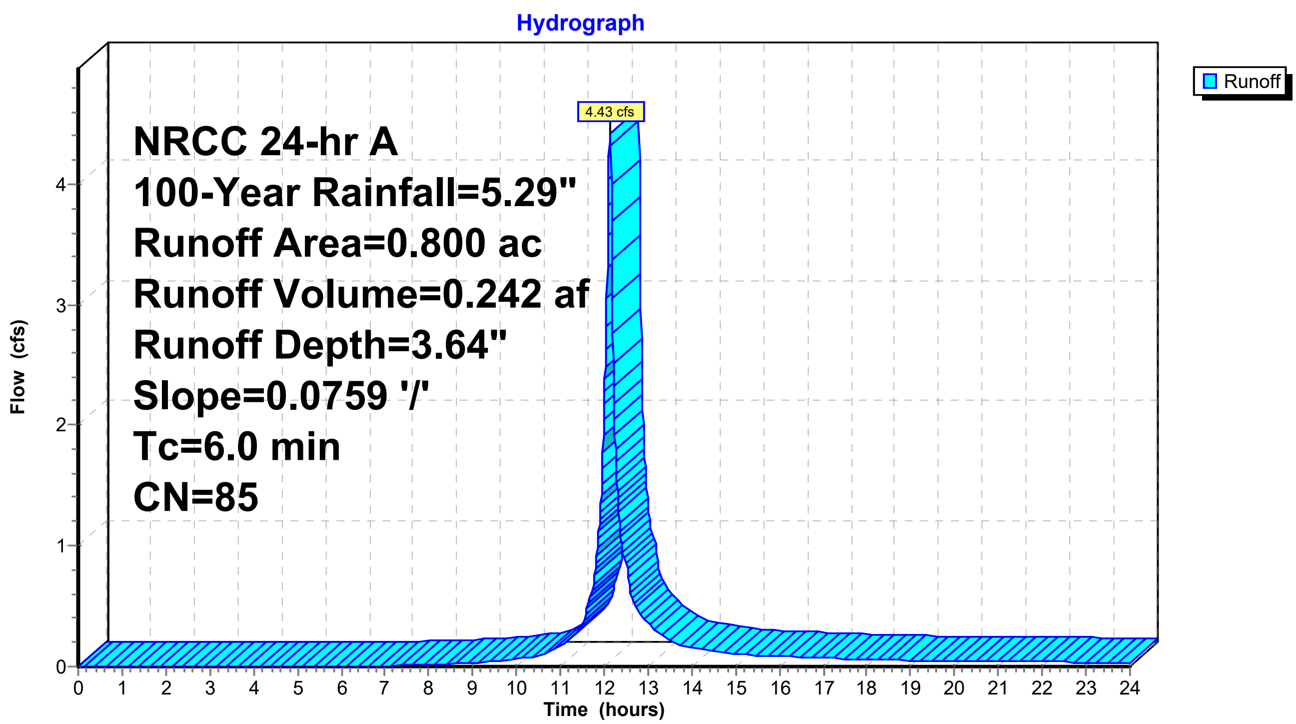
Runoff = 4.43 cfs @ 12.13 hrs, Volume= 0.242 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.580	80	>75% Grass cover, Good, HSG D
0.800	85	Weighted Average
0.580		72.50% Pervious Area
0.220		27.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0759			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 20: Lot #6 (good)



Summary for Subcatchment 21: Lot #5 (good)

CarlsonPlanXYPos|643492.4579|1040982.7482|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

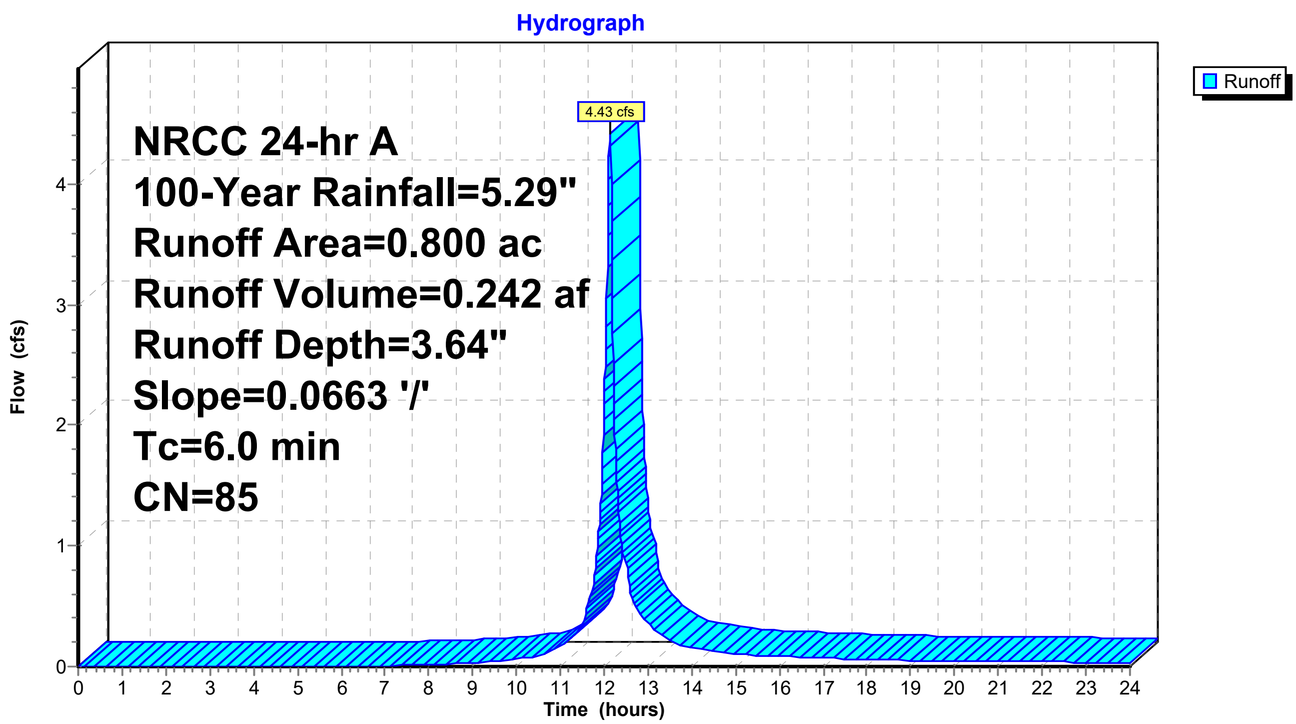
Runoff = 4.43 cfs @ 12.13 hrs, Volume= 0.242 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.580	80	>75% Grass cover, Good, HSG D
0.800	85	Weighted Average
0.580		72.50% Pervious Area
0.220		27.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0663			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 21: Lot #5 (good)



Summary for Subcatchment 22: Lot #4 (good)

CarlsonPlanXYPos|643706.8551|1040983.3562|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

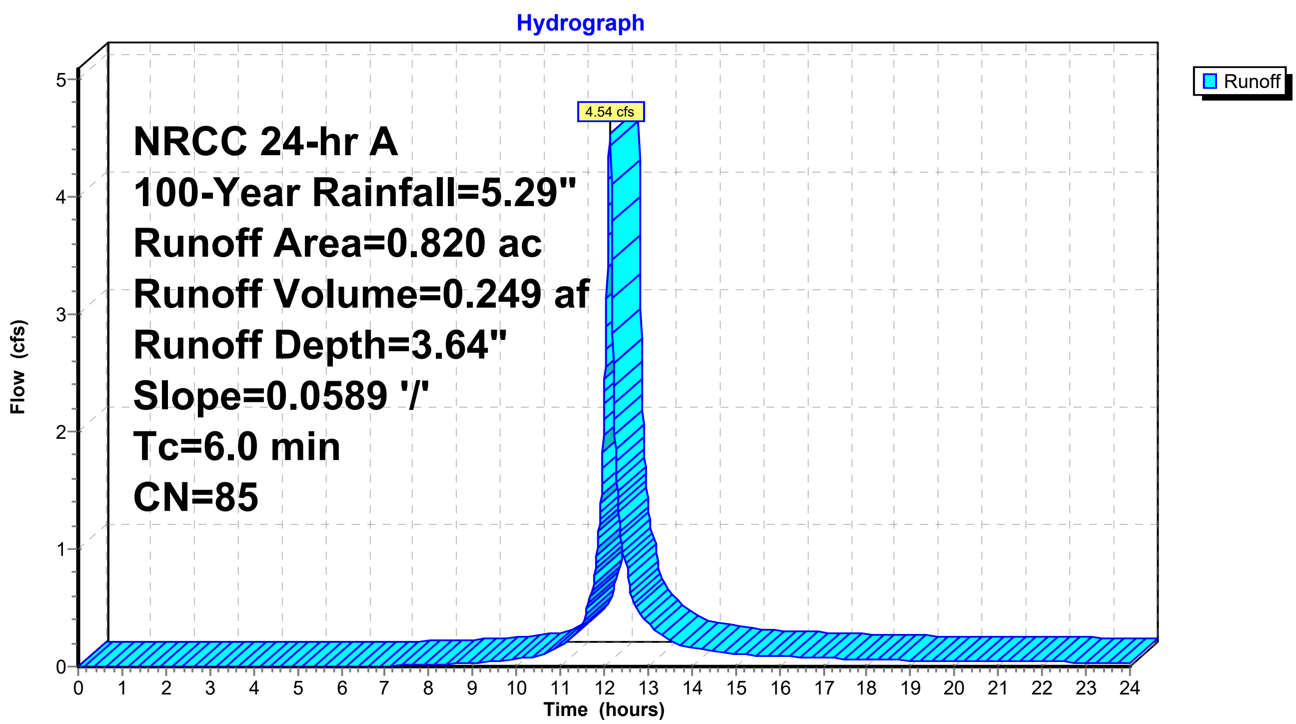
Runoff = 4.54 cfs @ 12.13 hrs, Volume= 0.249 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.600	80	>75% Grass cover, Good, HSG D
0.820	85	Weighted Average
0.600		73.17% Pervious Area
0.220		26.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0589			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 22: Lot #4 (good)



Summary for Subcatchment 23: Lot #3 (good)

CarlsonPlanXYPos|643896.4054|1040980.2593|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

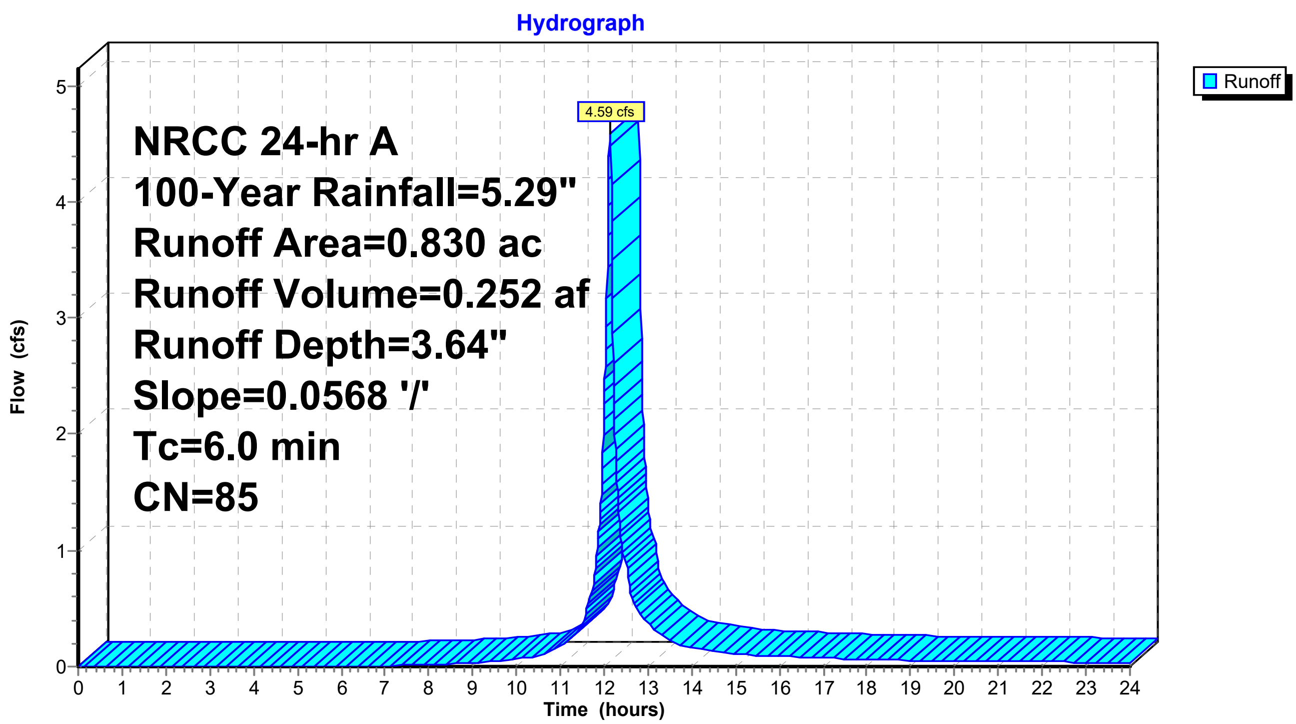
Runoff = 4.59 cfs @ 12.13 hrs, Volume= 0.252 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.610	80	>75% Grass cover, Good, HSG D
0.830	85	Weighted Average
0.610		73.49% Pervious Area
0.220		26.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0568			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 23: Lot #3 (good)



Summary for Subcatchment 24: Lot #2 (good)

CarlsonPlanXYPos|644102.7886|1040984.5776|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

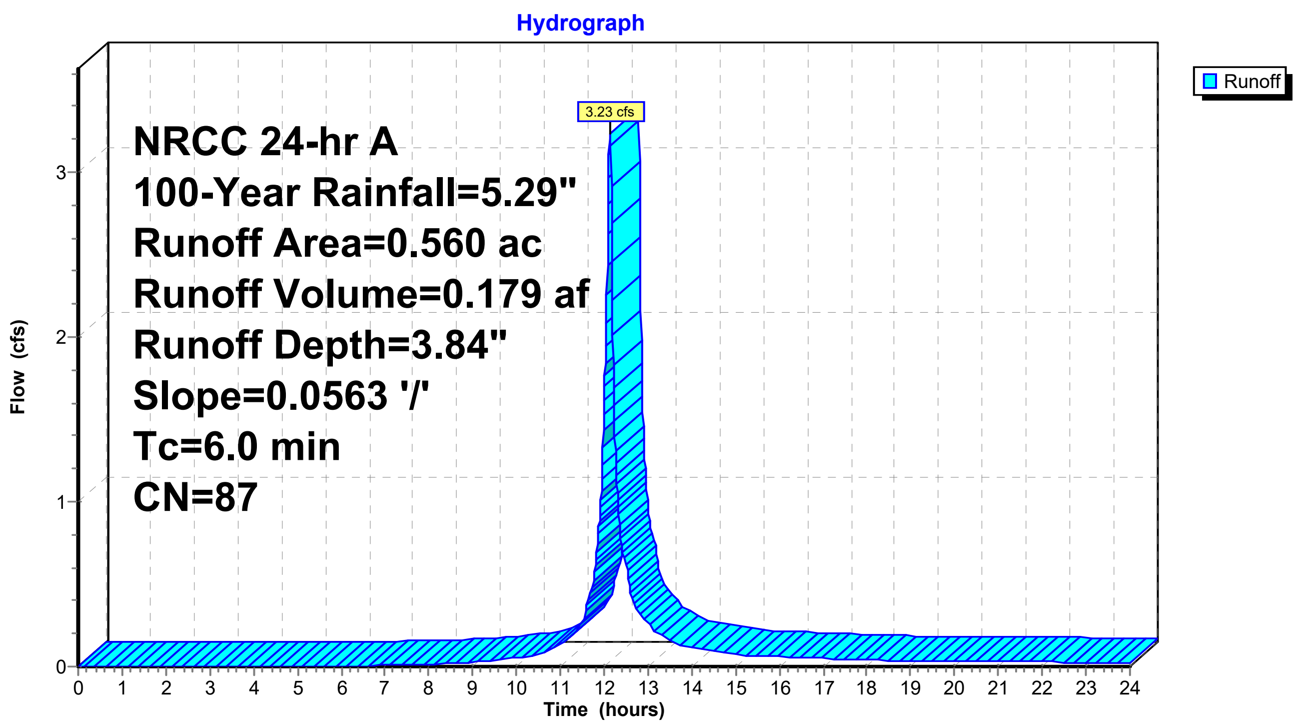
Runoff = 3.23 cfs @ 12.13 hrs, Volume= 0.179 af, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.340	80	>75% Grass cover, Good, HSG D
0.560	87	Weighted Average
0.340		60.71% Pervious Area
0.220		39.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0		0.0563			**Lag/CN Method,**
6.0					**Direct Entry,**
6.0	0	Total			

Subcatchment 24: Lot #2 (good)



Summary for Subcatchment 25: Lot #1 (good)

CarlsonPlanXYPos|644284.7705|1040971.5435|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

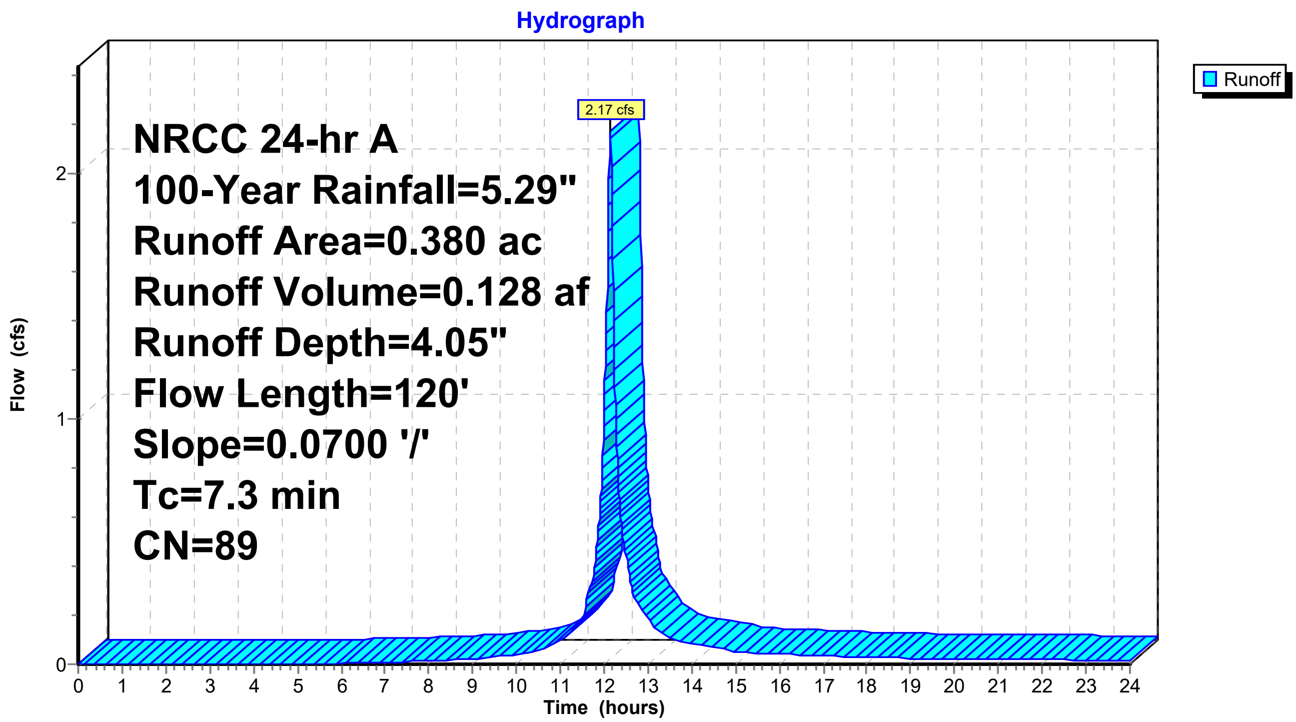
Runoff = 2.17 cfs @ 12.14 hrs, Volume= 0.128 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.200	98	Paved parking, HSG D
0.180	80	>75% Grass cover, Good, HSG D
0.380	89	Weighted Average
0.180		47.37% Pervious Area
0.200		52.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0700	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.1	20	0.0700	4.26		**Shallow Concentrated Flow, Shallow Concentated** Unpaved Kv= 16.1 fps
7.3	120	Total			

Subcatchment 25: Lot #1 (good)



Summary for Subcatchment 26: 26 (update Tc to Channel flow?)

CarlsonPlanXYPos|644192.3159|1041141.7328|
CarlsonSurface|C:\Users\Office 2\Dropbox (Marks Engineering)\2020 PROJECTS\20-243 Licciardello, Angelo - 3535 East Lake Rd. - To Cdga To Hopewell\Carlson Files\ex topo.tin|

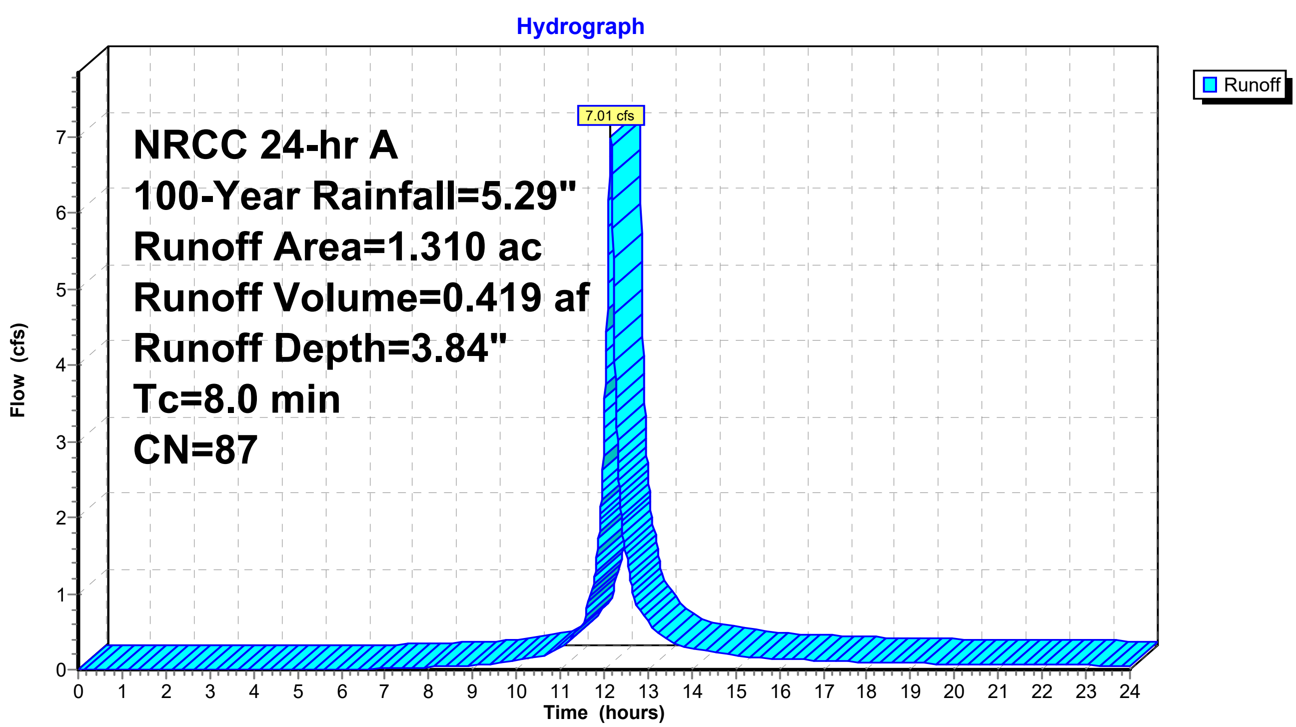
Runoff = 7.01 cfs @ 12.15 hrs, Volume= 0.419 af, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.490	98	Paved parking, HSG D
0.820	80	>75% Grass cover, Good, HSG D
1.310	87	Weighted Average
0.820		62.60% Pervious Area
0.490		37.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0					**Direct Entry,**

Subcatchment 26: 26 (update Tc to Channel flow?)



Summary for Subcatchment 37S: 1

CarlsonPlanXYPos|641307.9585|1041455.1221|
CarlsonSurface||

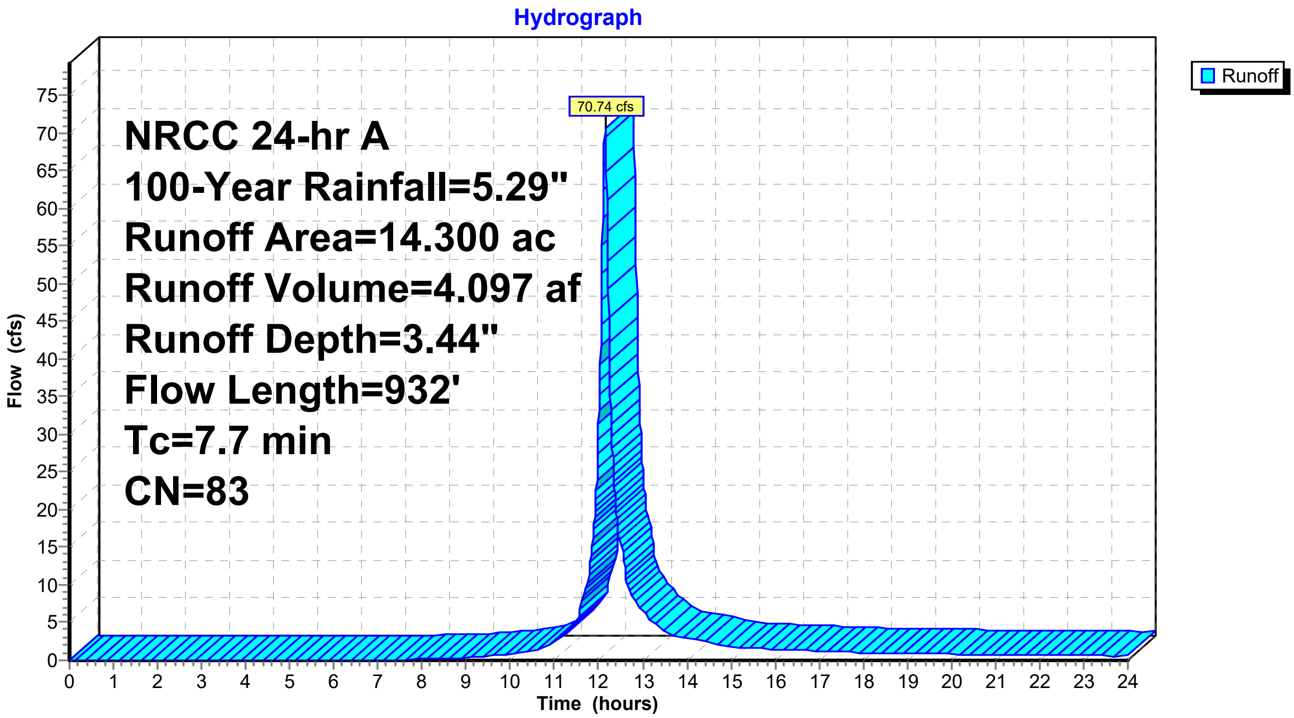
Runoff = 70.74 cfs @ 12.15 hrs, Volume= 4.097 af, Depth= 3.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.260	98	Water Surface HSG B
1.860	98	Paved parking HSG B
1.340	98	Paved parking HSG C
1.100	61	>75% Grass cover, Good, HSG B
9.180	80	>75% Grass cover, Good, HSG D
0.560	73	Brush, Good, HSG D
14.300	83	Weighted Average
10.840		75.80% Pervious Area
3.460		24.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	15	0.0200	0.78		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.19"
3.9	25	0.0200	0.11		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.3	81	0.0150	5.11	89.50	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
0.1	58	0.0340	7.70	134.75	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
0.2	132	0.0600	10.23	179.01	**Channel Flow, Channel Flow** Area= 17.5 sf Perim= 36.0' r= 0.49' n= 0.022
1.1	80	0.0060	1.16		**Shallow Concentrated Flow, Shallow Concentrated** Grassed Waterway Kv= 15.0 fps
0.5	114	0.0040	3.61	4.43	**Pipe Channel, Pipe Channel** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Corrugated PP, smooth interior
0.5	113	0.0040	4.07	7.20	**Pipe Channel, Pipe Channel** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Corrugated PP, smooth interior
0.1	35	0.0040	4.93	15.50	**Pipe Channel, Pipe Channel** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
0.7	279	0.0080	6.98	21.92	**Pipe Channel, Pipe Channel** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
7.7	932	Total			

Subcatchment 37S: 1



Summary for Subcatchment 46S: Portion of Lot #1

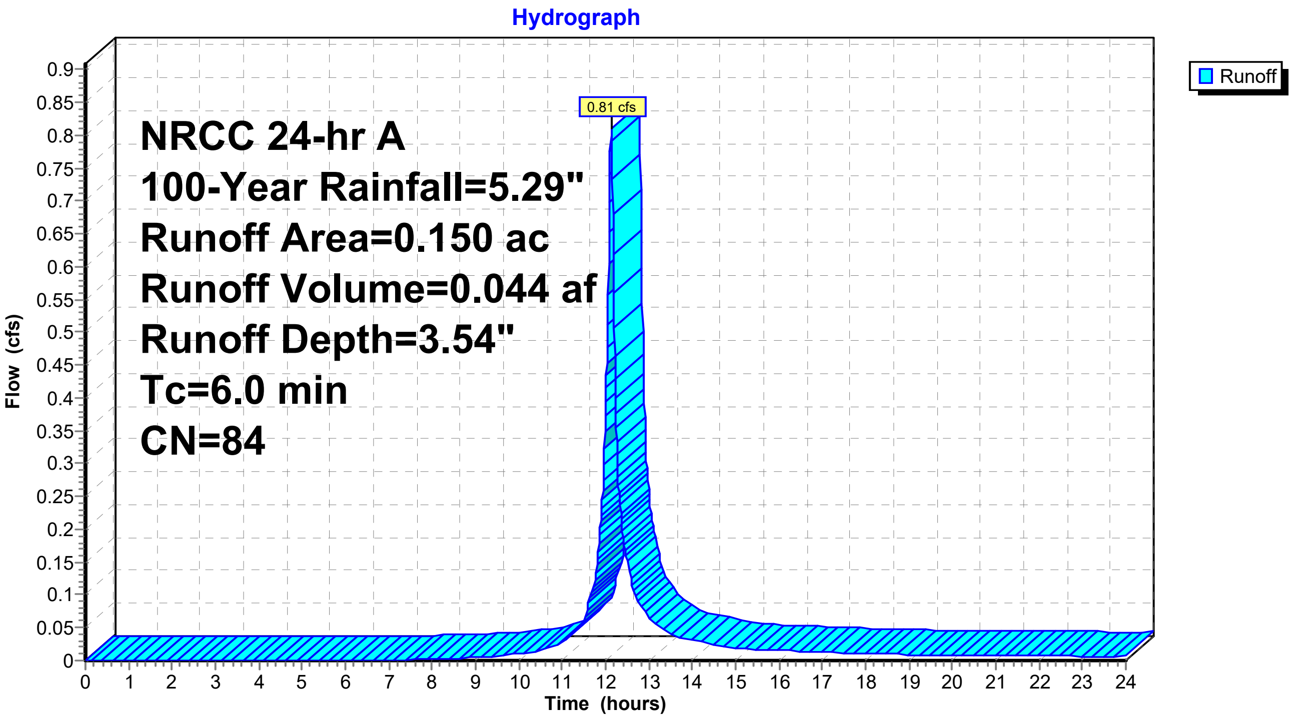
Runoff = 0.81 cfs @ 12.13 hrs, Volume= 0.044 af, Depth= 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
NRCC 24-hr A 100-Year Rainfall=5.29"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG D
0.120	80	>75% Grass cover, Good, HSG D
0.150	84	Weighted Average
0.120		80.00% Pervious Area
0.030		20.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 46S: Portion of Lot #1



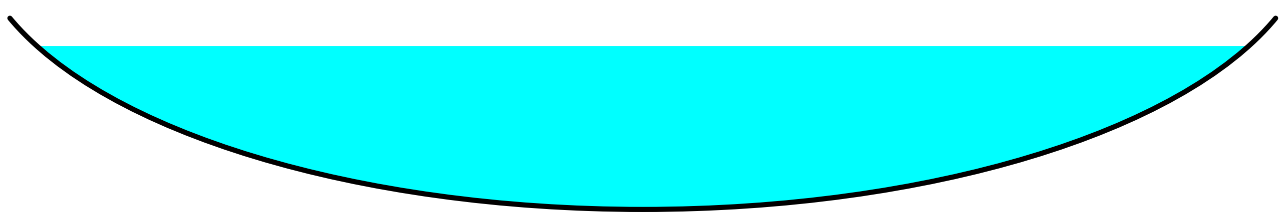
Summary for Reach 12R: Swale to off-site

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth > 2.68" for 100-Year event
Inflow = 41.42 cfs @ 13.35 hrs, Volume= 17.606 af
Outflow = 41.41 cfs @ 13.37 hrs, Volume= 17.605 af, Atten= 0%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.81 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 3.9 min

Peak Storage= 4,322 cf @ 13.37 hrs
Average Depth at Peak Storage= 0.85'
Bank-Full Depth= 1.00' Flow Area= 18.7 sf, Capacity= 58.17 cfs

28.00' x 1.00' deep Parabolic Channel, n= 0.030 Short grass
Length= 293.0' Slope= 0.0068 '/'
Inlet Invert= 703.00', Outlet Invert= 701.00'



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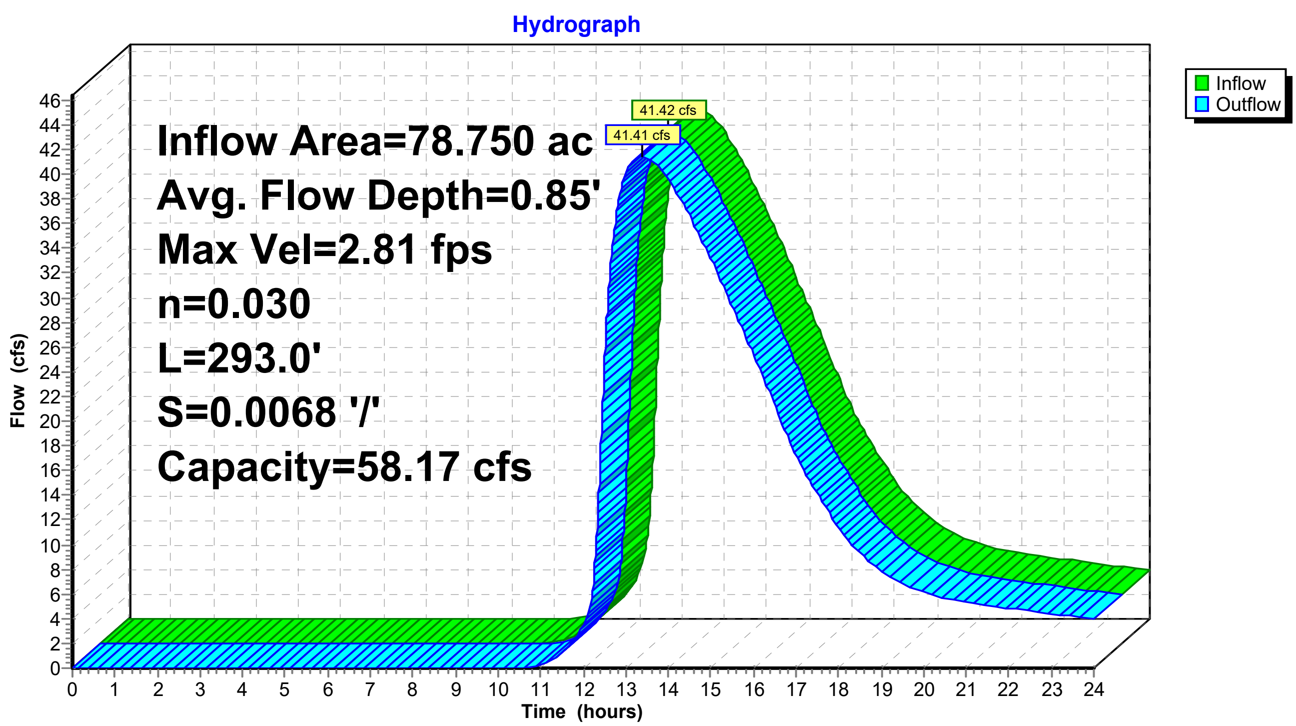
Reach 12R: Swale to off-site



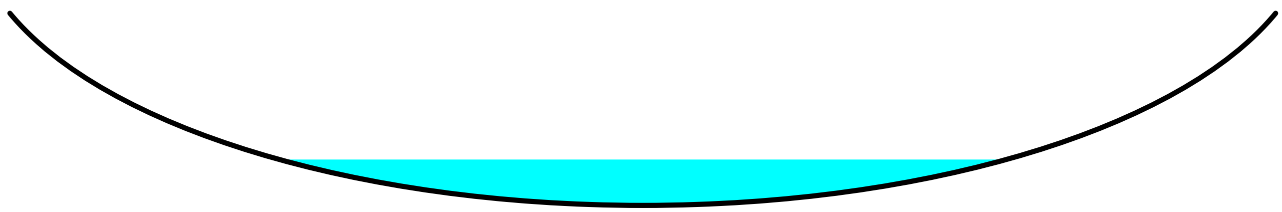
Summary for Reach 16R: Northside swale

Inflow Area = 1.310 ac, 37.40% Impervious, Inflow Depth = 3.38" for 100-Year event
Inflow = 5.10 cfs @ 12.22 hrs, Volume= 0.369 af
Outflow = 5.01 cfs @ 12.25 hrs, Volume= 0.369 af, Atten= 2%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.31 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 7.9 min

Peak Storage= 761 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 111.61 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 655.0' Slope= 0.0885 '/'
Inlet Invert= 804.00', Outlet Invert= 746.00'



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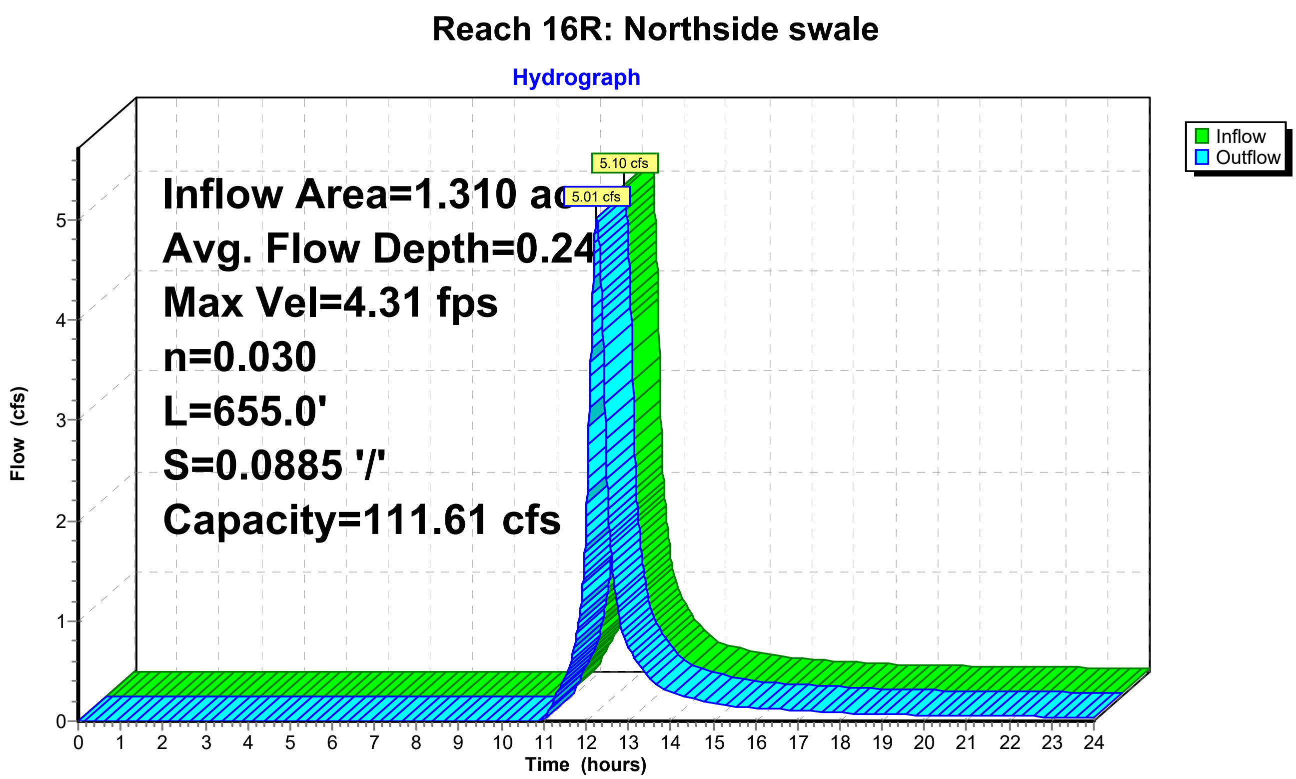


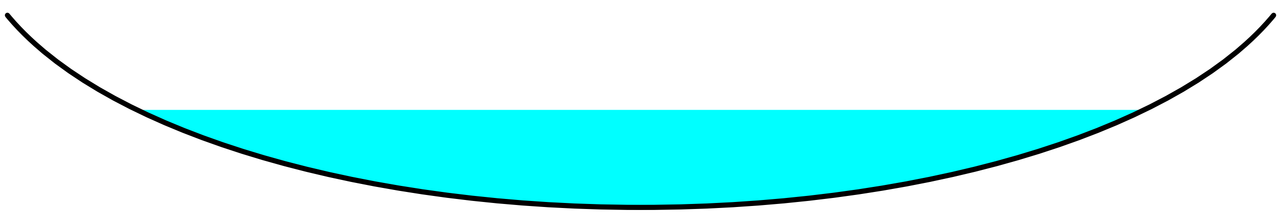
Summary for Reach 17R: Southside Swale

Inflow Area = 6.740 ac, 29.53% Impervious, Inflow Depth = 3.66" for 100-Year event
Inflow = 25.42 cfs @ 12.15 hrs, Volume= 2.055 af
Outflow = 25.05 cfs @ 12.17 hrs, Volume= 2.055 af, Atten= 1%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.91 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 2.12 fps, Avg. Travel Time= 5.6 min

Peak Storage= 2,573 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 108.12 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 710.0' Slope= 0.0831 '/'
Inlet Invert= 804.00', Outlet Invert= 745.00'



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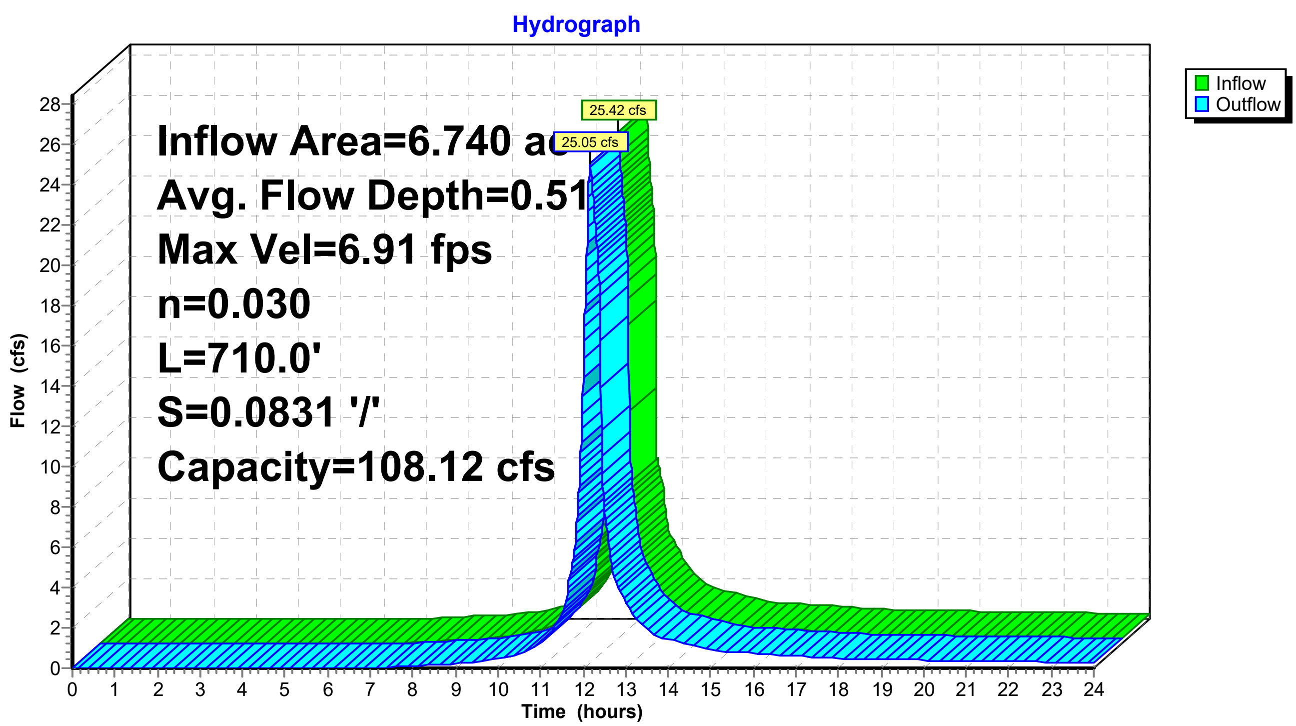
Reach 17R: Southside Swale



Summary for Pond 10P: Proposed 36" Culvert

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth = 2.69" for 100-Year event
Inflow = 152.87 cfs @ 12.50 hrs, Volume= 17.630 af
Outflow = 41.58 cfs @ 13.19 hrs, Volume= 17.607 af, Atten= 73%, Lag= 41.6 min
Primary = 13.16 cfs @ 12.92 hrs, Volume= 9.131 af
Secondary = 28.51 cfs @ 13.23 hrs, Volume= 8.476 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 706.99' @ 13.34 hrs Surf.Area= 256,337 sf Storage= 329,245 cf

Plug-Flow detention time= 121.2 min calculated for 17.607 af (100% of inflow)
Center-of-Mass det. time= 120.4 min (968.6 - 848.2)

Volume	Invert	Avail.Storage	Storage Description
#1	704.50'	609,456 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

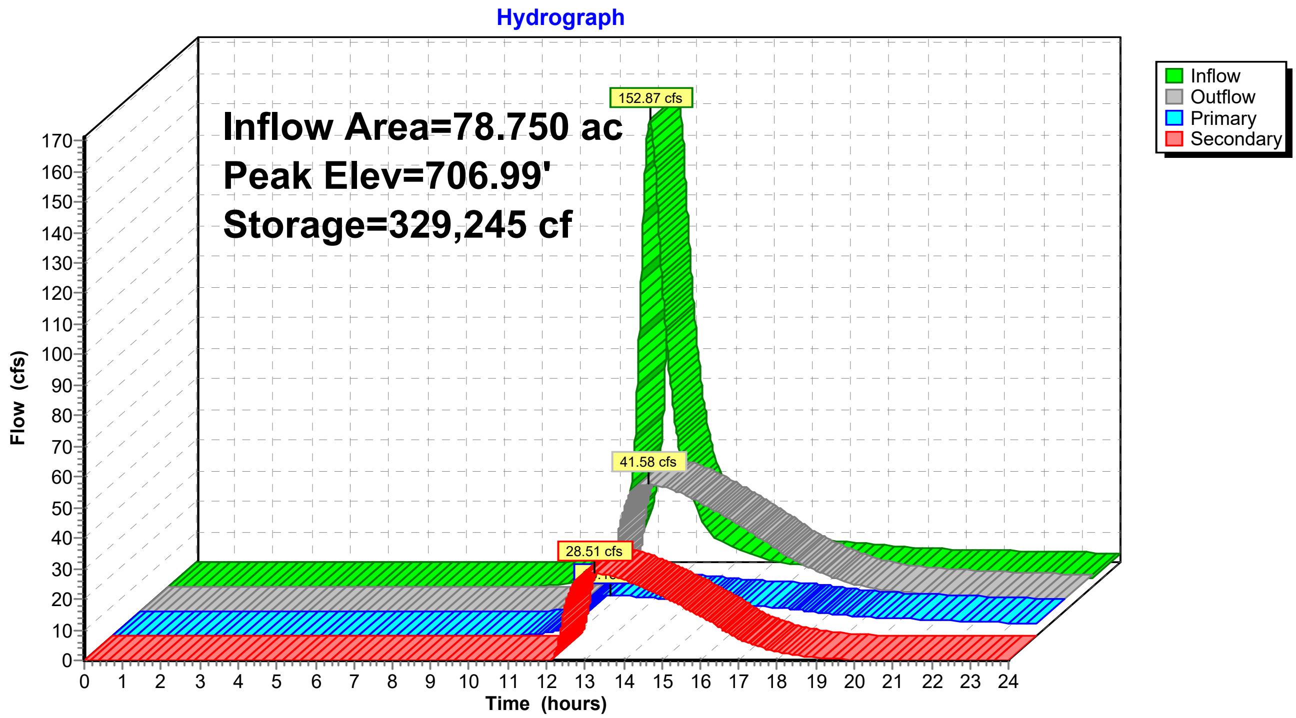
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
704.50	9,287	0	0
705.00	39,370	12,164	12,164
706.00	170,682	105,026	117,190
707.00	256,925	213,804	330,994
708.00	300,000	278,463	609,456

Device	Routing	Invert	Outlet Devices
#1	Primary	704.50'	**36.0" Round 36" Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 704.50' / 704.00' S= 0.0041 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Secondary	705.50'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=12.99 cfs @ 12.92 hrs HW=706.89' TW=706.60' (Dynamic Tailwater)
└─**1=36" Culvert** (Outlet Controls 12.99 cfs @ 2.95 fps)

Secondary OutFlow Max=28.45 cfs @ 13.23 hrs HW=706.99' TW=706.72' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 28.45 cfs @ 1.91 fps)

Pond 10P: Proposed 36" Culvert



Summary for Pond 11P: Proposed 36" Culvert

Inflow Area = 78.750 ac, 0.89% Impervious, Inflow Depth > 2.68" for 100-Year event
Inflow = 41.58 cfs @ 13.19 hrs, Volume= 17.607 af
Outflow = 41.42 cfs @ 13.35 hrs, Volume= 17.606 af, Atten= 0%, Lag= 9.6 min
Primary = 41.42 cfs @ 13.35 hrs, Volume= 17.606 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 706.73' @ 13.35 hrs Surf.Area= 7,010 sf Storage= 10,762 cf

Plug-Flow detention time= 4.1 min calculated for 17.606 af (100% of inflow)
Center-of-Mass det. time= 4.0 min (972.6 - 968.6)

Volume	Invert	Avail.Storage	Storage Description
#1	703.30'	12,772 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

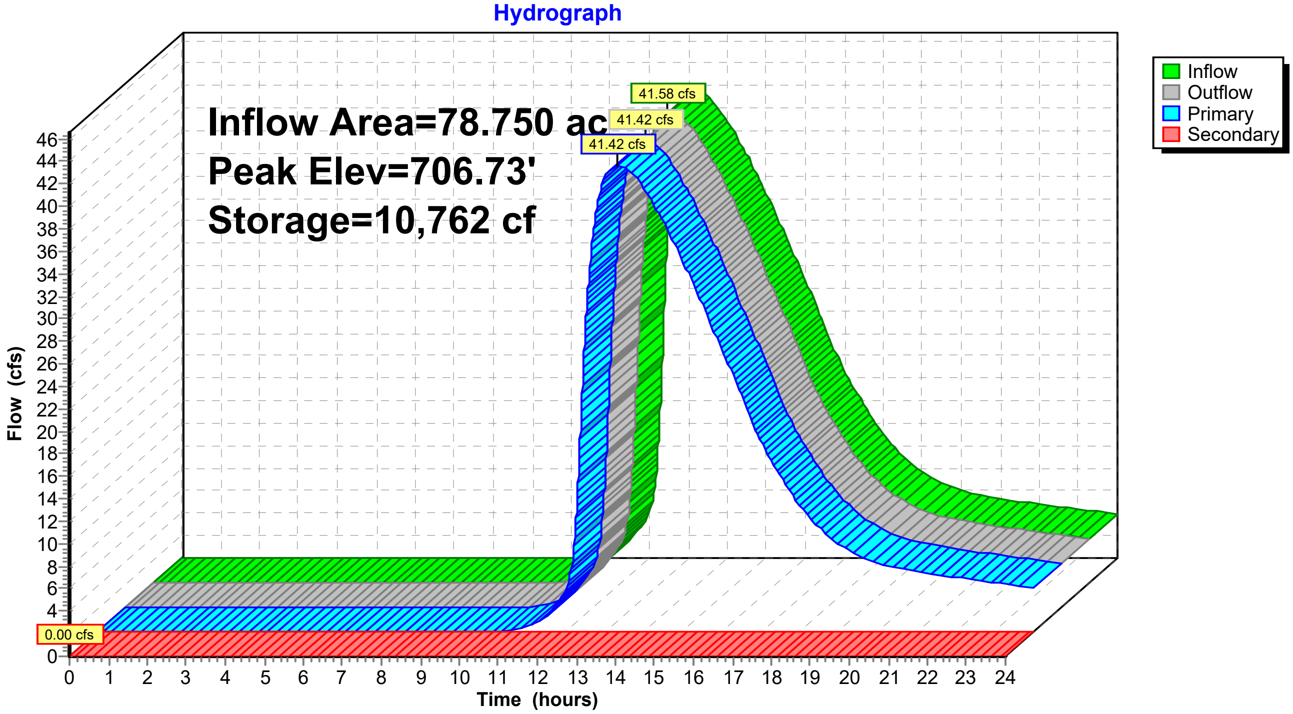
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
703.30	707	0	0
704.00	1,575	799	799
705.00	2,882	2,229	3,027
706.00	4,304	3,593	6,620
707.00	8,000	6,152	12,772

Device	Routing	Invert	Outlet Devices
#1	Primary	703.30'	**36.0" Round 36" cuvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 703.30' / 703.00' S= 0.0046 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf
#2	Secondary	706.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=41.42 cfs @ 13.35 hrs HW=706.73' TW=703.85' (Dynamic Tailwater)
└**1=36" cuvert** (Barrel Controls 41.42 cfs @ 6.42 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=703.30' TW=703.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 11P: Proposed 36" Culvert



Summary for Pond 17P: Bioswale (good)

Inflow Area = 6.740 ac, 29.53% Impervious, Inflow Depth = 3.67" for 100-Year event
Inflow = 25.43 cfs @ 12.15 hrs, Volume= 2.059 af
Outflow = 25.42 cfs @ 12.15 hrs, Volume= 2.057 af, Atten= 0%, Lag= 0.1 min
Discarded = 0.00 cfs @ 12.15 hrs, Volume= 0.002 af
Primary = 25.42 cfs @ 12.15 hrs, Volume= 2.055 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 808.54' @ 12.15 hrs Surf.Area= 491 sf Storage= 409 cf

Plug-Flow detention time= 1.7 min calculated for 2.057 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (800.6 - 799.4)

Volume	Invert	Avail.Storage	Storage Description
#1	806.50'	2,012 cf	**SWALE STORAGE ABOVE BOTTOM (Conic)** Listed below

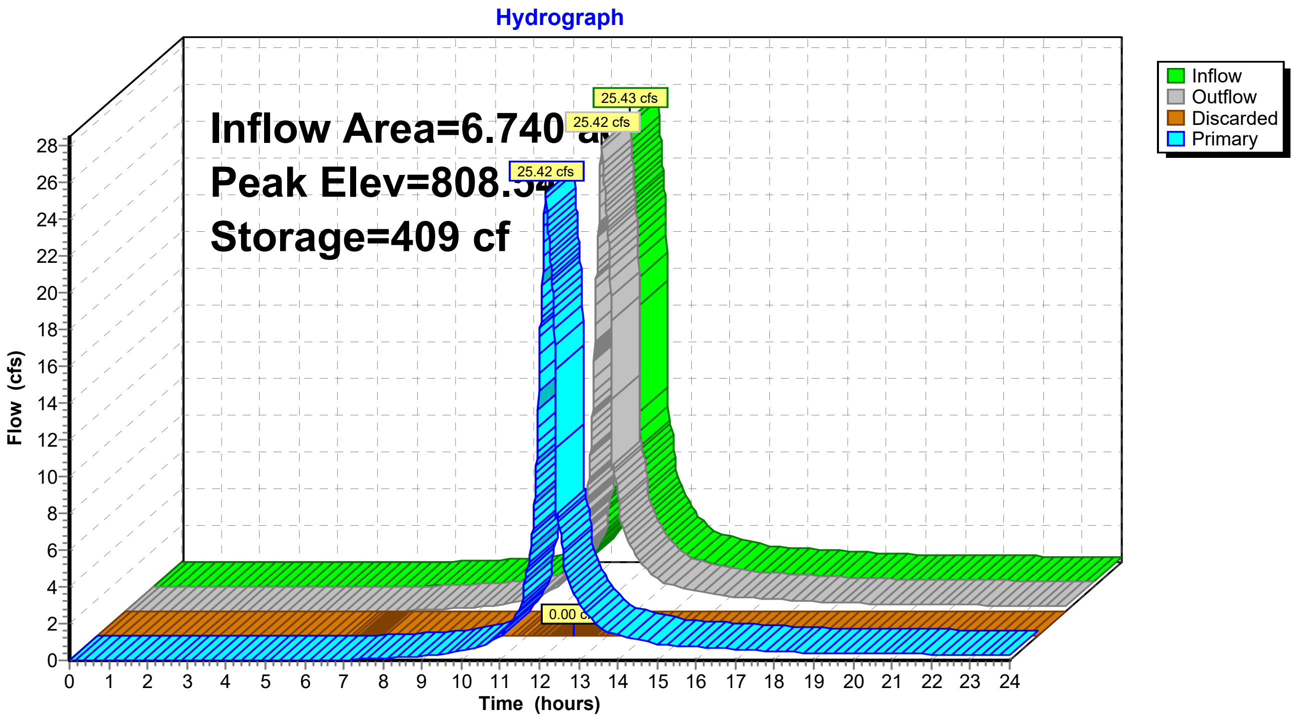
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
806.50	0	0	0	0
809.00	600	500	500	610
809.50	6,500	1,512	2,012	6,510

Device	Routing	Invert	Outlet Devices
#1	Discarded	806.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Primary	807.00'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.15 hrs HW=808.54' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=25.39 cfs @ 12.15 hrs HW=808.54' TW=804.50' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 25.39 cfs @ 3.29 fps)

Pond 17P: Bioswale (good)



Summary for Pond 18P: Bioswale (good)

Inflow Area = 5.900 ac, 30.00% Impervious, Inflow Depth = 3.67" for 100-Year event
Inflow = 21.19 cfs @ 12.17 hrs, Volume= 1.805 af
Outflow = 21.19 cfs @ 12.17 hrs, Volume= 1.805 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.00 cfs @ 12.17 hrs, Volume= 0.001 af
Primary = 21.19 cfs @ 12.17 hrs, Volume= 1.804 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 815.68' @ 12.17 hrs Surf.Area= 415 sf Storage= 346 cf

Plug-Flow detention time= 0.9 min calculated for 1.805 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (799.6 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	814.50'	3,041 cf	**SWALE STORAGE (Conic)** Listed below

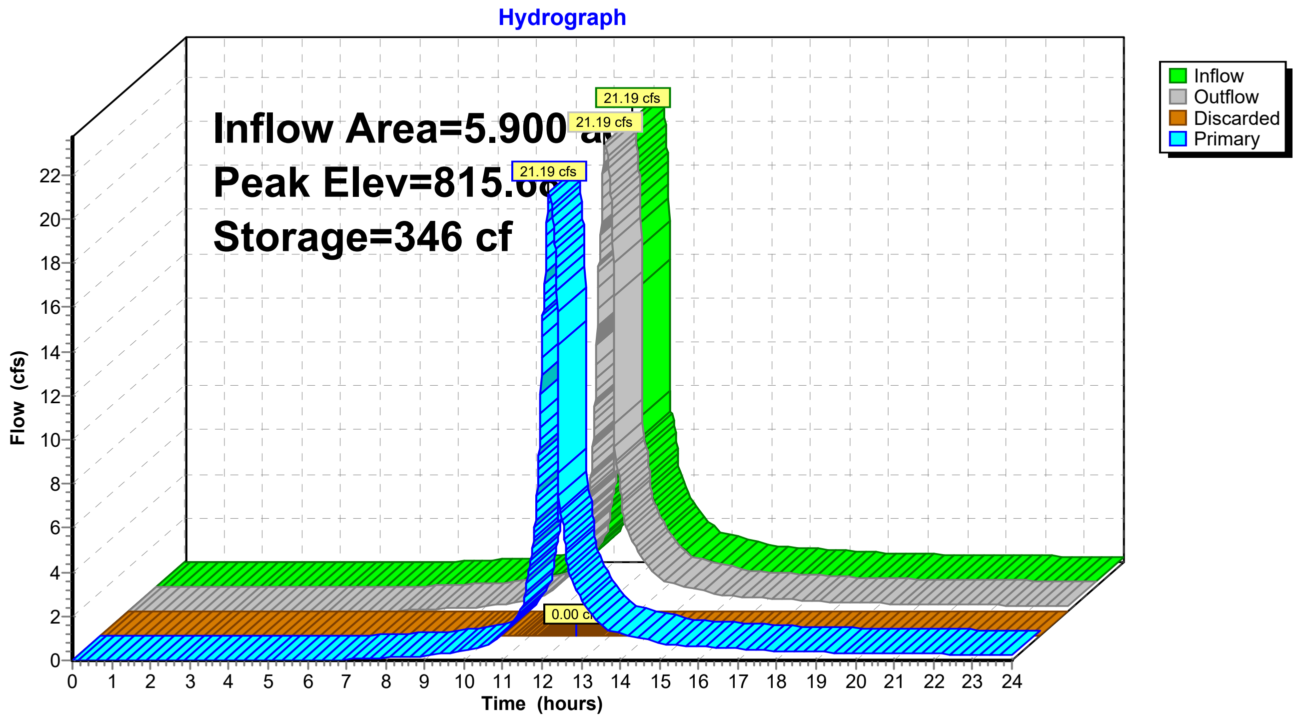
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
814.50	0	0	0	0
817.00	880	733	733	890
817.50	10,000	2,308	3,041	10,010

Device	Routing	Invert	Outlet Devices
#1	Discarded	814.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Device 3	814.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600
#3	Primary	812.50'	**24.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 812.50' / 812.00' S= 0.0109 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#4	Primary	814.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.17 hrs HW=815.68' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=21.18 cfs @ 12.17 hrs HW=815.68' TW=808.53' (Dynamic Tailwater)
├─**3=Culvert** (Passes 8.21 cfs of 17.63 cfs potential flow)
│ └─**2=Orifice/Grate** (Orifice Controls 8.21 cfs @ 3.48 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 12.97 cfs @ 2.65 fps)

Pond 18P: Bioswale (good)



Summary for Pond 19P: Bioswale (good)

Inflow Area = 5.150 ac, 30.10% Impervious, Inflow Depth = 3.68" for 100-Year event
Inflow = 19.71 cfs @ 12.16 hrs, Volume= 1.579 af
Outflow = 18.63 cfs @ 12.24 hrs, Volume= 1.579 af, Atten= 6%, Lag= 4.7 min
Discarded = 0.01 cfs @ 12.24 hrs, Volume= 0.001 af
Primary = 18.62 cfs @ 12.24 hrs, Volume= 1.578 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 830.27' @ 12.24 hrs Surf.Area= 1,866 sf Storage= 1,394 cf

Plug-Flow detention time= 0.6 min calculated for 1.579 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (799.0 - 798.4)

Volume	Invert	Avail.Storage	Storage Description
#1	829.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

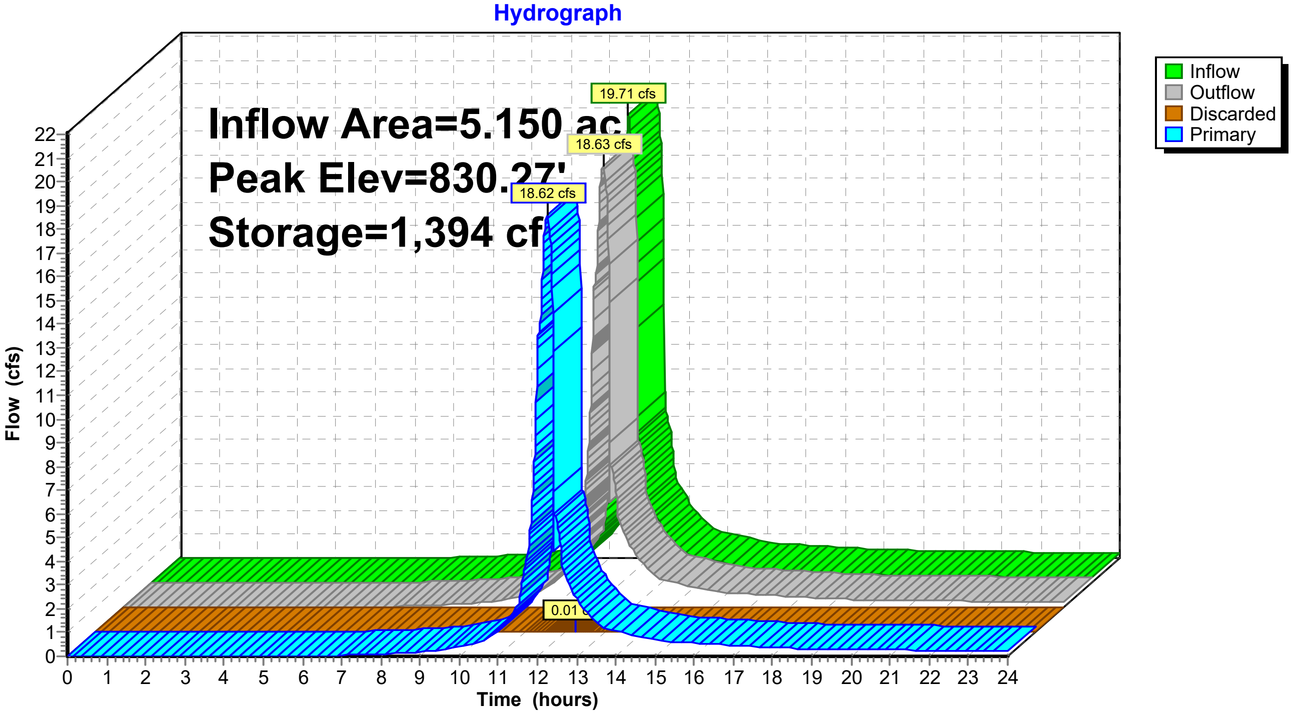
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
829.50	0	0	0	0
830.00	880	147	147	880
832.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Discarded	829.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 0.01'
#2	Device 3	829.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	827.50'	**18.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 827.50' / 827.00' S= 0.0109 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#4	Primary	829.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.01 cfs @ 12.24 hrs HW=830.27' (Free Discharge)
└─**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=18.62 cfs @ 12.24 hrs HW=830.27' TW=815.66' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 9.55 cfs @ 5.40 fps)
│ └─**2=Orifice/Grate** (Passes 9.55 cfs of 16.90 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 9.07 cfs @ 2.35 fps)

Pond 19P: Bioswale (good)



Summary for Pond 20P: Bioswale (good)

Inflow Area = 4.340 ac, 30.65% Impervious, Inflow Depth = 3.69" for 100-Year event
Inflow = 17.78 cfs @ 12.16 hrs, Volume= 1.334 af
Outflow = 16.61 cfs @ 12.23 hrs, Volume= 1.334 af, Atten= 7%, Lag= 4.2 min
Discarded = 0.01 cfs @ 12.23 hrs, Volume= 0.001 af
Primary = 16.60 cfs @ 12.23 hrs, Volume= 1.333 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 845.31' @ 12.23 hrs Surf.Area= 1,999 sf Storage= 1,563 cf

Plug-Flow detention time= 0.7 min calculated for 1.334 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (798.5 - 797.8)

Volume	Invert	Avail.Storage	Storage Description
#1	844.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

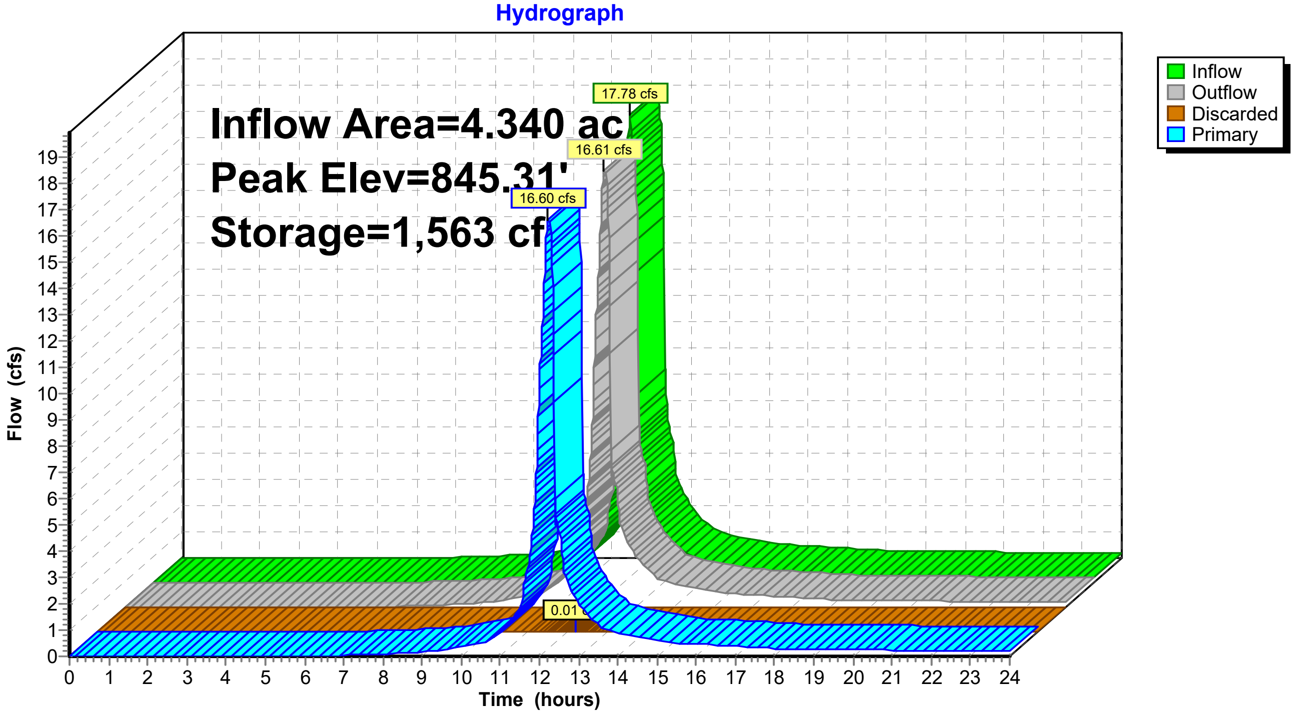
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
844.50	0	0	0	0
845.00	880	147	147	880
847.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Discarded	844.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	844.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	842.50'	**15.0" Round Culvert** L= 46.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 842.50' / 840.50' S= 0.0435 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#4	Primary	844.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.01 cfs @ 12.23 hrs HW=845.31' (Free Discharge)
└─**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=16.60 cfs @ 12.23 hrs HW=845.31' TW=830.27' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 6.89 cfs @ 5.61 fps)
│ └─**2=Orifice/Grate** (Passes 6.89 cfs of 17.30 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 9.71 cfs @ 2.41 fps)

Pond 20P: Bioswale (good)



Summary for Pond 21P: Bioswale (good)

Inflow Area = 3.540 ac, 31.36% Impervious, Inflow Depth = 3.70" for 100-Year event
Inflow = 15.61 cfs @ 12.15 hrs, Volume= 1.093 af
Outflow = 14.44 cfs @ 12.21 hrs, Volume= 1.093 af, Atten= 8%, Lag= 3.5 min
Discarded = 0.01 cfs @ 12.21 hrs, Volume= 0.001 af
Primary = 14.43 cfs @ 12.21 hrs, Volume= 1.092 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 859.19' @ 12.21 hrs Surf.Area= 1,576 sf Storage= 1,027 cf

Plug-Flow detention time= 0.6 min calculated for 1.093 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (797.8 - 797.2)

Volume	Invert	Avail.Storage	Storage Description
#1	858.50'	11,685 cf	**SWALE STORAGE (Conic)** Listed below

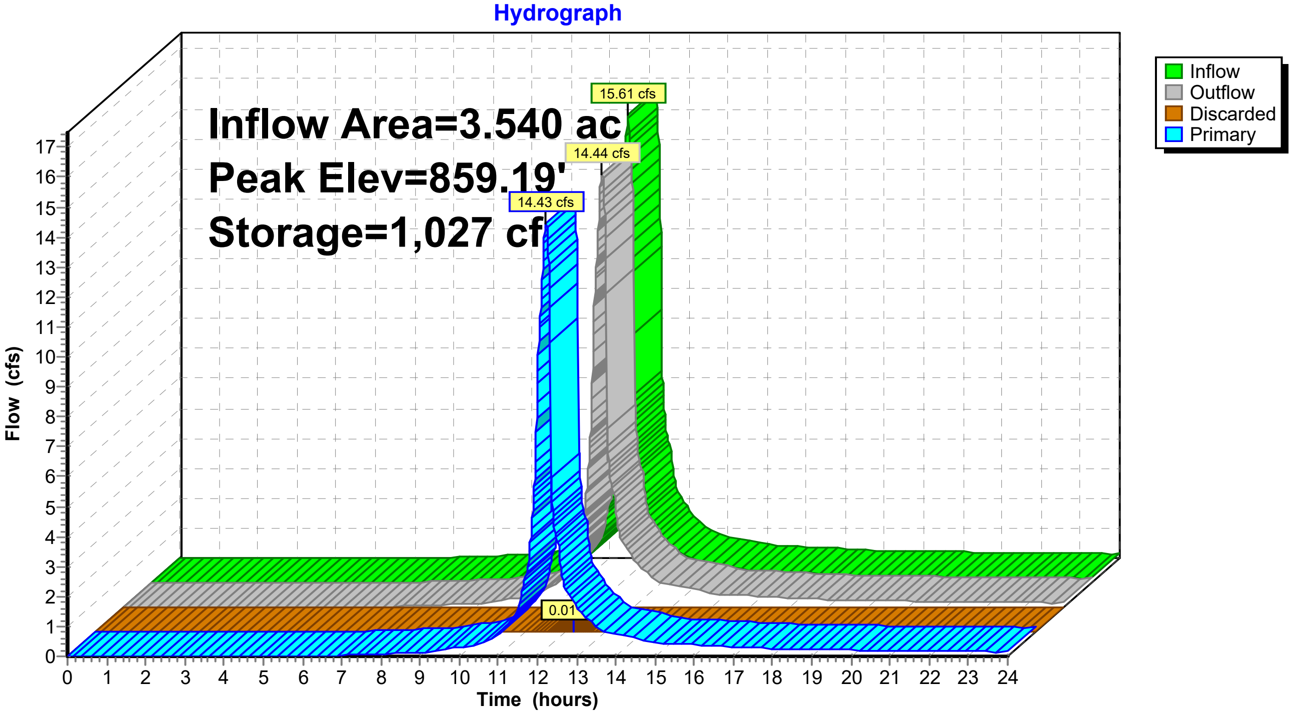
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
858.50	0	0	0	0
859.00	880	147	147	880
861.50	10,000	11,539	11,685	10,018

Device	Routing	Invert	Outlet Devices
#1	Device 3	858.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	858.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#3	Primary	856.50'	**15.0" Round Culvert** L= 47.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 856.50' / 854.00' S= 0.0532 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#4	Primary	858.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.01 cfs @ 12.21 hrs HW=859.19' (Free Discharge)
└─**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=14.43 cfs @ 12.21 hrs HW=859.19' TW=845.31' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 6.70 cfs @ 5.46 fps)
│ └─**1=Orifice/Grate** (Passes 6.70 cfs of 15.01 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 7.72 cfs @ 2.24 fps)

Pond 21P: Bioswale (good)



Summary for Pond 22P: Bioswale (good)

Inflow Area = 2.740 ac, 32.48% Impervious, Inflow Depth = 3.73" for 100-Year event
Inflow = 14.03 cfs @ 12.14 hrs, Volume= 0.851 af
Outflow = 12.05 cfs @ 12.20 hrs, Volume= 0.851 af, Atten= 14%, Lag= 3.4 min
Discarded = 0.01 cfs @ 12.20 hrs, Volume= 0.001 af
Primary = 12.04 cfs @ 12.20 hrs, Volume= 0.850 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 870.18' @ 12.20 hrs Surf.Area= 2,165 sf Storage= 1,334 cf

Plug-Flow detention time= 0.7 min calculated for 0.851 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (797.0 - 796.3)

Volume	Invert	Avail.Storage	Storage Description
#1	869.50'	13,006 cf	**SWALE STORAGE (Conic)** Listed below

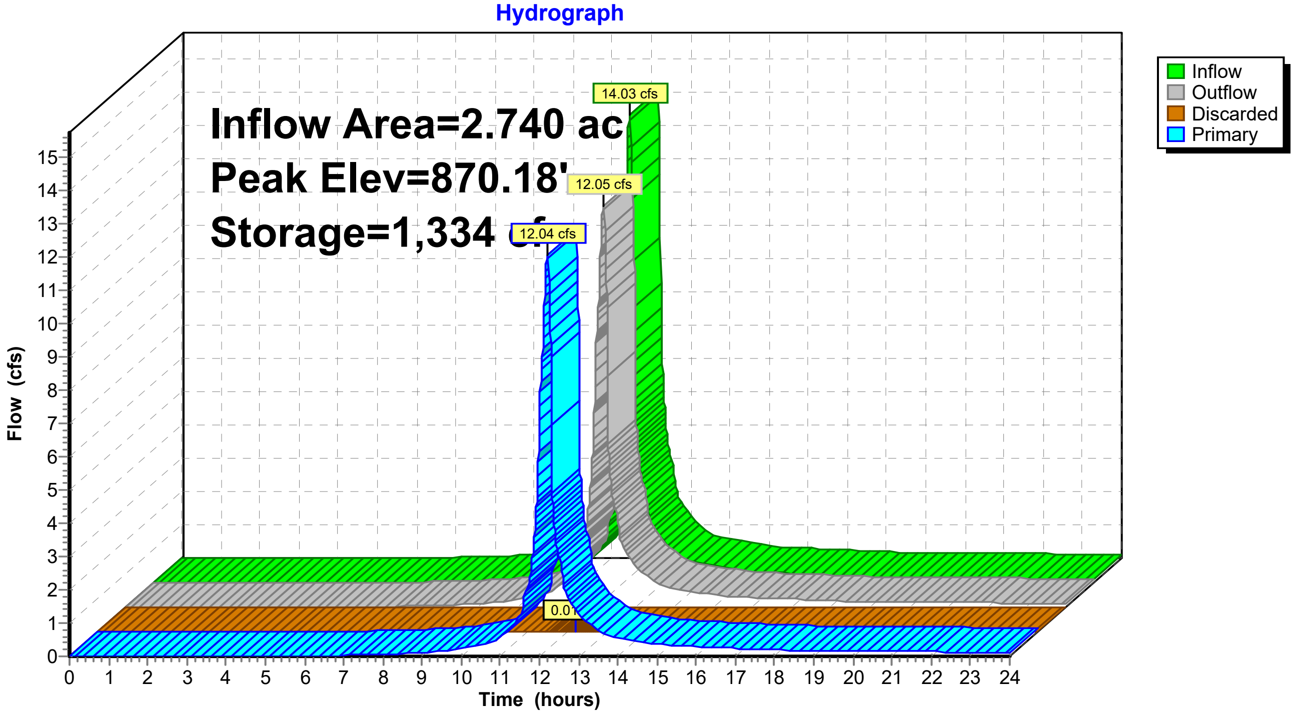
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
869.50	0	0	0	0
870.00	880	147	147	880
872.00	14,800	12,859	13,006	14,811

Device	Routing	Invert	Outlet Devices
#1	Discarded	869.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 750.00'
#2	Device 3	869.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	867.50'	**12.0" Round CMP_Round 12"** L= 47.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 867.50' / 866.00' S= 0.0319 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	869.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.01 cfs @ 12.20 hrs HW=870.18' (Free Discharge)
└─**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=12.04 cfs @ 12.20 hrs HW=870.18' TW=859.19' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Inlet Controls 4.41 cfs @ 5.62 fps)
│ └─**2=Orifice/Grate** (Passes 4.41 cfs of 14.82 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 7.62 cfs @ 2.23 fps)

Pond 22P: Bioswale (good)



Summary for Pond 23P: Bioswale (good)

Inflow Area = 1.920 ac, 34.90% Impervious, Inflow Depth = 3.77" for 100-Year event
Inflow = 10.72 cfs @ 12.14 hrs, Volume= 0.603 af
Outflow = 9.76 cfs @ 12.17 hrs, Volume= 0.603 af, Atten= 9%, Lag= 1.7 min
Primary = 9.76 cfs @ 12.17 hrs, Volume= 0.603 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 881.05' @ 12.17 hrs Surf.Area= 1,376 sf Storage= 398 cf

Plug-Flow detention time= 0.5 min calculated for 0.603 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (795.6 - 795.0)

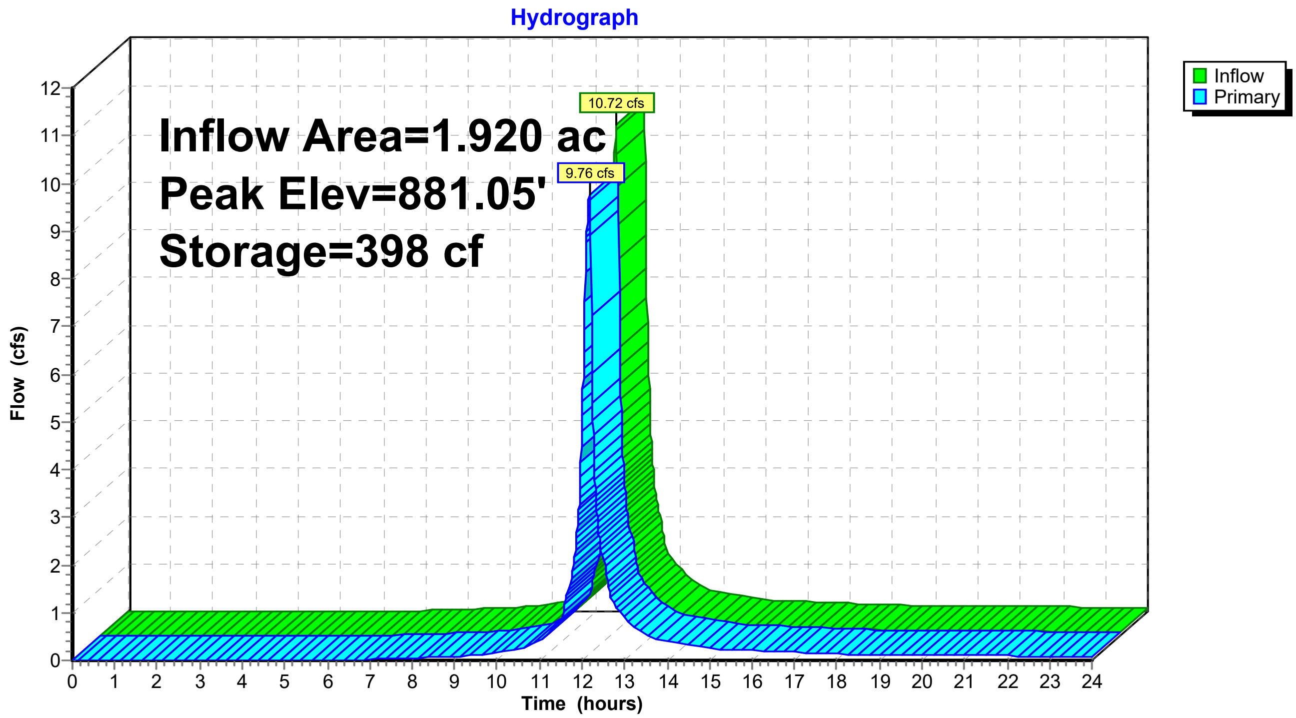
Volume	Invert	Avail.Storage	Storage Description
#1	880.50'	4,762 cf	**SWALE STORAGE (Conic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
880.50	0	0	0	0
881.00	880	147	147	880
882.00	10,000	4,615	4,762	10,003

Device	Routing	Invert	Outlet Devices
#1	Device 3	880.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	880.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	878.50'	**12.0" Round CMP_Round 12"** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 878.50' / 877.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	880.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=9.75 cfs @ 12.17 hrs HW=881.05' TW=870.16' (Dynamic Tailwater)
—**3=CMP_Round 12"** (Inlet Controls 4.28 cfs @ 5.45 fps)
 —**1=Exfiltration** (Passes < 0.01 cfs potential flow)
 —**2=Orifice/Grate** (Passes < 10.78 cfs potential flow)
—**4=Broad-Crested Rectangular Weir** (Weir Controls 5.47 cfs @ 1.97 fps)

Pond 23P: Bioswale (good)



Summary for Pond 24P: Bioswale (good)

Inflow Area = 1.090 ac, 41.28% Impervious, Inflow Depth = 3.87" for 100-Year event
Inflow = 6.19 cfs @ 12.14 hrs, Volume= 0.351 af
Outflow = 6.16 cfs @ 12.14 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 6.16 cfs @ 12.14 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 891.81' @ 12.14 hrs Surf.Area= 522 sf Storage= 87 cf

Plug-Flow detention time= 0.5 min calculated for 0.351 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (792.9 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	891.50'	5,468 cf	**SWALE STORAGE (Conic)** Listed below

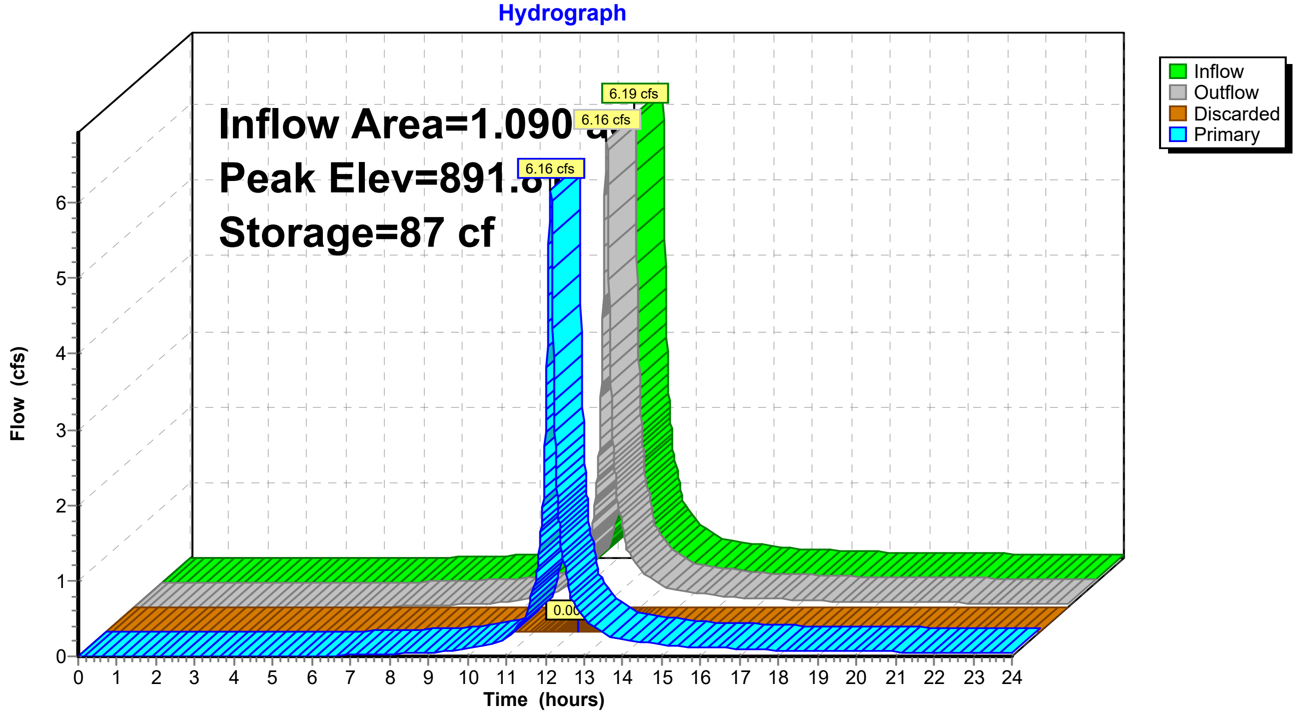
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
891.50	0	0	0	0
892.00	831	139	139	831
893.00	12,000	5,330	5,468	12,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	891.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	891.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	889.50'	**12.0" Round Culvert** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 889.50' / 888.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	891.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=891.81' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=6.15 cfs @ 12.14 hrs HW=891.81' TW=881.04' (Dynamic Tailwater)
├─**3=Culvert** (Inlet Controls 4.02 cfs @ 5.12 fps)
│ └─**2=Orifice/Grate** (Passes 4.02 cfs of 4.58 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 2.13 cfs @ 1.36 fps)

Pond 24P: Bioswale (good)



Summary for Pond 25P: Bioswale (good)

Inflow Area = 0.530 ac, 43.40% Impervious, Inflow Depth = 3.90" for 100-Year event
Inflow = 2.98 cfs @ 12.14 hrs, Volume= 0.172 af
Outflow = 2.98 cfs @ 12.14 hrs, Volume= 0.172 af, Atten= 0%, Lag= 0.1 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 2.98 cfs @ 12.14 hrs, Volume= 0.172 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 903.73' @ 12.14 hrs Surf.Area= 183 sf Storage= 30 cf

Plug-Flow detention time= 0.4 min calculated for 0.172 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (792.0 - 791.6)

Volume	Invert	Avail.Storage	Storage Description
#1	903.50'	2,142 cf	**SWALE STORAGE (Conic)** Listed below

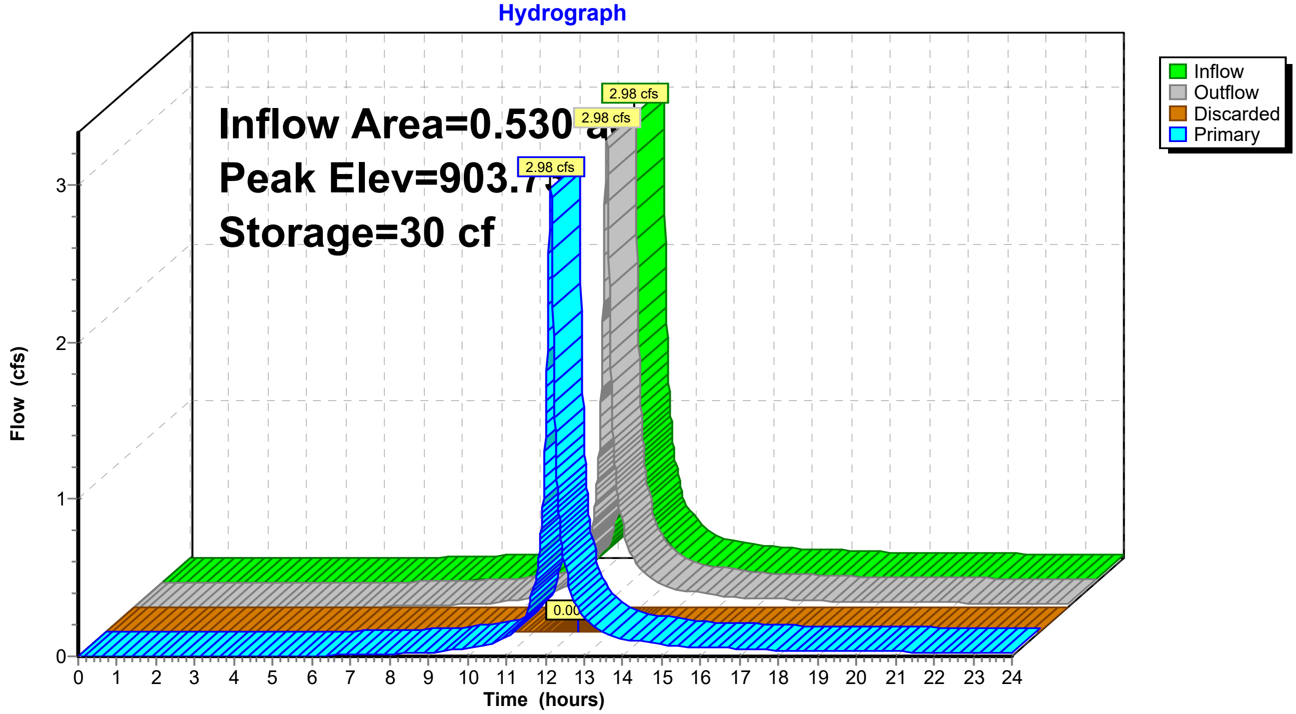
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
903.50	0	0	0	0
904.00	395	66	66	395
905.00	4,500	2,076	2,142	4,503

Device	Routing	Invert	Outlet Devices
#1	Discarded	903.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	903.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	901.50'	**12.0" Round CMP_Round 12"** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 901.50' / 901.00' S= 0.0086 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	903.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=903.73' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=2.97 cfs @ 12.14 hrs HW=903.73' TW=891.81' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 2.91 cfs of 3.93 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 2.91 cfs @ 1.57 fps)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.06 cfs @ 0.41 fps)

Pond 25P: Bioswale (good)



Summary for Pond 26P: Bioswale (good)

Inflow Area = 0.150 ac, 20.00% Impervious, Inflow Depth = 3.54" for 100-Year event
Inflow = 0.81 cfs @ 12.13 hrs, Volume= 0.044 af
Outflow = 0.81 cfs @ 12.14 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
Primary = 0.81 cfs @ 12.14 hrs, Volume= 0.044 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 907.60' @ 12.14 hrs Surf.Area= 125 sf Storage= 21 cf

Plug-Flow detention time= 1.0 min calculated for 0.044 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (801.6 - 800.6)

Volume	Invert	Avail.Storage	Storage Description
#1	907.50'	2,578 cf	**SWALE STORAGE (Conic)** Listed below

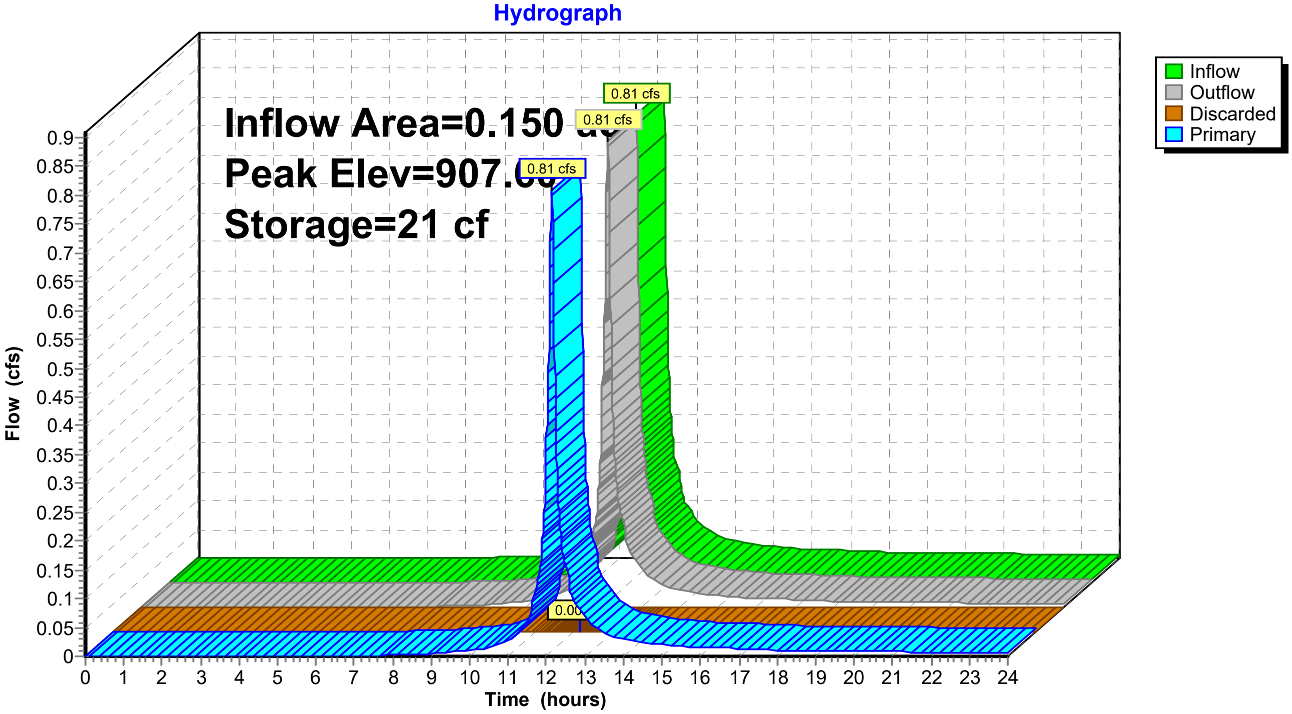
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
907.50	0	0	0	0
908.00	635	106	106	635
909.00	5,000	2,472	2,578	5,004

Device	Routing	Invert	Outlet Devices
#1	Discarded	907.50'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 800.00'
#2	Device 3	907.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	905.50'	**12.0" Round CMP_Round 12"** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 905.50' / 905.00' S= 0.0086 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#4	Primary	907.70'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=907.60' (Free Discharge)
└─**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.81 cfs @ 12.14 hrs HW=907.60' TW=903.73' (Dynamic Tailwater)
├─**3=CMP_Round 12"** (Passes 0.81 cfs of 3.77 cfs potential flow)
│ └─**2=Orifice/Grate** (Weir Controls 0.81 cfs @ 1.03 fps)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 26P: Bioswale (good)



Summary for Pond 27P: Dry Swale

Inflow Area = 1.310 ac, 37.40% Impervious, Inflow Depth = 3.84" for 100-Year event
Inflow = 7.01 cfs @ 12.15 hrs, Volume= 0.419 af
Outflow = 5.14 cfs @ 12.22 hrs, Volume= 0.408 af, Atten= 27%, Lag= 4.0 min
Discarded = 0.04 cfs @ 12.22 hrs, Volume= 0.039 af
Primary = 5.10 cfs @ 12.22 hrs, Volume= 0.369 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Peak Elev= 808.11' @ 12.22 hrs Surf.Area= 6,700 sf Storage= 2,973 cf

Plug-Flow detention time= 68.9 min calculated for 0.408 af (97% of inflow)
Center-of-Mass det. time= 53.1 min (847.8 - 794.7)

Volume	Invert	Avail.Storage	Storage Description
#1	807.00'	10,179 cf	**Custom Stage Data (Conic)** Listed below

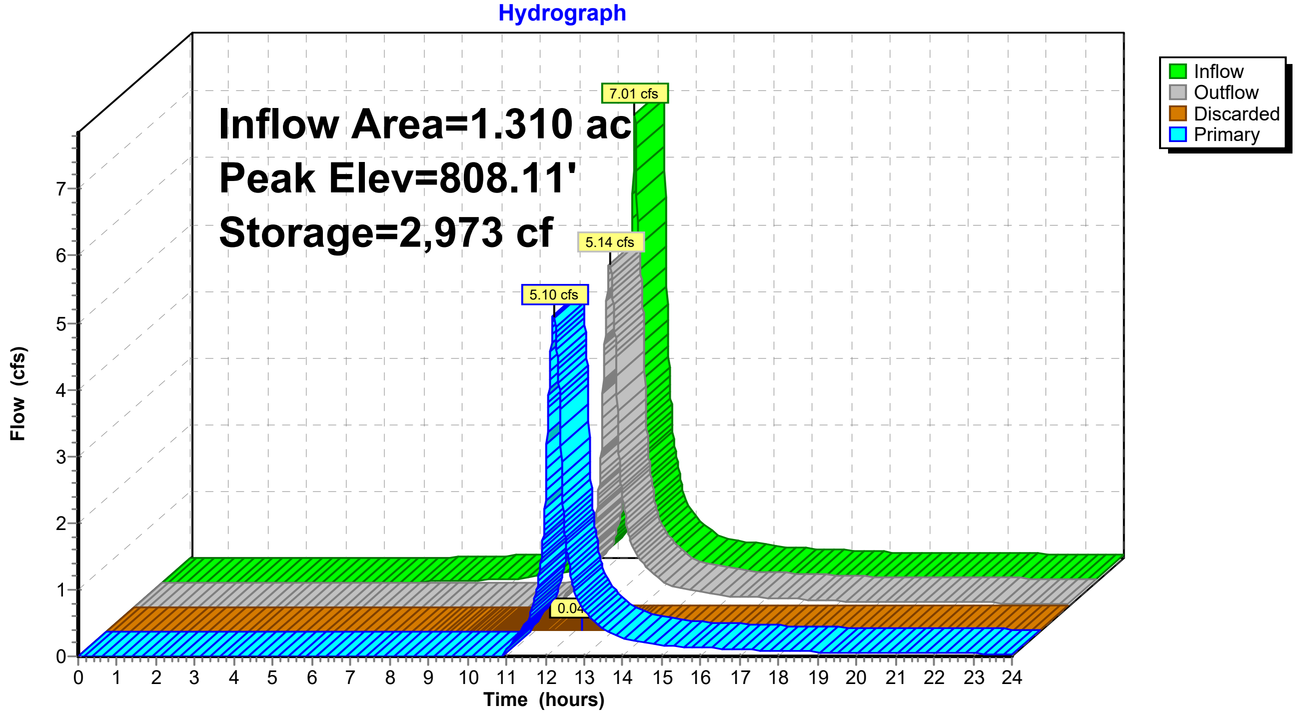
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
807.00	0	0	0	0
808.00	6,300	2,100	2,100	6,302
809.00	10,000	8,079	10,179	10,015

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	**4.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	807.00'	**0.250 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 700.00'

Discarded OutFlow Max=0.04 cfs @ 12.22 hrs HW=808.11' (Free Discharge)
└─**2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=5.10 cfs @ 12.22 hrs HW=808.11' TW=804.24' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 5.10 cfs @ 2.10 fps)

Pond 27P: Dry Swale



Summary for Pond 32P: Lower Pond

Inflow Area = 38.100 ac, 11.36% Impervious, Inflow Depth = 3.20" for 100-Year event
Inflow = 89.57 cfs @ 12.16 hrs, Volume= 10.151 af
Outflow = 67.82 cfs @ 12.26 hrs, Volume= 9.201 af, Atten= 24%, Lag= 6.0 min
Primary = 12.89 cfs @ 12.26 hrs, Volume= 4.682 af
Secondary = 54.93 cfs @ 12.26 hrs, Volume= 4.519 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Starting Elev= 700.50' Surf.Area= 14,196 sf Storage= 6,497 cf
Peak Elev= 704.43' @ 12.26 hrs Surf.Area= 30,816 sf Storage= 91,323 cf (84,826 cf above start)

Plug-Flow detention time= 128.9 min calculated for 9.049 af (89% of inflow)
Center-of-Mass det. time= 70.7 min (897.3 - 826.6)

Volume	Invert	Avail.Storage	Storage Description
#1	700.00'	124,144 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

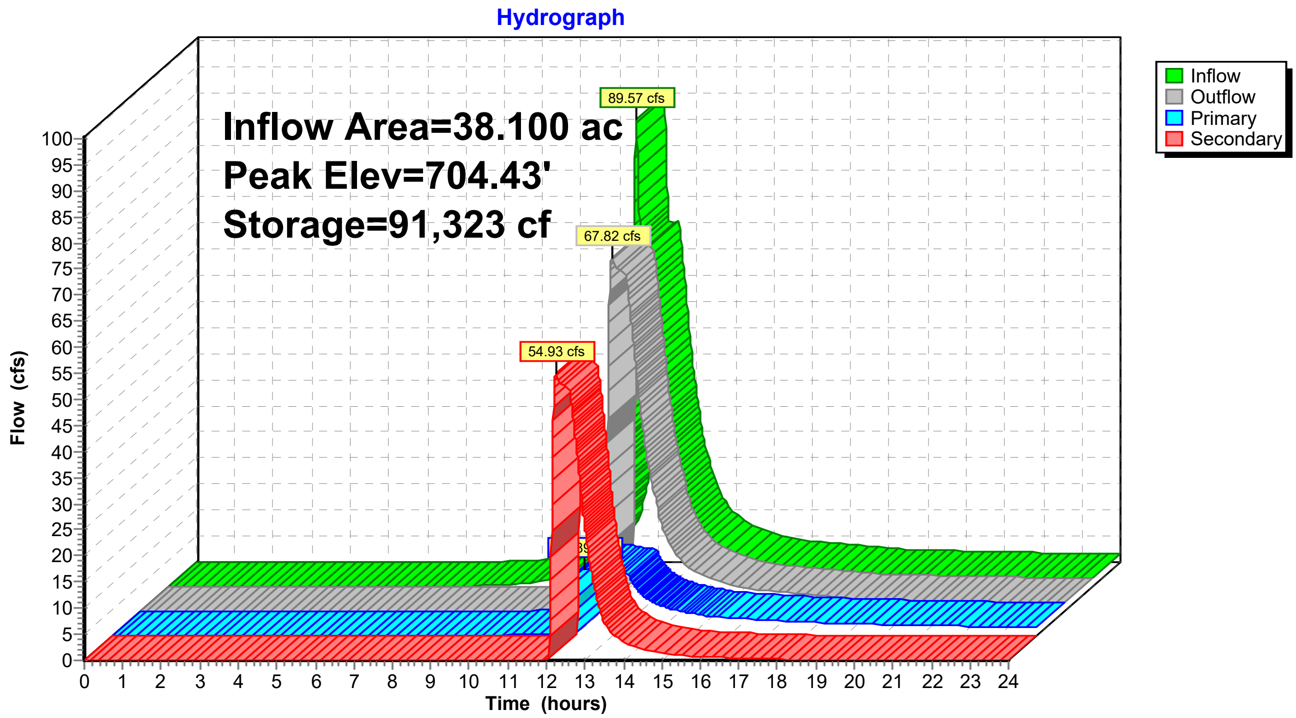
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
700.00	11,792	0	0
701.00	16,599	14,196	14,196
702.00	19,522	18,061	32,256
703.00	22,479	21,001	53,257
704.00	28,237	25,358	78,615
705.00	34,230	31,234	109,848
705.40	37,252	14,296	124,144

Device	Routing	Invert	Outlet Devices
#1	Secondary	703.60'	**27.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 4	703.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	700.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	700.00'	**18.0" Round Culvert** L= 21.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 700.00' / 699.80' S= 0.0095 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 1.77 sf

Primary OutFlow Max=12.89 cfs @ 12.26 hrs HW=704.43' TW=0.00' (Dynamic Tailwater)
└─**4=Culvert** (Inlet Controls 12.89 cfs @ 7.29 fps)
  ├─**2=Orifice/Grate** (Passes < 46.94 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 0.49 cfs potential flow)

Secondary OutFlow Max=54.92 cfs @ 12.26 hrs HW=704.43' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 54.92 cfs @ 2.45 fps)

Pond 32P: Lower Pond



Summary for Pond 33P: Upper Pond

Inflow Area = 32.150 ac, 14.71% Impervious, Inflow Depth = 3.12" for 100-Year event
Inflow = 106.60 cfs @ 12.24 hrs, Volume= 8.368 af
Outflow = 85.32 cfs @ 12.35 hrs, Volume= 7.357 af, Atten= 20%, Lag= 7.0 min
Primary = 27.45 cfs @ 12.35 hrs, Volume= 5.945 af
Secondary = 57.87 cfs @ 12.35 hrs, Volume= 1.412 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs
Starting Elev= 705.00' Surf.Area= 0 sf Storage= 0 cf
Peak Elev= 743.78' @ 12.35 hrs Surf.Area= 25,883 sf Storage= 115,573 cf

Plug-Flow detention time= 153.7 min calculated for 7.355 af (88% of inflow)
Center-of-Mass det. time= 99.5 min (917.3 - 817.8)

Volume	Invert	Avail.Storage	Storage Description
#1	737.50'	149,518 cf	**prop (Conic)** Listed below (Recalc)

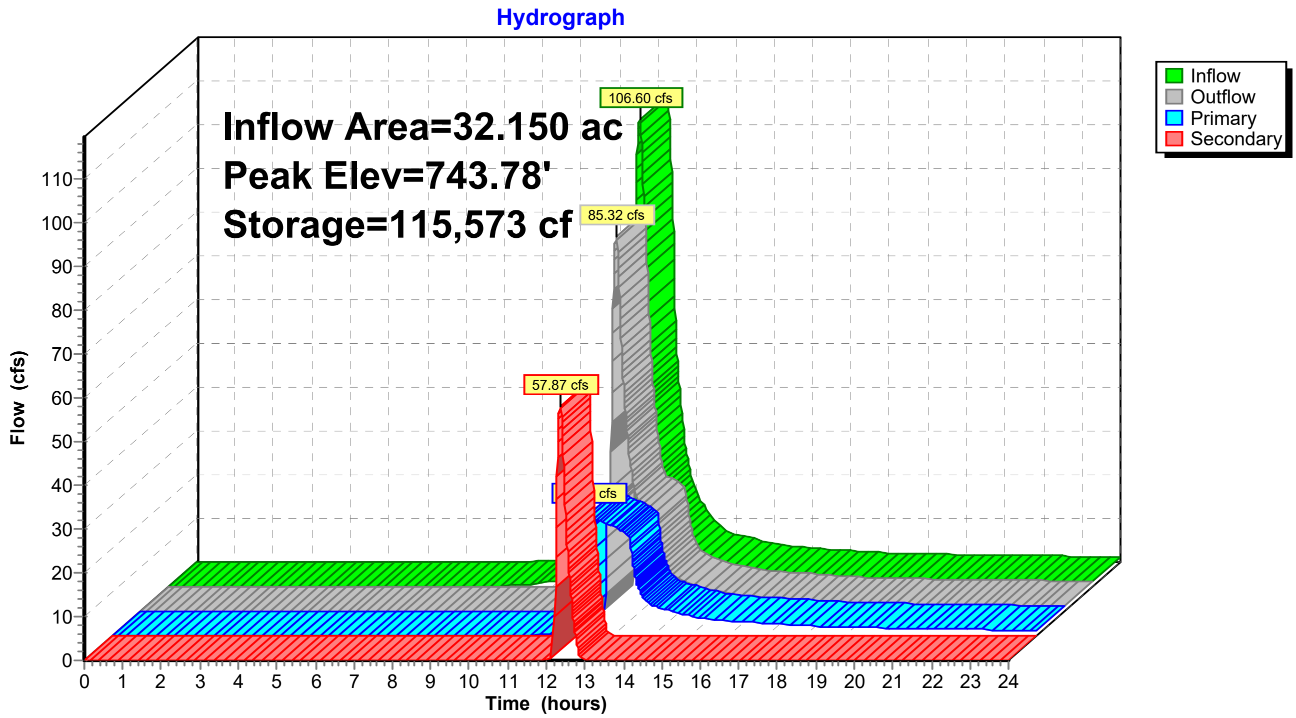
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
737.50	11,903	0	0	11,903
738.00	12,777	6,169	6,169	12,799
739.00	14,602	13,679	19,848	14,670
740.00	16,711	15,645	35,493	16,825
741.00	18,984	17,835	53,328	19,147
742.00	21,350	20,155	73,484	21,566
743.00	23,873	22,600	96,083	24,145
744.00	26,452	25,151	121,235	26,784
745.00	30,154	28,283	149,518	30,534

Device	Routing	Invert	Outlet Devices
#1	Secondary	743.00'	**31.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 4	741.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	737.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	737.50'	**24.0" Round Culvert** L= 35.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 737.50' / 735.00' S= 0.0714 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 3.14 sf

Primary OutFlow Max=27.45 cfs @ 12.35 hrs HW=743.78' TW=0.00' (Dynamic Tailwater)
└─**4=Culvert** (Inlet Controls 27.45 cfs @ 8.74 fps)
  ├─**2=Orifice/Grate** (Passes < 116.41 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 0.59 cfs potential flow)

Secondary OutFlow Max=57.81 cfs @ 12.35 hrs HW=743.78' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 57.81 cfs @ 2.38 fps)

Pond 33P: Upper Pond

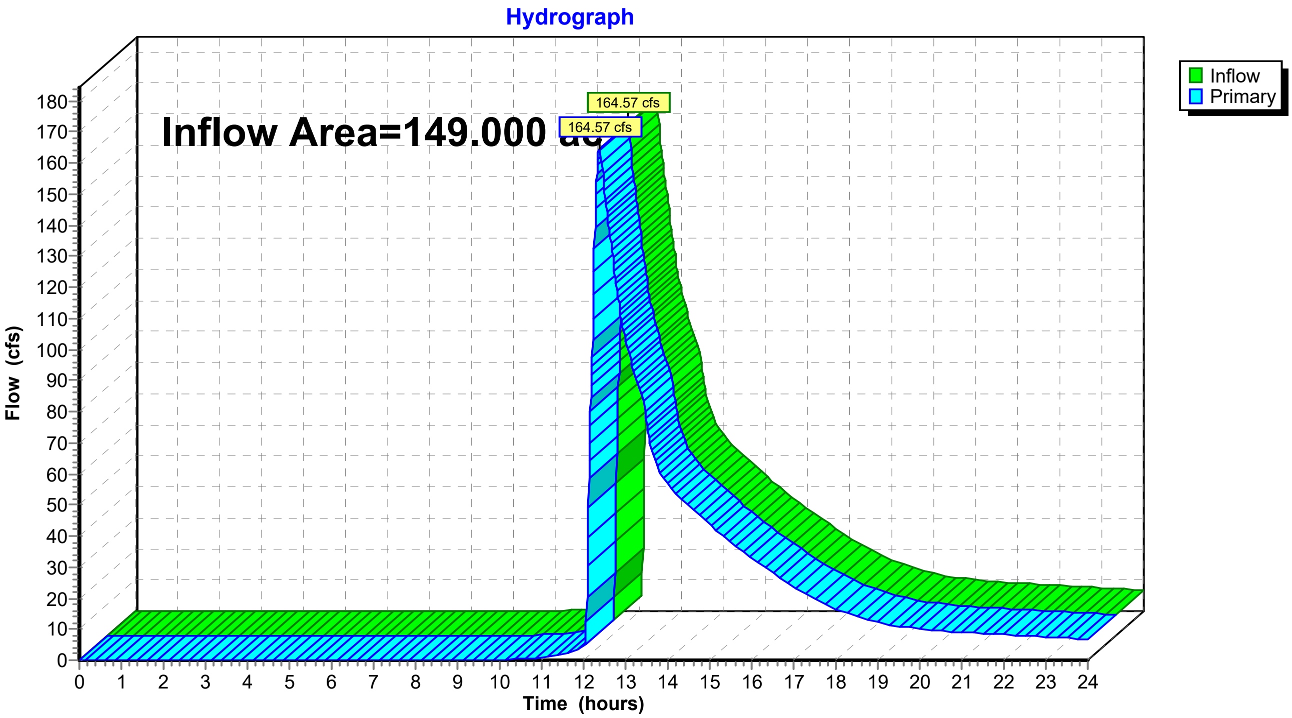


Summary for Link 49L: Total Off-site drainage

Inflow Area = 149.000 ac, 6.55% Impervious, Inflow Depth > 2.75" for 100-Year event
Inflow = 164.57 cfs @ 12.37 hrs, Volume= 34.163 af
Primary = 164.57 cfs @ 12.37 hrs, Volume= 34.163 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-37.00 hrs, dt= 0.01 hrs

Link 49L: Total Off-site drainage



APPENDIX C

Stormwater Design Calculations

***CALCULATIONS* :**	Project No.:	20-243
	Date:	9/21/2022
Project: **Sunset Ridge**	By:	JWJ
Overall WQv & RRv Calculations	Sheet	1 of 2

Subarea A

P (90% Rainfall Event) = **1.00 inches**
Water Quality Area = **62.2 acres** Total Contributng area
Impervious Area = **6.5 acres**
I = % Impervious = **10.5** %
Weighted S Value = **0.21**

Hydrologic Soil Group (HSG) Specific Reduction Factor "S" =

Soil Classification	Area (ac)	S Factor	Weighted #
A Soils	**0**	0.5	0
B Soils	**1.1**	0.4	0.44
C Soils	**0**	0.3	0
D Soils	**62.3**	0.2	12.46

Total Area = 62.2 acres
Total Weighted # = 12.9

Weighted S Value = **0.21**

Rv = 0.05 + 0.009(I)

Rv = 0.1440514

Required WQv - based on Enhanced Phosphorus removal (Chapter 10) of NYSDEC Design Manual
Req WQv = (Total drainage area)(1-year runoff volume)

2.503 af (inflow volume from hydrocad for contributing areas) **109,030 cf**

Minimum Allowable RRv for enhanced Phosphorous Removal

RRv= P1-yr * Rv* Aic*S 0.1945125 **8473 cf**
P1-yr= 1.89
Rv=.05+.009(I) 0.95
Aic= 6.5
S= 0.2

	CALCULATIONS:	Project No.: 20-243
		Date: 9/21/2022
	Project: Sunset Ridge	By: JWJ
	Area Reduction Calculations	Sheet 2 of 3

Subarea A

P (90% Rainfall Event) =	1	**inches**
Water Quality Area (Disturbed Area) =	62.20	**acres**
Impervious Area =	6.50	**acres**
I = % Impervious =	**10.5**	%

	Area Reduction Pratices	Impervious Area Reduced		Total Area Reduced	
1)			**ac**		ac
2)	**Conservation Easment Areas**	**4.1**	ac	**4.1**	ac
3)			ac		ac
4)			ac		ac
5)			ac		ac
6)			ac		ac
7)			ac		ac
8)			ac		ac
9)			ac		ac
10)			ac		ac
11)			ac		ac
12)			ac		ac
	Total	4.10	ac	4.10	ac

Adjusted Area	58.10	**acres**
Adjusted Impervious Area	2.40	**acres**
Recalculated I	**4.1**	%

Rv = 0.05 + 0.009(I)

Rv = 0.0871773

WQv = (Total drainage area)(1-year runoff volume)

WQv Provided = (59.30AC x0.48")x(1/12) 2.3 **103,324**

WQv Required = P * Area * Rv / 12

WQv = 0.42 AC-FT

WQv = 18386 CF

RRv Provided = (WQv from Page 1) - (WQv Above)

RRv Provided From Area Reduction Pratices= 5706 CF

	CALCULATIONS **:**	Project No.: 20-243
	Project: Sunset Ridge	Date: 9/21/2022
		By: JWJ
	WQv and RRv Summary	Sheet 2 of 2

Overall Required WQv = **109030 cf**

Minimum Allowable RRv = **8473 cf**

WQv Total

WQv Provided by Deep Pool (lower pond)	**14,409**	**cf**
WQv provided in Permanent Pool (lower pond)	**9,691**	**cf**
WQv provided by deep pool (Upper pond)	**6,039**	**cf**
WQv provided in Permanet Pool (Upper Pond)	**22,724**	**cf**
WQv provided by dry swale #1	**905**	**cf**
WQv provided by dry swale #2	**6,060**	**cf**
WQv provided by rain garden (lower lots)	**15,600**	**cf**
WQv provided by rain garden (upper lots)	**23,400**	**cf**
Total WQv Provided =	**98,828**	**cf**

RRv Total

RRv Provided by conservation areas	**5,706**	**cf**
RRv Provided by dry swale #1	**227**	**cf**
RRv Provided by dry swale #2	**1,520**	**cf**
RRv provided by rain gardens (lower lots)	**2,593**	**cf**
RRv provided by rain gardens (upper lots)	**1,777**	**cf**
Total RRv Provided =	**11,823**	**cf**

Total WQv Provided =	**110,651**	**cf**	**>**	**109,030**	**cf**
Total RRv Provided =	**11,823**	**cf**	**>**	**8,473**	**cf**

	CALCULATIONS :	Project No.:	20-243
	Project: Channel Protection Volume Calculations	Date:	9/21/2022
		By:	JWJ
	Sunset Ridge LOWER POND	Sheet	1 of 5

COMPUTE CHANNEL PROTECTION STORAGE VOLUME - STORMWATER MANAGEMENT FACILITY

Vs value per hydrocad 1-year design storm for Lower Pond

Vs **Vs VALUE =** **1.651 ac-ft**
71918 CF

CPv = 71918 CF

Release Rate over 24 Hours 71918 ft^3 / [(24 hr) (3600 sec / hr)] = **0.832 cfs**

CHANNEL PROTECTION VOLUME PROVIDED

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
700.00	11286	0
700.5	13,088	12,187
702.5	23,925	49,200
703.5	32,180	77,253

77,253 > 71,918
OK

COMPUTE OFIFICE DIAMETER

Required Channel Protection Volume (RCPv)= **71918 cf**

Elevation at RCPv = **703.2**

Flow Required to release RCPv over 24 Hrs.= **0.83 cfs**

OUTLET ORIFICE = **3 inch dimeter**

Invert @ Orifice = **700** Average Head = **1.54 ft**

Center of Orifice = **0.125 FT**

Q = CA[2GH]1/2= **Q=** **0.29 cfs**
Where C= 0.6

If Avearge Outflow Rate using oriface < Rate to release RCPv over 24 hrs "OK"
*(unless using smallest recommended orifice of 3")

0.293 < 0.83

OK

SPILLWAY CALCULATION

Extreme Flood Protection, Q of undetained 100-year inflow Hydrograph

100-year Storm Event Inflow (Q) to SMWF = **89.6** cfs

Height (H) from Spillway Invert to Top of Berm= **1.00** ft

Q =(0.666)*C*L*((2g)^.5)H^(3/2) L = **33.50** ft **Use L = 34 ft**
Where C= 0.5

FOREBAY SPILLWAY CALCULATION

Extreme Flood Protection, Q of undetained 100-year inflow Hydrograph

10-year Storm Event Inflow (Q) to SMWF = **39** cfs

Height (H) from Spillway Invert to Top of Berm= **1.00** ft

Q =(0.666)*C*L*((2g)^.5)H^(3/2) L = **14.58** ft **Use L = 15 ft**
Where C= 0.5

	CALCULATIONS **:**	Project No.:	**20243.00**
		Date:	**9/21/2022**
	Project: **Forebay/Deep Pool Sizing Calculations**	By:	**JWJ**
	Sunset Ridge LOWER POND	Sheet	**3 of 5**

WATER QUALITY VOLUME, WQv

Note: WQv calculated for the SWMF is to be used for pond sizing calcsulations only and is calculated based on contributing drainage area. The Calculated WQv shown below does not apply to the overall WQv requirements.

WATER QUALITY VOLUME, WQv

DRAINAGE AREA (A) TO FACILITY= **38.20 acres**

IMPERVIOUS AREA = **3.63 acres**

90 PERCENTILE RAINFALL EVENT = **1.00 inches**

CURVE NUMBER (CN) = **75.0**

TIME OF CONCENTRATION (Tc) = **0.620 hours**

IMPERVIOUS COVER (I) = **0.10**

RUNOFF COEFFICENT (Rv) = **0.14**

Rv = 0.05 + (I)(0.9)

WATER QUALITY VOLUME (WQv) = **0.431 acre-ft** **18793 cf**

WQv = P * Rv * A / 12

Pre-treatment volume (10% WQv) = 1879.251 cf (required)

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
699.00	174	0
700.00	618	396
701.00	1,200	1,305
702.00	1,893	2,852
		2,852 > 1,879 OK

Deep Pool Volume (50% WQv) = 9396.255 cf (required)

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
694.00	2,068	0
695.00	2,976	2,522
696.00	4,017	6,019
697.00	5,191	10,623
698.00	6,538	16,488
699.00	8,095	23,805
		23,805 > 9,396 OK

	***CALCULATIONS*:**	Project No.:	**20243.00**
		Date:	**9/21/2022**
	Project: **Forebay/Deep Pool Sizing Calculations**	By:	**JWJ**
	Sunset Ridge LOWER POND	Sheet	**3 of 5**

Permanent Pool Volume (between 699 and 700.8)

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
699.00	8,095	0
700.00	11,286	9,691
		9,691 > 0 OK

COMPUTE CHANNEL PROTECTION STORAGE VOLUME - STORMWATER MANAGEMENT FACILITY

Vs value per hydrocad 1-year design storm for Upper Pond

Vs **Vs VALUE = 0.851 ac-ft**
37070 CF

CPv = 37070 CF

Release Rate over 24 Hours 37070 ft^3 / [(24 hr) (3600 sec / hr)] = **0.429 cfs**

CHANNEL PROTECTION VOLUME PROVIDED

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
737.5	11903	0
738	12,777	6,170
739	14,602	19,860
740	16,711	35,517
741.00	18,984	53,365

53,365 > 37,070
OK

	CALCULATIONS :	Project No.: **20-243**
	Project: **Orifice / Spillway Calculations**	Date: **9/21/2022**
	Sunset Ridge (upper Pond)	By: **JWJ**
		Sheet **2 of 5**

COMPUTE OFIFICE DIAMETER

Required Channel Protection Volume (RCPv)= **37070 cf**

Elevation at RCPv = **740.2**

Flow Required to release RCPv over 24 Hrs.= **0.43 cfs**

OUTLET ORIFICE = **3 inch dimeter**

Invert @ Orifice = **737.5** Average Head = **1.29 ft**

Center of Orifice = **0.125 FT**

Q = CA[2GH]1/2= **Q=** **0.27 cfs**
Where C= 0.6

If Avearge Outflow Rate using oriface < Rate to release RCPv over 24 hrs "OK"
*(unless using smallest recommended orifice of 3")
0.268 < 0.43
OK

SPILLWAY CALCULATION

Extreme Flood Protection, Q of undetained 100-year inflow Hydrograph

100-year Storm Event Inflow (Q) to SMWF = **106.6** cfs

Height (H) from Spillway Invert to Top of Berm= **1.20** ft

Q =(0.666)*C*L*((2g)^.5)H^(3/2) L = **30.32** ft **Use L = 31 ft**
Where C= 0.5

Forebay Spillway Calculations

10-year storm event inflow (Q) to SWMF = **48** cfs

Height (H) from spillway Invert to Top of Berm **1** ft

Q =(0.666)*C*L*((2g)^.5)H^(3/2) L= 17.94 **Use L = 18 ft**
Where C= 0.50

	CALCULATIONS **:**	Project No.:	**20243.00**
		Date:	**9/21/2022**
	Project: **Forebay/Deep Pool Sizing Calculations**	By:	**JWJ**
	Sunset Ridge (upper pond)	Sheet	**3 of 5**

WATER QUALITY VOLUME, WQv

Note: WQv calculated for the SWMF is to be used for pond sizing calcsulations only and is calculated based on contributing drainage area. The Calculated WQv shown below does not apply to the overall WQv requirements.

WATER QUALITY VOLUME, WQv

DRAINAGE AREA (A) TO FACILITY= **32.16 acres**

IMPERVIOUS AREA = **4.30 acres**

90 PERCENTILE RAINFALL EVENT = **1.00 inches**

CURVE NUMBER (CN) = **77.0**

TIME OF CONCENTRATION (Tc) = **0.260 hours**

IMPERVIOUS COVER (I) = **0.13**

RUNOFF COEFFICENT (Rv) = **0.17**

Rv = 0.05 + (I)(0.9)

WATER QUALITY VOLUME (WQv) = **0.457 acre-ft** **19885 cf**

WQv = P * Rv * A / 12

Pre-treatment volume (10% WQv) = 1989 cf (required)

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
741.00	87	0
742.00	365	226
743.00	795	806
744.00	1,570	1,989
		1,995 > 1,989 OK

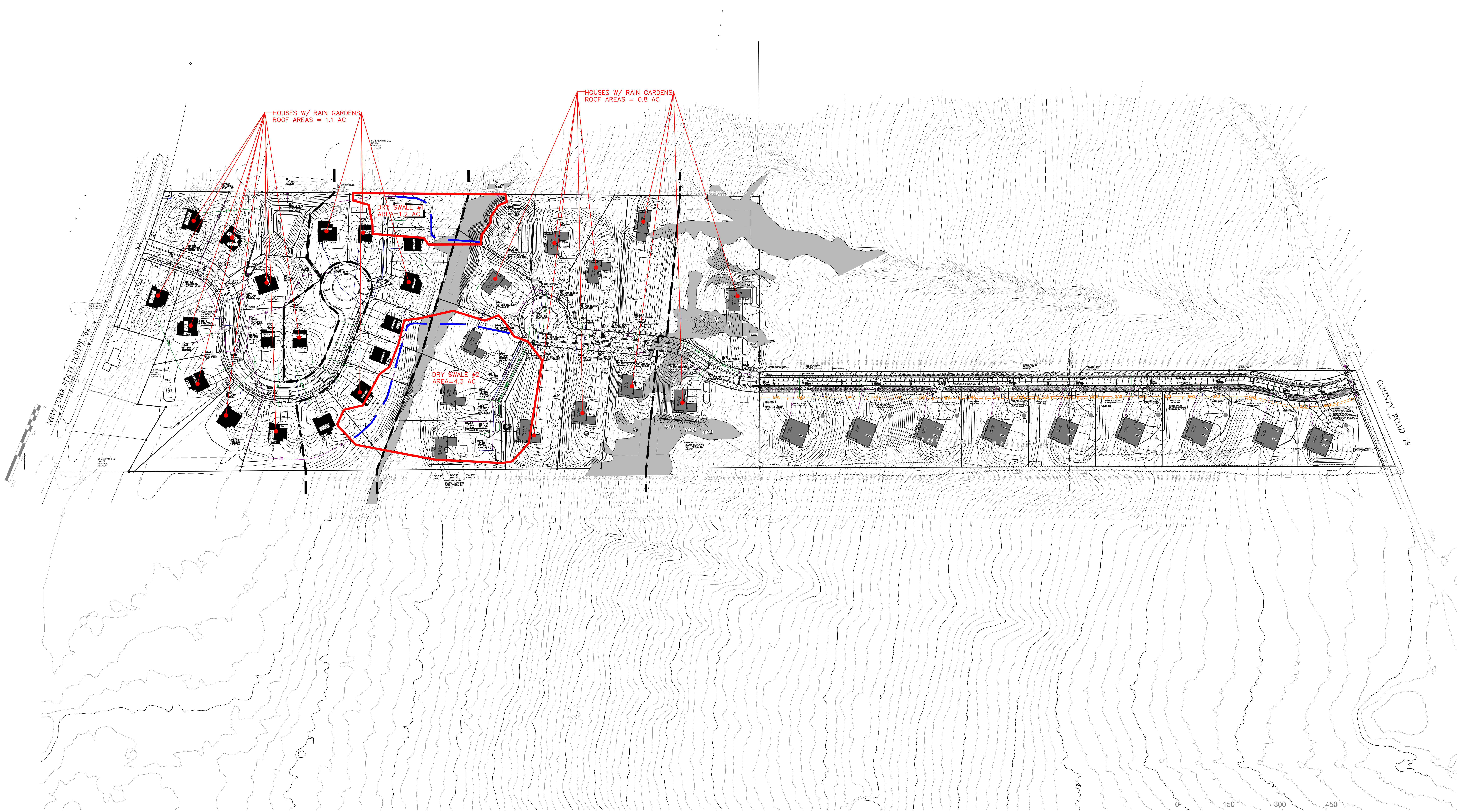
Deep Pool Volume (50% WQv) = 9943 cf (required)

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
732.00	1,957	0
733.00	2,867	2,412
734.00	3,903	5,797
735.00	5,062	10,280
736.00	6,342	15,982
		15,982 > 9,943 OK

	CALCULATIONS :	Project No.:	20243.00
		Date:	9/21/2022
	Project: Forebay/Deep Pool Sizing Calculations	By:	JWJ
	Sunset Ridge (upper pond)	Sheet	3 of 5

Permanent Pool Volume (between 736 and 737.5)

ELEVATION (ft)	CONTOUR AREA (ft^2)	TOTAL STORAGE (ft^3)
736.00	9,435	0
737.00	11,055	10,245
737.50	13,903	22,724
		22,724 > 0 OK



1 FIGURE 7 — WQv MAP
1"=150'

MarksEngineering
4 2 BEEMAN ST
CANANDAIGUA, NY 14424
www.marksengineering.com
Phone 585-905-0360
Fax: 585-485-6205
bmarks@marksengineering.com

STATE OF NEW YORK
BRENNAN A MARKS
093182
LICENSED PROFESSIONAL ENGINEER

STAMP

REVISIONS

NO.	DATE	DESCRIPTION OF REVISION	BY
7	12/19/22	PER MRB COMMENTS	BAM

SITE DEVELOPMENT PLANS PREPARED FOR:
SUNSET RIDGE ESTATES/ LAKEWOOD CUSTOM HOMES
RESIDENTIAL DEVELOPMENT
SHOWING LAND IN:
3535 STATE ROUTE 364 /0000 COUNTY ROAD 18
TOWN OF CANANDAIGUA/HOPEWELL
COUNTY OF ONTARIO STATE OF NEW YORK

DRAWING TITLE:
WQv MAP

DRAWN BY:	JPS
DESIGNED BY:	XXX
CHECKED BY:	BAM
SCALE:	AS NOTED
JOB NO.:	20-243
DATE:	02/01/2023
TAX MAP#:	98.19-1-20.10

FIG. 7

	CALCULATIONS :	Project No.:	20-243
		Date:	9/21/2022
	Project: **Sunset Ridge**	By:	JWJ
	WQv calcs for Dry swales	Sheet	1 of 2

Dry Swale #1

Water Quality Area = **1.20 acres** Area= Treatment area
Impervious Area = **0.13 acres**
I = % Impervious = **10.8** %
Weighted S Value = **0.20**

Hydrologic Soil Group (HSG) Specific Reduction Factor "S" =

Soil Classification	Area (ac)	S Factor	Weighted #
A Soils	**0**	0.5	0
B Soils	**0**	0.4	0
C Soils	**0**	0.3	0
D Soils	**1.2**	0.2	0.24

Total Area = 1.2 acres
Total Weighted # = 0.24

Weighted S Value = **0.20**

Rv = 0.05 + 0.009(I)

Rv = 0.1475

Required WQv - based on Enhanced Phosphorus removal (Chapter 10) of NYSDEC Design Manual
Req WQv = (Total drainage area)(1-year runoff volume)

0.026 af (Per hydrocad model) **1133** cf

Minimum Allowable RRv for enhanced Phosphorous Removal
RRv= P1-yr * Rv* Aic*S 0.0038903 **169** cf
P1-yr= 1.89
Rv=.05+.009(I) 0.95
Aic= 0.13
S= 0.2

	CALCULATIONS :	Project No.:	20-243
		Date:	9/21/2022
	Project: **Sunset Ridge**	By:	JWJ
	WQv calcs for Dry swaes	Sheet	1 of 2

Dry Swale #2

Water Quality Area =	**4.3 acres**	Area= Treatment area
Impervious Area =	**0.5 acres**	
I = % Impervious =	**10.9** %	
Weighted S Value =	**0.20**	

Hydrologic Soil Group (HSG) Specific Reduction Factor "S" =

Soil Classification	Area (ac)	S Factor	Weighted #
A Soils	**0**	0.5	0
B Soils	**0**	0.4	0
C Soils	**0**	0.3	0
D Soils	**4.3**	0.2	0.86

Total Area = 4.3 acres
Total Weighted # = 0.86

Weighted S Value = **0.20**

Rv = 0.05 + 0.009(I)

Rv = 0.1483721

Required WQv - based on Enhanced Phosphorus removal (Chapter 10) of NYSDEC Design Manual
Req WQv = (Total drainage area)(1-year runoff volume)

0.174 af **7579.44 cf**

Minimum Allowable RRv for enhanced Phosphorous Removal

RRv= P1-yr * Rv* Aic*S	0.0140648	**613 cf**
P1-yr=	1.89	
Rv=.05+.009(I)	0.95	
Aic=	0.47	
S=	0.2	

Dry Swale Worksheet

Design Point:	

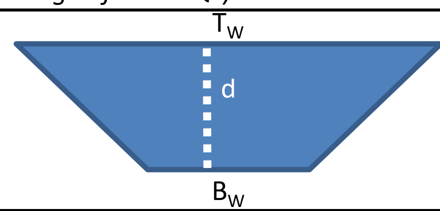
Enter Site Data For Drainage Area to be Treated by Practice

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Precipitation *(in)*	Description
1	1.20	0.13	.11	0.15	1132.56	1.00	Dry Swale
Enter Impervious Area Reduced by Disconection of Rooftops		0.00	11%	0.15	1,133	<<WQv after adjusting for Disconnected Rooftops	

Pretreatment Provided			Pretreatment Technique
Pretreatment (10% of WQv)	113	*ft^3*	

Calculate Available Storage Capacity

Bottom Width	6.7	*ft*	Design with a bottom width no greater than eight feet to avoid potential gullying and channel braiding, but no less than two feet
Side Slope (X:1)	4	*Okay*	Channels shall be designed with moderate side slopes (flatter than 3:1) for most conditions. 2:1 is the absolute maximum side slope
Longitudinal Slope	3%	*Okay*	*Maximum longitudinal slope shall be 4%*
Flow Depth	0.5	*ft*	*Maximum ponding depth of one foot at the mid-point of the channel, and a maximum depth of 18" at the end point of the channel (for storage of the WQv)*
Top Width	10.7	*ft*	
Area	4.35	*sf*	
Minimum Length	234	*ft*	
Actual Length	235	*ft*	
End Point Depth check	1.50	*Okay*	*A maximum depth of 18" at the end point of the channel (for storage of the WQv)*
Storage Capacity	1,136	*ft^3*	
Soil Group (HSG)		C	



Runoff Reduction

Is the Dry Swale contributing flow to another practice?	No	Select Practice	N/A
RRv	**227**	***ft^3***	**Runnoff Reduction equals 40% in HSG A and B and 20% in HSG C and D up to the WQv**
Volume Treated	905	*ft^3*	This is the difference between the WQv calculated and the runoff reduction achieved in the swale
Volume Directed	0	*ft^3*	This volume is directed another practice
Volume √	*Okay*		Check to be sure that channel is long enough to store WQv

Dry Swale Worksheet

Design Point:	

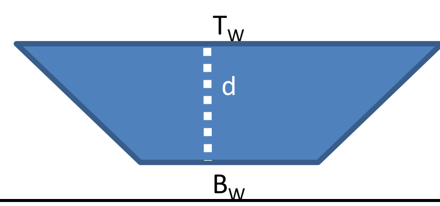
Enter Site Data For Drainage Area to be Treated by Practice

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Precipitation *(in)*	Description
5	4.30	0.50	.11	.15	7579.44	1.00	Dry Swale
Enter Impervious Area Reduced by Disconnection of Rooftops			53%	0.53	7,579	<<WQv after adjusting for Disconnected Rooftops	

Pretreatment Provided			Pretreatment Technique
Pretreatment (10% of WQv)	758	*ft^3*	

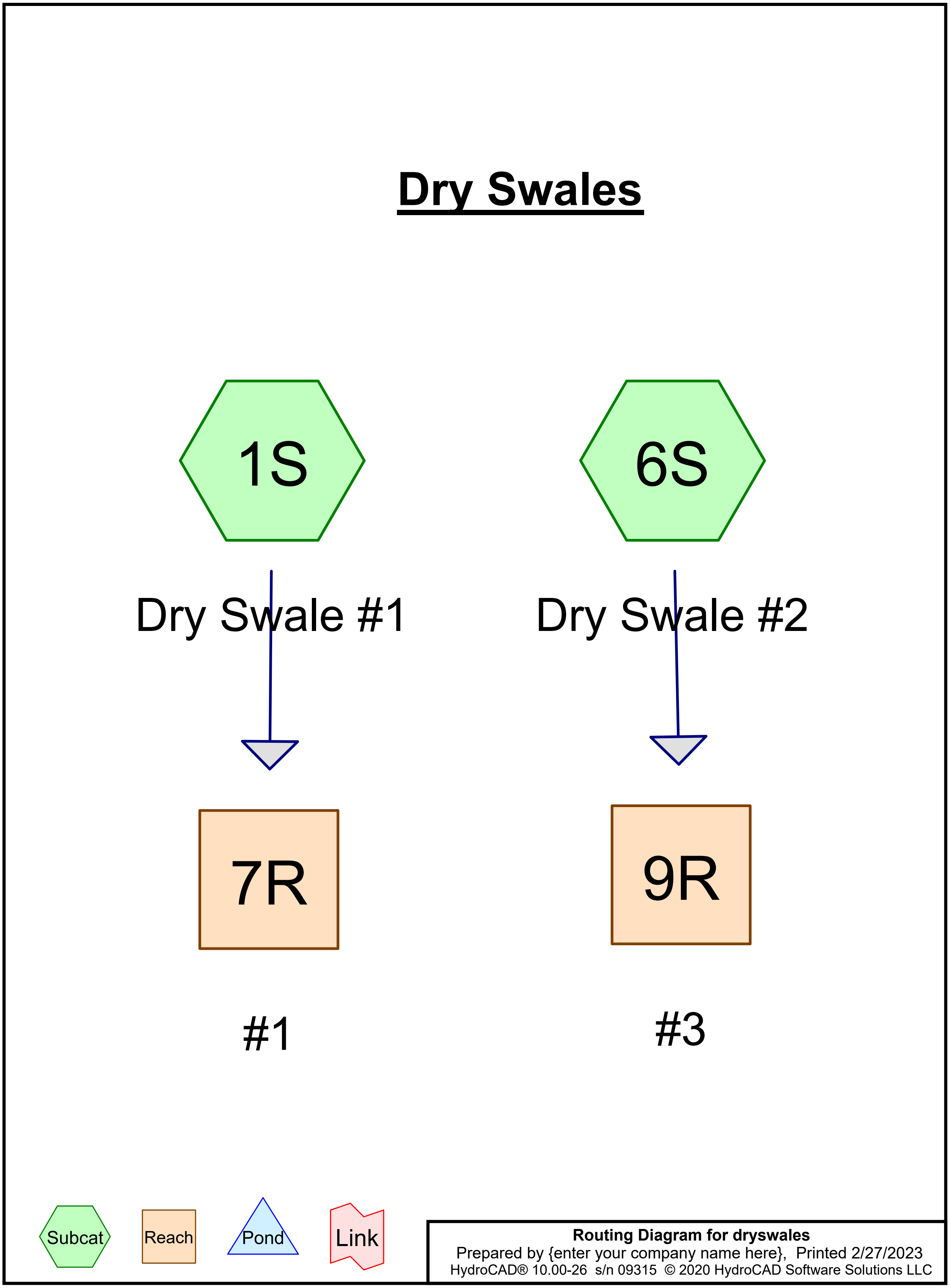
Calculate Available Storage Capacity

Bottom Width	8	*ft*	Design with a bottom width no greater than eight feet to avoid potential gullying and channel braiding, but no less than two feet
Side Slope (X:1)	10	*Okay*	Channels shall be designed with moderate side slopes (flatter than 3:1) for most conditions. 2:1 is the absolute maximum side slope
Longitudinal Slope	2%	*Okay*	*Maximum longitudinal slope shall be 4%*
Flow Depth	1	*ft*	*Maximum ponding depth of one foot at the mid-point of the channel, and a maximum depth of 18" at the end point of the channel (for storage of the WQv)*
Top Width	28	*ft*	
Area	18.00	*sf*	
Minimum Length	379	*ft*	
Actual Length	380	*ft*	
End Point Depth check	1.50	*Okay*	*A maximum depth of 18" at the end point of the channel (for storage of the WQv)*
Storage Capacity	7,598	*ft^3*	
Soil Group (HSG)			C



Runoff Reduction

Is the Dry Swale contributing flow to another practice?		No	Select Practice
RRv	**1,520**	***ft^3***	**Runnoff Reduction equals 40% in HSG A and B and 20% in HSG C and D up to the WQv**
Volume Treated	6,060	*ft^3*	This is the difference between the WQv calculated and the runoff reduction achieved in the swale
Volume Directed	0	*ft^3*	This volume is directed another practice



Routing Diagram for dryswales
Prepared by {enter your company name here}, Printed 2/27/2023

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.760	74	>75% Grass cover, Good, HSG C (1S)
3.230	80	>75% Grass cover, Good, HSG D (6S)
0.310	65	Brush, Good, HSG C (1S)
0.630	73	Brush, Good, HSG D (6S)
0.600	98	Paved parking, HSG D (1S, 6S)
5.530	**79**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.070	HSG C	1S
4.460	HSG D	1S, 6S
0.000	Other	
5.530		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.760	3.230	0.000	3.990	>75% Grass cover, Good	1S, 6S
0.000	0.000	0.310	0.630	0.000	0.940	Brush, Good	1S, 6S
0.000	0.000	0.000	0.600	0.000	0.600	Paved parking	1S, 6S
0.000	**0.000**	**1.070**	**4.460**	**0.000**	**5.530**	**TOTAL AREA**	

Time span=0.00-20.00 hrs, dt=0.01 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Dry Swale #1 Runoff Area=1.200 ac 10.83% Impervious Runoff Depth>0.26"
Flow Length=345' Tc=17.5 min CN=74 Runoff=0.32 cfs 0.026 af

Subcatchment6S: Dry Swale #2 Runoff Area=4.330 ac 10.85% Impervious Runoff Depth>0.48"
Flow Length=743' Tc=14.6 min CN=81 Runoff=2.86 cfs 0.172 af

Reach 7R: #1 Avg. Flow Depth=0.09' Max Vel=1.16 fps Inflow=0.32 cfs 0.026 af
n=0.030 L=140.0' S=0.0236 '/' Capacity=12.99 cfs Outflow=0.31 cfs 0.026 af

Reach 9R: #3 Avg. Flow Depth=0.20' Max Vel=1.64 fps Inflow=2.86 cfs 0.172 af
n=0.030 L=362.0' S=0.0166 '/' Capacity=90.64 cfs Outflow=2.67 cfs 0.171 af

Total Runoff Area = 5.530 ac Runoff Volume = 0.198 af Average Runoff Depth = 0.43"
89.15% Pervious = 4.930 ac 10.85% Impervious = 0.600 ac

Summary for Subcatchment 1S: Dry Swale #1

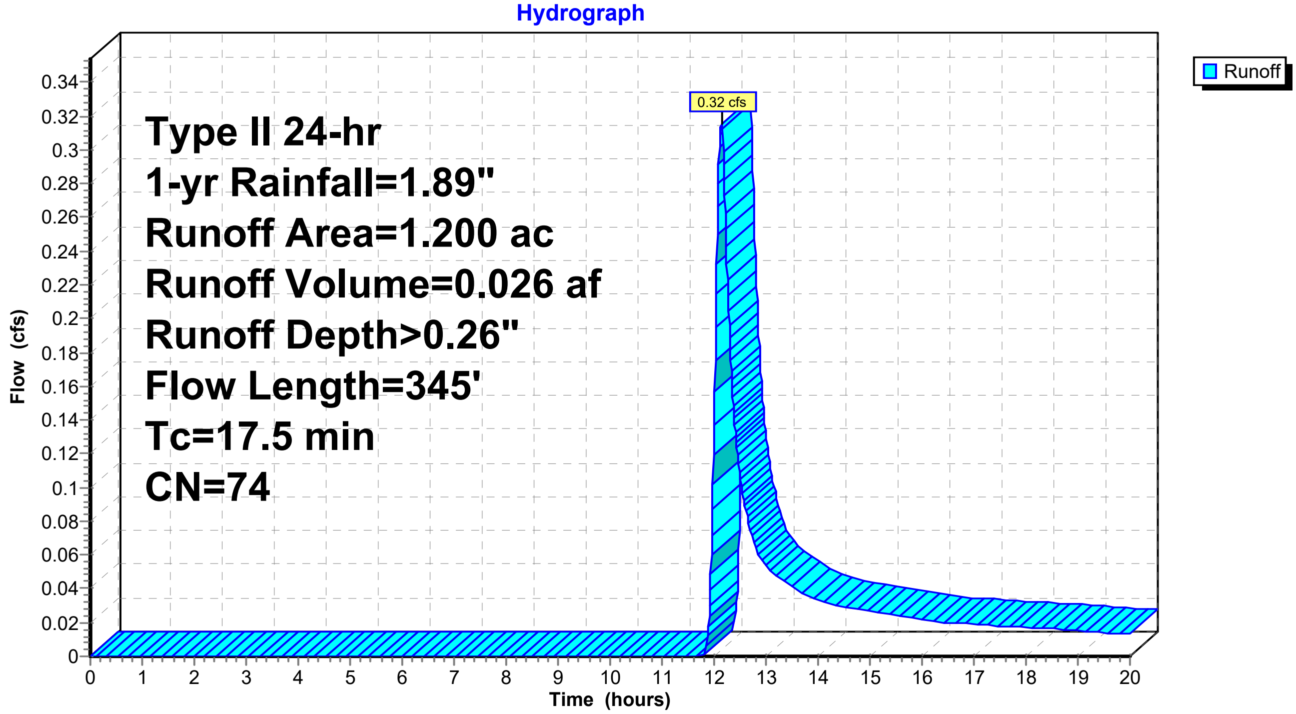
Runoff = 0.32 cfs @ 12.14 hrs, Volume= 0.026 af, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=1.89"

Area (ac)	CN	Description
0.130	98	Paved parking, HSG D
0.310	65	Brush, Good, HSG C
0.760	74	>75% Grass cover, Good, HSG C
1.200	74	Weighted Average
1.070		89.17% Pervious Area
0.130		10.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	28	0.5000	0.44		**Sheet Flow, Sheet Flow** Range n= 0.130 P2= 2.19"
16.0	72	0.1400	0.08		**Sheet Flow, Sheet Flow** Woods: Dense underbrush n= 0.800 P2= 2.19"
0.1	45	0.1100	5.34		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.3	200	0.0550	10.91	87.27	**Channel Flow, Channel Flow** Area= 8.0 sf Perim= 14.0' r= 0.57' n= 0.022 Earth, clean & straight
17.5	345	Total			

Subcatchment 1S: Dry Swale #1



Summary for Subcatchment 6S: Dry Swale #2

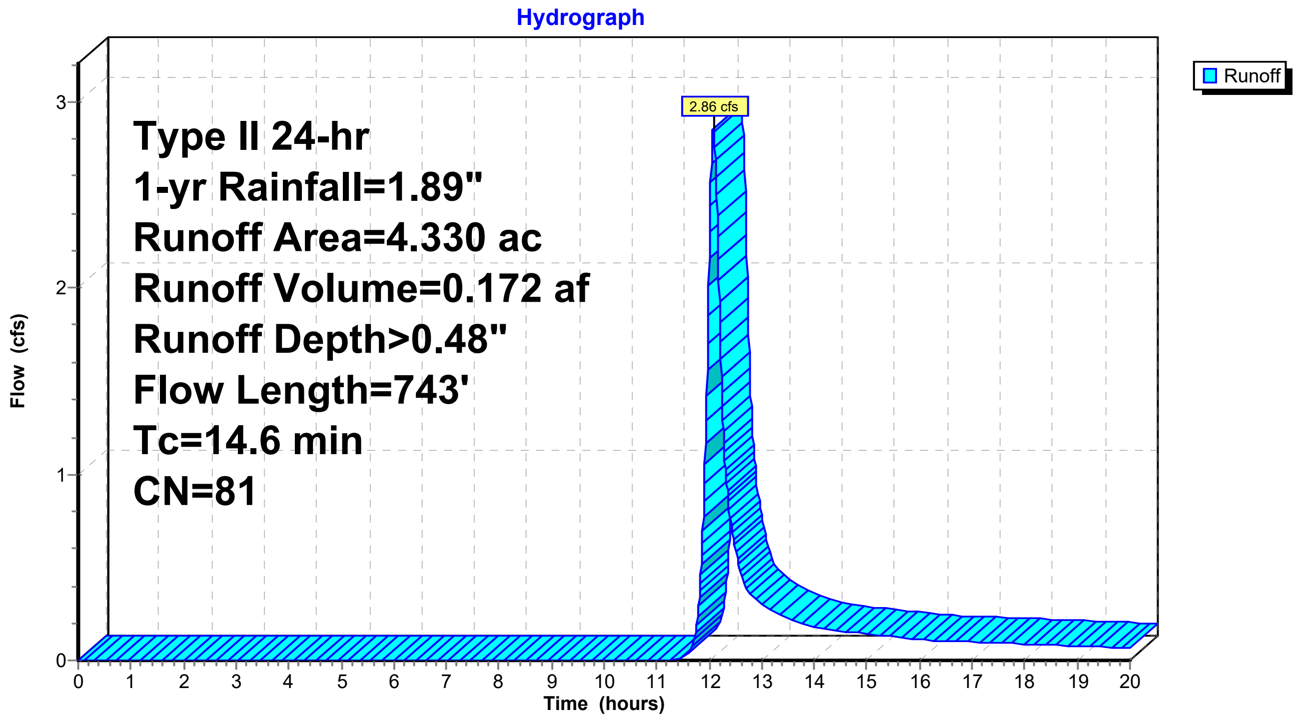
Runoff = 2.86 cfs @ 12.08 hrs, Volume= 0.172 af, Depth> 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=1.89"

Area (ac)	CN	Description
0.470	98	Paved parking, HSG D
0.630	73	Brush, Good, HSG D
3.230	80	>75% Grass cover, Good, HSG D
4.330	81	Weighted Average
3.860		89.15% Pervious Area
0.470		10.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	75	0.0130	0.11		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.19"
0.2	57	0.1200	5.58		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.7	110	0.0270	2.65		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
0.6	81	0.1850	2.15		**Shallow Concentrated Flow, Shallow Concentrated** Woodland Kv= 5.0 fps
0.4	40	0.0100	1.61		**Shallow Concentrated Flow, Shallow Concentrated** Unpaved Kv= 16.1 fps
1.5	380	0.0200	4.26	76.62	**Channel Flow, Channel Flow** Area= 18.0 sf Perim= 38.0' r= 0.47' n= 0.030 Earth, grassed & winding
14.6	743	Total			

Subcatchment 6S: Dry Swale #2



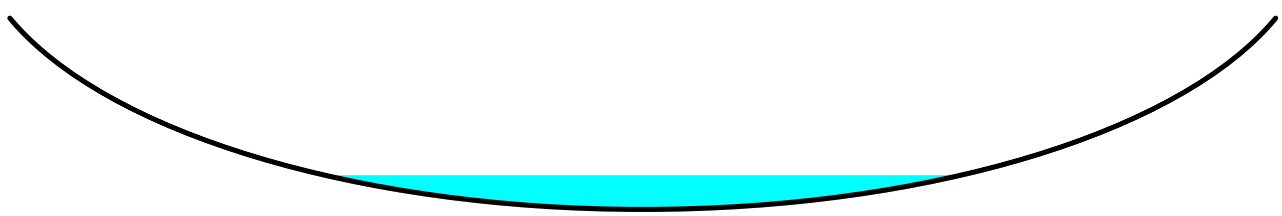
Summary for Reach 7R: #1

Inflow Area = 1.200 ac, 10.83% Impervious, Inflow Depth > 0.26" for 1-yr event
Inflow = 0.32 cfs @ 12.14 hrs, Volume= 0.026 af
Outflow = 0.31 cfs @ 12.20 hrs, Volume= 0.026 af, Atten= 2%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.16 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.56 fps, Avg. Travel Time= 4.2 min

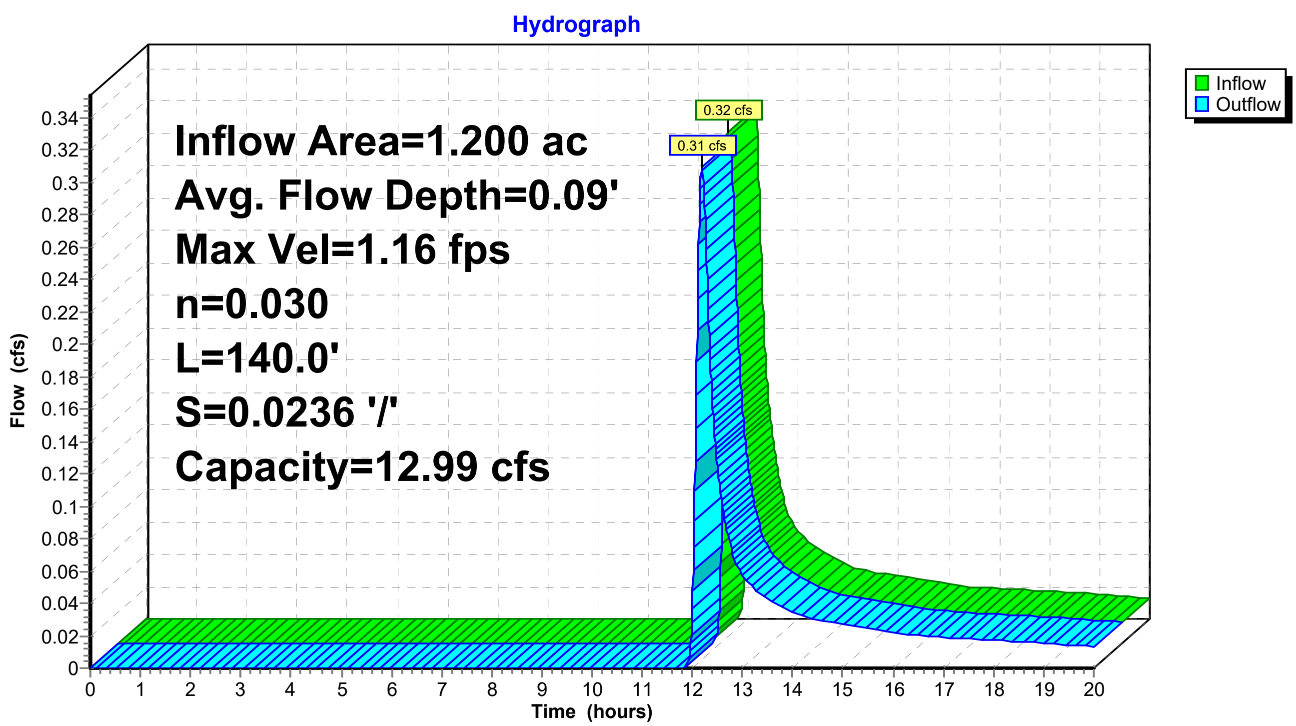
Peak Storage= 38 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 0.50' Flow Area= 3.6 sf, Capacity= 12.99 cfs

10.70' x 0.50' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 140.0' Slope= 0.0236 '/'
Inlet Invert= 707.50', Outlet Invert= 704.20'



‡

Reach 7R: #1



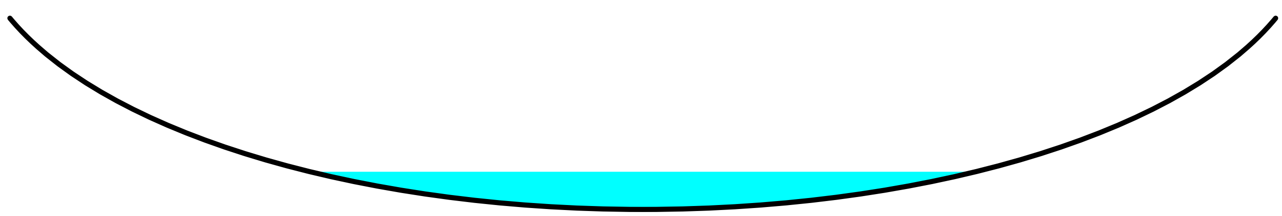
Summary for Reach 9R: #3

Inflow Area = 4.330 ac, 10.85% Impervious, Inflow Depth > 0.48" for 1-yr event
Inflow = 2.86 cfs @ 12.08 hrs, Volume= 0.172 af
Outflow = 2.67 cfs @ 12.18 hrs, Volume= 0.171 af, Atten= 7%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.64 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 8.8 min

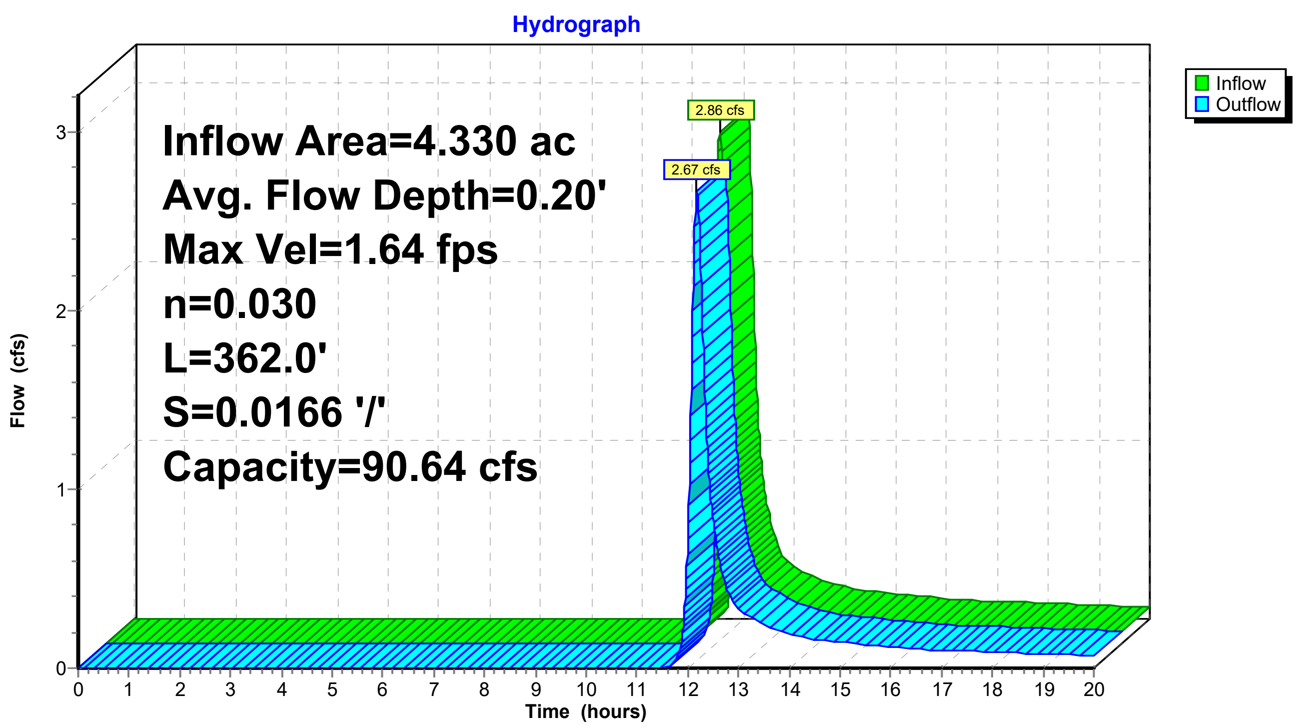
Peak Storage= 588 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 18.7 sf, Capacity= 90.64 cfs

28.00' x 1.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 362.0' Slope= 0.0166 '/'
Inlet Invert= 717.00', Outlet Invert= 711.00'



‡

Reach 9R: #3



	CALCULATIONS :	Project No.: 20-243
		Date: 9/21/2022
	Project: **Sunset Ridge**	By: JWJ
	WQv calcs for Rain Gardens (lower portion lots)	Sheet 1 of 2

Rain Garden

Water Quality Area = **1.1 acres** Area= Treatment area
Impervious Area = **1.1 acres**
I = % Impervious = **100.0** %
Weighted S Value = **0.20**

Hydrologic Soil Group (HSG) Specific Reduction Factor "S" =

Soil Classification	Area (ac)	S Factor	Weighted #
A Soils	**0**	0.5	0
B Soils	**0**	0.4	0
C Soils	**0**	0.3	0
D Soils	**1.05**	0.2	0.21

Total Area = 1.1 acres
Total Weighted # = 0.21

Weighted S Value = **0.20**

Rv = 0.05 + 0.009(I)

Rv = 0.95

Required WQv - based on Enhanced Phosphorus removal (Chapter 10) of NYSDEC Design Manual
Req WQv = (Total drainage area)(1-year runoff volume)

0.138 af **6011.28 cf**

Minimum Allowable RRv for enhanced Phosphorous Removal
RRv= P1-yr * Rv* Aic*S 0.0329175 **1434 cf**
P1-yr= 1.89
Rv=.05+.009(I) 0.95
Aic= 1.1
S= 0.2

	CALCULATIONS :	Project No.:	20-243
		Date:	9/21/2022
	Project: **Sunset Ridge**	By:	JWJ
	WQv calcs for Rain Gardens (lower portion lots)	Sheet	1 of 2

Rain Garden

Water Quality Area = **0.8 acres** Area= Treatment area
Impervious Area = **0.8 acres**
I = % Impervious = **100.0** %
Weighted S Value = **0.20**

Hydrologic Soil Group (HSG) Specific Reduction Factor "S" =

Soil Classification	Area (ac)	S Factor	Weighted #
A Soils	**0**	0.5	0
B Soils	**0**	0.4	0
C Soils	**0**	0.3	0
D Soils	**0.78**	0.2	0.156

Total Area = 0.8 acres
Total Weighted # = 0.156

Weighted S Value = **0.20**

Rv = 0.05 + 0.009(I)

Rv = 0.95

Required WQv - based on Enhanced Phosphorus removal (Chapter 10) of NYSDEC Design Manual
Req WQv = (Total drainage area)(1-year runoff volume)

0.102 af **4443.12 cf**

Minimum Allowable RRv for enhanced Phosphorous Removal
RRv= P1-yr * Rv* Aic*S 0.0233415 **1017 cf**
P1-yr= 1.89
Rv=.05+.009(I) 0.95
Aic= 0.78
S= 0.2

Rain Garden Worksheet

$WQv \leq VSM + VDL + (DP \times ARG)$
$VSM = ARG \times DSM \times nSM$
$VDL\ (optional) = ARG \times DDL \times nDL$

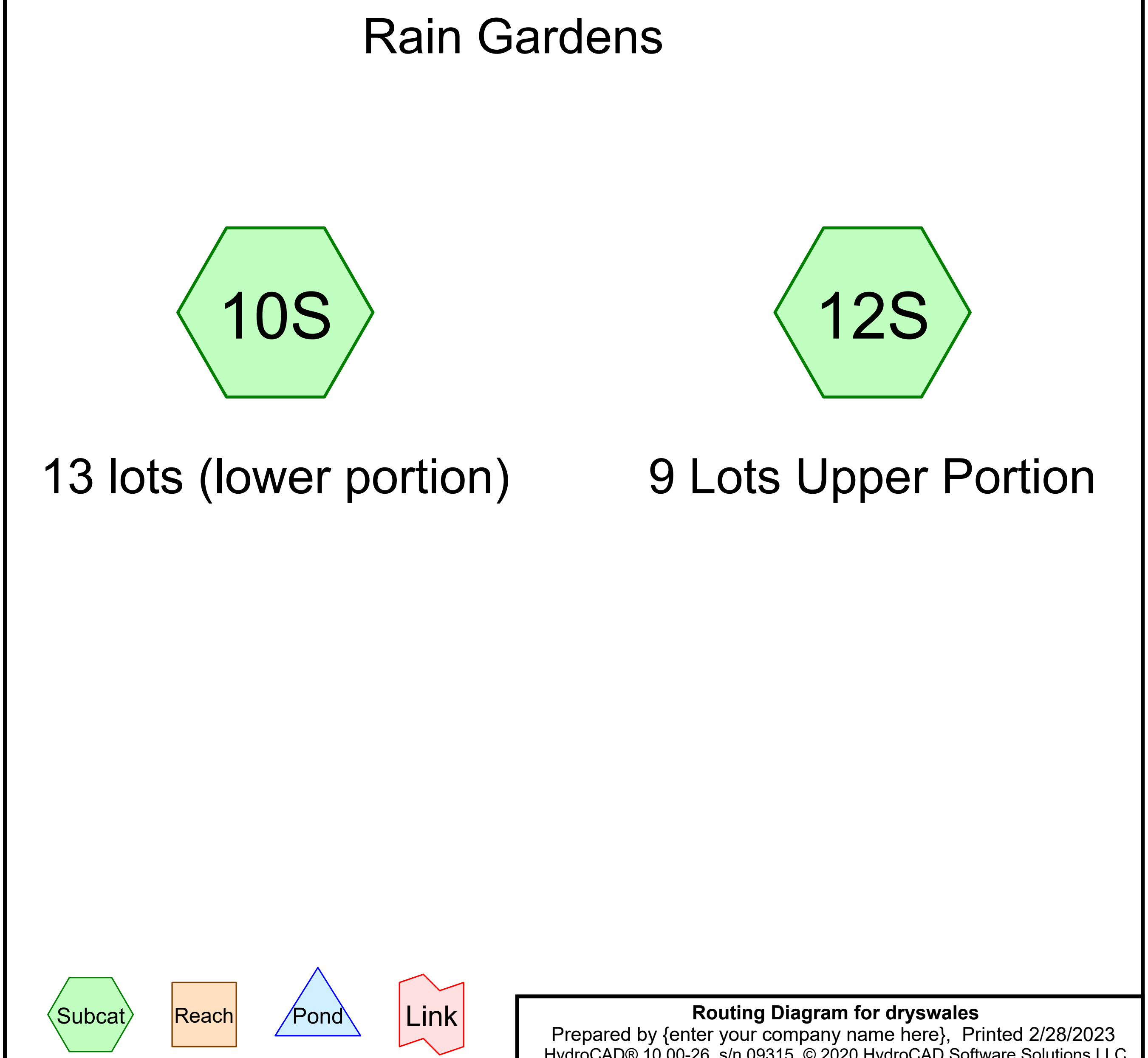
Design Point:							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
3	1.10	1.10	100%	0.95	6011.28	1.00	Rain Garden
Enter Impervious Area Reduced by Disconnection of Rooftops			87%	0.84	6,011	<<WQv after adjusting for Disconnected Rooftops	
Soil Information							
Soil Group		D					
Using Underdrains		*No*	*Okay*				
Infiltration Rate		0.50	*in/hour*	*Okay*			
Rain Garden Parameters							
Enter number of Rain Gardens			13				
Enter area of each Rain Garden			1,000				
Enter Rain Garden Surface area		ARG	13,000	*sf*			
Enter depth of Soil Media		DSM	1.50	*ft*	*1 to 1.50*		
Enter depth of drainage layer		DDL	1.00	*ft*	*≥ 0.50 ft*		
Enter ponding depth above surface		DP	0.50	*ft*	*≤ 0.50*		
Enter porosity of Soil Media		nSM	0.20		*≥20%, enter as a decimal*		
Enter porosity of Drainage Layer		nDL	0.40		*≥ 40%, enter as a decimal*		
Volume Provided In Soil Media		VSM	3,900	*ft^3*			
Volume Provided in Drainage Layer		VDL	5,200	*ft^3*			
Volume Provided In Ponding Area			6,500	*ft^3*			
Total Volume Provided			15,600	*ft^3*			
Determine Runoff Reduction							
Percent Reduction			40%				
Runoff Reduction			**2,405**	***ft^3***			
$WQv \leq VSM + VDL + (DP \times ARG)$ √			OK				

Rain Garden Worksheet

$$WQv \le VSM + VDL + (DP \times ARG)$$
$$VSM = ARG \times DSM \times nSM$$
$$VDL\ (optional) = ARG \times DDL \times nDL$$

Design Point:							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
4	0.8	0.8	100%	0.95	4443.12	1.00	Rain Garden
Enter Impervious Area Reduced by Disconnection of Rooftops			78%	0.76	4,443	<<WQv after adjusting for Disconnected Rooftops	

Soil Information				
Soil Group		D		
Using Underdrains		*No*	*Okay*	
Infiltration Rate		0.50	*in/hour*	
Rain Garden Parameters				
Enter number of Rain Gardens		9		
Enter area of each Rain Garden		2,000		
Enter Rain Garden Surface	ARG	18,000	*sf*	
Enter depth of Soil Media	DSM	2.00	*ft*	*1 to 1.5*
Enter depth of drainage layer	DDL	1.00	*ft*	*≥ 0.5 ft*
Enter ponding depth above surface	DP	0.50	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%, enter as a decimal*
Enter porosity of Drainage Layer	nDL	0.40		*≥ 40%, enter as a decimal*
Volume Provided In Soil Media	VSM	7,200	*ft^3*	
Volume Provided in Drainage Layer	VDL	7,200	*ft^3*	
Volume Provided In Ponding Area		9,000	*ft^3*	
Total Volume Provided		23,400	*ft^3*	
Determine Runoff Reduction				
Percent Reduction		40%		
Runoff Reduction		**1,777**	***ft^3***	
WQv ≤ VSM + VDL + (DP x ARG) √		OK		



Routing Diagram for dryswales
Prepared by {enter your company name here}, Printed 2/28/2023

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.830	98	Paved parking, HSG D (10S, 12S)
1.830	**98**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.830	HSG D	10S, 12S
0.000	Other	
1.830		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	1.830	0.000	1.830	Paved parking	10S, 12S
0.000	**0.000**	**0.000**	**1.830**	**0.000**	**1.830**	**TOTAL AREA**	

Time span=0.00-20.00 hrs, dt=0.01 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment10S: 13 lots (lower portion) Runoff Area=1.050 ac 100.00% Impervious Runoff Depth>1.57"
Tc=6.0 min CN=98 Runoff=2.75 cfs 0.138 af

Subcatchment12S: 9 Lots Upper Portion Runoff Area=0.780 ac 100.00% Impervious Runoff Depth>1.57"
Tc=6.0 min CN=98 Runoff=2.04 cfs 0.102 af

Total Runoff Area = 1.830 ac Runoff Volume = 0.240 af Average Runoff Depth = 1.57"
0.00% Pervious = 0.000 ac 100.00% Impervious = 1.830 ac

Summary for Subcatchment 10S: 13 lots (lower portion)

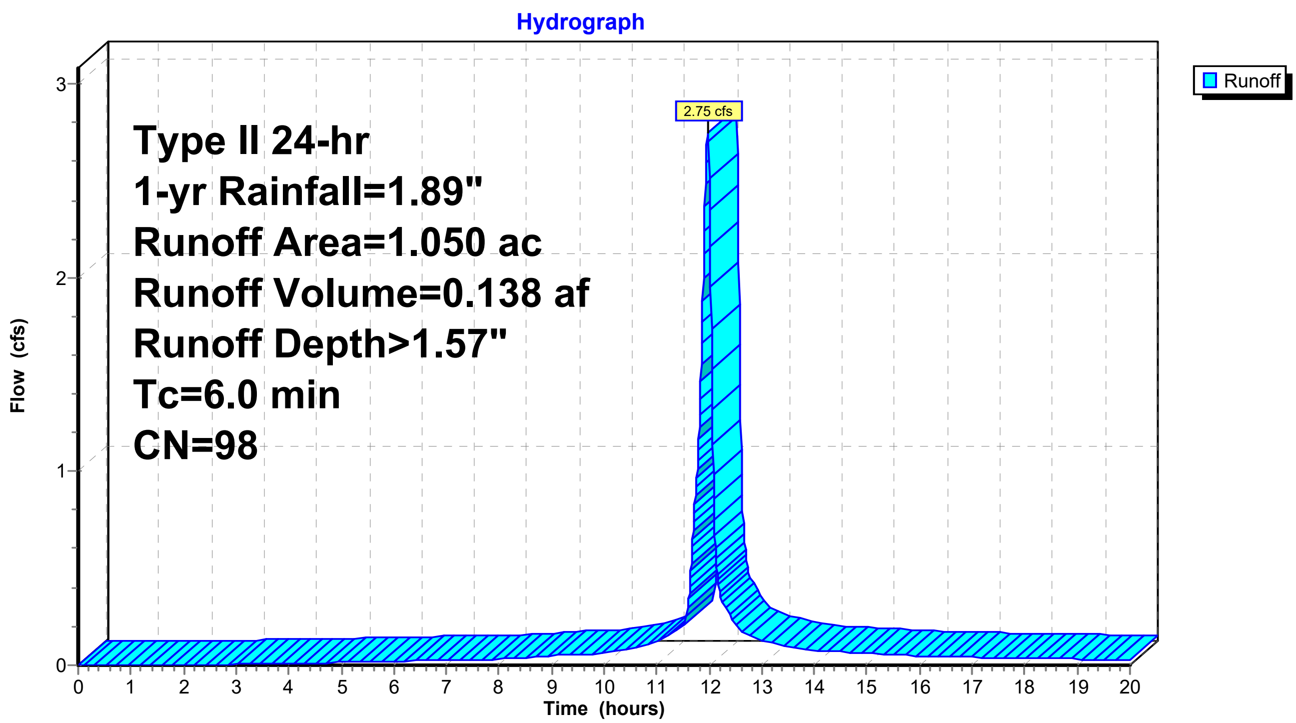
Runoff = 2.75 cfs @ 11.97 hrs, Volume= 0.138 af, Depth> 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=1.89"

Area (ac)	CN	Description
1.050	98	Paved parking, HSG D
1.050		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 10S: 13 lots (lower portion)



Summary for Subcatchment 12S: 9 Lots Upper Portion

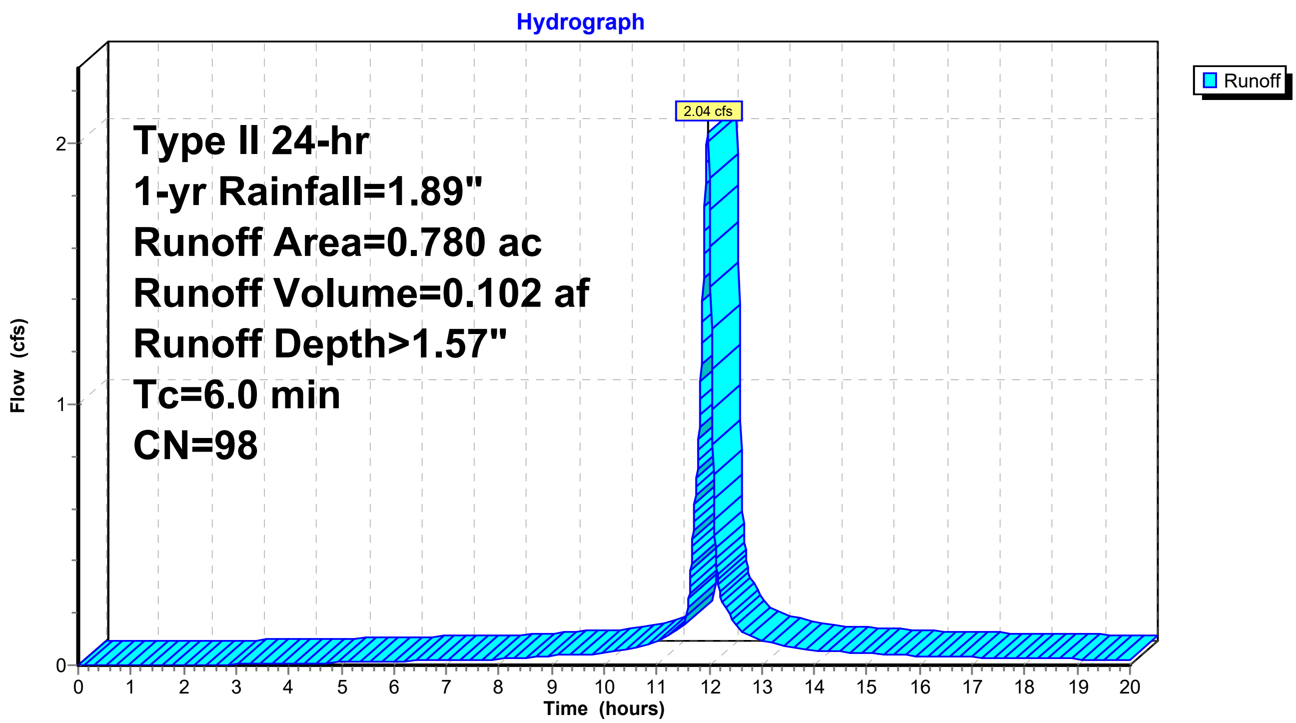
Runoff = 2.04 cfs @ 11.97 hrs, Volume= 0.102 af, Depth> 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=1.89"

Area (ac)	CN	Description
0.780	98	Paved parking, HSG D
0.780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 12S: 9 Lots Upper Portion



APPENDIX D

Notice of Intent
(NOI)

0644089821

NOTICE OF INTENT

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505

NYR ______ (for DEC use only)

Stormwater Discharges Associated with Construction Activity Under State Pollutant Discharge Elimination System (SPDES) General Permit # GP-0-20-001

All sections must be completed unless otherwise noted. Failure to complete all items may result in this form being returned to you, thereby delaying your coverage under this General Permit. Applicants must read and understand the conditions of the permit and prepare a Stormwater Pollution Prevention Plan prior to submitting this NOI. Applicants are responsible for identifying and obtaining other DEC permits that may be required.

-IMPORTANT-
RETURN THIS FORM TO THE ADDRESS ABOVE
OWNER/OPERATOR MUST SIGN FORM

Owner/Operator Information

Owner/Operator (Company Name/Private Owner Name/Municipality Name)
ATL Contractors

Owner/Operator Contact Person Last Name (NOT CONSULTANT)
Licciardello

Owner/Operator Contact Person First Name
Angelo

Owner/Operator Mailing Address
8242 East Bluff

City
Penn Yan

State
NY

Zip
14527 -

Phone (Owner/Operator)
585 - 820 - 0930

Fax (Owner/Operator)
- -

Email (Owner/Operator)
alhunter@rochester.rr.com

FED TAX ID
82 - 0829164 (not required for individuals)

6401089828

Project Site Information

Project/Site Name

Sunset Rdg. Estates/Lakewood Cust. Homes

Street Address (NOT P.O. BOX)

3535 East Lake Road

Side of Street

○ North ● South ○ East ○ West

City/Town/Village (THAT ISSUES BUILDING PERMIT)

Canandaigua

State	Zip	County	DEC Region
NY	14424 -	Ontario	8

Name of Nearest Cross Street

Oteiana Point

Distance to Nearest Cross Street (Feet)

100

Project In Relation to Cross Street

○ North ○ South ● East ○ West

Tax Map Numbers
Section-Block-Parcel

98.19-1-20.100

Tax Map Numbers

1. Provide the Geographic Coordinates for the project site. To do this, go to the NYSDEC Stormwater Interactive Map on the DEC website at:

https://gisservices.dec.ny.gov/gis/stormwater/

Zoom into your Project Location such that you can accurately click on the centroid of your site. Once you have located the centroid of your project site, go to the bottom right hand corner of the map for the X, Y coordinates. Enter the coordinates into the boxes below. For problems with the interactive map use the help function.

X Coordinates (Easting)

-7 7 2 4 9 2 1

Ex. -73.749

Y Coordinates (Northing)

4 2 8 5 6 4 4

Ex. 42.652

2. What is the nature of this construction project?

● **New Construction**

○ **Redevelopment with increase in impervious area**

○ **Redevelopment with no increase in impervious area**

3. Select the predominant land use for both pre and post development conditions.
SELECT ONLY ONE CHOICE FOR EACH

Pre-Development Existing Land Use

- ● FOREST
- ○ PASTURE/OPEN LAND
- ○ CULTIVATED LAND
- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ○ INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY
- ○ PARKING LOT
- ○ OTHER

Post-Development Future Land Use

- ○ SINGLE FAMILY HOME
- ● SINGLE FAMILY SUBDIVISION — Number of Lots: 31
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ○ INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ MUNICIPAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY (water, sewer, gas, etc.)
- ○ PARKING LOT
- ○ CLEARING/GRADING ONLY
- ○ DEMOLITION, NO REDEVELOPMENT
- ○ WELL DRILLING ACTIVITY *(Oil, Gas, etc.)
- ○ OTHER

***Note**: for gas well drilling, non-high volume hydraulic fractured wells only

4. In accordance with the larger common plan of development or sale, enter the total project site area; the total area to be disturbed; existing impervious area to be disturbed (for redevelopment activities); and the future impervious area constructed within the disturbed area. (Round to the nearest tenth of an acre.)

Total Site Area	Total Area To Be Disturbed	Existing Impervious Area To Be Disturbed	Future Impervious Area Within Disturbed Area
33.2	28.0	0.	6.3

5. Do you plan to disturb more than 5 acres of soil at any one time? ● **Yes** ○ **No**

6. Indicate the percentage of each Hydrologic Soil Group(HSG) at the site.

A	B	C	D
0 %	10 %	40 %	50 %

7. Is this a phased project? ○ **Yes** ● **No**

8. Enter the planned start and end dates of the disturbance activities.

Start Date 10/01/2022 - **End Date** 10/01/2025

9. Identify the nearest surface waterbody(ies) to which construction site runoff will discharge.

Name

Unnamed Class C Stream (Reg#898-196)

9a. Type of waterbody identified in Question 9?

- ○ Wetland / State Jurisdiction On Site (Answer 9b)
- ○ Wetland / State Jurisdiction Off Site
- ○ Wetland / Federal Jurisdiction On Site (Answer 9b)
- ○ Wetland / Federal Jurisdiction Off Site
- ○ Stream / Creek On Site
- ● Stream / Creek Off Site
- ○ River On Site
- ○ River Off Site
- ○ Lake On Site
- ○ Lake Off Site
- ○ Other Type On Site
- ○ Other Type Off Site

9b. How was the wetland identified?

- ● Regulatory Map
- ○ Delineated by Consultant
- ○ Delineated by Army Corps of Engineers
- ○ Other (identify)

10. Has the surface waterbody(ies) in question 9 been identified as a 303(d) segment in Appendix E of GP-0-20-001? ○ **Yes** ● **No**

11. Is this project located in one of the Watersheds identified in Appendix C of GP-0-20-001? ○ **Yes** ● **No**

12. Is the project located in one of the watershed areas associated with AA and AA-S classified waters? **If no, skip question 13.** ● **Yes** ○ **No**

13. Does this construction activity disturb land with no existing impervious cover and where the Soil Slope Phase is identified as an E or F on the USDA Soil Survey? **If Yes, what is the acreage to be disturbed?** ○ **Yes** ● **No**

14. Will the project disturb soils within a State regulated wetland or the protected 100 foot adjacent area? ○ **Yes** ● **No**

15. Does the site runoff enter a separate storm sewer system (including roadside drains, swales, ditches, culverts, etc)?
○ Yes ● No ○ Unknown

16. What is the name of the municipality/entity that owns the separate storm sewer system?

17. Does any runoff from the site enter a sewer classified as a Combined Sewer?
○ Yes ● No ○ Unknown

18. Will future use of this site be an agricultural property as defined by the NYS Agriculture and Markets Law?
○ Yes ● No

19. Is this property owned by a state authority, state agency, federal government or local government?
○ Yes ● No

20. Is this a remediation project being done under a Department approved work plan? (i.e. CERCLA, RCRA, Voluntary Cleanup Agreement, etc.)
○ Yes ● No

21. Has the required Erosion and Sediment Control component of the SWPPP been developed in conformance with the current NYS Standards and Specifications for Erosion and Sediment Control (aka Blue Book)?
● Yes ○ No

22. Does this construction activity require the development of a SWPPP that includes the post-construction stormwater management practice component (i.e. Runoff Reduction, Water Quality and Quantity Control practices/techniques)?
If No, skip questions 23 and 27-39.
● Yes ○ No

23. Has the post-construction stormwater management practice component of the SWPPP been developed in conformance with the current NYS Stormwater Management Design Manual?
● Yes ○ No

24. The Stormwater Pollution Prevention Plan (SWPPP) was prepared by:

- ● **Professional Engineer (P.E.)**
- ○ **Soil and Water Conservation District (SWCD)**
- ○ **Registered Landscape Architect (R.L.A)**
- ○ **Certified Professional in Erosion and Sediment Control (CPESC)**
- ○ **Owner/Operator**
- ○ **Other**

SWPPP Preparer
Marks Engineering, P.C.

Contact Name (Last, Space, First)
Marks, Brennan

Mailing Address
42 Beeman St.

City
Canandaigua

State: NY Zip: 14424-

Phone: 585-905-0360 Fax: - -

Email
bmarks@marksengineering.com

SWPPP Preparer Certification

I hereby certify that the Stormwater Pollution Prevention Plan (SWPPP) for this project has been prepared in accordance with the terms and conditions of the GP-0-20-001. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of this permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

First Name Brennan **MI** A

Last Name Marks

Signature

Date 04/21/2021

25. Has a construction sequence schedule for the planned management practices been prepared? ● Yes ○ No

26. Select **all** of the erosion and sediment control practices that will be employed on the project site:

Temporary Structural

- ● Check Dams
- ● Construction Road Stabilization
- ● Dust Control
- ○ Earth Dike
- ○ Level Spreader
- ○ Perimeter Dike/Swale
- ○ Pipe Slope Drain
- ○ Portable Sediment Tank
- ○ Rock Dam
- ○ Sediment Basin
- ● Sediment Traps
- ● Silt Fence
- ● Stabilized Construction Entrance
- ● Storm Drain Inlet Protection
- ○ Straw/Hay Bale Dike
- ○ Temporary Access Waterway Crossing
- ○ Temporary Stormdrain Diversion
- ● Temporary Swale
- ○ Turbidity Curtain
- ○ Water bars

Biotechnical

- ○ Brush Matting
- ○ Wattling

Vegetative Measures

- ○ Brush Matting
- ○ Dune Stabilization
- ● Grassed Waterway
- ● Mulching
- ● Protecting Vegetation
- ● Recreation Area Improvement
- ● Seeding
- ○ Sodding
- ○ Straw/Hay Bale Dike
- ○ Streambank Protection
- ○ Temporary Swale
- ● Topsoiling
- ● Vegetating Waterways

Permanent Structural

- ○ Debris Basin
- ● Diversion
- ○ Grade Stabilization Structure
- ● Land Grading
- ○ Lined Waterway (Rock)
- ○ Paved Channel (Concrete)
- ○ Paved Flume
- ● Retaining Wall
- ○ Riprap Slope Protection
- ● Rock Outlet Protection
- ○ Streambank Protection

Other

0182089828

Post-construction Stormwater Management Practice (SMP) Requirements

Important: **Completion of Questions 27-39 is not required if response to Question 22 is No.**

27. Identify all site planning practices that were used to prepare the final site plan/layout for the project.

- ● **Preservation of Undisturbed Areas**
- ● **Preservation of Buffers**
- ● **Reduction of Clearing and Grading**
- ● **Locating Development in Less Sensitive Areas**
- ○ **Roadway Reduction**
- ● **Sidewalk Reduction**
- ● **Driveway Reduction**
- ○ **Cul-de-sac Reduction**
- ● **Building Footprint Reduction**
- ● **Parking Reduction**

27a. Indicate which of the following soil restoration criteria was used to address the requirements in Section 5.1.6("Soil Restoration") of the Design Manual (2010 version).

- ● All disturbed areas will be restored in accordance with the Soil Restoration requirements in Table 5.3 of the Design Manual (see page 5-22).

- ○ Compacted areas were considered as impervious cover when calculating the **WQv Required**, and the compacted areas were assigned a post-construction Hydrologic Soil Group (HSG) designation that is one level less permeable than existing conditions for the hydrology analysis.

28. Provide the total Water Quality Volume (WQv) required for this project (based on final site plan/layout).

Total WQv Required

2.563 **acre-feet**

29. Identify the RR techniques (Area Reduction), RR techniques(Volume Reduction) and Standard SMPs with RRv Capacity in Table 1 (See Page 9) that were used to reduce the Total WQv Required(#28).

Also, provide in Table 1 the total impervious area that contributes runoff to each technique/practice selected. For the Area Reduction Techniques, provide the total contributing area (includes pervious area) and, if applicable, the total impervious area that contributes runoff to the technique/practice.

Note: Redevelopment projects shall use Tables 1 and 2 to identify the SMPs used to treat and/or reduce the WQv required. If runoff reduction techniques will not be used to reduce the required WQv, skip to question 33a after identifying the SMPs.

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Table 1 - Runoff Reduction (RR) Techniques and Standard Stormwater Management Practices (SMPs)

	Total Contributing Area (acres)		Total Contributing Impervious Area(acres)
RR Techniques (Area Reduction)			
● Conservation of Natural Areas (RR-1)	4.5	and/or	.
○ Sheetflow to Riparian Buffers/Filters Strips (RR-2)	3.8	and/or	.
○ Tree Planting/Tree Pit (RR-3)	.	and/or	.
○ Disconnection of Rooftop Runoff (RR-4)	.	and/or	.
RR Techniques (Volume Reduction)			
○ Vegetated Swale (RR-5)			.
○ Rain Garden (RR-6)			1.9
○ Stormwater Planter (RR-7)			.
○ Rain Barrel/Cistern (RR-8)			.
○ Porous Pavement (RR-9)			.
○ Green Roof (RR-10)			.
Standard SMPs with RRv Capacity			
○ Infiltration Trench (I-1)			.
○ Infiltration Basin (I-2)			.
○ Dry Well (I-3)			.
○ Underground Infiltration System (I-4)			.
○ Bioretention (F-5)			.
● Dry Swale (O-1)			6.28 0.63
Standard SMPs			
○ Micropool Extended Detention (P-1)			.
● Wet Pond (P-2)			5.4 9.05
○ Wet Extended Detention (P-3)			.
○ Multiple Pond System (P-4)			.
○ Pocket Pond (P-5)			.
○ Surface Sand Filter (F-1)			.
○ Underground Sand Filter (F-2)			.
○ Perimeter Sand Filter (F-3)			.
○ Organic Filter (F-4)			.
○ Shallow Wetland (W-1)			.
○ Extended Detention Wetland (W-2)			.
○ Pond/Wetland System (W-3)			.
○ Pocket Wetland (W-4)			.
○ Wet Swale (O-2)			.

Table 2 - Alternative SMPs (DO NOT INCLUDE PRACTICES BEING USED FOR PRETREATMENT ONLY)

Alternative SMP	Total Contributing Impervious Area(acres)
○ Hydrodynamic	.
○ Wet Vault	.
○ Media Filter	.
○ Other	.

Provide the name and manufacturer of the Alternative SMPs (i.e. proprietary practice(s)) being used for WQv treatment.

Name

Manufacturer

Note: Redevelopment projects which do not use RR techniques, shall use questions 28, 29, 33 and 33a to provide SMPs used, total WQv required and total WQv provided for the project.

30. Indicate the Total RRv provided by the RR techniques (Area/Volume Reduction) and Standard SMPs with RRv capacity identified in question 29.

Total RRv provided

0.618 **acre-feet**

31. Is the Total RRv provided (#30) greater than or equal to the total WQv required (#28).

○ **Yes** ● **No**

If Yes, go to question 36.
If No, go to question 32.

32. Provide the Minimum RRv required based on HSG.
[Minimum RRv Required = (P)(0.95)(Ai)/12, Ai=(S)(Aic)]

Minimum RRv Required

0.310 **acre-feet**

32a. Is the Total RRv provided (#30) greater than or equal to the Minimum RRv Required (#32)?

● **Yes** ○ **No**

If Yes, go to question 33.
Note: Use the space provided in question #39 to summarize the specific site limitations and justification for not reducing 100% of WQv required (#28). A detailed evaluation of the specific site limitations and justification for not reducing 100% of the WQv required (#28) must also be included in the SWPPP.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

33. Identify the Standard SMPs in Table 1 and, if applicable, the Alternative SMPs in Table 2 that were used to treat the remaining total WQv(=Total WQv Required in 28 - Total RRv Provided in 30).

Also, provide in Table 1 and 2 the total impervious area that contributes runoff to each practice selected.

Note: Use Tables 1 and 2 to identify the SMPs used on Redevelopment projects.

33a. Indicate the Total WQv provided (i.e. WQv treated) by the SMPs identified in question #33 and Standard SMPs with RRv Capacity identified in question 29.

WQv Provided

0.053 **acre-feet**

Note: For the standard SMPs with RRv capacity, the WQv provided by each practice = the WQv calculated using the contributing drainage area to the practice - RRv provided by the practice. (See Table 3.5 in Design Manual)

34. Provide the sum of the Total RRv provided (#30) and the WQv provided (#33a). 1.151

35. Is the sum of the RRv provided (#30) and the WQv provided (#33a) greater than or equal to the total WQv required (#28)? ● **Yes** ○ **No**

If Yes, go to question 36.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

36. Provide the total Channel Protection Storage Volume (CPv) required and provided or select waiver (36a), if applicable.

CPv Required 0.35 **acre-feet**

CPv Provided 0.35 **acre-feet**

36a. The need to provide channel protection has been waived because:
- ○ Site discharges directly to tidal waters or a fifth order or larger stream.
- ○ Reduction of the total CPv is achieved on site through runoff reduction techniques or infiltration systems.

37. Provide the Overbank Flood (Qp) and Extreme Flood (Qf) control criteria or select waiver (37a), if applicable.

Total Overbank Flood Control Criteria (Qp)

Pre-Development 44.51 **CFS**

Post-development 9.19 **CFS**

Total Extreme Flood Control Criteria (Qf)

Pre-Development 115.58 **CFS**

Post-development 68.97 **CFS**

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37a. The need to meet the Qp and Qf criteria has been waived because:

- ○ Site discharges directly to tidal waters or a fifth order or larger stream.
- ○ Downstream analysis reveals that the Qp and Qf controls are not required

38. Has a long term Operation and Maintenance Plan for the post-construction stormwater management practice(s) been developed?

● Yes ○ No

If Yes, Identify the entity responsible for the long term Operation and Maintenance

ATL Contractors

39. Use this space to summarize the specific site limitations and justification for not reducing 100% of WQv required(#28). (See question 32a) This space can also be used for other pertinent project information.

40. Identify other DEC permits, existing and new, that are required for this project/facility.

- ○ Air Pollution Control
- ○ Coastal Erosion
- ○ Hazardous Waste
- ○ Long Island Wells
- ○ Mined Land Reclamation
- ○ Solid Waste
- ○ Navigable Waters Protection / Article 15
- ○ Water Quality Certificate
- ○ Dam Safety
- ○ Water Supply
- ○ Freshwater Wetlands/Article 24
- ○ Tidal Wetlands
- ○ Wild, Scenic and Recreational Rivers
- ○ Stream Bed or Bank Protection / Article 15
- ○ Endangered or Threatened Species(Incidental Take Permit)
- ○ Individual SPDES
- ○ SPDES Multi-Sector GP N Y R
- ○ Other
- ● None

41. Does this project require a US Army Corps of Engineers Wetland Permit? ○ Yes ● No
If Yes, Indicate Size of Impact. .

42. Is this project subject to the requirements of a regulated, traditional land use control MS4? ● Yes ○ No
(If No, skip question 43)

43. Has the "MS4 SWPPP Acceptance" form been signed by the principal executive officer or ranking elected official and submitted along with this NOI? ● Yes ○ No

44. If this NOI is being submitted for the purpose of continuing or transferring coverage under a general permit for stormwater runoff from construction activities, please indicate the former SPDES number assigned. N Y R

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Owner/Operator Certification

I have read or been advised of the permit conditions and believe that I understand them. I also understand that, under the terms of the permit, there may be reporting requirements. I hereby certify that this document and the corresponding documents were prepared under my direction or supervision. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further understand that coverage under the general permit will be identified in the acknowledgment that I will receive as a result of submitting this NOI and can be as long as sixty (60) business days as provided for in the general permit. I also understand that, by submitting this NOI, I am acknowledging that the SWPPP has been developed and will be implemented as the first element of construction, and agreeing to comply with all the terms and conditions of the general permit for which this NOI is being submitted.

Print First Name
Angelo

MI

Print Last Name
Licciardello

Owner/Operator Signature

Date
02/01/2021

APPENDIX E

MS4 Stormwater Pollution Prevention Plan (SWPPP) Acceptance Form -

APPENDIX F

MAINTENANCE AGREEMENT

and

Management Inspection Checklist

Disconnection and Sheetflow Level 1 Inspection

The Level 1 Inspection focuses on the Drainage Area (D&S 1), Level Spreader/Energy Dissipater (D&S 2), and Treatment Area (D&S 3). This inspection should be conducted twice per year, preferably in the spring and fall. If possible, inspect the practice during a storm in order to better see any active blockages, bypassing, or other problems.

D&S 1. Drainage Area

Description: The drainage area consists of rooftops and/or impervious surfaces such as parking lots, driveways, or sidewalks. Pervious areas such as lawns or forests may also be part of the drainage area.

Instruction: Visually inspect any surfaces in the drainage area. Consult **Table 2.4.1** below.

Table 2.4.1 D&S Drainage Area

Problem (Check if Present)		Follow-Up Actions
	☐ Changes in flow; more runoff; runoff bypassing the practice	☐ For rooftop areas, make sure downspouts are still disconnected and conveying water into the treatment area. ☐ Look for and remove any “dams” of sediment and grass clippings that prevent water from entering the treatment area as sheet flow. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Changes to drainage area size or amount of runoff due to construction, tillage, etc.
	☐ For parking lots in the drainage area—sediment, grass clippings, or other debris has accumulated at pavement edge.	☐ For small, isolated amounts of debris, sweep up by hand and dispose properly so that it will not be exposed to runoff. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Sediment is widespread and cannot be removed by manual sweeping.
	☐ For parking lots in the drainage area—dips or damage at pavement edge caused flow to concentrate.	☐ Kick-Out to Level 2 Inspection: This will likely require special expertise to diagnose and fix pavement edge.

D&S 2. Level Spreader/Energy Dissipator

Description: Some disconnection and sheetflow practices have a structure in place to dissipate any concentrated runoff and turn it into sheet flow. This may consist of a stone or gravel spreader a concrete or wood level spreader, or other level and stable surface.

Instruction: Inspect the energy dissipator closely, during a rain event if possible. Consult the **Table 2.4.2** below.

Table 2.4.2 D&S Level Spreader/Energy Dissipator

Problem (Check if Present)		Follow-Up Actions
	☐ Debris and/or sediment accumulated behind or around the level spreader.	☐ Remove debris and sediment by hand and ensure that the area behind the level spreader is relatively flat. Too much debris and sediment can cause runoff to bypass the level spreader structure. ☐ Other:
	☐ Sinking, cracking, sloughing, or other structural problem makes the energy dissipator no longer level.	☐ For stone/gravel spreaders, add new material or rake out as needed to make it even. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Structural issues that cannot be easily fixed by hand

D&S 3. Treatment Area

Description: After runoff is dissipated as sheet flow, it enters the treatment area–a relatively flat grassy or vegetated area.

Instruction: Examine where flow enters the treatment area as well as the whole flow path. Look for signs of concentrated flow. Consult the table below.

Table 2.4.3 D&S Treatment Area

Problem (Check if Present)	Follow-Up Actions
☐ Trash and/or debris in the treatment area	☐ Collect trash/debris and dispose of properly.
 ☐ Grass filter strip has grown very tall, to the point that runoff cannot easily enter or is getting concentrated.	☐ Mow filter strip twice a year or more frequently in a residential yard.
☐ Sparse vegetation or bare spots	☐ For grassy areas, add topsoil (as needed), grass seed mulch, and water during the growing season to re-establish consistent vegetation cover. ☐ Other:
 ☐ Rills or gullies are forming in treatment area where flow has become concentrated	☐ For minor rills, fill in with soil, compact, and add seed and straw to establish vegetation. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Rills are more than 2" to 3" deep and require more than just hand raking and re-seeding.

2.5. Swales

Areas of Swales

- Key areas to inspect for swales include the following:
- SW 1. Drainage Area
- SW 2. Inlets
- SW 3. Swale Surface Area
- SW 4. Vegetation
- SW 5. Outlets

Note: The category of Swales includes:

- Vegetated Swale – shallow channel densely planted with variety of grasses, shrubs, and/or trees (also called bioswale or drainage swale)
- Wet Swale – a cross between a wetland and a swale, this linear system intercepts groundwater to maintain wetland vegetation

For the purposes of this chapter, the term “Swale” will be used to generally describe these practices.

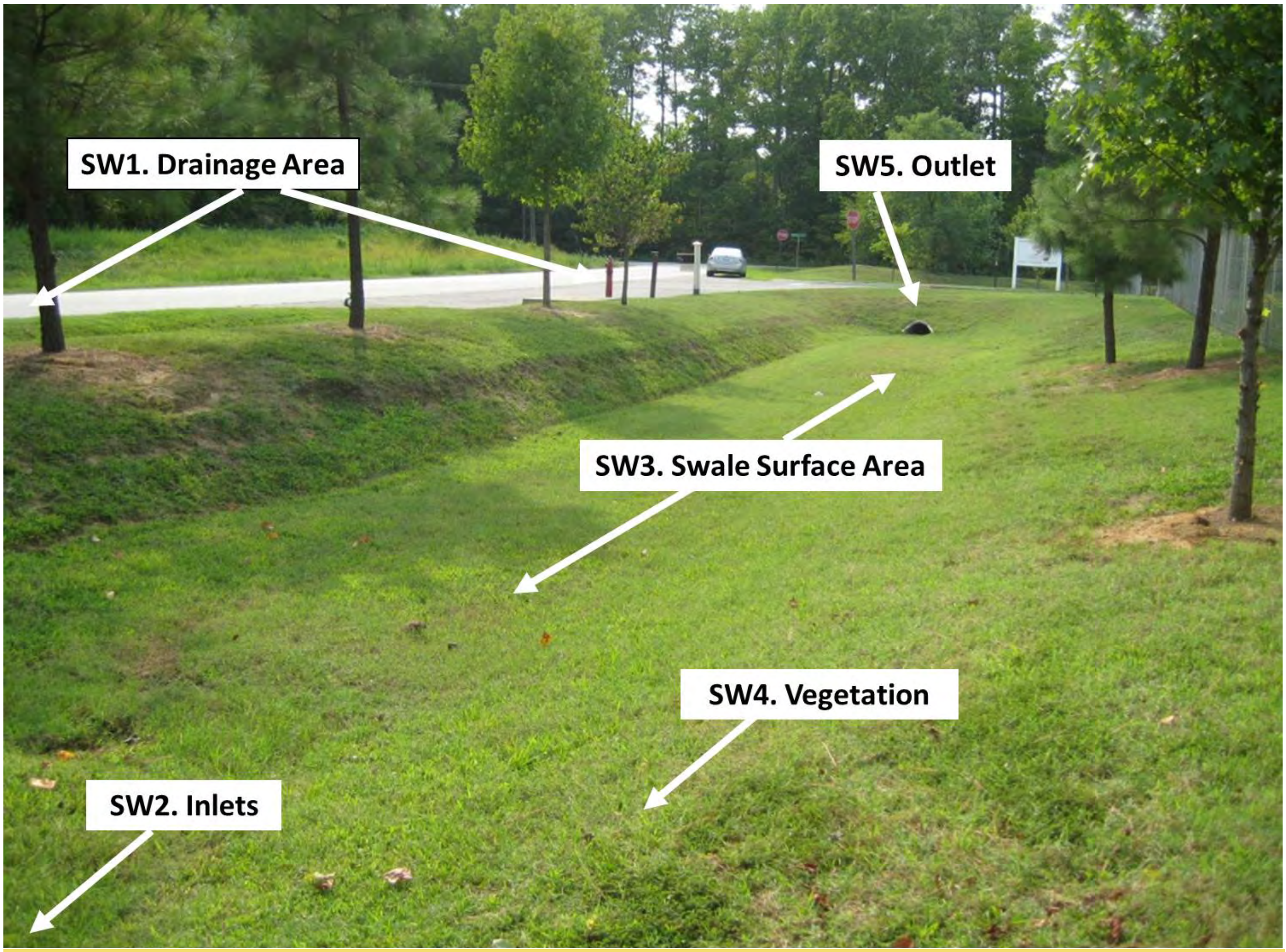


Figure 2.5.1 Key Areas for Level 1 Inspection of Swales Credit

Swale Level 1 Inspection

The Level 1 Inspection focuses on the Drainage Area (SW1), Inlets (SW2), Swale Surface Area (SW3), Vegetation (SW4), and Outlets (SW5). This inspection should be conducted on a regular basis, with an early spring inspection to ensure that the practice has survived the winter, particularly if there has been a significant amount of snow. An inspection during the growing season or in the early fall is also recommended to check on the health of vegetation.

SW 1. Drainage Area

Description: The drainage area sends runoff to and is uphill from the swale. When it rains, water runs off and flows to and along the swale.

Instruction: Look for areas that are uphill from the swale. Consult **Table 2.5.1** below.

Table 2.5.1 SW Drainage Area

Problem (Check if Present)		Follow-Up Actions
	☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and mulch or sod areas of bare soil to establish vegetation. ☐ Fill in erosion areas with soil, compact, and add seed and straw to establish vegetation. ☐ If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Large areas of soil have been eroded, or larger channels are forming. May require rerouting of flow paths
	☐ Piles of grass clippings, mulch, dirt, salt, or other materials	☐ Remove or cover piles of grass clippings, mulch, dirt, etc. ☐ Other:
☐ Open containers of oil, grease, paint, or other substances		☐ Cover or properly dispose of materials; consult your local solid waste authority for guidance on materials that may be toxic or hazardous.
		Kick-Out to Level 2 Inspection: Grass on edge of pavement continues to die off for unknown reasons. Swale edge may need to be replaced with other materials (e.g., stone diaphragm).
☐ Grass dying at edge of road		☐ Seed and mulch; add topsoil or compost if needed. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Grass on edge of pavement continues to die off for unknown reasons. Swale edge may need to be replaced with other materials (e.g., stone diaphragm).

SW 2. Inlets

Description: The inlets to a swale are where water flows in. Depending on the design, water can flow in through:

- Ditch, pipe, or curb opening at top of swale: This is the most common approach, where water enters the swale at the top.
- Along the entire edge of the swale: If the swale is along a roadway or parking lot, water may enter along the long side of the swale through defined curb openings or simply by water flowing into the swale from the pavement edge (known as “sheetflow”).

Instruction: Stand in the swale and look for all the places where water flows in. Consult **Table 2.5.2** below for possible problems.

Table 2.5.2 SW Inlets

Problem (Check if Present)	Follow-Up Actions
☐ Inlets or the swale edge are collecting grit, grass clippings, or debris or have grass/weeds growing. Some water may not be getting into the swale. The objective is to have a clear pathway for water to flow into the swale.	☐ Use a flat shovel to remove grit and debris (especially at curb inlets or opening). Parking lots will generate fine grit that will accumulate at these spots. ☐ Pull out clumps of growing grass or weeds, and scoop out the soil or grit that the plants are growing in. ☐ Remove any grass clippings, leaves, sticks, and other debris that is collecting at inlets or along the edge of the swale where water is supposed to enter. ☐ For pipes and ditches, remove sediment and debris that is partially blocking the pipe or ditch opening where it enters the swale. ☐ Dispose of all material properly in an area where it will not re-enter the swale. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Inlets are blocked to the extent that most of the water does not seem to be entering the swale.
 ☐ Some or all of the inlets are eroding so that rills, gullies, and other erosion are present, or there is bare dirt that is washing into the swale.	☐ For small areas of erosion, smooth out the eroded part and apply rock or stone (e.g., river cobble) to prevent further erosion. Usually, filter fabric is placed under the rock or stone. ☐ In some cases, reseeding and applying an erosion control matting can be used to prevent further erosion. Some of these materials may be available at a garden center, but it may be best to consult a landscape contractor. ☐ Other:
	☐ Level 2 Inspection: Erosion is occurring at most of the inlets or along much of the swale edge. The inlet design may have to be modified.

SW 3. Swale Surface Area

Description: The swale surface area is the vegetated area where water flows during a storm and also the side slopes that slope down into the swale bottom. Depending on the design, the swale may also contain “check dams,” which are small dams made out of earth, stone, wood, or other materials. The check dams slow down and temporarily pond water as it flows down the swale.

Instruction: Examine the entire swale surface and side slopes. Consult **Table 2.5.3** below for possible problems.

Table 2.5.3 SW Surface Area

Problem (Check if Present)	Follow-Up Actions
☐ Minor areas of sediment, grit, trash, or other debris are accumulating in the swale.	☐ Use a shovel to scoop out minor areas of sediment or grit, especially in the spring after winter sanding materials may wash in and accumulate. Dispose of the material where it cannot re-enter the swale. ☐ If removing the material creates a hole or low area, fill with good topsoil and add seed and straw to re-vegetate. ☐ Remove trash, vegetative debris, and other undesirable materials. ☐ If the swale is densely vegetated, it may be difficult to do the maintenance; check for excessive ponding or other issues described in this section to see if the accumulated material is causing a problem. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Sediment has accumulated more than 3 inches deep and covers 25% or more of the swale surface. ☐ The source of sediment is unknown or cannot be controlled with simple measures.
 ☐ There is erosion in the bottom or on the side slopes. Water seems to be carving out rills as it flows through the swale or on the slopes.	☐ Try filling the eroded areas with clean topsoil, and then seed and mulch to establish vegetation. ☐ If the problem recurs, you may have to use some type of matting, stone (e.g., river cobble), or other material to fill in eroded areas. ☐ If the erosion is on a side slope, fill with soil and cover with erosion-control matting or at least straw mulch after re-seeding.
	☐ Kick-Out to Level 2 Inspection: The problem persists or the erosion is more than 3 inches deep and seems to be an issue with how water enters and moves through the swale. ☐ Kick-Out to Level 2 Inspection: The problem does not seem to be caused by flowing water, but a collapse or sinking of the surface (e.g., “sinkhole”) due to some underground problem.
☐ Water does not flow evenly down the length of the swale, but ponds in certain areas for long periods of time (e.g., 72 hours after a storm). The swale does not seem to have “positive drainage.” Check during or immediately after a rain storm.	☐ If the problem is minor (just small, isolated areas), try using a metal rake or other tools to create a more even flow path; remove excessive vegetative growth, sediment, or other debris that may be blocking the flow. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Water ponds in more than 25% of the swale for three days or more after a storm. The issue may be with the underlying soil or the grade of the swale. ☐ Water ponds behind check dams for three days or more after a storm. Check dams may be clogged or not functioning properly.

SW 4. Vegetation

Description: The health of vegetation within the swale is perhaps the most critical maintenance item for the property owner or responsible party. Many vegetated swales become overgrown, and “desirable” vegetation becomes choked out by weeds and invasive plants. It is important to know what the swale is supposed to look like and what plants seem to be thriving or doing poorly. Periodic maintenance of vegetation will prevent larger problems that are more difficult and costly to manage.

Instruction: Examine the swale vegetation. Consult **Table 2.5.4** below for possible problems.

<table>
<tr><th colspan="2">Table 2.5.4 SW Vegetation</th></tr>
<tr><th>Problem (Check if Present)</th><th>Follow-Up Actions</th></tr>
<tr><td>
☐ Vegetation is too overgrown to access swale for maintenance activities</td><td>☐ Mow or bush-hog the path.
☐ Other:</td></tr>
<tr><td rowspan="2">
☐ Vegetation requires regular maintenance: pulling weeds, removing dead and diseased plants, adding plants to fill in areas that are not well vegetated, etc.</td><td>☐ If you can identify which plants are weeds or not intended to be part of the planting plan, eliminate these, preferably by hand pulling.
☐ If weeds are widespread, check with the local stormwater authority and/or Extension Office about proper use of herbicides for areas connected with the flow of water.
☐ Even vegetation that is intended to be present can become large, overgrown, block flow, and/or crowd out surrounding plants. Prune and thin accordingly.
☐ If weeds or invasive plants have overtaken the whole swale, bush-hog the entire area before seed heads form in the spring. It will be necessary to remove the root mat manually or with appropriate herbicides, as noted above.
☐ Replant with species that are aesthetically pleasing and seem to be doing well in the swale.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: You are unsure of the original planting design or the vegetation maintenance task is beyond your capabilities of time, expertise, or resources. If you are unsure of the health of the vegetation (e.g. salt damage, invasives, which plants are undesirable) or the appropriate season to conduct vegetation management, consult a landscape professional before undertaking any cutting, pruning, mowing, or brush hogging.</td></tr>
<tr><td rowspan="2">☐ Vegetation is too thin, is not healthy, and there are many spots that are not well vegetated.</td><td>☐ The original plants are likely not suited for the actual conditions within the swale. If you are knowledgeable about plants, select and plant more appropriate vegetation (preferably native plants) so that almost the entire surface area will be covered by the end of the second growing season.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: For all but small practices (e.g., in residential yards), this task will likely require a landscape design professional or horticulturalist.</td></tr>
</table>

SW 5. Outlets

Description: These are where water leaves the swale when it fills up or where water reaches the downstream end of the swale. There may be a small stone apron or rock dam here or even an outlet grate.

Instruction: Examine outlets that release water out of the swale. Consult **Table 2.5.5** below for possible problems.

Table 2.5.5 SW Outlets

Problem (Check if Present)	Follow-Up Actions
☐ Outlet is obstructed with mulch, sediment, debris, trash, etc.	☐ Remove the debris and dispose of it where it cannot re-enter the swale. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Outlet is completely clogged or obstructed; there is too much material to remove by hand or with simple hand tools.

2.6. Tree Planting

Tree Planting Actions for Maintenance

Key actions to take for tree planting maintenance include the following:

- TP1. Watering
- TP2. Mulch
- TP3. Pruning
- TP4. Disease or pests

Note: This is a simple, "non-structural" practice and, as such, maintenance tasks are similar to any landscape maintenance. Tree planting can involve individual trees or more, such as reforesting a riparian buffer.

For this type of practice, inspection is part of maintenance to check on the health of the trees.

Figure 2.6.1. Key Areas for Inspection and Maintenance for Tree Planting

Tree Planting Level 1 Inspection

The Level 1 Inspection goes hand in hand with active maintenance and includes watering (TP1), mulching (TP2), and Pruning (TP3). Watering should occur during the growing season. Mulching and pruning occurs once a year in the spring and early spring, respectively.

TP 1. Watering

Description: Proper water management is perhaps the most crucial maintenance activity to ensure survival of newly planted trees. Watering is essential during periods of drought, while over watering can be fatal. Watering options include regular or soaker hoses, sprinklers, buckets, drip irrigation, or installation of larger capacity watering tanks for irrigation systems. Consult the maintenance plan for instructions on the timing, volume, and method of watering that is appropriate for the specific species of trees.

Instruction: Inspect the trees to determine whether they need watering. Consult **Table 2.6.1** below.

Table 2.6.1 TP Watering

Problem (Check if Present)	Follow-Up Actions
☐ Soil is not moist to the touch and/or it has not rained in a week, and leaves/needles are starting to appear wilted/dry.	☐ Water trees deeply and slowly near the base. Soaker hoses and drip irrigation work best for deep watering of trees and shrubs. ☐ Other:

TP 2. Mulch

Description: Mulching is a common method of weed control and moisture retention. Organic mulch should be spread over the soil surface and extend out to a radius of 5 feet or the tree drip line, whichever is less. Slowly decomposing organic mulches, such as shredded bark, compost, leaf mulch, or wood chips provide many added benefits for trees. Mulch that contains a combination of chips, leaves, bark and twigs is ideal for reforestation sites. Consult the maintenance plan for instructions on the timing, depth, and type of mulch application needed for the specific species of trees present.

Instruction: Mulch should be applied twice per year—in the late spring and during leaf fall. Consult the table below for possible problems. Check the depth of mulch regularly. Rake the old mulch to break up any matted layers and to refresh the appearance. Consult **Table 2.6.2** below.

Table 2.6.2 TP Mulch

Problem (Check if Present)	Follow-Up Actions
☐ Mulch is too thin or thick (should be approximately 3" deep) or does not extend to tree canopy (or 5' radius if tree has a larger than 10' canopy reach).	☐ Add or remove mulch around tree canopy to maximum 5' radius but not within 3" of the bark. ☐ If mulch is against the stems or tree trunks, pull it back several inches to expose the base of the trunk and root crown. ☐ Other:

TP 3. Pruning

Description: Pruning is usually not needed for newly planted trees but may be beneficial for tree structure in older trees. If necessary, prune only dead, diseased, broken or crossing branches at planting. As the tree grows, lower branches may be pruned to provide clearance above the ground or to remove dead or damaged limbs that sprout from the trunk.

- Instruction: Examine the branches and tree shape. Consult Table 2.6.3 below for possible problems.

Table 2.6.3 TP Pruning

Problem (Check if Present)	Follow-Up Actions
☐ Presence of suckers, dead or diseased branches, branches that interfere with pedestrian traffic	☐ Selective cutting ☐ Prune to make the tree more aesthetically pleasing and remove disease. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Use an arborist or landscaper for more extensive pruning jobs.

2.7. Bioretention

Areas of Bioretention

Key areas to inspect for Bioretention include the following:

- BR 1. Drainage Area
- BR 2. Inlets
- BR 3. Bioretention Ponding Area
- BR 4. Vegetation
- BR 5. Outlets

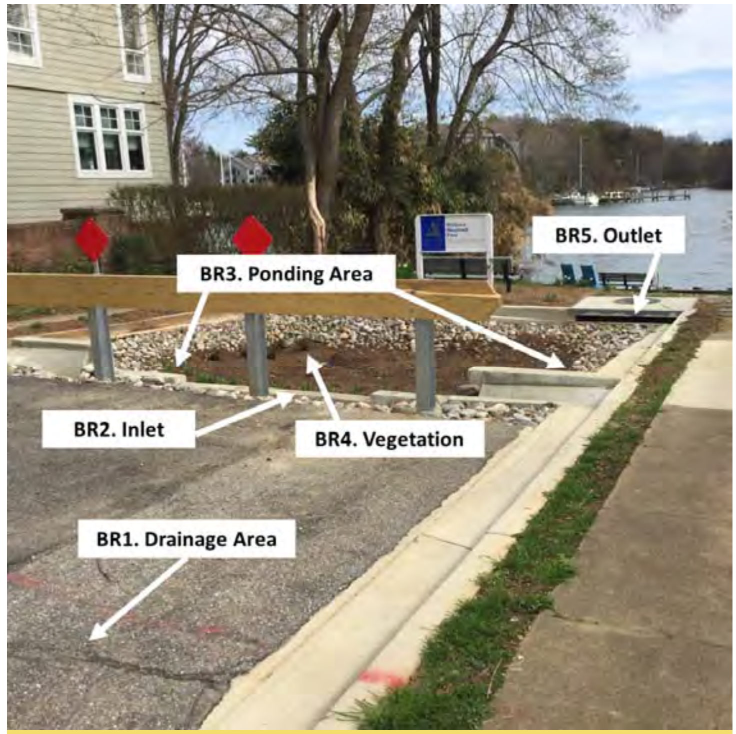


Figure 2.7.1. Key Areas for Level 1 Inspection of Bioretention

Note: The category of Bioretention includes:

- Bioretention cells – areas of soil, mulch, and vegetation that treat runoff
- Dry swales – long, linear bioretention cells, sometimes with check dams along a mildly sloping swale
- Rain gardens – usually small-scale bioretention practices on residential or small commercial properties
- Stormwater planters – usually in more urban settings, with soil and plants in a concrete box that receives roof runoff or perhaps other water from the site
- Tree pits – also a more urban practice where the bioretention is confined within some sort of box (e.g., concrete) and places along road curbs or other areas to treat runoff

For the purposes of this chapter, the term “Bioretention cell” will be used to generally describe these practices.

Bioretention Level 1 Inspection

The Level 1 Inspection focuses on the Drainage Area (BR1), Inlets (BR2), Bioretention Ponding Area (BR3), Vegetation (BR4), and Outlets (BR5). This inspection should be conducted on a regular basis, with an early spring inspection to ensure that the practice has survived the winter, particularly if there has been a significant amount of snow. An inspection during the growing season or in the early fall is also recommended to check on the health of vegetation.

BR 1. Drainage Area

Description: The drainage area sends runoff to and is uphill from the Bioretention cell. When it rains, water runs off and flows to the Bioretention cell and ponds within the cell temporarily (usually for no more than 48 hours). Sometimes, the runoff will contain dirt, grit, grass clippings, oil, or other substances that SHOULD NOT be directed to the Bioretention area.

Instruction: Look for areas that are uphill from the Bioretention cell. Consult **Table 2.7.1** below.

Table 2.7.1 BR Drainage Area

Problem (Check if Present)		Follow-Up Actions
	☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and mulch areas of bare soil to establish vegetation. ☐ Fill in erosion areas with soil, compact, and seed and straw to establish vegetation. ☐ If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ Other: ☐ Kick-Out to Level 2 Inspection: Large areas of soil have been eroded, or larger channels are forming. May require rerouting of flow paths.
	☐ Piles of grass clippings, mulch, dirt, salt, or other materials	☐ Remove or cover piles of grass clippings, mulch, dirt, etc. ☐ Other:
	☐ Open containers of oil, grease, paint, or other substances	☐ Cover or properly dispose of materials; consult your local solid waste authority for guidance on materials that may be toxic or hazardous. ☐ Other:

BR 2. Inlets

Description: The inlets to a Bioretention cell are where water flows into the cell. Depending on the design, water can flow in through:

- Curb cuts or openings in a parking lot or roadway
- Pipes or ditches that carry water into the Bioretention cell from the drainage area
- Flow directly over the land surface (known as “sheetflow”), sometimes across a strip of rock or stone

Curb cut – flow enter through defined place in curb

Curb cut

Gravel diaphragm – flow enters as sheetflow and is evenly distributed across length of practice

Grass filter strip: accepts sheet flow from the parking lot

Figure 2.7.2 Bioretention Cell Inlets

CSN, 2013

Instruction: Stand in the Bioretention cell itself and look for all the places where water flows in. Often there will be multiple points of inflow to the practice. Consult **Table 2.7.2** below for possible problems.

<table>
<tr><th colspan="2">Table 2.7.2 BR Inlets</th></tr>
<tr><th>Problem (Check if Present)</th><th>Follow-Up Actions</th></tr>
<tr><td rowspan="2">
☐ Inlets collect grit and debris or grass/weeds. Some water may not be getting into the Bioretention cell. The objective is to have a clear pathway for water to flow into the cell.</td><td>☐ Use a flat shovel to remove grit and debris (especially at curb inlets or openings). Parking lots generate fine grit that will accumulate at these spots.
☐ Pull out clumps of growing grass or weeds and scoop out the soil or grit that the plants are growing in.
☐ Remove any grass clippings, leaves, sticks, and other debris that is collecting at inlets.
☐ For pipes and ditches, remove sediment and debris that is partially blocking the pipe or ditch opening where it enters the Bioretention cell.
☐ Dispose of all material properly where it will not re-enter the Bioretention cell.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: Inlets are blocked to the extent that most of the water does not seem to be entering the Bioretention cell.</td></tr>
<tr><td rowspan="2">
☐ Some or all of the inlets are eroding so that rills, gullies, and other erosion is present, or there is bare dirt that is washing into the Bioretention cell.</td><td>☐ For small areas of erosion, smooth out the eroded part and apply rock or stone (e.g., river cobble) to prevent further erosion. Usually, filter fabric is placed under the rock or stone.
☐ In some cases, reseeding and applying erosion-control matting can be used to prevent further erosion. Some of these materials may be available at a garden center, but it may be best to consult a landscape contractor.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: Erosion is occurring at most of the inlets, and it looks like there is too much water that is concentrating at these points. The inlet design may have to be modified.</td></tr>
</table>

BR 3. Bioretention Ponding Area

Description: The ponding area fills up with water during a rainstorm. If you picture the Bioretention cell as a bathtub, there is the *bottom* (usually flat surface), *side slopes* (areas that slope down to the bottom from the surrounding ground), and *berms or structures that control the depth to which water ponds.*

Instruction: Examine the entire Bioretention surface and side slopes. Consult the table below for possible problems.

Table 2.7.3 BR Ponding Area

Problem (Check if Present)	**Follow-Up Actions**
 ☐ Mulch (if used) needs to be replaced or replenished. The mulch layer had decomposed or is less than 1-inch thick.	☐ Add new mulch to a total depth (including any existing mulch that is left) of 2 to 3 inches. The mulch should be shredded hardwood mulch that is less likely to float away during rainstorms. ☐ Avoid adding too much mulch so that inlets are obstructed or certain areas become higher than the rest of the Bioretention surface. ☐ Other:
 ☐ Minor areas of sediment, grit, trash, or other debris are accumulating on the bottom.	☐ Use a shovel to scoop out minor areas of sediment or grit, especially in the spring after winter sanding materials may wash in and accumulate. Dispose of the material where it cannot re-enter the Bioretention cell. ☐ If removing the material creates a hole or low area, fill with soil mix that matches original mix and cover with mulch so that the Bioretention surface area is as flat as possible. ☐ Remove trash, vegetative debris, and other undesirable materials. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Sediment has accumulated more than 2-inches deep and covers 25% or more of the Bioretention surface. ☐ Kick-Out to Level 2 Inspection: The Bioretention cell is too densely vegetated to assess sediment accumulation or ponding; see BR-4, Vegetation.

- ☐ There is erosion in the bottom or on the side slopes. Water seems to be carving out rills as it flows across the Bioretention surface or on the slopes, or sinkholes are forming in certain areas.
- ☐ Source: Stormwater Maintenance, LLC.

- ☐ Try filling the eroded areas with clean topsoil or sand, and cover with mulch.
- ☐ If the problem recurs, you may have to use stone (e.g., river cobble) to fill in problem areas.
- ☐ If the erosion is on a side slope, fill with clay that can be compacted and seed and mulch the area.
- ☐ Other:

- ☐ Kick-Out to Level 2 Inspection: The problem persists or the erosion is more than 3-inches deep and seems to be an issue with how water enters and moves through the Bioretention cell.
- ☐ Kick-Out to Level 2 Inspection: The problem does not seem to be caused by flowing water, but a collapse or sinking of the surface (e.g., “sinkhole”) due to some underground problem.

- ☐ The bottom of the Bioretention cell is not flat, and the water pools at one end, along an edge, or in certain pockets. The whole bottom is not uniformly covered with water. See design plan to verify that Bioretention surface is intended to be flat. Check during or immediately after a rainstorm.

- ☐ If the problem is minor (just small, isolated areas are not covered with water), try raking the surface OR adding mulch to low spots to create a more level surface. You may need to remove and replace plantings in order to properly even off the surface.
- ☐ Check the surface with a string and bubble level to get the surface as flat as possible.
- ☐ Other:

- ☐ Kick-Out to Level 2 Inspection: Ponding water is isolated to less than half of the Bioretention surface area, and there seem to be elevation differences of more than a couple of inches across the surface.

- ☐ Water stands on the surface more than 72 hours after a rainstorm and /or wetland-type vegetation is present. The Bioretention cell does not appear to be draining properly.

- ☐ Kick-Out to Level 2 Inspection: This is generally a serious problem, and it will be necessary to activate a Level 2 Inspection.

BR 4. Vegetation

Description: The health of vegetation within the Bioretention cell is perhaps the most critical maintenance item for the property owner or responsible party. Many Bioretention cells become overgrown, and "desirable" vegetation becomes choked out by weeds and invasive plants. It is important to know what the Bioretention cell is supposed to look like and what plants seem to be thriving or doing poorly. Periodic maintenance of vegetation will prevent larger problems that are more difficult and costly to manage.

Instruction: Examine all Bioretention cell vegetation. Consult the table below for possible problems.

Table 2.7.4 BR Vegetation

Problem (Check if Present)	Follow-Up Actions
 ☐ Vegetation requires regular maintenance—pulling weeds, removing dead and diseased plants, replacing mulch around plants, adding plants to fill in areas that are not well vegetated, etc.	☐ If you can identify which plants are weeds or not intended to be part of the planting plan, eliminate these, preferably by hand pulling. ☐ If weeds are widespread, check with the local stormwater authority and/or Extension Office about proper use of herbicides for areas connected with the flow of water. ☐ Even vegetation that is intended to be present can become large, overgrown, and/or crowd out surrounding plants. Prune and thin accordingly. ☐ If weeds or invasive plants have overtaken the whole Bioretention cell, bush-hog the entire area before seedheads form in the spring. It will be necessary to remove the root mat manually or with appropriate herbicides, as noted above. ☐ Re-plant with species that are aesthetically pleasing and seem to be doing well in the Bioretention cell. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: You are unsure of the original planting design, or the vegetation maintenance task is beyond your capabilities of time, expertise, or resources. If you are unsure of the health of the vegetation (e.g. salt damage, invasives, which plants are undesirable) or the appropriate season to conduct vegetation management, consult a landscape professional before undertaking any cutting, pruning, mowing, or brush hogging.
 ☐ Vegetation is too thin, is not healthy, and there are many spots that are not well vegetated.	☐ The original plants are likely not suited for the actual conditions within the Bioretention cell. If you are knowledgeable about plants, select and plant more appropriate vegetation (preferably native plants) so that almost the entire surface area will be covered by the end of the second growing season. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: For all but small practices (e.g., rain gardens), this task will likely require a landscape design professional or horticulturalist.

BR 5. Outlets

Description: Outlets are where water leaves the Bioretention cell when there is too much ponded water. There are various ways that outlets are configured. They can be a yard drain type of structure in the Bioretention cell itself or a rock weir where water flows during large storms. Many Bioretention practices have an underdrain, which is like a French drain, that helps the Bioretention cell drain properly after storms. The underdrain pipe may “daylight” (come to the ground surface) at some point downhill from the Bioretention cell.

Instruction: Examine outlets that release water out of the Bioretention cell. Consult the table below for possible problems.

Table 2.7.5 BR Outlets

Problem (Check if Present)	Follow-Up Actions
☐ Erosion at outlet	☐ Add stone to reduce the impact from the water flowing out of the outlet pipe or weir during storms. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Rills have formed and erosion problem becomes more severe.
 ☐ Outlet obstructed with mulch, sediment, debris, trash, etc.	☐ Remove the debris and dispose of it where it cannot re-enter the Bioretention cell. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Outlet is completely clogged or obstructed; there is too much material to remove by hand or with simple hand tools.

2.8. Green Roof

Areas of the Green Roof

Key areas to inspect for green roofs include the following:

GR 1. Vegetation and Surface
GR 2. Overflows and Drains

Note: Green Roofs consist of green infrastructure practices applied on rooftops, wherein stormwater is filtered through a vegetated planting bed. Green Roofs are a unique practice in that they are often covered by a professional ongoing maintenance contract, and their design is highly variable depending on the specific product. This section highlights some key inspection items.

Figure 2.8.1. Key Areas for Level 1 Inspection of Green Roof

GR 2. Overflows and Drains

Description: Green roofs typically drain through a network of underdrains to outlet at roof drainage infrastructure. These drainage structures need to be inspected and cleaned periodically to ensure that the medium drains properly.

Instruction: Review the specific maintenance plan for this practice to determine where inspection ports are. Remove the cover and inspect the port.

Table 2.8.2 GR Overflows and Drains

Problem (Check if Present)	Follow-Up Actions
☐ Inspection port for roof drainage (can be clogged with debris)	☐ Remove debris by hand or flush through with a hose. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Debris cannot be removed, or it appears that debris has accumulated in the underdrains.
☐ Damage to other roof drainage structures (e.g., roof scuppers)	☐ Call contractor or individual in charge of regular building maintenance. This is a building maintenance issue. ☐ Other:

2.9. Permeable Pavement

Areas of Permeable Pavement

Key areas to inspect for permeable pavement include the following:

- PP1. Drainage Area
- PP2. Pavement Surface

Note: Permeable pavements include several materials, including porous asphalt materials, which appear similar to an asphalt parking lot, permeable concrete, and "interlocking concrete pavers," which are individual paving blocks. References to removing and replacing individual blocks of pavement refer only to this last category.

Figure 2.9.1. Key Areas for Level 1 Inspection of Permeable Pavement

Permeable Pavement Level 1 Inspection

The Level 1 Inspection focuses on the Drainage Area (PP1) and the Pavement Surface (PP2). This inspection should be conducted on a regular basis, with an early spring inspection to ensure that the practice has survived the winter, particularly if there has been a significant amount of snow.

On a routine basis, the Level 1 Inspector should also ensure that the pavement area and its drainage are properly managed. Some key activities to avoid include:

1. Applying sand during winter months
2. Certain types of permeable pavement should not be plowed with steel-bladed plows.
3. Poor management of dumpsters
4. Storing or placing dirt, grit, mulch, sand, or other similar materials on or near the pavement surface

PP 1. Drainage Area

Description: The drainage area sends runoff to the Permeable pavement area and is uphill from the Permeable pavement. When it rains, water runs off and flows to the Permeable pavement area, and it may pond there temporarily.

Instruction: Look for areas that are uphill from the Permeable pavement. Consult **Table 2.9.1** below:

Table 2.9.1 PP Drainage Area

Problem (Check if Present)		Follow-Up Actions
 	☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and straw areas of bare soil to establish vegetation. ☐ Fill in erosion areas with soil, compact, and seed and straw to establish vegetation. ☐ If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Large areas of soil have been eroded, or larger channels are forming. May require rerouting of flow paths.
	☐ Piles of grass clippings, mulch, dirt, salt, or other materials	☐ Remove or cover piles of grass clippings, mulch, dirt, etc. ☐ Other:
	☐ Open containers of oil, grease, paint, or other substances	☐ Cover or properly dispose of materials; consult your local solid waste authority for guidance on materials that may be toxic or hazardous. ☐ Other:

2.10. Ponds and Wetlands

Areas of Ponds and Wetlands

Key areas to inspect for ponds and wetlands include the following:

- PO 1. Drainage area
- PO 2. Inlet pipes and swales
- PO 3. Pond area and embankments
- PO 4. Pond outlet

Note: This category includes the following practices:

- *Wet ponds* – have a permanent pool of water and may be divided into various "cells"
- *Stormwater wetlands* – have a variety of depth zones ranging from deep pools to shallow wetlands and are characterized by wetland vegetation

It is recommended strongly to have as-built drawings and copies of previous inspections at hand, if available. Aerial photos may be needed to help direct the inspector to the pond or wetland location if it is obscured by vegetation.

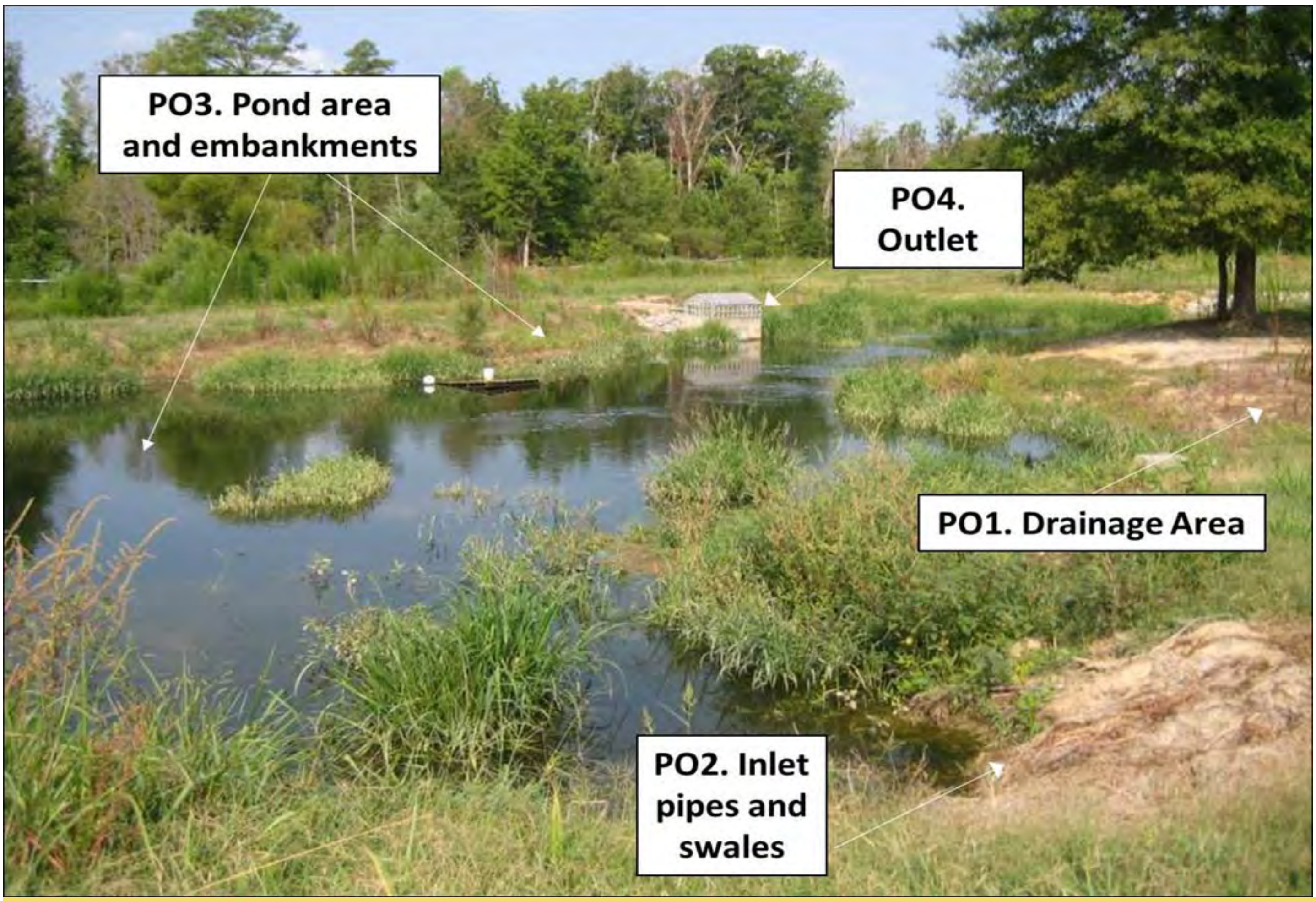


Figure 2.10.1. Key Areas for Level 1 Inspection of a Pond/Wetland

Pond and Wetland Level 1 Inspection

The Level 1 Inspection focuses on the drainage area (PW 1), inlet pipes or swales (PW 2), pond area and embankments (PW 3) and pond outlet structures and outfall (PW 4). This inspection should be conducted on a regular basis to ensure that a buildup of trash, vegetation, or sediment does not interfere with the pre-treatment, pond or wetland, and the outfall's normal flow or function. Pond embankments and dams should be regularly inspected for evidence of erosion, burrowing or tunneling animals, and large woody vegetation growing on the dam.

PW 1. Drainage Area

Description: The drainage area conveys runoff to and is uphill from the pond inlet. When it rains, water runs off through roof drains, yard drains, parking lots, roadways and underdrains to the ponds. Flow is through underground piping systems, overland via swales, or across the ground as sheetflow. Sometimes, the runoff will contain dirt, grit, grass clippings, leaves and woody debris that can collect in the drainage system. If left alone, blockages can occur and increase the chance of shallow flooding or standing water. Standing water in drainage systems foster mosquitos, pipe corrosion, and possible nuisance and odor conditions.

Instruction: Look for areas that are uphill from the pond. Consult **Table 2.10.1** below:

Table 2.10.1 PW Drainage Area

Problem (Check if Present)	Follow-Up Actions
☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and straw areas of bare soil to establish vegetation. ☐ Fill in eroded areas with soil, compact, seed and mulch with straw to establish vegetation. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ If large areas of soil have been eroded or larger channels are forming, this may require rerouting of flow paths or use of an erosion-control seed mat or blanket to reestablish acceptable ground cover or anchor sod where it is practical.
 ☐ Piles of grass clippings, mulch, dirt, salt, or other materials	☐ Remove or cover piles of grass clippings, mulch, dirt, etc. ☐ Remove excessive vegetation or woody debris that can block drainage systems. ☐ Other:
 ☐ Open containers of oil, grease, paint, or other substances exposed to rain in the drainage area	☐ Cover or properly dispose of materials; consult your local solid waste authority for guidance on materials that may be toxic or hazardous. ☐ Other:

PW 2. Pond Inlets

Description: Free, unobstructed flow from the drainage area to stormwater ponds is necessary to prevent shallow flooding and even structural damage from flooding. Pond inlets can consist of pipes, ditches, swales, or other means to convey stormwater to the pond or wetland.

Instruction: Look for all areas where water flows into the pond during storms. Note that there may be multiple points of inflow and types of structures (e.g., pipes, open ditches, etc.). Consult **Table 2.10.2** below:

<table>
<tr><th colspan="3">Table 2.10.2 Pond Inlets</th></tr>
<tr><th colspan="2">Problem (Check if Present)</th><th>Follow-Up Actions</th></tr>
<tr><td rowspan="2">
</td><td rowspan="2">☐ Inlets are buried, covered or filled with silt, debris, or trash, or blocked by excessive vegetation.</td><td>☐ If the problem can be remedied with hand tools and done in a safe manner, remove vegetation, trash, woody debris, etc. from blocking inlet structures.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 or 3 Inspection: If the amount of material is too large to handle OR there are ANY safety concerns about working in standing water, soft sediment, etc., the work will likely have to be performed by a qualified contractor.</td></tr>
<tr><td></td><td>☐ Inlets are broken, and, with pieces of pipe or concrete falling into the pond, there is erosion around the inlet, there is open space under the pipe, or there is erosion where the inlet meets the pond</td><td>☐ Kick-Out to Level 2 Inspection: These types of structural or erosion problems are more serious and will require a qualified contractor to repair.</td></tr>
</table>

PW 3. Pond Area and Embankments

Description: The pond area and embankment can consist of the following elements:

- Pre-treatment cell or small holding area where water first flows into the pond from the various inlets. These are commonly referred to as "forebays" and will be demarcated from the main pond area by small dams made of earth or rock. The purpose of forebays is to capture some of the sediment and pollutants before they reach the deep pool, making maintenance easier over time. Not all ponds will have forebays.
- The pond surface can be open water or a combination of open water and areas with wetland vegetation. Sometimes there is a shallow bench around the perimeter of a pond, known as an "aquatic bench."
- The "side slopes" are areas around the perimeter of the pond where the surrounding land slopes down to the pond surface.
- Most ponds will have a "riser structure," where the water exits a pond during storms. This can be a concrete or metal pipe that is open at the top, often with some type of trash rack. Some ponds also have an "emergency spillway," which is an open, rock-lined channel that carries water from large storms safely across the embankment.
- The dam or embankment holds water in the pond and is constructed of compacted soil, such as clay. There is often a pipe through the embankment that carries water from the riser structure safely through the embankment to the downstream channel.

The pond's pre-treatment areas or forebays should not be choked with vegetation or full of sediment. Removal of excessive vegetation and sediment and selective replanting are often annual maintenance activities.

Likewise, the pond's deep pool should not to be choked with vegetation or filled with sediment. Vegetation and sediment bars can restrict flow and cause short circuiting that reduces capture of sediment. Pond volume is to be maintained at the original design capacity and free of sediment bars or debris piles. Sometimes ponds are over-maintained and have no vegetation. Algae and turbidity (muddy water) are common problems in many ponds.

Instruction: Examine both interior and exterior pond banks as well as the pond body. Observe from the inlet pipes to the outfall structure and emergency overflow.

Table 2.10.3 PW Pond Area and Embankments

Problem (Check if Present)		Follow-Up Actions
	☐ The pretreatment area(s) or forebay(s) are filled with sediment, trash, vegetation, or other debris.	☐ If the problem can be remedied with hand tools and done in a safe manner, use a flat shovel or other equipment to remove small amounts of sediment. ☐ Remove trash and excessive vegetation from forebays if this can be done in a safe manner. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Large amounts of sediment or debris will have to be removed by a qualified contractor. ANY condition that poses a safety concern for working in standing water or soft sediments should be referred to a Level 2 Inspection or qualified contractor.

Table 2.10.3 PW Pond Area and Embankments		
Problem (Check if Present)		**Follow-Up Actions**
	☐ The pond area itself has accumulated sediment, trash, debris, or excessive vegetation that is choking the flow of the water, OR the pond area is covered with algae or aquatic plants.	☐ Level 1 includes handling only small amounts of material that can be removed by hand, or with rakes or other hand tools. Do not attempt any repair that poses a safety issue. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Most cases will call for a Level 2 Inspection and/or a qualified contractor. ☐ You are not sure what type and amount of vegetation is supposed to be in the pond. ☐ The algae or aquatic plants should be identified so that proper control techniques can be applied.
	☐ The side slopes of the pond are unstable, eroding, and have areas of bare dirt.	☐ If there are only minor areas, try filling in small rills or gullies with topsoil, compacting, and seeding and mulching all bare dirt areas with an appropriate seed. Alternatively, try using herbaceous plugs to get vegetation established in tricky areas, such as steep slopes. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Erosion and many bare dirt areas on steep side slopes will require a Level 2 Inspection and repair by a qualified contractor.
 	☐ The riser structure is clogged with trash, debris, sediment, vegetation, etc., OR is open, unlocked, or has a steep drop and poses a safety concern. The pond level may have dropped below its "normal" level.	☐ If you can safely access the riser on foot or with a small boat, clear minor amounts of debris and remove it from the pond area for safe disposal. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: The riser cannot be accessed safely, the amount of debris is substantial, or the riser seems to be completely clogged and the water level has risen too high. ☐ There are safety issues with the riser and concern about access to pipes, drops, or any other life safety concern. ☐ The riser is leaning, broken, settling or slumping, corroded, eroded or any other structural problem.

<table>
<tr><th colspan="3">Table 2.10.3 PW Pond Area and Embankments</th></tr>
<tr><th colspan="2">Problem (Check if Present)</th><th>Follow-Up Actions</th></tr>
<tr><td rowspan="2">
</td><td rowspan="2">☐ The dam/embankment is slumping, sinking, settling, eroding, or has medium or large trees growing on it.</td><td>☐ If there are small isolated areas, try to fix them by adding clean material (clay and topsoil) and seeding and mulching.
☐ Periodically mow embankments to enable inspection of the banks and to minimize establishment of woody vegetation.
☐ Remove any woody vegetation that has already established on embankments.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: Most of these situations will require a Level 2 Inspection or evaluation and repair by a qualified contractor. Seepage through the dam or problems with the pipe through the dam can be a serious issue that should be addressed to avoid possible dam failure.</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">☐ The emergency spillway or outfall (if it exists) has
☐ erosion, settlement, or loss of material. Rock-lined spillways have excessive debris or vegetation.</td><td>☐ Clear light debris and vegetation.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: Displacement of rock lining, excessive vegetation and erosion/settlement may warrant review and decision by Level 2 Inspector to check against original plan.
☐ Any uncertainty about the integrity of the emergency spillway should be referred to a Level 2 Inspector.
☐ Erosion or settlement such that design has been compromised should be reviewed by an engineer.</td></tr>
</table>

PW 4. Pond Outlet

Description: The pond's outlet enables the ponded water to discharge to downstream drainage systems or stream channels. The outlet is often at the base of the dam/embankment on the downstream side. Inspection of this point can help prevent flooding of the pond and upstream drainage systems and prevent pond failure at a weak point of a pond's containment system.

Instruction: Examine the outlet of the pipe on the downstream side of the dam/embankment where it empties into a stream, channel, or drainage system. Consult the table below for possible problems.

Table 2.10.4 PW Pond Outlet

Problem (Check if Present)	Follow-Up Actions
 ☐ The pond outlet is clogged with sediment, trash, debris, vegetation, or is eroding, caving in, slumping, or falling apart.	☐ If there is a minor blockage, remove the debris or vegetation to allow free flow of water. ☐ Remove any accumulated trash at the outlet. ☐ Outlet: ☐ Kick-Out to Level 2 Inspection: ☐ If the area at the outlet cannot be easily accessed or if the blockage is substantial, a Level 2 Inspection is warranted. ☐ Erosion at and downstream of the outfall should be evaluated by a qualified professional. ☐ Any structural problems, such as broken pipes, structures falling into the stream, or holes or tunnels around the outfall pipe, should be evaluated by a Level 2 Inspector and will require repair by a qualified contractor. ☐ The pool of water at the outlet pipe is discolored, has an odor, or has excessive algae or vegetative growth.

2.11. Infiltration

Areas of Infiltration

Key areas to inspect for Infiltration include the following:

- IN 1. Drainage Area
- IN 2. Inlets
- IN 3. Infiltration Area
- IN 4. Outlets

Note: The category of Infiltration includes:

- Infiltration Trench – Long, narrow infiltration practice, usually with small gravel at the surface and a reservoir of larger gravel or stone beneath
- Infiltration Basin – Larger practice, usually covered with grass and highly permeable soil beneath
- Dry Well – Small pit filled with stone or gravel, or precast concrete chamber surrounded by stone that receives and stores runoff to enable it to infiltrate into the underlying ground.

Figure 2.11.1 Key Areas for Level 1 Inspection of Infiltration Practice

Section 3. Level 2 and 3 Inspections

3.1. How to Use this Section

This section provides guidance for Level 2 and 3 inspections for 10 groups of stormwater management practices (SMPs). See Section 1 of this chapter for an explanation of the Maintenance Hierarchy approach.

- Section 3.2 provides general guidance for Level 2 and 3 inspections.
- Sections 3.3 through 3.12 provide detailed Level 2 and 3 inspection guidance for each of the 10 practice categories:
    - 3.3 Rainwater Harvesting
    - 3.4 Disconnection and Sheetflow
    - 3.5 Swales
    - 3.6 Tree Planting
    - 3.7 Bioretention
    - 3.8 Green Roofs
    - 3.9 Permeable Pavement
    - 3.10 Ponds and Wetlands
    - 3.11 Infiltration
    - 3.12 Sand and Organic Filters
- Each section has **tables** containing guidance for Level 2 inspectors on specific SMP conditions and possible repairs for those problems (in left column), as well as lists of conditions that would likely trigger a Level 3 evaluation or maintenance action (right column). In addition, **Appendix B** contains detailed checklists for Level 2 inspectors to use in the field during their inspections.
- **Section 3.13** provides a brief overview for Level 3 inspections and how these fit into the overall hierarchy. However, most of the content for Level 3 maintenance actions is contained in **Section 4.**

3.2. General Guidance for Level 2 and 3 Inspections

The Level 2 inspection will typically be performed by a municipal employee or landscape contractor with some training in stormwater operations and maintenance. Regardless of which type of practice is being inspected, some key procedures and equipment are necessary. Read through this guidance before going on an inspection, and use the specific guidance in **Sections 3.3 through 3.12** for the practice you are inspecting. While much of the equipment and general procedures are somewhat similar to Level 1 inspections, additional information is provided for Level 2 inspectors below.

When to Conduct a Level 2 Inspection

The Level 2 Inspection is needed for two reasons. First, routine inspections to comply with local stormwater regulations typically require a Level 2 inspector. In addition, a Level 2 inspection may be triggered to address or diagnose problems identified during a Level 1 inspection. In this situation, the Level 2 inspector should confer with the Level 1 inspector about problems they have identified and then conduct a follow-up inspection that focuses more on diagnosing the causes of the problems and possible solutions. The checklists in **Appendix B** and other resources cited in **Sections 3.3 through 3.12** can be used as tools.

The frequency of this type of inspection may be defined by the municipality. As with Level 1 inspections, the frequency may change with the age of the SMP, with higher frequencies the first couple of years after installation. Well-established and well-maintained practices may only need to be inspected every few years.

Notifying the Responsible Party

Consult the plan file and maintenance agreement to ascertain the responsible party. Confirm that there is right of access through the local code, signed maintenance agreement, or other means. Contact the responsible party at least three business days in advance of the proposed inspection. If the responsible party cannot be found or contacted, make a reasonable effort through file research to contact a property representative, and document these efforts in writing. If the inspection is in response to a Level 1 inspection and referral to your agency, try to speak with the person who conducted the Level 1 inspection and get any documentation they may have. For publicly owned and managed SMPs, the responsible party will likely be the municipality or other regulated MS4.

What to Take in the Field

Level 2 inspections may require more measurement and, as a result, need some additional materials. In addition, the Level 2 inspection may involve gaining access to private property. Consequently, additional identification is needed for these inspections. A list of recommended items to take in the field is provided in **Table 2.2.1**.

Table 3.2.1 What to Take in the Field for a Level 2 Inspection
• Safety equipment: safety vest, steel-toe shoes, traffic cones if working near traffic, etc. • Approved plan and as-built (record drawing) if available • Records of previous inspections if available • Engineering scale • Hand level and pocket rod if needed to measure relative elevations • Digital camera • Several copies of SMP checklist if paper forms are used (**Appendix B**) • Clipboard and pencils if paper forms are used • Dry erase white board and marker (optional) to include in photos to keep track of SMP tracking # in municipal database (see **Figure 3.2** as example) • Letter on municipal letterhead granting access and/or agency photo badge • Pipe wrench to open underdrain clean-out caps • Flashlight to look into underdrain cleanouts and/or manholes • Manhole puller • Soil probe or auger • 100' measuring tape • Shovel • Bug spray

Conducting the Inspection

In general, the inspection should follow a consistent, logical approach, such as outlined below.

- Conduct a quick tour of the practice to identify any obvious issues and important components: inlets (number, location), surface area, overflow structures, berms or impoundments, outfalls, downstream conveyance channels or receiving waters. Check these components against the design plan or as-built drawing (if available).
- Starting at the outlet or low point, use the checklists provided in Appendix B to evaluate the practice. The inspection will proceed from the outlet or outfall to the stormwater treatment area, berms, side slopes, inlets, and drainage area. Make sure to fill in key information on the inspection form, such as SMP identifier number, site name, inspector name, date, and weather conditions.

Figure 3.2. A white board and digital camera can be handy to note SMP tracking #, date of inspection, and other forms of documentation. Note that an inspector may alternatively tag photographs, particularly if they are recorded on a smartphone or Tablet.

- Take photos of important components or maintenance concerns, and mark photo locations and direction on a sketch.
- Review the inspection form before leaving the site to make sure that all necessary information has been collected.

Follow-Up Actions

Immediate follow-up actions include entering the inspection information in the appropriate database or hard copy file, downloading and labeling photos, and providing other necessary documentation.

Another possible follow-up action would be to activate a Level 3 inspection in certain situations. The Level 2 inspector will have to make a judgement call as to whether observed problems warrant a Level 3 investigation, and will also have to coordinate with the responsible party to pursue such an investigation. The Level 2 guidance in this chapter summarizes follow-up actions associated with various observations of SMP condition. Note that these tables are divided into “Level 2” and “Triggers for Level 3” follow-up actions, with Level 2 actions in *blue* cells and Level 3 in *green* cells. Consult **Section 4** of this chapter for more guidance on how to diagnose and correct some of the maintenance items included in these tables.

Another follow-up action involves communicating problems and corrective measures to the responsible party (private or public). This may involve instructing the responsible party to undertake a Level 3 inspection or to provide a timeframe for correcting simpler issues that do not require Level 3 involvement. Many local programs have existing procedures for sending letters or activating a compliance procedure. These procedures include verifying that repairs and corrections are completed by the responsible party.

Level 3 Inspection Guidance

The Level 3 inspection is typically conducted by a Qualified Professional such as a professional engineer or Landscape Architect. It is assumed that the Level 3 inspector is knowledgeable in stormwater management, as well as engineering and construction practices. The Level 3 inspector will not typically be completing a full practice inspection. This inspection is conducted only in response to problems identified during the Level 2 inspection, is more diagnostic in nature, assumes a greater degree of initial knowledge, and may require more extensive intervention.

The Level 3 inspection is also more results based in that it will lead to a specific repair to address the issue that triggered the inspection. **Section 4** identifies 12 problems typically addressed in a Level 3 inspection and discusses measures to diagnose the cause of the problem, as well as repairs needed to address it. It should be noted that the problems addressed in each **Section 4** subsection can occur in a variety of SMPs (e.g., erosion is a common issue in almost every type of SMP). As a result, each subsection identifies the SMPs where the problem most commonly occurs and, in some cases, an SMP-specific diagnosis procedure.

3.4. Disconnection & Sheet Flow – Level 2 Inspections and Triggers for Level 3

The most likely triggers for a Level 3 Inspection for Disconnection and Sheetflow practices are:

- Significant damage to level spreader/energy dissipator
- Major erosion

Table 3.4.1 Level 2 Inspection – DISCONNECTION AND SHEETFLOW	
Recommended Repairs	**Triggers for Level 3 Inspection**
Observed Condition: Significant sediment on pavement that drains to disconnection area (e.g., grass strip)	
Condition 1: Sediment on parking lot is widespread Enlist a mechanical sweeper or vacuum sweeper to remove sediment across entire pavement surface. Pay special attention to downhill edges of pavement where more sediment may have accumulated.	• Sediment accumulation is so serious that it cannot be sufficiently removed with mechanical sweeper. May indicate a high sediment load from uphill in the drainage area that needs to be mitigated.
Observed Condition: Pavement edge deteriorating	
Condition 1: Dips or damage at pavement edge causing runoff to concentrate Determine whether the damaged edge is causing significant enough concentration of runoff to warrant repair or regrading of the pavement.	• Edge must be patched or re-paved to make secure and level. • Parking lot not draining properly to the energy dissipator and treatment area.
Observed Condition: Level spreader/energy dissipator	
Condition 1: Level spreader sinking or uneven If basic equipment can be used, prop up and secure any section of level spreader that is sinking. Regrade soil all around level spreader and add stone as necessary to prevent erosion and bypassing. Condition 2: Level spreader is broken These repairs can be simple for small, residential-scale practices, such as at a downspout. Ensure the level spreader is level across, keyed in to soil at the edges, and made of durable material that can withstand the flow of water running across it. Larger or more complicated level spreaders (e.g., concrete) will likely require specialized skill and equipment.	• Level spreader requires specialized equipment, regrading, or large amount of material to make level again. • Level spreader needs to be re-designed and replaced.
Observed Condition: Erosion in treatment area	
Condition 1: Rills from concentrated flow Inspect energy dissipator to see whether it needs to be improved to better spread out incoming flow. Regrade flow path to ensure that it is relatively flat (if minor). If major re-grading is needed, the treatment area may need to be redesigned and fixed with specialized equipment.	• Major rills and gullies • Treatment area needs to be re-designed and major grading needed.

3.5. Swales – Level 2 Inspections and Triggers for Level 3

The most likely triggers for a Level 3 Inspection for Swales are:

- Standing water, swale not draining properly (not applicable to wet swales)
- Severe erosion around or under check dams
- Large area of vegetation overrun with weeds and/or invasive species
- Severe erosion at outlet that requires redesign

Table 3.5.1 Level 2 Inspection: SWALE

Recommended Repairs	Triggers for Level 3 Inspection
Observed Condition: Water Stands on Surface for More than 72 Hours after Storm	
Condition 1: Small pockets of standing water Use a soil probe or auger to examine the soil profile. If isolated areas have accumulated grit, fines, or vegetative debris or have compacted soil, try scraping off top 3 to 6 inches of soil and replacing with clean material. Also check to see that surface is level and water is not ponding selectively in certain areas. Condition 2: Standing water is widespread or covers entire surface Requires diagnosis and resolution of problem: Bad or compacted soil Filter fabric on the swale bottom Too much sediment/grit washing in from drainage area? Too much ponding depth? Longitudinal slope is too flat?	• Soil is overly compacted or clogged and problem is not evident from Level 2 inspection. • Level 2 inspection identifies problem, but it cannot be resolved easily or is associated with the original design of the practice (e.g., not enough slope down through the swale).
Observed Condition: Vegetation is predominantly weeds and invasive species	
For a small area, weed and dig up invasive plants. Replant with natives or plants from original planting plan. If longer than 100 feet, develop a new planting plan and have it professionally reviewed.	• Vegetation deviates significantly from original planting plan; swale has been neglected and suffered from deferred maintenance. • Owner/responsible party does not know how to maintain the practice. • For large area, hire a professional to develop a grading plan and develop a planting plan.

Observed Condition: Severe erosion of check dams, inlets, swale bottom, or side slopes	
	• Erosion (rills, gullies) is more than 12-inches deep at inlets or the swale bottom or more than 3-inches deep on side slopes. • Flow paths from the drainage area are higher than expected, such that the swale needs to be redesigned to handle higher flow rates and velocities.
Observed Condition: Significant sediment accumulation, indicating an uncontrolled source of sediment	
Condition 1: Isolated areas of sediment accumulation, generally less than 3-inches deep Sediment source may be from a one-time or isolated event. Remove accumulated sediment and top 2 to 3 inches of swale soil media; replace with clean material. Check drainage area for any ongoing sources of sediment. Condition 2: Majority of the surface is caked with “hard pan” (thin layer of clogging material) or accumulated sediment that is 3-inches deep or more This can be caused by improper construction sequence (drainage area not fully stabilized prior to installation of the swale) or another chronic source of sediment in the drainage area. Augering several holes down along the swale can indicate how severe the problem is; often the damage is confined to the first several inches of soil. Removing and replacing this top layer (or to the depth where sediment incursion is seen in auger holes) can be adequate, as long the problem does not recur.	• More than 2 inches of accumulated sediment cover 25% or more of the swale surface area. • “Hard pan” of thin, crusty layer covers majority of swale surface area and seems to be impeding flow of water along the swale. • New sources of sediment seem to be accumulating with each significant rainfall event.

3.6. Tree Planting – Level 2 Inspections and Triggers for Level 3

A Level 2 Tree Planting inspection should be conducted periodically during the growing season by the Cooperative Extension or an arborist.

Table 3.6.1 Level 2 Inspection: TREE PLANTING	
Recommended Repairs	**Triggers for Level 3 Inspection**
Observed Condition: Appearance of fungus or pest damage	
Condition 1: Fungus, discoloration, browning leaves or holes in leaves Check with arborist or other tree professional about the best way to proceed. This requires a Level 3 inspection. Condition 2: Burrowing insects, holes Check with arborist or other tree professional about the best way to proceed. This requires a Level 3 inspection.	• Any concerns about how to address infestation or disease

3.7. Bioretention – Level 2 Inspections and Triggers for Level 3

The most likely triggers for a Level 3 Inspection for Bioretention are:

- Standing water, clogged media
- Vegetation management
- Bioretention does not conform to original design plan in surface area or storage.
- Severe erosion of filter bed, inlets, or around outlets
- Significant sediment accumulation, indicating an uncontrolled source of sediment

Table 3.7.1 Level 2 Inspection: BIORETENTION NOTE: Key Source for this Information *(CSN, 2013)*	
Recommended Repairs	**Triggers for Level 3 Inspection**
Observed Condition: Water Stands on Surface for More than 72 Hours after Storm	
Condition 1: Small pockets of standing water Use a soil probe or auger to examine the soil profile. If isolated areas have accumulated grit, fines, or vegetative debris or have bad soil media, try scraping off top 3 inches of media and replacing with clean material. Also check to see that surface is level and water is not ponding selectively in certain areas. Condition 2: Standing water is widespread or covers entire surface Requires diagnosis and resolution of problem: • Clogged underdrain? • Filter fabric between soil media and underdrain stone? • Need to install underdrain if not present? • Too much sediment/grit washing in from drainage area? • Too much ponding depth? • Improper soil media?	• Soil media is clogged and problem is not evident from Level 2 inspection. • Level 2 inspection identifies problem, but it cannot be resolved easily or is associated with the original design of the practice.

Observed Condition: Vegetation is sparse or out of control	
Condition 1: Original design planting plan seems good but has not been maintained, so there are many invasives and/or dead plants Will require some horticultural experience to restore vegetation to intended condition by weeding, pruning, removing plants, and adding new plants. Condition 2: Original design planting plan is unknown or cannot be actualized A landscape architect or horticulturalist will be needed to redo the planting plan. Will likely require analysis of soil pH, moisture, organic content, sun/shade, and other conditions to make sure plants match conditions. Plan should include invasive plant management and maintenance plan to include mulching, watering, disease intervention, periodic thinning/pruning, etc.	• Vegetation deviates significantly from original planting plan; Bioretention has been neglected and suffered from deferred maintenance. • Owner/responsible party does not know how to maintain the practice.
Observed Condition: Bioretention does not conform to original design plan in surface area or storage	
Condition 1: Level 2 Inspection reveals that practice is too small based on design dimension, does not have adequate storage (e.g., ponding depth) based on the plan, and/or does not treat the drainage area runoff as indicated on the plan Small areas of deviation can be corrected by the property owner or responsible party, but it is likely that a Qualified Professional will have to revisit the design and attempt a redesign that meets original objectives or that can be resubmitted to the municipality for approval.	• More than a 25% departure from the approved plan in surface area, storage, or drainage area; sometimes less than this threshold at the discretion of the Level 2 inspector.
Observed Condition: Severe erosion of filter bed, inlets, or around outlets	
Condition 1: Erosion at inlets The lining (e.g., grass, matting, stone, rock) may not be adequate for the actual flow velocities coming through the inlets. First line of defense is to try a more non-erosive lining and/or to extend the lining further down to where inlet slopes meet the Bioretention surface. If problem persists, analysis by a Qualified Professional is warranted. Condition 2: Erosion of Bioretention filter bed This is often caused by "preferential flow paths" through and along the Bioretention surface. The source of flow should be analyzed and methods employed to dissipate energy and disperse the flow (e.g., check dams, rock splash pads). Condition 3: Erosion on side slopes Again, the issue is likely linked with unanticipated flow paths down the side slopes (probably overland flow that concentrates as it hits the edge of the slope). For small or isolated areas, try filling, compacting, and re-establishing healthy ground cover vegetation. If the problem is more widespread, further analysis is required to determine how to redirect the flow.	• Erosion (rills, gullies) is more than 12 inches deep at inlets or the filter bed or more than 3 inches deep on side slopes. • If the issue is not caused by moving water but some sort of subsurface defect. This may manifest as a sinkhole or linear depression and be associated with problems with the underdrain stone or pipe or underlying soil.
Observed Condition: Significant sediment accumulation, indicating an uncontrolled source of sediment	
Condition 1: Isolated areas of sediment accumulation, generally less than 3-inches deep Sediment source may be from a one-time or isolated event. Remove accumulated sediment and top 2 to 3 inches of Bioretention soil media; replace with clean material. Check drainage area for any ongoing sources of sediment. Condition 2: Majority of the surface is caked with "hard pan" (thin layer of clogging material) or accumulated sediment that is 3-inches deep or more This can be caused by an improper construction sequence (drainage area not fully stabilized prior to installation of Bioretention soil media) or another chronic source of sediment in the drainage area. Augering several holes down through the media can indicate how severe the problem is; often the damage is confined to the first several inches of soil media. Removing and replacing this top layer (or to the depth where sediment incursion is seen in auger holes) can be adequate, as long as the problem does not recur.	• More than 2 inches of accumulated sediment cover 25% or more of the Bioretention surface area. • "Hard pan" of thin, crusty layer covers majority of Bioretention surface area and seems to be impeding flow of water down through the soil media. • New sources of sediment seem to be accumulating with each significant rainfall event.

3.10. Ponds & Wetlands – Level 2 Inspections and Triggers for Level 3

The most likely triggers for a Level 3 Inspection for Ponds and Wetlands are:

- Severe erosion
- Excessive algae or aquatic plants
- Settlement and pipe corrosion
- Major sediment buildup

Table 3.10.1 Level Inspection: PONDS and WETLANDS	
Recommended Repairs and Required Skills	**Triggers for Level 3 Inspection**
Observed Condition: Bare Soil or Erosion in the Drainage Area	
Condition 1: Extensive problem spots, but no channels or rills forming Reseed problem areas. If problem persists or grass does not take, consider hiring a landscape contractor. Condition 2: Problem is extensive, and rills/channels are beginning to form May be necessary to divert or redirect water that is causing the erosion problem. If it appears that simple regrading—such as installing a berm or leveling a low spot–will fix the problem, make repairs and ensure that the problem is repaired after the next storm.	• Large rills or gullies are forming in the drainage area. • An attempt to regrade the drainage area has been unsuccessful. • Fixing the problem would require major regrading (i.e., redirecting more than a 100-square-foot area. • It is not clear why the problem is occurring.
Observed Condition: Manholes or Inlet Pipe Buried or Covered with Vegetation	
Condition 1: Nearest manhole and inlet pipe not found Consult as-built drawings to get to closest suspected location and use metal detector to search for metal manhole cover. If unsuccessful, identify nearest drain inlets and approximate pipe direction to locate next manhole. Condition 2: Manhole located and inspected Never enter a manhole, except by following confined-space entry protocols. If outlet pipe is not visible or greater than 25% full of sediment/debris or trash, it will typically require a qualified contractor to flush, clean and clear blockages. Condition 3: Inlet pipe not found at pond Clear vegetation and brush that may be covering the inlet pipe. Buried inlet pipes may be found through use of a metal probe. Condition 4: Inlet pipe buried in sediment or blocked by vegetation Once located, the pipe path can be cleared of vegetation with brush hook or other brush tools. Light digging may clear sediment from the end of the pipe.	• To locate buried manholes and lost storm lines, it is sometimes necessary to hire a pipeline inspection contractor with televising equipment or ground-penetrating radar and enter at the closest upstream access point. • Locating a buried inlet pipe may require wading in the edge of the pond and using a metal probe and brush axe to find and expose the pipe. • If other than light digging is necessary to remove accumulated sediment, a contractor with heavy equipment may be required.

Table 3.10.1 Level Inspection: PONDS and WETLANDS	
Recommended Repairs and Required Skills	**Triggers for Level 3 Inspection**
Observed Condition: Pipe or Headwall Settlement, Erosion, Corrosion or Failure	
Condition 1: Pipe or headwall settlement or failure Severe sinkholes, settlement or corrosion should be kicked out to Level 3 Inspection. Condition 2: Flow not confined to pipe and visible outside pipe wall With flashlight, observe the inside of the pipe and note its condition. Take photographs. Look for sinkholes developing that indicate pipe failure beneath the surface. Kick out to Level 3 inspection.	• Where blockages are visible, a decision is needed on whether to clear them or leave in place. If a third of the pipe is full of sediment, it should be removed by a contractor with pipe-cleaning equipment. • Corrosion of inlet pipes that allows flow around the pipe exterior is a structural concern because it can lead to settlement, sinkholes and undermining pond embankment. Evidence of this type of failure may require specialized pipe-inspection equipment and investigation by an engineer.
Observed Condition: Pond Conditions	
Condition 1: Pond pre-treatment zone is full of sediment or not constructed as shown on as-built drawings. Condition 2: Excessive buildup of sediment or overgrowth If the pre-treatment area or pond pool is overgrown or filled with sediment so that the original design is compromised, corrective measures are required. If plants have died, then replanting is necessary. If none of the original design exists due to alteration or sediment, kick out to Level 3 inspection.	• It may require inspection by an engineer to determine next steps for clearing, replanting or reconstruction. • Erosion or settlement such that design has been compromised should be reviewed by an engineer. Recurring erosion may require redesign and/or regrading to direct flow away from eroding area. • If sediment has filled more than 50% of the pond's capacity, dredging is likely needed and should be evaluated by a qualified contractor. • Removal or control of excessive algae or aquatic plants can be assessed by a qualified pond maintenance company.

Stormwater Ponds

Description: Constructed stormwater retention basin that has a permanent pool (or micropool). Runoff from each rain event is detained and treated in the pool through settling and biological uptake mechanisms.

Design Options: Micropool Extended Detention (P-1), Wet Pond (P-2), Wet Extended Detention (P-3), Multiple Pond (P-4), Pocket Pond (P-5)

KEY CONSIDERATIONS

FEASIBILITY

- Contributing drainage area greater than 10 acres for P-1, 25 acres for P-2 to P-4.
- Follow DEC Guidelines for Design of Dams.
- Provide a minimum 2' separation from the groundwater in sole source aquifers.
- Do not locate ponds in jurisdictional wetlands.
- Avoid directing hotspot runoff to design P-5.

CONVEYANCE

- Forebay at each inlet, unless the inlet contributes less than 10% of the total inflow, 4' to 6' deep.
- Stabilize the channel below the pond to prevent erosion.
- Stilling basin at the outlet to reduce velocities.

PREATREATMENT

- Forebay volume at least 10% of the WQ_v
- Forebay shall be designed with non-erosive outlet conditions.
- Provide direct access to the forebay for maintenance equipment
- In sole source aquifers, provide 100% pretreatment for hotspot runoff.

TREATMENT

- Provide the water quality volume in a combination of permanent pool and extended detention (Table 6.1 in manual provides limitations on storage breakdown)
- Minimum length to width ratio of 1.5:1
- Minimum surface area to drainage area ratio of 1:100

LANDSCAPING

STORMWATER MANAGEMENT SUITABILITY

X Water Quality

X Channel Protection

X Overbank Flood Protection

X Extreme Flood Protection

Accepts Hotspot Runoff: *Yes*

(2 feet minimum separation distance required to water table)

FEASIBILITY CONSIDERATIONS

L Cost

L Maintenance Burden

Key: L=Low **M**=Moderate **H**=High

Residential Subdivision Use: Yes

High Density/Ultra-Urban: *No*

Soils: *Hydrologic group 'A' soils may require pond liner*

Hydrologic group 'D' soils may have compaction constraints

Other Considerations:

- *Thermal effects*

STANDARD AND SPECIFICATIONS FOR SITE POLLUTION PREVENTION

Definition & Scope

A collection of management practices intended to control non-sediment pollutants associated with construction activities to prevent the generation of pollutants due to improper handling, storage, and spills and prevent the movement of toxic substances from the site into surface waters.

Conditions Where Practice Applies

On all construction sites where the earth disturbance exceeds 5,000 square feet, and involves the use of fertilizers, pesticides, petroleum based chemicals, fuels and lubricants, as well as sealers, paints, cleared woody vegetation, garbage, and sanitary wastes.

Design Criteria

The variety of pollutants on a particular site and the severity of their impacts depend on factors such as the nature of the construction activity, the physical characteristics of the construction site, and the proximity of water bodies and conveyances to the pollutant source.

1. All state and federal regulations shall be followed for the storage, handling, application, usage, and disposal of pesticides, fertilizers, and petroleum products.

2. Vehicle and construction equipment staging and maintenance areas will be located away from all drainage ways with their parking areas graded so the runoff from these areas is collected, contained and treated prior to discharge from the site.

3. Provide sanitary facilities for on-site personnel.

4. Store, cover, and isolate construction materials including topsoil, and chemicals, to prevent runoff of pollutants and contamination of groundwater and surface waters.

5. Develop and implement a spill prevention and control plan. The plan should include NYSDEC's spill reporting and initial notification requirements.

6. Provide adequate disposal for solid waste including woody debris, stumps, and other construction waste and include these methods and directions in the construction details on the site construction drawings. Fill, woody debris, stumps and construction waste shall not be placed in regulated wetlands, streams or other surface waters.

7. Distribute or post informational material regarding proper handling, spill response, spill kit location, and emergency actions to be taken, to all construction personnel.

8. Refueling equipment shall be located at least 100 feet from all wetlands, streams and other surface waters.

STANDARD AND SPECIFICATIONS FOR CONSTRUCTION ROAD STABILIZATION

Definition & Scope

The stabilization of temporary construction access routes, on-site vehicle transportation routes, and construction parking areas to control erosion on temporary construction routes and parking areas.

Conditions Where Practice Applies

All traffic routes and parking areas for temporary use by construction traffic.

Design Criteria

Construction roads should be located to reduce erosion potential, minimize impact on existing site resources, and maintain operations in a safe manner. Highly erosive soils, wet or rocky areas, and steep slopes should be avoided. Roads should be routed where seasonal water tables are deeper than 18 inches. Surface runoff and control should be in accordance with other standards.

Road Grade – A maximum grade of 12% is recommended, although grades up to 15% are possible for short distances.

Road Width – 12 foot minimum for one-way traffic or 24 foot minimum for two-way traffic.

Side Slope of Road Embankment – 2:1 or flatter.

Ditch Capacity – On-site roadside ditch and culvert capacities shall be the 10 yr. peak runoff.

Composition – Use a 6-inch layer of NYS DOT sub-base Types 1,2,3, 4 or equivalent as specified in NYSDOT Standard Specifications.

Construction Specifications

1. Clear and strip roadbed and parking areas of all vegetation, roots, and other objectionable material.

2. Locate parking areas on naturally flat areas as available. Keep grades sufficient for drainage, but not more than 2 to 3 percent.

3. Provide surface drainage and divert excess runoff to stabilized areas.

4. Maintain cut and fill slopes to 2:1 or flatter and stabilized with vegetation as soon as grading is accomplished.

5. Spread 6-inch layer of sub-base material evenly over the full width of the road and smooth to avoid depressions.

6. Provide appropriate sediment control measures to prevent offsite sedimentation.

Maintenance

Inspect construction roads and parking areas periodically for condition of surface. Top dress with new gravel as needed. Check ditches for erosion and sedimentation after rainfall events. Maintain vegetation in a healthy, vigorous condition. Areas producing sediment should be treated immediately.

STANDARD AND SPECIFICATIONS FOR CONCRETE TRUCK WASHOUT

Definition & Scope

A temporary excavated or above ground lined constructed pit where concrete truck mixers and equipment can be washed after their loads have been discharged, to prevent highly alkaline runoff from entering storm drainage systems or leaching into soil.

Conditions Where Practice Applies

Washout facilities shall be provided for every project where concrete will be poured or otherwise formed on the site. This facility will receive highly alkaline wash water from the cleaning of chutes, mixers, hoppers, vibrators, placing equipment, trowels, and screeds. Under no circumstances will wash water from these operations be allowed to infiltrate into the soil or enter surface waters.

Design Criteria

Capacity: The washout facility should be sized to contain solids, wash water, and rainfall and sized to allow for the evaporation of the wash water and rainfall. Wash water shall be estimated at 7 gallons per chute and 50 gallons per hopper of the concrete pump truck and/or discharging drum. The minimum size shall be 8 feet by 8 feet at the bottom and 2 feet deep. If excavated, the side slopes shall be 2 horizontal to 1 vertical.

Location: Locate the facility a minimum of 100 feet from drainage swales, storm drain inlets, wetlands, streams and other surface waters. Prevent surface water from entering the structure except for the access road. Provide appropriate access with a gravel access road sloped down to the structure. Signs shall be placed to direct drivers to the facility after their load is discharged.

Liner: All washout facilities will be lined to prevent leaching of liquids into the ground. The liner shall be plastic sheeting with a minimum thickness of 10 mils with no holes or tears, and anchored beyond the top of the pit with an earthen berm, sand bags, stone, or other structural appurtenance except at the access point.

If pre-fabricated washouts are used they must ensure the capture and containment of the concrete wash and be sized based on the expected frequency of concrete pours. They shall be sited as noted in the location criteria.

Maintenance

- All concrete washout facilities shall be inspected daily. Damaged or leaking facilities shall be deactivated and repaired or replaced immediately. Excess rainwater that has accumulated over hardened concrete should be pumped to a stabilized area, such as a grass filter strip.
- Accumulated hardened material shall be removed when 75% of the storage capacity of the structure is filled. Any excess wash water shall be pumped into a containment vessel and properly disposed of off site.
- Dispose of the hardened material off-site in a construction/demolition landfill. On-site disposal may be allowed if this has been approved and accepted as part of the projects SWPPP. In that case, the material should be recycled as specified, or buried and covered with a minimum of 2 feet of clean compacted earthfill that is permanently stabilized to prevent erosion.
- The plastic liner shall be replaced with each cleaning of the washout facility.
- Inspect the project site frequently to ensure that no concrete discharges are taking place in non-designated areas.

STANDARD AND SPECIFICATIONS FOR DUST CONTROL

Definition & Scope

The control of dust resulting from land-disturbing activities, to prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety problems.

Conditions Where Practice Applies

On construction roads, access points, and other disturbed areas subject to surface dust movement and dust blowing where off-site damage may occur if dust is not controlled.

Design Criteria

Construction operations should be scheduled to minimize the amount of area disturbed at one time. Buffer areas of vegetation should be left where practical. Temporary or permanent stabilization measures shall be installed. No specific design criteria is given; see construction specifications below for common methods of dust control.

Water quality must be considered when materials are selected for dust control. Where there is a potential for the material to wash off to a stream, ingredient information must be provided to the NYSDEC.

No polymer application shall take place without written approval from the NYSDEC.

Construction Specifications

A. **Non-driving Areas –** These areas use products and materials applied or placed on soil surfaces to prevent airborne migration of soil particles.

Vegetative Cover – For disturbed areas not subject to traffic, vegetation provides the most practical method of dust control (see Section 3).

Mulch (including gravel mulch) – Mulch offers a fast effective means of controlling dust. This can also include rolled erosion control blankets.

Spray adhesives – These are products generally composed of polymers in a liquid or solid form that are mixed with water to form an emulsion that is sprayed on the soil surface with typical hydroseeding equipment. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations for the specific soils on the site. In no case should the application of these adhesives be made on wet soils or if there is a probability of precipitation within 48 hours of its proposed use. Material Safety Data Sheets will be provided to all applicators and others working with the material.

B. **Driving Areas** – These areas utilize water, polymer emulsions, and barriers to prevent dust movement from the traffic surface into the air.

Sprinkling – The site may be sprayed with water until the surface is wet. This is especially effective on haul roads and access route to provide short term limited dust control.

Polymer Additives – These polymers are mixed with water and applied to the driving surface by a water truck with a gravity feed drip bar, spray bar or automated distributor truck. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations. Incorporation of the emulsion into the soil will be done to the appropriate depth based on expected traffic. Compaction after incorporation will be by vibratory roller to a minimum of 95%. The prepared surface shall be moist and no application of the polymer will be made if there is a probability of precipitation within 48 hours of its proposed use. Material Safety Data Sheets will be provided to all applicators working with the material.

Barriers – Woven geo-textiles can be placed on the driving surface to effectively reduce dust throw and particle migration on haul roads. Stone can also be used for construction roads for effective dust control.

Windbreak – A silt fence or similar barrier can control air currents at intervals equal to ten times the barrier height. Preserve existing wind barrier vegetation as much as practical.

Maintenance

Maintain dust control measures through dry weather periods until all disturbed areas are stabilized.

STANDARD AND SPECIFICATIONS FOR PROTECTING VEGETATION DURING CONSTRUCTION

Definition & Scope

The protection of trees, shrubs, ground cover and other vegetation from damage by construction equipment. In order to preserve existing vegetation determined to be important for soil erosion control, water quality protection, shade, screening, buffers, wildlife habitat, wetland protection, and other values.

Conditions Where Practices Applies

On planned construction sites where valued vegetation exists and needs to be preserved.

Design Criteria

1. Planning Considerations

   A. Inventory:

   1) Property boundaries, topography, vegetation and soils information should be gathered. Identify potentially high erosion areas, areas with tree windthrow potential, etc. A vegetative cover type map should be made on a copy of a topographic map which shows other natural and manmade features. Vegetation that is desirable to preserve because of its value for screening, shade, critical erosion control, endangered species, aesthetics, etc., should be identified and marked on the map.

   2) Based upon this data, general statements should be prepared about the present condition, potential problem areas, and unique features of the property.

   B. Planning:

   1) After engineering plans (plot maps) are prepared, another field review should take place and recommendations made for the vegetation to be saved. Minor adjustments in location of roads, dwellings, and utilities may be needed. Construction on steep slopes, erodible soils, wetlands, and streams should be avoided. Clearing limits should be delineated (See "Determine Limits of Clearing and Grading" on page 2.2).

   2) Areas to be seeded and planted should be identified. Remaining vegetation should blend with their surroundings and/or provide special function such as a filter strip, buffer zone, or screen.

   3) Trees and shrubs of special seasonal interest, such as flowering dogwood, red maple, striped maple, serviceberry, or shadbush, and valuable potential shade trees should be identified and marked for special protective treatment as appropriate.

   4) Trees to be cut should be marked on the plans. If timber can be removed for salable products, a forester should be consulted for marketing advice.

   5) Trees that may become a hazard to people, personal property, or utilities should be removed. These include trees that are weak-wooded, disease-prone, subject to windthrow, or those that have severely damaged root systems.

   6) The vigor of remaining trees may be improved by a selective thinning. A forester should be consulted for implementing this practice.

2. Measures to Protect Vegetation

   A. Limit soil placement over existing tree and shrub roots to a maximum of 3 inches. Soils with loamy texture and good structure should be used.

   B. Use retaining walls and terraces to protect roots of trees and shrubs when grades are lowered. Lowered grades should start no closer than the dripline of the tree. For narrow-canopied trees and shrubs, the stem diameter in inches is converted to feet and doubled, such that a 10 inch tree should be protected to 20 feet.

   C. Trenching across tree root systems should be the same minimum distance from the trunk, as in "B". Tunnels under root systems for underground utilities should start 18 inches or deeper below the normal ground surface. Tree roots which must be severed should be cut clean. Backfill material that will be in contact with the roots should be topsoil or a prepared planting soil mixture.

   D. Construct sturdy fences, or barriers, of wood, steel, or other protective material around valuable vegetation for protection from construction equipment. Place barriers far enough away from trees, but not less than the specifications in "B", so that tall equipment such as backhoes and dump trucks do not contact tree branches.

E. Construction limits should be identified and clearly marked to exclude equipment.

F. Avoid spills of oil/gas and other contaminants.

G. Obstructive and broken branches should be pruned properly. The branch collar on all branches whether living or dead should not be damaged. The 3 or 4 cut method should be used on all branches larger than two inches at the cut. First cut about one-third the way through the underside of the limb (about 6-12 inches from the tree trunk). Then (approximately an inch further out) make a second cut through the limb from the upper side. When the branch is removed, there is no splintering of the main tree trunk. Remove the stub. If the branch is larger than 5-6 inches in diameter, use the four cut system. Cuts 1 and 2 remain the same and cut 3 should be from the underside of the limb, on the outside of the branch collar. Cut 4 should be from the top and in alignment with the 3rd cut. Cut 3 should be 1/4 to 1/3 the way through the limb. This will prevent the bark from peeling down the trunk. Do not paint the cut surface.

H. Penalties for damage to valuable trees, shrubs, and herbaceous plants should be clearly spelled out in the contract.

PROTECTING TREES IN HEAVY USE AREAS

The compaction of soil over the roots of trees and shrubs by the trampling of recreationists, vehicular traffic, etc., reduces oxygen, water, and nutrient uptake by feeder roots. This weakens and may eventually kill the plants. Table 2.6 rates the “Susceptibility of Tree Species to Compaction.”

Where heavy compaction is anticipated, apply and maintain a 3 to 4 inch layer of undecayed wood chips or 2 inches of No. 2 washed, crushed gravel. In addition, use of a wooden or plastic mat may be used to lessen compaction, if applicable.

Table 2.6
Susceptibility of Tree Species to Compaction[1]

Resistant:

Box elder………………	*Acer negundo*	Willows…………………	*Salix spp.*
Green ash……………..	*Fraxinus pennsylvanica*	Honey locust……………	*Gleditsia triacanthos*
Red elm………………..	*Ulmus rubra*	Eastern cottonwood…….	*Populus deltoides*
Hawthornes……………	*Crataegus spp.*	Swamp white oak……….	*Quercus bicolor*
Bur oak………………..	*Quercus macrocarpa*	Hophornbeam……………	*Ostrya virginiana*
Northern white cedar….	*Thuja occidentalis*		

Intermediate:

Red maple…………….	*Acer rubrum*	Sweetgum……………….	*Liquidambar styraciflua*
Silver maple…………..	*Acer saccharinum*	Norway maple………….	*Acer platanoides*
Hackberry…………….	*Celtis occidentalis*	Shagbark hickory……….	*Carya ovata*
Black gum……………	*Nyssa sylvatica*	London plane…………..	*Platanus x hybrida*
Red oak………………	*Quercus rubra*	Pin oak………………….	*Quercus palustris*
Basswood…………….	*Tilia americana*		

Susceptible:

Sugar maple…………….	*Acer saccharum*	Austrian Pine……………	*Pinus nigra*
White pine………………	*Pinus strobus*	White ash……………….	*Fraxinus americana*
Blue spruce……………..	*Picea pungens*	Paper birch……………..	*Betula papyrifera*
White oak………………	*Quercus alba*	Moutain ash…………….	*Sorbus aucuparia*
Red pine………………..	*Pinus resinosa*	Japanese maple…………	*Acer palmatum*

[1] If a tree species does not appear on the list, insufficient information is available to rate it for this purpose.

STANDARD AND SPECIFICATIONS FOR STABILIZED CONSTRUCTION ACCESS

Definition & Scope

A stabilized pad of aggregate underlain with geotextile located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area. The purpose of stabilized construction access is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets.

Conditions Where Practice Applies

A stabilized construction access shall be used at all points of construction ingress and egress.

Design Criteria

See Figure 2.1 on page 2.31 for details.

Aggregate Size: Use a matrix of 1-4 inch stone, or reclaimed or recycled concrete equivalent.

Thickness: Not less than six (6) inches.

Width: 12-foot minimum but not less than the full width of points where ingress or egress occurs. 24-foot minimum if there is only one access to the site.

Length: As required, but not less than 50 feet (except on a single residence lot where a 30 foot minimum would apply).

Geotextile: To be placed over the entire area to be covered with aggregate. Filter cloth will not be required on a single-family residence lot. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

Criteria for Geotextile: The geotextile shall be woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydro-carbons, mildew, rot resistant, and conform to the fabric properties as shown:

Fabric Properties[3]	Light Duty[1] Roads Grade Subgrade	Heavy Duty[2] Haul Roads Rough Graded	Test Method
Grab Tensile Strength (lbs)	200	220	ASTM D1682
Elongation at Failure (%)	50	60	ASTM D1682
Mullen Burst Strength (lbs)	190	430	ASTM D3786
Puncture Strength (lbs)	40	125	ASTM D751 Modified
Equivalent	40-80	40-80	US Std Sieve
Opening Size			CW-02215
Aggregate Depth	6	10	-

[1]Light Duty Road: Area sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Acceptable materials are Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

[2]Heavy Duty Road: Area sites with only rough grading, and where most travel would be multi-axle vehicles. Acceptable materials are Trevira Spunbond 1135, Mirafi 600X, or equivalent.

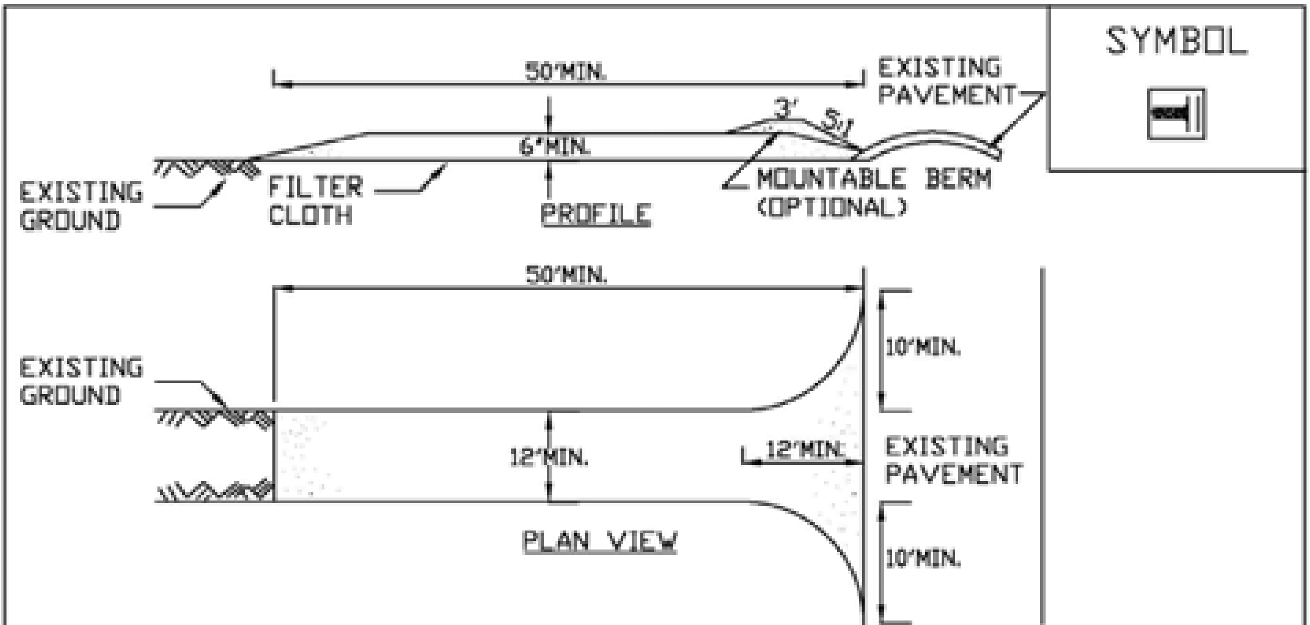
[3]Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

Maintenance

The access shall be maintained in a condition which will prevent tracking of sediment onto public rights-of-way or streets. This may require periodic top dressing with additional aggregate. All sediment spilled, dropped, or washed onto public rights-of-way must be removed immediately.

When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment-trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.

Figure 2.1
Stabilized Construction Access



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 1-4 INCH STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ACCESS SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	STABILIZED CONSTRUCTION ACCESS

STANDARD AND SPECIFICATIONS FOR WINTER STABILIZATION

Definition & Scope

A temporary site specific, enhanced erosion and sediment control plan to manage runoff and sediment at the site during construction activities in the winter months to protect off-site water resources.

Conditions Where Practice Applies

This standard applies to all construction activities involved with ongoing land disturbance and exposure between November 15th to the following April 1st.

Design Criteria

1. Prepare a snow management plan with adequate storage for snow and control of melt water, requiring cleared snow to be stored in a manner not affecting ongoing construction activities.

2. Enlarge and stabilize access points to provide for snow management and stockpiling. Snow management activities must not destroy or degrade installed erosion and sediment control practices.

3. A minimum 25 foot buffer shall be maintained from all perimeter controls such as silt fence. Mark silt fence with tall stakes that are visible above the snow pack.

4. Edges of disturbed areas that drain to a waterbody within 100 feet will have 2 rows of silt fence, 5 feet apart, installed on the contour.

5. Drainage structures must be kept open and free of snow and ice dams. All debris, ice dams, or debris from plowing operations, that restrict the flow of runoff and meltwater, shall be removed.

6. Sediment barriers must be installed at all appropriate perimeter and sensitive locations. Silt fence and other practices requiring earth disturbance must be installed before the ground freezes.

7. Soil stockpiles must be protected by the use of established vegetation, anchored straw mulch, rolled stabilization matting, or other durable covering. A barrier must be installed at least 15 feet from the toe of the stockpile to prevent soil migration and to capture loose soil.

8. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures should be initiated by the end of the next business day and completed within three (3) days. Rolled erosion control blankets must be used on all slopes 3 horizontal to 1 vertical or steeper.

9. If straw mulch alone is used for temporary stabilization, it shall be applied at double the standard rate of 2 tons per acre, making the application rate 4 tons per acre. Other manufactured mulches should be applied at double the manufacturer's recommended rate.

10. To ensure adequate stabilization of disturbed soil in advance of a melt event, areas of disturbed soil should be stabilized at the end of each work day unless:

    a. work will resume within 24 hours in the same area and no precipitation is forecast or;

    b. the work is in disturbed areas that collect and retain runoff, such as open utility trenches, foundation excavations, or water management areas.

11. Use stone paths to stabilize access perimeters of buildings under construction and areas where construction vehicle traffic is anticipated. Stone paths should be a minimum 10 feet in width but wider as necessary to accommodate equipment.

Maintenance

The site shall be inspected frequently to ensure that the erosion and sediment control plan is performing its winter stabilization function. If the site will not have earth disturbing activities ongoing during the "winter season", **all** bare exposed soil must be stabilized by established vegetation, straw or other acceptable mulch, matting, rock, or other approved material such as rolled erosion control products. Seeding of areas with mulch cover is preferred but seeding alone is not acceptable for proper stabilization.

Compliance inspections must be performed and reports filed properly in accordance with the SWPPP for all sites under a winter shutdown.

STANDARD AND SPECIFICATIONS FOR CHECK DAM

Definition & Scope

Small barriers or dams constructed of stone, bagged sand or gravel, or other durable materials across a drainageway to reduce erosion in a drainage channel by reducing the velocity of flow in the channel.

Conditions Where Practice Applies

This practice is used as a **temporary** and, in some cases, a **permanent** measure to limit erosion by reducing velocities in open channels that are degrading or subject to erosion or where permanent stabilization is impractical due to short period of usefulness and time constraints of construction.

Design Criteria

Drainage Area: Maximum drainage area above the check dam shall not exceed two (2) acres.

Height: Not greater than 2 feet. Center shall be maintained 9 inches lower than abutments at natural ground elevation.

Side Slopes: Shall be 2:1 or flatter.

Spacing: The check dams shall be spaced as necessary in the channel so that the crest of the downstream dam is at the elevation of the toe of the upstream dam. This spacing is equal to the height of the check dam divided by the channel slope.

Therefore:

$$S = \frac{h}{s}$$

Where:
S = spacing interval (ft.)
h = height of check dam (ft.)
s = channel slope (ft./ft.)

Example:

For a channel with a 4% slope and 2 ft. high stone check dams, they are spaced as follows:

$$S = \frac{2\ \text{ft}}{0.04\ \frac{\text{ft}}{\text{ft}}} = 50\ \text{ft}$$

For stone check dams: Use a well graded stone matrix 2 to 9 inches in size (NYS – DOT Light Stone Fill meets these requirements).

The overflow of the check dams will be stabilized to resist erosion that might be caused by the check dam. See Figure 3.1 on page 3.3 for details.

Check dams should be anchored in the channel by a cutoff trench 1.5 ft. wide and 0.5 ft. deep and lined with filter fabric to prevent soil migration.

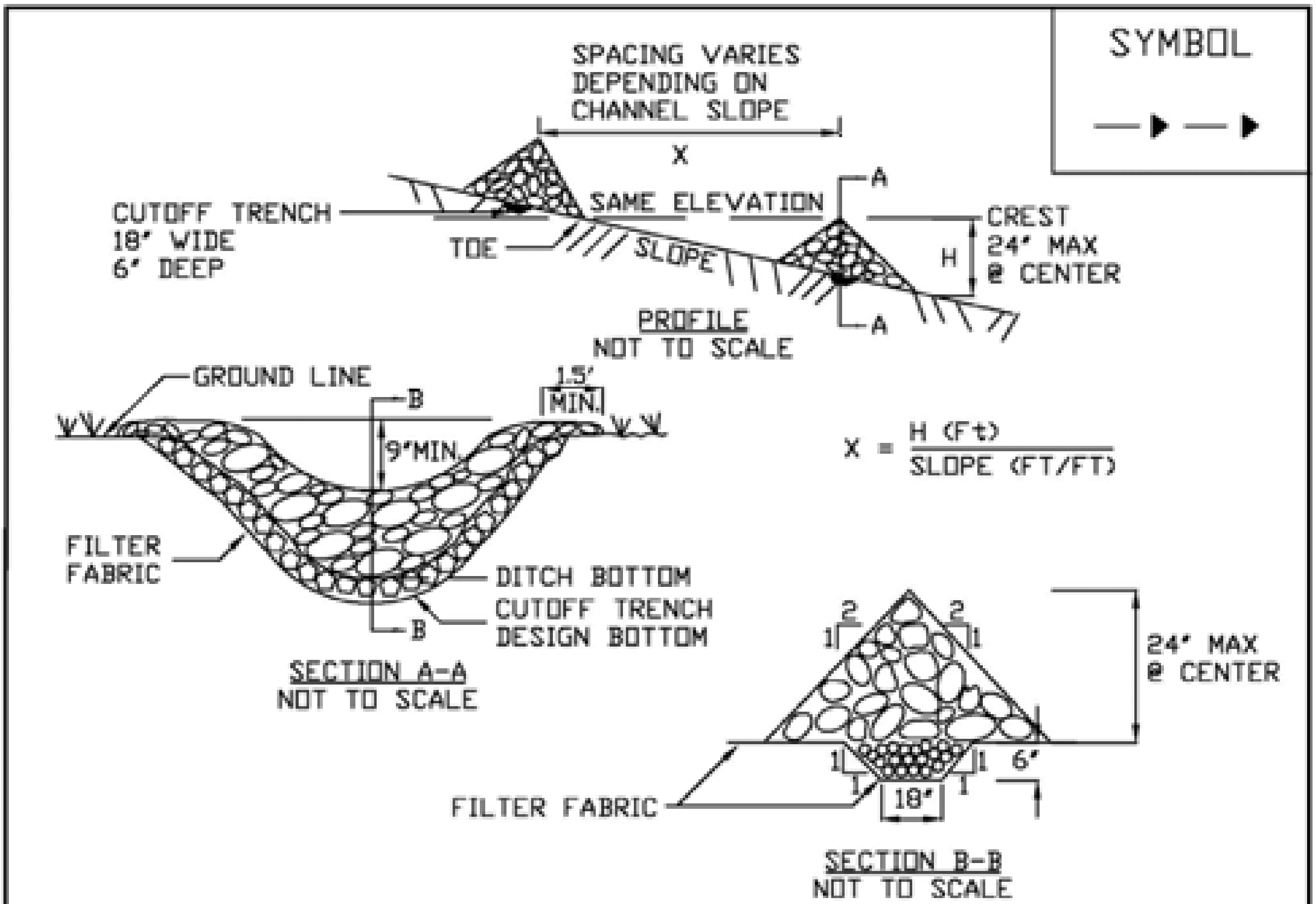
For filter sock or fiber roll check dams: The check dams will be anchored by staking the dam to the earth contact surface. The dam will extend to the top of the bank. The check dam will have a splash apron of NYS DOT #2 crushed stone extending a minimum 3 feet downstream from the dam and 1 foot up the sides of the channel. The compost and materials for a filter sock check dam shall meet the requirements shown in the standard for Compost Filter Sock on page 5.7.

Maintenance

The check dams should be inspected after each runoff event. Correct all damage immediately. If significant erosion has occurred between structures, a liner of stone or other suitable material should be installed in that portion of the channel or additional check dams added.

Remove sediment accumulated behind the dam as needed to allow channel to drain through the stone check dam and prevent large flows from carrying sediment over the dam.

Figure 3.1
Stone Check Dam Detail



CONSTRUCTION SPECIFICATIONS

1. STONE WILL BE PLACED ON A FILTER FABRIC FOUNDATION TO THE LINES, GRADES AND LOCATIONS SHOWN IN THE PLAN.
2. SET SPACING OF CHECK DAMS TO ASSUME THAT THE ELEVATIONS OF THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION OF THE TOE OF THE UPSTREAM DAM.
3. EXTEND THE STONE A MINIMUM OF 1.5 FEET BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.
4. PROTECT THE CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.
5. ENSURE THAT CHANNEL APPURTENANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE.

MAXIMUM DRAINAGE AREA 2 ACRES.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	STONE CHECK DAM

STANDARD AND SPECIFICATIONS FOR FLOW SPREADER

Definition & Scope

A **permanent or temporary,** non-erosive outlet for concentrated runoff, constructed to disperse concentrated flow uniformly over a hardened weir into a stabilized area as shallow, low velocity, sheet flow.

Conditions Where Practice Applies

Where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion; where a hardened level weir can be constructed without filling; where the area below the weir is uniform with a slope of 10% or less and the runoff will not re-concentrate after release; and where no traffic will disturb the flow spreader.

Design Criteria

1. **Drainage area:** The maximum drainage area to the spreader may not exceed 5 acres.

2. **Discharge to a flow spreader:** The peak stormwater flow rate to a flow spreader due to runoff from a 10-year 24-hour storm must be less than 0.5 cubic feet per second (0.5 cfs) per foot length of flow spreader lip.

3. **Length of flow spreader:** The flow spreader length may not be more than 30 feet if flow is entering from one end of the spreader. Longer lengths require flow to split evenly from the center of the spreader.

4. **Receiving area of buffer:** Each flow spreader shall have a vegetated receiving area with the capacity to pass the flow without erosion. The receiving area shall be stable prior to the construction of the flow spreader. The receiving area shall have topography regular enough to prevent undue flow concentration before entering a stable watercourse but it shall have a slope that is less than 10%. If the receiving area is not presently stable, then the receiving area shall be stabilized prior to construction of the flow spreader. The receiving area below the flow spreader shall be protected from harm during construction. Sodding and/or turf reinforced mat in combination with vegetative measures shall stabilize disturbed areas. The receiving area shall not be used by the flow spreader until stabilization has been accomplished. A temporary diversion may be necessary in this case.

5. **Weir:** The weir of the flow spreader should consist of a pressure treated 2"x12" timber plank laid on edge and set at level elevation perpendicular to flow. Alternate hardened weir structures may be used as long as a hard, durable, continuous weir is maintained.

6. **Channel:** The flow spreader entrance channel shall be a minimum of 1 foot deep with a minimum 2 foot bottom width to trap sediment and reduce lateral flow velocities. Side slopes shall be 2:1 or flatter. The channel shall be constructed with a 0% grade to ensure uniform flow distribution. Velocity entering the channel shall be reduced to ensure non-erosive low approach velocity in the weir.

7. **Maintenance:** Long term maintenance of the flow spreader is essential to ensure its continued effectiveness. The following provisions should be followed. In the first year the flow spreader should be inspected semi annually and following major storm events for any signs of channelization and should be immediately repaired. After the first year, annual inspection should be sufficient. Spreaders constructed of wood, asphalt, stone or concrete curbing require periodic inspection to check for damage and to be repaired as needed.

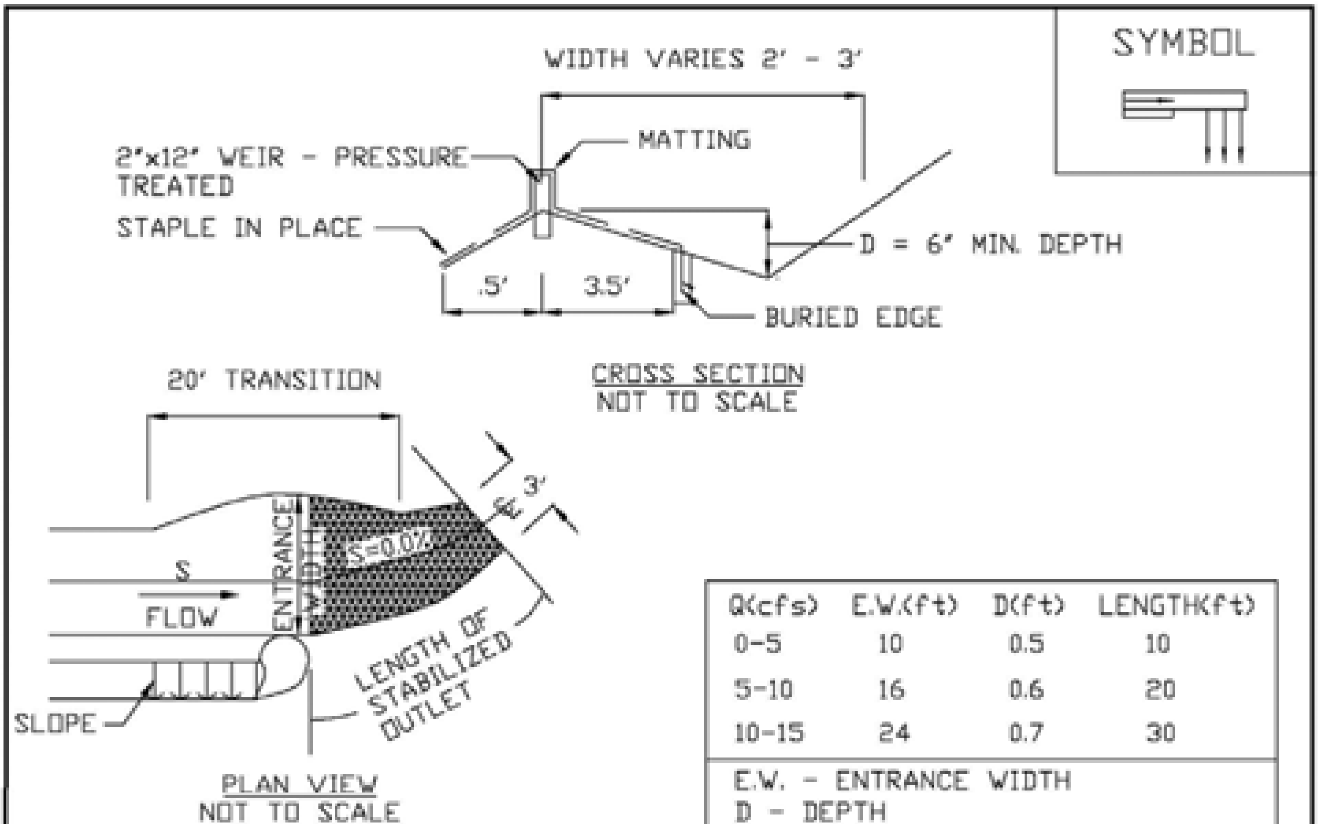
    A. **Inspections:** At least once a year, the spreader pool should be inspected for sand accumulation and debris that may reduce capacity.

    B. **Maintenance Access:** Flow spreaders should be sited to provide easy access for removal of accumulated sediment and rehabilitation of the berm.

    C. **Debris Removal:** Debris buildup within the channel should be removed when it has accumulated to approximately 10 to 20% of design volume or channel capacity. Remove debris such as leaf litter, branches, tree growth and any sediment build-up from the spreader and dispose of appropriately.

    D. **Mowing:** Vegetated spreaders may require mowing.

Figure 3.7
Flow Spreader Detail



Q(cfs)	E.W.(ft)	D(ft)	LENGTH(ft)
0-5	10	0.5	10
5-10	16	0.6	20
10-15	24	0.7	30

E.W. - ENTRANCE WIDTH
D - DEPTH

CONSTRUCTION SPECIFICATIONS

1. THE MATTING SHOULD BE A MINIMUM OF 4FT. WIDE EXTENDING 6 INCHES OVER THE WEIR AND BURIED 6 INCHES DEEP IN A VERTICAL TRENCH ON THE LOWER EDGE. THE UPPER EDGE SHOULD BUTT AGAINST SMOOTHLY CUT SOD AND BE SECURELY HELD IN PLACE WITH CLOSELY SPACED HEAVY DUTY WIRE STAPLES AT LEAST 12 INCHES IN LENGTH.
2. ENSURE THAT THE WEIR IS LEVEL TO UNIFORMLY SPREAD DISCHARGE.
3. THE WEIR SHALL BE PLACED IN UNDISTURBED SOIL NOT FILL.
4. A 20 FOOT TRANSITION SECTION WILL BE CONSTRUCTED FROM THE DIVERSION CHANNEL TO THE SPREADER TO SMOOTHLY BLEND THE DIFFERENT DIMENSION AND GRADES.
5. THE RUNOFF DISCHARGE WILL BE OUTLETED ONTO A STABILIZED VEGETATED SLOPE NOT EXCEEDING 10%.
6. SEED AND MULCH THE DISTURBED AREA IMMEDIATELY AFTER CONSTRUCTION.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	FLOW SPREADER

STANDARD AND SPECIFICATIONS FOR GRASSED WATERWAY

Definition & Scope

A natural or **permanent** man-made channel of parabolic or trapezoidal cross-section that is below adjacent ground level and is stabilized by suitable vegetation. The flow channel is normally wide and shallow and conveys the runoff down the slope without causing damage by erosion.

Conditions Where Practice Applies

Grass waterways are used where added vegetative protection is needed to control erosion resulting from concentrated runoff.

Design Criteria

Capacity

The minimum capacity shall be that required to confine the peak rate of runoff expected from a 10-year 24 hour frequency rainfall event or a higher frequency corresponding to the hazard involved. This requirement for confinement may be waived on slopes of less than one (1) percent where out-of-bank flow will not cause erosion or property damage.

Peak rates of runoff values used in determining the capacity requirements shall be computed by appropriate methods. Where there is base flow, it shall be handled by a stone center, subsurface drain, or other suitable means since sustained wetness usually prevents adequate vegetative cover. The cross-sectional area of the stone center or subsurface drain size to be provided shall be determined by using a flow rate of 0.1 cfs/acre or by actual measurement of the maximum base flow.

Velocity

Please see Table 3.1, Diversion Maximum Permissible Design Velocities on page 3.10, for seed, soil, and velocity variables.

Cross Section

The design water surface elevation of a grassed waterway receiving water from diversions or other tributary channels shall be equal to or less than the design water surface elevation in the diversion or other tributary channels.

The top width of parabolic waterways shall not exceed 30 feet and the bottom width of trapezoidal waterways shall not exceed 15 feet unless multiple or divided waterways, stone center, or other means are provided to control meandering of low flows.

Structural Measures

In cases where grade or erosion problems exist, special control measures may be needed such as lined waterways (see page 3.27), or grade stabilization measures (see page 3.21). Where needed, these measures will be supported by adequate design computations. For typical cross sections of waterways with riprap sections or stone centers, refer to Figure 3.8 on page 3.24.

The design procedures for parabolic and trapezoidal channels are available in the NRCS Engineering Field Handbook. Figure 3.9 on page 3.25 also provides a design chart for parabolic waterway.

Outlets

Each waterway shall have a stable outlet. The outlet may be another waterway, a stabilized open channel, grade stabilization structure, etc. In all cases, the outlet must discharge in such a manner as not to cause erosion. Outlets shall be constructed and stabilized prior to the operation of the waterway.

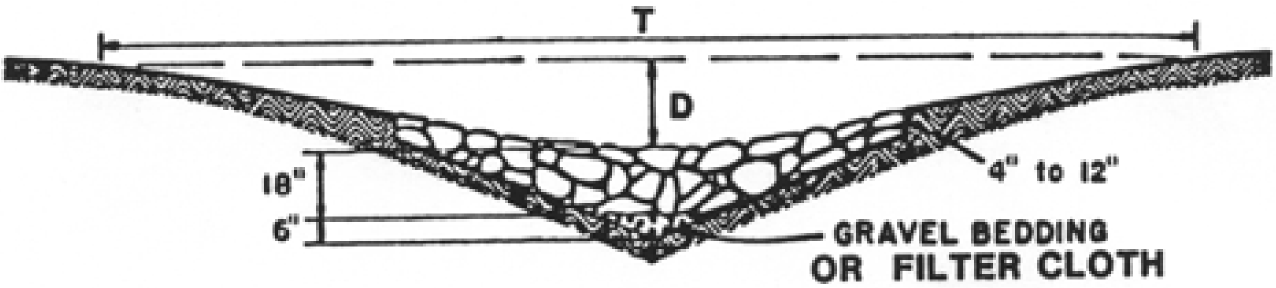
Stabilization

Waterways shall be stabilized in accordance with the appropriate vegetative stabilization standard and specifications, and will be dependent on such factors as slope, soil class, etc. See standard for Vegetating Waterways on Page 4.78.

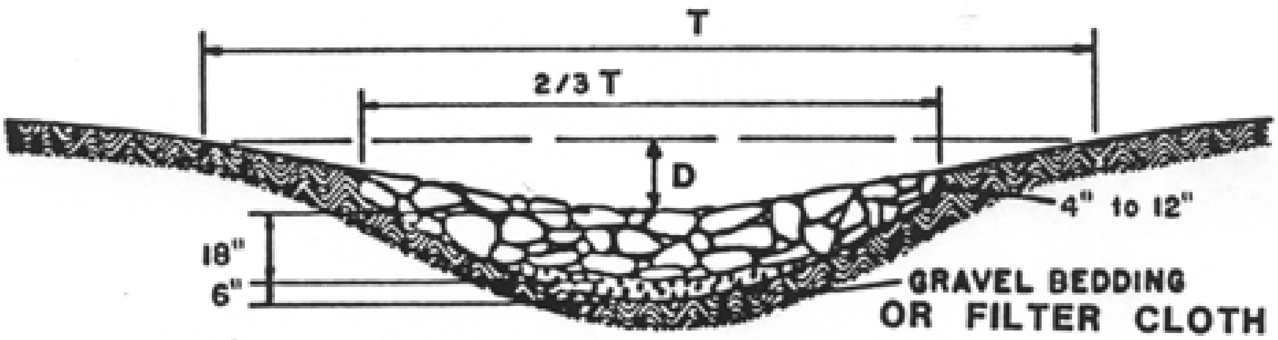
Construction Specifications

See Figure 3.10 on page 3.26 for details.

Figure 3.8
Typical Waterway Cross Sections Details

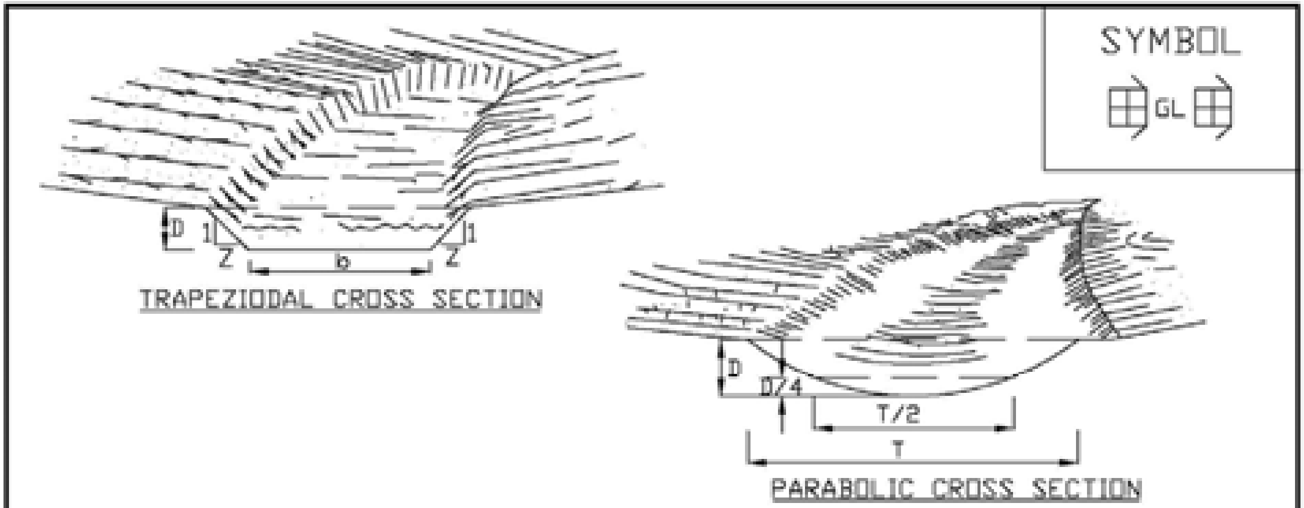


Waterway with stone center drain. "V" section shaped by motor grader.



Waterway with stone center drain. Rounded section shaped by bulldozer.

Figure 3.10
Grassed Waterway Detail



CONSTRUCTION SPECIFICATIONS

1. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE WATERWAY.
2. THE WATERWAY SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN, AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
3. FILLS SHALL BE COMPACTED AS NEEDED TO PREVENT UNEQUAL SETTLEMENT THAT WOULD CAUSE DAMAGE IN THE COMPLETE WATERWAY.
4. ALL EARTH REMOVED AND NOT NEEDED IN CONSTRUCTION SHALL BE SPREAD OR DISPOSED OF SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE WATERWAY.
5. STABILIZATION SHALL BE DONE ACCORDING TO THE APPROPRIATE STANDARD AND SPECIFICATIONS FOR VEGETATIVE PRACTICES.
   A. FOR DESIGN VELOCITIES OF LESS THAN 3.5 FT. PER. SEC., SEEDING AND MULCHING MAY BE USED FOR THE ESTABLISHMENT OF THE VEGETATION. IT IS RECOMMENDED THAT, WHEN CONDITIONS PERMIT, TEMPORARY WATERWAYS OR OTHER MEANS SHOULD BE USED TO PREVENT WATER FROM ENTERING THE WATERWAY DURING THE ESTABLISHMENT OF THE VEGETATION.
   B. FOR DESIGN VELOCITIES OF MORE THAN 3.5 FT. PER. SEC., THE WATERWAY SHALL BE STABILIZED WITH SOD, WITH SEEDING PROTECTED BY JUTE OR EXCELSIOR MATTING OR WITH SEEDING AND MULCHING INCLUDING TEMPORARY DIVERSION OF THE WATER UNTIL THE VEGETATION IS ESTABLISHED.
   C. STRUCTURAL - VEGETATIVE PROTECTION
   SUBSURFACE DRAIN FOR BASE FLOW SHALL BE CONSTRUCTED AS SHOWN ON THE STANDARD DRAWING AND AS SPECIFIED IN THE STANDARD AND SPECIFICATIONS FOR SUBSURFACE DRAIN.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	GRASSED WATERWAY

STANDARD AND SPECIFICATIONS FOR ROCK OUTLET PROTECTION

Definition & Scope

A **permanent** section of rock protection placed at the outlet end of the culverts, conduits, or channels to reduce the depth, velocity, and energy of water, such that the flow will not erode the receiving downstream reach.

Conditions Where Practice Applies

This practice applies where discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This applies to:

1. Culvert outlets of all types.
2. Pipe conduits from all sediment basins, dry storm water ponds, and permanent type ponds.
3. New channels constructed as outlets for culverts and conduits.

Design Criteria

The design of rock outlet protection depends entirely on the location. Pipe outlet at the top of cuts or on slopes steeper than 10 percent, cannot be protected by rock aprons or riprap sections due to re-concentration of flows and high velocities encountered after the flow leaves the apron.

Many counties and state agencies have regulations and design procedures already established for dimensions, type and size of materials, and locations where outlet protection is required. Where these requirements exist, they shall be followed.

Tailwater Depth

The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. If the tailwater depth is less than half the diameter of the outlet pipe, and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition; see Figure 3.16 on page 3.42 as an example. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition; see Figure 3.17 on page 3.43 as an example. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition; see Figure 3.16 on page 3.42 as an example.

Apron Size

The apron length and width shall be determined from the curves according to the tailwater conditions:

Minimum Tailwater – Use Figure 3.16 on page 3.42
Maximum Tailwater – Use Figure 3.17 on page 3.43

If the pipe discharges directly into a well defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less.

The upstream end of the apron, adjacent to the pipe, shall have a width two (2) times the diameter of the outlet pipe, or conform to pipe end section if used.

Bottom Grade

The outlet protection apron shall be constructed with no slope along its length. There shall be no overfall at the end of the apron. The elevation of the downstream end of the apron shall be equal to the elevation of the receiving channel or adjacent ground.

Alignment

The outlet protection apron shall be located so that there are no bends in the horizontal alignment.

Materials

The outlet protection may be done using rock riprap, grouted riprap, or gabions. Outlets constructed on the bank of a stream or wetland shall not use grouted rip-rap, gabions or concrete.

Riprap shall be composed of a well-graded mixture of rock size so that 50 percent of the pieces, by weight, shall be larger than the d_{50} size determined by using the charts. A well-graded mixture, as used herein, is defined as a mixture composed primarily of larger rock sizes, but with a sufficient mixture of other sizes to fill the smaller voids between the rocks. The diameter of the largest rock size in such a mixture shall be 1.5 times the d_{50} size.

Thickness

The minimum thickness of the riprap layer shall be 1.5 times the maximum rock diameter for d_{50} of 15 inches or less; and 1.2 times the maximum rock size for d_{50} greater than 15 inches. The following chart lists some examples:

D_{50} (inches)	d_{max} (inches)	Minimum Blanket Thickness (inches)
4	6	9
6	9	14
9	14	20
12	18	27
15	22	32
18	27	32
21	32	38
24	36	43

Rock Quality

Rock for riprap shall consist of field rock or rough unhewn quarry rock. The rock shall be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual rocks shall be at least 2.5.

Filter

A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap. Riprap shall have a filter placed under it in all cases.

A filter can be of two general forms: a gravel layer or a plastic filter cloth. The plastic filter cloth can be woven or non-woven monofilament yarns, and shall meet these base requirements: thickness 20-60 mils, grab strength 90-120 lbs; and shall conform to ASTM D-1777 and ASTM D-1682.

Gravel filter blanket, when used, shall be designed by comparing particle sizes of the overlying material and the base material. Design criteria are available in Standard and Specification for Anchored Slope and Channel Stabilization on page 4.7.

Gabions

Gabions shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening shall not exceed 4 ½ inches and the area of the mesh opening shall not exceed 10 square inches.

Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions shall be of single unit construction and shall be installed according to manufacturer's recommendations.

The area on which the gabion is to be installed shall be graded as shown on the drawings. Foundation conditions shall be the same as for placing rock riprap, and filter cloth shall be placed under all gabions. Where necessary, key, or tie, the structure into the bank to prevent undermining of the main gabion structure.

Maintenance

Once a riprap outlet has been installed, the maintenance needs are very low. It should be inspected after high flows for evidence of scour beneath the riprap or for dislodged rocks. Repairs should be made immediately.

Design Procedure

1. Investigate the downstream channel to assure that nonerosive velocities can be maintained.

2. Determine the tailwater condition at the outlet to establish which curve to use.

3. Use the appropriate chart with the design discharge to determine the riprap size and apron length required. It is noted that references to pipe diameters in the charts are based on full flow. For other than full pipe flow, the parameters of depth of flow and velocity must be used to adjust the design discharges.

4. Calculate apron width at the downstream end if a flare section is to be employed.

Design Examples are demonstrated in Appendix B.

Construction Specifications

1. The subgrade for the filter, riprap, or gabion shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density of approximately that of the surrounding undisturbed material.

2. The rock or gravel shall conform to the specified grad-

ing limits when installed respectively in the riprap or filter.

3. Filter cloth shall be protected from punching, cutting, or tearing. Any damage other than an occasional small hole shall be repaired by placing another piece of cloth over the damaged part or by completely replacing the cloth. All overlaps, whether for repairs or for joining two pieces of cloth shall be a minimum of one foot.

4. Rock for the riprap or gabion outlets may be placed by equipment. Both shall each be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. The rock for riprap or gabion outlets shall be delivered and placed in a manner that will ensure that it is reasonably homogenous with the smaller rocks and spalls filling the voids between the larger rocks. Riprap shall be placed in a manner to prevent damage to the filter blanket or filter cloth. Hand placement will be required to the extent necessary to prevent damage to the permanent works.

STANDARD AND SPECIFICATIONS FOR ANCHORED STABILIZATION MATTING

Definition and Scope

A **temporary** or **permanent** protective covering placed on a prepared, seeded planting area that is anchored in place by staples or other means to aid in controlling erosion by absorbing rain splash energy and withstand overland flow as well as provide a microclimate to protect and promote seed establishment.

Conditions Where Practice Applies

Anchored stabilization mats are required for seeded earthen slopes steeper than 3 horizontal to 1 vertical; in vegetated channels where the velocity of the design flow exceeds the allowable velocity for vegetation alone (usually greater than 5 feet per second); on streambanks and shorelines where moving water is likely to erode newly seeded or planted areas; and in areas where wind prevents standard mulching with straw. This standard does not apply to slopes stabilized with sod, rock riprap or hard armor material.

Design Criteria

Slope Applications - Anchored stabilization mats for use on slopes are primarily used as mulch blankets where the mesh material is within the blanket or as a netting over previously placed mulch. These stabilization mats are NOT effective in preventing slope failures.

1. Required on all slopes steeper than 3:1
2. Matting will be designed for proper longevity need and strength based on intended use.
3. All installation details and directions will be included on the site erosion and sediment control plan and will follow manufactures specifications.

Channel Applications - Anchored stabilization mats, for use in supporting vegetation in flow channels, are generally a non-degradable, three dimensional plastic structure which can be filled with soil prior to planting. This structure provides a medium for root growth where the matting and roots become intertwined forming a continuous anchor for the vegetated lining.

1. Channel stabilization shall be based on the tractive force method.
2. For maximum design shear stresses less than 2 pounds per square foot, a temporary or bio-degradable mat may be used.
3. The design of the final matting shall be based on the mats ability to resist the tractive shear stress at bank full flow.
4. The installation details and procedures shall be included on the site erosion and sediment control plan and will follow manufacturers specifications.

Construction Specifications

1. Prepare soil before installing matting by smoothing the surface, removing debris and large stone, and applying lime, fertilizer and seed. Refer to manufacturers installation details.
2. Begin at the top of the slope by anchoring the mat in a 6” deep x 6” wide trench. Backfill and compact the trench after stapling.
3. In channels or swales, begin at the downslope end, anchoring the mat at the bottom and top ends of the blanket. When another roll is needed, the upslope roll

should overlay the lower layer, shingle style, so that channel flows do not peel back the material.

4. Roll the mats down a slope with a minimum 4” overlap. Roll center mat in a channel in direction of water flow on bottom of the channel. Do not stretch blankets. Blankets shall have good continuous contact with the underlying soil throughout its entire length.

5. Place mats end over end (shingle style) with a 6” overlap, use a double row of staggered staples 4” apart to secure mats.

6. Full length edge of mats at top of side slopes must be anchored in 6” deep x 6” wide trench; backfill and compact the trench after stapling.

7. Mats on side slopes of a channel must be overlapped 4” over the center mat and stapled.

8. In high flow channel applications, a staple check slot is recommended at 30 to 40 foot intervals. Use a row of staples 4” apart over entire width of the channel. Place a second row 4” below the first row in a staggered pattern.

9. The terminal end of the mats must be anchored in a 6”x6” wide trench. Backfill and compact the trench after stapling.

10. Stapling and anchoring of blanket shall be done in accordance with the manufactures recommendations.

Maintenance

Blanketed areas shall be inspected weekly and after each runoff event until perennial vegetation is established to a minimum uniform 80% coverage throughout the blanketed area. Damaged or displaced blankets shall be restored or replaced within 2 calendar days.

STANDARD AND SPECIFICATIONS FOR LANDGRADING

Definition & Scope

Permanent reshaping of the existing land surface by grading in accordance with an engineering topographic plan and specification to provide for erosion control and vegetative establishment on disturbed, reshaped areas.

Design Criteria

The grading plan should be based upon the incorporation of building designs and street layouts that fit and utilize existing topography and desirable natural surrounding to avoid extreme grade modifications. Information submitted must provide sufficient topographic surveys and soil investigations to determine limitations that must be imposed on the grading operation related to slope stability, effect on adjacent properties and drainage patterns, measures for drainage and water removal, and vegetative treatment, etc.

Many municipalities and counties have regulations and design procedures already established for land grading and cut and fill slopes. Where these requirements exist, they shall be followed.

The plan must show existing and proposed contours of the area(s) to be graded. The plan shall also include practices for erosion control, slope stabilization, safe disposal of runoff water and drainage, such as waterways, lined ditches, reverse slope benches (include grade and cross section), grade stabilization structures, retaining walls, and surface and subsurface drains. The plan shall also include phasing of these practices. The following shall be incorporated into the plan:

1. Provisions shall be made to safely convey surface runoff to storm drains, protected outlets, or to stable water courses to ensure that surface runoff will not damage slopes or other graded areas; see standards and specifications for Grassed Waterway, Diversion, or Grade Stabilization Structure.

2. Cut and fill slopes that are to be stabilized with grasses shall not be steeper than 2:1. When slopes exceed 2:1, special design and stabilization consideration are required and shall be adequately shown on the plans. (Note: Where the slope is to be mowed, the slope should be no steeper than 3:1, although 4:1 is preferred because of safety factors related to mowing steep slopes.)

3. Reverse slope benches or diversion shall be provided whenever the vertical interval (height) of any 2:1 slope exceeds 20 feet; for 3:1 slope it shall be increased to 30 feet and for 4:1 to 40 feet. Benches shall be located to divide the slope face as equally as possible and shall convey the water to a stable outlet. Soils, seeps, rock outcrops, etc., shall also be taken into consideration when designing benches.

   A. Benches shall be a minimum of six feet wide to provide for ease of maintenance.

   B. Benches shall be designed with a reverse slope of 6:1 or flatter to the toe of the upper slope and with a minimum of one foot in depth. Bench gradient to the outlet shall be between 2 percent and 3 percent, unless accompanied by appropriate design and computations.

   C. The flow length within a bench shall not exceed 800 feet unless accompanied by appropriate design and computations; see Standard and Specifications for Diversion on page 3.9

4. Surface water shall be diverted from the face of all cut and/or fill slopes by the use of diversions, ditches and swales or conveyed downslope by the use of a designed structure, except where:

   A. The face of the slope is or shall be stabilized and the face of all graded slopes shall be protected from surface runoff until they are stabilized.

   B. The face of the slope shall not be subject to any concentrated flows of surface water such as from natural drainage ways, graded ditches, downspouts, etc.

   C. The face of the slope will be protected by anchored stabilization matting, sod, gravel, riprap, or other stabilization method.

5. Cut slopes occurring in ripable rock shall be serrated as shown in Figure 4.9 on page 4.26. The serrations shall be made with conventional equipment as the excavation is made. Each step or serration shall be constructed on the contour and will have steps cut at nominal two-foot intervals with nominal three-foot horizontal shelves. These steps will vary depending on the slope ratio or the cut slope. The nominal slope line is 1 ½: 1. These steps will weather and act to hold moisture, lime, fertilizer, and seed thus producing a much quicker and longer-lived vegetative cover and better slope stabilization. Overland flow shall be diverted from the top of all serrated cut slopes and carried to a suitable outlet.

6. Subsurface drainage shall be provided where necessary to intercept seepage that would otherwise adversely affect slope stability or create excessively wet site conditions.

7. Slopes shall not be created so close to property lines as to endanger adjoining properties without adequately protecting such properties against sedimentation, erosion, slippage, settlement, subsidence, or other related damages.

8. Fill material shall be free of brush, rubbish, rocks, logs, stumps, building debris, and other objectionable material. It should be free of stones over two (2) inches in diameter where compacted by hand or mechanical tampers or over eight (8) inches in diameter where compacted by rollers or other equipment. Frozen material shall not be placed in the fill nor shall the fill material be placed on a frozen foundation.

9. Stockpiles, borrow areas, and spoil shall be shown on the plans and shall be subject to the provisions of this Standard and Specifications.

10. All disturbed areas shall be stabilized structurally or vegetatively in compliance with the Permanent Construction Area Planting Standard on page 4.42.

Construction Specifications

See Figures 4.9 and 4.10 for details.

1. All graded or disturbed areas, including slopes, shall be protected during clearing and construction in accordance with the erosion and sediment control plan until they are adequately stabilized.

2. All erosion and sediment control practices and measures shall be constructed, applied and maintained in accordance with the erosion and sediment control plan and these standards.

3. Topsoil required for the establishment of vegetation shall be stockpiled in amount necessary to complete finished grading of all exposed areas.

4. Areas to be filled shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots, or other objectionable material.

5. Areas that are to be topsoiled shall be scarified to a minimum depth of four inches prior to placement of topsoil.

6. All fills shall be compacted as required to reduce erosion, slippage, settlement, subsidence, or other related problems. Fill intended to support buildings, structures, and conduits, etc., shall be compacted in accordance with local requirements or codes.

7. All fill shall be placed and compacted in layers not to exceed 9 inches in thickness.

8. Except for approved landfills or nonstructural fills, fill material shall be free of frozen particles, brush, roots, sod, or other foreign objectionable materials that would interfere with, or prevent, construction of satisfactory fills.

9. Frozen material or soft, mucky or highly compressible materials shall not be incorporated into fill slopes or structural fills.

10. Fill shall not be placed on saturated or frozen surfaces.

11. All benches shall be kept free of sediment during all phases of development.

12. Seeps or springs encountered during construction shall be handled in accordance with the Standard and Specification for Subsurface Drain on page 3.48 or other approved methods.

13. All graded areas shall be permanently stabilized immediately following finished grading.

14. Stockpiles, borrow areas, and spoil areas shall be shown on the plans and shall be subject to the provisions of this Standard and Specifications.

Figure 4.11
Landgrading - Construction Specifications

CONSTRUCTION SPECIFICATIONS

1. ALL GRADED OR DISTURBED AREAS INCLUDING SLOPES SHALL BE PROTECTED DURING CLEARING AND CONSTRUCTION IN ACCORDANCE WITH THE APPROVED EROSION AND SEDIMENT CONTROL PLAN UNTIL THEY ARE PERMANENTLY STABILIZED.
2. ALL SEDIMENT CONTROL PRACTICES AND MEASURES SHALL BE CONSTRUCTED, APPLIED AND MAINTAINED IN ACCORDANCE WITH THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
3. TOPSOIL REQUIRED FOR THE ESTABLISHMENT OF VEGETATION SHALL BE STOCKPILED IN AMOUNT NECESSARY TO COMPLETE FINISHED GRADING OF ALL EXPOSED AREAS.
4. AREAS TO BE FILLED SHALL BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS OR OTHER OBJECTIONABLE MATERIAL.
5. AREAS WHICH ARE TO BE TOPSOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF FOUR INCHES PRIOR TO PLACEMENT OF TOPSOIL.
6. ALL FILLS SHALL BE COMPACTED AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, SUBSIDENCE OR OTHER RELATED PROBLEMS. FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES AND CONDUITS, ETC. SHALL BE COMPACTED IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.
7. ALL FILL SHALL BE PLACED AND COMPACTED IN LAYERS NOT TO EXCEED 9 INCHES IN THICKNESS.
8. EXCEPT FOR APPROVED LANDFILLS, FILL MATERIAL SHALL BE FREE OF FROZEN PARTICLES, BRUSH, ROOTS, SOD, OR OTHER FOREIGN OR OTHER OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
9. FROZEN MATERIALS OR SOFT, MUCKY OR HIGHLY COMPRESSIBLE MATERIALS SHALL NOT BE INCORPORATED IN FILLS.
10. FILL SHALL NOT BE PLACED ON SATURATED OR FROZEN SURFACES.
11. ALL BENCHES SHALL BE KEPT FREE OF SEDIMENT DURING ALL PHASES OF DEVELOPMENT.
12. SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION SHALL BE HANDLED IN ACCORDANCE WITH THE STANDARD AND SPECIFICATION FOR SUBSURFACE DRAIN OR OTHER APPROVED METHOD.
13. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY FOLLOWING FINISHED GRADING.
14. STOCKPILES, BORROW AREAS AND SPOIL AREAS SHALL BE SHOWN ON THE PLANS AND SHALL BE SUBJECT TO THE PROVISIONS OF THIS STANDARD AND SPECIFICATION.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	LANDGRADING SPECIFICATIONS

STANDARD AND SPECIFICATIONS FOR SOIL RESTORATION

Definition & Scope

The decompaction of areas of a development site or construction project where soils have been disturbed to recover the original properties and porosity of the soil; thus providing a sustainable growth medium for vegetation, reduction of runoff and filtering of pollutants from stormwater runoff.

Conditions Where Practice Applies

Soil restoration is to be applied to areas whose heavy construction traffic is done and final stabilization is to begin. This is generally applied in the cleanup, site restoration, and landscaping phase of construction followed by the permanent establishment of an appropriate ground cover to maintain the soil structure. Soil restoration measures should be applied over and adjacent to any runoff reduction practices to achieve design performance.

Design Criteria

1. Soil restoration areas will be designated on the plan views of areas to be disturbed.
2. Soil restoration will be completed in accordance with Table 4.6 on page 4.53.

Specification for Full Soil Restoration

During periods of relatively low to moderate subsoil moisture, the disturbed subsoils are returned to rough grade and the following Soil Restoration steps applied:

1. Apply 3 inches of compost over subsoil. The compost shall be well decomposed (matured at least 3 months), weed-free, organic matter. It shall be aerobically composted, possess no objectionable odors, and contain less than 1%, by dry weight, of man-made foreign matter. The physical parameters of the compost shall meet the standards listed in Table 5.2 - Compost Standards Table, except for “Particle Size” 100% will pass the 1/2” sieve. **Note: All biosolids compost produced in New York State (or approved for importation) must meet NYS DEC’s 6 NYCRR Part 360 (Solid Waste Management Facilities) requirements. The Part 360 requirements are equal to or more stringent than 40 CFR Part 503 which ensure safe standards for pathogen reduction and heavy metals content.**

2. Till compost into subsoil to a depth of at least 12 inches using a cat-mounted ripper, tractor mounted disc, or tiller, to mix and circulate air and compost into the subsoil.
3. Rock-pick until uplifted stone/rock materials of four inches and larger size are cleaned off the site.
4. Apply topsoil to a depth of 6 inches.
5. Vegetate as required by the seeding plan. Use appropriate ground cover with deep roots to maintain the soil structure.
6. Topsoil may be manufactured as a mixture or a mineral component and organic material such as compost.

At the end of the project an inspector should be able to push a 3/8” metal bar 12 inches into the soil just with body weight. This should not be performed within the drip line of any existing trees or over utility installations that are within 24 inches of the surface.

Maintenance

Keep the site free of vehicular and foot traffic or other weight loads. Consider pedestrian footpaths.

Table 4.6
Soil Restoration Requirements

<table>
<tr><th>Type of Soil Disturbance</th><th colspan="2">Soil Restoration Requirement</th><th>Comments/Examples</th></tr>
<tr><td>No soil disturbance</td><td colspan="2">Restoration not permitted</td><td>Preservation of Natural Features</td></tr>
<tr><td>Minimal soil disturbance</td><td colspan="2">Restoration not required</td><td>Clearing and grubbing</td></tr>
<tr><td rowspan="2">Areas where topsoil is stripped only - no change in grade</td><td>HSG A&B</td><td>HSG C&D</td><td rowspan="2">Protect area from any ongoing construction activities.</td></tr>
<tr><td>Apply 6 inches of topsoil</td><td>Aerate* and apply 6 inches of topsoil</td></tr>
<tr><td rowspan="2">Areas of cut or fill</td><td>HSG A&B</td><td>HSG C&D</td><td rowspan="2"></td></tr>
<tr><td>Aerate* and apply 6 inches of topsoil</td><td>Apply full Soil Restoration**</td></tr>
<tr><td>Heavy traffic areas on site (especially in a zone 5-25 feet around buildings but not within a 5 foot perimeter around foundation walls)</td><td colspan="2">Apply full Soil Restoration (decompaction and compost enhancement)</td><td></td></tr>
<tr><td>Areas where Runoff Reduction and/or Infiltration practices are applied</td><td colspan="2">Restoration not required, but may be applied to enhance the reduction specified for appropriate practices.</td><td>Keep construction equipment from crossing these areas. To protect newly installed practice from any ongoing construction activities construct a single phase operation fence area</td></tr>
<tr><td>Redevelopment projects</td><td colspan="2">Soil Restoration is required on redevelopment projects in areas where existing impervious area will be converted to pervious area.</td><td></td></tr>
<tr><td colspan="4">* Aeration includes the use of machines such as tractor-drawn implements with coulters making a narrow slit in the soil, a roller with many spikes making indentations in the soil, or prongs which function like a mini-subsoiler.
** Per “Deep Ripping and De-compaction, DEC 2008”.</td></tr>
</table>

STANDARD AND SPECIFICATIONS FOR VEGETATING WATERWAYS

Definition & Scope

Waterways are a **permanently** constructed conveyance channel, shaped or graded. They are vegetated for the safe transport of excess surface water from construction sites and urban areas without damage from erosion.

Conditions Where Practice Applies

This standard applies to vegetating waterways and similar water carrying structures.

Supplemental measures may be required with this practice. These may include: subsurface drainage to permit the growth of suitable vegetation and to eliminate wet spots; a section stabilized with asphalt, stone, or other suitable means; or additional storm drains to handle snowmelt or storm runoff.

Retardance factors for determining waterway dimensions are shown in Table 3.1 on page 3.10 and "Maximum Permissible Velocities for Selected Grass and Legume Mixtures" (See Table 4.10 on page 4.79).

Design Criteria

Waterways or outlets shall be protected against erosion by vegetative means as soon after construction as practical. Vegetation must be well established before diversions or other channels are outletted into them. Consideration should be given to the use of turf reinforcement mats, excelsior matting, other rolled erosion control products, or sodding of channels to provide erosion protection as soon after construction as possible. It is strongly recommended that the center line of the waterway be protected with one of the above materials to avoid center gullies and to protect seedlings from erosion before establishment.

1. Liming, fertilizing, and seedbed preparation.

   A. Lime to pH 6.5.

   B. **The soil should be tested to determine the amounts of amendments needed.** If the soil must be fertilized before results of a soil test can be obtained to determine fertilizer needs, apply commercial fertilizer at 1.0 lbs/1,000 sq. ft. of N, P_2O_5, and K_2O.

   C. Lime and fertilizer shall be mixed thoroughly into the seedbed during preparation.

   D. Channels, except for paved section, shall have at least 4 inches of topsoil.

   E. Remove stones and other obstructions that will hinder maintenance.

2. Timing of Seeding.

   A. Early spring and late August are best.

   B. Temporary cover to protect from erosion is recommended during periods when seedings may fail.

3. Seed Mixtures:

Mixtures	Rate per Acre (lbs)	Rate per 1,000 sq. ft. (lbs)
A. White clover or ladino clover[1]	8	0.20
Smooth bromegrass	20	0.45
Creeping red fescue[2]	2	0.05
Total	30	0.70
OR		
B. Smooth bromegass[3]	25	0.60
Creeping red fescue	20	0.50
Perennial ryegrass	10	0.20
Total	55	1.30

[1] Inoculate with appropriate inoculum immediately prior to seeding. Ladino or birdsfoot trefoil may be substituted for common white clover and seeded at the same rate.

[2] Perennial ryegrass may be substituted for the creeping red fescue but increase seeding rate to 5 lbs/acre (0.1 lb/1,000 sq. ft).

[3] Use this mixture in areas which are mowed frequently. Common white clover may be added if desired and seeded at 8 lbs/acre (0.2 lb/1,000 sq. ft.)

4. Seeding

Select the appropriate seed mixture and apply uniformly over the area. Rolling or cultipacking across the waterway is desirable.

Waterway centers or crucial areas may be sodded. Refer to the standard and specification for Stabilization with Sod. Be sure sod is securely anchored using staples or stakes.

5. Mulching

All seeded areas will be mulched. Channels more than 300 feet long, and/or where the slope is 5 percent or more, must have the mulch securely anchored. Refer to the standard and specifications for Mulching for details.

6. Maintenance

Fertilize, lime, and mow as needed to maintain dense protective vegetative cover.

Waterways shall not be used for roadways.

If rills develop in the centerline of a waterway, prompt attention is required to avoid the formation of gullies. Either stone and/or compacted soil fill with excelsior or filter fabric as necessary may be used during the establishment phase. See Figure 4.25, Rill Maintenance Measures. Spacing between rill maintenance barriers shall not exceed 100 feet.

Table 4.10
Maximum Permissible Velocities for Selected Seed Mixtures

Cover	Slope Range [2] (%)	Permissible Velocity [1]	
		Erosion-resistant Soils (ft. per sec.) K=0.10 - 0.35 [3]	**Easily Eroded Soils (ft. per sec.) K=0.36 - 0.80**
Smooth Bromegrass Hard Fescue	0-5 5-10 Over 10	7 6 5	5 4 3
Grass Mixtures	[2] 0-5 5-10	5 4	4 3
White/Red Clover Alfalfa Red Fescue	[4] 0-5	3.5	2.5

[1] Use velocities exceeding 5 feet per second only where good covers and proper maintenance can be obtained.
[2] Do not use on slopes steeper than 10 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.
[3] K is the soil erodibility factor used in the Revised Universal Soil Loss Equation. Visit Appendix A or consult the appropriate USDA-NRCS technical guide for K values for New York State soils.
[4] Do not use on slopes steeper than 5 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.
[5] Annuals - use on mild slopes or as temporary protection until permanent covers are established.
[6] Use on slopes steeper than 5 percent is not recommended.

STANDARD AND SPECIFICATIONS FOR BUFFER FILTER STRIP

Land Slope (%)	Minimum Filter Strip Width (ft.)
≤10	50
20	60
30	85
40	105
50	125
60	145
70	165

Definition & Scope

A **temporary/permanent** well vegetated grassed area below a disturbed area that can be used to remove sediment from runoff prior to it reaching surface waters or other designated areas of concern, such as parking lots and road pavement.

Condition Where Practice Applies

This practice is effective when the flow is in the form of sheet flow and the vegetative cover is established prior to disturbance. Surface water must be protected from sediment-laden runoff until buffer filter strip vegetation is established, and then the proposed disturbance can be undertaken. This practice is effective when the flow is in the form of sheet flow (maximum of 150 feet).

Design Criteria

1. The vegetation should be a well established perennial grass. Wooded and brushy areas are not acceptable for purposes of sediment removal.

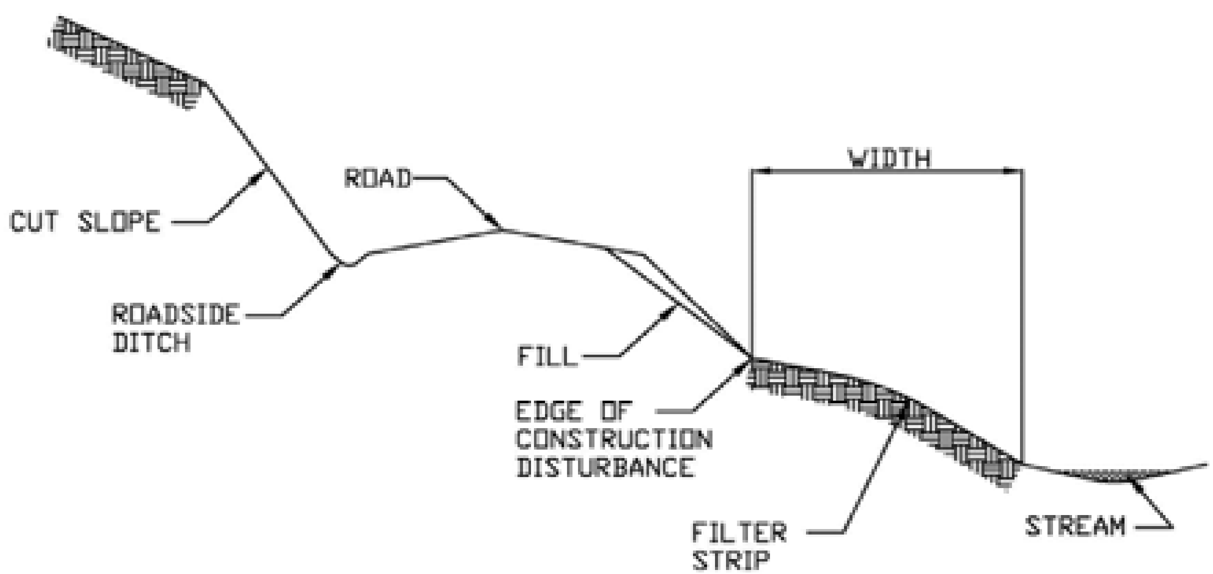
2. The minimum buffer filter strip width for stream protection shall be in accordance with the following table:

3. The minimum buffer filter strip width to protect paved areas during construction is 20 feet.

Maintenance

If at any time the width of the buffer filter strip has been reduced by sediment deposition to half its original width or concentrated flow has developed, suitable additional practices should be installed. The erosion and sediment control plan shall include these details.

Figure 5.1
Buffer Filter Strip



ADAPTED FROM DETAILS PROVIDED BY: PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION.	BUFFER FILTER STRIP

STANDARD AND SPECIFICATIONS FOR COMPOST FILTER SOCK

Definition & Scope

A **temporary** sediment control practice composed of a degradable geotextile mesh tube filled with compost filter media to filter sediment and other pollutants associated with construction activity to prevent their migration offsite.

Condition Where Practice Applies

Compost filter socks can be used in many construction site applications where erosion will occur in the form of sheet erosion and there is no concentration of water flowing to the sock. In areas with steep slopes and/or rocky terrain, soil conditions must be such that good continuous contact between the sock and the soil is maintained throughout its length. For use on impervious surfaces such as road pavement or parking areas, proper anchorage must be provided to prevent shifting of the sock or separation of the contact between the sock and the pavement. Compost filter socks are utilized both at the site perimeter as well as within the construction areas. These socks may be filled after placement by blowing compost into the tube pneumatically, or filled at a staging location and moved into its designed location.

Design Criteria

1. Compost filter socks will be placed on the contour with both terminal ends of the sock extended 8 feet upslope at a 45 degree angle to prevent bypass flow.

2. Diameters designed for use shall be 12" – 32" except that 8" diameter socks may be used for residential lots to control areas less than 0.25 acres.

3. The flat dimension of the sock shall be at least 1.5 times the nominal diameter.

4. The **Maximum Slope Length** (in feet) above a compost filter sock shall not exceed the following limits:

Dia. (in.)	Slope %						
	2	5	10	20	25	33	50
8	225*	200	100	50	20	—	—
12	250	225	125	65	50	40	25
18	275	250	150	70	55	45	30
24	350	275	200	130	100	60	35
32	450	325	275	150	120	75	50

* Length in feet

5. The compost infill shall be well decomposed (matured at least 3 months), weed-free, organic matter. It shall be aerobically composted, possess no objectionable odors, and contain less than 1%, by dry weight, of man-made foreign matter. The physical parameters of the compost shall meet the standards listed in Table 5.2 - Compost Standards Table. **Note: All biosolids compost produced in New York State (or approved for importation) must meet NYS DEC's 6 NYCRR Part 360 (Solid Waste Management Facilities) requirements. The Part 360 requirements are equal to or more stringent than 40 CFR Part 503 which ensure safe standards for pathogen reduction and heavy metals content. When using compost filter socks adjacent to surface water, the compost should have a low nutrient value.**

6. The compost filter sock fabric material shall meet the

7. Compost filter socks shall be anchored in earth with 2" x 2" wooden stakes driven 12" into the soil on 10 foot centers on the centerline of the sock. On uneven terrain, effective ground contact can be enhanced by the placement of a fillet of filter media on the disturbed area side of the compost sock.

8. All specific construction details and material specifications shall appear on the erosion and sediment control constructions drawings when compost filter socks are included in the plan.

Maintenance

1. Traffic shall not be permitted to cross filter socks.

2. Accumulated sediment shall be removed when it reaches half the above ground height of the sock and disposed of in accordance with the plan.

3. Socks shall be inspected weekly and after each runoff event. Damaged socks shall be repaired in the manner required by the manufacturer or replaced within 24 hours of inspection notification.

4. Biodegradable filter socks shall be replaced after 6 months; photodegradable filter socks after 1 year. Polypropylene socks shall be replaced according to the manufacturer's recommendations.

5. Upon stabilization of the area contributory to the sock, stakes shall be removed. The sock may be left in place and vegetated or removed in accordance with the stabilization plan. For removal the mesh can be cut and the compost spread as an additional mulch to act as a soil supplement.

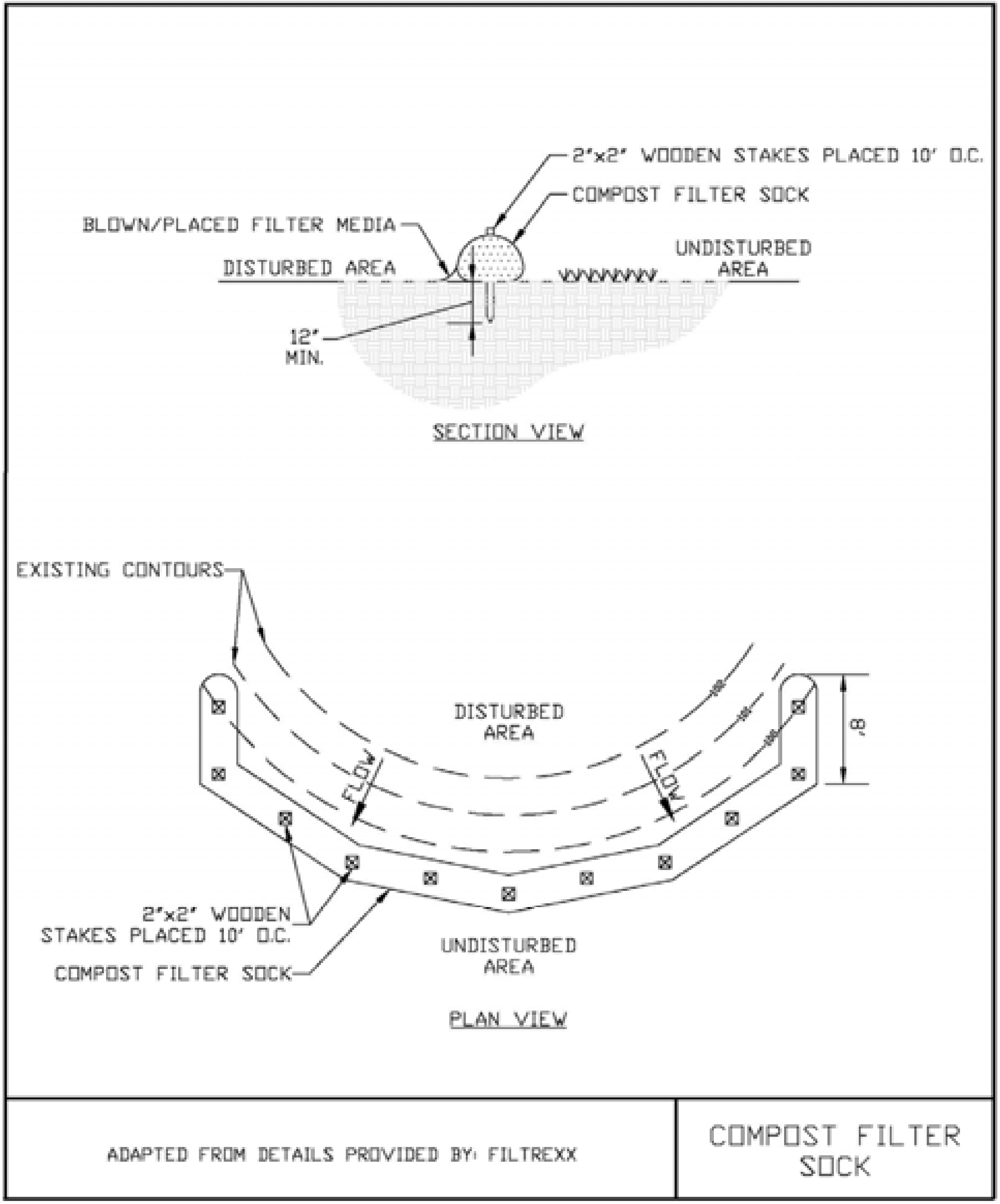
Table 5.1 - Compost Sock Fabric Minimum Specifications Table

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photodegradable	Photodegradable	Biodegradable	Photodegradable	Photodegradable
Sock Diameters	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years

Table 5.2 - Compost Standards Table

Organic matter content	25% - 100% (dry weight)
Organic portion	Fibrous and elongated
pH	6.0 – 8.0
Moisture content	30% - 60%
Particle size	100% passing a 1" screen and 10 - 50% passing a 3/8" screen
Soluble salt concentration	5.0 dS/m (mmhos/cm) maximum

Figure 5.2
Compost Filter Sock



STANDARD AND SPECIFICATIONS FOR SEDIMENT BASIN

Definition & Scope

A **temporary** basin with a barrier or dam constructed across a drainage way or at other suitable locations to intercept sediment-laden runoff and reduce the amount of sediment leaving the disturbed area in order to protect drainageways, properties, and rights-of-way below the sediment basin.

Conditions Where Practice Applies

A sediment basin is appropriate where physical site conditions or land ownership restrictions preclude the installation of other control measures to adequately control runoff, erosion, and sedimentation. However, it is required that other erosion control measures be used with the sediment basin. The basin may be used below construction operations which expose critical areas to soil erosion. The basin shall be maintained until the disturbed area is protected against erosion by permanent stabilization.

This standard applies to the installation of temporary sediment basins on sites where: (a) failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities; (b) the drainage area does not exceed 50 acres; and (c) the basin is to be removed within 36 months after the beginning of construction of the basin.

Permanent (to function more than 36 months) sediment basins, or structures that temporarily function as a sediment basin but are intended for use as a permanent pool shall be classified as **permanent** structures and shall conform to criteria appropriate for permanent structures. These structures shall be designed and constructed to conform to NRCS Standard And Specification No. 378 for Ponds in the National Handbook of Conservation Practices and the New York State Department of Environmental Conservation, "Guidelines for the Design of Dams."

Design Criteria

Compliance with Laws and Regulations

Design and construction shall comply with state and local laws, ordinances, rules and regulations, including permits.

Location - Maximum Drainage Area = 50 acres

The sediment basin should be located to obtain the maximum storage benefit from the terrain and for ease of cleanout of the trapped sediment. It should be located to minimize interference with construction activities and construction of utilities. Whenever possible, sediment basins should be located so that storm drains may outfall or be diverted into the basin. **Do not locate basins in perennial streams.**

Size and Shape of the Basin

The sediment basin will contain two separate zones. The lowest zone is the sediment storage zone. This zone is sized for a volume equal to 1,000 cubic feet per disturbed acre over the course of the life of the project, contributing to the basin as measured from the bottom of the basin to the bottom of the dewatering zone. It shall have a minimum depth of 1 foot. Layered above this zone is the dewatering zone. This zone is sized for a minimum volume equal to 3,600 cubic feet per each acre draining to the basin. This volume is temporarily stored between the sediment storage zone and the crest of the principal spillway. This zone should be a minimum of 3 feet deep. See Figures 5.8 and 5.9 on pages 5.26 and 5.27. This 3,600 cubic feet per acre is equivalent to one inch of sediment per acre of drainage area. The entire drainage area is used for this computation, rather than the disturbed area above, to maximize trapping efficiency. The length to width ratio shall be 2:1 or greater, where length is the distance between the inlet and outlet. A wedge shape shall be used with the inlet located at the narrow end. See Figure 5.22 on page 5.41.

Surface Area

Research studies (Barfield and Clar 1985; Pitt, 2003) indicate that the following relationship between surface area and peak inflow rate gives a trapping efficiency of 75% for silt loam soils, and greater than 90% for loamy sand soils:

$A = 0.01\ Qp$ or, $A = 0.015x\ D.A.$ (whichever is greater)

where,

A = the basin surface area, acres, measured at the service spillway crest; and

Qp = the peak inflow rate for the design storm. (The minimum design storm will be a 10 year, 24 hour storm under construction conditions).

D.A. = contributing drainage area.

Sediment basins shall be cleaned out when the sediment storage zone volume described above is reduced by 50 percent, except in no case shall the sediment level be permitted to build up higher than one foot below the bottom of the dewatering zone. At this elevation, cleanout shall be performed to restore the original design volume to the sediment storage zone.

The elevation corresponding to the maximum allowable sediment level shall be determined and shall be stated in the design data as a distance below the top of the riser and shall be clearly marked on the riser.

The basin dimensions necessary to obtain the required basin volume as stated above shall be clearly shown on the plans to facilitate plan review, construction, and inspection.

Spillway Design

Runoff shall be computed by standard accepted hydrologic methods noted previously in this book of standards. **Runoff computations shall be based upon the worst soil cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of the structure.** The combined capacities of the principal and emergency spillway shall be sufficient to pass the peak rate of runoff from a ten (10) year frequency, 24 hour duration storm.

1. Principal spillway: A spillway consisting of a vertical pipe or box type riser joined (watertight connection) to a pipe (barrel) which shall extend through the embankment and outlet beyond the downstream toe of the fill. The minimum capacity of the principal spillway shall be 0.2 cfs per acre of drainage area when the water surface is at the emergency spillway crest elevation. For those basins with no emergency spillway, the principal spillway shall have the capacity to handle the peak flow from a ten-year frequency rainfall event. The minimum size of the barrel shall be 8 inches in diameter. See Figures 5.10, 5.11 and 5.12 on pages 5.28, 5.29, and 5.30 for principal spillway sizes and capacities.

   A. <u>Crest elevation</u>: When used in combination with an emergency spillway, the crest elevation of the riser shall be a minimum one foot below the elevation of the control section of the emergency spillway.

   B. <u>Watertight riser and barrel assembly</u>: The riser and all pipe connections shall be completely watertight except for the inlet opening at the top, or a dewatering opening. There shall not be other holes, leaks, rips, or perforations in the structure.

   C. <u>Dewatering the basin</u>:

   1) Preferred Method- The preferred method for dewatering sediment basins is by using surface skimmers to decant the cleaner top surface water from the basin as the sediment settles out. See Dewatering Device Standard, page 5.10.

   2) Alternative Method– A fixed vertical riser pipe configured with perforations and filter fabric with a cone of pea gravel or small crushed stone is an alternative option for use. See Figure 5.5 on page 5.14.

   The sediment basin dewatering system shall be designed to release the dewatering zone volume between 2 to 7 days in watersheds not impaired by sediment, and 4-7 days in sediment impaired watersheds (check the NYSDEC Waterbody Inventory/Priority Waterbody List - **http://www.dec.ny.gov/chemical/36730.html**, to see if your site is in an impaired watershed). The design performance range will depend on the percent of silt and clay in the soils tributary to the basin. If the performance of the basin does not meet water quality objectives after 7 days, chemical treatment may be necessary.

   D. <u>Anti-vortex device and trash rack</u>:

   An anti-vortex device and trash rack shall be securely installed on top of the riser and shall be the concentric type as shown in Figure 5.13 and 5.14 on pages 5.31 and 5.32.

   E. <u>Base</u>:

   The riser shall have a base attached with a watertight connection and shall have sufficient weight to prevent flotation of the riser. Two approved bases for risers ten feet or less in height are: 1) a concrete base 18 in. thick with the riser embedded 9 in. in the base, and 2) a ¼” minimum thickness steel plate attached to the riser by a continuous weld around the circumference of the riser to form a watertight connection. The plate shall have 2.5 feet of stone, gravel, or compacted earth placed on it to prevent flotation. In either case, each side of the square base shall be twice the riser diameter.

   For risers greater than ten feet high, computations shall be made to design a base which will prevent flotation. The minimum factor of safety shall be 1.20 (Downward forces = 1.20 x upward forces). See Figure 5.15 on page 5.33 for details.

F. Anti-Seep Collars: Anti-seep collars shall be installed around all conduits through earth fills of impoundment structures according to the following criteria:

1) Collars shall be placed to increase the seepage length along the conduit by a minimum of 15 percent of the pipe length located within the saturation zone.

2) Collar spacing shall be between 5 and 14 times the vertical projection of each collar.

3) All collars shall be placed within the saturation zone.

4) The assumed normal saturation zone (phreatic line) shall be determined by projecting a line at a slope of 4 horizontal to 1 vertical from the point where the normal water (riser crest) elevation touches the upstream slope of the fill to a point where this line intersects the invert of the pipe conduit. All fill located within this line may be assumed as saturated.

$$2(N)(P) = 1.15(L_s) \qquad N = (0.075)(L_s)/P$$

When anti-seep collars are used, the equation for revised seepage length becomes:

Where: Ls = Saturated length is length, in feet, of pipe between riser and intersection of phreatic line and pipe invert.

N = number of anti-seep collars.

P = vertical projection of collar from pipe, in feet.

5) All anti-seep collars and their connections shall be watertight. See Figures 5.16 and 5.17 on pages 5.34 and 5.35 for anti-seep collar design and Figure 5.18 on page 5.36 for construction details. Seepage diaphragms may be used in lieu of anti-seep collars. They shall be designed in accordance to USDA NRCS Pond Standard 378.

G. Outlet: An outlet shall be provided, including a means of conveying the discharge in an erosion free manner to an existing stable channel. Where discharge occurs at the property line, drainage easements will be obtained in accordance with local ordinances. Adequate notes and references will be shown on the erosion and sediment control plan.

Protection against scour at the discharge end of the pipe spillway shall be provided. Measures may include basin, riprap, revetment, excavated plunge pools, or other approved methods. See Standard and Specification for Rock Outlet Protection, Section 3, page 3.39.

2. Emergency Spillways: The entire flow area of the emergency spillway shall be constructed in undisturbed ground (not fill). The emergency spillway cross-section shall be trapezoidal with a minimum bottom width of eight feet. This spillway channel shall have a straight control section of at least 20 feet in length; and a straight outlet section for a minimum distance equal to 25 feet.

A. Capacity: The minimum capacity of the emergency spillway shall be that required to pass the peak rate of runoff from the 10 year 24-hour frequency storm, less any reduction due to flow in the pipe spillway. Emergency spillway dimensions may be determined by using the method described in Figure 5.19 on page 5.37 and the Design Tables in Figures 5.20 and 5.21 on pages 5.38 and 5.39.

B. Velocities: The velocity of flow in the exit channel shall not exceed 5 feet per second for vegetated channels. For channels with erosion protection other than vegetation, velocities shall be within the non-erosive range for the type of protection used.

C. Erosion Protection: Erosion protection shall be provided for by vegetation as prescribed in this publication or by other suitable means such as riprap, asphalt or concrete.

D. Freeboard: Freeboard is the difference between the design high water elevation in the emergency spillway and the top of the settled embankment. If there is no emergency spillway, it is the difference between the water surface elevation required to pass the design flow through the pipe and the top of the settled embankment. Freeboard shall be at least one foot.

Embankment Cross-Section

1. The maximum height of dam = 15 feet (measured from the low point of original ground at the downstream toe to the top of the dam).

2. Minimum top width of dam = 10 feet.

3. Side slopes shall be 2.5 to 1 or flatter.

Entrance of Runoff into Basin

Points of entrance of surface runoff into excavated sediment basins shall be protected to prevent erosion. Considerable care should be given to the major points of inflow into basins. In many cases the difference in elevation of the inflow and the bottom of the basin is considerable, thus creating a potential for severe gullying and sediment generation. Often a riprap drop at major points of inflow would eliminate gullying and sediment generation.

Diversions, grade stabilization structures or other water control devices shall be installed as necessary to ensure direction of runoff and protect points of entry into the basin. Points of entry should be located so as to ensure maximum travel distance of entering runoff to point of exit (the riser) from the basin.

Disposal

The sediment basin plans shall indicate the method (s) of disposing of the sediment removed from the basin. The sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the basin, adjacent to a stream or floodplain. Disposal sites will be covered by an approved sediment control plan.

The sediment basins plans shall also show the method of disposing of the sediment basin after the drainage area is stabilized, and shall include the stabilization of the sediment basin site. Water contained within the storage areas shall be removed from the basin by pumping, cutting the top of the riser, or other appropriate method prior to removing or breaching the embankment. **Sediment shall not be allowed to flush into a stream or drainageway.**

Chemical Treatment

Precipitation of sediment is enhanced with the use of specific chemical flocculants that can be applied to the sediment basin in liquid, powder, or solid form. Flocculants include anionic polyelectrolytes such as polyacrylimides, aluminum sulfate (alum), polyaluminum chloride and chitosan. Cationic polyelectrolytes have a greater toxicity to fish and other aquatic organisms than anionic polyelectrolytes because they bind to the gills of fish resulting in respiratory failure (Pitt, 2003).

Chemical treatment shall not be substituted for proper erosion and sediment control. To reduce the need for flocculants, proper controls include planning, phasing, sequencing and practice design in accordance to NY Standards. **Chemical applications shall not be applied without written approval from the NYSDEC.**

Safety

Sediment basins are attractive to children and can be very dangerous. Local ordinances and regulations must be adhered to regarding health and safety. The developer or owner shall check with local building officials on applicable safety requirements. If fencing of sediment basins is required, the location of and type of fence shall be shown on the plans.

Construction Specifications

Site Preparation

Areas under the embankment shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots, or other objectionable material. In order to facilitate cleanout and restoration, the pool area (measured at the top of the pipe spillway) will be cleared of all brush, trees, and other objectionable materials.

Cutoff-Trench

A cutoff trench shall be excavated along the centerline of earth fill embankments. The minimum depth shall be two feet. The cutoff trench shall extend up both abutments to the riser crest elevation. The minimum bottom width shall be four feet, but wide enough to permit operation of excavation and compaction equipment. The side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for embankment. The trench shall be dewatered during the back-filling/compaction operations.

Embankment

The fill material shall be taken from approved areas shown on the plans. It shall be clean mineral soil free of roots, woody vegetation, oversized stones, rocks, or other objectionable material. Relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW & SP) shall not be placed in the embankment. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of a ball, it is too wet for proper compaction. Fill material shall be placed in six to eight-inch thick continuous layers over the entire length of the fill. Compaction shall be obtained by routing and hauling the construction equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment or by the use of a compactor. The embankment shall be constructed to an elevation 10 percent higher than the design height to allow for settlement.

Pipe Spillway

The riser shall be securely attached to the barrel or barrel stub by welding the full circumference making a watertight structural connection. The barrel stub must be attached to the riser at the same percent (angle) of grade as the outlet conduit. The connection between the riser and the riser base shall be watertight. All connections between barrel sections must be achieved by approved watertight bank assemblies. The barrel and riser shall be placed on a firm, smooth foundation of impervious soil. Pervious materials such as sand, gravel, or crushed stone shall not be used as backfill around the pipe or anti-seep collars. The fill material around the pipe spillway shall be placed in four-inch layers and compacted under and around the pipe to at least the same density as the adjacent embankment.

A minimum depth of two feet of hand compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment. Steel base plates on risers shall have at least 2 ½ feet of compacted earth, stone, or gravel placed over it to prevent flotation.

Emergency Spillway

The emergency spillway shall be installed in undisturbed ground. The achievement of planned elevations, grades, design width, entrance and exit channel slopes are critical to the successful operation of the emergency spillway and must be constructed within a tolerance of +/- 0.2 feet.

Vegetative Treatment

Stabilize the embankment and emergency spillway in accordance with the appropriate vegetative standard and specification immediately following construction. In no case shall the embankment remain unstabilized for more than three (3) days.

Erosion and Pollution Control

Construction operations shall be carried out in such a manner that erosion and water pollution will be minimized. State and local laws shall be complied with concerning pollution abatement.

Safety

State and local requirements shall be met concerning fencing and signs, warning the public of hazards of soft sediment and floodwater.

Maintenance

1. Repair all damages caused by soil erosion and construction equipment at or before the end of each working day.

2. Sediment shall be removed from the basin when it reaches the specified depth for cleanout noted on the plans which will not exceed 50% of the capacity of the sediment storage zone. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment, adjacent to a stream or floodplain.

Final Disposal

When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of in accordance with the approved sediment control plan. The proposed use of a sediment basin site will often dictate final disposition of the basin and any sediment contained therein. If the site is scheduled for future construction, then the basin material and trapped sediments must be removed, safely disposed of, and backfilled with a structural fill. When the basin area is to remain open space, the pond may be pumped dry, graded, and backfilled.

Information to be Submitted

Sediment basin designs and construction plans submitted for review to a local municipality, New York State DEC, New York City DEP, Soil and Water Conservation District, or other agency shall include the following:

1. Specific location of the basin.

2. Plan view of the storage basin and emergency spillway, showing existing and proposed contours.

3. Cross section of dam, principal spillway, emergency spillway, and profile of emergency spillway.

4. Details of pipe connections, riser to pipe connections, riser base, anti-seep control, trash rack cleanout elevation, and anti-vortex device.

5. Runoff calculations for 1 and 10-year frequency storms, if required.

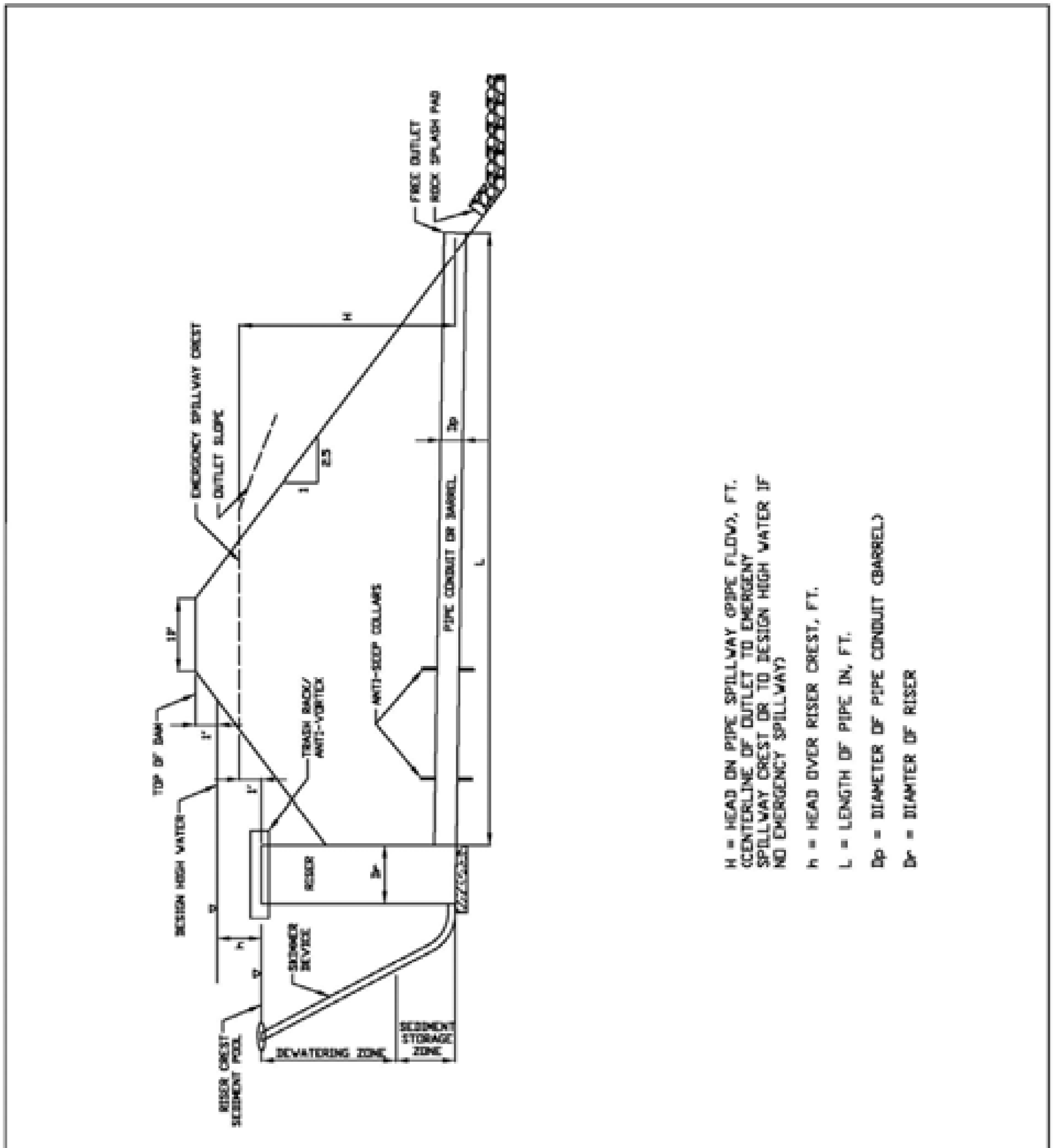
6. Storage Computations

    A. Zones total required

    B. Zones total Available

    C. Elevation of sediment at which cleanout shall be required; also stated as a distance from the riser

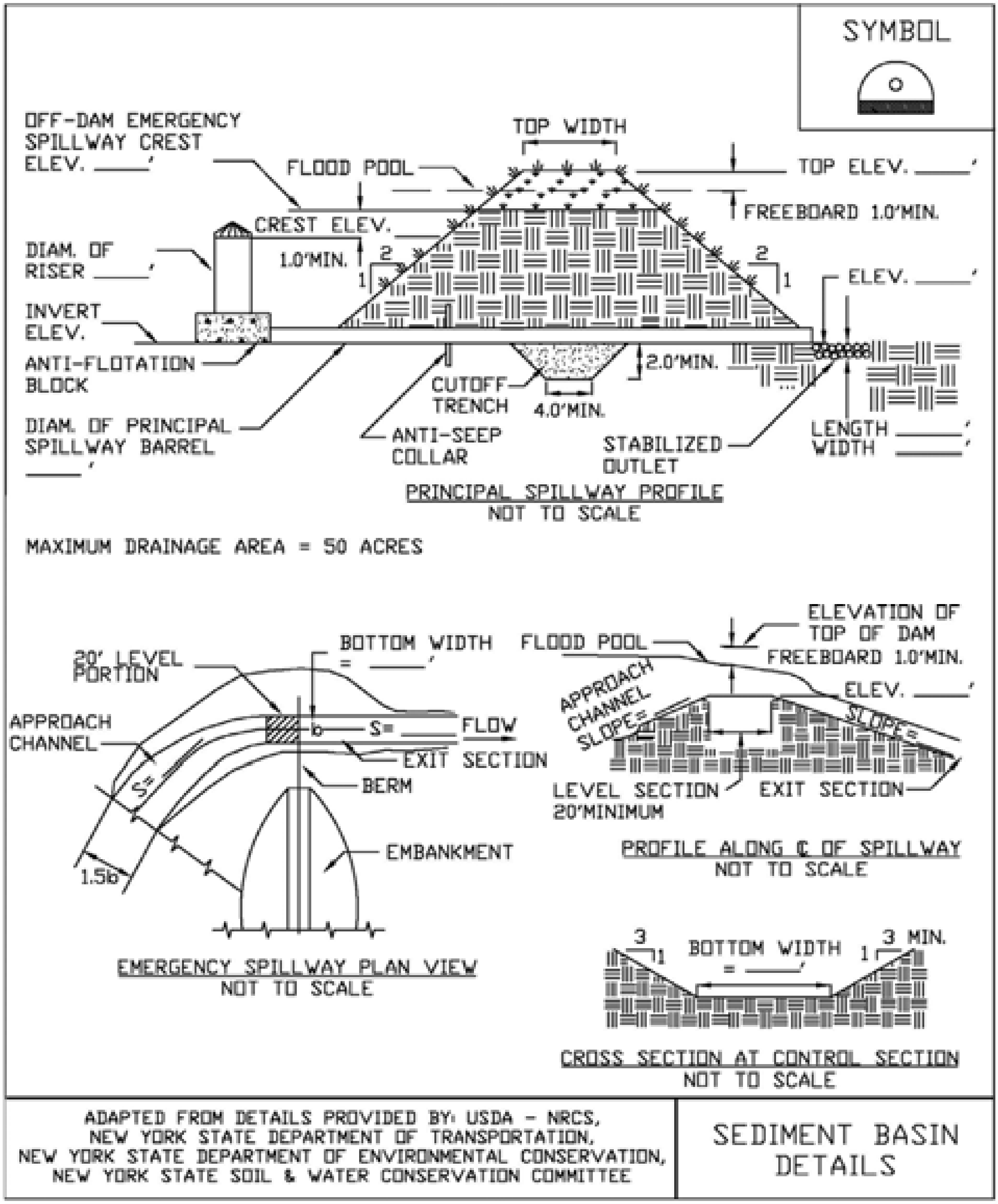
Figure 5.8
Pipe Spillway Design



ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

PIPE SPILLWAY DESIGN

Figure 5.9
Sediment Basin



STANDARD AND SPECIFICATIONS FOR SEDIMENT TRAP

Definition & Scope

A **temporary** sediment control device formed by excavation and/or embankment to intercept sediment-laden runoff and trap the sediment in order to protect drainageways, properties, and rights-of-way below the sediment trap from sedimentation.

Conditions Where Practice Applies

A sediment trap is usually installed in a drainageway, at a storm drain inlet, or other points of collection from a disturbed area for one construction season.

Sediment traps should be used to artificially break up the natural drainage area into smaller sections where a larger device (sediment basin) would be less effective.

Design Criteria

If the drainage area to the proposed trap location exceeds 5 acres, or the trap is in place beyond one construction season, or any of the additional design criteria presented here cannot be met, a full Sediment Basin must be used. See Standard and Specification for Sediment Basin on page 5.19.

Drainage Area

The maximum drainage area for all sediment traps shall be 5 acres.

Location

Sediment traps shall be located so that they can be installed prior to grading or filling in the drainage area they are to protect. Traps must **not be located any closer than 20 feet** from a proposed building foundation if the trap is to function during building construction. Locate traps to obtain maximum storage benefit from the terrain and for ease of cleanout and disposal of the trapped sediment.

Trap Size

The volume of a sediment trap as measured at the elevation of the crest of the outlet shall be at least 3,600 cubic feet per acre of drainage area. A minimum length to width ratio of 2:1 should be provided. The volume of a constructed trap shall be calculated using standard mathematical procedures. The volume of a natural sediment trap may be approximated by the equation: Volume (cu.ft.) = 0.4 x surface area (sq.ft.) x maximum depth (ft.).

Trap Cleanout

Sediment shall be removed and the trap restored to the original dimensions when the sediment has accumulated to ½ of the design depth of traps I-II, and 1/3 the depth for trap III. Sediment removed from the trap shall be deposited in a protected area and in such a manner that it will not erode.

Embankment

All earth embankments for sediment traps shall not exceed five (5) feet in height as measured at the low point of the original ground along the centerline of the embankment. Embankments shall have a minimum four (4) foot wide top and side slopes of 2:1 or flatter. The embankment shall be compacted by traversing with equipment while it is being constructed. The embankment shall be stabilized with seed and mulch as soon as it is completed

The elevation of the top of any dike directing water to any sediment trap will equal or exceed the maximum height of the outlet structure along the entire length of the trap.

Excavation

All excavation operations shall be carried out in such a manner that erosion and water pollution shall be minimal. Excavated portions of sediment traps shall have 1:1 or flatter slopes.

Outlet

The outlet shall be designed, constructed, and maintained in such a manner that sediment does not leave the trap and that erosion at or below the outlet does not occur.

Sediment traps must outlet onto stabilized (preferable undisturbed) ground, into a watercourse, stabilized channel, or into a storm drain system. Distance between inlet and outlet should be maximized to the longest length practicable.

All traps must be seeded and mulched immediately after construction.

Trap Details Needed on Erosion and Sediment Control Plans

Each trap shall be delineated on the plans in such a manner that it will not be confused with any other features. Each trap on a plan shall indicate all the information necessary to properly construct and maintain the structure. If the drawings are such that this information cannot be delineated on the drawings, then a table shall be developed. If a table is developed, then each trap on a plan shall have a number and the numbers shall be consecutive.

The following information shall be shown for each trap in a summary table format on the plans.

1. Trap number
2. Type of trap
3. Drainage area
4. Storage required
5. Storage provided (if applicable)
6. Outlet length or pipe sizes
7. Storage depth below outlet or cleanout elevation
8. Embankment height and elevation (if applicable)

Type of Sediment Traps

There are three (3) specific types of sediment traps which vary according to their function, location, or drainage area.

I. Pipe Outlet Sediment Trap
II. Stone Outlet Sediment Trap
III. Compost Filter Sock Sediment Trap

I. Pipe Outlet Sediment Trap

A Pipe Outlet Sediment Trap consists of a trap formed by embankment or excavation. The outlet for the trap is through a perforated riser and a pipe through the embankment. The outlet pipe and riser shall be made of steel, corrugated metal or other suitable material. The top of the embankment shall be at least 1 ½ feet above the crest of the riser. The preferred method of dewatering the sediment trap is by surface skimmer. See Dewatering Device Standard, page 5.10. If the riser alone is used for dewatering, the top 2/3 of the riser shall be perforated with one (1) inch nominal diameter holes or slits spaced six (6) inches vertically and horizontally placed in the concave portion of the corrugated pipe.

No holes or slits will be allowed within six (6) inches of the top of the horizontal barrel. All pipe connections shall be watertight. The riser shall be wrapped with ½ to ¼ inch hardware cloth wire then wrapped with filter cloth with a sieve size between #40-80 and secured with strapping or connecting band at the top and bottom of the cloth. The cloth shall cover an area at least six (6) inches above the highest hole and six (6) inches below the lowest hole. The top of the riser pipe shall not be covered with filter cloth. The riser shall have a base with sufficient weight to prevent flotation of the riser. Two approved bases are:

1. A concrete base 12 in. thick with the riser embedded 9 in. into the concrete base, or

2. One quarter inch, minimum, thick steel plate attached to the riser by a continuous weld around the circumference of the riser to form a watertight connection. The plate shall have 2.5 feet of stone, gravel, or earth placed on it to prevent flotation. In either case, each side of the square base measurement shall be the riser diameter plus 24 inches.

Pipe outlet sediment traps shall be limited to a five (5) acre maximum drainage area. Pipe outlet sediment trap is interchangeable in the field with stone outlet provided that these sediment traps are constructed in accordance with the detail and specifications for that trap.

Select pipe diameter from the following table:
See details for Pipe Outlet Sediment Trap ST-I in Figure 5.25 and 5.26 on pages 5.49 and 5.50.

Optional sediment trap dewatering devices are shown on Figure 5.29 on Page 5.53.

Minimum Sizes

Barrel Diameter[1] (in.)	Riser Diameter[1] (in.)	Maximum Drainage Area (ac.)
12	15	1
15	18	2
18	21	3
21	24	4
21	27	5

[1] Barrel diameter may be same size as riser diameter

II. Stone Outlet Sediment Trap

A Stone Outlet Sediment Trap consists of a trap formed by an embankment or excavation. The outlet of this trap is over a stone section placed on level ground. The minimum length (feet) of the outlet shall be equal to four (4) times the drainage area (acres).

Required storage shall be 3,600 cubic feet per acre of drainage area.

The outlet crest (top of stone in weir section) shall be level, at least one (1) foot below top of embankment and no more than one (1) foot above ground beneath the outlet. Stone used in the outlet shall be small riprap (4 in. x 8 in.). To provide more efficient trapping effect, a layer of filter cloth should be embedded one (1) foot back into the upstream face of the outlet stone or a one (1) foot thick layer of two (2) inch or finer aggregate shall be placed on the upstream face of the outlet.

Stone Outlet Sediment Traps may be interchangeable in the field with pipe outlet sediment traps provided they are constructed in accordance with the detail and specifications for those traps. Stone outlet sediment traps shall be limited to a five (5) acre maximum drainage area.

See details for Stone Outlet Sediment Trap ST-II in Figure 5.27 on page 5.51

III. Compost Sock Sediment Trap

A compost sock sediment trap consists of a trap formed by creating an enclosure of geotextile mesh tubes filled with a compost filter media. These traps are used in locations where there is no opportunity to direct runoff into larger traps or well vegetated areas. This could occur at site entrances and access points or in tight areas due to construction boundary limits.

Surface runoff can be directed to the trap with standard conveyance practices. Groundwater or surface ponding in low areas can be pumped into the compost sock sediment trap with appropriate energy dissipation at the pump outlet to prevent scour.
Design criteria for Compost Sock Sediment Trap

1. The maximum drainage area tributary to the trap shall be 5 acres.

2. The minimum settled height above ground shall be 2.0 feet formed by staking 3 compost filter socks in a pyramid as shown in Figure 5.28 on page 5.52.

3. The storage volume provided in the compost sock sediment trap shall be 3,600 cubic feet per tributary drainage acre.

4. If necessary, additional storage area can be created by excavating a sump 1 foot deep beginning at least 5 feet away from the inside sock.

5. All compost filter sock materials, mesh, and compost, will meet the material specifications listed in the Compost Filter Sock standard. No spillway is required.

6. Compost filter sock sediment traps shall be inspected weekly and after every rainfall event. Sediment shall be removed when it reaches one third, 1/3, the height of the trap.

7. The maximum limit of use for a compost sock sediment trap is one (1) year. The existing trap shall be replaced if there is a need for a trap beyond that time limit.

8. Upon completion of the work, the compost sock sediment trap shall be removed. The compost within the socks may be used during cleanup as a vegetative growth medium in accordance with the site stabilization plan.

Figure 5.25
Pipe Outlet Sediment Trap: ST-I

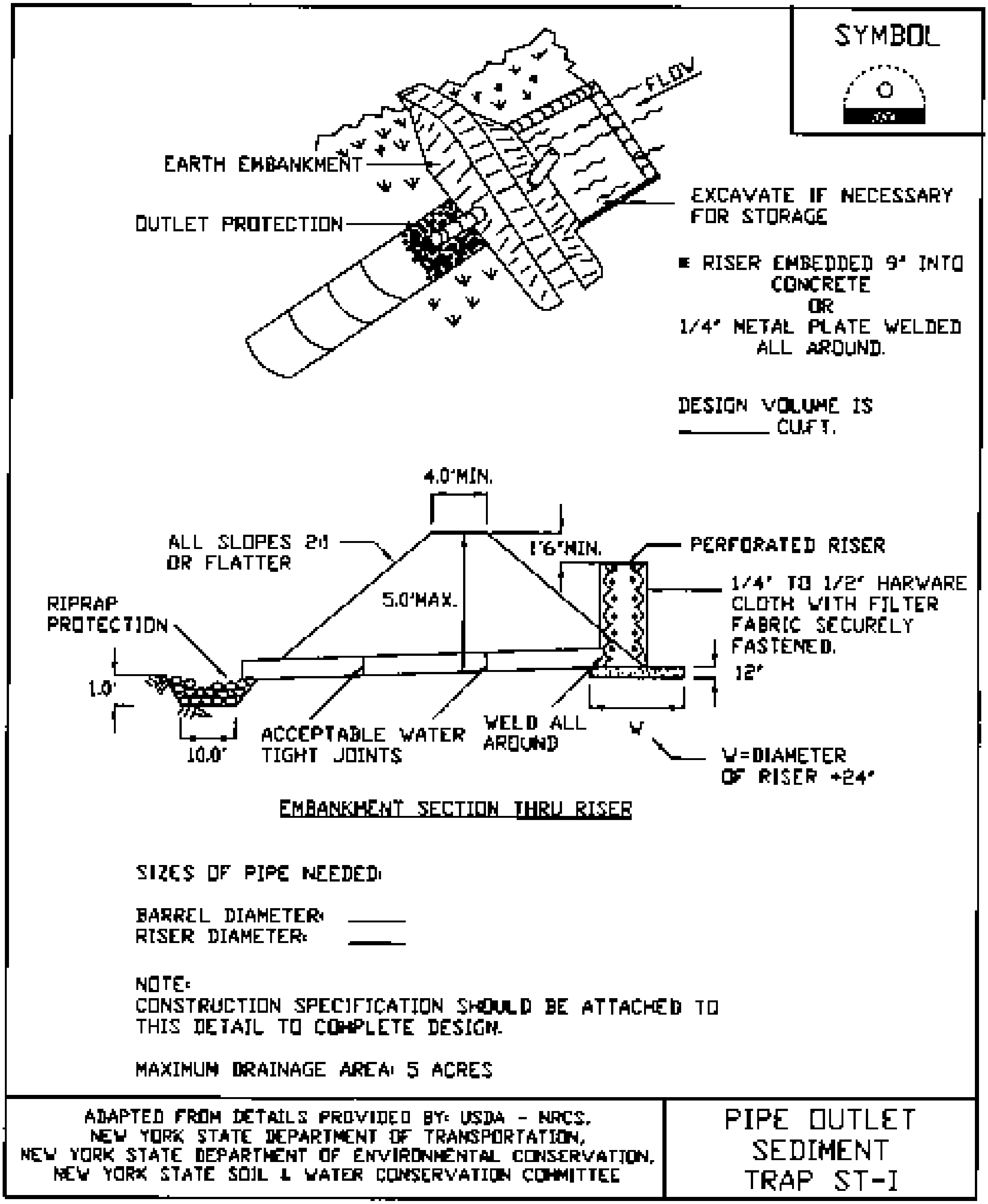
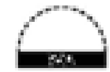


Figure 5.26
Pipe Outlet Sediment Trap: ST-I - Construction Specifications

SYMBOL

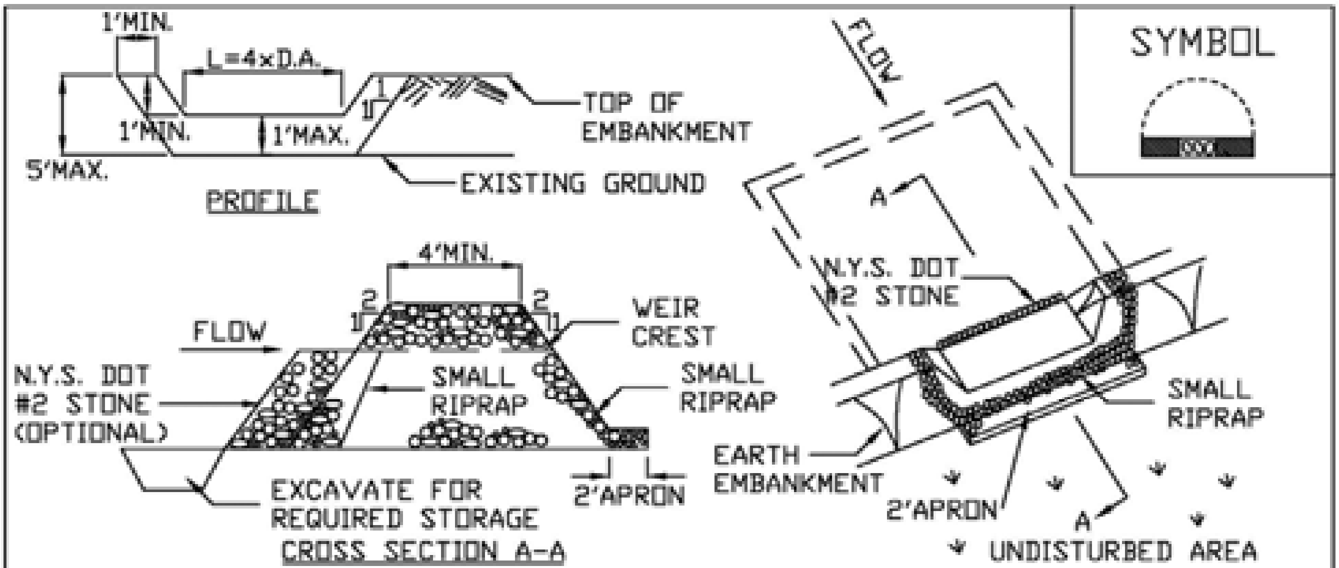


CONSTRUCTION SPECIFICATIONS

1. AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED.
2. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVER-SIZED STONES, ROCKS, ORGANIC MATERIAL, OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
3. VOLUME OF SEDIMENT STORAGE SHALL BE 3600 CUBIC FEET PER ACRE OF CONTRIBUTORY DRAINAGE.
4. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA AND STABILIZED.
5. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED.
6. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND SEDIMENT ARE CONTROLLED.
7. THE STRUCTURE SHALL BE REMOVED AND AREA STABILIZED WHEN THE DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.
8. ALL FILL SLOPES SHALL BE 2:1 OR FLATTER; CUT SLOPES 1:1 OR FLATTER.
9. ALL PIPE CONNECTIONS SHALL BE WATERTIGHT.
10. THE TOP 2/3 OF THE RISER SHALL BE PERFORATED WITH ONE (1) INCH DIAMETER HOLES OR SLITS SPACED SIX (6) INCHES VERTICALLY AND HORIZONTALLY AND PLACED IN THE CONCAVE PORTION OF PIPE. NO HOLES WILL BE ALLOWED WITHIN SIX (6) INCHES OF THE HORIZONTAL BARREL.
11. THE RISER SHALL BE WRAPPED WITH 1/4 TO 1/2 INCH HARDWARE CLOTH WIRE THEN WRAPPED WITH FILTER CLOTH (HAVING AN EQUIVALENT SIEVE SIZE OF 40-80). THE FILTER CLOTH SHALL EXTEND SIX (6) INCHES ABOVE THE HIGHEST HOLE AND SIX (6) INCHES BELOW THE LOWEST HOLE. WHERE ENDS OF THE FILTER CLOTH COME TOGETHER, THEY SHALL BE OVER-LAPPED, FOLDED AND STAPLED TO PREVENT BYPASS.
12. STRAPS OR CONNECTING BANDS SHALL BE USED TO HOLD THE FILTER CLOTH AND WIRE FABRIC IN PLACE. THEY SHALL BE PLACED AT THE TOP AND BOTTOM OF THE CLOTH.
13. FILL MATERIAL AROUND THE PIPE SPILLWAY SHALL BE HAND COMPACTED IN FOUR (4) INCH LAYERS. A MINIMUM OF TWO (2) FEET OF HAND COMPACTED BACKFILL SHALL BE PLACED OVER THE PIPE SPILLWAY BEFORE CROSSING IT WITH CONSTRUCTION EQUIPMENT.
14. THE RISER SHALL BE ANCHORED WITH EITHER A CONCRETE BASE OR STEEL PLATE BASE TO PREVENT FLOTATION. FOR CONCRETE BASE THE DEPTH SHALL BE TWELVE (12) INCHES WITH THE RISER EMBEDDED NINE (9) INCHES. A 1/4 INCH MINIMUM THICKNESS STEEL PLATE SHALL BE ATTACHED TO THE RISER BY A CONTINUOUS WELD AROUND THE BOTTOM TO FORM A WATERTIGHT CONNECTION AND THEN PLACE TWO (2) FEET OF STONE, GRAVEL, OR TAMPED EARTH ON THE PLATE.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	PIPE OUTLET SEDIMENT TRAP ST-I

Figure 5.27
Stone Outlet Sediment Trap: ST-II



OPTION: A ONE FOOT LAYER OF N.Y.S. DOT #2 STONE MAY BE PLACED ON THE UPSTREAM SIDE OF THE RIPRAP INPLACE OF THE EMBEDDED FILTER CLOTH.

CONSTRUCTION SPECIFICATIONS

1. AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED.
2. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS AND OTHER WOODY VEGETATION AS WELL AS OVER-SIZED STONES, ROCKS, ORGANIC MATERIAL OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
3. ALL CUT AND FILL SLOPES SHALL BE 2:1 OR FLATTER.
4. THE STONE USED IN THE OUTLET SHALL BE SMALL RIPRAP 4"-8" ALONG WITH A 1' THICKNESS OF 2" AGGREGATE PLACED ON THE UP-GRADE SIDE ON THE SMALL RIPRAP OR EMBEDDED FILTER CLOTH IN THE RIPRAP.
5. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. IT SHALL BE PLACED ON SITE AND STABILIZED.
6. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED.
7. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND SEDIMENT ARE CONTROLLED.
8. THE STRUCTURE SHALL BE REMOVED AND THE AREA STABILIZED WHEN THE DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

MAXIMUM DRAINAGE AREA 5 ACRES

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	STONE OUTLET SEDIMENT TRAP ST-II

STANDARD AND SPECIFICATIONS FOR SILT FENCE

Definition & Scope

A **temporary** barrier of geotextile fabric installed on the contours across a slope used to intercept sediment laden runoff from small drainage areas of disturbed soil by temporarily ponding the sediment laden runoff allowing settling to occur. The maximum period of use is limited by the ultraviolet stability of the fabric (approximately one year).

Conditions Where Practice Applies

A silt fence may be used subject to the following conditions:

1. Maximum allowable slope length and fence length will not exceed the limits shown in the Design Criteria for the specific type of silt fence used ; and

2. Maximum ponding depth of 1.5 feet behind the fence; and

3. Erosion would occur in the form of sheet erosion; and

4. There is no concentration of water flowing to the barrier; and

5. Soil conditions allow for proper keying of fabric, or other anchorage, to prevent blowouts.

Design Criteria

1. Design computations are not required for installations of 1 month or less. Longer installation periods should be designed for expected runoff.

2. All silt fences shall be placed as close to the disturbed area as possible, but at least 10 feet from the toe of a slope steeper than 3H:1V, to allow for maintenance and roll down. The area beyond the fence must be undisturbed or stabilized.

3. The type of silt fence specified for each location on the plan shall not exceed the maximum slope length and maximum fence length requirements shown in the following table:

		Slope Length/Fence Length (ft.)		
Slope	Steepness	Standard	Reinforced	Super
<2%	< 50:1	300/1500	N/A	N/A
2-10%	50:1 to 10:1	125/1000	250/2000	300/2500
10-20%	10:1 to 5:1	100/750	150/1000	200/1000
20-33%	5:1 to 3:1	60/500	80/750	100/1000
33-50%	3:1 to 2:1	40/250	70/350	100/500
>50%	> 2:1	20/125	30/175	50/250

Standard Silt Fence (SF) is fabric rolls stapled to wooden stakes driven 16 inches in the ground.
Reinforced Silt Fence (RSF) is fabric placed against welded wire fabric with anchored steel posts driven 16 inches in the ground.
Super Silt Fence (SSF) is fabric placed against chain link fence as support backing with posts driven 3 feet in the ground.

4. Silt fence shall be removed as soon as the disturbed area has achieved final stabilization.

The silt fence shall be installed in accordance with the appropriate details. Where ends of filter cloth come together, they shall be overlapped, folded and stapled to prevent sediment bypass. Butt joints are not acceptable. A detail of the silt fence shall be shown on the plan. See Figure 5.30 on page 5.56 for Reinforced Silt Fence as an example of details to be provided.

Criteria for Silt Fence Materials

1. Silt Fence Fabric: The fabric shall meet the following specifications unless otherwise approved by the appropriate erosion and sediment control plan approval authority. Such approval shall not constitute statewide acceptance.

Fabric Properties	Minimum Acceptable Value	Test Method
Grab Tensile Strength (lbs)	110	ASTM D 4632
Elongation at Failure (%)	20	ASTM D 4632
Mullen Burst Strength (PSI)	300	ASTM D 3786
Puncture Strength (lbs)	60	ASTM D 4833
Minimum Trapezoidal Tear Strength (lbs)	50	ASTM D 4533
Flow Through Rate (gal/min/sf)	25	ASTM D 4491
Equivalent Opening Size	40-80	US Std Sieve ASTM D 4751
Minimum UV Residual (%)	70	ASTM D 4355

2. Fence Posts (for fabricated units): The length shall be a minimum of 36 inches long. Wood posts will be of sound quality hardwood with a minimum cross sectional area of 3.5 square inches. Steel posts will be standard T and U section weighing not less than 1.00 pound per linear foot. Posts for super silt fence shall be standard chain link fence posts.

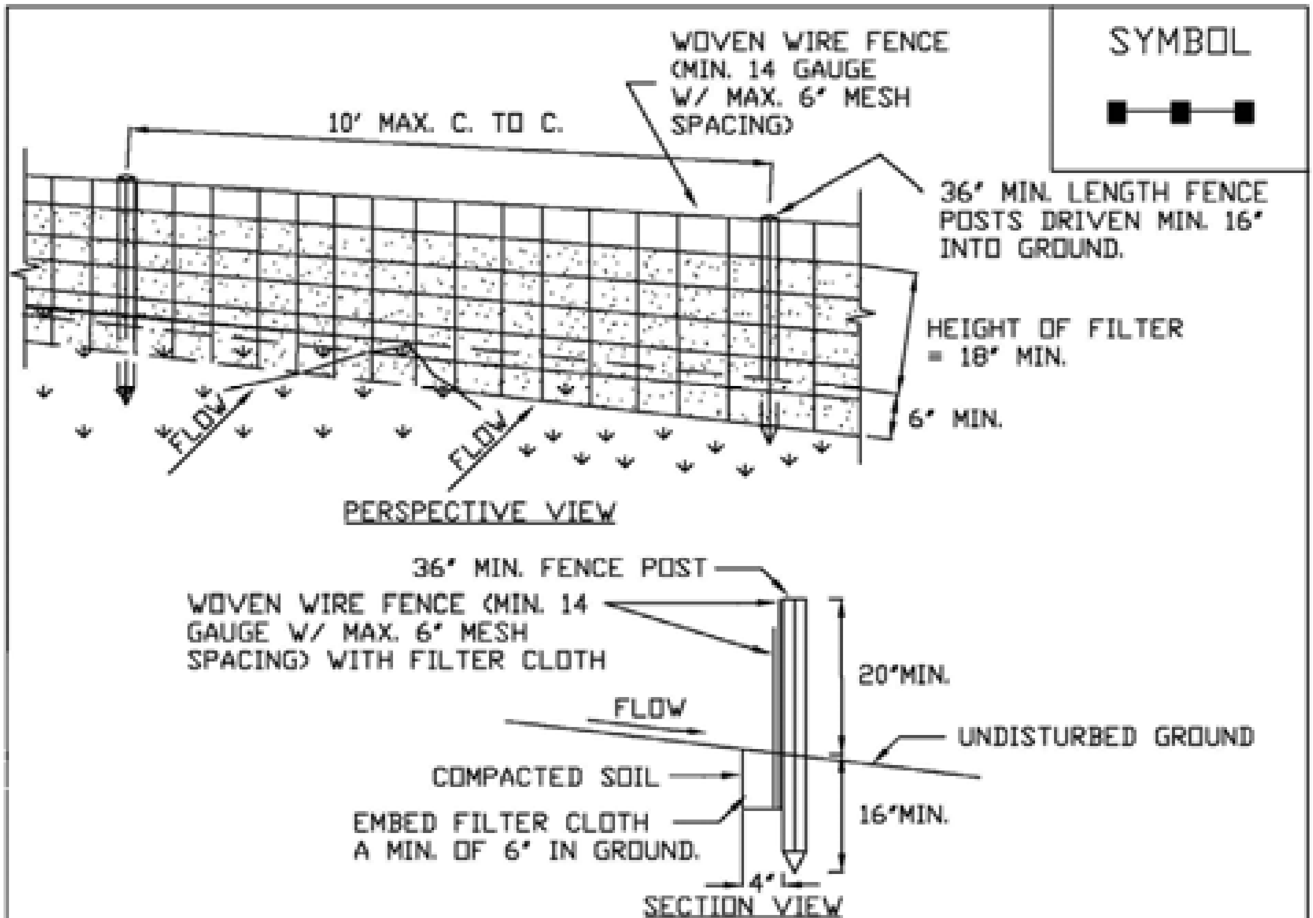
3. Wire Fence for reinforced silt fence: Wire fencing shall be a minimum 14 gage with a maximum 6 in. mesh opening, or as approved.

4. Prefabricated silt fence is acceptable as long as all material specifications are met.

Reinforced Silt Fence

Super Silt Fence

Figure 5.30
Reinforced Silt Fence



CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL MEET THE MINIMUM REQUIREMENTS SHOWN.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	REINFORCED SILT FENCE

STANDARD AND SPECIFICATIONS FOR STORM DRAIN INLET PROTECTION

Definition & Scope

A **temporary** barrier with low permeability, installed around inlets in the form of a fence, berm or excavation around an opening, detaining water and thereby reducing the sediment content of sediment laden water by settling thus preventing heavily sediment laden water from entering a storm drain system.

Conditions Where Practice Applies

This practice shall be used where the drainage area to an inlet is disturbed, it is not possible to temporarily divert the storm drain outfall into a trapping device, and watertight blocking of inlets is not advisable. **It is not to be used in place of sediment trapping devices.** This practice shall be used with an upstream buffer strip if placed at a storm drain inlet on a paved surface. It may be used in conjunction with storm drain diversion to help prevent siltation of pipes installed with low slope angle.

Types of Storm Drain Inlet Practices

There are five (5) specific types of storm drain inlet protection practices that vary according to their function, location, drainage area, and availability of materials:

I. Excavated Drop Inlet Protection
II. Fabric Drop Inlet Protection
III. Stone & Block Drop Inlet Protection
IV. Paved Surface Inlet Protection
V. Manufactured Insert Inlet Protection

Design Criteria

Drainage Area – The drainage area for storm drain inlets shall not exceed one acre. Erosion control/temporary stabilization measures must be implemented on the disturbed drainage area tributary to the inlet. The crest elevations of these practices shall provide storage and minimize bypass flow.

Type I – Excavated Drop Inlet Protection

This practice is generally used during initial overlot grading after the storm drain trunk line is installed.

Limit the drainage area to the inlet device to 1 acre. Excavated side slopes shall be no steeper than 2:1. The minimum depth shall be 1 foot and the maximum depth 2 feet as measured from the crest of the inlet structure. Shape the excavated basin to fit conditions with the longest dimension oriented toward the longest inflow area to provide maximum trap efficiency. The capacity of the excavated basin should be established to contain 900 cubic feet per acre of disturbed area. Weep holes, protected by fabric and stone, should be provided for draining the temporary pool.

Inspect and clean the excavated basin after every storm. Sediment should be removed when 50 percent of the storage volume is achieved This material should be incorporated into the site in a stabilized manner.

Type II – Fabric Drop Inlet Protection

This practice is generally used during final elevation grading phases after the storm drain system is completed.

Limit the drainage area to 1 acre per inlet device. Land area slope immediately surrounding this device should not exceed 1 percent. The maximum height of the fabric above the inlet crest shall not exceed 1.5 feet unless reinforced.

The top of the barrier should be maintained to allow overflow to drop into the drop inlet and not bypass the inlet to unprotected lower areas. Support stakes for fabric shall be a minimum of 3 feet long, spaced a maximum 3 feet apart. They should be driven close to the inlet so any overflow drops into the inlet and not on the unprotected soil. Improved performance and sediment storage volume can be obtained by excavating the area.

Inspect the fabric barrier after each rain event and make repairs as needed. Remove sediment from the pool area as necessary with care not to undercut or damage the filter fabric. Upon stabilization of the drainage area, remove all materials and unstable sediment and dispose of properly. Bring the adjacent area of the drop inlet to grade, smooth and compact and stabilize in the appropriate manner to the site.

Type III – Stone and Block Drop Inlet Protection

This practice is generally used during the initial and intermediate overlot grading of a construction site.

Limit the drainage area to 1 acre at the drop inlet. The stone barrier should have a minimum height of 1 foot and a maximum height of 2 feet. Do not use mortar. The height should be limited to prevent excess ponding and bypass flow.

Recess the first course of blocks at least 2 inches below the crest opening of the storm drain for lateral support. Subsequent courses can be supported laterally if needed by placing a 2x4 inch wood stud through the block openings perpendicular to the course. The bottom row should have a few blocks oriented so flow can drain through the block to dewater the basin area.

The stone should be placed just below the top of the blocks on slopes of 2:1 or flatter. Place hardware cloth of wire mesh with ½ inch openings over all block openings to hold stone in place.

As an optional design, the concrete blocks may be omitted and the entire structure constructed of stone, ringing the outlet ("doughnut"). The stone should be kept at a 3:1 slope toward the inlet to keep it from being washed into the inlet. A level area 1 foot wide and four inches below the crest will further prevent wash. Stone on the slope toward the inlet should be at least 3 inches in size for stability and 1 inch or smaller away from the inlet to control flow rate. The elevation of the top of the stone crest must be maintained 6 inches lower than the ground elevation down slope from the inlet to ensure that all storm flows pass over the stone into the storm drain and not past the structure. Temporary diking should be used as necessary to prevent bypass flow.

The barrier should be inspected after each rain event and repairs made where needed. Remove sediment as necessary to provide for accurate storage volume for subsequent rains. Upon stabilization of contributing drainage area, remove all materials and any unstable soil and dispose of properly.

Bring the disturbed area to proper grade, smooth, compact and stabilize in a manner appropriate to the site.

Type IV – Paved Surface Inlet Protection

This practice is generally used after pavement construction has been done while final grading and soil stabilization is occurring. These practices should be used with upstream buffer strips in linear construction applications, and with temporary surface stabilization for overlot areas, to reduce the sediment load at the practice. This practice includes sand bags, compost filter socks, geo-tubes filled with ballast, and manufactured surface barriers. Pea gravel can also be used in conjunction with these practices to improve performance. When the inlet is not at a low point, and is offset from the pavement or gutter line, protection should be selected and installed so that flows are not diverted around the inlet.

The drainage area should be limited to 1 acre at the drain inlet. All practices will be placed at the inlet perimeter or beyond to maximize the flow capacity of the inlet. Practices shall be weighted, braced, tied, or otherwise anchored to prevent movement or shifting of location on paved surfaces. Traffic safety shall be integrated with the use of this practice. All practices should be marked with traffic safety cones as appropriate. Structure height shall not cause flooding or by-pass flow that would cause additional erosion.

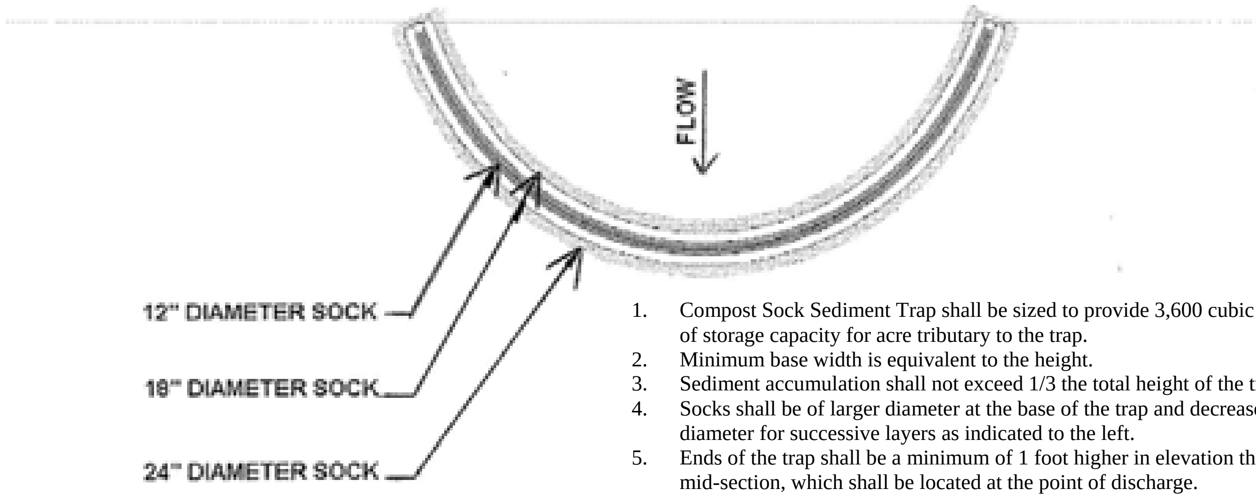
The structure should be inspected after every storm event. Any sediment should be removed and disposed of on the site. Any broken or damaged components should be replaced. Check all materials for proper anchorage and secure as necessary.

Type V - Manufactured Insert Inlet Protection

The drainage area shall be limited to 1 acre at the drain inlet. All inserts will be installed and anchored in accordance with the manufacturers recommendations and design details. The fabric portion of the structure will equal or exceed the performance standard for the silt fence fabric. The inserts will be installed to preserve a minimum of 50 percent of the open, unobstructed design flow area of the storm drain inlet opening to maintain capacity for storm events.

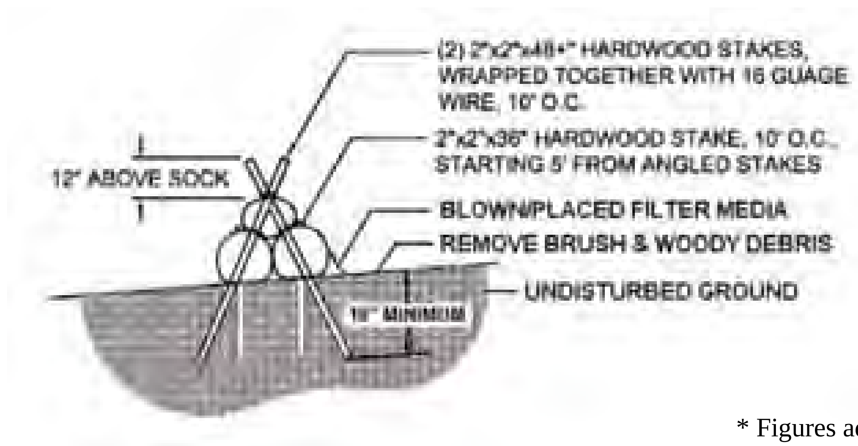
Figure 5.28
Compost Filter Sock Sediment Trap: ST-III

Plan View



1. Compost Sock Sediment Trap shall be sized to provide 3,600 cubic feet of storage capacity for acre tributary to the trap.
2. Minimum base width is equivalent to the height.
3. Sediment accumulation shall not exceed 1/3 the total height of the trap.
4. Socks shall be of larger diameter at the base of the trap and decrease in diameter for successive layers as indicated to the left.
5. Ends of the trap shall be a minimum of 1 foot higher in elevation that the mid-section, which shall be located at the point of discharge.

Staking Detail



* Figures adapted from Filtrexx

Specifications:

1. Sock infill and filter media material shall meet the standards of Table 5.1 on page 5.8 . Compost shall meet the compost filter sock standard of Table 5.2 on page 5.8.

2. Compost sock sediment traps shall not exceed three socks in height and shall be stacked in pyramidal form as shown above. Minimum trap height is one 24 inch diameter sock. Additional storage may be provided by means of an excavated sump 12 inches deep extending 1 to 3 feet upslope of the socks along the lower side of the trap.

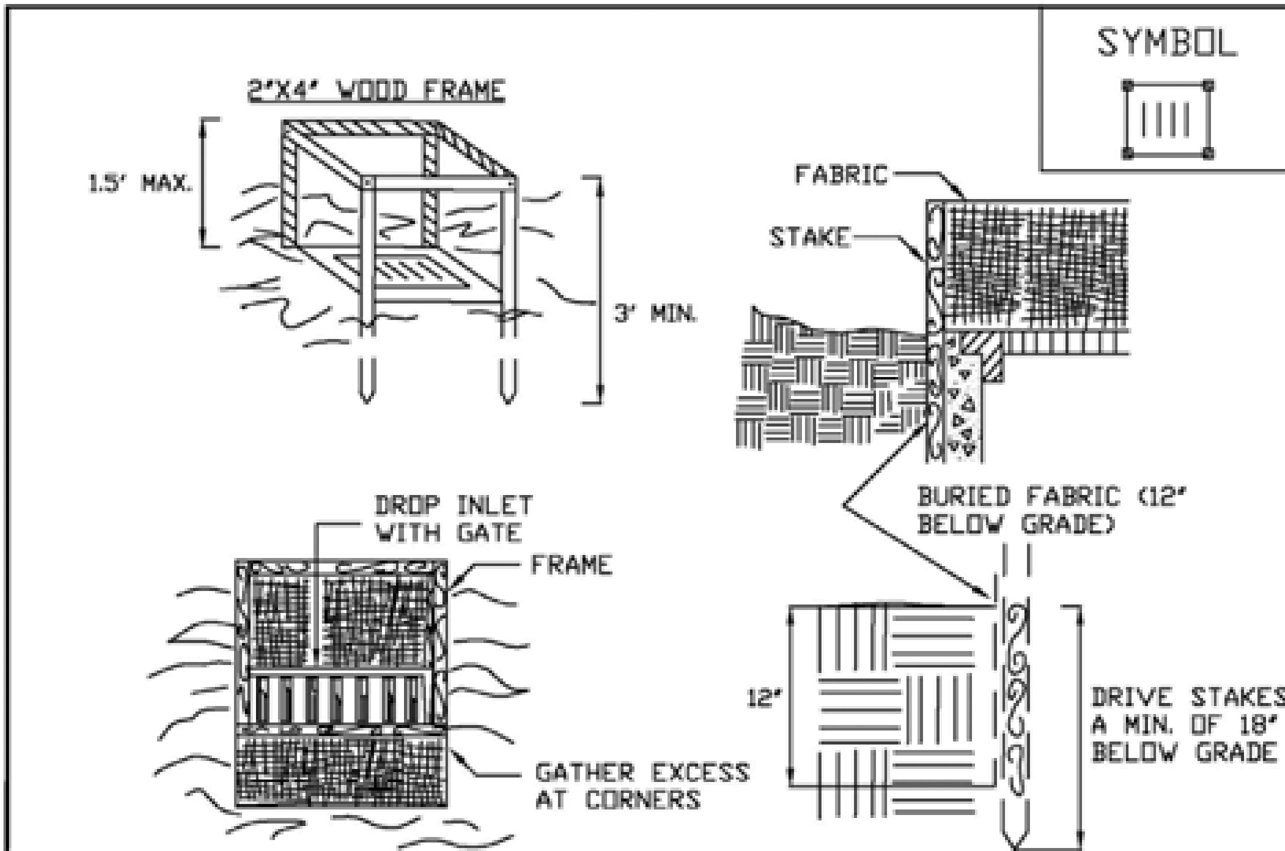
3. Compost sock sediment traps shall provide 3,600 cubic feet storage capacity with 12 inches of freeboard for each tributary drainage acreage. (See manufacturer for anticipated settlement.)

4. The maximum tributary drainage area is 5.0 acres. Since compost socks are “flow-through,” no spillway is required.

5. Compost sock sediment traps shall be inspected weekly and after each runoff event. Sediment shall be removed when it reaches 1/3 the height of the socks.

6. Photodegradable and biodegradable socks shall not be used for more than 1 year.

Figure 5.32
Fabric Drop Inlet Protection



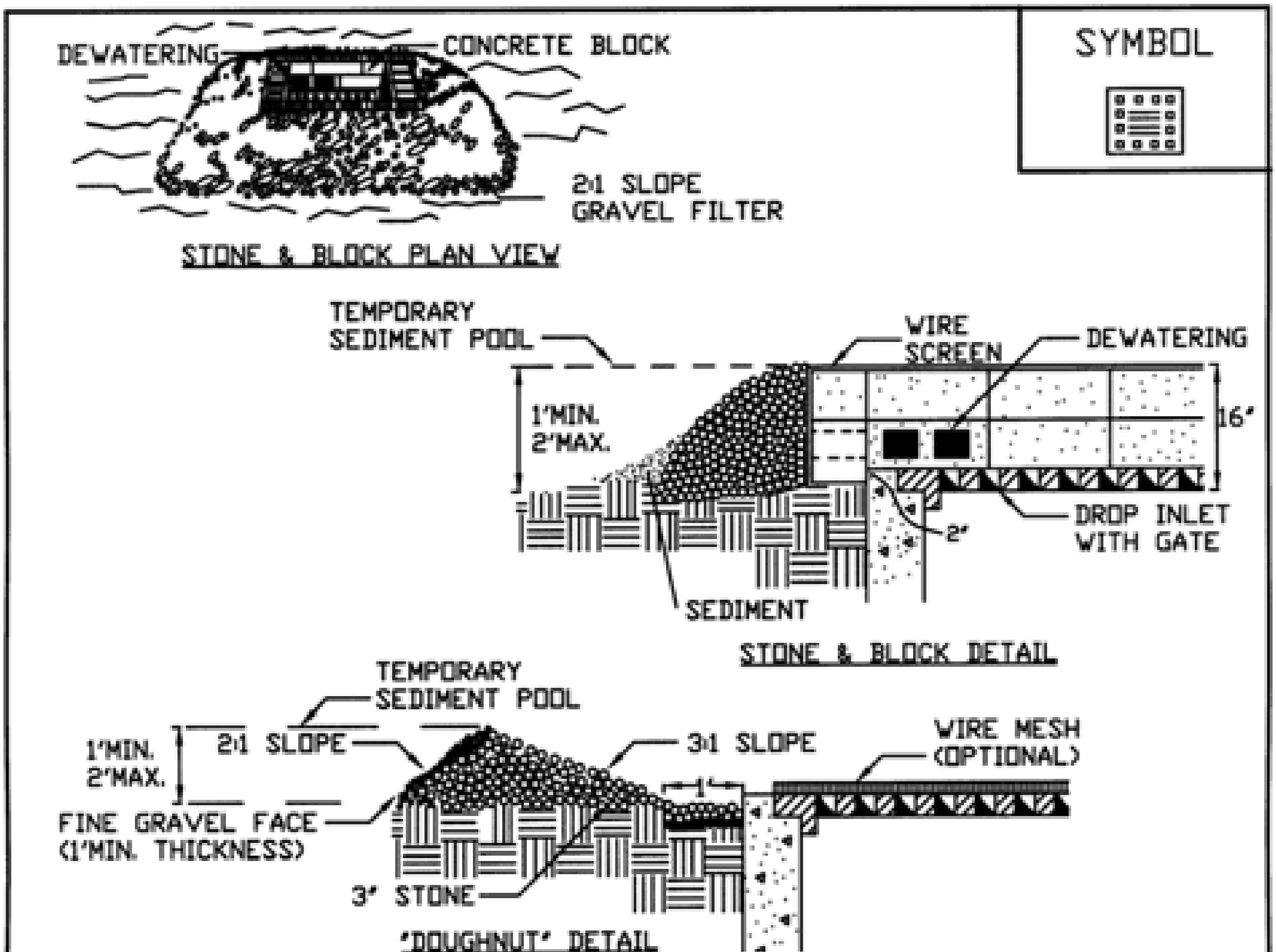
CONSTRUCTION SPECIFICATIONS

1. FABRIC SHALL HAVE AN EOS OF 40-85. BURLAP MAY BE USED FOR SHORT TERM APPLICATIONS.
2. CUT FABRIC FROM A CONTINUOUS ROLL TO ELIMINATE JOINTS. IF JOINTS ARE NEEDED THEY WILL BE OVERLAPPED TO THE NEXT STAKE.
3. STAKE MATERIALS WILL BE STANDARD 2" x 4" WOOD OR EQUIVALENT. METAL WITH A MINIMUM LENGTH OF 3 FEET.
4. SPACE STAKES EVENLY AROUND INLET 3 FEET APART AND DRIVE A MINIMUM 18 INCHES DEEP. SPANS GREATER THAN 3 FEET MAY BE BRIDGED WITH THE USE OF WIRE MESH BEHIND THE FILTER FABRIC FOR SUPPORT.
5. FABRIC SHALL BE EMBEDDED 1 FOOT MINIMUM BELOW GROUND AND BACKFILLED. IT SHALL BE SECURELY FASTENED TO THE STAKES AND FRAME.
6. A 2" x 4" WOOD FRAME SHALL BE COMPLETED AROUND THE CREST OF THE FABRIC FOR OVER FLOW STABILITY.

MAXIMUM DRAINAGE AREA 1 ACRE

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	FABRIC DROP INLET PROTECTION

Figure 5.33
Stone & Block Drop Inlet Protection



CONSTRUCTION SPECIFICATIONS

1. LAY ONE BLOCK ON EACH SIDE OF THE STRUCTURE ON ITS SIDE FOR DEWATERING. FOUNDATION SHALL BE 2 INCHES MINIMUM BELOW REST OF INLET AND BLOCKS SHALL BE PLACED AGAINST INLET FOR SUPPORT.
2. HARDWARE CLOTH OR 1/2" WIRE MESH SHALL BE PLACED OVER BLOCK OPENINGS TO SUPPORT STONE.
3. USE CLEAN STONE OR GRAVEL 1/2-3/4 INCH IN DIAMETER PLACED 2 INCHES BELOW TOP OF THE BLOCK ON A 2:1 SLOPE OR FLATTER.
4. FOR STONE STRUCTURES ONLY, A 1 FOOT THICK LAYER OF THE FILTER STONE WILL BE PLACED AGAINST THE 3 INCH STONE AS SHOWN ON THE DRAWINGS.

MAXIMUM DRAINAGE AREA 1 ACRE

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	STONE & BLOCK DROP INLET PROTECTION

APPENDIX G

Notice of Termination (NOT)

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505
(NOTE: Submit completed form to address above)

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity

Please indicate your permit identification number: NYR ___ ___ ___ ___ ___ ___

I. Owner or Operator Information

1. Owner/Operator Name:

2. Street Address:

3. City/State/Zip:

4. Contact Person: | 4a.Telephone:

4b. Contact Person E-Mail:

II. Project Site Information

5. Project/Site Name:

6. Street Address:

7. City/Zip:

8. County:

III. Reason for Termination

9a. □ All disturbed areas have achieved final stabilization in accordance with the general permit and SWPPP. ***Date final stabilization completed** (month/year): ______________________________

9b. □ Permit coverage has been transferred to new owner/operator. Indicate new owner/operator's permit identification number: NYR ___ ___ ___ ___ ___ ___
(Note: Permit coverage can not be terminated by owner identified in I.1. above until new owner/operator obtains coverage under the general permit)

9c. □ Other (Explain on Page 2)

IV. Final Site Information:

10a. Did this construction activity require the development of a SWPPP that includes post-construction stormwater management practices? □ yes □ no (If no, go to question 10f.)

10b. Have all post-construction stormwater management practices included in the final SWPPP been constructed? □ yes □ no (If no, explain on Page 2)

10c. Identify the entity responsible for long-term operation and maintenance of practice(s)?

____

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity - continued

10d. Has the entity responsible for long-term operation and maintenance been given a copy of the operation and maintenance plan required by the general permit? □ yes □ no

10e. Indicate the method used to ensure long-term operation and maintenance of the post-construction stormwater management practice(s):

□ Post-construction stormwater management practice(s) and any right-of-way(s) needed to maintain practice(s) have been deeded to the municipality.

□ Executed maintenance agreement is in place with the municipality that will maintain the post-construction stormwater management practice(s).

□ For post-construction stormwater management practices that are privately owned, a mechanism is in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan, such as a deed covenant in the owner or operator's deed of record.

□ For post-construction stormwater management practices that are owned by a public or private institution (e.g. school, university or hospital), government agency or authority, or public utility; policy and procedures are in place that ensures operation and maintenance of the practice(s) in accordance with the operation and maintenance plan.

10f. Provide the total area of impervious surface (i.e. roof, pavement, concrete, gravel, etc.) constructed within the disturbance area? ______________________________ (acres)

11. Is this project subject to the requirements of a regulated, traditional land use control MS4? □ yes □ no

(If Yes, complete section VI - "MS4 Acceptance" statement

V. Additional Information/Explanation:

(Use this section to answer questions 9c. and 10b., if applicable)

VI. MS4 Acceptance - MS4 Official (principal executive officer or ranking elected official) or Duly Authorized Representative (Note: Not required when 9b. is checked -transfer of coverage)

I have determined that it is acceptable for the owner or operator of the construction project identified in question 5 to submit the Notice of Termination at this time.

Printed Name:	
Title/Position:	
Signature:	Date:

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity - continued

VII. Qualified Inspector Certification - Final Stabilization:	
I hereby certify that all disturbed areas have achieved final stabilization as defined in the current version of the general permit, and that all temporary, structural erosion and sediment control measures have been removed. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.	
Printed Name:	
Title/Position:	
Signature:	Date:
VIII. Qualified Inspector Certification - Post-construction Stormwater Management Practice(s):	
I hereby certify that all post-construction stormwater management practices have been constructed in conformance with the SWPPP. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.	
Printed Name:	
Title/Position:	
Signature:	Date:
IX. Owner or Operator Certification	
I hereby certify that this document was prepared by me or under my direction or supervision. My determination, based upon my inquiry of the person(s) who managed the construction activity, or those persons directly responsible for gathering the information, is that the information provided in this document is true, accurate and complete. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.	
Printed Name:	
Title/Position:	
Signature:	Date:

(NYS DEC Notice of Termination - January 2015)

APPENDIX H

Environmental Impact Information

NEW YORK STATE OF OPPORTUNITY. | Parks, Recreation, and Historic Preservation

ANDREW M. CUOMO
Governor

ERIK KULLESEID
Commissioner

July 29, 2021

Lindsey Tidd
Marks Engineering, P.C.
42 Beeman St.
Canandaigua, NY 14424

Re: DEC
Canandaigua Shores Construction of Residential Development Project
3535 State Route 364, Canandaigua, Ontario County, NY
21PR02254

Dear Lindsey Tidd:

Thank you for requesting the comments of the Division for Historic Preservation of the Office of Parks, Recreation, and Historic Preservation (OPRHP). We have reviewed the Phase I (IA & B) Cultural Resource Investigation report prepared by Powers Archaeology LLC (Powers, July 13, 2021; 21SR00419) in accordance with the New York State Historic Preservation Act of 1980 (section 14.09 of the New York Parks, Recreation, and Historic Preservation Law). These comments are those of the Division for Historic Preservation and relate only to Historic/Cultural resources.

Based on this review, OPRHP understands no archaeological cultural resources were identified during the above-noted investigation, and thus no further archaeological investigations are warranted. It is, therefore, OPRHP's opinion that no properties, including archaeological and/or historic resources, listed in or eligible for the New York State and National Registers of Historic Places will be impacted by this project. Should the project design be changed OPRHP recommends further consultation with this office.

If you have any questions, I can be reached via e-mail at Josalyn.Ferguson@parks.ny.gov.

Sincerely,

Josalyn Ferguson, Ph.D.
Scientist Archaeology

via email only

c.c. Brennan Marks, Marks Engineering
c.c. Charles Vandrei, DEC
c.c. Chris Jensen, Town of Canandaigua
c.c. Justin Bruen, Town of Hopewell